3.3.2 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five year

S.No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	Year of Publication	ISBN/ISSN number of the proceeding	Affiliating Institute at the time of publication	Name Of The Publisher
1	Dr. Garima Mathur	Healthcare Monitoring and Data Analysis using IoT: Technologies and applications	Analysis of Big Data in electroencephalography (EEG)			International	2022	ISBN: 9781839534379 e-ISBN: 9781839534386 Chapter DOI: 10.1049/PBHE038E	PCE	The Institution of Engineering and Technology, United Kingdom
2	MANISH CHOUBISA	Real-Time Applications of Machine Learning in Cyber-Physical Systems	Crop Protection Using Cyber Physical Systems and Machine Learning for Smart Agriculture			International	2022	DOI: 10.4018/978-1-7998-9308-0.ch009 ISSN: 978-1-7998-9308-0	PCE	IGI Global Publisher of Timely Knowledge
3	NIKITA JAIN	Graph learning and network science for Natural Language Processing	Analysis of Medical Images using Machine Learning Techniques			International	2022	eBook ISBN 9781003272649	PCE	Taylor and francis group
4	REENA SHARMA	Cybersecurity: Ambient technologies, IoT, and Industry 4.0 Implications (Artificial Intelligence (AI):	Analysis of Medical Images using Machine Learning Techniques			International	2022	ISBN: 0367702169 ISSN13: 9780367702168	PCE	Taylor & Francis Group
5	DR PAYAL BANSAL	Basic Designing Theory of Communication Filters	Subject Book			International	2022	ISBN-13: 978-620-4-74453-7 ISBN-10: 6204744534	PCE	LAP, Germany
6	DR PAYAL BANSAL, Devendra Kumar Somwanshi	Advances in Image and Data Processing using VLSI Design, Volume 2,	Role of reduction techniques in VLSI design			International	2022	ISBN: 978-0-7503-3921-6 DOI: 10.1088/978-0-7503-3923-0ch16	PCE	IOP Publication
7	Shilpi Jain	Fractional Order System and Applications in Engineering	On basic Humbert confluent hypergeometric functions			International	2022	eBook ISBN: 9780323909549 Paperback ISBN: 9780323909532	PCE	Elesevier
8	DR PAYAL BANSAL, Devendra Kumar Somwanshi	Computational Intelligence for Sustainable Development	IoT-Based Security System using ESP-32 and Laser and its Various Applications			International	2022	ISBN: 979-8-88697-198-9	PCE	Nova Science Publisher
9	Shilpi Jain	Fractional Order Systems and Applications in Engineering	Derivatives of Horn's hypergeometric functions G1, G2, Gamma1, and Gamma2 with respect to their			International	2022	eBook ISBN: 9780323909549 Paperback ISBN: 9780323909532	PCE	Elsevier
10	MANOJ GATTANI	Jindagi Unchi Udane Ya Sangarsho ki Potli (Hindi-Life management and Business)	Subject Book			National	2022	ASIN : B09RSX1TXF	PCE	Authorvine publication (new Delhi)
11	Mahesh Bundele	Sustainable Engineering, Energy, and the Environment	Relationship Formed for Process Time by Using an Approach of a Mathematical Model for Sewing Machine			International	2022	eBook ISBN: 9781003277484	PCE	Taylor and Francis Group
12	DR PAYAL BANSAL	Advanced in Image and Data Processing using VLSI Design	Design and development of an iOS mobile application with the help of VLSI design			International	2022	Online ISBN: 978-0-7503-3923-0 Print ISBN: 978-0-7503-3921-6	PCE	IOP Publication
13	Pooja Gupta , Denis Jangeed , Harish Uniyal		AAC Blocks an Innovation as Eco-friendly Material in Construction		Two-Day (March 31, 2022 and April 01, 2022) 2nd International E-	Internatitional	2022	ISSN:1938-5862; E-ISSN:1938-6737	PCE	
14	Archika Jain, Devendra Somwanshi, Dr. Rajesh Singh, Ghanshyam Singh		Hybrid Layered Classification Model for Heart Disease Diagnosis		4th International Conference In London On Intelligent	International	2022	ISBN: 978-1-6654-6756-8	PCE	
15	Archika Jain, Devendra Somwanshi, Barkha Narang	Algorithms for Intelligent Systems	Data Mining based Diseases Classification		International Conference on IntelligentSystems (ICIS-2022) |	International	2022	ISSN 2524-7565	PCE	
16	Archika Jain, Devendra Somwanshi, Dharani kumar Talapula, Kapil joshi		Artificial Intelligence based Software Cost Estimation		International Conference on Innovative Development in	International	2022	ISSN: 2094-0343, 2326-9865	PCE	
17	Archika Jain, Harshita Virwani, Neha Shrotriya, Devendra Somwanshi		Information Retrieval Using Data Mining		2nd International Conference on Machine Vision & Augmented	International	2022	ISSN: 2094-0343, 2326-9865	PCE	
18	Mayank Sharma, Dr. Sunil Kumar Gupta		Vivaldi Antenna for UWB Applications: A Review		3rd International Online Conference On Emerging Trends in Multi-Disciplinary	International	2022	ISSN: 2094-0343, 2326-9865	PCE	
19	Shubham Dadhich, Dr. Garima Mathur, Arun Dev Dhar Dwivedi		Mobile Charge Carrier Based Modeling of 4H–21 DNTT and Structure Analysis of OTFT		2021 IEEE 2nd International Conference on Technology,	International	2022	Electronic ISBN:978-1-6654-2778-4 Print on Demand(PoD) ISBN:978-1-6654-2779-1	PCE	IEEE
20	Shubham Dadhich, A. D. D. Dwivedi & Garima Mathur		Numerical Simulation and Analytical Modelling of C8-BTBT-C8 Organic Transistor and Analysis of		ICTSES-2021: Intelligent Computing Techniques for	International	2022	Print ISBN: 978-981-19-0251-2 Online ISBN: 978-981-19-0252-9	PCE	Springer
21	1. Dr. Surendra Kumar Yadav 2. Dr. Kamlesh Gautam 3. Manish Choubisa		Handwritten Character Segmentation in Various Epochs		International Conference on Advanced Materials in Innovative		2022	ISBN: 9798886847581	PCE	
22	DR SURENDRA KUMAR YADAV, Ms Harshita Veervani, Mr Manish Dubey, Dr Gajendra		Comparative Analysis for The Prediction of Various Lungs Diseases Through Chest X-Ray Images		2nd International Convention on green Environment Technology &		2022		PCE	
23	Sagar Motdhare and Garima Mathur		An Experimental Analysis on EMG Artifact Removal Methods from EEG Signal Records		3 INTERNATIONAL ONLINE CONFERENCE ON EMERGING TRENDS		2022	ISSN: 2326-9865	PCE	Mathematical Statistician and Engineering Applications

24	Surendra Kumar Saini		Response parameters modeling of abrasive jet machined composite using artificial neural network		International Conference on Materials, Processing &	International	2022	ISSN: 2214-7853	PCE	Elsevier
25	Surendra Kumar Saini		Optimization of MRR for CNC Turning of Steel		International Journal of Scientific Research inScience, Engineering and	International	2022	Print ISSN: 2395-1990 Online ISSN : 2394-4099	PCE	
26	Nikita Gautam, Dr. Amit Shrivastava	Algorithms for Intelligent Systems book series (AIS)	A Review on Carpal Tunnel Syndrome Various Terminologies		Proceedings of the Third International Conference on Information	International	2022	Print ISBN: 978-981-19-2064-6 Online ISBN: 978-981-19-2065-3	PCE	Springer
27	Jitendra Hemwani, Raj Kumar Satankar, Yatna Bhagat, and Y. P. Deshmukh		Analysis of Parameters Affecting Effectiveness of Industrial Cooling Towers		International Conference on Futuristic Advancements in	International	2022	Print ISBN: 978-981-19-6472-5 Online ISBN 978-981-19-6470-1	PCE	Springer
28	SURENDRA KUMAR SAINI, Dubey A.K. and Upadhyay B. N.,		Modeling and Optimization of RLT in Laser Trepanned ZTA Plate		Springer Lecture Notes in Mechanical Engineering/2nd International	International	2022	Print ISBN: 978-981-19-0560-5 Online ISBN 978-981-19-0561-2	PCE	Springer
29	Nikita Jain, Rakesh Kumar, Dinesh Goyal		A Comparative Study On Face Recognition Using Deep Learning		International Conference on Smart Innovations for Society ICSIS		2022		PCE	
30	SURENDRA KUMAR SAINI		Modeling of Quality Characteristics of Abrasive Jet Machined Polymer Nanocomposite using		Second International Conference on Materials and		2022		PCE	
31	SURENDRA KUMAR SAINI, Avanish Kumar Dubey		Multiobjective optimization of hole characteristics during Laser Trepan Drilling of ZTA plate		2nd Online International Conference on Materials and		2022		PCE	
32	RAJ KUMAR SATANKAR, VIJAY PRAKASH SHARMA, DEVENDRA KUMAR		A Literature Review on Renewable Energy Resource and Optimization		Second International Conference on Sustainable Energy,	International	2022	1084 (2022) 012002 ISSN: 1755-1315	PCE	IOP Publishing Ltd
33	RAJ KUMAR SATANKAR, VIJAY PRAKASH SHARMA, DEVENDRA KUMAR		Optimization of Renewable Energy Resource -A Review		Second International Conference on Sustainable Energy,	International	2022	ISSN: 1755-1315	PCE	
34	DEVENDRA KUMAR SOMWANSHI, VIJAY PRAKASH SHARMA, SIKHA SHARMA,KALPIT		COMPRESSIVE STRENGTH OF WASTE PET BOTTLE BASED FIBRE		IOP Conference Series: Earth and Environmental Science (Scopus	International	2022	1084 (2022) 012068	PCE	IOP Publishing Ltd
35	DEVENDRA KUMAR SOMWANSHI, VIJAY PRAKASH SHARMA, SIKHA SHARMA,KALPIT		A LITERATURE REVIEW ON MECHANICAL PROPERTIES OF WASTE PET BOTTLE BASED FIBRE		IOP Conference Series: Earth and Environmental Science (Scopus	International	2022	1084 (2022) 012069	PCE	IOP Publishing Ltd
36	Dr. Surendra Kumar Yadav, Ms Archna Soni, Dr Kamlesh Gautam		Intelligent Information Retrieval Ontology Merging Using SPARQL on Education Field		Innovative advancements in Engineering and Technology		2022		PCE	
37	Payal Bansal, Rahul Sharma, B.K. mishra		Process of Writing a Good Quality Research Paper for Journal		National Conference on Intellectual Property, Innovation & Entrepreneurship	National	2022		PCE	SEAS Transactions
38	Pallavi Spakale, Payal Bansal, Moresh Mukhdekar, Sandhya Sharma		Sentimental Segregation for Social Media Using Lexicon Technology		International Conference on artificial Intelligence , Advances &	International	2022		PCE	
39	Mr. Gaffar G. Momin , Dr. Narayan Lal Jain		Experimental Investigation on Performance, Emission Analysis of a Direct Ignition Diesel Engine fuelled with		3rd International Conference on Emerging Trends in multidisciplinary	International	2022		PCE	
40	Dr. Narayan Lal jain, Shailesh katara		Hydrogen Fuel Cell Technology		4 National Level Technical Paper and Model Contests		2022	ISSN:1087-9595	PCE	
41	Dr. Narayan Lal Jain, Atul Singh		An Introduction and Prospect of Geothermal Energy in Power Sector of India		4 National Level Technical Paper and Model Contests		2022	ISSN:1087-9595	PCE	
42	RAHUL SHARMA		Synthesis and Investigation of Physical Behavior of Coconut Shell Particular and Walnut Shell Particular filled Epoxy		Materials Today: Proceedings		2022	ISSN: 2214-7853.	PCE	
43	Anil Gupta1 , Harihar Sah1 , Dr. Manoj Gattani1 and Raj kumar Satankar		Design and development of the divergent wind turbine		Second International Conference on Sustainable Energy,	International	2022	ISSN: 1755-1315	PCE	IOP Publisher
44	Archika Jain , Devendra Somwanshi, Dr. Kapil Joshi, Dr. Siddharth Shankar		A Review: Data Mining Classification Techniques		2022 3rd International Conference on Intelligent	Internatioanl	2022	Electronic ISBN:978-1-6654-6756-8 Print on Demand(PoD) ISBN:978-1-6654-6757-5	PCE	IEEE
45	Vijay Prakash Sharma, Devendra Kumar Somwanshi, Kalpit Jain, Raj Kumar		A Literature Review on Renewable Energy Resource and Optimization		IOP Conf. Series: Earth and Environmental Science	International	2022	ISSN: 1755-1315	PCE	IOP publisher
46	Swapna Ghatole, Mahesh Bundele, Yashpal,J P Modak	Sustainable Engineering, Energy, and the Environment	Relationship Formed for Process Time by Using An Approach of a Mathematical Model for Sewing Machine			International	2022	eBook ISBN9781003277484	PCE	Apple Academic Press
47	Sonam Gour, Priya Chaudhary, and Amit Rathi	Flexible Electronics for Electric Vehicles	Survey of Microstrip Antenna in Nanotechnology Using Different Nanostructures				2022	Online ISBN 978-981-19-0588-9 Print ISBN 978-981-19-0587-2	PCE	Springer
48	Abha Sharma, Vijay Kumar Sharma, Sonam Gour, Amit Rathi		Conical Shaped Frequency Reconfigurable Antenna using DGS for Cognitive Radio Applications		8th International Conference on Advanced Computing and		2022	ISBN: 978-1-6654-0816-5 Electronic ISSN: 2575-7288	PCE	IEEE

49	Sachin Sharma, Priyanka Pandey, Pooja Gupta, Abhay M. Shende and Rakesh		An Experimental Behavior on Green Concrete utilizing Granite Slurry Waste (GSW) as Partial Substitute of		International Conference on Sustainable Energy, Environment and	International	2022	ISSN: 1755-1315	PCE	IOP publication
50	Jyoti Shukla; Basanta K. Panigrahi; Subhendu Pati; Monika Vardia		Imaging Time-Series Technique with CNN for Power Quality Disturbances Classification		4th International Conference on Energy, Power and Environment (ICEPE)	International	2022	Electronic ISBN:978-1-6654-7124-4	PCE	IEEE
51	Asik Rahaman Jamader, Biswaranjan Acharya, Dr. Mohammad Israr	Production Management: Theory and Practices	Subject Book				2021	ISBN-10 : 6138954149 ISBN-13 : 9786138954149	PCE	Scholar's Press, Germany
52	Asik Rahaman Jamader Dr. Mohammad Israr Puja Das	Operations Management: Special Emphasis in office Management	Subject Book				2021	SBN-10 : 6138953436 ISBN-13 978 : -6138953432	PCE	Scholar's Press, Germany
53	Asik Rahaman Jamader, Dr.Mohammad Israr, Biswaranjan Acharya	Housekeeping Management: A Theory & Practice During COVID-19	Subject Book				2021	ISBN-10 : 6203870498 ISBN-13 : 978-6203870497	PCE	Lambert Academic Publishing (LAP), Germany
54	Dr. PAYAL BANSAL, Dr. A. BENO	analog & Digital Communication	Subject Book				2021	ISBN10: 6138954726 ISBN13: 9786138954729	PCE	Scholar's Press, Germany
55	Himani Goyal Sharma	Emerging Materials and Advanced Designs for Wearable Antennas	Subject Book				2021	ISBN13:9781799876113, ISBN10:179987611X, EISBN13:9781799876120,	PCE	IGI Global Development Team'
56	DR. GARIMA MATHUR, Amit Kumar Jain, Tarun Mishra	Planar Antenna: Design, Fabrication, Testing, and Application	carr				2021	ISBN: 978-1-53619-898-0	PCE	Nova Science Publishers, Inc. USA
57	DR PAYAL BANSAL	Advances in Image and Data Processing using VLSI Design, Volume 1	The roles of delay and power optimization techniques in VLSI design			International	2021	Online ISBN: 978-0-7503-3919-3 • Print ISBN: 978-0-7503-3917-9	PCE	IOP Publication
58	Vibha Beniwal, Tarun Mishra, Amit Kumar Jain, Garima Mathur	Proceedings of Second International Conference on Smart Energy and Communication	Bluetooth-Based Smart Sensor Networks			Internatioanl	2021	Print ISBN: 978-981-15-6706-3 Online ISBN: 978-981-15-6707-0	PCE	Springer
59	Dr. Anila Dhingra, Tanya Mittal, Soniya, Varun	Algorithms for Intelligent Systems.	Acess Control of Door and Home Security System			Internatioanl	2021	Print ISBN 978-981-15-6706-3Online ISBN 978-981-15-6707-0	PCE	Springer
60	Dr. Anila Dhingra, Shefali		Finger Tracking in Real-Time Human–Computer Interaction		Proceedings of the Second International Conference on	Internatioanl	2021	Print ISBN 978-981-15-9688-9 Online ISBN- 978-981-15-9689-6,	PCE	Springer
61	Prem Pal Singh, Payal Bansal, Sudhir Kumar Sharma, Nush Nalin Jayakody,Abhishek		Frequency and Bandwidth Reconfigurable Patch Antenna Loaded with PIN Diode		10TH International Conference on Information and automation for	International	2021	ISSN: 2151-1810	PCE	IEEE
62	Abhilasha, Vyas V., Rathore V.S., Chaplot N.		Proposed method to identify oil seed leaf diseases by deep learning techniques		2nd International Conference on Data Analytics and Management	International	2021	Print ISBN 978-981-16-6288-1 Online ISBN: 978-981-16-6289-8	PCE	Springer
63	Tarun Varshney, Vikassingh Bhadoria, Pravin Sonwane and Nitin Singh		Optimization of Fractional Order PID Controller(FOPID)Using Cuckoo Search		2nd International Conference on Artificial Intelligence:	International/SPRINGER BOOK SERIES, 'ALGORITHMS	2021	Print ISBN: 978-981-16-6331-4 Online ISBN: 978-981-16-6332-1	PCE	Springer
64	Jain, G., Dadhich, M., Jayaswal K., Sharma, V		Natural Ventilation Improvement of Building Using Solar Chimney Made of Honey Comb Structure: A CFD		The 1st IEEE First International Conference on Emerging Trends in	International	2021	Electronic ISBN:978-1-6654-2237-6	PCE	IEEE
65	Ms. Neha Shrotriya, Ms. Reena Sharma, Ms. Nikita Jain		A critical Analysis on Face Detection Algorithms of Video Surveillance		ADVANCES IN INTELLIGENT ALGORITHMS AND INDUSTRIAL	International	2021	eBook ISBN: 978-981-16-6332-1 Series ISSN: 2524-7565	PCE	Springer
66	Dr. Shuchi Dave,Dr. S.D Purohir,Dr. Ritu Agarwal,Aman,Deepak Saksham		SMART LADY E-WEARABLE SECURITY SYSTEM FOR WOMEN WORKING IN THE FIELD		CIS2020	International	2021	Print ISBN: 978-981-33-4581-2 Online ISBN: 978-981-33-4582-9	PCE	Springer
67	1. Manish Dubey 2. Manish Choubisa		Best Practices of Machine Learning Methods in the Field of Cybersecurity: A Review		International Conference on Artificial Intelligence:	International Conference	2021	Print ISBN: 978-981-16-6331-4 Online ISBN: 978-981-16-6332-1	PCE	
68	Harshwardhan Singh Chouhan, Raj Kumar SatankarRam Vilas Meena1		Construction & Demolition Waste as an Alternative of Rigid Pavement Materials: A Review		ICSEEGT2021	International	2021		PCE	IOP Publishing Ltd
69	Teekam Singh1 , B L Swami2 , Pawan Kalla3 , Harshwardhan Singh		Effect Of Nano Particle Based Anti-Stripping Agent On Moisture Induced Damage For Bituminous Concrete		ICSEEGT2021	International	2021		PCE	IOP Publishing Ltd
70	Dr Surendra Kumar Yadav, Dr Manju Kaushik		Comparative Study of Effectiveness on Class Participation of Computer Science Teaching by Online		International Conference on Global Entrepreneurship	International	2021		PCE	
71	Dr Surendra Kumar Yadav, Yati Chouhan, Manish Dubey		A Comparative Study of Cloud System Scheduling for Load Balancing		International Conference on Global Entrepreneurship	International	2021		PCE	
72	Dr Surendra Kumar Yadav, Shalu J. Rajawat, Manju Kaushik		Security Issues with Fraud detection & Prevention in e-Banking System:A Review		International Conference on Global Entrepreneurship	International	2021		PCE	
73	Garima Mathur, Amit Kumar Jain, Tarun Mishra		Modified Rectangular Patch Antenna for WLAN & Wi-MAX Application		International Conference on Communication & Computational	International	2021	Print ISBN: 978-981-16-3245-7 Online ISBN: 978-981-16-3246-4	PCE	Springer

74	Meena R., Chouhan H.S., Jain J.K., and Satankar R.K.,		Construction & demolition waste as an alternative of rigid pavement material: A Review		International Conference on Sustainable Energy, Environment and	International	2021	ISSN: 1755-1315	PCE	IOP Publishing Ltd
75	Mistri P., Pathak K. and Satankar R.K		Building and Performance Evaluation of Novel Solar Cooking System in Gujarat, India		International Conference on Sustainable Energy, Environment and	International	2021	795 012015	PCE	IOP Publishing Ltd
76	Gaurav Jain, Pankaj Verma, Nitish Katal, Kuldeep Jayaswal		Global Maximum Power Point Tracking methods for Multi-Peak Power versus Voltage Curve of Photovoltaic: A		IEEE CONFERENCE ICRAIE 2021	International	2021	Electronic ISBN:978-1-6654-3402-7 Print on Demand(PoD) ISBN:978-1-6654-3403-4	PCE	IEEE-ICRAIE
77	Amit Kumar Jain, Tarun Mishra & Garima Mathur		Modified Rectangular Patch Antenna for WLAN and WiMAX Application		Proceedings of International Conference on Communication and	International	2021	Print ISBN 978-981-16-3245-7 Online ISBN 978-981-16-3246-4	PCE	Springer
78	SURENDRA KUMAR SAINI, Arpit Singh		Modeling of Surface Roughness of Abrasive Jet Machined Nanocomposite using Artificial Intelligence		7TH INTERNATIONAL CONFERENCE ON ADVANCED	International	2021		PCE	
79	SURENDRA KUMAR SAINI, Md. Yusuf Rahmani		Ultrasonic Welding of Composites: A Review		International Conference On Futuristic Developments In		2021		PCE	
80	Shuchi Dave, Aman Jain, Deepak Sajnani, and Saksham Soni		Women Shield		SCRS conference Proceeding on intelligent system	National	2021	ISBN: 978-93-91842-08-6-4	PCE	SCRS publication
81	Payal Bansal, Pallavi spakale, Sandhya shrama		Minimization of Power in Home Automation by IOT Based Interactive Home		ICIMMI 2021	International	2021	Print ISBN 978-981-19-2064-6 Online ISBN 978-981-19-2065-3	PCE	Springer
82	DR. Kuldip Sharma		English Language and Society		Paper Presented in 15th International and 51st Annual Conference of ELTAI,		2021		PCE	
83	Mr. Gaffar Momin, Dr. Narayan Lal Jain, Aakansha P. Pukar		Design and Manufacturing of Engine Heath Monitoring System for Two Wheeler		International Online Conference on Emerging Trend in Multi Disciplinary		2021		PCE	
84	Manoj Sharma, Dr. Narayan Lal Jain, Dr. Jayant Kishor Purohit		Biomedical Waste Management and Circular Economy Actions in the COVID-19 Pandemic Situation		2ND INTERNATIONAL CONFERENCE ON INDUSTRIAL AND		2021		PCE	
85	Pankaj Dhemla, Prakash Somani, B.L. Swami, Arun Gaur		Optimizing the design of sintered fly ash light weight concrete by Taguchi and ANOVA analysis		Second International Conference on Engineering	International	2021		PCE	Elsevier
86	Akash Rawat, Arpita Tiwari, Sonam Gour, Ravi Joshi		Enhanced Performance of Metamaterials Loaded Substrate Integrated Waveguide Antenna For		2021 IEEE International Conference on Mobile Networks	International	2021	ISBN: 978-0-7381-4637-9	PCE	IEEE
87	Pankaj Dhemla, B L Swami and Prakash Somani		Experimental Investigation of Light Weight Concrete Using Sintered Fly Ash Aggregates 795 (2021) 012032		International Conference on Sustainable Energy, Environment and	Internatioanl	2021	ISSN: 1755-1315	PCE	IOP Publisher
88	Bhuvnesh Rathor, Anamika Kumari, Ajit Singh Rajawat, Vishvendra Singh		Robust Control Techniques for Four-Area System with DFIG System		6th IEEE International Conference on Recent Advances	International	2021	Electronic ISBN:978-1-6654-3402-7 Print on Demand(PoD) ISBN:978-1-6654-3403-4	PCE	IEEE
89	Shubham Dadhich; Arun Dev Dhar Dwivedi; Garima Mathur		Surface Charge Based Modeling of TIPS-Pentacene TFT		8th International Conference on Smart Computing and	International	2021	Electronic ISBN:978-1-7281-9687-9	PCE	IEEE
90	Sagar Gupta, Garima Mathur, Venkatesan R, and S. Purushotham	Applications of Artificial Intelligence for Smart Technology	Enhancement of Toll Plaza System With Smart Features				2021	ISBN13: 9781799833352	PCE	IGI-Global
91	Shivanshi, Vijay Bahadur Singh & Arvind Kumar Jha		Geotechnical Properties of Lime Treated Soil Contaminated with Sulphatic Water		Proceedings of the Indian Geotechnical Conference 2019	International	2021	Print ISBN 978-981-33-6443-1 Online ISBN 978-981-33-6444-8	PCE	Springer
92	Pravin M. Sonwane; Pankaj Gakhar; Tarun Varshney; Neeraj Kumar Garg; Kuldeep		Optimal allocation of Distributed Generator placement: An optimal approach to enhance the		6th IEEE International	International	2021	Electronic ISBN:978-1-665	PCE	IEEE
93	Gaurav Kapoor; Pankaj Gakhar; Pankaj Verma; Pravin Sonwane; Bhuvnesh Rathore		A Double-Ended Scheme for Fault Identification and Phase-Type Categorization in Fixed Series Compensated		6th IEEE International Conference on Recent Advances	International	2021	Electronic ISBN:978-1-665	PCE	IEEE
94	Virendra Sharma; Jayesh Verma; Pravin Sonwane; Harsh Sharma; Aditya Gupta;		Power Management and voltage regulation of self governed hybrid RE source microgrid system for		6th IEEE International Conference on Recent Advances	International	2021	Electronic ISBN:978-1-6654-3402-7	PCE	IEEE
95	Virendra Sharma; Kavita Rawat; Gaurav Jain; Nishant Agrawal; Shaaz Rizvi; Prabhat		Hybrid SPV & Fuel-Cell power optimization by Battery Storage System for utility network load with & without		6th IEEE International Conference on Recent Advances	International	2021	Electronic ISBN:978-1-665	PCE	IEEE
96	Mohammad Asif Iqbal & Virendra Sangtani	Algorithms for Intelligent Systems book series (AIS)	Investigation and Assessment of TCAD-Based Modeled and Simulated PPV/PCBM Bulk Heterojunction Solar Cells		Proceedings of International Conference on Computational	International	2021	Online ISBN 978-981-16-4103-9 Print ISBN 978-981-16-4102-2	PCE	Springer
97	Dr. Ajay Yadav, Namrata Saxena Yadav	Fiber Optics Communications	Subject Book			National	2020	ISBN-10 : 9383266430 ISBN-13 : 978-9383266432	PCE	Ashirwad Publications, Jaipur
98	Asha Kumawat, Sanjay Kumawat	Mechatronics System	Subject Book			National	2020	ISBN: 9788194250661	PCE	Ashirwad Publication, Jaipur

99	Trimesh Kumar, Mayank Sharma and Brijraj Singh Solanki		New Designs and Analysis of Multi-Core Photonic Crystal Fiber Using Ellipse with Different Radiuses and Angles		International Conference on Artifical Intelligence: Advances and	International	2020	Print ISBN: 978-981-15-1058-8 Online ISBN: 978-981-15-1059-5	PCE	Springer
100	Payal Bansal; Ashok Kumar Kajla ; Manisha Kmawat; Devendra		Study of MSPA in Aspect of design & Parameter with Three Different Substrate Materials		2020 5th IEEE International Conference on Recent Advances	IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
101	Devendra Somwanshi, Kalpit Jain, Dhananjay Kumar		Optimal Parameter Selection for Multi Blade Granite Block Cutting Machine Ensuring High Production		5th IEEE International Conference on Recent Advances	IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
102	Kalpit Jain, Devendra Somwanshi, Akshay Jain		Effect of Process Parameter on Plastic Parts Using ANOVA with Moldflow Simulation		International Conference on Advances in Materials Processing	Springer	2020	Print ISBN: 978-981-16-0908-4 Online ISBN: 978-981-16-0909-1	PCE	Springer
103	Abhilasha, Vyas V., Rathore V.S., Chaplot N.		Analysis of Diseases in Plant's Leaves Using Deep Learning Techniques		Information and Communication Technology for Competitive	Springer	2020	Print ISBN: 978-981-16-0881-0 Online ISBN: 978-981-16-0882-7	PCE	Springer
104	Pravin Sonwane;Vaishali Shirsath;Himani Sharma;Gaurav Jain		Failure Analysis of 30 Bus System by Capacitor Sizing and Placement		2020 5th IEEE International Conference on Recent Advances	International IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
105	Bhuvnesh Rathor;Gaurav Jain;Rajkumar Jain;Pravin Sonwane		Smart Modern AC Microgrid Monitoring System using Power Line Communication		2020 5th IEEE International Conference on Recent Advances	International IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
106	Pravin Sonwane;Vaishali Shirsath;Tarun Varshney		Optimal Placement of Shunt Capacitor to Enhance Distribution System Reliability		2020 IEEE International Conference on Power Electronics,	International IEEE	2020	ISBN: 9781728156736	PCE	IEEE
107	Jain, G., Kapoor, G., Yadav, A.,		Protection of Wind Park Incorporated Series Compensated Transmission Line Using DMWT		IEEE first International Conference on Power, Control And	IEEE	2020	ISBN: 1-7281-4998-3 1-7281-4997-5	PCE	IEEE
108	Garima Mathur, Sanjeev Yadav, Amit Kumar Jain & Tarun Mishra		Monitoring and Detection of Blood Flow based on Internet of Things		5th IEEE International Conference on Recent Advances	IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
109	Durgesh Kumar, Mahendra Choudhary		Design and Analysis of Ultra High Speed 16 Channel Cascaded EDFA-DWDM Network with Post		IEEE International Conference ICRAIE 2020	IEEE	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE
110	1.Mr. Manish Dubey , 2.Ms. Upma Kumari , 3. Dr. Sonal Sharma		Food recognitions system using SVM classification approach		33rd National Convention of Computer Engineers and National	National Conference	2020		PCE	
111	Mukesh Kataria and Pawan Kumar Patidar		Image Enhancement Performance of Fuzzy Filter and Wiener Filter for Statistical Distortion		Information Management & Machine Intelligence (ICIMMI 2020)	International	2020	Print ISBN: 978-981-15-4935-9 Online ISBN: 978-981-15-4936-6	PCE	Springer
112	Gaurav kapoor, Anamika Yadav, Gaurav Jain, and Raj Kumar Jain.		Protection of Series Capacitor Compensated Wind Park Connected Transmission Line Using HHT		In 2020 International Conference on Power Electronics &	International	2020	Electronic ISBN:978-1-7281-6575-2 DVD ISBN:978-1-7281-6574-5	PCE	IEEE
113	Dr. Shalini Puri		Efficient Fuzzy Similarity based Text Classification with SVM and Feature Reduction		Congress on Intelligent Systems (CIS 2020)	International	2020	Print ISBN: 978-981-33-6983-2 Online ISBN: 978-981-33-6984-9	PCE	Springer
114	Dr. Shalini Puri		A Review on Dimensionality Reduction in Fuzzy and SVM based Text Classification Strategies		Congress on Intelligent Systems (CIS 2020)	International	2020	Print ISBN: 978-981-33-6983-2 Online ISBN: 978-981-33-6984-9	PCE	Springer
115	Prachi Shah, Amit Kumar Jain, Tarun Mishra and Dr. Garima Mathur		IoT-Based Big Data Storage Systems in Cloud Computing		Second International Conference on Smart Energy and	International	2020	Print ISBN: 978-981-15-6706-3 Online ISBN: 978-981-15-6707-0	PCE	Springer
116	Brijraj Singh Solanki, Renu Kumawat, Seshadhri Srinivasan		An Impact of Different Uncertainties and Attacks on the Performance Metrics and Stability of Industrial Control		2nd International Conference on Communication and Intelligent Systems	International	2020	Print ISBN: 978-981-16-1088-2 Online ISBN: 978-981-16-1089-9	PCE	Springer
117	A Kajla, D Somwanshi		Reconfigurable Microstrip Patch Array Antenna: Design and Performance		International Conference on Artificial Intelligence:	International	2020	Print ISBN 978-981-15-1058-8 Online ISBN 978-981-15-1059-5	PCE	Springer
118	A Kajla, D Somwanshi		Lamp-Shaped Frequency Reconfigurable Microstrip Patch Array Antenna Design and Analysis		International Conference on Artificial Intelligence:	International	2020	Print ISBN 978-981-15-1058-8 Online ISBN 978-981-15-1059-5	PCE	Springer
119	Dadhich, T., Gupta, S.		Detecting Aggressive Driving Behavior using Spectral Kurtosis and MEMS accelerometers		Second International Conference on Information	International	2020	Print ISBN 978-981-15-9688-9 Online ISBN 978-981-15-9689-6	PCE	Springer
120	Sakar Gupta, Sunita Gupta		Analysis and Comparison of Sensor Node Scheduling Heuristic for WSN and Energy Harvesting WSN.		Smart Systems and IoT: Innovations in Computing-2020	International	2020	Print ISBN 978-981-13-8405-9 Online ISBN 978-981-13-8406-6	PCE	Springer
121	Dr. Anila Dhingra,Ravi Kumar Pokharna, Ritesh Kumar Jain, Prashant Sharma		Nodemcu based power monitoring system using iot"		33rd National Convention of Computer Engineers,	National	2020		PCE	
122	Dr. Anila Dhingra, Aadesh Sharma		A Reference Model for Internet of Things Middleware		33rd National Convention of Computer Engineers,	National	2020		PCE	
123	Himani Goyal, Rina Sharma, Devendra Somwanshi		A Comparison of Lifetime in WSN with Static and Mobile Sink		5 th IEEE International Conference On Recent Advances	International	2020	ISBN: 1728188687, 9781728188683	PCE	IEEE

124	Sunil Pal and Surendra Kumar Saini		Experimental Study on Movement of Crankshaft during Machining		International Conference on Evolution in Manufacturing	International Conference	2020	Print ISBN: 978-981-16-3032-3 Online ISBN: 978-981-16-3033-0	PCE	Springer
125	Rajesh Kumar Mohanty and Surendra Kumar Saini		Optimization of EDM Process Parameters for Machining of Steel		International Conference on Evolution in Manufacturing	International Conference	2020	Print ISBN: 978-981-16-3032-3 Online ISBN: 978-981-16-3033-0	PCE	Springer
126	Sunil Pal and Surendra Kumar Saini		Productivity Improvement of Crankshaft Manufacturing Industry.		International Conference on Industrial and Manufacturing	International Conference	2020	eBook ISBN 978-3-030-73495-4 Series ISSN 2522-5022	PCE	
127	Abhishek Mukhija and Surendra Kumar Saini		Study of Hardness in Sand Casting of SG Iron		2nd International Conference on Recent Advances in Mechanical	International Conference	2020	Print ISBN: 978-981-15-9677-3 Online ISBN: 978-981-15-9678-0	PCE	Springer
128	Surendra Kumar Saini		Role of Indian Industries to Accelerate Engineering Education after COVID-19		International Online Conference "COVID-19:Emergence and Resurgence of	International Conference	2020		PCE	
129	Surendra Kumar Saini and Prashant Kumar		CNC turning process parameters optimization for stainless steel		International Conference on Systems, Control and Computing	International Conference	2020	Print ISBN: 978-981-33-4861-5 Online ISBN: 978-981-33-4862-2	PCE	Springer
130	Abhishek Mukhija and Surendra Kumar Saini		Optimization of Sand Casting of SG Iron		International Conference on Systems, Control and Computing	International Conference	2020	Print ISBN: 978-981-33-4861-5 Online ISBN: 978-981-33-4862-2	PCE	Springer
131	Ramesh Chand Meena; Mahesh Bundele; Meenakshi Nawal		RYU SDN Controller Testbed for Performance Testing of Source Address Validation Techniques		3rd International Conference on Emerging Technologies in	International	2020	Electronic ISBN:978-1-7281-1683-9 Print on Demand(PoD) ISBN:978-1-7281-1684-6	PCE	IEEE
132	Devendra Somwanshi & Anmol Chaturvedi		Design and Optimization of a Grid-Connected Hybrid Solar Photovoltaic-Wind Generation System for an		International Conference on Artificial Intelligence:	International	2020	Online ISBN 978-981-15-1059-5 Print ISBN 978-981-15-1058-8	PCE	Springer
133	ıkaj Gakhar & Manoj Gu	Algorithms for Intelligent Systems	Power Quality Improvement in a Grid-Tied SPV System Using Fractional-Order Proportional Integral		International Conference on Artificial Intelligence:	International	2020	Print ISSN: 2524-7565 Online ISBN 978-981-15-1059-5	PCE	Springer
134	Arun Dev Dhar Dwivedi, Sushil Jain, Rajeev Dhar Dwivedi, Shubham Dadhich	Hybrid Nanomaterials - Flexible Electronics Materials	Numerical Simulation and Compact Modeling of Thin Film Transistors for Future Flexible Electronics			International	2020	ISBN 978-1-83880-338-4 PRINT ISBN 978-1-83880-337-7	PCE	
135	Kamlesh Lakhwani, Sandeep Bhargava, Kamal Kant Hiran, Mahesh M Bundele,		Prediction of the Onset of Diabetes Using Artificial Neural Network and Pima Indians Diabetes Dataset		5th IEEE International Conference on Recent Advances	International	2020	ISBN: 9781728188683 ISSN: 2639-7420	PCE	IEEE
136	Mahesh Bundele, Harish Sharma, Mukesh Gupta, Pushpendra Singh		An elderly fall detection system using depth images		5th IEEE International Conference on Recent Advances	International	2020	ISBN: 9781728188683 ISSN: 2639-7420	PCE	IEEE
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142	Garima Mathur, Harish Sharma, Mahesh Bundele, Nilanjan Dey, Marcin Paprzycki	Algorithms for Intelligent Systems book series (AIS)	International Conference on Artificial Intelligence: Advances and Applications			International	2020	eBook ISBN 978-981-15-1059-5 Series ISSN 2524-7565	PCE	Springer
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145	Devendra Somwanshi, Anmol Chaturvedi and Pushpendra Mudgal	Algorithms for Intelligent Systems book series (AIS)	ABCD Features Extraction-Based Melanoma Detection and Classification		International Conference on Artificial Intelligence:	International	2020	Online ISBN 978-981-15-1059-5	PCE	Springer
146	Anmol Chaturvedi, Devendra Somwanshi, Mahesh Bundele & Charu Dubey	Algorithms for Intelligent Systems	Monitoring and Traffic Optimization Using Vertical Controller in Multi-domain SDN		International Conference on Artificial	International	2020	Online ISBN978-981-15-1059-5	PCE	Springer
147	it Mamodiya, Neeraj Tiwari		Design, Implementation & Performance Analysis of Solar Tracking System on Simulink Platform		IOP Conf. Series: Materials Science and Engineering	International	2020	ISSN : 1757-899X	PCE	IOP publisher
148	Shailendra Kasera; Rajlakshmi Nayak; Shishir Chandra Bhaduri		Energy Efficiency Analysis of Variable Speed DC Compressor using R290		International Conference on Recent Advances and Innovations in	International	2020	Electronic ISBN:978-1-7281-8867-6	PCE	IEEE

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152	Deepti; Ajay Khunteta; Ajit Noonia		An Efficient Two Stage Clustering Algorithm for Signed Social Networks		5th IEEE International Conference on Recent Advances	International	2020	Electronic ISBN:978-1-7281-8867-6	PCE	IEEE
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155	Virendra Swaroop Sangtani, Jaswant Suthar, Ajay Kumar Bansal	Algorithms for Intelligent Systems (AIS)	Optimal Design of a Stand-Alone Hybrid System Using GA, PSO and ABC		International Conference on Artificial Intelligence:	International	2020	Book ISBN 978-981-15-1059-5 Series ISSN 2524-7565	PCE	Springer
156	M. Babita Jain & Venu Gopala Rao		A Clustering and Weighted Euclidean Norm-Based Short-Term Load Forecasting of Normal and Anomalous Days		Innovations in Electrical and Electronic Engineering	International	2020	Print ISBN 978-981-15-4691-4	PCE	Springer
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158	Dr. Ajay Yadav, Amit Kumar Jain	Microwave Theory & Techniques	Subject Book			National	2019	ISBN-10 : 819425065X ISBN-13 : 978-8194250654	PCE	Ashirwad Publications, Jaipur
159	Rekha Nair, Meena Tekriwal, Harshit Tiwari	Algorithms for intelligent systems Springer book series (AIS)	Air Quality Status in Jaipur and nearby Areas of Rajasthan		International Conference on Artificial Intelligence:	International	2019	Print ISBN: 978-981-15-1058-8 Online ISBN: 978-981-15-1059-5	PCE	Springer
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171	Sonal Sharma, Sandeep Kumar, and Kavita Sharma		Improved Gbest artificial bee colony algorithm for the constraints optimization problems		Evolutionary Intelligence	International	2019	https://doi.org/10.1007/s12065-019-00231-8	PCE	Springer
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Chapter 3

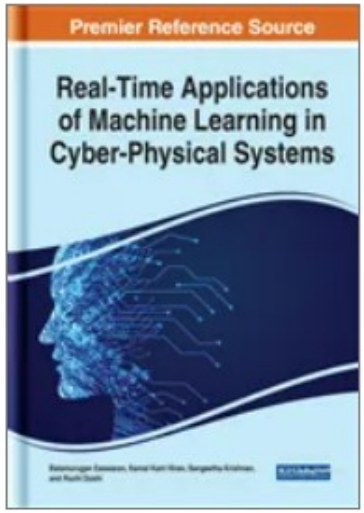
Analysis of Big Data in electroencephalography (EEG)

Sagar Motdhare[1], Garima Mathur[1] and Ravi Kant[2]

Abstract

Human beings have expansive tendencies and coherent thinking abilities. A few of these are grown hereditarily, while a few are displayed in the course of knowledge. These progressions may be seen in various scales along with elements of neurons. Subsequently, it is fundamental to examine the neuronal conduct in tremendous information sizes above various human networks. "Big Data analytics" is arising quickly as an examination zone in the research area. It goes about as an apparatus to aggregate, examine, and oversee enormous amount of disparate, organized and unstructured information, especially in the current clinical frameworks. Big Data idea is unfathomably useful in the sickness discovery region like identification of epileptic seizure. In any case, the conversion pace and exploration openings are deferred by several essential matters in the Big Data model. The fundamental target of this section is to numerically display the information created by an electroencephalography (EEG) acquisition method. Utilization of Big Data in dealing with an immense measure of information is proposed to investigate. Furthermore, we explore the utilization of Big Data in epileptic EEG assessment.

Keywords: Artifacts; Big Data; Compression standard; Electroencephalography (EEG); EEG activity; EEG application; EEG channels; EEG framework; EEG recording system; EEG data storage; EEG video; Electrode placement system; Epilepsy; Human mind; Mathematical model; Medicine; Neurology; Sampling rate; Sample size; Seizure



Crop Protection Using Cyber Physical Systems and Machine Learning for Smart Agriculture

Manish Choubisa (Poornima College of Engineering, Jaipur, India) and Ruchi Doshi (Azteca University, Mexico)

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Abstract

Currently the world is experiencing the global digital transformation of the fourth generation revolution for industry in the field of cyber physical systems (CPS) and artificial intelligence. Moreover, by utilizing artificial intelligence, cyber physical systems will be able to perform more proficiently, collaboratively, and spiritedly. Agriculture crop control is a process to protect the crop as much as possible so the crop is not infected by the different kinds of pests. Pests are any living organisms including insects, animals, weeds, pathogens, and other creatures that can harm the agriculture crop. Pests and other diseases cause an average of 20-30% global potential loss of crop production in every year. So, crop protection is required to reduce these losses. This chapter explores CPS concept to improve crop production to protect the crop from wild animals using machine learning and cyber physical systems. The smart agriculture process under CPS includes crop suggestion, irrigation and fertilization automation, crop protection, plant monitoring, and harvesting.

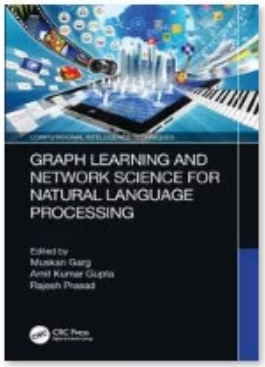
Chapter Preview

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Introduction

In this digital era, embedding the biotechnology, informational technology and physical space has directed to the 4th revolution in industry i.e. industry 4.0. These revolution in industry has change the life style of human being. The main feature of revolution is transition from semi-adapted fabrication to mass, fully-adapted manufacturing. The emerging technologies for such revolution are embedded system, Internet of Things (IoT), Artificial Intelligence and Machine Learning and many cloud services with next generation internet technology. In basic level of the production line, actuators, sensors devices armed with wired or wireless communication networks are combined and convert the designing of embedded system in to CPS. The major processing units used to monitor and control the CPS in physical space.

The crop protection method are presented in terms of (i) brief introduction new resolution in industry 4.0 and cyber physical system (ii) Smart Agriculture process (iii) prototype designing for crop protection using Machine learning and (iv) pest identification using different sensor techniques.



Chapter

Analysis of Medical Images Using Machine Learning Techniques

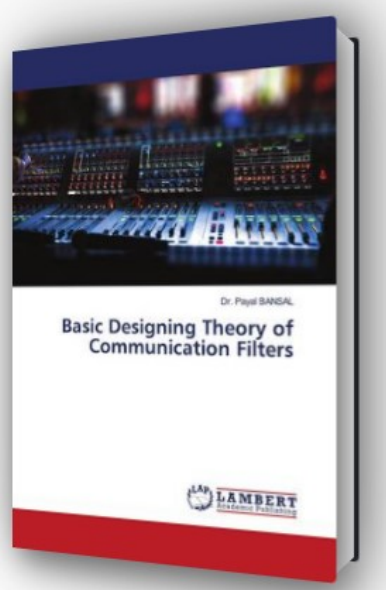
By Nikita Jain, Mahesh Kumar Joshi, Vishal Jain, Manish Dubey

Book Graph Learning and Network Science for Natural Language Processing

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ABSTRACT

In medical research and development, the computational domain provides support and calculative power to perform unique and innovative tasks, among which image categorization is a huge and an important issue. In the world of medical science, every day doctors encounter with various types of image-related problems. Pattern classification is a solution to categorize images. In the human body, the brain plays a vital role, and the sudden growth of anomalous tissues in the brain can cause brain cancer. When unusual cells and tissues grow relatively slowly, the resulting tumors are classed as benign, which indicates they are non-cancerous, whereas in malignant tumors, the cells grow very rapidly and cause serious harm to the brain, often leading to death. There are many methodologies for producing medical images of the brain. Among them, magnetic resonance imaging is a very powerful technique for producing digital images of internal slices of the brain. This information is very helpful for medical diagnosis and research. To identify and classify a tumor in the human body, the first process is image acquisition, then image segmentation techniques are used to explore the anomalous tissues. The method proposed in this chapter is motivated by the need for improved and quicker medical image analysis for brain tumors. In this image segmentation approach, Otsu's method is used along with principal component analysis to select the appropriate features for extraction. The gray level co-occurrence matrix method is used to calculate some valuable texture parameters, and finally, machine learning techniques and kernel functions are used to achieve high accuracy with the help of support vector machines.



Basic Designing Theory of Communication Filters

978-620-4-74453-7

This book presents a new approach to designing spatial filters (frequency selective surfaces) having extensive applications in communications and radar systems. A Frequency Selective Surface (FSS) can be deliberated to be a surface creation working as a filter for plane waves at any angles of incidence. Frequency selective surface has been extensively used in broadband communications, radar systems, and antenna technology. In the present days there is an increasing demand for multifunctional antennas for communication systems.

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CHAPTER 16

Role of reduction techniques in VLSI design

Payal Bansal[1], Uma[2] and Abhishek Sharma[3]

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Pages 16-1 to 16-14

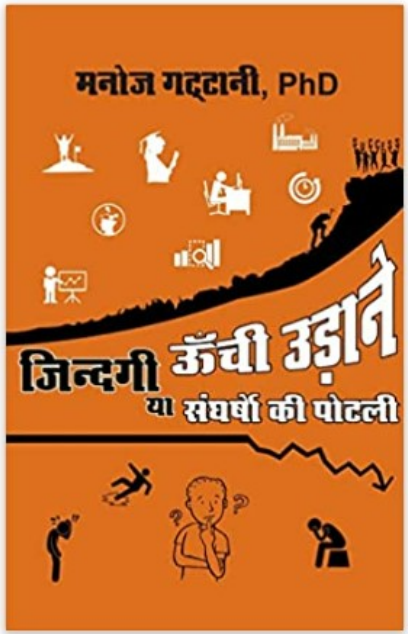
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Abstract

In the final chapter, Payal *et al* have described the role of reduction techniques in VLSI design. The authors have described different types of process variations and the die-to-die and within-die process variations in a VLSI system. The hardware can have devices affected by process variation and NBTI. The authors have later explained the methodology used to reduce the effect of process variation in VLSI circuits.





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Chapter

Relationship Formed for Process Time Using An Approach of a Mathematical Model for Sewing Machine Operation

By Swapna Ghatole, Yashpal, Mahesh Bundele, J. P. Modak

Book Sustainable Engineering, Energy, and the Environment

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Pages	18
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ABSTRACT

Pedal sewing operation is a man-machine system. This operation takes place at a workstation usually known as single-person-owned premises meant for stitching clothes of the clients of the shop owner. The data collected comprises 30 sewing machine operators working on standalone pedal-driven sewing machines. The field study indicated that there is a considerable Musculoskeletal disorder on the part of the operator. Based on this data, mathematical co-relationships are established between various causes and effects of this activity. The chapter reports on: (i) planning of collection of data; (ii) execution towards collection of data; (iii) presentation of collected data; (iv) processing of the data for formulation of cause-effect relationships. Upon formulation of model, the reliability of model and its optimization is executed. The collection of data was done on 40 causes/input parameters/ independent variables and 1 effects/output parameters/dependent variables. The causes are clubbed and converted into five independent dimensionless terms known as pi terms such as Π_{11} Π_{21} Π_{31} Π_{41} Π_{5}. The effects/output/ dependent parameter is nomenclated as Z1.

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Hybrid Layered Classification Model for Heart Disease Diagnosis

Conference Paper · April 2022

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Hybrid Layered Classification Model for Heart Disease Diagnosis

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***Abstract*— Over past few decades due to hectic schedule and careless behavior of human much of disease has arises in form of life killer. Among several Heart diseases is one of the most leading destroyer diseases around the globe. Only a precise and timely forecast of this disease can aid in its prevention. Although many ways have been presented to assist professionals, each algorithm has its own set of obstacles. To improve the prognosis accuracy with low false alarms a new ensemble algorithm has proposed in this paper. To show the effectiveness of proposed approach it has simulated with the traditional and modern algorithm. The results indicates that proposed approach has improve prediction accuracy significantly.**

Keywords— Data mining, Hybrid layer Classification, Naive bayes, Human Heart, Neural Network, Multi-Level Perceptron, Decision Trees

I. INTRODUCTION

Over the last ten years, heart disease at a very high rates all over the world. Cardiac disease has been dedected by many data mining techniques. The healthcare business now produces a vast amount of data about patients' disease diagnoses, which is used to create biological databases. To extract those datasets, the majority of health-care firms use sophisticated healthcare information systems. These databases are consulted to uncover concealed patterns or connections among information. data mining uses a variety of strategies to uncover hidden knowledge in medical databases. The basic goal of a healthcare organization is to deliver high-quality care at a reasonable price. The term "quality of service" refers to correctly identifying diseases and providing patients with effective treatments. Working with databases of cardiac patients can be comparable to a real-life situation. Do the following to assign a weight to each attribute; the doctor's comprehension is essential. There is a need for more weight. Our blood arteries grew weak as a result of the fatty foods we ate, which might lead to a variety of heart ailments. Increased artery pressure can cause the heart's walls to thicken. It can cause a blood clot, which can lead to heart problems.
This research introduces a novel way for decreasing the complexity of diagnosing heart disease by using a novel data mining ensemble classification technique.

II. HUMAN HEART STRUCTURE AND HEART DISEASE EFFECT

The soul is a hollow muscle in the human body that uses repetitive, rhythmic contractions to pump blood throughout the blood arteries. The weights of mature human heart around 250 to 350 grms 1]. The striated muscular tissue of the heart is known as cardiac muscle, and it is exclusively present in the heart. Pump blood is very crucial for the heart. Over the course of a 66-year lifespan, 72 beats per minute an average human heart beat and will beat 2.5 billion times and pump 4.7-5.7 liters of blood every minute.

Many heart disease risk element can be managed, while others cannot.

- **Age:** People 65 and older make up there are over 83 percent of those people pass away with coronary artery disease heart disease. Older women die from heart attacks easily as compared to older men.
- **Being male:** Men Suffers from heart attack more easily as compared to women, and typically experience heart attacks when they were younger. Women's hearts continue to beat even after menopause and death rates rise, they are still lower than men's.
- **Family history:** People who have heart disease in their It is more likely that parents or close relatives may contract it.
- **Race:** Heart disease is more common in African Americans, Indigenous People, Mexican Americans, , local Hawaiians, and other Asian Americans than in Caucasians.
- **Smoking:** Heart disease must be increase when we smoke.
- **High cholesterol:** The risk of coronary heart disease increases as blood cholesterol levels rise.
- **High blood pressure:** The stress on the heart is increased by high blood pressure, It thickens and stiffens as a result of this. You're also more likely to have a stroke, a heart

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attack, kidney failure, or congestive heart failure. The risk of a heart attack or stroke is increased by smoking, having hypercholesterolemia, and having diabetes amplifies the prospect of a myocardial infarction or stocks.

- **Sedentary lifestyle:** Idle is associated to an increased risk of coronary heart disease.
- **Diabetes:** Diabetic patients are at a higher risk of getting coronary artery disease Diabetics die from heart or blood vessel disease in about three-quarters of cases.
- **Too much weight:** High cholesterol: The risk of coronary heart disease increases as blood cholesterol levels rise.
- **Excessive blood pressure:** The stress on the heart is increased by high blood pressure, causing It will thicken and stiffen as a result of this. You're also more likely to have a stroke, a heart attack, kidney failure, or congestive heart failure. The risk of a heart attack or stroke is increased by smoking, having high blood cholesterol, and having diabetes and the risk of a heart attack or stroke is magnified multiple times.
- **Stationary lifestyle**: Ideaness is linked to an increased risk of coronary heart disease.
- **Diabetes:** Patients with diabetes are more likely to develop cardiovascular disease. Diabetics die from heart or blood vessel disease in about three-quarters of cases.
- **Extra weight:** Even if they have no other risk factors, those people with extra body fat around the waistline is more predictive of heart disease and stroke.

III. PROPOSED WORK

Methods for mining data are used to create a "Intelligent Heart Disease Prediction System (IHDPS)." Sellappan Palaniappan et al.[2] proposed Naive Bayes, Neural Networks, and Decision Trees. The findings given the mining aims. It aided in the discovery of critical information such as patterns and correlations among healing element linked to heart ailment. IHDPS is a browser-based, convenient, extensible, dependable, and expansible system.

The authors of [3] proposed an unique prediction mechanism based on HRV's (Heart Rate Variability) which is linear and nonlinear features. Statistical and classification techniques were used to develop the multi-parametric HRV characteristic. They also tested HRV's linear and non-linear characteristics in three recumbent positions: supine, left lateral, and right lateral. They put a number of classifiers to the test, including Bayesian classifiers like SVM, decision tree and CMAR [5]. SVM outperformed other classifiers. “The prediction of Heart disease, Blood Pressure and Sugar with the aid of neural networks” Anil Dahiya [6] proposed it. Investigation were conducted on a fictitious directory of patient documentation. For the diagnosis of heart problems, the monitored network has been proposed. Traning can be calculated by back propagation technique. When the doctor provided unknown data to the algorithm, the algorithm recognized the unknown data by comparing it to previously learned information and returned a list of illnesses to which the patient is likely to succumb. For data training and testing, supervised networks, such as neural networks with back propagation algorithms, are used. "Predicting Survival Causes After out of Hospital Cardiac Arrest using Data Mining Method", A decision tree with a patient database is] in their work on health technology and informatics. This might be used for any therapy or condition, and data could be gathered from a service or source of information. A comparison of traditional analysis and data extract analysis, which concluded the data and factors' relevance or effect on the study's condition, indicated the alms of the data extraction approach in the foregather of variables. Skill accession and the necessity together relevant data to develop a suitable model were two significant drawbacks of the procedure. Proposed a grading approach for deriving multiple dimensional properties from ECG data. The associative classifier experiment used a dataset of 670 people separated into two families: healthy family and heart disease sufferers.

“The problem of identifying constrained association rules for heart disease prediction” Carlos Ordonez [9] investigated the situation. Medical records of persons with heart disease who had risk factors, heart perfusion measures, and arterial narrowing were analyzed. To reduce the amount of patterns, three limits were established. The first criterion is that the attributes must only exist on one side of the rule. The second classifies attributes into categories that are boring. The final limitation limits the number of characteristics that may be used in a rule. Experiments revealed that the limitations lowered the number of rules identified while simultaneously shortening the time it took to execute them. In four different cardiac arteries, two sets of criteria were utilized to predict the presence or absence of heart disease. Clinical fact extract approaches give benefit physicians in predicting patient survival and, as a result, adapting their practices. Boleslaw Szymanski presented a unique SUPANOVA [10] has a heuristic for efficient sparse kernel calculation. It was put to good use.

[11] According to R.Subramanian CANFIS is a prototype that was developed by the Canadian National Institute for detected sickness. The CANFIS model's performance was assessed based on training results and classification accuracy. The results show that the CANFIS model is promising in terms of predicting heart disease. A approach was proposed by John Peter [12] to test the accomplishment of unlike grading algorithms on a heart disease dataset. The dataset has a huge amount of information, which necessitates additional time for categorization. Using attribute selection approaches, it was able to reduce the dimensionality of the data. The data is then classified using a variety of classification algorithms. After using the CFS attribute selection approach, it was discovered that the NB classifier has a higher accuracy for heart disease prediction. Maryam Tayef et colleagues. presented a decision tree algorithm-based prognostic model for coronary heart disease in [13]. On a training group of 1640 records, the scientists developed a decision tree with 11 classic CHD associated parameters. As analysis of 706 records from

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training datasets was perform to evaluate their proposal model. The variables were selected using the Gini index, and the resulting tree was trimmed. The authors demonstrated that Using a decision tree technique, hs-CRP levels in the blood and other conventional CHD risk factors markers were combined. They were able to achieve a 94 percent accuracy rate.

To aid in the identification of heart disease, S Silvia Priscila and M Hemalatha present an effective classification strategy in [14], the ECG signal was divided into separate rhythms. The Morphological Filter is used to remove unwanted baseline wandering from the ECG signal before it is further processed. Then, using different intervals such as RR interval, TT interval, and PR interval, The preprocessed ECG is used to extract temporal, statistical, and morphological data. The Real Coded Genetic Algorithm is used to minimize the dimensionality of the features, The recommended PBNN network is used to classify the selected characteristics. The PBNN classifier is used to classify data and categories arrhythmias such as Normal N, LBBB, APB, VE, and VF. To classify cardiac arrhythmia disease, the investigators used the MIT-BIH arrhythmia database. The database contains 250 recordings obtained from outpatient and inpatient.

The purpose of this test is to determine the severity of various heart disorders. The recordings are 30 minutes long and in total the data contain 109,000 beat labels. The data contain 23 NSR items with values ranging from 100 to 124, as well as 25 cardiac abnormalities with values ranging from 201 to 235. The recital of the suggested organization is judge as a function of exactness, precision or recall.

IV. PROPOSED SCHEME

To improve forecast correctness of heart disease an ensemble classification technique has employed in proposed approach. The anticipated scheme predict disease with the prediction power of Naïve Bayes and one of the most popular Artificial Neural Network technique known as Multilayer Perception (MLP). In most cases, a Classification Algorithm is a method for selecting a hypothesis from a set of alternatives that best fits a set of data. Two-step process used in Data classification. In classifier a predetermined set of data classes is built in first step. The classifier build in classification algorithm and used the learning analyzing. Dataset tuples are made by training set and associated with the class labels. Figure 1 depict the process flow diagram of proposed approach.

Schema chart has performed a feature selection mechanism which select an optimal feature and then use naïve bayes as first classification technique to predict disease correctly. Second prediction mechanism i.e. neural network has applied to predict it again. After the classification process the result is compared with the on-hand technique. Both the techniques has applied in a form of layer i.e. one after the other. Each layer is designed with a separate prediction mechanism, in this investigation at first layer the algorithm naïve bayes has been evaluated with the opted minimal set of attributes and after the evaluation process the data that has been correctly predicted has removes from the original dataset. The new dataset have smaller amount of instances with the same attributes. This new dataset has been use as the input datasets of the next layer in proposed designed prediction system. The same data prediction process has been executed again and after completion of such process the accuracy has been calculated on the base of remaining data that has not been predicted correctly. The layering process improves the chance of correctly data prediction.

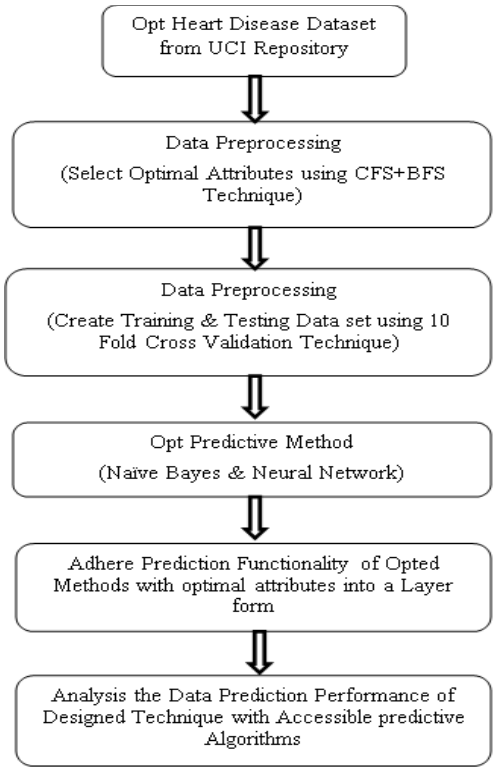


Figure 1: Schema chart of Proposed Work

The Processing steps of proposed approach can be point out as

1. Go to the UCI repository and get a medical dataset of heart disease patient and a healthy individual.
2. Make use of preprocessing approach,
   i. For partitioning the dataset into train and test parts, use the 10-fold cross validation approach.
   ii. Select an optimum feature set using CFS and BFS approach.
3. Analyze data using the Nave Bayes method's prediction mechanism.
4. If the data was successfully predicted, update the dataset by eliminating it from the processed dataset.
5. If data predicted incorrectly it supply to the next technique i.e. MLP for prediction.
6. Repeat step 3 to 5 until complete dataset has not analyzed.
7. Calculate the accuracy of employed method.

V. EXPERIMENTAL RESULTS

Three different dataset i.e. Statlog (Heart) dataset, Z-Alizadeh Sani dataset, and Hungarian dataset are used for the experiments.

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TABLE 1 DATASET USED FOR EXPERIMENTS

S.No.	Dataset	No. of Attributes	Instances
1	Statlog (Heart)	14	270
2	Hungarian dataset	14	294
3	Cleveland dataset	14	303

A. Analysis Performance Using Statlog (Heart) dataset:

The statlog dataset with 14 attributes and 270 instances was used in this round of the experiment. The collection contains the records of 121 people with cardiac disease, as well as 150 healthy people.

TABLE 2 COMPARATIVE PERFORMANCES OVER STATLOG DATASET

S.No.	Prediction Techniques	Accuracy (%)
1	**Proposed Approach**	**95.19**
2	Naïve Bayes	81.11
3	Multi-Level Perceptron (MLP)	78.14

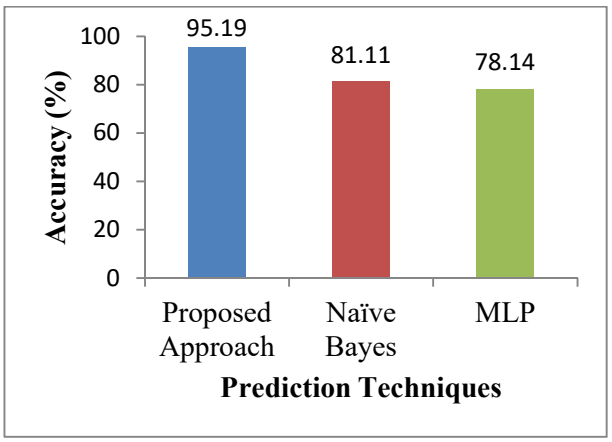


Figure 2: Execution of Prefer Technique with Statlog Dataset

Figure value of table & figure 2 evidently shows the significant results of proposed approach in comparison of others standalone data prediction methods.

B. Analysis Performance of Proposed Scheme Using Hungarian & Cleveland Dataset

Evaluate different approaches with usage of different parameter on different datasets i.e. Hungarian & Cleveland datasets. The table 3 has illustrates the comparative results in same way as analysis at the time of previous evaluation. The statistics of table presents that as the same as previous evaluation results the proposed data prediction technique outperform in comparison of accessible standalone prediction approach performance. The results of evaluation have shown that the designed algorithm has real time efficiency for the data prediction system.

TABLE 3 PERFORMANCES OVER HUNGARIAN DATASET

S.No.	Prediction Techniques	Accuracy (%)
1	**Proposed Approach**	**97.96**
2	Naïve Bayes	84.04
3	Multi-Level Perceptron (MLP)	85.03

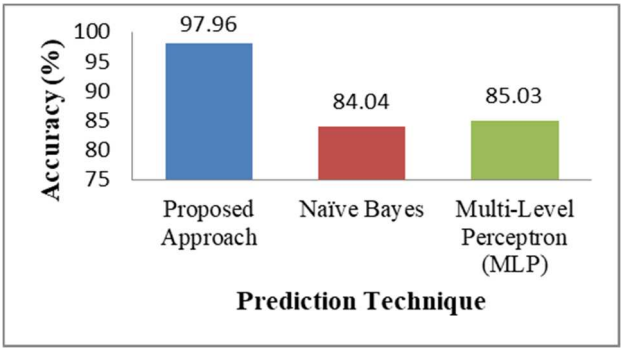


Figure 3 Performance of Prediction Technique with Hungarian Dataset

The above figure has demonstrates that the prediction technique has produces significant evaluation outcome in contrast of standalone prediction approaches as it provides in its previous assessment.

TABLE 4 PROPOSED APPROACH VS RFRS CLASSIFICATION SYSTEM OVER STATLOG HEART DISEASE DATASET

S.NO.	Approaches	Accuracy (%)
1.	**PROPOSED APPROACH**	**95.19**
2.	**RFRS classification system, Xiao Liu 2017, [15]**	92.59

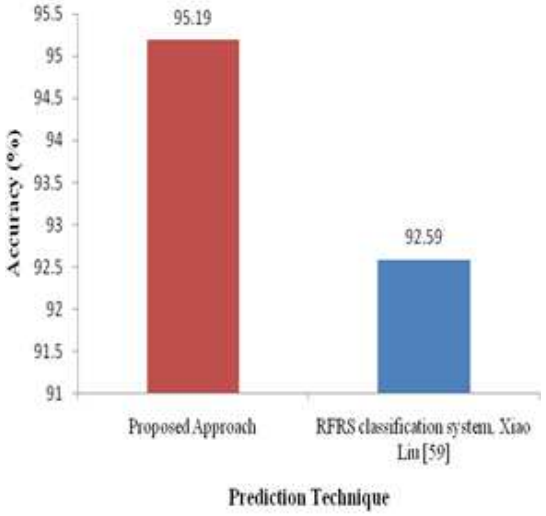


Figure 4: Proposed Scheme vs RFRS classification system over Statlog Heart Disease Dataset [15]

VI. CONCLUSION & FUTURE WORK SCOPE

We analysis our different datasets like Statlog datasets, Hungarian datasets and Cleveland datasets with the 14 no. of attributes for all and varies the instance like 270, 294 and 303 respectively. When 14 attribute and 270 instance is used for ststlog datasets then it obtain 95.19% accuracy as compared to Naïve Bayes and Multi Level perceptron. And when we apply

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these techniques on Hungarian datasets and Cleveland datasets then obtain the accuracy 97.96%. Now observed that these technique is best for Hungarian datasets.

Future work can be done in direction of reducing required data evaluation time which may improve performance of presented approach in a new way.

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Data Mining based Diseases Classification

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Abstract.

Data mining is fast gaining traction in a variety of fields, including organic chemical research, financial forecasting, healthcare, and weather forecasting. Data mining in healthcare is a rapidly growing discipline that may help with prognosis and a better understanding of medical data. Investigation of infirmary for finer well-being decision-making and determent of health centre mistake, early disclosure, and determent of ailment and avertible health centre demise, more utility for funds and cost effectives, and discernment of crooked security claims are all examples of data mining applications in healthcare. Data mining techniques are being used in the detection of a variety of ailments, including diabetes, stroke, cancer, and heart disease. We employ two types of datasets in this study: breast cancer and diabetes databases. We use the WEKA tool to put the techniques into practice. On breast cancer dataset, MLP is better error-free classifier in contrast of remaining with the highest accuracy i.e. 74.12%. On diabetes dataset, SMO is better accurate classifier in contrast of others with the highest accuracy i.e. 79.30%.

Keywords. WEKA tool, Data mining, Diseases.

1. INTRODUCTION

Data mining is an action of analysing enormous data bank to uncover previously unknown patterns, correlations, and information that would be difficult to identify using standard statistical approaches. Data mining is a computational approach that imply the use of intelligent retrieval, predictive analytics, and data bank arrangement to discover figure in enormous number of data file [5]. The extensive motive of the data extract action is to bring out facts from a data cluster and turn it into a formation. Data bank and data administration matter, data pre-processing imitation and inference deliberations, allure measures, difficulty deliberations, post-processing of establish forms, perceptions, and online refurbish are all part of it [3].

In terms of data mining applications, the healthcare business is essential since it generates an extensive range of repository that varies in magnitude, diversity, and rapidness. Condemnatory illnesses such as lymphoma, pulmonary disease, as well as diabetes are among the world's top causes of mortality [6]. Vital information may be obtained from a huge database using data mining tools and methodologies, providing an easy manner for

prophylactic educator to make dominant choices and enhance restorative aid [6]. WEKA is used in view of the fact that it allows ourselves quickly assess and collate knowledge discovery in data algorithms on actual facts [7]. It is now feasible to forecast many disorders more accurately because to developments in computing technology supplied by computer science technologies. As illustrated in Fig 1, data mining may be separated into sub-processes that include data selection, pre-processing, transformation, data mining, and ultimately data interpretation [8]. The classification approach is commonly employed in the health and medical fields. It gives a step-by-step method for creating a classifier model using training data, which is subsequently tested using test data and used to make predictions.

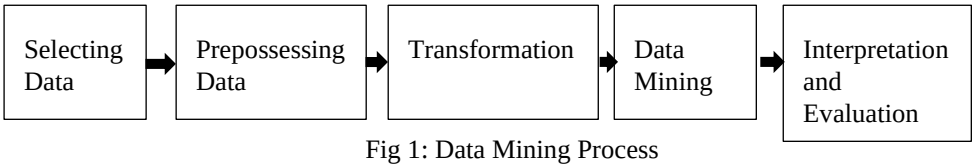


Fig 1: Data Mining Process

*1.1 **Data Excavate Job:*** Fact extraction job may be categorized:

- Prognostic imitation
- Depictive imitation

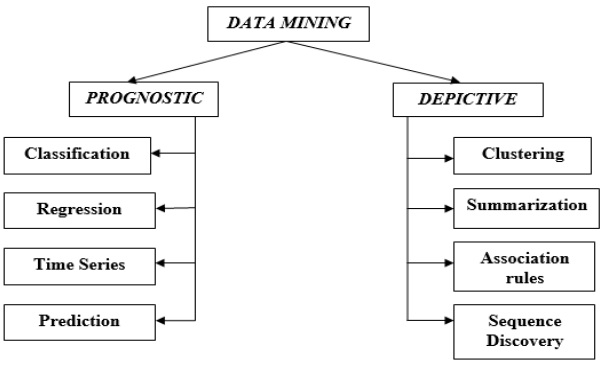


Fig 2: Data Excavate Job

2. CLASSIFICATION IS USED IN PROPOSED WORK

Table 1 List of Attributes

Dataset Name	No. of Attributes	No. of Instances	Attributes
Breast Cancer	9	296	Period, menopause, swell size, bosom canker, vertex
Diabetes	10	788	Pregnant, claret, pressure, skin steroid, paediatric

2.1 Flow Charts of Proposed System:

A flow chart and steps of proposed work as shown:

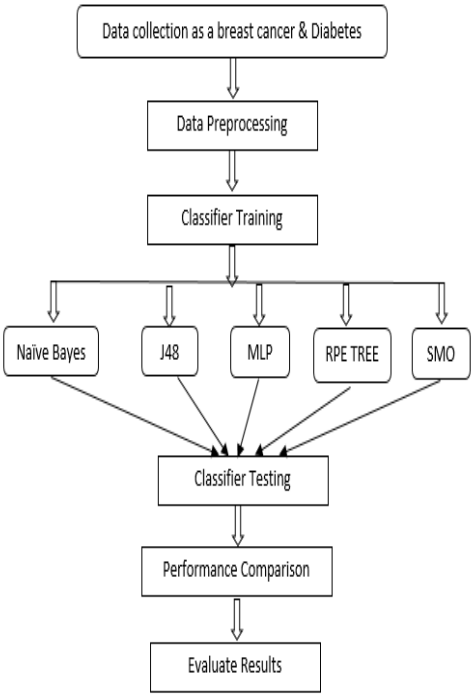


Fig 3: Flow Chart

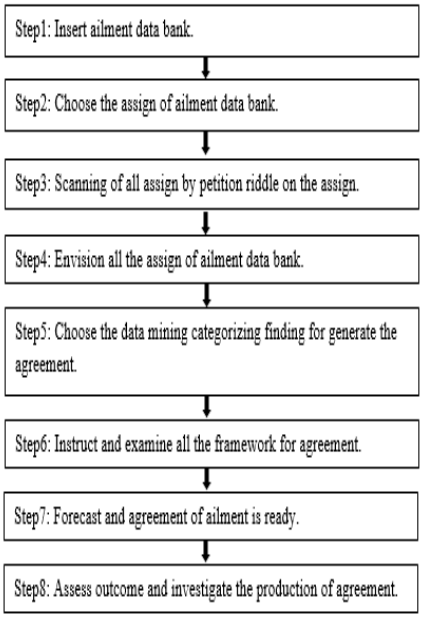


Fig 4: Steps of Proposed Work

3. EXPERIMENTAL WORK

3.1 Breast cancer dataset attributes description:

- Period [5], Menopausal, Quadruple-nodes [3], Fork top, Malignancy [7], Bosom canker [5], Bosom vertex, Betterment, Classification [1].

3.2. Diabetes dataset attributes description:

- Pregnant, Claret, Pressure, Skin, Steroid [3], Multitude, Pediatric [1], Lifetime, Class.

3.3. Performance of classifiers on Breast cancer dataset:

Table 2 Performance of classifiers on Breast cancer dataset

Evaluation Criteria	**Classifiers**				
	Naive Bayes	**J48**	**MLP**	**RPE Tree**	**SMO**
Correctly classified instances	69	66	72	64	68
Incorrectly classified instances	28	31	25	33	29
Accuracy (%)	71.10	68.0	74.12	65.95	70.00

From above table 2 we can conclude that on breast cancer dataset, MLP is better error-free classifier in contrast of others also it is clearly observed meaning it has a higher proportion

of correctly categorized occurrences and a lower proportion of mistakenly classified instances than Naive Bayes, SOM, Rep Tree and J48.

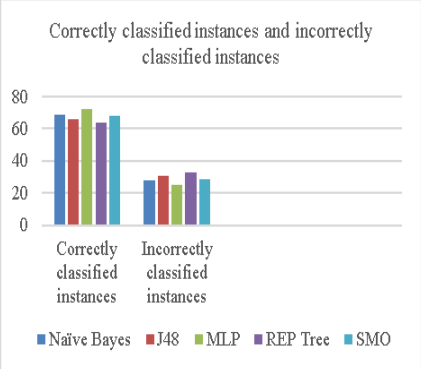


Fig 5: Representational of instances on Breast cancer

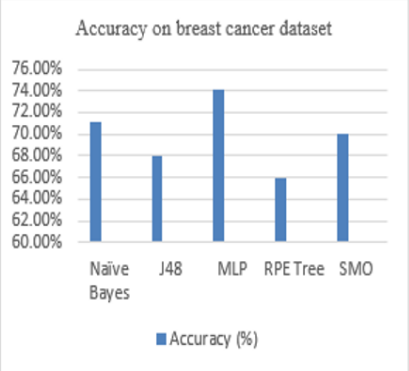


Fig 6: Diagrammatic representation of accuracy on Breast cancer

3.4. Performance of classifiers on Diabetes dataset:

Table 3 Performance of classifiers on Diabetes dataset

Evaluation Criteria	Classifiers				
	Naive Bayes	**J48**	**MLP**	**RPE Tree**	**SMO**
Correctly classified instances	201	199	194	197	207
Incorrectly classified instances	60	62	67	64	54
Accuracy (%)	77.00	76.2	74.30	75.45	79.30

From above table 3, SMO is better error-free classifier and has a higher proportion of correctly categorized occurrences and a lower proportion of mistakenly classified instances than Naive Bayes, MLP, REP Tree and J48.

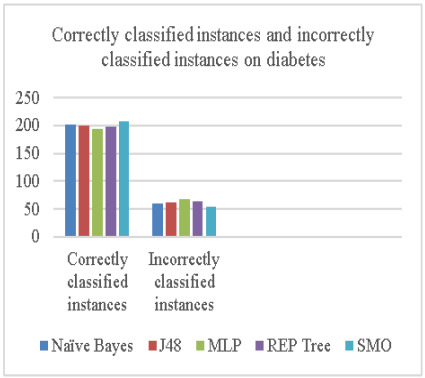


Fig 7: Representational of instances on Diabetes

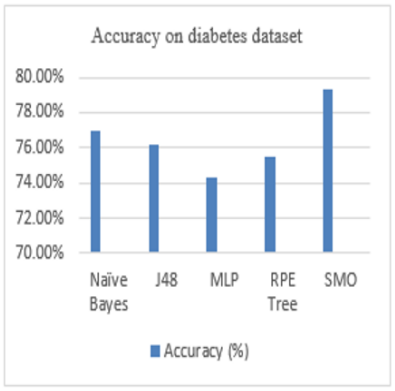


Fig 8: Diagrammatic representation of Accuracy on Diabetes

4. CONCLUSION & FUTURE WORK

We culminate that WEKA instrument is examine as one of the finest apparatus for data extraction categorizing. In this we have used two types of datasets breast Cancer datasets

and Diabetes datasets. And obtain the good results by using the all attributes. On breast cancer dataset, MLP is better error-free classifier in contrast of others also it is clearly observed meaning it has a higher proportion of correctly categorized occurrences and a lower proportion of mistakenly classified instances than Naive Bayes, SOM, Rep Tree and J48. On diabetes dataset, SMO is better error-free classifier in contrast of others also it is clearly observed meaning it has a higher proportion of correctly categorized occurrences and a lower proportion of mistakenly classified instances than Naive Bayes, MLP, REP Tree and J48.

We used percentage split test option for testing the parameters, so in future we will use other testing mode options to increase accuracy of classifiers.

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Artificial Intelligence based Software Cost Estimation

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Abstract: The estimation of software costs is the key step in the software growth process. It estimates the volume of time and effort required to develop a software set up. It is the very important duty, and a precise estimate gives a solid foundation for the growth process. The Constructive Cost Methodology (COCOMO), the most extensively used estimated cost model, is discussed. For perceptron learning technique the artificial neural networks utilized for creating model. The network is trained and tested using COCOMO dataset. The goal of the study is to improve COCOMO model's approximation validity by including artificial neural networks.

Keywords: Cost Estimation, COCOMO Model, Artificial Neural Network

I. INTRODUCTION

Artificial Neural Networks for Software Cost Estimation becomes a challenging task for the researchers for estimating the cost [4]. Software cost estimation is an estimation or prediction of the cost of the required resources that will be necessary to complete a project. Software cost estimation is becoming increasingly important. There were only a few computers in use when the computer era began in the 1940s, and most applications were tiny. With the passage of time, the field of computers grew in popularity. The quantity, size, and relevance of applications that needed to be developed increased. Software development costs, complexity, and effort all increased. The repercussions of numerous forms of errors in software cost estimation got increasingly severe as a result of that unexpected growth. Many cost estimates for software projects are still inaccurate today. Personnel salaries account for the majority of a project's total costs. Human labor costs, on the other hand, are directly proportional to the amount of effort required to complete the job. Human effort estimation also has a lot of variables and is difficult to quantify. As a result, in order to make an acceptable cost estimate, an accurate assessment of the overall work is required. The effort is calculated based on the project's size and complexity, both of which are determined by the specification. Because the software's needs are likely to vary, it's also important to factor that in when calculating the effort. One of the most difficult difficulties to tackle throughout the estimation phase is the large disparity in software developer productivity. One of most respected survey (CHAOS Reports) that is a projects in industry and government. Only 29% of major business software projects were successful, 53% were challenged, and 18% failed to deliver on time and within budget. Troubled projects has average budget overrun the 56%. This data shows a major and persistent peril control problem. Software cost estimating is a difficult task that necessitates a thorough understanding of many important aspects of the project for which the estimate is being created. Creating reliable software cost estimates necessitates a thorough understanding of numerous elements [39].

II. TARGETED WORK

2.1 COCOMO: Due to its simplicity, the cost model [08] is extensively used approach for predicting the cost technique. This model provide efforts according to its person months, growth time, and the team size. It calculates these parameters using mathematical equations [8].

Thousands of program managers utilize COCOMO fetch approximation model, which was built on a research of century of programs. COCOMO, unlike supplementary cost estimation prototype, is an open miniature, which means that all of the features, counting:

- Equations that underpin fetch estimates
- Each and every model presumption (e.g. "the project will enjoy good management")
- Each and every depiction (e.g. the exact depiction of the consequence blueprint of a estimate)

- An estimate's fetch are specified openly (e.g., project managers are included, while secretaries are not) [8].

2.2 Block Diagram of Constructive Cost Estimation Model:

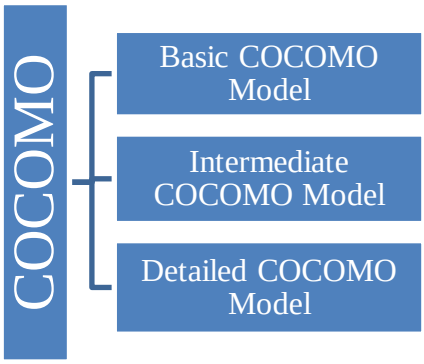


Figure 1: Block Diagram of Constructive Cost Estimation Model

2.2.1 Initial COCOMO Model: The initial COCOMO model was constructed using a parameterized equation with little explanation of the project's parameters and features [6].

$$MM = a\,(size)^b \quad (1)$$

$$TDEV = 2.5* \quad (2)$$

Where
MM denotes man-month
TDEV denotes development time

2.2.2 Intermediate COCOMO Model: The Intermediate COCOMO by Boehm improves precision to the Basic COCOMO by include a collection of 15 cost drivers [6].

2.2.3 Detailed COCOMO Model: The effort can be calculated as a function of program size in COCOMO model and weight can be set by cost drivers in software lifecycle phase [6].

III. EXPERIMENTAL DESIGN AND IMPLEMENTATION

3.1 Process Flow Diagram: The Process flow diagram shown in Fig.2 provides the details of experimentation work carried out.

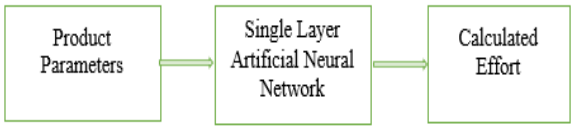


Figure 2: Process Flow Diagram

3.1.1 Description of Flow Diagram:

3.1.1.1. Product Parameters/ Input Parameters: In System Implementation number of different parameters are used for designing the neural network. These parameters can be number of surface the number of neurons per surface, the number of training repetition and learning rate.

- **Effort Multiplier**: Fifteen (15) effort multipliers are used in implementation. A set of rating levels and accompanying effort multipliers are defined below for each multiplicative cost driver. Rating Levels are Vastly Little, Little, Normal, Excessive, and Vastly Excessive. Effort multiplier of 1.00 does not change the estimated effort. Beyond the normal ratings change the estimated effort.
- **Bias:** Axon could be prejudiced; it means that it has extra load with sustained utility. In this implementation bias value assigned by1.
- **Learning Rate:** Learning rate value between [0, 1]. In this implementation initialized value by 0.1.
- **Weights:** Neurons contain a huge amount of processing element in the Artificial Neural Network. These neurons are connected to each other by directed communication links, which are associated with weights. Weights are information used by the neural network to solve a problem. Axon is casting up all constituents of the insert route accumulate by the mass, and the outcome is used as defense of the reinvigorating purpose. The Wi (Effort Multiplier Weight) is set to 1.

$$(1, 2)$$

3.1.1.2. Artificial Neural Network (ANN): To determine the calculation of software costs in the suggested system, a single layer ANN is used. For this, One bias weight and the 15 Effort Multiplier (EM) are used as input parameters (b).

3.1.1.3. Estimated Effort: A single layer artificial neural network is designed for creating the system, which is trained using the perceptron leaning technique. To train and test the network, the COCOMO dataset is employed.

$$Total = total + EMi * Mi \quad (3)$$

$$O_{estimate} = b+ total; \quad (4)$$

$$MRE = ((O_{actual} - O_{estimate}) / O_{actual}) * 100 \quad (5)$$

Where
$O_{estimate}$ denotes estimated effort,
Mi denotes effort multiplier weight,
MRE denotes magnitude relative error,
O_{actual} denotes actual effort

3.1.2 Architectural Diagram:

The utilization of a sole surface artificial axon grid to estimate software costs can be demonstrated more precisely by following architectural diagram shown in Figure 3

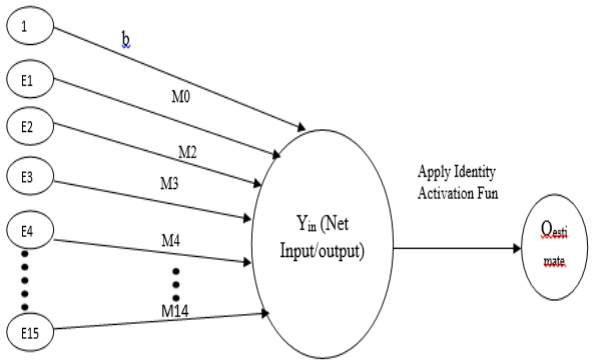


Figure 3: Single Layers Artificial Neural Network Architecture

Figure 3 shows there is a single layer of connections between source and sink, it is known as an artificial neural network that is designed for single layer. In this architecture the input consists of input neuron i.e. from E1 to E15 and bias weight (b) on a connection from a unit whose activation is 1. Weighted interconnectivity W1 to W15 connects the sourse neurons are connected to the sink neurons. The identity activation function is used to judge effort after calculating the total source and sink (the sum of the consequence of each input axon's mass).

$Y_{in} = b + total$ (6)

Where, Total = Total + Wi*Emi (7)

O_{est} = Yin (Identity Activation Function) (8)

3.2 Performance Evaluation Criteria:

MRE is utilized for measuring the performance of the suggested work.

3.2.1 Magnitude of Relative Error (MRE):

MRE (Magnitude of Relative Error) is a widely used criterion for evaluating software cost estimating methods. The gap between actual and estimated effort is known as magnitude relative error (MRE).The MRE for each observation project can be obtained as:

$$MRE = ((O_{act} - O_{est}) / O_{act}) * 100 \quad (9)$$

Where O_{act}= Actual Effort

O_{est} = Estimated Effort

3.3 Different Parameters used for Experimentation:

Table 3.3.1 Parameters used for Cost Estimation

Parameters	Initialize by Value
Effort multiplier	14
W_i(for i=0to14)	1
Bias (b)	1
Training rate	.2
Threshold value (Θ)	5

3.4 System Implementation Flow Chart:

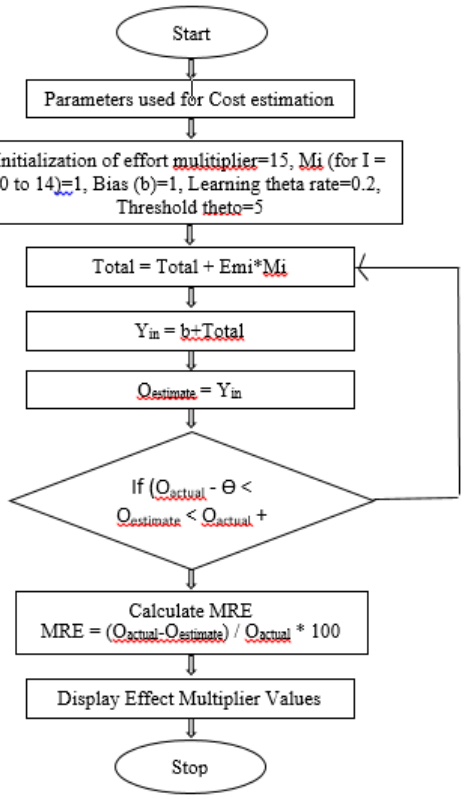


Figure 4: Flow Chart

3.4.1 Proposed Model Step:

Step1: Parameters are used for cost estimation.

Step2: Set the bias (b=1), Mass (Mi=1 for i=0to14), set training theta value =0.2 and Threshold value (Θ) value=5.

Step3: Calculate the total number of put in (16), which includes the Complete Endeavor Multiplier (15) and the single Bias.

Step4: Compute each unit's response.

Step4.1) Compute total put in using Total = Total+ $EM_i * W_i$

Step4.2) Compute total input output using Net input/output(Y_{in}) = b + Total

Step5: Try identity activation function and compute estimated output i.e effort using Oest=Net input/output(Y_{in})

Step6: if (Oact-Θ<Oest<Oact+ Θ).

Step7: Condition false then go to step 5

Step9: Else compute MRE= ((O_{act}- O_{est}) / O_{act})*100

Step10: Exhibit effect multiplier value.

Step 11: Stop.

3.5 Software used for Experimentation:

3.5.1 Net Framework:

The .NET Framework is a composite platform for designing, deploying, and conduct next-generation requisition. In a tiered structure, the layer of developer tools is lie in the middle of the M S system program and the designed apps. .NET can be a platform and a technology because it is manufactured by multiple components such as various type of studies, performing mechanism, association, and it associate with the system program. The latest category of the .NET Framework 4.0 is used by Microsoft Visual Studio 2010.

3.5.2 Architecture of the .NET Framework:

Consider the.NET Framework as a layered architecture to better comprehend its structure. The.NET Framework 4.0 architecture is depicted in Figure 4 as a high-level diagram. Operating system is the high level of the representation, whereas the layers of .NET resides between the system and the apps. The most work is done by the Common Language Runtime (CLR) which is a second level and it is a part of the .NET Framework. The Base Class Library (BCL) which is a next level that contains all .NET articles that used in the key and by optical fundamental when building petitions. The rear most extent is made up of petitions that depend on the antecedent layers.

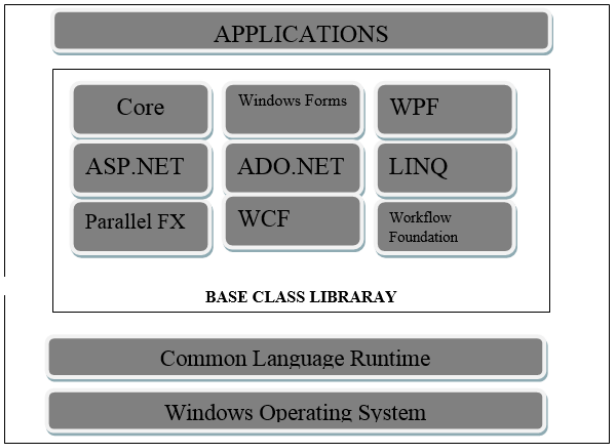


Figure 5: Architecture of the .NET Framework.

3.6 System Implementation using .Net Framework:

In cost estimation model we are using .Net Framework to calculate software cost.

This model is having input parameters;

We are using 15 parameters to calculate cost estimation. Each parameter is having 6 checkboxes as shown in Figure 6.

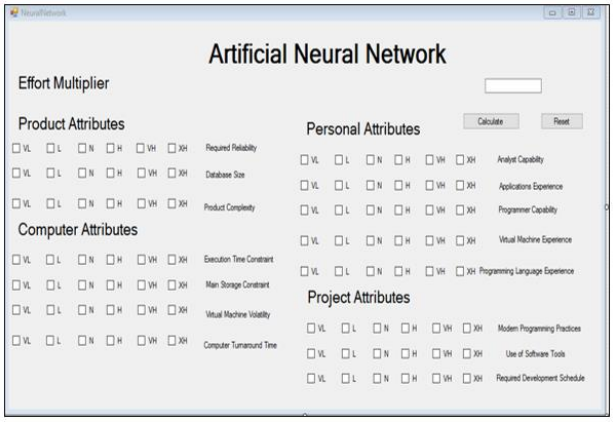


Figure 6: Software Cost Estimation using ANN GUI input parameter

Every checkbox is having different values as VL(Very Low), L(Low), N(Nominal), H(High), VH(Very High), XH(Extra High)

Here actual effort dataset value is inserted by a user in form of Text Box. Then user checked any checkbox according to its need or requirement, then estimation cost effort and MRE will be calculated on equation basis as shown in Figure 6 having selected check boxes and inserted actual effort in text box.

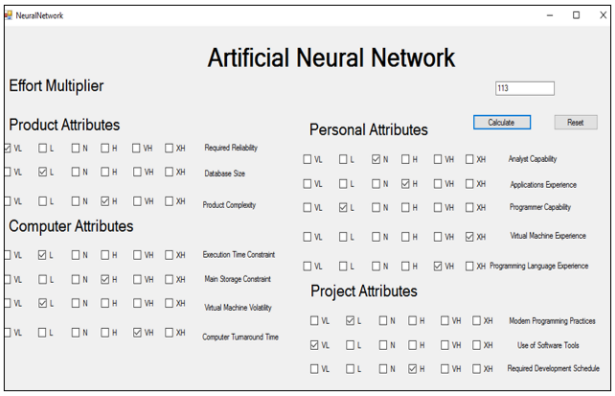


Figure 7: Software Cost Estimation using ANN GUI with values inserted

Now input parameters have calculated a sum of values with bias value. After calculating cost estimation, if results are approximate to the actual effort then estimated output will be visible but if an effort is not approximate to an actual effort then weight will be updated with help of identity activation function and learning rate.

After weight updating effort estimation can be recalculated with the same checkboxes as the previous condition. If these condition or estimated result is approximate to actual result then process will be terminated.

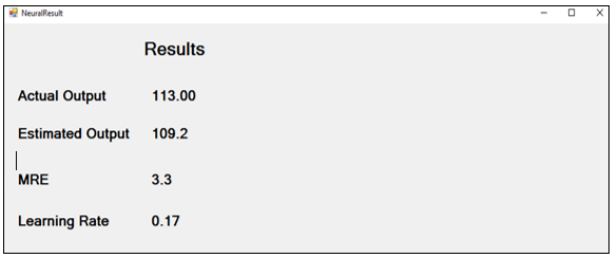


Figure 8: Software Cost Estimation using ANN Result Output

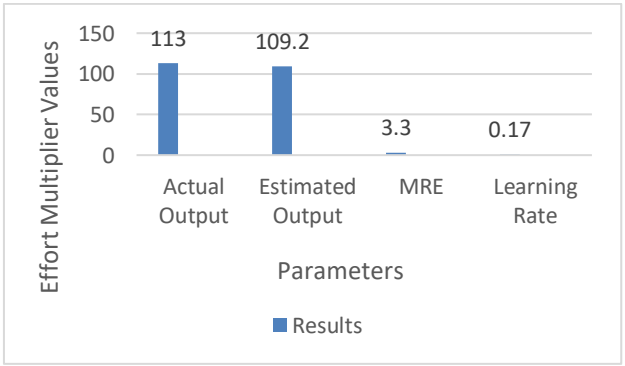


Figure 9: Graphical Representation of Software Cost

Estimation using ANN

In this system Artificial Neural Networks (ANN) is used that helps to check estimated effort.

IV. SCOPE FOR THE WORK IN AREA

The experimental results show their significance in achieving the objectives of artificial neural networks that used the estimate software costs. Limitations of our work is the scarcity of the projects available to train and test the model. Published datasets such as NASA [B1], PROMISE [B2], COCOMO [B3], and CeBASE [B4] do not include information about use case diagrams.

V. CONCLUSION

Various situations and scenarios were used in the design and implementation of the model for Neural Network and for Cost Estimation. The number of total reviews is carried out as 100. The cost estimation has been carried out for calculating the estimated effort, Magnitude Relative Error. The limitation of the proposed approach is that it didn't give estimated effort equal to the actual effort. It always gives result less than or greater to actual effort.

Finally the purposed model estimated effort is compared with actual effort. It could be found that the designed model gives the best results and its gives nearby accurate values to actual output.

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Information Retrieval Using Data Mining

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Abstract: The expansion of Information Processing has generated huge quantity of data bank and large data in different domain. Free Conjoin is modify in fact extract organization since it can get any section of matter stored in data collection by more flaccidity and in well-organized manner. Therefore the fact extract organization can be categorize according to the kinds of data collection. Data Mining is faced with some major issues like information retrieval, similarities and differences in spatial data mining techniques, mining of data clusters. To learn about data mining, a review process involving 4 stage approaches has been undertaken for 40 research papers which were published in the period of year 2001 to year 2014. After an exhaustive review process, seven key issues were found "Information retrieval, Similarities and differences in spatial data mining techniques, Mining of data clusters, Changing in land price, Data load balancing, Privacy protection and Gap between academia and business tools." problems have been resolved and explained through the use of appropriate approaches. Various research have found a number of approaches to solve the problem. In this article, the review's conclusions are given in the form of multiple findings. The results covered the algorithms and approaches utilized to tackle a specific study topic, as well as their strengths and drawbacks, as well as the scope for future research in the field.

Key words: Data load balancing, Clustering, Domain Driven Data Mining Privacy protection, Knowledge Discovery in Database, and Actionable Knowledge Discovery

1 Introduction

It is necessary to collect a large amount of data in order to develop information. Simple numerical numbers and text documents can be used, as well as more complicated information including spatial data, multimedia data, and hypertext pages. It is difficult to keep track of the large volume of data saved in files, databases, and other repositories.
It's becoming increasingly vital to provide sophisticated tools for analysing and interpreting such data, as well as for extracting useful knowledge that might aid

decision-making. Data mining is a collection of techniques for analyzing large amounts of data and discovering new, hidden, or unexpected patterns in data, as well as uncommon patterns in data. Data mining software forecasts future trends and behaviors, allowing firms to make informed, proactive decisions. Data mining's automated, future analyses go beyond the analysis of previous occurrences provided by decision support systems' retrospective capabilities. Data mining tools can provide answers to business questions that were previously too time consuming to answer. They scour databases for hidden patterns, uncovering predicting data that specialists may overlook because it falls beyond their realm of experience. There are many different types of data mining tools on the market, each with its own set of advantages and disadvantages. Internal auditors must be informed of the various types of data mining technologies available and advocate the acquisition of one that best suits the organization's present investigation requirements. There are four types of data mining tasks that are often used. [7].

Classification: Data is organized into predetermined groups by classification. An email programmer, for example, might try to determine whether an email is genuine or spam Common algorithms include Decision Tree Learning, naive Bayesian classification, and neural networks. [2]

Clustering: It's similar to classification, except the groups aren't predefined, thus the algorithm will try to group elements that are related. [2]

Regression: Attempts to discover the least error-prone function for modelling the data. [2]

Learning association rules: Correlations between variables are sought. A supermarket, for example, might keep track on its customers' shopping habits. The store can use association rule learning to figure out which issue are routinely purchased jointly and use that data for vending. On occasion, this is mentioned to as "market basket analysis". [2]

2 Approved Assessment Procedure

A writing study is required to learn about the research topic and what problems have been solved and what problems still need to be solved in the future. To keep the procedure simple and customizable, the review process was broken down into five steps. The stages were as follows:

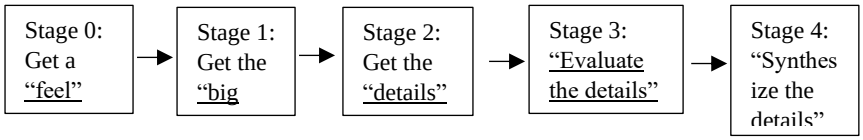


Fig 1: Review Process Adopted

Stage 0: Get a "feel" for the situation:

This step gives the details that will be checked before using a broader domain, conduct a literature review and categories the results as reported to the

specification.

Stage 1: Acquire a sense of the "big picture":

The research articles are organized into groups based on common topics and application subcategories. It is vital to read the Section and Subsection Headings, as well as the title, abstract, introduction, and conclusion in order to grasp the work and to find the answers to particular queries.

Stage 2: Find out the "details":

Stage 2 entails delving deeper into each research study to comprehend the technique used to account for the complication, the relevance and creativity of the infusion salute, the specific topic label, the significant benefaction, opportunity, and restrictions of the projects given.

Stage 3: "Evaluate the details":

This is evaluates the specifics, such as the seriousness of the problem, novelty, relevance of the solution, uniqueness of approach, veracity of statements, and so on.

Stage 4: "Synthesize the details":

It is concerned with evaluating the information provided, as well as, to some extent, generality the writers' synthesis of the data, concept, and outcomes takes place at this stage.

3 A Range Of Problems in the Area

After reading 40 research papers on information retrieval, I came to the conclusion that Using Data Mining, we uncovered the following concerns, which are detailed below.

The problems are as follows:

1) **Information retrieval.**
2) **Similarities and differences in spatial data mining techniques.**
3) **The problem of data cluster mining.**
4) **Problem of changing in land price.**
5) **Data load balance issue.**
6) **Problem of privacy protection.**
7) **Problem of gap between academia and business tools.**

4 Issue Wise Discussion

Issue 1: Information retrieval

Most of the perspectives were used for this matter which are SD- miner, spatial priory algorithm, knowledge discovery in database, spatial clustering, Bayesian network are performed for information retrieval. Ant colony optimizer and genetic algorithm has also been proposed. ACO handles uncertainty property of customer data and GA overcome the sensitivity to the initial election data. Information retrieval may be correctly managed and mined using these solution ways.

Issue 2: Similarities and differences in spatial data mining techniques
Four tier of J2EE architecture, hair data model, cross thermometric and visualization technique are the approaches that have been given. J2EE architecture provides data sharing, fast, easy access to spatial knowledge & treatment to mass data. When problem occur then hair data model frequently change the data. Cross thermometric provide higher accuracy and reliability of temporal data and also improved the speed.
Issue 3: The problem of data cluster mining
The technique of "density based sampling algorithm" for solves the problem of mining of data clusters. It provides scalability to large data sets effectively and efficiently. BIRCH, a data clustering algorithm that is highly efficient for clustering big data bases, has been proven.
Issue 4: Problem of changing in land price
Integrated techniques between geographic information system and spatial data mining solve the problem of changing in land price. The idea is to combine the spatial data mining with geographic information system is to establish an intelligent land grading information system. It is helpful in route design, route guide and route display.
Issue 5: Data load balance issue
Grid based parallel data mining and MapND strategy has been solved the data load balancing problem. MapND strategy divided the data sets into data blocks than combined every data chunk to communicate mining node according to less time. Author use the parallel data mining for data mapping.
Issue 6: Problem of privacy protection
Bottom-up generalization method has been given for solving the problem of privacy protection. Once the data has been masked, typical data mining techniques can be used without any changes.
Issue 7: Gap between academia and business tools
Actionable knowledge discovery system has been analyzing the gap between academia and business tools. AKD system used the flexible framework for the hidden patterns.

5 Issue Wise Solution Assessment Used

The infusion assessments below the different matter have been pictured in the **Table 1.** The comparative examination of alternative solution approaches is also described in the same table.

6 Solution Approaches for the Specific Issues

Table 1: Solution Approaches & Outcomes by Issue

Issue Name	Solution Approach	Results	Ref

Information retrieval	SD-miner technique	Handle both spatial and non-spatial data easily, and automatically detect what kind of data is used.	[10]
	Bayesian network	It combines qualitative and quantitative analysis and has a great aptitude for reasoning and semantic representation.	[15]
Similarities and differences in spatial data mining techniques	Four tier of J2EE architecture	It provides data sharing, fast, easy access to spatial knowledge & treatment to mass data.	[11]
	Hair data model	When problem occur then hair data model frequently change the data.	[24]
The problem of data cluster mining	Density based sampling algorithm	It provides scalability to large data sets effectively & efficiently.	[16]
Problem of changing in land price	GIS & SDM techniques	They dynamically explore the land data and deal with wide range of application.	[21]
Data load balance issue	Grid based parallel data mining MapND strategy	Dynamic flexibility is poor and hardware demand is high.	[32]
Problem of privacy protection	Bottom-up generalization method	Once the data has been masked, standard DM technique can be applied without modification.	[6]
Gap between academia and business tools	Actionable knowledge discovery (AKD) system	AKD system use flexible framework for hidden patterns.	[17]

6.1 Common Findings

Issue 1: Information retrieval

- The SD-miner technique has been enhanced to readily support both geographical and non-spatial data. And it can provide techniques for geographical data mining that are more successful and efficient in real-world applications.
- CD-TIN Technique is considered worst approach because in this

implicit and obscure knowledge in spatial database cannot be discovered. And second data mining approach does not paid much attention in real world application like finance and business field.

Issue 2: Similarities and differences in spatial data mining techniques

- Four tier of J2EE architecture has been considered as the best approach because it provides data sharing, fast, easy access to spatial knowledge and many treatments to mass data.
- Because it cannot execute on a data warehouse, the spatial data cube's spatial data mining technique is regarded as the worst approach. Complex spatial data is not supported by this data model.

Issue 3: The problem of data cluster mining

- Density based sampling algorithm has been considered as the best approach because It not only solves the dual clustering problem, but it also scales effectively and efficiently to big datasets.
- ICC algorithm has been considered as the worst approach because it has not solved the dual clustering problem effectively.

Issue 4: Problem of changing in land price

- Geographic information system and spatial data mining techniques dynamically explore the land data.

Issue 5: Data load balance issue

- Map ND strategy can solve the problem of data load balancing for data mining nodes and also improve the performance of parallel data mining in grid.

Issue 6: Problem of privacy protection

- After the data has been masked, typical data mining techniques can be used without any changes. But it has some quality and scalability issues.

Issue 7: Gap between academia and business tools

- Actionable knowledge discovery is used for hidden patterns. It is a flexible framework.

6 Conclusion

In order to examine and discover current difficulties and scope of work, a study of 40 research articles in the domain of Information Retrieval Using Data Mining was conducted. Following the review, I discovered a number of issues that should be addressed when data mining is done properly. These papers are contemplate of different mining matters that have an impact on related data mining work. The motive of these methodologies and strategies is to decrease data mining inefficiencies and improve system reliability. I found seven separate issues that were handled using different strategies and techniques.

7 Future Work

SPMML will be extended to describe the spatio temporal data models. The spatial data types and spatial data transformation in SPMML will be redesigned too. Due to distributed nature of bio databases security issue is very important. So privacy mechanism and security issues should be taking into future work. For that developed a new data mining algorithm that is capable in extracting frequent, sequential and structured patterns, as well as classifying and clustering bio data. Analyzed some other trajectory data sets like vehicle and animal movement and include temporal information during clustering.

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Handwritten Character Segmentation in Various Epochs

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***Abstract*— The purpose of this work is to segment a range of scan texts and investigate how changing ANN models affect the results. Neural Networks are primarily used for pattern recognition in today's environment. The behaviour of various CNN models utilized for OCR is described in this paper. OCR is the most popular Neural Network application. Number of HLs (hidden layers), size of HLs, and no. of epochs have all been examined. Back propagation was employed in a multilayer feed-forward network. For character segmentation, normalisation, and de-skewing, we employed some basic techniques in preprocessing. Here, multiple neural network models are used and each CNN is subjected to a check attack to determine its validity.**

Keywords—Backpropagation Network, Optical Character Recognition (OCR), Artificial Neural Network, Skew Detection insert

I. INTRODUCTION

It is software like this that comes in handy the time-consuming process of converting our hardcopies to digital. Even though software like this can speed up the process by about 80%, it still needs to be tested after the conversion is done [1].

OCR is a computer programme that turns images of typed text that can be edited by a machine or converts video footage of letters into a typical concealed writing theme that represents them in a document (ASCII or Unicode). OCR emerged from AI and machine vision research [2]. While instructional analysis is still utilised in the industry, the emphasis in optical character recognition have moved to well-established algorithms.

II. BACKGROUND

Changing pattern recognition is difficult. With little or no effort, animals appear to be able to recognise huge no. of objects and be aware of huge amount of visual information. To the extent that physical constraints allow, simulating the duties of an anti-degree master's student will be extremely beneficial to the system. To accomplish this, artificial neural networks must be studied and simulated [3]. Every node performs a simple calculation, and each affiliation transmits a signal called the "connection strength" or "weight," which indicates the connection's effect on signal amplification or dilution.

The network evaluates the effects of different weighting options on different functions [4]. It is necessary to employ a learning algorithm to identify the weight values that will help the network achieve its goal in the face of random weights.

The computing system is given the moniker "ANN" by algorithm. As a result, the network's capabilities were severely limited by a single node function [5].

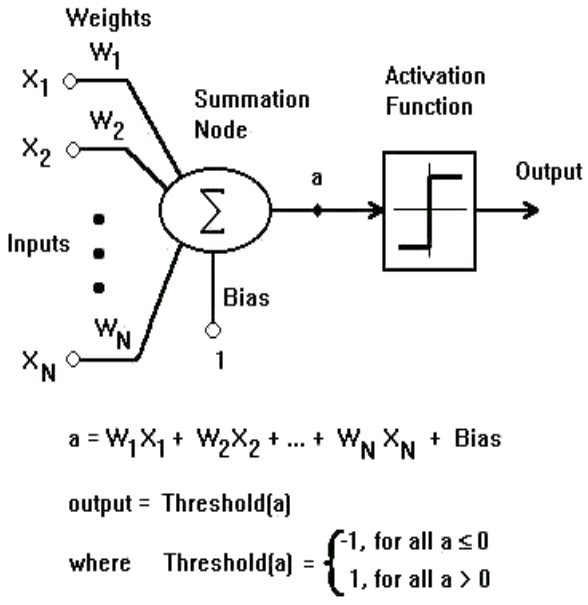


Figure 1. A Simple Neuron Description

A two-pass approach is common when developing pattern recognition systems. As a first step, the data is run through a feature extractor, which seeks for data elements relevant to the current task (e.g., finding bars of pixels within an image for character recognition). The classifier, which has a broader purpose and may be taught with CNN and sample data sets, is second pass. There's no denying that the feature extractor is more time consuming to create because it has to be made by hand based on the application's goals. Using multi-layer neural

networks instead of hand-crafted feature extractors can enable neural networks to learn complicated mappings in high-dimensional spaces, which is a substantial addition to pattern recognition [6-8]. This research focuses on establishing a basic backpropagation neural network rather than developing sophisticated feature detection algorithms. It also includes the preprocessing that is necessary for effective results.

As a result, the Wi-Drow-Hoff backpropagation technique was applied to networks with several layers and nonlinear differentiable transfer functions. Using input and target vectors, a network can be trained to approximate performance, associate input vectors with defined output vectors, or categorise in-place vectors according to your parameters. There are networks that can be utilized to approximate any performance that has a limited amount of discontinuities [9]. Biases, a sigmoid layer, and a linear out-of-place layer are present in these networks.

III. Analysis

In this work, a parameter is observed that has an impact on the accuracy of the OCR system after evaluating the OCR. Skewing, slanting, thickness, cursive handwriting, and joint characters are some of the parameters listed in these papers. If these parameters are carefully considered during the preprocessing stage, the overall accuracy of the neural network will be improved as a result.

A. Design and Implementation

At first, we tend to square measure when developing the algorithmic programme for Character Extraction. We have a proclivity for utilising MATLAB as a tool for creating algorithmic programmes. To get the greatest outcomes, we wish to own a Neural Network with a certain design. Finding the best neural network model does not have a set method. It can only be discovered by trial and error. Train completely separate neural network models and observe the output accuracy.

In our paper, Processing and character recognition are effectively two separate processes. In the initial portion, here used square measure preprocess to separate the characters from the scanned document and normalise each character. We frequently specify an image file as an input, it has been made available for examination and preliminary processing. Because image is typically in RGB format, we have a tendency to transform it to binary format. A threshold is used to transform a grayscale image to a binary image once the input image has been converted to grayscale (if it hasn't already been converted to intensity), i.e. all pixels greater than the bound threshold are represented as one and all pixels lower than the bound threshold are represented as zero [10-12]. To begin, we desired a strategy for extracting a certain character from a document. To do this, we frequently alter the visuals' eight-way connected rule (which we tend to decision as Edge-Detection).

IV. Preprocessing

A. Character Extraction Algorithm

i. Make a Traverse List: This is a list of pixels that have been travelled previously. This list is, by default, empty.

ii. Scan row by row, pixel by pixel

iii. When we get a black element, we check to see if it's already in the traverse list; if it is, we ignore it and move on; if it isn't, we use the Edge detection formula.

iv. To the Traverse List, add the List of Pixels returned by the Edge Detection Formula.

v. Repeat steps two through five for all rows..

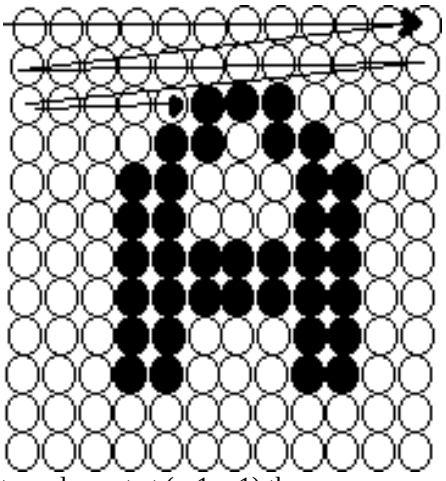
B. Edge Detection Algorithm

The Traverse list is part of the Edge Detection algorithmic software. It's the list of images elements that the algorithm has previously traversed.

Detection of edges (x, y, Traverse List):

1) Drag and drop this image element into the Traverse List. The picture element's current position is (x, y).

2) Traverse List + current position = New Traverse List (x, y).



If picture element at (x-1,y-1) then

Check if it's not in Traverse List. Edge detection (x-1, y-1, New Traverse List);

Figure 2. The respective calls representation of the character.

If picture element at (x-1, y) then

Check if it's not in Traverse List. Edge detection (x-1, y, New Traverse List);

If picture element at (x-1, y) then

Check if it's not in Traverse List. Edge detection (x-1, y+1, New Traverse List);

If picture element at (x, y-1) then

Check if it's not in Traverse List. Edge detection (x, y-1, New Traverse List);

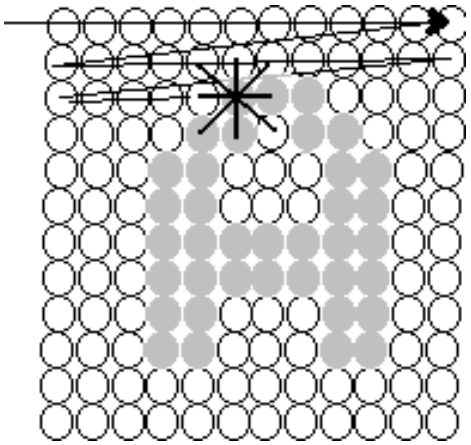


Figure 3. It illustrates the respective calls made to each of the eight neighboring pixels.

If picture element at (x, y+1) then

Check if it's not in Traverse List. Edge detection (x, y+1, New Traverse List);

If pixel at (x+1,y-1) then

Check if it's not in Traverse List. Edge detection (x+1, y-1, New Traverse List);

If pixel at (x+1,y) then

Check if it's not in Traverse List. Edge detection (x+1, y, New Traverse List);

If pixel at (x+1,y+1) then

Check if it's not in Traverse List. Edge detection (x+1, y+1, New Traverse List);

The Edge Detection Formula terminates once it has coated all of the character's pixels using the position of each pixel in the Traverse List. As a result, decision-making about Edge Detection is now disabled.

C. Normalizing

Now that we've gotten the persona out of the way. We'd like to make the characters' scales more consistent. Every Character has huge differences in size. As a result, we'd like a way to standardise the scale. We've discovered a simple way to carry out the normalisation. Consider the following example: we've extracted a personality of size seven X eight to understand this technique. We'd want to scale it down to ten by ten inches. Therefore, we have a tendency to build a matrix of seventy X eighty by duplicating rows and columns. currently we have a tendency to divide this seventy X eighty into Submatrix of seven x eight. We have a habit of extracting each sub matrix and calculating number of ones in each sub matrix [13]. We have a propensity to assign one to corresponding location in normalised matrix if the number of one's is more than 0.5 on the Submatrix scale. As a result, the output will be an X 10 matrix.

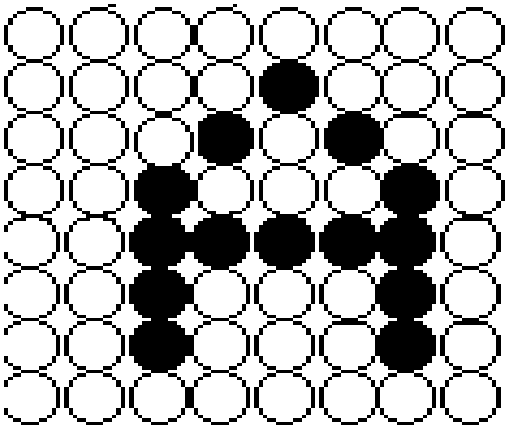


Figure 4. Shows original representation of the character.

V. Test And Results Analysis

This section discusses some of the implementation outcomes. In the testing, the training variables included the number of cycles, the dimensions of the hidden layer, and also the range of the hidden layer. The collection contained typewritten characters ranging in size and type. As a result, the input layer contained one hundred neurons, whereas the output layer contained twenty-six neurons (one for every character).

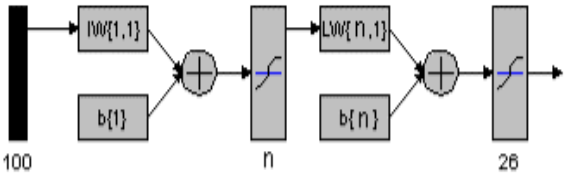


Figure 5. Neural Network Description

TABLE I. THE PERCENTAGE OF ACCURACY IN DIFFERENT EPOCHS FOR ONE HIDDEN LAYER WITH VARIOUS NODES

Epochs	No. of HL	Configuration (Number of nodes in HL)	Accuracy (%)
300	1	26	20
600	1	26	65
1000	1	26	82
300	1	52	25
600	1	52	69
1000	1	52	88
300	1	78	27
600	1	78	71
1000	1	78	91

TABLE II. THE PERCENTAGE OF ACCURACY IN DIFFERENT EPOCHS FOR THREE HIDDEN LAYER WITH VARIOUS NODE

Epochs	No. of HL	Configuration (Number of nodes in HL)	Accuracy (%)
300	3	26-52-26	31
600	3	26-52-26	65
1000	3	26-52-26	82
300	3	26-52-78	29
600	3	26-52-78	74
1000	3	26-52-78	92
300	3	78-26-78	27
600	3	78-26-78	71
1000	3	78-26-78	91

TABLE III. THE PERCENTAGE OF ACCURACY IN DIFFERENT EPOCHS FOR TWO HIDDEN LAYER WITH VARIOUS NODES

Epochs	No. of HL	Configuration (Number of nodes in HL)	Accuracy (%)
300	2	26-52	23
600	2	26-52	67
1000	2	26-52	81
300	2	52-78	40
600	2	52-78	78
1000	2	52-78	96
300	2	26-78	27
600	2	26-78	77
1000	2	26-78	89

TABLE IV. THE PERCENTAGE OF ACCURACY IN DIFFERENT EPOCHS FOR THREE HIDDEN LAYER WITH VARIOUS NODE

Epochs	No. of HL	Configuration (Number of nodes in HL)	Accuracy (%)
300	3	26-52-26	31
600	3	26-52-26	65
1000	3	26-52-26	82
300	3	26-52-78	29
600	3	26-52-78	74
1000	3	26-52-78	92
300	3	78-26-78	27
600	3	78-26-78	71
1000	3	78-26-78	91

In an ideal world, our coaching and testing data would comprise thousands of samples. Unfortunately, this is not achievable due to the fact that this data was developed from scratch.

VI. CONCLUSION

This work will fragment scan texts and compare the results of several ANN models. Pattern recognition now uses neural networks. Several OCR neural network models are described here. OCR is a popular Neural Network use. The epochs and hidden layer count were all evaluated. In a multilayer feed-forward network, Character segmentation, normalization, and de-skewing were done in preprocessing. Validation of multiple neural network models is used here. The evaluation results shows that accuracy is increases always with increases number of epochs for every case of hidden layers.

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Comparative Analysis for The Prediction of Various Lungs Diseases Through Chest X-Ray Images

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Abstract. The sudden outburst of COVID – 19 (Also known as NOVEL CARONA VIRUS) started from country CHINA and from there it had given a massive tremor to the whole world in the form of Health, Economic or Social Issues. For Decision making in Hospitals, we first need to identify the actual disease of patients and then start their medications according to the defined disease. To get the actual reading, we have focused on Radiography Lungs images and through that, we are predicting whether the particular person is suffering from COVID - 19, LUNG OPACITY, or PNEUMONIA. As these diseases have common symptoms like High Fever, cold, etc. so there is a major need to identify those diseases. For the Prediction, various algorithms have been used like Neural Network, Logistic Regression, Naïve Bayes, Decision Tree, and Ada-Boost. The tool used for the prediction of these diseases is ORANGE TOOL. The GUI interface of ORANGE makes it easy to use various Algorithms just by dragging different Algorithm icons into the main window. And then just passing it to different widgets such as prediction, Test and Score, etc. to get appropriate results. As these Diseases can spread widely, we need to identify those diseases sooner and start the medications in the more efficient and effective way possible.

Keywords: COVID-19, PNEUMONIA, Algorithm, LUNG OPACITY, Prediction, Orange,

I-INTRODUCTION

The sudden outburst of COVID – 19 (Also known as NOVEL CARONA VIRUS) with fatal infection from one human being to another was transferred at an exponential rate.[1] Due to this, we need to detect this disease in the early stages so the medication can be done quickly. The symptoms of COVID -19 are similar to various viral infections such as pneumonia, lung opacity, etc. So, there was a need to detect the particular type of disease at the same time. Also, these lung diseases are increasing day by day at an exponential rate because of various factors such as Weather changes, lifestyle, etc. This paper in end can help hospitals out there to discriminate between various lung diseases as symptoms of the below-mentioned disease are similar in nature. This would eventually help in the medications of those patients as these diseases will be detectable [8]. So, here we have taken class labels as, COVID, Pneumonia, Lung opacity, and Normal. We have used different models such as Naïve Bayes, Decision Tree, Ada Boost, Logistic Regression, and Neural Network to predict these class labels.

Also, many other Researchers have thrown the limelight on different aspects concerning the prediction of various other lung diseases. [[1],[2],[6],[8]]. In this paper, we have compared different techniques of classification or prediction, so that we can detect among these techniques which techniques will be preferable for the prediction of Chest X-Ray images.

The Dataset was collected from Kaggle. Kaggle offers more than 50,000 datasets to work upon. Also, they have different portals for the competition where they provide all the datasets to work upon, and from them after applying a technique, we need to take out meaningful information from that data. Various cash prices are also provided to winners. The data which was collected was named as Covid Radiography Dataset which includes 4 directories and 5 files. It includes 6012 different radiography Lungs Images which were further accumulated from the Radiological Society of America.

After this, for prediction, we divided the dataset into 2 sets which are the training dataset and the test dataset. After this, we imported all the Chest X-RAY Images into an orange tool. The orange tool is a GUI tool for machine learning or data mining. With this tool, we can create all the workflows clearly by just dragging and dropping the widget available. It is also used for data visualization so the information can be clearly understood.

After this, the images were embedded by using an image embedding widget. Here we used Inception V3 Embedder. After embedding all the images, these images were passed onto different models such as Naïve Bayes, Decision Tree, Ada Boost, Logistic Regression, and Neural Network so that they can learn and classify all the Chest X-ray images into COVID, Pneumonia, Lung Opacity, or Normal. This can also be seen in figure -7: Workflow for all the models. All the predictions can be seen in the Prediction widget.

In the end, we got the most accurate results with Neural Network with 85.3%.

II- LITERATURE REVIEW

R.G. Babu Karthik [1] and other researchers gave limelight to COVID - 19 Disease as the cases of this disease are exponentially rising day by day. So, from there arose the need for a faster and more economical solution for the medication of COVID-19. Here they want to predict by viewing all the CXR Images Samples of lungs and let it know whether the particular person is suffering from COVID -19 or not. For this, they worked upon Genetic Deep Learning CNN with calculating its fitness and also compare it with other models such as VGG16, Squeeze Net, resenet50, Densenet-121, and resenet18. After the comparison with other methods, they found that their model performed well. Also, after some time they will work with larger datasets and then check their model for accuracy.

Minaee [2] talked about COVID 19 and its effects in different parts of the world. Detecting COVID-19 is one of the crucial steps in the medication of COVID 19. The faster the Detection faster will be the medication and the lesser will be the cases of COVID – 19. They collected the dataset comprising of more than 5000 Chest X-RAY Images and then tested it with different deep learning models such as Squeeze Net, DenseNet-12, resNet50, and resNet18. To get the results they divided the dataset into test and train datasets which comprise 2000 and approx. 3000 chest X-RAY Images. The rate of specificity came out to be around 90% and the sensitivity rate was around 98%. To get the results a detailed analysis of the experiment was done. They mainly followed the transferred learning approach. It is mainly used when we have limited samples. This is generally done for extracting different features. As the data set was limited, they tuned their last layer of Convolutional Neural Network to get all the features extracted and get more accurate results. They checked the models with 4 different parameters as Specificity, Sensitivity, AUC, and ROC. As the specificity and sensitivity of all the models came out to be around 90% so this comparison was quite successful and, in the future, they will work upon larger datasets to get more accurate results.

Joseph Paul Cohen [3] and other researchers decided to work on COVID Detection in the early stages because at that time the HOTSPOTS in every country were increasing at an exponential rate. At that time no vaccination came so from there arose a major need to detect this and work on the medication of this disease. This was mainly done to help doctors in different countries to detect COVID in the early stages so that the hotspots are reduced. To make their dataset for research they collected the chest X-RAY IMAGES from more than 26 countries. As the dataset was huge so different biases and problems were coming in their way so they applied the technique of leaving one continent or one country out. For the test and training dataset, they took out different units of groups of countries or continents to get accurate results. They mainly predicted the severity of COVID – 19. The technique used was Logistic Regression and Linear Regression. From they made the first dataset of Chest X-RAY images with more than 20 outcomes. They also counted different images based on the different types of Diseases.

Harsh Panwar [4] and other researchers worked on the Early Detection of COVID-19 using various Deep Learning Techniques as it was most successful with other techniques available in machine learning for prediction. Mainly they focused on the main approach which is Color Visualization. For detection of COVID – 19 they have considered 3 datasets which are as follows:

1. Chest X-Ray Images of COVID – 19 Disease

2. COV-2 CT-scan

3. CHEST X-RAY IMAGES OF PNEUMONIA

The model of Deep learning can predict COVID in less than 3 seconds. They also estimated the patterns in Pneumonia and COVID – 19 as the symptoms of both the diseases are quite similar. Also, for color Visualization, they have focused on Grad CAM-based color visualization technique.

Heidari [5] and other researchers have focused on COVID – 19 Disease as it is a type of infectious disease so the detection of this is very crucial in the early stages. It will also help to control the spreading of this disease in the most efficient and effective way possible. Here also CHEST X-RAY dataset is used for prediction. In this, they tested Novel CAD (Computer-aided Diagnosis) scheme. The main classes which they have considered are Pneumonia (Non - COVID), Pneumonia (COVID), and Normal (Non -COVID and NO Pneumonia). After applying this scheme to the model, the accuracy comes out to be 94.5% with around 98% of specificity and sensitivity.

Moutaz Alazab[6] and other researchers have focused on COVID because this disease is an infectious disease. It was rapidly spreading at that time. To get more accurate results they get 1000 real Chest X-RAY Images. They have mainly focused on Deep Learning Technique and its types as the autoregressive integrated moving average model, prophet algorithm, and long short-term memory neural network. From this, they predicted the number of deaths, recoveries, and confirmation in the next upcoming 7 days. The prediction of all Chest X-RAY Images was done in non-coastal areas such as Australia and Jordan. They also informed that this model can be used where there is a higher number of infections. The prediction of death recovered and confirmed cases of this were done in form of a graph for India, Australia, and Jordan.

In this paper, Authors [7] have given major Limelight to various techniques of prediction such as CNN, flatten, VGG16, dropout, and dense AveragePooling2D to build an effective model. In this, for optimization, they have used ADAM to predict COVID-19 after the prediction of Pneumonia Disease. They have received an Accuracy of 91.69%. They also have said that their model has increased Accuracy by following these steps. Also, there was a little training loss. And also, this provided great efficiency to the model. The X-RAY images of both Pneumonia and Covid-19 Xray were passed to the image data generator which was further passed to the VGG16 Model. After passing to the specified model, various techniques were applied such as Flattening, dense various layers, and dropout. Also, they have calculated various testing scores such as F1- Score, Precision, and recall. Also, they work with different testing parameters such as Sensitivity, Specificity, and Accuracy. The below figure shows how they implemented their model.

III - DATA COLLECTION

The data was collected from the Kaggle website which was named Covid Radiography Dataset which includes 4 directories and 5 files. It includes 6012 different radiography Lungs Images which were further accumulated from the Radiological Society of America. For the data integration, the data was divided equally into 2 sets Train Dataset and Test Dataset. And after that, we passed the data into the import images widget which was further passed to the Image Embedding widget in Orange Tool. In this, it embeds the images into particular models to get results. Some sets of images can be seen in below figure – 3 with the Image Viewer widget.



Figure 2: Image Viewer

For the Image Embedding Tool, We have used the V3 tool by google on ImageNet which is depicted in the following figure as figure 3. This was used for both Train and Test datasets.

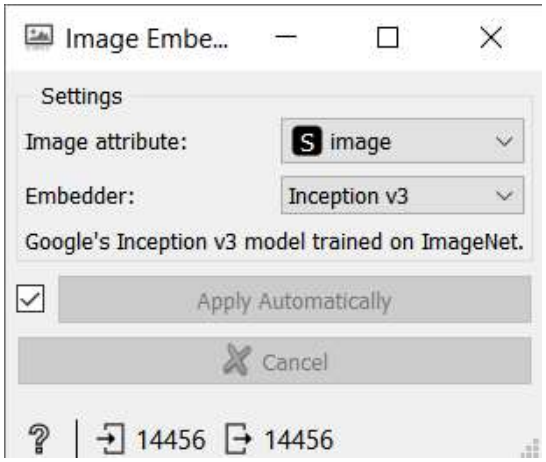


Figure 3: Image Embedding for Training Dataset

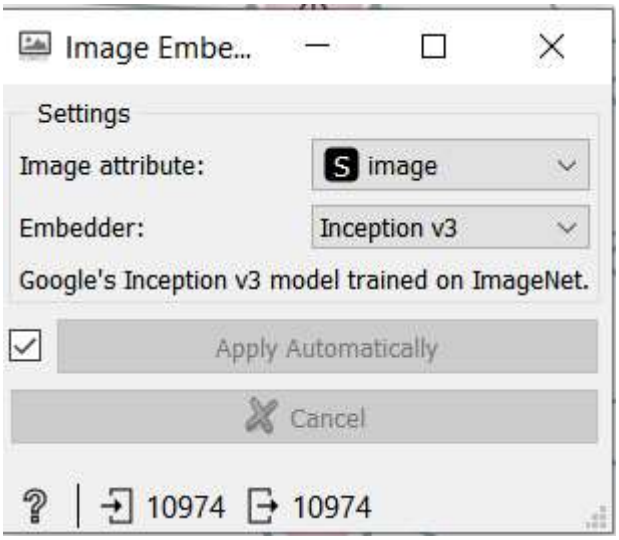


Figure 4: Image Embedding for Test Dataset

IV- METHODOLOGY:

For the Prediction of various parameters such as COVID, PNEUMONIA, LUNG_OPACITY, and NORMAL, we have used various classification and regression techniques. These techniques are used to predict different labels. Here we give a particular label to different types of prediction problems.

1. Naïve Bayes

Naïve Bayes is one of the Classification algorithms which can classify different objects into different classes. It presumes that all the different features selected are independent of each other. This algorithm works on the concept of BAYES ALGORITHM. To make all the calculations for BAYES THEOREM detectable, the Probabilities of all features are simplified. In the flowchart of Orange Tool, From the Image Embedding tool images were embedded into Naïve Bayes Model and then connected with train set Prediction to learn all the Lungs images and then later connected with the test dataset to get the results. It also compares the results with other algorithms. Figure – 6: workflows for all models.

2. Decision Tree

This model basically works on Tree Architecture. They also come in the category of Classification and Regression. This Algorithm develops gradually by dividing the data into smaller and smaller alternatives. In this, all the internal nodes are known as attributes and each branch of tree is known as the results of tests. In the flowchart of Orange Tool, From Image Embedding tool images were embedded into Trees Model and then connected with train set Prediction to learn all the Lungs images and then later connected with test dataset to get the results. It also compares the results with other algorithms. Figure – 6: workflows for all models.

3. Logistic Regression

This model basically works with the Linear equation to predict different labels here as COVID, PNEUMONIA, LUNG-OPACITY, or NORMAL. It actually calculates the best fit class label for your classification or Prediction problems. It is also said that it is one of the best Analytic techniques. In the flowchart of Orange Tool, From Image Embedding tool images were embedded into Logistic Regression Model and then connected with train set Prediction to learn all the Lungs images and then later connected with test dataset to get the results. It also compares the results with other algorithms. Figure – 6: workflows

for all models. It comprises of 2 Regularization types as Lasso and Ridge. Here Ridge is been considered. The Details of this can be seen in Figure – 6: Regularization type for Logistic Regression.

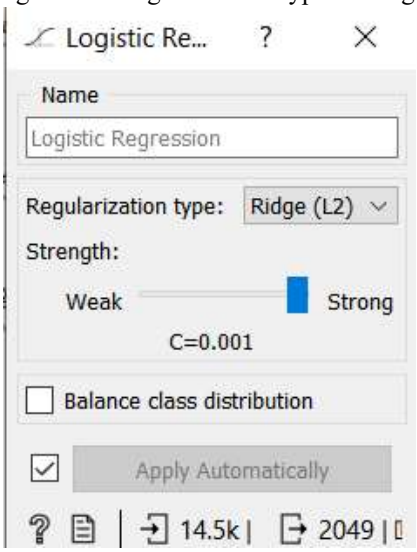


Figure5: Regularization type for Logistic Regression

4. Ada Boost

It is one of the best algorithms as it combines different types of Classification algorithms. It combines all of the weak algorithms of classification to make one of the strongest algorithms. This algorithm makes different units of data and then after it is passed on to different weak algorithms which are further integrated as one strong algorithm. It is also known as Adaptive Boosting. This algorithm also works for both Regression and Classification Problems. In the flowchart of Orange Tool, From Image Embedding tool images were embedded into AdaBoost Model and then connected with train set Prediction to learn all the Lungs images and then later connected with test dataset to get the results It also compares the results with other algorithms. Figure – 6: workflows for all models.

5. Neural Networks

This algorithm was inspired by Human Brain. It works the same way as Human Brain works. As the human Brain comprises Different Neurons, we have different Nodes in this model. After a certain period of time, it searches for different hidden patterns in Raw data, and then thereafter it clusters the same type of patterns, and then after that, it classifies into different Classification class Labels. In this manner, the Learning is constantly with different levels of improvement. It receives different units of Input and after continuously Learning it gives the best-fit Output in its best improvement. In the flowchart of Orange Tool, From Image Embedding tool images were embedded into AdaBoost Model and then connected with train set Prediction to learn all the Lungs images and then later connected with test dataset to get the results. It also compares the results with other algorithms. Figure – 6: workflows for all models.

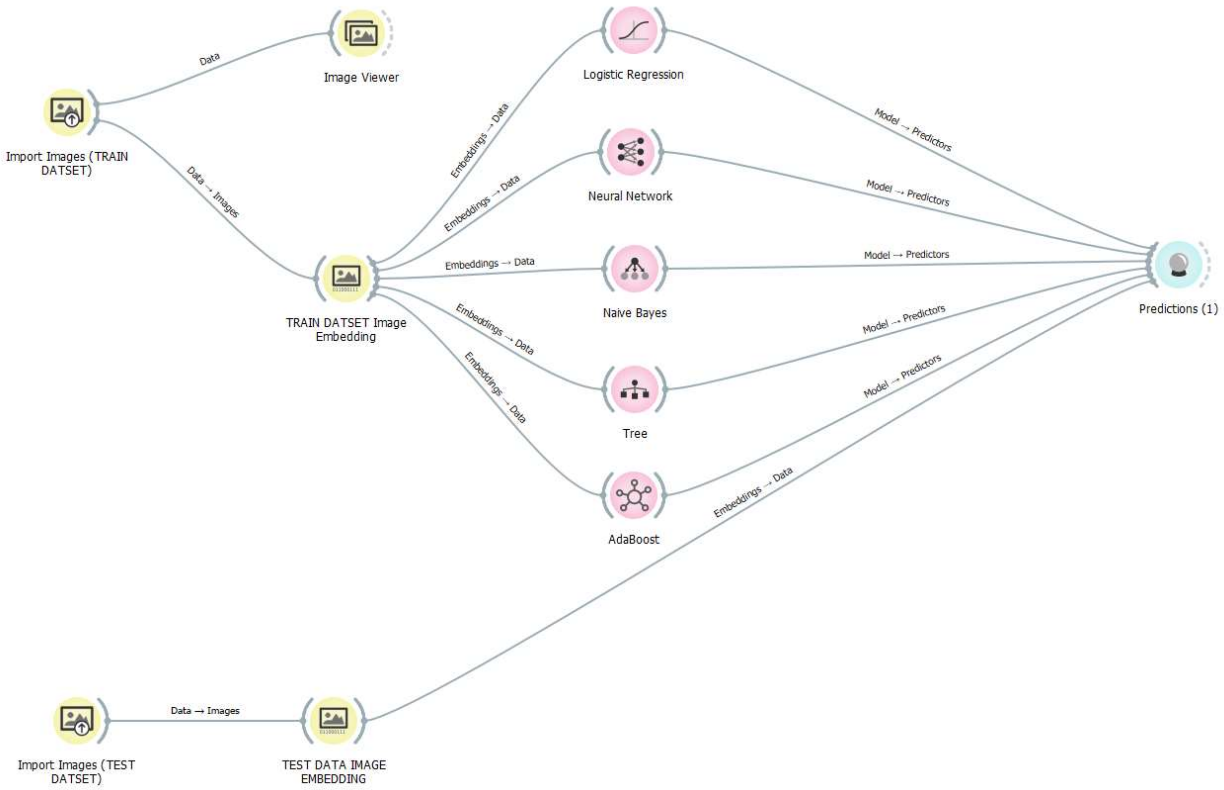


Figure 6: Workflow For All The Models

V - RESULTS AND ANALYSIS

The Prediction results were calculated on the basis of various parameters such as Area under ROC (AUC), Classification accuracy (CA), F-1, Precision, and Recall. The area under ROC is used to calculate the performance of the prediction model. If we consider our workflow, we will see that we have a higher performance rate of Neural network with 95.6% and the lowest performance rate is of decision tree with 71.1%.

In CA (Classification Accuracy), the ratio of all the correct classifications includes all the true positives and all true negatives from all the cases. It generally ranges from 0 to 1. If the predictions are closer to 1, the more predictions are correct. The more accurate results were given by Neural network with 85.3% and the lowest one was AdaBoost with 65.2%.

In Precision, the ratio between all correct positive classifications that are true positive tuples from all the cases that are really predicted to be positive is included in it. The highest one with the greatest precision is with 85.6% and the lowest one is with 64.7 % in AdaBoost.

In recall, the ratio of all the correct positive tuples from all the cases that were real positives. The highest one is 85.3% in Neural Network and the lowest one was 65.2% in AdaBoost.

F1 includes the function of precision and recall. From this, we check the balance between recall and precision. The highest one is 85% in Neural Network and the lowest one was 64.9% in AdaBoost. This can be seen in the figure

In the below figure, we can see all the predictions done by different models. Each section (model) is predicting the class labels and in the end, the original class label is given so that we can see each model result.



	Logistic Regression	Neural Network	Naive Bayes	AdaBoost	Tree	category
1797	0.10 : 0.55 : 0.33 : 0.02 → Lung_Opa...	0.00 : 0.99 : 0.01 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.95 : 0.05 : 0.00 : 0.00 → COVID	COVID
1798	0.19 : 0.22 : 0.53 : 0.07 → Normal	0.96 : 0.00 : 0.04 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 0.99 : 0.01 → Normal	COVID
1799	0.39 : 0.36 : 0.18 : 0.07 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.67 : 0.33 : 0.00 : 0.00 → COVID	COVID
1800	0.39 : 0.53 : 0.05 : 0.03 → Lung_Opa...	0.99 : 0.01 : 0.00 : 0.00 → COVID	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.03 : 0.97 : 0.00 : 0.00 → Lung_Opa...	COVID
1801	0.85 : 0.06 : 0.07 : 0.01 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.97 : 0.03 : 0.00 : 0.00 → COVID	COVID
1802	0.32 : 0.33 : 0.26 : 0.09 → Lung_Opa...	0.54 : 0.18 : 0.27 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.95 : 0.05 : 0.00 : 0.00 → COVID	COVID
1803	0.66 : 0.19 : 0.15 : 0.00 → COVID	0.25 : 0.75 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	COVID
1804	0.44 : 0.22 : 0.33 : 0.01 → COVID	0.99 : 0.00 : 0.01 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	1.00 : 0.00 : 0.00 : 0.00 → COVID	COVID
1805	0.13 : 0.10 : 0.76 : 0.01 → Normal	0.04 : 0.00 : 0.96 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	COVID
1806	0.86 : 0.10 : 0.04 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	COVID
1807	0.30 : 0.07 : 0.61 : 0.02 → Normal	0.05 : 0.00 : 0.95 : 0.00 → Normal	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	COVID
1808	0.29 : 0.42 : 0.13 : 0.16 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	COVID
1809	0.44 : 0.35 : 0.16 : 0.05 → COVID	0.99 : 0.01 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	COVID
1810	0.03 : 0.91 : 0.05 : 0.01 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.02 : 0.95 : 0.02 : 0.00 → Lung_Opa...	Lung_Opacity
1811	0.02 : 0.93 : 0.03 : 0.01 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.01 : 0.98 : 0.01 : 0.00 → Lung_Opa...	Lung_Opacity
1812	0.02 : 0.05 : 0.90 : 0.02 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 0.00 : 1.00 : 0.00 → Normal	Lung_Opacity
1813	0.07 : 0.70 : 0.22 : 0.01 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	Lung_Opacity
1814	0.03 : 0.94 : 0.02 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	Lung_Opacity
1815	0.25 : 0.73 : 0.02 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 0.00 : 1.00 : 0.00 → Normal	Lung_Opacity
1816	0.02 : 0.96 : 0.02 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.01 : 0.98 : 0.01 : 0.00 → Lung_Opa...	Lung_Opacity
1817	0.22 : 0.43 : 0.25 : 0.10 → Lung_Opa...	0.00 : 0.00 : 1.00 : 0.00 → Normal	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.50 : 0.00 : 0.50 : 0.00 → COVID	Lung_Opacity
1818	0.39 : 0.38 : 0.21 : 0.01 → COVID	0.07 : 0.74 : 0.19 : 0.00 → Lung_Opa...	1.00 : 0.00 : 0.00 : 0.00 → COVID	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	Lung_Opacity
1819	0.02 : 0.96 : 0.01 : 0.01 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.01 : 0.98 : 0.01 : 0.00 → Lung_Opa...	Lung_Opacity
1820	0.04 : 0.88 : 0.08 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	0.00 : 1.00 : 0.00 : 0.00 → Lung_Opa...	Lung_Opacity

Figure 7: Prediction of all CHEST X-RAY IMAGES

To get a more accurate idea of results, here we also have put the limelight on both ROC Analysis which can also be termed as Receiver- Operator Characteristic Analysis. This is generally used for all predictive models. Through the above analysis, we can analyze the performance of all the above models for prediction.

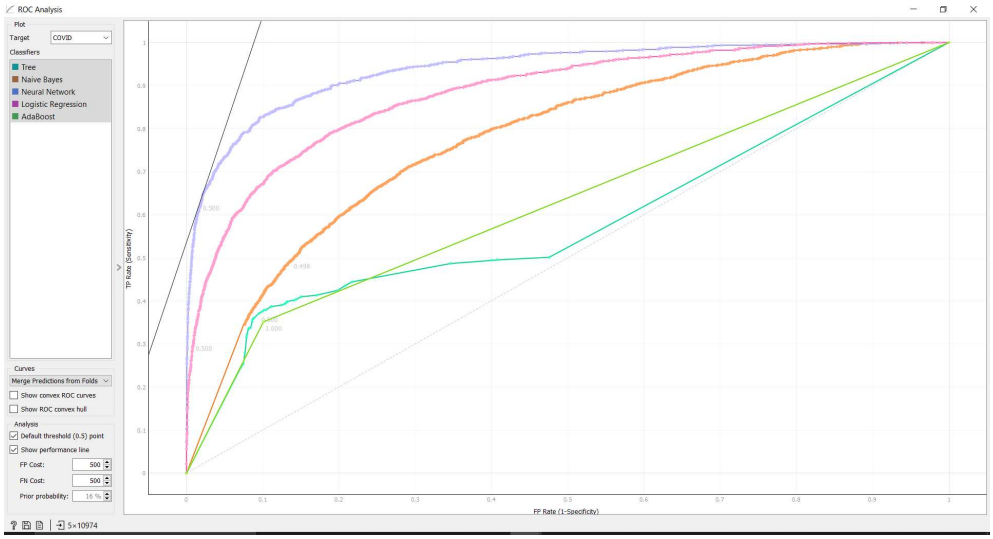


Figure 8: ROC Analysis In Case Of COVID

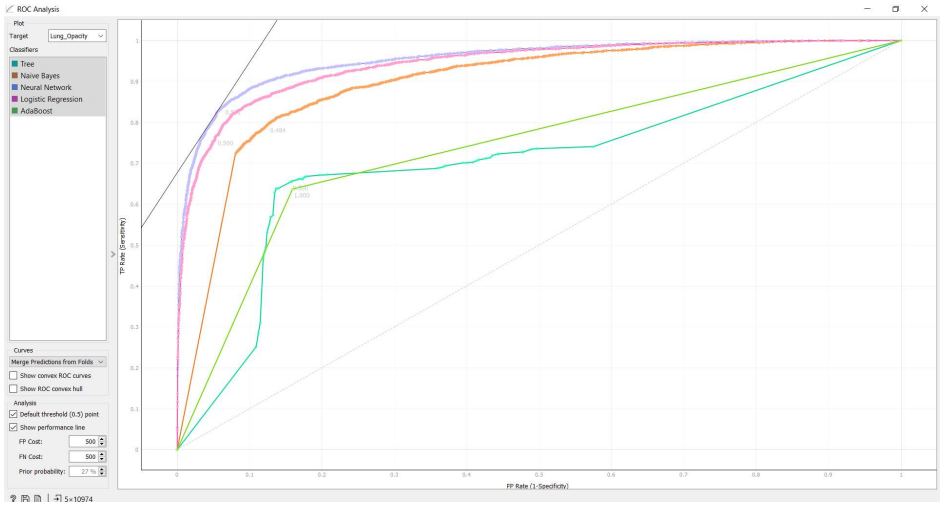


Figure 9 ROC Analysis In Case Of LUNG_OPACITY

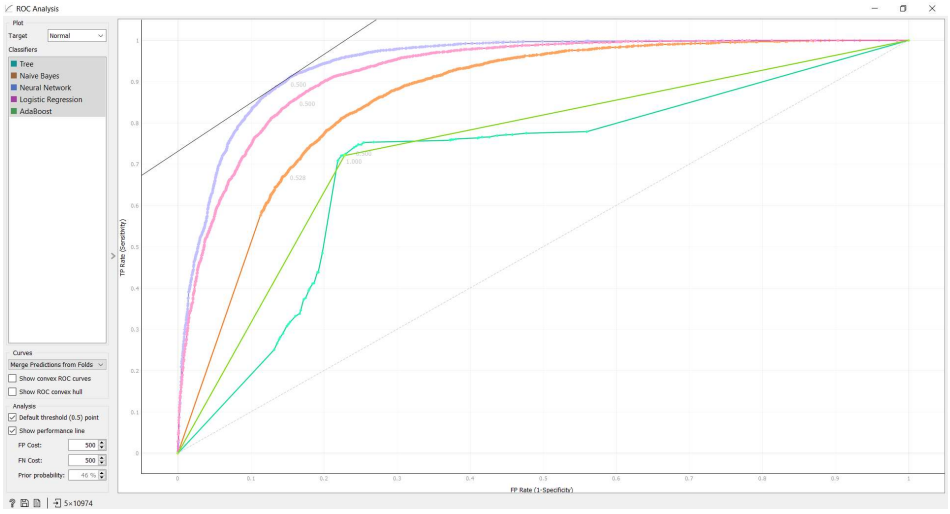


Figure 10: ROC Analysis In Case Of NORMAL

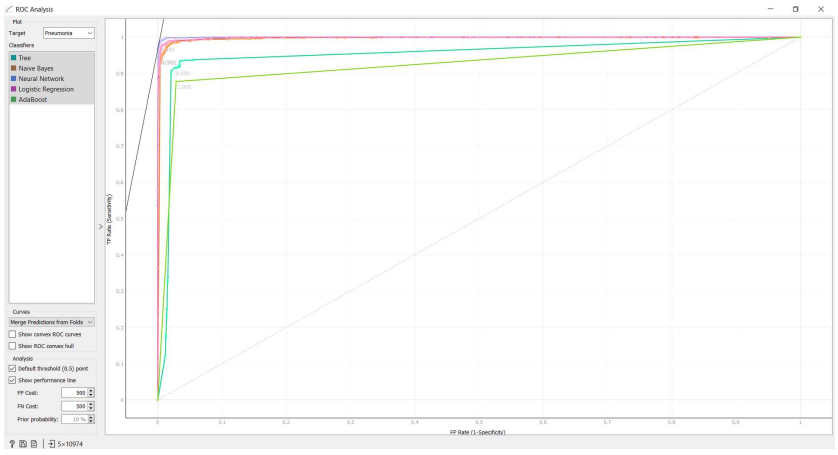


Figure 11: ROC Analysis In Case Of PNEUMONIA

Confusion Matrix is to get all the true positives and true negatives to map the performance of all the working models for prediction.

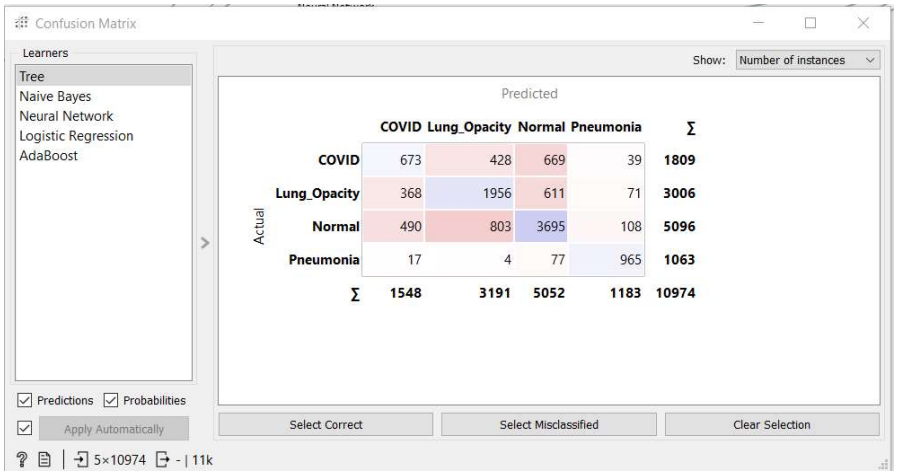


Figure 12: Confusion Matrix In Case Of Decision Tree

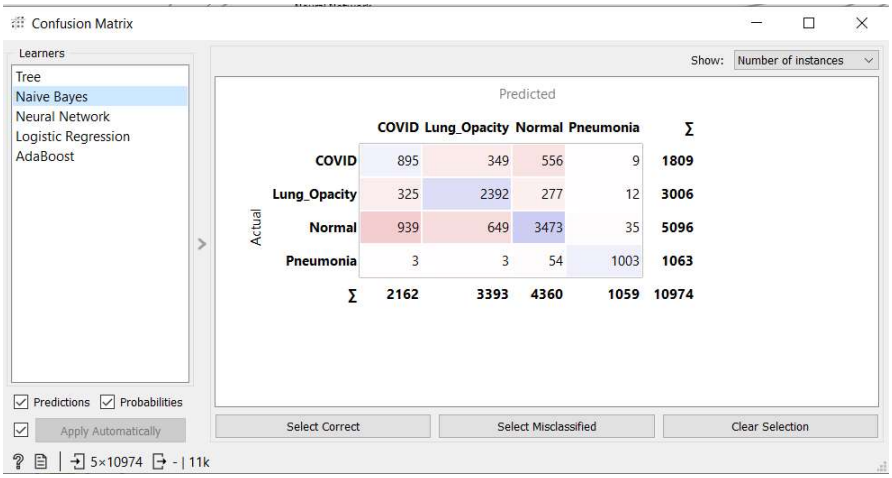


Figure 13: Confusion Matrix In Case Of Naïve Bayes

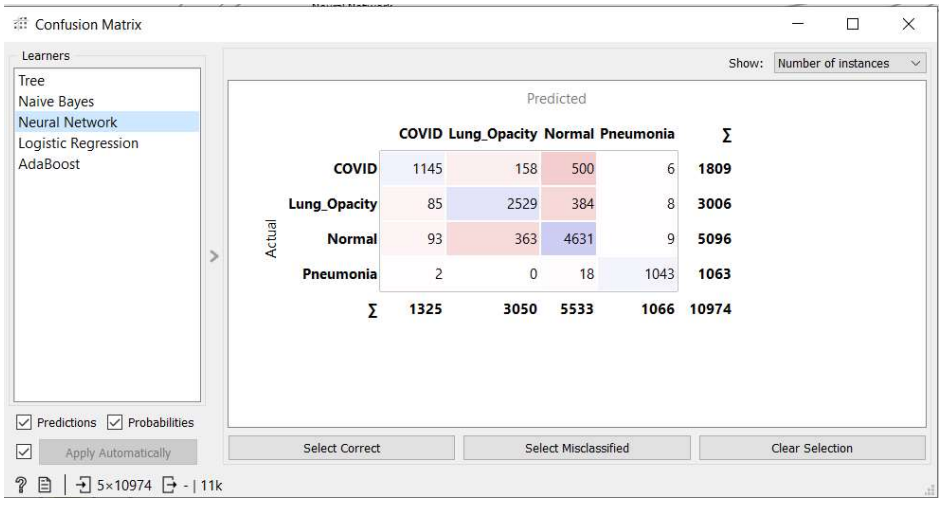


Figure 14: Confusion Matrix In Case Of Neural Network

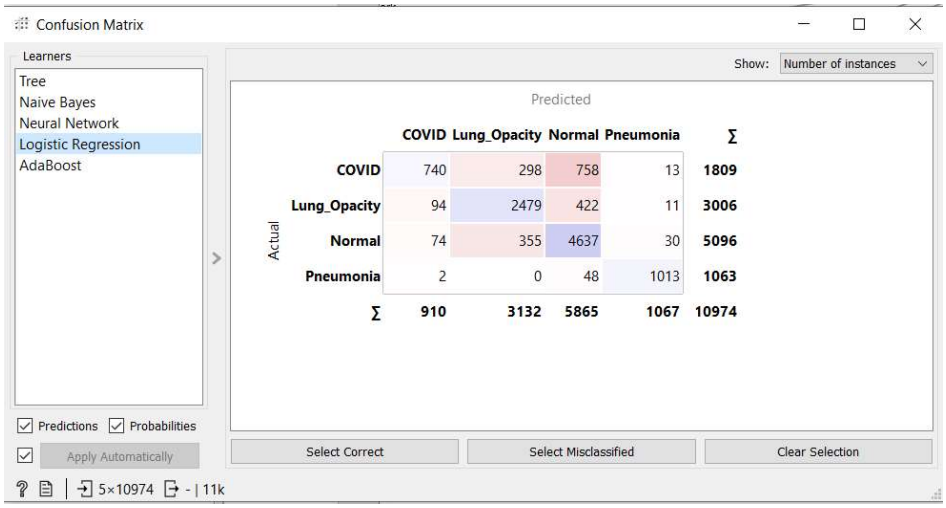


Figure 15: Confusion Matrix In Case Of Logistic Regression

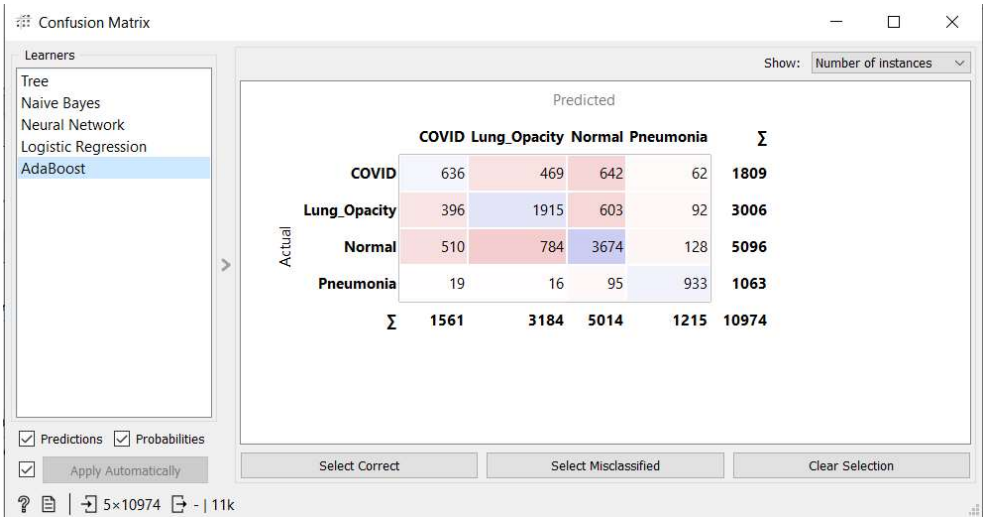


Figure 16: Confusion Matrix In Case Of Ada Boost

Model	AUC	CA	F1	Precision	Recall
Neural Network	0.956	0.853	0.850	0.856	0.853
Logistic Regression	0.930	0.808	0.796	0.810	0.808
Naive Bayes	0.870	0.707	0.712	0.723	0.707
AdaBoost	0.743	0.652	0.649	0.647	0.652
Tree	0.711	0.664	0.660	0.658	0.664

Figure 17: Test and Score

VI -CONCLUSION

In this paper, we have discussed different models such as Naïve Bayes, Neural Networks, AdaBoost, Logistic Regression, and Decision tree. The models were applied to all Chest X-RAY Images to predict all the labels which were COVID, Pneumonia, Lung Opacity, and Normal. This was really essential as COVID is increasing day by day. There is a need for faster detection, so faster recovery is possible. Also, the symptoms of COVID are common with other diseases so it is essential to know exactly which is the disease it is, so the medications can be done accordingly. Here we have used the ORANGE tool for prediction. It is a famous data mining and data visualization tool. Here we have different widgets available for use. Here the training dataset is passed to all the defined models so that these models can learn and the test dataset was further passed on to predictions with different models. Leave one out is said to get them closer, efficient, and reliable accuracy rates. That's why here leave one out is used to test the accuracy of the model. The classification accuracy was maximum in the Neural network with 85.3% Accuracy. Same other parameters for testing are also calculated.

In the future, we will consider more Chest X-RAY Images to get more accurate results. Also, we will use more models for prediction to get closer results. Also, we will consider more Algorithms for predictions. Also, we will try to make some new models so that the above Results can be improvised.

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Optimization of MRR for CNC Turning of Steel

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ABSTRACT

Stainless steel is mainly used for manufacturing of different parts like bio-implants, milk and food containers drink cans, surgical tools and structural components. It possesses excellent chemical and mechanical properties. Turning of this steel with digital control lathe enhance the material removal rate as well other desired quality characteristics than conventional lathe. Therefore in the present study digitally control lathe that is computer numerical control (CNC) lathe used to machine stainless steel. Turning on work material conducted using orthogonal array twenty seven by varying control factors speed, feed and depth of cut. Significant factor is evaluated using analysis of variance method. Depth of cut is found as significant control factor followed by feed and speed.

Keywords: steel, CNC turning, orthogonal array, coated carbide tool, Taguchi method

I. INTRODUCTION

Computer numerical control (CNC) lathe digitally control the distinct control parameters that affects the quality characteristics. However these parameters can be control manually in conventional lathe. Evaluation of optimum turning parameters for different materials may have a reference values for emerging industries. Therefore researchers have reported their work based on turning of different hard materials. Later suggested optimum values of process parameters obtained from different statistical methods [1-6]. Akhtar et al. conduct turning on aluminium alloy using orthogonal array and revealed optimum values of parameters [7]. Rizvi and Ali analysed the surface and material characteristics of CNC turned steel using hybrid approach [8]. Qinge et al. [9] had done turning to optimize turning parameters. They used hybrid method i.e. fuzzy logic and data mining for optimization of power consumption during turning. Their experimental and simulation finding were superimposed. Riadh et al. [10] studied parametric effects on surface roughness and material removal rate for turning of cobalt alloy. Tamizharasan et al. [11] used Taguchi methodology for investigation of chip thickness ratio during CNC turning of metal matrix composite. They reported that cutting speed has more effect on chip thickness ratio. Palanisamy et al. [12] used orthogonal array during turning of nickel based super alloy. Surface roughness, micro-hardness and material characteristics of work material have investigated. Ngoc et al. [13] used Taguchi-adaptive neuro-fuzzy inference system-teaching learning based model to find the optimum values of process parameters for carbon steel turning. Surface finish of analysed by varying control factors feed, speed

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and depth of cut for turning of steel [14-15]. Accuracy of developed techniques found robust. From the short literature review, author unable to find CNC turning of hard steel (AISI 304) using CNC Turn 250 (Model Manufacturer: EMCO Concept) with coated carbide cutting tool made of ceratizit. Orthogonal arrays (L27) are used for conduct the experiment. The main aim of present study is to obtain the optimum value of CNC lathe control factors (i.e. spindle speed, feed and depth of cut) for material removal rate. Values of optimum control factors have been obtained using Taguchi and analysis of variance methods. In this analysis it is found that the depth of cut is most significant.

II. MATERIALS AND METHODS

The Stainless steel (AISI304) is elected because it has wide applications like bio-implants, milk and food containers drink cans, surgical tools and structural components, textile equipments, cryogenic vessels and coal hopper etc. Chemical composition of work material is shown in Table I. The work piece tensile strength (MPa) = 124, experimentally calculated density (Kg/m3) = 7964, thermal conductivity (W/m-k) = 116 and melting temperature (^{0}C) = 885. Coated carbide cutting tool made of ceratizit used for cutting (turning) and CNC Turn 250 made of EMCO Concept lathe (Figure 1) used for turning. Control factors spindle speed (rpm), feed (mm/rev) and depth of cut (mm) and their associated levels are selected based on preliminary literature review and catalogue provided by cutting tool manufacturer for machining of AISI 304 stainless steel. The levels of turning process parameters are shown in Table II. Material removal rate is calculated by the weight difference of the work piece before and after machining using weighing machine then divide by the machining time multiply with the density of the selected material. Material removal rate is measured in term of (mm^3/min). To determine the MRR in term of signal to noise ratio (SNR) equation (1) is used.

TABLE I CHEMICAL COMPOSITION OF WORK PIECE (IN PERCENTAGE)

Fe	Si	Mn	P	S	Cr	Ni	N	C
66-74	1.0	2.0	0.045	0.03	18-20	8-11	0.10	0.08



Figure 1: Photograph of EMCO Concept Turn 250 machine tool used for turning.

Table II Levels of control factors

Factors	Units	Levels		
		i	ii	iii
Spindle Speed (SS)	RPM	1400	1600	1800
Feed	mm/rev	0.08	0.14	0.2
Depth of Cut (DOC)	mm	0.4	0.8	1.2

Signal-to-Noise Ratio for MRR:

$$\left[\frac{S}{N} = -10log\left(\frac{\left(\sum\frac{1}{Y_i^2}\right)}{n}\right)\right]_{Larger-The-Better} \quad (1)$$

III. RESULTS AND DISCUSSION

Turning operation performed on work material using CNC lathe with coated carbide cutting tools. Material removal rate is calculated by the weight difference of the work piece before and after turning using weighing machine then divide by the machining time multiply with the density of the selected material. The experimental values of MRR are present in Table III.

TABLE III ORTHOGONAL ARRAY LAYOUT (L_{27}) AND CORRESPONDING VALUE OF MRR

Exp. No.	Input parameters			MRR	
	SS	Feed	DOC	Experimental values (mm^3/min)	Signal to noise ratio (dB)
1	1400	0.08	0.4	1711.991	64.6700
2	1400	0.08	0.8	3358.02	70.5217
3	1400	0.08	1.2	5087.312	74.1298
4	1400	0.14	0.4	2674.663	68.5454
5	1400	0.14	0.8	6588.058	76.3751
6	1400	0.14	1.2	9660.706	79.7002
7	1400	0.20	0.4	4158.724	72.3792
8	1400	0.20	0.8	8566.931	78.6565
9	1400	0.20	1.2	13432.547	82.5632
10	1600	0.08	0.4	2154.555	66.6672
11	1600	0.08	0.8	5004.753	73.9877
12	1600	0.08	1.2	54175.257	94.6760
13	1600	0.14	0.4	5129.8157	74.2020

14	1600	0.14	0.8	10146.888	80.1267
15	1600	0.14	1.2	11329.797	81.0844
16	1600	0.20	0.4	6134.568	75.7557
17	1600	0.20	0.8	12022.136	81.5996
18	1600	0.20	1.2	18293.522	85.2459
19	1800	0.08	0.4	2719.479	68.6897
20	1800	0.08	0.8	5569.003	74.9155
21	1800	0.08	1.2	7774.587	77.8135
22	1800	0.14	0.4	4988.176	73.9588
23	1800	0.14	0.8	8768.331	78.8583
24	1800	0.14	1.2	12614.619	82.0175
25	1800	0.20	0.4	6717.615	76.5443
26	1800	0.20	0.8	12144.053	81.6873
27	1800	0.20	1.2	12905.436	82.2155

Analysis of Variance (ANOVA) method was introduced by Sir Ronald Fisher to evaluate different statistical components like sums of squares, degrees of freedom, error variance and F-values. Maximum material removal rate is always desired on CNC turned work part. Therefore higher is better type quality characteristic used to evaluate the signal to noise (S/N) ratio as shown in Table III. Rank of control factors evaluated by Taguchi method that is shown in Table IV. The ANOVA test performed at the significance level of 5% and confidence level of 95% [16]. From Table V, depth of cut found high than other control factors. It means depth of cut is more responsible for high material removal rate. This validates the results obtained using Taguchi method based optimization. The Figure 2 depicts the effect of control factors.

TABLE IV EVALUATION OF SIGNIFICANT CONTROL FACTORS

Levels	SS	Feed	DOC
i	74.17	74.01	71.27
ii	79.26	77.21	77.41
iii	77.41	79.63	82.16
Difference of maximum and minimum	5.09	5.62	10.89
Rank	3	2	1

Table V ANOVA TEST RESULT

Factors	DOF			
		SS	MS	F-value
SS	2	283727854	141863927	1.75
Feed	2	29506189	14753095	3.18

DOC	2	684455765	342227882	4.22
SS*Feed	4	269312890	67328223	0.83
Feed*DOC	4	242266043	60566511	0.75
SS*DOC	4	368326042	92081510	1.13
Error	8	649193073	81149134	
Total	26	252678785		
S = 9008.28	R-Sq = 74.31%	R-Sq (adj) = 16.50%		



Figure 4: Main effect of SNR versus control factors

IV. CONCLUSION

Turning on stainless steel (grade AISI304) conducted using computer numerical control turn machine. Material removal rate of work material has analyzed using Taguchi and analysis of variance methods. Following observations are found from present study.

a. Orthogonal array design used for turning on work material.
b. Analysis of variance test done on 95% of confidence level.
c. Depth of cut is found significant parameter.

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A Comparative Study On Face Recognition Using Deep Learning

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Abstract. In the present scenario handling the facial pictures could be a major problematic task. Pictures square measure created often by many alternative sources like defense, satellite unreal, bioscience, geography, social media, and design. This ends up in the creation of colossal information of these pictures. Because of this reason storing and process of terribly great amount of accessible knowledge repositories and reach to the terribly advanced system of hardware, systems meant for facial identification have evolved hugely over the past few decades.

Keywords: Deep learning, VGG, Clustering

INTRODUCTION

Face is one in the entire foremost vital human's statistics that is employed multiple times in daily human communication and because of a number of distinctive characteristics plays a serious task in transference individuality and feeling. To this point varied ways are planned for face recognition, however it's still remained terribly difficult in real world applications and up to date; there's no technique that equals human ability to acknowledge faces despite several variations in a appearance that the face will have in a scene and provides a sturdy resolution to any or all things. [1]

Face recognition has recently become a awfully active analysis space, part attributable to the exaggerated interest in biometric security systems generally, however conjointly attributable to current advances have taken the progressive way on far side of initial tries of exploitation to the direct comparison of image. Face detection system is invented since 1970. Because of the drawback of estimation, system can't be glad the need of users, that is establish the real time passport photograph. [11] At the start of 1990's techniques square measure planned centered on the face recognition and it will boost the requirement of face detection. The field of face recognition has attracted a lot of awareness and the analysis has speedily swollen by solely engineers as well as conjointly scientists.

The field of deep learning encompasses a gaggle of computer science ways that use an outsized range of easy interconnected units to perform sophisticated tasks. [2] The tasks solved by these algorithms embrace localizing and classifying objects in pictures, understanding language, enjoying games, and lots of others. whereas the flagship of deep learning, Convolutional neural networks, were initial introduced decades gone, it's solely the last five years that showed associate astonishing success of those formulas elevating their standing from a remarkable however principally impractical plan to the go-to algorithm in computer science.

A rapid growth is created in image process and recognition, principally because of the provision of deep convolutional neural networks (CNN) and huge annotated datasets. [3] A good model for prediction is mandatory to evaluate the attainable outputs and formulate the procedures which will be dispensed to restrain the lifestyle of cancer in patients. [4] but, some accuracies rely upon however expeditiously algorithms on data.
From last three years, Deep CNNs have achieved the promise leads to detect carcinoma. Improving the efficiency and accuracy of the automated detection of melanoma remains urgent thanks to the visual similarity of benign and malignant dermoscopic images. [16] There's also a requirement for rapid as well as computationally efficient systems for mobile application target caregivers and houses. [14] Consistent with the specified position of the detected object within the cell, the network will attempt to predict the bounding box of the thing and therefore the class accuracy score. [12]ML may be a quickly developing space that made excellent progress in tackling our way of life issues. In this paper we doing the survey of various technologies and then after we are able to find out the algorithm on which we will start working for our research purpose and proposed methodology.

LITERATURE REVIEW

Facial recognition may be a technology, supported AI (AI), that leverages biometric data to spot an individual supported their facial patterns. In current scenario, the government has in progress to employing this technology to

reinforce enforcement capabilities. Within the long-standing the strategy is to build countrywide programmed face recognition System (AFRS) to renew the method for criminal detection and proof by different organizations crosswise the countryside. On the other hand, these tools elevate a number of confidentiality and safety concerns. [16]
Members clarified face acknowledgment as an innovation will not to dissect human appearances for the necessities of 'confirmation' and 'distinguishing proof' of individuals. They showed the 2 kinds of facial acknowledgment: one-on-one check and one to a few distinguishing proof. [17] Members featured that AFRS, the main face acknowledgment framework inside the world, has been proposed by the Indian government for all Police powers the nation over. [13]
Given the size of the pandemic, innovation will assume a significant part in tending to each feature of COVID-19. There's additionally a progressive increment inside the quantity of utilization instances of face acknowledgment to flood the interest. Significant applications presented utilizing face acknowledgment frameworks are for security evaluation and biometric ID. In numerous nations, authorization and association have moved from heritage frameworks to confront acknowledgment answers for downsize the overall spread of COVID-19.[18]
The learning in concern give application, commercial center patterns, impact factor, and advancement realities of the product by end-clients, for example, wellbeing and law requirement, medical care, exchange, and opposite end clients. **[1]**

In 2016, author presented a paper in which they reviews the various algorithms of face recognition and proposed a chain which offers lower execution time and optimal classification accuracy. The AR database is used for this research. The proposed method gives the 96% accuracy.[5]

In 2015, the author presented a paper the different approaches, methods and their respective solutions, open problems and challenges in still images and videos for face de-identification. [6]

In 2016, author proposed a method which is the fastest growing research area in biometric trait of face, since there is no deterministic calculation exists to discover the face in a given video or picture. This proposed method achieves 97.85% accuracy. This proposed method is tested on Baodatabase which contains 157 images, Muct Database contains 751 images, 2800 images in FEI database and GTAV database has 1188 images.[7] In 2014, author presented a paper on the present era, person re-identification and recognition is an active computer vision research. According to the research, person recognition is a challenging research problem. [8]

In 2015, Choung and Tay, presented a paper in which the challenges and possibilities of deep architectures in the video based anomaly detection.[10]

In 2016, Marco Del Coco et al. presented a paper in which deep learning approach is now becoming a popular and effective approach. The proposed method achieves the 96% accuracy. [9]
The Related work is also shown in the table given below which shows the accuracy and the method the author has used.

Author Name	**Techniques**	**Accuracy**
Coco [9]	Deep learning	96%
Choung and Tay[10]	challenges and possibilities of deep architectures in the video based anomaly detection.	-
Yadav and Nain[7]	Face detection in video and picture	97.85%
Slobodan and Nikola[6]	challenges in still images and videos for face de-identification.	96%
Shankar and Udupi[5]	a chain which offers lower execution time and optimal classification accuracy	96%

TABLE 1. Related work

DATA AND DETAILED METHODOLOGY/TESTING OF HYPOTHESIS

All face detection and recognition systems need the utilization of datasets of face for testing purpose and training purposes. Especially, the performance of CNNs is very hooked in to huge datasets of training. Except this various datasets are available and some of them are discussed here.

Ref No.	**Link of dataset**	**Total no of images**	**Condition of images**
VGG-Face [21]	http://www.robots.ox.ac.uk/~vgg/data/vgg_face/	2,600 000 images. 2,622 identities. Celebrity	images in unconstrained conditions
MORPH Database [15]	http://www.faceaginggroup.com/morph/	1724 images. 515 identities (1962-1998) More recent album: 55,134 images. 13,000 individuals	Large longitudinal face database showing effects of aging
YouTube Faces (YTF) [19]	https://www.cs.tau.ac.il/~wolf/ytfaces/	3425 videos. 1595 identities.	Benchmark for unconstrained video-based face verification
WIDER FACE [20]	http://mmlab.ie.cuhk.edu.k/projects/WIDERFace/	32,203 images containing 393,703 faces	Face detection with large illumination, expression, makeup, occlusion, scale and pose variations
VGG2-Face [13]	http://www.robots.ox.ac.uk/~vgg/data/vgg_face/	3,310,000 images 9131 identities	Downloaded from Google Image Search
MS-Celeb-1M [14]	https://www.msceleb.org/	10,000,000 images 100,000 identities	Celebrity images with associated entity keys

TABLE 2. Availability of various Datasets

The methodology of the face recognition is shown in the fig 1 given below-

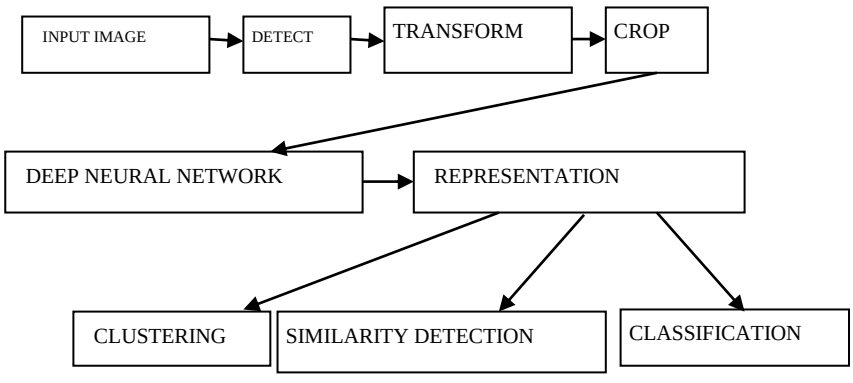


FIGURE 1. *Methodology of Face Recognition*

In figure 1 the input image is fed into the system and then the image is processed and then the processed image is fed into the deep neural network or the proposed network and then after the image is represented in the way the user

required according to the application. The author is proposing the model using deep learning for the classification of face.

RESULTS AND DISCUSSION

After the literature review of various methodologies and also the survey of various methodology of face recognition and the datasets we have studied. We will work with the face detection and face recognition. We will use the VGG data base as it will consist of large number of images and also the images are of unconstrained images. We will detect the face in the video and the deep learning method to implement this face recognition methodology.

CONCLUSION

The anticipated results of this research include a benchmark in the field of classification and detection of face. This paper will produce a large amount of data for performance measure to researchers. For the computational field, this paper will lay down the knowledge base for the deep learning and face recognition. The results will be used to create a roadmap for improving resource and data manageability. The future work for this research is to implement this proposed work and then also proposed some new framework in the Deep learning for face recognition.

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Multi-Objective Optimization of Hole Characteristics during Laser Trepan Drilling of ZTA Plate

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ABSTRACT

Excellent fracture toughness and hardness of Zirconia Toughened Alumina (ZTA) ceramic composite make it worthy to fabricate the parts for defence, aerospace and bio-implants industries. But machining of ZTA with stringent design requirements is challenging due to its improved properties. The present research paper investigates the optimum set of control factor to simultaneously optimize the hole geometrical characteristics i.e., circularity and taper during laser trepan drilling of ZTA plate. The research findings show an overall improvement of approximately 33% in multiple quality characteristics. Further, optimum results have been verified with confirmation experiment that shows small variation of 4.89%.

Keywords: ZTA, Laser trepan drilling, hole circularity, taper.

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A Literature Review on Renewable Energy Resource and Optimization

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Abstract. Step by step the energy request is broadening and in this way the necessities for a manageable source that won't hurt the climate are of prime significance. Several projections express that by 2050 the energy requesting will basically increase. In any case bigger part of the energy necessities is fulfilled by oil subordinates yet by the utilization of innocuous to the environment power designs could help in giving the energy requests. As we in general understand that feasible power is the energy which is either established by the environment or straightforwardly from the sun or from heat conveyed critical inside the earth. In this review paper the renewable energy s power and warmth, which is produced using sun based, wind, sea, hydropower, biomass, geothermal assets, bio engages and hydrogen and these resources are known as unlimited resources.

Keyword: Renewable Energy, Wind Energy, Hydropower, Biomass, Geothermal

1. Introduction

A most tremendous pursuit in our cutting-edge human progress is ―energy of various plans. Different chief cut-off points can be at a stop without energy. In this way, energy is a piece of our life. There are different sort of energy utilization cycle such unpleasant energy in falling water, in stores of coal, oil and gas, and so on are most exceptional development [1].

Sustainability is become from typical cycles that are revitalized constantly. In its various plans, it gets directly from the sunlight, or from temperature conveyed tremendous exclusively from the earth [2]. Related with the explanation are control and warmth conveyed from sunshine based, wind, sea, hydropower, biomass, geothermal assets, bio fills and hydrogen grown from renewable resources [3].

Fuel sources which are recovered after a common time cycle are reliably known as unlimited wellsprings of energy like hydro power, sun arranged energy, wind energy, streaming energy, biomass fills, and so forth. In a specific district open feasible power sources are confined total, which relies on their particular qualities [4]. Precisely when economic power sources are disconnected at a higher rate than its regenerative rate is gets non-renewable. Energy conveyed from limitless common assets and advances.

The continuous energy request is expanding step by step an immediate consequence of different reasons like developing individuals, the yearning for managed supposition for conventional comforts and general money related and mechanical new development [5]. The power age framework is in a

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general sense relied on imported oil and own vaporous petrol. Then again, as the data about the stores of oil-based products, on the off chance that they are eaten up at the continuous rate, the turned ignitable gas and coal will be depleted persistently 2020 to 2030.
To reduce the dependence on imported fuel and the pressure on oil gas, the ongoing power age system ought to be improved and all the while local energy resources should be examined and made. It very well may be referred to that concern for environment is a now a general issue and standard energy prompts ozone draining substances with disagreeable consequences for prosperity and climate [6]. In these points of view, furnishing of manageable power sources and movement of relative advancements is an astoundingly basic choice. Networks in natural locales and mostly in far away regions have near no potential outcomes to supply share on the public power.
Hardly examiners broke down limit of the breeze energy. A large portion of inspectors worked for developing the energy produced using wind. Split the difference of wind energy into existing power structure causes explicit difficulties like voltage rule, steadiness, and power quality. Various methods of reasoning like battery storing, diesel generator set were recommended for developing the security and managing the effectiveness of wind energy [7].

2. Literature Review

2.1. Building Integrated Photovoltaic Generation System

Kumar P., et al, 2009 highlights that significant amount of R & D work on PV / thermal technology was done in developed nations but very little work was done in India to build solar wall system which will help in saving natural resources like fossil fuels & issues like global warming & detoriation of environment & generate pollution free & clean renewable energy. Authors explain the advantages of early building design of ventilated PV systems into the building envelopes. In this innovation air was actively circulated behind the PV modules which maintain the temperature of cells to keep up with productivity during summer & a hot air was blown behind the PV modules which helps in melting ice formed on PV modules during winter. Building integrated PV (BIPV) was quickly creating idea of reconciliation of PV gadgets into building envelopes where PV can be coordinated into the façade of the structure as cladding or coating. Authors recommend various models like Metrological and Airflow model, Thermal model and Electrical model which work at the same time [8]. Haque, et al, 2013 presented an observational concentrate on assortment of sunlight based chargers in BIPV power age applications. Creators introduced four different sun powered charger types which included poly silicon twofold sided glass light through modules, single side tone polysilicon mistiness glass modules, formless silicon slight film modules and stack-type mu-translucent silicon layer modules. Authors implemented and designed BIPV experimental platform which specifies and defects different kind of solar panel structure power flows to explore the accuracy of PV simulating BIPV module replaces original building materials to convert sunlight into electricity for supplying household energy and to improve conversion efficiency of solar cell, module and system and reduce overall cost. In the experiment PV solar cells used where 4.2Kwp poly silicon, 1.89Kwp colour poly silicon, 0.75Kwp amorphous and 1-2Kwp stack type membrane. Each PV module was connected with appropriate inverter to record monitor indoor energy consumption, room temperature and humidity control, illumination, outdoor power equipment, sunlight intensity, environmental temperature, humidity and wind speed monitoring systems to provide long term testing on empirical research data. Data was recorded to the system before the experiment [9].
Majumder, et al, 2014 proposed PV/Wind/Biomass hybrid system for supplying electrical load in remote villages having 300 households through IRES. The village has good potential for generation of solar energy. Simulation of IRES was carried out in HOMER & 3744 simulations were done to compute the unit cost of energy. The results of simulation showed the lowest cost of energy Rs 12.462 Kwh with PV generator of 5 KW, wind turbine Rs 6 of 250 KW and hydro generator of 10 KW. HOMER modeled technical & economic factors involved. The values obtained using HOMER are not realistic & needs realistic & proper estimation & requires procedures to estimate values using statistical technique [10].

2.2. Issue Related to Building Integrated Photovoltaic Generation System

- The researchers analyzed BIPV by integrating PV devices into building envelopes in type of exteriors, rooftops or PV coating
- Authors determined different models like Meteorological & airflow Model, Electrical Model, Thermal Model [11].
- The solution approaches were found by Simulation models using MATLAB / Simulink.
- Authors concluded that the simulation studies verified different situation by using the functional load under the performance of system & indoor temperature was minimum during summer [12].
- Researchers concluded the solar divider system to be skilled to keep up with load interest during busy time [13].
- Authors analyzed the limitation of renewable energy resources and how to overcome by developing Integrated Renewable Energy System (IRES) [14].
- Researchers carried out Simulation in Hybrid Optimization Model for Electric Renewable (HOMER).
- Authors concluded that the model developed through HOMER was based on assumption of values and was not realistic and a statistical technique must be adopted using realistic estimations [15].

2.3. Wind Energy Generation

Lias Claire Dangelmaier, et al, 2011 portrayed the moderation measures to further develop the power framework recurrence execution and changing power framework age and activity and control. It additionally portrays changes to customary creates and prerequisites for existing and expected ages offices. Author had the chance to notice genuine working experience, issues connected with power framework recurrence control and reaction under different degrees of variable age of force framework. The Hawaii Electric Light Co. (HELCO) had experienced significant change in power generation in last decade wind power generation in last decade wind power generation had been increased from 15% to 11.8% in last 10 years. HELCO evaluated the system impacts of changes in generation mix and appointed a consultant. Consultant analyzed higher levels of variable generation increased load shedding events. HELCO implemented at least 2 out of 3 large steam units to be online operating to control [16].

Nicholas Miller, et al, 2011 introduced a contextual investigation on conceivable close term organization of wind-power on the Oahu power framework. The Oahu power framework was displayed in GE Multi Area Production Simulation and GE Positive Sequence Load Flow. New instruments were created to get to sub-hourly framework execution. These devices were utilized to distinguish framework execution and attributes during testing framework occasions, transient recurrence execution for important high wind possibilities. The above evaluation, various potential methodologies were considered to further develop framework activity, unwavering quality and financial matters. Fluctuation of force age from assets like wind and solar plant was difficult for framework tasks. Because of absence of accessible solar based information didn't allow definite examination of sun-oriented power in framework load. Simulation was done utilizing five essential devices. The outcomes gave the wind/sun oriented abbreviation start/come by unit, working hours by unit and absolute factor cost of activity. The framework execution during this specific time was broke down in powerful reproduction apparatus. The basic occasions like supported wind power drops in no less than 60 minutes, unpredictable wind power changes, HVDC link trip possibility occasion and burden dismissal possibility occasion were analyzed. The consequences of the study recommended attainable activity of the Oahu power framework with elevated degrees of wind and sun based power and proposed changes to introduce functional practices and other framework alterations to empower the activity of lattice with high inexhaustible infiltration. Framework change proposed like wind power, gauge and up guideline necessity expanded breeze energy by 7% by lessening wind energy shortening and diminished variable expense by 4% [17].

Mundackal J, et al, 2013 highlighted the issues related to renewable energy when connected to Grid. The power generated from this source vari es due to fluctuation in environmental conditions. Fluctuation in wind power when injected in to grid affects the power quality like active power reactive power variation of voltages harmonics of electrical behaviour of switching operation. Reconciliation of wind energy into existing power framework presents a specialized difficulties of requires thought of voltage guideline, dependability of force quality issue, which had extraordinary significance to the breeze turbine. In a steady speed wind turbine activity, change of wind speed prompts enormous variable of electrical power on the toil framework. A static compensator (STATCOM) was proposed for improving the power quality and provides energy saving and uninterruptable power. Mahmud et al, 2012 highlighted that, India was as yet reliant upon Coal and oil as significant energy sources. The problem of limited stock of fossil fuels & the adverse impact on global environment was a major concern. Although India is a major player in producing wind energy with support from Government of India and major costal stretch available. India stands on 3rd position in the world in producing wind energy but it was estimated that the energy demand will increase 3 times between 2005 to 2030 & India produce 70% of total energy from wind energy of total non-conventional energy sources still it faces lot of challenges & has great potential to generate wind energy in India. With a long shoreline of 7516 Km India has huge chance to tap the wind energy asset. States like Tamilnadu, Karnataka, Gujarat, Rajasthan, Kerala & Madhya Pradesh have wind energy installation. Due to lack of coordination with government authorities, non availability of land, huge initial investment are the major factors which lead to delay or failure of wind energy generation projects [18].

2.4 Issue Related to Wind Energy Generation

- Researchers analysed Wind Energy Potential in states like Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan & Tamilnadu, Hawaii.
- featured the difficulties of the wind energy area like failure and serious dependability issues make negative difference [16].
- Researchers analysed dissected factors impacting the development of seaward wind energy in India like government support, monetary and share motivators, accessibility of nearby skill, capital for speculations and building and empowering R&D environments [17].
- Researchers analysed the wind power forecasting and reserve strategies.
- Researchers analysed the inclusion of Static compensator (STATCOM) and battery energy storage system (BESS) to rectify the power quality problems of wind power [18].
- Researchers analysed the wind power extraction with batteries and hysteresis based current controller.
- Researchers analysed incorporation of smart energy meters which are fit for estimating prompt voltage and flow of electrical circuit [19].

3. Conclusion

In current situation different metropolitan networks are logical going to benefit with supply of power conveyed by furnishing locally accessible harmless to the ecosystem power. Undeniable confirmation of specialty districts that would plainly benefit with such a method, evaluation and assessment of all helpful choices for power supply is crucial for outline and execute intervention drives in such manner. Other than a survey of energy supply circumstance is fundamental, it is imperative to lead energy frames in a couple of system and un-charged towns and evaluate innocuous to the environment power asset receptiveness in the equivalent.

Taking into account the disclosures of energy studies and other optional information plan, appropriate achievable power-based structures will be organized and their yearly power transport assessed. The piece of client moderateness and energy to pay the social classes for innocuous to the biological system power-based power supply while considering the designs organized in the assessment will in addition be dissected.

In this manner, by considering the above examination of economic power, one can in actuality handle the importance of creating electrical power from manageable power in a little while and additionally the obstacles like low reasonability and deficient disguising impact should be dealt with.
This study will give the data about the undeniable interest of energy and weight the board in future, this dissected information can be utilized to make the arrangement outline of power. Study will in addition be significant for those areas, which are unmindful of the manageable power creation by virtue of absence the sun-based energy.
Some consideration endeavours will correspondingly be done to cautious the nearby individuals and the more energetic students in regards to innocuous to the biological system power age and defending non-practical power sources and saving climate.

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Compressive Strength of Waste PET Bottle Based Fibre

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Abstract. PET (polyethylene terephthalate) bottles have progressively turned into a crucial and fundamental piece of an everyday person's life. Thus the need emerges to course these waste plastic containers to their ideal use. To add to it, incorporation of waste PET bottles in concrete composites is a promising technique for developing sustainable composite materials which may be applied to the construction industry. Hence concrete with waste PET bottles proves not only as an effective plastic waste management technique, but also an approach towards economic, environment friendly and sustainable development of building materials in the future. In the research work, an experimental study has been carried out to analyze the possibility of using waste PET bottle fibres with 3 different aspect ratios of 10, 20, and 30, in concrete at different replacement dosages of 0.5%, 1%, and 1.5% of sand by weight, and compared against control mix with no replacements of sand.

Keyword: PET, Bottles, Fibres, Composite Materials

1. Introduction

The changed lifestyle and ceaselessly extending people has achieved a gigantic development in how much plastic waste creation. The yearly usage of plastic materials by and large has extended from 5 million tons during the 1950s to around 100 million tons in the new times, which has lead to plastic waste age in tremendous aggregates. It was evaluated in 2016 that 56 million tons of PET things are made consistently [1]. Anyway it is ensured that most thermoplastics would be capable, on a key level, be reused, regardless, Recycling of PET compartments is more sensible than a few other plastic applications because of the extraordinary worth of the gum and the essentially particular use of PET for water and carbonated soft drink bundling on a wide scale all around the planet [2].

This waste is either scorched or dumped in soil as landfill, the two of which are damaging for the environment. The consuming of plastic results in appearance of horrendous compound gases which directly cause air tainting and in the end lead to occasion of respiratory sicknesses on receptiveness with time. Of course, on being dumped in ground as landfill, plastic wastes achieves loss of soil readiness, decline in water saturation, contamination of ground water, awful waste, etc [3]. Along these lines, among different waste segments, plastic waste benefits excellent thought by temperance of its non-biodegradable property in view of which it causes defilement in the environment. In India around 40 million tons of solid waste is conveyed consistently. This is extending at a speed of 1.5 to 2% reliably. Waste plastics contain 12.3% of outright waste made most of which is from discarded

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water bottles. The waste PET containers can't be sorted out off by either dumping or consuming, as they produce uncontrolled fire on consuming and contaminate the soil and vegetation on dumping [4]. Polyethylene Terephthalate (PET) is the most routinely used thermoplastic polyester. PET is used fantastically as containers for taking care of carbonated and non-carbonated drinks. A direct polymer has incredible mechanical properties and extraordinary layered reliability under factor load. Semi clear thermoplastic polyester, intense, low gas permeability, falsely and thermally consistent, successfully dealt with and dealt with, mileage safe and non biodegradable is the ordinary ascribes of PET [5]. Considering its adaptability, it is also used in materials, films, utility item, athletic attire, etc. Food taking care of endeavors slant toward PET for all intents and purposes, significant solid areas for sterile, weight. This shows that it has a wide extent of purposes. PET has a spot with the thermoplastics with phenomenal genuine properties [6].

2. Literature Review

Betioli AM and Silva DA, 2005 examined their examination work in which they assessed the debasement and strength of PET filaments, acquired from the reused plastic jugs presented to solutions for a considerable length of five month, through Fourier-Transform Infrared spectroscopy (FTIR) and checking electron microscopy (SEM) [7]. Albano C, et-al, 2009 introduced the investigation of mechanical way of behaving of concrete with reused Polyethylene Therephtalate (PET), differing the water/concrete proportion (0.50 and 0.60), PET substance (10 and 20 vol. %) and the molecule size. The mixes were presented to various temperatures (200, 400, 600 degree C), and thus the impact of the warm debasement of PET in the substantial was examined [8]. Kim SB, et-al, 2010 introduced an exploratory examination to concentrate on the strength, malleability and disappointment method of reused PET fiber built up concrete that was completed. The researchers checked the presentation limit of reused PET fiber supported concrete, and contrasted it and that of polypropylene (PP) fiber built up concrete for fiber volume parts of 0.5%, 0.75%, and 1.0% [9]. Foti D, 2011 announced the aftereffects of certain tests performed on substantial examples supported with filaments produced using waste polyethylene terephthalate (PET) bottles which were gotten by basically cutting the bottles. Materials utilized for making of substantial blend included roundabout Ready blend concrete PET filaments 1% by volume of concrete, shifting in thickness acquired from single layer, twofold layer, and four layers of covering bottles [10].

3. Experimental Procedure

Conclusively 4 types of mixes were designed for each aspect ratio and 180 Specimens were cast in total consisting of cubes, cylinders and beams, each 60 in number.
Concrete mixes prepared are as follows:
Conventional mix without addition of PET fibers.

- Addition of PET fibre @ 0.5% partial replacement of sand with above aspect ratio
- Addition of PET fibre @ 1.0% partial replacement of sand with above aspect ratio
- Addition of PET fibre @ 1.5% partial replacement of sand with above aspect ratio

Table 1. Specimen Details

% PET fibre addition	Days of Curing	Compressive (Cubes)			Split Tensile (Cylinders)			Flexure (Beams)			Total
		Aspect Ratio-10			Aspect Ratio-20			Aspect Ratio-30			
		10	20	30	10	20	30	10	20	30	
0%	3		2			2			2		6
	7		2			2			2		6
	28		2			2			2		6
0.50%	3	2	2	2	2	2	2	2	2	2	18
	7	2	2	2	2	2	2	2	2	2	18
	28	2	2	2	2	2	2	2	2	2	18

1%	3	2	2	2	2	2	2	2	2	2	18
	7	2	2	2	2	2	2	2	2	2	18
	28	2	2	2	2	2	2	2	2	2	18
1.50%	3	2	2	2	2	2	2	2	2	2	18
	7	2	2	2	2	2	2	2	2	2	18
	28	2	2	2	2	2	2	2	2	2	18
			60			60			60		180

3.1. Workability Concrete

Workability of concrete is a significant property to decide prior to setting of concrete, A substantial is supposed to be serviceable in the event that it is effectively moved, set, compacted and completed with no isolation. Concrete with high compaction factor is supposed to be more useful. Table 2 shows values of compaction factor for the different values of PET fibre content in concrete.

Table 2. Compaction Factor of Concrete w.r.t. PET Fiber Percentage

PET Fiber %	Compaction Factor (AR-10)	Compaction Factor (AR-20)	Compaction Factor (AR-30)
0%	0.960	0.96	0.96
0.50%	0.868	0.857	0.843
1%	0.847	0.836	0.82
1.50%	0.823	0.799	0.771

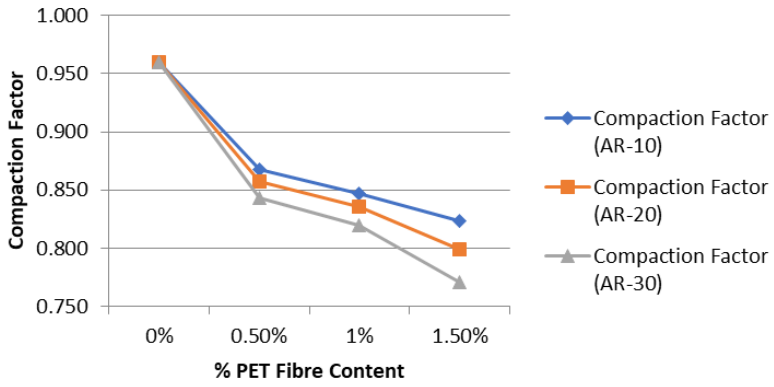


Figure 1. Compaction Factor of Concrete for different aspect ratios w.r.t. PET Fiber Percentage

Figure 1 shows the comparison of Compaction factor for various fibre content percentages. It is seen that as the steel fiber content in concrete increments compaction component of concrete declines in like manner consequently the usefulness diminishes.

3.2. Compressive Strength of Concrete

By and large augmentation in strength of concrete with age is noticed. Table 3 shows the suggested strength of concrete at various ages in examination with the strength at 28 days in the wake of projecting.

Table 3. Recommended Strength gain Percentage % with successive days

Age	**Strength percentage %**
1 day	16%
3 days	40%

7 days	65%
14 days	90%
28 days	99%

Table 4 shows the recommended strength for different grades of concrete in N/mm2 after 14 and 28 days of casting.

Table 4. Grades of Concrete and its Recommended Strength gain of 7 days & 28 days in N/mm^2

Grade of Concrete	Minimum compressive strength (N/mm^2) at 7 days	Specified characteristic compressive strength (N/mm^2) at 28 days
M15	10	15
M20	13.5	20
M25	17	25
M30	20	30
M35	23.5	35
M40	27	40
M45	30	45

Compressive strength of concrete is utmost property of concrete. Cubes of dimensions with 150×150×150 mm were cast and testes foe compressive strength on compression testing machine.

Table 5. Compressive Strength of Cubes (AR - 10)

% PET fibre addition	3 Days Compressive Strength			7 Days Compressive Strength			28 Days Compressive Strength		
	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased
0	2	20.00		2	32.00		2	39.56	
0.50	2	25.33	26.67	2	31.11	-2.78	2	40.00	1.12
1	2	28.89	44.44	2	34.22	6.94	2	42.22	6.74
1.50	2	23.11	15.56	2	32.89	2.78	2	40.00	1.12

Table 5 shows the upsides of compressive strength of concrete shapes and rate increase in strength of cubes after expansion of explicit substance of PET fiber of aspect ratio - 10, for curing of 3, 7 and 28 days. For 28 days restoring it was seen that compressive strength of concrete increase with expansion of PET fiber (0% to 1%) however decrease with additional option of fiber (1.5%).

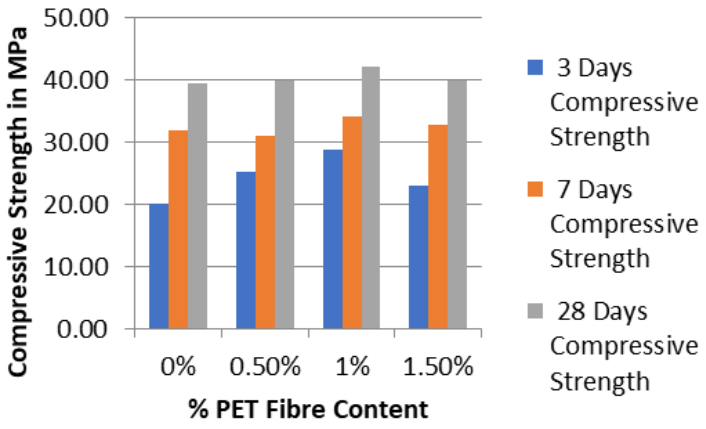


Figure 2. Compressive Strength of Cubes (Aspect Ratio - 10)

Table 6. Compressive Strength of Cubes (AR - 20)

% PET fibre addition	3 Days Compressive Strength			7 Days Compressive Strength			28 Days Compressive Strength		
	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased
0	2	20.00		2	32.00		2	39.56	
0.50	2	26.22	31.11	2	32.00	0.00	2	40.89	3.37
1	2	29.33	46.67	2	35.11	9.72	2	42.22	6.74
1.50	2	24.44	22.22	2	32.44	1.39	2	40.00	1.12

Table 6 shows the values of compressive strength of concrete cubes and percentage increment in strength of cubes after addition for specific content of PET fibre of aspect ratio - 20, for water curing of 3, 7 and 28 days. For 28 days curing it was observed that compressive strength of concrete increases with addition of PET fiber (0% to 1%) but decreases with further addition of fiber (1.5%).

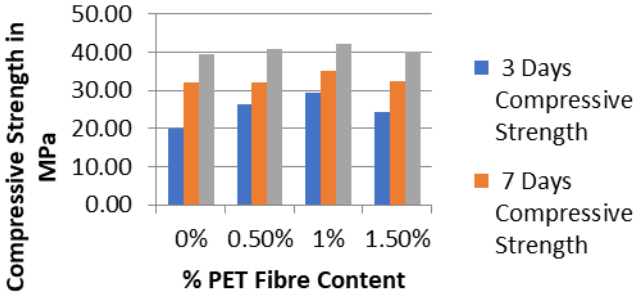


Figure 3. Compressive Strength of Cubes (Aspect Ratio - 20)

Table 7. Compressive Strength of Cubes (AR - 30)

% PET fibre addition	3 Days Compressive Strength			7 Days Compressive Strength			28 Days Compressive Strength		
	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased
0	2	20.00		2	32.00		2	39.56	
0.50	2	25.78	28.89	2	36.44	13.89	2	40.44	2.25
1	2	26.22	31.11	2	35.56	11.11	2	41.33	4.49
1.50	2	22.22	11.11	2	33.33	4.17	2	40.44	2.25

Table 7 shows the values of compressive strength of concrete cubes and percentage increment in strength of cubes after addition for specific content of PET fibre of aspect ratio - 30, for water curing of 3, 7 and 28 days. It was observed that compressive strength of concrete increases with addition of PET fibre up to 1%, but reduces on further addition of fibres (1.5%).

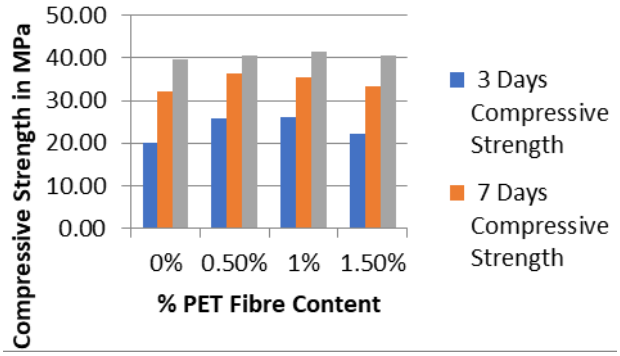


Figure 4. Compressive Strength of Cubes (Aspect Ratio-30)

Table 8. Compressive Strength of Cubes (28 days)

% PET fibre addition	Aspect Ratio - 10			Aspect Ratio - 20			Aspect Ratio - 30		
	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased	No. of Cubes	Compressive Strength	% Increased
0	2	39.56		2	39.56		2	39.56	
0.50	2	40.00	1.12	2	40.89	3.37	2	40.44	2.25
1	2	42.22	6.74	2	42.22	6.74	2	41.33	4.49
1.50	2	40.00	1.12	2	40.00	1.12	2	40.44	2.25

Table 8 shows the values of compressive strength of concrete cubes and percentage increment in strength of cubes after addition for specific content of PET fibre of aspect ratio -10, 20 and 30, for water curing of 28 days. Though the change in strength was very small with change in aspect ratio of fibres, however, the strength of concrete was almost same for specimens with PET fibres with aspect ratio 10 and 20 and was little less for fibres with aspect ratio of 30.

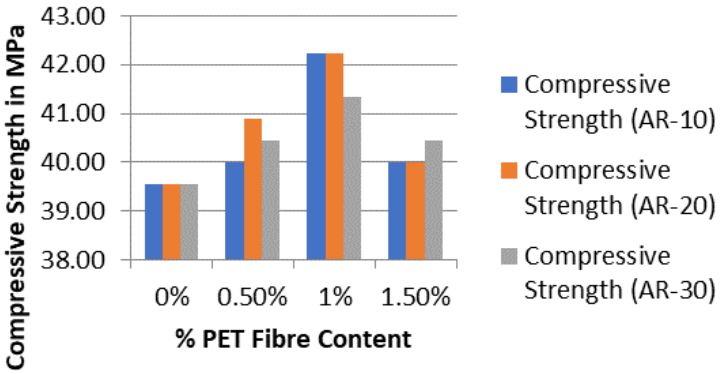


Figure 5. Compressive Strength of Cubes (28 Days)

4. Conclusion

In this research work, Mix-Design of M-30 grade concrete; reference IS 10262: 2009, having water-concrete proportion 0.45 is used for the experiment. Keeping any remaining constituent materials consistent waste PET fibres are penetrated at rates of (0% to 1.5%) while supplanting fine sand. Actually 180 specimens of PET Fiber Reinforced Concrete (PFRC) were projected with incredible accuracy and were restored for 3 days, 7 days and 28 days. Every one of the specimens were restored in water. During concreting/projecting of shapes, compaction factor test on new concrete was led for check of functionality with above rate (%) expansion of PET fiber for example (0% to 1.5%). After

culmination of development time of concrete, compressive strength test was directed on every one of the specimens with individual date of casting. From the review it was seen that compressive strength expanded with rate (%) of PET fiber (0% to 1.0%) 3 days, 7 days and 28 days and from that point diminished on expansion of 1.5% PET fiber for all ages. It was additionally seen that ideal rate increase in compressive strength of concrete was 46.67 % for 3 days restoring, 9.72 % for 7 days relieving, and 6.74 % following 28 days restoring on supplanting sand by 1% PET strands (perspective proportion - 20).

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A Literature Review on Mechanical Properties of Waste PET Bottle Based Fibre

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Abstract. PET which stands for polyethylene terephthalate. It is a form of polyester just like the clothing fabric. PET bottles is a clear, strong, and lightweight plastic that is widely used for packaging foods and beverages, especially convenience-sized soft drinks, juices and water. Have increasingly become an indispensable and essential part of a common man's life. The joining of waste PET containers in substantial composites is a promising method for creating manageable composite materials which might be applied to the development business. Consequently, concrete with squander PET jugs demonstrates not just as a viable plastic waste administration procedure, yet in addition a methodology towards financial, climate well-disposed and reasonable advancement of building materials later on. In this review paper, properties of reinforced concrete made by the incorporation of waste PET bottle fibres have been analysed and discussed.

Keyword: Renewable Energy, Wind Energy, Hydropower, Biomass, Geothermal

1. Introduction

The changed way of life and perpetually expanding populace has brought about a huge expansion in the amount of plastic waste creation. Due to massive use of PET in plastic materials, utilization of such materials has been expanded to more than 100 million tons in the 20th century which has led to plastic waste age in gigantic sums. It was assessed in 2016 that 56 million tons of PET items are created every year [1]. However it is guaranteed that most thermoplastics would be able, on a fundamental level, be reused, in any case, Recycling of PET containers is more reasonable than some other plastic applications as a result of the great worth of the gum and the practically selective utilization of PET for water and carbonated soda pop packaging on a wide scale all over the planet [2].

This waste is either singed or unloaded in soil as landfill, the two of which are destructive for the climate. The consuming of plastic outcomes in arrival of destructive compound gases which straightforwardly cause air contamination and in the end lead to event of respiratory illnesses on openness with time. Then again, on being unloaded in ground as landfill, plastic squanders brings about loss of soil ripeness, decrease in water permeation, pollution of ground water, unfortunate waste and so on [3]. In this way, among various waste portions, plastic waste merits exceptional consideration by virtue of its non-biodegradable property because of which it causes contamination in the climate. Approximately 2% consistent growth is registered in generation of such waste in India only and now almost 50 million tons of such waste is generated every year in the country. Squander plastics comprise 12.3% of absolute waste created the greater part of which is from disposed of water bottles. The waste PET jugs can't be

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arranged off by one or the other unloading or consuming, as they produce uncontrolled fire on consuming and sully the dirt and vegetation on unloading [4].
The most regularly utilized thermoplastic polyester is Polyethylene Terephthalate one reason is that it is utilized transcendently as jugs for putting away carbonated and non-carbonated drinks. A straightforward polymer has great mechanical properties under factor load and great layered dependability. Semi translucent thermoplastic polyester, tough, low gas porousness, artificially and thermally steady, effectively handled and took care of, mileage safe and non-biodegradable are the normal attributes of PET [5]. In view of its flexibility, it is additionally utilized in materials, films, utility product, athletic apparel and so forth. Food handling enterprises incline toward PET as it is, major areas of strength for sterile, weight. This shows that it has a wide scope of uses. PET has a place with the thermoplastics with fantastic actual properties [6].

2. Literature Review

A detailed review of research papers, on Mechanical Performance Analysis of Waste PET bottles-based Fibre Reinforced Concrete published within the period from 2005 to 2020 has been undertaken. Authors studied the effects of using plastic on mechanical properties of concrete by varying percentages of plastic as fibre to improve the properties of concrete. The various percentages of fibre used for experimental work were 0%, 0.2%, 0.4%, 0.6%, 0.8% and 1.0%. It is evident from the above studies that strength of PET fibre induced concretes was less than that of conventional concrete. But, the authors did not discuss any literature review which may have led to poor knowledge for strength enhancing techniques while using PET fibres in concrete, and consequently no improvements were recorded for compressive strengths for concrete [1].
The inference derived from the research paper was that PET fibres are degraded in alkaline environment. However, the process of degradation of these fibres is a long process and hence takes time for significant effects. Therefore, the authors suggested to carry out experimental analysis for extended periods such as up to 365 days and further, so that effects of fibres over longer periods may be observed and inferences be made accordingly [2].
Paper reported the results of some tests performed on concrete specimens reinforced with fibres made from waste polyethylene terephthalate (PET) bottles which were obtained by simply cutting the bottles. Materials used for making of concrete mix included circular Ready mix concrete PET fibres 1% by volume of concrete, varying in thickness obtained from single layer, double layer, and four layers of overlapping bottles [3].
Authors discussed the experimental investigation that was carried out to study the mechanical behaviour of hybrid fibrous concrete reinforced with steel fibres and Recycled Polyethylene Terephthalate fibres. M 40 grade of concrete was used for this study in which the steel fibres were mixed at a percentage level of 0.5 and RPET fibres were mixed from 0 to 0.5%, at equal intervals of 0.1% [4].
Authors presented the experimental analysis carried out to investigate the compressive strength of concrete by replacing natural aggregates with recycled aggregates in various percentages of 25%, 50%, 75% and 100% of, accompanied by incorporation of PET fibres at 1% and 2% by volume in M-20 grade concrete. From the past literatures the authors learnt that with the use of binders the strengths of PET fibre reinforced concrete were improved as compared to conventional concrete mix [5].
Authors discussed the investigation which aimed at partial replacement of sand with 5 to 20% of waste plastic material in M25 grade of concrete to make an attempt to increase the ductile strength of concrete as it is generally found weak in tension. From past literatures the authors learnt that higher flexural strength for RCC beams could be achieved by adding 2% waste plastic fibres [6].
Authors investigated the effects of substitution of sand with PET processed particles. In this process cubic and cylindrical specimens with varying w/c ratios were prepared and tested for physical properties of fresh concrete. For testing the mechanical properties, the specimens were cured in specific standard conditions which gave interesting results [7].
Authors discussed the use of PET fibres as an alternative material in M-25 concrete by replacement of 0.5%, 1%, 2%, 4% & 6% of fine aggregate by waste PET fibres. Some other ideas such as PET panels and mattresses and direct use of PET bottles for construction of non-load bearing walls with appropriate fillers have also been discussed. The authors, from past literatures learnt about various benefits of using

waste PET fibres in concrete, as they improve acoustic properties in concrete, reduce shrinkage by acting as crack arresters and reduce dead load of the structure by 2-6% approximately [8].

Authors investigated the experimentally evaluated effects of steel and PET (polyethylene terephthalate) fibres separately on the properties of both fresh and hardened Self-compacting concrete (SCC). From review of previous literatures the authors learnt that due to high cementitious content and fillers in SCC more early-age cracking of SCC (due to plastic shrinkage, as well as thermal stress) and more drying shrinkage, compared to normal concrete are witnessed as common characteristics. Therefore use of fibres in SCC was a good idea to promote ductility and to reduce early-age cracking [10].

The results showed a greater compressive strength for unreinforced concrete though, however PET fibre reinforced concrete showed satisfactory results for and was observed at a value of 40 MPa as compared to 42.4 for un-reinforced concrete. For four point bending test a maximum load bearing capacity of 15.18 KN was reported by the authors for PET fibres reinforced concrete as compared to 13.91 KN for unreinforced concrete specimens and consequently the strengths for the two types of specimens varied from a maximum value of 4.07 MPa to 3.77 MPa respectively. For first crack strength improved values were observed at a mean value of 4.78 MPa for PET fibre reinforced concrete against a value of 3.39 MPa for unreinforced concrete. For energy absorption capacities a mean value of 0.46 for ductility indices was reported for PET fibre reinforced concrete resulting in post crack energy of 1753 Nmm2 [11].

Authors discussed the experimental analysis carried out to study the compressive strength of M-20 grade concrete using plastic and a combination of plastic and steel fibres in the ratio of 2:1 in concrete. A controlled specimen with 0% fibre was also prepared for comparing the result values with that of fibre reinforced concrete. The objective of the paper was to produce fibre reinforced concrete using waste plastic and to optimize their use and resulting benefits in concrete. The results reported by the authors showed a decrease in 28 day strength for plastic fibre reinforced concrete when compared to 0% fibre mix. The 28 day strength was reduced from 630 KN for 0% fibre mix to 621, 596, 587, 577, and 570 KN for 0.2, 0.4, 0.6, 0.8 and 1% fibre induced mixes, respectively [12].

Materials used for experimental analysis included fine aggregate, coarse aggregate, and plastic aggregate. For Coarse Aggregate, tests conducted to study the properties were Abrasion Test (<25%) and Flakiness Index (<25%). For Fine Aggregate, tests for angularity (>45%), and water absorption test (<2%) were conducted. Plastic aggregates were formed from collecting, cleaning, shredding, heating and melting of waste polypropylene and PET plastics. It was suggested by the authors that 10% Fibre reinforced concrete may be used for non-structural elements and less important works such as walkways. In this paper testing of specimens was carried out while varying the % replacement by plastic aggregates to which the negative results were obtained [13].

Author presented an experimental study conducted to determine the compressive strength and adsorption of normal and PET fibre reinforced concrete (PFRC) for grades of M-20 and M-30 along with varying geometry and aspect ratio of fibres incorporated in PFRC. The dosage of these fibres was also varied from 0 to 3%. During the review of past literatures the authors were educated about some bitter properties such as low tensile and impact strength, brittleness, low resistance to cracks and high density. From review of past literatures the authors learnt that for replacement of fine aggregates, up to 20 %, by ground waste plastic, resulted in reduction of slump value by approximately 25% [14].

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Table 1. Compressive Strength of Different Location

Sr. No.	Year & Location	Days of Testing	% PET added or Replaced	% Change in Compressive Strength	% Change in Split-Tensile Strength	% Change in Flexural Strength
1	2009, Venezuela	7, 14, 28	0, 10, 20	12.73(↓),45.45(↓)	10.71(↓), 19.64(↓)	8.24(↑), 1.18(↓)
2	2010, South Korea		0, 0.5, 0.75, 1	1.89(↓), 5.66(↓), 9.43(↓)	-	7.5(↑), 7.3(↑), 6.31(↑)
3	2011, Tamil Nadu, India	7,28	0,0.5	5.12 (↑)	1.75(↑)	-
4	2011, Portugal	7,28,63	0,0.5,1 & 1.5	1.93(↑),13.53(↓), 4.39(↓)		19.42(↑),33.98(↑)
5	2012, Maharashtra	7,14,128	0, 0.2, 0.4,0.6 & 0.8, 1	10.5(↓), 14.74(↓), 21.84(↓), 23.42(↓) & 22.07(↓)	(6.31(↑), 19.42(↑), 25.24(↑), 35.19(↑) & 19.53(↑)	-
6	2012, Brazil	28,150	0, 0.05 & 0.18, 0.3	0.65(↑), 3.01(↓),7.50(↓)	-	-
7	2013, Kerela, India	28	0,20	+21.51(↑)	22.04(↓)	3.641.18(↓)
8	2013, Tamil Nadu, India	28	0,0.1, 0.2, 0.3, 0.4,0.5	0.47(↑), 0.87 (↑), 0.19(↓),0.8(↓) ,3.85(↓)	3.84(↑), 24.5(↑), 30.18(↑),22.45(↑),13.2(↓)	1.71(↑), 2.39(↓), 3.24(↓), 4.44(↓), 11.09(↓)
9	2013, Chennai, India	28	0, 5, 10, 15, 20	2.47(↑), 4.13,7.42(↑), 4.67(↓)	0.99(↑), 3.94(↑), 13.79(↑),25.62(↓)	
10	2013, Iran	28	0, 5,10,15	+2.00(↑), 3.22(↓),10.73(↓)	2.5(↓), 7.50(↓), 15(↓)	4.32(↑), 5.60(↓), 13.12(↓)
11	2012, Tamil Nadu, India	7,14,28	0, 0.5, 1, 2, 4,6	(6.45(↑), 29.03(↑),29.03(↑), 22.58(↑), 19.35(↑)	5.85(↑), 9.04(↑), 13.30(↑), 10.64(↑), 9.04(↑)	40.63(↑), 62.5(↑), 78.13(↑), 84.38(↑),84.32(↑)
12	2013, Switzerland		0, 0.5, 1, 1.5	+ 9.09(↑), 0.45(↓),4.86(↓)	9.1(↑), 15.5(↑), 23.6(↑)	-
13	2014, Jabalpur, India	7,28	0,0.2 & 0.4, 0.6, 0.8, 1	4.17(↓), 7.92(↓), 12.5(↓),14.58(↓),16.67(↓)	-	-
14	2014, Uttar Pradesh, India	7,28,56	0,0.5, 0.75, 1	1.40(↑),4.20(↑), 3.80(↓)	-	-
15	2014, Maharashtra, India	28	0, 0.05, 1,1.5, 2,2.5,3	2.89(↑), 5.39(↑),2.52(↑), 3.59(↓), 14.03(↓),21.58(↓)	-	-
16	2014, Ghana	7,14,28	0, 10, 20, 30, 40, 50, 60	-	8.87(↓), 22.17(↓), 27.63(↓), 39.72(↓), 45.97(↓),54.03(↓)	7.02(↓), 14.73(↓), 21.57(↓), 33.05(↓), 39.55(↓),47.95(↓)
17	2015, Maharashtra, India	7,28	0, 10, 20, 30,40,50	23(↓), 29.8(↓), 40.75(↓), 44.3(↓),49.5(↓)	-	-
18	2015, Tamil Nadu, India	7,28	0,0.25,.05,1	3.02(↑), 1.5(↓),3.91(↓)	+3.35, ,1.67(↓),4.07(↓)	-
19	2015, Maharashtra, India	7,28	0, 10, 20, 30,40,50	32.7(↓), 42.5(↓), 53.2(↓),54.35(↓), 54.45(↓)	-	-
20	2015, Arunachal Pradesh, India	28	0,10,20	22.22(↓),33.59(↓)	-(18.8,33.76)	-

21	2015, Theissur	28	0,15	3.75(↓)	-8.33	14.43(↓)
22	2015, Australia		0,1,1.5	1.14(↑), 12.29(↓)	+(45.45, 45.45)	-
23	2015, Rajkot	28	0,0.5,1,2,4,6	, 27.98(↓), 27.98(↓), 28.62(↓), 8.56(↓), 18.14(↓), 3.56(↓)	-	-
24	2015, Sri Lanka	28	0,1,2,3	0.83(↑),0.33(↑), 10.45(↓)	+(4.35, 7.83, 29.13)	-
25	2016, Maharashtra, India	7,28	0,10,15	9.14(↑),16.85(↑)	-	-
26	2016, Algeria	7,28	0, 10, 20,30,40	22.50(↑),27.50(↑), 10(↑), 4(↑)	-	-
27	2016, Tamil Nadu, India	7,28	0,0.5,1, 1.5, 2	8.43(↑), 11.09(↑), 6.44(↑),4.46(↑)	+(21.38,33.33)	-

Authors concluded that strengths of specimens up to 10% replacements of natural aggregates with plastic aggregates were within permissible limi ts as per IS code whereas for 20% replacements it was found satisfactory for M20 grade concrete. With the increase in waste plastic content the density of the mix reduced proportionally [17].
The authors suggested that such low strength concrete mix may be used for mass concreting structures such as pavements, where high strengths are not required. In this paper the authors laid emphasis on preparation of green concrete with increasing concerns over environmental pollution [18].
Author discussed the study conducted to determine the compressive strength of concrete masonry units with plastic bottle cores and PET fibres in concrete. Centre voids were created with the use plastic bottles in concrete masonry units. Partial replacement of fine aggregate was done using PET fibres in varying quantities of 0.5 %, 1%, 2%, 4% and 6% of fine aggregate by weight [22].
Authors discussed about the suitability of PET fibres in concrete pipes that are otherwise reinforced with steel bars and used for carrying water. Thus, in this study authors carried out an experimental investigation to check for the feasibility of replacing steel bars with standard sized PET fibres, at different dosage levels increasing from 0 to 3%, at fixed intervals of 1%, for reinforcing concrete pipes at w/c ratios of 0.3 and 0.45 [23].
Authors discussed about the study that was carried out to investigate various physical and mechanical properties of concrete consisting of Polyethylene terephthalate (PET) and Low density Poly ethylene (LDPE) as fine aggregates, as a partial replacement for sand in various percentages of 0, 10, 20, 30 and 40%. Also these waste plastics were incorporated in concrete in fibre form at various percentages of 0, 0.5, 1, 1.5 and 2% by volume of sand to further study their effects in fibre form [25].
Table 1 shows the comparative analysis of compressive strength based on research on different locations. The positive in the percentages shows by the help of this sign (↑) and negative in the percentages shows by the help of (↓) this sign.

3. Strengths and Weakness

After, the review of research papers under the solid area, Workability and waste materials utilized, and part of steel fiber utilized protection from various synthetic assaults. We can ready to find, the qualities and shortcomings of different arrangement approaches used to address the issues.

3.1. Strengths

- Fibers treated with NaOH solution prior to use in concrete mix gave better results in terms of bonding strength with concrete and consequently higher compressive and split-tensile strengths were achieved [6].
- Replacement of Natural River Sand by ground plastic resulted in higher strengths as well as helped conservation of natural resources [8].
- With the increase in replacement of sand by grounded PET in concrete mix, the bulk density of concrete reduced proportionally [10].
- Addition of Glenium 51 improved the workability of concrete mix and thus higher values for slump and toughness and bending strengths were achieved in conjunction with increased deflection [9], [12].
- Use of waste PET in concrete mix reduced the water absorption of concrete by 57% approximately [19], [11].
- PET fibre addition results in reduction in shrinkage cracks and delaying of shrinkage time in concrete by 78.57% [7], [15].
- In PET fibre reinforced concrete the size of shrinkage cracks such as length and width reduced to 20% when compared to unreinforced concrete [24].
- Flexural toughness and impact strength of specimens increased by 15-20% on addition of PET fibres into the concrete mix [22].

- Addition of PET to concrete results in restraining segregation of fresh concrete mix [25].
- PET has good thermal and sound insulation properties and resistance to freeze-thaw cycle making [6], [21].
- Replacing coarse aggregates with plastic aggregates reduced the dry density and consequently the overall dead weight of the structural component thus making it light and easy to carry [18], [11], [9]
- Reduced internal pores and air cavities were observed on replacement of sand with PET fibres in concrete [23].
- Width of cracks occurring from shrinkage in concrete reduced significantly with the addition of Recycled PET fibres in concrete reducing ingress of water and other harmful chemicals, reducing its deterioration and hence making it durable [18].

3.2. Weakness

- Modulus of elasticity reduced proportionally with the increase in dosage of PET fibres [14].
- With the increase in PET fibre addition in concrete the workability of the mix reduced proportionally and significantly [7], [14].
- Fibres added to concrete mix undergo degradation over a period of time due to the presence of highly alkaline environment and therefore, comparatively reduced strengths were achieved at later ages for the mix [16].
- PET fibres added to concrete resulted in formation of non-homogeneous mixtures due to reduced workability which in turn prohibited proper mixing of the constituent materials added to the mix [19].

4. Conclusion

The review of research papers has been done in the space of mechanical execution investigation of waste PET container-based fiber supported cement to research and figure out flow difficulties and extent of work nearby. After the review, one issue was found in the literature, which depended on exploratory methodology. Study of literature was done inside and out of normal discoveries of research works, qualities and shortcomings and gaps to construct issue proclamation and goal.

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A Review: Data Mining Classification Techniques

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***Abstract*— There are three types of learning methodologies for data mining algorithms: supervised, unsupervised, and semi-supervised. The algorithm in supervised learning works with a collection of instances whose labels are known. In the case of a classification job, the stamps can be ceremonial worth, whereas in the case of a regression work, the labels can be numerical values. In unsupervised learning, on the other hand, the dataset are unknown in the labels of the instances, and the finding often seeks to group examples based on their attribute values' similarity, which is referred to as a clustering problem. Finally, semi-supervised learning is commonly utilized when only a limited number of labelled instances are accessible, but a large number of unlabeled examples are.**

***Keywords*— *Data mining, Classification, Diseases*.**

I. INTRODUCTION

The classification task is a supervised approach in which each instance is assigned to a class based on the value of a particular objective attribute, or simply the class attribute. The aim property might have many category values, which corresponds to a different class. The example is made up of two segment: attribute values and target attribute values. The former is used to estimate the worth of the latter. The predictor properties should be useful in predicting an instance's class. Mutually exclusive and exhaustive sets are mined in collection of instances. In the classification process they are known as training set and testing set. Two phases training are divided into the classification process. The training and testing sets are used to create the categorization model. The algorithm has access to the values of both predictor attributes and the oil attribute for all cases in the training set throughout the training phase, and it utilizes this information to develop a classification model. This model contains classification information that allows the class of an example to be predicted based on the predictor attribute values. The class values of the examples are not shown in the test set for testing. Only after a prediction has been made is the algorithm allowed to observe the actual class of the recently categorized case during the testing phase. One of the main aims of a classification algorithm is to maximize the classification model's predicted accuracy when categorizing cases in the test set that were not observed during training [20].

Classification is a method of supervised learning. It categorizes the information into predetermined groups. It is used to create a model that can categories a big population of data. The data attribute value must be used to define classes in the classification process. It characterizes these classes based on the qualities of data that has previously been assigned to them. These pre-defined examples are used by the classifier training algorithm to identify the set of parameters necessary. Tutoring examples are utilized in classification to create a dummy that can categories data samples into recognized classes. The following steps are involved in the classification process:

- Create a data set for training.
- Define the attributes and classes of a class.
- Identify categorization features that are beneficial (Relevance analysis).
- Use the training examples in the Training set to learn a model.

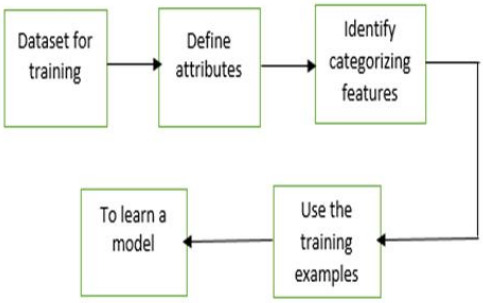


Figure 1: Categorizing Process

A. WEKA Classifiers: Six classifiers were employed for classification tasks in this study to investigate their classification accuracy and performance across two datasets [18]. WEKA classifiers are divided into categories such as Bayes, Functions, Lazy, Rules, Tree based classifiers, and so on. From these groupings, a

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solid blend of algorithms for distributed data mining has been chosen. Naive Bayes (from Bayes), Multilayer Perceptron, SVM, J48, MLP, Conjunctive rule, and Decision Table are just a few examples.

a. ***Naïve Bayes Classifier***: It is the quickest statistical classifier algorithms. It works by calculating the probability of each characteristic in a data sample and then classifying them appropriately. It is used to forecast class membership probabilities, or the likelihood of a tuple belonging to a specific class or not. The Bayes theorem underpins Bayesian categorization [6]. In a nutshell, naive Bayes is a conditional probability model that assigns probabilities p to each of k potential outcomes. Problem instance in classes to be categorized and represented by a vector X with encoding some n attributes. The difficulty with the above formulation is that it is impossible to base such a model on probability tables. A large number of values and features gives the result as author rework the model to make it more tractable. The conditional probability may be decomposed using Bayes theory. To put it another way, the same equation may be expressed as using Bayesian probability language as follows:

Posterior = $prior \times likelihood\ evidence$.

b. ***Multilayer Perceptron****:* In today's world, it is the most widely used network design. Each unit produces its output by performing a biased weighted sum of their inputs and then passing this activation level through a transfer function [15]. A layered feed forward topology is used to assemble the units. With the weights and thresholds. The number of surface and units in each surface decide the function difficulty, allowing such networks to reproduce functions of practically. Number of hidden layers and units in design specification are critical concerns in Multilayer Perceptron. Perceptron-based nonlinear classifier is Multilayer Perceptron. Input and output layers in the back propagation neural network is known as a Multilayer Perceptron (MLP). A three-layer perceptron network is depicted in the diagram below.

c. ***Support Vector Machine (SVM)****:* The notion of decision planes, which establish decision limits, underpins the Support Vector Machine (SVM) [30]. A decision plane is a diagram that divides a group of items into several classes. The standard SVM takes a set of input data and predicts which of two potential classes the input belongs to for each given input, making it a non-probabilistic binary linear classifier [10].

d. ***J48 classifier****:* J48 is a basic supervised classification decision tree algorithm. It generates a tiny binary tree as a result. It's a single-variable decision tree. It's a variation on the ID3 algorithm. The Break and Defeat strategy is used to categories the data in this classifier [9]. It separates the data into ranges depending on the attribute value found in the training sample for that value. This strategy does not outperform the multivariate approach since it is range based and uni-variant. This decision tree technique is particularly effective in forecasting values since it is based on a decision tree. The J48 accuracy of correctly categorized instances is substantially higher than that of other uni-variant methods.

e. ***Conjunctive Rule****:* It is a decision-making rule in which the prospective buyer gives the lowest values to a number of criteria and discards any outcome that does not reach the bare minimum value on all of the elements, i.e. greater performance on one factor cannot compensate for a deficiency on another. The AND logical connection is used by the conjugative rule to associate stimulus properties. Conjunctive rule is a two-class classifier that is easy to understand.

f. ***Decision Table****:* It is a classification-based predictive modelling equipment. It includes a visualizer and an inducer (a method for building decision table models). The Decision Table approach, unlike the evidence model, does not presume that the traits are independent. A decision table is a hierarchical representation of data, containing two attributes at each level. It inducer determines the most significant features for categorizing the fact, and the visualizer that comes with it visually depicts the resultant model. The dataset is summarized using a decision table with the same amount of characteristics as the original dataset. The wrapper technique is used by Decision Table to determine an appropriate subset of characteristics to include in the table. The approach decreases the chance of over-fitting by removing features that contribute little or nothing to a model of the dataset, resulting in a smaller and more condensed traits decision table.

B. ***Classification Algorithm Characteristics***: Author focused on the three variables of properly categorized occurrences, erroneously classified instances, and correctness in this study.

- ***Correctly classified instance****:* It is a example of accurately classifies classification algorithm. Accuracy is defined as the percentage of properly categorized cases.

- ***Incorrectly classified instances****: T*he method does not appropriately classify these situations. Data that has been wrongly categorized might sometimes keep inconsistent fact, noisy fact, or fact that is out of bound.

- ***Accuracy****:* Accuracy refers to the correct value that will obtain. The following is the generic formula:

$$\text{Accuracy} = \frac{Tp+Tn}{P+N}$$
$$\text{And } P = Tp + Fn$$
$$N = Fp + Tn.$$

Where, Tp = True positive
Tn = True negative
P = total positive
N = total negative.

C. ***Data Mining Applications in Wellness Program***: Large volume of massive data include in the health care business regarding patients, hospital resources, illness diagnosis, electronic patient records, and medical gadgets, among other things. Larger volumes of data are a valuable resource that must be handled and evaluated in order to extract information and help cost-cutting and decision-making. The evaluation of data mining applications in healthcare may be divided into major areas.

a. ***Treatment effectiveness***: Applications for data mining can be used in medical treatments. By comparing and contrasting, symptoms, and therapy rule, knowledge discovery in data can yield an examination of efforts are most favorable.

b. ***Healthcare management***: Applications for data mining can be used in medical treatments. By comparing and contrasting, symptoms, and treatment rules, data mining can provide an examination of which course of efforts are most useful.

c. ***Customer relationship management (CRM)***: It is a critical technique for managing interactions between commercial organizations—typically banks and retailers—and their customers, and it's no different in healthcare. Customers may interact with call centers, physicians' offices, billing departments, inpatient institutions, and ambulatory care settings.

d. ***Fraud and abuse***: Fact mining programmers, physicians, hospitals, and others endeavor to develop quality and detect fraud and other wrongdoings. Inappropriate referrals, fraudulent insurance and medical claims are detected by using data mining tools.

e. ***Medical Device Industry***: Medical devices are an integral part of the healthcare system. This one is frequently employed for the finest communication results. Mobile healthcare applications that provide a simple, safe, and continuous way of monitoring patients' vital signs have become viable as wireless biosensors and mobile communications have grown more affordable. Ubiquitous Data Stream Mining techniques can execute real-time analysis on smart devices.

f. ***Pharmaceutical Industry***: Pharmaceutical companies are using the technology to assist them manage their stocks and develop new products and services. A firm's merciless position require a profound comprehension of the knowledge concealed in the Pharma data.

g. ***Hospital Management***: Modern hospitals, for example, are capable of creating and collecting giant bulk of data. Knowledge discovery in data is used to depict the secular behavior of worldwide hospital operations using data taken down in a hospital information organization. Hospital management is divided into three layers: services for healthcrae administration, sufferers and healthcare personnel.

h. ***System Biology***: The databases obtains a wide range of facts, with complex relational structures in many cases. As a result, biological data is commonly subjected to multi-relational data mining approaches. Systems biology is more difficult than genomic challenge that has enthralled worldwide scientists and piqued public interest.

II. LITERATURE REVIEW

A comprehensive assessment of more than 30 research articles, processing, and enhancement approaches published between 2009 and 2020 was conducted.

A. Common Findings of Review in "Data Mining Classification Techniques"

More than 30 research publications were analyzed for the literature study, all of which were linked to Comparative Analysis of Diseases Using Different Data Mining Techniques. Common techniques used by researchers are:

- SVM
- NAÏVE BAYES
- RANDOM TREE
- REP TREE
- DECESION TREE
- SVM(Support vector machine)
- MLP(Multilayer perceptron)

Findings of Reviews are as follows:

- Thanks to machine learning algorithms, doctors can identify cardiac problems at an earlier stage [13].
- The top performance algorithm for classified accuracy was Naive Bayes, which obtained maximum accuracy of 77.34 percent properly categorized cases and had the lowest mean absolute error with a maximum ROC= 0.819 [2].

- Various data mining approaches are utilized to diagnose and forecast cardiac disease [8].
- The risk rate of heart disease was discovered using the KNN and ID3 algorithms, and the accuracy level was also supplied for a variety of variables [2].
- The most accurate classification algorithms are the Nave Bayes algorithms, which have an accuracy of 90 percent [5].
- Chronic Kidney disease used accurate and efficient fact mining [14].
- In order to attain high accuracy in categorization, a greater number of characteristics should be introduced [6].
- The modified J48 classifier predicts illnesses with the greatest accuracy of 99.70 percent [9].
- Machine learning algorithms, Artificial Neural Network, Bayesian Network, and Association Rule Mining are all approaches for diabetes prediction that give patients' conditions of Normal, Pre-diabetes, and Diabetes [1].
- Naïve Bayes is effective & efficient for healthcare care domain [3].
- Get more accuracy in bio medical data [26].

B. Solution Approaches and their results

TABLE I. DIFFERENT SOLUTION APPROACHES AND RESULTS

Proposed Approach	Algorithm used	Tool Used	No of Instances	No of Attributes	Overall Performance	Remark
Comparative Analysis of Classification Algorithms on Diabetes [1]	J48	WEKA	768	9	73.82%	Multilayer Perceptron is better
An Empirical Comparison by Data Mining on Diabetes [2]	Naïve bayes	WEKA	768	9	77.34%	Best performance classifier
An Analysis on Breast Cancer Using Classification [3]	Naïve Bayes	WEKA	286	10	75%	Effective and efficient for Healthcare domain.
Chronic Kidney Disease Data mining Classification [4]	Naïve Bayes	WEKA	400	25	95%	Better classification accuracy
Prediction of Chronic- Kidney-Disease [6]	Naïve Bayes	WEKA	350	20	93%	Gives better accuracy
Chronic Disease Analysis Using Mining Classification Techniques [5]	Naïve Bayes	Rapid-miner tool	400	25	90%	Accuracy with Naive Bayes is 90% and with ANN 72.73% .
Heart Disease Prediction using Data Mining Techniques [8]	Neural Network	WEKA	456	15	90.74%	Highest accuracy
Dengue Disease Prediction using data mining [9]	J48	WEKA	108	18	99.70%	Best classifier algorithms
Liver Disease Prediction [10]	SVM	MATLAB 2013 tool	189	22	79.66%	Better classifier.
To Predict and Resolve Breast Cancer Survivability [7]	Simple Logistic	WEKA	286	9	74.47%	Improve the conventional classification methods
Data Mining Techniques for Diagnosing Diabetes and Hepatitis Disease [11]	Classification and prediction.	WEKA	458	12	82.6%	Reduce the human effort
Chronic Kidney Disease Prediction using KNN [14]	KNN	WEKA	657	11	75.89%	Better than other.
Diagnosis Of Diabetes Mellitu using Data Mining Techniques [12]	KNN	WEKA	786	9	77.86%	Lower accuracy
Classification accuracy of Multilayer Perceptron algorithms on Diabetes [15]	MLP	WEKA	768	9	75.39%	Better algorithm.
Hybrid data mining technique on Heart disease [13]	Decision Trees	WEKA	758	15	96.62%	Promising results in the diagnosis

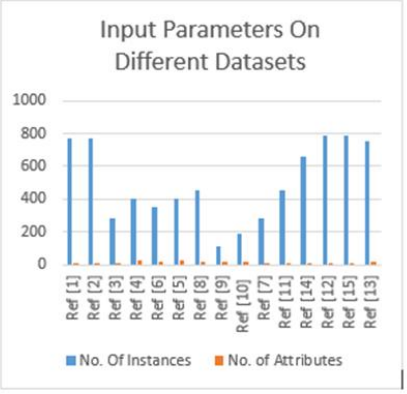


Figure 2: Input Parameter on Different Datasets

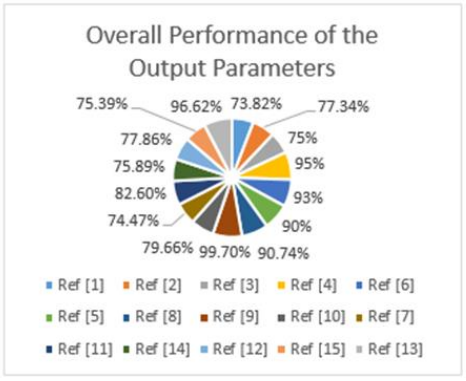


Figure 3: Overall Performance of the Output Parameters

C. Strengths and weakness of Research work Reviewed

a. Strengths

- Using nave bayes, SMO, MLP, REP tree, and J48 classification algorithms, the risk level of a cardiac patient is classified [8].
- In heart disease prediction, using a larger number of characteristics increases the risk level's accuracy [13].
- The highest performance algorithm for classified accuracy is Naive Bayes, which obtained maximum accuracy of 77.34percent properly categorized cases and had the lowest mean absolute error with a maximum ROC= 0.819 [2].
- The Department of Health might collaborate with government-run hospitals, Phil Health, and the National Statistics Office to collect and evaluate public health indicators using data mining techniques. Use data mining tools to look for trends in disease outbreaks or fatalities (for example, newborn mortality) by area and hospital [11].
- Among all SMO, MLP, and J48 classifiers, Nave Bayes classification methods have the greatest accuracy of 93 percent [6].
- When compared to other machine learning algorithms, KNN is the simplest approach for predicting heart disease [12].
- The updated J48 classifier outperforms other algorithms in terms of classification accuracy, and KNN can add more cases without having to retrain the dataset [14].
- Author use data mining techniques to find and diagnose illnesses, as well as give decision assistance to medical experts, by combining patient histories, health information, and databases [4].
- Author can readily detect early stages of disease, identify disease phases, and develop treatment strategies using data mining categorization algorithms [12].
- Working with a huge number of features and characteristics in a dataset and determining the importance of some features over others [13].
- Missing values may be simply imputed using KNN in classification techniques [14].

b. Weakness

- In most circumstances, numerical characteristics in a naive bayes classifier require discretization [3].
- Due to its high error rate, the KNN is not suitable for multidimensional datasets [14].
- The Nave Bayes classifier is not appropriate for huge datasets with numerous characteristics [2].
- One major impediment to data mining in healthcare is the privacy of records and the ethical use of patient information [13].

D. ***Gaps in the Published Research***: Many strategies and methodologies for comparative analysis of various diseases utilizing data mining techniques were offered by the researchers.

- The majority of researchers utilized predetermined chosen criteria to calculate the accuracy level, however they didn't always discover superior results, indicating that more qualities may be added to improve accuracy [9].

- Collect disease dataset from repository [23].
- Classify all attributes of disease datasets using classification algorithm [27].
- Predict the performance analysis of classification algorithms [20].

III. CONCLUSION AND FUTURE SCOPE

In order to examine and discover current difficulties and scope of work, a study of more than 30 research articles in the domain of Data Mining Classification Techniques are used to analyses and classify various diseases was conducted. Following the review, I discovered a number of findings and research gap that should be addressed when data mining is done properly. These papers are contemplate of different mining matters that have an impact on related data mining work. The motive of these methodologies and strategies is to decrease data mining inefficiencies and improve system reliability.

As author used different data mining techniques for classification and prediction the disease but author can only deal with the predefined disease dataset of WEKA tool. It means it doesn't found actual impact of parameters. So author should be take real life based parameters of patient's health to see the actual impact of parameters and it improves the classifiers accuracy. Future work can used other classification tools.

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Bluetooth-Based Smart Sensor Networks



Vibha Beniwal, Tarun Mishra, Amit K. Jain, and Garima Mathur

Abstract Wireless sensor networks are networks of small computers, fitted with sensors, microprocessors, and wireless interfaces. This technology has achieved a lot of attention lately. These networks are suggested for the wide range of modern and fascinating applications, from personal health care to environmental monitoring and military applications. Different wireless technologies, such as simple RF, Bluetooth, UWB or infrared, may be used to communicate between sensors. The core concepts, features, and problems of Bluetooth-based wireless sensor networks are outlined in this, as well as the execution of a simple Bluetooth-based sensor network. The presentation of the main problems experienced during the implementation and applied solutions is also done. This is specified on the smart sensor networks using the Bluetooth topology. How smart sensor networks are used and can be implemented using the Bluetooth technology. How they are used as the purpose of communication in industrial field, how they are built, their working and concept are reviewed. Architecture, network, applications, and working have been reviewed basically for the communication and research purpose.

Keywords Wireless sensor networks · Media access control · Wide area network

1 Introduction

Wireless sensor networks are networks of small devices having sensors, microprocessors, and wireless communication interfaces. This technology has become famous lately. For the purpose of communication in industrial field, WSN technology is widely used. Sensors are used for the communication in industries. In this process, the signals are sending through the wires from each field devices and are monitored on central control room. With the beginning of wiring concept, the field device is

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used for minimizing the wiring cost. Wireless technology is introduced to eliminate the wires as they are costly, bulky and can be easily damaged [1].

Ericsson mobile communications started a research to explore the usefulness of consuming low power, low cost, low ratio interface and to find a process to remove wires between the devices in the year 1994. Then the Bluetooth technology was invented by an electrical engineer Dr. Jaap Haartsen and named the technology Bluetooth to the honor of the tenth-century King Harald "Bluetooth" of Denmark. The aim of Bluetooth is harmony and unification [2]. It also enables different devices to communicate through wireless connectivity. Bluetooth uses frequency-hopping spread spectrum technique and works in the illicit ISM band at 2.4 GHz frequency. A distinctive quality Bluetooth device holds a range of about 10 m and can be extended to 100 m. The total bandwidth of 1 Mb/s is supported by communication channel. A topmost data transfer rate of 721 kbps maximum of three channels is supported through a single channel [1, 2].

1.1 Technology Overview

Bluetooth is low-priced, short-range wireless technology with small power utilization and suitable for diverse small battery-driven devices like mobile phones, cameras, laptops. [1]. There are two topologies used in Bluetooth architecture: Piconet and Scatternet.

A Piconet: It is an improvised network used to link wireless devices using Bluetooth technology. It is group of up to 8 devices that share similar frequencies. It uses the concept of master and slave. Each piconet has one master, and rest of the device acts as slave. Usually, the device that starts off the piconet behaves as master [3]. To establish a piconet, first the device searches for the other Bluetooth devices in the range. When the two devices have the same frequency, then the required information is exchanged and to establish the connection paging procedure can be used. For more than 7 devices need to exchange information, there are two possibilities:

The initial one is by putting one or more devices into park state. The modes used in Bluetooth are sniff, hold, and park which are used for low power consumptions [4]. When a device changes to the park mode, then it disconnects from Piconet, but schedule adjustment will be maintained. The master of piconet continuously transmits signals to invite the slaves to retain the piconet. If there are less than 7 slave devices in the piconet, then only the slave will rejoin [2–4]. If not then one of the active slave device will be park by the master. Due to these actions, there will be delay and it can be undesirable for some applications like procedure control applications that need an instant reply from the command center.

Scatternet: It is composed of interconnected piconets that maintain communication between more than 8 devices. Scatternets are formed when a device of one piconet that can be master or slave chooses to act as a slave in second another piconet [4]. Scatternets provide higher throughput. Also in different piconets, multiple-hop

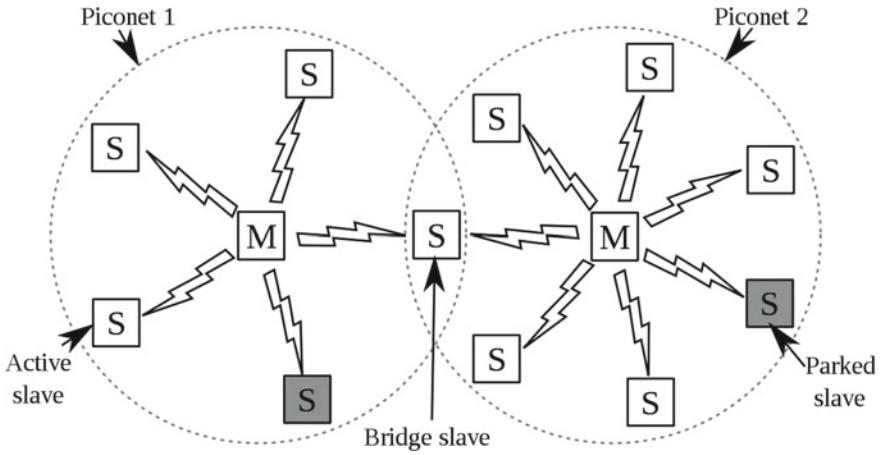


Fig. 1 A Scatternet

routing between devices is possible. That means at one time only single component can interface in one piconet so they hop from one to another relying upon the channel limit [3] Fig. 1.

2 Bluetooth-Based Sensor Network

To produce different countless applications, the developers are proving operability between different devices. Wireless sensor networks are example of such applications. It has various small devices consisting of sensing unit, microprocessor, power source, and wireless communication bond.

Important features of wireless sensor networks:

1. During the task in process, network nodes combine with each other.
2. It has a particular attention on data.

As the position of junctions is not decided in the field and formation of smart sensor nodes is not planned, it could be experienced that some sensor nodes close in such positions that they either can accomplish needed measurement or the error probability is more [1, 5]. To overcome these problems, a small node of repetitive number is disposed. These nodes additionally merge and share data and thus ensures better outcomes. The collected data is sent to the users by "gateway" using multiple-hop routes in the smart sensor nodes that are scattered in the field.

2.1 Bluetooth Hardware Architecture

Bluetooth hardware has 3 prime function modules:

1 2.4 GHz Bluetooth radio frequency transreceiver unit.
2 Link controlling unit.
3 Host controller interface.

Host controller is made up of a digital signal processing section with link controller and central processor. Link controller composed of both hardware and software parts for the execution of baseband processing and physical layer protocols. CPU core helps Bluetooth module to filter page requests and to handle enquiries [5]. Link manager is software which runs on the CPU and communicates to them with the help of link manager protocols.

3 A Wireless Sensor Network

Wireless sensor network provides two important actions querying and tasking.

Querying: When there is need of current value of the observed event, queries are used.

Tasking: It is more composite operation and is useful when an event needs to be noticed for a long time.

These two services querying and tasking are allocated to the system through "gateway" which also forwards the collected responses to users [1].

The main functions of a gateway are

- Interaction with sensor networks.
- Short wireless transmission is used.
- It contributes functions like finding of smart sensor nodes.
- It provides techniques of sending and receiving data from sensors and routing.
- It controls gateway attachment and dataflow to and from sensor network.
- It provides standard of dealing with ideas that gives detail about the current participating sensors and their characteristics.
- It allocates function for consistent approach to sensors without being affected by their type, location or network topology, introduce queries and tasks, and gather respond.
- Communication with users.
- Gateway communication with user and another sensor networks through the Internet, WAN, satellite, or other short communication technology.

3.1 Sensor Network Implementation

The main target of the sensor network execution was to construct a hardware plan and common software answers that can work as support and for the motive of research in wireless sensor network agreement. Implemented sensor networks involve smart sensor nodes and a gateway. Every node has countless sensors and is connected with microcontroller and Bluetooth element [4, 6].

Gateway and smart nodes behave as the part of the piconet, for example, a Bluetooth pressure sensor.

The sensor is attached on the Bluetooth node. It has the pressure feeling element, smart signal-conditioning circuitry containing density and temperature reception, and the transducer electronic data sheet (TEDS). These are integral features of sensor microcontroller which are used for node communication control and also for the memory for TED's arrangement [6].

3.2 Smart Sensor Nodes Discovery

For the execution for the gateway installation, the first step is the locating of the smart sensor nodes. With the help of gateway, all the smart nodes are found and build the list of the attribute of sensors and network topologies. After that for making the process easy for the removal of existing sensor and addition of the new, it is executed concurrently [1, 6, 7].

Algorithm: After the initialization of gateway is done, Bluetooth performs the inquiry procedure. Major and minor device classes are checked after the detection of the Bluetooth devices. Some parameters are set by the sensor nodes for defining the type of device and type of attached sensor. To give some further explanation of the offered service, the duty class field is used [4]. And if the founded device is not a smart node, then it is disposed. As there is no particular sensor profile at ongoing time, the database is hunt for the serial port outline link. Once interrelated string is acquired, then the Bluetooth link is accepted and the transfer of the data is started.

4 Advantages

- Inexpensive.
- Low power utilization.
- Small range.
- Wireless technology.
- Sensible throughput.

- Cheap maintenance cost.
- Easy link formation.
- Share voice and data.

5 Limitations

- Low data range.
- Interference with other device.
- Low security.
- Low data rate.

6 Conclusion

Wireless sensor networks are fascinating research area with multi-feasible applications and with many solutions. They are combination of various tiny devices having the ability of interacting and dealing with data. Bluetooth is an easy and suitable option for data communication in sensor networks [2]. To plan routing and application-level procedures, we overlook multiple affairs related to MAC layer, physical layer, application layer, and routing layer [8]. For the automatic link up and information exchange, the Bluetooth devices need to bring within the range of another device.

7 Applications

- Constant sensing
- Health monitoring
- Event detection and local control of actuators
- Smart buildings
- Smart grid and energy control system
- Environmental monitoring
- Military and security and surveillance
- Industrial safety
- Home and other commercial areas.

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Frequency and Bandwidth Reconfigurable Patch Antenna Loaded with PIN diode

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Abstract –In this proposed research work, an antenna which is reconfigurable for frequency is presented. The antenna operates from 5.20 GHz to 8.60 GHz. To reconfigure the antenna for frequency two PIN diodes are implemented. Antenna operates in three modes of diodes. Antenna operates in dual band mode for first state. The beauty of this antenna is that the operating bands can be controlled easily. The operating frequencies for the proposed antenna are 6.30, 7.46 and 8.46 GHz. thus antenna operates in three bands and these are 5.20-7.46 GHz, 6.80-8.2 GHz and 7.88-8.60 GHz. Antenna is compact in size with dimensions of 18×23 and fabricated on FR-4 substrate having dielectric constant of 4.4 and thickness 1.6 mm. Partial slotted ground is employed in this antenna. Average gain of 3.5 dB with stable radiation pattern obtained at each operating bands. Due to its compactness this antenna is useful for portable communication devices like cellphones, tablets PCs and other satellite communication devices operating in C-band of frequency spectrum.

Keywords— **Reconfigurable antenna, PIN diodes, satellite communication, C-band, Reconfigurability**

I. INTRODUCTION

Demand for high bandwidth is increasing in modern communication system. Also extension of spectrum efficiency is necessary. For this concept of reconfigurable antennas was introduced. In modern wireless communication reconfiguration is an important feature. Reconfigurable antenna patented first time in 1983 by Schaubert. Research on the reconfigurable antenna has been done in the past fifteen years for number of applications. There are various features as reconfiguration capability, low fabrication cost and size minimization proved the reconfigurable antenna to be advantageous and easy to integrate in a wireless system [1]. Antenna can be reconfigured for frequency, polarization or radiation pattern. Frequency reconfigurable antennas are perfect solution to utilize the frequency spectrum. Interference between bands can also be overcome with frequency reconfigurable antenna. Basically frequency reconfigurable antennas are based on the variation of current distribution. Current distribution can be varied electronically, mechanically or by changing the properties of material. PIN diode, varactor diode, RF-MEMS switches are some of the options used as switches for reconfiguration. Reconfigurable antennas provide compactness and flexibility also. A compact and cedar shaped antenna with frequency reconfiguration reported in [2]. Five PIN diodes were employed as switch to reconfigure the antenna. Antenna operates on multiple frequencies. Boukarkar et.al [3] presented an antenna operating from 2.35 to 3.43 GHz with frequency reconfiguration characteristics. Total six PIN diodes are used with biasing circuit are used. One radiating edge is shorted with ground plane which is responsible for size reduction. PIN diodes change the electrical length whiles the biasing of PIN diodes changes. For diverse applications frequency reconfigurable antennas are very useful because it reduces the bandwidth required [4]. Reconfigurable antennas can be very useful for cognitive radio (CR) applications for spectrum sharing and sensing. For this an antenna is reported in [5] for cognitive radio applications that can switch between UWB and narrow band characteristics. Radiating patch is a circular disc shaped patch and ground partial with FR-4 dielectric material used as substrate having relative permittivity (4.4) and the area of the substrate is 40×40 mm^2. Rajeev K. et.al reported a frequency reconfigurable patch antenna with a quadrilateral shaped patch in [6]. FR-4 dielectric substrate of length L= 50 and width W=50 is used for antenna modeling using HFSS EM simulator. A slot of triangular shape is cut in the ground plane. Total six PIN diodes were used to vary the length of the triangular slot for frequency reconfiguration. By changing the states of PIN diodes antenna operating frequency varies from 2.46 to 3.90 GHz. Integration of control circuits, operation on multiple frequencies and compact size also proved reconfigurable antennas a solution for cognitive radio applications. In [7] an antenna of area 30×30 mm^2 with a wine glass shaped patch and a ground plane with a ring slot is proposed. The antenna operates in three different modes and resonates on 4.5 GHz (LTE), 5.9 GHz (ITS), and 3.8 GHz (LTE)/5.00 GHz for Wi-Fi applications. Antenna proposed in [8] occupied a total area of 50×60 mm^2 works between 0.9 and 2.6 GHz loaded with three PIN diodes. Antenna realized using five patches. Patch side looks like a tree with a W-shaped and inverted-U structure. Current density and electrical length of the antenna are varied using PIN

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diodes. This antenna can be useful for future mobile applications. An alternative solution of multiband antenna is reconfigurable antenna. A quad band reconfigurable antenna for multiple application reported in [9] with '5' shaped stub. It provides dual band operation for WiFi and Wi-Max applications. Multiband antennas are designed to cover multiple services at the same time but this can create challenges and also there can be interference between services so this problem can be overcome by the use of reconfigurable antenna.

In this paper, proposed antenna is reconfigured in frequency in which operating frequency can be controlled by PIN diodes is discussed. Ground plane is partial ground. Two PIN diodes are responsible for reconfiguration of the antenna inserted at appropriate position.

In section II geometry of the antenna is explained. In section III results such as return loss characteristics, current distribution, and radiation patterns are discussed and final section of the paper concludes the paper.

II. Antenna Geometry and Design

This section describes the antenna geometry and switching mechanism used for the antenna. To enable the antenna to work for different frequencies, current density and electrical length need to be varied. For this purpose, in the simulation lumped elements are employed for PIN equivalent. Better radiation efficiency is achieved with partial and slotted ground.

The geometry of the proposed antenna is shown in figure 1.

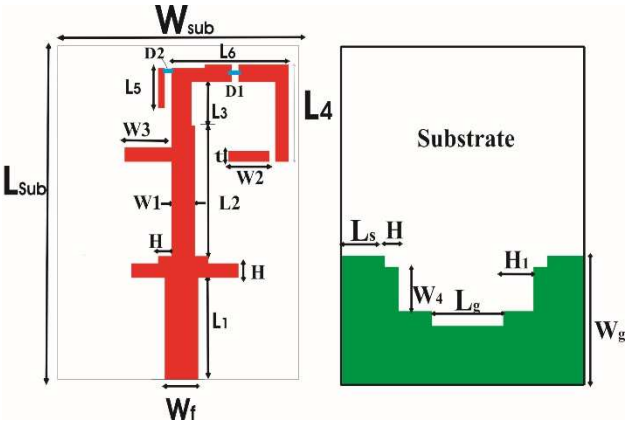


Fig. 1 Geometry of Proposed Antenna (a) Top View (b) Back View

Many reconfigurable antennas were designed in literature with frequency reconfiguration. Antenna is simulated with FR-4 substrate having dielectric constant of 4.4 and thickness of 1.6 mm. Length of the substrate L_{Sub} is 23 mm and width W_{Sub} is 18 mm. Two PIN diodes are connected to vary the current distribution of the patch and thus the operating frequency also varies. Dimensions of the antenna are illustrated in table 1.

Antenna is compact and simple in design which can be easily integrated in wireless devices. BAR50-02V PIN diode manufactured by Infineon technologies and parameters of this model of PIN diode are shown in figure 2.

The effective length of the antenna was calculated using transmission mode theory given in equation 1[8].

$$L_{fr} = \frac{c}{4f_r\sqrt{\varepsilon_{eff}}} \quad (1)$$

c = speed of light in the vacuum, ε_{eff} is the effective dielectric constant; f_r is the lower operating frequency.

Table 1: Dimensions of Antenna

Parameter	Value (mm)	Parameter	Value
L_{Sub}	23	L_6	8.75
W_{Sub}	18	Ls	3.25
Wg	8.75	W_f	2.5
Lg	5.25	W_1	1.75
L_1	7	W_2	3.05
L_2	9	W_3	3.5
L_3	3	W_4	3
L_4	6.7	H	1
L_5	2.75	H_1	2.25
t	0.75		

When the PIN diode is forward bias, it acts as a series combination of inductor and resistance while in the 'OFF' state PIN diode act as parallel combination of resistance and capacitor with inductor connected in series as shown in figure 2 (a) and (b).

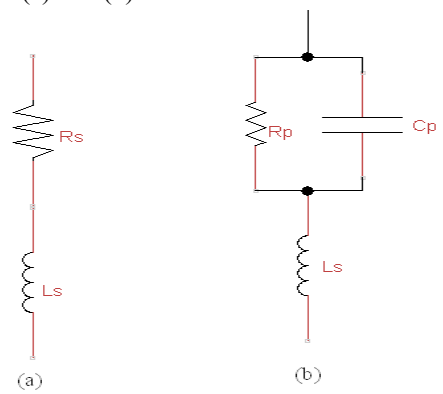


Fig. 2: Equivalent circuit of PIN diode

Table 2: Parameters of PIN diode

PIN Diode Model	State	L_S	C_P	R_P	R_S
BAR50-02V	OFF	0.6nH	0.15 pF	3 KΩ	
	ON				3Ω

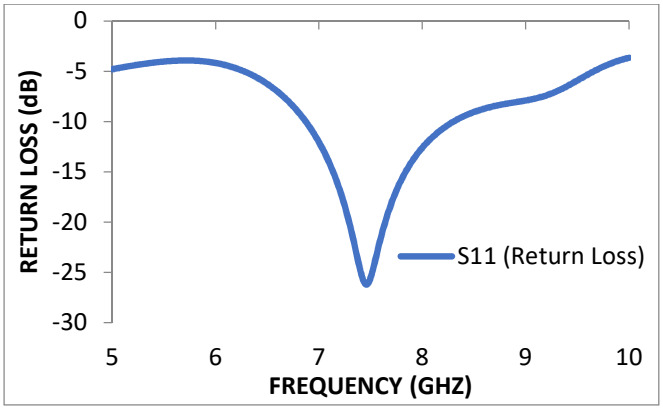
III. Results and Discussions

Antenna simulated on HFSS and return loss, gain and radiation pattern are observed for all operating states PIN diodes. 'ON' state of the diode is denoted as '1' and 'OFF' state as '0'. All the possible operating states except only

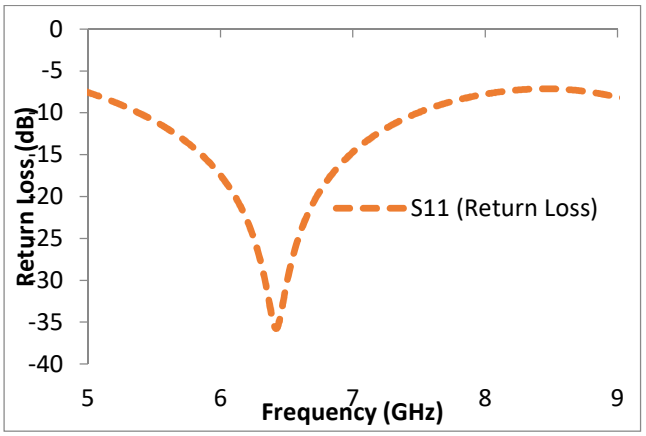
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for one state for which the antenna is not operating in any required band of operation for two diodes are shown in table 3. States of the switches are represented in binary form as 00, 01 and 11.

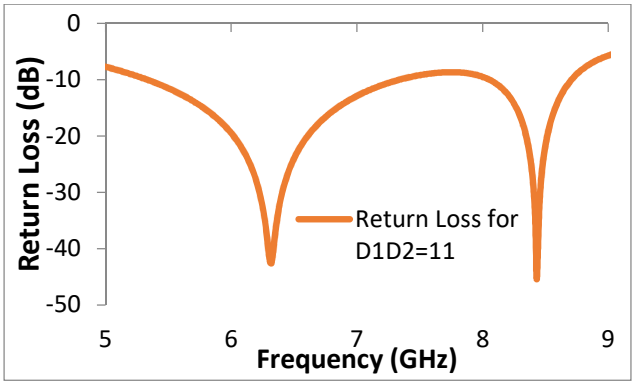
Return loss characteristics of the three modes is shown in figure 3 (a) to (c). In figure 3(d) return loss characteristics of three modes are shown combined. In mode-1, both the PIN D1 and D2 are set to OFF state. In this case antenna acts as single band antenna and operates on 7.42 GHz and return loss value is -25.56 dB. Current distribution for mode 1 is shown in figure 4 (a).



(a)



(b)



(c)

Fig. 3 Return Loss Parameters for Diode Configurations (a) D_1D_2=00 (b) D_1D_2 =01 (c) D_1D_2 =11

For mode 2 diode D1 remains OFF and D2 turned ON. In this manner operating frequency shifted to lower band with resonant frequency of 6.42 GHz. Return loss value for this mode is -35.75 dB and bandwidth is 2.13 GHz. Surface current distribution shows that as the diode biasing changed current path also changes. Effective area of radiation increases and thus resonant frequency shifted to lower frequency. Maximum gain provided in this mode is 2.41 dBi. For frequency reconfiguration effective electrical length or current path must be changed. In mode 3, both the diodes inserted in the antenna turned ON and antenna converted to dual band mode.

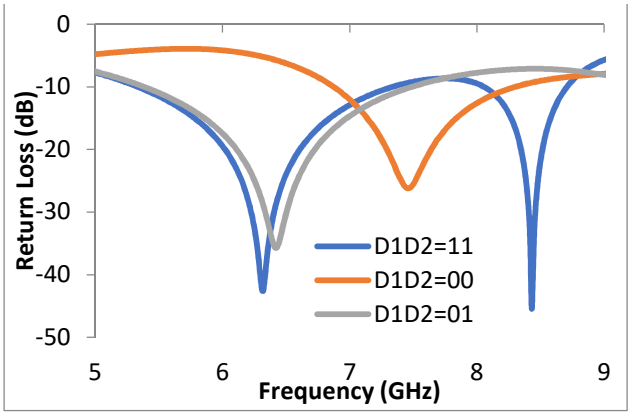


Fig. 4 Return Loss Characteristics for all three modes

Table 3: Operating States of Diodes

Operating Modes	Diode State	
	D_1	D_2
"1"	0	0
"2"	0	1
"3"	1	1

In this case antenna operates at 6.31 GHz and 8.43 GHz. A good impedance matching is provided in this mode with appropriate bandwidth. Capacitance effect of the PIN diode affect the performnce of the antenna.

To understand the working of the antenna further, surface current distribution of the respective operating state can be observed. Current distribution indicates that the operating frequency of the antenna is inversaly proportional to the effective length. Current is uniquely distributed on the antenna. This is shown in figure 5 (a), (b) and (c) for state 1, 2 and 3 respectively. Antenna frequency can be varried by varying the length L_5. As the length L_5 increases the operating frequency decreases because the area of surface current increases. So the operating frequency can be controlled by the length L_5.

Designed antenna is fabricated using FR-4 substrate material. The fabricated prototype is shown in figure 6. For all three modes of operation, the antenna has stable radiation pattern and provides gain in the range of 2.00-3.00 dBi. Radiation pattern and gain for mode 1 to mode 3 is shown in figure 7 and figure 8 respectively. Simulated results for all modes of operation are summarized in table 4.

Table 4. Summarized Results of the Proposed Antenna

Operating Mode	Diode State	Operating	Return

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	D_1	D_2	Frequency (GHz)	Loss (dB)	Gain (dBi)
Mode 1	0	0	7.40	-26.16	2.97
Mode 2	0	1	6.40	-34.50	2.40
Mode 3	1	1	6.31, 8.45	-42.58, -45.35	2.36, 2.48

reconfigurable antennas in the table 5 which proves the presented antenna better in the terms of area, bandwidth, and number of switches used. It can be observed from table that the antenna is superior compared to the previously developed antennas in terms of area occupied and number of PIN diodes. Due to small size, antenna can be easily integrated in compact wireless devices.

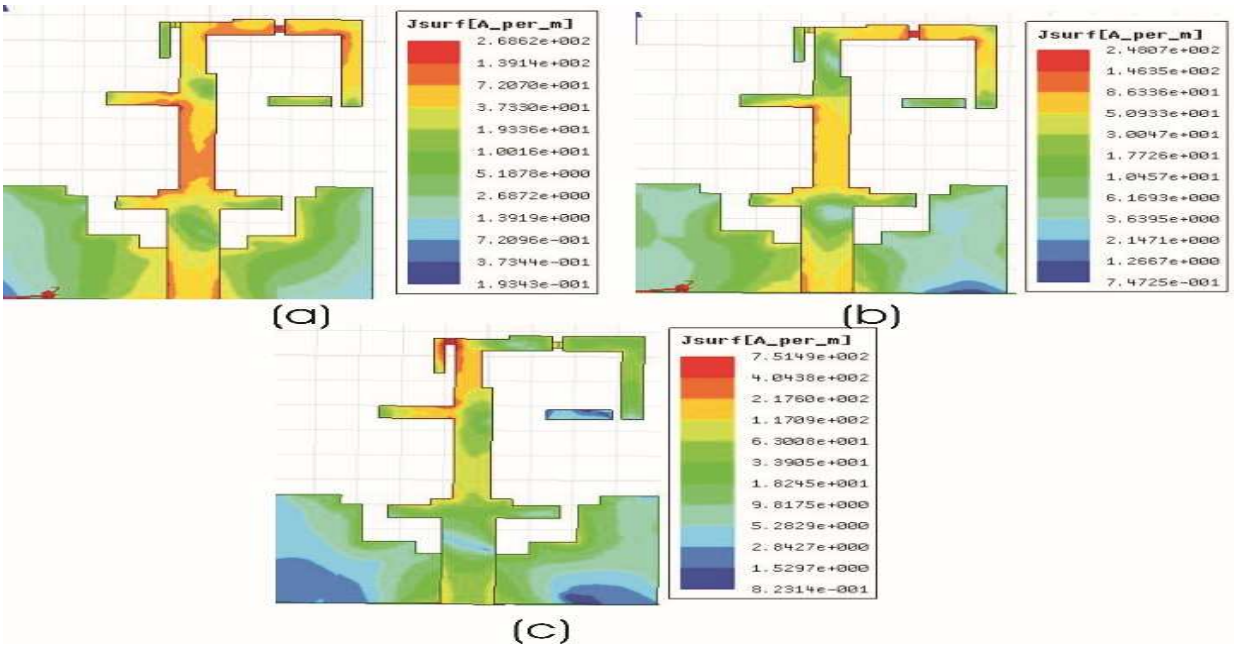
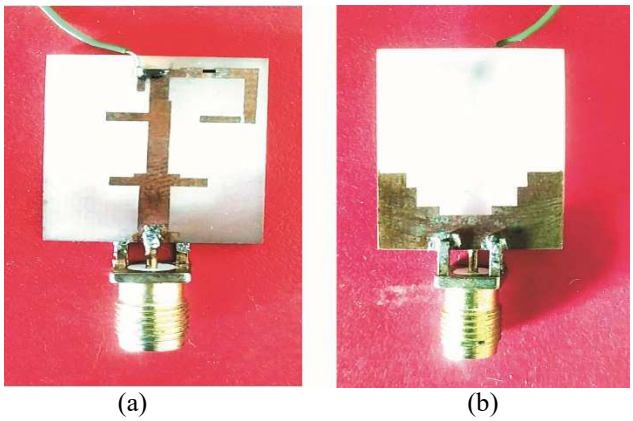


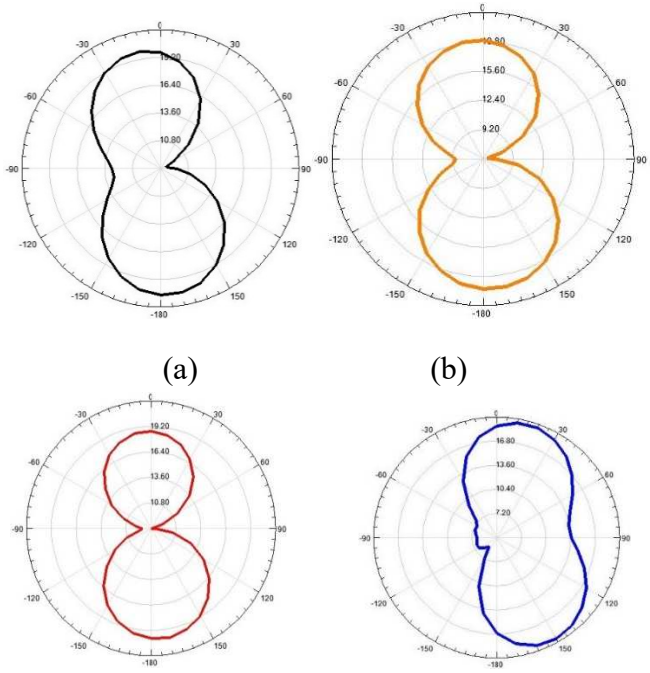
Fig. 5 Surface current distribution for Three Diode Modes



(a) (b)

Fig. 6 Prototype of the designed Antenna (a) Patch Side View (b) Ground Plane View

Gain characteristics plots are illustrated in figure 8 and the maximum gain of 2.97 dBi at 8.45 GHz provided by the antenna. Proposed antenna is also compared and validated with the recently developed frequency

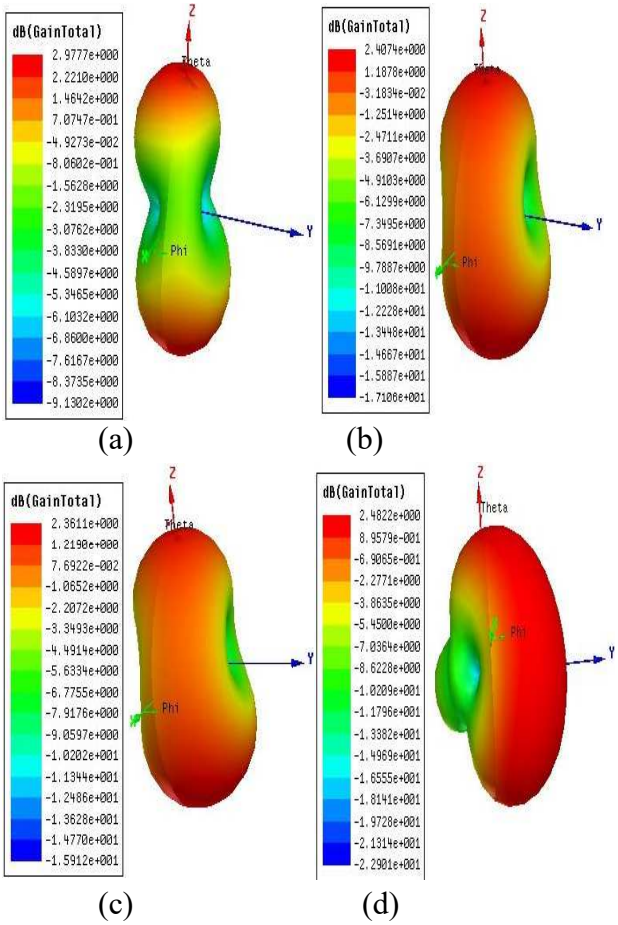


(a) (b)

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(c) (d)

Fig. 7 radiation Pattern Characteristics at (a) 7.40 GHz (b) 6.40 GHz (c) 6.31 GHz (d) 8.45 GHz



(a) (b)

(c) (d)

Fig. 8 Simulated Gain at (a) 7.40 GHz (b) 6.40 GHz (c) 6.31 GHz (d) 8.45 GHz

Table 5: Validation of Antenna

Ref.	Size (mm^2)	No. of Bands	No. of Switches
[2]	60×40	Multiband	4
[3]	40×40	multiband	6
[4]	50×45	5	2
[5]	40×40	Multiband reconfigurable	4
[6]	50×50	4	6
Proposed	23×18	4	2

IV. CONCLUSION

In this paper, a compact printed antenna with frequency and bandwidth reconfiguration is presented. The antenna operates on four different frequencies. The proposed antenna operated on four different frequencies with two single mode operations (6.40 GHz and 7.40 GHz) and one dual band operation (6.31 GHz and 8.45 GHz). All four operating bands are useful in C- and X-band applications. High gain achieved for all operating states of the antenna with stable radiation pattern. It can be used for in cellphones, tablets PCs and other satellite communication devices operating in C- and X-band of frequency spectrum. The antenna is small in size with dimensions of W_{Sub}× L_{Sub}= 23mm×18mm. Two PIN diodes are integrated in the radiating patch to achieve reconfigurability. Energy through reconfiguration mechanism is an advantage of using the proposed antenna. Proposed antenna is preferred for wireless applications in the C-band for satellite and WLAN applications. In future, for high speed switching the PIN diodes can be replaced with other switches such as RF-MEMS switches. Also the manual switching or reconfigurability can be replaced by automatic circuitry. This can be done by IoT controlling of switching device.

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Natural Ventilation Improvement of Building using Solar Chimney Made of Honey Comb Structure: A CFD Based Study

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Abstract:- **Aim of this study is to improve the thermal comfort of residential buildings located in rural area of Rajasthan by using solar chimney technique. Investigations were focused on development of new kind of improved solar chimney. Three designs of absorber plates used for natural ventilation improvement are following: simple plate, vertical plate combinations and honeycomb structure. Year round results were gained by using CFD commercial software ANSYS FLUENT 14.5. Experimental validation is also carried out by using prototype modeling technique for proposed designs. Comparison of solar chimney with honeycomb and without honeycomb is also studied in present study to find relation with thermal performance of chimney. The performance of the system is highly influenced by solar intensity. Improvement of room temperature in the building for May month is also studied using solar chimney. With the change of chimney design (honeycomb and without honeycomb), the change in velocity distribution and the air flow inside the chimney was observed.**

Keywords—component, formatting, style, styling, Solar.

NOMENCLATURE

Nu: Nusselt number
Re: Reynolds's number
Pr: Prandtl number
h: heat transfer coefficient- W/m2K
k: thermal conductivity of air- W/m-K
Cp: Specific heat of air- kJ/kg-K
ṕ: Density of air- kg/m3
cb: Chimney body point
r1:room1
r2:room2
iv1: Invent1
iv2: Invent2

I. INTRODUCTION

For providing optimum quality of indoor circulation of air within the buildings and maintaining acceptable level of thermal comfort Natural Ventilation [1] plays a key role in live buildings without necessity for employment of mechanical systems such as heating, ventilation and air condition (HVAC) [2]. The rate of ventilation can be enhanced by using solar chimneys for natural ventilation. A solar chimney consists of an absorber plate and a glass surface. The glass surface is mounted on the absorber plate. The bottom part of the chimney is opened into the room and the top part is opened to the atmosphere. An insulating material [3] is placed between the absorber plate and the outer wall of the room, to prevent the conduction of heat to the room. The absorber plate is made of a conducting material [4]. For obtaining high heat absorption capacity the surface of the absorber plate is kept black. To maximize the radiation intensity the face of the chimney i.e. the glass surface is kept placing in south direction for areas above equator and north direction for areas below equator [5]. The radiation enters the glass surface and is trapped inside during the daytime as shown in figure 1. The absorber plate absorbs the major portion of heat. The residual heat either gets transmitted through glass surface or gets absorbed at second incidence [6] on the plate. The temperature of air inside the chimney is increased during the whole process. Now the air inside the room is at a comparatively low temperature. The difference in temperature creates a low pressure in the chimney and high pressure in the room. The air inside the chimney escapes into the atmosphere. A partial vacuum is created in the chimney and the air inside the room gushes in to fill the volume. Therefore fresh air is introduced into the room through the window attached to it to maintain equilibrium. This phenomenon is known as "Stack Effect". Stack effect [7] is temperature induced. When there is a temperature difference between two adjoining volumes of air, the warmer air will have lower density and be more buoyant, thus will rise above the cold air creating an upward air stream.

In order for a building to be ventilated adequately via stack effect, the inside and outside temperatures must be different so that warmer indoor air rises and escapes the building at higher apertures [8], while colder, denser air

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from the exterior enters the building through lower level openings [10-12].

The solar chimneys use renewable source of energy i.e. solar energy, so it can be used in rural areas to save electricity on fans and coolers.

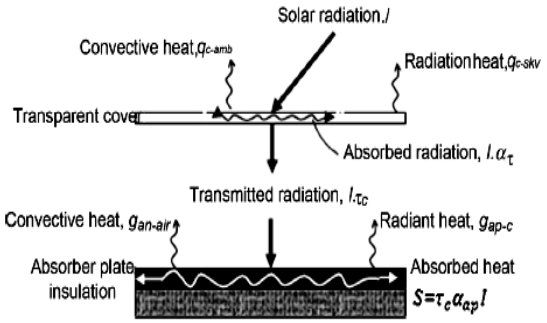


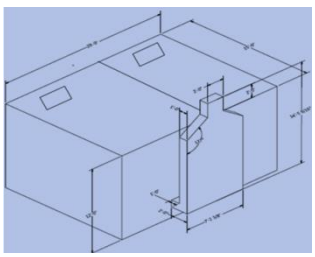
Fig.1. Heat Transfer Process

II. CFD MODELLING

Computational fluid dynamics (CFD) is a branch of science which predicts the fluid flow, heat and mass transfer, chemical reactions, and any other related physical phenomenon The CFD modelling is done on ANSYS FLUENT 14.5. CFD modelling solves the mass, momentum and energy equations [13-15]. CFD modelling provides more accurate results than other techniques. (RNG) and k-ε model was employed to approximate turbulence. Basically there are three steps in CFD modelling as follows:

A. Pre-processing

Geometrical Details-The geometry consists of two adjoining rooms each of dimensions-length 10 feet, width 15 feet and height 12 feet. Dimension of Invents: Length-2 feet, Height- 1.5feet and Dimension of out vent: Length-2 feet, Height- 1 feet. Area of absorber plate of the chimney: 85.53 ft^2. Two separate geometries are created, one with honeycomb and other with without honeycomb. Simulations are made to run separately for both cases of chimney. Schematic representation of CAD file is shown in figure 2.



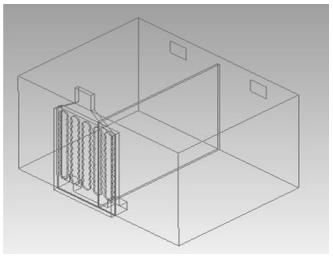


Fig.2. Chimney and Room line diagram with and without honey comb structure

Mesh generation- Meshing is the discretization of the domain into control volume. In this study hex-dominant mesh method was used. Total quantity of control volumes are approx. 400,000, which is shown in figure 3.

Model- in this study three types of governing equations were solved named continuity equations, momentum equations and energy equations. But in ANSYS fluent these equations were dependent on model selection. Viscousmodeling shows turbulence solutions for CFD domains, author select K-e RNG turbulence model for this purpose. Radiation model was Roseland model having solar calculator (for Jaipur) for whole day simulations.

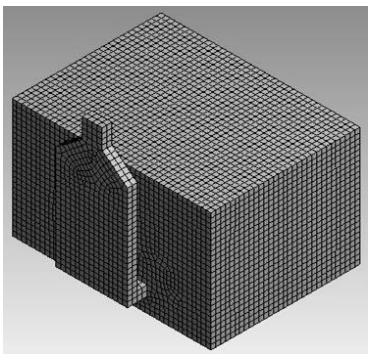


Fig.3. Mesh generation

Material properties- Air is taken as the fluid medium. The room walls are made of bricks. The front surface of chimney is made of glass and inner back surface is made of aluminum (absorber plate).Grid independency test is shown in figure 4. This test was performed on both the models of chimneys (with or without honeycomb) and it was concluded that the velocity does not change by change the element size which means that the both the models pass the grid independency test.

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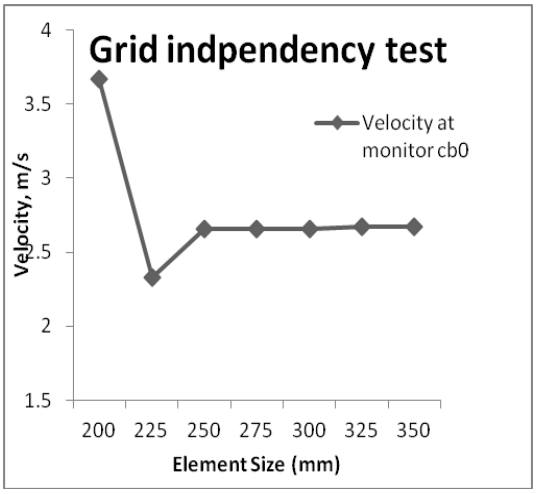


Fig.4. Grid independency test between velocity and element size

Table I. Summary of Boundaries used for simulation

S.No.	Boundary Name	Type	Properties
1.	Absorber Plate	Wall	Wall thickness- 0.01 ft; Al; absorptivity=0.85
2.	In vents 1,2	Inlet vent	Natural ventilation; loss coefficient=0.5
3.	Out vent	Outlet vent	Natural ventilation; loss coefficient=0.5
4.	Glass	Wall	Wall thickness-0.016ft; Glass; ɾ =0.85

Table II. Input data used for boundaries

S.NO.	Boundary Conditions	Month (MAY) (temp. K)
1.	Inlet vent 1,2	307
2.	Outlet vent	307
3.	Solar radiation intensity	(8am to 5pm)

Boundary conditions– The boundary conditions for different materials are different and shown in Table 1. In Table 2 all required input data is shown.

B. Solver

After giving the boundary conditions, various equations governing the fluid flow are solved for these values. The accuracy of the results depends upon the number of iterations per time step.

C. Post Processing

The surface monitors for each room are created to check the velocity and temperature at different points. Surface monitors are also created at inlets and outlets of the room and chimney. There are eighteen surface monitors in each room. i.e. nine at three feet and nine at six feet, one monitor at each inlet and outlet & two within the chimney body, which were shown in figure 5. The solution is initialized and calculations are made to run to obtain results.

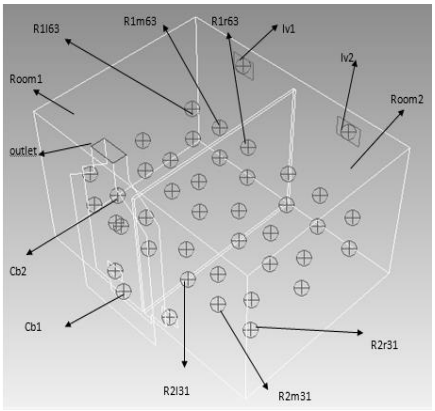


Fig.5. Points showing different surface monitor inside the rooms and chimney

III. VALIDATION

The simulation obtained heat transfer coefficient is confirmed with the correlations for Nusselt Number. Validation is done for the solar chimney body by taking into consideration the parameters at the inlet of the chimney from the room. The cross section of the chimney is rectangular. The total heat transfer rate and average temperature is taken at the out vent of the chimney to procure Nusselt number (Nu), Reynolds number (Re) and Prandtl number (Pr). Comparison between Dittus-Boelter'scorrelation, Gnielinski's correlation, Petukhov's correlation [10] and numerical analysis is staged in terms of these dimensionless parameters which are shown in figure 6.

'Nu' number is given as Eq. (1):

$$\mathrm{Nu} = \frac{\mathrm{hD_h}}{\mathrm{k}} \quad (1)$$

Re Number is given as Eq.(2):

$$\mathrm{Re} = \frac{\rho \mathrm{v D_h}}{\mu} \quad (2)$$

Prandtl number is given as Eq.(3):

$$\mathrm{Pr} = \mathrm{C_p}\frac{\mu}{\mathrm{k}} \quad (3)$$

Dittus-Boelter's Correlation is given as Eq. (4): Figure 17 and 18 shows contours of velocity for both cases of chimneys. Throughout the day, the velocity distribution is more in with honeycomb chimney as compared to without honeycomb chimney.

$$\mathrm{Nu} = 0.024\mathrm{Re}^{0.8}\mathrm{Pr}^{0.3} \quad (4)$$

Gnielinski's Correlation is given as Eq.(5):

$$\mathrm{Nu} = \frac{\left(\frac{\mathrm{f}}{8}\right)(\mathrm{Re}-1000)\mathrm{Pr}}{1+12.7\left(\frac{\mathrm{f}}{8}\right)^{0.5}(\mathrm{Pr}^{0.67}-1)} \quad (5)$$

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Further Petukhov's Correlation is given as Eq. (6):

$$f = (0.79\ln(Re) - 1.64)^{-2} \quad (6)$$

Where constant C in the above equation can be defined as:

$$C = 1.07 + \frac{900}{Re} - \left[\frac{0.63}{(1+10Pr)}\right] \quad (7)$$

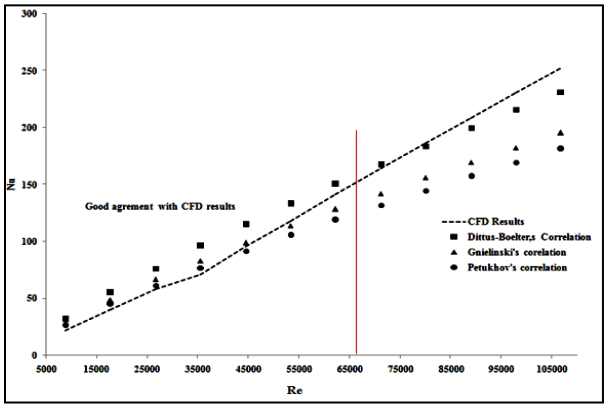


Fig.6 Comparison of Simulation results with the predictions of correlations.

III. Results And Discussion

A. Effect on room for both design of solar chimney

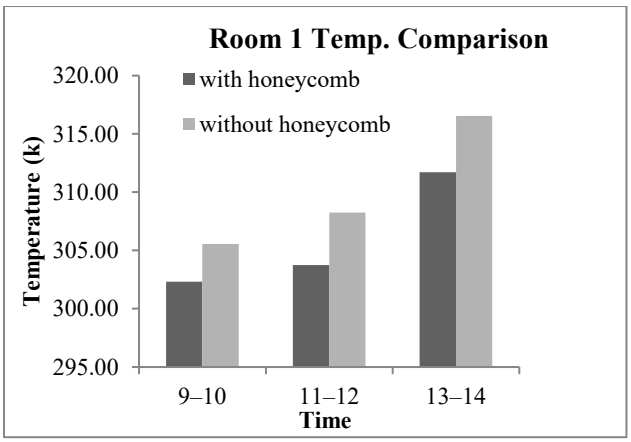


Fig.7. Comparison of Simulation results of temperature for with and without honeycomb for room 1

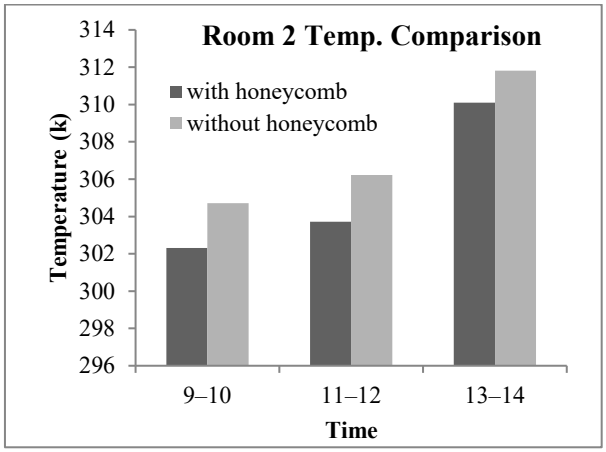


Fig.8. Comparison of Simulation results of temperature for with and without honeycomb for room 2

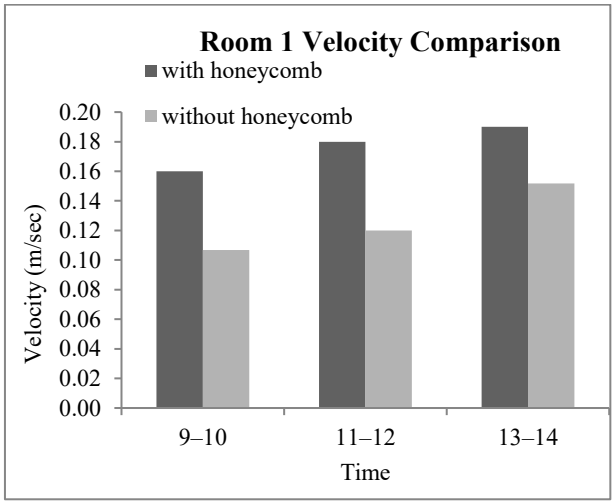


Fig.9. Comparison of Simulation results of Velocity for with and without honeycomb for room 1

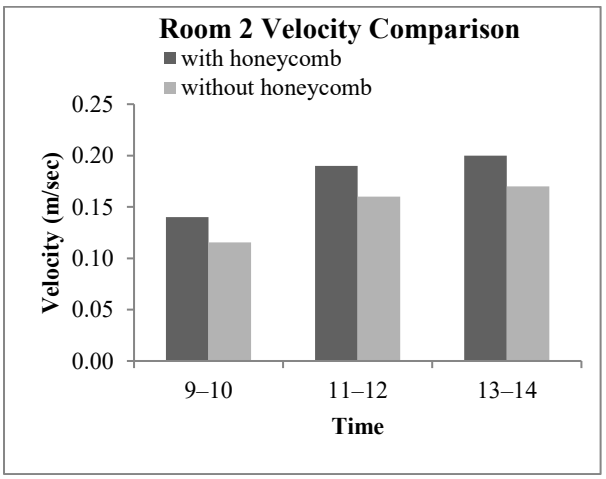


Fig.10. Comparison of Simulation results of Velocity for with and without honeycomb for room 2

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In this study May month was taken under consideration: May (summer). Simulations were made for both cases of solar chimney. Readings were taken on an r1m31and r2m31 (surface monitor) to obtain following results, which are shown from figure 7 to figure 10.

B.Effect of Honeycomb on Chiminey

Readings were taken from the two surface monitors: cb1 at the bottom part of the chimney & cb2 at the top part of the chimney for temperature and velocity as shown in figure 11 to 14.

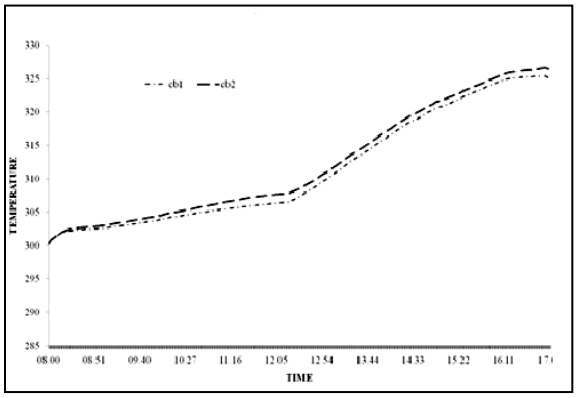


Fig.11. Temperature variation for without honeycomb chimney at cb1 & cb2 inside chimney body for May

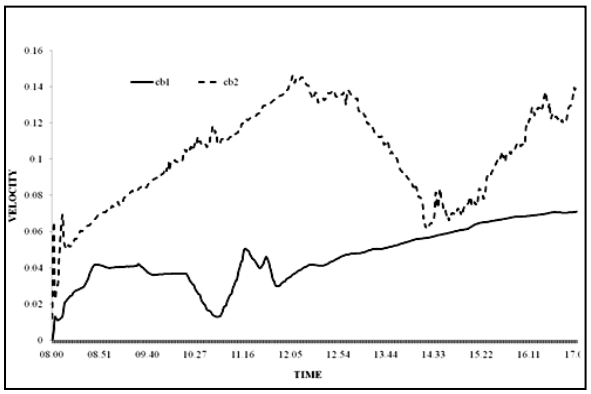


Fig.12.Velocity variation for without honeycomb chimney at point cb1 & cb2 inside chimney body for May.

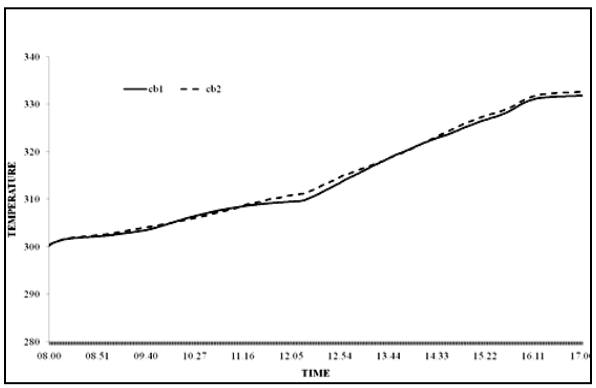


Fig.13. Temperature variation for with honeycomb chimney at cb1 & cb2 inside chimney body for May

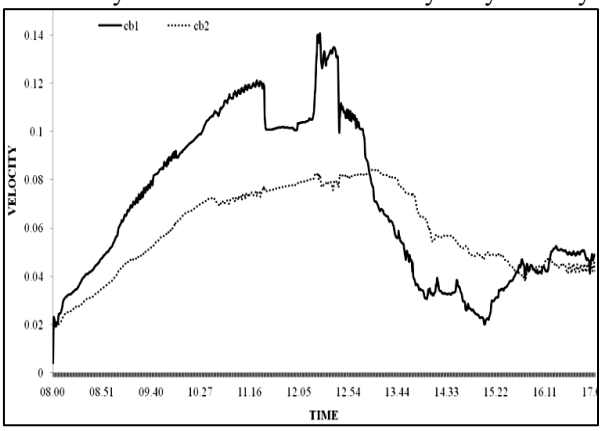


Fig.14. Velocity variation for with honeycomb chimney at point cb1 & cb2 inside chimney body for May.

For both the cases it can be seen that the rise in temperature is more after twelve noon because of the increase in radiation intensity on the absorber plate. For cb2, the velocity profile is uniformly increasing till 1:00pm. There is a decrease in velocity from 1:00 pm to 2:30 pm. This was due to proceeding of the day. As the day proceeds the value of solar intensity decreases.

C.Effect of Single Day on natural Ventilation

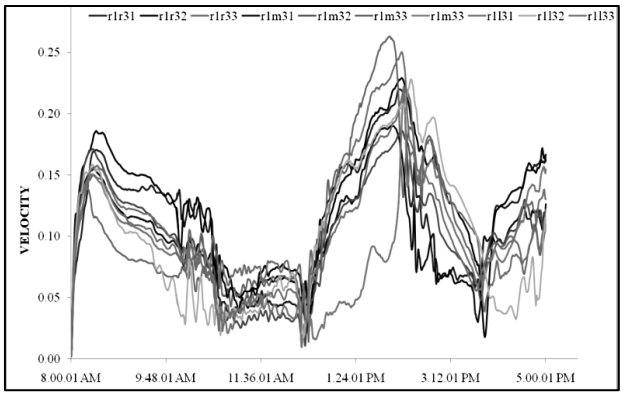


Fig.15. Variation of velocity at different points on three ft inside room1 for without honeycomb chimney (May).

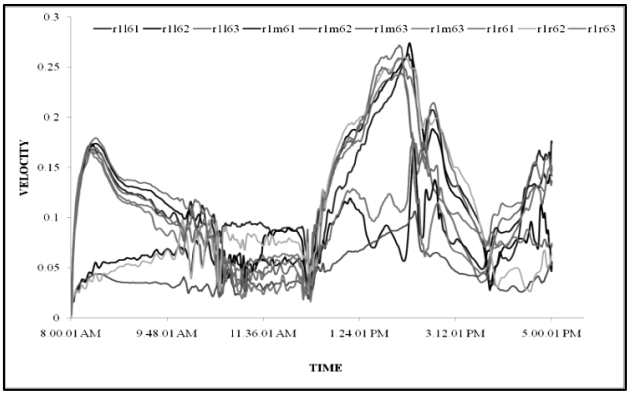


Fig.16. Variation of velocity at different points on three ft

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inside room1 for with honeycomb chimney (May). Figure 15 and 16 shows velocity variation for without honeycomb chimney for May; the velocity variation at three feet for both the cases of chimney is almost same throughout the room. All the points at a particular height follow a similar pattern. The velocity after increasing decreases from 8:30 am to 1:00 pm. Then there is an increase in velocity from 1:00 pm to 3:00 pm.

D. Velocity Contours on Two Different Chimneys

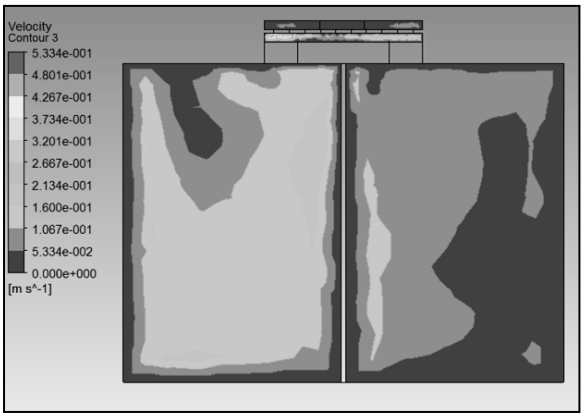


Fig.17. Contours of velocity distribution at 3 ft in chimney with honeycomb

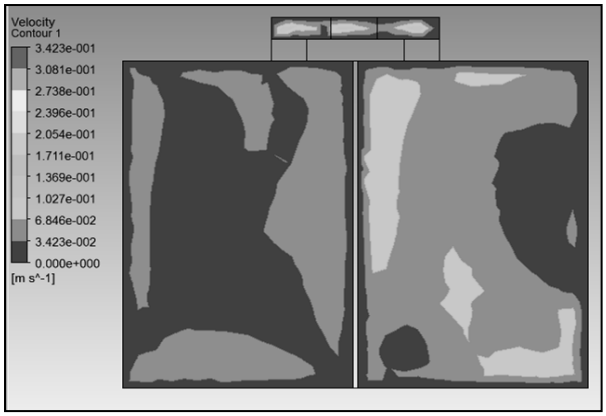


Fig.18. Contours of velocity distribution at 3 ft in chimney without honeycomb

Figure 17 and 18 shows contours of velocity for both cases of chimneys. Throughout the day, the velocity distribution is more in with honeycomb chimney as compared to without honeycomb chimney.

IV. Conclusion

From table 3 and table 4 given below, the velocity of air for with honeycomb chimney is more than without honeycomb chimney. Due to increase in the velocity in the honeycomb structure the turbulence in the chimney increases and due to this turbulence effect the temperature inside the room the room decreases in comparison with the chimney without honeycomb structure. This shows that that the chimney with honeycomb structure is more effective in comparison with the chimney without honeycomb structure. During the peak period, i.e. from 11:00 to 12:00, the temperature inside the room for with honeycomb chimney is lesser than the temperature inside the room for without honeycomb chimney due to negative percentage temperature difference. With honeycomb chimney gives a lesser temperature inside the room from time 09:00 to 15:00. Therefore, in terms of draft risk comfort, with honeycomb chimney is a better option because the circulation of air is better in with honeycomb chimney and the temperature is lesser during 09:00 to 15:00. It can be concluded finally that in rural areas where there is shortage of electricity, solar chimney is a viable option.

Table III. Comparison between both cases (Response is Temperature, K)

Design Time	with honeycomb - chimney	without honeycomb - chimney	percentage difference
ROOM 1:			
8:00-9:00	311.7	311.3	0.13
9:00-10:00	312.96	314.24	-0.41
10:00-11:00	313.98	316.28	-0.73
11:00-12:00	315.63	318.96	-1.06
12:00-13:00	318.25	319.25	-0.31
13:00-14:00	320.24	321.84	-0.50

Table IV. Comparison between both cases (Response is Velocity, m/s)

design time	with honeycomb - chimney	without honeycomb - chimney	percentage difference
ROOM 1:			
8:00-9:00	0.14	0.13	6.43
9:00-10:00	0.12	0.11	7.83
10:00-11:00	0.09	0.08	11.11
11:00-12:00	0.07	0.06	15.71
12:00-13:00	0.11	0.09	17.27
13:00-14:00	0.18	0.15	16.11
14:00-15:00	0.15	0.12	20.67

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A critical Analysis on Face Detection Algorithms of Video Surveillance

Abstract

Biometric systems are an alternate to traditional identification systems. In the present era the face recognition is rapidly growing aspect of biometric traits. Its applications are broadly ranging from the efficiency of industry, consumer applications and monitoring the various solutions. To drawn the research attention to the increasing development in face recognition and detection area we used all aspects ranging from face tracking, detection, feature extraction and face recognition. In this paper we focus on the various algorithms of face detection and video surveillance which are based on artificial neural network and try to go in depth analysis of algorithms of face detection.

Keywords: Biometric traits, feature extraction, face detection

1.1 Introduction: Biometric traits will identify the face of the person but the efficient way to detect and recognize the people from the video is to deploy any surveillance system is required. This will require finding the face from the video and applying it for the recognition. The face recognition is more challenging in videos comparatively to the normal 2D face recognition because a conventional face recognition system based on still images and a video surveillance systems based face recognition contains the video as a input. The interest is developed due to video surveillance and deep learning networks.

Video is an electronic medium to display, recording, playback, broadcasting of a visual media. Initially it is developed for television system. Actually a video is a series of electronic signals. It uses the still images to generate the steady source and which will stimulate the movement. It is used for entertainment, education, downloading or streaming the video. It is recording of a set of images or a motion picture. There are a unit of 2 styles of Video- Analog Video and Digital Video. In Analog video analog signal is used to transfer the video signal which contains brightness, luminance and chrominance of an image and it will combine to a single video which is known as composite video. This type of video is used for professional products like television and consumer products also.

1.2 Developments in Biometric Traits: There are multiple biometric traits which are used for research purpose such as-

- **Ear:** - Face recognition system extracts the attributes of faces from the images which are having faces in front; the ears are visible at the side faces, so it makes a important and relevant biometric trait in various scenarios. Ears are measured and defined by the geometric measurement of curves of the ear and surface of ear. Abaza et al. discussed the several advantages of using the ears as a biometric trait such that firstly the structure of the ear is quite stable and it is unaffected by the aging effect after the age of 4 years the ear growth is linear. Secondly, ears are minimally impacted like as facial expressions. Third, Ear Acquisition does not require the direct contact with the sensor.
- **Gait:** - The human identification from a distance is a demand of current culture in the unconstrained environment with un-cooperative subjects in the non uniform background and variable illumination. Biometric traits like iris, fingers, will not be detected from larger distances, but faces, gait will be acquired from larger and smaller distance. At the larger distances it will reduces

the accuracy. Gait refers to human motion, practically it recognizes by static and dynamic features both i.e., body shape.

- **Hand Geometry:** It refers to the hand geometric structure, which includes finger width at several locations, palm width, figure length, thickness of palm, palm contour etc as discussed by Duta. The hand geometry literature is available on patents or applications oriented description. Latest research is explored in hand geometry with finger prints and low resolution is discussed in Duta 2009 and Kong et al. 2009 and palm prints for improving efficiency and accuracy is analyzed by Jain et al 2015.

- **Periocular:** The eye region is represented by the Periocular. Park et al. represents the region around the eyes. This region will consist of the skin, eye, and eyebrows. It is a good tradeoff between the face and iris for recognition.

1.3 Face Detection Algorithms in Video Sequences

The various algorithms were existing for face detection in video sequences. Some of the algorithms were discussed here.

1.3.1 Viola Jones Algorithm

By moving towards the historical account of face detection 1991 is the learning based approach for face detection as mentioned by Turk. After that for competitive object detection in real time the viola and Jones proposed their framework in 2001. This framework is motivated by the problem of face detection and for trained the variety of object classes. Viola Jones is used for face detection in video sequences.

The viola Jones detector contains three steps-

- **Feature Extraction:** For feature extraction and selection Haar like features are used. These features are the rectangular type features. Haar features are digital image features which are used for object detection. It will consider a rectangular region at a specific location in a detection window. Suppose there is a database of human faces. It is observed that some sort of resemblance in features will exist in the faces. It is a scalar product between the image and some haar like features and is shown in fig 2.25 is discussed by Kumar et al. in 2011.

Moving precisely, let I is an image and P is a pattern both are of same size (N*N).The features associated with pattern P of image I is defined as-

$$\sum_{1\le i\le N}\sum_{1\le j\le N} I(i,j)1_{p(i,j)\ is\ white} - \sum_{1\le i\le N}\sum_{1\le j\le N} I(i,j)1_{p(i,j)\ is\ black} \quad (1)$$

Sample Haar-like features are shown in figure

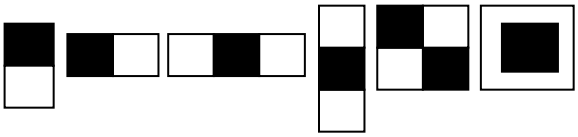


Fig 2.25: Haar-like features

- **Feature Selection:** Feature selection is performed by the Adaboost algorithm. It is a machine learning method used for the face detection. Adaboost algorithm is used to select the best features and also train the classifiers. Adaboost algorithm is a linear combination of weighted weak classifiers and will constructs the strong classifier.
- **Cascading Classifiers:** The word cascade means that it will consist of several things which are your region of interests. Here, the cascade classifiers means that it will consists of several classifiers and make the resultant classifier which is subsequently applied to the region of interest till the candidate is rejected or all stages are passed. After cascading each strong classifiers the model is obtain the non face region and face region is discussed by Krishna and Srinivasulu in 2012.

1.3.2 KLT

KLT stands for Kanade Lucas Tomasi. In 1981 Lucas and Kanade proposed a iterative Image registration technique with an application to stereo vision. In 1991 Kanade and Tomasi proposed a method for detection and tracking of feature points. This method is known as KLT method. This method is divided into parts one is Lucas Kanade part and another is Tomasi Kanade part. Lucas Kanade part speaks that how should we track them frame to frame and another Tomasi and Kanade speaks how should the features will be selected. So, Lucas Kanade projected technique for orientating (tracking) an image patch and Tomasi Kanade anticipated a way for selecting the most effective feature (image patch) for tracking. Once the detection traces the face detect the feature points that can be constantly tracked. The KLT tacking approach calculates the movements of an object in consecutive video frames when the image brightness constraint is fulfilled and image movement is small.

1.3.3 Face Detection by skin color

According to Yadav et al. it is a very popular and informative approach in face detection algorithms. It is a simplest method and it leads to the construction of rapid classifier. It is a feature to identify the face in an image because it is significantly different color and entirely different from the background objects. There are many models which are used for skin classification but mostly are nRGB, YCbCr, etc. These models will use the thresholding for skin pixels. Skin classification is performed on skin color. After the classification decide a threshold for all values. Then, the boundary box area is calculated and applies a threshold on area. If the selected area is greater than the threshold then mark it as a face reason otherwise discarded is discussed by Phung et al. in 2001.

1.3.4 Histogram of Oriented Gradients (HOG)

Initially the concepts behind the HOG are described by Robert k. McConnell in 1986 without the name using HOG. Then in 2005 by Navneet Dalal and Bill Triggs presented their work on HOG and they focused this on the pedestrian detection in static images and also expand their tests to human detection in videos.

Steps to calculate the HOG:

- Preprocessing: When there is a large image then calculating the HOG descriptor patch is calculated. This patch is cropped out of an image and resized the image. The only constraint is that the patches being analyzed have a fixed aspect ratio for example 1:2.Suppose the size of the image is 720x475 pixels then the patch size is 100 x 200 and the cropped and resize image is of 64x128 pixels that is 1:2 aspect ratio.

- Compute the Gradient of images: Now, calculate the horizontal and vertical gradients because from this the histogram of gradients is calculated. This can be done by the filtering of image and initially a grey scale image is filtered. The derivatives of x and y are-

$$D_X = [-1\ 0\ 1] \quad (2)$$

$$D_Y = [-1\ 0\ 1]^T \quad (3)$$

Now, find the magnitude and direction of the gradient by using the below formula-

$$|G| = \sqrt{I_X{}^2 + I_Y{}^2} \quad (4)$$

$$\theta = arctan\frac{I_X}{I_Y} \quad (5)$$

- Calculate the histogram of Gradients in Resize image: Now the size of the resize image is 8x8 cells, so the histogram is calculated for 8x8 cells. The first question arises in the mind while taking the 8x8cells is why only this set is used? Because it provides a compact representation. For the 8x8 cells image the size is 8x8x3 i.e 192 pixels. The gradient of this patch is calculated in magnitude and direction

per pixel. The histogram contains 9 bins corresponding to the angles of 0, 20, 40, 60 … .160.

- Block Normalization: In the previous step histogram is created which is based on the gradient of image. Normalization is required so that the histogram will not affect by the lighting conditions. Various normalization methods are available so pick any one method and normalize the image.

- Calculate the HOG feature vector: To calculate the final feature vector for the entire image patch, the vectors are concatenated into one giant vector having the size of 3780.This is because 16x16 blocks have 105 positions having 7 horizontal and 15 vertical positions and making a total of 7x15= 105 positions. Then after each 16x16 block is represented by a 36x1 vector. So, when it is concatenated to a one giant vector then it will obtain 36x105=3780 dimensional vector.

1.3.5 Bayesian Framework Based on Face Detection

It is a probabilistic measure of similarity based on Bayesian analysis of image difference. Moghaddam et al. and Daliri and Saraf described this technique for matching of images for the purpose of face recognition. Bayes classifier is the best classifier and it is the best criterion for evaluate the feature sets. In the simplest form of similarity measure S (I_1,I_2) between two images I_1 and I_2 cab be set to be the inversely proportion to the norm || I_2-I_1||.

The similarity measure will be expressed in terms of probability

$$s(I_1, I_2) = P(\Delta \in \Omega_r) = P(\Omega_r|\Delta) \qquad (6)$$

Where P ($\Omega_r|\Delta$) is the posterior probability

P ($\Omega_E|\ \Delta$) is the estimates of the likelihoods.

1.3.6 Local Binary Pattern

LBP is a texture descriptor and introduced by Ojala et al. in 1994. It is motivated with a new invariant simple feature sets. This approach is quite good for texture classification image retrieval, segmentation etc as mentioned in Yeon et al. It can also be applied for both face detection and face recognition. It is motivated by the grey scale transformations. It will divide the facial image in several regions where the LBP will extract the features and concatenate the features into the feature vectors which later will use as feature descriptor as described by Singh et al. In this method assign a label to each pixel of an image by a 3x3 neighborhood with the centre pixel value and consider the result with a binary value. The circular 0 and 1 resulting values are read either clockwise or counter clockwise.

Rahim et al. says if there is a pixel position of x_c and y_c , LBP is defined as a ordered set of binary comparisons of pixel intensities between the center pixel and the surrounding pixel. The resulting value is defined as -

$$LBP(x_c, y_c) = \sum_{n=0}^{7} s(l_n - l_c)2^n \qquad (7)$$

Where l_c corresponds to the grey value of the centre pixel

l_n to the grey values of 8 surrounding pixels

s(k) function is defined as follows-

$$s(k) = \begin{cases} 0, & k < 0 \\ 1, & k \geq 0 \end{cases} \qquad (8)$$

In order to treat the textures on the different scales, the LBP operator was extended to make the use of neighborhood at different sizes. This will be defined as

(P, R) means P are the sampling point of the circle of R radius.

1.3.7 Adaboost Algorithm

Adaboost stands for Adaptive boosting. It is a learning algorithm based on boosting. The idea

behind the boosting algorithm is that it is a combination of simple learners and only the better than the random could yield a good final hypothesis. Adaboost is the practical algorithm of the boosting theory it is explained in Julien Meynet. Adaboost is a machine learning algorithm. It is an algorithm of algorithm which is known as Meta algorithm. In Adaboost algorithm the subsequent classifiers built in the instances by those which are misclassified by the by the previous classifiers. The basic plan of boosting is really to use the weak learners of the options calculated to create a high correct prediction rules by career the weak learner repeatedly processed on the different distributions over the training samples. The Adaboost algorithm is based on two major goals one is selecting a few set of features which represents as well as possible faces. And secondly, train a strong classifier with a linear combination of these best features. It is shown in the fig.2.26 given below-

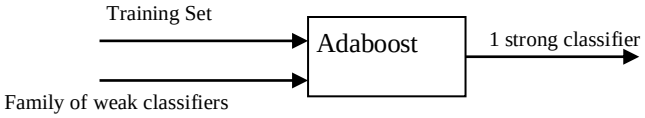


Fig 2.26: Adaboost Algorithm

1.3.8 Artificial Neural Networks

This method is used to detect the frontal views of faces in a gray scale images as mentioned in Rowley et al. The algorithms and the training methods are applied to the images. The training from the neural network is a challenging task because it is difficult to categorize the non face images. It is easy to get a representative sample of images which will contain the faces but harder to characterized who has not the same. Usually the multi layer perceptron is used for this method is described by Thai Hong le in his paper.

2.0 Literature Review of Video Surveillance

In 2013 the paper titled authors Assaleh et al. proposed a system in which the face recognition is done using different surveillance cameras and in different lighting conditions. The proposed work uses the linear classification, frequency domain feature extraction, and image filtering and image segmentation. The proposed system is based on night vision mode and non-night vision mode. The average recognition rate in night vision mode is 41.85% and without night vision mode is 68.50%.

In 2014, Kartheeswari and Vijay Laxmi proposed a discusses the various positions and unlimited orientations of face. They proposed a cluster human faces using spatio temporal method which consists of 3 steps; initially they can localize the faces and then extract the features from all the faces from frames.

Again in 2014, Yadav et al. proposed an approach for motion detection for automatic video surveillance. They proposed a three modules for motion detection i.e., Background Modeling module, Block Based module and Human detection module. This method uses the wavelet threshold algorithms and its confusion matrix accuracy rate is 65%.Khaligh et al. 2012 proposed method has an eight-layered network that consists of five convolutional layers and three fully connected layers to classify the shots into long, medium, close-up, and out-of-the-field shots and achieved the precision of 91.07%

In 2015 Hannane et al. proposed a video surveillance indexing system for facial features using SURF method in their paper.The accuracy obtained by this system is 87.92%. The CHOKEPOINT dataset is used for this purpose, which consists of 48 videos sequences with 179349 frames and having 64204 face images in these frames.

In 2015, Ojha and Sakhare presented a paper. The author discusses the architecture of classification which consists of 3 steps i.e., Motion Segmentation, Object Tracking and Classification. This author also discuss the

various object representation methods, feature descriptors, motion segmentation approaches i.e., Background Subtraction, temporal differencing, optical flow then after object classification is discussed by their methods of shape based, motion based, color based, texture based classification approach .Object tracking procedures are Region based tracking ,Active Contour Based tracking, Feature based tracking is discussed in this paper. At last this will discuss the problem domain, various challenges and future work.

- Again in 2015, Patil et al. discusses the stages of video surveillance system i.e., moving object detection, object classification, object tracking, behavior, and activity analysis and person identification. The author uses gray scale conversion and noise removal in the preprocessing of proposed system. The main objective of the approach is to find the difference between the existing frame and reference frame or one can say that difference between two consecutive frames.
- In 2015, Paul et al. presented in which the author presents a review of the diverse application areas of video surveillance like person identification, gender classification, abnormal event detection, human gait detection, crowd detection, fall detection for elder people etc. Initially, detection process is performed to detect the object or face in a motion and for performing the same background subtraction, optical flow, spatio temporal methods are used. After detecting the face, the next part is performance comparison to find the accuracy and computational time of each technique which is used. In 2016, Sukhija et al. proposed an algorithm to recognize an unknown image by comparing it with stored templates and gives information regarding the person recognized. The author proposes a improved genetic algorithm and after that it will compared with the PCA and LDA. The author proves that proposed approach is applied to ORL database then its recognition rate is 98.58%, if UMIST database is used then it is 100% and in INDBASE database it is 98.33%.Hou, 2017 proposes a proposes a novel alcoholism identification approach that can assist radiologists in patient diagnosis and achieves the precision of 91.28%.Minhas et al. 2019 in this research work, propose an effective shot classification method based on AlexNet Convolutional Neural Networks (AlexNet CNN) for field sports videos. The proposed method has an eight-layered network that consists of five convolutional layers and three fully connected layers to classify the shots into long, medium, close-up, and out-of-the-field shots and they have achieved the accuracy of 96.78%. Similarly Wang et al. 2019 states about the Alcoholism affect all parts of the body, but it particularly affects the brain. AlexNet was used as the basic transfer learning model and the author achieved the accuracy of 97.42%. Lima 2018 perform Haar wavelet transform and principal component analysis and use back propagation neural network (BPNN) as the classification tool and achieve the precision of 81.48%.

Conclusion: In this paper we have discussed the analysis of face detection, face recognition and video surveillance with the biometric traits. The face detection methods can help in identifies the person by using different algorithms. There is enough space in the scope of face recognition and face detection methods for research. The researchers can apply rough set, fuzzy logic; soft computing and neural networks based approaches for improving the performance of face recognition systems.

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Smart Lady E-wearable Security System for Women Working in the Field



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Abstract Women's security is still a big issue in our society. Women in the rural Rajasthan are very hard working; they spend their day in farms and also manage household stuff. To provide safety to the woman, an ornament worn by them could be modified with the design named 'Borla' suggested here. This ornament is having an e-wearable security system so that the women on fields are not afraid of any emergency, and the location is traceable. Technology as their armor will protect them and provides a lot of freedom which consists of live location with a continuous server update, high definition camera along with instant capture and voice recording. It also uses sensor like environmental alcohol sensor for environmental alcohol measurement. An alert message will be generated for a specified condition which is then transmitted from the transceiver (GSM system) to the mobile phone. This device is reliable and easy to handle.

Keywords RFID · Nano-technology · Digital jewelry · Wearable technology · Empowerment in design · Aesthetic values

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1 Introduction

Women security in India has become a serious issue since 2012. Crimes against women are coming out in front of them in the various forms such as molestation, domestic abuse and sex assault. Because of these crimes, the gender ratio decreased a lot [1]. The gender inequality ratio is 0.524 which positioned it in the backside of 20% of the ranked international locations [2]. As per the report of the National Crime Records Bureau (NCRB), the crime rate against women per 100,000 female populations was 55.2 in 2016, up from 41.7 in 2012. As per the above figure, violence against women has expanded each year. Violence in opposition to ladies in India is clearly greater gift than it can appear at the start glance, as many incidents of violence are not considered crimes or may also in any other case cross unreported or undocumented because of sure Indian cultural values and ideals. According to the National Crime Records Bureau of India, said incidents of crime toward girls increased 6.4% throughout 2012, and against the law, a girl is devoted every three minutes. According to the National Crime Records Bureau in 2015, 329,243 instances of crimes in opposition to ladies were filed, and 338,954 cases have been registered in 2016. The instances labeled as crimes in opposition to women encompass murder, rape, suicide abetment, dowry death, acid attack, cruelty against girls, kidnapping, etc. According to the NCRB statistics for 2017, maximum cases had been registered is 25,993 in Rajasthan [3].

Rajasthan has earned the doubtful difference of registering the highest number of instances in indecent illustration of ladies and is a number of the top 10 states in crimes toward women, information launched by using the National Crime Records Bureau (NCRB) for the year 2017 [4]. Rape victims are more and more reporting their rapes and confronting the culprits. Women are becoming more unbiased and educated, which is growing their chance to report their rape. Although rapes are getting greater frequently mentioned, many move unreported or have the grievance files withdrawn due to the notion of circle of relatives honor being compromised. Women frequently do not obtain justice for the rapes, because police frequently do no longer supply a truthful hearing, and/or scientific evidence is frequently unrecorded which makes it clean for offenders to get away with their crimes below the modern-day legal guidelines. Increased interest within the media and awareness among each Indian and the out of doors global is both bringing attention to the problem of rape in India and assisting empower women to document the crime [5]. After global information pronounced, the crowd rape of a 23-year-old student on a shifting bus that befell in Delhi [6], in December 2012, Delhi skilled a significant increase in reported rapes [7]. The variety of reported rapes approximately doubled from 143 reported in January–March 2012 to 359 at some point of the three months after the rape. After the Delhi rape case, Indian media has devoted to report each and every rape case. As per the State Police Department information, Rajasthan has witnessed a 66.78% upward thrust in crime against ladies in first 1/2 of this 12 months as compared to equal final year. Total variety of the cases between January and July 2019 is 25,420 in comparison with 15,242 in 2018 [8]. In July alone, cases of the

girl's atrocities are a whopping 4898 while they were 2614 in July 2018. Heinous crime like rape has visible a jump from 2587 to 3677. Molestation shows an upward push from 3171 to 5329. Abduction rose from 2687 to 3762. Cases of domestic violence jumped from 5884 to 11,459 [9]. Dowry associated deaths from 231 to 273. Most of the cases were closed as fake reporting, and about 50% cases were taken to court. Kota and Jodhpur cities are India's pinnacle 10 inside the crime toward girls. Jaipur commissionerate suggests an upward thrust of 105.74% police attribute this to boom in focus about crime reporting or repayment. However, reality remains that is an indicator of sexual disparity in crime and girls nonetheless being seen as a smooth target [10].

1.1 Historical Background and Idea Evolved for Borla Design

A woman in India has been a problem with many changes over the span of recorded Indian history. As all of us recognize the story of the golden deer in Ramayana, Rama goes chasing a golden deer (which certainly is the Raakshasa Maricha in disguise) and does not return for a long term [11]. When Sita coerces Lakshmana to depart in search of his brother, Lakshmana who cannot bear to look Sita's cry in grief reluctantly makes a decision to look for Rama, but under subject to his situation that Sita will not passes the protective line he draws. If anybody aside from Rama, Sita, and himself attempting to go the road might be signed by way of flames erupting from the road. After then Lakshmana leaves searching for Rama, the demon king Ravana comes in the character of a monk and asks Sita for alms. Sita does not understand his trick, she unsuspectingly crosses the Lakshmana Rekha to provide alms to him, and Ravana kidnaps her in his Pushpaka Vimana [12].

From this story, we got an idea to make a device which can protect every woman through our device 'Borla' which is similar to Lakshman Rekha made by Lakshman for Sita in Ramayana with subject to condition that every woman working outside home will wear that device and keep her safe.

1.2 Method

In this project, a series of concepts has been developed in the form of surveys, workshops, discussions, sketches, prototypes tests and evaluation. Women, the users, from rural Rajasthan play a very important role in the economy. The users are involved in the beginning of the research phase, and the main project is to emphasize on research through design and exploration of armor.

During the project, some visits to different villages of Rajasthan near to Jaipur District (see Table 1 and pictures in Fig. 1) were made, and continuous interaction was

done with the women of different age group to understand their needs, requirements and desires when they wearing jewelry [13], and we had also discussed women's safety issues in social contexts.

Table 1 List of villages as per 2011 Census of India [14]

Village name	Total worker on fields	Male	Female
Begas (near Bagru)	138	57	81
Mundiya Purohitan (near Bagru)	130	64	66
Bhoodharpura	68	20	48
Dhankya (Jhotwara)	48	22	26
Manchwa (Jhotwara)	43	19	24
Sanchoti (Jhotwara)	37	17	20
Malpura Chaur (Jhotwara)	31	13	18
Gajadharpura (Jhotwara)	34	17	17
Himmatpura	14	6	8
Champapura	16	8	8
Durjaniyawas	6	1	5
Laxmipura	6	2	4
Bhaterivillage, Bassi	26	4	22
Khelwas	212	6	206
Chak Rojwari	82	40	42
Toonga	111	54	57
Prempura	27	12	15
Rajpura Patalwas	30	7	23
Rampura@chandaliya	24	8	16
Doobli	33	3	30
Total-20 village			



Fig. 1 Left and middle images show village women working in the field, and in right-side picture, a woman is telling about problems faced by them during working in fields

1.3 Pre-study on 'Rural' Indian Women

The project started with research about aesthetic principles and technical solutions for the armor. The work has begun with a pre-study, where surveys of 20 villages with 55 users were conducted (see Table 1). The target group of these surveys is girls and women of all age group. Their needs about the safety and the idea of carrying a Borla were discussed. It was an open discussion with them. The discussions and observations are summarized in the next paragraph.

For fulfilling daily needs, women have to go miles away to bring vegetables, food items and sometimes water also. In villages, people are still making food on mud Chulha. The water crisis is severe, and it also affects the production of the crops. Thus, GDP declines, and people's living conditions fall. Income from land is very low approximately INR 2,00,000 per annum. Hospitals are also far from residential areas. Villages have a few schools up to senior secondary classes. In villages, people are simple, purity in food items like milk, vegetable fruit, air, no pollution, etc. Wheat and bajara crop grows in land. Houses are built in between fields. People in villages are good-natured and simple. Maximum women are illiterate. The literacy rate is medium. Few places like Bassi, where the literacy rate is higher, and the rate of crimes is less.

Because of the ignorance of the local governments, the facilities are not reachable to the villagers. Road transport is not good in villages; to avail a public transport like bus, the villagers have to walk about 3–10 km distance. There are no road lights to show path during night. Government schools are in very bad conditions, students themselves doing all works, cleaning utensils, distributing food, etc. toilets are opened, and their doors are broken. The electricity problem is also there in villages.

Most of girls leave their education after the class 10th or 12th and start earning for their family income by doing stitching, farming, etc. Girls are killed only for the prestige of family. The atmosphere of villages is worst for women till now because of teasing, abusing and comments in the majority in villages [15]. At night, some people drink and move on bikes and comments on girls. Fear of drunkards is common.

Cellular network works well in some villages. Network facilities are made available by some service providers. Women have no phone with them. Male member keeps mobile with them. Women go most of the time in groups. Women do not know to use mobile. But they would like to use the device.

Women mostly work in field, and some of them work in the nearby city area for their family income. Women work in the field from 8 am to 5 pm. They do many works like sowing seeds, cutting crops, cattle care, etc. Many women work in various firms like pepper factory, spray factory, steel factory, nearby college and university, etc. due to income problems in the village. In Begas, five 'anganbari' centers are run by women.

They travel to these places alone. Most of the women wear artificial jewelry. Maximum old women wear Borla, and young women occasionally wear it. Some women are working in *anganbari*, and some are self-employed but need security for themselves at night in the village. Women want the free device to wear for security.

Maximum women like Borla which is worn by them occasionally, but they wear locket regularly. For the purpose of their security, they expressed their consent and wish to wear the 'Borla' regularly.

During the survey, a visit to the homes of the rape victims was also made. The victim is an Indian social employee from Rajasthan, who was gang-raped in the year 1992 via better caste men angered by way of her efforts to prevent a baby marriage of her own family. Her subsequent treatment with the help of police had done, but court acquittal of the accused. After this incident, the victim attracted substantial countrywide and global media interest in women rights, and she had become a landmark episode in India's women rights movement. Rape victim is still living in Rajasthan; however, her family is boycotted socially as she speaks boldly against the wrong practices of the society. The family of the victim is not invited in the circle of relative's gatherings and features. Villagers notice her by means of hatred eyes. Many crimes manifest there. No one wishes to report the wrongdoings and speak against the powerful people of the village. Police stations and hospitals are very far from the residential places.

2 The Design Process: Prototypes and Tests

The design process has series of sketching and designing, concepts, prototypes, user tests and evaluation of the armor. Two concepts have been developed and tested through several working prototypes. One of the most important discussions in the workshops was about the design of Borla. What type of jewel should it be? Should it be a pendant cum Borla, only Borla, only Pendant or a newly designed jewelry with ancient look. There are two concepts: only Borla and Borla cum pendant. Both of these have good and bad sides. The advantage of Borla is that it is a jewelry, in which users can hide the device in the unsafe areas. It can be worn in such a way such that it is not exposed in public places since it looks like a jewelry and can be worn 24 h. It may work like a watch. The Borla empower women. It is eye catchy and easy to use and make women carrying it feel stronger. Radiation effect on head is a major disadvantage of this concept of the Borla.

Designing the armor started with series of sketches manually with pen and paper (see Fig. 2) and later digitally. One concept of many sketches for further work has been chosen to develop it.

2.1 Technical Aspect of Design

Many devices have been built for women security till now which are mostly based on mobile phones or linked to the other devices [16]. The gadget named '**Borla**' proposed in this paper is gorgeous head accessory which is worn by a hook at the center parting of the hair, with the pendant falling on the center of the forehead

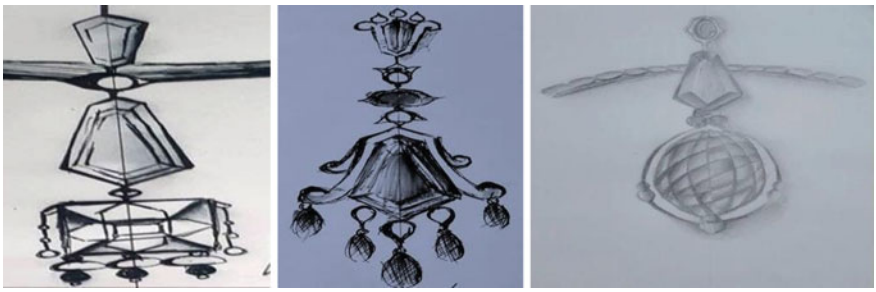


Fig. 2 Sketches of the Borla design

provides women's prettiness and security. It is an ornament worn by women in Rajasthan. This device has the technology that can transmit an alert message using GSM system to mobile phones. Transmission of search messages does not have any limitation; text message or alert message can be sent using GSM to any other mobile phone. This device is user-friendly and can be used easily by anybody. The device is very light in weight and easy to carry. GSM represents Global System for portable and wireless communications. General Packet Radio Service (GPRS) was built up a couple of years after the fact permitting bundle changed applications consequently empowering access to web and combination of numerous bearers for higher speed.

The GPRS contributions were monetarily presented first in the mid of twentieth century. Arduino microcontroller is a stage on which mix of equipment and programming is actualized. It offers a progression of simple and advanced data sources. The improvement condition is unreservedly accessible for all stages and is effectively programmable. Nature is additionally exceptionally adaptable. The GSM module utilized for the gadget is a SIM800L module. It is profoundly perfect with ATmega328p microcontroller. The gadget is enacted by the women in trouble by squeezing a signal for an emergency response.

The signal for an emergency response initiates the GSM module for correspondence. The module comprises of a normal SIM card which will be utilized for calling and SMS purposes. The module will send the directions of the women to put away portable numbers registered in the gadget. The idea driving the gadget is added to present a cost-productive gadget. Borla also consist of several sensors with microcontroller. Sensors like environmental alcohol sensor, camera for quick capture microphone for voice sensing and recording, GSM system for transmission of alert message and other important information. If there is some miss happening, then the device will generate the alert message directly and automatically to your device and other devices too, and there is no need of pushing any button. The microcontroller ATmega328p can be programmed through a software name Arduino IDE by using simple C language. The device is low cost as the material used is also low cost [17].

The Borla consist of fabulous design having an implanted printed circuit board with different sensors, microcontroller and button cells. The picture and voice

captured by the camera module can be sent as a multimedia message to two other phones through GSM and can be uploaded on web using some android applications. The power supply here needed in this device is only 5 V and 1 A.

The device has two parts, the forehead part and the back head part; forehead has all the sensors including camera microphone and environmental call sensor. This device is program in such a way that all components work simultaneously, and a combined information in the form of a text message will send to the linked mobile phone. Device is compatible with both keypad phones and touch screen smartphones. To improve device accuracy and size, surface mount technology (SMT) has been used. This technology can lower the size of the internal components of a device which includes the ICS capacitors resistors and all the other important components.

2.2 Safety Devices in the Form of Jewelry

Before the innovative device 'Borla' designed here, many other devices/gadgets have been prepared. They are also working well in the case of security. Here, the jewelry model has been used to comprise the various components and features of security. Other innovative ideas include:

Smart Bracelet: Adafruit flora controller, accelerometer, gyroscope, temperature sensor and pressure sensor, GPS, microphone, external battery.
The Sunshine Necklace: Alarm technology, wearable sensors.
Borla: This is an innovative device; it is made by using different components ATmega328p, camera, environmental alcohol sensor, GSM, microphone, button cells.

2.3 Hardware Architecture

In the hardware diagram of the device (Fig. 3), a GPS will be mounted on the back of the middle blue color gem to use the location of the victim. A printed circuit board will be mounted to the bottom of the device to send the place of the victim to the nearest police station and will detect the attacker which is drunkard or not by the alcohol sensor, and these components will be triggered by the ATmega328P microcontroller. Camera will be there in middle gem at the bottom to recognize attacker face. There will be a button for on/off the device.

2.4 Components Used in the Device Borla

(i) **ATmega328P**
It is an 8-bit microcontroller mainly used in the Arduino (Fig. 4). It is a high performance and low power controller. It is based on AVR RISC architecture. This microcontroller is a 28-pin IC [18].
For the better efficiency and parallelism, the AVR uses Harvard architecture with separate memories and buses for program and data. Its operating voltage is +1.8 V to +5.5 V. It has 23 programmable I/O lines. JTAG interfacing is available. The analog to digital convertor has 10-bit resolution and has 6 channels. The analog comparators are pin 12 and pin 13. The CPU speed is 1 MIPS for 1 MHz. Its RAM speed is 2 Kb. It has the program memory of 32 KB. The programming of this microcontroller can be done using Arduino IDE [13].

(ii) **SIM800L module**
The GSM module utilized is a SIM800L module [19]. It is a GSM/GPRS module with quad-band which performs satellite correspondence utilizing GPS innovation. It has very compact size [20]. It supports mobile class station B so that it gets connection with mobile network. Its quad-band frequency is 850/900/1800/1900 MHz. It has low power consumption. A micro-SIM is used (Fig. 5).



Fig. 3 Hardware diagram of Borla

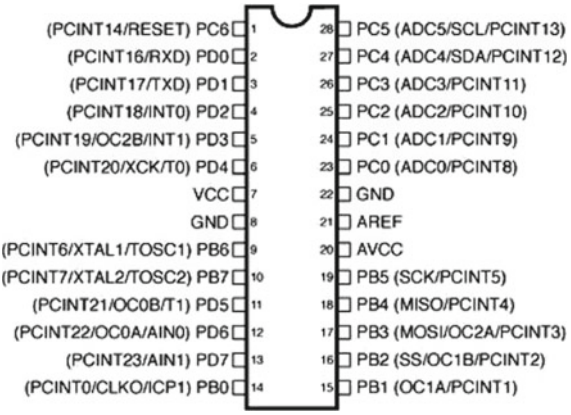


Fig. 4 Pin diagram of ATMega328P

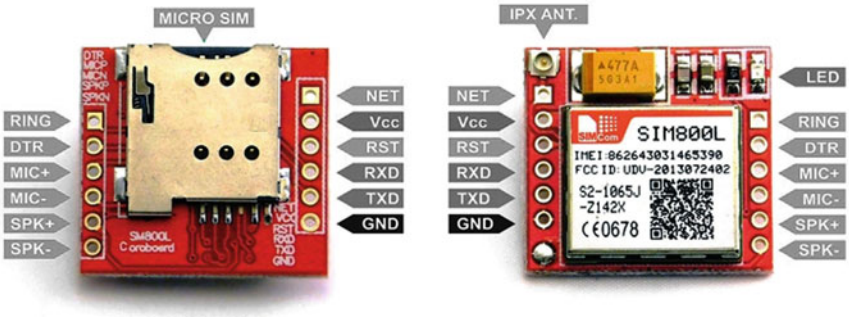


Fig. 5 SIM800L GSM module

(iii) **OV7670 Camera Module**

It is a low voltage CMOS image sensor and has the capability of a single-chip VGA camera and image processor. It can be operated at 30 fps, i.e., 640 × 480, or we can say 0.3 MP. This pre-processing of the image can be configured via serial camera control bus (Fig. 6).



Fig. 6 OV7670 Camera module

(iv) **GPS Module**
It is a Global Positioning System. It has 161 dBm sensitivity, 5 Hz updates, and 50 channels which come with a mounted ceramic antenna with built-in rechargeable backup battery and can retrieve ephemeris data. It is operated at 3.3 V/5 V. In the proposed device, the coordinates of latitude and longitude will be obtained through this (Fig. 7).

(v) **System Design**
The system design mounted on a printed circuit board will connect all the components, i.e., alcohol sensor, GPS module & SIM800L. A center tap button will also be put there to send the location to the victim. The message via GSM will be https://www.google.com/maps/place/lat,lng. The latitude and longitude will be traced by the GPS module (Fig. 8).



Fig. 7 GPS module

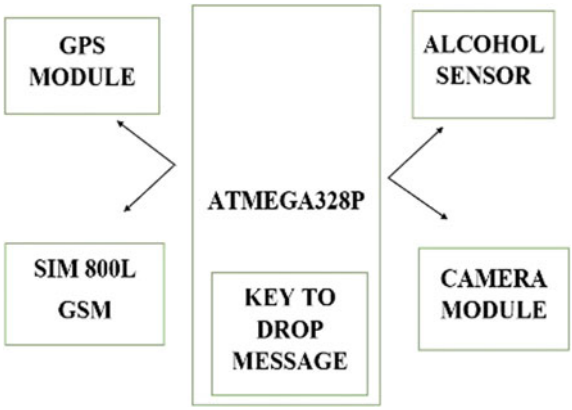


Fig. 8 System design

(vi) **GSM ATMega328p Interfacing**

The ATmega328p is interfaced with the GSM module utilizing two pins, pins 9 and 10, associated with the TX and RX pins of the module separately. The module is fueled up by a different 5 V power supply. As referenced, the GSM reacts to AT orders which are sent to the module through the microcontroller by programming it utilizing the Arduino IDE. The GSM reacts to the AT orders continuously with a modest quantity of deferral of around 2–3 s relying upon the order sent. Henceforth, when information is perused from the module, the cradle gets cleared, which is the reason timing each order and perusing its reaction is basic to getting the necessary reaction. On the off-chance that both these activities are not done in a state of harmony, at that point the ideal yield cannot be secured from the module [21]. The reactions from the module can be shown on the serial monitor of the Arduino IDE which frames the premise of interfacing. The AT orders [22] utilized in the proposed gadget are orders to send and get writings, acquire the directions and make calls. 'AT + CMGF = 1' sets the GSM in content mode which is required for both sending and getting writings. 'AT + CMGS = xxxxxxxxxx' sets the versatile number to which content is to be sent. 'AT + CNMI = 2,2,0,0,0' sets the GSM in content get mode which reacts just when a content is gotten by the module.

The directions in particular scope and longitude can be gotten utilizing either GPS or GPRS. In this gadget, GPRS is utilized since it is substantially more dependable than GPS as GPS requires an open situation. Once GPRS is actuated, the directions are acquired utilizing the orders 'AT + CIPGSMLOC = 1,1'.

The message will be sent to the family member of the device holder and police station, and the message will be 'HELP ME' www.google.com/maps/place/lat,lng.

By using the above link, police and her family members will reach there. This device will send live location of the device. The initiation of call mode turns on the amplifier information and speaker yield of the module. At the point when the

necessary gadgets are associated with these ports in the correct arrangement, a client can banter with the beneficiary. The media and voice captured by the camera module can be sent as a multimedia message to two other phones through GSM and can be uploaded on web using some android applications. The power supply here needed in this device is only 5 V and 1 A.

There has been a solar charging system is given in this device the battery will charge by solar power. The device has two parts, the forehead part and the back head part; forehead part has all the sensors including camera microphone, ultrasonic sensors and environmental call sensor.

2.5 Live Tracking

After initiating live tracking, the message will be dropped within 7 s to the police and family members. The message has a hyperlink which connects the coordinates of the beneficiary straight to Google maps where the area of beginning of the pinned message will be shown. Device will send the coordinates to recipient (Fig. 9).

Outcome This device will be able to detect the place, face of the attacker and the voice of the victim. The attacker can be arrested by the face recognition via camera.

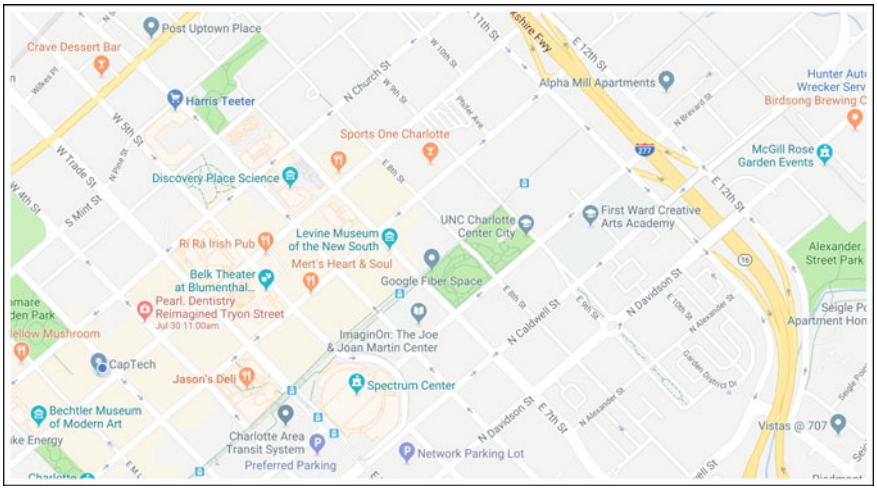


Fig. 9 Google map

3 Conclusion

Borla is a wearable gadget through which family members and police can watch women. The proposed gadget will be used as a crisis gadget for women in trouble. This is a smart women safety system using radio-frequency identification (RFID) and Global Positioning System (GPS). It is packed with features for both everyday safety and real emergencies. This device will offer the fastest and simplest way to get the nearest help of the police. Women have to do a single click and all features of this device start functioning. The main idea here is using an RFID transmitter with a RFID receiver for the information, and this information is transferred to the microcontroller. Once the information is received by the microcontroller, it sends the message to the contacts through the GSM module, and the place is tracked through the GPS. The women can get help by the police or her family members. We are using programming on ATmega328p using Arduino IDE. Borla final model is going to be ready to use in next few months.

The result of the study is an interactive, digital device named Borla. This device is programmed in such a way that all components work simultaneously, and a combined information in the form of a text message will be sent on the connected smartphone. Device is compatible with both keypad phones and touch screen smartphones. To improve device accuracy and size, surface mount technology (SMT) technique has been used. This technology can decrease the size of the internal components of a device which includes the ICS capacitors resistors and all the other important components.

The study indicates some areas for future intervention.

- Women need to be united with any form of an association, at source as well as at destinations, in order to fight the odds against them.
- Proper registration, database about women-related issues to be maintained at panchayat, block and district level so that the women can be tracked and services can be rendered at the time of emergency.
- The issue and problems of women need to be advocated with local, district and state governments for better inclusion.
- Villages should be adopted by colleges and universities. Awareness programs should be planned for them. Technology should be used in the betterment of villagers so that their problems can be removed.

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Best Practices of Machine Learning Methods in the Field of Cybersecurity: A Review

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Abstract. In this review paper, many research studies on machine learning (ML) procedures for analysis of computer network intrusion detection are described. With Machine Learning techniques, cybersecurity systems frameworks can analyze designs and improvement from them to help prevent similar attacks and react to changing behavior. In addition it presents a short instructional exercise clarification on each ML/DL strategy. Information holds a huge situation in ML/DL strategies; thus this paper features the datasets utilized in ML procedures, which are the essential tools for analyzing the overall the traffic in computer networks. Moreover, we expand on the issues encountered in utilizing ML & DL for cyber security and offer counsels for forthcoming examinations.

Keywords: Intrusion detection, Cyber security, Machine learning, Deep learning.

1 Introduction

Information security is a traditional technologies and processes designed to secure computers, internet, process and data from attacks and illegal access [1]. A computer network security system consists firewalls, antivirus software, and intrusion detection systems (IDS). IDSs used to determine, define and detect unauthorized access of the system activities such as uses, replication, alteration and damage [2]

In this paper we review some applications of cyber security in current time and also offerings the outcomes of a previously research in the field of machine learning (ML), deep learning (DL). In addition, it describes the various methods for ML and DL and their uses in network intrusion detection concerns. Also providing a set of comparison standards for DL/ML methods, the paper examines the difficulty of different DL/ML algorithms. Over the last short-period, the Information and Communication Technology (ICT) engineering has evolved prominently, which is global and strictly joined with our world. Thus, securing the ICT systems and its applications from hackers has been apprehensive by the safety representatives in recent times. The action of securing ICT systems from several cyber-threats or attacks are recognized as the term cybersecurity.

The Cyber Security systems and our personal computer security systems essentially make up the cyber security systems. So we need to update our antivirus software, network firewall, defender and an intrusion detection system (IDS) must be incorporated in all of these things [1]. In addition proof of identity, the work of discovering and determine the unauthorized use done by intrusion detection systems [2]. The inner intrusions and outside interruptions are known as the security penetrates. In distinguishing security issues, the fake wise and AI based techniques have become a fundamental piece of our lives [3]. The standards of security play out a significant job in the office of the best security applications keeping in view their usage and security tosses. They are fundamental for network protection research from this point of view, for example, interruption identification framework.

2 Literature Review

With the help of computer program, a select method to tackle principal logical and designing inquiries is given by the AI applications [10]. During most recent twenty years, extremist progressions have been seen in the field of AI with a simple admittance to the amateurs [11]. A research center "discovery" climate has fundamentally set off the AI, which has then changed into a down to earth application and business organizations are continuously actualizing it for an enormous scope [10, 11]. The product applications PC vision [12, 13], normal language preparing [11–14], discourse acknowledgment [12], robot control [13] and other arising applications are the developments of AI [10]. For getting upgrades client experience, to advance uncommon contributions and sug-gest buys [10], AI is utilized by significant organizations, for example, Amazon, Facebook and Google. Rather than programming the conventional info measure yield, it is far simpler for AI engineers to prepare a framework. They accomplish it by creating recreations of foreseen yield [11]. Different enterprises have noticed the effect of AI looking like information concentrated issues, for example, network safety [10]. Some different fields going from science [12] to cosmology to sociology [13] can likewise take points of interest of Machine learning for bringing astounding changes [11]. The exploratory information can be handled and broke down by mama chine learning in new manners [11]. Hypothetically, we can all the more likely comprehend the ideas of "huge information" by chipping away at AI calculations. In addition, these technolo-gies can be utilized to improve related execution measurements in vertical applica-tions. There can be an incredible variety in the AI calculations regarding remarkable capacities (e.g., strategic relapse, direct Regression, Naive Bayes, choice trees, irregular woods, uphold vector machines, profound learning and Gradient Boosting calculations). By the by, AI acquaints imaginative ways with dissect immense measures of information with a plan to produce transformative methodology. Additionally, more noteworthy advancement can be given by the progressive ages of calculations [11]. The huge volume of information can in a perfect world be handled through AI and digital protection [11]. The stages and organizations are powerless against assault. The viability of these assaults rely upon the quantity of devices to check and assess targets [10]. AI is utilized by the enemies to additional expansion their assaults.

Later ly, a few diaries have distributed not many studies on the security viewpoint of AI and computerized reasoning [4–6]. Moreover, [4] accentuated on contemporary writing of the Intrusion Detection for network security and Machine Learning Techniques utilized in IOT. In this way, for computer network examination of interruption identification, [5] clarified key writing reviews on ML & DL methods and Deep learning (DL) techniques with an illustrative portrayal of every ML & DL strategy. Throughout preparing and testing or construing of ML from an information driven see, a thorough writing audit with respect to cautious procedures and security dangers was introduced by [5]. Also, [3] advised on security issues with respect to man-made reasoning, particularly the fortification and managed learning calculations. Conversely, refreshes on security issues and cautious techniques in the existence pattern of an AI based framework from preparing to derivation were investigated by [14].

3 Organization of Machine Learning Algorithms for CyberSecurity

Previously Machine Learning methods Improvement of models getting input information other than using factual examination to conjecture a yield an incentive inside a reasonable reach is the vital goal of ML [3]. The ML is one of the quickly developing territories with complete applications in the space of software engineering [3]. The managed, solo and Reinforcement Learning are among the groupings of ML algorithms. The notable systems utilized in the AI calculations are as a matter of fact the administered calculations. Besides, relapse and grouping are the further sub-divisions of managed calculations. Various AI calculations are utilized in writing [13].

Another part of AI, i.e., the profound learning has as of now acquired broad acknowledgment and the equivalent has been utilized for interruption discovery. Moreo-ver, customary strategies are surpassed by the profound learning according to the discoveries of the examinations [8]. For stream based oddity identification, a profound learning approach subject to a profound neural organization has been used by the creators in [4]. As indicated by the experi-mental results, irregularity recognition in programming characterized organizations can likewise be per-shaped through profound learning. In [4], utilizing self-trained learning (STL) on the seat mark NSL-KDD dataset, a profound learning based methodology is proposed in an organization interruption identification framework. The procedure is discovered to be more productive as far as its exhibition when contrasted with those talked about in past examinations. Regardless, the component decrease capacity of the profound learning is underscored by this classification. It actualizes characterization through the conventional oversight model and profound learning strategies are basically utilized for pre-preparing. Applying the profound learning technique to straightforwardly perform grouping is a strange undertaking, and writing is without the investigations outlining the presentation in multiclass order. The RNNs are accepted to be the diminished size neural organizations as per [12]. In this section, three-layer RNN design was proposed for abuse based IDs with 41 highlights as information sources and four interruption classes as yields. The capacity of deep

learning for modeling high dimensional highlights isn't shown by the decreased RNNs and the hubs of layers are incompletely associated. The presentation of the model in the double classification isn't investigated by the creators. [8] Figured out how to display an interruption discovery framework based on profound learning and a profound learning approach was suggested for interruption location utilizing repetitive neural organizations. Moreover, the performance of the model in double arrangement and multiclass order was likewise examined. It was found that the exhibition of the proposed model is influence by various learning rate and the quantity of neurons. For demonstrating an order model with high exactness, the interruption location utilizing repetitive neural organizations are discovered entirely appropriate as indicated by the experimental results. In both multiclass and paired characterization, it portrays superior than the conventional AI grouping strategies. The RNN-IDS model offers another examination strategy for interruption discovery and the exactness of the interruption location is additionally upgraded.

4 Cybersecurity Datasets

Presently, information is set up by different exploration bunches both for their own investigation and for arrangement to local area archives [3]. Utilizing AI and fake clever examination, the current security associated datasets are classified in this part.

4.1 Knowledge Discovery in Databases-1999 Dataset

Knowledge Discovery in Databases -1999 (KDD'99) has been the most wildly used data set for the evaluation of anomaly detection methods. The information acquired from MIT Lincoln Labs involves BSM list records and tcpdump notwithstanding KDD Cup-99 [4]. The information caught in DARPA'98 IDS assessment program added to this specific dataset [10]. For evaluation of interruption detection frameworks, this dataset is likewise considered as benchmark information. One of the eminent informational indexes to survey execution of peculiarity identification strategies is in all honesty the KDD'99 [3]. By means of, Knowledge Discovery in Databases dataset is utilized through different scientists.

4.2 Information Security and Object Technology (ISOT) Dataset

The Information Security and Object Technology datasets including 1,675,424 complete traffic stream aggregately. Taking everything into account, the equivalent was gained from French part of honeynet project enveloping Storm and Waledac botnets [6].

4.3 HTTP CSIC 2010 Dataset

The HTTP dataset CSIC 2010 contains the generated traffic targeted to an eCommerce web application developed at our department. In this web application, users can

buy items using a shopping cart and register by providing some personal information. As it is a web application in Spanish, the data set contains some Latin characters.

The web assault assurance frameworks can be tried through this dataset. Almost 6,000 ordinary solicitations or more 25,000 odd solicitations figure this information. Besides, HTTP demands are marked as odd or ordinary [3].

4.4 CTU-13 (Czech Technical University) Dataset

The objective of the dataset was to have a huge catch of genuine botnet traffic blended in with normal traffic and foundation traffic. The CTU-13 dataset comprises in thirteen catches (called situations) of various botnet tests. On every situation we executed a particular malware, which utilized a few conventions and performed various activities. The combination of captures of 13 diverse malwares in a nonfictional organization environment is alluded to as the CTU-13 (Czech Technical University) dataset. This dataset is a deliberately named dataset catching the systems did in a controlled climate, which is one of the advantages of utilizing it [3].

5 Conclusion and Future Work

The security of data and information in cyber security from cyber-attacks is one of the major problem for the world. Several researches have been conducted using several datasets and also artificial intelligent and machine learning algorithms play a significant role in security of computer systems.

The basic central points of contention for public and global security is the wellbeing of PC frameworks from digital assaults. With various ML procedures, a review on security apprehensions has been introduced in this paper. A few datasets have been utilized to lead different investigates. Furthermore, a huge part in security of PC frameworks is performed by ML. The model papers clarifying different ML & DL methods in the digital area were deliberately found and inescapable classes of different datasets have been characterized alongside their preferences and hindrances. We intend to produce new dataset later on, which will be available to all.

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Effect of Nano Particle Based Anti-Stripping Agent on Moisture-Induced Damage for Bituminous Concrete Mixes

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Effect of Nano Particle Based Anti-Stripping Agent on Moisture-Induced Damage for Bituminous Concrete Mixes

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Abstract. Moisture damage occur due to loss of bond between bitumen and aggregates. Ingression of water in bituminous mixes leads to various damage. The objective of this study is to investigate extent of performance of Nano particle based anti-stripping agent (Wet Bound- S) in resisting the moisture damage and improving the durability of bituminous mix. Bituminous mixes were prepared with polymer modified binder (PMB-40); optimum binder content was found using Marshall testing procedure. To check the resistance toward moisture, specimen was prepared at three void ratios of 3%, 5% and 7%, each sample set was tested in dry condition and moist condition by injecting moisture at 30 psi and 40 psi. Then each of these sample set were subjected to indirect tensile strength ratio test and dynamic creep test. Use of anti-stripping agent was done to see its effect under adverse condition. From the outcome of this study, it was observed that PMB-40 with additive exhibit more resistance to moisture.

Keywords. Pavement material; moisture susceptibility; moisture induced stresses; anti- stripping agent

1. Introduction

Moisture damage is the major cause of damage of bituminous pavement [1]. It is an extremely complicated mode of pavement distress [2]. Infiltration of water cause the weakening of bond between aggregates and binder reducing the service life of pavement. When a vehicle's tire rolls over submerged pavement, the water entrapped between the tire and the pavement is subjected to high pressure. This forces the water into the accessible pores into the bituminous mix. When vehicle's tire rolls away from this area creating a negative pressure (suction) as a result the water drains or is pulled out from the pores back to the surface of the bituminous pavement. It is very important to assess the moisture susceptibility of flexible pavements.[3]. A pavement that is suffering from moisture damage can self-deteriorate itself even without the application of loading, and the damage is accelerated when this moisture induced pavement is introduced to traffic, resulting in loss of stiffness or strength of pavement[4][5]. Decades of research have been conducted to find a solution to this problem[6][7][8][9]. Through the development of laboratory testing facilities and experimenting with different anti-stripping agents, advanced progress has been made in producing more resilient pavements, with an increasing emphasis towards sustainability. A

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Nanotechnology based material known as wet bond-S (WBs) has been used to study its feasibility to prevent the moisture damage of bituminous mixes.

2. Material and experiments

2.1 Aggregates and asphalt binder

Aggregates used in the design of bituminous concrete mix (BC) were procured from crushing plant Delhi-Najafgarh border. Aggregates were tested for physical properties as per the relevant code, the result of which are summarized in table 1. Polymer Modified Bitumen (PMB-40) was used in the design of bituminous concrete. PMB-40 used in the present study was tested for their physical properties such as penetration, softening, elastic recovery, viscosity, specific gravity etc., the obtained and permissible values of which are summarized in table 2.

Table 1. Physical properties of aggregates

S. No.	Property	Test	Result	MoRT&H Specifications
1	Particle Shape	Combined Flakiness and Elongation Index	32.34%	< 35%
2	Strength	Log Angeles Abrasion Aggregation Impact Value	25.58% 17.6 (3%)	< 30% < 24%
3	Water Absorption	Water Absorption	0.40%	< 2%
4	Striping Value	Without additive With additive	2% Traces	< 5%
5	Specific Gravity	Coarse aggregate. Fine aggregate Stone dust	2.68 2.83 2.86	N.A.

Table 2. Properties of binder PMB-40

S. No	Properties	Test Results	Recommendations as per IS:15462-2004
1	Penetration at 25 °C, 0.1 mm, 5 sec	47	30-50
2	Softening Point, °C, min	61.65	Min.60
3	Specific Gravity	1.03	---
4	Viscosity, 150 °C, Poise	5.55	3.0-9.0
5	Elastic recovery, 15 °C, %	70.17	Min.70

2.2 Testing Program

The objective of the study is to assess the performance of Nano particle based anti-stripping agent wet bound-s (WBs) on moisture resistivity of bituminous mix. Study samples were prepared in two sets, one without the anti-stripping agent and one with anti-stripping agent. Each sample set contained Marshall specimen prepare at three void ratio i.e. 3%, 4% and 7% and each sample was tested for moisture resistivity by introducing to three different temperature condition i.e. 400°C, 500°C and 600°C at two different pressure condition of 30si and 40psi respectively.

2.3 Mix performance

2.3.1 Indirect Tensile Strength test (ITS)
ITS test is used to measure the resistance toward the tensile deformation of sample. The samples were prepared using Marshall method of mix design. Each sample set is divided into two subsets of approximately equal void content. One subset is maintained in a dry condition while the other subset is partially saturated with water to simulate moisture induced damage condition. The ratio of tensile strength of sample in wet condition to dry condition is called as Tensile strength ratio (TSR). A sample having TSR value greater than 80% is considered to have satisfactory resistance toward moisture condition.
ITS test was conducted on a set of three samples for each void content, each condition and average of test result of three samples have been reported as test result. Initially ITS and TSR values were determine for samples soaked as par conventional method and afterwards same at different temperature (40°C, 50°C & 60°C) pressure conditions (30psi & 40psi) Dry & Wet ITS values obtained for each air void content.

2.3.2 Moisture Induced Sensitivity Testing (MIST)
MIST is an accelerated test used to simulate the action of a pavement submerged in water. The test was carried on submerged Marshall sample prepared at different air void. Conditioning in MIST of each sample takes approximately four hours to complete. The testing was performed as per the guidelines specified in ASTM D7870/D7870M – 13 for MIST. After processing each sample in MIST. ITS, resilient modulus and creep tests were performed.

2.3.3 Dynamic Creep Test
Dynamic creep test is used to assess the permanent deformation of a bituminous mix under repeated loading condition. This simulates permanent deformation under the moving traffic. Universal Testing Facility is used to for this test. During the test, a cyclic stress of 69 kPa was applied with a seating stress of 11 kPa and haversine pulse is applied with loading width of 0.1 s followed by a rest period of 0.9 s. A maximum of 3600 load cycles were applied and accumulated permanent strain was measured and the strain calculated. The test was conducted for two different conditions, dry and wet. Four specimens were prepared for each set of target air voids (3%, 5% and 7%). Due to time constrain for the present study, samples were conditioned in MIST at 60 °C and 40 psi. These parameters were selected to see the maximum effect of moisture damage for on the permanent accumulated strain.

3. Result and Discussion

3.1 Optimum binder content (OBC)
Optimum binder content was taken as maximum of stability value, 4%air void and maximum specific gravity. The OBC value obtained for the bituminous sample prepare with PMB 40 was 5.1. The quantity of WBs added was decided based on trial studies. It was observed adding WBs more than 1% also gave significant result but increased the cost of overall project, hence keeping economical aspect into consideration 1% WBs was set as permissible limit. Since the focus of the paper is to study the durability performance of WBs on bituminous mix, hence the study is not reported in this paper.

3.2 Indirect Tensile Strength Test
Figure 1 and figure 2 shows the test result of dry and wet ITS vale of sample without WBs and with WBs respectively. The indirect tensile strength (dry & wet) of bituminous mixes is less for PMB-40 without

additive mixes compared to PMB-40 with additive mixes, indicating that inclusion of WBs improved resistance against moisture susceptibility.

The MIST was conducted at temperatures 40°C, 50°C & 60°C and pressure 30 psi, 40 psi respectively; the result of which are summarized in figure 3, 4, 5 and 6 respectively. On comparing the results at same psi it can be observed that on increasing the temperature in MIST at 30psi and 40psi pressure the ITS values decreases for all the samples prepared with and without additive. After conducting the entire test, it was observed that use of PMB-40 with additive in bitumen mix improves the ITS and TSR values.

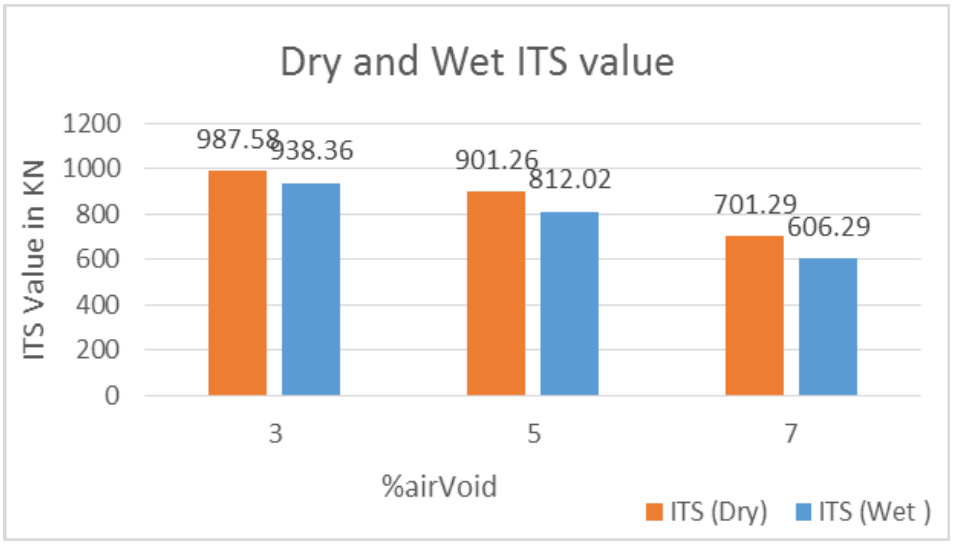


Figure 1. Dry and Wet ITS value of sample without additive

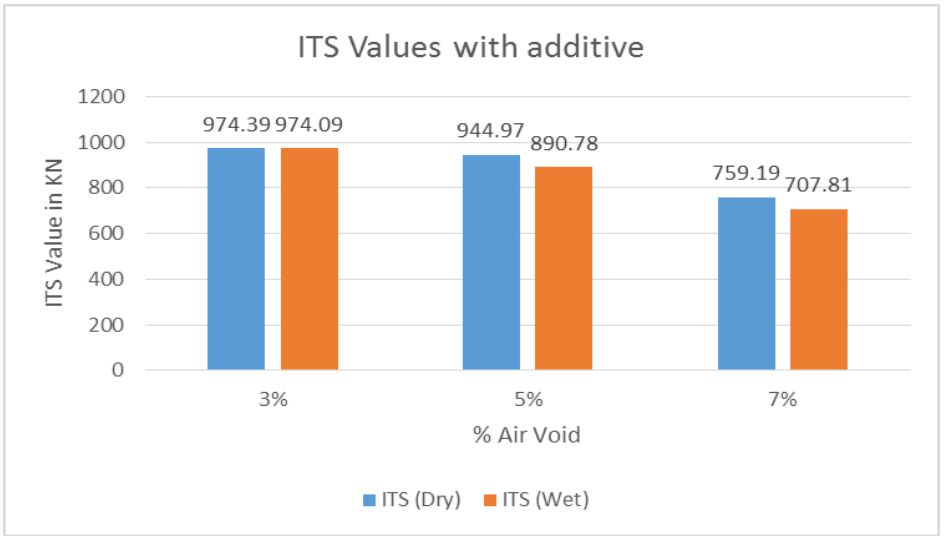


Figure 2. ITS value of sample after additive

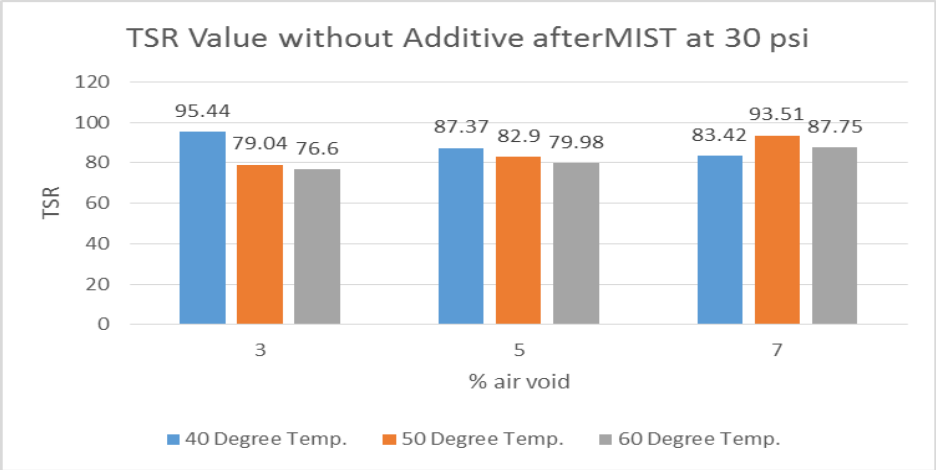


Figure 3. TSR value without additive after sample subjected to MIST at 30 psi

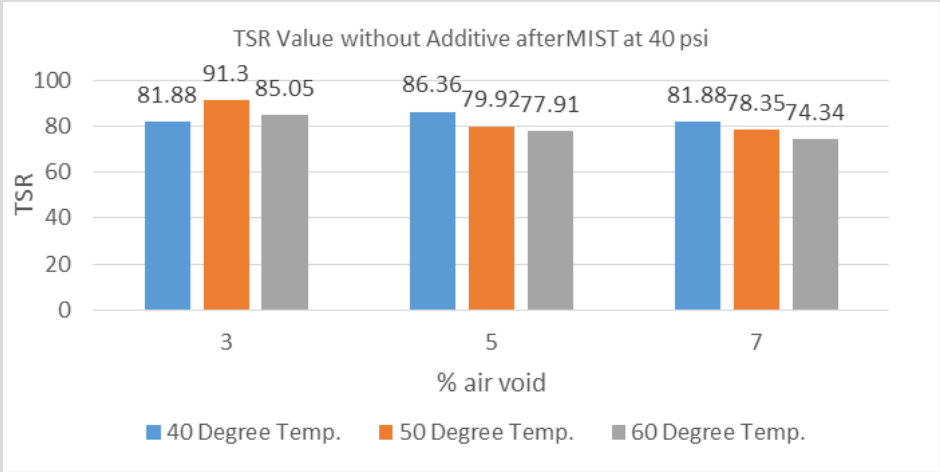


Figure 4. TSR value without additive after sample subjected to MIST at 40 psi

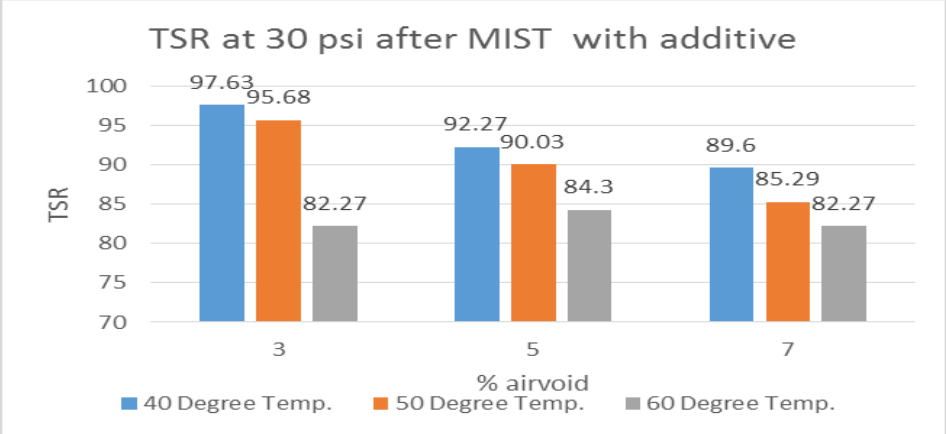


Figure 5. TSR value with additive after sample subjected to MIST at 30 psi

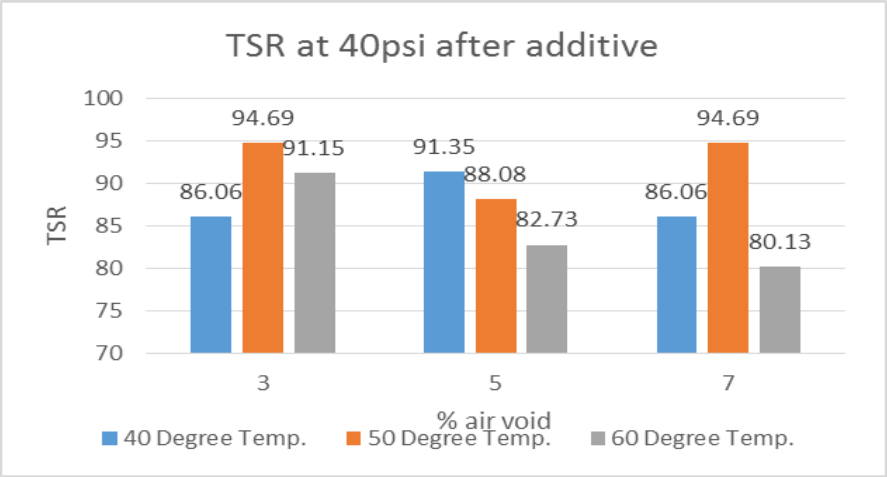


Figure 6. TSR value without additive after sample subjected to MIST at 40 psi

3.3 Dynamic Creep Test

Figure 7 shows the relationship between accumulated strain and number of repetitions for dry sample set and samples induced with moisture. Accumulated strain values of PMB-40 for specimen in dry condition are 0.484% for 3% air voids, 0.684% for 5% air voids, 0.764% for 7% air voids after completion of 3600 cycles. While in case of specimen after MIST, accumulated strain values are 0.534 % for 3% air voids, 0.794% at 5 % air voids, 1.01% at 7% air voids for PMB-40 after completion of 3600 cycles. Figure 8 shows the relationship between accumulated strain and number of repetitions. Accumulated strain values of PMB-40 (with additive) dry condition are 0.464% for 3% air voids, 0.538% at 5% air voids, 0.769% at 7%. While in case of specimen after MIST, shown in figure 9, accumulated strain values are 0.534 % for 3% air voids, 0.794% at 5 % air voids, 1.01% at 7% air voids for PMB-40 after completion of 3600 cycles. In case of specimen after MIST of PMB-40 (with additive), result shown in figure 10, accumulated strain values for PMB-40 (with additive) obtained are 0.479 % for 3% air voids, 0.584% for 5 % air voids, 0.878 % for 7% air voids. It was observed that after using PMB-40 with additive the total accumulative strain decreases. It can be seen that for PMB-40 (with additive) accumulated strain is much lower than for PMB-40 (without additive) mixes at 45°C. It was observed that after using additive the total accumulative strain decreases.

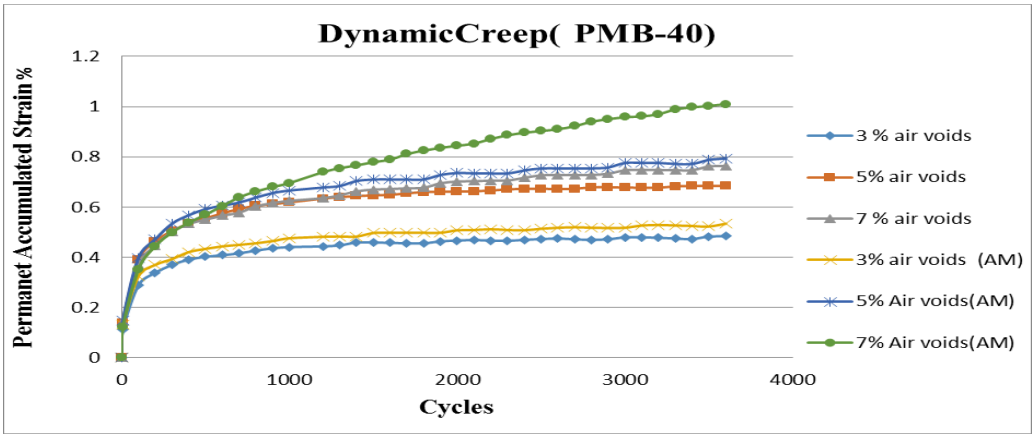


Figure 7. Dynamic creep result of control sample

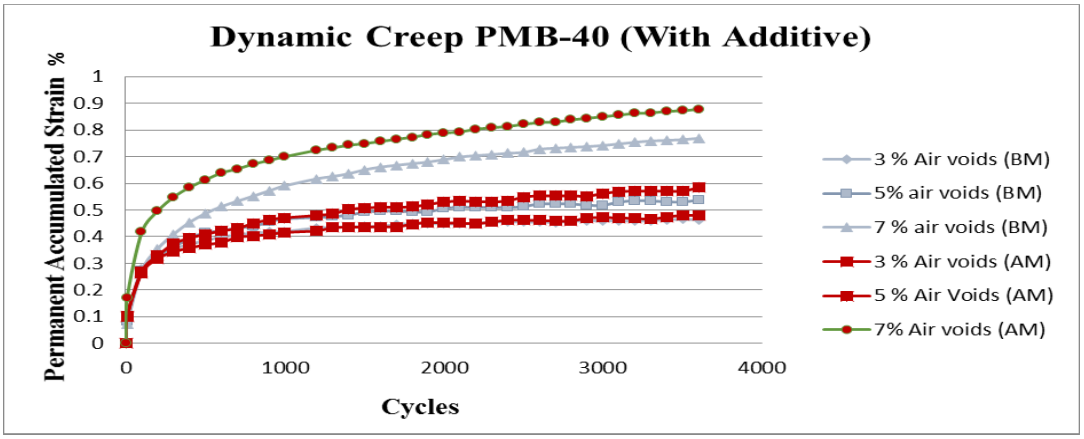


Figure 8. Dynamic creep result of sample containing additive

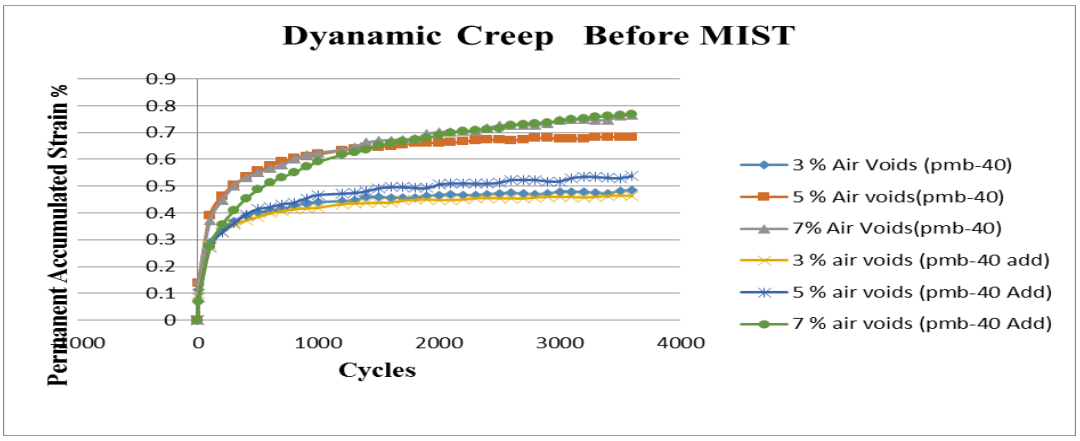


Figure 9. Dynamic creep result of sample containing additive before MIST

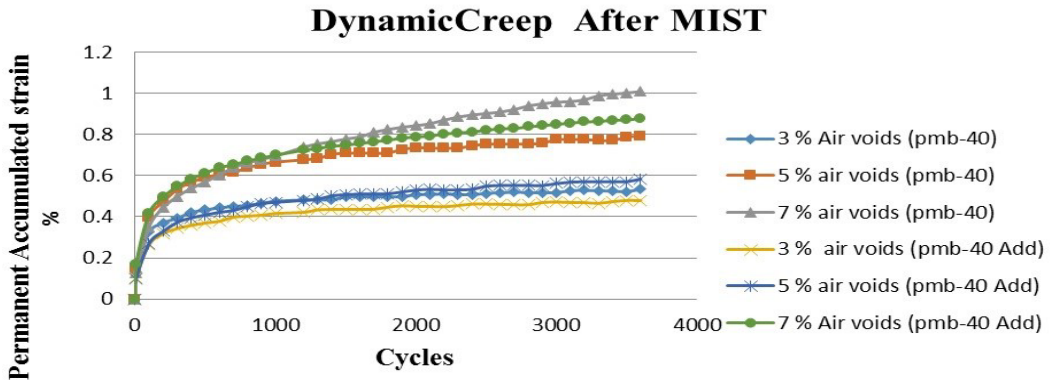


Figure 10. Dynamic creep result of sample containing additive after MIST

4. Conclusions

From the test result it is evident that using Nano technology based (Wet Bond – S) anti stripping additive with PMB-40 prevents the moisture damages and enhances the properties and characteristics of the bituminous mixes, the result is summarized as follows:

- After conducting laboratory performance tests, it was observed Tensile Strength Ratio (TSR) value obtained for 3%, 5%, 7% air voids were more than 80%. The TSR value samples performed on samples conditioned in MIST decreases about 10 % in both the cases of PMB-40 with and without additive.
- The use of PMB - 40 with Nano technology based (Wet Bond – S) anti stripping additive in bituminous mixes increases TSR values of bituminous mixes approximately 6%. This indicates that bituminous mixes prepared using PMB - 40 with additive will exhibit more resistance to moisture damages.
- It was observed that accumulated permanent strain of bituminous mixes with PMB-40 after conditioning in MIST increases and was also observed that use of PMB - 40 with Nano technology based (Wet Bond – S), decreases accumulated permanent strain.
- It was also observed that permanent deformation was lower and stiffness was higher in the bituminous mixes prepared with Nano-technology based (Wet Bond – S) compared to bituminous mixes without additive.
- It was also observed from this study that the MIST in laboratory studies may be carried out at 60C temperature and 40 psi pressure as the losses observed were significant at this condition and the bituminous mixes able to withstand this condition may be considered suitable for bituminous construction.
- Conventional tests (TSR, retained stability and stripping tests) in laboratories takes more time than MIST to study and observe moisture induced damages in bituminous mixes. In laboratory study, MIST test gave more moisture induced damages in bituminous mixes compared to conventional methods for study moisture damages in laboratory.

Thus, it can be concluded that use of Nano technology based (Wet Bond – S) additive as anti-stripping additive in bituminous mixes improves the moisture resistance of the bituminous mixes and its use in the areas subject to heavy rainfall will produce strong and durable flexible pavements.

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Comparative Study of Effectiveness on Class Participation of Computer Science Teaching by Online Tools at Engineering Level

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Abstract. The digital classroom or online classroom can be defined as a place where more than two people gather together online via any app like Google classroom, Google MEET , Hangout, ZOOM, YouTube, Microsoft Team etc. for the purpose of learning, with one having the role of teacher. Many academic institutions that were earlier reluctant to change their old-style academic methods had no possibility but to change completely online teaching process. It is supposed that online teaching learning is easily accessible and can even stretch to rural and remote areas. The research was conducted to investigate the significance difference of the students of controlled group and experimental group of class participation of teaching computer science subject through online platform and conventional teaching. The collected data were subjected to statistical analysis and test. The result of research was in favor of Experimental group through online teaching.

Keywords: class participation, Experimental group, controlled group, Computer Science, statistical analysis, behaviorist perspective.

1 Introduction

The term “interaction” is made up of two morphemes, namely *inter* and *action.* It is a mutual or reciprocal action or influence. Interaction is at the heart of the social constructivist theory of learning. From a behaviorist viewpoint, study hall cooperation is diminished to displaying, repetition, and drills. This way to deal with educating is mostly educator focused. Understudies are simple beneficiaries whose power over connection is decreased to the base. The intellectual model of study hall cooperation depends on the student preparing of what's going on in the homeroom to sort out the world. Here, the student is effectively engaged with the learning through two cycles, to be specific osmosis and convenience. These are complementary processes through

which awareness of the outside world is internalized by learners. The input that the learner receives is processed and adapted to learner's prior knowledge.

Significance of Study:

The main Objective of this research is to identify and measure the effectiveness of teaching by online tools on engineering level studies at student's classroom participation level. Experimental research design is based on B. Tech. Students of computer science from Jaipur district of Rajasthan state.

Objectives of the research study:

1. To Study the significance difference of the students of controlled group and experimental group of class participation of teaching of computer science subject through online tools and conventional teaching.
2. To Study the significance difference of the boys and girls of controlled group of class participation of teaching of computer science subject through conventional teaching.
3. To Study the significance difference of the boys and girls of Experimental group of class participation of teaching of computer science subject through online tools.

Hypothesis of the study:

1. There is no significance mean difference **($\mu_1 = \mu_2$)** of the students of controlled group **(μ_1)** and experimental group **(μ_2)** of class participation of teaching of computer science subject through online tools and conventional teaching.
2. There is no significance mean difference **($\mu_1 = \mu_2$)** of the boys **(μ_1)** and girls **(μ_2)** of controlled group of class participation of teaching computer science subject through conventional teaching.
3. There is no significance mean difference **($\mu_1 = \mu_2$)** of the boys **(μ_1)** and girls **(μ_2)** of Experimental group of class participation of teaching computer science subject through online tools.

2. Design of the study:

Sample: For the present study the quantitative experimental research method was adopted. A sample of 120 engineering level students studying in B. Tech. of Jaipur city of Rajasthan state were selected using stratified random sampling. The study involves comparison between two different teaching methods impact on classroom participation

level, and comparison between male and female students level of classroom participation. All 120 students divided in two groups one is an experimental group who taught by online tools and second is a controlled group who taught by traditional teaching method.

Tool: For measuring classroom participation level of B. Tech. student's researcher prepare an attitude scale "Attitude scale towards classroom participation". This scale consists of 46 items based on the eight dimensions of classroom interactions. Some of the items of this scale are positive and some is negative. Every statement has five alternatives: Strongly Agree, Agree, Undecided, Disagree and strongly disagree according to Likert five point scale. For positive statements marks allotted as strongly agree (4), agree (3), undecided (2), disagree (1) strongly disagree (0) and for negative statements marks allotted as strongly agree (0), agree (1), undecided (2), disagree (3) strongly disagree (4). After 15 days experimental teaching the data were collected.

Statistical techniques used: Researcher is used 'z' test and 't' Test for analysis of data. A z-test is a statistical test used to decide if two populace implies are different when the fluctuations are known and the example size is enormous. The z-test is best utilized for more than thirty examples on the grounds that, under as far as possible hypothesis, as the quantity of tests gets bigger, the samples are considered to be approximately normally distributed. So, Z test is define as,

$$Z = \frac{\left|\overline{X} - \overline{Y}\right|}{S\sqrt{\frac{1}{n1} + \frac{1}{n2}}}$$

Where,

$$S = \sqrt{\frac{1}{n1 + n2 - 2}\left[\sum\left(x_i - \bar{x}\right)^2 + \sum\left(y_i - \bar{y}\right)^2\right]}$$

so,

$$S = \sqrt{\frac{\sum\left(x_i - \bar{x}\right)^2 + \sum\left(y_i - \bar{y}\right)^2}{n1 + n2 - 2}}$$

3. Results and discussion

a) To Study the significance difference of the students of controlled group and experimental group of class participation of teaching computer science subject through online tools and conventional teaching.

Table 1: Data of Boys and Girls of Controlled Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(y_i-y)^2$**
Sum	470	1133	1168	569	887	911	1009	453	19010
Mean	7.83	18.88	19.47	9.48	14.78	15.18	16.82	7.55	
S.D.	2.23	3.11	3.79	1.82	2.76	2.66	2.73	1.35	

Table 2: Data of Boys and Girls of Experimental Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(x_i-x)^2$**
Sum	609	1163	1229	611	946	966	1052	443	19494.98
Mean	10.15	19.38	20.48	10.18	15.77	16.10	17.53	7.38	
S.D.	2.52	3.95	3.82	2.12	3.40	3.51	2.96	1.76	

So Here, $\sum\left(x_i-\bar{x}\right)^2$ = 19494.98, $\sum\left(y_i-\bar{y}\right)^2$ = 19010,

$n1+n2-2$ = 118

So that, S= 18.06 and Z=11.63

Z > 1.96 or 11.63 > 1.96

Since premeditated value of Z=11.63 is much larger than the tabularized value of Z for 5% level of importance is 1.96. So, we discard the null hypothesis and Hence, we determine that the teaching through online tools to the Experimental group is much effective than the teaching through conventional method to the Controlled group.

b) To Study the significance difference of the boys and girls of controlled group of class participation of teaching computer science subject through conventional teaching.

Table3: Data of Boys of Controlled Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(y_i-y)^2$**
Sum	241	566	587	276	451	460	495	222	8737.87
Mean	8.03	18.87	19.57	9.20	15.03	15.33	16.50	7.40	
S.D.	2.24	2.87	4.03	1.77	2.70	2.75	2.49	1.25	

Table4: Data of Girls of Controlled Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(x_i-x)^2$**
Sum	229	567	581	293	436	451	514	231	10271.87
Mean	7.63	18.90	19.37	9.77	14.53	15.03	17.13	7.70	
S.D.	2.24	3.38	3.61	1.85	2.84	2.61	2.96	1.44	

So Here, $\sum\left(x_i-\bar{x}\right)^2$ = 10271.87, $\sum\left(y_i-\bar{y}\right)^2$ = 8737.87, $n1+n2-2=58$

So that, S= 18.10 and t=0.028

t < 1.96 or 0.028 > 1.67

Since calculated value of t=0.028 is less than the tabulated value of t for 5% level of significance for one tailed alternative is 1.67. Hence, we conclude that there is no mean difference of boys (μ1) and girls (μ2) classroom participation level in conventional teaching of controlled group.

c) To Study the significance difference of the boys and girls of Experimental group of class participation of teaching computer science subject through online tools.

Table5: Data of Boys of Experimental Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(y_i-y)^2$**
Sum	292	549	592	290	455	482	522	220	12565.2
Mean	9.73	18.30	19.73	9.67	15.17	16.07	17.40	7.33	
S.D.	2.85	3.75	4.27	2.22	3.56	3.17	2.95	1.75	

Table6: Data of Girls of Experimental Group

	Student to Student	**Student to Teacher**	**Teaching method**	**Study Habits**	**Classroom Environment**	**Student level of preparation and knowledge**	**Student confidence and personality**	**Students self-motivation**	**$(x_i-x)^2$**
Sum	317	614	637	321	491	484	530	223	6159.36
Mean	10.57	20.47	21.23	10.70	16.37	16.13	17.67	7.43	
S.D.	2.11	3.91	3.22	1.91	3.18	3.88	3.01	1.79	

So Here, $\sum\left(x_i-\bar{x}\right)^2$ = 6159.36, $\sum\left(y_i-\bar{y}\right)^2$ = 12565.2, $n1+n2-2=58$

So that, S= 17.96 and **t**=1.59

t < 1.96 or 1.59 > 1.67

Since calculated value of t=1.59 is less than the tabulated value of t for 5% level of significance for one tailed alternative is 1.67. Hence, we conclude that between boys and girls of Experimental group of class participation of teaching computer science subject through online tools and conventional teaching have not any difference.

4. Conclusion:

The purpose of this research study was to understand difference of the students of controlled group and experimental group of class participation of teaching computer science subject through online tools and conventional teaching. It has been confirmed that the teaching through online tools to the Experimental group is much effective than the teaching through conventional method to the Controlled group but boys and girls of both group of class participation of teaching computer science have not any difference in term of learning and understanding. Through a review of relevant research and participants observations, the findings of this research support the use of online tools in the classroom as valuable learning resource.

Future Study:

Questions have been raised by this research study that could lead to further study that regarding the effectiveness of online technology and social platforms on study of Academic Achievement of teaching computer science subject at the Engineering level. How can teacher digitally manage students more effectively?

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Chapter 53
Modified Rectangular Patch Antenna for WLAN and WiMAX Application



Amit Kumar Jain, Tarun Mishra, and Garima Mathur

1 Introduction

Microstrip reception apparatuses have increased more consideration of scientists lately because of their lightweight, little size [1, 2], simple multiplication and integrability with the hardware [3, 4]. In the previous not many decades, the advancement in correspondence with a fast speed spectacularly affected the human life. The development in remote neighborhood (WLAN) symbolizes one of the key interests in the field of correspondence and data [5, 6]. Consequently, the current pattern in rule and business correspondence frameworks has been to grow low profile receiving wires with minimal effort [3] and ostensible weight [7], which can keep up superior over a wide scope of frequencies [8]. This logical pattern has centered to an incredible stretch out for the structuring of microstrip fix reception apparatuses.

Fix receiving wires with basic geometry offer a few points of interest which are not ordinarily shown in other distinctive radio wire setups. The significant focal points controlled by the fix reception apparatuses are their position of safety nature, insignificant weight and modest to create [9]. The strategy utilized for manufacture is the present-day printed circuit board innovation which is exceptionally good with microwave and millimeter-wave incorporated circuits [10] and can fit in with planar and non-planar surfaces [11]. The plans become progressively versatile and adaptable as far as impedance, working recurrence and polarization if the shape and the working method of the fix are chosen [12]. The assortment in structure that is conceivable with microstrip radio wire likely surpasses that of some other sort of receiving wire component [13]. Utilizing the idea of multiband microstrip receiving wire, a multiband rectangular microstrip radio wire is planned and re-enacted right

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now. There are some products which are accessible to investigate and enhance the framework execution.

WiMAX is a broadband development that approaches fast. Generally speaking, Interoperability for Microwave Access (WiMAX) is an accreditation mark for things that easily finish the reasonableness appraisal with the standard IEEE 802.16. WiMAX is a remote advancement that gives a broadband relationship over noteworthy separations [14].

New planned is proposed for an ordinary microstrip radio wire stacked with three sets of L-formed spaces for triple-band frequency. The principal goal of the paper is to structure the multiband microstrip reception apparatus with the assistance of a solitary component rectangular microstrip receiving wire. The proposed reception apparatus is reproduced utilizing virtual stage IE3D [15] and vector organize analyzer is utilized to estimate the aftereffect of created radio wire [16, 17].

2 Antenna Design and Simulated Result Analysis

Opened receiving wire is moved toward a FR4 substrate with relative permittivity of 4.4 and plane at a stature of 1.59 mm. The ordinary littler scope strip fix receiving wire is modified to achieve proposed radio wire geometry.

2.1 The Proposed Conventional Antenna

The setup of the ordinary printed miniaturized scale strip fix radio wire is appeared in Fig. 1 with $L = 20$ mm, $W = 22$ mm; microstrip line feed is put at proper spot to coordinate with its information impedance 50 Ω.

Re-authorization results obtained for proposed standard microstrip fix radio wire are reflection coefficient $= -24.5$ dB, VSWR $= 1.23$, smith graph impedance $=$ 54.59−j3.38 at resonating repeat 3.4 GHz as showed up in Figs. 2, 3 and 4 exclusively.

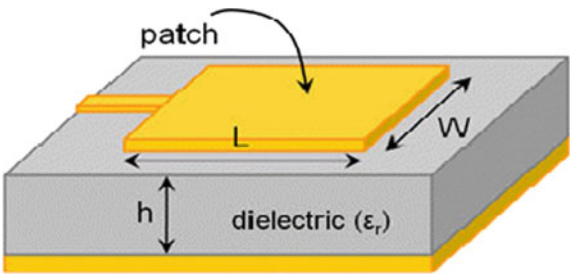


Fig. 1 Microstrip patch antenna

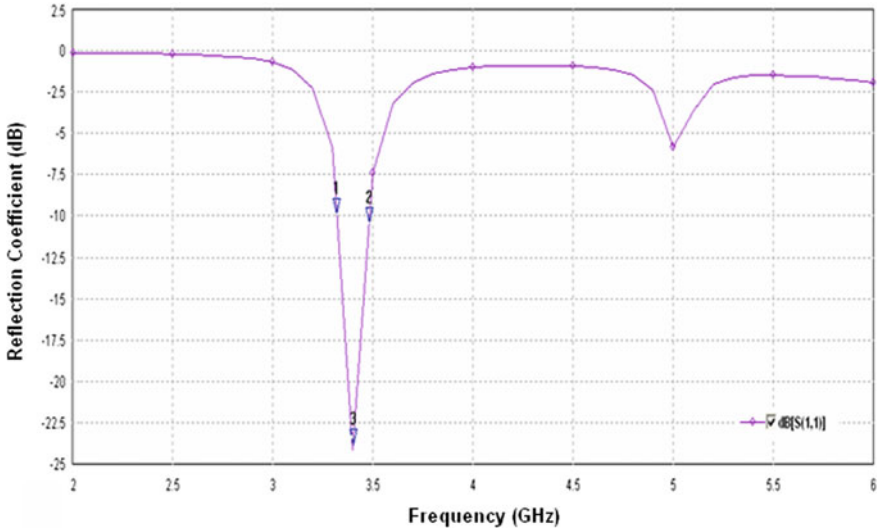


Fig. 2 Varieties in reflection coefficient with recurrence

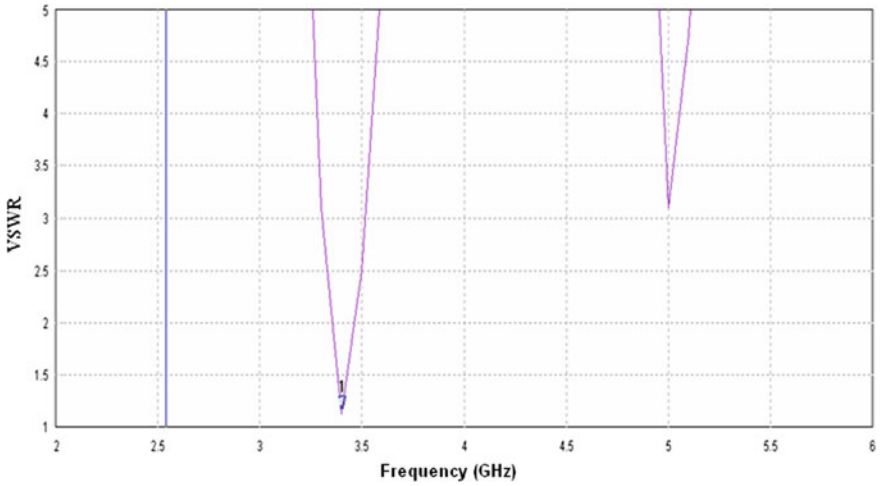


Fig. 3 Variations in VSWR with frequency

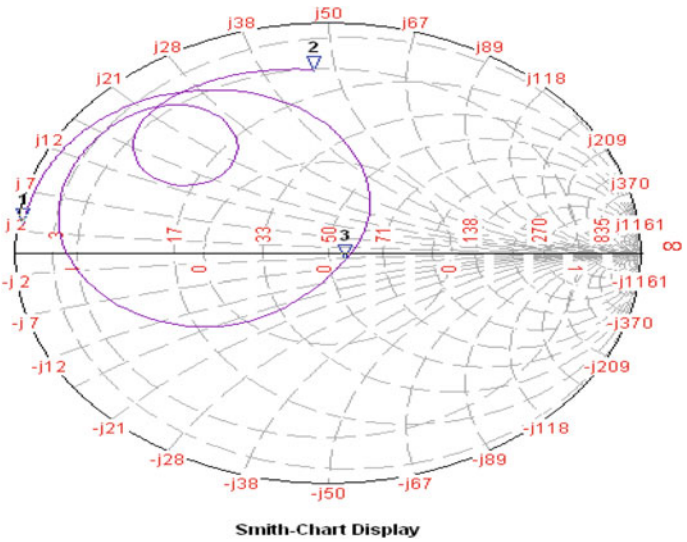


Fig. 4 Variations in input impedance with frequency

2.2 The Modified Antenna Loaded with Three Pair of L-Shaped Slots

So as to have multiband activity, some transmitting component with an alternate resounding length is presented. Altered radio wire comprises of three sets of L-molded space is carved on the traditional microstrip fix. Proposed adjusted receiving wire is appeared in Fig. 5.

Central parameters for this receiving wire are recorded in Table 1 (Figs. 6, 7 and 8).

3 Proposed Antenna Fabrication and Experimental Result

At long last proposed radio wire stacked by three sets of the L-shape spaces with fix size 20 * 22 mm is created on FR4 substrate utilizing PCB shrewd work. Manufactured proposed receiving wire geometry is appeared in Fig. 9.

Finally, test testing of proposed reception apparatus geometry has been finished by utilizing VNA testing instrument from VNA; three parameters have been estimated for the proposed receiving wire: 1. Reflection Coefficient, 2. VSWR and 3. Smith Chart.

The deliberate reflection coefficient as for recurrence is appeared in Fig. 10. The deliberate two reverberation frequencies are 3.45 and 5.7 GHz. These deliberate qualities are in reasonable concurrence with recreated frequencies. Yet, here one

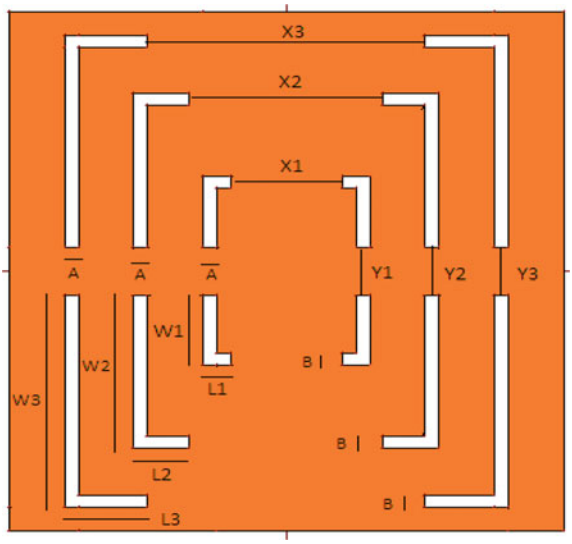


Fig. 5 Geometry of modified conventional RMSA loaded with three pair of L-shaped slots

Table 1 Parameters for conventional rectangular patch loaded by three pair of L-shaped slots

Parameter	Value or information
Structure of patch	Rectangular patch
Length in mm	20
Width in mm	22
Dielectric substrate	Glass epoxy FR4
Dielectric constant value	4.4
Value of loss tangent	0.025
Thickness of substrate in mm	1.59
Patch thickness in mm	0.002
Center feed line (mm * mm)	10 * 2
Cut dimension in mm	$L1 = 1$, $L2 = 2$, $L3 = 3$ and $W1 = 3$, $W2 = 6.5$, $W3 = 9$
Cut slot width in mm	$A = 0.5$, $B = 0.5$
Cut spacing in mm	$X1 = 4$, $X2 = 7$, $X3 = 10$ and $Y1 = 2$, $Y2 = 2$, $Y3 = 2$
Frequency range in GHz	2–6.5

recurrence band is missing in estimated result after assess with recreated result, might be because of limited arrangement ground manufacture limit.

It might be seen from chart that the VSWR at all the reverberation recurrence is near wanted 1.0 worth. For recurrence 3.45 and 5.7 GHz, VSWR is 1.04 and 1.4 individually. This shows top notch coordinating between proposed radio wire and information feed line arranges endures (Fig. 11).

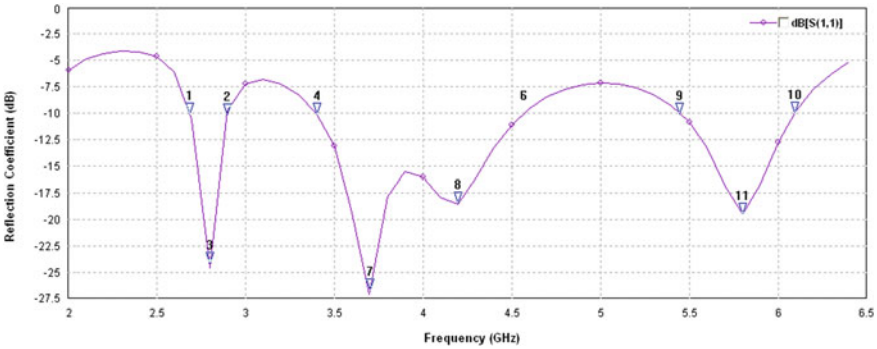


Fig. 6 Varieties in reflection coefficient with 3 sets of L-formed openings with recurrence

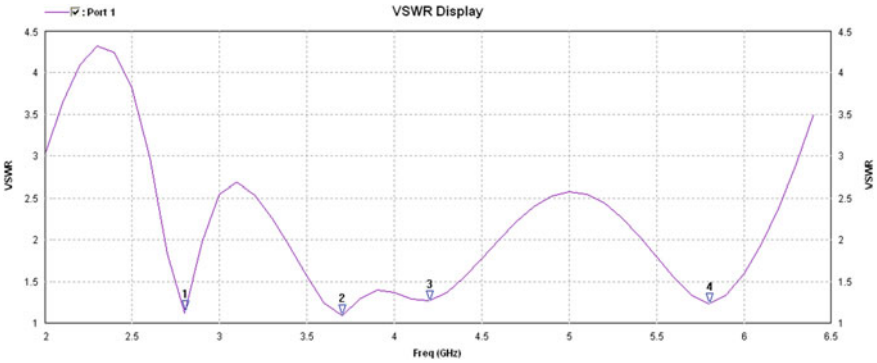


Fig. 7 Variety in VSWR with 3 sets of L-molded openings with recurrence

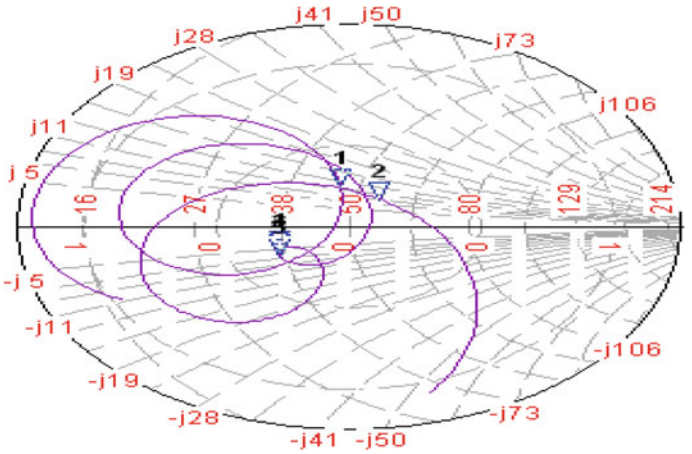
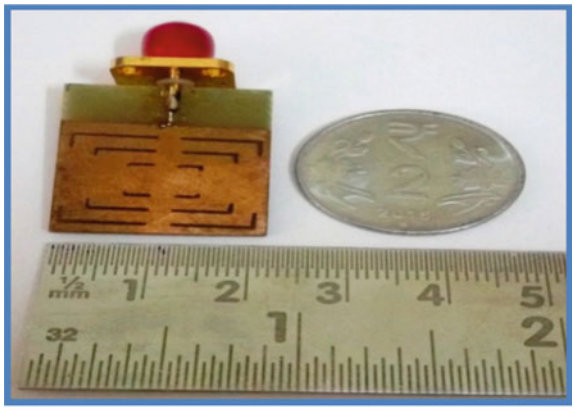
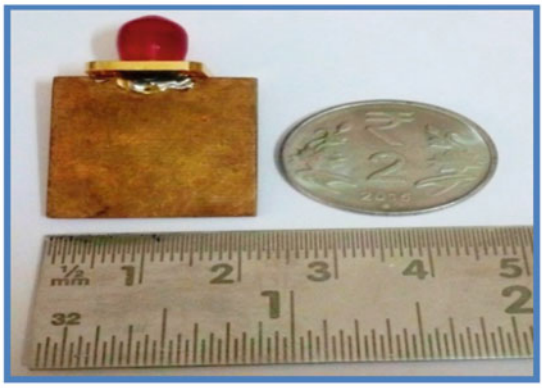


Fig. 8 Variation in input impedance with 3 pair of L-shaped slots with frequency



(a) Patch Top View



(b) Patch Back View

Fig. 9 Fabricated proposed antenna under test

The exploratory aftereffect of info impedance for proposed reception apparatus at full frequencies is appeared in Fig. 12. The deliberate information impedances are (47.9−j0.51) Ω at recurrence 03.45 GHz, (53.68−j17.64) Ω at recurrence 05.7 GHz, which are into reasonable contact with input test.

4 Results and Discussion

Changed rectangular receiving wire portrays a dual band conduct of the geometry with great return misfortune and data transmission. Right now, proposed reception apparatus works in three thunderous frequencies allotted in the recurrence groups for WiMAX correspondence frameworks. Despite the fact that little distinction in estimated and mimicked frequencies is acknowledged, that is maybe because of manufacture impediments of fix geometry.

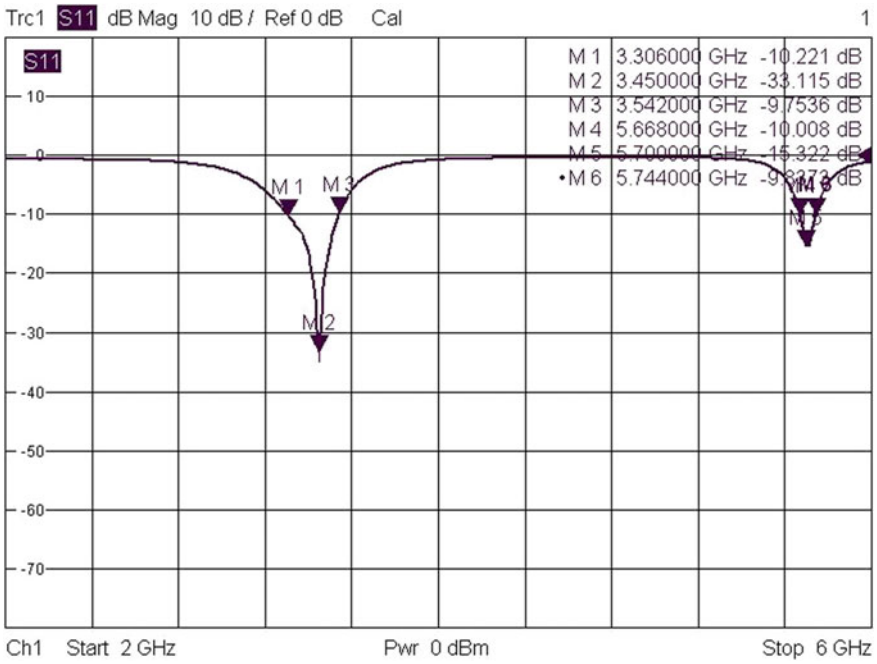


Fig. 10 Measured variations in return loss with respect to frequency

The recreated and trial results got are thought about in Table 2. The organized outcomes further legitimize that reproduced and trial results are almost nearer to one another.

Changes in estimated result are exact moment as contrast with mimicked result, for proposed receiving wire change in first and second full recurrence is 0 and 5.4% as it were.

5 Conclusion

Proposed smaller size opened microstrip fix radio wire structured is recreated and tried for various execution parameters. The primary point of the paper is to improve the arrival misfortune and the transmission capacity of the receiving wire which has been accomplished by cutting the L-molded spaces on base state of radio wire. These planned reception apparatus geometries can be adequately utilized in numerous fields of present-day correspondence frameworks.

Reproduction and estimated aftereffects of proposed reception apparatus plan with three sets of L-molded openings show thunderous frequencies 2.7, 3.65 and 5.7 GHz with accessible impedance band width 07.40, 33.00 and 14.03% separately. Proposed geometry has two frequencies lying in the two endorsed groups for WiMAX

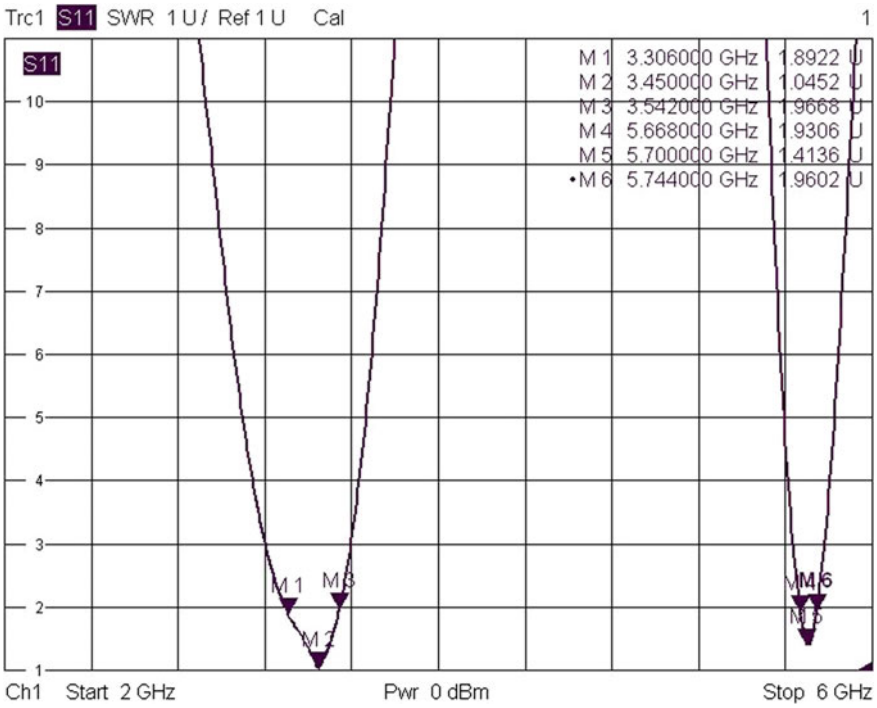


Fig. 11 Variations in VSWR with respect to frequency

correspondence frameworks and according to estimated result radio wire is likewise proper for Wi-Fi correspondence frameworks. It might be additionally reasoned that reception apparatus has diminished size 10.45% and effortlessness for accomplishing better outcomes.

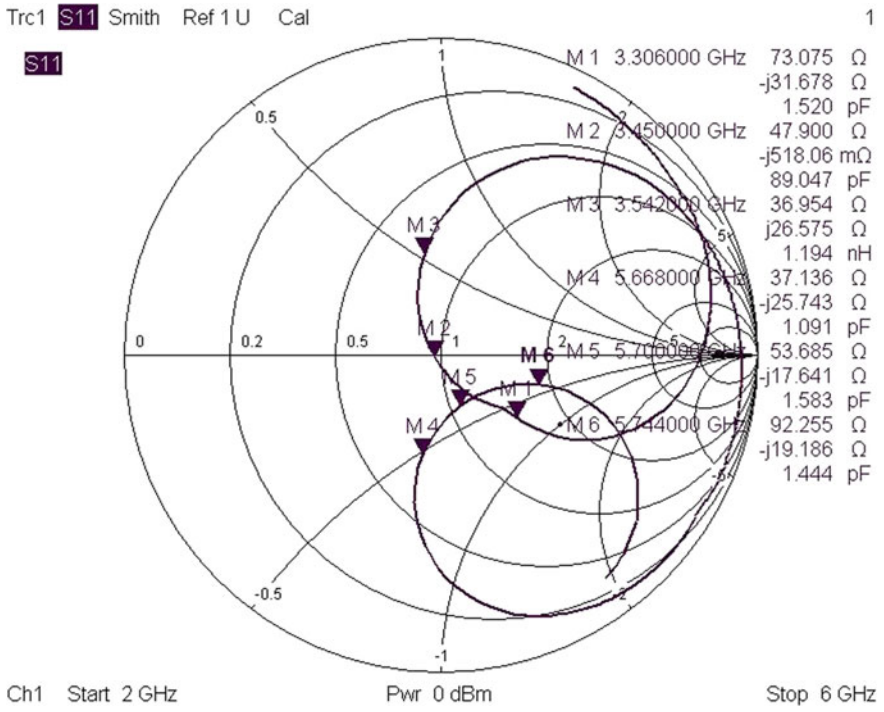


Fig. 12 Input impedance variations with respect to frequency

Table 2 Comparisons between simulated and measured results

Antenna parameters	Simulated results	Measured results
Resonant frequency 1	**2.70 GHz**	**2.58 GHz**
Return loss	−25.0	−30.11
VSWR	1.2	1.04
Resonant frequency 2	**3.65 Hz**	**3.45 GHz**
Return loss	−27.5	−33.11
VSWR	1.2	1.04
Resonant frequency 3	**5.7 GHz**	**5.7 GHz**
Return loss	−19.0	−15.32
VSWR	1.3	1.41

Antenna Parameters: Typical parameters of antennas are gain, bandwidth, radiation pattern, beamwidth, polarization, and impedance
Simulated Results: Results to be generated by virtual performance
Measured Results: Results to be generated by Actual designed device
Resonant Frequency: The resonant frequency can be defined as the natural frequency of an object where it tends to vibrate at a higher amplitude

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Construction and Demolition Waste as an Alternative of Rigid Pavement Material: A Review

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Abstract. Current study involves review of waste material from construction and demolition activities, further utilised in construction of rigid payment. Recently Government has placed strong emphasis to utilize solid waste in different manner to reduce or decrease their negative environmental impacts, in Indian context such type of work is limited, and we are progressively working toward it. This study presents a summarised overview of studies conducted in India using RCA (Recycled concrete aggregate), RAP (Recycled Asphalt Pavement) and WFS (Waste Foundry Sand). Research has reported effective use of RAP, RCA or WFS with partial replacement of aggregates and cement, however workability issue has to be identified and further research may be done.

Keywords. RAP, RCA, WFS, Rigid pavement

1. Introduction

Growth of a nation mainly depends on the development of industry based on various aspects, one of the such industry is construction industry which not only a back bone of all the development activities but also proved to a major source of solid waste from demolition as well as construction activities itself. A systematic disposal of Construction and demolition (C&D) waste still has scope of work because of its very less engineering utilization. Other industries like coal-based industry, fertilizer industry, metal-based industries and textile industry etc. directly or indirectly contributes generation of C &D waste, which has alarming effects on environment. Current study mainly focused on the solid waste produced by construction related activities mostly from demolition and construction waste. In the recent few decades population over globe has increased many folds, thus the increased urbanization can be seen all around the world. India, who has a renowned place among the developing nations, faced tremendous changes in field of infrastructure development which contains destruction of old and useless buildings, roads, bridges, fly-overs etc. as per requirement and government's guidelines and construction of many more to feed the demand. Infrastructure development has also utilized the needs of current scientific and economic facilities like research centres, laboratories, stone modelling & smoothening units, craft industries etc. which produces considerable amount of solid waste, some of which has adverse environmental impacts. So it becomes mandatory to have effective waste management involving good coordination of industrial and academia professionals, business tycoons and government agencies. Handling and utilization of solid waste considered as a best practice of disposal as a construction material [1]. Pursuance to the Indian Government estimation, India generates at present time around 165-170 million tonnes (MT) of waste yearly and as par Union Ministry of Urban Development, India generated 12-14.7 MT of C & D waste per year. Anwar et al. 2014 reported that Marble dust powder danger for environmental, additionally to forming dust in summer and threatening agriculture and public goodness [2]. According to Shen et al. 2004, "C & D waste is as a mixture of remaining components produced from construction, destruction and

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renovation activities such as land excavation, site clearance, demolition and roadwork"[3]. The Solid Waste Management guidelines (2015) also defined C & D waste as "Waste containing of building materials rubble and debris causing from construction, restoration, destruction and remodelling of any civil construction". Concrete is the most useful construction material in all worlds and used in all type construction of civil engineering works. C& D waste had been utilized effectively as a replacement material for concrete constituents. Mehrjard et al. 2020, assessed the possibility use C&D waste in road construction [4]. R.V. Silva et al. used C&D waste materials in new construction application like a, hydraulically-bound, unbound, bitumen-bound applications, as well as non -structural concrete in building and road construction[5] .Junhui Zhang et al. studied the feasibility of C&D waste in highway embankment. Thus, C&D waste used as opposed to soil would increase the structural ability and decrease rutting damage [6]. The typical composition of the demolition waste in Indian context has been summarized in table 1

Table 1. Typical Composition of Demolition Waste in Indian context

Sr. No.	Components	Percentage
1	Concrete	40%
2	Ceramics	30%
3	Wood	10%
4	Plastics	5%
5	Metal	5%.
6	Others	10%

Above table shows that major components of demolished waste material consist of concrete and ceramics, which together contribute 70% in its whole volume produced. Ceramics involve waste bricks, tiles, glass etc. which are made of inorganic and non-metallic compounds such as clay. Al Bakri et al. 2006 has done experimental research for replacing waste ceramic partially with aggregates and he found that compressive strength of concrete with quarry dust as aggregates is the highest with 30.82 MPa with density 2251.85 kg/m^3.which strongly recommend that waste ceramic and quarry dust can be used as an substitute source of aggregates [7].

2. Reclaimed Asphalt Pavement (RAP)

Highway projects are the most widely spread construction projects, which utilises thousands of tonnes of aggregates every year. It imposes huge load on natural resources. Though the natural resources are very limited, use of reclaimed asphalt in pavement construction proved to be very effective as studies has suggested. The various properties of RAP have been summarized in Table 2. During the restoration of prevailing asphalt pavement, removed old materials while reconstruction and resurfacing of the road surface. The removed top surface material consists of bitumen and aggregate, it becomes recycled asphalt pavement (RAP) [1]. However, replacement of reclaimed asphalt has restricted to some amount only and it is advisable to use 50% RAP and 50% CSA (Crushed stone Aggregate) with 2% of cement to get a CBR value more than 100%, which is well in criteria described by IRC (30% for granular sub base and 100% for granular base) [8][9]. However, the use of RAP alone does not satisfy IRC recommendations for strength of base and sub-base material, due to gap gradation of aggrade sand that's why crushed stone aggregates are mixed in right proportion to achieve desired strength.

Table 2. Physical Properties of RAP [10]

S. No.	Parameters	Values
1.	Unit Weight (kg/m^3)	1900-2500
2.	Asphalt content	5-6%

3	Moisture content	Max 3-5%
3.	Compacted unit weight (kg/m^3)	1500-1950
5	Asphalt penetration (%) at 25^o C	10-80
6.	California Bearing Ratio (CBR)	100% RAP: 20-25%



Figure 1. Demolished Asphalt Pavement (Mahal Road, Jaipur)

A another study by Zeeshan et al. 2017 which utilised demolished brick an marble as a partial substitution of aggregate for concreting, has stated a reduce in compressive strength with time [11]. Lower strength 22.01 to 27.07% of conventional concrete were produced by replacing coarse aggregates 20 and 10% respectively, it sounds to be unsuitable for concreting works where there strength requirements are more than 25-30MPa. Construction of concrete pavements rely on PPC having a strength ranging from 20.68MPa to 34.47MPa (as per IRC: SP 62 - 2004), may provide a platform to utilize demolished brick and marble with corrected proportions. The results indicate that compressive strength, flexural strength, splitting tensile strength and modulus of elasticity was reduced as the increased percentage of RAP in concrete [12]. However there is no major effect on the thermal expansion and drying shrinkage of concrete.

Micro coating of asphalt in RAP aggregate (about 6 to 9 μ m thick) acts like asphalt interface layer when mixed in concrete between aggregate cement mortar, it restricts propagation of micro cracks, and slower the widening process of cracks [12]. Finite element analysis by Hossiney et al. 2010, to assess the maximum stress in characteristic concrete pavements in grave temperature and load condition, ratio of maximum stress to flexural stress found to be reduced as compared to reference concrete with no RAP[9]. Hence use of RAP with concrete may improve performance of concrete pavement.

3. Recycled Concrete Aggregates (RCA) for Rigid Pavements

Concrete is the major construction material used around the globe, without it application, construction of any cannot be imagined. It most widely adopted for civil engineering works. In developing countries like in India, generally C&D waste is not properly disposed in an unorganized manner thereby leading the problem of environmental issues [13]. Recycle concrete aggregate are produced from construction and demolition activities, it has been utilized as partial o fully replacement of fresh aggregates. However recycle concrete aggregate based concrete has lower E (Elastic modulus), and strength with increased porosity when 20mm size aggregate are used[14]. RCA can be effectively use in Rural Road construction which have very less traffic load, thus very less amount of strength is required. Compressive strength equal to 30N/mm^2 was reported sufficient for rural roads. However proportion of recycled aggregate is not more than 50%. A proportion of 30% RAC with 70% NAC gives maximum strength 32.10N/mm^2 according to Verian et al. 2013[14].Though specific gravity of recycled concrete aggregates lower than natural aggregate which lowers the unit weight of concrete made of recycle aggregate. And water absorption is slightly higher in comparison to natural aggregate based concrete (more than 5%). Rakesh et al.[15] evaluated the slump, fresh density, abrasion resistance, compressive and flexural strength of concrete. In this study, NCA was 100 percentage substituted by RCA at in paving concrete[15].

3.1 Physical properties of RCA

Following are the physical properties reported by Shinde et al. 2013[16]. They have prepared 3 mixes for M25, M020 and unknown proportion to analyse these physical properties of reclaimed crushed stone. They founded that RCA have higher amount of water absorption then natural aggregates and its 3-5% more than natural aggregate. Which have negative impact on strength of concrete so, it should be carefully determined. RCA based concrete have low value of compressive strength a compare to normal concrete. The different physical properties of RCA has been summarized in Table 3.

Table 3: Physical Properties of RCA [16]

Sr.	Particulars	N.A	RA1	RA2	RA3	RA4
1	Water absorption	0.6%	2.05%	2.4%	3.5%	3.7%
2	Abrasion value	18.9%	21.2%	22.6%	25.4%	36.6%
3	Impact Value	9.5%	12.50%	16.2%	19%	26.4%
4	Agg. Attrition value	---	---	---	2.72%	---
	With ball	1.4%	4.6%	5.36%	7.63%	9.12%
	Without ball	0.4%	2.0%	2.4%	2.72%	2.8%

4. Waste Foundry Sand

Sand base modelling and casting has been done from ancient time, foundry sand is one of the finest sands which effectively utilised in metal casting. WFS is characterised as high quality silica sand, having uniform size will high cleanliness produced as a by-product of ferrous and non-ferrous metal casting industry. WFS show very good thermal conductivity property, hence best suits as moulding material[17]. Ferrous or non-ferrous material may be utilised in concrete after it becomes a refused material for reuse in foundry, the en product renowned as WFS. Sometimes also known as SFS (Spent foundry sand) or UFS (use foundry sand).

WFS may further classify d based on binder system used in metal casting:

a) Clay bounded Sand, containing natural binder materials (like silica sand: 85-95%, bentonite clay: 4-10%), an carbonaceous additive (2–10%) to facilitate casting process. Clay bounded WFS content upto 90% carbon.

b) Chemically bonded WFS effectively used where there strength matters, to withstand the heat of molten material as a mould. It consists of silica and chemical binder, 93–99% and 1–3% respectively.

4.1 Physical and chemical properties of WFS

Different researcher studied WFS and its application in concrete time to time, it was reported that specific gravity of WFS particles vary from 2.39 to 2.79, with low absorption which shows its non-plastic behaviour. Other important physical properties are summarized in Table 4.

Table 4: Physical Properties of WFS [18]

Properties	Naik	Goney	Javed & Lovell	Siddique
Specific gravity	2.79	2.45	2.39-2.55	2.61
Unit Weight (kg/m^3)	1784	---	---	1638
Fineness modulus	2.32	---	---	1.78
Moisture content (%)	---	3.25	0.1-10.1	---
Absorption(%)	5.0	-	0.45	1.3
Materials finer than 75 μm(%)	1.08	24	----	18
Clay lumps and friable particles	0.4	---	1-44	0.9

Chemical properties of WFS affect performance of concrete in which it is utilised. Major component of WFS is reported to be silica followed by aluminium oxides as shown in Table 5.Silica and aluminium play very important role in properties of concrete. Aluminium's compound imparts strength in concrete. Researcher may use knowledge of its composition for further work.

Table 5: Chemical Properties of WFS [18]

Constituent	Etxeberria	Guney	American Founday	Siddique
SiO_2	95.10	98	87.91	78.81
Fe_2O_3	0.49	0.25	0.94	4.83
Al_2O_3	1.47	0.8	4.70	6.32
SO_3	0.03	0.01	0.09	0.05

CaO	0.19	0.035	0.14	1.88
MgO	0.19	0.023	0.30	1.95
K_2o	0.68	0.04	0.25	---
Na_2O	0.26	0.04	0.19	0.10
Mn_2O_3	--	---	0.02	---
TiO_2	0.04	---	0.15	---
SrO	---	---	0.03	---
LOI	1.32	---	5.15	2.15

5. Environmental Intervention of RCA, RAP and WFS

Intensive quarrying of stones to fulfil the demands of infrastructure development activities across the India has imposed threat of environmental imbalance, measure studies in past continuously reported that excessive quarrying such a study was documented by Lad & Samant 2014[19]. Main environmental effects are annihilation of vegetation, disturbance of animal habitats, change and blockage of natural drainage systems, river siltation and soil erosion, vibration and noise; and dust pollution. It is to be renowned that in spite of its notable direct and indirect involvement towards development, mining and quarrying is also accountable for several socio-economic impacts and negative environmental, particularly, when the mining activities is carried out casually and not as per the recommended norms and rules[19].

Recycling of C&D waste denotes one way to change a waste product into a resource but the environment profits through energy consumption, fallouts reductions and emissions are not certain. Marinković et al. 2010 used recycled aggregate of coarser size in concrete and compared it with concrete based on natural aggregated; they found that mechanical properties of concrete and durability of RAC are lesser than NAC when water cement ratio was kept constant[20]. To achieve same amount of compressive strength a slight addition about 5% of cement was required. Mechanical and durability related issues restrict use of RAC in actual concrete. For measure projects of high impotence recycled aggregate concrete has restricted use, due to low strength produced. Structures subjected to moderate to extreme exposure conditions (like corrosive acidic environment) again restrict use of RAC due to uncertainty in durability. However in the structural element which requires low strength, RAC has tremendous scope.

5.1 Environmental Impact assessment

Assessment of the environmental reactivity of concrete made of natural aggregates and recycled aggregate remained very popular research topic among the researchers. Whole environmental impacts in terms of energy use, eutrophication, global warming, photochemical oxidant and acidification creation depend on transport distances and types which were analysed and following are the key points:

1. RAC transported at small distance compare to NAC; Both NAC & RAC have same impacts.
2. RAC & NAC transported at same distance; RAC has larger impacts ranging 11.3% to 36.6% depending on impact category.
3. Energy saving in recycling is only possible if recycling unit is located nearer to construction site.

6. Conclusion

After reviewing literature for recent uses of RCA, RAP and WFS in Rigid Pavement, following conclusion points could be drawn:

1. Studies reviewed has reported that recycled concrete aggregates can be utilized for rigid pavements subjected to lower amounts of loads. For rigid pavement roads which requires compressive strength less than 30kN/mm^2, could effectively use RCA.
2. Village roads such as "Gaurav Path" may be best suitable for utilising RCA, RAP or WFS based concrete roads as per suggested by studies that these concrete gives good results for low volume roads.
3. Water absorption for RCA has found to be more than the normal concrete, though it affects the strength of concrete negatively. However, it may facilitate reduction of cost of admixtures if use for high slump value.
4. Use of RCA, RAP, & WFS replaces aggregates required for normal concrete, therefore decreasing the environmental effects of aggregate quarrying.
5. Local available waste material if used as replacement of aggregates, transportation cost of fresh aggregates may be saved and waste also dispose.
6. RAP, WFS & RCA based concrete can be proven as cost cutter for Transportation and Hauling costs, if locally available.
7. In addition to the resource management aspect, RCA and RAP absorb a huge quantity of carbon dioxide from the nearby environment.
8. Though the waste produced by the construction activities has negative effect on environment which has proven by different studies, emphasis has been given to minimize the amount of waste production, an optimum production analysis may help us to get rid of excess waste generation. However, it seems to be very tricky task to optimize the quantity of waste generated; so, reuse and recycling of waste material gives us an effective way to reduce or refuse the waste generated.

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Building and Performance Evaluation of Novel Solar Cooking System in Gujarat, India

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Abstract. Wood is generally used as a source of energy for cooking in rural and semi-urban areas of India. Approximately 216 million tons per year of wood is consumed in the cooking of which 9.731 million tons per year is used in Gujarat. The use of wood causes deforestation and increases indoor pollution. To reduce this, solar energy can be used as an alternate source of energy for cooking. The current research aims to present the findings of two weeks of experiments in the Indian (Gujarat) climate with the novel solar cooker. The cooker was build using a parabolic dish collector (85 % reflectivity) with a supporting structure and adjustable mechanism, a receiver (heat exchanger) and a cooking burner with a pot. The experimental result shows that the maximum temperature available at the receiver is 110°C with 560.7 W/m^2 of average solar irradiation, justifying solar cooking as a viable alternative source of energy for cooking in Gujarat and India.

1. Introduction

Currently, about 67.3% of the population in rural areas and 14% in urban and semi-urban areas consume wood as a fuel for various purposes (NSSO 2012). A woman uses wood to a large degree for cooking purposes in rural areas. They spend roughly 374 hours on cutting wood in a year [1]. 216.4 million tons of wood is used as fuel every year by 854 million people (FSI, 2011), of which 9.731 million ton is used annually in Gujarat. Coal, cow dung-cakes, firewood, etc. are still used as the primary source of energy for cooking in about 100 million households [1, 12]. The smoke produced by the burning of such fuel causes indoor pollution and lead to respiratory diseases, particularly in women and children [2, 10, 11]. More than 1, 00,000 people die prematurely as a result of inhaling the smoke. Burning wood also increases the emission of greenhouse gases by 93%.

Solar energy is one of the most promising paths for lowering air pollution and optimizing the usage of natural energy sources in India. The solar energy capacity at various locations varies from 4 to7 kWh/m^2 [3]. Solar cookers can be used in cooking for more than 300 days a year in arid areas of India [7]. The energy required in cooking per house of a small family comes out to be much smaller than the solar energy available on the roof of such houses [4]. The use of biomass, cow dung and kerosene as fuel can also be reduced by cooking with solar energy which can lead to reduced indoor pollution and deforestation.

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The Ministry of Non-Conventional Energy Sources (MNES) was established in 1982 by the Government of India to promote the use of non-conventional sources of energy. In the early 80s MNES promoted the use of box type solar cookers for household cooking [8, 9].The box type solar cooker was made up of four pots, a single flat plate reflector and a box type enclosure [14]. Looking at the potential market of solar cooker, industries were motivated to enhance and optimize the design of cooker for improved efficiency. On account of which various types of solar cookers are now available in the market with different designs and cooking features. Solar cooker with parabolic concentrator has been recently introduced in India by Sheffler Group and EG Solar.EG solar focused on the solar cooker for household use, while Sheffler group focused on large solar cookers suitable for community cooking [5, 13].

Considering the recent trends in solar cooker design, a parabolic dish type solar collector was selected for the current study to develop a novel solar cooker. High temperatures values can be obtained by a parabolic collector, which is ideal for Indian cooking [2, 15]. A parabolic dish collector is made from a mirror-polished aluminum sheet with 85 percent reflectivity. An experimental study has been carried out to predict the solar cooker's output at a different time interval and different weather conditions. Results from the study were used to analyze the performance of the proposed solar cooker.

2. The building of the proposed cooker

2.1. Construction Details of the cooker

The prototype of the proposed solar cooker consists of a parabolic dish type collector, receiver and cooking pot. It was constructed from mild steel pipes, aluminum reflector sheets, copper tubes, insulating material, aluminum cooking pot and glass. Aluminum reflector sheets are mounted in a series of segments to construct a parabolic dish collector. In the cooking system, a glass wool coated aluminum cooking pot was used as the burner. The supporting structure of the parabolic dish collector was made from mild steel pipes. A spiral-shaped copper tube filled with thermic fluid was used as a receiver to absorb solar energy from the sun. The receiver was composed of a 0.5 mm thick and 1076 mm long copper tube. The thermic fluid is then used to transfer heat from the receiver to the cooking pot. The various parts of the cooker are shown in Figure 1. The complete experimental setup was assembled at Gujarat Power Engineering and Research Institute, Mehsana, Gujarat, India as per the standard procedure.

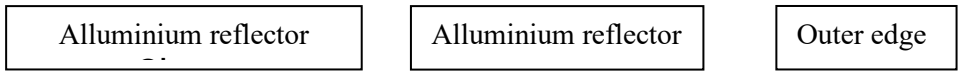




Figure 1. Schematic diagram of the proposed solar cooker

Table 1. Test Details

Parameters	**Designation**	**Test data**
Ambient temperature	T_a	21.5 °C
Average solar beam radiation	I	560.7 W/m^2
Average cooking power	P	23.5 W

2.2. Testing and Evaluation

An experimental study was carried out at Gujarat Power Engineering and Research Institute, Mehsana, Gujarat, India [Latitude: 23.5275311 and Longitude: 72.3881041]. The experimental set-up was placed on the terrace of the Institute workshop in such a way that it can receive solar radiation on the parabolic collector without any obstruction, as shown in Figure 1.The solar radiation reflected through the reflector is concentrated on the receiver. The receiver is kept in a glass enclosure to minimize the convective heat loss to the surrounding. Absorbed solar energy is transported by thermic fluid to the burner, which is gradually transferred to a cooking load in the cooking pot. The novelty of the present

prototype lies in the use of the heat absorbed by thermic fluid for cooking as thermic fluid can absorb and store heat throughout the day. Manual tracking of the device was done during the testing of a cooker to get maximum efficiency. Since dal rice is the most popular food in Gujarat, the mixture of rice and water was selected for a cooking load. Initially, water was used as a cooking load to measure the thermal performance of the cooker. The results obtained from the experiments were validated with existing literature.

2.3. Heating Test

The experiments were carried out between 17thJanuary 2020 and 29thJanuary 2020 to determine the cooker's efficiency. The solar radiation, wind velocity, ambient temperature, receiver temperature and cooking pot temperature were taken at a different time interval during the load test. The data collected was evaluated at the end of the test and the performance of the cooker was estimated. The thermal performance indicator such as cooking power, standardized cooking power and thermal efficiency can be determined through equation (2.3.1) – (2.3.3).

2.3.1. Cooking Power [6]: Useful amount of solar energy acquired for the duration of heating. It is calculated as a change in the sensible heat of the water. Now, cooking power can be obtained theoretically using equation (2.3.1).

$$P = \frac{T_2 - T_1}{t} m_w C_{pw} \quad (2.3.1)$$

Where P is the power required for cooking in watts (W), m_w is mass of water in kilogram (kg), C_{pw} is specific heat in J/kgK, t is time in second, $T_1$and $T_2$are the initial and final temperature of water respectively in °C.

2.3.2. Standardized Cooking Power [6]: Using the predefined value of standard solar isolation as 700 W/m^2, standardized cooking power is calculated using the equation (2.3.2).

$$P_s = P\left(\frac{700}{I}\right) \quad (2.3.2)$$

Where I is interval average isolation in W/m^2, and P_s is standardized cooking power (P_s) in watts (W)

2.3.3. Efficiency [6]: Thermal efficiency is obtained using equations (2.3.3) by ref. [6]

$$\eta = \frac{m_w * C_{pw} (T_2 - T_1)}{A_{sc} \int I dt} \quad (2.3.3)$$

Where m_w is mass of water in kilogram (kg), C_{pw} is the specific heat of the water in J/kgK, A_{sc} is the surface area of the solar cooker (m^2),I is interval average isolation in W/m^2, $T_1$and T_2 are an initial and final temperature of water respectively in °C.

After the various load tests, it is to be noted that the surface temperature of the receiver can be achieved as 100°C to 110°C provided 500 W/m^{2}solar irradiation. Cooking power and then cooking efficiency can be calculated by equation 2.3.1 and 2.3.3 respectively.

3. Result and discussion

Load test on the cooker was carried with 500 ml of water in a cooking pot. The wind velocity, ambient temperature, receiver temperature, cooking pot temperature and solar radiation received by the concentrator were measured at different time intervals. Based on the results, graphs have been plotted for further analysis, as shown in Figure 2, 3 and 4. Solar radiation intercepted by the concentrator varied from 373 to 515 W/m^2 for an average ambient temperature of 21.5 °C. At the beginning of the

load test, the water temperature was 18 ° C, which steadily rose to its boiling point as the day advanced. The decrease in temperature (Figure 3) was caused by an increase in heat loss on the side of the receiver tube, which was then reduced by the glass cover which improved the surface temperature. The intensity of solar radiation declines after 14 hours which also evident from Figure 2, 3 and 4. Due to this, the temperature of the cooking pot decreases steadily. The maximum temperature measured on the surface of the receiver was 110°C.The temperature and cooking power obtained by the suggested method can be varied for domestic cooking in Gujarat.

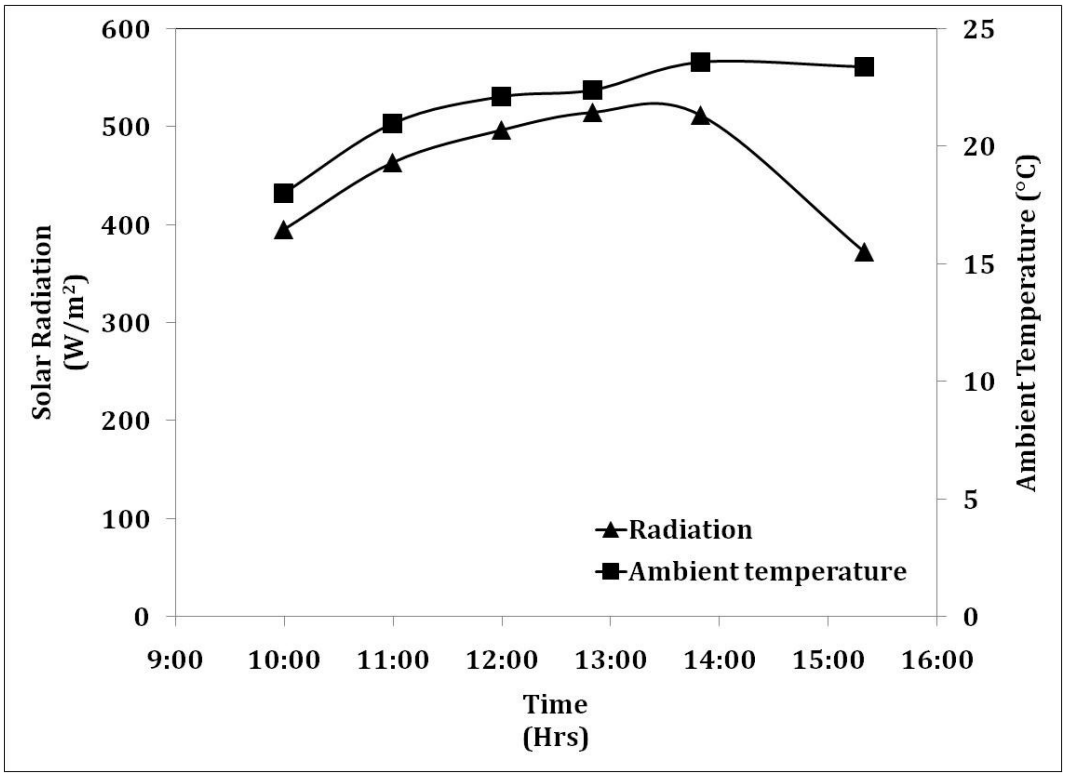


Figure 2. Graph of solar radiation against ambient temperature

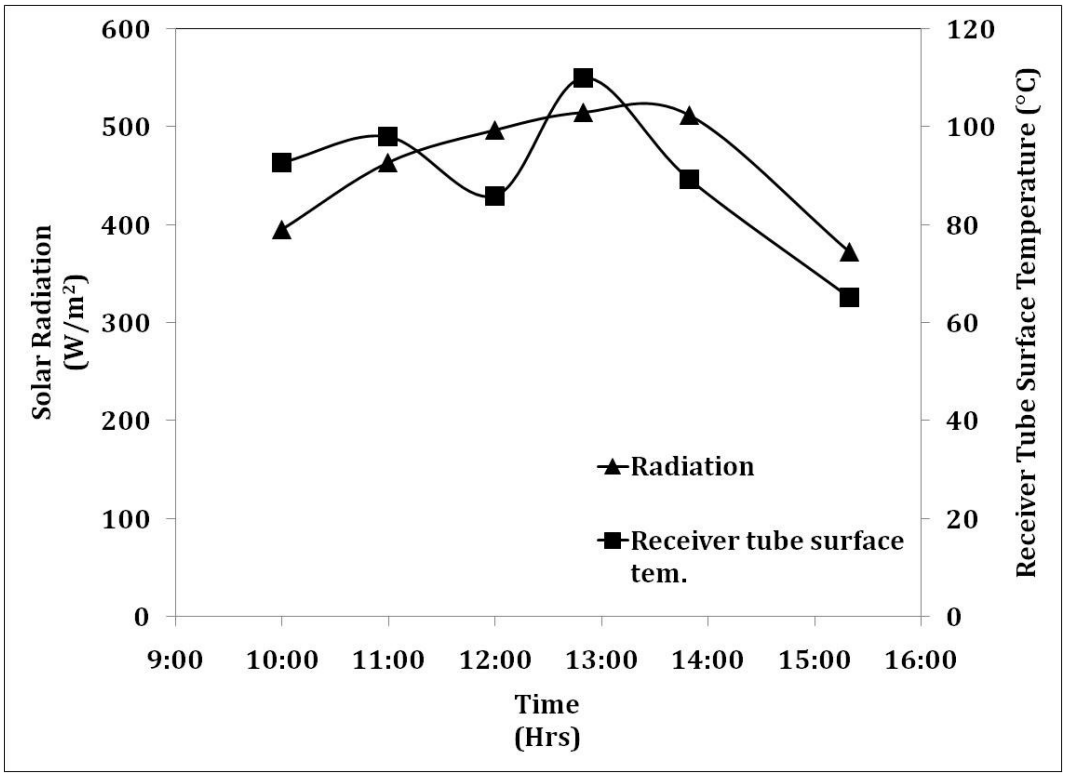


Figure 3. Graph of solar radiation against receiver tube surface temperature

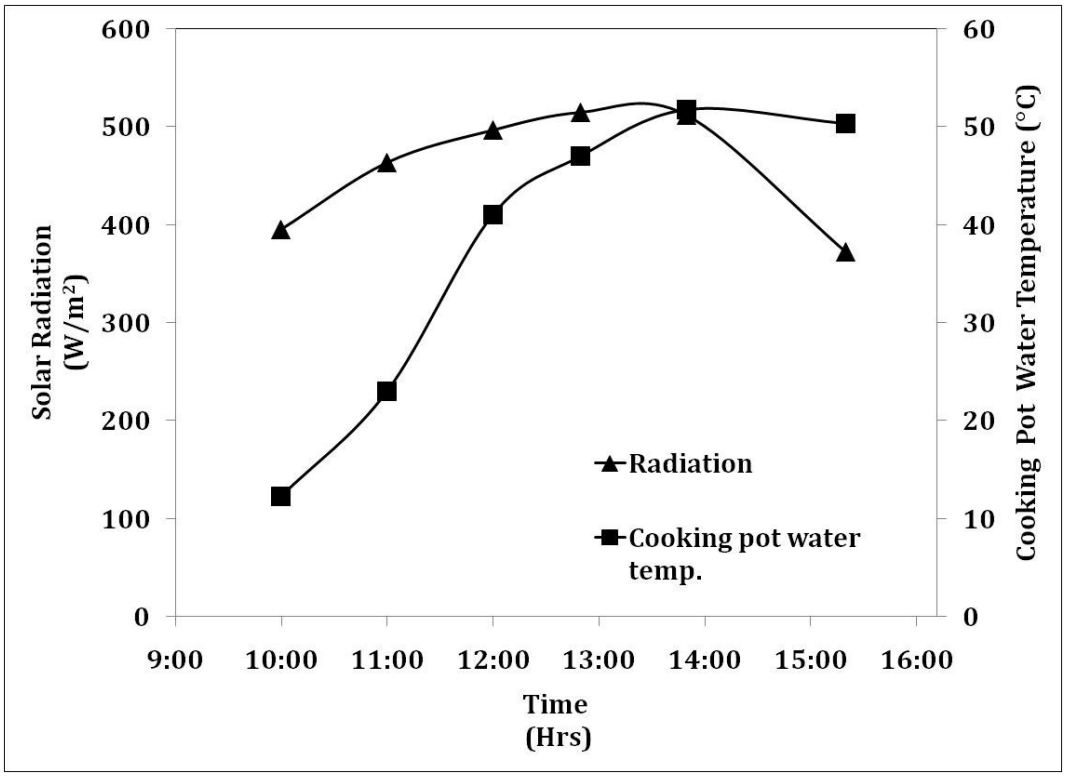


Figure 4. Graph of solar radiation against cooking pot water temperature

The thermal efficiency of the proposed device is in the range of 5 to 15 percent, which is in line with literature data [4].The efficiency of the cooker can be further improved by using a material with higher reflectivity and reducing the convective heat loss.

4. Conclusion

The proposed prototype of the solar cooker was build and installed at Gujarat Power Engineering and Research Institute, Mehsana, Gujarat, India.Load test on the proposed cooker was carried with 500 ml of water in a cooking pot. The results obtained were used to analyze the performance of the cooker. The measured solar radiation incident on the concentrator varied from 373 to 515 W/m^2 with an average ambient temperature of 21.5 °C. The intensity of the solar radiation decreases after 14 hours which causes the temperature of the cooking pot to decrease. The maximum temperature measured on the surface of the receiver was 110°C.The thermal efficiency of the proposed cooker is in the range of 5 to 15 percent which can be further improved by using a material with higher reflectivity and reducing the convective heat loss. Unlike other types of solar cooker, the proposed solar cooker can work effectively throughout the day time. The test results obtained show the practical viability of the proposed solar cooker for different cooking processes, including water boiling and rice cooking. The use of the proposed solar cooker can mitigate the harm to the atmosphere and human health caused by the burning up of wood as a fuel.

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Nomenclatures and abbreviations

A_{sc} Surface area of solar cooker [m^2]
C_{pw} Specific heat of water [J/kgK]
dt Time difference
I Average isolation [W/m^2]
m_w Mass of water [kg]
η Thermal efficiency
P Cooking power [W]
P_s Standardized cooking power [W]
t Time
T_1 Initial temperature of water [°C]
T_2 Final temperature of water [°C]

Modeling of Surface Roughness of Abrasive Jet Machined Nanocomposite using Artificial Intelligence Approach

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Processing of polymer based nanocomposite using advanced machining processes like abrasive jet machining is very challenging. Though these materials possess unique properties and developed for specific applications. Therefore analysis of material processing performance of a particular machining process is become essential. Performance of a process can be understood by establish a mathematical relationship between input and output parameters. This empirical relationship can be useful for election of significant variable factors. Once these factors elected then better quality characteristics can be obtained at economical cost. In present study a mathematical model for surface roughness is developed using artificial neural network. To check the accuracy of developed mathematical model the predicted values of consider quality characteristic is compared with previous published experimental values. Input parameters jet pressure, traverse rate, weight percentage of multi-walled carbon nanotubes and stand of distance for abrasive jet machining of carbon fiber reinforced polymer composite are considered. Average percentage prediction error found less than10% that shows predicted values from developed model is well coped with experimental values.

Keywords: Carbon fiber reinforced polymer composite, abrasive jet machining, surface roughness and artificial neural network.

Women's Shield

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The women's majesty is always respectable but presently the cruelty of humans and the jeopardy on women are not leading us towards hell only but also degrading our sublimity. A lot of women were sexually and mentally harassed while some are beaten to death and many of the cases are even not registered in the papers. Generally, when the wrong behavior happening to the woman, at that time she alone fought with them, no one comes to save her life because no one saw her and if she went to the police, she has no proof. So, for the safety of the women, we think to design such a device so that the woman could get help from the police department and her family too. The device contains e-components like GSM, GPS, ESP32 camera module, battery, etc. The whole design will be coded in the IC ATmega328p. Later on, the design will be printed on the PCB. The device will be in a very small design in the form of "Borla" a Rajasthani traditional wear. Because of the device, we will make a direct touch with the lady and along with the live tracking of that woman. It will also help us in tracking delinquents to put them behind the bars with adequate proofs. With the help of GSM, GPS the nearest police department and her family members will get the location of the woman via mobile message and the police will lead the rest. It will give a complete shield to the woman just with a single touch. In this paper, we tried to reduce the cost of women's shields with help of value analysis and optimization.

Keywords: ESP, GPS, 3D-Modelling, GPS, Buck-Buck Convertor, Value Analysis, Cost Reduction, Optimization Techniques

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1 Introduction

This research was conducted in rural areas of Rajasthan which is the implementing area of our gadget. In order to minimize its cost all components cost, making and distribution should be allocated optimally. To minimize the size and cost of this device it is necessary to do the planning in the components cost, making and distribution so that the size and cost is very optimal. The aim of this study is to analyze the prospect of size and cost reduction through value analysis technique. Value engineering is the process of finding and using acceptable material and process substitutes that will optimize both the cost and the performance of a structure. Manufacturing process of conventional Women's Shield is regarding to its basic functions. This study focuses on the design alteration of the Women's Shield by changing materials used for manufacturing of it. This study presents the functional and cost analysis of Women's Shield and ideas are proposed to reduce the cost of manufacturing per product. Through newly proposed analyzed to apply the value analysis technique in order to reduce cost [5]. Value analysis is the study of existing process to reduce the cost incurred on the manufacturing of a product through process reengineering or design alteration without reducing the performance of the product ideas; cost saving per Shield is expected to be reduced [3]. Value engineering is the process of finding and using acceptable material and process substitutes that will optimize both the cost and the performance of a structure. At the Engineering design, when our project is on a tight budget and an even tighter construction schedule, we are skilled at applying Value Engineering and Optimization principles, to obtain the following results:

How the whole design space can be used using creative and analytical tools to optimize spaces what types of materials can equally perform substituting acceptable construction materials that add value the design model and ease of designing a structure that is optimized for fast and easy construction. The benefit of value engineering and optimization goes beyond a budgetary or time factor benefit. The stakeholders receive a value for the money and time invested because the structure is built for functional efficiency. We work on it to gather the key criteria needed for the project, and then we set about asking the questions that lead to acceptable alternatives – every step of the design process. All value-based decisions concerning the building's design layout, construction materials, and installation of components are verified and validated to be the right choice. The Engineering Design to apply the strategies of value engineering and optimization save our time and money. The manufacturing process at Women's Shield roughly includes printing and programming of circuit on PCB, etching the plate, cleaning and disposal of the circuit board and finally fixation of the components with the strings to hold it. A survey is conducted to gather the data about current costing of the Shield to explore the areas where improvement is possible along with the functional analysis of the various parts and processes to study their importance in the process. In the technical terminology of the value engineering, this phase is known as orientation phase. In order to reduce the cost incurred on the manufacturing of the Women's Shield,

the detailed study of current costing is undertaken to identify the possible areas of improvement. The overall study showed that the small design aspects are capable of producing significant impact on the cost of manufacturing and are need to be carefully studied. The ideas presented in this manuscript propose slight change in the design of the product through changing the shape and material used during manufacturing of the Shield. The potential of the ideas is also explored in this text through expected reduction in the cost of manufacturing. Further, the existing and newly proposed costs are compared to estimate the cost saving per piece. The process of cost reduction through value analysis is explained step by step through this manuscript [6].

2 Method

There are certain steps involve in it

(a) Orientation Step

In this phase, functional analysis of e-components and processes is carried out to differentiate them into basic and secondary functions [1]. The segregation is done based on the individual function and their functional contribution to assembly. Basic function is what a product or process must do to work or sell and the customer is willing to pay for, followed by secondary functions that support that basic function. Secondary functions can be modified or eliminated to reduce product cost. The Shield is mainly divided into following components:

- Microcontroller
- Camera
- GSM
- GPS
- PCB
- Battery

The functional analysis is also presented in Table 1 based on their contribution to the assembly [4]. The numbers indicated in the functional evaluation table indicate:

- Major Performance = 3
- Medium Performance = 2
- Minor Performance = 1
-

(b) Information Phase

In the information phase, the detailed information regarding the costing of the Shield gathered from the survey of the production line. The Shield manufacturing consists of overall 5 stages. As a unit, the current manufacturing cost of the Shield per piece is 3505/-. Camera and 3D- modeling of Shield are the two expensive elements in the manufacturing of a borla which share 44.5% of the total cost of a borla. The primary

focus is kept on these two elements for the cost reduction [2]. The detailed costing of the parts and processes is presented in the following table.

Table 1. Functional Analysis of Parts and Processes

S.No.	Component Description	Performance level	Functional Definition		Part		Assembly	
			Verb	Noun	Basic	Secondary	Basic	Secondary
A	Microcontroller	3	Programming	Processor	✓		✓	
			Storing constant and variable	Memory	✓			
			input/output (I/O) peripherals	Interface with a given job	✓			
B	Camera	2	CAPTURE	IMAGE	✓			
C	GSM	2	SEND	MESSAGE	✓			
D	GPS	2	FIND	LOCATION	✓			
E	PCB	3	CIRCUIT	designing	✓			
F	Battery	2	POWER	supply	✓			
G	3D-Modelling	1	Improve	Appearance	✓			
			Provide	Strength				
H	Shinning paint	1	Enhance	beauty		✓		
I	Buck-Buck converter	1	Voltage manager	manage	✓			

Table. 2 Detailed Costing of Parts and Processes

S.No.	Component Description	Quantity	COST IN Rs.
1	Microcontroller	1	200
2	Camera	1	560
3	GSM	1	350
4	GPS	1	645
5	PCB	1	300
6	Battery	1	50
7	Buck-buck converter	1	150
8	3D-Modelling	1	950
9	Shinning paint	1	300
	Total		3505/-

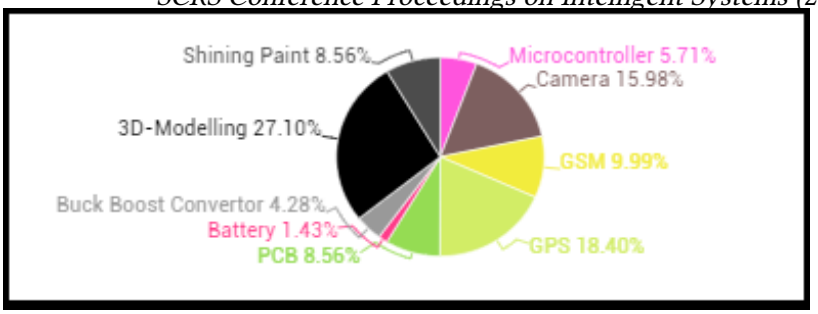


Fig. 1. Components vs. Cost graph

Table. 3 Comparisons of Functional Weightage and Cost

Key word	Component	Function	Weight	Cost (in %)
A	Microcontroller	Programming Processor	9	5.7
B	Camera	Capture Image	2	15.97
C	GSM	Send Message	2	9.98
D	GPS	Find Location	2	18.40
E	PCB	Circuit designing	3	8.56
F	Battery	Power Supply	2	1.42
G	Buck -Buck converter	Voltage manager	2	4.27
H	3D-modelling of Shield	Provide Strength	2	28.53
I	Shinning paint	Enhance Appearance	1	8.55

(c) Creative Phase

This phase is concerned with, "What are the other options which could satisfy the same functions" of the handle assembly. Many ideas are generated and discussed in the brain storming session. Following ideas were generated during this phase.

1. Change in the design (round shape): Instead of using the hexagonal shaped CAMERA, the round shaped design can be incorporated to reduce the manufacturing time and thereby, manufacturing cost.
2. 3D printer is used for making model to save the cost.

3. Golden Polish is used for giving beautiful look.

After discussing on the ideas put forth, the function cost worth analysis is performed on the product to estimate the effectiveness of the newly proposed ideas.

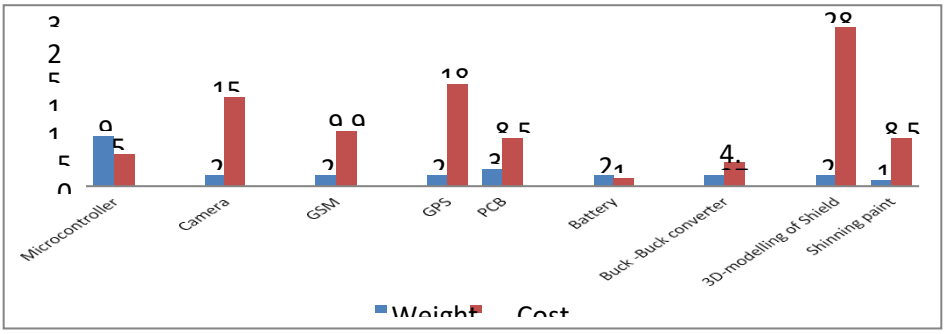


Fig. 2 Comparison between Functional Weightage and Cost

Table. 4 Function Cost worth Analysis

Function		Existing cost	Worth tentative alternative	Estimated Cost	Value Gap	Ranking
Verb	Noun					
Programming	Processor	200	None	200	0	
CAPTURE	IMAGE	560	ESP32	450	110	III
SEND	MESSAGE	350	None	350	0	
FIND	LOCATION	645	None	645	0	
Designing	Circuit	300	None	300	0	
Supply	Power	50	None	50	0	
voltage	manager	150	None	150	0	
Provide	Strength	950	Technology 3D	500	450	I
Enhance	Appearance/beauty	300	Golden polish	150	150	II
Total		3505		2795	710	

3 Result

In the evaluation phase, the costing of the new ideas is done considering one piece of model but if the monthly demand is more than one piece than cost of borla will be less in amount. The percentage saving and total per order is also calculated.

- Saving per product = 710/-
- % saving per product = 20.25 %
- Monthly demand = 1,000
- Actual monthly overall cost = 35,05,000/-
- New monthly overall cost = 27,95,000/-
- Total monthly saving = 7,10,000/-

Table. 5 Comparison of Existing and Estimated Cost

Part Name	Existing Cost	Estimated Cost	Gap
Microcontroller	200	200	0
Camera	560	450	110
GSM	350	350	0
GPS	645	645	0
PCB	300	300	0
Battery	50	50	0
Buck Buck Converter	150	150	0
3D-modelling of Shield	950	500	450
Shinning paint	300	150	150

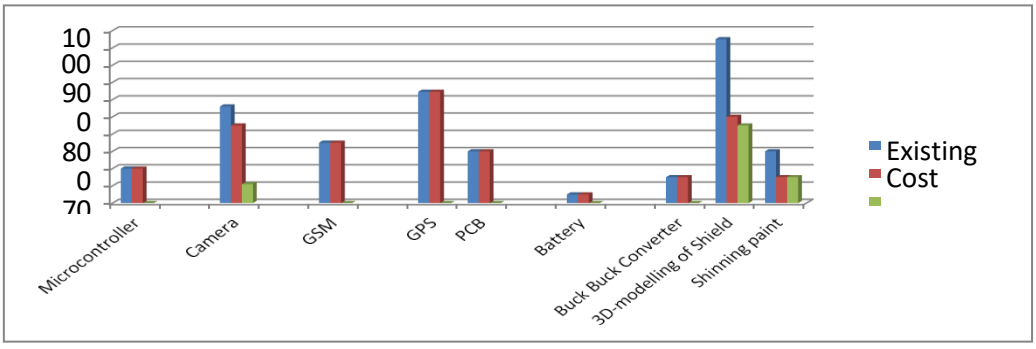


Fig. 3 Comparison of Existing and Estimated costs

4 Discussion

With the proposed design changes, it is expected to reduce the cost for the manufacturing of the one piece of Borla by 38.76%.It is a huge reduction in the cost.

The saving expected per order is Rs. 1000/- which will be utilized for the additional manufacturing of nearly 633 extra Borla. The new design will also give the product more aesthetic look which will be more appealing to the customers. New ideas are also expected to achieve more customer satisfaction along with the performance improvement and cost reduction.

Acknowledgment

Authors are thankful for RTU, Kota as this work is done under the project sanction TEQIP- III/RTU (ATU)/CRS/2019-20/49, Borla: Bring on the real lady armor (Development of smart lady E-Wearable Security System for Women working in the field with location tracking system).

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English Language and Society

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ABSTRACT

Language is both a system of communication between individuals and a social phenomenon. The area of language and society – sociolinguistics – is intended to show how our use of language is governed by such factors as class, gender, race, etc. A subsection of this area is anthropological linguistics which is concerned with form and use of language in different cultures and to what extent the development of language has been influenced by cultural environment. The study of language and society – sociolinguistics – can be dated to about the middle of the twentieth century. But a set of independent, objective principles, in short a methodology for investigating social factors in language use, was not available until some decades after the advent of Saussurean structuralism. In the early 1960s a number of linguists in America began to investigate English usage in the United States from a social point of view. Since, then there has been a flood of publications in this vein, primarily in America but soon afterwards in Europe as well (notably in Britain).

KEYWORDS: SOCIOLINGUISTICS, SOCIOLOGICAL, MODERN LINGUISTICS, STRUCTURALISM.

Introduction

In any scientific study there are some views and ideas which possess different or similar forms about a particular phenomenon. Linguistics which is known as the scientific study of language is no exception. First of all, if we start with the phrase (the study of language) we will find that it is very important in this discussion to analyze what this phrase mean. Particularly, by dividing it into two words the study and the language. We will find that language according to Cambridge Advanced Learner's Dictionary (2008) means a system of communication consisting of sounds, words and grammar, or the system of communication used by a particular country or profession. While the study means the examination of subject in detail in order to discover new information. Subsequently, it could be said that the study of language is considered as a wide subject related to different aspects amongst is the social context which also can be divided into two words social which means activities in which you meet and spend time with other people and context which is defined as the text or speech that comes immediately before and after a particular phrase or piece of text and helps to explain its meaning. Cambridge Advanced Learner's Dictionary (2008). Hence, there seems a relationship between the study of language and the social context according to the view of some writers in linguistics domain. This view is that the study of language cannot be divorced or separated from its social context. On the other side, some writers tend to be against this view. It seems, therefore, that the argument about the study of language cannot be divorced from its social context tends to be a controversial issue. This essay will shed light on this argument by discussing this view on one hand and the other view on the other hand.

The connection between language and society is tightly anchored. The relationship of the two is deeply rooted. Language performs various functions in the society and the society does the same way. If one will not exist, the other one will be affected.

Language is the primary tool for communication purposes, for establishing peace and order in our society, for showing authority and power, and for attaining goals and objectives. But, it can also destruct the society if it will use inappropriately. It must follow the conformity governing the society to avoid conflict s and to meet the boundary of individual differences.

Society however controls our language by giving us preferences as what are acceptable and not, because each one of us has our own perception or point of view. A group of people may accept our language, but for others, it could be kind of offence or insult. We must know how, when and where to say it and for what purpose.

Social changes produce changes in language. This affects values in ways that have not been accurately understood. Language incorporates social values. However, social values are only the same as linguistic values when the society is a stable and unchanging one. Once society starts changing, then language change produces special effects.

Language and Society

A society can be seen from its physical environment. Our view of physical environment may be conditioned by our language. In this relation, it can be explained that the physical environment in which a society lives can be reflected in its language, normally in the structure of its lexicon (the way in which distinctions are made by means of single words). For instance, English has only one word for snow but Eskimo has several. For English people, it is not necessary to make distinction of snow because their physical environment of society does not enable it; there is only kind of snow in the society. For Eskimos, it is essential to distinguish one kind of snow from another in individual words. Their physical environment 'force' them to make some names of snow (Trudgill, 1983:26). Other than the physical environment, the social environment can also be reflected in language, and can often have an effect on the structure of the vocabulary (Trudgill, 1983:27). For example, a society's kinship system is generally reflected in its kinship vocabulary.

A language is used by a man as a means of communication in his effort to interact one with another. In reality, he is not free from rules of using language agreed by speech communities in which he lives and interact with the other members of the community in accordance with the values and the other cultural aspects. The values of a society, for instance, can have an effect on its language. The most interesting way in which this happens is through the phenomenon known as taboo. Taboo can be characterized as being concerned with behaviour which is believed to be supernaturally forbidden, or regarded as immoral or improper; it deals with behaviour which is prohibited in an apparently with behaviour.

Relationship between Language and Society

An important concept in the discussion of communication is the speech community. It refers to a group of people who use the same system of speech signals. Another definition of the speech community is any human aggregate characterized by means of a shared body of verbal signs and set off from similar aggregates by significant differences in language use (John T. Plat and H.K. Plat, 1975: 33).

The relationship between language and the context in which it is used (Janet Holmes,2001:1). In other words, it studies the relationship between language and society. It explains why people speak differently in different social contexts. It discusses the social functions of language and the ways it is used to convey social meaning. All of the topics provide a lot of information about the language works, as well as about the social relationships in a community, and the way people signal aspects of their social identity through their language.

Ronald Wardhaugh (1986: 10-11) summaries the relationship between and society. According to him, there are some possible relationships between language and society. A first one is that, viewed from the participants, social structure may either influence or determine linguistic structure and/or behaviour. For instance, in relation to the age-grading phenomenon, whereby young children speak differently from older children and, in turn, children speak differently from mature adults. Socially, the participants may have different

origins, either regional, social, or ethnic origins; and, they must met with the particular ways of speaking, choices of words, and even rules for conversing.

A second possible relationship between language and society is directly opposed to the first: linguistic structure and/or behaviour may either influence or determine social structure. This is supported by the Basil Bernstein's finding on the use of elaborated and restricted codes. This finding will be discussed more detailed in the next chapter.

A third possible relationship between language and society is that language and society may influence each other; this influence is dialectical in nature. This is to say that speech behaviour and social behaviour are in a state of constant interaction and that material living conditions are an important factor in the relationship.

Conclusion

A language is an important thing in a given community, a speech community. It is not a means for communication and interaction but also for establishing and maintaining human relationships.

One characteristic of a language is that is social. That is to say that all speech events must be in relation to the social aspects. A new-born child acquires a language in the social environment (family as a part of the speech community). A language use also occurs in the speech community.

Based on the geographical area, one community may be different from one to another. This results in the different varieties of language: dialects. These kinds of dialects are known as geographical or regional dialects. The fact also shows us that the members of a community or speech community are in the same social hierarchy. Consequently, there are also varieties of the same language used by the different types of the language users. These kinds of language varieties are known as social dialects.

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"Design and Manufacturing of Engine Health Monitoring System for Two-Wheeler"

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ABSTRACT

Vehicles need repair after a certain interval of time and if are not repaired at fixed intervals it can lead to accidents. If we monitor air pressure of tire, quality of exhaust gas, wearof breaks, leakage of oil, the excessive heating of the engine or the blockage in fuel pipe, battery charging etc. then we can predict the damage to vehicle before it occurs. Gas sensor gives the readings of amount of carbon dioxide (CO_2), Nitrogen Oxides (NO_x) etc. as amount and quality of exhaust gives the proper working condition of engine. Engine vibrations depend on speed, but along with that pressure and temperature fluctuations, load on engine, wear of parts, forces, lubricating oil viscosity also affect the frequency of vibration. Thus, engine vibrations are measured using vibration sensor. And battery is nowadays main part of vehicle thus battery voltage is monitored using voltage sensor.

Key Words: Gas Sensor, Battery Sensor, Vibration Sensor, Arduino.

1.0 INTRODUCTION

The Two-wheeler health monitoring system aimed to observe the various parameters of two-wheelers for alerting and quantifying a significant change which may lead to unexpected failure. It has a distinctive benefit that state which would curtail service life of two-wheelers can be highlighted before breakdown. It generally involves fixing a single transducer or multiple transducers to mechanical parts to be monitored in order to track failures and malfunctions. This project is aimed at finding a reliable monitoring system for two-wheelers as visual inspection and physical assessment cannot always provide early warning to an emergency. At times, a

small fault in the system can quickly develop into a dangerous failure mode without any notable signs. In addition, inaccurate interpretations of operational conditions may often result in false alarms and unnecessary repairs and downtime. Atwo-wheeler health monitoring includes measurement of important parameters in which repair and maintenance decisions are taken based on the condition or state of the machinery instead of machine hours or time.

2.0 LITERATURE REVIEW

Poonam Pal[1] analyzed level of pollution has increased with times by lot of factors like the increase in population, increased vehicle use, industrialization and urbanization which results in harmful effects on human well being by directly affecting health of population exposed to it. **Sridhar Babu**[2] reviewed presently vehicles have low emphasis on showing the performanceof the components including mileage, enginequality and battery quality. It employs sensors and IoT to derive engine quality and battery quality adopting a Fuzzy inference system. Based on the current performance, various suggestions are given to improve and calibrate the vehicle so that components work effectively and efficiently for a longer period of time. **Mr. Vishal M. Shrivastav**[3] in his paper included CFD analysis and Fluid structural interaction analysis to be performed on the current design of the exhaust muffler with boundary conditions as per engines. Design of the muffler will be generated according to requirements. Exhaust gas temperatures, Velocities and back pressure will be evaluated and verified through the Finite Element Analysis package ANSYS. **Dr.S.S.Gawade**[4] in his paper explained about internal combustion engine and measurement of vibration. As per standard it is necessary to analyze the vibration. Researcher explained about vibration testing of single cylinder diesel engine by using FFT (Fast Fourier Transform) & Accelerometer.

3.0 SYSTEM COMPONENTS

A new and improved design for the vehicle monitoring system was developed based on the literature review and the problem identification. The components required for the fabrication are selected. The specific types of sensors are used for their desired work.

3.1 ENGINE



Figure No. 01: - Engine

- **SPECIFICATIONS**
- Model: - Honda Activa 3g
- Engine capacity: - 109.2CC, 4-stroke, SI-engine
- Power (HP): - 8bhp@7500rpm
- Torque (Nm): - 8.83Nm@5500
- Battery capacity: - 3Ah

3.2 MICROCONTROLLER

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

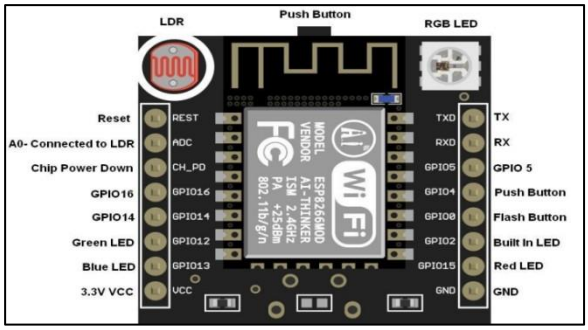


Figure No 02: - NodeMCU unit(ESP8266)

- **NodeMCU ESP8266 Specifications**
  - Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
  - Operating Voltage: 3.3V
  - Input Voltage: 7-12V
  - Digital I/O Pins (DIO): 16
  - Analog Input Pins (ADC): 1
  - UARTs: 1 SPIs: 1 I2Cs: 1
  - Flash Memory: 4 MB
  - SRAM: 64 KB
  - Clock Speed: 80 MHz

3.3 ADS1115(Analog to Digital converter)

The main purpose of the ADS1115 16-Bit 4-Channel ADC is to serve as a low-consumption, powerful and accurate analogue-to-digital converter that can be adapted to perform different conversions. It therefore has an excellent maximum data throughput (860 SPS), and can also be programmed for a much lower rate**.**

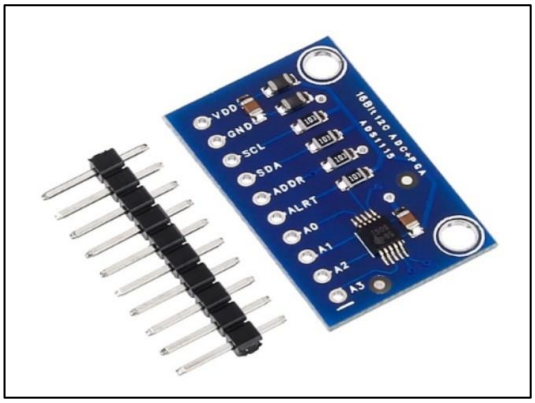


Figure No 03: - ADS1115

3.4 GAS SENSOR (MQ-7 & MQ-135)



Figure No:- Gas sensor

MQ-7 CO Carbon Monoxide Coal Gas Sensor Module detects the concentrations of CO in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of 10 to 10,000 ppm. The sensor can operate at temperaturesfrom -10 to 50°C and consumes less than 150 mA at 5 V.

Sensor MQ-135 composed of micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made of plastic and stainless-steel net. The enveloped MQ-135 has 6 pins, 4 of them are used to fetch signals, and the other 2 are used for providing heating current.

3.5 VIBRATION SENSOR

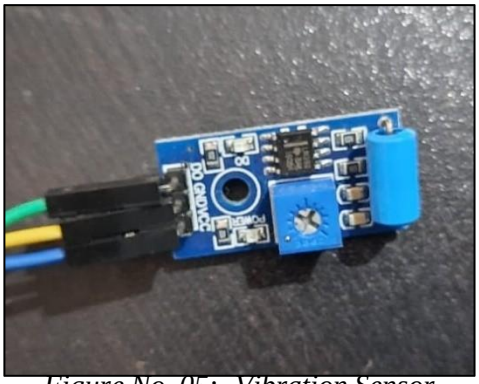


Figure No. 05:- Vibration Sensor

The vibration sensor is also called a piezoelectric sensor. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. Vibration Sensor Module comes with SW-420 vibration sensor, integrated with adjustable sensitivity via on board potentiometer. There are also LED indicators for power and the digital output status on board. It has a simple and straightforward 3-pin interface, VCC, GND and the DO (digital output). It supports 3.3V or 5V power.

3.6 VOLTAGE SENSOR

A voltage sensor is a sensor is usedto calculate and monitor the amount of voltage in an object. Voltage sensors candetermine both the AC voltage and DC voltage level.

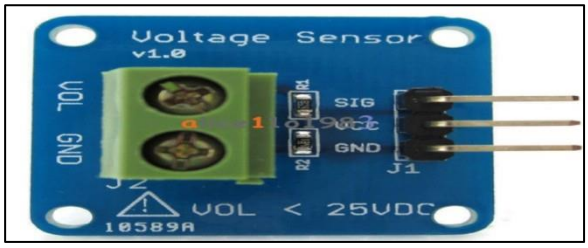


Figure No 06: - Voltage Sensor

4.0 CIRCUIT DESIGN

PCB design is main part of Circuit Design. Since a PCB holds all thecomponents of a circuit, its design depends on the complexity of the circuit. If the circuit is simple, a single layer board may be enough.

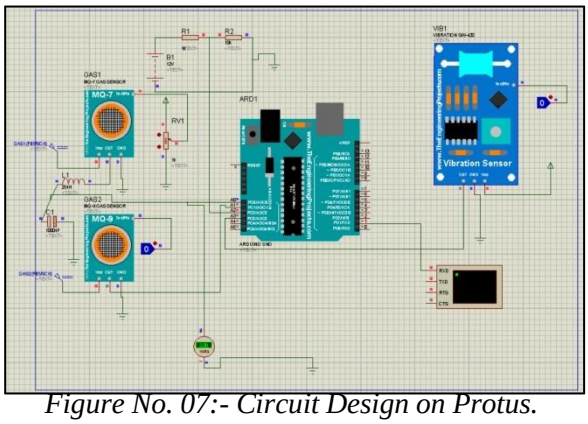


Figure No. 07:- Circuit Design on Protus.

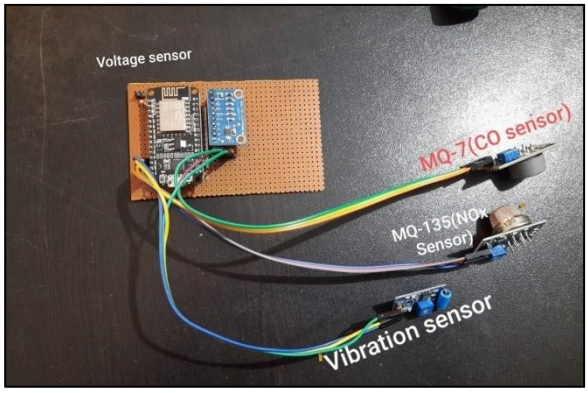


Figure No. 08:- Original Circuit

5.0 WEBPAGE DESIGN

To design webpage, we used XAMPP to integrate Arduino with Webpage and used PHP, HTML and MYSQL to design webpage.

1) PHP

- PHP is an acronym for "PHP: Hypertext Preprocessor “.
- PHP is a server scripting language, and a powerful tool for making dynamic and interactive Web pages.
- PHP scripts are executed on the server.

- PHP is a widely-used, free, and efficient alternative to competitors such as Microsoft's ASP.

2) HTML

- HTML stands for Hyper Text Markup Language.
- HTML is the standard markup language for creating Web pages.
- HTML describes the structure of a Web page.
- HTML consists of a series of elements which tell the browser how to display the content.
- HTML elements label pieces of content such as "this is a heading", "this is a paragraph", "this is a link", etc.

3) MYSQL

- MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by Oracle Corporation.
- MySQL is a freely available open source Relational Database ManagementSystem (RDBMS) that uses Structured Query Language (SQL).
- SQL is the most popular language for adding, accessing and managing content in a database. It is most noted for itsquick processing, proven reliability, ease and flexibility of use.
- MySQL is an essential part of almost every open source PHP application.

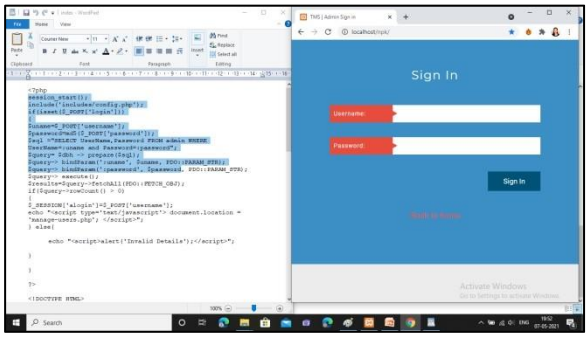


Figure No 09:- Design of Login Page

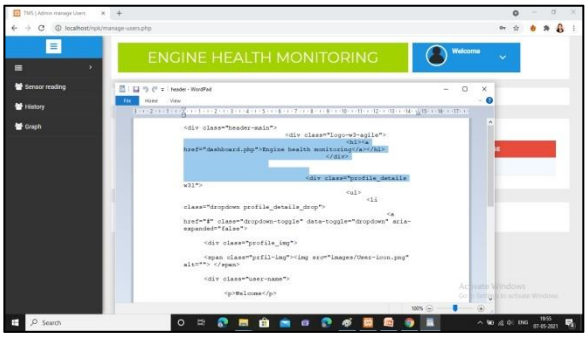


Figure No 10:- Design of Header of Main Page

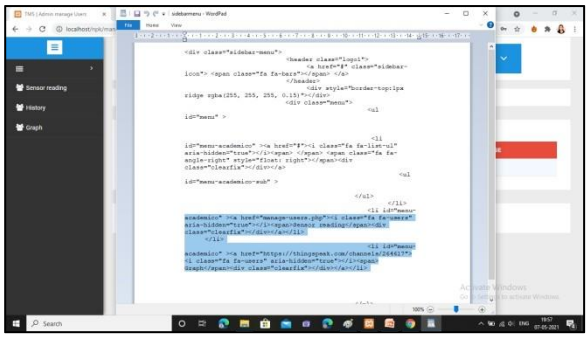


Figure No 11:- Design of Sidebar of Main Page

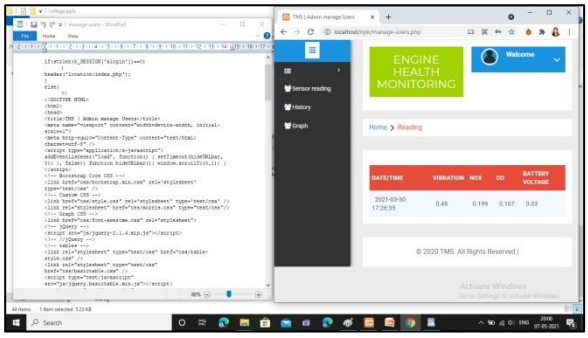


Figure No 12:- Design of Main Page



Figure No 13:- Format of Recorded Readings

5.0 ARDUINO PROGRAMMING

As Arduino Program is much bigger, sample image showing start of program and libraries included in program is attached.



Figure No 14:- Arduino page

6.0 INSTALLATION AND TESTING

➢ INSTALLATION

1) For the installation the node MCU and arduino module are installed at themiddle section of the scooter for safety from weather conditions as well as for easy access for users. Wires to other sensors are extended.
2) Power to the sensor is given by the battery itself through the adapter.
3) Locations of sensors are fixed for battery sensor at battery, CO and NOx sensor at exhaust and vibration sensor near engine for maximum utility of sensors.
4) For the battery sensor, the connections are made to the positive and negativeterminal of the battery.
5) For CO and NOx sensors, sensors are attached externally at the end of the exhaust silencer pipe. Vibration sensor is placed on the engine.

➢ TESTING

1) For testing the circuit and its full functionality, a common hotspot and server is needed in a close proximity.
2) Hotspot ID and and password are set as mention in a code of program
3) Node MCU and server automatically connect to each other when they are connected to a common Hotspot.
4) The readings of the sensors taken can be seen in a server as well as a web page which can be seen in mobile devices.

7.0 RESULTS

PARAMETER \CONDITION	ENGINE VIBRATION	CARBON MONOXIDE	NITROGEN OXIDES	BATTERY VOLTAGE
STANDARD VALUES	2 TO 100 Hz	4.5 mg/km	60mg	6/12 Volts
AVERAGE VALUES BEFOR SERVICING VEHICLE	12 Hz	0.3%	1.2 mg	2 Volts
AVERAGE VALUES AFTER SERVICING VEHICEL	7 Hz	0.2 %	0.9 mg	5 Volts

Figure No 12:- Results

The average value of vibration for an engine with old oil was 10.68 Hz, corresponding average values for CO emission, NOx emission and battery were 0.3%, 1.164mg and 2V. Whereas the average value of vibration for an engine withnew oil was 6 Hz, corresponding averagevalues for CO emission, NOx emission and battery were 0.164%, 1.209mg and 4.5V.

NOTE:- All the readings are measured at 0 speed i.e. idling condition.

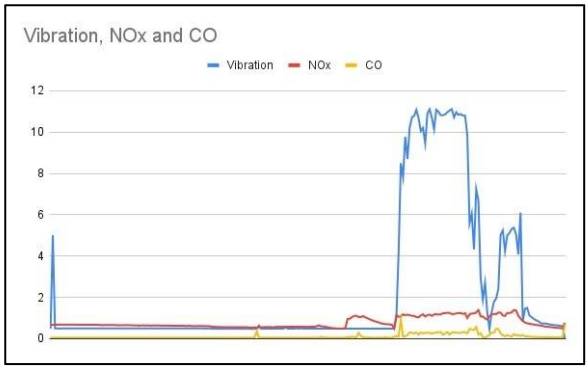


Figure No 14:- Result Graphs.

8.0 ADVANTAGES

- **Safety:** You can monitor your bike through your mobile phones, with the ability to control it. They can provide personal safety.
- **Your Pocket Personal Assistance**: IoT Applications can provide personal assistance (monitoring) and can buzz alarm on every uncontrolled action.
- **Contribution to healthy environment:** Damaged vehicles produce more amounts of vibrations and toxic gases.

9.0 DISADVANTAGES

- **Complexity:** The IoT is a diverse and complex network. Any failure or bugs in the software or hardware will haveserious consequences.

Eg. –buzz of alarm without any uncontrolled action, etc**.**

10.0 CONCLUSION

This Experiment is conducted on the bike by using the IOT application. Vibration sensor is in contact with Engine. Gas sensors are in contact with exhaust gases. Voltage sensor is in contact with battery terminals. As the results were presented with respect to time, the CO and NOx are measured in values similar to values in PUC of vehicle i.e. 0.3% and 1.12 mg. It is observed that after servicing and changing lubricating oil the amount of vibration, CO and NOx are reduced to 0.2% and 0.9 mg. And the battery voltage was 2.65V before changing battery and after that it is showing 5V. Vibration of engine before servicing at idling condition i.e. at 0rpm was 10 to 12 Hz and after servicing it was 5-7 Hz.

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Biomedical Waste Management and Circular Economy Actions in the COVID-19 Pandemic Situation in Jaipur District, India

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Abstract- Circular economy is gaining popularity across the world, but its implementation in Jaipur District, as in other developing nations, is lacking. The Covid-19 epidemic has resulted in massive volumes of hazardous trash that require specific handling. The goal of this study was to evaluate CE and waste management efforts in Jaipur District, India during the Covid-19 epidemic. Two quarantine healthcare centres in Jaipur District were used as case studies, with data collected using quantitative and qualitative approaches and evaluated to establish the problems of hazardous waste management in Jaipur District. A total of 220 questionnaires were sent to the employees, with 216 (98.18%) of them being returned.

There were 118 males (55%) and 98 women (45%) among the respondents, who worked in a variety of fields, including health workers (n=108; 50%), maintenance personnel (n=62; 28.7%), and cleaners/waste handlers (n=46; 21.29%). The majority of the participants (94.44%) said Covid-19 wastes should be separated, whereas 116 people (53.7%) thought managing personal protective equipment during a pandemic was reasonable.

According to the findings, training and retraining of personnel on hazardous waste management at the examined healthcare institutions is critical to the implementation and enforcement of national policies for solid waste management. Rajasthan's government must dispose of biological waste in one step, straight out of town, rather than in two steps, first in Jhalana, Jaipur and then in Jamdoli, Jaipur.

Keywords- Circular Economy (CE), Covid-19, Solid waste, Isolation center, Solid Waste Management (SWM), Hazardous Waste Management

1. Introduction

Zhu (1998) give the proposed concept of a circular economy (CE) in China and formally accepted in 2002 by the central government of China. Feng et al. (2004) gave the core of CE is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases. The "3R" principles—reduction, reuse, and recycling of materials and energy—are often cited to describe the three possible approaches in practice [1].

In linear economy of manufacturing work on take, make and dispose principle in Jaipur as well as India due to lack of legislative act or enforcement for solid waste management (SWM). By the use of special attention and effective techniques of management Medical wastes can reduce. Hazardous waste management minimizes harmful effects on the human health and environment through use of proper techniques of treatment, storage, handling, transportation and disposal [2].

In Jaipur district solid waste is disposed by transportation in two stages by mini truck first to JHALANA which is located in city near K.V. 3 School and Malaviya National Institute of Technology (MNIT) where population is too high. After that solid waste is collect again in trucks and discharge in open dumps which are located at near JAMDOLI, Jaipur. This place is located outside of Jaipur city where humans are minimal.

According to 2011 census the population of Jaipur district is 66.3 lakhs and area is 11,152 km^2 . On the based on population output of solid waste in this district is 11.16 lakhs tons per annum. This model has suggested that Jaipur district will be produced solid waste 18.16 lakhs tons per annum by the year of 2030. So if the SWM will not follow by this district then it will increase day by day. Solid waste management is a public health service which controls the waste, recycle and reuse it. Poor waste management systems linked with a hot climate increase the environmental problems and health problems [3].

As of now, open dump frameworks are among the significant dangers to wellbeing and ecological feel, while they additionally debase regular assets and increment the danger of fire episodes, contamination of waterways and underground offices by leachate, and other grave medical problems [4,5]. Disease transmission, fire danger, odour pollution, atmospheric and water pollution, aesthetic pollution, and economic losses are some of the most prevalent concerns connected with poor solid waste management [8]. Through anaerobic decomposition, open dump systems have significantly contributed to climate change, resulting in methane emissions and negatively harming human quality of life. The fact that SWM is accompanied by a public health emergency, such as the Coronavirus Disease 2019 (Covid-19) pandemic, emphasizes the necessity of these services to the authorities even more [9]. Covid-19is a disease caused by a novel corona virus strain that has never been detected in humans before, and it was designated a worldwide pandemic in February 2020, immediately caused monumental challenges. The effect of Covid-19is spread over in Jaipur as well as India. The Indian government is attempting to protect its citizens from the Corona virus by issuing SOPs for lock-down to all states and offering services such as home isolation, testing, and treatment, as well as establishing Covid-19 centers. But government of Rajasthan in Jaipur city not focused on produces hazardous waste materials and their management during lock-down.

Hospitals, healthcare institutions, and individuals have been creating more waste than normal in response to the Covid-19 pandemic, including masks, gloves, and other protective equipment that may be contaminated with the virus [10]. Infected medical wastes may be subjected to uncontrolled disposal, increasing public health concerns, while their open burning or uncontrolled cremation may result in the release of different poisons. While SWM is an essential sanitary barrier for disease control, it is not without flaws [11]. Uncollected solid waste is a major source of disease transmission in cities.

Following the emergence and spread of Covid-19over the last several months, critical observations have revealed that the SWM situation in Jaipur City in terms of collection, recycling, and disposal has usually gotten hazardous for waste handlers [12]. There have been no recommendations or warnings released about the management of municipal solid trash originating from the Covid-19lock-down and limitations, as well as COVID-19 wastes, which may escape the essential protocols in private and government hospitals in the treatment of such wastes. Covid-19 wastes should be monitored by developed nations, who should optimize current waste management methods while minimizing possible long-term environmental effects [10]. However, irregular clearance of Covid-19 medical wastes at multiple hospitals in Jaipur constitutes a serious threat to the spread of the COVID-19 viral infection, which has been linked to the virus's resurgence in and around hospitals during the current pandemic owing to ineffective management.

In this aspect, waste management standards have been weak and obsolete, and trash storage and collection procedures have been mainly ineffective throughout the current epidemic, with no accurate recording of waste creation rates or waste composition. When toxic and hazardous wastes are dumped indiscriminately, municipal wastes are mixed up with them, resulting in an inefficient economy. To close the loop in a circular economy, it is necessary to recycle waste resources. Furthermore, waste energy recovery is critical to establishing a proper and safe waste management system. Waste disposal should be phased out as much as possible, and if it is unavoidable, it should be handled efficiently to ensure that it is safe for human health and the environment [13].

During the Covid-19 epidemic, Figure 1 shows unsegregated solid wastes in a hospital environment.



Figure 1: Unsegregated solid waste disposal during Covid-19 pandemic in SMS Hospital, Jaipur

Because of reasons such as the lack of a regulatory framework to govern dangerous waste management practices and the insufficiency of the current infrastructure to adequately handle the volume and types of generated trash, Jaipur is becoming increasingly concerned about the circular economy [14]. The lack of implementation of existing laws and legislations, the need to upgrade obsolete legal instruments, insufficient budgetary provisions and funding mechanisms, and poor monitoring and evaluation mechanisms to guide environmentally safe SWM practices are all contributing to the country's main issue with SWM [15].
The executive, legislature, and judiciary at the federal, state, and local government levels are all involved in Jaipur SWM policy. The policy covers the major sources of solid waste in Nigeria, ensuring that trash is segregated, collected, transported, stored, treated, and disposed of in accordance with legal requirements to preserve the environment and human health.

The policy document was to be followed in terms of compliance and enforcement by the Federal Government of Jaipur's 5R hierarchy for SWM (reduces, repair, reuse, recycle, and recover). Environmental standards are protected, rules and legislation are enforced, international treaties are followed, and standards are adhered to. As a result, Jaipur must transition to a more circular economy by mainstreaming its concepts and practices into local, in each ward road maps for a long-term transition from a linear to a circular economy, which appears to be critical at this time.
In several parts of life, Jaipur implements circularity, such as micro-level engagement in home trash reduction and reuse techniques, as well as the usage of informal marketplaces as garbage scavengers, merchants, and recyclers [14].

COVID-19 is a novel virus that has been labeled a pandemic by the World Health Organization (WHO). As a result, hazardous waste management requires specific attention and measures In order to evaluate circularity and management activities during the epidemic in Jaipur City, this study was performed to address human issues, quantified with numbers using surveys, and evaluated using statistical tools.

2. Materials And Methods

This study was conducted in 2021 at the Swai Maan Singh Hospital (S.M.S.) and Rajasthan University of Health Science Hospital (RUHS), which are primarily two large COVID centers in Jaipur as the COVID-19 isolation facilities in Jaipur, Rajasthan State, India, with a focus on the recognition of the challenges in the management of such a waste category. Data was collected using quantitative and qualitative approaches, as well as a checklist [15]. In line with Creswell 2009, questionnaires were sent to healthcare professionals, maintenance workers, and cleaners/waste handlers at health institutions. COVID-19 healthcare wastes (identification, characterization, and segregation in healthcare facilities), emergency preparedness and response, safety, health, and the environment were all covered in the checklist. Field observations and key informant interviews were used to achieve the qualitative approach.

Data on the management and disposal of COVID-19 wastes, perceptions of medical wastes during the COVID-19 pandemic and other technical questions were collected using a series of semi-structured questionnaires. The distribution of the study instrument was done using simple random sampling among hospital employees (medical and healthcare professionals) and maintenance staff (ward attendants, cleaners, waste handlers, incinerator operators, and cleaning supervisors).

A total of 220 questionnaires were distributed, with 160 being provided at the SMS and 56 being distributed in the RUHS. There were 216 surveys returned in all.

3. Statistical Analysis

Data from the examined Covid-19 isolation facilities was cleaned, edited, and frequency tables were created in SPSS version to illustrate the findings.

4. Result And Discussion

Jaipur City, Rajasthan State Covid-19 Centers and Infectious Waste Management

Table 1: shows the total bed availability in hospitals in Jaipur district during Covid-19 in year 2021.

District	Total Hospitals in Jaipur City - 126	General Beds			Oxygen Beds			ICU Beds Without ventilator			ICU Beds With ventilator		
		T	O	A	T	O	A	T	O	A	T	O	A
Jaipur	Total	2815	93	2722	3178	44	3134	924	16	908	629	76	553
Note: The above information is courtesy Medical & Health Department Government of Rajasthan.													
Source: https://Covidinfo.rajasthan.gov.in/Covid-19hospital-wisebedposition-wholeRajasthan.aspx													

Table 1: Total No. of Beds Available in Jaipur City during Covid-19 period, 2021.

Table 2: shows the bio-data of the respondents: 120 of 216 (55.55%) were aged between 18-40 years of age while 96 of 216 (44.44%) were aged between 41-65 years. 118 of 216 (55%) were male while 98 of 216 (45%) were female.

Characteristics		N	%
Age of Respondents (year)	18-40	120	55.55
	41-65	96	44.44
Gender	Male	118	55
	Female	98	45

Table 2: Bio-data

Table 3: shows the status of cases of Covid in Jaipur as 31.05.2021.

STATE/UTS	TOTAL CASES	ACTIVE	DISCHARGED	DEATHS	ACTIVE RATIO	DISCHARGE RATIO	DEATH RATIO
Jaipur	1,84,653	37	1,82,861	1754	0.02%	99.03%	0.95%
Note: The above information is courtesy Medical & Health Department Government of Rajasthan.							

Table 3: Status of Cases of COVID in Rajasthan till 31.05.2021

Table 4: included technical questions about respondents' discipline, solid waste rating prior to COVID-19, attention paid to the disposal and management of Personal Protective Equipment (PPE) during and prior to COVID-19, separation of COVID-19 hazardous waste from other solid wastes, extent of PPE use during the pandemic, and whether PPE was purchased from personal purse.

Characteristics	Number	Percentage
Discipline		
Healthcare Worker (Doctors, Nurses etc.)	108	50
Cleaner/Waste Handler	62	28.7
Maintenance Staff	46	21.29
Prior to COVID-19, solid waste was rated.		
Poor	63	29.16
Good	135	62.5
Very Good	15	6.94
Excellent	3	1.38

Is the appropriate attention being paid to the disposal and management of PPE at this time?		
Yes	205	94.9
No	11	5.09
Before COVID-19, how would you evaluate the disposal and management of personal protective equipment (PPE)?		
Poor	57	26.38
Good	128	59.25
Very Good	29	13.42
Excellent	2	0.92
Should COVID-19 wastes be segregated from other solid wastes, in your opinion?		
Yes	204	94.44
No	12	5.55
Do you utilise more personal protective equipment (PPE) during COVID-19 than before the pandemic?		
Yes	205	94.9
No	11	5.09
Do you purchase personal protective equipment with your own funds?		
Yes	49	22.68
No	167	77.31
How would you rate the COVID-19 disposal and management of expired PPE?		
Poor	27	12.5
Good	116	53.7
Very Good	58	26.85
Excellent	15	6.94
Is it possible to prevent the spread of COVID-19 using present waste management practices?		
Yes	170	78.7
No	46	21.29
Do you think you're paying more attention to how you dispose of your worn PPE today than you were before COVID-19?		
Yes	208	96.29
No	8	3.7
Is it possible to dispose of COVID-19 wastes in separate trash bins?		
Yes	118	54.62
No	98	45.37
Is it possible for COVID-19 to spread through solid waste?		

Yes	200	92.59
No	16	7.4
How often does your company's solid trash be hauled away to be disposed of?		
Daily	152	70.37
Twice Daily	56	25.92
Every Two Days	6	2.77
More than Two Days	2	0.92

Table 4: included technical questions

The number of the confirmed cases increased to 1,84,653 with 1,82,861 discharged patients and 1,754 deaths as of 31th May 2021.

The infected patients in Jaipur are confined at the RUHS Hospital isolation unit in Jaipur, the state capital. The S.M.S, on the other hand, is the state's largest government hospital, and it sees suspected cases that are later verified at the diagnostic facility. Various steps have been put in place by the state to limit the epidemic and manage its extremely contagious medical waste.

The present investigation found that both study sites had double chambered storage facilities for processing hazardous trash. As a result, all trash coming from the hospital must be burned openly by waste managers. Furthermore, neither of the research sites separates trash, thus all of the waste generated by the isolation centers is regarded as infectious waste and sent to the dump yard.

5. Conclusion

During the present pandemic in Jaipur District, Rajasthan State, India this study intended to analyse the circular economy and problems in the management of COVID-19 wastes at two important locations. According to the findings, there are significant flaws in the handling of hazardous wastes.The two regions employ linear economy and use double chambered storage facilities for final waste disposal.

The majority of respondents (59.25%) rated the management of used COVID-19 PPE as good, 94.9% agreed to more used PPE during the pandemic than before, some (22.68%) use their own money to provide PPE for their own safety, 78.7% believe current waste management practises are effective in preventing COVID-19 spread, and the majority (96.29%) pay more attenuation during the pandemic than before. The respondents in this survey appear to be aware of the hazards that may arise from improper waste management; nonetheless, health care providers must do more in terms of providing sufficient PPE and trash management. Government of Rajasthan have to dispose the biomedical waste in one step directly out of city instead of two steps in Jhalana, Jaipur and then to out of city Jamdoli, Jaipur.

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Enhanced Performance of Metamaterials Loaded Substrate Integrated Waveguide Antenna For Multiband Application

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***Abstract*—The investigation of the design and analysis of a Metamaterials loaded SubstrateIntegrated Waveguide(SIW)antenna for Multiband Applications. A ground arrangement through aradiating rectangularpatch conflicting the feed line as well as a mixture of Substrate Integrated Waveguide and Metamaterials is presented for the proposed antenna. These are utilized to improve the antenna's bandwidth and Radiation pattern while also reducing its size. To improve directivity, gain, and bandwidth, a complementary square split ring resonator and Substrate Integrated Waveguide are utilized. The proposed antenna structure is made of FR-4 epoxy with a ε_r=4.4. The antenna functions over the frequency range of 6-18 GHz, with a resonant frequency for Wireless LAN and WIMAX.**

Keywords—Substrate integrated waveguide, CPW, SIW, WLAN, WIMAX, Ku-Band, Satellite application, SIW based slot Antenna.

I. INTRODUCTION

An antenna is a device radiating in free space by means of EM waves i.e. Electromagnetic waves starting from a Radio Frequency signal in a normal conductor. Normal antenna radiates when a signal of certain frequency is fed into it. The antenna starts radiating Electromagnetic waves in free space. An antenna is an array of conductors electrically connected to the receiver or transmitter. While the antenna is transmitting, the current acquired by the antenna which comes from the transmitter, develops an oscillating current which in turn gives rise to electric and magnetic fields circulating the antenna. This distribution of power in the free space which the antenna emits is called as radiation pattern [1-2]. Analysis of the radiation pattern is very vital because radiation pattern gives the amount of power that is radiated from the transmitter to the receiver majority in the main lobe [3]. The usefulness of any antenna relies on its parameters like polarization, Beam width, levels of the main side and back lobes etc., which in turn can evaluate how much the antenna is beneficial in its applications [4].

II. RELATED WORK

Wireless communication technologies that operate in the microwave frequency band have been rapidly expanding in recent years [5-6]. Multiband antennas can be used to reduce thenumber of antennas in a transceiver system and are in high demand. Volume decrease, gain enhancement, bandwidth augmentation as well as multiband are all benefits of the complementary square split ring resonator and SIW based metamaterial employed in design of antenna. SIW was created because waveguide devices are chosen for high frequency applications. High gain, excellent antenna efficiency, high quality factor, and superior power handling capabilities are all advantages of traditional SIW technology. When SIW and metamaterials are combined, bandwidth is increased, gain is improved, antenna size is reduced, and antenna efficiency is increased. The creation of Ku bandantennas has been the focus of recent study [7-9]. In recent years, various forms of multiband antennas have been investigated with the goal of achieving antenna operation in multiple bands. [10]. Metamaterial-loaded inspired antennas for a various application are potentially a possibility [11]. Because antenna is made of solid material that can't be bent and has a small bandwidth, cannot be used directly on the human body. At 20.4 GHz tone incidence, a dumbbell-shaped slot antenna [12] base on SIW knowledge was developed with 9 dB gain. Only very high frequencies may be used with this antenna, and it has a low efficiency. SIW sub-array is used to create a small and circularly polarised planar antenna [13]. The axial relation and emission effectiveness are affected if the space between vias is too short. For WLAN applications, DLSIW antenna (compact dual line SIW) is built employing semi form SIW, although this structure has a narrow bandwidth. For WLAN / ISM band applications, a triplexer [14] is created utilizing SIW technology. Because this low-profile antenna has three ports, it requires more power and has a smaller bandwidth. Yan et al. [15] built a dual band textile antenna based on SIW

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technology for WLAN applications, but the antenna construction has a low gain. In piece of writing[16-17], a Co-Planar Waveguide feed metamaterial enthused courtyard groupcircularly polarized antenna by means of radiation effectiveness and small gain was created for WiMAX band, X-band downlink satellite communication, WLAN/ISM/Bluetooth, and ITU band applications.

According to the literature review, most antenna structures are insufficient withinfrequency range and concurrent accomplishment of bandwidth and directivity is still a research challenge. The antenna structure's incorporation of Metamaterial and SIW is still early stages of development and study. By merging SIW with Metamaterials, this study offers a unique multiband antenna that improves antenna properties such as gain, directivity, and bandwidth.Suggested antenna resonate at four oscillations, making it appropriate for use in the C, X, and Ku bands.

III. Antenna Design and Methodology

Three primary processes are involved in the building of the planned antenna.The first step is to create a simple patch antenna.The characteristic of CSSRR isdetermined usingunit cell analysis in the secondstage, and SIW modelsare added. Because of its small size, low defeat, as well as high power management capability, substrate integrated waveguide has sparked a lot of interest in microwave circuit design. SIW enables straightforward integration while maintaining good isolation and power defeat. The thickness of the via is 0.5 mm, along with the spacing between vias is 2 mm, pleasing the requirements $d/\lambda \leq 0.1$ and $d/p \geq 0.5$. Where "d" refers to the thickness of vias and "p" refers spacing between vias.

Metamaterials, which have negative permittivity, permeability, or both, play an important position in electromagnetic surroundings. It leads to increased bandwidth, gain, antenna size reduction, antenna efficiency increase in addition to complementing quadrangle split ring resonators as Metamaterials.The proposed design structure uses CSSRR.The corresponding circuit diagram for double CSSRR is shown in Fig 1.

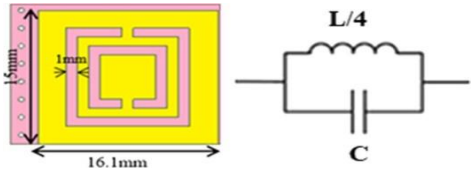


Fig. 1. Corresponding Circuit of Double CSSRR

IV. Simulation Results

The parametricresearchutilizesCSTstudioElectromagneticSolver. Geometrical characteristicssuchasradiatedpower,currentdistribution,gain, directivityand bandwidthallaffecttheantennaperformance.Thegoalofthisinnovativeantenna configurationistoincreaseantennacharacteristicswhilemaintaiiningacompact form.Becausethesuggestedantennaisintendedtooperateinamultiband environment,themetamaterialstructureusesorthogonalpolarization.The investigationofasolitaryunitcellofametamaterialarrangement wascarriedout for this purpose. The nearby area aboutthe unitcellserves asmaster,while region conflictingitserveasslave.Floquetportislocatedatthetopandbottomofthe structure.

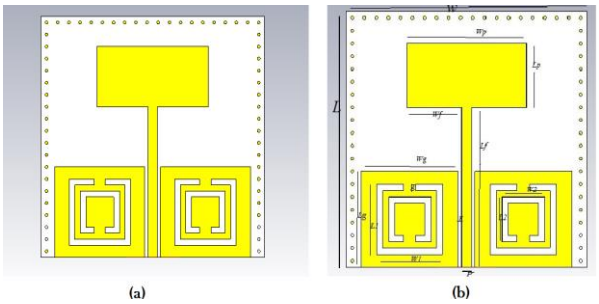


Fig. 2. a) Top View of Proposed Antenna b) Top View with dimensions parameters

In the table I shown the dimensions of the proposed antenna structure.

TABLE I. Dimensions Of Proposed Antenna

Parameters	Value
W	40
h	1.6
L	40
t_p	0.0256
W_f	1.6
L_f	25
W_p	20
L_p	2.5
W_g	16.1
L_g	15
W_1	5.5
L_1	5.5
G_1	1
W_2	3.5
L_2	3.5

Theproposedantennastructure'sreflectioncoefficientiscalculatedforfourf0 frequenciesthatareintendedforS,XandKubandapplications.Refection coefficient is shown in several levels in fig 3 and VSWR is shown in Fig 4. Three bands clearly accomplish the required return loss and VSWR.

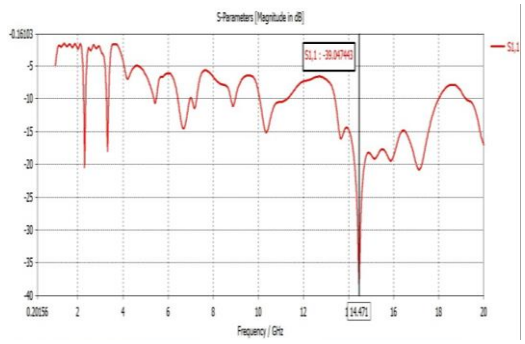


Fig. 3. Reflection Coefficient

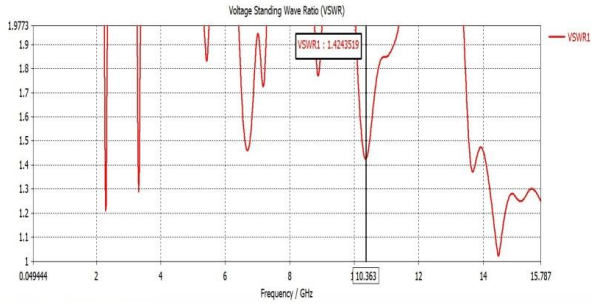


Fig. 4. Voltage Standing Wave Ratio (VSWR)

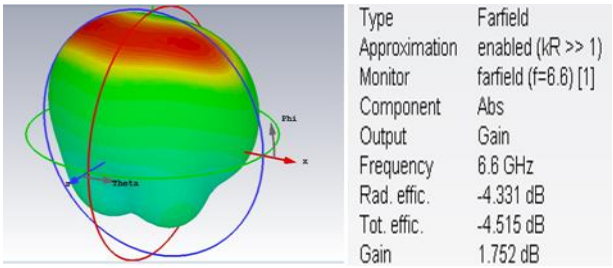


Fig. 5. Obtained Simulated Gain at frequency 6.6 GHz

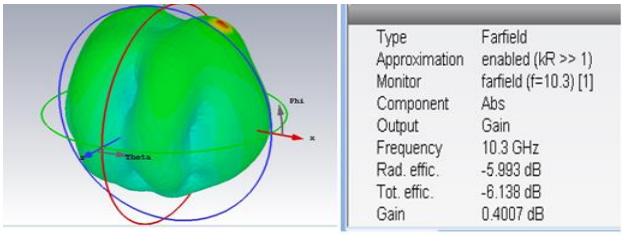


Fig. 6. Obtained Simulated Gain at frequency 10.3 GHz

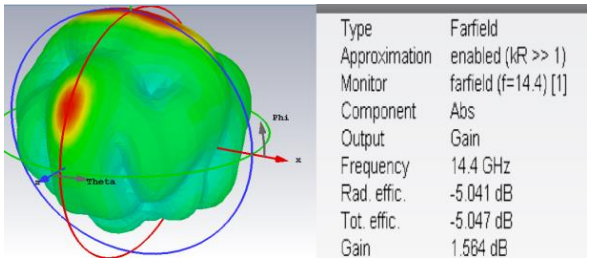


Fig. 7. Obtained Simulated Gain at frequency 14.4 GHz

In the fig 5, 6 and 7 shown the obtained simulated gain at 6.6GHz, 10.3 GHz and 14.4 GHz operating frequency respectively. The obtained gain at 6.6Ghz frequency is 1.752dB, at 10.3Ghz frequency is 0.4007dB and at 14.4 GHz frequency 1.584dB.

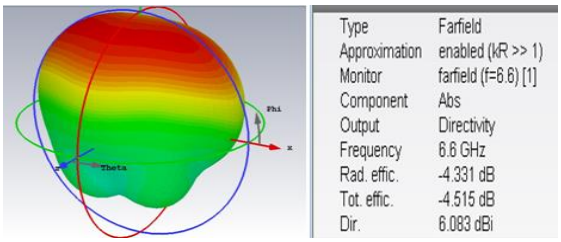


Fig. 8. Obtained Simulated Directivity at 6.6 GHz frequency

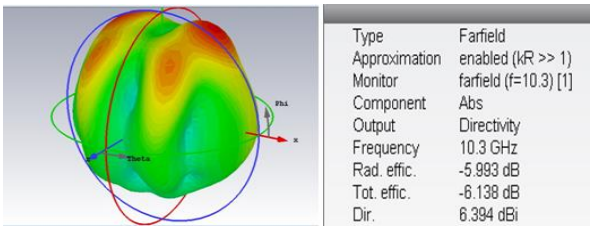


Fig. 9. Obtained Simulated Directivity at 10.3 GHz frequency

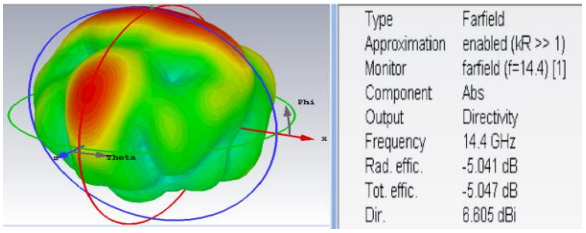


Fig. 10. Obtained Simulated Directivity at 14.4 GHz frequency

In the fig 8, 9 and 10 shown the obtained simulated directivity at 6.6GHz, 10.3 GHz and 14.4 GHz operating frequency respectively. The obtained directivity at 6.6Ghz frequency is 6.083 dBi, at 10.3Ghz frequency is 6.394 dBi and at 14.4 GHz frequency 6.606 dBi.

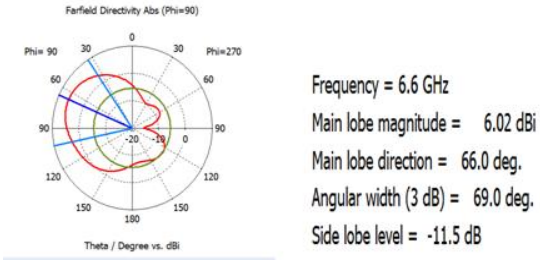


Fig. 11. Farfield (phi=90) Pattern at 6.6 GHz frequency

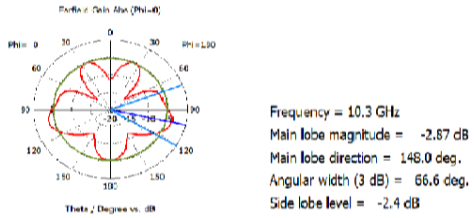


Fig. 12. Farfield (phi=90) Pattern at 10..3 GHz frequency

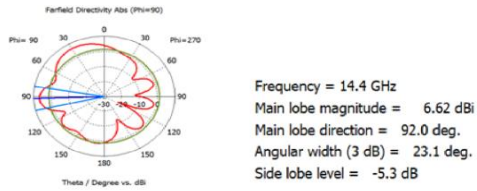


Fig. 13. Farfield (phi=90) Pattern at 14.4 GHz frequency

In the fig 11, 12 and 13 shown the farfield (phi=90) pattern at 6.6GHz, 10.3 GHz and 14.4 GHz operating frequency respectively.

TABLE II. RESULTS AND OBSERVATIONS OF THE PROPOSED ANTENNA

Parameter	Observations		
Frequency (GHz)	6.6	10.3	14.4

Return Loss(dB)	-15	-15	-39.04
Gain (dBi)	1.752	0.4007	1.564
VSWR	1.4	1.45	1.05
Bandwidth (GHz)	0.7	1.1	4.5
Directivity (dB)	6.083	6.394	6.605

Directivity and gain are revealed by the radiation pattern. The major lobe receives the most radiation. The antenna that has been proposed is omnidirectional. The gain and directivity of an omnidirectional antenna are often low. However, because of its high directivity, suggested antenna overcomes the disadvantage. Table 2 comparesthe proposed antenna's performance.

V. CONCLUSION

AttheS,XandKubands,thesuggestedantennahasaelevatedbandwidthand directivity.BycombiningCSSRRbasedmetamaterial,substrate integrated waveguide (SIW)aswellasCPWfeed, anuniquedesignisdevelopedthataidsintheimprovementofantennaparameters (i.e. directivity, gain and VSWR). Designed antenna is multiband, resonating at four differentfrequencies:oneinSband,oneinXbandandtwointheKuband.The projected antenna arrangement is made of FR-4 epoxy with a εr=4.4 and a diameter of40 × 40 × 1.6mm,anditwasstudiedusingCST.The developed antenna has a directivity of more than 6dB at four frequencies (i.e., 6.6, 10.3 and 14.4 GHz), Sband(ISM,WLAN,WiMax),Xband(military)andKuband(satellite communications) applications are supported.

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A Double-Ended Scheme for Fault Identification and Phase-Type Categorization in Fixed Series Compensated Transmission Line during Distorted Signals

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***Abstract*— A quick, double-sided, and hybrid protection system for identification and phase-type categorization of fault generated noisy signals on a 500 kV, 300 km long transmission line (TL) is introduced in this paper. The proposed scheme takes advantage of Fourier analysis and haar wavelet analysis and makes use of currents at equally relaying sides of a TL. Haar wavelet is used in the wavelet analysis of current signals. The simulation effects attained show that the scheme is quick and flawless as the phase-type is classified within 15 ms time.**

Keywords*— Fourier analysis, fault identification, phase type classification, transmission line, wavelet analysis.

I. INTRODUCTION

The protection of fixed-series connected transmission line (FSCTL) during the presence of distorted signals is very challenging due to the effect of noise present in the line current. Hence, a protection system which can conquer the disputes in the FSCTL and work successfully and competently under an extensive variety of fault circumstances would be an appreciable move in this observation. Various protection systems have been suggested for TLs utilizing discrete wavelet analysis [1], DT with wavelet analysis [2], Fourier analysis with k-nearest neighbor [3], Discrete Fourier transform with SVM [4], symmetrical component analysis with Walsh analysis [5], transient monitor index [6], synchrophasor measurement technology [7], wavelet analysis with ANN [8], spatial pyramid pooling (SPP) and hashing classifier (HC) with convolution neural network (CNN) [9], and covariance coefficients with cumulative sum [10] .

In this paper, a double-sided protection system is introduced for FSCTL during the presence of distorted current signals based on the differential spectral energy index (DSEI) values.

The application of the scheme is presented in Section-II. Double-sided protection system is illustrated in Section-III. The results of the research are included in Section-IV. Section-V gives the conclusion of the research.

II. FIXED SERIES COMPENSATED POWER SYSTEM

Simulation representation of a 500 kV power system is built in MATLAB and SIMULINK as illustrated in Fig. 1. The generator (G) and load are connected through a 300 km TL. The faults are incepted between both compensation devices C1 (capacitor unit-1) and C2 (capacitor unit-2) varying initialization time of fault, impedance, and location.

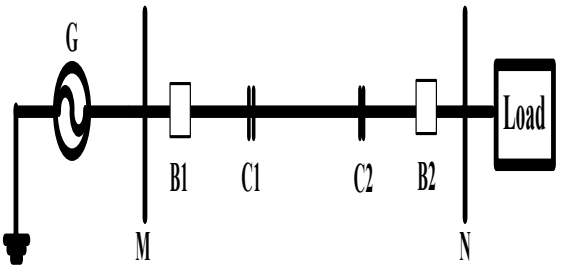


Fig. 1. Fixed series compensated power system.

III. PROPOSED SCHEME

The plan of the protection system is given below:-

i. Measurement of currents at both ends of the power system.

ii. Feature extraction using DFT.

iii. Analyze features extracted from DFT using DHWT and calculate DSEI (differential spectral energy index).

iv. Check whether DSEI of phase-A or B or C > THV (threshold value). If yes, then the trip signal will be initiated else no trip.

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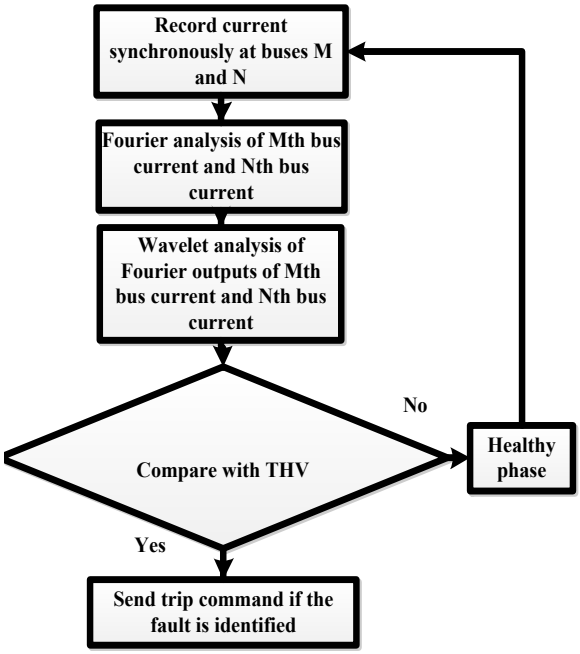


Fig. 2. The plan of the protection system.

IV. Results and Discussions

The results of the protection system are given below.

A. *Varying Fault Application Time*

The scheme is authenticated for an ACG fault applied at 150 km. The fault in ΦA and ΦC is applied at 0.05 s. Fig. 3 presents both end currents during ACG fault. The noisy signals recorded at both ends with SNR (ΦA, ΦB, ΦC) =25 dB are verified in Fig. 4. The performance of scheme is presented in Fig. 5. The distorted ΦA and ΦC are detected at 0.065 second. The distorted phase detection time (DPDT) in this case is 15 millisecond. The absolute values of DSEI under variation of FAT for different types of faults with various SNR are demonstrated in Table I. The SNR input values are varied from 25 dB up to 45 dB. Table II presents the DPDT for various faults when FAT is varied. The maximum DPDT time is 15 millisecond and minimum DPDT is 5 millisecond.

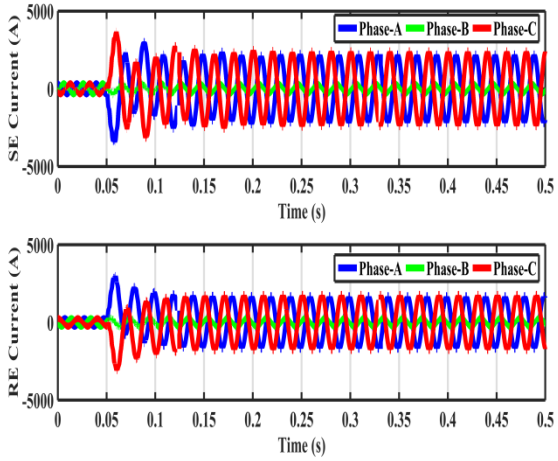


Fig. 3. Both ends currents during ACG fault at FAT=0.05 s.

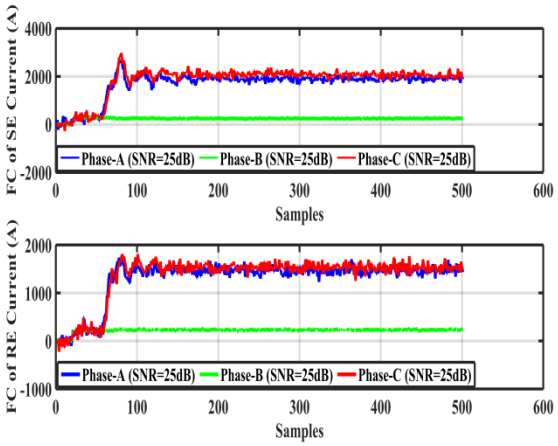


Fig. 4. Noisy signals recorded at both ends during ACG fault with SNR=25 dB.

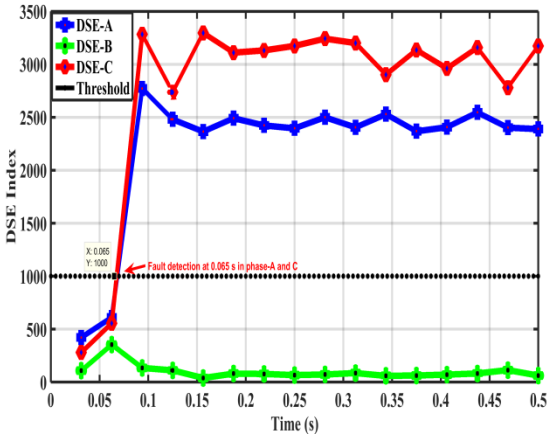


Fig. 5. Fault recorded in ΦA and ΦC with DPDT=15 ms (ph. A and C).

TABLE I. DSEI Absolute Values when FAT is Varied

Situation	SNR (dB)	DSEI Absolute Values		
		DSEI (ΦA)	DSEI (ΦB)	DSEI (ΦC)
ACG	25	$2.7724*10^3$	354.5546	$3.2967*10^3$
AB	30	$3.4199*10^3$	$2.4142*10^3$	423.8515
AG	35	$2.2612*10^3$	400.9161	404.7905
ABC	40	$3.5461*10^3$	$3.2425*10^3$	$3.4369*10^3$
ABCG	45	$3.1979*10^3$	$3.1460*10^3$	$3.1602*10^3$

TABLE II. Distorted Phase Detection Time when FAT is Varied

Situation	FAT (s)	Distorted Phase Detection Time (ms)		
		DPDT (ΦA)	DPDT (ΦB)	DPDT (ΦC)
ACG	0.05	15	-	15
AB	0.1	5	10	-
AG	0.15	15	-	-
ABC	0.2	10	10	15
ABCG	0.25	5	5	5

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B. *Varying Fault Impedance*

The scheme is validated for an ABCG fault created at 150 km. The fault application time (FAT) is 0.10 s. Fig. 6 represents both end currents during ABCG fault. The noisy signals recorded at both ends with SNR (ΦA, ΦB, ΦC) = 28 dB are demonstrated in Fig. 7. Fig. 8 depicts the plot of fault recorded in ΦA, ΦB and ΦC. The distorted ΦA is detected at 0.105 second. The distorted ΦB and ΦC are detected at 0.11 second. The distorted phase detection time (DPDT) in this case is 5 millisecond for ΦA and 10 millisecond for ΦB and ΦC respectively. Under variation of fault impedance, the absolute values of DSEI for different types of faults with various SNR are demonstrated in Table III. The SNR input values are varied from 28 dB up to 48 dB. Table IV presents the DPDT for various faults when the fault impedance is varied. The maximum DPDT is 25 millisecond and minimum DPDT is 5 millisecond.

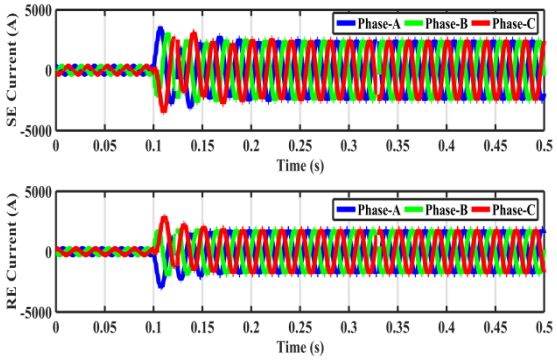


Fig. 6. Both ends currents during ABCG fault at FAT=0.05 s.

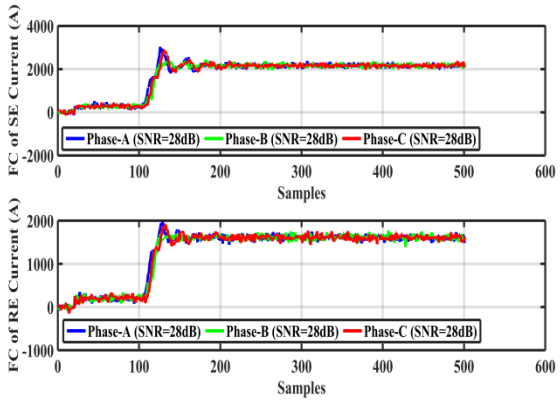


Fig. 7. Noisy signals recorded at both ends during ABCG fault with SNR=28 dB.

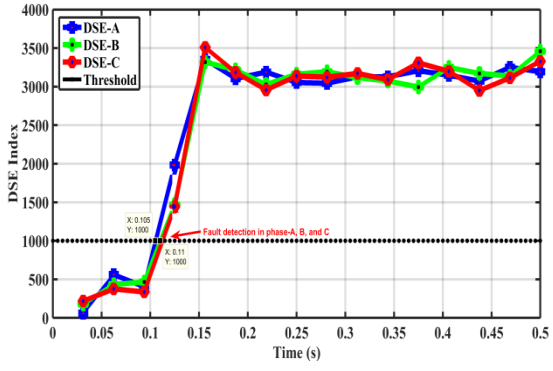


Fig. 8. Fault recorded in ΦA, ΦB and ΦC with DPDT=5 ms (ΦA) and DPDT=10 ms (ΦB and ΦC).

TABLE III. DSEI ABSOLUTE VALUES WHEN FAULT IMPEDANCE IS VARIED

Situation	SNR (dB)	FI (Ω)	DSEI Absolute Values		
			DSEI (ΦA)	DSEI (ΦB)	DSEI (ΦC)
ABCG	28	5	3.3523 $*10^3$	3.4586 $*10^3$	3.5097 $*10^3$
ABG	33	15	3.2783 $*10^3$	2.7015 $*10^3$	389.3994
BC	38	25	400.0975	3.4755 $*10^3$	2.3708 $*10^3$
CG	43	35	395.3264	468.7275	2.3168 $*10^3$
BG	48	45	425.4933	2.2101 $*10^3$	394.5162

TABLE IV. DISTORTED PHASE DETECTION TIME WHEN FAULT IMPEDANCE IS VARIED

Situation	FAT (s)	Distorted Phase Detection Time (ms)		
		DPDT (ΦA)	DPDT (ΦB)	DPDT (ΦC)
ABCG	0.1	5	10	10
ABG	0.1	5	10	-
BC	0.1	-	10	25
CG	0.1	-	-	15
BG	0.1	-	15	-

C. *Varying Fault Location*

The scheme is validated for an AB fault initiated at 145 km. The fault application time (FAT) is 0.15 s. Fig. 9 shows both end currents during AB fault. The noisy signals recorded at both ends with SNR (ΦA, ΦB, ΦC) =29 dB are demonstrated in Fig. 10. Fig. 11 shows the plot of fault recorded in ΦA, ΦB and ΦC. The distorted ΦA and ΦB are detected at 0.16 second. The distorted phase detection time (DPDT) in this case is 10 millisecond. Under variation of fault location, the absolute values of DSEI for different types of faults with various SNR are demonstrated in Table V. The SNR input values are varied from 29 dB up to 49 dB. Table VI verifies the distorted phase detection time for various faults when the location of fault is varied. The maximum DPDT time is 20 millisecond and minimum DPDT is 10 millisecond.

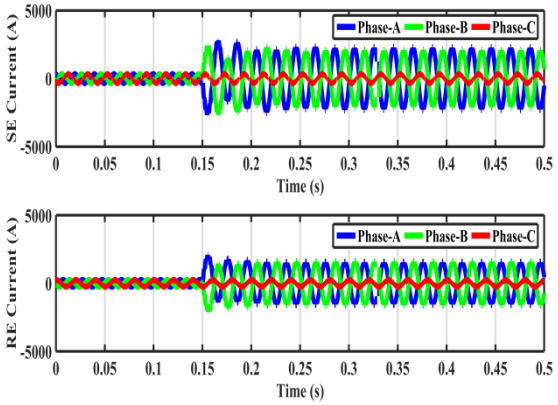


Fig. 9. Both ends currents during AB fault at FAT=0.15 s.

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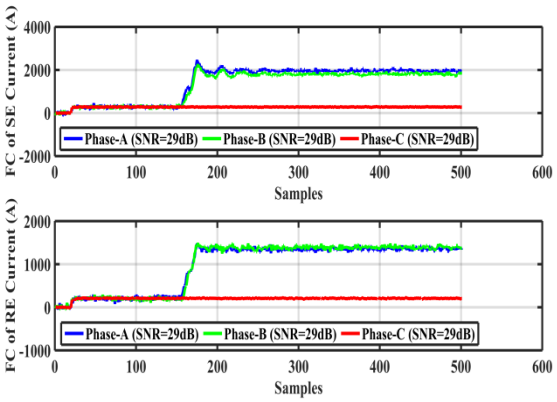


Fig. 10. Noisy signals recorded at both ends during AB fault with SNR=29 dB.

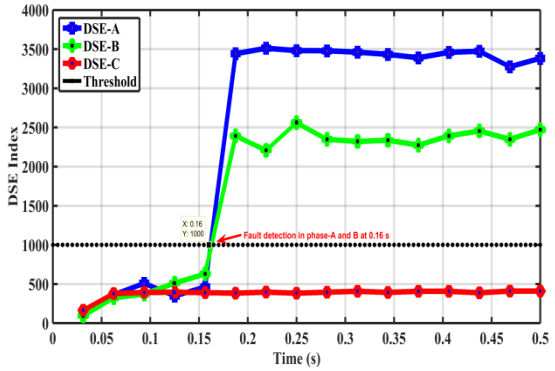


Fig. 11. Fault recorded in ΦA and ΦB fault with DPDT=10 ms.

TABLE V. DSEI ABSOLUTE VALUES WHEN FAULT LOCATION IS VARIED

Situation	SNR (dB)	FL (km)	DSEI Absolute Values		
			DSEI (ΦA)	DSEI (ΦB)	DSEI (ΦC)
AB	29	145	3.5116 $*10^3$	2.5614 $*10^3$	410.1613
AC	34	160	2.2383 $*10^3$	400.8129	3.1892 $*10^3$
AG	39	140	2.6617 $*10^3$	401.5780	397.6563
BG	44	165	389.7357	1.5411 $*10^3$	386.8677
ABCG	49	135	3.8265 $*10^3$	3.7192 $*10^3$	3.7450 $*10^3$

TABLE VI. DISTORTED PHASE DETECTION TIME WHEN FAULT LOCATION IS VARIED

Situation	FAT (s)	Distorted Phase Detection Time (ms)		
		DPDT (ΦA)	DPDT (ΦB)	DPDT (ΦC)
AB	0.15	10	10	-
AC	0.15	15	-	15
AG	0.15	10	-	-
BG	0.15	-	20	-
ABCG	0.15	10	10	10

V. CONCLUSIONS

A protection system for distorted signals detection in transmission line with fixed-series connected capacitors compensation has been presented in this paper. The protection system calculates the difference of spectral energy of distorted current signals using DHWT to identify fault with proper threshold value. The performance of the protection system has been evaluated through extensive fault studies. Simulation results illustrate that the protection system has a great level of accuracy in the different situation such as different fault application time, fault impedance, and fault location. The minimum calculated value of DPDT is 5 millisecond and the maximum calculated value of DPDT is 25 millisecond. Simulation effects presents evidence that the protection system is perfect and reliable from the wide-ranging investigation.

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Chapter 18
New Designs and Analysis of Multi-Core Photonic Crystal Fiber Using Ellipse with Different Radiuses and Angles



Trimesh Kumar, Mayank Sharma and Brijraj Singh Solanki

1 Introduction

Photonic crystal fiber has exposed this firmly established area indicates a vast range of novel optical properties to achieve by using conventional fiber technology [1]. PCF is regularly known as microstructure optical fiber. A systematic air hole in the triangular lattice with the axis of the core is utilized along with the solid core [2]. PCF is characterized by geometric constraints such as holes with hole spacing, pitch, air hole diameter, and air filling portions [3]. PCF's unique manufacturing technology allows accurate modulation of optical properties by changing these geometric parameters. By applying these constraints [4], PCF can be designed to be utilized in a wide range of applications in the field of nonlinear optics [5], optical communication, telecommunications, biomedical sensing, high power technology, and military system. Apart from this, fiber tilt in some applications and properties can be an important issue [6]. Nevertheless, compared to conventional fibers, many air holes in the cladding are much stronger in bending to PCF bending [7].

Based on design details, PCF can be firmly designed for small or large effective mode areas, where small scale or large scale modes area are very powerful or delicate leading to optical nonlinearities [8]. Great mode reduces the loss caused by various nonlinear effects in the area, which limits the performance of upper power systems [9].

In addition, the removal of air holes nearby the core is an alternative technique to increase the core size [10]. The proposed PCF for our knowledge displays the largest effective mode field with some missing air holes to date [11]. It is shown that down doping silica in PCF core can be significantly improved in the effective mode

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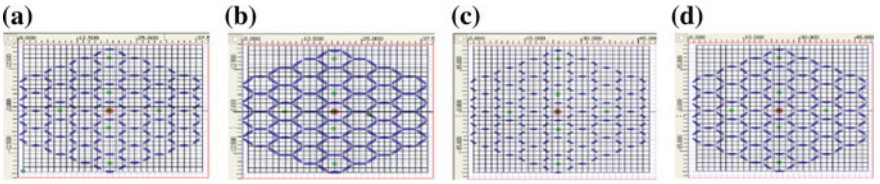


Fig. 1 PCF structure radius of pitch 1.3 and circular **a** ellipse $R = 0.26$ and 1, **b** ellipse $R = 0.3$ and 1.4 and PCF structure radius of pitch 1.6 **c** ellipse $R = 0.26$ and 1, **d** ellipse $R = 0.3$ and 1.4

area [12]. Mostly, studies have shown that while the wide range of wavelengths can be dramatically different in the PCF [13], the reasonable comparison on the specific wavelength shows a light difference in the direction between the effective mode area and the inclination sensitivity [14].

Presently, research for the PCF has been widely searched in an attempt to see and use their broad potential. Mode area is an important section in fiber laser to grow and feel great power systems [15]. In wavelength and structure systems, nonlinear effects are unavoidable and can not be ignored to be systematic. Therefore, it is required to use PCF with a great mode area. For many applications, it is necessary to turn insensitive PCF design which simultaneously displays big mode areas and low confinement loss [16]. In this study, several hexagonal PCF structures are proposed as shown in Fig. 1.

This paper is divided into five sections. Section 1 presents a brief introduction. Section 2 discusses the proposed structure. Section 3 is a simulation and the outcome is discussed in Sect. 4. Comparative analysis is presented in Sect. 4 and paper is concluded in Sect. 5.

2 Proposed Structure

The main objective of the proposed PCF structure is to achieve a larger effective mode area along with grate birefringence and confinement loss. In this regard, various doping levels have been used in Fig. 1a–d to improve the effective mode area and reduce the loss of the prison. We have designed four hexagonal structures; different ellipses radiuses are used name wise R_1, R_2, R_3, and R_4. They are given the different values $R_1 = 0.26$ μm, $R_2 = 1$ μm, $R_3 = 0.30$ μm, and $R_4 = 1.4$ μm. These are structure design by two pitch values $\Lambda = 1.3$ and $\Lambda = 1.6$. Wavelength is 0.7–1.8 μm. These three different angles are using <450, <1350, <1800.

These four designs are converted by ref. index. The position of the hexagonal structure radiuses and pitch values used is shown in Fig. 2a–d.

In this section, we propose a new design of index guided photonic crystal fiber. The proposed geometry of index guided PCF design is shown in Fig. 1a–d. The proposed hexagonal-shaped PCF structure consists of one circular ellipses waveguide of two radiuses ($R_1 = 0.26$ μm and $R_2 = 1$ μm) and pitch value 1.3 μm. The second

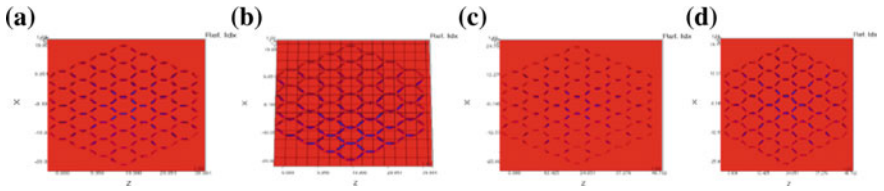


Fig. 2 PCF structure for ref. index pitch 1.3 **a** ellipse $R = 0.26$ and 1, **b** ellipse $R = 0.3$ and 1.4. ref. index pitch 1.6 **c** ellipse $R = 0.26$ and 1, **d** ellipse $R = 0.3$ and 1.4

innermost ring consists of circular air ellipses of fixed radius ($R_3 = 0.30$ μm and $R_4 = 1.4$ μm) and pitch value 1.6 μm.

For simulation propose, circular radius of PCF is kept constant at diameter $D_1 = 0.4$, $D_2 = 0.46$, $D_3 = 0.0.325$, and $D_4 = 0.375$ μm and wavelength varied 0.7 and 1.8 μm for calculates refractive index and electric field distribution with polarization. Simulation is carried out for getting effective electric field distribution and polarization with a variable axis for low confinement's loss and grate birefringence.

We have investigated the various papers for the optical fiber properties of the proposed PCF in hexagonal structure. The different types of loss are:

2.1 Dispersion

$$D = \frac{\lambda}{c}\frac{d^2 n_{\text{eff}}}{\mathrm{d}\lambda^2} \tag{1}$$

2.2 Birefringence

We have reduced the polarization of photonic crystal fiber birefringence should be the most high coupling. The different modes of real-valued part of the effective index of the two modes in x, y direction the define is birefringence in Eq. 2.

$$B = \left|\mathrm{Re}\left(n_{\text{eff}}^{y}\right) - \mathrm{Re}\left(n_{\text{eff}}^{x}\right)\right| \tag{2}$$

The effective refractive index (n_{eff}) of proposed fiber Eq. 3.

$$n_{\text{eff}} = \frac{\lambda}{2\pi}\beta \tag{3}$$

where λ define is a wavelength and β is a propagation constant. This is the real part and imaginary part, respectively, used to find birefringence and confinement loss and both are effective refractive index compromised.

2.3 Beat Length

It is Eq. 4 beat length of the fiber.

$$L_B = \frac{\lambda}{B} \tag{4}$$

where B is the birefringence and λ is wavelength using.

2.4 Confinement Loss

Confinement loss part of the proposed parameter photonic crystal fiber and from the measuring dB/km is the loss of the fiber that can be calculated by using Eq. 5.

$$CL = 8.686\frac{2\pi}{\lambda}\mathrm{Im}(n_{\mathrm{eff}}) \tag{5}$$

where n_{eff} is the effective index and Im is the imaginary part of Eq. 5.

3 Analysis of Simulation and Result

Using the multi-core, final proposed geometry of PCF as per Fig. 1a–d is simulated consisting of wavelengths 0.7–1.8 μm. Pitch factor is kept $\Lambda_1 = 1.3$ μm and $\Lambda_2 = 1.6$ μm from center to center at different spacing between two air ellipses to get characteristics of lattice. They are given the different values $R_1 = 0.26$ μm, $R_2 = 1$ μm, $R_3 = 0.30$ μm, and $R_4 = 1.4$ μm. The proposed structure by circular radius of PCF is kept constant at diameter $D_1 = 0.4$, $D_2 = 0.46$, $D_3 = 0.0.325$, and $D_4 = 0.375$. Some angles are using <45°, <135°, <180°. The proposed structure is uploaded via a refractive index for 3D mode and corresponding results obtained are projected in Fig. 3a–d. The result justifies that dispersion is very less and proper coupling of signal can be achieved to the best extent. It further justifies the uniform distribution of electric field distribution (Table 1).

The proposed simulation may be used in applications were mininezion dispersion is at most important, confinements loss and grat Birefringence with polarization. We

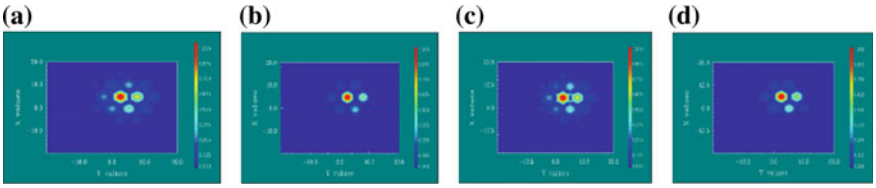


Fig. 3 Polarization pitch 1.3 **a** ellipse $R = 0.26$ and 1, **b** ellipse $R = 0.3$ and 1.4 and polarization pitch 1.6 **c** ellipse $R = 0.26$ and 1, **d** ellipse $R = 0.3$ and 1.4

have observed the effect of changing the hole-to-hole spacing on the effective area curve, keeping the pore areas of all three structures the same.

The effective index was found to be a modal solution of optical analysis. Figure 4a, b shows the combined results of the effective index and wavelength function for all types of PCF. A PCF having an elliptical hole shows a higher effective refractive index than a PCF with multi-core ellipse having angles <45°, <135°, <180° PCF with core exhibits higher values than elliptical holes PCF. It was found that the effective mode index decreases as the wavelength increases.

Figure 5a, b shows the confinement loss when the core area changes by 1 and 5%. In this case, the ellipse pitch remains fixed for all 1.3 μm PCF. PCF with ellipse radiuses of $R = 0.26$ and 1; a reduction in the area of the cores was observed to reduce the effective area. For PCF with elliptical, we noticed that the increase in core size reduces the value of the effective area.

As can be seen from Fig. 6a, b, the birefringence increases with increasing wavelength.

At a wavelength of 0.7–1.8 μm are used of the hexagonal geometries, the ellipse Fig. 6a aperture PCF has a birefringence of very high, the porosity PCF has a birefringence of low, and Fig. 6b a aperture PCF has a birefringence of 0.0010. Among the three types of PCF, PCF with an elliptical hole showed the highest value of birefringence, and PCF with a round hole showed the lowest value of birefringence. At a wavelength of 1500 nm, the circular aperture PCF has a birefringence of 3.000e−006, the porosity PCF has a birefringence of 0.0018, and the rectangular aperture PCF has a birefringence of 0.0010. Among the three types of PCF, PCF with an ellipse hole showed the highest value of birefringence, and PCF with a round hole showed the lowest value of birefringence.

4 Comparative Analysis

The comparative analysis of the proposed designs with other designs clearly shows the effectiveness of our design, which is a multi-core, modified photonic crystal fiber. The variation in radius of the air holes is cussed as a result we can see the dispersion level in all cases, i.e., low as compared to single-core design. We further compared

Table 1 Some parameters are used in over of our proposed PCF structure simulation result with other work

Wavelength	Pitch (Λ) = 1.3				Pitch (Λ) = 1.6			
	$R_{1.1}$ = 0.26 μm and $R_{1.2}$ = 1 μm		$R_{2.1}$ = 0.3 μm and $R_{2.2}$ = 1.4 μm		$R_{3.1}$ = .26 μm and $R_{3.2}$ = 1 μm		$R_{4.1}$ = .3 μm and $R_{4.2}$ = 1.4 μm	
	Real(n_{eff})	Im(n_{eff})	Real(n_{eff})	Im(n_{eff})	Real(n_{eff})	Im(n_{eff})	Real(n_{eff})	Im(n_{eff})
0.7	1.55729161	0.00000001	1.55703775	0.00000002	1.55842986	−0.00000004	1.55822758	−0.00000003
0.8	1.55642215	0.00000001	1.55608207	0.00000002	1.5579126	−0.00000003	1.55764107	0
0.9	1.55545488	−0.00000001	1.55501058	0	1.5573333	−0.00000001	1.55362441	0.00000001
1.0	1.55439353	0	1.5538248	0	1.55669361	−0.00000001	1.55133115	0
1.1	1.55324393	0.00000001	1.55253251	0	1.55599837	−0.00000001	1.54954428	0
1.2	1.55201785	0.00000004	1.55113531	0.00000001	1.55525691	0	1.54954428	0.00000001
1.3	1.5507203	0.00000011	1.54963915	0.00000004	1.55447868	0.00000004	1.54553929	0.00000003
1.4	1.54937508	0.00000024	1.54804892	0.00000009	1.55365982	0.00000006	1.54332853	0.00000006
1.5	–	–	1.54637031	0.00000014	1.55282752	−0.00000001	1.54098347	0.0000001
1.6	–	–	1.5446178	0.00000022	1.55196155	−0.0000002	1.53850753	0.00000019
1.7	–	–	1.554425592	0.00020814	1.55107974	−0.00000082	1.53590394	0.00000032
1.8	–	–	1.55425592	0.00015067	1.55023242	0.00000068	1.53317575	0.00000052
1.9	–	–	–	–	–	–	1.53032608	0.00000082

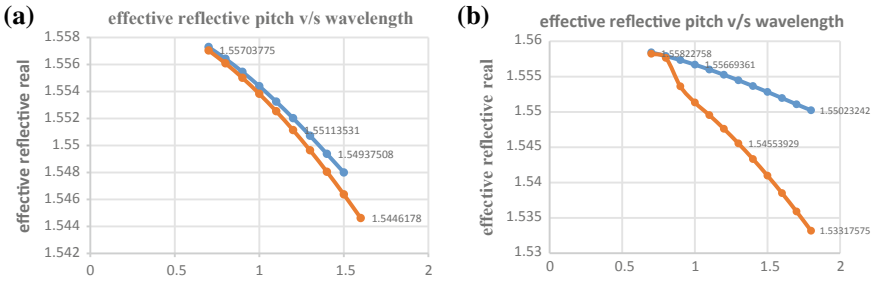


Fig. 4 **a** Effective reflective pitch 1.3 (a) ellipse radius using $R_{11} = 0.26\ \mu m$, $R_{12} = 1\ \mu m$, $R_{21} = 0.3\ \mu m$ and $R_{22} = 1.4\ \mu m$. **b** Effective reflective pitch 1.6 (a) ellipse radius using $R_{31} = 0.26\ \mu m$, $R_{32} = 1\ \mu m$, $R_{41} = 0.3\ \mu m$ and $R_{42} = 1.4\ \mu m$

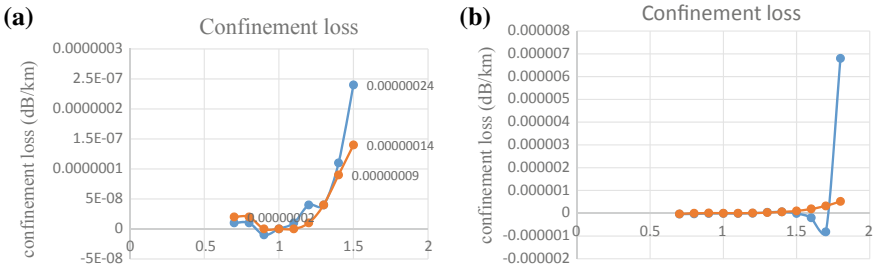


Fig. 5 **a** Confinement loss pitch 1.3 (a) ellipse radius using $R_{11} = 0.26\ \mu m$, $R_{12} = 1\ \mu m$, $R_{21} = 0.3\ \mu m$ and $R_{22} = 1.4\ \mu m$. **b** confinement loss pitch 1.6 (a) ellipse radius using $R_{31} = 0.26\ \mu m$, $R_{32} = 1\ \mu m$, $R_{41} = 0.3\ \mu m$ and $R_{42} = 1.4\ \mu m$

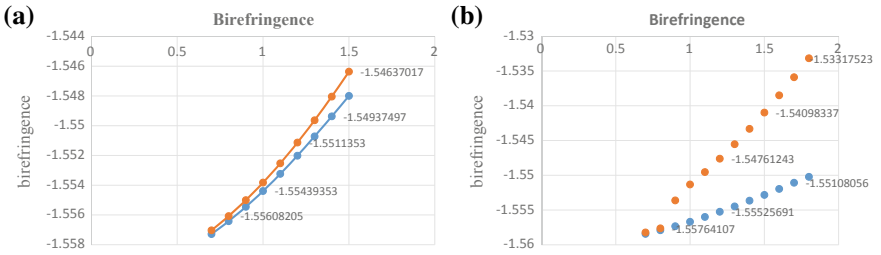


Fig. 6 **a** Birefringence pitch 1.3 (a) ellipse radius using $R_{11} = 0.26\ \mu m$, $R_{12} = 1\ \mu m$, $R_{21} = 0.3\ \mu m$ and $R_{22} = 1.4\ \mu m$. **b** Birefringence pitch 1.3 (a) ellipse radius using $R_{31} = 0.26\ \mu m$, $R_{32} = 1\ \mu m$, $R_{41} = 0.3\ \mu m$ and $R_{42} = 1.4\ \mu m$

with the waveguide pattern which was scattered in single-core design is now become uniform in multi-core design (Table 2).

The change in shapes from rectangular to hexagonal has given the result as a reduction in confinement loss with were medium in single-core designs now become low in multi-core design.

Table 2 Comparison of our proposed PCF structure result with other work

Wavelength	Pitch (ʌ) = 1.3		Pitch (ʌ) = 1.6		Other
Dispersion	Medium	Low	Medium	Low	Large
Electric field distribution	Scattered	Uniform	Scattered	Uniform	Uniform
Waveguide patten	Scattered	Uniform	Scattered	Uniform	Scattered
Shapes	Hexagonal	Hexagonal	Hexagonal	Hexagonal	Octagonal
Material	Silicon	Silicon	Silicon	Silicon	Germanium
Confinement loss	Medium	Low loss	Medium	Low loss	Medium
Birefringence	Uniformly Medium	Uniform high	Uniform medium	Uniform high	Uniform low

5 Conclusion

Four geometries are described generally by the total ellipse hole and a core of circle in the refractive index with polarization. This is a process with the show, as all result is profitable for the core region is proposed and analysis by optiFDTD simulation. We have all results observation and when ellipse radius using $R_{31} = 0.26\ \mu m$, $R_{32} = 1\ \mu m$, $R_{41} = 0.3\ \mu m$ and $R_{42} = 1.4\ \mu m$ of core and cladding high, angle between <45°, <135°, <180° low pitch values 1.3 and 1.6 μm. Low dispersion and low confinement loss with polarization. With the given flat birefringence and low confinement loss curve for all wavelength. We have knowledge of all simulation with different and fine results. It can be said that there is almost minimal dispersion by both *X* and *Y* polarization at the wavelength of the multi-core area for the structures.

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Study of MSPA in Aspect of design & Parameter with Three Different Substrate Materials

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***Abstract*— In this paper we want to present a comparison of different parameters with different substrate materials. Here we are presenting a design and simulation of E shape H shape of an antenna that is micro strip patch. For realization of this design, we are using a glass epoxy substrate with dielectric constant 4.2. & its thickness is of 1.6 mm and the plane is considering finite ground plane. The antenna is made by two different substrate materials using epoxy-Kevlar material& another material is fr4-epoxy. For fulfillment of this purpose we are using glass epoxy Substrate here, its thickness is of 1.6 mm and dielectric constant is 4.2, and finite ground plane. So it is observed that, effect of change in base material or substrate material of antenna, than it will the cause of different change in parameter of an antenna parameter like radiation pattern, bandwidth, return loss, VSWR, &gain.**

Keywords*— *Micro strip patch antenna; dielectric constant; loss tangent; Co-axial fed; micro strip patch antenna, antenna gain, antenna efficiency, power loss; reflection coefficient of antenna; VSWR of antenna

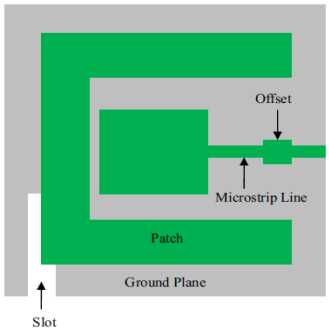
I. INTRODUCTION

Today is the time of new technologies, so the new research &rapid development in wireless communication systems is very much useful in various fields. It requires the demand for such type of antennas, who is having wideband operating frequencies with high gain. So, the micro strip patch antenna is a device that can be transmit or receives electromagnetic waves. A micro strip patch antenna is small in size & raised of a radiating patch on one side of dielectric substrate while has a ground plane on the other side [1]. Any material which is having the dielectric constant from 2.2 to12 can be used as substrate. The permittivity of eoxy-kevlar is 3.6.Microstrip patch antennas can easily be integrated with the microwave integrated circuits [3].A micro strip patch antenna has several advantages comparatively to other antennas. They also have some unique that they are very light in weight, having low profile, low cost and low volume. This paper presents a comparison between E shape, H shape & C shape patch antenna for enhancing the impedance bandwidth. The permittivity of used material is 4.4. We are using FR4-epoxy here for this simulation.

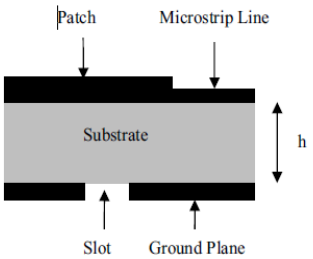
II. ANTENNA DESIGN

The main &very important parameter is dielectric constant of the substrate that is related to the bandwidth and the size of an antenna. In this paper my aim to represent the effect of different materials of different dielectric constant is how matters in the designing of an antenna &substrate produce larger bandwidth.

A. First design



(a) Top view of the antenna.

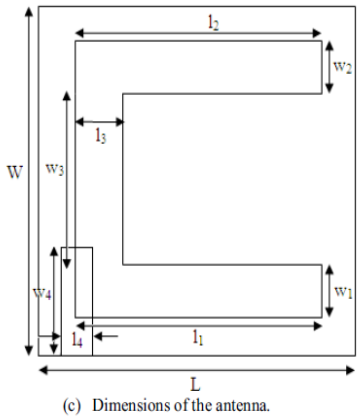


(b) Side view of the antenna.

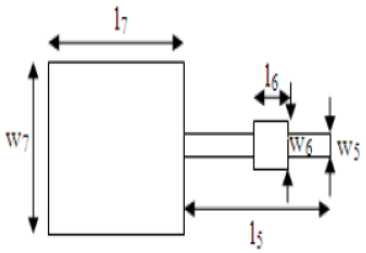
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(c) Dimensions of the antenna.



(d) Dimensions of the microstrip line feed.

Fig. 1 Dimensional cross sectional view

Table 1. The proposed patch antenna design parameters.

Parameter	Value [mm]	Parameter	Value [mm]
W	60	w_4	22
L	40	l_4	5
w_1	5	w_5	2
l_1	30	l_5	8
w_2	5	w_6	4
l_2	30	l_6	2
w_3	20	w_7	16
l_3	5	l_7	20

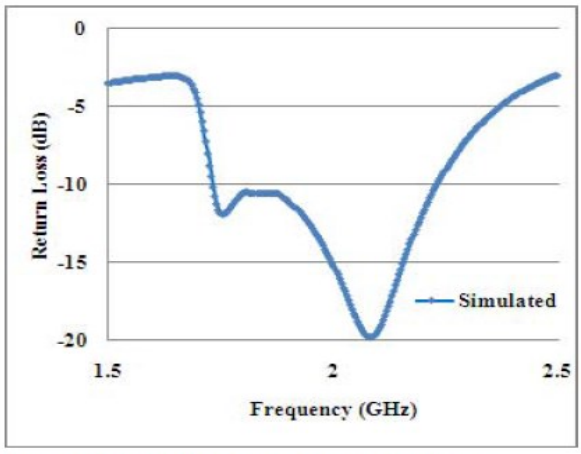


Fig.2. Simulated return loss of the proposed antenna.

The proposed design is a c-shape micro strip patch antenna with dielectric constant 4.2. Here I am using substrate is glass epoxy having the height h of 1.6 mm. The geometry of an antenna is shown in figure 1.All views are available in the figures (b), (c), (d) respectively. The dimensions like width & length are represented by W and L. Here we taking ground plane is finite. The different lengths & widths are shown by l_1,l_2,l_3 & w_1,w_2,w_3. The coordinates of the vertical center are (5, 11). . The feeding is of 50 ohms. Feeding technique causes the enhancement of BW. An offset is present in the middle of the feed line. The designing parameters for the proposed antenna is presented in Table 1.The proposed antenna is simulated for -10 dB return loss &impedance bandwidth of 25% is achieved.

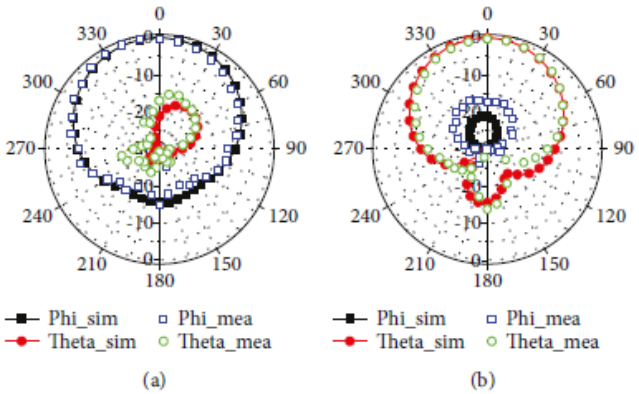


Fig-3. Measured Radiation Pattern of antenna

B. Second Design:-

In the second design, we are presenting a microstrip patch antenna with H-shape. The substrate is having the dimension of 58mm * 49.4mm. By cutting H shape slot, we acquire very different results. The patch is of 38mm * 20.74mm size. For feeding purpose we are using coaxial feeding technique.1.6mm is the thickness of the substrate using for this.

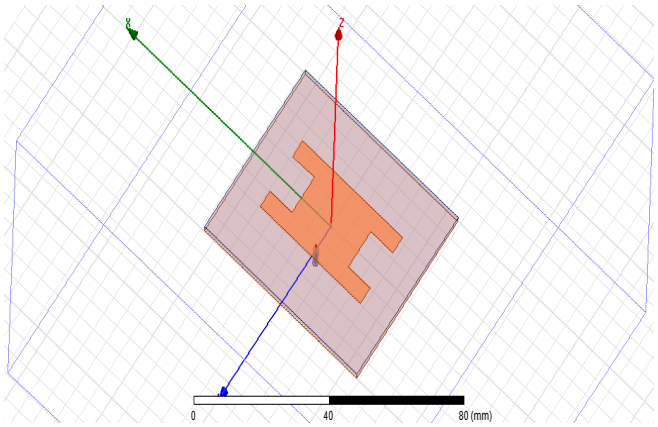


Fig- 4 Design of H shape antenna

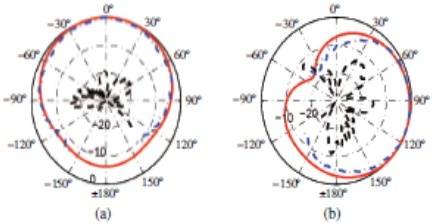


Fig- 4 Measured Radiation Pattern of antenna

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Using fr4 as a substrate material simulation results:-

For simulating the proposed design, we are using CST Software. For designing of this antenna, we are using FR4 as substrate material. It is well known that the dielectric constant of FR4 is 4.4. For this H shape antenna the operating frequency is 2.40 GHz. At this frequency, we are having return loss is -15.07 dB & gain is 1.43 dB In the Fig.2, we can see the plot of reflection coefficient (S11) Vs. frequency. It is clear to see, the antenna is resonate at the frequency of 2.37 GHz &the ending working frequency is 2.42 GHz In this situation bandwidth of antenna is 44 Mhz.

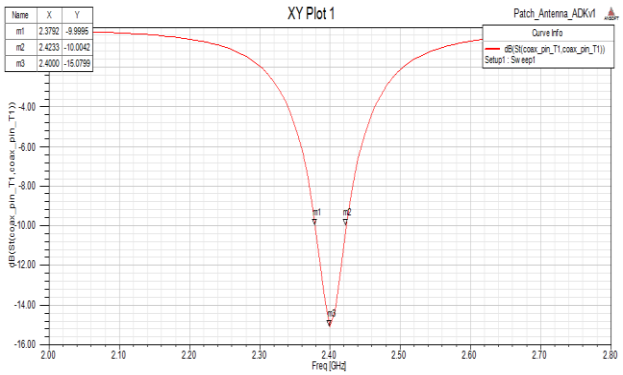


Fig. 5 Return loss with gain margin

Using Kevlar material as a substrate material & it's Simulation results:-

Now, for optimization the results we will do some changes in the substrate material with same shape the dielectric constant of the substrate material is 3.6, & the name of material used is Kevlar. For better performance, the feed position is also changed from previous one. In this case, the antenna resonates at the frequency of 2.45 GHz. In this case the return loss is -11.06 dB, & starting working frequency is 2.451 GHz & ending working frequency is 2.46. GHz. In this case the band width is 13 MHz the results are shown in graph:-

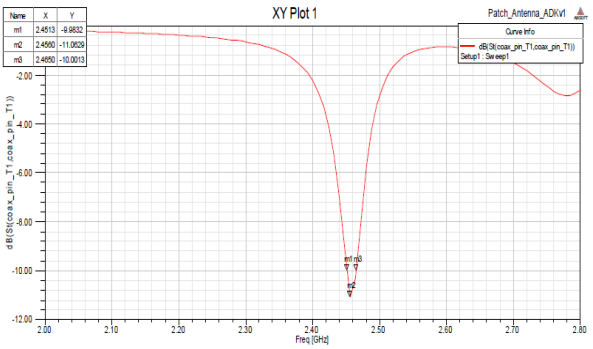


Fig 6. Curve on resonating frequency

C. Third Design:-

Now, we are proposing the next design, this is an E shaped antenna as it is shown in Fig. The size of the substrate of 41mm x 31mm. The patch is made of E shape with two arms of the size 8.5mm x 3.5mm. Middle arm ishaving the dimensions like 8.5mm x 7.5mm. The feeding technique for this design is co-axially fed. The thickness of the substrate is1.5mm & represented by (H).

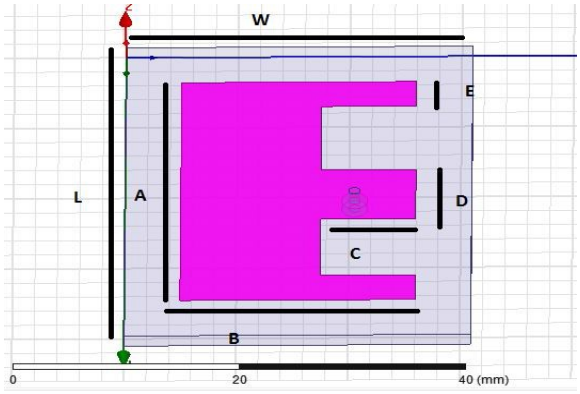


Fig- 7 Design of E- shape antenna

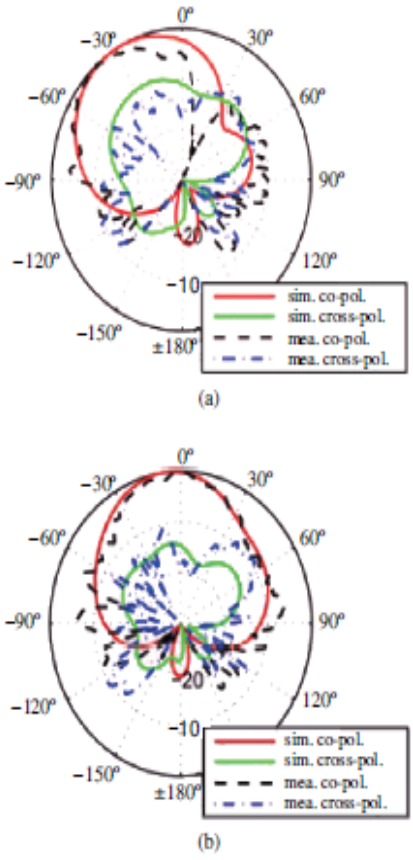


Fig-8 Measured Radiation Pattern of antenna

Using Fr4 As Substrate Simulation Results:-

For simulation purpose of above design, we are using FR4 as a dielectric material with dielectric constant 4.4. In this proposed design the operating frequency of the antenna is 9.8 GHz. We can see the return loss is -21.4158dB. By changing the material of substrate the gain is 4.45 dB, which is very useful & good. This antenna is radiating very efficiently

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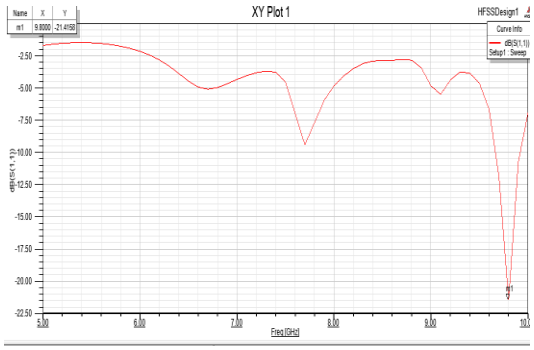


Fig- 9 Return Loss curve

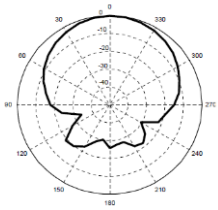


Fig-10 Measured Radiation Pattern of antenna

Using Kevlar material as Substrate Simulation Results:- If we use epoxy-Kevlar as a substrate material, which is having dielectric constant 3.6. The rest design is same as previous one. In the proposed design, antenna is resonating at 10.8 GHz. In this situation the measured gain is6.2916 dB & the return loss is -21.2481dB. The simulated results are shown below.

TABLE II TABLE FOR COMPARATIVE STUDY

S. No.	Shape	Material used	Dielectric constant	Return Loss	Resonating Frequency
1	C-Shape	Glass Epoxy	4.2	-20.23 dB	2.1 GHz
2	H-Shape	(a) Fr4	4.4	-15.07 dB	2.40 GHz
		(b) Kelwar	3.6	-11.06 dB	2.46 GHz
3	E-Shape	(a) Fr4	4.4	-21.41 dB	9.8 GHz
		(b) Kelwar	3.6	-21.24 dB	10.8 GHz

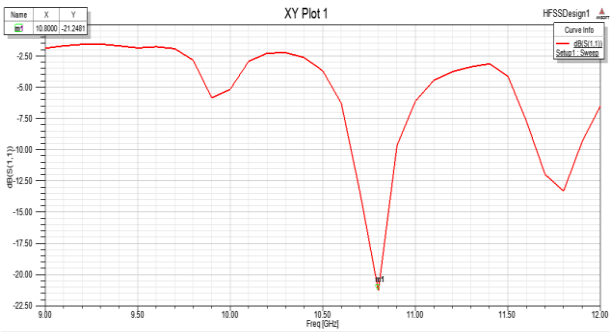


Fig.11 Curve of return loss with gain margin

III. CONCLUSION

In this paper, we are trying to optimize the results with different shapes & base materials, like C shape, E shape, H shape micro strip antenna three different substrate materials. We want to enhance the gain and bandwidth. Here we are presenting a table for the same-

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Optimal Parameter Selection for Multi Blade Granite Block Cutting Machine Ensuring High Production

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***Abstract*— The stone processing industry has a very huge market in world. There is only three basic need of a human i.e. food, clothes and shelter, where stone covers big part of shelter, hence the requirement is also high. Basically most of the stone processing industries in India are small scale industry. The basic detail about the stone cutting machine is discussed and along with that a brief overview about granite, its future outlook and current scenario is also discussed in this paper. The study of cutting of granite block by using multi blade circular saw is studied and the process parameters of the multi blade cutting machine is discussed like number of blade, depth of cut, & cutting speed. In this study, the experiment is conducted on two different materials namely Malpura Black & Rajasthan Black. The number of blades and depth of cut is varied through the experiment and result obtained in the terms of production, cost of electricity and cost of segments is discussed in detail. The results were then used to train the data in PLC unit of the machine in order to preset the cutting feeds for Malpura Black and Rajasthan Black material cutting.**

Keywords*— Granite Cutting Machine, Multi Blade Cutting, Optimal Parameter Selection

I. Introduction

In India there is a huge deposit of all type of dimension stones. It is the largest producer of the dimension stone in world [1]. Over one million workforces are involved in this industry. This industry plays vital role in economy of many states of India [2]. Granite is light coloured plutonic rock made of feldspars, plagioclase, quartz and different type of mafic minerals like biotite, hornblende, pyroxene, iron oxides, etc [3]. But if we look at it in a commercial way, these are those all crystalline rocks which have pleasing colours, strength to bear the process of quarrying and cutting and polishing and are used commonly for decorative purposes [4-5]. As compared with marble, granite is more resistant to wear and tear as well as weathering, granite is more sought after stone to be used as building as well as decorative stone, this is because of its mirror like polish, high compressive strength, longevity and beauty [6]. India is second largest exporter of raw granite after China and ahead of Brazil and South Africa. India ranked fifth in export of processed product [7-8]. As discussed above that India has a huge deposit of granite, hence there are huge number of plants operating and doing quarrying, cutting, polishing the material and making monuments etc [9]. The present demand of the product is not about the quantity but it's about the quality and good quality starts with the good and healthy machinery involve in the processing [10]. In this paper the Optimal Parameter for a Multi Blade Granite Cutting Machine is discussed. As in order to get the good quality product, parameters for operating the machine is the most important part of it [11].

II. Types of Granite Cutting Operations

In this section different type of granite cutting process are discussed.

A. Circular Peripheral Cutting

In Circular peripheral cutting via multi blade cutting machine there is a series of different diameters blade starting from 3.5-meter diameter and the diameter of the smallest blade diameter is 0.42 meter. In Fig. 1[12] a multi blade cutting machine with 9 blade set is shown, this is a three axis machine in which the bridge moves left and right, the main box moves to and fro for cutting and the spindle moves up and down for the cutting depth feed [13].



Fig. 1 Multi Blade Granite Block Cutting

B. Reciprocating Cutting

In reciprocating cutting via gang saw machine there is a series of steel straight cutters placed adjutant to each other and there could be up to 80 cutters, and on them the diamond segments were installed and the frame moves to and fro to cut the granite, in granite gang saw machine the trolley on which the block is placed moves up in the direction as a cutting feed and the frame is fixed. The motion which the cutting frame makes is known as coarse run[14]. In the fig. 2. is shown

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Fig. 2 Granite Gang Saw

C. *Linear Motion Cutting*

In linear motion cutting via multi wire saw machine there is a series of diamond wire fitted on the drum and that rotates in a clockwise motion at high rpm which provide the surface speed of 27 m/s. Diamond beads were feed in the steel wire at a gap of 35mm to 40mm. This type of machine can have wire up to 82 nos [15]. In Fig. 3, a wire saw is shown

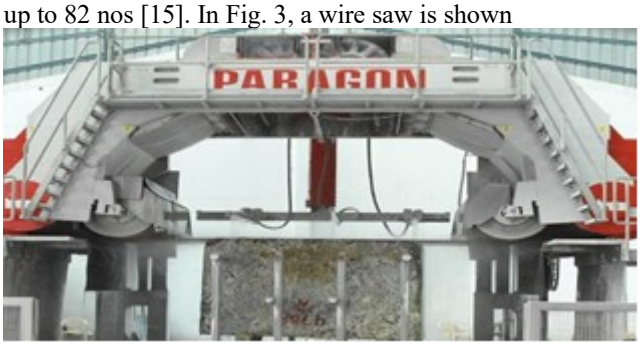


Fig. 3 Multi Wire Saw

Flow chart is shown in figure 4

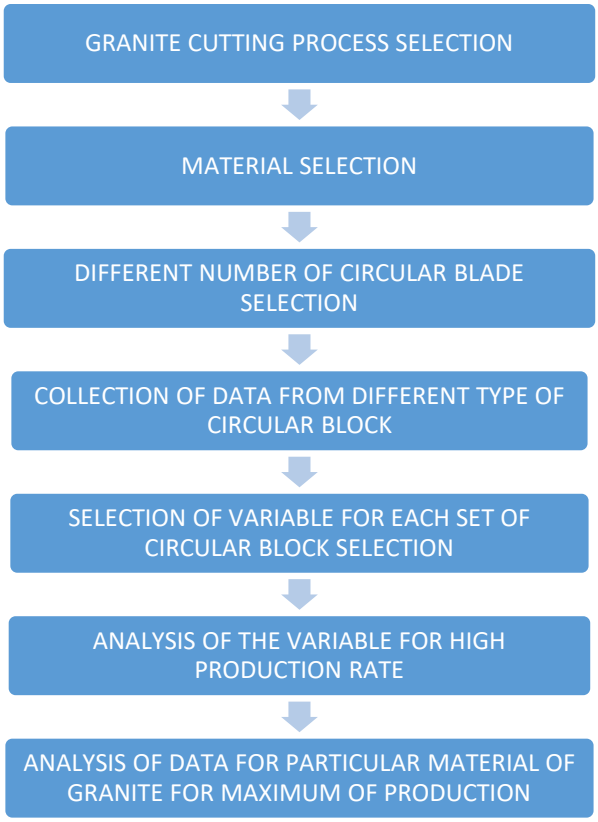


Fig. 4 Flow Chart of Experiment

III. Selection of Machine, Material & Parameters

For the experiment, a multi blade circular saw machine is selected in which different sets of blades can be installed e.g. 5 blades set, 9 blades set and 10 blades set. The technical detail about the machine is given in Table 1. The Fig. 4 shows the working of cutting machine. A data is collected for every new block cutting for a fixed duration of 10 hours a day hence in this experiment the time is a fixed constraint throughout the experimental procedure. Sometimes the size of the block is big and in order to cut the complete block it takes more than 10 hours hence the data of production is collected for 10 hours only. The cutting parameters of the multi blade cutting machine is listed in Table 2.

TABLE 1 SPECIFICATION OF MACHINE

Machine Name	Multi Blade Block Cutter
Machine Manufacturer	Shri Bhagwati Machines Pvt. Ltd.
Machine Model	Metro B12
Spindle Motor	75 H.P
X- Axis Motor	3 H.P.
Z- Axis Motor	5 H.P.
Y- Axis Motor	2 H.P
No of Blade	12 Blades Maximum

TABLE 2 PARAMETERS OF THE MACHINE

S. No.	Parameter Name	Unit of Measure	Formula (if (any)
1	Cutting Speed	m/min	(r.p.m) * (π x dia. of pinion)
2	Cutting Feed	mm/cut	As per the feed value
3	Cutting Slab Size	mm/cycle	As per the slab size
4	Segment Bond	Soft/Hard	
5	Blade Set	5/9/10 (nos.)	
6	Water Flow Rate	liter/min	As per the pump spec.
7	Material Density	Kg/m^3	NA
8	Spindle Speed	r.p.m.	
9	Blade Alignment	mm	
10	Material Hardness	Mohs	
11	Condition of Spindle Bearing	Ok/ Not Ok	
12	Condition of X-Axis Bearing	Ok/ Not Ok	

During the experiment the flow of water is kept constant at the delivery head of 3 meter by a 5 Hp pump, the segment was kept same of the same manufacturer “Vinayka Diamond Segments”, and the cutting time is kept constant as discussed above i.e. 10 Hour. The experiment was conducted and as shown in the above flow chart, the results were obtained for the production in every possible combination of variation of variable. The image of Rajasthan black and Malpura black granite is shown in Fig. 5 & Fig. 6.

A. *Experimentation and Data Collection*

From the data collection it is clear that the two different type of granite i.e. Malpura Black and Rajasthan Black is experimentally tested for cutting via circular saw multi blade machine under three different type of blade sets viz. 5 Blade set, 9 Blade set, 10 Blade set of different diameter of the maximum blade size 3.0 meter., 2.284 meter, & 2.394 respectively.

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Fig. 5 Rajasthan Black



Fig. 6 Malpura Black

The sub variable in the cutting parameter is depth of cut and that also is varied as 1.5 mm, 2.0 mm and 3.0 mm and simultaneously the production as well as the other parameter like current drawn, thickness of blade, gully thickness, segment thickness and r.p.m. of the y axis is noted.

The cost of electricity per unit is taken as Rs. 7 and the cost of segment is taken as Rs. 49.04. The complete experiment is divided into six segments made up of the two different types of granite and in that two different type of granite, each of them were cut by three different types of circular blade saw sets, and in each blade set cutting the depth of cut is a variable which is varied in three different values. The experiment is iterated for 6 samples in each set and then the average values of the results were taken in the results to overcome the error of machine and other parameters.

IV. Result Discussion

Performance of machine is evaluated by varying the depth of cut, number of blade & material and the effect is noted and plotted on the production, cost of electricity & cost of segment. In Fig. 7, Performance of machine is evaluated when number of blades is 5. It can be seen from the figure that Rajasthan Black production is high as compared with the production of Malpura Black for the depth of cut of 3mm. The density of the Rajasthan Black is softer and it's less dense as compared with Malpura Back. The production amount of Rajasthan Black is 966.55 Sq. ft. & production amount of Malpura Black for 438.39 Sq. ft.

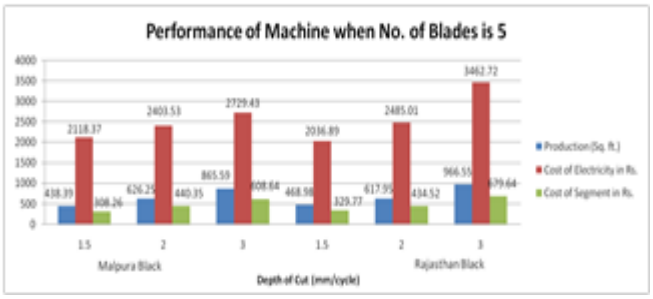


Fig. 7 Performance of Machine when Material is varied and No. of Blade is 5.

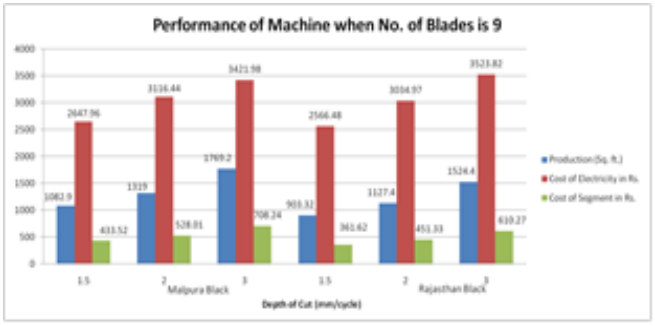


Fig. 8 Performance of Machine when Material is varied and No. of Blade is 9

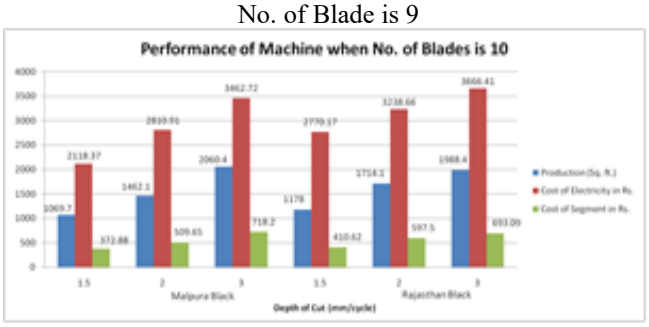


Fig. 9 Performance of machine for varying material and No. of Blade is 10

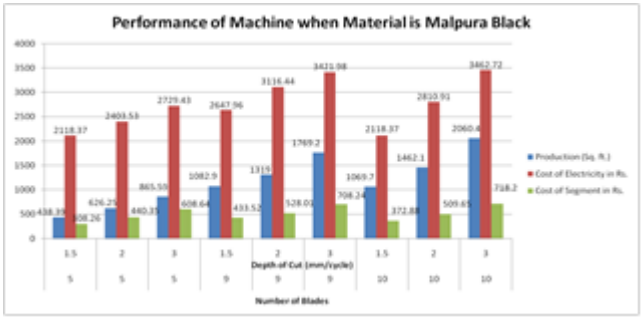


Fig. 10 Performance of Machine when Material is Malpura Black

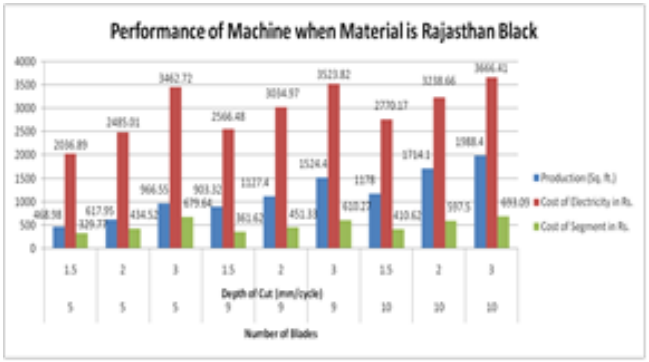


Fig. 11 Performance of Machine when Material is Rajasthan Black

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Performance of machine is shown when the number of blades is 9, the value of production of Malpura Black is high as compared with Rajasthan Black. In Fig 9, Performance of Machine is shown when the number of blades is 10, the value of production of Malpura Black is high as compared to Rajasthan Black. The detail about the optimum result of parameter optimization of the multi blade cutting machine is discussed in conclusion.

V. Conclusion

A. For Material Malpura Black

In 5 blade experimentation: optimum production is achieved by 3 mm D.O.C. and the value of production is 865.59 Sq. ft., cost of electricity is Rs. 2729 & cost of segment is Rs. 608.

In 9 Blade experimentation: The optimum production is achieved by 3 mm D.O.C. and the value of production is 1769.17 Sq. ft., cost of electricity is Rs. 3421 & cost of segment is Rs. 708.

In 10 Blade experimentation: The optimum production is achieved by 3 mm D.O.C. and the value of production is 2060.39 Sq. ft., cost of electricity is Rs. 3462 & cost of segment is Rs. 718.

B. For Material Rajasthan Black

In 5 Blade experimentation: The optimum production is achieved by 3 mm D.O.C. and the value of production is 966.55Sq. ft., cost of electricity is Rs. 3462 & cost of segment is Rs. 679.

In 9 Blade experimentation: The optimum production is achieved by 3 mm D.O.C. and the value of production is 1524.44 Sq. ft., cost of electricity is Rs. 3523 & cost of segment is Rs. 610.

In 10 Blade experimentation: The optimum production is achieved by 3 mm D.O.C. and the value production is 1988.38 Sq. ft., cost of electricity is Rs. 3666 & cost of segment is Rs. 693.

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Effect of Process Parameter on Plastic Parts Using ANOVA with Moldflow Simulation



Kalpit Jain, Devendra Somwanshi, and Akshay Jain

Abstract This research work has been conducted on polypropylene (PP) material using Moldflow Adviser (MFA). Moldflow Adviser (MFA) has been used to contemplate and confirm the impact of procedure boundaries and advance the volumetric shrinkage and fill time. Streamlining of procedure boundaries is finished using L27 design of experiments (DOE). Further, analysis of variance (ANOVA) has been conducted. Ideal blend of procedure boundaries is represented by ANOVA. Two unique combinations of sprue and sprinter framework are utilized for simulation. Analysis of variance shows that packing pressure is most huge variable for volumetric shrinkage in both of the cases. Regression model conditions for volumetric shrinkage and fill time are likewise created in this investigation. It will assist little with micro industry in improving nature of an injection molded plastic parts.

Keywords Volumetric shrinkage · Regression model equations · ANOVA

1 Introduction

For building up the thermoplastic materials on higher production rate, plastic injection molding (PIM) is most significant method which has gigantic dimensional control[1]. PIM is most critical methodologies for assembling the plastic items due to top part surfaces, short product cycles, and lightweight [2]. In PIM, a framework is a client intelligent framework giving a well-disposed condition to the end-client for providing essential data from the framework [3]. The location of the gate for filling of the mold cavity is very significant effects on warpage. The effect of melt temperature, injection time, and packing pressure is more significant as compared to mold temperature and packing time on fill time [4]. Timon-3D v.6.11 CAE programming was utilized to complete the simulation. The runner, sprue, and gate are

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the segments of the conveyance framework [5]. The metering size, melt temperature, injection rate, and injection pressure influence the thickness of the article [6]. Natural fiber composite material is one of the suitable materials to manufacture window frame [7]. To examine the warpage, the melt temperature and packing pressure are most significant boundaries [8]. The intensity of packing pressures influences the volumetric shrinkage which occurs near the gate at the end of fill location. Lower shrinkage is indicated by higher packing pressure, and high volumetric shrinkage is a result of low packing pressure [9]. Conformal cooling channel is the most appropriate cooling framework for the plastic part among other cooling channels. Flow simulation for various gate size and locations was broke down. Air traps can be limited by giving air vents in center and hole embeds [7]. Holding pressure was the fundamental factor impacting all injection molding procedures and creating varieties of the TR up to 9% for IM, 3.5% for ICM, and 5.5% for VIM. Injection speed was additionally the second most significant factor [8]. PIM is most commonly used method for developing thermoplastic materials [9]. Plastic injection molding machine can be a used to obtain molded product by melted plastic material by heat into a mold. Parametric optimization of machining input parameter is required to get the desired optimized results [10–14].

2 Research Methodology

First step is the planning of simulation-based design of experiments. In the second step, apply Autodesk Moldflow Adviser (MFA) software to conduct MFA simulations based on the planned DOE. To identify most or least significant factors, ANOVA is used as third step.

In the fourth step, regression analysis has been done to find out the statistical relationship between input and output parameters. Once the regression has been done, modeling equations for output parameters have been generated using residual analysis.

In this investigation, a typical material was chosen for item making and determination depended on absolutely writing audit and statistical surveying, and material name was polypropylene (PP). L27 orthogonal array has been used for data analysis on two different sprue and runner locations. In this investigation, five input parameters with three levels have been used. L27 OA has been used for design of experiment. Primary reactions from all tests were volumetric shrinkage, and fill time of item chose. Two designs of sprue and runner were utilized in this investigation, which are shown in Fig. 1a and b.

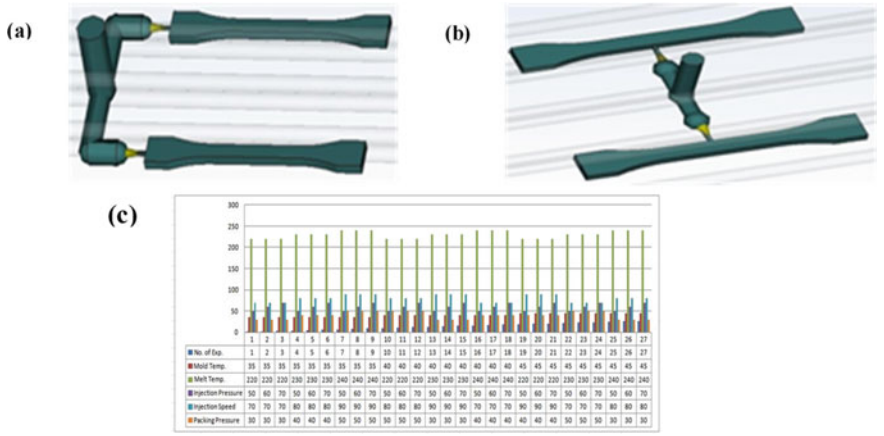


Fig. 1 **a** Sprue location at side for Case 1**, b** sprue location at center for Case 2, **c** orthogonal array for Case 1 and Case 2

2.1 Factors and Levels Along with Orthogonal Array

Design of experiments table was just conceivable by determination of proper factors and their levels. In this research work, five input parameters with three levels have been used which have been shown in Table 1.

Response parameters for this investigation are volumetric shrinkage (%) and fill time (s). Here, L27 has been used for five parameters and their three levels for each parameter.

3 Experimental Result and Analysis

The simulated values of fill time and volumetric shrinkages have been shown in Fig. 2a and b for both cases 1 and 2, respectively.

Table 1 Factor and level for case 1 and Case 2

Levels	Mold temp.	Melt temp.	Injection pressure	Injection speed	Packing pressure
1	35	220	50	70	30
2	40	230	60	80	40
3	45	240	70	90	50

Units: temperature in °C, pressure in Mpa, injection speed in %

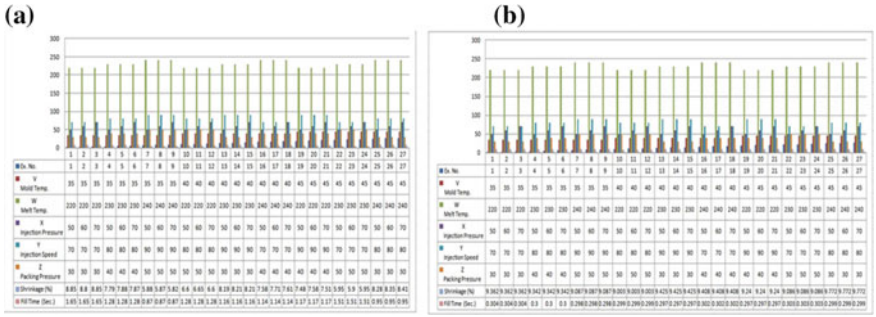


Fig. 2 **a** Shrinkage and fill time values for Case 1, **b** shrinkage and fill time values for Case 2

3.1 Analysis of Variance (ANOVA)

The analysis of variance (ANOVA) was determined for the two cases, and results were appeared in Tables 2 and 3. F-test was directed for contrasting a model variance and a residual variance in ANOVA examination. *F* esteem was determined by isolating a model mean square by residual mean square value. On the off chance that *f* esteem was drawing closer to one method, the two differences were same, concurring F esteem most noteworthy was ideal to discover basic input parameter.

From literature review, it has been found that *P* esteem has exceptionally little (under 0.05) at that point the terms in the regression model have a huge impact to the reactions.

Table 2a and b has shown one important result that F-value for regression models is very high (Table 2 *F*-value was 73.20 for Case 1, and like Table 3, *F*-value was 358.92 for Case 2) than P-value is very less (approx. 0.0000) suggested that all parameters are significant.

3.2 Regression Equation

In this study, regression equations were also obtained from Minitab for both cases, for both responses volumetric shrinkage and fill time.

Regression equation for shrinkage for Case 1

$$\begin{aligned}\text{Shrinkage} = 18.45 - 0.0245 * \text{V} \ - 0.01905 * \text{W} \ + 0.00118 * \text{X} \\ - 0.01358 * \text{Y} \ - 0.11627 * \text{Z}\end{aligned} \tag{1}$$

Table 2 Comparison analysis of ANOVA results of shrinkage for Case 1 and Case 2

	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
Source	DF		Adj. SS		Adj. MS		*F*-value		*P*-value	
Regression	5	5	25.5921	1.228	5.1184	0.2456	73.2	58.77	0	0
V	1	1	0.2699	0.04712	0.2699	0.04712	3.86	11.28	0.063	0.003
W	1	1	0.6532	0.21912	0.6532	0.21912	9.34	52.43	0.006	0
X	1	1	0.0025	0	0.0025	0	0.04	0	0.851	1
Y	1	1	0.3318	0.00541	0.3318	0.0054	4.75	1.29	0.041	0.268
Z	1	1	24.3346	0.95634	24.3346	0.95634	348	228.85	0	0
Error	21	21	1.4685	0.08776	0.0699	0.004179				
Total	26	26	27.0605	1.31576						

Table 3 Comparison analysis of ANOVA results of fill time for Case 1 and Case 2

	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2	Case 1	Case 2
Source	DF		Adj. SS		Adj. MS		*F*-value		*P*-value	
Regression	5	5	1.27532	0.000163	0.255064	0.000033	29.9	358.92	0	0
V	1	1	0.01491	0.00004	0.01491	0.00004	1.75	46.35	0.2	0
W	1	1	0.65677	0	0.656773	0	77	1.38	0	0.254
X	1	1	0	0	0	0	0	0	1	1
Y	1	1	0.59809	0.000158	0.59809	0.000158	70.12	1746.36	0	0
Z	1	1	0.00554	0	0.005544	0	0.65	0.5	0.429	0.489
Error	21	21	0.17912	0.00002	0.00853	0				
Total	21	26	1.45444	0.000165						

Regression equation for shrinkage for Case 2

$$\begin{aligned}\text{Shrinkage} = 7.416 &+ 0.01023 * V + 0.01103 * W - 0.000 * X \\ &- 0.00173 * Y - 0.02305 * Z\end{aligned} \tag{2}$$

Regression equation for fill time for Case 1

$$\begin{aligned}\text{Fill time} = 7.376 &- 0.00576 * V - 0.01910 * W + 0.00 * X \\ &- 0.01823 * Y - 0.00176 * Z\end{aligned} \tag{3}$$

Regression equation for fill time for Case 2

$$\begin{aligned}\text{Fill time} = 0.32902 &- 0.000097 * V - 0.000008 * W + 0.0 * X \\ &- 0.000297 * Y + 0.000005 * Z\end{aligned} \tag{4}$$

Residual results for regression equations have been shown in Fig. 3a and b, respectively. The residual result shows the differences between simulation and predicted results.

Figure 4 shows that the normal probability plot is near to the straight line, so it is residual.

4 Conclusion

The point of this investigation is to advance MFA simulation results for mold flow plastic injection process. This investigation uses L27 orthogonal array for informative investigation on two distinctive sprue and location of runner. In this investigation, analysis of variance (ANOVA) and regression analysis were principle input strategies to explain reaction and factor relations emphatically.

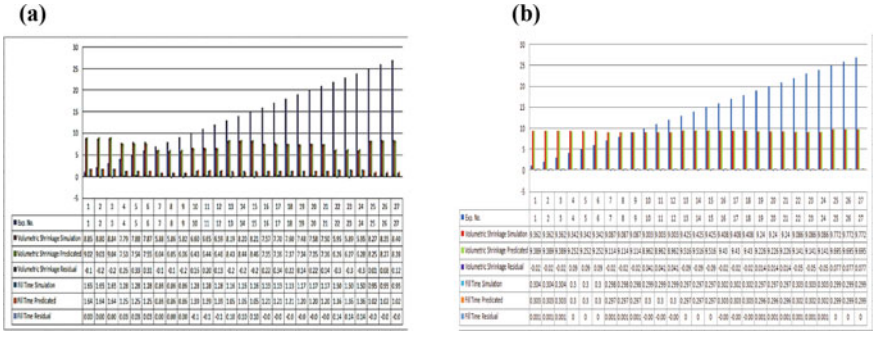


Fig. 3 **a** Residual results for Case 1, **b** residual results for Case 2

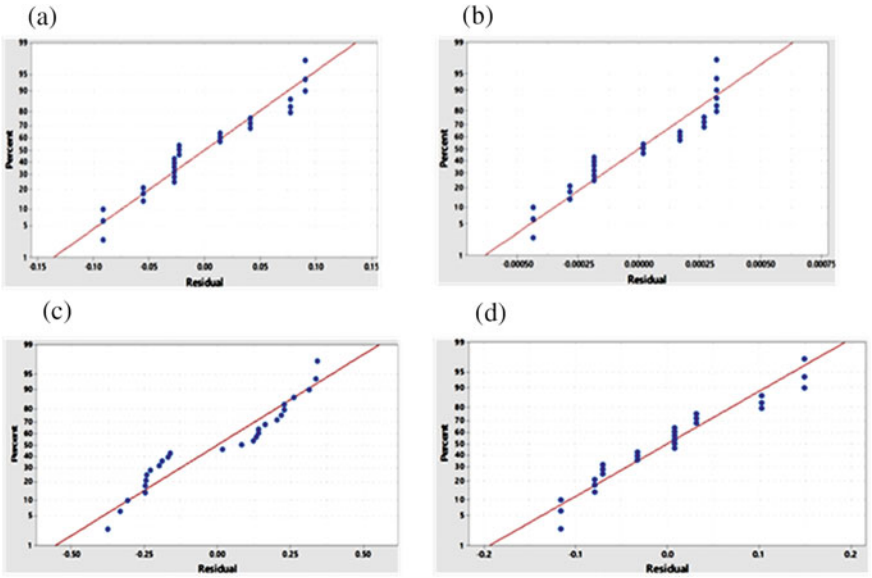


Fig. 4 **a** Case 1 shrinkage normal probability plot, **b** Case 1 fill time normal probability plot, **c** Case 2 shrinkage normal probability plot, **d** Case 2 fill time normal probability plot

ANOVA outcomes demonstrate that the packing pressure is major noteworthy factor for volumetric shrinkage for Case 1 and packing pressure with melt temperature was most critical element for volumetric shrinkage for Case 2. Like that for fill time, melt temperature and injection speed were most critical variables for Case 1, and for Case 2, mold temperature and injection speed were most noteworthy elements.

Model conditions related to fill time and shrinkage were anticipated precisely with Minitab programming and show 90% great forecast for reactions and can be utilized by any plastic injection molding procedure producer.

5 Future Scope

In this investigation, two cases were examined utilizing symmetrical cluster idea, structure change depended on sprue, and location of runner, yet in this investigation, sprue and runner were fixed for all reproduction cases for both cases. For future work, it will be a great way to deal with study factor change dependent on geometrical difference in sprue and runner framework.

ANT colony and response surface optimization can be used for prospect investigation to get the better consequences of process related to plastic injection molding.

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Analysis of Diseases in Plant's Leaves Using Deep Learning Techniques



Abhilasha, Vaibhav Vyas, Vijay Singh Rathore, and Neelam Chaplot

Abstract Diseases can be identified in plants through visualizing roots, leaves and stem for abnormalities. It has always been an area or interest for researchers and scholars. With the help of modern computer programming based image detection methods farmers can detect diseases accurately and work on resolving them. In this paper our focus is on introduction of various deep learning methods, based on image processing. We would focus on doing a comparative study of working processes and capabilities of different models already developed by researchers.

Keywords Machine learning · Deep learning · Computer Vision · Convolutional neural networks

1 Introduction

India is a major developing economy. Approx 65% of the country's population for livelihood is dependent on agriculture directly or indirectly [1]. Because of diseases and insects plant's leaves are infected resulting in major losses to farmers. At the start of twenty-first century as a result of various pests there was a loss in tonnages [2]. In Fig. 1 we can see higher damages in year 2017 and 2019 due to weeds in agriculture. Plant diseases do also contributed as major reason of loss in year 2017 and 2019, 15-17% respectively [3]. This is not an avoidable issue it is a serious in nature because agriculture ultimately affects economy.

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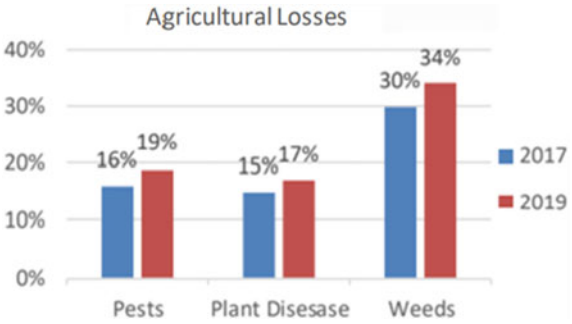


Fig. 1 Factors in agricultural losses in years 2017 and 2019 [3]

Artificial Intelligence thorough Machine learning is applied in most fields of Science and Technology using techniques such as computer vision or image processing. Deep learning, which is considered sub-segment of machine learning, has made incredible advances [4–14] in the area of Health, Agriculture, Medical science, Computers and so on recently. With the help of DL technology, users can detect diseases very easily with minimal human intervention thus reducing of wastage of men power. That will also help in figuring diseases timely so preventive measures can be taken. Many researchers have used different Convolutional neural network models to do their work while changing the ratio of train data and test data sets [15]–16]. Researchers use Computer vision with Deep learning approach to figure out diseases in plants. The major aid of this paper is as below:

- We categorize related work of deep learning applications in disease identification through leaves in two sections. First one from year 2015 to 2017 and second from year 2019 to 2020.
- We summarize deep learning Basic process.
- We categorize Models of CNN which are required for Deep learning Process.
- We give concise details of well-known platforms of deep learning.

2 Related Work

In order to detect diseases precisely, Researchers have employed a lot of technique by means of machine learning, pattern recognition and Deep learning. Here we present various deep learning techniques used by researchers in leaves' disease identification in plants. Rothe et al. [17] suggested an approach that uses pattern recognition system for categorization of cotton leaves. Three different diseases of cotton leaves are picked up in this work. Captured image of infected leaf is used as input. Image segmentation is performed on this using Active contour model and then feature extraction using Hu's moments. It can ascertain infected leaf by classifier, which uses back propagation algorithm for image test and train. Accuracy of this system is 85%. Wang et al. [18] proposes a deep learning approach to automatically do fine-grained classification of apple black rot images in an image dataset. Processing

includes image processing, resizing, pixel value division. Augmentation is used to overcome over fitting problems with images. Transfer learning is also used in this paper. Accuracy of this developed system is 90.4%. Liu et al. [19] introduced an approach to identify apple leaf disease. It involved image processing using direction disturbance, light disturbance and PCA jittering. This model focuses on Alexnet model by taking out few fully connected layers and adding up polling layer, which introduces GoogleNet Interception structure applying the NAG algorithm. Accuracy of this approach is 97.62%. Mique et al. [20] proposed a CNN approach for disease identification through rice leaf. He developed an android application for mobile which is helpful for farmers in detecting rice diseases. In this paper researcher did not develop new model but retrained inception v3 model by supplying images. Accuracy of this model is 90.9%. Arivazhagan et al. [21] suggested an approach for mango leaf disease. Five types of diseases can be picked up using this model. Proposed model uses CNN, which consist input layer, output layer and three hidden layers. Hidden layer having conv layer, pooling, ReLU, dropout and normalization layers. Accuracy of proposed CNN model is 96.67%. Zhang et al. [22] proposed an approach for maize leaves. 9 different diseases of maize leaves can be identified using this proposed approach. In this paper GoogLeNet and ciffer 10 CNN models were used. In CNN model some parameters are changed such as increased recognition correctness by raising the diversity of pooling operations, the adding of a Relu function and dropout operations, and with multiple adjustments of the model parameters. Accuracy of proposed CNN model is 98.8%. Zhang et al. [23] focal point on deep learning Convolutional neural networks with transfer learning for tomato leaf infection using. This CNN network uses Stochastic Gradient Desce and Adam optimization methods. Accuracy of this CNN model is 96.51%. Bhattacharya et al. [24] developed a CNN Model for rice leaf disease, 3 type of rice leaf diseases can be identified using this model. In this model collected images go through image pre-processing and augmentation. In CNN model an input layer, an output layer and two hidden layers are used. Accuracy of this proposed model is 94%. Darwish et al. [25] proposed CNN approach for maize leaf diseases. Orthogonal learning particle swarm optimization (OLPSO) algorithm is used in this paper. In these four phase CNN model work on Data preparation, hyper-parameters optimization, learning, evaluation. Accuracy of proposed model is 98.2%. Desai et al. [26] proposed CNN model having 11 Convolutional Layers and three Dropout layers with keras framework. Two different optimisation Algorithms that are Adam optimization methods and RMSprop are used for training this model. Accuracy of this proposed CNN model is 99%. Dasgupta et al. [27] focused on disease detection in potato leaves. In this proposed Model images taken as input were resized, Images are also retrained by already developed CNN model. Transfer learning algorithm is used in this mode. 100% accuracy is findout when compared with other already developed models. Jadhav et al. [28] proposed a CNN Model for soyabean leaf diseases identification. AlexNet and GoogleNet models have been used in this paper. Few parameters were changed in this which are max epoch, minibatch size, and bias learning rate. Correctness of given model is 93%. Singh et al. [29] suggested an approach which uses mean average precision to evaluate the model nd using labelling tool for creating bounding box around the leaves. The deep

learning backend Keras with Tensorflow platform. Accuracy of proposed model is 99.3%.

3 Deep Learning Basic Process

Computer vision with deep learning is used for identification of diseases through plant's leaves. Basic steps included as part of computer vision to achieve this are acquisition, pre-processing, segmentation step, feature extraction, and classification. After this Convolution neural network is used for two stage, those are training and testing. In training phase CNN model is trained to identify healthy and infected plant leaves. In the testing phase, trained classifier identifies the test image as a healthy section or an infected. In Fig. 2 we show basic steps which are required in computer vision and in Fig. 3 in brief basics Steps of Convolution neural network.

Steps of Image Processing Phase
Acquisition or collection of different images of same plant in different conditions is first step which is performed in deep learning process. Images can be acquired by researcher using camera or can be collected from a research centre. Images are

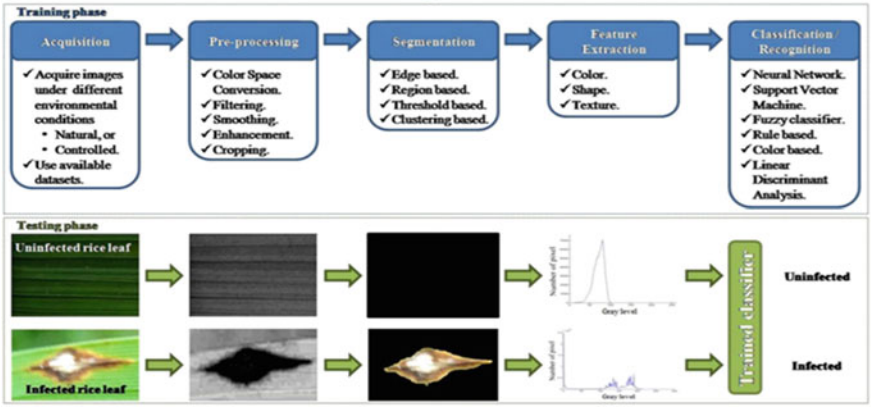


Fig. 2 Steps of image processing in training and testing phase [30]

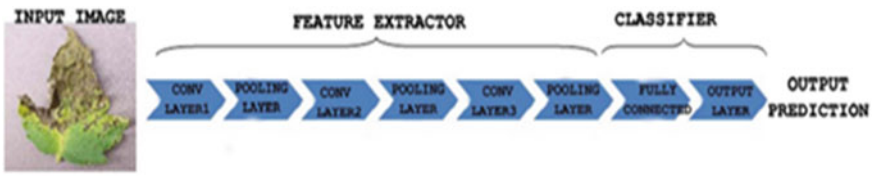


Fig. 3 Phases for disease prediction using convolutional neural network [21]

required for training phase [30–33]. Pre-processing reduces noise and removes bluer images. It includes multiple techniques such as cropping, smoothing, color space conversion, and enhancement. Colour space conversion is followed by filtering, smoothing, enhancement, crop [34–38]. Segmentation determines affected area of leaf using CNN classifier. Technique used are Edge based, Region based, Threshold based and Clustering based [39, 40]. Feature Extraction is used to increase accuracy of Interpretation. Best method for analysis is Texture based image interpretation [41].Classification or Recognition Different types of classification methods are available in CNN such as SVM, Fuzzy, Rule or color based and linear discriminate analysis [42].

Steps of Convolutional Neural Network Phase
Convolutional Neural Network: In CNN Model basic layers are input and output layers which are also called label. Between these layers multiple hidden layer are available. Hidden layers are used according to developed model. Conv layer, pooling, ReLU, dropout and normalization are part of hidden layers. Feature extraction is done by convolution layer and Pooling layer and classification is done by fully connected layer. The main parameters used in CNN are Depth, Stride, Feature map and Zero Padding [21].

4 Deep Learning Platforms

Many platforms such as TensorFlow, Torch,DeepLearning4J, MXNet, keras,Theano,Microsoft Cognitive Toolkit,Caffe and Caffe2 are available to implement or build upon deep learning systems. We describe in brief about platforms used by researchers for diseases identification in plant leaves. Every platform has different characteristic and features.

TensorFlow: It was developed by Google in 2015 and latest version is 2.1.3 that was released this year. Tensor Flow supports deep learning algorithms CNN, GAN, RNN and many more on Linux, windows, MAC, Android systems. Data flow graphs provided by it, edges represent multidimensional data arrays and nodes represent operations. JAVA, C, Go APIs are available in Tensor flow library. High elasticity, exact portability, multi-language maintain, well-heeled algorithm library, and outstanding documents are benefits of it [43, 44].

Caffe and Caffe2: Full form of caffe is Convolution Architecture for Feature Extraction. In 2014 devloped Caffe was deliberated via Berkeley Vision and Learning Center and Berkeley AI Research at UC. It make available expressive architecture and GPU support for deep learning and primarily image classification,. Languages supported in caffe are Python, C++ , and MATLAB. It support Linux, Mac OS X, and Windows. Feeding Data from a file or Preloaded data is used for data input. It supports only CNN. Caffe provides high speed and ease to handle large tasks [45].

Keras: CNN networks can be built using Keras deep learning library in Python with Thenon backend. Its API is written in Python 2.7–3.6. It is user-friendly,

modular, requires less battery power and has an extensible interface. Keras Supports CNN and RNN [46].

OpenCV: OpenCV libraries are available for free. It is used broadly in image processing application for leaf diseases detection. It supports Windows, Mac OS, Linux, and Android. Supported languages are C, C++ , Python and Java. OpenCv basically focus on real time images [47].

5 Convolution Neural Network Model

CNN Models are based on Artificial neural network concept. Main characteristic is to train the process by supervised learning. Feed forward and backward methodology is used as per requirements. In Fig. 4 we can see many CNN models are developed by researchers. Here we describe only mostly used CNN models.

AlexNet Architecture: First developed CNN Models was LeNet but it has many drawbacks so it is not used in too many applications. After LeNet, AlexNet is developed by krishevesky et al. [49] and also won the price in Image Net Large Scale Visual Recognition Challenge 2012.It is having conv layer are 5 by 5, pooling layers are 3 which are followed by fully connected layers are 3. In this AlexNet CNN Model Dropout layer is used to decrease the over fitting issue and with the help of

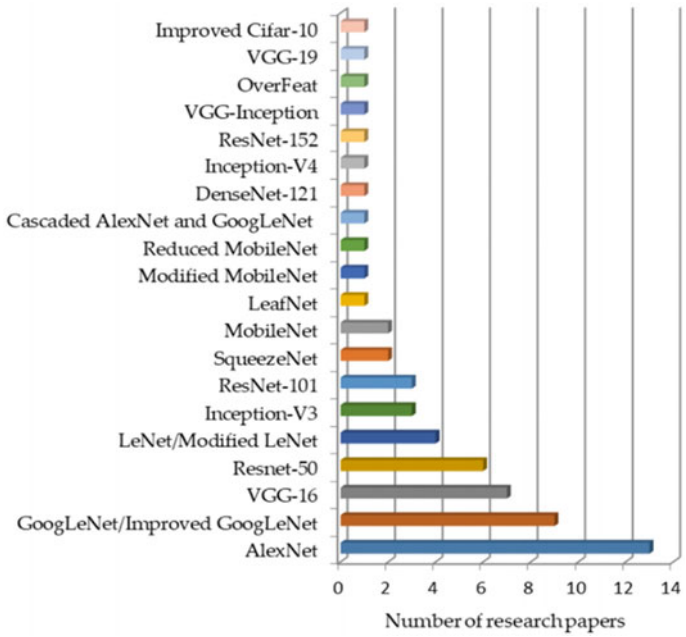


Fig. 4 Different CNN models used by researchers [48]

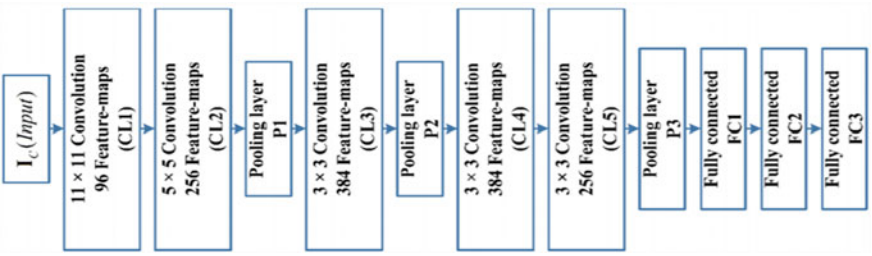


Fig. 5 AlexNet Architecture [50]

Filters convolve the image, and generates feature maps. So Non-linear operations are performed by ReLU which converts all negative values to zero. Pooling Layer used for reduce the Feature map which is introduced by previous layer.Alexnet is efficiently used by many reasearchers for finding diseases in leaves (Fig. 5).

Google net: It is an inception architecture which has a won first award in ImageNet Large Scale Visual Recognition Challenge 2014. Google Net architecture is stacked by inception module total of 9 inception module on top of all, convolution layers 2,Max pooling layers 4, fully connected layer 1, dropout and softmax. Google Net has performed better than AlexNet. It Introduced merge plan, Split transform and block theory [51] (Fig. 6).

VGG net: VGG is modular in layer patterns. It is having Convolution layer, ReLu, Max Pooling after conv to maintain spatial resolution, FC layer with rectified linear unit and in end Softmax layer. VGG supports both image classification and localization problems. Advantages of VGG is ease, homogenous topology, and increased depth but it has 138 million parameters which makes its difficult and expensive [53] (Fig. 7).

ResNet: It is planned to deal with the degradation issue. ResNet won first price in Large Scale Visual Recognition Challenge 2015.ResNet follows stacked residual units by a network-in-network architecture. It is having convolution, pooling, layers.Benifits of using high performance, reduction computing resources and training time. ResNet performs better than VGG due to uses of overall standard pooling rather than FC layers [54] (Fig. 8).

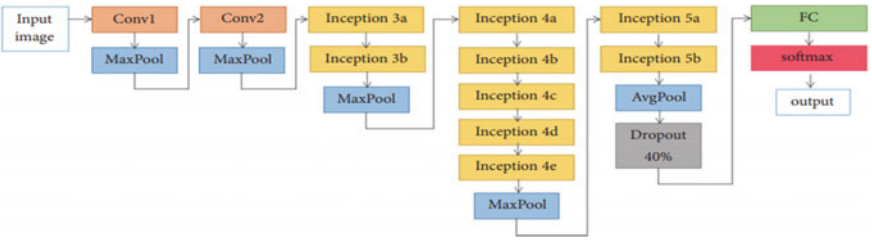


Fig. 6 GoogleNet Architecture [51, 52]

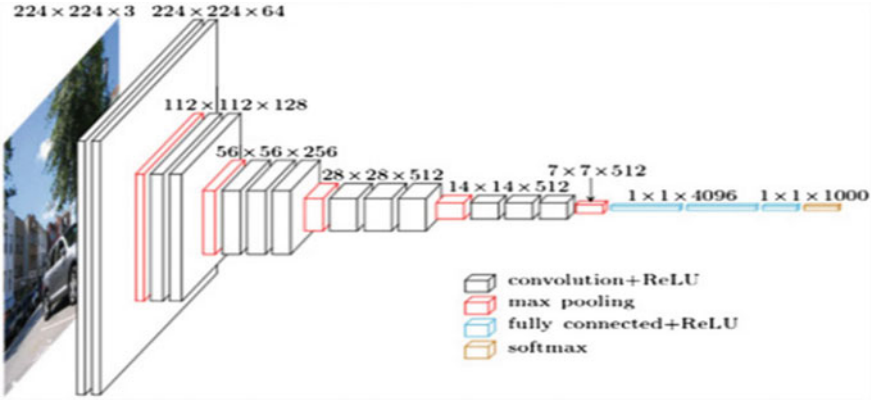
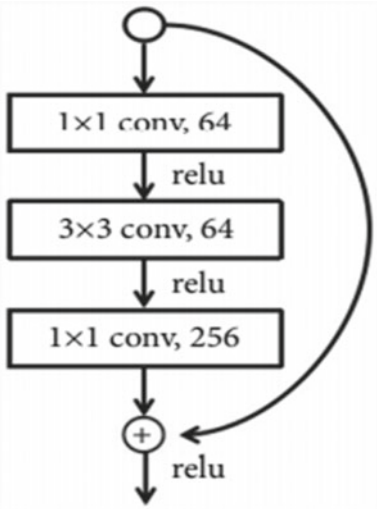


Fig. 7 VGG net model [27]

Fig. 8 ResNet bottleneck residual building block [27]



Inception V4: Inception V<N> here *N* explain version of architecture. It is invented with Convolution and Pooling layers. Pooling layer is used for dimension diminution. Lesser convolutions can raise local character and the larger ones can perceive high-level abstract character [55] (Fig. 9).

Conclusion

Deep learning methodologies are utilised with different choices of computer vision technology. Researchers can develop their own CNN Model or they can customize any exciting CNN Model to identify different plant disease through leaves with high accuracy. As we have known that these developed processes are very helpful to

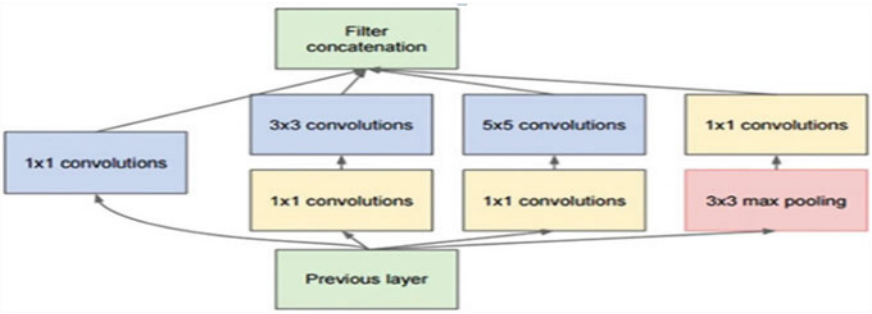


Fig. 9 Inception V4 [27]

farmers in helping them identify diseases in early stage, this can help them to take preventive measures at correct time.

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Failure Analysis of 30 Bus System by Capacitor Sizing and Placement

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***Abstract*—Optimal shunt capacitor placement and sizing or optimal capacitor configuration for distribution system has received considerable attention for researchers from last three decades. In this paper, loss reduction in system using genetic algorithm and particle swarm optimization(PSO) for capacitor placement and sizing are presented. While studying the optimal capacitor configuration problem there is a need to consider a single phase as well as three phase loads with voltage, power factor and harmonic constraints. Distribution system reliability indices in distribution system network is also improved and results of reliability indices are presented. Proposed method for optimal capacitor placement using particle swarm optimization (OCP-PSO) is discussed in this paper. It is observed that losses are reduced in both GA and PSO method.**

***Index Terms*—Optimal capacitor placement; particle swarm optimization; genetic algorithm**

I. Introduction

Transmission line Power losses are reduced by optimal capacitor placement(OCP) method. Other addon profit of OCP are mainly reactive power compensation, improvement in power factor, system reliability improvement and obviously line capacity release. In such cases the problem is the process of finding the location and determining size of the capacitor which is to be placed in a system such that maximum benefits can be achieved. It is well known that capacitor is acting as reactive load locally, they improve load carrying capability of the lines and hence plays the same role as a redundant lines. It must be noted that optimal capacitor configuration may improve reliability indices [1] to [6]. Capacitors are inadequate in discrete sizes and only fixed capacitors are used in distribution system. Calculations of optimal capacitor configuration needs to take into multiple objective functions [7]. The genetic algorithms structure, its application to the capacitor placement problem in distribution systems, and experimental numerical results are discussed in [9]. In most of capacitor placement problem , particle swarm optimization or swarm technology (PSO) and its variants to least-cost generation expansion planning (GEP) is used.

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The PSO are generally available with its variants are generally applied to a synthetic test system. The results obtained are compared with dynamic programming (DP) in terms of speed and efficiency [10]. The impact of network topology on transmission network reliability is analyzed and the usefulness of transmission network reliability indicators is briefly discussed [11]. A PSO approach for finding the optimal size and location of capacitors, which summarizes to determine the appropriate values or rating of fixed and switched capacitors. A dynamic sensitivity analysis method is also popular to select the candidate installation locations of the capacitors to reduce the search space of this problem. In case of more than one location, the dynamic sensitivity helps in deciding other locations considering the effect of previously decided locations and values of capacitors. The harmonics generated by DER devices can cause distortion in power system voltages and currents. In addition to the power quality issues, losses, and component failures harmonics can have an economic impact on distribution networks. Harmonics produced from multiple sources such as solar, wind and energy storage systems is analyzed in [12]. Particle swarm optimization is also utilized for analyzing mixed integer nonlinear reliability problems in series, series-parallel and bridge systems [14]. Overall system reliability, subject to the nonlinear resource constraints consist of system cost, volume and weight are considered to develop hybrid algorithm with the features of advanced genetic algorithm and particle swarm optimization. A Modified Particle Swarm Optimizer (MPSO) based method is discussed in [15] for placement of multiple WPDGs and capacitors. The Capacitor placement issues addressed by many researchers are the process of exactly finding the location, appropriate KVAR size and number of the capacitor to be placed in a radial distribution system such that maximum benefits can be achieved. The Objectives are to reduce the losses in the system and to maintain the desired voltage profile within the limits. The behavior of feeder loads is not known, distribution networks are always complex and uncertainty of distribution companies in spending the initial capital for capacitor placement [16]. Optimal capacitor placement and

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sizing problem has been the topic of many research works in the past five decades. Capacitor banks are inadequate in discrete sizes and only fixed capacitors are used in distribution system calculations of optimal capacitor configuration needs to take into multiple objective functions. This paper **contributes** mainly genetic algorithm and particle swarm optimization method for loss reduction through capacitor placement in IEEE 30 bus system. A novel OCP-PSO software is developed in dot net framework for optimal capacitor sizing and placement. PSO parameters are tuned for getting most appropriate results.

II. Problem Description

IEEE 30 bus system is selected as case study. This system has 41 branches, 30 buses and 5 transformers in addition to 132kV and 33kV transmission network as available. Only 33kV buses are selected for optimal capacitor placement program. A new and efficient approach for loss reduction using optimal capacitor configuration based on PSO tool is developed. All PSO parameters are well set such that proper evaluation on IEEE 30 bus system is carried out. OCP-PSO software is developed to evaluate for optimal capacitor placement problem for the multi-dimensional objective function including reliability cost, cost of capacitor and cost due to power losses. For this research work, a case study of IEEE 30 bus system is selected to implement optimal capacitor placement. In developed software (OCP-PSO) module, all parameters which are evaluated for all number of capacitors as shown in Fig.1. As PSO run in two different modes namely Local and Global. So each constraint studied twice for each mode. At the same time, voltage constraint is studied for two different limits (i) $0.95 < \mathrm{V} < 1.05$ and (ii) $0.9 < \mathrm{V} < 1.1$.

A. Objective Function

Objective function is developed considering reliability cost as one of the factor measurably missed by previous researchers.

$$min_f = ECOST + \sum_{i=1}^{Nbus} CC + C_2 \sum_{i=1}^{Nbus} E_l \tag{1}$$

Where,
ECOST - Reliability cost
CC - *cost of capacitor bank*
E_l - energy loss
For the constraint,

$$V_{min} < \mathrm{V} < V_{max}$$
$$\mathrm{PF} > PF_{min}$$
$$THD_i < THD_{max}$$

Assumptions considered in the development of the objective function are (a) Balanced network considered for simplicity, (b) Capacitors are available in step size and (c) Capacitor placement affects only the flow of reactive power in the feeder. Eq. 1 is the cost function which is required to be evaluated using PSO tool. In this paper Eq. 1 is used considering voltage and power factor as constraints with OCP algorithm techniques. All values of cost function are undergone treatment of regression analysis to develop the equation coefficient for each assigned bus. These coefficients are referred here as PSOFEED search space. PSO finds best capacitor size for given bus using PSO tool.

B. Reliability Cost Function

Reliability cost (ECOST) is mathematically represented by,

$$ECOST = \lambda_i \times C_i \times L(a)_i \tag{2}$$

Where,
λ_i - *failure rate at bus$_i$*
C_i - *customer composite damage function at bus$_i$*
$L(a)_i$ - *average load at bus$_i$*
Eq. 2 represents evaluation of reliability cost based on Failure rate (denoted by λ). This Failure rate is decreased with strengthening power system by means of (i) appropriate management by reactive power with control strategy (ii) Keeping power factor towards unity and (iii) maintaining voltage profile. Failure rate is modified by considering life of transformer and other equipments considering thermal stress. An algorithm is developed for failure rate modification.

C. Capacitor Cost Function

Now, the capacitor cost (CC) is farmulated by,

$$CC = x_i C_{0i} + Q_{ci} C_{1i} + B_i C_{2i} T \tag{3}$$

Where,
x_i - *0/1, 0 means no capacitor installed at bus$_i$*
C_{0i} - *Bank Installation cost at bus$_i$*
C_{1i} - *kVAr cost of capacitor bank at bus$_i$*
Q_{ci} - *Capacitor size (bank) in KVAr at bus$_i$*
B_i - *Number of capacitor banks at bus$_i$*
C_{2i} - *operating cost of per bank, per year at bus$_i$*
T - *Planning period (years)*

D. Energy Loss cost function

Similarly energy loss (E_l) is combination of active power loss (P_{Li}) and reactive power loss (Q_{Li}) as given below,

$$E_l = T_i\left(\sum_{i=1}^{Nbus} P_{loss} + \sum_{i=1}^{Nbus} Q_{loss}\right) \tag{4}$$

First component of Eq. 4 is active power component where as second component is reactive power component treated separately for evaluation of active and reactive power losses.

III. Methodology Implemented

A. Genetic Algorithm

It is critical to minimize cost, while numerically deciding the capacitor size and location. Since this is an improvement issue, a optimization approach is utilized. This is where the ETAP OCP module excel. It is a very amazing powerful tool specifically planned for such issues. The OCP module permits you to put capacitors for voltage backing and power factor

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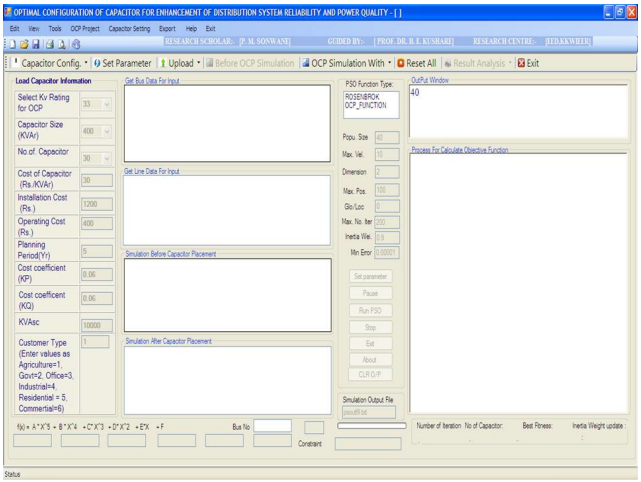


Fig. 1: OCP-PSO software using IEEE 30 bus system

margin, while minimizing overall cost. The serious realistic interface gives the flexibility to control the capacitor position supportive of cess, while allowing to view the results instantly. The exact count approach decides the best place and bank sizes. Moreover, it reports branch capacity release and savings during the planning period due to var loss reduction.

The genetic algorithm is an optimization based technique based on the theory of natural selection. A genetic algorithm begins with a generation of solutions with wide diversity to showcase characteristics of the whole search space. By mutation and crossover, good characteristics are obseved and selected and carry forward to the next generation. The best optimal solution can be reached through repeated generations. OCP uses the present worth method to perform alternative comparisons. It considers initial installation and operating costs, which include maintenance, depreciation, and loss reduction savings. ETAP utilizes the genetic algorithm for optimal capacitor placement.

B. Particle Swarm Optimization tool development

OCP-PSO software is developed to remove the drawback of ETAP software and used a tool PSO rather than genetic algorithm. OCP-PSO software is developed to remove the drawback of ETAP software and used a Particle Swarm Optimization tool rather than genetic algorithm which is used in ETAP. This software is developed in the dashboard format using dot net technology as shown in Fig. 1. Load capacitor information is a module which can be enable for capacitor information. Various parameters like capacitor voltage rating, KVAr rating, maximum number of capacitors, cost of capacitor, installation cost, operating cost, active power cost coefficient, reactive power cost coefficient and customer type can be edited and set for evaluation purposes by pressing Set Parameter tab(button). Upload tab (button) is provided for uploading IEEE 30 bus information of bus and branch data required for evaluation.

IV. Simulation Results and Discussion

TABLE I: Optimal Capacitor Placement Results in PSO

Bus No	No of Particle	Simulation No	Cap No Using PSO
10	4	1	0
12	1	1	0
14	7	1	0
15	10	1	0
16	5	5	4
17	4	1	4
18	9	1	0
19	18	1	0
20	16	1	0
21	5	1	4
22	12	5	6
23	7	1	1
24	9	1	6
25	1	1	0
26	1	1	0
27	14	7	6
29	9	4	3
30	15	1	0

Table I is the result of optimal capacitor placement using PSO tool. Second column is Number of particles provided to PSO, third column is simulation number observed by PSO and last column is the result of number of capacitor placed at bus_i. It is observed that, 34 capacitors of size 400kVAr are required using PSO whereas 70 capacitors of same size is required in genetic algorithm and there is no compromise in loss reduction as well as objective cost as tabulated in Table II.

Second Column of Table II is the result of genetic algorithm based number of capacitor placed at bus_i. Installation cost, operating cost and purchase cost is also tabulated.

TABLE II: Optimal Capacitor Placement Results in GA

Bus	#Cap	kVAR	Installation	Purchase	Operating
BUS 12	8	3200	1200.00	96000	3200
Bus 14	1	400	1200.00	12000	400
Bus 15	2	800	1200.00	24000	800
Bus 16	3	1200	1200.00	36000	1200
Bus 17	9	3600	1200.00	108000	3600
Bus 18	2	800	1200.00	24000	800
Bus 19	5	2000	1200.00	60000	2000
Bus 20	1	400	1200.00	12000	400
Bus 21	23	9200	1200.00	276000	9200
Bus 22					
Bus 23	2	800	1200.00	24000	800
Bus 24	3	1200	1200.00	36000	1200
Bus 25					
Bus 26	6	2400	1200.00	72000	2400
BUS 27					
Bus 29	2	800	1200.00	24000	800
Bus 30	3	1200	1200.00	36000	1200
Total	70	28000	16800	840000	28000

Fig. 2 discusses regarding profit planning of five year planning period. It is concluded that only in first planning period (year) less profit is observed due to huge installation cost, which is recovered in next year and accumulative profit increases continuously as graphically represented in Fig. 3. Reliability index for customer average interruption duration index is graphically represented in Fig. 4. It is observed that customer average interruption duration index (CAIDI) is improved after capacitor placement using PSO technique.

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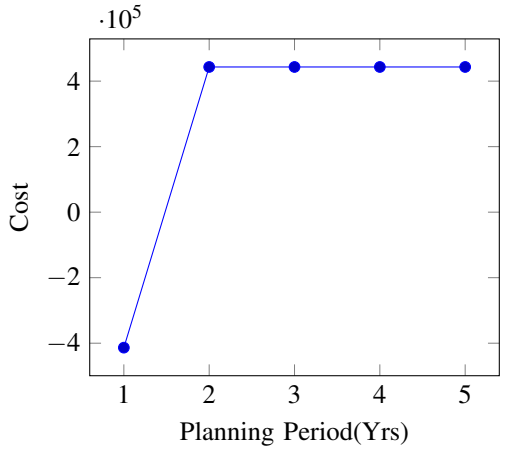


Fig. 2: Profit Planning

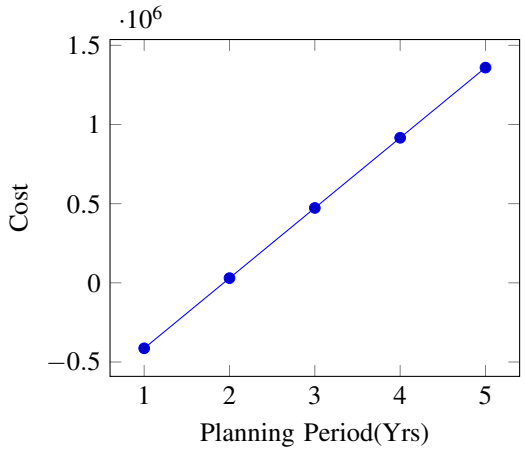


Fig. 3: Accumulative Profit

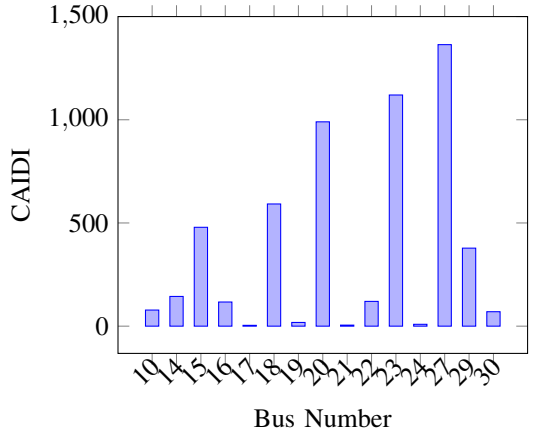


Fig. 4: Customer average interruption duration index

In case of genetic algorithm customer average interruption duration index (CAIDI) improvement is comparatively low. Fig. 5 compares objective function evaluated before and after capacitor placement using proposed method in OCP-PSO software. Objective Functions are evaluated as mathematically represented in Equ. 1. From the graphical representation it is observed that objective function cost after capacitor placement is less as compared with objective function in before capacitor placement. Fig. 6 represents system average interruption duration index. It is observed that system average interruption duration index (SAIDI) is also improved in PSO as well as genetic algorithm equally.

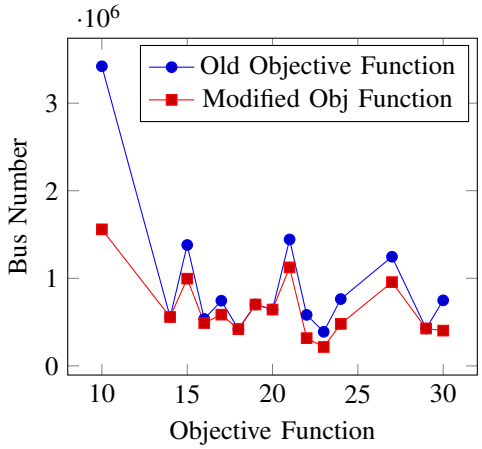


Fig. 5: Comparison of cost function

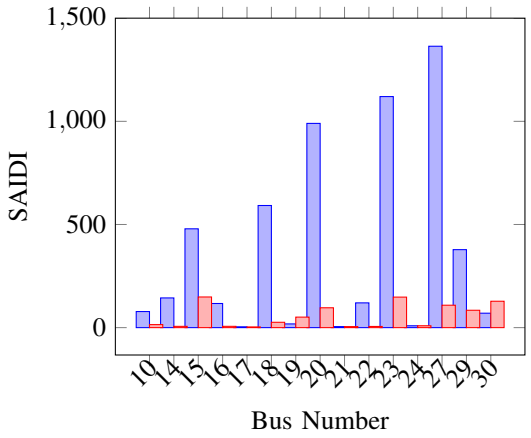


Fig. 6: System average interruption duration index

TABLE III: Reliability Indices at Bus$_i$

Bus	SAIFI	SAIDI	CAIDI	CTADI	CAIFI	ASAI
10	0.19	14.71	78	0.78	0.0282	0.9992
14	0.04	6.22	144	1.44	0.0345	0.9999
15	0.31	148.59	479	4.79	0.0620	0.9994
16	0.05	6.33	117	1.17	0.0270	0.9998
17	0.85	3.4	4	0.04	0.0084	0.9886
18	0.04	25.92	592	5.92	0.0437	0.9999
19	2.83	50.99	18	0.18	0.0283	0.9886
20	0.1	96.26	990	9.9	0.0486	0.9998
21	1	5.01	5	0.05	0.0100	0.9886
22	0.05	5.72	120	1.2	0.0214	0.9997
23	0.04	47.97	1120	11.2	0.0179	0.9997
24	1.01	9.13	9	0.09	0.0101	0.9886
27	0.08	108.69	1364	13.64	0.0796	0.9999
29	0.22	84.2	378	3.78	0.0400	0.9994
30	1.83	127.93	70	0.7	0.0182	0.9886

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TABLE IV: Branch Losses before and after OCP using proposed method

Branch	Before OCP		After OCP	
	KW losses	KVAR losses	KW losses	KVAR losses
1-2	5185.9	9691.8	5185.2	9682.9
1-3	3114.9	6966.8	3105.6	6920.2
2-4	1015.5	-791.2	1000.9	-854.5
2-5	2951.4	7993.4	2933.5	7913
2-6	1947.5	1966.1	1942.2	1932.3
3-4	857.6	1594.8	854.5	1580.1
4-6	634.4	1287.0	639.1	1296.9
4-12	4.7	4686.8	4.3	4296.4
5-7	171.2	-1633.6	154.9	-1678.9
6-7	381.3	-550.7	380.6	-562
6-8	109.6	-534.8	101.7	-565.6
6-28	57.8	-1117.5	58.5	-1125.9
6-9	1.6	1627.6	1.8	1826.6
6-10	1.3	1283.2	1.4	1378.6
8-28	2.2	-4345.5	0.5	-4371.9
9-10	799.9	105.1		786.4
9-11	0.5	465.6	0.2	169.9
10-17	14.2	37.1	10.6	27.7
10-20	81.5	182.0	75.3	168.2
10-21	111.3	239.6	79.1	170.1
10-22	52.7	108.7	38.3	79
12-14	74.4	154.7	63.2	131.3
12-15	217.2	427.8	181.1	356.8
12-16	54.0	113.5	41.1	86.5
12-13	0.1	138.3	0	0.4
14-15	6.0	5.4	3.7	3.3
15-18	38.7	78.8	32.4	65.9
15-23	31.5	63.6	20.7	41.8
16-17	7.6	27.8	6.1	22.3
18-19	4.9	9.9	4.1	8.2
19-20	17.1	34.2	16.2	32.3
21-22	0.6	1.2	0.6	1.1
22-24	45.6	71.0	44.4	69.1
23-24	6.0	12.4	2.9	6
24-25	10.0	17.4	9.9	17.2
25-26	44.7	66.7	29.1	43.5
25-27	24.1	45.9	28.4	54.2
27-29	86.3	163.0	77.2	145.9
27-30	162.3	305.5	147.5	277.7
28-27	1.3	1287.5	1.2	1189.8
29-30	33.6	63.4	31.2	58.9
Total Losses	17562.7	33045.0	17309.2	31681.9

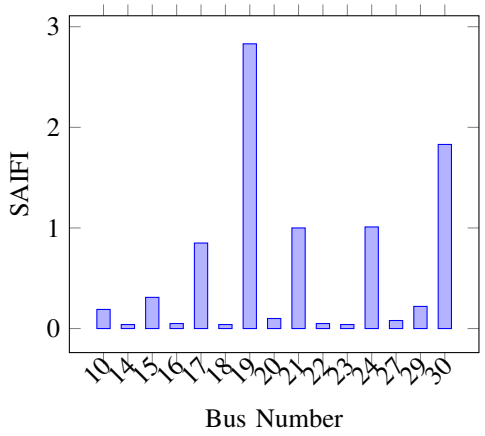


Fig. 7: System average interruption frequency index

Reliability Indices are also tabulated in Table III. These indices are after capacitor placement. It is observed from table that reliability indices are improved in OCP. System average interruption frequency index is now below 2.83 which was upto 3.42 for without capacitor placement. SAIDI also improved up to 148.59 which was 178. Similar improvement is also observed in CAIDI. Table V represents branch capacity release in MVA.

TABLE V: Branch Capacity Release in MVA

Branch ID	Capacity Release	Branch ID	Capacity Release	Branch ID	Capacity Release
1-2	-0.153	8-28	2.350	16-17	0.326
1-3	-0.082	9-10	-0.388	18-19	0.194
2-4	0.210	9-11	6.409	19-20	0.028
2-5	0.223	10-17	0.788	21-22	-0.011
2-6	-0.079	10-20	0.139	22-24	-0.091
3-4	-0.150	10-21	2.471	23-24	0.620
4-6	-0.533	10-22	1.094	24-25	-0.053
4-12	1.384	12-14	0.514	25-26	0.676
5-7	0.962	12-15	1.309	25-27	-0.532
6-7	-0.085	12-16	0.868	27-29	0.171
6-8	0.995	12-13	10.097	27-30	0.124
6-28	-0.123	14-15	0.337	28-27	0.638
6-9	-2.110	15-18	0.391	29-30	0.027
6-10	-0.949	15-23	0.980		
Total					28.986

Fig. 7 is graphical representation of system average interruption frequency index and it can be stated that system average interruption frequency index (SAIFI) in PSO improves much more rather than genetic algorithm. In Table IV, active and reactive power losses are compared for before capacitor placement and after capacitor placement using PSO. In this case also, it can be stated that result of PSO is much more superior than genetic algorithm.

TABLE VI: Harmonic Constraint in Voltage % THD

Bus	V mod	H=1	H=3	H=5	H=7	H=49
10	1.045	0.723	1.016	1.238	1.415	2.236
12	1.057	0.727	1.022	1.245	1.423	2.249
14	1.0445	0.723	1.016	1.238	1.415	2.236
15	1.04	0.721	1.014	1.235	1.412	2.231
16	1.0455	0.723	1.017	1.239	1.415	2.236
17	1.042	0.722	1.016	1.236	1.413	2.233
18	1.035	0.72	1.011	1.232	1.408	2.226
19	1.029	0.717	1.008	1.229	1.404	2.219
20	1.046	0.723	1.017	1.239	1.416	2.237
21	1.045	0.723	1.016	1.238	1.415	2.236
22	1.038	0.721	1.013	1.234	1.41	2.229
23	1.043	0.722	1.015	1.237	1.414	2.234
24	1.037	0.721	1.015	1.233	1.41	2.228
25	1.0345	0.72	1.011	1.232	1.408	2.225
26	1.019	0.714	1.004	1.223	1.397	2.208
27	1.03	0.718	1.009	1.229	1.405	2.22
29	1.018	0.714	1	1.219	1.393	2.207
30	1.022	0.715	1.005	1.225	1.399	2.212

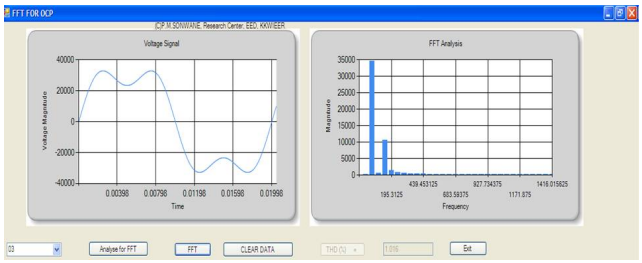


Fig. 8: FFT Spectrum for 3rd harmonic at Bus 10

V. Harmonic Constraint

In order to analyze complex signals that have many different frequencies present, a number of mathematical methods were developed. One of the more popular is called the Fourier Transform. However, duplicating the mathematical steps required in a microprocessor or computer-based instrument is

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quite difficult. So more compatible processes, called the FFT for Fast Fourier Transform, or DFT for Discrete Fourier Transform, are used in evaluating THD in voltage of bus_i in IEEE 30 bus system. These methods only work properly if the signal is composed of only the fundamental and harmonic frequencies in a certain frequency range. The frequency values must not change during the measurement period. It is observed from Table VI that, total harmonic distortion (V_{THD})in optimal capacitor placement method used in IEEE 30 bus system is less than 5% hence within the limit.

VI. Conclusion

It is observed from graphs, tables, results and comparison tables that voltage and PF constraint applied with limits V_{min} = 0.95 pu & V_{max}=1.05 pu and $PF < 0.9$ is applied to newly developed and validated software OCP-PSO. Reliability cost and overall objective function cost including capacitor cost and active & reactive power loss cost are evaluated and observed that the cost is decreased after appropriate number of capacitor placed in bus_i. Results of particle swarm optimization is compared with genetic algorithm and it is concluded that very less capacitors are required to place in bus_i using particle swarm optimization tool. It is also concluded that, for the given limit, the capacitor placement and sizing is optimal. Active and reactive power losses are decreased in both cases, but much more decrease in loss, is observed using particle swarm optimization tool.

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Smart Modern AC Microgrid Monitoring System using Power Line Communication

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***Abstract*— In this paper investigate and plans to examine the active tasks of the low-voltage ac Grid like that microgrid. The schematic arrangement is calm of a low-voltage ac grid which is called micro grid, 3-phase PI section x-mission line, 3-phase x-mer as well as a load or burden on system. In Smart Grids, several distributed power resources data transmission and its communication arrangement are assembled so as to all the more likely control the framework. Subsequently, control necessities and communiqué configurations of grid which are design and simulate in Matlab/Simulink platform and analyzed in this work. The distribution line is demonstrated by practical data of x-mission line. The projected PLC which is essential for investigation for this work is overseen by BPSK modems. And it's likewise evolved utilizing carrier recuperation to lessen dangerous impacts of the channel through Matlab platform.**

Keywords*— *BPSK, Remote Monitoring, (PLC) Power Line Communication, Micro-grid, Smart grid, Carrier Recover.

I. INTRODUCTION

In the course of recent many years, powers have played an inexorably significant part in the technical & economically development. The worldwide power demand is expanding as of late and it's relied upon to be multiplied in following twenty years [1]. In many nations, it's hard to fulfill the demand throughout the year by one fuel bases. Subsequently it's important to connect other non-renewable sources unwavering quality and consistence supply. Sustainable sources deal a reasonable option in contrast to the arrangement of intensity in country zones [2]. Solar PV and wind are two most significant elective power sources being used in numerous pieces of the worldwide and the broadly accessible fuel sources [3]-[4].

Other than achievements in power equipment, identifying, watching, and control development, Smart Grid enabling impacts are the spreads that in the latest era have been completed in the domain of broadcast communications. There is a not extraneous once-over of relating and once in a while challenging remote and wireline specifics measures that can be utilized in Smart Grid arrangements [5]. Manufacturing reception and huge scope client move outs are immobile in their earliest stages, and it is difficult to make an exact expectation of "champs" and "failures." What appears to be clear is that PLCs that's communications terminated the current framework, will have their amount to performance meanwhile they give the normal overhaul from basic power conveyors to half and half and in both directional power and information communication arrangements [6]-[8].

Utilizing electrical lines similarly for communication determinations has just been recently been everywhere at the opening of the main outstanding era [9]. The prominent great position is the wide spread availability of electrical system, thus that speculatively plan charges are bound to interfacing modems to the current.

The power cable improvements can be assembled into (NB-PLC) narrowband PLC, working normally underneath 500 kHz, and broadband (BB) PLC, working as a rule at frequencies beyond 1.8 MHz [10]-[11]. By the by, the accompanying begins with a prologue to PLC situations, trailed by channel, clamor, and electromagnetic similarity (EMC) perspectives. Uninhibitedly accessible corresponding perusing on PLC cutting edge can likewise be found in [12]. Another significant wellspring of the PLC-related writing is the as of late settled IEEE Communication Society's online interface on Best Readings in PLC [13].

With the improvement in smart power grid, and the AMI framework is consistently advanced around world. The AMI framework has gotten, ones of significant methods for electricals organizations to diminish line misfortune and improvement in activity income. In AMI framework, local zone network among concentrator and meters unit underpins different correspondence advances, for example, radio frequency and PLC.

Between in these type of communication techniques, PLC has characteristic favourable circumstances, for instance, wide inclusion, and low development [14], and it's pointed toward limiting the extra observing costs, for example, the different

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energy-checking procedures [15] that dependent on SCADA, GSM or Ethernet-based frameworks by utilizing the proposed strategy

The examine and analysed in this research work mainly focusing on modelling of medium low voltage microgrid that can supplant by a different power sources and 25 km length transmission line, the foundation of PLC is overseen by BPSK modems.

According to the difficulties experienced by PLC structures that experience the bad effects of the noise made by channel and devices related with the electrical lines organization, to decide this troublesome we are used a transporter recuperation and channels obstructs that arranged by Butterworth channels to lessen harming effects of the station. [16], [17]

II. Communication Technique

An epic methodology is prescribed where the electrical links used to send the communicate data of the grid. This thought furthermore depicts the basic arrangement of a keen framework. The utilization of an electrical link as a transmission channel prevents additional circumstance up costs to interface the structure Smart Grid.

Electrical cable Communication (PLC) is a settled innovation that permits the transmission of information through electrical wires. A key preferred position of PLC is its minimal effort of arrangement when the electrical wiring foundation as of now exists, empowering it to contend or work related to remote innovations. PLC has as of late got developing consideration and huge speculations inside the advancement of the Smart Grid (SG) that thus requires modern information trade and communication. This book presents an extensive prologue to the administrators engaged with the utilization of narrowband and broadband PLC innovations in the SG, and to utilizing these advances especially when irregular sustainable power sources are utilized. Parts spread key ideas of present day advanced communications, the primary coding procedures, explicit attributes of the PLC channels, the essentials of the SG, and the contrasts between the narrowband and broadband innovations for SG applications. The work covers the principle guidelines and a few related best in class works, just as some key parts of the utilization of sustainable power sources. Electrical cable Communication Systems for Smart Grids is fundamental perusing for scientists, experts and graduate understudies engaged with the investigation and improvement of PLC frameworks, SG and related subjects. [18]

PLC is a promising broadband access innovation. In this transmission mode, mixed media administration signals, including fast information, voice, and video, are transmitted over low-voltage electrical cables.

PLC has such focal points as the electrical cable is under the full locale of the force segment and handily oversaw; it can associate with any estimation and control point; signs can be transmitted through electrical cables, blocking the need to raise extraordinary lines; and no consent from the Federal Communications Commission is fundamental. [19]

It likewise has a few inconveniences, for example, low transmission speed; affectability to aggravation, nonlinear bending, and cross-balance between channels; enormous size, and significant expense of capacitors and inductors utilized in the PLC framework.

Regardless of its generally in past, PLC was not mostly used because of data or signal weakening and also produce noise so certain discoveries were accomplished in 21st era. As of late, PLC innovation has been applied in an ever increasing number of fields, for example, smart grid, modern control in industries and home organizations [14]. It implies each gadget associated with the organization on power line.

So control and screen, the utilization of a PLC is a potential correspondence in a brilliant framework. The PLC is an innovation that utilizes the substance of EDS as the communication intermediate, and it's a fast data correspondence close by the wellbeing of far off correspondence systems, and this development for the most part utilizes for information communication intermediate & low voltage electrical cables [19].

Low-voltage (LV) and medium-voltage (MV) arranges principally utilize one of three narrowband communication strategies:

Single-transporter adjustments, for example, paired stage move keying (BPSK) and recurrence move keying (FSK)

Symmetrical recurrence division multiplexing (OFDM)

Direct-arrangement spread range (DSSS), along with code division numerous entrance (CDMA)

The most generally sent narrowband PLC arrangements utilize moderately straightforward, however amazingly financially savvy, FSK and BPSK tweak procedures. These methods structure the premise of a few interoperable gauges, strikingly Lon and DLMS. [20]

The PLC can likewise control resignation and the movement of distribution lines. It’s basic particularly for sub-stations situated in rural regions where there is not any communication framework. Then again, there are a few challenges & disadvantages that obstruct utilizing PLC as widespread communication framework. For sure, notwithstanding the obstruction issue made radiation from x-mission lines, the PLC frameworks experience from disturbance or noise made by burdens and gadgets associated with the PLC [3] [9].

III. Strategy of PLC With BPSK Modem

Modulation in a computerized system which moves a character which is in advanced structure consuming pointer fitting to get sign by objective termination for detained together communication phase of communication short of taking information spillage.

With BPSK, advanced farewell enclosure could be able since the disreputable situation cell or static position to the adaptable supporters contrast with another tweak like QPSK [21].

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The BPSK regulation plan is some of the supreme powerful advanced plans counter to to commotion impacts. Dual unique phases that are commonly isolated by 180 degree from one another are utilized in this mapping strategy

The signal S_{BPSK} is arithmetically spoken to by the accompanying equation:

$$(S_{BPSK}) = \begin{cases} (S_1) & Data1 \\ (S_2) & Data0 \end{cases} \quad (1)$$

Here $0 \le t \le T_b$

$$S_1 = \sqrt{\frac{2E_b}{T_b}}\cos(2\pi f_c * t) \quad (2)$$

$$S_2 = -\left(\sqrt{\frac{2E_b}{T_b}}\right)\cos(2\pi f_c \times t) \quad (3)$$

The basic signal :

$$\varphi_1(t) = \left(\sqrt{\frac{2}{T_b}}\right) \times \cos(2\pi f_c \times t) \quad (4)$$

The BPSK signal is:

$$(S_{BPSK}) = \begin{cases} (\sqrt{E_b} \times \varphi_1) \times t \\ -(\sqrt{E_b} \times \varphi_1) \times t \end{cases} \quad (5)$$

Where E_b = Energy per bit
T_b = Bit per Period
F_c = Carrier Frequency

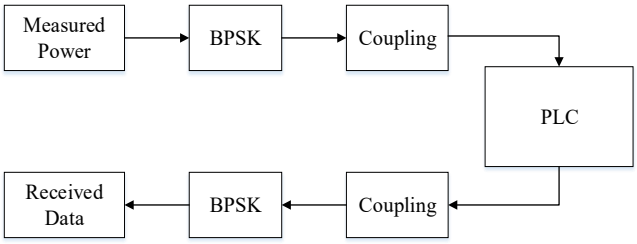


Fig. 1. Basic Block Illustration of PLC using BPSK

Its level variations between -1 to 1. If the data value is 1 then the S_{BPSK} will be became zero (0), else the phase angle will be 180 degree or π.

IV. Results And Discussion

The adjusting information using BPSK procedure in here examination are picked as the yield data of grid. The modulator yield is joined with line catcher circuit PLC modem which showed up in figure - 2.

The x-mission line length is set to 25 km and the changed data or information are injected to voltage of line by using 2 of 3 stage to stage and stages to nonpartisan. The demodulator of BPSK modem, showed up in figure - 3. The amusement diagram in Simulink model with BPSK modem is showed up in figure - 4.

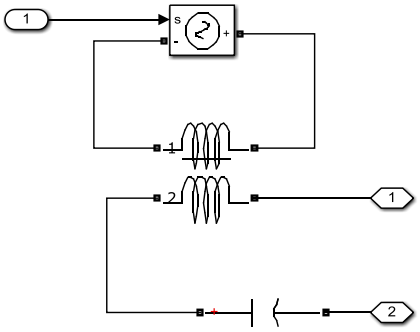


Fig. 2. PLC Modem Transmitter Terminal

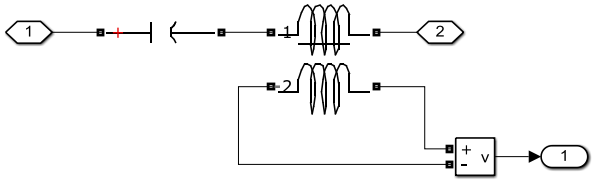


Fig. 3. PLC modem Receiver Terminal

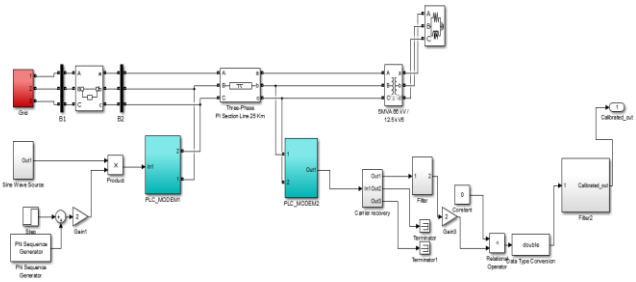


Fig. 4. BPSK with PLC

The BPSK adjusted information is given to demodulator, by then message signal got by demodulator BPSK structure is isolated to diminish harming effects on channel and a short time later demodulation cycle is moreover recognized at the CRB and transporter recurrence is used at 4 kHz and data rate 1 kb for every second. To get fitting results, a low-pass Butterworth (LPB) channels utilized at the demodulator structure appeared in Figure - 5.

For simulation of miniature matrix framework, have considered the sign wave tool compartment as wellspring of sign of the assessment information of the framework.

In first diagram depicts the yield signal as assessed information in figure. - 5, while the ensuing chart or plot is the discrete or quantized information sign of modulator in figure - 6. The demodulated information at the yield of the demodulator in figure - 7. The Received information and adjusted information at the opposite finish of the x-mission line as showed up in figure 8 and 9 independently.

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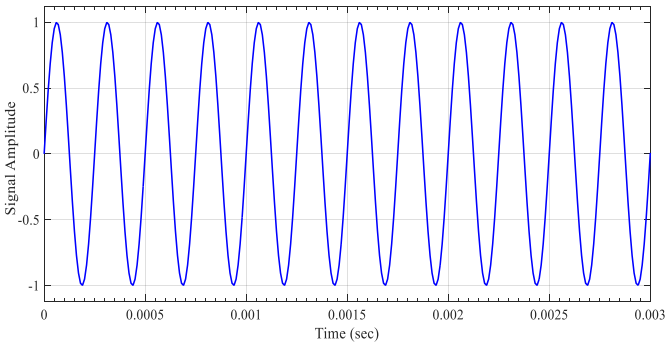


Fig. 5. Input (i/p) Signal

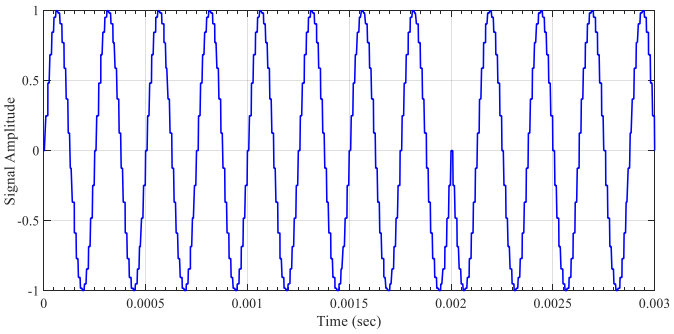


Fig. 6. BPSK Modolator with PLC

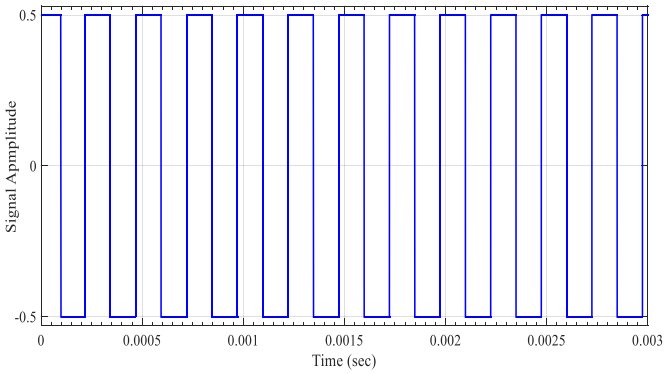


Fig. 7. BPSK Demodolator with PLC

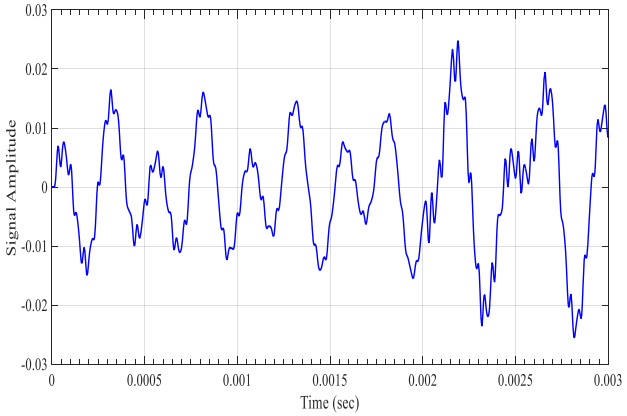


Fig. 8. BPSK Demodulator Established Data

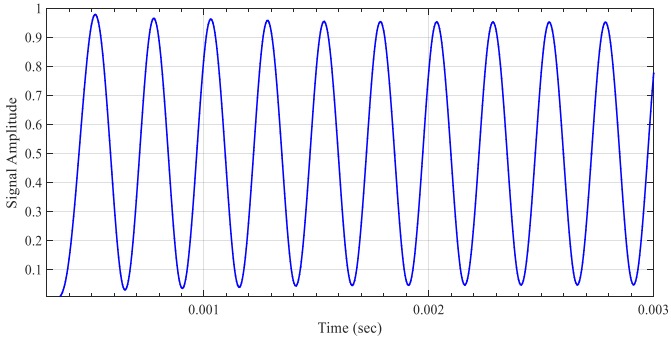


Fig. 9. BPSK Standardized Data

As a result this work and the adjusted yields that portrayed in the last graph illustrations that observing framework by PLC can be productively used to screen a different sustainable power sources without any disturbance or noise made by the x-mission channel and gadgets associated with the electrical cable organization utilizing modulator & demodulator with carrier recovery.

V. Conclusion

The projected framework motivations on sending and receiving the deliberate data signals of the modeled PV in smart micro-grid system by using of the PLC method established with BPSK variation via Matlab software. The demonstrated framework has likewise been enhanced to empower the incitement sequential associations of many panels in model.

The projected PLC is kind of investigation depends on combination of modulation and demodulation scheme using BPSK method which is a reasonable strategy and capacity to regulate the data x-mission for smart micro-grid. The moderated signals data that enclose the deliberate information of the grid are communicated over line in 3 -phases. After the planned demodulator toward finish of the x-mission line gets with the CRB and filters to lessen dangerous impacts of the channel.

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Optimal Placement of Shunt Capacitor to Enhance Distribution System Reliability

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***Abstract*—Today reliability is a significant boundary in Electrical industry to accomplish high security and ampleness of the system. There are three significant boundaries required to present in reliability analysis viz client composite damage function, average load and failure rate. The vast majority of the intelligent techniques incorporate capacitor cost and reserve funds because of decrease in power through loss. In this research work notwithstanding capacitor cost and advantages because of power loss, reliability cost is likewise included. This paper introduces the novel method for failure rate using thermal loading and life expectancy of transformer and overhead transmission line. Modified failure rate is applied to calculate reliability cost and hence accordingly objective function is calculated. Particle swarm optimization (PSO) is used as an intelligent tool to find the optimal locations and capacitor sizing using dot net framework based software. Before applying PSO tool, IEEE 30 bus system is passed through ETAP load flow study. Load flow data is processed through optimal capacitor placement (OCP) module designed in developed novel software. This paper focuses on OCP for reliability enhancement in voltage constraint while applying objectives to PSO tool. Results are used for comparison of voltage profile, power factor improvement, loss reduction, capacity release and objective cost reduction in OCP.**

***Index Terms*—Optimal capacitor placement, Reliability indices, particle swarm optimization.**

I. Introduction

Most effective and useful methods in case of reducing power losses specifically in distribution system as well as in transmission system is optimal capacitor placement. Optimal capacitor configuration in such system has a number of return such as reducing losses, improvement in voltage profile, improvement in power factor and so on. The by and large seen about the Capacitor placement issues is the process of identification of the location, designing the size and amount of the capacitor number to be placed in a radical distribution system such that maximum benefits can be achieved. Objectives are to minimize the losses in the transmission as well as distribution system and to maintain the preferred voltage profile within the limits. As discussed in IEEE Sandard 1036, capacitor supply reactive load locally in addition to that, they also improve load carrying capacity of the transmission lines and therefore plays the same role as redundant lines. Optimum capacitor placement can also improve reliability indices of the distribution system as discussed in IEEE Standard 1366. Since the capacitor bank is added in discrete steps the objective function is not differentiable and the capacitor placement problem is a mixed integer nonlinear program [1], [4]. The proposed method [6] [7], does not consider major failure events when common mode is creating many failures and presume each sustained interruption impacts the system in same way in spite of the frequency. The objective of proposed work is to improvement by loss reduction with reactive power management and avoiding penalty due to low power factor. In addition to this, objective is to improve the reliability.

An innovative reliability estimate based algorithm for a complex radical system which contains a subroutine of superior distribution load flow analysis with dynamically responding the change of restoration network based topology introduced by system reconfiguration to inspect the network parameter constraint after network reconfiguration is proposed in [8] [11]. Quantitative reliability evaluation methods are of considerable significance for the various types of distribution systems. Reliability estimate models for five commodity used distribution systems are developed according to their possible system configuration, the operating characteristics of protectors and component reliability parameters [10]. To offer good approximation of the system reliability indices based operation characteristics may be modeled as reasonably as possible. To get better modeling it is needed to include component fault rate, to be associated with system loading as well time dependent reserve capacity in each point of the system. An novel algorithm is discussed in [9] [12], to estimate the system reliability which takes into account load switching to another substitute source of feed with reserve capacity in normally open points considering the transmission line that operate in radial form. Any reliability enhancement assignment of distribution system configuration must involve reliability cost/worth based assessment. The reliability cost is majorally the capital cost of convenience invested to improve the reliability of customer's service point of view, whereas the reliability worth is basically the payback received by customers associated with better and reliable power supply. Notable optimization tools such as GA or SA are used by some researchers for optimal scheming of distribution system based on total cost of reliability. Differential evolution based come close to optimal distribution system reliability planning taking both customer interruption cost and utility cost together into contemplation is discussed [13] [14].

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II. Problem Formulation

A new and efficient approach for optimal capacitor placement in IEEE 30 bus system is selected in this research work. The novel developed methodology has two sections: in section one GA is used to optimal capacitor placement using ETAP software where as in section two a novel algorithm of OCP-PSO is prefered to estimate the optimal size of capacitors in kvar at the optimal location is determined using particle swarm optimization tool which is developed for targeted problem. Objective function for reliability cost is mathematically expressed in equation (1) as given below,

$$E_{COST} = \lambda_i \times C_i \times L(a)_i \tag{1}$$

Where, E_{COST} is the Reliability Cost considered in this cost function, C_i is the customer composite damage function as one of the reliability parameter, λ_i is denoted for failure rate and $L(a)_i$ is the average load. Suffix i denotes here as i^{th} bus number. Eq. 1 represents evaluation of reliability cost based on Failure rate (denoted by λ). Failure rate can be decreased with strengthening power system by means of (i) proper reactive power management and control (ii) maintaining power factor towards unity and (iii) improving voltage profile. Now, the capacitor cost (CC) is given by,

$$CC = x_i C_{0i} + Q_{ci} C_{1i} + B_i C_{2i} T \tag{2}$$

Where, x_i is represented with numerical value as 0 or 1, 0 means no capacitor installed at bus i. C_{0i} is Installation cost and C_{1i} is per kVAr cost of capacitor bank in the system. Additional parameter in in equation 2 is Q_{ci} means Capacitor bank size in KVAr with B_i as Number of capacitor banks. C_{2i} is the operating cost of per bank, per year and T is Planning period (years). Then energy loss (El), active power loss (PLi) and reactive power loss (QLi) are given below,

$$E_l = T_i P_{Li} \tag{3}$$

$$P_{Li} = \sum_{i=1}^{Nbus} P_{loss} + \sum_{i=1}^{Nbus} Q_{loss} \tag{4}$$

First component of Eq. 4 is active power component where as second component is reactive power component treated separately for evaluation of active and reactive power losses. Now the problem can be stated as follows,

$$Cost_{min} = E_{COST} + \sum_{i=1}^{Nbus} CC + C_2 \sum_{i=1}^{Nbus} E_l \tag{5}$$

Where,
CC - *cost of capacitor bank*
C_2 - *Cost of each kWh loss in Rs/kWh*

For the constraint,

$$V_{min} < \mathrm{V} < V_{max}$$

Where, CC is the cost of capacitor bank connected in system and C2 is the Cost of each kWh loss in Rs/kWh. Assumptions considered in the development of the cost function are Balanced network, Capacitors in step size and Capacitor affects only reactive power in the feeder. Eq. 5 is the minimum cost function which is required to be analyzed using PSO. In this paper Eq. 5 is used in solving for voltage constraints using OCP algorithm. All values of cost function are processed to form the equation coefficient for each bus. These coefficients are provided as PSOFEED search space. PSO finds best capacitor size for given bus using PSO.

III. Methodology Implemented

Loading like transformer devices: Theta is considered as temperature due to heat losses in transformers. Using average load in (MW), reactive power (MVAR) and MVA rating, loading per unit is calculated. Life expectancy table is prepared for the range 0.01 to 1.8 pu loading of equipment then loading per unit for any bus is calculated and then respective life per unit is collected from the life expectancy table. As there is no modification in thermal stress, this life is treated as per unit uncompensated life (Luc). Similarly in the simulation process, thermal stress of the equipment is increased or decreased as per the number of capacitor placed at bus which changes the resultant current and hence the loading. New life expectancy from the table is collected and is treated as per unit compensated life (Lc). Then modified Life (Lm) of transformer or transmission line is evaluated. If actual Life of equipment is 1.0 per unit, then failed life or dead life (Lf) of given equipment is calculated. Now this failed life (Lf) is used as multiplying factor for updating failure rate. As a result modified failure rate is given by,

$$\lambda_{mod} = \lambda_{old} \times L_f \qquad L_m = 1 - L_f \qquad L_m = \frac{L_c - L_{uc}}{L_c} \tag{6}$$

Now using Lambda mod from Eq. 6, CCDF and average load La(i), reliability cost and reliability indices viz SAIFI, SAIDI and CAIDI are also evaluated.

Particle Swarm Optimization (PSO), which involves simulating social behavior among individuals or particles, has been used for solving the capacitor placement problem in radial distribution system. The target problem is reformulated by a multidimensional/ compressive objective function. It was realized that there is no good way to guess whether p- or g-increment should be larger. Thus, these terms are used separately in this OCP-PSO algorithm. The current simplified particle swarm optimizer now adjusts weights, positions XY and velocity by the following mathematical representation.

$$InertiaW = (w_i - 0.4)\frac{i_{max} - i}{i_{max}} + 0.4 \tag{7}$$

Where w_i is an inertia weight in i^{th} iteration, i_{max} is defined here as maximum iteration and i is current iteration number.

$$V = (0.5 + \frac{r}{2})V + 2 \times r_0(p_{best} - x_i) + 2 \times r_1(g_{best} - x_i) \tag{8}$$

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Eq. 7 and 8 is used to update weights for each particle. There is no fix value for inertia (W). It is observed from previous literature that PSO gives most success ratio for the range 0.4 to 0.9.

IV. Simulation With Concluding Remarks

Voltage constraint is always used in capacitor placement or equivalent study to maintain the voltage profile of bus or node within the limit to avoid further electrical accidents. In any electrical network, if capacitor is added the voltage proportional to kVAr is always added as per equations discussed in IEEE standard 1036, 1992 'IEEE guide for application of shunt power capacitors'. Many times distribution companies prefer capacitor bank in distribution system or transmission system at major buses to provide appropriate voltage support to individual customers. Generally capacitor banks placed on system lines for support voltage along the entire length of line. It is mostly suggested that, installed Capacitor banks for voltage support should be switched on during the peak loading periods as more inductive load may lead to low-voltage situation. This is to avoid decrease in system voltage.
In simulation of OCP module initially all objectives for all buses and for all possible maximum capacitors are evaluated and stored in the memory space either in sequel query language (SQL) and database tables. When voltage constraint algorithm runs, all these objectives are filtered by the minimum and maximum limit of voltage modified and restored in the memory space. These filtered objectives as given by Table 1 for the limit Vmin = 0.95 and Vmax =1.05 is processed to convert into bus wise polynomial equation.

Programming codes are developed in dot net for equation generator using regression analysis for a curve fitting using the given set of points for generated objective functions in OCP-PSO tool. These codes are used to find the best suitable equation which can be used in PSOFEED table. All objective functions are separated by bus wise. Using these equation coefficients, the PSOFEED table is prepared and applied to PSO tool to optimize the solution as given in [1]. In this, bus number 10 and 12 are absent due to the modified voltage is not in the given constraint and hence such objective solution is neglected by PSO search space. In PSOFEED table which consists '0' coefficient for bus 10 and 12. Table [2,3] discusses power factor, voltage profile, reactive power loss, reliability cost and cost function. In novel PSO tool, output is simulation number. This simulation number helps to find the exact solution for number of capacitor at busi as discussed in Table [4]. Using this information result table for the parameters are IEEE 30 bus is prepared and given in Table [3] followed by the IEEE 30 bus results of load flow study before optimal capacitor placement application using OCP-PSO tool and tabulated in [2]. In fig. 1b, modified reliability cost with capacitor placement is shown and it is observed that the cost of reliability is decreased after OCP-PSO simulation.

TABLE I: PSO FEED TABLE

Bus	Av	Bv	Cv	Dv	Ev	Fv	ParticalV
10	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
14	0	0	0	0.001	-0.000	0.163	3
15	0	0.012	-0.094	0.309	-0.431	0.609	7
16	0	0	0	0	-0.078	0.236	2
17	0	0.002	-0.026	0.101	-0.155	0.296	5
18	0	0	0.001	-0.009	0.029	0.101	15
19	2E-6	-9E-6	0.001	-0.014	0.038	0.181	17
20	5E-7	-0.000	0.004	-0.029	0.081	0.128	17
21	4E-6	-0.000	0.004	-0.037	0.094	0.361	11
22	0	-3E-5	0.001	-0.011	0.033	0.146	11
23	1E-7	-6E-6	0.001	-0.007	0.019	0.101	16
24	1E-7	-6E-6	0.001	-0.011	0.025	0.210	20
25	0	0	0.001	-0.013	0.053	0.082	24
26	0	0	4E-6	4E-6	-0.004	0.094	31
27	2E-6	0	0.002	-0.023	0.071	0.316	19
29	2E-5	-6E-7	4E-6	4E-6	-0.000	0.127	31
30	0	0	8E-6	-9E-6	-0.017	0.246	31

TABLE II: Parameters in 30 Bus System for Voltage Constraint 0.95 to 1.05 Before OCP-PSO

Bus	ObjFun	PF_{old}	V_{old}	Q_{loss}
10	3420724	86.796	1.045	1136
12	3299909	90.745	1.057	1394
14	557964	94.71	1.042	10
15	1380349	92.96	1.038	286
16	535487.9	91.055	1.044	56
17	744031.8	84.06	1.04	28
18	419593.4	96.945	1.028	20
19	701161	94.15	1.026	10
20	643556.7	93.755	1.028	68.25
21	1443767	84.23	1.033	1
22	582590.6	83.5	1.033	72.157
23	388985.5	85.87	1.027	12.368
24	763062	79.23	1.022	0
25	437603.9	15.96	1.0195	84.12
26	291029.7	83.57	1	0
27	1246241	97.84	1.023	513.94
29	427003.5	96.16	1.003	63.421
30	748333.6	98.43	0.992	0

Here one can state that the modified reliability cost is much less than the cost of reliability when no capacitor is placed. Fig.1c indicates objective function observed that modified objective function is less in many buses. This means that cost of capacitor is definitely recovered and becomes profitable. The profit is also recovered in reliability cost and cost of benefits by maintaining voltage profile and Power factor in addition to decrease in losses. Figure 1d is the modified failure rate in simulation. It is observed that modified failure rate is decreased. This signifies that reliability is improved in terms of cost. Reliability must be discussed in terms of indices.

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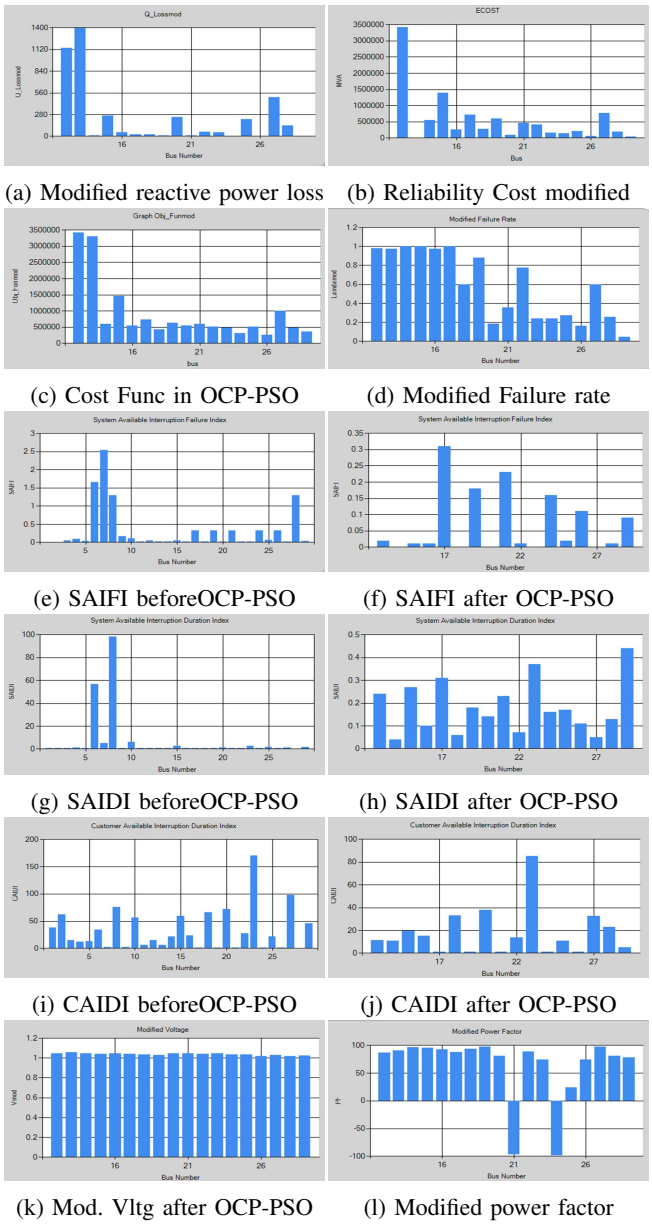
TABLE III: Parameters in 30 bus System for Voltage Constraint 0.95 to 1.05 After OCP-PSO

BusID	PFmod	Vmod	QLossmod	CC	ObjFunmod
10	86.796	1.045	1136	0	3420724
12	90.745	1.057	1394	0	3299909
14	96	1.0445	9.1	52000	597117.6
15	95.2	1.04	267.97	78000	1463011
16	92.4	1.0455	51.93	27200	542964.1
17	87.7	1.042	25.89	26000	741536.5
18	93.85	1.035	24.73	151200	436034.4
19	97.5	1.029	9.34	38400	634770
20	80.95	1.046	245.66	374400	547939.4
21	-96.6	1.045	0.83	125200	596556.9
22	88.25	1.038	59.56	101600	519403
23	73.7	1.043	48.33	324800	480139.6
24	-99	1.037	0 149492.9	162400	311892.9
25	23.85	1.0345	219.07	300000	517108.3
26	74.6	1.019	0	199600	261631.9
27	97.73	1.03	499.78	226800	1001664
29	80.6	1.018	140.96	300000	485922.7
30	78.3	1.022	0	311200	353506

TABLE IV: PSO Simulation

Bus	Simulation No	No of Capacitor Placed
10	0	0
12	3	2
14	3	2
15	3	2
16	2	1
17	3	2
18	7	6
19	4	3
20	16	15
21	11	10
22	5	4
23	14	13
24	14	13
25	13	12
26	17	16
27	7	6
29	13	12
30	26	25

simulation as shown in fig. 1g and fig. 1h. Customer average duration index is also having the similar conclusion.



(a) Modified reactive power loss (b) Reliability Cost modified

(c) Cost Func in OCP-PSO (d) Modified Failure rate

(e) SAIFI beforeOCP-PSO (f) SAIFI after OCP-PSO

(g) SAIDI beforeOCP-PSO (h) SAIDI after OCP-PSO

(i) CAIDI beforeOCP-PSO (j) CAIDI after OCP-PSO

(k) Mod. Vltg after OCP-PSO (l) Modified power factor

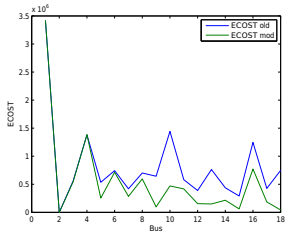
Fig. 1: Reliability Parameters

Reliability Indices are graphically shown in fig. 1e to fig. 1j. System Average Interruption Frequency Index (SAIFI) is one of the parameter in reliability evaluation indicating that represents number of failures in one year. It is obvious that SAIFI should be minimum. SAIFI before simulation is up to 3.2 and after simulation is 0.3 as shown in fig. 1e and fig. 1f. System Average Interruption Duration Index (SAIDI) is one of the parameter in reliability evaluation. SAIDI should be minimized. In IEEE 30 bus system considered in this work, it is observed that SAIDI is almost less than 0.45 after capacitor placement whereas it is much more before

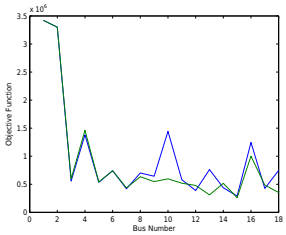
CAIDI is less than 85 in all buses for the OCP simulation with capacitor and reaches up to 165 for no capacitor placement case as graphically represented in fig. 1i and 1j. Voltage is always boosting in case of added capacitor as shown in fig.1k as voltage constraint is applied the voltage of bus will always remain within the limit. It is observed from the result that the modified voltage is maintaining the limits applied and also observed that the voltage is increased. It is observed that improved power factor is always tends to unity but this is not the task given in this paper. Few buses are observed with improved power factor and in some cases

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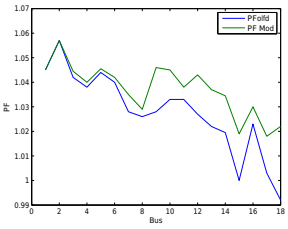
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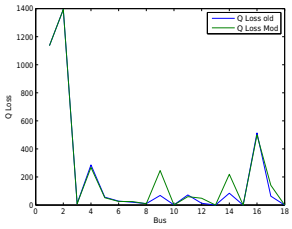
(a) Reliability Cost comparison



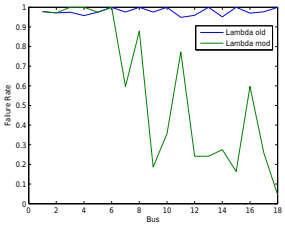
(b) Objective Fun comparison



(c) Power Factor comparison



(d) React Power loss comparison



(e) Failure rate comparison

Fig. 2: Optimal Solutions

power factor is decreased. Fig. 11 is modified power factor. In this case voltage constraint alone is selected so power factor constraint seems to be careless and no limit is applied for the power factor. However it must be noticeable to understand that negative power factor may damage the voltage profile. Care needs to considered which is not the scope of this research article. Due to this, many times leading power factor or reverse reactive power flow may occur and we are getting the results in this fashion. Modified reactive power loss is given in fig. 2a. From the figure it can be observed that in bus number 20, 25 and 29 the reactive power loss is increased whereas in other buses either power losses are decreased or remain same. This happens in most of the cases and hence overall reactive power loss may or may not be less in all the time. It depends on the proper constraint selection. Bus wise Reliability cost is graphically compared in fig. 2b and objective function is compared and shown by fig. 2c. Comparison of power factor is represented in fig. 2c. Reliability indices are studied in all cases of OCP-PSO simulation. Most of the distribution companies are interested in SAIFI, SAIDI and CAIDI indices based on sustained interruption. In addition to above CTADI, CAIFI and ASAI are also discussed and calculated in this research. From fig. 2d reactive power loss is compared and observed that there is saving in losses. Similarly the comparison of failure rate is shown in fig.2e.

V. Conclusion

It is observed from graphs, tables, results and comparison tables that voltage constraint applied with limits Vmin =0.95pu and Vmax =1.05 is applied to newly developed and tested software OCP-PSO simulator and reliability cost and overall objective function cost is evaluated and observed that the cost is decreased after appropriate number of capacitor placed in busi. So it can be concluded that in voltage constraint case for the given limit the capacitor placement and sizing is optimal, losses are decreased, reliability indices are improved and cost function is optimum.

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Protection of Wind Park Incorporated Series Compensated Transmission Line Using DMWT

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***Abstract*—In this study, the discrete Meyer wavelet transform (DMWT) is exploited for the recognition of faults and categorization of faulted phase in the wind park incorporated series compensated transmission line (WPISCTL). The DMWT is immensely inspected using the simulation model of the WPISCTL. The three-phase fault currents measured by the transducers linked at the generator-bus of the power system network are inserted to the proposed DMWT-based design for fault recognition and faulted phase categorization. The recognition of fault and categorization of faulted phase are studied with great appropriateness.**

Keywords—DMWT, fault recognition, faulted phase categorization, wind park incorporated series compensated transmission line.

I. INTRODUCTION

Precise fault recognition and faulted phase categorization are the two noteworthy facets of any protective relaying scheme for renewable energy integrated power transmission system. Over the existence, researchers have been in the chase to be acquainted with speedy and perfect recognition of fault and categorization of faulty section of the power system by means of various relaying methods. The fault affected part of power system must be removed from the healthy part so as to keep away it from the vital consequences effectuated through the fault. Consequently, it is extremely critical to include an efficient protection technique for recognizing the faults and categorizing the faulty section. In the recent years, researchers suggested different relaying techniques for the protection of SCTLs utilizing support vector machines [1], wavelet-fuzzy combined approach [2], HOS-FL incorporated method [3], combined wavelet-adaptive neuro-fuzzy inference system [4], CNN [5]. Combined DWT and KNN-based non-unit protection scheme has been reported for double-circuit SCTLs in [6]. The faulty phase recognition (FPR) and classification technique based on DFT and FL is discussed in [7]. Fault classification algorithms have been proposed for SCTLs using fast discrete orthogonal S-transform as feature extraction techniques and decision tree [8] and bagged tree ensemble classifier [9] as fault classification technique. VMD has been used for power system faults recognition [10]. In [11], ANN and PD have been used for islanding categorization in smart-grid. Further FD and FPC of ML-TLG faults in TPTL using WT is reported in [12]. In [13], POVMD and WPNRVFLN have been used for locating faults in SCDCTL. In [14], data mining and mathematical-morphology have been used for HIF's recognition.

In this effort, the DMWT is used and implemented for fault recognition and faulty phase categorization in the WPISCTL. Such category of research has not been described thus far to the preeminent of the facts of the instigators. The outcomes epitomize that the DMWT aptly recognizes the faults and categorizes the faulty phase and the authenticity of the DMWT is not perceptive to different fault inputs.

This manuscript is arranged as: Section II gives the information of the description of WPISCTL. Section III details the DMWT flow-chart. Section IV reports the results. Finally, Section V ends the article.

II. DESCRIPTION OF WPISCTL

Fig. 1 illustrates the single line graphic of WPISCTL. A voltage supply of 400 kV∟0° is linked at B-1 and a wind park at B-2. The WPISCTL has an overall span of 200 km, which is mid-point series compensated using a capacitor bank. The TL is estranged into two zones. The CT's are attached at bus-1 for the relaying of the WPISCTL.

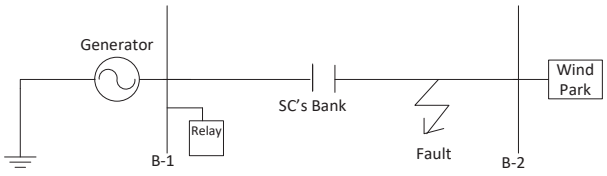


Fig. 1. The representation of WPISCTL

Fig. 2 exemplifies the three-phase currentsand voltages during healthy situation of WPISCTL. Fig. 3 shows the DMWT outputs during healthy situation. Table I details the outputs of DMWT for healthy situation.

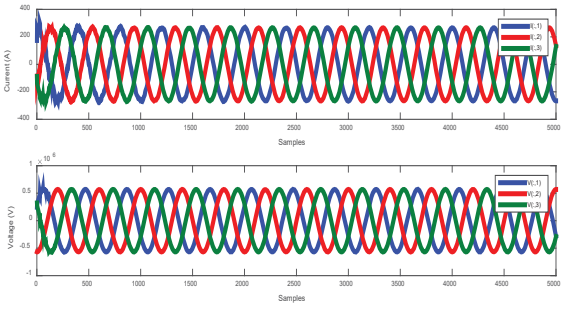


Fig. 2. Current and voltage waveforms during no-fault condition

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TABLE I. DMWT PERFORMANCE FOR HEALTHY SITUATION OF WPISCTL

DMWT Outputs		
"A" Phase	**"B" Phase**	**"C" Phase**
339.1188	317.4410	354.4921

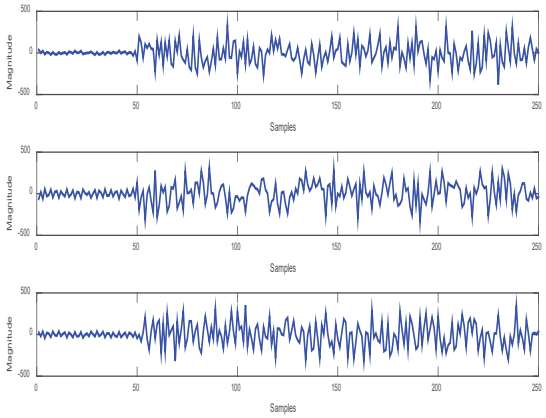


Fig. 3. DMWToutputs for no-fault condition

III. DMWT TECHNIQUE

Fig. 4 explains the flowchart of DMWT-based fault recognition and faulty phase categorization. The steps involved are described below:

Step-1: The three-phase currents are measuredat bus-1.

Step-2: The DMWT is used to process the three phase currents.

Step-3: If the DMWT output of any phase>threshold, then fault is detected and faulty phase is classified otherwise no-fault.

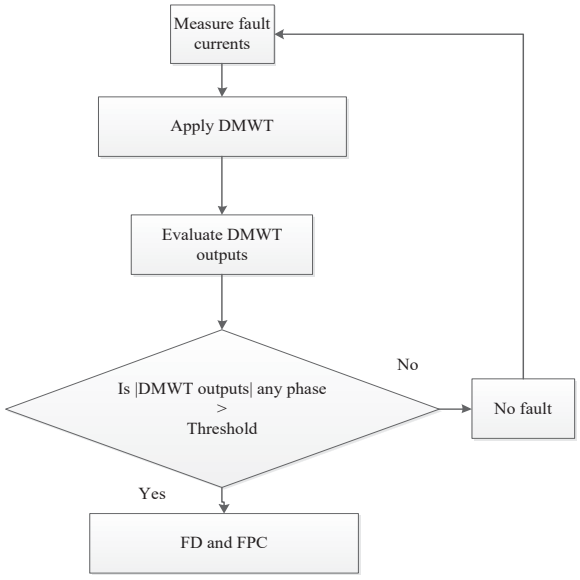


Fig. 4. DMWT-based fault detection (FD) and faulted phase classification (FPC) technique

IV. PERFORMANCE EVALUATION

To substantiate the ability of the DMWT-based FD and FPC scheme, the simulation work has been approved for many faults. The implication of deviation in fault factors has been studied. The responses of the DMWT for different fault cases are discussed below.

A. Response of DMWT for Different $F_{T's}$

In this section, the DMWT is investigated for various fault types (F_T) and its response is shown in Table II. Like, the AG fault at 90 km at 0.0415 s is tested among R_G = 1.5 Ω and R_F = 0.5 Ω. Fig. 5 illuminates the AG fault current waveform. Fig. 6 represents the DMWT outputs for AG fault. Here, T=0.0415 s, F_L= 90 km, R_G = 1.5 Ω and R_F = 0.5 Ω. The outcomes are detailed in Table II. It is investigated that the DMWT executes well for different fault types.

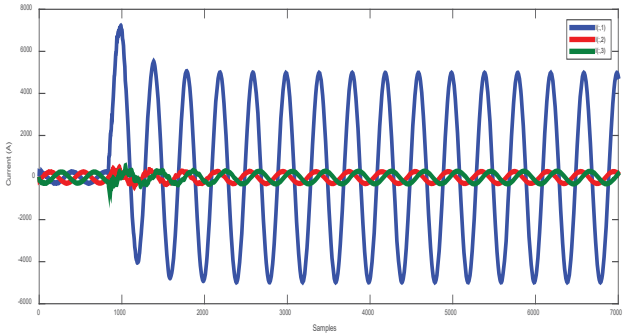


Fig. 5. Current waveforms during AG fault at 90 km at 0.0415 s

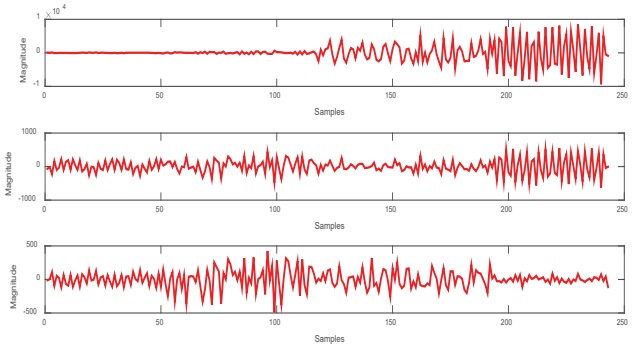


Fig. 6. DMWT outputs for AG fault at 90 km at 0.0415 s

TABLE II. DMWT PERFORMANCE FORFAULT TYPES

Fault Type	FTT (Sec)	F_L (Km)	DMWT Outputs		
			"A" Phase	**"B" Phase**	**"C" Phase**
AG	0.0415	90	8.5754*10^3	551.8941	424.1967
ACG	0.0415	90	1.9132*10^4	876.7464	1.8696*10^4
ABCG	0.0415	90	4.7229*10^4	3.3627*10^4	5.0371*10^4
BCG	0.0415	90	614.9862	1.7186*10^4	1.6821*10^4
BG	0.0415	90	857.3609	5.4197*10^3	856.1149

B. DMWT Performance for Different $R_{F's}$

The DMWT is analyzed for various values of R_{Fs} ranging from 5 Ω to 150 Ω. Like, an ABG fault at 125 km at T = 0.05 s, R_F = 5 Ω and R_G = 0.001 Ω is examined and Fig. 7 presents the ABG fault current waveform. Fig. 8 shows the DMWT outputs for the ABG fault atT=0.05 s, F_L= 125 km, and R_G = 0.001 Ω and the outcomes are addressed in Table III. It is monitored that varying R_F does not perturb the response of DMWT.

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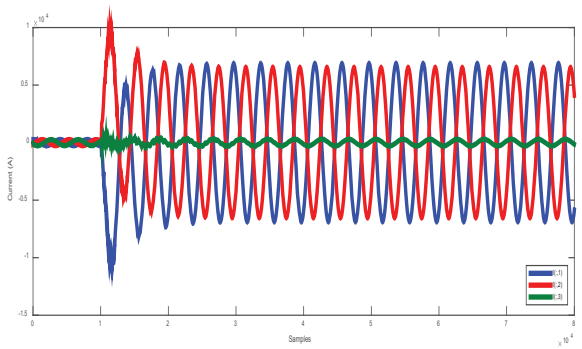


Fig. 7. Current waveforms during ABG fault at 125 km at 0.05 s

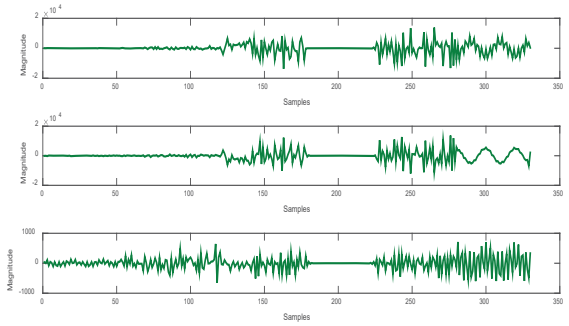


Fig. 8. DMWT outputs for ABG fault at 125 km at 0.05 s

TABLE III. DMWT OUTCOMES FOR VARIOUS RESISTANCES OF FAULTS

Fault Type	R_F (Ω)	DMWT Outputs		
		"A" Phase	"B" Phase	"C" Phase
ABG	5	1.3843*10^4	1.3725*10^4	711.0827
ACG	30	1.0008*10^3	414.3854	1.2576*10^3
ABCG	70	5.1822*10^3	6.5303*10^3	7.1016*10^3
BG	100	379.0940	2.3207*10^3	366.4329
CG	150	376.7637	643.5602	1.9607*10^3

C. *Response of DMWT during Near-End Faults*

The DMWT is probed for the faults which occur near to the position of the relay. Fig. 9 depicts the CBG near-end faultat 5 km at 0.1 s, R_G = 2.5 Ω and R_F = 1.5 Ω. Fig. 10 exemplifies the DMWT outputs for CBG fault. The results for diverse near-end faults are noted in Table IV. It is perceived that the DMWT exquisitely recognizes all types of near-in relay faults.

D. *Response of DMWT during Far-End Faults*

The DMWT is inspected for the faults which incident at the distant position from the relay. Fig. 11 exemplifies the ABCG fault current when the ABCG fault is tested at 0.07 seconds, at 180 km. Fig. 12 exemplify the DMWT outputs for the ABCG fault at 180 km. The inputs of fault are set as R_F = 2.25 Ω, FTT= 0.07 s and R_G = 3.25 Ω and the results for various far-end faults are declared in Table V. The results of the Table V points up that the DMWT executes fine for the recognition of far-end faults.

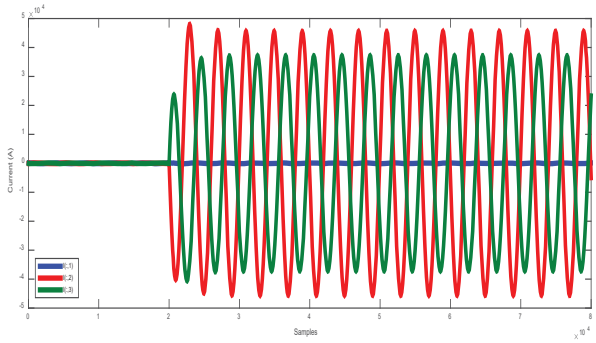


Fig. 9. Current waveforms during CBG fault at 0.1 s, 5 km

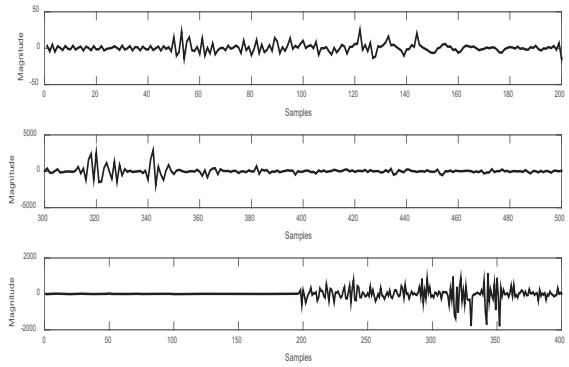


Fig. 10. DMWT outputs for CBG fault at 0.1 s, 5 km

TABLE IV. DMWT PERFORMANCE FOR NEAR-ENDFAULTS

Fault Type	FTT (Sec)	F_L (Km)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
CBG	0.1	5	25.6296	2.9263*10^3	2.1962*10^3
ACG	0.1	10	4.6127*10^3	552.2544	6.8486*10^3
AG	0.1	15	1.0206*10^4	530.0105	540.9280
ABG	0.1	20	1.1265*10^4	1.0138*10^4	914.7766
ABCG	0.1	25	1.4603*10^4	1.5318*10^4	1.6341*10^4

TABLE V. DMWT PERFORMANCE FOR FAULTS AT DISTANT-END

Fault Type	FTT (Sec)	F_L (Km)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
ABCG	0.07	180	2.6510*10^4	3.3839*10^4	2.3587*10^4
ABG	0.07	185	1.5522*10^4	1.3158*10^4	837.0105
AG	0.07	190	7.6819*10^3	379.1323	390.3269
BCG	0.07	195	434.0684	1.7533*10^4	1.5670*10^4
CG	0.07	200	504.8301	502.4420	7.2841*10^3

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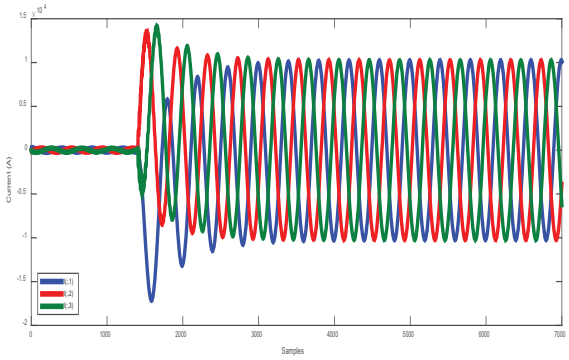


Fig. 11. Current waveforms during ABCG fault at 180 km at 0.07 s

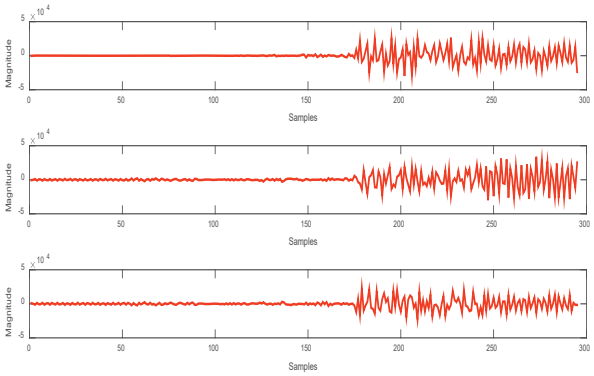


Fig. 12. DMWT outputs for ABCG fault at 0.07 s, 180 km

E. Response of DMWT for Transforming Faults

In this section, the DMWT is examined for various transforming faults. Fig. 13 shows the waveform of transforming fault simulated on WPISCTL as the BG fault at 75 km at 0.05 s, R_G = 4.5 Ω and R_F = 5.5 Ω is transformed into BCG fault at FTT=0.25 s. Fig. 14 shows the DMWT outputs for the BG to BCG fault case. Table VI details the outcomes of DMWT. It is investigated that the transforming faults are easily recognized by the DMWT.

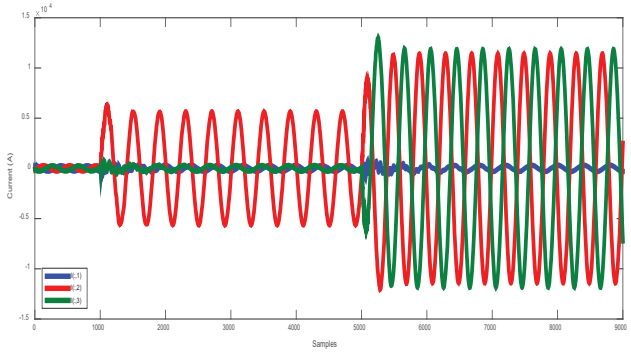


Fig. 13. Current waveforms during BG fault at 0.05 s at 75 km is transformed into BCG fault at 0.25 s

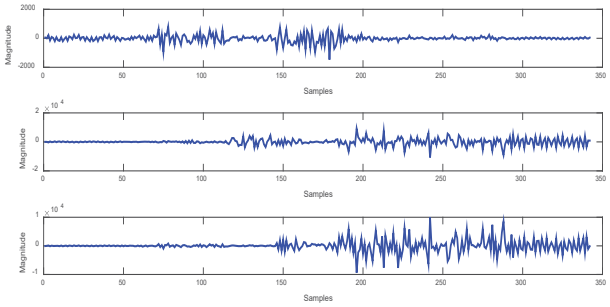


Fig. 14. DMWT outputs when BG fault at 0.05 s at 75 km is transformed into BCG fault at 0.25 s

TABLE VI. DMWT PERFORMANCE FOR TRANSFORMING FAULTS

Fault Type With Time (Sec)	Converted Fault Type With Time (Sec)	DMWT Outputs		
		"A" Phase	"B" Phase	"C" Phase
BG (0.05)	BCG (0.25)	806.6415	9.1592*10^3	9.9567*10^3
AG (0.1)	ACG (0.2)	1.2296*10^4	585.0702	1.0588*10^4
CG (0.05)	BCG (0.2)	795.8181	7.6837*10^3	9.2820*10^3
ABCG (0.116)	BG (0.2)	1.5940*10^4	2.3562*10^4	1.4289*10^4
CG (0.072)	ABCG (0.235)	1.1769*10^4	1.4870*10^4	8.6091*10^3

F. Response of DMWT for Faults at Two Different Positions

In TLs there is a possibility of occurrence of two faults at two diverse positions, such faults are known as cross-country faults or multi-location faults. The DMWT is explored for two dissimilar position faults. The waveform of the AG fault current at 70 km ahead of the bank of SC's and CG fault current at 130 km behind the bank of SC's among FTT=0.075 seconds, R_G = 3.5 Ω and R_F = 1.5 Ω is illustrated in Fig. 15. Fig. 16 confirms the DMWT outputs for AG and CG faults. The outcomes for two different position faults are detailed in Table VII. It is understandable that the DMWT works well for recognizing the two different position faults.

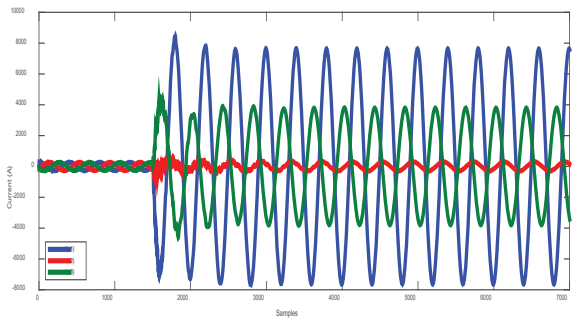


Fig. 15. Current waveforms during AG fault at 70 km and CG fault at 130 km, 0.075 s

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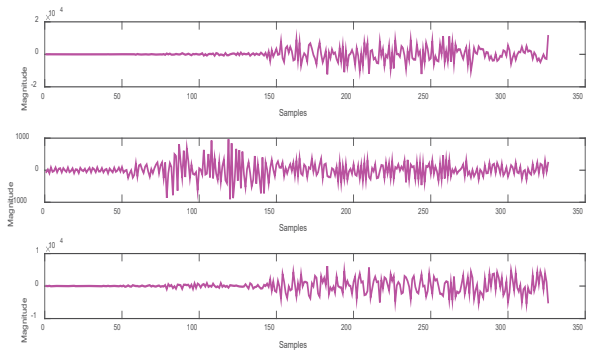


Fig. 16. DMWT outputs for AG fault at 70 km and CG fault at 130 km, 0.075 s, R_G = 3.5 Ω and R_F = 1.5 Ω

G. DMWT Performance for V_S and F_S Deviation

The DMWT is examined for various parameters of V_S and F_S. Fig. 17 exemplify the AG fault current at 100 km at 0.1 s, V_S= 385 kV, F_S= 49.85 Hz, R_F = 0.45 Ω and R_G = 0.75 Ω. Fig. 18 epitomizes the DMWT outputs for AG fault at 50%. The inputs of fault are: FTT=0.1 seconds, F_L = 50%, R_G = 0.75 Ω and R_F = 0.45 Ω. Table VIII details the outcomes. It is inspected that variation in the source parameters does not influences the working of DMWT.

TABLE VII. DMWT OUTPUTS FOR FAULTS AT TWO DIVERSE POSITIONS

Fault-1 With Location (km)	Fault-2 With Location (km)	FTT (Sec)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
AG (70)	CG (130)	0.075	1.1235*10^4	966.2930	6.1351*10^3
CG (85)	BG (115)	0.075	614.1013	1.2431*10^4	1.7746*10^4
ACG (110)	BG (90)	0.075	9.4122*10^3	1.4348*10^4	2.2866*10^4
AG (155)	BG (45)	0.075	7.0638*10^3	8.6151*10^3	1.9035*10^3
BG (65)	CG (135)	0.075	975.8672	1.3379*10^4	4.0483*10^3

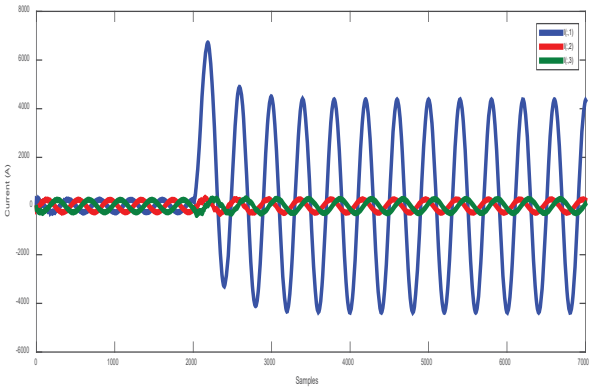


Fig. 17. Current waveforms during AG fault at 50%, V_S = 385 kV, F_S = 49.85 Hz, R_G = 0.75 Ω, FTT=0.1 s, and R_F =0.45 Ω

H. Response of DMWT for Number of Wind Turbines

DMWT is analyzed for number of wind turbines in the wind park. Fig. 19 represents the BG fault at 130 km with FTT=0.05 seconds, three wind turbines, R_G = 2.75 Ω and R_F = 1.25 Ω. Fig. 20 exemplifies the DMWT outputs for BG fault among the three wind turbines. The fault inputs are: FTT=0.05 seconds, R_G = 2.75 Ω, R_F = 1.25 Ω and F_L= 130 km. Table IX details the outputs of DMWT. It is examined that the DMWT effectively recognizes all faults with different wind turbines.

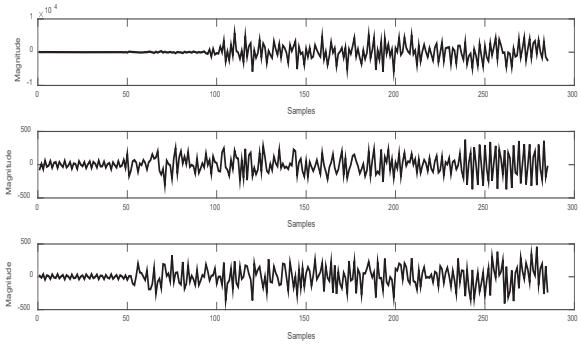


Fig. 18. DMWT outputs for AG fault at 0.1 s, at 50%, V_S = 385 kV, F_S = 49.85 Hz, R_G = 0.75 Ω and R_F = 0.45 Ω

TABLE VIII. DMWT OUTPUTS FOR DIFFERENT SOURCE VOLTAGE AND FREQUENCY

Fault Type	Voltage (kV)	Frequency (Hz)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
AG	385	49.85	5.7983*10^3	376.6880	458.0634
BCG	390	49.95	800.8338	1.6176*10^4	1.5111*10^4
ABG	395	50.05	1.7647*10^4	1.8687*10^4	952.7817
BG	405	50.10	973.3071	6.5404*10^3	966.5418
CG	410	50.35	710.2728	721.0394	1.1040*10^4

TABLE IX. DMWT OUTPUTS WITH DIFFERENT WIND TURBINES

Fault Type	No. of WT Units	F_L (Km)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
BG	3	130	491.2453	5.4790*10^3	493.4779
AG	5	130	5.2724*10^3	443.2669	264.3784
CG	4	130	712.4162	716.4990	6.5287*10^3
ACG	1	130	1.0878*10^4	747.5478	9.9536*10^3
ABCG	2	130	9.1372*10^3	2.0172*10^4	2.3623*10^4

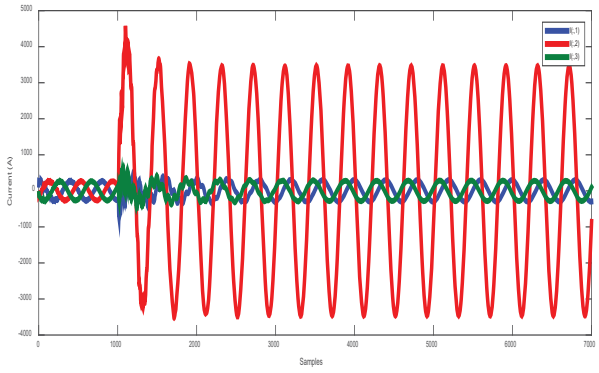


Fig. 19. Current waveforms during BG fault at 0.05 s,F_L=130 km

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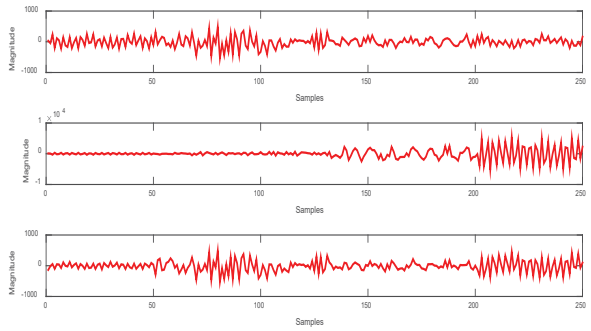


Fig. 20. DMWT outputs for BG fault at 0.05 s, F_L=130 km

I. *Response of DMWT for Varying Fault Triggering Time*

The DMWT is examined for fault triggering time variation. Fig. 21 exemplifies the ABG fault current at 0.055 seconds. Fig. 22 shows the DMWT outputs for the ABG fault. The results for the FTT variation have been detailed in Table X, which confirms that it does not affect the performance of DMWT-based scheme.

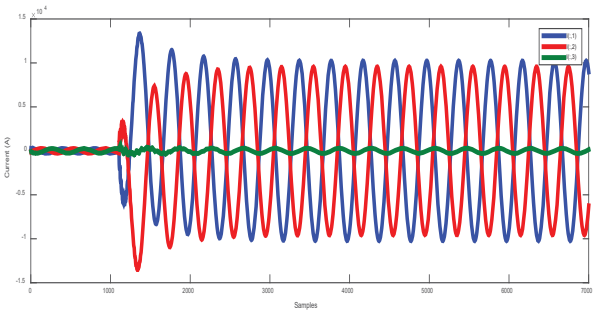


Fig. 21. Current waveforms during ABG fault at 80km, 0.055s

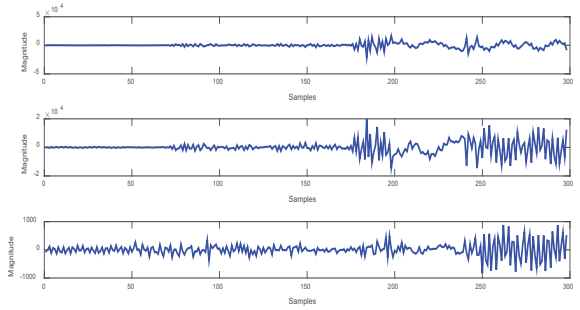


Fig. 22. DMWT outputs for ABG fault at 0.055s, F_L=80 km

TABLE X. DMWT OUTCOMES FOR VARYING FAULT TRIGGERING TIME

Fault Type	FTT (Sec)	F_L (Km)	DMWT Outputs		
			"A" Phase	"B" Phase	"C" Phase
ABG	0.055	80	1.6936*10^4	1.9869*10^4	881.6341
BCG	0.112	80	674.4914	2.1858*10^4	1.6184*10^4
AG	0.215	80	6.4806*10^3	686.1873	756.6083
BG	0.308	80	376.5200	8.6582*10^3	401.3757
CG	0.19	80	572.8821	604.8165	9.8388*10^3

V. CONCLUSION

The DMWT is realized to be very efficacious beneath miscellaneous fault varieties for protection of the WPISCTL. The DMWT outputs of the fault currents are determined. The WPISCTL model fault inputs are altered. It is reported that the fault inputs do not influence the reliability of DMWT. The results corroborate that the DMWT has the adequacy to protect the WPISCTL against various fault scenarios.

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Monitoring and Detection of Blood Flow based on Internet of Things

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***Abstract*— In this paper, detection and monitoring system of blood flow is proposed and developed. This monitoring system is based on Internet of things in which blood flow is analyzed. The analysis of blood is done with the help of various optical sensors and smart phone. The sensors are used for sensing and the sensed data us send to the smart phone after amplification and filtering for analysis. However, the received signals are affected by the motion artifact and ambient light. All the processing work is done by the smart phone application, which makes the complete system light weight and portable and can be mounted easily. The system has been implemented and interfacing with the smart phone application has been proposed in this paper. The proposed system gives the analysis of blood flow, which reveals large amount of information related to health and wide range of applications such as sports and industry.**

Keywords— *optical sensors, smart phone, Internet of things*

I. Introduction

Today's scenario healthcare monitoring system has become major challenge in human life. Humans are facing a lots of problem due to heart attack because of provide a medical care to patient at right time. At present, the global populace is facing of advanced years, standard of comfort have been improved, the petition for health maintenance in distant areas is also growing, the patient's physiological parameters of real-time monitoring, these tangible factors are to promote the traditional medical changes, mobility and portability of medical electronic devices continue to develop [1]. Traditional medical equipment is larger, the function is relatively simple, for the ordinary people in terms of their own physical health to have a good understanding, in addition to the traditional signs of disease to be used to judge other than the other way. Although the hospital's examination can be a good physical examination of the body, but very convenient, and expensive. Now the social aging is serious, the health management of the elderly groups is a big problem, with the progress of society, not only the elderly, but also everyone in society will have high demands on their own body, so portable Integration, to carry, to real-time monitoring of the body's physiological parameters of the instrument will have a great market [2-4].

In this paper, by using Body Area Network (BAN) technology, hardware is designed with hardware sensors and android phone application. The optical sensor present in the hardware will detect the body temperature and the heart rate of patient [5]. This data is transformed to android smart phone via Bluetooth/Wi-Fi. With the help of the device, patient move freely and continuously monitored through the data transferred wirelessly for analysis. Tissue health report can be known with the help of blood flow analysis. As increased blood rate can be an indicator of infection, disease or inflammation whereas its decrease indicate the heart failure, diabetes or atherosclerosis diseases. The sensors are used to detect the blood flow and heart rate which are generally the soft skin sensing devices which are mainly composed of thermal (heat) sensing sensors or devices. These devices sense the flow of blood and generate the little warm to get the response signal to be detected by other devices (PPG & GSR sensors) [6]. After that, the sensed information is sent to the computer or controller which will calculate the blood flow rate. By using mobile application, pulse rate reflect the symptom of heart attack as the received data and if any causality are shown message will be transfer to patient's doctor, relatives and hospitals [7-9].

In Section II, technology is discussed on which the system is based on. In Section III, designing and implementation of this complete system is discussed. In Section IV, results are presented and discussed and in Section V, the conclusion is presented.

II. Working Technology

The system is designed for portable device, which amplifies the cardiac of patient by pulse devices are attached on one of the digits and then the outcome is displayed on an Android request edge. Diminished cardiovascular monitoring is based on Arduino. It proposed the benefit of portability over tape-based footage.

Photo PlethySmography (PPG) is a low value optical technique which is able of track down quality transformation in the hemoglobin flowing over duct from the skin area as shown in Fig. 1. It became advanced inner the late 1800s wherein expert keep actual-time red fluid flow by the use of mild bulbs. It turned into internal the past due Nineteen Thirties that the time span 'photoplethysmography' converted into coined by way of chemists. These attire gadgets are normally connected to a peripheral device to explain the output acquired. It additionally gives great eventualities statistics removal, to

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illustrate, by bottomless gaining knowledge of, in addition to a variety of other modern pulsate evaluation methods.

PPG alternatively achieved in accordance of subsequent shares:

- The vulva (vaginal photoplethysmography)
- The genitalia (clitoral photoplethysmography)
- The esophagus

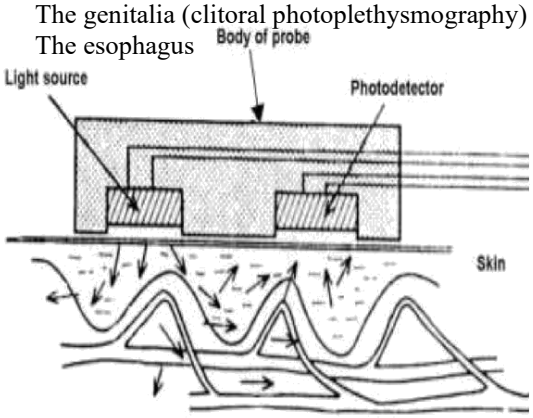


Fig. 1 PPG Placement Photo Diode

III. Design and Implementation

The system design constitutes of three parts, namely (a) a longsuffering alliance, namely, portable pulse sensor level (b) Robot managed method, namely, a mobile phone, and (c) an entrance site. The remote monitoring system is shown in Fig. 2



Fig. 2 Remote Monitoring System

The complete system is divided into two parts, hardware and software. For designing of hardware part some of the following components are used namely, Pulse sensor and Temperature sensor is used for the sensing, Bluetooth/WiFi is used for wireless transmission of sensed data from sensors for analysis. Connecting wires are used for giving connections in the circuitry. USB cable for providing the power to the circuit. Android Mobile device for analysis of transferred data and LCD for display.

The software requirement for the system is Bluetooth/WiFi Terminal for wirelessly receiving the data collected by the sensors. Admin and Sub-Admin Panel for analysis of received data. Mobile Application for processing the data and send to the user.



Fig. 3Smart Monitoring system based on IoT

A sphygmomanometer monitor uses an inflatable air-bladder cuff and a hearing device to measure blood pressure in an artery. Two methods are using monitoring & performed: arterial wall voiding (the oscillatory method), or manually inflated cuffs with a stethoscope to monitor blood pressure in which arterial wall vibration (oscillometric method). There is a pressure sensor for sensing.

An automatic monitor blood pressure inflates a cuff around an arm with enough pressure to stop the flow of blood to the local main artery. This pressure is slowly released flowing through the artery, the measurement of which determines the systolic pressure. Pulse rate is also conscious at this time. When blood flow is not restricted, a measurement cycle is performed automatically with a pump, cuff, and valve and pressure sensor.

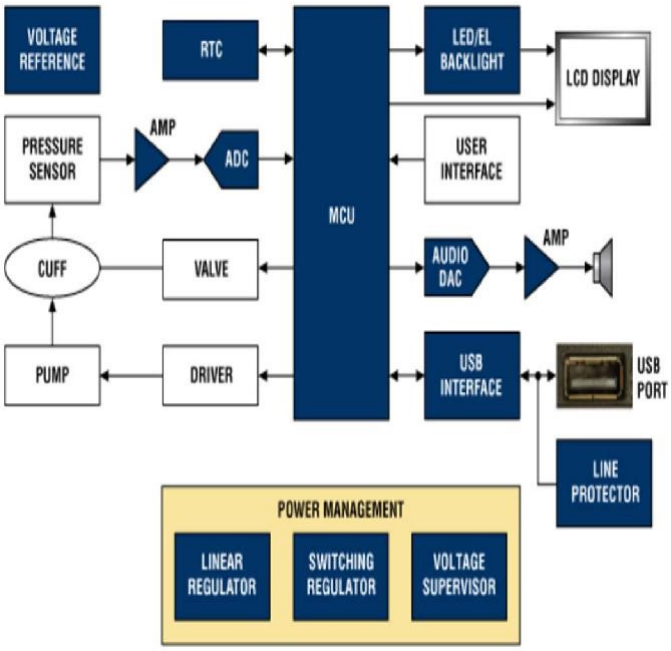


Fig. 4 Block Diagram of Blood Pressure Monitoring System

From the Fig. 4 the signal from the pressure sensor is conditioned by an analogy to digital converter (ADC) with an op-amp circuit or instrumentation amplifier prior to data conversion. The systolic pressure, diastolic pressure, and pulse rate are calculated using the appropriate method for the use of monitors and sensors in the digital domain. The resulting systolic, diastolic and pulse-rate measurements are displayed on a liquid-crystal display (LCD), time/date-stamped, and stored in non-volatile memory.

IV. EXPERIMENTAL RESULTS

There is frequently a need to get to pulse estimating instrument which give exact and fast readings of patients. In contrast to the traditional strategy, the specialist shouldn't be available at the hour of estimating the pulse. The framework takes the physical contribution from beat sensor by putting the patients' finger on the sensor and afterward the information is prepared by Arduino to check the no. of heartbeats and showing the yield. Catalyst takes data from

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the board & utilizing USB port or battery. Interface the beat sensor to the board.

Data received on the mobile phone through application is transferred to the admin panel. From admin panel this data can be access by sub-admin. Sub-admin will manage the user (patient) and provide regular updates. The output at the serial monitor is shown in Fig. 5. The mobile output is shown in Fig. 6

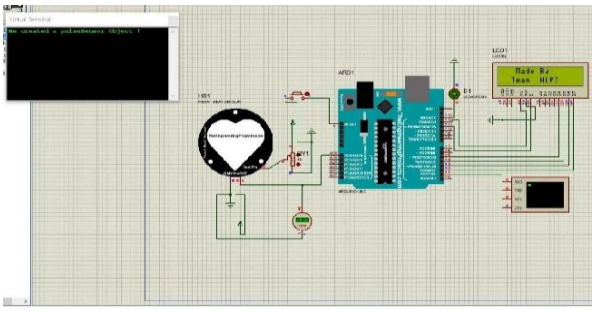


Fig. 5 Circuit Diagram

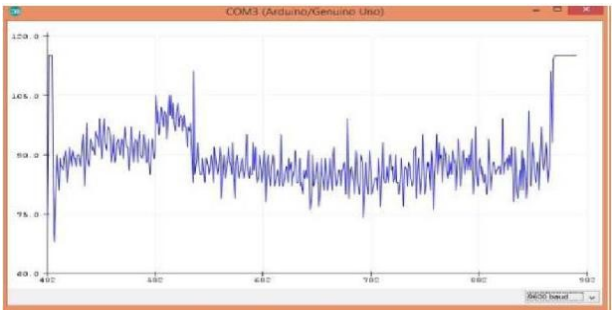


Fig. 6 Serial Monitor

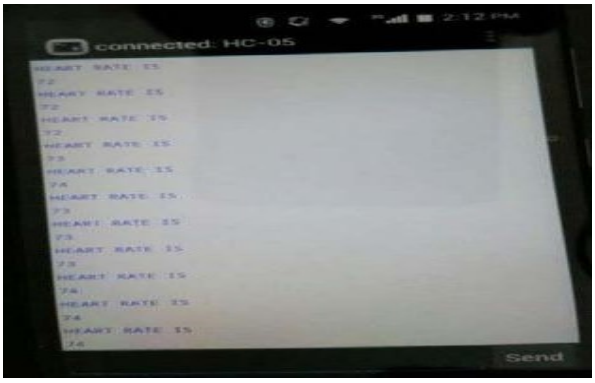


Fig. 7 Mobile output

V. Conclusion

The results show concentrates on the heart rate directing and warning which is capable of directing the pulse rate situation of patient. The system examines the heart beat rate per minute. Outcome of this paper is that it is absolutely important to measure the human body specifications which are in tough condition and to display the data on LCD, without identifying can't examine the exact problem and found the data then analyze patient more precisely. By examining the output signal frequency from the heartbeat sensor we found that which signal is to be considering as heartbeat. The correct simulation of heartbeat will display on the LCD.

Acknowledgment

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Design and Analysis of Ultra High Speed 16 Channel Cascaded EDFA-DWDM Network with Post Dispersion Compensations Using Optimization of Fiber Bragg Grating

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Abstract: **This article introduces an optimization of optical network system using the residual power of doped-fiber amplifier (EDFA) and optimized dispersion management by fiber bragg grating. If transmitted signal speed is increased to 8 * 5 Gbps, the dispersion is caused due to several reasons and pulse becomes indistinguishable at the destination. Its purpose is to use DCF in network to design and analyze the dispersion compensation system and here FBG used as a post-dispersion compensator. The main purpose is to achieve a constant gain over the entire transmission spectrum of the 16 narrow gap channels to match the amplitude gain of the DWDM system. The method was simulated using Optisystem 16.1 software package to achieve the uniformity of EDFA gain by changing the EDFA pump source power and system CW power. The planner gain is 41±0.4 decibels in the wavelength range from 1548 to 1556 nm, the NF close to 7 dB, the flattened EDFA gain at fiber length close to 8m, the frequency interval between channels is 0.5nm and dispersion significantly managed.**

Keywords-FBG: FiberBragg grating, Q factor: quality factor, EDFA(Er+3 doped fiber amplifier) - DWDM (Dense wavelength division multiplexing), NF: Noise figure, DCF(dispersion compensated fiber)

I. INTRODUCTION

Fiber amplifiers doped with Er^{+3} rare earth materials are primarily used in DWDM optical network designs because of the large bandwidth spectra required to facilitate high-speed network services so that bandwidth will increase[5]. It can operate fast and efficiently without impacting cost [1]. Its main feature is an operating wavelength of 1.55 μm [3] [7], which maintain the least attenuation compared to other light transmission windows of communication. If the bit rate increases to 40 Gbps the pulses begin to expand and overlap, loss and distortion will be introduced into the fiber, which will eventually lead to cross talk and ISI(inter-symbol interference), resulting in errors at the destination end [2].By using FBG as the post-dispersion compensation for the the optical network link, the dispersion can be minimized. This is one of the ways to reduce dispersion, because the grating reflects different wavelengths at different distances [2].
The technical characteristics of the EDFA include effective pumping, low noise, high gain, low distortion, and minimal crosstalk between channels. Most importantly, it amplifies the data channel at high data rates in the optical region and fiber operating range. This can result in imbalances in the power of the transmitted WDM channels due to the uneven wavelength of performance and the gain spectrum of the optical amplifier. Therefore, by equalizing the gain of electronic devices, error-free transmission of optical link signal detection is realized. Passive optical networks (PONs) are considered one of the most promising structures used in highlight multipoint (P2MP) organizations. By continuously checking the reflectivity level of WDM beneficiaries, the fibers can be observed effectively.

II. DESIGN PRINCIPLE

The proposed system simulate on OptiSystem 16.1 simulation software. It is also used as a design tool for simulating the design of any typed doped fiber amplifiers like (EDFAs) in TDM-PON systems. The EDFA system consists of a 1548-1556 nm laser source and a 980 nm pump laser, WDM multiplexer, isolator, EDF, and back propagation pump coupler[9][10]. There are usually many ways to design the optical plane spectral gain, such as controlling the pump power, controlling the length of the optical fiber, changing the input power, and correctly selecting the characteristics of the optical notch filter. In this article, reflectors used in optical communications are FBG, which can reflect specific wavelengths and transmit all other light waves. In FBG, there are periodic changes in the refractive index in the transmission medium [2][8]. At a specific wavelength, the refractive index changes alternately. During refraction, a very low amount of photon is reflected [6].The reflection occurs at a wavelength called the Bragg wavelength that forms the Bragg condition. The equation relating the periodicity of the grating to the Bragg wavelength is affected by the effective FBG refractive index neff, and the equation is

$$\lambda_B = 2n_{eff}\,\Lambda \qquad (1)$$

Where ,λ_B= Operated Bragg wavelength;
Λ = FBG Grating period;
n_{eff} = Effective refractive index of the transmitting medium
If the bit rate is increased to 40Gbps, as the pulses begin to widen and overlap each other, loss and distortion will be introduced into the fiber, which will eventually lead to crosstalk and inter-symbol interference, resulting in errors at the receiver [3].By using FBG at the receiver end of the

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fiber link, chromatic dispersion can be minimized. This is one of the ways to reduce dispersion, because the gratting reflects different wavelengths at different distances in the grating [4]. As shown in Figure 1, the pump laser signal excites the ground plane electrons (E1) to a higher energy state (E3). However, E3 is unstable and soon ions quickly fall to the metastable state E2 (that is, no photons are released) through a non-radiative decay process. When an optical signal with a wavelength of 1550 nm passes through a fiber-doped fiber, the metastable particles are in the ground state under the action of stimulated radiation, and the same photon as the photon is generated in the incident signal light. Therefore, the gain obtained by signal amplification is

$$\text{Gain (dB)} = 10 \log10(\text{Pout/Pin}) \qquad (2)$$

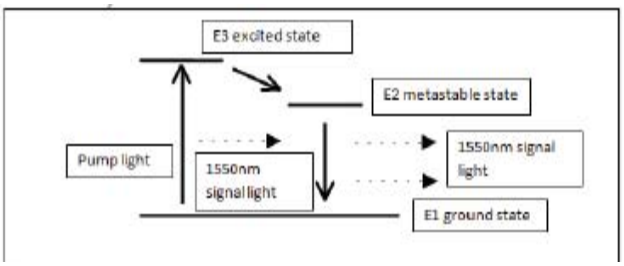


Figure 1: Typical three level EDFA energy band diagram.

At high information power, Gain immersion happens, diminishing addition of EDFA as increase is relative to the distinction in the number of inhabitants in moderate level and lower level.

III. BACKGROUND

EDFA DWDM design has been always a required option to use them as light amplifiers or we can say that non electrical domain amplification without any electronic conversation. In this context previous work has flat gain of around 36 dB for 8 channel WDM system, maintaining frequency spacing between channels around 0.8 nm. As other work focused on EDFA flattens gain characteristics ranged 30 to 40 dB for a 16 channel DWDM system with narrow spacing among corresponding channel. Other work focused on EDFA gains are flattened to around 24 dB for 16 channel DWDM system, maintaining frequency spacing between channels to 0.8 nm by changes in EDFA core characteristics.

In this context

In previous work EDFA operated at 1490 - 1550 nm optical light transmitted in the fiber medium .The FBGs characteristic are plotted using an Optical time domain Analyzer [1]. In our proposed model the pre Erbium Doped Fiber Amplifier (EDFA) as in line amplifier in 40 Gbit/s 8 narrow spaced in frequency domain channels operating system with NRZ-OOK modulation propagation and operating wavelength range 980nm and counter propagation 1480nm. Finally shown noise factor values within 4 - 4.5 dB both for 10m and 30m long [2]. In proposed WDM system is combined Raman dissipating and EDFA's six WDM narrow spaced model channels in the range of 1560 and 1563 nm. When design a post dispersion compensation management systems using specially designed fiber like FBG [4]. The system performance of the proposed system is presented changes in dispersion through the changes in the eye diagram design and Q factor. The designed link Q factor ranged between wavelengths of 1554nm is 99.05 with the eye height of 0.5574.Finally it is observed that previous work proposed a simulation model that provides EDFA-DWDM maximum gain in the range of 30 to 40dB and noise figure around 5- 9dB for 8 to 16 channels by variation of fiber length and pump power an d mainly focused on low data rate but we proposed a system having high data rate and dispersion management system, it provided one solution to many issue which are practically faced in optical transmission. By simulation it provide gain around 41 dB with flatness and very low BER at high data rate.

IV. RESULT & DISCUSSION

We simulated a very narrow spaced 16-channel system in the wavelength range 1548 to 1556 nm[5]. However, it is sometimes modified to analyze system for changes in wavelength. The frequency interval between each channel is usually set at 0.5nm and the wavelength range is 0.8nm. The power of each channel is -26 dBm and the data rate is 40 Gbps, but in order to analyze the influence of changes in input power on the gain and noise of the active fiber, it can be changed. Optical isolators are also used to achieve stable power operation of the optical amplifier; this function prevents reflected light from entering the amplifier. The 980nm variable pump is used to excite the dopant atoms to higher energy levels. The results of the APD and PIN photodetectors were obtained on the BER analyzer. The Bessel filter used limits the sound power.

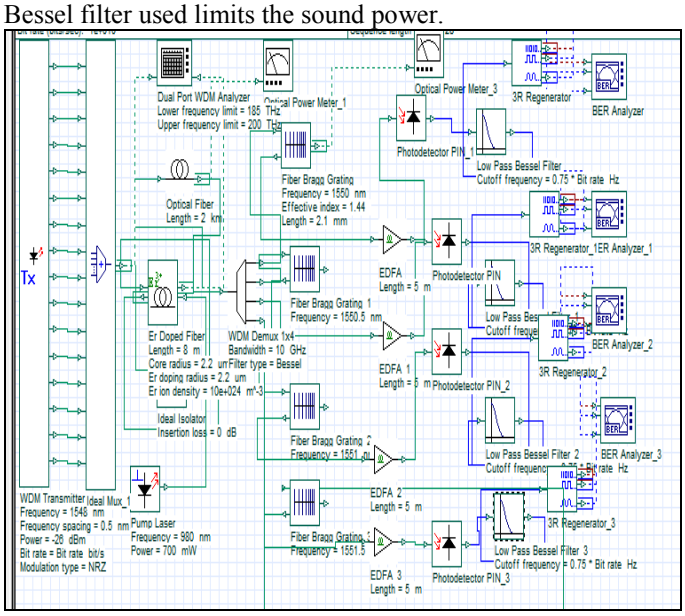


Figure 2: Schematic design of EDFA-DWDM network with dispersion management.

In order to achieve $N_2 > N_1$, density of atom in higher energy level must be exceed to lower energy lever , we need to pump intermediate ions at a medium level. There are two methods: pump them directly or indirectly at the wavelength of 980nm. In the indirect method (980nm), the Er ions continuously move from a lower state to a higher energy level, where they decay to an intermediate energy level without radiation, and from there to the length d lower wave

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required for radiation. Energy level (1500-1600 nm[8]. This is called the three-level energy system for population and for stimulated emission. Lifespan or spontaneous emission time is the average length of time that an atom remains at a certain energy level before spontaneously falling to higher energy level. The lifespan of higher level ions is only about 1 µs, while the lifespan of medium level ions exceeds 10.
EDFA has always been the first choice for optical amplifiers, because EDFA can amplify signals in the non electrical domain or directly in light in fiber. By using EDFA-DWDM, travel distance and data rate of the optical system are increased, and its characteristic is to provide a flat gain in a certain frequency range. In proposed simulation has a flat gain of about 41 dB for a narrow spaced 16 channel WDM system.

TABLE 1 DESIGN PARAMETER

Parameters	Values(Units)
Quantity of Channels	16
System frequency of DWDM	1548 nm
System frequency spacing DWDM	0.5 nm
BW of DWDM	10GHz
Modulation Scheme	NRZ
Doped fiber gain length	8 m
Optical amplifier core radius	2.2µm
Optical amplifier ion density	1.425e+025 m^{-3}
NA	0.24
Pump Laser frequency	980 nm
FBG effective index	1.46

Figure 3 shows that the EDFA gain increases as the length of the EDFA fiber increases, and the results show that the EDFA is flat near the range of 8 m to achieve the optimized EDFA length here. As you can see, the maximum flattening gain of about 41 dB is achieved with a pumping power of close to 8 m, and most importantly, the wavelength spacing between channels is decreased upto 0.50 nm.

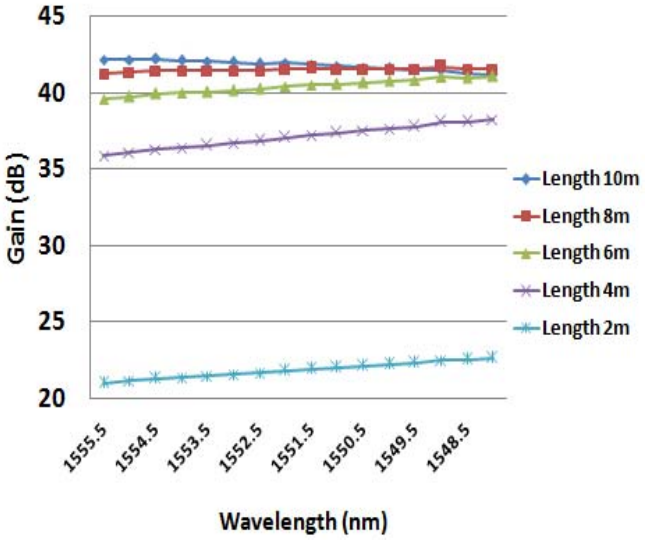


Figure 3: change in Gain on the optical wavelength for various EDFA fiber length at different DWDM input power

Figure 4 shows the gain variation of the various pump outputs. Here, it is visualized that the lower the pump, the lower the power gain and the higher the likelihood of signal distortion.

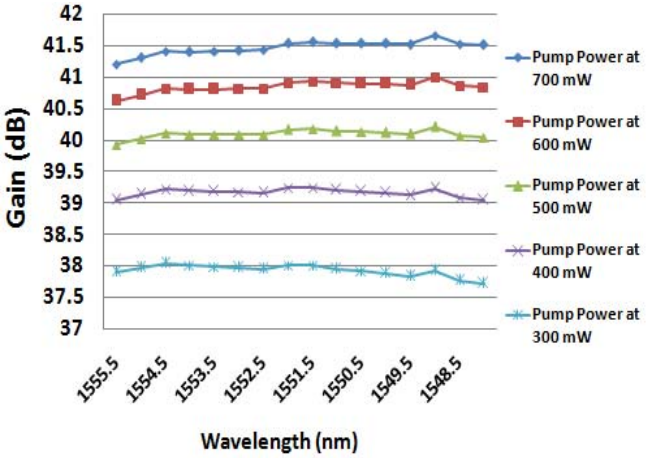


Figure 4: Changes in Gain with the transmitted wave for different pump level at steady transmitted signal.

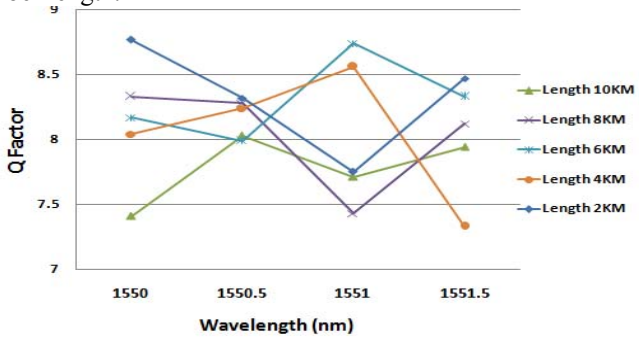
TABLE 2 CHANGES IN BER WITH THE TRANSMITTED WAVE FOR DIFFERENT FBG EFFECTIVE LENGTHS AT STEADY TRANSMITTED SIGNAL

Wave Length (nm)	BER at Length 2.1	BER at Length 2.0	BER at Length 1.9	BER at Length 1.8	BER at Length 1.7
1550	3.29* 10e-13	1.51* 10e-15	5.29* 10e-16	2.25* 10e-14	5.23* 10e-16
1550.5	1.68* 10e-13	5.24* 10e-13	6.49* 10e-16	1.71* 10e-12	1.68* 10e-13
1551	6.09* 10e-13	8.10* 10e-12	2.32* 10e-12	4.62* 10e-13	6.23* 10e-12
1551.5	6.86* 10e-14	5.78* 10e-16	2.78* 10e-14	4.31* 10e-15	1.08* 10e-14

TABLE 3 CHANGES IN WAVELENGTH BER FOR VARIOUS EFFECTIVE INDICATORS OF FBG AT CONSTANT INPUT POWER

Wave Length (nm)	FBG effective Index 1.47	FBG effective Index 1.46	FBG effecti ve Index 1.45	FBG effective Index 1.44	FBG effective Index 1.43
1550	3.66* 10e-17	2.11* 10e-12	2.53* 10e-15	2.75* 10e-15	1.48* 10e-15
1550.5	2.86* 10e-15	3.94* 10e-22	1.40* 10e-15	1.19* 10e-16	4.51* 10e-21
1551	5.97* 10e-17	4.11* 10e-15	6.79* 10e-17	1.65* 10e-13	5.46* 10e-13
1551.5	1.71* 10e-18	9.69* 10e-16	6.20* 10e-20	2.43* 10e-18	2.47* 10e-18

The parameters displayed provide the highest quality factor and eye height, It also provides a change in Q factor with fiber length.



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Figure 5: Variation of Q factor on the wavelength for various optical fiber lengths

TABLE 4 PROPOSED SYSTEM COMPARISON WITH PREVIOUS WORK

Parameter	Proposed system	[1]	[2]	[3]	[4]	% Improv ement
Number of Channel	16	8	8	6	1	100
Data rate Gbit/s	40	40	40	10	40	NA
Gain (dB)	41±0.4	22-30	30	30-38	30	10
Noise Figure (dB)	7	5	4-4.5	5	6	10
Dispersion Improveme nt	10e-12 - 10e-22	10e-12	10e-16	Not Disc uss	10e-20	10

CONCLUSION

As above table 2, 16-channel amplification system is analyzed with the following method From 1548nm to 1556nm of bandwidth, it has an inherent gain flatness of 41 ± 0.5 dB. The length of EDFA fiber of 2-10m and the variable gain obtained from different pump power by simulation, and the average noise figure is 7.4dB. The BER performance of this DWDM system is good, on the order of range 10e-14 to 10e-22. The change in ionic concentration changes the gain. When the concentration is 1000 ppm-weight and the pump power is 250 mW, the best performance is obtained and the Q value is 7.33. All values are measured at a pump wavelength of 980 nm. We also analyzed the dispersion compensation system at a bit rate of 40 Gbps, and observed the changes in the Quality factor. The wavelength compatible with this bit rate is 1554 nm, which is optimized by changing it between 1548 nm and 1556 nm. It can be seen that the best input power is -26 dBm, the best effective FBG effective index is 1.42 and the FBG fiber length is 2.1 mm.

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Image Enhancement Performance of Fuzzy Filter and Wiener Filter for Statistical Distortion



Pawan Kumar Patidar and Mukesh Kataria

1 Introduction

Image enhancement is a vital image processing [1] task, i.e. as a process itself as well as a component in other processes. There are many ways to enhance an image or a set of data and methods exists. The important property of a good image enhancement model is that it should completely remove distortion as far as possible as well as preserve edges. Traditionally, there are two types of models, i.e. linear model and nonlinear model. Generally, linear models are used. The benefits of linear distortion removing models is the speed and the limitations of the linear models is that the models are not able to preserve edges of the images in an efficient manner, i.e. the edges, which are recognized as discontinuities in the image, are smeared out. On the other hand, nonlinear models can handle edges in a much better way than linear models. One popular model for nonlinear image enhancement is the Total Variation (TV)-filter.

We suggest to enhance a degraded image I given by $I = O + D$, where O is the original image and D is an Additive White Statistical distortion with unknown variance [2]. The rest of the paper is organized as follows:

- In the second section, we present the method of statistically designed filter.
- In the third section, we present the method of Blurred filter.
- In the fourth section, we described the image distortion.
- The simulation results are discussed in part fifth.
- We conclude and future work in part sixth and seventh.

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2 Statistically Designed Filter

The goal of the statistically designed filter [3] is to filter out distortion that has corrupted a signal. It is based on a statistical approach. Typical filters are designed for the desired frequency response. The statistically designed filter approaches filtering from a different angle. One is assumed to have knowledge of the spectral properties of the original signal and the distortion, and one seeks the LTI filter whose output would come as close to the original signal as possible. Statistically designed filters are characterized by the following:

a. Assumption: signal and (additive) distortion are stationary linear random processes with known spectral characteristics.
b. Requirement: the filter must be physically realizable, i.e. causal (this requirement can be dropped, resulting in a non-causal solution).
c. Performance criteria: minimum mean square error.

2.1 Statistically Designed Filter in the Fourier Domain

The Statistically designed filter is:

$$R(x, y) = \frac{K^*(x, y)\, Q_s(x, y)}{|K(x, y)|^2 Q_s(x, y) + Q_n(x, y)} \tag{2.1}$$

Dividing through by Q_s makes its behavior easier to explain:

$$R(x, y) = \frac{K^*(x, y)}{|K(x, y)|^2 + \frac{Q_n(x, y)}{Q_s(x, y)}} \tag{2.2}$$

where

$K(x, y)$ Degradation function
$K^*(x, y)$ Complex conjugate of degradation function
$Q_n(x, y)$ Power Spectral Density of Distortion
$Q_s(x, y)$ Power Spectral Density of un-degraded image.

The term Q_n/Q_s can be interpreted as the reciprocal of the signal-to-distortion ratio.

3 Blurred Filter

Blurred filter (FF) is based on gray level mapping into a blurred plane, using a membership function [4]. The aim is to generate an image of higher contrast than the original image by giving a larger weight to the gray levels that are closer to the mean gray level of the image than to those that are farther from the mean. An image f of size $M \times N$ and L gray levels can be considered as an array of blurred singletons, each having a value of membership denoting its degree of brightness relative to some brightness levels. For an image $t(p, q)$, we can write in the notation of blurred sets:

$$t(p, q) = U_{pq}\mu_{pq}/Z_{pq} \tag{3.1}$$

where

p 1, 2, …, M
q 1, 2, …, N
Z_{pq} The intensity of (p, q)th value
μ_{pq} Membership value.

The membership function characterizes a suitable property of image like darkness, edginess, textural property, etc. and can be defined globally for the whole image or locally for its segments. The basic principles of blurred enhancement schemes are illustrated in Fig. 1.

Blurred filter method for image enhancement based on blurred set theory. This filter employs blurred rules for deciding the gray level of a pixel within a window in the image. This is a variation of the MF and Neighborhood Averaging filter with blurred values. The algorithm includes the following steps:

1. At first the gray values of the neighborhood pixels ($n \times n$ window) are stored in an array an then sorted in ascending or descending order.
2. Then, blurred membership value is assigned for each

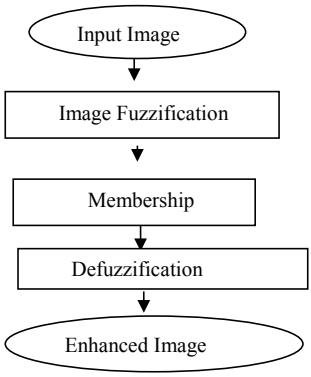


Fig. 1 The basic principles of blurred enhancement

neighbor pixels:
This step has the following characteristics:

i. A Π-shaped membership function is used.
ii. The highest and lowest gray values get the membership value 0.
iii. Membership value 1 is assigned to the mean value of the gray levels of the Neighborhood pixels.

3. Now, we consider only $2 \times r + 1$ pixels ($r/2 \leq n2$) in the sorted pixels and they are the median gray value and r previous and forward gray values in the sorted list.
4. Now, the gray value that has the highest membership value will be selected and placed as output.

4 Image Distortion

Image distortion is the random variation of brightness or color information in images produced by the sensor and circuitry of a scanner or digital camera. Image distortion can also originate in film grain and in the unavoidable shot distortion of an ideal photon detector [5].

Image distortion is generally regarded as an undesirable by-product of image capture. Although these unwanted fluctuations became known as "distortion" by analogy with an unwanted sound they are inaudible and actually beneficial in some applications, such as dithering. The types of distortion are the following:

- Amplifier distortion (Statistical distortion)
- Salt and pepper distortion
- Shot distortion (Poisson distortion)
- Speckle distortion.

4.1 Amplifier Distortion (Statistical Distortion)

The standard model of amplifier distortion is additive, statistical, independent at each pixel and independent of the signal intensity, caused primarily by Johnson–Nyquist distortion (thermal distortion), including that which comes from the reset distortion of capacitors ("kTC distortion"). In color cameras, where more amplification is used in the blue color channel than in the green or red channel, there can be more distortion in the blue channel. Amplifier distortion is a major part of the "read distortion" of an image sensor, that is, of the constant distortion level in dark areas of the image [6].

5 Simulation Results

In this section, experimental results are presented which explored the characteristics of the various filters used and tested. The comparative analysis has been presented on the basis of the different standard deviation of distortion for the original image (512 * 512) which is shown in Table 1. The result is taken by comparing the performance of blurred filter and statistically designed filter on the basis of PSNR and MSE value (Figs. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14).

Table 1 Standard deviation, MSE and PSNR values of blurred filter and statistically designed filter

Filter name	Standard deviation (σ)	MSE value	PSNR value
Blurred filter	8	387.4825	22.2483
	10	395.3612	22.1609
	12	402.8893	22.0789
	14	412.4349	21.9772
Statistically designed filter	8	44.5471	31.6426
	10	62.4977	30.1722
	12	81.4361	29.0226
	14	100.4175	28.1127

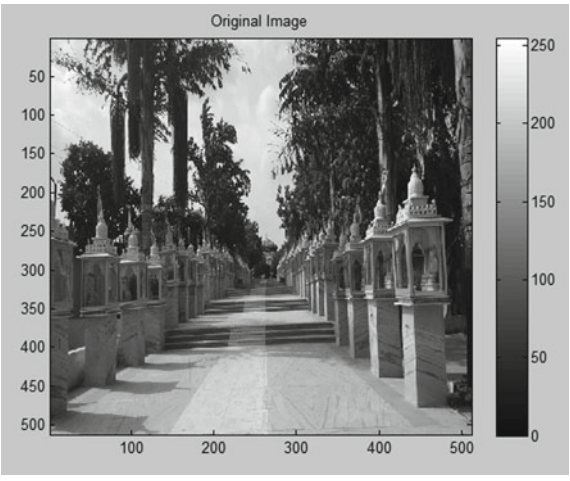


Fig. 2 Original image

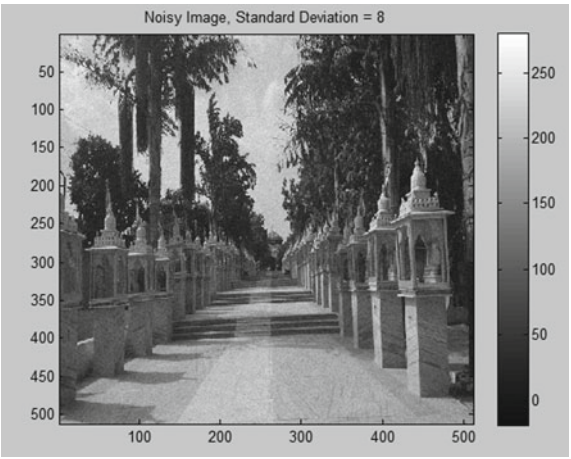


Fig. 3 Adding statistical distortion with standard deviation (8)

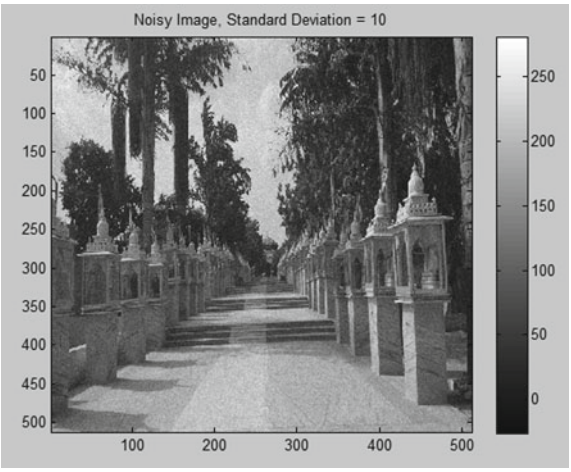


Fig. 4 Adding statistical distortion with standard deviation (10)

6 Conclusion

This paper focuses on the effective algorithms which have been used for Image Filtering by using a blurred filter and statistically designed filter which tell that: The performance of the statistically designed filter is better than blurred filter according to PSNR values for different standard deviation. PSNR high means good quality and low means bad quality. PSNR is using a term mean square error (MSE) in the denometer. So, low the error, high will be the PSNR. The performance measure of blurred filter and statistically designed filter is shown in Fig. 15.



Fig. 5 Adding statistical distortion with standard deviation (12)



Fig. 6 Adding statistical distortion with standard deviation (14)

7 Scope for Future Works

Future works include using new concepts to modification of membership value without affecting the performance of result in blurred filtering. Use adaptive properties for comparison of all filters. The construction of other blurred filtering methods for color and gray images to filtering other types of distortion (salt and pepper, quantization, speckle, etc.). Use a median filter for comparison with blurred filter for salt and pepper distortion, Poisson distortion or speckle distortion. Use some new filters for comparison with different types of distortion and different types of images (MRI Image, Mammogram Image…etc.) which have different pixel values. Use new algorithms to cancellation distortion from video frame.

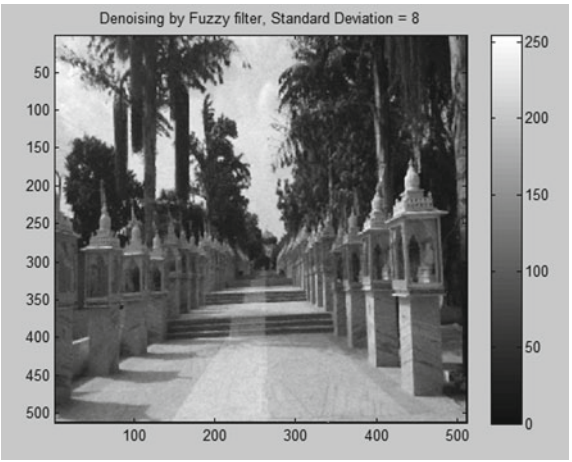


Fig. 7 Enhancement by blurred filter, standard deviation = 8

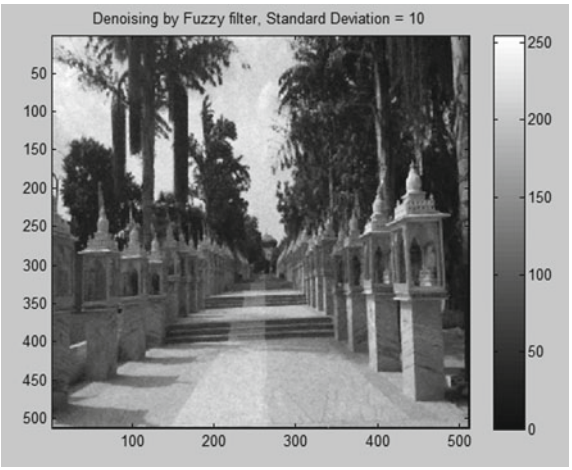


Fig. 8 Enhancement by blurred filter, standard deviation = 10



Fig. 9 Enhancement by blurred filter, standard deviation = 12



Fig. 10 Enhancement by blurred filter, standard deviation = 14

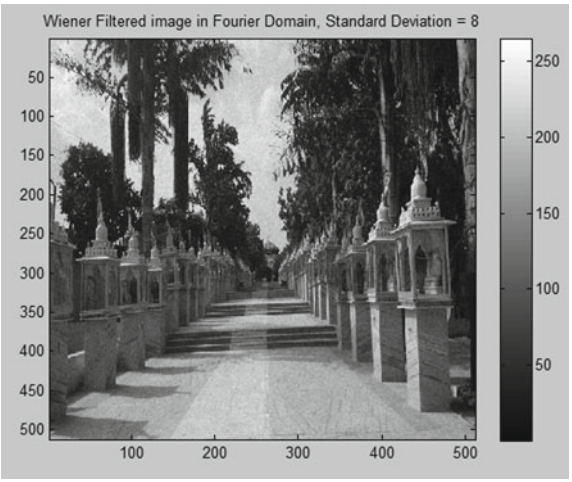


Fig. 11 Enhancement by statistically designed filter, standard deviation = 8



Fig. 12 Enhancement by statistically designed filter, standard deviation = 10

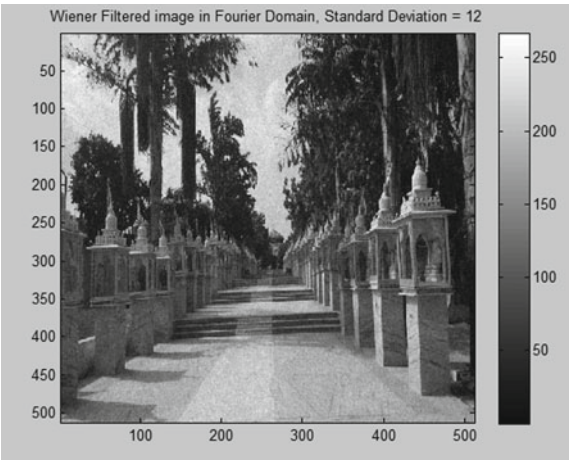


Fig. 13 Enhancement by statistically designed filter, standard deviation = 12

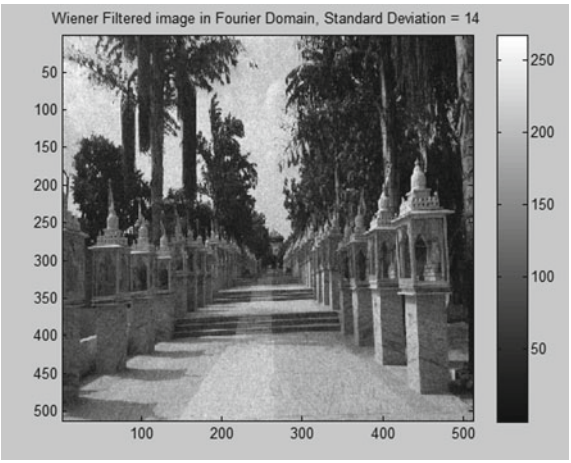


Fig. 14 Enhancement by statistically designed filter, standard deviation = 14

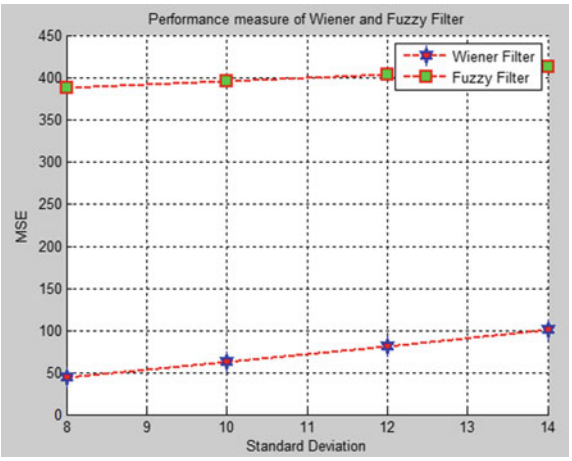


Fig. 15 Performance measure of blurred filter and statistically designed filter

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Protection of Series Capacitor Compensated Wind Park Connected Transmission Line Using HHT

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***Abstract*—This paper presents a protection technique for the recognition of faults in a 400-kV transmission line connected with a wind park and compensated using series capacitors. The reported technique is developed using the Hilbert-Huang transform (HHT) which is employed to identify the faults and categorize the fault and the healthy-situations. A 400-kV power transmission line (PTL) has been modeled and simulated using MATLAB/SIMULINK. The outcome of the simulations demonstrates that the HHT-based fault categorization technique is remarkably sensitive and reliable to diverse faults. The preeminence of the HHT is that it factually categorizes all probable faults in a PTL by operating the fault currents obtained at only the first-end of PTL.**

Keywords— Hilbert-Huang transform, fault categorization, series-compensation, transmission line protection, wind parks.

I. INTRODUCTION

Perfect fault recognition and faulted phase categorization are the two noteworthy components of a protective relay for a capacitor compensated power-transmission system. Over the years, researchers have been in the track to recognize immediate and ideal recognition of fault and classification of faulty divisions of the transmission system using many protective relays. The faulted part must be detached from the strong part of the network so as to evade the significant consequences originated due to a fault. Consequently, it is very decisive to have a proficient relay for categorizing faults. Different methods are accessible in the works for fault categorization in TL's. The work showed in [1] established a fault position calculation method based on GPR (Gaussian process regression) to locate and categorizes faults in the CSC-based high voltage-DC lines. A fault recognition technique for a 400-kV TL utilizing ANN and ANFIS has been presented in [2]. In [3], a TMI (transient-monitor index)-based distance relay has been developed for categorizing and identifying faults in UPFC connected TL with wind-park. In [4], an (AART) adaptive auto-reclosing technique has been introduced for 110-kV wind-park and statcom connected TL's. A DPT (differential protection technique) was recently introduced in [5] for recognizing faults in micro-grid with three-alternators. The perception of DVTW (differential voltage travelling wave) has been proposed to protect HV-direct current (VCS-based) TL's [6]. A short-circuit categorization method using DWA has been detailed in [7]. Fault recognition and location implementing a technique which uses samples of voltage and currents has been clarified in [8] for 1200-kV MTB-dc micro-grid system. The study represented in [9] detailed a scheme which uses ZSC (zero-sequence currents) to categorize a 20-kV, 197-km faulted feeder in AGN's (active-grounded networks). In [10], an IMF (instant multiple faults) recognition technique was presented for IEEE-39 bus system using SPWVD (smoothed pseudo wigner-ville distribution) and HT (Hilbert-transform).

After scrutinizing the imperfections portrayed in the precedent texts, this manuscript realize implore to add a superior illumination. This manuscript suggests a fault categorization scheme for the transmission line based on the HHT.

The rest of this paper is prearranged as: Section-II displays the wind-park connected transmission line. Section-III elucidates the protection technique based on HHT approach. Section-IV explicates the simulation outcomes of protection technique. Section-V presents the achievement of the paper.

II. DESCRIPTION OF SCCWPCTPTL

In this exertion, the accomplishment of HHT has been investigated on a transmission-line connected with a wind park and simulated in MATLAB, as pointed up in Fig. 1. The test-system consists of a transmission line (TL) connected to a 400-kV power source (50-Hz) at first-end (first-bus). The TL is also connected to a wind-park at the second-end (second-bus). The entire span selected for a TL is 200 km. The fault currents are fetched at the first-bus of test-system and then fed to the HHT program for fault categorization in wind-park connected-TL.

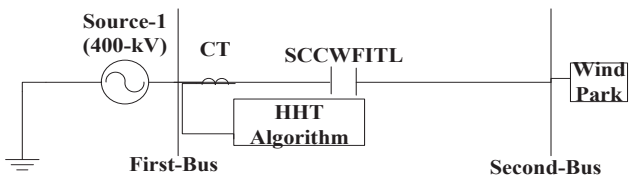


Fig. 1. The schematic of SCCWPCTL

During no-fault, the current and voltage plots are presented in Fig. 2 and the outputs of HHT are illustrated in Fig. 3. The outcomes of HHT have been detailed in Table I.

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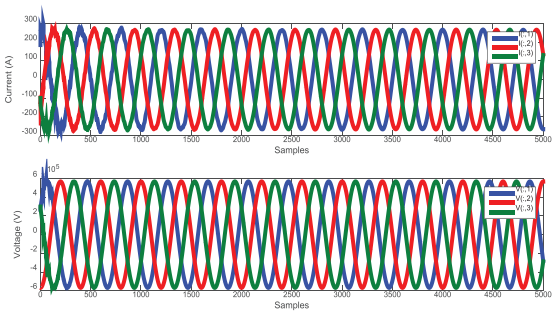


Fig. 2. Current and voltage plots during no-fault

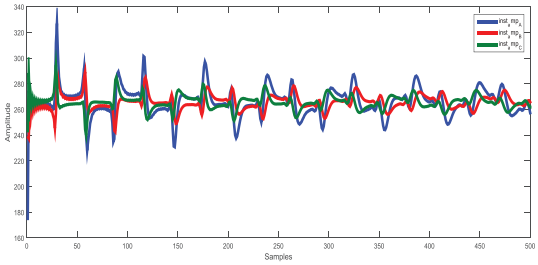


Fig. 3. HHT outputs of currents during no fault

TABLE I. HHT OUTPUTS DURING NO-FAULT

HHT Outputs		
Phases		
A	B	C
327.0054	289.3852	294.6071

III. HHT-BASED TECHNIQUE

The flow-map of protection technique has been confirmed in Fig. 4.

i. The post-fault currents fetched at the first-end (first-bus) of the power system are scrutinized with the help of HHT to pluck the analogous outputs of HHT.

ii. The high-frequency amplitude of signatures (HFAOS) is computed.

iii. Lastly, the HFAOS will be correlated with the amplitude of threshold (AOT) to produce a concluding decision i.e. no-trip/trip.

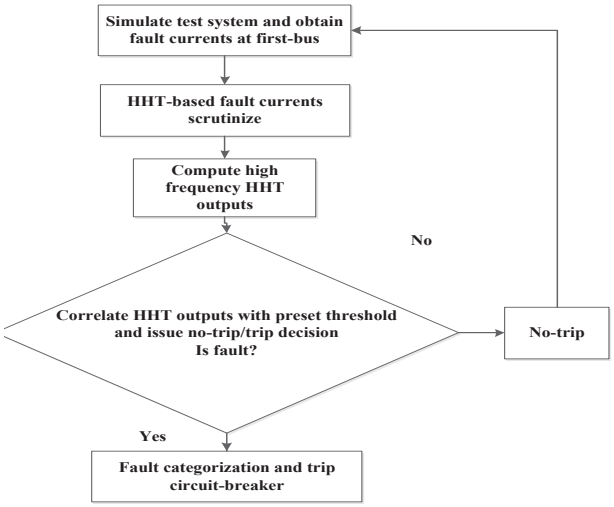


Fig. 4. Flow-map of HHT-based fault categorization scheme

IV. PERFORMANCE EVALUATION

The HHT-method is realized on the test-system which is displayed in Fig. 1 and modeled in MATLAB. The fault-currents are fetched at the first-bus are examined using HHT. The outcomes of assorted simulations are deliberated underneath.

A. *Response of HHT for Variation in F_T*

In this segment, the HHT is tested for different types of faults (F_T) and the outcomes are detailed in Table II. The simulation outcome of "ABG" fault created at 42.5% is presented in Fig. 5. The "ABG" fault is switched at 0.05 s. The fault and ground resistances are chosen as 3.5 Ω and 2.5 Ω, respectively. The output of HHT is demonstrated in Fig. 6. For the remaining faults, only the fault type is varied and the other fault parameters are kept the same. The acquired HHT outcomes which are detailed in Table II point towards the admirable performance of HHT during the testing of different faults.

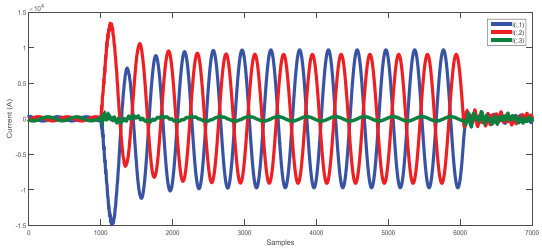


Fig. 5. "ABG" fault at 42.5%, 0.05 s, G_R = 2.5 Ω, and F_R = 3.5 Ω

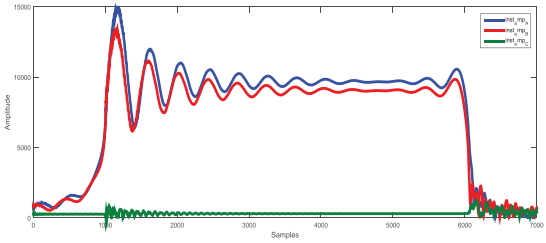


Fig. 6. HHT outputs for "ABG" fault at 42.5%, 0.05 s, G_R = 2.5 Ω, and F_R = 3.5 Ω

TABLE II. HHT OUTPUTS FOR VARIOUS FAULT TYPES

Fault Type	FST (Sec)	F_L (%)	HHT Outputs		
			Phases		
			A	B	C
ABG	0.05	42.5	1.4811*10^4	1.3440*10^4	1.2976*10^3
BCG	0.05	42.5	1.2978*10^3	1.1045*10^4	1.0379*10^4
ACG	0.05	42.5	1.4273*10^4	1.2978*10^3	1.4347*10^4
AG	0.05	42.5	7.4760*10^3	693.8103	801.2513
BG	0.05	42.5	940.9052	6.3625*10^3	756.5573

B. *Response of HHT for Variation in F_R*

Here the manipulation of F_R on the performance of HHT has been looked over for F_R deviated from 10 Ω up to 200 Ω as it is the only fault parameter which harmfully affects the response of relay during grounded faults. Fig. 7 presents the plot of "ABCG" fault simulated with F_R of 10 Ω. The fault has been switched at 0.0415 s at 50% after first-bus. The fault categorization output of HHT has been presented in

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Fig. 8. In Table III, the outcomes of simulation of HHT for various $F_{R's}$ have been shown. Thus, the HHT effectively categorizes all fault types as demonstrated in Table III. Moreover it is surveyed that the performance of HHT is not at all affected by low and high resistance faults.

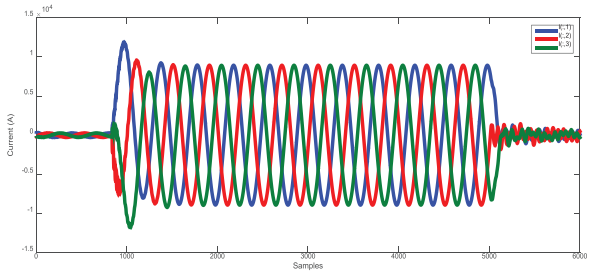


Fig. 7. "ABCG" fault at 50%, 0.0415 s, G_R = 3 Ω, and F_R = 10 Ω

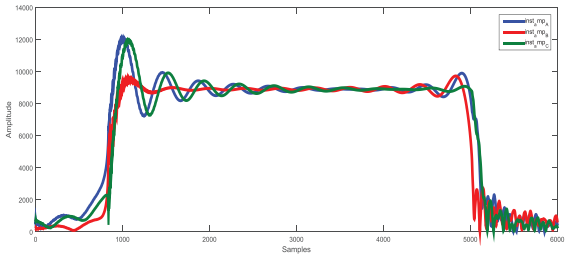


Fig. 8. HHT outputs for "ABCG" fault at 50%, 0.0415 s, G_R = 3 Ω, and F_R = 10 Ω

TABLE III. HHT OUTPUTS FOR VARIOUS FAULT RESISTANCES

Fault Type	F_R (Ω)	HHT Outputs		
		Phases		
		A	B	C
ABCG	10	1.2138*10^4	9.7290*10^3	1.2005*10^4
ACG	50	5.5891*10^3	779.1286	4.9978*10^3
BCG	100	510.5039	2.8092*10^3	3.3612*10^3
AG	150	2.0273*10^3	465.6386	477.0536
CG	200	427.4353	487.0853	1.6256*10^3

C. *Response of HHT for Nearby Faults*

The execution of HHT is also validated during nearby faults and it is known that the performance of HHT-technique stays unaffected during nearby faults. To make this obvious, a fault study has been deliberated (Fig. 9) by creating the "BCG" nearby fault at 2.5% (5 km). The fault has been switched at 0.06 s. The input values of fault and ground resistances used here for all are 4.5 Ω and 3.5 Ω, respectively. Five types of nearby faults have been simulated and examined in this study and the capability of HHT has been tested at five unlike sites i.e. at 2.5%, 3%, 3.5%, 4%, and 4.5% from first-bus. The output of HHT is represented in Fig. 10. The HHT outcomes of five different faults which are created at 2.5%, 3%, 3.5%, 4%, and 4.5% are detailed in Table IV. Hence, it is substantiated from Table IV that the HHT-technique intelligently recognizes all nearby-faults.

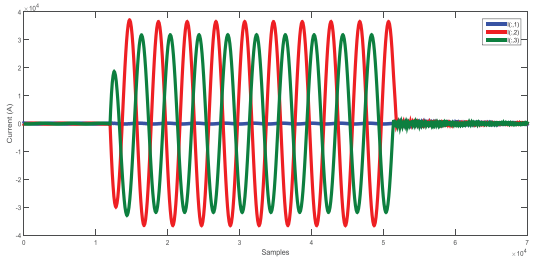


Fig. 9. "BCG" fault at 2.5%, 0.06 s, G_R = 3.5 Ω, and F_R = 4.5 Ω

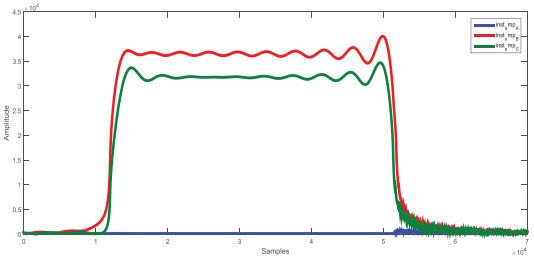


Fig. 10. HHT outputs for "BCG" fault at 2.5%, 0.06 s, G_R = 3.5 Ω, and F_R = 4.5 Ω

TABLE IV. HHT OUTPUTS FOR NEARBY FAULTS

Fault Type	FST (Sec)	F_L (%)	HHT Outputs		
			Phases		
			A	B	C
BCG	0.06	2.5	769.5553	4.0069*10^4	3.4688*10^4
BG	0.06	3	742.8632	2.7029*10^4	696.3502
CG	0.06	3.5	734.5776	742.0862	2.5894*10^4
ABG	0.06	4	3.9067*10^4	3.4112*10^4	792.4821
ACG	0.06	4.5	3.5316*10^4	801.8498	3.7107*10^4

D. *Response of HHT for Faraway Faults*

The execution of HHT is also corroborated during faraway faults and it is acknowledged that the performance of HHT-technique stays unaffected during faraway faults. To make this evident, a fault study has been deliberated (Fig. 11) by simulating the "ACG" faraway fault at 97.5% (195 km). The fault has been switched at 0.08 s. The input values of fault and ground resistances used here for all are 5 Ω and 2 Ω, respectively. Five types of faraway faults have been created and examined in this study and the competence of HHT has been tested at five unlike sites i.e. at 97.5%, 98%, 98.5%, 99%, and 99.5% from first-bus. The output of HHT is represented in Fig. 12. The HHT outcomes of five different faults which are created at 97.5%, 98%, 98.5%, 99%, and 99.5% are tabularized in Table V. Hence, it is authenticated from Table V that the HHT-technique astutely categorizes all faraway-faults.

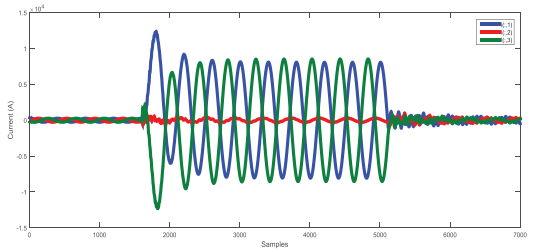


Fig. 11. "ACG" fault at 97.5%, 0.08 s, G_R = 2 Ω, and F_R = 5 Ω

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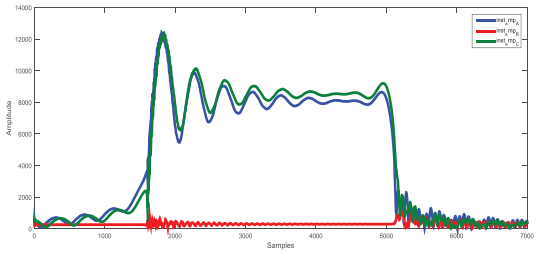


Fig. 12. HHT outputs for "ACG" fault at 97.5%, 0.08 s, G_R = 2 Ω, and F_R = 5 Ω

TABLE V. HHT OUTPUTS FOR FARAWAY FAULTS

Fault Type	FST (Sec)	F_L (%)	HHT Outputs		
			Phases		
			A	B	C
ACG	0.08	97.5	1.2420*10^4	1.0856*10^3	1.2402*10^4
ABG	0.08	98	1.2913*10^4	1.1644*10^4	1.0938*10^3
BG	0.08	98.5	955.2878	5.5080*10^3	810.8885
AG	0.08	99	6.4751*10^3	641.6129	759.2269
ABCG	0.08	99.5	1.4433*10^4	1.1824*10^4	1.2294*10^4

E. *Response of HHT for Evolving Faults*

Here, the presentation of HHT-based procedure has been scrutinized for evolving faults (EF's). A type of fault in which the first fault at a particular FST is evolved into the second fault at related or unalike FST is known as EF's. Fig. 13 portrays the simulation of evolving fault and Fig. 14 describes the HHT detailed signatures of fault currents. At the beginning, "CG" fault is created at 50% at 0.06 s, G_R = 3.5 Ω, F_R = 4.5 Ω. This "CG" fault after few fault current cycles is evolved into "BCG" fault at 50% at 0.25 s. In Table VI, the simulation outcomes of HHT for various evolving faults identification have been declared. The outcomes designate that the HHT has outstanding performance throughout the evolving faults.

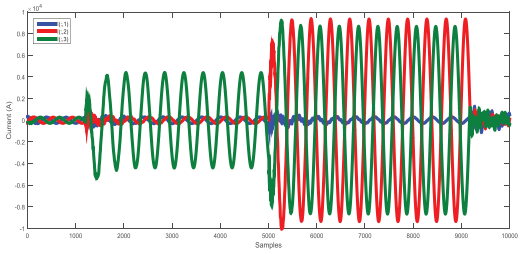


Fig. 13. "CG" fault at 50% at 0.06 s is evolved into "BCG" fault at 50%, 0.25 s, G_R = 3.5 Ω, and F_R = 4.5 Ω

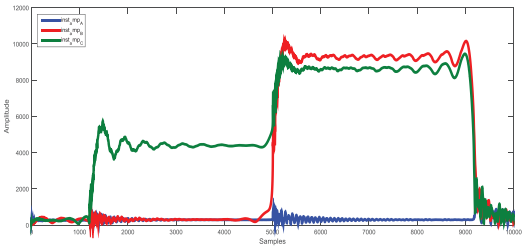


Fig. 14. HHT outputs when "CG" fault at 50% at 0.06 s is evolved into "BCG" fault at 50%, 0.25 s, G_R = 3.5 Ω, and F_R = 4.5 Ω

TABLE VI. HHT OUTPUTS FOR EVOLVING FAULTS

First Fault And Time (Sec)	Evolved Fault And Time (Sec)	HHT Outputs		
		Phases		
		A	B	C
CG (0.06)	BCG (0.25)	1.3810*10^3	1.0213*10^4	9.4532*10^3
ACG (0.077)	CG (0.2)	9.4499*10^3	1.3027*10^3	9.6288*10^3
BG (0.087)	ABCG (0.218)	2.0264*10^4	1.0331*10^4	1.4518*10^4
AG (0.055)	BG (0.25)	5.0605*10^3	6.6975*10^3	1.8584*10^3
BG (0.09)	CG (0.3)	1.6163*10^3	5.3802*10^3	6.5701*10^3

F. *Response of HHT for Faults at Two Different Positions*

In TL's, there is a risk of phenomenon of faults at two or more unalike sites and the aforementioned faults are called as MPF's (multi-position faults). Here the implementation of HHT has been experienced for five MPF's which are created on TL. A case study of MPF's created on TL has been presented in Fig. 15. At the beginning, "AG" fault is switched at 30% from first-bus. Another "CG" fault is also switched at 70% from first-bus. The fault switching time for both the faults are kept at 0.085 s. i.e. both faults are switched at an equivalent time. Here, the values of fault and ground resistances used are 5 Ω and 4 Ω, respectively. The outputs of HHT-technique are discovered in Fig. 16. In Table VII, the simulation outcomes of protection technique for MPF's categorization have been detailed. The attained effects indicate that the HHT-technique executes well during the MPF's.

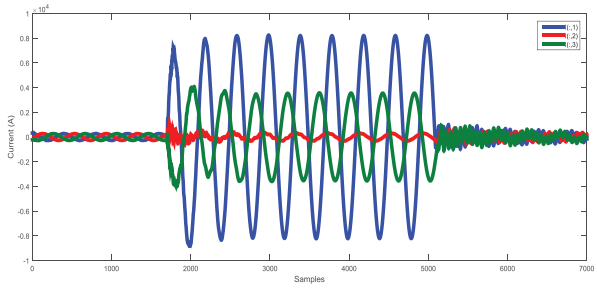


Fig. 15. "AG" fault at 30% and "CG" fault at 70%, 0.085 s, G_R = 4 Ω, and F_R = 5 Ω

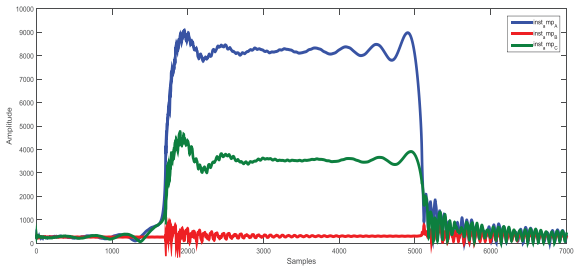


Fig. 16. HHT outputs for "AG" fault at 30% and "CG" fault at 70%, 0.085 s, G_R = 4 Ω, and F_R = 5 Ω

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TABLE VII. HHT OUTPUTS FOR FAULTS AT TWO DIVERSE POSITIONS

Fault-1 With Position	Fault-2 With Position	FST (Sec)	HHT Outputs		
			Phases		
			A	B	C
AG (30%)	CG (70%)	0.085	9.0767*10^3	802.6256	4.7570*10^3
BG (45%)	AG (55%)	0.085	4.9128*10^3	8.6084*10^3	806.7856
AG (60%)	CG (40%)	0.085	6.3459*10^3	743.4854	5.3904*10^3
CG (35%)	BG (65%)	0.085	755.4193	4.9961*10^3	1.0049*10^4
AG (77.5%)	BG (22.5%)	0.085	6.0676*10^3	5.5052*10^3	843.3935

G. *Response of HHT for Deviation in V_S and F_S*

The usefulness of HHT has been inspected for deviation in source frequency and voltage. An "ABG" fault is simulated at 50% as of first-bus. The fault has been triggered at 0.09 s. The selected inputs of voltage and frequency for "ABG" fault are 385-kV and 49.85-Hz. In order to see the effects of ground and fault resistances, the values preferred for all faults are 4.35 Ω and 3.45 Ω, respectively. The simulation outcomes of the "ABG" fault are presented in Figs. 17 and 18, respectively. Table VIII details the HHT-outputs for deviation in source frequency and voltage and therefore supports the efficacy of the HHT.

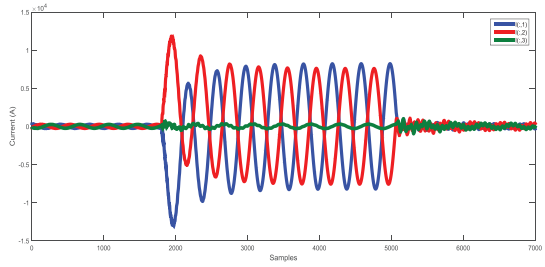


Fig. 17. "ABG" fault at 50%, 0.09 s, V_S = 385 kV, F_S = 49.85 Hz, G_R = 4.35 Ω, and F_R = 3.45 Ω

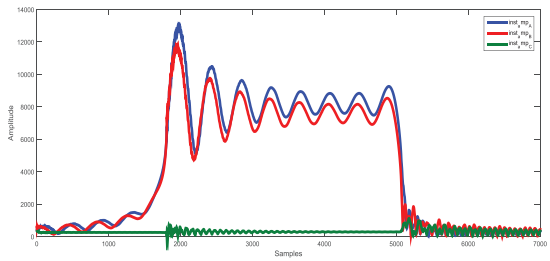


Fig. 18. HHT outputs for "ABG" fault at 50%, 0.09 s, V_S = 385 kV, F_S = 49.85 Hz, G_R = 4.35 Ω, and F_R = 3.45 Ω

TABLE VIII. HHT OUTPUTS FOR VARYING SOURCE VOLTAGE AND FREQUENCY

Fault Type	Voltage (kV)	Frequency (Hz)	HHT Outputs		
			Phases		
			A	B	C
ABG	385	49.85	1.3119*10^4	1.1849*10^4	1.1195*10^3
ACG	390	49.95	1.2370*10^4	1.1382*10^3	1.2551*10^4
BG	395	50.05	949.1802	5.2966*10^3	791.8708
BCG	405	50.10	1.1879*10^3	9.9464*10^3	9.4016*10^3
CG	410	50.35	661.9549	863.0437	6.0233*10^3

H. *Response of HHT for Varying Turbo-Generator Sets*

Here the feasibility of HHT has also been ensured for different faults by deviating turbo-generator sets in a wind-park. A LLLG fault "ABCG" has been switched at 0.11 s. The site of fault, number of "TG" sets, and the resistances (ground and fault) opted here are 62.5%, 4-TG sets, 3.25 Ω (ground), and 4.15 Ω (fault), respectively. In Fig. 19, the waveform of "ABCG" fault current has been demonstrated and in Fig. 20, the output waveform of HHT has been presented. During the testing of HHT performance for above mentioned variation, all the faults are simulated at a common place i.e. at 62.5%. The acquired simulation outcomes signify that the HHT has better performance during different number of TG-sets and it has been monitored that the deviation in the TG-sets does not manipulates the implementation of HHT.

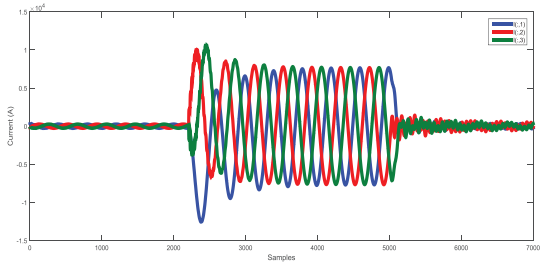


Fig. 19. "ABCG" fault at 62.5%, 0.11 s, 4-TG sets, G_R = 3.25 Ω, and F_R = 4.15 Ω

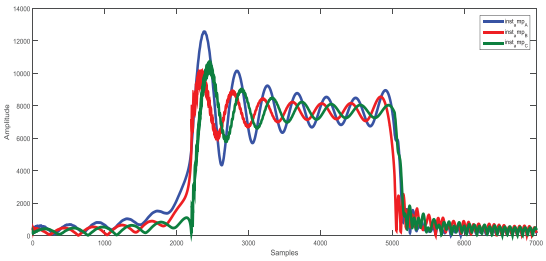


Fig. 20. HHT outputs for "ABCG" fault at 62.5%, 0.11 s, 4-TG sets, G_R = 3.25 Ω, and F_R = 4.15 Ω

TABLE IX. HHT OUTPUTS FOR VARYING TG SETS IN WIND PARK

Fault Type	No. of TG Sets	F_L (%)	HHT Outputs		
			Phases		
			A	B	C
ABCG	4	62.5	1.2569*10^4	1.0157*10^4	1.0660*10^4
AG	3	62.5	5.2703*10^3	606.6439	706.6032
CG	5	62.5	649.0045	718.7620	4.7428*10^3
BCG	1	62.5	1.4795*10^3	8.1595*10^3	7.6539*10^3
ABG	2	62.5	1.1086*10^4	1.0031*10^4	968.3155

I. *Response of HHT for Varying Fault Switching Time*

The prospective of HHT has also been inspected for different switching time of faults. A "BCG" fault has been simulated and switched at 0.03 s. The "BCG" fault has been created at 47.5% after first-bus as presented in Fig. 21. The HHT outputs are presented in Fig. 22. The attained outcomes (Table X) prove that the deviation in switching time of fault does not concern the response of HHT.

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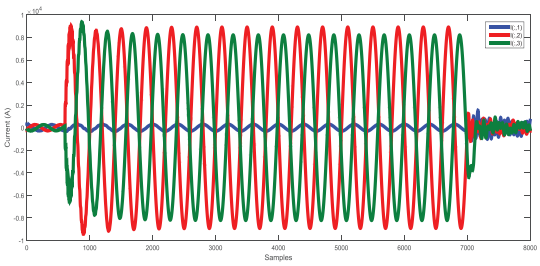


Fig. 21. "BCG" fault at 47.5%, 0.03 s, G_R = 3.75 Ω, and F_R = 2.65 Ω

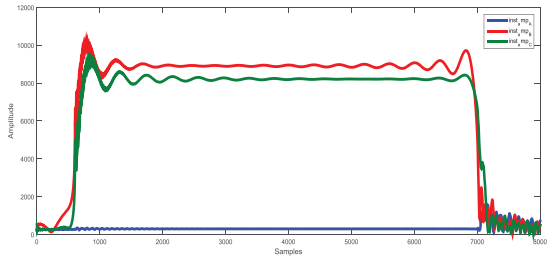


Fig. 22. HHT outputs for "BCG" fault at 47.5%, 0.03 s, G_R = 3.75 Ω, and F_R = 2.65 Ω

TABLE X. HHT OUTPUTS FOR DIFFERENT FAULT SWITCHING TIME

Fault Type	FST (Sec)	F_L (%)	HHT Outputs		
			Phases		
			A	B	C
BCG	0.03	47.5	1.5741*10^3	1.0261*10^4	9.4030*10^3
ACG	0.057	47.5	9.8623*10^3	1.2090*10^3	1.0314*10^4
ABG	0.109	47.5	1.4709*10^4	1.3663*10^4	1.2093*10^3
AG	0.071	47.5	6.7463*10^3	661.6167	772.6761
BG	0.132	47.5	1.0563*10^3	5.4289*10^3	808.0208

V. CONCLUSION

This paper presented a fault categorization scheme based on HHT for wind-park connected transmission line by computing the high frequency HHT-outputs. These high frequency outputs are evaluated by utilizing the currents of PTL which are fetched at the first side (first-bus) of PTL merely. It is traceable from the outcomes of the simulations that the protection technique based on HHT intelligibly categorizes the distinction linking the faulty and healthy circumstances.

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Efficient Fuzzy Similarity-Based Text Classification with SVM and Feature Reduction



Shalini Puri

Abstract With the generation of enormous data day by day, the need of feature reduction has tremendously increased in the field of text classification. In this direction, this paper presents two text classification systems, called concept-based mining model using threshold (CMMT) and fuzzy similarity-based concept mining model using feature clustering (FSCMM-FC). Both systems aim to classify the English text documents into pre-defined mutually exclusive categories. These systems preprocess the documents at the sentence, document, and integrated corpora levels; apply feature extraction and reduction; train the classifier; and finally, classify the documents using support vector machine. CMMT cuts off the less frequent features by applying threshold on the extracted features, whereas FSCMM-FC reduces the features by finding the feature points using fuzzy C-means. The experimental results obtained 95.8% and 94.695% feature reduction in CMMT and FSCMM-FC, respectively, and also the 85.41% and 93.43% classification accuracy in CMMT and FSCMM-FC, respectively. Therefore, these results state that FSCMM-FC outperformed CMMT greatly with effective memory usage and efficient classification accuracy.

Keywords Text classification · Feature reduction · Thresholding · Fuzzy C-means · Feature clustering · Support vector machine

1 Introduction

Because of the rapid generation and the use of dynamic, multi-dimensional, multi-type, gigantic-sized data, the management, extraction, transformation, and maintenance of such data have become very crucial and challenging in corporate sectors, industries, and research fields. In recent years, many researchers have contributed their different text classification algorithms [1, 2] with the use of dimensionality reduction (DR) and feature reduction methods [3–11]. These algorithms use the concepts of artificial intelligence, machine learning, and soft computing fields. This paper discusses and compares two systems called concept-based mining model using

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threshold (CMMT) and the fuzzy similarity-based concept mining model using feature clustering (FSCMM-FC) [1, 2]. Both systems used different feature reduction methods, but both included support vector machine (SVM) for text classification. They have been implemented using four standard document sets; and their experimental results show that the FSCMM-FC system performs better than the CMMT system.

Nowadays, the hybridization of fuzzy logic and SVM has gained a lot of attention in comparison of other learning approaches. Therefore, it provides the solutions for many real-world problems. The reason behind the use of SVM in both the systems is that SVM has very high generalization performance and has good mathematical base even with the noisy or increased number of training datasets. It is known as the well-known machine learning algorithm in the area of classification problems [9]. On the other side, fuzzy logic has the strong base of membership functions, rules framing, and controllers. Fuzzy C-means (FCM) is a soft clustering method in which each data includes a specific degree of freedom, so that it can belong to all the clusters rather than only one single cluster.

This paper is organized as follows. Section 2 presents a review on various existing feature reduction-based text classification methods. In Sect. 3, the algorithmic details of proposed CMMT and FSCMM-FC systems are provided. Section 4 discusses about the datasets; results of feature reduction; classification accuracy; and resultant support vectors. Section 5 explains and compares the performance of both the systems. Last section concludes the paper with future extensions.

2 Related Work

This section presents a review on various existing feature reduction-based text document processing and classification systems. The feature reduction methods used in them are given as FCM, fuzzy-rough sets, Gini index context similarity (GI_{cs}), document frequency context similarity (DF_{cs}), class discriminating measure context similarity (CDM_{cs}), accuracy balance context similarity ($Acc2_{cs}$), and fuzzy clustering. Many of these systems primarily used SVM and neural networks for the classification. The classification system presented in [4] first calculated the feature importance and document frequency through context similarity measurement; and then, it classified the text documents of $Data_{BCII}$ and Reuters-21578. This system used four feature selection methods called GI_{cs}, DF_{cs}, CDM_{cs}, and $Acc2_{cs}$ to find the document context similarity.

Another method [5] first preprocessed the input of meeting transcripts; calculated the frequency of features; extracted nouns and obtained the clusters using FCM; obtained the principal keywords; and finally reduced these keywords by solving synonym, homonym, hyponymy, and polysemy problems. In the same direction, the algorithm presented in [6] extracted the features using singular value decomposition and principal component analysis (PCA) in the unsupervised way. The system in [7]

presented an Interval Type-2 (IT2) fuzzy-rough sets based feature selection method. It selected and evaluated the features for dependency, relevance, and significance.

In [8], the kernel fuzzy SVM based method first extracted the optimum kernel parameters; transformed the training patterns; classified the text with k-fold cross-validation; and finally obtained the promising results for nonlinear datasets. The fast and de-noise SVM training system in [9] used an iterative algorithm for removing noisy data from training dataset at first stage; and then employed FCM to reduce the number of training data at the second stage. This method depended upon the convex hull data, class center displacement, and FCM; and then, it obtained the results for large and real-world UCI datasets. It achieved the accuracy in the range of 95.28–99.22% and found the training time in the range of 4.08–27.13 units. Next, classification algorithm [10] firstly applied the FCM to classify the mixed integer, nominal, and continuous attributes; and then, it classified the datasets using SVM. The classification method in [11] preprocessed the words; extracted the features; reduced the data dimensions with PCA; and then classified the text using multi-level fuzzy min–max neural network classifier. Therefore, it is observed that all these algorithms primarily used the feature extraction and the SVM for reduction and classification purposes, respectively. It is found that there is a high need of the advanced, hybrid, fuzzy SVM based text classification system which can contribute for the efficient feature reduction.

3 Algorithmic Details of CMMT and FSCMM-FC Systems

The first system, concept-based mining model using threshold (CMMT), classifies a set of text documents into pre-defined categories by first preparing them on sentence, document, and integrated corpora levels and then providing them training while reducing the features and removing the ambiguity at each level [1]. This system [1] applies a threshold value (TV) on integrated corpora feature vector (ICFV) to reduce the total number of features, and then, it trains the non-probabilistic binary SVM classifier. Here, TV cuts off all those features whose frequency is less than TV. TV depends upon the document size, and it should be chosen very carefully. Low TV tends more features which drastically increases the need of memory resources and computational time; whereas high TV may cut many necessary features. It is at times hard to decide the cut-off value, so certain important words may be missed in this process. Therefore, an advanced fuzzy similarity-based concept mining model using feature clustering (FSCMM-FC) system is introduced.

The FSCMM–FC system is the enhancement of the CMMT system which includes the additional stage of feature clustering [2] called fuzzy feature category similarity analyzer (FFCSA). FFCSA finds the matching of each extracted feature of ICFV with the corresponding classes [2]. The one-third of vocabulary size is chosen as the number of clusters. FSCMM-FC forms the reduced and well-defined structured set of centers for multi-class problem, so that it clusters the ICFV words into more meaningful representation. It is subjected to SVM training using a linear membership

function where these clusters are provided with their respective classes. In this way, SVM builds the support vectors for the available classes. The main procedure of the whole system is given below.

Main Procedure ()

```
Step 1: Take a set of n known text documents.
Step 2: Preprocess all documents and remove ambiguity.
Step 3: For each document i // 1 ≤ i ≤ n
Step 4: For each sentence j of document i // 1 ≤ j ≤ i
Step 5: For each word k of sentence j // 1 ≤ k ≤ j
Step 6: Count the frequency of important words and discard the unim-
portant ones with the help of Pseudo-thesaurus.
Step 7: End for. End for. End for.
Step 8 (a): For CMMT, apply TV on ICFV and train the SVM using impor-
tant features.
(b): (OR) For FSCMM-FC, apply feature clustering using FCM on ICFV
under FFCSA and train the SVM with feature points.
Step 9: Test CMMT or FSCMM-FC for an unknown document set.
```

4 Experimental Results

The proposed CMMT and FSCMM-FC systems were implemented using MATLAB Version 8.1.0.604 (R2013a) 64-bit (win64) with processor Intel (R) Core™ i4-5200U@2.20 GHz, 8.00 GB RAM, and 64-bit operating system on Windows 8.1 single language edition. Section 4.1 provides the details of four standard text document sets for the experimentation. Sections 4.2 and 4.3 explain the experimental results of feature reduction and classification accuracy, respectively. Section 4.4 presents the resultant support vectors.

4.1 Datasets Used

To perform the experiments, four text documents sets were used. They were collected from Reuters 21578; Yahoo! News; and also from online Web sites of radio astronomy and IBM training. These documents were used to analyze, estimate, and compare the results of feature reduction and classification accuracy for both the proposed systems. Out of total 172 text documents, 139, i.e., 80.81%, documents were used for system training; and 33, i.e., 19.18% documents, were kept for system testing. The number of documents is represented in the form of (training, testing) pairs. They are (100, 15), (32, 16), (4, 1), and (3, 1) for Reuters 21578, Yahoo! news, radio astronomy, and IBM training, respectively. In Reuters 21578, five classes such as *'Acquisition', 'Copper', 'Earn', 'Ship' and 'Wheat'* were used with equal distribution over the documents. The Yahoo! news articles were used with equal distribution over eight classes such

as *'Automobile', 'Business', 'Cinema', 'Crime', 'Health', 'Politics', 'Sports', and 'Technology'*. Only one single class called *'astronomy'* and the class called *'training'* were taken for radio astronomy and IBM training documents, respectively.

4.2 Feature Reduction

The feature reduction refers to the ratio of the discarded features with the total number of features. This section explains the feature reduction computation of both CMMT and FSCMM-FC systems for all four types of document sets. The reduction procedure is shown step by step, especially, for Reuters 21578 and Yahoo! news documents.

Feature Reduction in CMMT. The CMMT system reduced 96.85% and 96.6% features of radio astronomy and IBM training documents, respectively as there was only one class of each of them. CMMT obtained 31 features out of 986 and 42 features out of 1237 features for radio astronomy and IBM training document sets, respectively. Tables 1 and 2 show the reduction steps, i.e., measures, of all the classes of Reuters 21578 and Yahoo! news articles, respectively. These steps include the computation of total feature set; reduction at ICFV stage; reduction after applying threshold; total to ICFV; reduction from ICFV to threshold result; and final reduction from total to threshold results. CMMT reduced 94.03% and 95.72% features with Reuters 21578 and Yahoo! News, respectively. Maximum reductions were obtained in the *'Wheat'* class and the *'Business'* class of Reuters 21578 and Yahoo! News, respectively, whereas minimum reductions were obtained in the *'Ship'* class and the *'Cinema'* class of both document sets, respectively.

Impact of Varying Threshold. To get the impact of varying thresholds, the CMMT system was tested on total number of 8 and 32 news articles of Yahoo! using three threshold values 2, 3, and 5. CMMT obtained 238, 162, and 84 features for eight news articles by applying thresholds 2, 3, and 5, respectively. On the other side, it obtained 665, 521, and 337 features for 32 news articles by applying thresholds 2,

Table 1 Feature reduction in CMMT with Reuters 21578 document set

S. No.	Measures	Acquisition	Copper	Earn	Ship	Wheat	Total reduction
1	Total features	1472	1355	1263	1543	1109	6742
2	At ICFV	589	713	642	840	361	3145
3	After applying threshold						402
4	Reduction %: (1–2)	59.98	47.38	49.16	45.56	67.44	53.35
5	Reduction %: (2–3)						87.21
6	Final reduction %: (1–3)						94.03

Table 2 Feature reduction in CMMT with Yahoo! news articles

S. No.	Measures	Automobile	Business	Cinema	Crime	Health	Politics	Sports	Technology	Total reduction
1	Total features	1012	1397	834	937	814	984	1203	711	7892
2	At ICFV	481	565	492	535	421	496	560	378	3928
3	After applying threshold									337
4	Reduction %: (1–2)	52.47	59.55	41	42.9	48.28	49.59	53.44	46.83	50.22
5	Reduction %: (2–3)									91.42
6	Final Reduction %: (1–3)									95.72

3, and 5, respectively. It was observed that the increase in TV decreased the number of features which led to the variation in the number of clusters as TV varied.

Figure 1 depicts the comparative change impact of ΔTV for 8 and 32 documents of Yahoo! news articles, where ΔTV, ΔTV1, and ΔTV2 represent the TV variation, TV variation 2–3, and TV variation 3–5, respectively. For eight documents, CMMT achieved 31.93% reduction as ΔTV1 and 48.14% reduction (on 31.93%) as ΔTV2. Furthermore, it achieved 21.65% and 35.31% reductions as ΔTV1 and as ΔTV2, respectively, for 32 articles. Such results show that TV must be chosen very carefully, neither too small nor too big. Therefore, TV was set to 5 in CMMT.

Feature Reduction in FSCMM-FC. FSCMM-FC system reduced 98.37% and 97.97% features of the radio astronomy and IBM training documents, respectively. FSCMM-FC obtained 16 features out of 986 features for radio astronomy documents, and 25 features out of 1237 features for IBM training documents. Tables 3 and 4 show reduction steps, i.e., measures for all the classes of Reuters 21578 and Yahoo! news articles, respectively. These steps include the computation of the total feature set, reduction at ICFV stage; reduction with data points after feature clustering; and reduction from total to feature clustering results. FSCMM-FC reduced total 91.82% and 90.62% features in Reuters 21578 and Yahoo! News, respectively. Maximum reductions were obtained in the *'Wheat'* class and the '*Technology'* class of Reuters 21578 and Yahoo! news datasets, respectively. Minimum reductions were obtained in the '*Ship'* class and the '*Crime*' class of both sets, respectively.

Therefore, it was observed that good level of feature reduction was achieved for both the systems using all four document sets. Increasing the threshold surely reduced more number of features in CMMT, but FSCMM-FC proved to generate unique set of

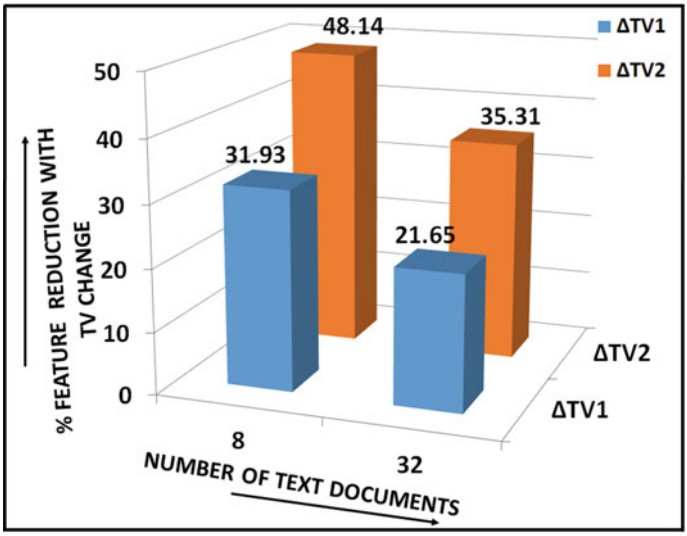


Fig. 1 Analysis of ΔTV and feature reduction for Yahoo! news articles

Table 3 Feature reduction in FSCMM-FC with Reuters 21578 document set

S. No.	Measures	Acquisition	Copper	Earn	Ship	Wheat	Total reduction
1	Total features	1472	1355	1263	1543	1109	6742
2	At ICFV	589	713	642	840	361	3145
3	Reduction of 3145 to 2819 features, as all features are merged to make ICFV						2819
4	Data points after feature clustering	118	97	83	179	74	551
5	Final reduction %	91.98	92.84	93.42	88.39	93.32	91.82

clusters and produced better results for generating a meaningful set of strong clusters even with increasing training datasets. Table 5 depicts the overall feature reduction, 95.8% and 94.695%, with CMMT and FSCMM-FC systems correspondingly.

4.3 Classification Accuracy

Both CMMT and FSCMM-FC systems used SVM classifier for text classification. The system complexity is found $O(n)$ for n labelled classes, say, 1, 2, …, n, in order to classify the test samples. As such SVM is built for class 1 versus classes 2, 3, 4, …, n at the initial stage, if the test feature is classified as class 1; otherwise, it calls the same procedure recursively for class 2 versus classes 3, 4, …, n, and so on. This process continues until all the test features are classified accurately. Therefore, the system accuracy is defined as the ratio of correctly classified documents with the total number of documents. The CMMT and FSCMM-FC systems achieved total 66.66% and 80% classification accuracy with Reuters 21578 document sets, respectively, as given in Table 6. Here, the highest accuracy of 100% was achieved with the '*Ship*' class for CMMT, and with the '*Acquisition', 'Ship', and 'Wheat'* classes for FSCMM-FC. The lowest accuracy was obtained with the '*Wheat*' class for CMMT and the '*Earn*' class for FSCMM-FC.

Table 7 depicts that the classification accuracy for both the systems. The CMMT and FSCMM-FC systems achieved 75% and 93.75% accuracy, respectively. Here the highest and lowest accuracy results were 100% and 50%, respectively. The comparison between the results of Tables 6 and 7 depicts that both systems obtained better accuracy with Yahoo! news documents than with Reuters 21578. The reasons behind such misclassification in Reuters 21578 is that in spite of using FSCMM-FC, there was a significant drop in accuracy because Reuters 21578 had some closely related classes, and it shared many similar words in their respective class histograms. Second reason is that most of the documents contained very little data in order to describe the news. The overall accuracy of 85.42% and of 93.43% was achieved in CMMT and FSCMM-FC systems, respectively, for all the four document sets as given in

Table 4 Feature reduction in FSCMM-FC with Yahoo! news articles

S. No.	Measures	Automobile	Business	Cinema	Crime	Health	Politics	Sports	Technology	Total reduction
1	Total features	1012	1397	834	937	814	984	1203	711	7892
2	At ICFV	481	565	492	535	421	496	560	378	3928
3	Reduction of 3928 to 2214 features, as all features are merged to make ICFV									2214
4	Data points after feature clustering	95	117	64	133	84	91	104	52	740
5	Final reduction %	90.61	91.62	92.32	85.8	89.68	90.75	91.35	92.68	90.62

Table 5 Overall feature reduction in CMMT and FSCMM-FC systems

System	Reuters 21578	Yahoo! news	Radio astronomy	IBM training	Overall feature reduction
CMMT	94.03	95.72	96.85	96.6	95.8
FSCMM-FC	91.82	90.62	98.37	97.97	94.695

Table 6 Classification accuracy with Reuters 21578 documents

System	Acquisition	Copper	Earn	Ship	Wheat	Total accuracy
CMMT	66.67	66.67	66.67	100	33.33	66.67
FSCMM-FC	100	66.67	33.33	100	100	80

Table 8. 100% accuracy was achieved with both radio astronomy and IBM training document sets as there was only one class in each one. Therefore, it is observed that FSCMM-FC achieved better classification results than CMMT.

Error Analysis with Big-Sized Documents. Both CMMT and FSCMM-FC systems were tested on four random sets of big-sized Yahoo! news articles to find the word misclassification rate. These articles were evenly distributed over five classes such as '*Business', 'Cinema', 'Politics', 'Sports', and 'Technology'*. The number of documents, 1, 3, 6, and 15, were taken for these four article sets. Table 9 shows the classification rate of both the systems in terms of the number of rightly classified words for all four sets. Figure 2 shows the comparative analysis of their classification results. It is found that with the increase in the number of documents, it also increases the word misclassification rate, especially for those words which belong to the multiple classes. It is also observed here that CMMT deteriorates its performance with the use of big-sized documents and correlated classes. Therefore, it is stated that FSCMM-FC achieves lower misclassification rate than CMMT.

4.4 Resultant Support Vectors

The SVM classifier is used to draw a decision boundary in the middle of the void, i.e., between data items of two classes; and such distance determines the classifier margin from decision surface to the closest data point. In this way, the SVM decision function defines the separator position and generates the support vectors. These vectors distinguish the documents of one class from the other one in both CMMT and FSCMM-FC systems. Figure 3a, b depict these vectors for Yahoo! news classes such as '*Sports' and 'Business',* and *'Health' and 'Cinema',* for CMMT system. Figure 3c, d show these vectors for Yahoo! news classes such as '*Business' and 'Sports',* and *'Politics' and 'Business'* in FSCMM-FC system.

These vectors show how closely the margins are related to each other, because some classes have same word usage over and over again. Consider the example of

Table 7 Classification accuracy with Yahoo! news articles

System	Automobile	Business	Cinema	Crime	Health	Politics	Sports	Technology	Total accuracy
CMMT	100	100	50	100	100	50	50	50	75
FSCMM-FC	100	100	100	100	100	50	100	100	93.75

Table 8 Overall classification accuracy of CMMT and FSCMM-FC systems

System	Reuters 21578	Yahoo! news	Radio astronomy	IBM training	Overall accuracy
CMMT	66.67	75	100	100	85.41
FSCMM-FC	80	93.75	100	100	93.43

Table 9 % of words rightly classified in Yahoo! news articles

Number of test documents	Total words obtained	% of words rightly classified	
		CMMT	FSCMM-FC
1	105	58	81
3	476	50	78
6	1068	43	63
15	1975	32	42

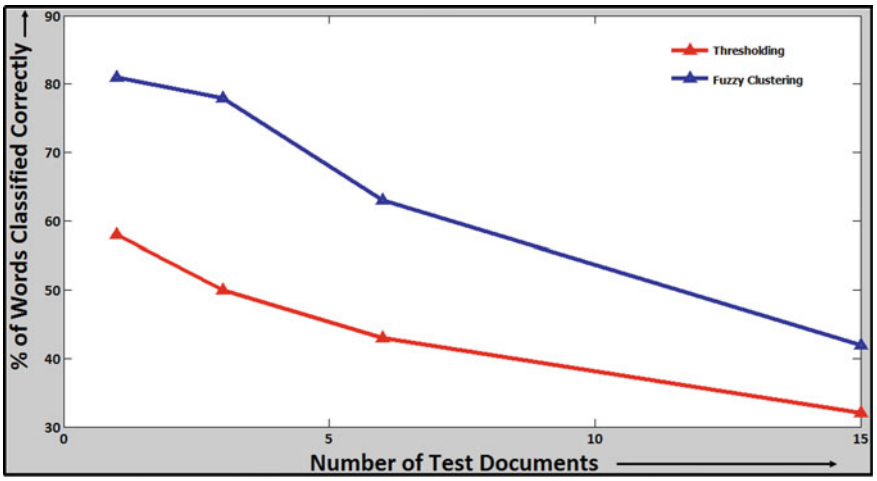


Fig. 2 Comparative analysis of word misclassification in CMMT and FSCMM-FC

'*Business' and 'Sports'* classes, the news related to a businessman may talk about *'Sports'*, say cricket, who was watching the match in the playground. Such scenario often occurs with the news data, so margins are closely bound on each other. Except the overlapping vectors of Fig. 3d, all others clearly discriminate the classes.

Several experimental results were performed on both the CMMT and FSCMM-FC systems with four different text classification sets. These results show that CMMT achieved better results in feature reduction than FSCMM-FC, whereas FSCMM-FC achieved better classification accuracy results than CMMT. Both the systems outperformed with Yahoo! news documents rather than with the Reuters 21578 documents. Furthermore, both systems were analyzed and tested with big-sized Yahoo! news

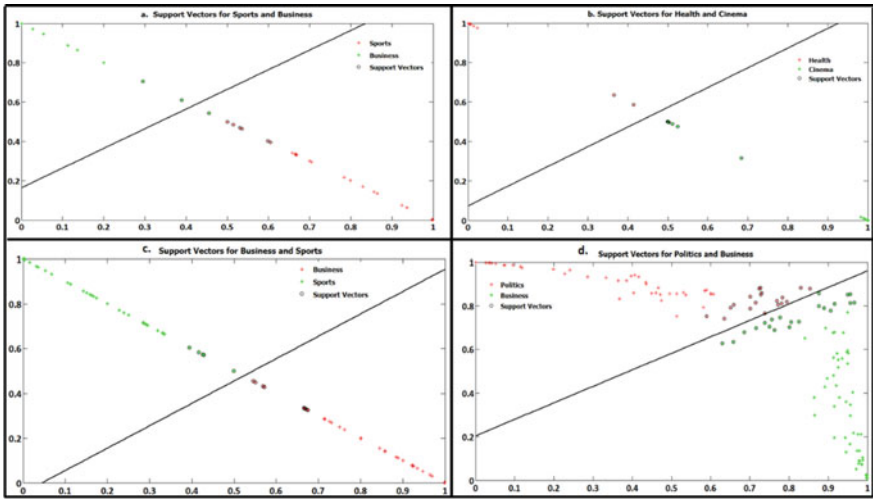


Fig. 3 Support vectors for Yahoo! news classes **a** sports and business, **b** health and cinema with CMMT, and for Yahoo! news classes, **c** business and sports, and **d** politics and business with FSCMM-FC

articles to obtain the % of rightly classified words. The support vectors showed the clear discrimination between two classes for each system.

5 Performance Analysis

The performance of the proposed CMMT and FSCMM-FC systems is analyzed by comparing their results for feature reduction and classification accuracy parameters. Sections 5.1 and 5.2 show the comparative analysis of overall feature reduction and accuracy estimation, respectively, for all four datasets such as Reuters 21578, Yahoo! news, radio astronomy, and IBM training, with both the systems.

5.1 Performance Analysis of Feature Reduction

Figure 4 depicts the comparison of feature reduction results of CMMT and FSCMM-FC, as given in Table 5, for all the four document sets. It is observed that overall 95.8% and 94.695% feature reduction were obtained with these systems, respectively.

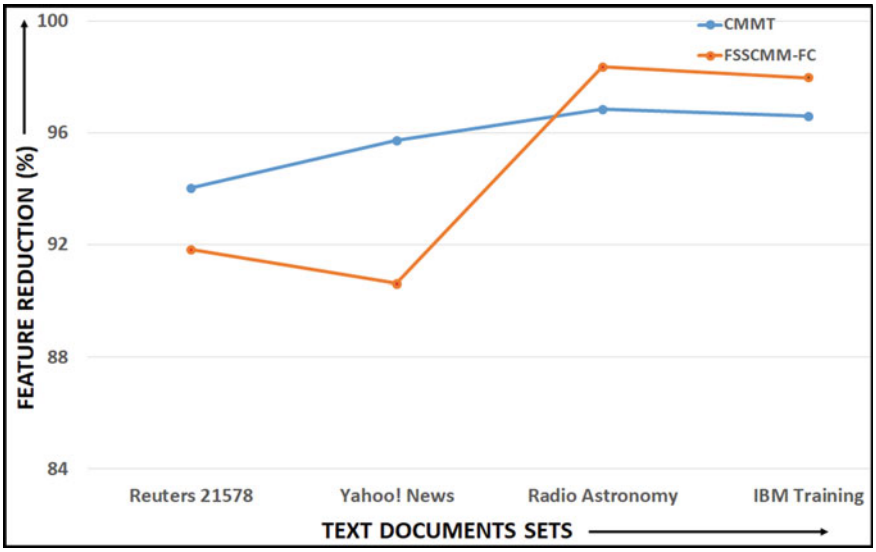


Fig. 4 Comparing the feature reduction of CMMT and FSCMM-FC systems

5.2 Performance Analysis of Classification Accuracy

This section analyzes the performance of both CMMT and FSCMM-FC systems by comparing their classification accuracy results for all the four document sets. Figure 5 depicts such result comparison for which these results have been taken from Table 8. It is observed here that FSCMM—FC clearly outperforms CMMT. The maximum accuracy was achieved with radio astronomy and IBM training datasets both; and the minimum accuracy was achieved with Reuters 21578 for both CMMT and FSSCMM-FC systems. The use of hybrid fuzzy SVM method in FSCMM-FC system led to achieve better results than CMMT.

6 Conclusion and Future Extensions

This paper demonstrated and compared two SVM based classification systems, CMMT and FSCMM-FC, with their feature reduction and classification accuracy results. Both the systems were implemented and tested on various sets of English text documents such as Reuters 21578, Yahoo! news, radio astronomy, and IBM Training. CMMT system achieved better feature reduction, i.e., 95.8%, using threshold 5 as compared to 94.695% of FSCMM-FC. Due to the use of TV, overall CMMT classification performance was found lower than of FSCMM-FC. The less number of features led CMMT toward more document misclassifications. On the other side, overall 85.41% and 93.43% accuracy results were achieved with them, respectively.

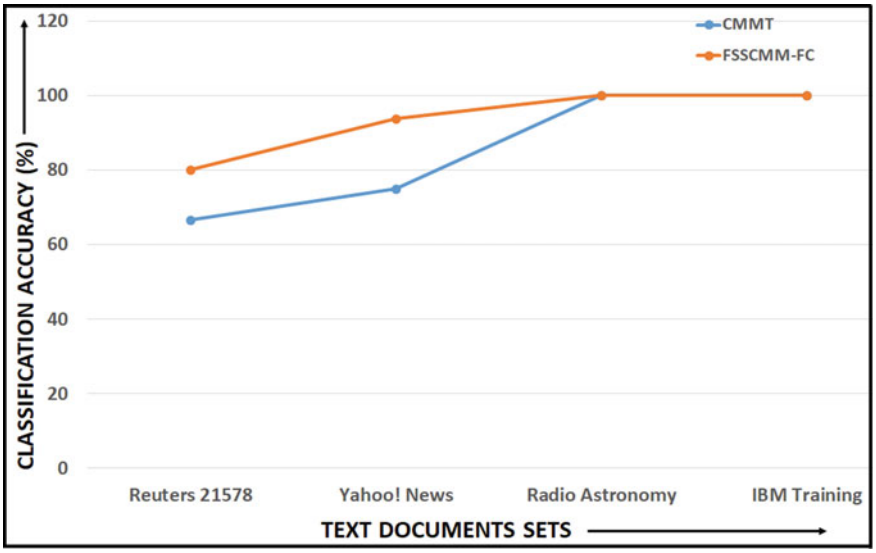


Fig. 5 Comparing the classification accuracy of CMMT and FSCMM-FC systems

This work can further be extended with other Latin and non-Latin languages. Another extension can be its implementation with the bilingual English and Hindi printed and handwritten images.

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A Review on Dimensionality Reduction in Fuzzy- and SVM-Based Text Classification Strategies



Shalini Puri

Abstract Due to the increased level of the big-sized documents in recent years, dimensionality reduction has become a significant step in the text document processing and classification systems. The high data dimensions in such documents make the classifier learning difficult and also increase the computation time exponentially. Text document classification systems optimally apply various searching and reduction methods on the feature set, thereby reducing the computational overhead, cost and complexity of the system, and also improving the text classification accuracy and execution time. In this direction, this article is designed to analyze several feature reduction and dimensionality reduction parameters of various fuzzy and support vector machine-based text document classification systems. The findings from their comparative studies show that the feature extraction and the support vector machine became the primary choice of the existing systems. Their % usage is observed as 43.3% and 26.08%, respectively, among all other existing methods.

Keywords Dimensionality reduction · Feature extraction · Feature selection · Fuzzy analysis · Support vector machine

1 Introduction

In today's world, dimensionality reduction (DR) or attribute reduction has become an essential and integral part of every text document processing and classification system. The feature reduction approaches such as feature extraction and feature selection are primarily used to obtain the relevant and important features in optimization-based and real-time-based systems. On the other side, feature clustering approach has been evolved as an ideal alternative of the feature selection approach, which reduces the high-dimension data into lower one greatly. To see the role and significance of these approaches in such systems, this article is designed to review and compare their key parameters of DR and classification results with the base of support vector machine (SVM) and fuzzy logic. On one side, the SVM is used as a binary and

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multi-class classifier, whereas the fuzzy logic works with uncertainty, membership, controllers and rule framing. With this, the analytical results of this review show the scope and the need of the advancement.

This paper is organized as follows. Section 2 discusses an overview of various existing text document classification systems. Section 3 provides two comparative studies and their observations which are based upon DR and classification results of the existing systems. Section 4 shows their analytical results and findings which have been obtained from both studies. Section 5 includes the conclusion and future scope.

2 An Overview of Existing Text Classification Strategies

Over three decades, various text document classification strategies using SVM and fuzzy have been introduced, which not only classified the text documents with high accuracy, but also greatly reduced the high dimensions of the data or features into low dimensions. This section describes many such existing algorithms and methods, which achieved the effective DR with the efficient implementation of such systems. The method in [1] included a statistical language-, context-, and frequency-independent-based approach using English, German and Portuguese languages. This approach extracted the strong concepts from the relevant single-word and multi-word units by first finding the fixed distances between concepts and then classifying them as either a single-word or a multi-word. The text categorizer in [2] used the combination of distributional clustering and learning logic Lsquare. The distributional clustering was used for the text document projection on word clusters, and Lsquare was used for text classification. Ref. [3] used fuzzy C-means (FCM)-based clustering to first reduce the large-sized numerical data into C intervals and then it produced the effective results. It evaluated the fuzziness of granular principals with parametric quantitative index.

The five algorithms, Sammon's algorithm (SAM), principal component analysis (PCA), original neural network (ONN), modified NN (MNN), fuzzy rules extracted by Takagi–Sugeno (FRTS) and fuzzy rules extracted by Mamdani–Assilian (FRMA), were implemented in [4] for text structure preservation. In this, [4] performed the input augmentation with corresponding projected data points; augmented the dataset clustering with FCM; and translated them into fuzzy rules to approximate the Sammon's nonlinear projection with steepest descent. The unsupervised dimension reduction and text categorization method of [5] encoded the documents into large term-document matrix. Here the dimensions were first reduced using PCA, multi-dimensional scaling (MDS), ISOmetric MAPping (ISOMAP), locally linear embedding (LLE), and Lafon's diffusion maps (LDM); and then the documents were categorized into different categories. The hybrid Gaussian mixture and k-nearest neighbor (KNN)-based data reduction model [6] selected the non-overlapping slices; constructed the Gaussian model; obtained the kernel matrix; built the generalized

eigen decomposition; estimated the sub-space; searched the nearest neighbors; and finally applied the mixture model to the classification.

The fuzzy logic-based improved keyword extraction framework (FL-IKEF) was designed to reduce the number of keywords by solving synonym, homonym, hyponymy and polysemy (SHHP) [7]. It used the steps of pre-processing; word frequency and noun extraction with Qtag tool; noun comparison; dissimilarity calculation; single word replacement for similar keywords; hyponym words comparison using WordNet; and finally keyword extraction. Another DR-based algorithm [8] first extracted the attributes and then evaluated its impact on the text classification. It extracted the words from news bodies of Reuters-21758 and then projected them onto a new hyperplane having dimensions equal to the number of classes. The fast incremental text classification approach with fuzzy self-constructing feature clustering [9] used three weighting feature extraction approaches such as hard-fuzzy feature clustering (H-FFC), soft-FFC (S-FFC), and mixed-FFC (M-FFC). The worst time complexity of proposed, divisive clustering (DC), information gain (IG), and incremental orthogonal centroid (IOC) methods were found as O (mkp), O (mkpt), O (mp + mlogm) and O (mkpn), respectively. Here m, k, t and n represented original features, clusters, number of iterations, and number of documents, respectively.

The weight-based feature extraction method [10] first obtained the synthesized attributes from original ones using transformation matrix and then performed the classification on the converted data. Another unsupervised method [11] extracted the most relevant features using singular value decomposition (SVD). The descriptive feature extraction and classification method [12] extracted and classified the non-noisy efficient features by computing each feature's contribution. For this, it used Zipf's law, improved term frequency–inverse document frequency category frequencies (TF/IDF-CF), and statistical analysis of the features' classified information. Next a fuzzy-rough feature selection method using fuzzy entropy [13] was introduced which produced smaller feature sub-sets and achieved good overall classification accuracy. This work [13] was further extended in [14] with the use of lower approximation dependency and distance metric; thereby using the boundary region objects. Its [13] next advancement [15] used DMQUICKREDUCT along with distance and rough-set dependency values, and it [15] achieved $(n * n + n)/2$ complexity with n dimensions. It also compared three rough set approaches such as distance-metric-assisted rough-set attribute reduction (DMRSAR), variable precision rough sets (VPRS) and tolerance rough set model (TRSM) to use the similarity relation for data minimization. Here DMRSAR and VPRS were used to include fuzziness in rough set and to utilize the boundary region information.

Next method [16] used fuzzy enhancing support vector decision function (fuzzy ESVDF) to select the features; to evaluate their weights using SVDF; and to apply fuzzy inferencing for ranking the features. By including both feature selection and feature extraction, fuzzy rough set-based algorithm [17] measured the relevance and significance quantitatively. Then it obtained the maximum relevance and maximum significance (MRMS) of reduced feature set to finally remove the redundancy. Ref. [17] was extended in [18] by including Interval Type-2 (IT2) fuzzy rough set-based feature selection for MRMS and by obtaining the lower and

upper fuzzy equivalence partition matrices. The methodology of [18] was further compared with the Maximal-Relevance, QUICKREDUCT (Max-Dependency and rough sets), fuzzy–rough QUICKREDUCT (Max-Dependency and fuzzy rough sets), neighborhood QUICKREDUCT (Max-Dependency and neighborhood rough sets), minimal-Redundancy Maximal-Relevance (mRMR), fuzzy rough set-based mRMR, and PCA. The hybrid weighted IT2-based fuzzy rough QUICKREDUCT algorithm [19] reduced the features for interval-valued data with rule extraction. It used weights to reduce the unknown information effect.

The text document categorizer [20] first computed the features' importance and then categorized the documents by using four context similarity (cs)-based feature selection methods such as Gini Index cs (GIcs), Document Frequency cs (DFcs), Class Discriminating Measure cs (CDMcs) and Accuracy-based context similarity (Acc2cs). A review on semantics preserving DR [21] discussed five techniques of crisp rough set reduction methods such as Rough-Set Attribute Reduction (RSAR using QUICKREDUCT), Entropy-Based Reduction (EBR), Genetic algorithm-based RSAR (GenRSAR), Ant-based RSAR (AntRSAR), and Simulated annealing-based RSAR (SimRSAR). The text classification with nonlinear DR [22] first evaluated the document similarity by using Geodesic distances; mapped the high-dimensional text into low dimensional ISOMAP; and then classified the reduced data using SVM.

The fuzzy similarity-based concept mining model for text classification [23] was designed to classify the text documents into pre-defined classes. It first pre-processed the documents on the sentence, document and integrated corpora levels with threshold based feature reduction, and then classified them using SVM. Its extension [24] used feature clustering to obtain more feature reduction. Furthermore, a survey on existing fuzzy similarity-based approaches of [23, 24] was discussed in [25], where it reviewed distinct parameters of existing approaches. These parameters were performance, accuracy, speed, time, storage, etc. It also discussed many methods such as feature clustering, fuzzy association, fuzzy production rules, fuzzy clustering, FCM and fuzzy signatures. Another text categorization algorithm [26] used QHull algorithm, FCM and SVM to eliminate and identify the outliers which were based upon the movement of the convex hull data center. The meaningful features were first selected and reduced to purify the data size, and then these purified cluster centers were used to train the SVM.

To classify the mixed integer, nominal and continuous attributes using SVM, the agglomeration FCM-based method [27] first reduced the cluster center randomness using economical validity index for compactness and separation of the clusters, and then it classified them. The kernel fuzzy-based SVM method [28] tuned the kernel parameters with k-fold cross-validation under various kernel functions. Another text classification method [29] pre-processed the documents; extracted the features; reduced them using PCA; and then classified them using neural network. An integrated mechanism of feature selection and fuzzy rule extraction [30] first discarded the bad and indifferent features. It conducted the nonlinear interactions among various features only and also among the features and the tools. Then, it performed the classification.

It is observed that all these existing systems primarily used feature extraction and feature selection methods to design their fuzzy and SVM-based classification systems. Therefore, it is stated that feature reduction and DR methods are of great significance to effectively design the text document classification systems.

3 Comparative Studies on DR and Classification Results of Existing Strategies

Section 2 discussed many algorithms and strategies related to the text document classification systems along with the use of different DR techniques. This section presents two detailed comparative studies based upon those classification systems. The first study analyzes and compares distinct DR-based aspects of the systems, and the second study includes the comparative analysis of their classification methods and experimental results.

3.1 Study I: A Review Based upon Various DR-Based Key Aspects

Study I provides the detailed review on various DR techniques and its related aspects which were used in various existing systems. Table 1 depicts the DR type, the DR method, the DR % achieved, and the significant aspects of these algorithms. It is seen that they used several types of DR methods such as feature extraction, feature selection, feature clustering, fuzzy clustering, rule extraction, and Gaussian mixture models. The DR methods used in these systems are FCM clustering, fuzzy rough sets, FCM, PCA, MDS, ISOMAP, LLE, LDM, SVD, Gaussian models, threshold, and their variations. Table 1 depicts them along with their significant aspects.

It is observed from Study I that most of the existing works used feature extraction and feature selection methods as the primary attribute reduction methods. Feature clustering methods were also used in some works. So, it is seen here that fuzzy-based clustering method reduced the data dimensions greatly than other methods. Their significant aspects included the important related concepts and parameters of the algorithms.

3.2 Study II: A Review on Datasets Used and Classification Results

Study II discriminates these existing methods on the basis of classifier usage, datasets, experimental results and different parameters. These results are compared and shown

Table 1 Comparing DR types, DR methods, DR % achievement, and significant aspects of existing methods

Ref. No.	DR type	DR method and DR achieved (%)	Significant aspects
[1]	–	90% single-word and 85% multi-word concepts	Word: a concept or a non-concept. No use of morpho-syntactic information. Found consistent words' relative specificity for all languages
[2]	Feature clustering	Information bottleneck for word similarity. High attribute reduction	Minimum use of aggressive feature selection. No information loss. Use of linear SVM-light for decision surface. Used 120 clusters to compute performance and time
[3]	Feature extraction	FCM clustering (granularity). High reduction	Improved noise robustness and efficiency
[4]	Feature extraction	FCM. High attribute reduction	Extraction of hyper-spherical clusters. Low-cost DR. More predictable and computationally efficient than Sammon's method. High outlier detection. Obtained from time-invariant probability distribution. Tuning of FRTS parameters with least square error, fixed antecedent membership, and gradient descent. Tuning of FRMA parameters of antecedent and peak membership using gradient descent
[5]	DR	PCA, MDS, ISOMAP, LLE and LDM. Good with dimensions varying between 700 and 3300	Reduced noisy impact. Preserved inter-document relationships. Improved training and testing time. Helps in literature-based discovery or sentiment analysis
[6]	Gaussian model	SVM for data augmentation. Good DR	Varying reduction with PCA and factor analysis. Fast method
[7]	Feature extraction	FCM clustering. Good DR	Word frequency computation and noun extraction. Use of defuzzification

(continued)

Table 1 (continued)

Ref. No.	DR type	DR method and DR achieved (%)	Significant aspects
[8]	Feature extraction	Good attribute reduction	Used porter stemmer, bag of words and term weight. No use of eigenvalues, vectors and SVD. Dimension No. = class number
[9]	Feature extraction	Incremental fuzzy feature clustering (FFC). Attribute reduction	Automatic creation of fuzzy similarity-based clusters. Non-trial-and-error method to get total extracted features. Same contribution of all words in a cluster. Used 1-D Gaussian functions with clusters. Found statistical mean and deviation for each cluster. Threshold-based cluster size with number of clusters. No need of variance in underlying cluster. In FFC, 0 is set as 0.25
[10]	Feature extraction	High feature reduction	Non-trial-and-error method to get number of extracted features. Had small computations and fast method. Number of extracted features = Number of document classes
[11]	Feature extraction	PCA-SVD. High attribute reduction	Used SVD uniquely. Ranking the constraints with SVD. Better performance of Euclidean difference-based k-ranked SVD to reduce relative errors. Had minimum reconstruction error. Used surrogate constraint (second norm). Need of 80–90% threshold to select minimum features. Cannot use SVD directly

(continued)

Table 1 (continued)

Ref. No.	DR type	DR method and DR achieved (%)	Significant aspects
[12]	Feature extraction	Global and partial extraction. Good attribute reduction	Use of average 56 features. 1% z-low, -high and document frequency threshold. 90% rate of category-emergence. 0.0005 CF and 0.01 adjustment coefficient in TF/IDF-CF. 500 neighbors and $\beta = 1$ for word frequency
[13]	Feature selection	Fuzzy entropy-based rough sets. Good DR	Small subset sizes. Improved prediction performance
[14]	Feature selection	Distance metric-based rough sets. Good DR	Same as of [13]
[15]	Feature selection	Rough sets. Good DR	Used indiscernibility. No exhaustive generation. Rely on data information. TRSM and DMRSAR thresholds: 0.9 and 0.95, respectively
[16]	Feature selection	SVD and forward selection. Good DR	Used feature ranking. Computed feature weights and fuzzy inference using SVDF
[17]	Feature selection and extraction	Fuzzy rough sets. Good DR	Obtained small feature set in less time. Used η and r to control the class overlapping and feature set size
[18]	Feature selection	Same as of [17]	Obtained small feature set in less time. Multiplicative parameter $\eta = 1.5$ and weight parameter $\omega = 0.5$
[19]	Feature selection	Same as of [17]	Weight enhanced the prior knowledge and reduced the unknown effects
[20]	Feature selection	GIcs, DFcs, CDMcs, and Acc2cs. High DR	–

(continued)

Table 1 (continued)

Ref. No.	DR type	DR method and DR achieved (%)	Significant aspects
[21]	Feature selection	Rough sets and fuzzy rough sets. Good DR	AntRSAR and SimRSAR performed well throughout. Used 3 discernibility matrix-based methods: hill climbing, clause-based search and NS. Selected 1 or more most predictive features. Used fuzzy-rough sets instead of costly entropy-based (hill-climbing heuristic), exhaustive search and non-optimized conventional rough set methods. Finding minimal subset of conditional attributes with maximum degree of dependency
[22]	Non-linear DR	ISOMAP. Good DR	DR using neighborhood parameters. Used 10- and 15-dimensional datasets
[23]	Feature extraction	Threshold method. 40%	Grouping of same words by patterns. Got low-dimension features at sentence, word, and document levels. Thresholds used: 5 and 8
[24]	Feature extraction	Feature clustering. 60%	Same as of [23] except the use of threshold method
[26]	Fuzzy clustering	FCM. Good reduction	Insensitive to noise. Reduced training time. Very fast method. Handled large dataset. Small parameters to form hyperplane
[27]	Fuzzy clustering	FCM. Good reduction	If attribute range <8, then do nominal conversion; else use FCM clustering
[28]	Feature extraction	Kernel fuzzy-based SVM. Good DR	Used 10-, 20- and 30-fold cross-validations
[29]	Feature extraction	PCA. High attribute reduction	Used vector space models. Determined hyper-box using minimum and maximum points of the hyper-box
[30]	Feature selection and rule extraction	K-means with Gaussian membership function. Good DR	Created minimum fuzzy rules with genetics. Used feature modulator, error function, and gradient descent for learning. Used threshold for modulators. No parameter tuning of rule base

in Table 2. They have used different classifiers such as SVM, fuzzy-based, KNN, C4.5, Lsquare, Naïve Bayes, linear, quadratic, random forest, JRip, J48, partial decision trees, linear discriminant analysis (LDA), graph-based, KEF-based and concept-based classifiers. Their results are primarily compared for accuracy, execution time, precision, recall, F1-measure, and other related parameters.

It is observed that these existing algorithms were implemented on simple to complex types of distinct and multi-type document sets and then they achieved promising results. It is seen that Reuters 21578, NGs and UCI datasets were used as the primary choices among all; and SVM and fuzzy classifiers produced better results in many cases. Therefore, these comparative studies I and II showed that SVM and fuzzy-based text classification methods have got great attention in recent years. The feature reduction has become an essential and integral part of the text classification and processing systems.

4 Analytical Results with Studies I and II

This section discusses two analytical results which are based upon the findings obtained from the Studies I and II, respectively. Their findings are primarily concerned to show the DR-type usage and the classifier usage in various existing algorithms, respectively.

4.1 DR-Based Findings from Study I

The findings based on the DR types include the usage of reduction techniques in different existing text classification architectures and algorithms. These findings are obtained from different observations of Study I. Figure 1 depicts graphically the 43.33% usage of feature extraction; 33.33% usage of feature selection; 6.66% usage of nonlinear DR and fuzzy clustering each; and 3.33% usage of feature clustering, Gaussian model and rule extraction each.

4.2 Classifier Usage-Based Findings from Study II

The classifier usage-based findings present the % contributions of various classifiers by analyzing the existing text classification systems. These findings are obtained from the observations of Study II. With 26.08% usage, SVM is found as the most preferred classifier among all others. Along with this, Fig. 2 depicts the 15.21%, 13.04%, 8.69%, and 6.52% usage of KNN, fuzzy-based, KEF-based, and J48 classifiers, respectively; 4.34% usage of classifiers such as JRip, partial decision trees and C4.5

Table 2 Comparing the classifiers, datasets, and experimental results of existing methods

Ref. No.	Classifier and data sets	Parameters and classification results
[1]	Concept-based classifier. Big corpus with millions of words. Different and random subject documents	*Concept extractor (precision, recall):* unigrams (0.92, 0.95)-better than TF/IDF. N-grams (0.87, 0.89)-better than local-max
[2]	Lsquare and SVM. Web knowledge base, 20 news groups (NG) and Reuters-21578. Small training document set	*Accuracy, break-even point and F1 (%):* Lsquare (96.8, 93.2 and 92.99) and SVM (94.59, 88.69 and 88.52). *For 200 documents:* Lsquare (97.88, 94.79 and 94.73) and SVM (96.05, 91.42 and 91.36). *For 20 NG-100 examples of 6 groups:* Lsquare (98.96, 96.81, and 96.74) and SVM (98.88, 96.13 and 96.04). *Macro-average and μAverage:* Lsquare ((96.8 and 98), (85.13 and 87.8) and (83.05 and 86.45)) and SVM ((94.77 and 97.42), (85.13 and 84.82) and (78.19 and 84.62)). Lsquare had high classification accuracy which was better than SVM. *Training performance (%):* Lsquare (94.57) and SVM (95.53). *200 documents from 20 NG:* training time (3.15 min) and testing time (2.27 min)
[3]	Fuzzy-based algorithm. Large synthetic datasets	Achieved high accuracy
[4]	Iris, helix, sphere-shell, elongated-clusters and 10-D normal-mixture	*Generalization, preserve structure and prediction:* good accuracy with FRTS and FRMA but not good with ONN and MNN *Performance for elongated clusters and sphere-shell:* best in FRTS and worst in ONN. Smaller size obtained in FRTS *Performance for helix:* Good in FRTS and FRTA but poor in ONN
[5]	KNN, linear and quadratic. Handled critical data. Some small documents had 2–3 sentences only	*Accuracy:* good and improved with small dimensions (5–500), and 81% for reducing PCA with KNN on 20 dimensions *Performance and classification*: best in MDS. Found good ISOMAP with few dimensions and with difficult datasets. Poor results of PCA for difficult datasets
[6]	KNN. Iris, letter recognition, glass identification, and breast cancer	*Misclassification rate (%) and computation time (sec)*: Iris (6 and 0.34) and letter recognition (5.85 and 143.68). Both were high for glass identification and breast cancer datasets

(continued)

Table 2 (continued)

Ref. No.	Classifier and data sets	Parameters and classification results
[7]	LDA, SVM, graph-based, IKKEF, SHHP-KEF, FL-KEF and FL-SHHPKEF. Meeting transcripts (supreme court dialogs) corpus	*Precision, recall, F-measure, root mean squared error (RMSE) and classification accuracy (%)*: LDA (0.7522, 0.6725, 0.71, 0.4325 and 67), max entropy (0.833 0.7575, 0.7931, 0.3927 and 76), SVM (0.933, 0.707, 0.8036, 0.4157 and 71), graph-based (0.9387, 0.7254, 0.8183, 0.3201 and 75), IKKEF (0.9454, 0.7878, 0.8593, 0.2868 and 79), SHHP-KEF (0.9563, 0.7899, 0.865, 0.2437 and 80), FL-KEF (0.9743, 0.7954, 0.8757, 0.2208 and 84) and FL-SHHPKEF (0.9878, 0.8167, 0.8941, 0.2013 and 87). FL-SHHP-KEF had best accuracy; better precision of 3.15% than SHHP-KEF and of 1.35% than FL-KEF; better recall of 2.68% than SHHP-KEF and of 2.13% than FL-KEF; better F–measure of 2.91% than SHHP-KEF and of 1.84% than FL-KEF; and better accuracy of 7% than SHHP-KEF and of 3% than FL-KEF
[8]	Naive Bayes, J48 tree (C4.5), 1-nearest neighbor (1-NN), 10-nearest neighbor (10-NN) and random forest (with 10 trees). Reuters 21758 newswire with short descriptive non multitopic documents	Fast classification, 94.14% average accuracy and improved average classifier accuracy by 27.62%. *Accuracy (%) and F-measures:* Naïve Bayes (93.1 and 0.931), J48 tree-C4.5 (91.3 and 0.912), 1-NN (96.5 and 0.965), 10-NN (96.9 and 0.969), and random forest (92.9 and 0.929). *Classifier accuracy (%):* Naïve Bayes (22.3), J48 (7.6), 1-NN (34.6), 10-NN (35), and random forest (38.4)

(continued)

Table 2 (continued)

Ref. No.	Classifier and data sets	Parameters and classification results
[9]	SVM aggregation. 20 NGs, Reuters Corpus Volume 1 (RCV1) and Cade12	*20 NG-processing speed:* faster FFC than DC and IOC. High feature extraction made DC and IOC slow. *Classification accuracy (%):* for 20 features, worst IG (95.795) < S-FFC (98.46), but exceptionally, H-FFC (98.43) and M-FFC (98.54) except 20 features. Worst DC (97.73) and IOC (97.09) with small feature set. *Performance:* micro-averaged F1 (MicroF1): S-FFC > M-FFC > H-FFC > DC. μaveraged precision (MicroP): H-FFC > S-FFC. μaveraged recall (MicroR): S-FFC > H-FFC. Good M-FFC results with MicroP, MicroR, and MicroF1 *RCV1-processing speed.* Faster FFC than DC and IOC. High feature extraction made DC and IOC slow. *Classification accuracy (%)*: for 18 features, worst IG (96.95) < S-FFC (98.39) < M-FFC (98.31) < H-FFC (98.13). All 3 FFCs performed well at all times. Total accuracy is 98.83%. *Performance:* MicroF1: S-FFC > M-FFC > DC > H-FFC. MicroP: 80% to 85% for all methods. Good results of M-FFC with MicroP, MicroR, and MicroF1 *Cade12-processing speed*: faster FFC than DC and IOC. *Classification accuracy (%)*: worst IG (7.04) for MicroR, S-FFC, and M-FFC. H-FFC was a little bit worse than IG in MicroP, but was good in MicroR. No accuracy for IOC when number of extracted features >22. *Performance:* S-FFC > M-FFC > H-FFC > DC. All methods were good for micro-accuracy, but no method worked satisfactorily for MicroP, MicroR, and MicroF1. Hard to get feature reduction with Cade12

(continued)

Table 2 (continued)

Ref. No.	Classifier and data sets	Parameters and classification results
[10]	20 NGs. Top 10 datasets of Reuters 21578	*NGs*: more accurate and faster than DC and IG. *Accuracy (%) and execution time (s) with 20 features:* 88.18%. Accuracy < full feature Naive Bayes (88.4%); > DC (78.54%); and >IG (18.34%). *Time:* 1300.8 s which was better than IG (1337.3 s) and DC (1817.3 s). *Accuracy (%) and execution time (s) with >5000 features*: DC performance was better than proposed at the cost of time. IG was better than proposed with all features *Reuters 21578: accuracy (%) and execution time (s) with 10 features*: achieved 83.75% which was 2.52%. 83.75% < full feature Naive Bayes (86.27%); > DC (80.2%); and >IG (55.06%). *Time:* 492.1 s which was better than IG (513.6 s) and DC (563.3 s). *Accuracy (%) and execution time (s) with >200 features:* better DC performance than proposed at the cost of time (approx. > 1898.9 s) and better IG than proposed when using full features
[11]	Two different datasets	Good
[12]	Improved KNN. NGs	Computed precision and recall. Achieved high classification accuracy and was better than KNN
[13]	J48, JRip, partial decision trees. Water 2, water 3, Cleveland, glass, heart, ionosphere, iris, olitos, and wine	Good accuracy
[14]	Fuzzy classifier QSBA. All datasets of [13] except ionosphere	High accuracy

(continued)

Table 2 (continued)

Ref. No.	Classifier and data sets	Parameters and classification results
[15]	JRip, J48, and partial decision trees. All datasets of [13] except iris. Data size: 47–2000 objects and 7–57 attributes	Increased classification accuracies by 30% with DR in short run time. Better performance than PCA. Fast DMRSAR than fuzzy rough feature selection (FRFS) for smaller subset sizes. Low classification accuracy of FRFS and DMRSAR for unreduced data. In many cases, TRSM outperformed FRFS and DMRSAR. Got poor TRSM classification accuracy. *In Hausdorff metric:* got best DMRSAR results in all cases; obtained 566 s runtime with LED; and failed to get useful information at boundaries
[16]	SVM. Text documents	Satisfactory performance with low false-positive rate. Time efficient at training and testing phases
[17]	SVM, C4.5, and KNN. Kent Ridge Bio-medical repository: satimage, segmentation, isolet, and multiple features of UCI machine learning repository. Breast cancer I, colon cancer, lung cancer, leukemia I, breast cancer II, and leukemia II	Achieved best classification accuracy with all three classifiers. Proposed DR was better than PCA, max-relevance, max-dependency and MRMS. Achieved highest accuracy with 10 training–testing sets. Fast method; computationally complex; and based on significant and insignificant features. Used ten-fold cross-validation
[18]	SVM, KNN, and C4.5 decision tree. Satimage, segmentation, isolet, multiple features, breast cancer I, colon cancer, lung cancer, leukemia I & leukemia II	Obtained best classification accuracy with SVM and C4.5 in all cases. Better MRMS performance than max-dependency and max-relevance for all cases. Better IT2 fuzzy rough sets performance than IT1 sets for all cases. Achieved best classification accuracy with MRMS feature selection using IT2 fuzzy-rough sets. *Classification accuracy (%):* KNN: 86.6/12, 86.0/10, 90.2/36; SVM: 86.2/25, 91.8/11, 90.2/42; and C4.5: 86.9/25, 91.1/16, 88.4/19 for satimage, segmentation, and leukemia II, respectively
[20]	SVM. $\text{Data}_{\text{BCII}}$ and Reuters-21578	Outperformance of proposed approach. Better than frequency based methods with μ- and macro-F1 measures
[21]	Rough sets. 13 text document sets	*Execution time-based ordering*: RSAR (minimum) < EBR < SimRSAR < AntRSAR < GenRSAR (maximum)

(continued)

Table 2 (continued)

Ref. No.	Classifier and data sets	Parameters and classification results
[22]	SVM. Demo dataset from osu_svm3.00 and 20 NGs	1. *Minimum accuracy with minimum dimension:* 53%; and training and testing time: 0.609 and 0.108 sec, respectively. 2. *Maximum accuracy with maximum dimension:* 88%; and training and testing time: 1.47 and 0.391 sec, respectively. *In 20 NG:* 68.75% minimum accuracy and 74% maximum accuracy. *Computation time (Dim = 2):* training in 0.529 s and testing in 0.061 s. *Computation time (Dim = 100):* Training in 2.91 s and testing in 0.142 s. Reduced execution efficiency of classifier. Very much time consuming with increased number of dimensions
[23]	SVM. Text documents	Good system performance
[24]	SVM. Text documents	Better system performance than [23]. 70–75% with high quality
[26]	SVM. Balance, four class, SVM guide and banana of UCI database	Good classification accuracy. *For 4 datasets, accuracy % (normal SVM, FCM-SVM, proposed):* (95.19, 96.15, 99.22), (99.48, 98.78, 99.76), (95.35, 94.69, 95.80), and (94.58, 95.11, 95.28). *Training time in sec (Normal SVM, FCM-SVM, proposed):* (1.79, 3.34, 4.08), (2.97, 5.48, 5.7), (113.02, 79.30, 62.47) and (76.4, 40.73, 27.13)
[27]	SVM. Balance scale, servo, lense, cancer, pima Indian, and heart	Better accuracy of nominal (81.2%) than original data (74%). *Classifier accuracy (%) in 6 original datasets*: 97, 18, 90, 89.3, 75, and 80; and *in 6 nominal datasets*: 97, 18, 90, 94.3, 96, and 92
[28]	Fuzzy SVM. Good datasets	Significant and good results with nonlinearly separable data. Used kernel-based learning algorithm
[29]	Multi-level fuzzy min-max neural networks. Reuters 21578 and 20 NGs	94% accuracy in Reuters 21578 and 95% in NGs. Less execution time than other supervised methods
[30]	Fuzzy. Synthetic datasets. Iris, Wisconsin diagnostic breast cancer, wine, heart, ionosphere, sonar, and glass from California Univ., machine learning DB	Good and improved accuracy due to feature elimination. 0% misclassification rate in all datasets with ten-fold cross-validation

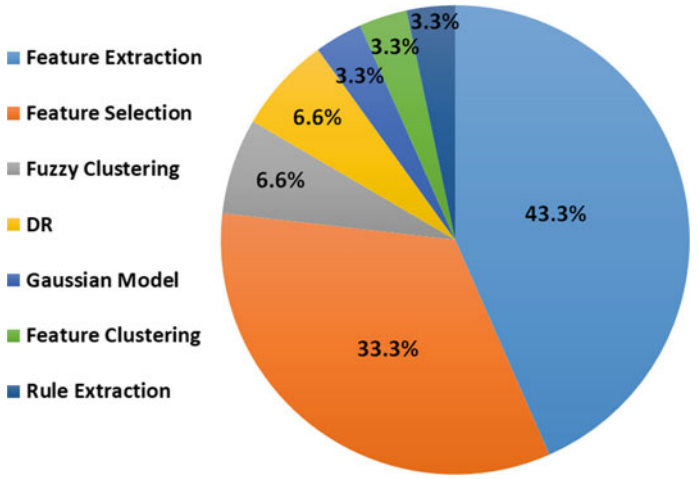


Fig. 1 Percentage usage of feature and dimension reduction methods in existing algorithms

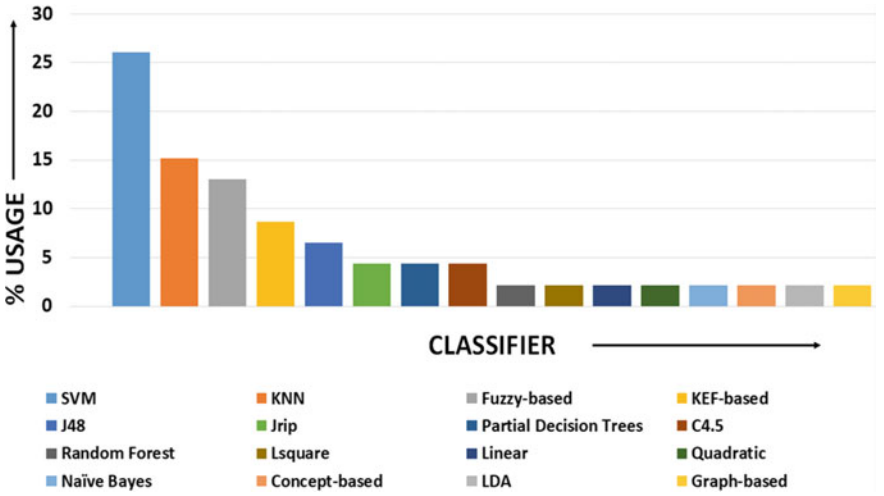


Fig. 2 Percentage usage of different classifiers in existing algorithms

each; and 2.17% usage of classifiers such as random forest, Lsquare, linear, quadratic, naive Bayes, concept-based, LDA, and graph-based each.

5 Conclusion and Future Scope

This review provided the description and comparative analysis of DR-based methods used in many SVM- and fuzzy-based text document classification systems. It was represented as two detailed studies in terms of many key parameters such as DR, attribute reduction, classification methods, results, and their related concerns. The observations from studies stated that most of the techniques used the feature extraction as the primary reduction method; and the SVM and the fuzzy as the most preferred classifiers.

Although these reduction and classification results were found promising, yet there is still scope of designing a highly efficient classification system along with the add-on of high dimension and feature reduction. On the other side, the hybridization of fuzzy and SVM techniques is used to provide very fruitful solutions for the accurate and efficient classification of textual data. In future, this review can be expanded for analyzing the features of images and videos in the bilingual, trilingual, and multilingual environment.

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IoT-Based Big Data Storage Systems in Cloud Computing



Prachi Shah, Amit Kr. Jain, Tarun Mishra, and Garima Mathur

Abstract IoT-based applications have developed as a significant sector for designers and scientists, exemplifying the size and effect of information relevant issues to be resolved in voguish merchandise associations especially in dispersed computing. The paper presented here basically gives a utilitarian system that distinguishes the securing, the executives, managing and mining zones of large Internet of Things info, and distinct parallel functional subjects are individualized and portrayed as much as their pivotal qualities and abilities Wang and Chu (Data management for Internet of things: challenges and opportunities, pp. 1144–1151, 2013 [1]). At that point of ebb and flow look into Web of things, usance is examined, in addition, the complications and operations related with large IoT-based information are recognized. We additionally communiqué an investigation of basic IoT-based application productions and research proposals dependent on similar erudite and commerce distributions. At last, some open issues and challenges what is more, some run of the mill models are delivered under the prospective IoT-based research structure Hasan, E. Curry (Internet Technol. (TOIT), 14(1):2, 2014 [2]).

Keywords IoT-based applications · Big data storage systems · Cloud computing · Distributed data processing · Data administration

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1 Introduction

The Web of things is an arrangement of interdependent registering gadgets, involuntary and advanced gadgets, living beings that are equipped with exceptional qualifiers and the scope to move data on a system beyond compelling man-to-man or man-to-PC connection. In IoT, it can be considered as a machine-to-machine correspondence. A "thing," in the Internet of things, can be a car operating through sensors to caution the rider if the tire pressure is below a certain level—or some varied common or human developed items that can be allotted an IP address and give the capacity to move information on a system [1].

Profuse information has been devised by massive methods of dispersed sensors, on how to get, integrate, deposit, procedure and employ the available info to get a dire and significant issue for undertakings to pull off the business intentions. As an outcome, the scientists and designers are accosted with a confrontation of taking care of the huge diversified data in thoroughly appropriate circumstances, especially in cloud stages.

1.1 Notable Attributes of IoT-Based Information in Cloud Stages Are

- Multi-source significant conglomeration information
- Tremendous scope influential information.
- Low-level with powerless connotation information.
- Inaccurate information.

Likewise, by the exploitation of online cloud stage for IoT data exchange, qualifying and incorporation, various prerequisites are handed over for volume, constant and unorganized data handling housing various levels, e.g., data capacity, data representation and data scrutiny.

The IoT innovation coordinates with the enormous information access to control shrewd mechanical computerization application. In huge scope of mechanical robotization applications, a large number of computerized gadgets are created with zillions of such IoT coins to build the IoT models, and the systems of these zillions of IoT articles may establish an enormous scope of modern IoT circumstances, from where organized, semi-organized and disorganized large IoT information are delivered in a genuine timeframe [3].

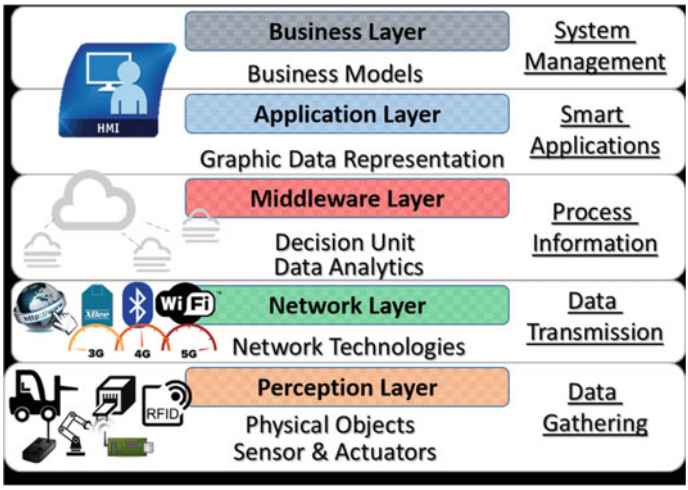


Fig. 1 IoT layer

2 Related Work

IoT expands on the achievement of Internet advances to interface substantial items, or things to the Web and empower plenty of uses, for example, helped driving, increased sensitivity or savvy and agreeable households. An essential prerequisite to understand IoT is a foundation of correspondence arrangements and interoperability guidelines. The Internet of things additionally demands middleware layer that can sketch the app designers from the basic advancements; this is vital to IoT-based applications' selection and progression. Mix of contrasting bulky information is a genuine test as appears in Fig. 1.

3 The Operational Framework of Cloud-Based IoT Applications

The commonplace structure of IoT is composed of perception layer, structural layer and application layer. The application layer is the basic layer for storage systems based on IoT in distributed computing since it is formed from middleware. Enough tasks have been performed to entrust lucrative and furthermore, astute data handling and inspection in operation layer in view of dispersed computing [4]. The frontal layer corresponds to RFID, WSN are intelligent options. Considering the handling method of Web application, a system of Internet-dependent data inventory frame of reference in distributed computing is depicted in Fig. 1. The groundwork dwells of a few elements that secure and incorporate information, information build_up, information preparing and information mining and application improvement module.

Alluding to Fig. 1, relevant innovations can be isolated into a few practical modules as below:

- **Data Acquisition and Integration Module**: As an information module, the process of gathering and incorporating amalgamated data from circulated networks and cellular phones is a crucial concern for the entire structural evolution.
- **Data Storage Module**: Taking into account various types of Internet-based data including formulated, semi-formulated and disorganized data of colossal sum, varied database types or record framework, e.g., XML documents in Hadoop circulated record framework (HDFS), relational database management system (RDBMS) and not just SQL (NoSQL). A NoSQL database gives capacity to a system and recovery of information that is displayed. Graph DBMS ought to be consolidated to accomplish a high proficiency for information stockpiling in cloud stages [3].
- **Data Management Module**: The recovering of information from immense volumes of data gathered from various sources with steep productivity, various techniques, e.g., data list, metadata, connotation relationships and interlinked data is approved for information board at different stages.
- **Data Processing Module**: At cloud stage, mass data preparation systems, e.g., Map-R are refined for equal and disseminated info preparation. Information questioning can be done in a more flexible way to alter with enormous quantity of information.
- **Data Mining Module**: Scrutinizing the info from sensors to avail invariably cheap and low-level of information, elevated level of info should be separated, ordered, disengaged and broke down for application reason. Thus, data mining depending on IoT information chiefly means to realize extensive prospects or information investigation outcomes for end-clients [5].
- **Application Optimization Module**: Based on investigations of operation, relevant calculations or approximations are obligatory for preparing information on cloud platform giving exceptional consummation requisites, e.g., decreased input/output accelerated intermingling, surveillance, flexibility, possibility, reduced cost and so on.

4 Structure and Objections

With relevance to useful system of IoT information preparing on cloud stage, the following techniques with challenges can be listed.

4.1 Data Acquisition and Integration Module

IoT uses various kinds of sensor gadgets, e.g., RFID, ZigBee sensors, GPS gadgets, temperature sensors and so forth. It makes enormous conglomerate information, so

the model is useful for picking up and incorporating such large information. As a part of information preparation in distributed computing, we might group the procedure of data acquisition and integration module into three techniques like info portrayal figures [6].

Data Representation Models
Information description models ought to be outlined dependent on numerous operational objectives with a versatile and key organization. In any case, there is an issue in conventional transferring techniques for IoT, on the grounds that IoT sensor produce heterogeneous information. Traditional transferring policy for the sensor data in licensed arrangements is not plentiful for the applications of IoT. It could be illuminated utilizing overseeing occasional information utilizing RDF framework, and along these lines, occasional information is required to inspect inbound together, incorporated and associated in a way since the occasional information depends on gigantic, various and interlinked data sources [7]. In this manner, sensor information must be advanced and changed into RDF group for additional transformation. VO model is suggested to enhance the sensors with setting data to help brilliant town applications dependent on subjective IoT objects. The figure speaks to genuine items for mass information casually getting to and generates a surge of crude sensor measurements. A different matter related with IoT is UI, in light of the fact that user interface is getting progressively significant with the advancement of the IoT applications. The manifesto form-based applications operate as digital natural-communal frameworks. In the era of connotation level collaboration with setting, there are some current arrangement and guidelines like, sensor ML, which is an endorsed Open Geospatial Consortium standard, gives specific designs and XML coding for depicting sensors and estimation forms. The SSN philosophy can display sensor gadgets, frameworks, procedures and perceptions protests in order to empower expressive portrayal of sensors, sensorial perceptions and information on the earth [7].

Multi-source Data Fusion Right now might want to concentrate on the best way to collect and coordinate gigantic amalgamated data that will originate from various sensors. It is run of the mill to perceive the sort and combination of such information. A theoretical solution for amalgamated sensor information mixed in horde notifying applications is introduced to centralize various types of conventions for various sorts of data. Three ways of assembly, e.g., HL7 for therapeutic data, BACnet for structure analyzing and consideration and assessment model for ecological data, are incorporated into one information model to foresee sensors and exercises [5]. It utilizes smaller scale infusion to utilize a heterogeneous system of remote sensor hubs. These sensor hubs transmit conditional data, e.g., material build up conditions, encompassing lab temperature and moistness. Keeping up the effortlessness and adaptability in assortment of use in IoT is mind boggling task, which can be resolved utilizing Thing Broker means to correlate IoT objects with various qualities, stipulations, collocations and limitations while keeping up the bluntness and adaptability necessity for a combination of usage [7].

Data Transmission and Communication
In the wake of finishing of picking up info from different sensors in IoT, we need to transfer info and develop correspondence among various sensors for commerce. Internet uses TCP and UDP show for transferring information over a framework. Usually, IoT engineers picked UDP as a result of its steady component, yet when sorted out obstructions and channel disturbance happen, then package hardship happens successfully by UDP show, which is a progressing test [3]. The introduction of CoUDP show is much better than UDP and TCP since it incorporates estimate management and brisk re-transmission framework over UDP application and abandons tedious information like TCP. Directly a separate test was to give guarantee at correspondence level. This is cultivated in a prospective sorted out level security using closeness-based affirmation. In closeness-based approval, access is expected to handle the remote correspondence interface. Still in data representation models in cloud condition don't have a bound together structure in the piece of getting sensor data and compromise. Multi-source data blend is until now a standard issue in applications. Regardless of the way that data move shows are created [5].

4.2 Data Storage Module

IoT generates abundant conglomerated information, and to deposit such large information is a continuous test. Cloud stage gives an arrangement of capacity as administrations. Therefore, to share and separate the information on cloud stage are the primary difficulties in IoT information stockpiling. Information stockpiling module incorporates two sub-segments [5].

Data Storage Types. Cloud stage is a plausible approach to deal with and collect the colossal information. Essentially, we have ordered information into three kinds: ordered, unordered and semi-organized information. It requires capacity type, and thus, we arranged capacity types into

1. RDBMS
2. NOSQL DBMS
3. DBMS dependent on HDFS
4. Main-memory DBMS and
5. Graph DBMS.

RDBMS. In IoT, huge information is created quickly and differently, the correlations amidst the information are constantly basic for a multi-occupant information stockpiling framework. Structural information is the sort of information that comprises assortment of lines and sections. It is too simple to administer the ACID rules on organized information. Cloud dependent on virtualization, it produces fundamental social information and we have to consolidate this information with customary social information for uniform pattern, however sends out bound together information get to view to go about as a multi-inhabitant database for various occupants.

The proposed methodology of RDBMS known as Ultra-wrap encrypts a legitimate portrayal of each database as a RDF diagram and uses SPARQL inquiries to acquire the information on the current social put away perspectives [7].

NoSQL DBMS. Unorganized information oversees by utilizing NoSQL management system in a basic worth proposal. However, NoSQL database is not sufficient at conforming atomicity, uniformity, desolation and persistence of information. Moreover, it cannot bolster for some appropriate inquiries and the primary issue of NoSQL database. It gives a few properties, e.g., flat adaptability, appropriated capacity, progressively composition and so on.

DBMS integrated with HDFS. Utmost noteworthy test in piece of IoT information; different information are produced in XML organization, and the management of these little measured, tremendous volumes of XML documents turns into a significant test. This could be resolved utilizing the improved putting away and getting enormous little XML records in HDFS. Some XML records are converted into bigger documents to decrease the metadata, and in this way, related instruments could be utilized to enhance the information storage performance. With the assistance of another focal ordering administration finding framework, in light of Apache Hadoop HBase information storage, the exhibition of administration finding is expanded [5].

Main-Memory DBMS. Fundamental storage databases that are converted into doable as of late with the expanding accessibility of huge modest memory can give preferable execution and steady throughput over circle-based database frameworks. There is an enormous scope of RFID application in the primary storage database framework H2. Moreover, it gives a multidimensional hash-based file plan structure and accomplishes a beat presentation assessment [7].

RDF-based data storage. RDF-based information implies unorganized information for Internet data asset. RDF Schema proposed a cosmology signifying language for gathering assets into idea and perceiving connection between ideas (Table 1).

Data Isolation in Cloud Platform. Information seclusion is a genuine test because information amass emanates from credit flexibility in distributed computing system, because of data authority and data arrangement administration happen with information separation in cloud stage. Cloud stage shares basic asset with multi-tenant for optimum use of asset. This methodology might lead to the issue of inconsistency and dormancy in data content [3].

4.3 Data Management Module

In IoT, to oversee conglomerated information utilizing data management module shapes a clever and compelling database for additional appropriated or equivalent IoT applications. The information of the executives, relevant works can be ordered into three angles: metadata, connotation comment and data aligning [3].

Table 1 Comparative study of various data types in IoT

Features Data types	Support for ACID	Support for semi-structured data and unstructured data	Support for structured data	Support for scalability	Support for massive and distributed processing
RDBMS	Not sound	Not sound	Yes	Not sound	Not sound
NoSQL DBMS	Yes	Yes	Not sound	Yes	Yes, but it is stiff
DBMS integrated with HDFS	Yes	Yes	Yes	Yes	Yes
Main-memory DBMS	Common	Yes	Yes	Not sound	Yes, but it is stiff
Graph DBMS	Common	Use graph structures with nodes, edges	Use graph structures with nodes, edges	Yes	Yes

Data management based on metadata. Metadata is commonly identified as the start to finish cycle and the organization structure for composing, supervising, upgrading, associating, organizing and coping with metadata composition, model or other oriented aggregation structure, either individually or inside an archive and the similar backing procedures. It makes data handily composed and comprehended by clients without being associated with everything regarding the arrangement.

Semantic annotation. Loads of IoT-based applications robustly depend upon the apprehension of the info, with the target that enormous scope of info interpretation has found concentrated attention lately. As a significant piece of restored modernization, the rigor of connotation remark determines the recovery outcomes [5] (Table 2).

Data indexing strategy. Information aligning can make data restoration activities increasingly viable at the expense of excess compounding tasks and supplementary info require extra space for info storage. With records, DBMS can briskly search data without going through every single line in the database tables. In the territory of data realigning, current relevant task can be characterized into three different ways that are bitmap file, compound info design list and rearranged lists [2].

4.4 Data Processing Module

In distributed computing, disseminated servers are used for capacity and procedure. The enormous information utilizing Map-R system is an open source execution. Apache Hadoop is a well-renowned platform for equivalent handling strategies in cloud stage. Guide Reduce is broadly utilized in inquiry handling for info diagnosis

Table 2 Similar investigation of data indexing methods

Features	Data structure	Suitable data characteristics	Suitable scene	Performance	Cost	Current usage status
Bitmap index	Bitmap	Values of a variable repeat frequently	Analytical process such as OLAP	Less efficient	Less space	Common
Complex data structure index	Tree, graph or others	Values of a variable repeat frequently	Transaction process such as OLTP	Efficient	More Space	Common
Inverted index	Mapping from content to location	New key values monotonically increase such as sequence numbers	Large-scale process such as search engines	More efficient	More space and increased processing	Rising trend

assessment in cloud stages. Another test in information preparing utilizing Map-Reduce is it does not legitimately bolster increasingly complex tasks, e.g., joins. With elevations in research, explanatory authorization of obscure data, e.g., RDF is essential for equal preparation of IoT information in the cloud.

4.5 Data Mining Module

Because of the colossal capacious disseminated highlights of net-based information, it is expected to detect a fruitful and productive advent to account for colossal measure of data. For most parts, there are three different ways of information delving for IoT operations, similar to data digging in equal programming, data digging in portable figuring, data digging for diagrams and so on [6].

5 Future Scope and Conclusion

Currently, researchers have discovered the greater part of potential difficulties in the field of IoT. The editorial has been segmented into five modules, for example,

1. Data acquisition and integration module,
2. Data storage module,

3. Data management module,
4. Data processing module and
5. Data mining module [4].

Here, we have distinguished some problems in the horizons of big data systems aligned with cloud computing and attempt to give answers to expel these predicaments.

In future, we might want to explore the fields of information digging system for settling issues related to Map-Reduce problems, while acquiring the information through IoT, on the off chance that we utilized Map-Reduce, it might limit our approach due to a constraint in Map-Reduce, referring to selective access to information which could be resolved in future by enhancing some strategies such as indexing, data layout technique [8].

We might want to lessen cost while information correspondence via IoT by improving partitioning, collocation technique. Considering Map-Reduce, inadequacy of help for m-way activities, we may conquer it by utilizing additional MR stage, redistribution of keys or the record duplication method. For distribution of work in IoT, Map Reduction is an additionally common employment since load adjustment is a frail purpose of Map-Reduce, so we could understand utilizing the method, for example, preprocessing testing, repartitioning and clumping.

Low level of data with feeble semantics information in Web of things demands interactive inquiry in information examination errands; however, in Map-R system, there is grouped implementation, absence of communication which could be resolved by upgrading looping, caching, pipelining, recursion, steady processing strategy. Dealing with low-level data with powerless semantics information in Web of things necessitates question streamlining, yet in Map-R absences of the board and prospective reutilization of outcomes, we can utilize advancements in processing, specification adjustment, planning clarification, administrator backtracking, code investigation, dataflow improvement method for reutilization of outcomes [4].

Internet of things (IoT) may create uncertain information, to oversee such information, it requires "exploratory questions" even in Map-Reduce. Lack of snappy recovery of inexact data could limit the utilization of improvised method such as reasoning dependent on formal articulation, for example, cosmology result. At last, we reason that in the wake of illuminating those predicaments, we could deliver great framework for overseeing such powerful, heterogeneous and enormous information concerned with high and low levels of information and also limit the erroneous information at the hour of mining of information from huge information.

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An Impact of Different Uncertainties and Attacks on the Performance Metrics and Stability of Industrial Control System

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Abstract The revolutionized growth in the networked control system has made the system more vulnerable to different types of threats such as delays, packet losses, and attacks. Such uncertainties in the control system may be introduced in the forward and/or feedback direction by the intended attackers while transmitting the signal. Herein, the system is estimated by modeling different parameters along with the knowledge about the actual system while considering the delay, packet loss rate, etc., using system identification and True-Time tool. Also, the particle swarm optimization (PSO) algorithm is used for modeling the system and estimation of controller parameters. The efficacy of the estimated model is shown by evaluating the various performance measures along with the introduction of design of a model of attacks based on the estimated system parameters to compromise the actual network control performance. In the absence of attacks, the estimated model used here shows above 94% fit to the estimation data which indicate the efficacy of the estimated model. Later, different rates of packet loss such as 0, 5, 15, and 25% are introduced for estimating the system model. For each case, the attack is simulated to show the impact of service degradation attack on the performance metrics of the networked control system. The overshoots are 15.698% for 0% packet loss, 17.4% for 5% packet loss, 17.9% for 15% packet loss, and 17.5% for 25% packet loss along with modeled attack. The other metrics such as rise time, settling time, and peak time increase substantially, whereas root mean square value decreases, and the cost function increases for estimated system with different packet loss rate and attack, which is an indication of a compromised system.

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1 Introduction

The networked connected control systems are characterized as a system where physical components are coupled together with closed control loop using communication network, while increasing the complexity of the system. Nowadays, networked control systems are being used in many applications such as industrial processes control, robotics control, medical field, and aircraft systems. The upgradation in technology is becoming the solution for faithfully transmitting the packets/signals and overcoming the problem of time delay in the networked connected control systems. The delays and packet losses in the networked control system worsen the response/performance of the physical process and try to fetch the system to the verge of instability. Therefore, estimation of delays, packet losses, and bandwidth are the key factors in stabilizing the physical process. These systems are also more vulnerable to malicious attacks. Thus, it is necessary to stabilize the system against the introduction of the attacks.

The networked control system may be fetched to the verge of instability by introduction of the attacks into the communication system that may be in the forward and/or backward stream. The main broad category of intervention may be service degradation, denial of service, etc., as have been reported in the literature. In this paper, the impact of these attacks on performance of the networked control system is presented.

The rest organizational flow of the paper is described as follows: The literature work is briefly described in the Sect. 2. Section 3 presents the problem formulation, and it also discusses the performance parameters for degradation of networked control system (NCS). The responses of the estimated system on the proposed methodology are summarized in Sect. 4. At the last, in Sect. 5, the conclusive remarks and future work are presented.

2 Background Work

In the networked control system, uncertain delays and packet losses are the key parameters to investigate the stability, where packet losses are designed using Bernoulli process. Some stability conditions have been derived to show the quality of measure of the defined method [1].

The predictive controller is designed to elaborate the response of the designed method for the controlled system. This may be affected by transmitting data due to insertion of denial of service attack [2, 3]. The introduced attacks are calculated

for the wireless connected networked control systems using the intrusion detection system, and authors have also validated the proposed method to be stable [4].

The delay estimation in the communication system is very important to design a controller for the networked control system, and it is estimated using Markov chain Monte Carlo method and from MODBUS over TCP/IP [5]. It has been observed that designed regulator performs better under the consideration of delay [6]. The stochastic optimal control system is designed to estimate the network delay dynamics, which showed the upgraded performance parameter of the control system [7].

The time delay attacks on the linear system are described in [8]. It is revealed that cryptography free time delay switch method showed the improved stability under delayed attack system. The networked motion control is simulated using the True-Time tool box, and it has been shown that the speed of the motor is not much affected by sudden change in the load [9]. The stability of the system also verified using the dynamical model of the said system by considering the parameter of network nodes. The better communication among the control devices and stability is achieved by the evaluated simulated system along with vehicle ad hoc network [10].

In this paper, the True-Time toolbox is used for developing the model of control system. It has been shown that the proposed method gives consensus along with the performance of the communication system while considering the delay. The improved performance for networked control system against service degradation, denial of service, and system identification attack was demonstrated in [11–13]. The optimized coefficients of plant and controller are estimated using system identification tool and BSA algorithm which shows the better performance while inducing such attacks.

The messaging data traveling from sensor to controller and from controller to actuator can be corrupted using different attacking techniques such as denial of service and replay attacks. The receding horizon control law and exponential stability are proposed to derive the stability condition for analyzing the performance [14, 15]. The improved performance of the control system for the distribution network control is addressed in [16]. The scheduling mechanism and strategy are used to show the efficacy of the system employed. The effect of delay, jitter, and loss of data packet in the transmission which is the key factor of instability of system is also discussed.

The performance of the control system is enhanced using the equivalent input disturbance estimator by rejection of the disturbances. Author also discussed the sufficient condition of the stability using linear matrix inequality tool to estimate the gain of state feedback controller. The system stability and performance can also be improved by using Smith predictor which compensates the delay [17]. The wireless communication system is used to model the distributed plant along with the True-Time MATLAB-based toolbox. Moreover, in [18, 19] author used PLEC block set for modeling the electrical system. In this, a wireless communication network link is used to control the active power and generator plant. The communication is the key issue between connected devices.

The general regression neural network (NN) is presented to model the delays, which affects the control system performance adversely and tries to fetch the system to the verge of instability. The genetic algorithm is used to get the best estimate

of the parameter which minimizes the error factor used for designing the proposed controlled system. It is shown that approximated delay compensation control scheme achieves good results than the methods reported in literature [20]. The effects of the delay and jitter on control system are discussed in [21–24] and also evaluated the parameters as solution for designing the control system. In this linear quadratic regulator, genetic algorithm is used to solve the optimization problem as well as to synthesize the performance and stability of the control system.

The packet lost and time delay problems are investigated to show the improved NCS performance by introducing switched model based on effective sensor packet and stabilizing condition which are also derived using linear matrix inequality [25]. The real-time networked control systems are simulated using the True-Time toolbox with different network protocols and scheduling strategies [26–31]. It has been shown that the simulated system can be imitated to show the performance under different attack scenario. The stability condition, considering packet loss probability for stabilizing the wireless networked control system using linear matrix inequality (LMI), and Markov jump linear system are proposed for designing the suitable controller so that improved performance of the system could be estimated [32]. The anomaly detection in cyber-physical system is discussed with the use of neural network technique and showed the efficacy of the proposed method [33]. The model of actual system can be estimated using the system identification tool by exploiting the knowledge of output and input data given to the system [34]. The estimated model is used to degrade the performance metrics of the system. The predictive control method based on the input/output data of system is used to compensate the packet loss, which showed the improved system performance [35]. To overcome the delay constraints, an optimized proportional gain, integral, and derivative controller gains are computed by employing the evolutionary algorithm for the given control problem and improved performance verified/validated using True-Time and UPPAAL [36]. To identify the intruder activity and securing the networked physical control system devices, honeypots of self-configuring nature were implemented in [37]. The stability condition for networked connected control system with Kalman filter and linear quadratic Gaussian (LQG) controller discussed to analyze the effects of attack and noise on the stability of networked control system [38].

It has been observed in the literature that there are some key factors which affect the performance of the networked control system such as delay, noise, packets loss, denial of service, and service degradation attacks. Hence, it is necessary to secure the control system mechanism against abovementioned parameters. In literature, it is also observed that the estimation of the model while considering uncertainties (such as delay, packet loss, and modeled attacks altogether) has not been addressed to show the performance measure degradation of the compromised system. This motivates to emphasize on designing of networked control system considering the factors as illustrated.

3 Problem Formulation

3.1 Description of the System:

The basic block diagram of the networked connected control system is presented in Fig. 1. Here, the output/response of the plant is sampled through the sensor and is directed toward the controller via the communication network which may be wire/wireless. The controller computes the control signal according to the sampled signal and reference signal using algorithm designed for the control purpose. The computed signal travels toward the actuator side through the communication channel to operate the plant following the targeted output. Herein, the dynamics of the process model are considered linear time invariant. In different literature, it has been observed that the attacker may interfere in any direction (i.e., forward and/or feedback) of the control system to degrade the control performance of plant.

The continuous time transfer function of the plant in Laplace domain is described as $G_p = 1.28/(0.002691s^2 + 0.2484s + 1.671)$.

The sampling time is taken as 0.02 s. The discrete form of plant $G_p(z)$ and controller $G_c(z)$ transfer function is represented as

$$G_p(z) = (0.05504z + 0.03005)/(z^2 - 1.047z + 0.1578) \tag{1}$$

$$G_c(z) = (14.73z - 12.63)/(z - 1) \tag{2}$$

The difference equation for control system is obtained as

$$y(k) = 1.047y(k-1) - 0.1578y(k-2) + 0.05504u(k-1) + 0.3005u(k-2) \tag{3}$$

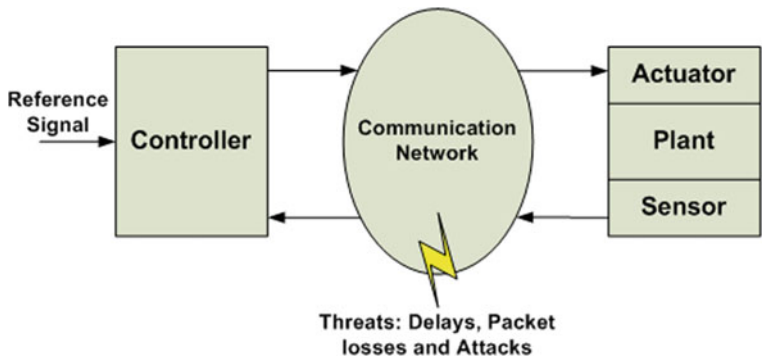


Fig. 1 Different types of uncertainty in NCS

$$u(k) = u(k-1) + 14.73e(k) - 0.1701e(k-1) \tag{4}$$

$$e(k) = r(k) - y(k) \tag{5}$$

In the above equations, 'y' represents the response of the plant; 'u' represents the control signal; 'e' denotes the error input to controller; the unit reference input is defined by 'r'. The time response for this case under normal condition, i.e., without considering delay factor and intrusion is as follows: rise time $t_r = 0.0198$ s, peak overshoot Mp $= 15.4\%$, setting time $t_s = 0.0964$ s, and cost function value is 4.3369e−04.

3.2 Uncertain Delay Dynamics

The sampled response taken by sensor is routed to controller through the communication channel, and controller generated control signal is sent toward the actuator through the communication network. Hence, there are delays from sensor toward controller and controller toward actuator signal, i.e., t_{sc} and t_{ca}, respectively. There are also processing delays which are very small in magnitude that can be neglected as compared to t_{sc} and t_{ca}. This random delay dynamics are dependent on the communication network length, bandwidth, etc. To predict the desired response, it is necessary to estimate the time delay very precisely and accurately.

The stochastic nature of the delay disturbance makes the system approach to instability. So, it is required to include the delay dynamics in modeling the system and designing controller. The time delay can be modeled using different approaches as reported in literature [24].

To transfer the packet effectively, the sampling time τ_s must follow the below-mentioned criterion:

$$\tau_s > t_{sc} + t_{ca} + (\text{processing delay}) \tag{6}$$

3.3 Random Packet Dropout

The sampled sensor signal travels to the controller and from controller toward the actuator to actuate the process. Hence, there is probability of packet dropout while traveling through the communication network. The problem of packet dropout may be present in both directions, i.e., forward and feedback. The packet dropout may be modeled by considering the following distribution function as follows:

$$p(\gamma_k) = \begin{cases} p, & \text{if } \gamma_k = 1 \\ 1-p, & \text{if } \gamma_k = 0 \end{cases} \tag{7}$$

where $p \in [0, 1]$ represents the packet loss rate. If packet is lost at an instant k, then $\gamma_k = 0$, and when packet is arrived successfully at an instant k, then $\gamma_k = 1$. The time stamp theory is used for packet transmission, and packet is stored in buffer with time stamp. The linear time-invariant (LTI) system with networked delay τ_s and packet loss is represented as follows:

$$x(k+1) = Ax(k) + \gamma_k \mathrm{Bu}(k - \tau_s) \tag{8}$$

$$y(k) = Cx(k) \tag{9}$$

where the state vector and the control vector are $x(k)$and $u(k)$, respectively. The output signal is $y(k)$, and A, B, C are matrices with appropriate dimensions.

It is also considered that the sum of the total delay is less than that of the sampling interval. The above equation for a sampling interval $[kT_s, (k+1)T_s)\forall k$ can be expressed as follows:

$$x_{(k+1)} = A_o + \sum_{i=0}^{\eta-1} \gamma_{(k-i)} B_i^k u_{(k-i)} \tag{10}$$

where η is the delay bound and $i = 0, 1, 2 \ldots \eta - 1$. Now $x_{(k)} = x(kT_s)$, $y(k) = y(kT_s)$, and $A_o = e^{AT_s}$. Here based on above equation, new state variable is defined as $h_k = \begin{bmatrix} x_k^{\mathrm{T}} & u_{k-1}^{\mathrm{T}} \ldots & u_{k-\eta}^{\mathrm{T}} \end{bmatrix}^{\mathrm{T}}$ such that the equation becomes $h_{(k+1)} = A_{h_k} + B_{h_k} u_k$. Now, the matrices are converted to

$$A_{h_k} = \begin{bmatrix} A_0 & \gamma_{k-1}B_1^k & \cdots & \gamma_{k-i}B_i^k & \cdots & \gamma_{k-\eta}B_\eta^k \\ 0 & 0 & \cdots & \cdots & \cdots & 0 \\ 0 & I_m & \cdots & \cdots & 0 & 0 \\ \vdots & 0 & I_m & \cdots & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & \cdots & I_m & 0 \end{bmatrix},$$

$$B_{h_k} = \begin{bmatrix} \gamma_k B_0^k \\ I_m \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}$$

The controller minimizes the cost function:

$$J_o = \int_0^\infty \left[x^{\mathrm{T}} Q_o x + u^{\mathrm{T}} R_o u\right] \mathrm{d}t \tag{11}$$

where Q_o is symmetric, square weighting matrix, and R_o is symmetric, square control cost matrix.

3.4 System Modeling

In networked control system, the performance of the plant can be degraded by introduction of large time delay, packet loss, and injecting the attack. These issues may arise in the feed-forward and/or feedback direction. There are different types of attacks that have been reported in the literature which are the key factors of the degradation of the system performance. Some of the most common attacks are service degradation and denial of service attacks. The denial of service attack is intended to interrupt the processing of the plant which makes the process unstable. The service degradation attack is indented to reduce the response of the process which costs to efficiency. The attacks may be designed by the intruder based on the knowledge of the system acquired through eavesdropping. The system can be modeled if the output of system and input to the system are known. The system can also be modeled if the plant transfer function coefficients are known.

In this paper, particle swarm optimization (PSO) algorithm is used to estimate the coefficients of the plant transfer function. These coefficients are determined by minimizing the cost function as used herein. The PSO is a meta-heuristic, swarm-based optimization algorithm which uses large search space to find optimized solution to the given problem. The size of population used here is 100, and maximum iteration used is 100 with a search space of $[-1, 1]$. The dynamics of the system model of networked control system are also estimated using MATLAB system identification toolbox/Simulink. To identify the continuous and discrete time model, it is required to use time and frequency domain input and output data. So, if the attacker is having the knowledge about input and output data of the system, the model of the system can be estimated for designing the intended attack. The block diagram representation for model estimation from the real-time system is shown in Fig. 2.

In this section, performance measures without attack and packet loss of actual as well as estimated models obtained using system identification tool as well as particle swarm optimization algorithm are shown in Figs. 3, 4, 5, and 6. The performance measures used here are rise time, settling time, overshoot, mean value, and cost function. The estimated model used here shows that above 94% fit to estimation data which indicate the efficacy of the estimated model. The rise time for actual and estimated model using system identification and PSO are 0.0198 s, 0.02558 s, and 0.07345 s, respectively, which are close to each other as indicated in Fig. 3.

Similarly, in Fig. 4, the overshoots for actual and estimated systems are 15.69, 8.152, and 6.989% which is close to actual system value. The mean value as shown

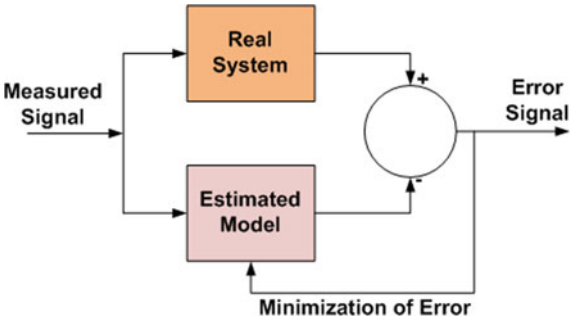


Fig. 2 Estimation of model from real-time system

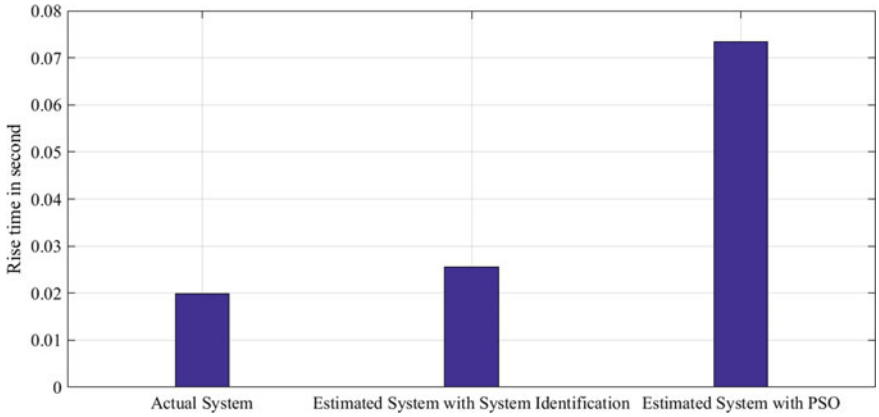


Fig. 3 Rise time for actual and estimated system

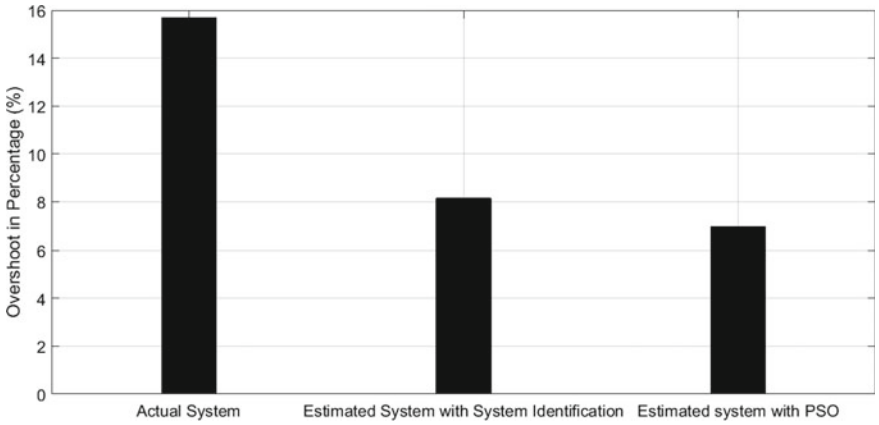


Fig. 4 Overshoot for actual and estimated system

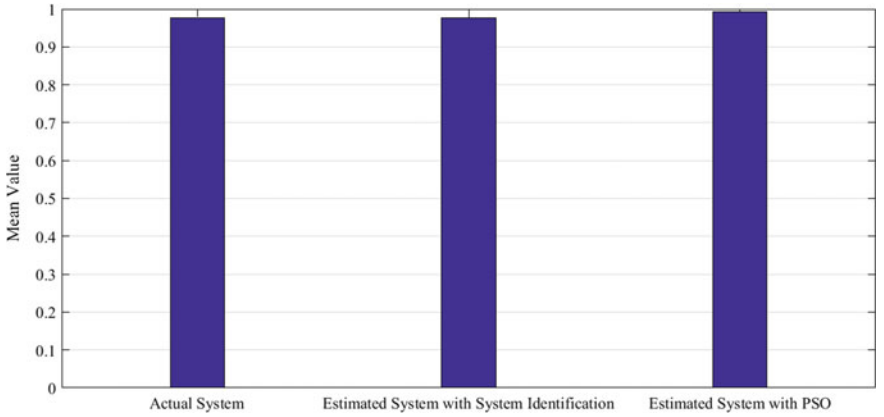


Fig. 5 Mean value for actual and estimated system

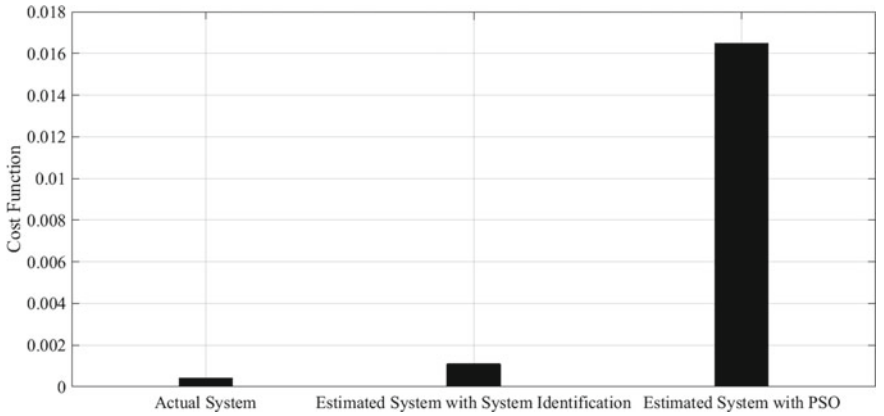


Fig. 6 Cost function for actual and estimated system

in Fig. 5 for all system is approximately equal which shows that estimated system shows the better performance measure compared to actual system. In Fig. 6, the cost function for actual system and estimated model also shows same pattern.

This parameter comparison shows the efficacy of the estimated model which can be used by attacker to compromise the actual system performance measure. These performance metrics are also evaluated in Sect. 4 for different cases of packet loss and attacks, modeled based on estimated parameters of the system, to show the networked control system performance degradation.

3.5 Controller Configuration

In this paper, to simulate the control signal, proportional–integral–derivative control elements are used. The control signal is estimated based on the error signal which is the difference of reference and sensor signal received through communication network. The control algorithm for proportional–integral–derivative action is shown below:

$$u_{\mathrm{c}}(t) = K_{\mathrm{c}}\left(e(t) + \frac{1}{T_{\mathrm{r}}}\int_0^t e(t)\mathrm{d}t + T_d\frac{\mathrm{d}e}{\mathrm{d}t}\right) \tag{12}$$

where $u_{\mathrm{c}}(t)$ is the signal computed by controller, K_{c} is gain of proportional controller, $e(t)$ is error signal which is the difference between reference and sensor signal received through communication network, T_{d} is derivative time, T_{r} is reset time required due to integral type control action to just equal the output response due to proportional action following a change in error. Equation (12) can also be shown in Laplace domain as transfer function of controller model:

$$G_{\mathrm{c}}(s) = P_{\mathrm{c}} + I_{\mathrm{c}}\frac{1}{s} + D_{\mathrm{c}}s \tag{13}$$

where $G_{\mathrm{c}}(s)$ is overall gain of the controller in Laplace domain, P_{c} is gain for proportional action, I_{c} is gain for integral action, and D_{c} is controller gain for derivative action. The performance measure taken herein as a cost function is the integral time absolute error (ITAE). The minimizing integral time absolute error value reduces the error by adjusting the parameters of the system.

It also reduces the rise time which limits the effect of initial errors and reduces peak overshoots and settling time which limits effects of small errors presenting for a long time.

$$J_{\mathrm{c}} = \int_0^t t|e(t)|\mathrm{d}t \tag{14}$$

where J_{c} is the cost function, and $|e(t)|$ is absolute error which is the difference between reference and sensor signal received through communication network.

4 Performance Measures with Modeled Attacks

In this section, different performance measures are computed while considering the attack scenario and different packet loss probabilities.

The networked control systems are vulnerable to different uncertainties which may be encountered in any direction (i.e., feed-forward and/or feedback direction) in the control system. The computational delay and different rate of packet loss are also considered here to estimate the model of the actual system. For estimating the system transfer function with different rate of packet loss MATLAB/Simulink system identification, True-Time tool and particle swarm optimization (PSO) algorithm are used.

The various performance measure parameters of the networked control system for actual and estimated system are shown graphically from Figs. 7, 8, 9, 10, 11, 12, 13, and 14.

Here, different rates of packet loss such as 0, 5, 15, and 25% are used for estimating the system model. For each case, the attack is simulated based on the parameters of the estimated system to show the impact of service degradation attack on the

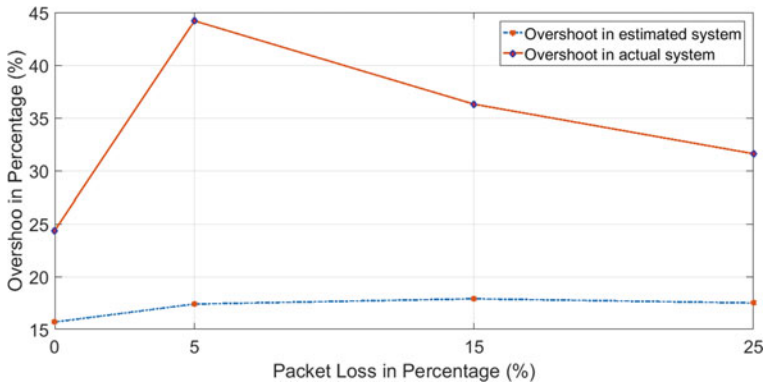


Fig. 7 Overshoot for actual and estimated system with different packet loss and attack

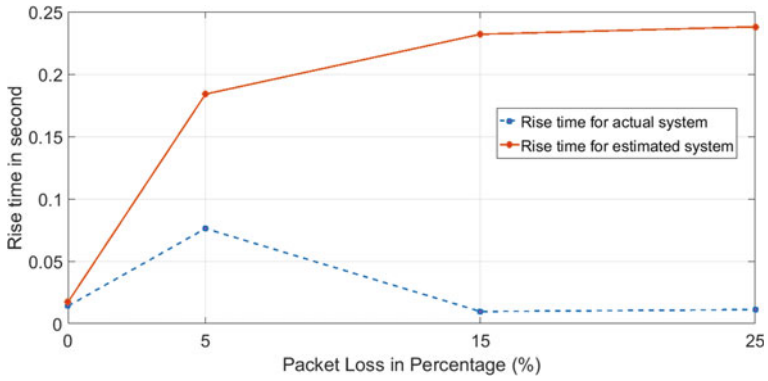


Fig. 8 Rise time for actual and estimated system with different packet loss and attack

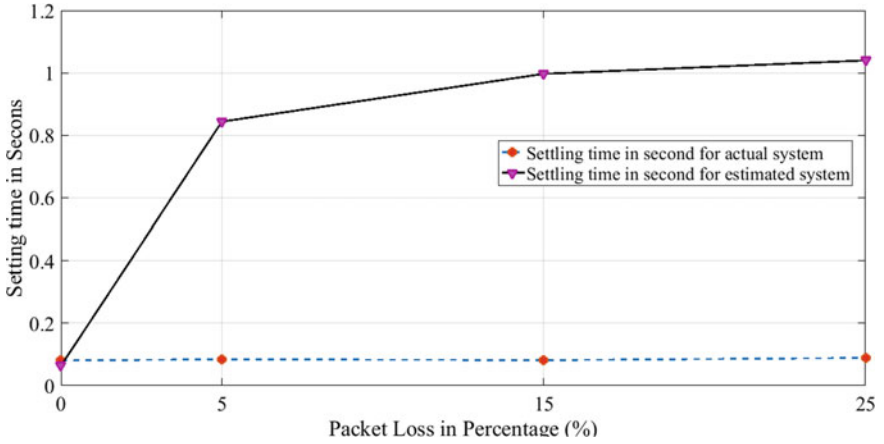


Fig. 9 Settling time for actual and estimated system with different packet loss and attack

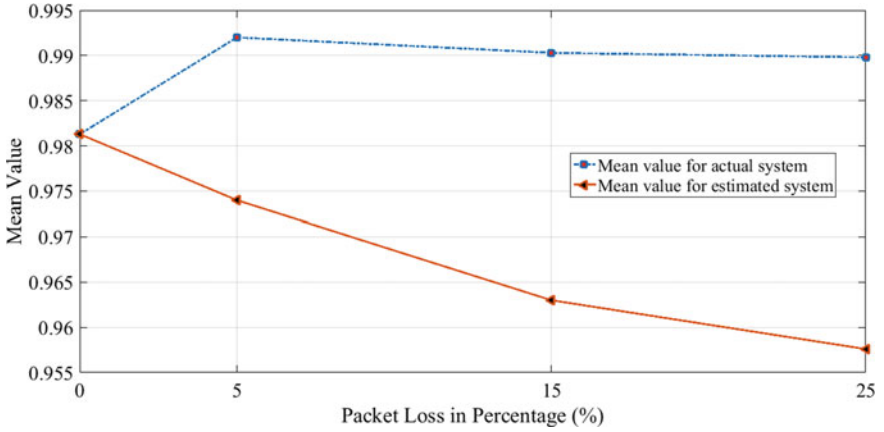


Fig. 10 Mean value for actual and estimated system with different packet loss and attack

performance metrics of the networked control system. The attack is modeled to show the consistency of overshoot in the estimated model of the actual system.

The overshoots are of same order for all cases of the packet loss probability. The overshoots are 15.698% for 0% packet loss, 17.4% for 5% packet loss, 17.9% for 15% packet loss, and 17.5% for 25% packet loss along with modeled attack.

Figure 7 shows that performance of networked control system can be compromised using service degradation attacks with model identification process. Figure 8 plots the rise time for both actual and estimated system for each case of packets loss and modeled attack. The rise time increases for estimated system.

Similarly in Fig. 9, the settling time for actual system is near about the same magnitude, whereas in estimated system the settling time increases much more than

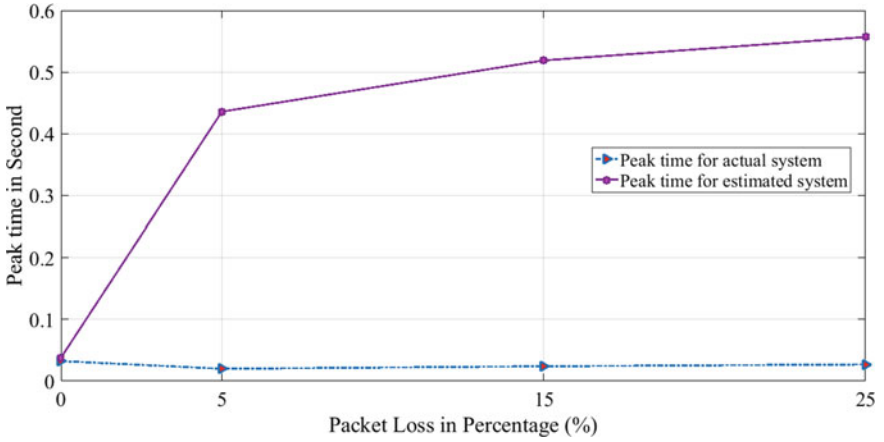


Fig. 11 Peak time for actual and estimated system with different packet loss and attack

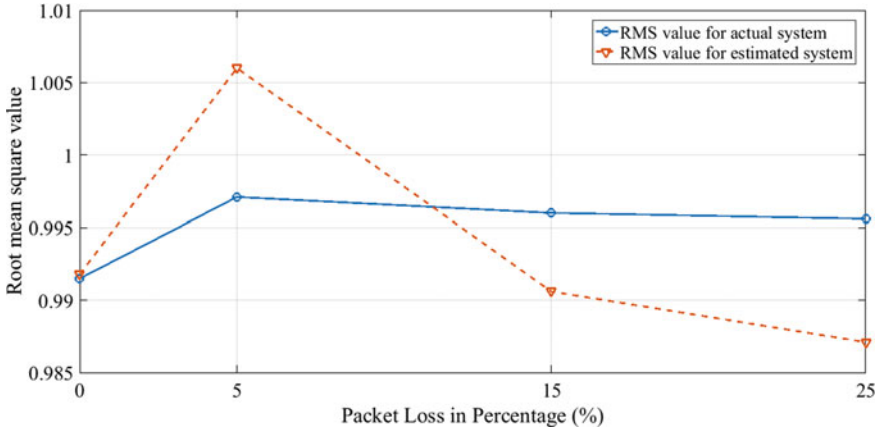


Fig. 12 Root mean square value for actual and estimated system with different packet loss and attack

actual system which is the indication of compromised system performance due to service degradation attack.

The mean value of the response for each case of packet loss and attack is shown in Fig. 10. The mean value is of the same order in each case which shows the effectiveness of compromised system involving estimation of the system using system identification. Figure 11 shows that the peak time to response for actual system under various packet loss and attack scenario is of the same pattern, whereas for estimated system it increases under the same condition.

The pattern of root mean square value as shown in Fig. 12 is same of order as in the case of actual system performance for different types of packet losses and attack

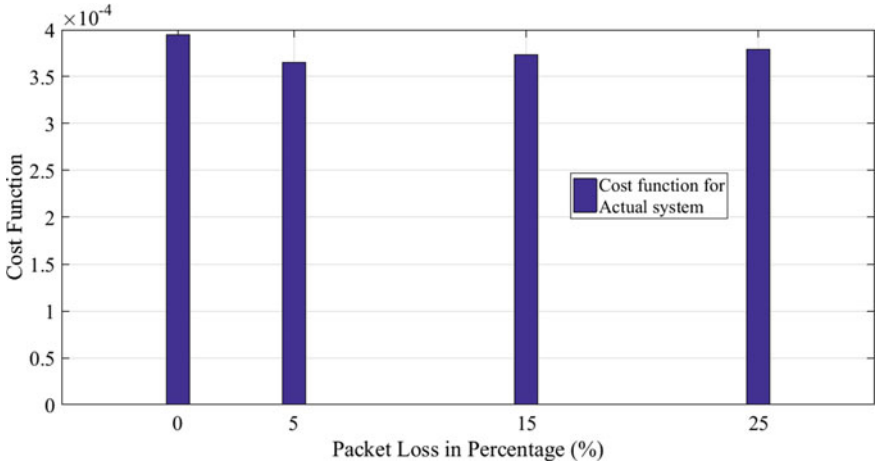


Fig. 13 Cost function for actual system with different packet loss and attack

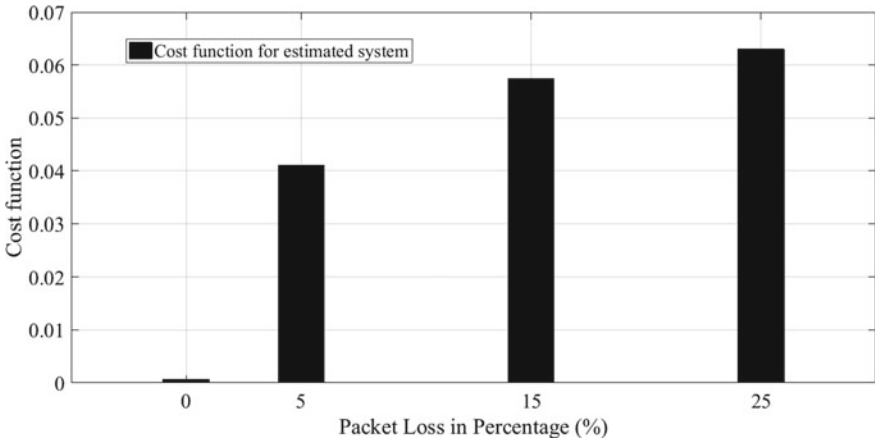


Fig. 14 Cost function for estimated system with different packet loss and attack

scenarios. However, in the estimated system, it is slightly decreasing which shows the compromised degradation of the system performance. The cost function value for actual system shows the same magnitude pattern for different rate of packet loss and attack as presented in Fig. 13. Similarly, Fig. 14 shows that cost function value increases with increase in the rate of packet loss and attack.

To summarize, it has been shown that the networked control system performance decreases due to uncertainties which may be encountered in the form of delay, packet loss and attacks modeled to perform denial of service attacks. Here, various performance metrics are presented for the better understanding of networked control system degradation under various rates of packet loss and attacks.

5 Conclusion and Future Work

The conclusive remarks over the performance metrics of networked control system under different uncertain conditions are presented in this section. It has been shown that system can be modeled efficiently if the attacker is having the basic knowledge of the output and the input to the system. To simulate the estimated model from the actual system, MATLAB/Simulink system identification and True-Time tool along with particle swarm optimization algorithm are used. The various performance metrics, i.e., overshoots, rise time, peak time, mean value, root mean square value, and cost function value are computed under delay, different rate of packet loss (i.e., 0, 5, 15, 25%), and modeled attacks. From Figs. 6, 7, 8, 9, 10, 11, 12, 13, and 14, the simulation result shows that the system can be compromised by estimation of modeled system from actual system and designing the attacks.

The overshoot, in each case of different packet loss, maintained approximately in between 15 and 17.9% which show the efficacy of the estimated system. The other metrics such as rise time, settling time, and peak time increase substantially, whereas root mean square value decreases, and also the cost function increases for estimated system with different packet loss rate and attack, which is an indication of a compromised system.

The networked control system performance metrics can be improved by suitably designing control system considering the delay, packet loss, and different attacks. The aforementioned uncertainties have also left the future scope in designing optimal control algorithm to mitigate these imperfections quickly such that performance metrics show better result.

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Chapter 32
Reconfigurable Microstrip Patch Array Antenna: Design and Performance Analysis



Ashok Kajla and Devendra Somwanshi

1 Introduction

Wireless communication has become an integral part of modern world. Microstrip patch antenna consists of a dielectric substrate with a ground plane on other side. A simple, low cost and high gain reconfigurable microstrip patch array antenna have been demonstrated in this paper with suitable feeding technique and dielectric substrate for GHz frequency range applications. Single microstrip patch antenna comes up with many advantages like low cost, low weight, low profile and conformal, etc. But it has certain limitations as well like low gain, low directivity, low efficiency and narrow bandwidth. To overcome these limitations implementation of multiple patches has been proposed in the array configuration. Because of the advancement of technology in the present scenario there is a need for antenna which can satisfy changing operating requirements. The reconfiguration capability of reconfigurable antennas is used to maximize antenna performance in a changing scenario. So, in this paper we have designed array of microstrip patch antenna and developed reconfigurability in it so that we can get all benefits together like low profile, low weight, low cost, high gain, high directivity and different operating capability. PIN diodes are used to achieve reconfigurability. Diodes basically change the path of current flow and thereby achieve reconfigurability. This antenna can be widely used in Satellite Communication, WLAN communication as WiFi and weather Radar systems.

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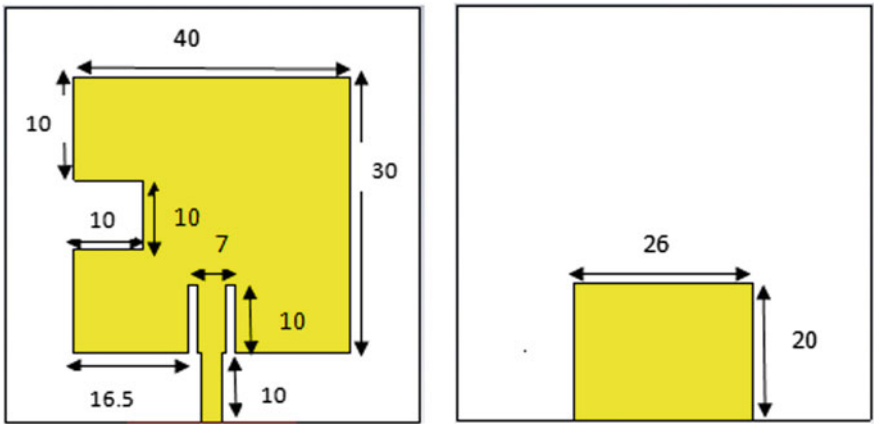


Fig. 1 Simulated design of 1 × 1 reconfigurable Antenna for WLAN communication when the diode is OFF (front view and back view) with dimensions

2 Array Design

2.1 Design of 1 × 1 Array

The geometrical structure of the antenna and the radiating element including dimensions is shown in Fig. 1. The antenna is based on a 60 mm × 60 mm FR4-epoxy substrate with a dielectric constant of 4.4, loss tangent 0.02 and a thickness of 1.6 mm. The patch, which is square-shaped, is fed using a 3 mm wide microstrip feed line. The width of feed is chosen according to best impedance matching. Antenna is printed on non-grounded part of substrate. The antenna inhabits an area of 40 mm × 40 mm. Reconfigurability is achieved by using a PIN diode as shown in fig. 2.

2.2 Design of 1 × 2 Array

Here 1 × 2 reconfigurable array antenna has been designed with above-said dimensions. In this design, as shown in Fig. 3, two patches are joined together with a common feed. PIN diodes are used to achieve reconfigurability.

2.3 Design of 1 × 4 Array

Here 1 × 4 reconfigurable array antenna has been designed with above-said dimensions. In this design shown in Fig. 4, two 1 × 2 reconfigurable array antennas are

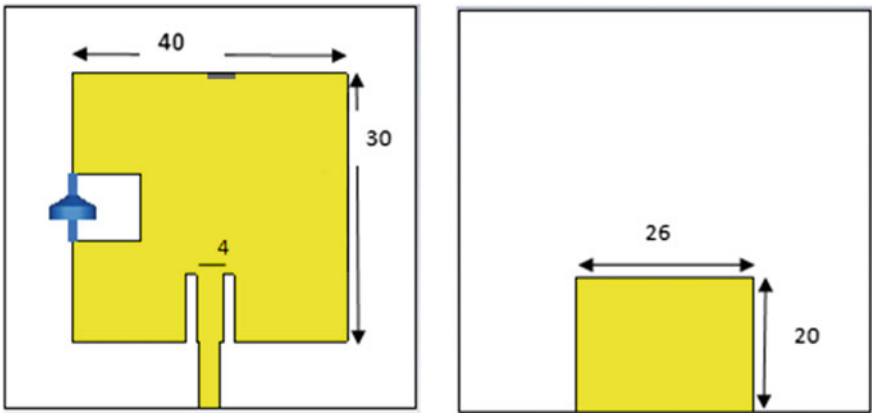


Fig. 2 Simulated design of 1 × 1 reconfigurable Antenna for WLAN communication when the diode is ON (front view and back view) with dimensions

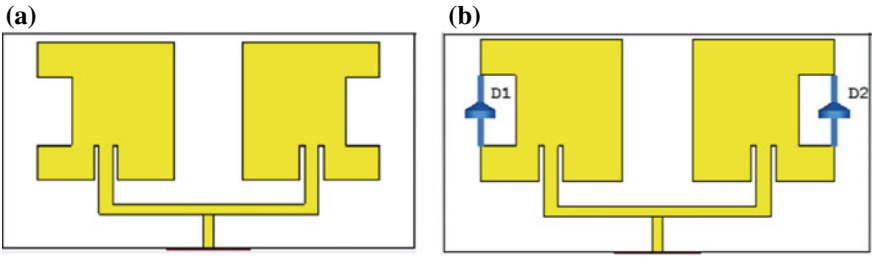


Fig. 3 Simulated design of 1 × 2 array reconfigurable antenna for WLAN Communication. **a** When diode is OFF, **b** When diode is ON

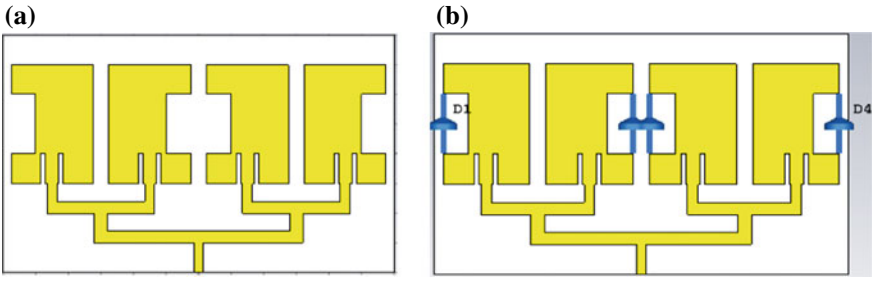


Fig. 4 Simulated design of 1 × 4 array reconfigurable antenna for WLAN Communication. **a** When diode is OFF, **b** When diode is ON

joined together which is sharing a common feed. In this configuration as well, diodes are used to achieve reconfigurability.

3 Simulation and Study Results

3.1 Simulation and Results of 1 × 1 Antenna

In Fig. 5, we can determine the return loss and Radiation characteristics of 1 × 1 antenna. When diode is in OFF state, then it radiates on frequency 5.194 GHz and when diode is in ON state, it radiates on frequency 5.182 GHz. Also, for this antenna reconfigurability is developed in radiation pattern at 5 GHz as shown in Fig. 6.

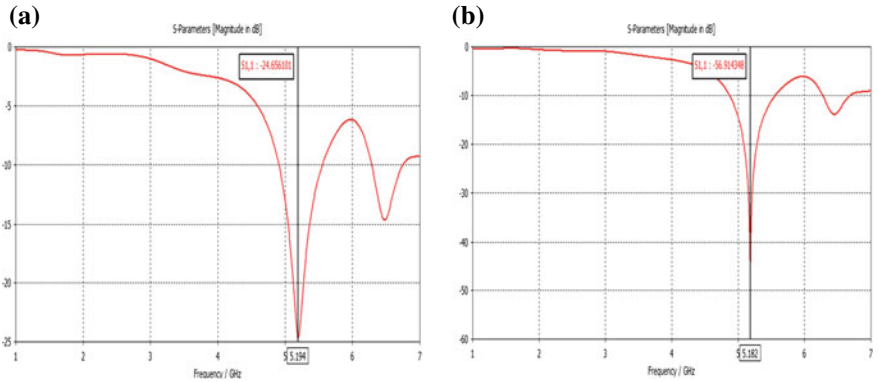


Fig. 5 Return loss of 1 × 1 antenna in OFF and ON condition of diode: **a** When diode is OFF, **b** When diode is ON

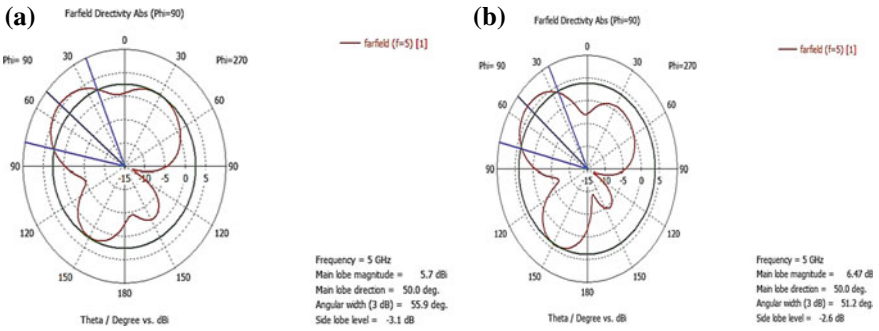


Fig. 6 Radiation pattern of 1 × 1 antenna in OFF and ON condition of diode: **a** When diode is OFF, **b** When diode is ON

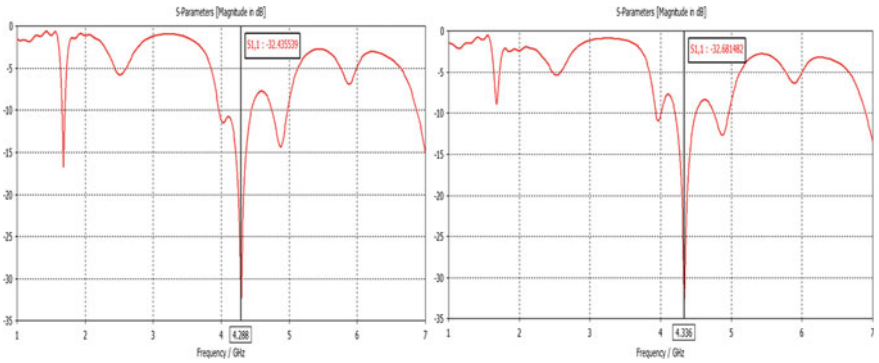


Fig. 7 Return loss of 1 × 2 array antenna in OFF and ON condition of diode

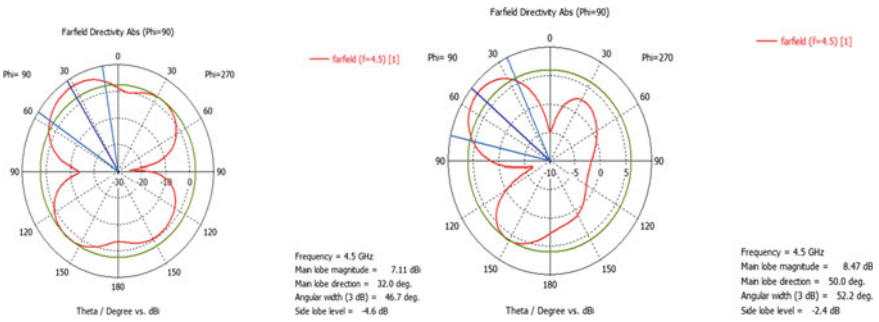


Fig. 8 Radiation pattern of 1 × 2 array antenna in OFF and ON condition of diode

3.2 Simulation and Results of 1 × 2 Array

In Fig. 7, we can determine the return loss and Radiation characteristics of 1 × 2 array antenna. When diode is in OFF state, then it radiates on frequency 4.288 GHz and when diode is in ON state, it radiates on frequency 4.366 GHz. Also, for this antenna reconfigurability is developed in radiation pattern at 4.5 GHz as shown in Fig. 8.

3.3 Simulation and Results of 1 × 4 Array

In Fig. 9, we can determine the return loss and Radiation characteristics of 1 × 4 array antenna. When diode is in OFF state, then it radiates on frequency 5.092 GHz and when diode is in ON state, it radiates on frequency 5.128 GHz. Also, for this antenna reconfigurability is developed in radiation pattern at 5 GHz as shown in Fig. 10.

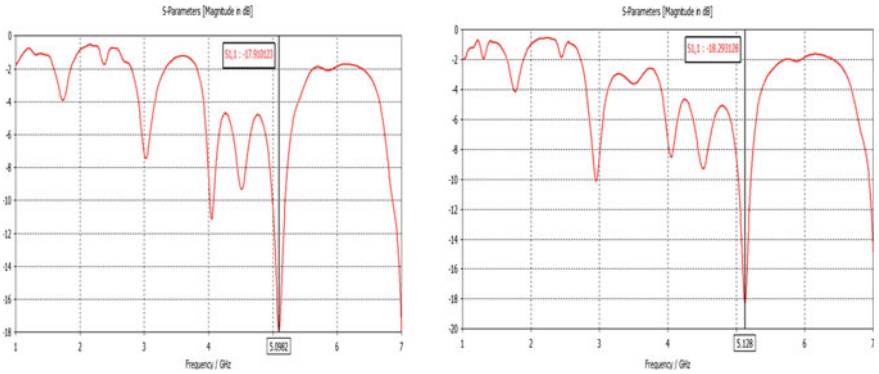


Fig. 9 Return loss of 1 × 4 array antenna in OFF and ON condition of diode

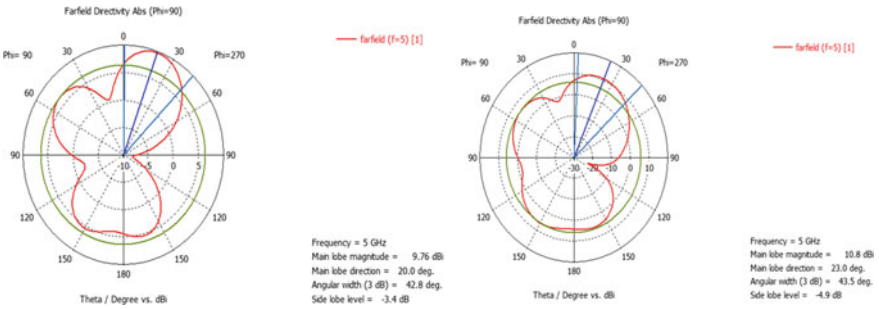


Fig. 10 Return loss of 1 × 4 array antenna in OFF and ON condition of diode

4 Comparative Study of All the Designs

As we can see in Table 1, when there is single Patch Antenna with no diodes, then it radiates on frequency 5.194 GHz, with Gain as 3.979 dBi and Directivity as 5.914 dBi. On applying diode, radiation frequency slightly changed to 5.182 GHz, with Gain and Directivity increased as 4.258 dBias 6.261 dBi resp. Similarly, we can clearly see

Table 1 Operating frequency, and return loss, gain and directivity of the antenna for each condition

Design	Frequency	*S*-Parameter	VSWR	Gain	Directivity
1 × 1	5.194	−24.656	1.124	3.979	5.914
1 × 1 with diodes	5.182	−56.914	1.002	4.258	6.261
1 × 2 array	4.288	−32.435	1.048	4.761	7.773
1 × 2 array with diodes	4.366	−32.681	1.047	5.084	8.236
1 × 4 array	5.096	−17.913	1.291	6.026	9.608
1 × 4 array with diodes	5.128	−18.293	1.277	6.389	9.989

from Table 1, as numbers of patches in the array are increased, Gain and Directivity are also getting increased. In this paper, we have designed up to 4 patches in the array and obtained maximum gain and directivity as 6.389 and 9.989 dBi resp.

5 Conclusion

In this paper, we have proposed 1×1, 1×2 and 1×4 array antennas and developed reconfigurability for all the three proposed structures. In this design, we have used PIN diodes to achieve reconfigurability, which acts as a switch. From above it is clear that with the increase of the no. of elements, antenna parameters like gain and directivity are getting improved. As future work, we can simulate 1×4 microstrip array antenna with different diode configurations to achieve better radiation characteristics like more gain, directivity and bandwidth and reduced return loss. The operating frequency of all our designed antennas ranges from 4.288 to 5.194 GHz, which is suitable for C-band applications, WLAN applications and Satellite applications.

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Chapter 33
Lamp-Shaped Frequency Reconfigurable Microstrip Patch Array Antenna Design and Analysis



Ashok Kajla and Devendra Somwanshi

1 Introduction

Wireless communication has become an essential part of modern era. Microstrip patch antenna consists of a dielectric substrate with a ground plane on other side. A reconfigurable microstrip patch array antenna which is simple, low cost and high gain has been demonstrated in this paper with suitable feeding technique and dielectric substrate for GHz frequency range applications. Single microstrip patch antenna comes up with many advantages like low cost, low weight, low profile and conformal, etc. But it has certain limitations as well like low gain, low directivity, low efficiency, and narrow bandwidth. To overcome these limitations, implementation of multiple patches has been proposed in the array configuration. Because of the advancement of technology in the present scenario, there is a need for antenna which can satisfy changing operating requirements. Reconfigurable antennas are used to maximize antenna performance in a changing scenario. So, in this paper we have designed array of microstrip patch antenna and developed reconfigurability in it so that we can get all benefits together like low profile, low weight, low cost, high gain, high directivity, and different operating capability. PIN diodes are used to achieve reconfigurability. Diodes basically changes the path of current flow and thereby achieve reconfigurability. The desired antenna because of its multi-band operation capability can be widely used in Mobile Broadband Wireless Access (MBWA) protocols based on standards specifications such as IEEE 802.20 or ATIS/ANSI HC-SDMA(such as iBurst) operate between 1.6 and 2.3 GHz to give mobility and in-building penetration characteristics similar to mobile phones but with vastly greater spectral efficiency,

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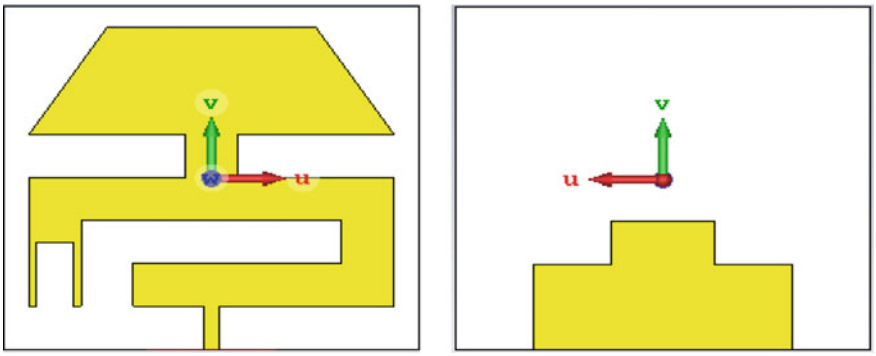


Fig. 1 Simulated Design of 1 × 1 reconfigurable antenna when the diode is OFF (front view and back view respectively.)

amateur radio, amateur satellite operator and amateur television repeaters that operates in S band at 3.4 GHz. 1.260–1.270 GHz band is used for amateur satellite up-links, and 4.9 GHz is used for 802.11j public safety WLAN and 6 and 7 GHz spectrum band for point-to-point microwave backhaul links.

2 Array Design

2.1 Design of 1 × 1 Array

The geometrical structure of the antenna and the radiating element including dimensions is shown in Fig. 1. The antenna is based on a 40 mm × 40 mm FR4-epoxy substrate with a dielectric constant of 4.4, loss tangent 0.02 and a thickness of 1.6 mm. The patch, which is square-shaped, is fed using a 3 mm wide microstrip feed line. The width of feed is chosen according to best impedance matching. Antenna is printed on non-grounded part of substrate. The antenna inhabits an area of 35 mm × 37.5 mm. Reconfigurability is achieved by using a PIN diode. Simulated design of antenna when diode is OFF and when diode is ON is shown in Figs. 1 and 2 respectively.

2.2 Design of 2 × 1 Array

Here 2 × 1 reconfigurable array antenna has been designed with above-said dimensions. In this design, as shown in Fig. 3, two patches are joined together with a common feed. PIN diodes are used to achieve reconfigurability.

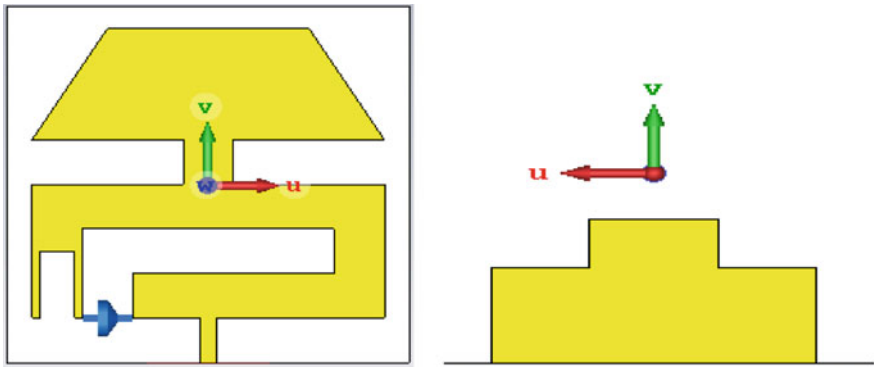


Fig. 2 Simulated design of 1 × 1 reconfigurable antenna when the diode is ON (front view and back view respectively.)

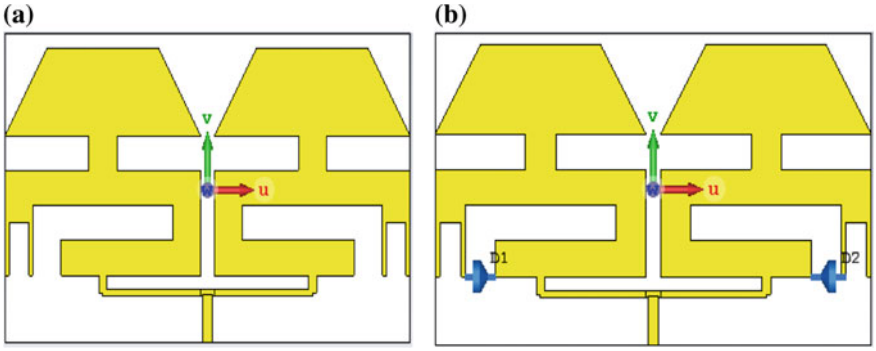


Fig. 3 Simulated design of 2 × 1 reconfigurable antenna. **a** When diode is OFF, **b** When diode is ON

3 Simulation and Study Results

3.1 Simulation and Results of 1 × 1 Antenna

Return loss characteristics of 1 × 1 antenna is displayed in Fig. 4. When diode is in OFF state, then it radiates on frequencies 1.786, 3.484 and 6.136 GHz (green color curve in Fig. 4) and when diode is in ON state, it radiates on frequency 6.61 GHz (red color curve in Fig. 4). In this design with the application of PIN diode reconfigurability is developed in frequency.

Gain and Directivity characteristics of 1 × 1 antenna is displayed in Fig. 5 when diode is in OFF state and in Fig. 6 when the diode is in ON state. It is clearly inferred from Figs. 5 and 6 that when diode is in OFF condition Gain and Directivity of 1 × 1 antenna at resonant frequency 6.136 GHz is 5.76 dBi and 8.674 dBi, respectively

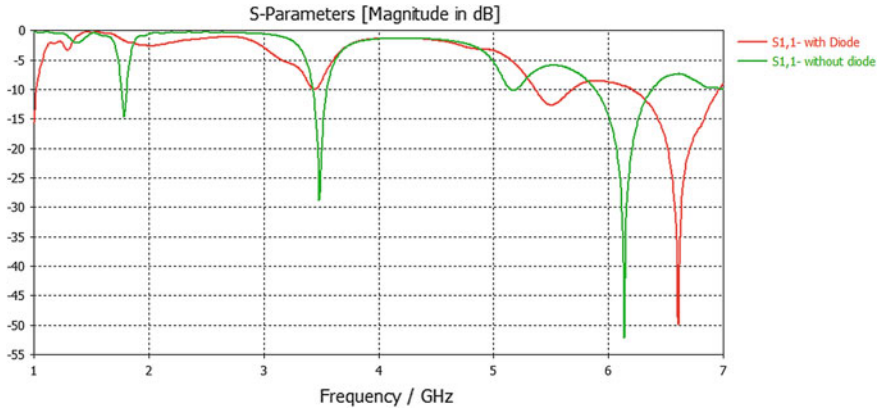


Fig. 4 Return loss of 1 × 1 antenna in OFF and ON condition of diode



Fig. 5 Gain and directivity curve of 1 × 1 antenna when diode is in OFF state

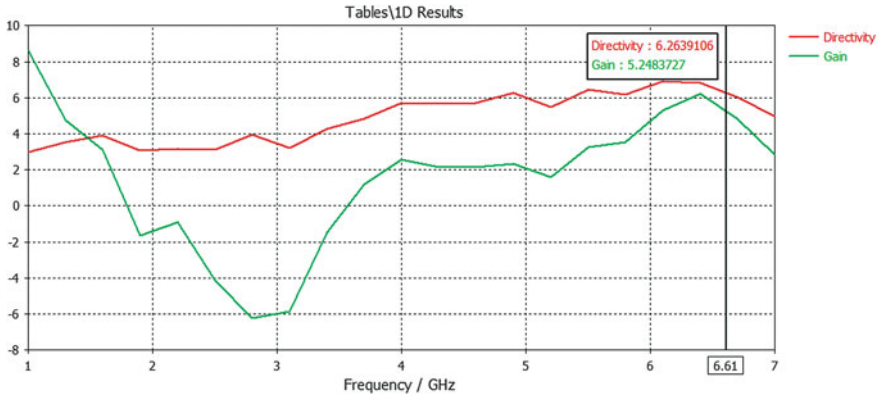


Fig. 6 Gain and Directivity curve of 1 × 1 antenna when diode is in ON state

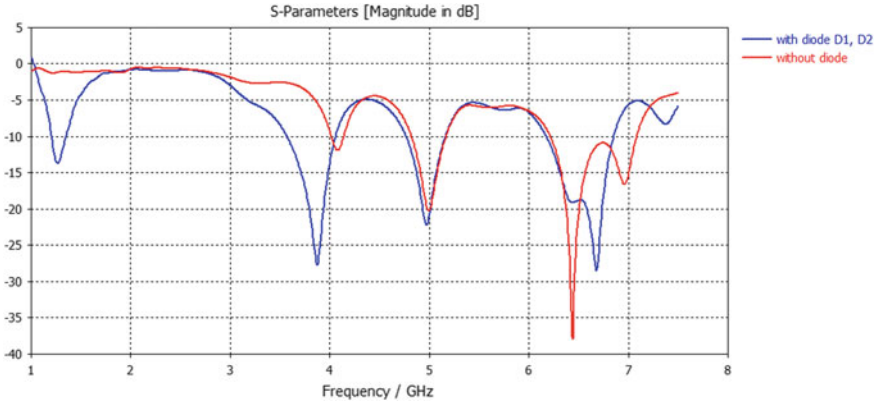


Fig. 7 Return loss of 2 × 1 array antenna in OFF and ON condition of diode

and when diode is in ON condition Gain and Directivity of 1 × 1 antenna at resonant frequency 6.61 GHz is 5.248 dBi and 6.263 dBi, respectively. Simulation and Results of 1 × 2 array.

3.2 Simulation and Results of 2 × 1 Array

Return loss characteristics of 2 × 1 array antenna is displayed in Fig. 7. When diode is in OFF state, then it radiates on frequencies 4.075, 4.991, 6.44, and 6.943 GHz (red color curve in Fig. 7) and when diodes are in ON state, it radiates on frequencies 1.266, 3.878, 4.971, and 6.681 GHz (blue color curve in Fig. 7). In this design with the application of PIN diode reconfigurability is developed in frequency.

Gain and Directivity characteristics of 2 × 1 array antenna are displayed in Fig. 8 when diode is in OFF state and in Fig. 9 when the diode is in ON state. It is clearly inferred from Figs. 8 and 9 that when diode is in OFF condition Gain and Directivity of 2 × 1 array antenna at resonant frequency 6.44 GHz is 6.78 dBi and 9.97 dBi respectively and when diode is in ON condition Gain and Directivity of 2 × 1 array antenna at resonant frequency 6.681 GHz is 5.572 dBi and 9.53 dBi, respectively.

4 Comparative Study of All the Designs

As we can see in Table 1 when there is single Patch Antenna with no diodes, then it radiates on frequencies 1.786, 3.484 and 6.136 GHz, and Gain and Directivity at max resonant frequency as 5.76 dBi and Directivity as 8.764 dBi. On applying diode, resonant frequency changed to 6.61 GHz with return loss as −49.927, and Gain and Directivity as 5.248 dBi and 6.263 dBi resp. Similarly, we can clearly see from

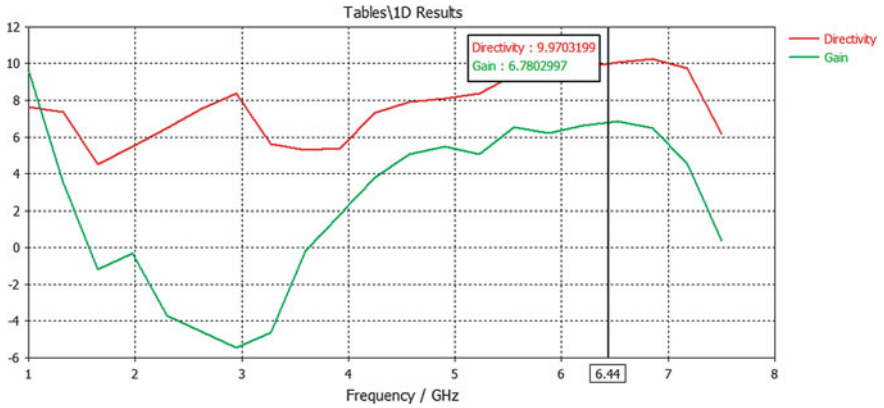


Fig. 8 Return loss of 1 × 4 array antenna in OFF and ON condition of diode

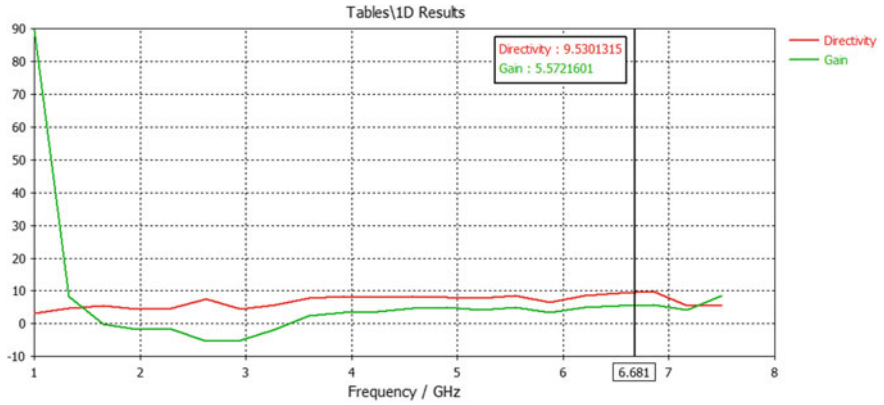


Fig. 9 Gain and Directivity curve of 2 × 1 array antenna when diode is in ON state

Table 1 Operating frequency, and return loss, gain and directivity of the antenna for each condition

Design	Frequency	*S*-Parameter	VSWR	Gain	Directivity
1 × 1	6.136	−52.090	1.004	5.760	8.764
1 × 1 with diodes	6.610	−49.927	1.006	5.248	6.263
2 × 1 array	6.440	−37.953	1.025	6.780	9.970
2 × 1 array with diodes	6.681	−28.516	1.077	5.572	9.530

Table 1, as numbers of patches in the array are increased, Gain and Directivity are also getting increased. In this paper, we have obtained maximum gain and directivity as 6.780 dBi and 9.970 dBi resp. when diode is OFF and 5.572 dBi and 9.53 dBi resp. when diode is ON.

5 Conclusion

In this paper, we have proposed 1 × 1 and 2 × 1 array antennas and developed reconfigurability for all the proposed structures. In this design, we have used PIN diodes to achieve reconfigurability, which acts as a switch. From above, it is clear that with the increase of the no. of elements, antenna parameters like gain and directivity are getting improved. As future work, we can simulate 4 × 1 and 8 × 1 microstrip array antenna with different diode configurations to achieve better radiation characteristics like more gain, directivity and bandwidth, and reduced return loss. The designed antennas operate in L band, S band, and C band and can be used in multiple applications like WLAN, Satellite, Radio applications, etc.

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Detecting Aggressive Driving Behavior Using Spectral Kurtosis and MEMS Accelerometers



Tarun Dadhich and Sakar Gupta

Abstract World Health Organization has shown that nearly 1.25 million people die in road traffic accidents each year. In fact, the American Automobile Association conducted a research showing that unsafe driving accounted for more than 56% of road accident fatalities. Due to the explosion of sharing economy, we can easily hail a ride at anywhere and anytime in most urban cities. Such ride-hailing platforms, e.g., Uber, benefit our everyday travel and ensure efficient use of vehicles. However, the riding experience differs a lot among drivers, and sometimes they may even adopt aggressive driving behaviors to arrive earlier. In order to make driving safer, monitoring the traffic system by investing in loop detectors, road-side speed indicators, or constant vigilance through CCTVs throughout a city can become pretty expensive. This becomes a vital issue when states lag behind in driver safety improvement programmes and proper road maintenance due to financial crunches along with disregard of drivers toward traffic safety rules. So, a cost-effective and real-time solution for road safety monitoring was very much in need since smart transportation system is one of the most essential components for realizing a smart city.

Keywords MEMS · Accelerometer · Spectral kurtosis · Aggressive driving behavior · Gyroscope · Magnetometer

1 Introduction

World Health Organization reports on the enhancement of mortality rate due to traffic accidents. It claims in the report that more than 1.3 million victim's loss their life in a year globally. In the list of reason behind the death causes, traffic accidents place ninth around the world. The major factors responsible for such high rate of deaths regarding road accidents are:

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https://doi.org/10.1007/978-981-15-9689-6_2

- Lacking of awareness and education by people under the influence of psychoactive substances during driving such as the effect of alcohol
- Habits to drive aggressively on the name of skillful driving
- Health issues.

Such points characterize the drivers as aggressive, distracted, teenage, drowsy, and impaired. Indian roads provides a stressful experience to the drivers exclusively on highways due to ever-rising risk of road rage day by day. In India, Transport Research Wing (TRW) of Ministry of Road Transport and Highways, New Delhi, collected the data of road accidents in the year of 2014. It stated that State Highways witnessed the 25.2% of accidents while National Highways had 28.2% of the accidents out of the total recorded cases of 489,400 [1]. This report delivered that the driver has the extreme safety threat. Intelligent Transportation System (ITS) has the raid technological development in order to lessen this threat connected with the transportation system. Nowadays, vehicular environment has the IEEE 802.11 p as the wireless access technologies resulting the progress of several road safety applications that leads to lessen the fatalities number due to road accidents.

Driving is always a complex decision-making process. It is because of the complex relationships between the major entities (driver, environment, and vehicle) and the dynamic nature of such entities [2]. Cognitive science and psychology has several recent advances showing that the emotions (like fatigue, stress, distraction, anger, and fear) of an individual play the significant role in the behavior of person during aggressive driving. Such behavior of driver (rash driving) has attracted the researchers for carrying out their research in order to estimate the crucial aspects causing the road accidents or the factors that significantly affect the individual's ability to drive safely [3]. Driver, vehicle, and environment are the major parameters that affect the complex system of driving behavior. Some other factors are discomfort due to long driving hours, vehicle safety features, traffic, attention workload, training/experience, capabilities, memory, expectancies, distraction, goals, errors, drowsiness, fatigue, and automaticity. Numerous researchers from psychology field are considering that rash driving due to aggressiveness of driver in order to reach early at the destination is the prime cause of road accidents. The other leading factors are drunk or high-speed driving, fatigue, and drowsiness. Therefore, it becomes necessary to detect the driver behavior and driving states for real-time monitoring system with the actions that leads to aggressive driving [4].

2 Literature Review

Driving monitoring system techniques: it is a complex issue to consider the driver behavior characterization due to it is subjected to numerous individualities of traffic state as well as driver and is a multidimensional issue. Group of constraints such as driver behavior, vehicle kinematic, and road conditions derive the complete traffic state. A set of vague driving rules explain all such constraints developing through

experience for diverse conditions and drivers. Consequently, tactics and maneuvers as the recognition of driver behavior recognition must be attained. Recognition and evaluation of driving style consider different constraints such as physiological/biological status, identifications and classification of events and vehicle, road state, and environmental factors. It is difficult to create a complete and accurate model depending on all such constraints and impossible to achieve practically. Analysis of driver behavior proposed several research systems and different commercial techniques mostly in the last ten years. It gives the methods to assist drivers and examine the performance of driver. Driving monitoring system shares a common infrastructure for all these systems. Such systems are generally characterized into real-time monitoring systems or in-vehicle data recording systems and smartphone-based sensing in vehicles.

(a) **In-Vehicle Data Recording Systems**

It becomes important to record and monitor the driving performance through the utilization of external devices and in-vehicle sensory with data acquisition or classical monitoring systems. The available systems are depending on achieving data of driving from using OBD interface or direct CAN-BUS [5]. Sometimes, CAN-BUS system fails to deliver the obtainable or accessible parameters. Therefore, extraction of the information carried out by the utilization of sensory systems in other methods. Sensor fusion technique improves the reliability and accuracy of both systems by the integration of both external sensory as well as in-vehicle systems called hybrid systems. Research suggested another system depending on installation of Camera inside the car where the driver is suffering from fatigue or distracted. This technique easily detect the status and can send alert to the driver directly. Another work illustrates the installation of two cameras at the end and in front of the car helping in to make lane-changing decisions by driver. Advanced systems include the installation of in-vehicle data recording feature for the identification of various maneuvers of driving under environment condition as analysis factor. Another report suggested a system for visual features to observe swinging heads to detect behavior and drowsiness detection of the driver. RFID technology also utilizes for developing the method to estimate the violations of the traffic through detection system.

(b) **Smartphone-based Sensing in Vehicles**

Last decades witness the advancement of smart phones enabling to the owners by carrying the processing power and a significant computational at all times. In addition, nowadays, smart phones have carried the advance features with the equipment of a wide range of sensing devices like magnetometer, gyroscope, accelerometer, and several other sensors. Smartphone offers a link to the Global Positioning System (GPS) in addition to built-in sensors via satellite network that permits the tracking and navigation to the systems. Depending on smart phones, several driving behavior systems are available to evade the numerous issues linked with the utilization of different hardware devices. Furthermore, these get connected with the advancement of smartphone technology like cheap cost and different sensors availability (magnetometer, gyroscope, accelerometer, etc.).

It has also other merits boosting the smartphone as an efficient and good for the monitoring and detection of driver behavior. Another feature attached as the motion sensors in smartphone for driving classification as aggressive and normal behavior. Furthermore, another system has the driver maneuvers detection depending on only the accelerometer sensor. A report suggested a system for driver behavior recognition. Advancement of this work carries the smartphone motion sensors for the detection of the behavior as to observe the driver's distraction with mobile. Some other work suggested the mobile applications for the detection of inefficient and dangerous driving [6]. They involve the driving maneuvers detection in systems depending on smartphone. A system provides the unsafe driving detection through the smartphone connected with the orientation sensor and accelerometer.

3 Tool and Techniques

3.1 MEMS Accelerometer

In general, such components used in industrial applications for the conversion of mechanical action with respect to its electrical output signal are capacitive, piezoresistive, and piezoelectric in nature. Capacitive accelerometers can operate in frequencies up to 1 kilohertz and are chosen for the applications such as the material in silicon-micro machined sensor [7]. Piezoresistive devices are utilized in extreme and sudden applications of vibration. Piezoelectric devices are more considered for high frequency range up to 100 KHz or in cases where it is easily mounting and to be used in very high temperatures. All such devices deliver optimum linearity and very high stability.

In modern world, a unique of accelerometer known as micro electro-mechanical system (MEMS) accelerometer. It is being utilized as extremely cost effective, reliable, and simple. It is including a seismic mass associated with a cantilever beam that deviates because of acceleration applied. Such deviation is calculated using digital/analog methods and will be a measure at applied acceleration. Piezoelectric accelerometer is the most commonly device in MEMS. It utilizes the concept of piezoelectric effect as the name suggests. The device is containing a quartz crystal as piezoelectric material that applies the accelerative force for the measurement of its value [8]. The crystal generates a voltage proportional to the accelerative force because of the property of special self-production. Such device is known as vibrating sensor as the device explores its application as an extremely precise vibration-measuring device. Measurement of vibration can be performed by vibration in bearings of pressure lines and heavy equipment. The characterization of piezoelectric accelerometer can be done into two was such as low impedance accelerometer and high impedance output accelerometer.

3.2 Spectral Kurtosis

Spectral kurtosis (SK) indicates the variation of signal according to frequency with the level of impulsiveness including the statistical parameter. Meanwhile as the rolling elements strike faults on the races resulting the faults in rolling element, bearings produce a short impulse response series [9–11]. Usually, SK consisting the resonance frequencies coming from fault excitement that becomes significant in estimating the frequency bands dominated by the bearing fault signals. Such activity will be helpful in conducting "envelope analysis" that is based on the above data it leads to select the optimum frequency band for demodulation performing on the bearing signals. Resonance frequencies excitement dominated the whole procedure as the bearing fault signal in raw spectrum form carry out small diagnostic information, while amplitude modulation achieves the envelope signal including the needed data of repetition frequency with their influences and fault passages causing any modulation through the load zone.

In the existing literature, a long debate has been recorded on the selection of best method for frequency band and envelope analysis in demodulation process. Few researchers suggested the response analysis on the bearings for hammering taps. However, comparing the spectra is the most logical method after and before the manifestation of a variation thought because of the fault in bearing. As compared with the rate of excitation, it leads to the occurrence at very high frequencies. In the later, small random fluctuations are developing the response spectrum to smear any harmonics that could otherwise specify the repetition frequencies. However, a bearing fault causes the variation, the difference in dB (i.e., 20 log 10 (As/An), where As is the amplitude of the spectrum value with fault, and An is the original spectrum value, or masking noise) would illustrate that where the bearing signal's signal/noise ratio to background is optimum. In addition, it also provides a better guidance to the demodulation band with their optimum center frequency. Several works show that band demodulated width directly estimates the maximum frequency in the achieved envelope spectrum. Any fault diagnosis can be achieved through this that is at least four times of the inner race fault frequency.

3.3 Dynamic Time Warping

The aim of time-series comparison procedure is to generate a distance metric between two input time series. Conversion of the data into vectors measures the dissimilarity and similarity of two time series and measuring the distance as Euclidean between those points in vector space.

Dynamic time warping algorithm computes the proximity between two vectors with respect to the speed or time variation. DTW calculation keeps the track on the most ideal way at that example in spite of the above-mentioned algorithm that never

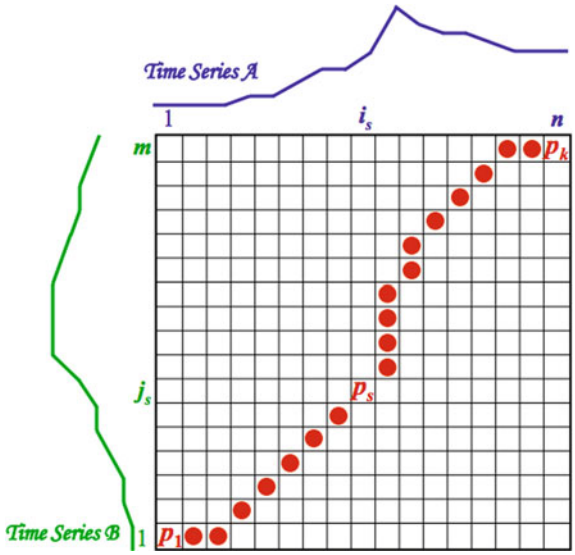


Fig. 1 Dynamic time warping technique

determines all the possible manners that complete the tasks ate definite condition. This is the dynamic time warping intensity calculation.

It functions as pursues in systematic order as:

1. Divide the two arrangements into equivalent focuses.
2. Compute the Euclidean separation between the primary point in the main arrangement and each point in the subsequent arrangement. Store the base separation determined (This is the 'time twist' arrange).
3. Move to the subsequent point and go to step 2. Move well-ordered along focuses and repeat 2 till all focuses are depleted.
4. Repeat 2 and 3, however, with the second arrangement as a source of perspective point.
5. Add up all the base separations that were put away, and this is a genuine proportion of similitude between the two arrangements.

Dynamic time warpping algorithm is subjected to certain constraints or optimisations as per the features of path through the grids which are acceptable—condition of Slope constraint, condition of warping window, boundary condition, continuity condition, condition of monotonic (Fig. 1).

4 System Model

The circuit diagram is shown in Fig. 2. For constructing the data acquisition device, VCC +5V pin of Arduino UNO is connected to VCC pin of MPU6050. Ground

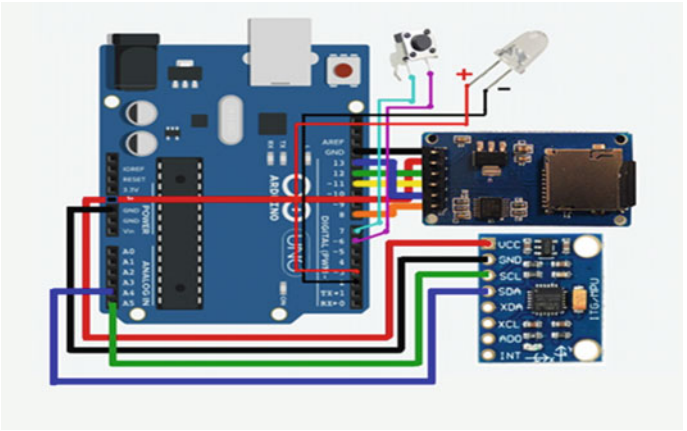


Fig. 2 Proposed circuit diagram for aggressive driving detection

pin of Adriano is connected to ground pin of MPU6050. SCL pin of MPU6050 is connected to analog pin A5 of Arduino. SDA pin of MPU6050 is connected to A4.

Positive and negative terminals of read write indicator LED are connected to Digital pin 3 and 2 of Arduino UNO. Terminals of button are connected to Digital pins 6 and 7 of Arduino UNO. VCC pin of micro SD card reader is connected to 5V VCC of Arduino UNO. Multi input single output (MISO) pin of micro SD card reader is connected to Digital pin 12 of Arduino UNO.MOSI (Multi Output Single Input) pin of micro SD card reader is connected to Digital pin 11 of Arduino UNO.Serial clock (SCK) pin of micro SD card reader is connected to Digital pin 13 of Arduino UNO. Chip select (CS) pin of micro SD card reader is connected to Digital pin 8 of Arduino UNO.

The fabricated data acquisition device is shown in Fig. 3. The data for training was acquired from a four-wheeler (EON) as shown in Fig. 3. The training data was gathered for smooth driving, normal driving, rash driving, sharp left and right turns, wrong pick up, and hit and run driving behavior. The data was gathered during 8 km travel from MNIT, Jaipur to Jagatpura Flyover.



Fig. 3 Fabricated data acquisition device

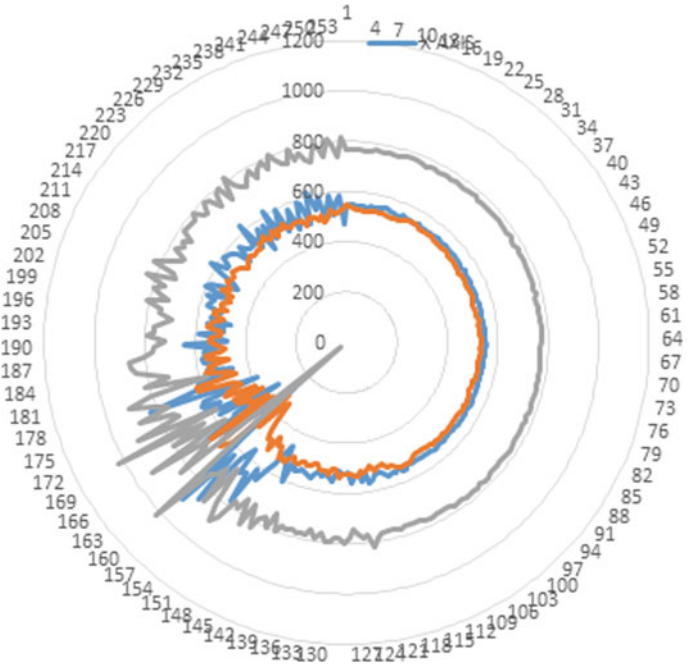


Fig. 4 Acceleration signature during sharp left turn

5 Result and Discussion

The gathered data is split into training and testing database in ratio of 6:4. The acceleration signatures generated during various driving behaviors are shown in Figs. 4, 5, 6, and 7. The developed application for data analysis unit is shown in Fig. 8, firstly test case is selected from the list box. After clicking the start button firstly, raw acceleration data and acceleration signatures acquired after spectral kurtosis are displayed. Then classification takes place by dynamic time warping algorithm and identified case is displayed. Figure 8 shows the final result obtained in MATLAB.

The efficiency of the proposed approach is 97% which is higher than the previous approaches as shown in Fig. 9.

6 Conclusion

In this research, an algorithm for detecting aggressive driving behavior by MEMS accelerometer is demonstrated. The driving behaviors used in the proposed approach are smooth driving, normal driving, rash driving, sharp left and right turns, wrong pick up, and hit and run driving behaviour. Spectral kurtosis is applied for preprocessing

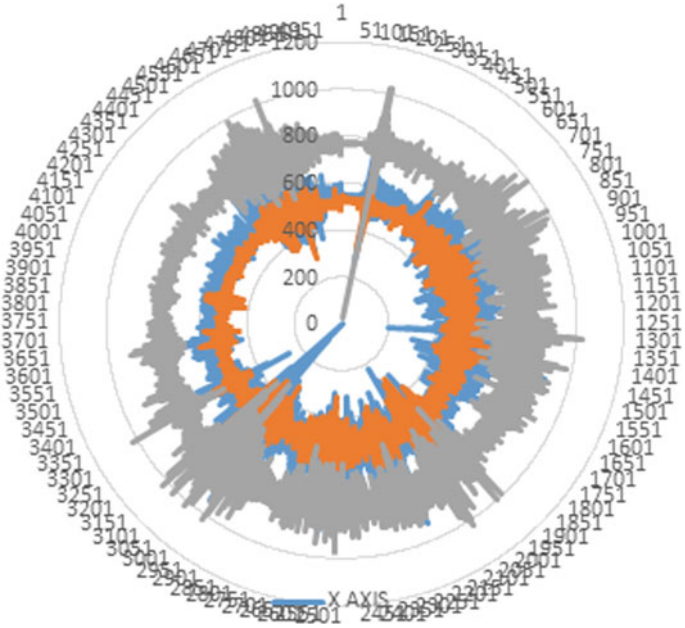


Fig. 5 Acceleration signature during smooth driving

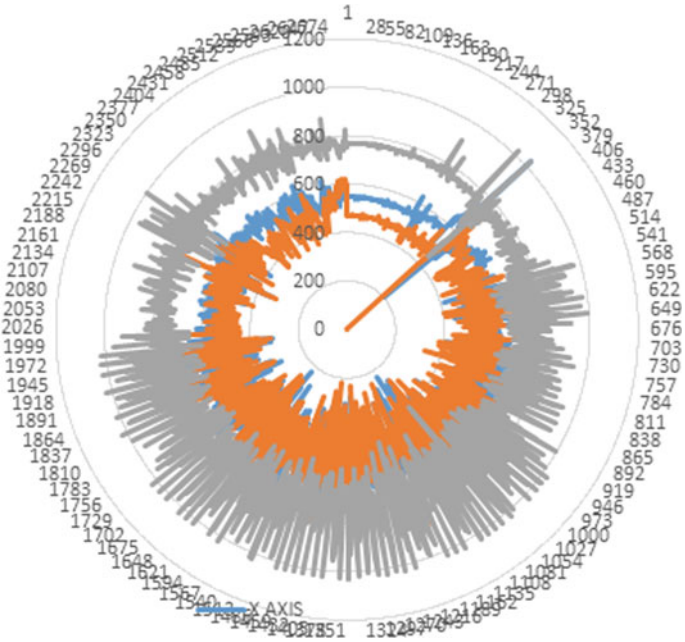


Fig. 6 Acceleration signature during normal driving

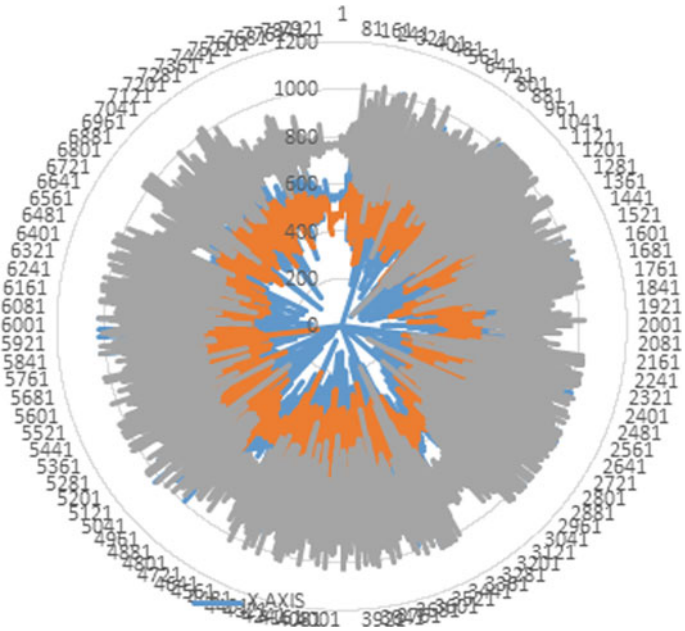


Fig. 7 Acceleration signature during rash driving

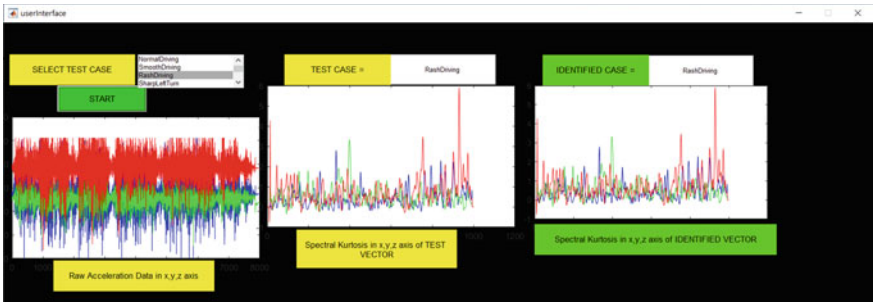


Fig. 8 Identified rash driving behavior

for removing noise, and dynamic time warping algorithm is used for classification prosecute data which is gathered from real-road conditions. The aggressive driving behavio accuracy of the proposed approach is 97%. The algorithm can be used for detecting aggressive driving behavior. The proposed approach has immense future scope. The algorithm can be linked to engine control unit and behavioral biometrics for automated countermeasures in case of aggressive driving. In future, the research can be further extended by incorporating other aggressive driving behaviors such as over speeding. The proposed approach can be linked with Global Positioning System to forecast drivers and vehicle information to nearby Police Stations in case

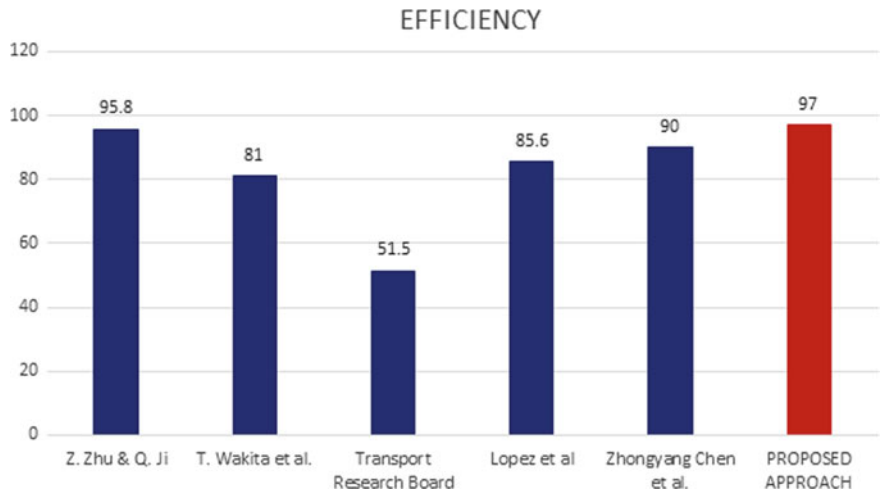


Fig. 9 Performance analysis of proposed technique

of aggressive driving. The system can be linked with cloud computing for faster processing and tracking.

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Chapter 14
Analysis and Comparison of Sensor Node Scheduling Heuristic for WSN and Energy Harvesting WSN



Sakar Gupta and Sunita Gupta

Abstract Wireless Sensor Network (WSN) comprises of many small size sensors used to monitor targets data effectively. WSN is used to solve many such problems that are very hard to solve using other technologies. Also, some sensor nodes are damaged due to natural events or accidents. So topology of the network changes frequently. Due to inaccessible areas, some WSNs are very difficult to reach and it is almost impractical to change or recharge their batteries as it is very slow and expensive process. After deploying a WSN, battery of a node to be utilized properly to enhance the lifetime of the WSN. Reducing the energy consumption and maximizing the sensor network lifetime is therefore the main challenge in Wireless Sensor Networks. Designing of energy conservation scheme is very difficult. In order to override the limitations associated with power, Energy harvesting Wireless Sensor Networks (EH-WSNs) are proposed but these are not persistent. The aim of EH-WSN is to supply long-term power supplied WSN and rechargeable batteries. Ambient energy sources and the scavenging methods that can be used in WSNs to deal with energy issues are surveyed in this paper. Modified QC-MCSC is proposed for WSN supplemented with energy harvesting resources and it is compared with QC-MCSC used in battery-powered WSN. Challenges, issues are also focused next.

Keywords WSN · Connectivity · WSN-HEAP · Coverage · EH-WSN

14.1 Introduction

A WSN is made by many sensor nodes. Each Sensor node has the radio, battery, microcontroller, and sensor interface. Communication subsystem consumes maximum energy of a typical sensor node. The key constraint in WSN is the battery,

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which is the main source of energy. There are many energy efficient target coverage issues and every target coverage issues effect more or less in some way the lifetime of WSN [1]. The key factors of energy use in communication are idle listening of nodes, retransmission due to collisions, overheads of control packets, overhearing and very high power used in transmitting, etc.

WSN must efficiently execute its application with least power usage. There are many approaches that can be used for power saving like clustering, scheduling, routing, etc. So the focus is to find better system where power may be inhibited and so enhancing the lifetime of battery. A comparison of techniques used for energy minimization and Sensor Node Scheduling heuristics in WSN, is given in [2] and [3], respectively. A comparison of scheduling heuristic and artificial bee colony deployment algorithms is given in [4].

EH-WSN eliminates the overheads of WSNs. EH-WSNs uses natural and available energy resources from the environment such as solar power, wind power, temperature, etc. Battery-free Wireless Sensor Network (BF-WSN), harvests energy from available ambient energy resources.

The paper is structured as given: Architecture of energy harvesting is given in II. Different harvesting techniques are given in III. Modified QC-MCSC for EH-WSN is given in Sect. 14.4. Simulation and comparison between modified QC-MCSC for WSN supplemented with energy harvesting resources and QC-MCSC for battery powered WSN is given in Sect. 14.5. Challenges and issues of Energy harvesting in WSN are given in Sect. 14.6. The paper is concluded in Sect. 14.7.

14.2 Architecture of Energy Harvesting Wireless Sensor Network

Energy harvesting is a method for translating the idle ambient energy into electrical energy. The gained energy in this way is called harvested energy. A sensor is the main component in a Wireless Sensor Node. Other components equipped are Transceiver, Memory, Microcontroller and Power unit. EH-WSNs pull outs energy from several sources of the environment and transforming it into electrical power. Energy harvesters are combined with batteries (that can be recharged) and supercapacitors to provide uninterrupted WSN operations.

In EH-WSN, ambient energy is provided from energy harvesting device as shown in Fig. 14.1. Energy harvesting is a method in which energy is generated from external sources like solar power, wind energy, etc. Energy harvesting also called as energy scavenging or ambient power source. Energy harvesting sources provides harvested energy and it is stored for future use.

Energy is stored in storage component using secondary rechargeable batteries or using supercapacitors also called ultracapacitors as given in [5]. Authors in [6] give a sustainable solution of power supply using energy harvesting. A solution for

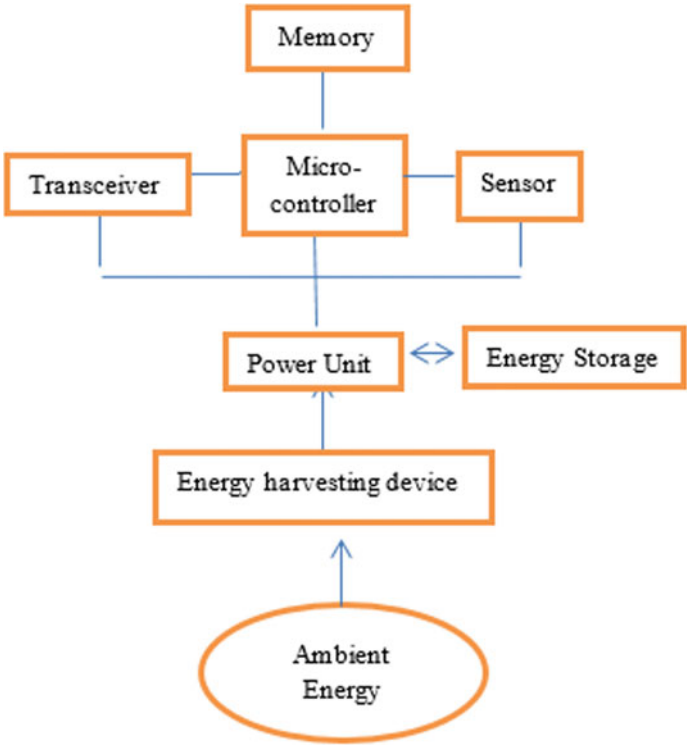


Fig. 14.1 Architecture of energy harvesting WSN

enhancing lifetime of network using radio frequency energy harvesting technique is given in [7].

Thus lifetime using EH-WSN is increased. Difference among battery powered WSN, battery-powered WSN supplemented by energy harvesting and WSN that is power-driven by ambient energy (WSN-HEAP) can be summarized as shown below in Table 14.1.

14.3 Energy Harvesting Techniques

EH-WSNs are capable of consuming energy from EH-WSN sources and change them to electrical energy in addition to the sensory and memory function. Various sources of energy harvesting are given below.

(1) Mechanical energy harvesting

Energy Harvester component in EH-WSN converts energy of displacement and oscillations into electrical energy. Energy harvesting is done using other techniques such

Table 14.1 Differences between battery-powered WSN, battery-powered WSNs supplemented by energy harvesting and WSN-HEAP

Difference	Battery-powered WSNs	Battery-powered WSNs supplemented by energy harvesting	WSN that is powered by ambient energy (WSN-HEAP)
Goal	Main goal is on utilizing battery power properly to increase the lifetime of WSN. So latency and throughput can be tolerated	Main goal is maximizing throughput and minimizing delay as longer lifetime is achieved by harvested energy	Main goal is maximizing throughput and minimizing delay as concept of network lifetime is not applicable
Predictions about energy model, protocols and heuristic design	Energy model is well understood. Sleep-and-active state schedules can be determined exactly	Highly accurate Energy model is predicted. Sleep-and-active state routine can be decided exactly if calculations about future accessibility are correct	Energy harvesting rate depends and changes according to time, space and type of energy harvesters used. Sleep and wake-up routines cannot be forecasted

as Piezoelectric, electrostatic and electromagnetic [8]. It does not require any explicit source for voltage since the electrical energy conversion here would generate required voltage implicitly. However, breakability of piezoelectric materials and the Charge leakage may cause a problem.

(2) Photovoltaic energy harvesting

This is one of the most commercial forms of energy harvesting technique which is appropriate for larger scale energy harvesting systems as it releases higher power output level. This technique converts the photons generated from sources like natural solar or artificial light. It depends on the light source with which the conversion process is performed. The level of power generated and efficiency has effects based on materials used for cell. The importance of the method lies in solar cells, Maximum Power Point Tracker (MPPT) and voltage converter.

(3) Thermal energy harvesting

In this technique, thermal energy created by the thermal gradients is changed into electrical energy. Energy availability is dependent on the availability of thermal difference induced [9]. Electric energy is created from difference between temperatures by thermoelectric power generators (TEGs).

(4) RF energy harvesting

In RF energy harvesting, electromagnetic wave is converted into electrical energy using rectifying antenna like cellular phones and Wi-Fi. Powers efficiency for RF energy harvesting is in micro or mill watts. It depends on the distance of transmitter and harvester [10].

(5) Wind energy harvesting

Airflow or wind energy is converted into electric energy. A wind turbine generator (WTG) coupled with an electrical generator is used for the energy harvesting in [11]. Kinetic energy of air is converted into mechanical energy using turbine and then into electrical energy using generator. Turbines at big level are very proficient. But, Small size wind energy harvesting has a low flow rates, unpredictability of flow sources, etc.

(6) Biochemical energy harvesting

In Biochemical energy harvesting, Oxygen and endogenous substances are converted into electricity through electrochemical reaction [12]. Biofuel cells act as active enzymes. Catalysts are harvest electrical energy from biochemical energy. A person's body contains different kinds of substances which have the capacity to harvest energy.

(7) Acoustic energy harvesting

High and acoustic waveforms are converted into electricity using acoustic transducer or resonator. The proof this technique is that it is used at places where power is not available for long term.

(8) Energy harvesting from dynamic fluid

It consists of power of flowing wind and water. There are two methods of harvesting Kinetic energy of fluids. Electricity is generated by mechanical parts or by non-mechanical parts for dynamic fluids that induces mechanical vibrations and converted into electricity. All above energy harvesting techniques and are shown below in Fig. 14.2.

Different energy harvesting techniques combined together can be used simultaneously for a single platform for maximum battery life and it is called Hybrid Energy Harvesting. Power Density and Conversion efficiency decide the amount of energy harvestable.

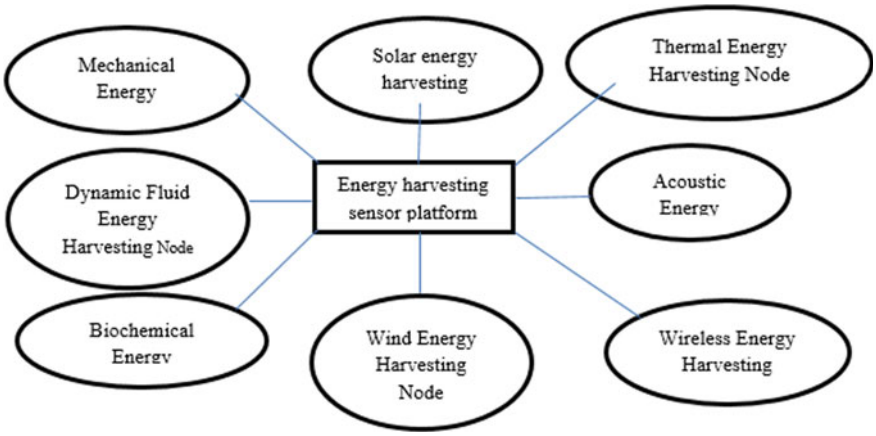


Fig. 14.2 Energy harvesting methods [13]

14.4 Modified QC-MCSC for EH-WSN

Sensor node scheduling algorithm QC-MCSC [14] is modified to use for WSN supplemented with energy harvesting resources. In [15], QC-MCSC and existing heuristics are compared over Energy Latency Density Design Space. QC-MCSC [14] is modified and supplemented with energy harvesting resources as given below.

Coverage Phase
A critical target T and a sensor S with greatest contribution function is selected and $C_k = C_k \cup \{S\}$ and for all T that are covered by S, Uncover_level (T) = Uncover_level (T) −1.

Connectivity and Redundancy Reduction Phase
BFS is used shortest path from each $S \in C_k$ to BS. To reduce redundancy of nodes, least priority nodes are removed from C_k and checked if it is a connected set cover or not.

Energy and Priority Updation Phase

For all sensors $B_i = B_i + E_{harvested}$ and l_k = Lifetime (C_k) = Min (l, Max_lifetime (C_k)).

For relay sensor S_i, $B_i = B_i - E2$.

For a sensing node S_i, $B_i = B_i - (E_1 + E_2)$.

If $B_i < E_2$ then that sensor is removed from Sensor set S.

Priorities of nodes are changed as per their remaining energy.

14.5 Simulation and Comparison Between Modified QC-MCSC for WSN Supplemented with Energy Harvesting Resources and QC-MCSC for Battery Powered WSN

The proposed modified QC-MCSC is simulated in MATLAB and results are analysed and given below. In Fig. 14.3, lifetime is calculated for modified QC-MCSC for $q_m = 1$, by varying target counts, for fixed number of sensors. Lifetime is calculated for different values of l (Lifetime granularity constant) (Table 14.2).

The proposed modified QC-MCSC heuristic is compared with QC-MCSC [14] and results are given below. In Fig. 14.4, for fixed number of sensors, lifetime of WSN is calculated by varying the target counts and for different values of l (Lifetime granularity constant). It is observed that the lifetime of WSN supplemented with

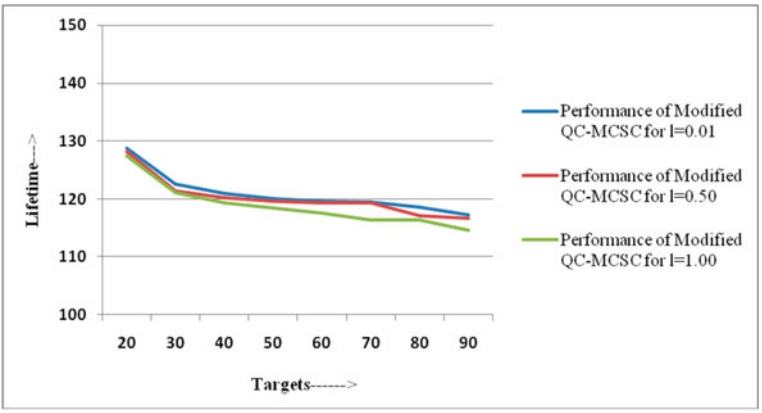


Fig. 14.3 Lifetime of WSN for modified QC-MCSC for $q_m = 1$, by Varying target counts

Table 14.2 Lifetime of WSN for modified QC-MCSC for $q_m = 1$, by varying target counts

No. of targets	Lifetime for modified QC-MCSC		
	l = 0.01	l = 0.50	l = 1.00
20	128.757	128.234	127.366
30	122.625	121.333	121.067
40	120.933	120.277	119.377
50	119.991	119.654	118.366
60	119.543	119.366	117.477
70	119.455	119.288	116.367
80	118.511	117.176	116.368
90	117.246	116.679	114.545

energy harvesting resources is approximate twice then the lifetime obtained using QC-MCSC for battery powered WSN (Table 14.3).

14.6 Challenges and Issues

Including energy harvesting systems to WSNs requires a lot of processes like capturing, storing, conditioning, regulating, and managing. The minimum size of harvesting system is required. and it is challenging. Efficiency of system is a great challenge. For most systems, conversion efficiency is low. The harnessed power should also efficiently stabilize, stored and send to the required destinations. The surplus energy is stored well. Harvested power is not constant. So energy storing devices have responsibility of providing constant power supply. By controlling transmission power and using wake-up and sleep schedules for sensors, energy can be conserved. Harvesting

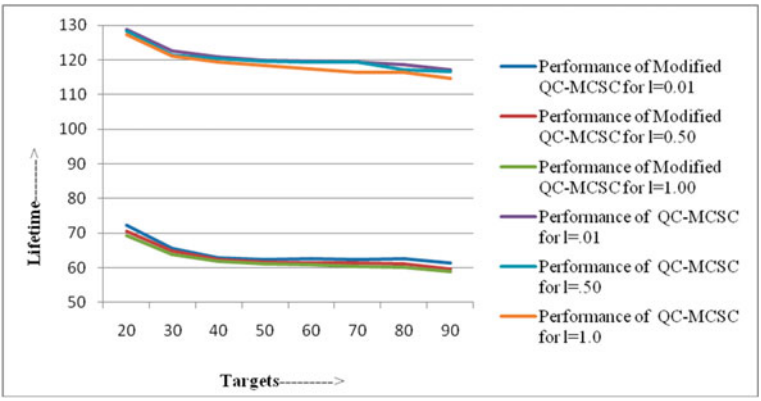


Fig. 14.4 Comparison of lifetime of WSN between modified QC-MCSC and QC-MCSC

Table 14.3 Comparison of lifetime of WSN between modified QC-MCSC and QC-MCSC

No. of targets	Lifetime for modified QC-MCSC			Lifetime for QC-MCSC [14]		
	l = 0.01	l = 0.50	l = 1.00	l = 0.01	l = 0.50	l = 1.00
20	128.757	128.234	127.366	72.175	70.437	69.264
30	122.625	121.333	121.067	65.637	64.787	63.938
40	120.933	120.277	119.377	62.943	62.276	61.773
50	119.991	119.654	118.366	62.392	61.657	61.123
60	119.543	119.366	117.477	62.543	61.363	60.823
70	119.455	119.288	116.367	62.457	61.298	60.422
80	118.511	117.176	116.368	62.508	61.176	60.173
90	117.246	116.679	114.545	61.248	59.697	58.876

energy is a great effort to resolve energy problem. Implementing harvesting technique only is not enough to gather all the profit of energy harvesting.

14.7 Conclusion

The fundamental aspects of EH-WSNs and different type of energy harvesting techniques which helps in overcoming the challenge of energy efficiency problem in WSN are covered here. The widely used and efficient energy harvesting techniques are surveyed. Different challenges and issues for efficient harvesting are discussed as well. So harvested energy is regular, safe and clean, and it power WSNs endlessly. Lifetime of WSN can be extensively increased if energy harvesting resources are properly used along with sensor scheduling heuristics.

The future work focuses on implementing all energy harvesting techniques to single network and measuring its performance and behaviour.

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NODEMCU BASED POWER MONITORING SYSTEM USING IOT

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***Abstract*: Efficient energy utilization plays a vital role for development in smart grid in power system. For this, proper monitoring and controlling of energy consumption is important. In India, the existing system compose of a physical meter which can only be monitored by having definite interactions with it, which is a bit of less efficient if we are not in that particular location where the meter lies. To make this problem solve and get the reading from remote locations, for the energy consumption we here propose a smart meter based on Internet on Things (IoT). The proposed smart energy meter calculates the energy consumption using ACS712 current sensor, Arduino Uno and NodeMCU. The information collected is transferred to cloud and we can remotely access to it. Therefore, the analyzation of energy becomes easier for consumer. This system also helps the consumer to control the power utilization if excess, by the help of analytics. Thus, this smart meter is a good step towards the Digital India.**

Keywords: **Internet of things, Smart Meter, Arduino, NodeMCU, ACS712**

I.INTRODUCTION

The internet of thing is network of smart devices. The thing in iot could be a person with a heart monitor with built in sensors. The iot technology mostly use the embedded technology. The embedded technology provides the interconnection between human and machine. Today the energy consumption is the Main issue and it's rapidly increases and it will become a very big issue. An applicable system is made to reduce the power consumption. In existing system, we have manual operation in which one person come from electricity department. And take the reading and generate the power consumption bill on the spot. This process is time taken and required more men power. The bill generated by men is less accurate. The values we get from existing system is less precise. So, for these reasons me need some improvement in our system. The smart grid Play an important role in present society. The smart meter removes these problems from our society. In which we calculate the meter reading automatically and send the reading to users Phone and e-mail. Where user have the option to pay the bill through online portal. The smart energy meter provides the two-way communication between consumer and suppliers. It provides better controllability and efficiency. The smart energy meter provides the real time analysis of energy consumption. In proposed plan the energy consumption bill is send to consumers on their daily basis. Whenever the consumption bill crosses the set value the supply of electricity will be disconnect to customers. The iot based energy meter have 3 main parts Wi-Fi module controller, and current sensor. The controller plays an important role controller receives the instructions from current sensor and calculate the energy consumption bill. Using esp8265 Wi-Fi module. We send the power consumption to consumers.

II.PROPOSED SYSTEM

The proposed system is cost effective and compact, so, installment becomes much easier. The result is uploaded at every interval into cloud space called “Adafruit.io” and monitoring can be done by consumer.

In the proposed model, we connect the load to supply and ACS712 current sensor. The current sensor is connected to Arduino and then to NodeMCU. The Figure 1 below shows the block diagram of proposed smart monitoring system.

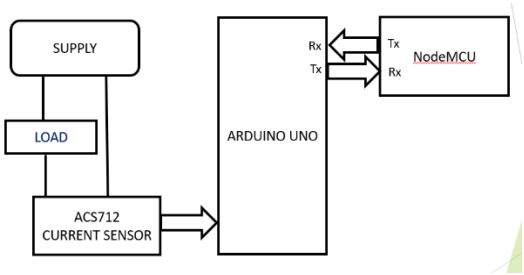


Figure 1: Block Diagram of circuit

The main functional unit of this system is discussed hereafter.

- Current Sensor- ACS712 current sensor gives precise current measurement for both AC and DC signals. These are good sensors for metering and measuring overall power consumption of systems. The ACS712 current sensor measures up to 5A of DC or AC current.
- NodeMCU- The Node MCU (Node Micro-Controller Unit) is associate degree open supply computer code and hardware development atmosphere that's engineered around an awfully cheap System-on-a-Chip (SoC) referred to as the ESP8266. The ESP8266, designed and made by Systems, contains all crucial parts of the trendy computer: central processing unit, RAM, networking (Wi-Fi), and even a contemporary software package and SDK.
- Arduino- Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.
- Adafruit-Adafruit provides us a cloud server and web interface to our project which let the consumers access the information from remote locations.
- Power Supply-A 220V AC power supply is given to the system in order to power. Wi-Fi module power is supplied by 5V DC through Arduino.

The Arduino UNO and NodeMCU are programmed by the Arduino IDE software. The value measured through current sensor is converted to the power through program algorithm uploaded to the Arduino and then the consumption analytics are made through it as the data obtained is transferred to the cloud server of adafruit. Then the monitoring can be done on web platform from any remote location without any physical interaction with the system. Thus, the human error is reduced. The Figure 2 shows the practical circuit diagram.

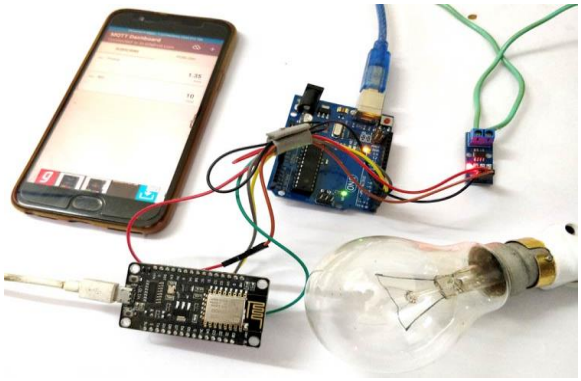


Figure 2: Practical Circuit

III. PRACTICAL IMPLIMENTATION

Energy monitoring and saving consumption is very difficult task and in today's method of energy measurement a person comes from electricity department and note the reading of our energy meter then bill is generating in the end of every month and to control the energy savings and better utilization is much difficult. Here in this project we are measuring the energy consumption using NodeMCU and MQTT with

the help of internet of things. Power has been calculated through Arduino board and current is measured using current sensors ACS712. Power supply is connected to acs current sensor and load which provides the potential difference by using application of hall effect. This voltage helps us to calculate the power consumption which is done through Arduino uno through the algorithm coded by Arduino IDE. And we can receive our energy consumption amount on adafruit cloud server through NodeMcu Wi-Fi module which is connected to Arduino uno. Thus, we can check our energy consumption on the daily basis and we can control the power utilization and consumption of electricity.

IV. RESULT AND DISCUSSION

This project is an innovative idea for replacing the daily meter checking by going to the electric meter of the house and rather than going, just checking over the web platform and getting the reading by sitting anywhere in the world where the web services are available.

The results are obtained on Adafruit platform for the human interactions. The figure 3 shows the example for the adafruit reading.

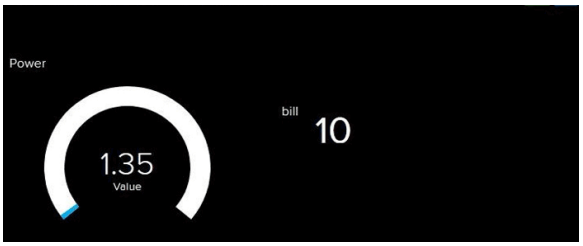


Figure 3: Consumption Reading on Adafruit

Some Advantages are:

- Reduce Time
- The system excludes manual bill calculation
- Reduce Man power

Some Disadvantages are:

- Users must have a reliable internet connection.
- There is no human interaction if users have some enquiry.

This model is at a primary stage and can be incorporated with many additional features to make it more efficient and reliable.

V. CONCLUSION

The moto of this project is to make an individual more interactable with the electricity consumption meter and make the consumption and billing system more transparent which will make an individual resulting no doubts about the consumptions such as sometimes he would feel the consumption reading on the meter is resulting in excess quantity but due to this project he would not have any this kind of doubt and rather than this he can record and analyze the daily consumption anywhere on web platform and also take a step towards saving energy.

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A Reference Model for Internet of Things Middleware

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Abstract- Internet of Things (IoT) is a term used to describe an physical environment where billions of objects, constrained in terms of resources are connected to the Internet. Many objects connected in IoT platform, the environment in which they are placed becomes smarter. Software, called middleware, plays a key role since it is responsible for most of the intelligence in IoT, integrating data from devices, allowing them to communicate, and make decisions based on collected data. Then, considering requirements of IoT a platform, a reference architecture model for IoT middleware is analyzed, thus, it is concluded that middleware plays a crucial role in IoT solutions and the proposed. How in IoT Middleware layer play a key role has been discussed.

Keywords—Internet of Things (IoT), middleware, middleware architecture for IoT, reference model

1. INTRODUCTION:

Internet of Things Middleware is software that serves as an interface between components of the IoT, making communication possible among elements that would not otherwise be capable. Middleware connects different, often complex and already existing programs that were not originally designed to be connected Layers between OS and Distributed application. Provides common programming abstraction and infrastructure for distributed application. Middleware takes the form of APIs, listing the devices, their capabilities, and services. As IoT devices collect a large amount of data from their sensors and actuators, this data must be analyzed in great detail. It is imperative to incorporate machine learning techniques into edge computing. The middleware supporting IoT should have certain security controls, including user authentication and access control management. As the cloud is an integral part of IoT deployment, it is imperative for IoT middleware to have the potential to run on various types of clouds. As the name suggests, middleware is a software that is located in the middle (between two things). The primary goal of a middleware is bringing different systems together so they can interact with each other. The role of middleware is not

only to enable communication but to facilitate it. No middleware can be applied to every scenario, so they are generally built for specific or set of scenarios. In the literature, IoT middleware solutions are sometimes referred to as IoT platforms or IoT middleware platforms because generally, the middleware is a platform, but it is not the only type of IoT platform.

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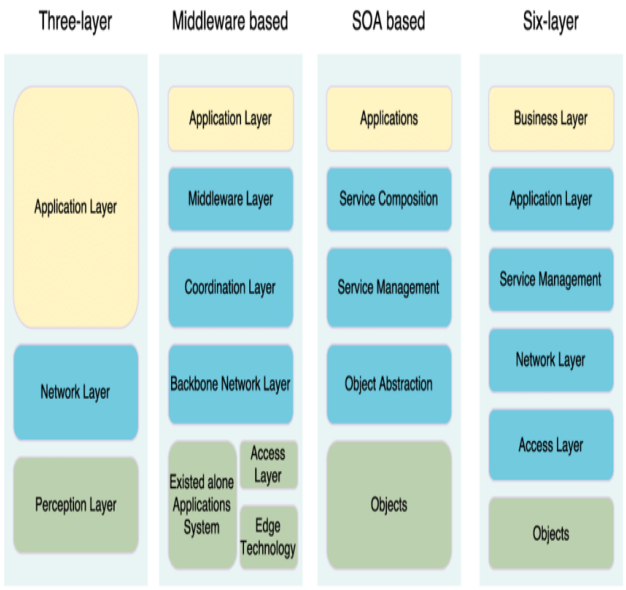


Fig1: Architecture of IoT

2. NEED FOR MIDDLEWARE IN IOT:

Middleware for IoT acts as a bond joining the mixed domains of applications communicating over heterogeneous interfaces. Middleware implies the need for integration, transmission and security. Data from devices will need to be analyzed and then correct actions need to be taken with regards. Connecting to the Internet in IoT in IoT, most objects are constrained in resources. For this reason, nearly everything that works on the current Internet requires a lightweight IoT version. A rapid analysis of the most common wireless methods of accessing the Internet reveals that the current Internet protocol stack does not take the limitations of IoT into account. Wi-Fi (IEEE 802.11 a/b/g/n/ad/ac) is not battery efficient, does not cover a large area, and does not support a high number of end devices. For this reason, alternatives, such as Bluetooth 5 and IEEE 802.15.4 are being deployed in IoT solutions. Bluetooth 5 is the most recent version of the mainstream Bluetooth standard. Like Bluetooth 4.2, Bluetooth 5 also supports IP networks (Bluetooth's IP capabilities are rarely explored by end-users). IEEE 802.15.4 is a standard for low-rate wireless personal area networks that specifies the physical and MAC layers of the OSI model. The most common implementations of IEEE 802.15.4 are IPv6 over low power wireless personal area networks (6LoWPANs) and ZigBee. 6LoWPAN is an Internet engineering task force approach that compresses and encapsulates the IPv6 headers, then accommodates them on the frame IEEE 802.15.4. ZigBee was developed and

maintained by ZigBee Alliance. It is famous for its mesh topology, but it supports other topologies, such as star and tree. The most prominent advantage of 6LoWPAN is that it natively supports IP networks. When using ZigBee or traditional Bluetooth, a gateway is necessary to communicate with the Internet, which increases overhead. All technologies that do not support IP natively use a similar concept to connect to the Internet. ZigBee recognized the importance of IP networks and releases ZigBee IP that uses many 6LoWPAN concepts, especially the header fragmentation and compression scheme. to that data. Middleware has a role to play in security. IoT solutions should incorporate access control and data authentication while maintaining the privacy of users and devices.

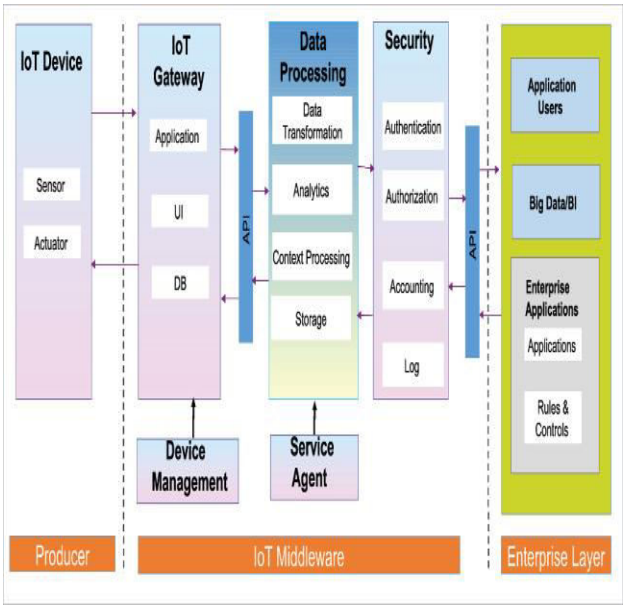


Fig2: The Middleware Working in terms of IoT

3. LAYERS OF IOT:

- **Application Layer** (interconnects the physical and digital world)
- **Gateway and the network layer** (Supports the communication requirements)
- **Management Service layer** (Ensures security and privacy of data)
- **Sensor layer** (Provides a user interface)

4. ADVANTAGES:

Middleware is reusable infrastructure software residing between applications and the underlying operating systems, networks and hardware. Middleware is exactly like that - it enables multiple systems to communicate with each other across different platforms. Middleware is important because it makes synergy and integration across those applications possible.

5. LIMITATIONS:

- Inter-operability
- Scalability
- Abstraction
- Spontaneous interaction between things
- Distributed infrastructure
- Security
- Privacy

6. APPLICATIONS:

- Mule soft, Oracle, Red Hat and WSO2 are among the companies that offer IoT middleware. These products provide API management as well as basic messaging, routing and message transformation
- Middleware acts as an agent between the service providers (IoT devices) and service consumers (enterprise applications).
- It is a software layer that sits in between applications and objects. It is a mediator

5. FUTURE DEVELOPMENT:

- The middleware for IoT acts as a bond joining the heterogeneous domains of applications communicating over heterogeneous interface
- Jump connections to output nodes
- Hidden nodes that vary in structure
- It creates a true ubiquitous or smart environment.

7. CONCLUSION:

The IoT is a scenario where most devices are constrained in resources, which means that the intelligence will be delegated to a more capable entity. This entity is a software identified as IoT middleware or IoT middleware platform, and sometimes it is simply referred as IoT platform although it is not the only type of IoT platform. Choosing the right platform for a particular scenario can be the difference between a good and bad IoT solution because it is a long-term investment. Understanding what middleware should accomplish, and recognizing their role in IoT solutions will be crucial for organizations or individuals interested in the IoT market. Middleware developers should spend additional time making them more user-friendly without compromising security, as usability with a certain degree of quality might be the key to prosperity in this already overloaded market. Currently, there is no objective way of comparing the different middleware. Therefore, a performance assessment based on objective metrics can substantially contribute to selecting middleware for each environment, so further effort should be placed in this regard.

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5th IEEE International Conference on Recent Advances and Innovations in Engineering- ICRAIE 2020 (IEEE Record#51050)

A Comparison of Lifetime in WSN with Static and Mobile Sink

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Abstract - **Wireless Sensor ability is shifting our lives at a quick speed. Detecting highlight and remote component are two extraordinary things about this innovation that watches the encompassing condition without wire. A wide spread scope of entries are utilizing the Wireless Sensor innovation. Arranged work is to evaluate execution of Adhoc On-demand Multipath Distance Vector (AOMDV) with static and mobile sink hub based on following nature of administrations parameters Average End to End delay, Packet Delivery Ratio, Average Throughput, and Consumed Energy. Simulation based results contrasted static sink hub and moving sink hub and shows that arbitrary sink hub is increasingly skilled as far as generally speaking execution in WSN.**

Keywords: Wireless Sensor Network, Quality of Services, Packet Delivery Ratio, Adhoc on Demand Multipath Distance Vector Routing

I. INTRODUCTION

Gigantic measures of little sensors with a static sink structure a delegate remote sensor arrange. The life expectancy of WSNs is a principle issue and ought to be painstakingly taken before genuine use as sensors regularly have confined energy[1].Lifespan of the hubs close to the sink is in every case less since they need to progress altogether the data created by the middle of the road hubs. Mobile sink typically brings organize lifetime improvement. The hubs close by mobile sink each time changes, consequently adjusting the vitality admission in the framework and improving the framework life expectancy [1].In difference to completely useful PCs contributing in impromptu systems the sensor hubs have significantly second rate correspondence and operational abilities. The issue of energy resources is primarily testing in WSN [4].Normally the energy wellspring of the sensor hub is nonrenewable however certain sensor hubs may be fit to chase resources from their condition. It is important to consider the issue of creative utilization of intensity assets in directing conventions utilized in sensor systems [5].The requirement energy viability in the system can be upgraded by the sink portability along compelled way. Arbitrarily introduced sensor hubs make some little memories for information gathering time because of the way limitations. So there is a test to propel the information assortment &dropping energy utilization [2].The rest of the paper is composed as pursues. Segment 2 overviews the related work. Area 3 presents organize model and proposed work. Execution assessment of static and mobile Sink is assessed in Section 4. At long last, Section 5 finishes up the paper.

II. RELATED WORK

Hussein Mohammed Salman [5] thought about the energy admission, comfort and the dependability of heading discovering conventions for WSN. Abdulaleem Ali [6] features the idea of the multipath steering procedure and its significant difficulties, likewise the rudimentary motivations for utilization of this training in remote sensor systems. Abdul Waheed Khan [3] examines numerous information giving out game plans that utilize sink versatility. Characterize the current game plans grounded on sink portability in the sensor field into three kinds. i) Path obliged; ii) Path unconstrained, and Controlled sink versatility. M. Emre Keskin [4] offers an exact prototypical which consolidates WSN procedure decisions on sensor places, development plans, measurements courses, way of the versatile sink(s). A.Rehash Rushmi Pavitra [10] Wireless Sensor Networks helped with Movable Sinks (WSN-MSs) stay saw to be a reasonable cost usable substitution towards the work of old remote detecting system. Information gathering seems to be a vocation of greatest centrality in WSN-MSs. Awais Ahmad [7] shows that information gathering from sensor hubs by portable sink lessens multi jump information transmission and builds energy productivity. Xiaobing Wu [1] proposes a Dual-Sink draws near. Reproduction results show that after system scales up, the system utilizing Dual-Sink appreciates solid life

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expectancy improvement from sink development, though the system with single versatile sink accomplishes no more beneficial than the system with a solitary static sink. Dattatray S. Waghole [2] recommends the strategies, procedures, game plan utilized for energy effectiveness, dropping energy admission and intake in the remote sensor systems. Above greatness of administrations acknowledges for information assembling in the remote sensor organize utilizing the static and portable sinks. Hinal Upadhyay [8] concentrated on conveyance dormancy minimization issue. To diminish the idleness, most limited way should be found. In the event that the voyaging course is littler than dormancy can be limited. Narendran M [9] Energy equipped and versatility data is a principle issue in remote sensor systems. Gateway arrangement is a generally used to spare energy in organize dealing with, for example, versatility, information conglomeration. Shiv kumar S. Jawaligi [11] powerful and energy skilled solitary portable sink grounded WSN information gathering convention is introduced. Unique present methodologies; an improved incorporated grouping prototypical is built up on the establishment of desire amplification (EM) idea. Catalina Aranzazu Suescun [12] accentuations on systems administration conventions used to report occasions to a versatile sink and present the best in class in instruments used to report information and occasions to a portable sink. Peijun Zhong [13] Wireless sensor systems are developing quick lately, because of their wide looming applications. Anyway there happens the alleged problem area issue, explicitly the hubs close by to static sink hub tend to kick the bucket sooner than different hubs as they have significant burden to advance. The enlistment of portable sink hub can adequately lighten this issue.

III. PROPOSED WORK

We take up N sensor hubs are homogeneously circulated in a field and structure a joined system. A static sink is arranged at the midpoint of the field, while a portable sink can travel wherever in the field. The sensor hubs are homogeneous. All sensor hubs and the two sinks utilize the equivalent fixed correspondence span in information transmission. Different parameters to improve the proficiency of Wireless Sensor Network (WSN) are Packet Delivery Ratio (PDR), Average Throughput, Average End to End Delay and Consumed Energy.

A. Packet Delivery Ratio

In WSN message is delivered in the form of packets. It is the ratio of packet delivery from source to destination. Some of packets drop in between the routing path e.g. if T is the total packets and T-D reached at the destination then

$$PDR= \frac{(T-D)*100}{T} \qquad (1)$$

B. Throughput

Total Work completed in the specified time unit. It is also related with the working speed of the system e.g if the system delivers more packets at the specific time period then it's throughput is good enough. It should be maximum for good results.

C. Average Delay

It is the time interval between source to destination. When a packet is send by source at S Time and reaches at destination at E time than

$$DELAY= E-S \qquad (2)$$

Different packets have different delay time. After that we can calculate the average delay by adding all and divided by total number of packets. It should be minimize.

D. Energy Consumption

When the message is send from one node to another some sort of battery power (energy) is consumed. As energy is the most precious thing in the sensor nodes, so we must follow the path which consume less energy. Energy consumption should be minimize.

Most of analysts underlined to build the proficiency of WSN by making the nature of administrations parameters (QoS) better. In this work AOMDV steering convention with two unique situations of 25 hubs and 50 hubs are actualized for assessment. The two situations are assessed with static sink and irregular sink hub.

Network Simulator 2 is used for result analysis which is an open-source and event-handling, specially design for research in networking. Moreover, it is compatible with the different protocols. It is well suited for both wired network and wireless network. It is mainly based upon UNIX operating system.

E. Algorithm

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Algorithm is based on the following linear program

Maximization of life span $T=\frac{\sum t_k}{K}$ (3)

Restrictions: $\frac{\sum t_k P_{k<=E}}{K}$ (4)

Here P_k and E are exhibits that indicate the energy consumption of every hub when the sink hushes at a specific stay point k and the underlying energy stores everything being equal, individually. This definition essentially implies that we gauge, through the age t_k, the stay focuses dependent on the relating P-profile P_ks, so that the P_ks that supplement each other are favored. We characterize the P_ks by instrumenting the model of a steering convention. Two-stage calculation is actualized to estimate the above programming issue:

I) Stage I - Initialization:

- The mobile sink visits all the anchor points
- The sink gathers the energy consumption of all nodes and creates a P-profile
- At the final phase, the sink implements the programming (1) and drops an anchor point if its weight T_i is extremely low.

II) Stage II - Operation:

- The mobile sink goes through the trajectory repetitively but only pauses at selected nodes.
- At a given point k, the sink again collects power consumption information and builds a profile P_k.
- On the basis of new profile and previous profiles the programming (1) is re-implemented

IV. RESULT ANALYSIS

In this work AOMDV protocol of routing is assessed for static and arbitrary sink hub. Ad-hoc On-demand Multipath Distance Vector (AOMDV) is the enhanced variation of AODV protocol, it belongs to reactive and on demand routing protocol of ad-hoc wireless networks. The main goal is to compute multiple loop-free and link-disjoint paths between source and destination pair. The worth of AOMDV is estimated in terms of enhanced throughput, packet delivery ratio and decreased average end-to-end delay and control overhead.

Here we contrast the result of AOMDV with static sink hub and AOMDV with arbitrary sink hub. The examination is accomplished for 25, 50 hubs.

TABLE: 4.1 AVERAGE DELAY

No of Nodes	25	50
Static Sink Node	0.04717	0.02484
Random Sink Node	0.00166	0.00169

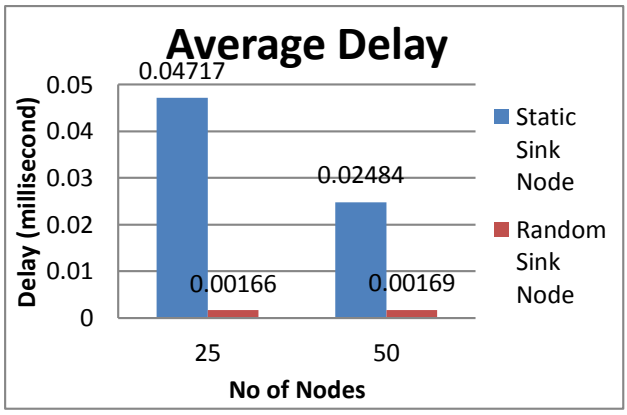


Figure 4.1: Average End to End Delay

Figure 4.1 shows that Average End to End delay by AOMDV with static sink node is 0.004717 millisecond (ms) and Average delay by AOMDV with arbitrary sink node is 0.00165 ms for 25 nodes, Average End to End delay by AOMDV with static sink node is 0.002483 ms and Average delay by AOMDV with arbitrary sink node is 0.001686 ms for 50 nodes.

TABLE: 4.2 THROUGHPUT

No of Nodes	25	50
Static Sink Node	25.0735	17.095
Random Sink Node	26.5065	18.7855

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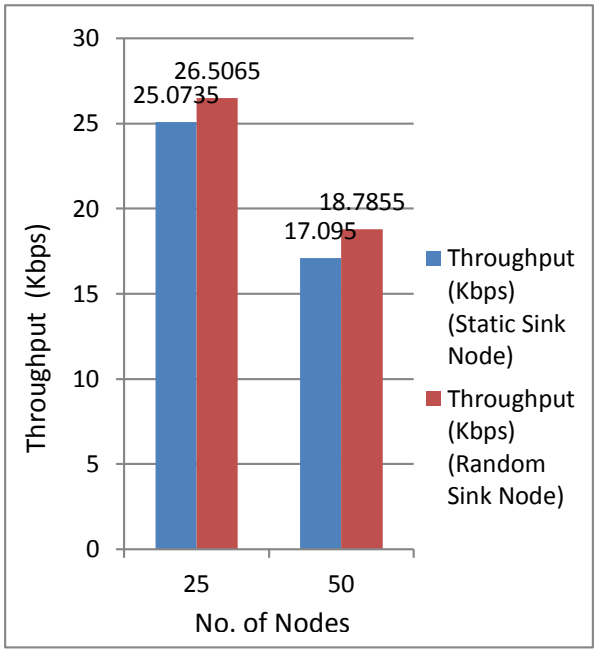


Figure 4.2: Throughput

Figure 4.2 shows that Throughput of network by AOMDV with static sink node is 25.0735 Kilo bits per second (Kbps) and Throughput of network by AOMDV with arbitrary sink node is 26.5065 for 25 nodes, Throughput of network by AOMDV with static sink node is 17.095 and Throughput of network by AOMDV with random sink node is 18.7855 for 50 nodes.

TABLE: 4.3 PACKET DELIVERY RATIO

No of Nodes	25	50
Static Sink Node	94.59	91
Random Sink Node	100	100

Figure 4.3 shows that Packet Delivery Ratio by AOMDV with stationary sink node is 94.59% and Packet Delivery Ratio by AOMDV with arbitrary sink node is 100.00% for 25 nodes, Packet Delivery Ratio by AOMDV with static sink node is 91.00% and Packet Delivery Ratio by AOMDV with arbitrary sink node is 100.00% for 50 nodes.

TABLE: 4.4 CONSUMED ENERGY

No of Nodes	25	50
Static Sink Node	259.513	519.406
Random Sink Node	253.395	511.172

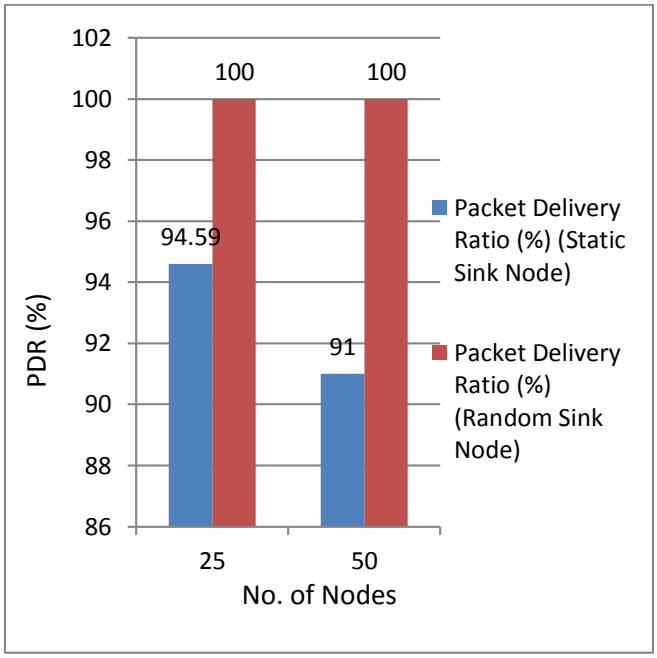


Figure 4.3: Packet Delivery Ratio (PDR)

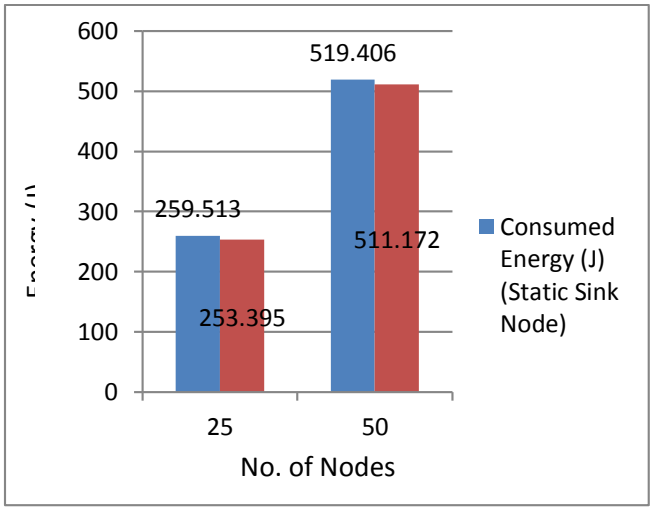


Figure 4.4: Utilized Energy

Figure 4.4 shows that Utilized Energy by AOMDV with static sink node is 259.513 Joule (J) and utilized Energy by AOMDV with arbitrary sink node is 253.395(J) for 25 nodes, Utilized Energy by AOMDV with static sink node is 519.406 (J) and utilized Energy by AOMDV with arbitrary sink node is511.172 (J) for 50 nodes.

V. CONCLUSION

Wireless sensor networks have many applications to detect and collect information on the climate, natural disaster and to observe patients. One major problem in WSNs is saving energy. Sensor hubs are with restricted battery power and it is

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generally hard to recharge them, thus it is not an easy job to spare energy. When WSNs are introduced in forceful areas where human contact is limited and reviving or swapping remote hubs is unreasonable in such circumstances, procedures to limit control utilization so as to draw out system lifetime is vital.

Simulation based results show that PDR and throughput both are improved in the case of mobile sink node, 5.72% in 25 nodes and 9.89% in 50 nodes. Average Delay is reduced, which is again an improvement. It is decreased by 96.48% in 25 nodes scenario and 93.19% in 50 nodes scenario. Energy Consumption is also reduced in the case of mobile sink node, 2.36% in 25 nodes and 1.59% in 50 nodes.

In view of our expansive recreations, we see that when sink hub moves, it has most noteworthy execution in term of system lifetime, littler E2E delay, higher PDR and throughput. In the close by future, we will stretch our recreation by taking into consideration numerous portable sinks just as other system measurements, for example latency and so forth.

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Experimental Study on Movement of Crankshaft During Machining



Sunil Pal and Surendra Kumar Saini

1 Introduction

To enhance the productivity of a small-scale industry that manufacture crankshaft for Eicher Tractor, the DMAIC technique is used to identify the problems with the help of flow process and basic observations in terms of material movement and rate of production. In order to achieve required mechanical properties, most of crankshafts for automobile are forged with micro alloyed steel. Usually, the shapes of crankshafts are complex [1, 2]. Forged crankshaft passes through a number of processes and thus prepared a finished crankshaft as per the desired dimensions and design. Subharaj et al. [3] developed a sustainable ecodesign for crankshaft speed sensor assembly line. Li et al. [4] developed a mathematical model to optimize the conventional layout and scheduling (i.e., multi-row workshop layout and flexible job shop scheduling) for crankshaft. Their objective of study was to develop the green manufacturing environment for shipbuilding industry. Rehman et al. [5] employed lean technique to decline the manufacturing waste for productivity improvement.

Jamwal et al. [6] improved productivity of caravan using continuous improvement method. They simulate the entire process and validated to enhance the product life cycle. Ou et al. [7] proposed industry 4.0 applications such as data analytics and cloud technology to upgrade smart manufacturing of automotive crankshaft. Lee [8] studied effectiveness of Internet of things, cloud environment to support the cyber manufacturing. He reveled that these tools have capability to detect real-time changes in ongoing process in advanced industries. Diverse optimization techniques have studied and fuzzy and Taguchi methodology used for elect the optimum parameters for computer numerical control machining of steel [9–12]. Jamwal et al. [13] implemented lean manufacturing technique to obtain zero wastes in small-scale

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industry. The purpose of the present study is to reduce the material movement. The time required in transportation and handling is also needed to reduce by suitable modifications in the present process.

2 Material and Methods

Forged crankshaft is machined at "SWATI INDIA PRIVATE LIMITED" Alwar, Rajasthan. Different machining operations performed on the forged crankshafts. It is used in single cylinder of Eicher Engines. The work study examines the work process and eliminates nonproductive processes, which can reduce the number of process, space utilization, and production and operation time. The data that needs to be carried out in this work is flow process of the work, details of each process, distance traveled by the work piece for specific process, number of crankshafts that can be produced in specific time. To improve the productivity, either input is reduced for same output or output is increased with same input resources.

Method study concerned with the way in which work is carried out and used for finding better ways of doing work. It is a procedure for cost reduction. An incredible accept of method study is that there is always a better way for doing a task. The unique thing of method study is that it is a step-by-step process for improvements of methods of work. It proceeds to the collection and recording of the facts, identification of the problem and finally suggested solution. Method study involves Select, Record, Examine, Develop, Define, Install, and Maintain [6]. Plant layout is the most effective physical arrangement, either existing or in plans of industrial facilities, i.e., arrangement of machines, processing equipment, and service department to achieve greatest co-ordination and efficiency of resources.

3 Results and Discussion

Present process is observed in working industry. Distance travel and cycle time are elected for improvement in present process. Cycle time is observed 92.73 min using stop watch with present layout. The total flow of work piece within the unit for machining at various stations is observed as 6574 inches horizontal and 365 inches vertical. To conduct different operations on work, movement of work is done manually. A trolley is used to transport large amount of material in initial stages of machining. By applying method study, the complete movement of work piece is observed moving from one work station to other. There are many point observed in this study where movement of the work piece is very large, and required serious effort to reduce. For this, few alterations are suggested and implemented, so that the flow of work piece is in one direction and back tracking and queuing are also avoided.

In order to reduce the movement of work piece between the work stations, some alterations are applied in the present layout. Initial step of centering-facing is performed on the lathe. Then, it is used to shift in the successive machining shed along with the raw material place. Hence, flow of the material is uni-directional and avoids excess movement of the work piece. The stock of raw material in its new place has one more advantage. Unloading of the work pieces from the truck becomes easier and lesser distance required to travel in order to place it in its desired place. In the initial phase, the distance travel by the work piece is 598 in. horizontally which are reduced to 199 in. by implementing the alteration. Thus, material movement is reduced in the first step.

By shifting the grinding machine, a large effect is observed with the material movement. This results in the accordance of the group technology as the similar processes are performed in the particular area or premises. The distance travel by the work piece before the alteration is 635 in. horizontally and after the alteration is 560 in.

By changing the sequence of buffing and lapping operation, the motion of material is reduced. If lapping and then pin buffing are performed, the material flow is 267 in. horizontal, and if the process is reversed, i.e., if pin buffing and then lapping is applied, the motion of the work piece is observed as 96 in. horizontally keeping the vertical movement same in both the case, and then, no need to mention it separately.

These improvements are implemented because of the observations of present data being recorded and analyzed. Various bottlenecks are observed and efforts are made to eliminate or to reduce them up to a great extent.

The material handling process need to be improved as it required a large amount of material flow manually, and the time required for this process is very high which directly affects the productivity. By doing this, the labor requirement as well as the queued time by the machine tools is reduced in many of the work stations. This helps in the cost reduction of the process.

4 Conclusions

Modified horizontal and vertical distance traveled by work piece is measured. It is found that traveled distance is reduced by 809 in. in horizontal and 128 in. in vertical. These modifications directly affect the cost of the machining system which is reduced to a great extent thus productivity are improved. The cost of machining in present process is Rs. 211.15, and after implementing the modifications, this cost is reduced to Rs. 196.19.

Acknowledgements Thanks to SWATI INDIA PRIVATE LIMITED Alwar, Rajasthan (India) for extending their facilities to conduct this study. Also thanks to Poornima College of Engineering Jaipur for support and guidance.

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Optimization of EDM Process Parameters for Machining of Steel



Rajesh Kumar Mohanty and Surendra Kumar Saini

1 Introduction

Materials like hard steels, composites, carbides and super alloys find applications in distinct types of industries such as nuclear, tool and die making, aerospace and biomedical, etc. [1]. However, machining of these materials is grim with conventional machining methods. Researchers are exploring the capability of advanced machining processes to machine such materials. Electrical discharge machining process is widely used machining process to machine such materials. In electrical discharge machining process, the metal removal takes place by electric spark or in other words metal erosion takes place because of the electric spark. Here, in this process, the electric spark formed between two electrodes is used to erode material from work piece. The shape of the tool is an actual replica of the shape that is to be produced in the work piece [2]. A high pulsating electric charge of high density is being given to the work piece through the electrode. So there is a continuous erosion of metal which occurs in work piece at a controlled rate [3]. Molineti et al. [4] studied the influence of manganese and silicone powders in two different concentrations of dielectric, while study of EDM on AISI H13 too steel.

They investigated hardness, surface roughness, microstructure and chemical composition. They found surface hardness five times better in comparison of conventional EDM. They concluded that powder suspended in the dielectric was responsible for surface quality improvement. EDM on Inconel X-750 was performed by Pratap et al. [5], and they optimized process parameters. The input parameters are pulse duration, peak current and voltage while the quality responses are material removal rate and surface roughness. The optimum values for parameters such as depth of cut, feed and cutting speed elected for machining of metals using hybrid

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optimization techniques. They also reviewed different techniques of optimization used for machining parameters optimizations [6–9]. Wire electrochemical discharge machining (WECDM) on quartz was investigated by Kumar et al. [10]. They found WECDM has enormous scope to machine hard and brittle materials. They used WECDM process which is basically a combination of ECM and wire EDM and so combines the characteristics of both processes. Taguchi orthogonal array and ANOVA were being used to find the optimum factors and their significant influence on response parameters.

Kumar et al. [11] performed EDM on Inconel 706. They investigated the EDM of Inconel-706 by using a hybrid magnetic field assisted powder mixed process. They observed that by increasing peak current and pulse on time results into a rough surface because of presence of microholes. Machining of aluminum-based SIC reinforced composite was performed using EDM by Nayim et al. [12]. The input parameters are pulse on/off duration and current while response parameters were material erosion rate, microhardness, and surface roughness and recast layer thickness. They observed a higher surface finish with higher pulse off time and lower peak current. In present research work electric discharge machining on steel H13 with copper tool performed. Experimental values are measured and analyzed. Signal-to-noise ratios which are associated with the observed values were determined. Factors that affect the most on response were found out using MINITAB software.

2 Experimentations

Orthogonal array is used to perform EDM experiments on steel (grade H 13). Copper made tool used as electrode and make positive polarity. Photograph of machining setup (EDM with work material) is shown in Fig. 1. Electrode thickness is taken with two levels while pulse on time and current is taken with three levels (Table 1). Orthogonal array (L18) design is used to perform the EDM experiments on H 13 steel (Table 2). Weight of the work piece and tool measured using precision weighing machine. Image of machined work is shown in Fig. 2.

3 Optimization

Equation 1 used to calculate single to noise (S/N) ratio for considered response, i.e., MRR (using larger is better). Table 3 shows the mean values of S/N ratio.

$$\mathrm{S/N} = -10 \log 10 \,(\mathrm{M.S.D}) \tag{1}$$

where, M.S.D. = Mean square deviation.



Fig. 1 Photograph of die sinker EDM

Table 1 Variables with level

Variables	Unit	Levels		
		1	2	3
Electrode thickness (A)	mm	5.2	6.2	–
Discharge current (B)	A	1	3	5
Spark/pulse on time (C)	μs	200	300	400

ANOVA for the factors is shown in Table 4. From Table 4, it can be found out that spark on time is the most important factor. The next is electrode thickness and last is discharge current. Main effects of parameters on MRR are shown in Fig. 3. Mean ratio of S/N of MRR is shown in Fig. 4. Optimum level of process parameters for MRR is electrode thickness ($B2 = 6.2$ mm), discharge current ($B3 = 5$ A) and spark time ($C1 = 200$ μs) as shown in Fig. 3.

4 Conclusion

Machining of tool steel (grade H-13) by EDM with copper electrode done successfully. Following inference are found from present study.

- The machining parameters selected are pulse on time, discharge current and thickness of the tool. Orthogonal array L18 used to performed experiments and response

Table 2 Experiment design matrix

S. No.	*A*	*B*	*C*
1	5.2	1	200
2	5.2	1	300
3	5.2	1	400
4	5.2	3	200
5	5.2	3	300
6	5.2	3	400
7	5.2	5	200
8	5.2	5	300
9	5.2	5	400
10	6.2	1	200
11	6.2	1	300
12	6.2	1	400
13	6.2	3	200
14	6.2	3	300
15	6.2	3	400
16	6.2	5	200
17	6.2	5	300
18	6.2	5	400



Fig. 2 Image of machined work piece

Table 3 Mean (S/N) ratio for MRR

Parameters	Level 1	Level 2	Level 3
Electrode thickness (*A*)	*A*1 = 11.93	A2 = 19.767	–
Discharge current (*B*)	*B*1 = 10.654	*B*2 = 17.169	B3 = 19.722
Spark on time (C)	C1 = 21.142	*C*2 = 15.842	*C*3 = 10.561

Table 4 ANOVA results for MRR

Parameters	DOF	SS	MS	F_0 = (MS/MS error)	Contribution (%)
Electrode thickness (*A*)	1	276.5	276.5	51.04	29.43
Discharge current (*B*)	2	262.19	130.10	24.017	27.9
Spark on time (*C*)	2	335.878	167.939	31.002	35.75
Error	12	65	5.417		6.92
Total	17	939.568			100

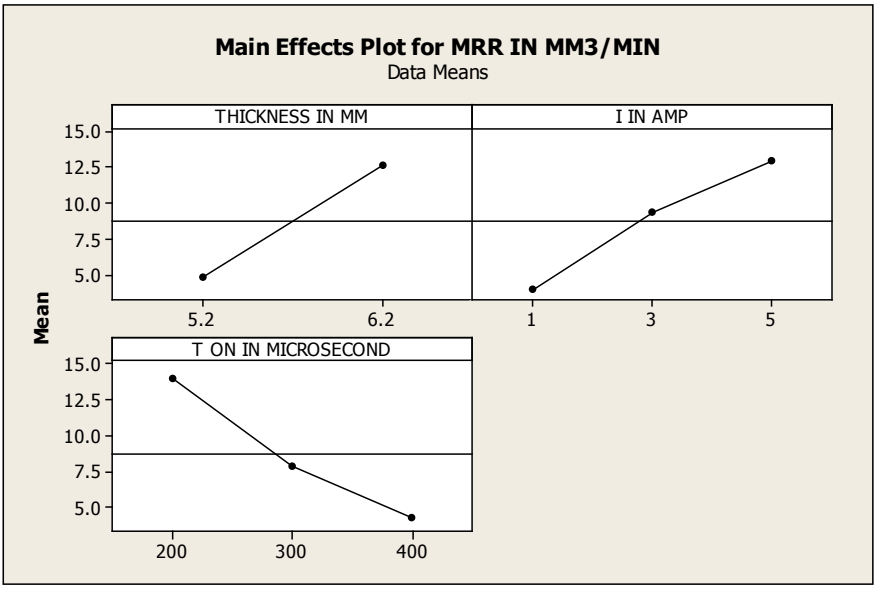
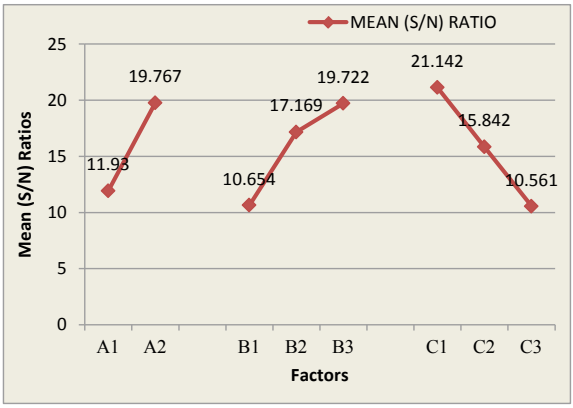


Fig. 3 Main effect plot for MRR

Fig. 4 Graph for mean (S/N) ratio for MRR



material removal rate taken. Optimization of process parameters for EDM of H13 steel done.

- Pulse on time is influencing parameter then electrode thickness and the last is discharge current for elected response.
- Optimum level of process parameters for MRR are electrothickness (6.2 mm), discharge current (5 A) and spark time (200 μs).

Acknowledgements Thanks to PMC, Ghaziabad Utter Pradesh (India), for extending their facilities to conduct this study. Authors also thank to Poornima College of Engineering Jaipur for support and guidance.

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Study of Hardness in Sand Casting of SG Iron



Abhishek Mukhija and Surendra Kumar Saini

1 Introduction

Manufacturing processes play a significant role in manufacturing industries [1–4]. Casting is one of the essential procedures for manufacturing of automotive parts, space craft components, jewelry and ornaments [5]. Casting of components is a common activity, but quality of sand casted parts hampered mainly due to different defects like misrun, cold shut, blowhole, sand inclusion, shrinkage, etc. Each and every step in the sand molding process is very critical for production of good-quality castings. Therefore, the best possible characterization and distinguishing proof of a specific defect is the fundamental essential to address and control quality of casting. A standard quality management methodology has to be designed to achieve the optimum quality improvement through better control on the process. Patil et al. [6] observed that the improper control of different factor involved in casting practice leads to the defects in the casting and resulted in the imperfection. Siddaling Swami et al. [7] found that it was extremely hard to create castings without defects.

The optimum values of casting process parameters obtained using conventional and artificial intelligence-based techniques [8, 9]. Achamyeleh et al. [10] stated that Pareto chart is an exceptional kind of visual diagram that can be utilized to demonstrate the general recurrence of various problems. Sama and Manogharan [11] did experimental and numerical study for printing and sand casting of impeller part. Kuo et al. [12] did sand casting of stainless steel and studied the various defects. The motivation behind present research work is to diminishing of the casting defect and enhance production yield. Spheroidal graphite iron (i.e., ductile cast iron) is a sort of cast iron incorporates automotive components, impellers, agricultural equipment, machineries, etc. Objective of the present research paper is to control hardness variation in sand casted parts of spheroidal graphite iron using bar chart.

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Fig. 1 Photograph of sand casted part of spheroidal graphite iron

2 Experimentation

Sand casting is old process of manufacturing metallic components for different applications. The mold is prepared with green sand (75–85%), water (2–4%), bentonite clay (5–11%), and remaining (3–5%). Casting of spheroidal graphite (SG) iron has been done at Hariom Precision Alloys (Private Limited) at Alwar, Rajasthan, as shown in Fig. 1. Hardness along length of casted parts has been measured at different position. Hardness is defined as the ability of a material to resist plastic deformation, usually by indentation. The SG iron is good material for metal castings due to its specific characteristics. However, microstructure, hardness and chemical composition variation cause metallurgical defects into sand casted parts. The lower and upper hardness values are found less than 207 brinell hardness number (BHN) and greater than 262 BHN, respectively. Hence, parts found out of specified ranges, i.e., 207–262 BHN, have been rejected.

3 Results and Analysis

Table 1 shows the experimental results (part rejection data of three months, i.e., January, February and March). Bar charts are used to analyze casting defect in casted parts. The purpose of using bar chart is to identify the number of rejections due to corresponding factors. Different responsible defects for casting rejection of three months are shown by Figs. 2, 3 and 4. The possible defects, i.e., sand drop, swelling, slag, shifting, cold metal, mold break and hardness, are presented in sand casted parts of SG iron. Maximum rejection 16.69% is found in month of February followed by 15.37% and 14.54% in March and January, respectively. Hardness variations are high compared to other defects in casted parts as shown in Figs. 2, 3 and 4. The sand casted parts are divided into groups—one lower hardness and other higher hardness. Further to control hardness variation within specified ranges, i.e., 207–262 HBN. The percentage of copper in the chemical composition of cast materials has

Table 1 Summary of rejected parts

Month	Quantity	Rejection quantity	Total rejection (%)
January	2125	309	14.54
February	2642	441	16.69
March	3142	483	15.37

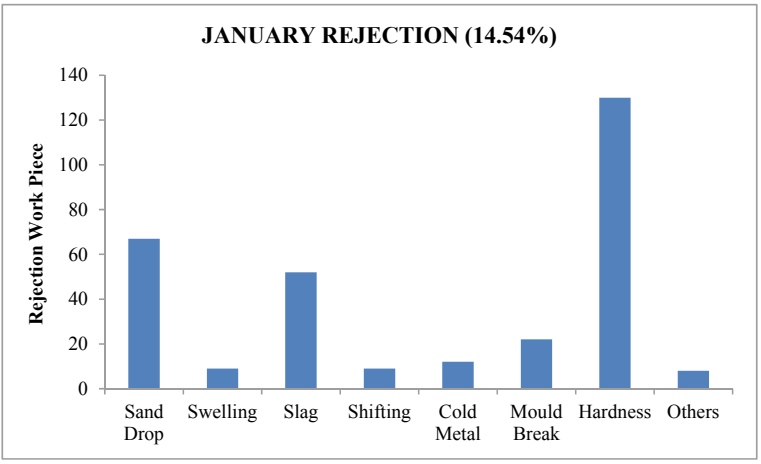


Fig. 2 Bar chart showing the rejection components in the month of January

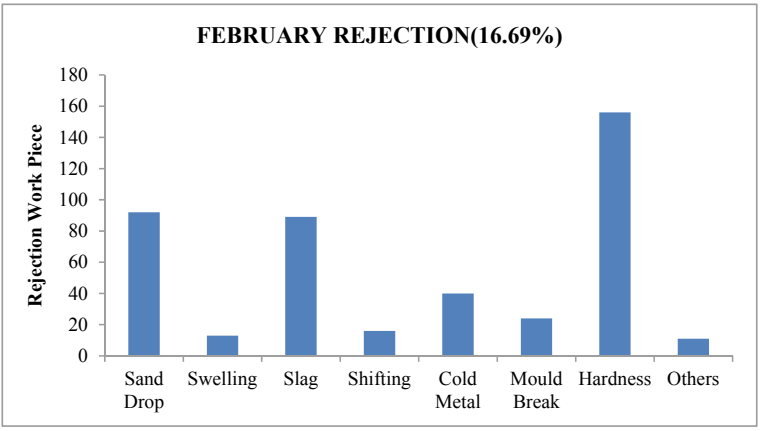


Fig. 3 Bar chart showing the rejection components in the month of February

increased from 0.047 to 0.327%, while rest silicon (2.25%) and phosphorus (0.02%) kept constant. Then, it is found that hardness variation was reduced up to 16% in sand casted parts.

4 Conclusion

Study of different defects on sand casted of SG iron has done successfully. The major rejection of SG iron sand casted parts was due to high hardness variation in

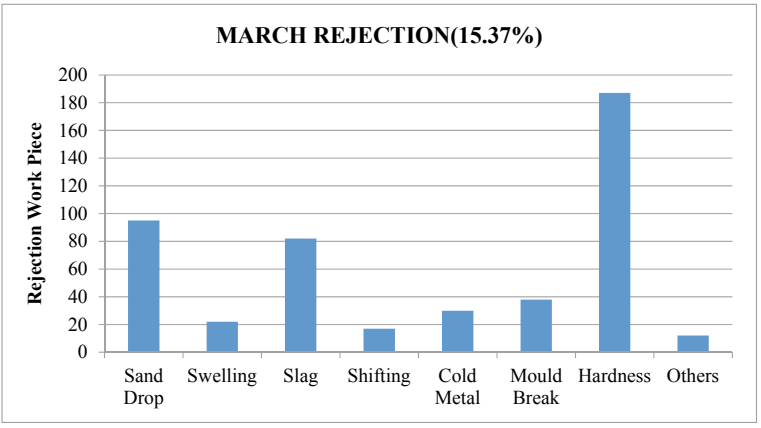


Fig. 4 Bar chart showing the rejection components in the month of March

compared to other defects. Further control in hardness variation has been done by increasing the percentage of copper from 0.047% to 0.327%, while silicon (2.25%) and phosphorus (0.02%) kept constant in the chemical composition of cast material. It is observed that hardness variation was reduced up to 16% by increase of copper.

Acknowledgements Authors are indebted to Shri T. C. Vishwakarma, Managing Director of Hariom Precision Alloys (P) Ltd., and their staffs for extending experimental facilities. Thanks also goes to PCE Jaipur, for their support.

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Chapter 6
CNC Turning Process Parameters Optimization for Stainless Steel



Surendra Kumar Saini and Prashant Kumar

1 Introduction

Computer numerical control (CNC) lathe is acting a major role in manufacturing industries [1–3]. Optimum value of turning process parameters for different engineering materials has obtained using statistical and artificial intelligence techniques. Many researchers have reported their work based on CNC turning of different work materials and study of optimum process parameters [4–6]. Asilturk [7] used an artificial neural network for modeling of surface characteristics of turning steel. Munawar [8] investigated surface characteristics during turning of steel. He revealed that surface characteristics of turn work material rely on cutting tool nose radius. Qinge et al. [9] optimized energy-efficient turning parameters using heuristic techniques. They used data mining and fuzzy logic techniques to obtained optimum specific power consumption. It has concluded that simulation and experimental result are found in the agreement. Riadh et al. [10] performed turning on cobalt alloy (stellite 6) to study significant parameters on tangential force, material removal rate, and surface roughness. They used Pareto analysis to validate the analysis of variance result. Tamizharasan et al. [11] studied chip thickness ratio during CNC turning of aluminum composite. Turning on work material were conducted using Taguchi methodology. They revealed that cutting speed has 65% influence on chip thickness. Palanisamy et al. [12] applied Taguchi orthogonal array during turning of Incoloy superalloy. They measured micro-hardness and surface and material characteristics of work material. Ngoc et al. [13] applied hybrid optimization method (Taguchi-adaptive neuro-fuzzy inference system and

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teaching–learning-based optimization) to investigate optimum process parameters during turning of carbon steel. They revealed that mentioned optimization techniques were found robust for parameters optimization. In the present research work, CNC turning operation on AISI 304 stainless steel has been performed using L_{27} Taguchi orthogonal arrays. Effect of CNC turning parameters (i.e., spindle speed, feed, and depth of cut) is analyzed for surface roughness (SR). The optimum set of process parameters has been obtained using Taguchi and analysis of variance (ANOVA) approaches. Optimum study revealed that surface roughness is influenced by feed than other parameters. The aim of the present study is to obtain optimum values of the CNC process parameter for surface roughness of AISI 304 stainless steel.

2 Experimentation

AISI 304 stainless steel is chosen as work material due to it has wide application like food process equipments in chemical containers, threaded fasteners and springs, refinery equipments, architectural trim, marine equipments, sanitary fittings, cryogenic vessels, coal hopper, etc. Table 1 represents the chemical composition and physical properties of work material.

Three input parameters, viz., spindle speed (SS), feed, and depth of cut (DOC), and their levels are shown in Table 2. In the present work, total numbers of experiments have been designed using orthogonal array. Later, turning operations (experiments) have been performed on work material using CNC turning machine (model = CNC Turn 250). Coated carbide cutting tool has been used for turning of work material as shown in Fig. 1.

Table 1 Chemical composition and physical properties of work material

Chemical composition								
C	Si	Mn	P	S	Cr	Ni	N	Fe
0.08	1.0	2.0	0.045	0.03	18–20	8–11	0.1	74
Physical properties								
Density(Kg/m^3)							8500	
Tensile strength (MPa)							124	
Melting point temperature (°C)							885	
Thermal conductivity(W/m-k)							116	

Table 2 Levels of process parameters

Input parameters	Levels		
	i	ii	iii
SS (RPM)	1400	1600	1800
Feed (mm/rev)	0.08	0.14	0.2
DOC (mm)	0.4	0.8	1.2



Fig. 1 Selected coated cutting tool insert and tool holder

3 Optimization and Result Analysis

Minimum surface roughness is always desired on CNC turned workpiece. Therefore, smaller is better type quality characteristic used to evaluate the signal to noise (S/N) ratio. Later, S/N values determined the order of optimum parameters. Taguchi quality characteristics and ANOVA are both robust statistical approaches. ANOVA tool is used to analyzing the experimental results [9]. Generally, ANOVA consists of components like sums of squares, degrees of freedom, error variance, F-test, and percent contribution. The experimental data obtained after turning operation is present in Table 3 corresponding to experimental run. Table 4 shows the response of input process parameters for considered characteristics, i.e., surface roughness.

ANOVA is used to validate the effect of input parameters on considered response (i.e., surface roughness) as shown in Table 4. ANOVA analysis has been performed at the 95% confidence level [14]. Table 5 shows the computed result of ANOVA for response parameter. From Table 5, F-value indicates that the highest value of parameter has more effect on response parameter. From the ANOVA analysis, feed found as significant parameter followed by DOC and SS for surface roughness as depicted in Table 5. This validates the results obtained using Taguchi method-based optimization. Figure 2 shows the effect of input parameters on

Table 3 Matrix of orthogonal array and their corresponding surface roughness

Exp. No.	Input parameters			Response variable	
	SS (rpm)	Feed (mm/rev)	DOC (mm)	SR (Ra) (μm)	SNR (Ra) (dB)
1	1400	0.08	0.4	5.28	−14.452
2	1400	0.08	0.8	6.42	−16.150
3	1400	0.08	1.2	3.70	−11.364
4	1400	0.14	0.4	2.34	−7.384
5	1400	0.14	0.8	2.85	−9.096
6	1400	0.14	1.2	3.33	−10.448
7	1400	0.20	0.4	3.66	−11.269
8	1400	0.20	0.8	4.37	−12.809
9	1400	0.20	1.2	5.07	−14.100
10	1600	0.08	0.4	1.55	−3.806
11	1600	0.08	0.8	1.59	−4.027
12	1600	0.08	1.2	1.70	−4.606
13	1600	0.14	0.4	2.99	−9.513
14	1600	0.14	0.8	3.27	−10.291
15	1600	0.14	1.2	3.39	−10.604
16	1600	0.20	0.4	4.61	−13.274
17	1600	0.20	0.8	4.82	−13.660
18	1600	0.20	1.2	5.17	−14.269
19	1800	0.08	0.4	1.19	−1.510
20	1800	0.08	0.8	1.27	−2.076
21	1800	0.08	1.2	1.16	−1.289
22	1800	0.14	0.4	2.95	−9.396
23	1800	0.14	0.8	3.17	−10.021
24	1800	0.14	1.2	3.11	−9.855
25	1800	0.20	0.4	4.13	−12.319
26	1800	0.20	0.8	4.24	−12.547
27	1800	0.20	1.2	4.39	−12.849

Table 4 Optimum values of input parameters for response

Levels	Surface roughness		
	SS (rpm)	Feed (mm/rev)	DOC (mm)
i	−11.897	−6.587	−9.214
ii	−9.340	−9.623	−10.076
iii	−7.985	−13.011	−9.932
Delta	3.912	6.424	0.862
Rank	2	1	3

Table 5 ANOVA result of surface roughness

Independent parameter	DOF	SS	MS	F-value
SS	2	7.5994	3.7997	12.16
Feed	2	16.9872	8.4936	27.18
DOC	2	0.6383	0.3191	1.02
SS × Feed	4	21.2316	5.3079	16.98
Feed × DOC	4	1.8401	0.4600	1.47
SS × DOC	4	0.5599	0.1400	0.45
Error	8	2.5002	0.3125	
Total	26	51.3568		
S = 0.5590, R-Sq = 95.13%, R-Sq (adj) = 84.18%				

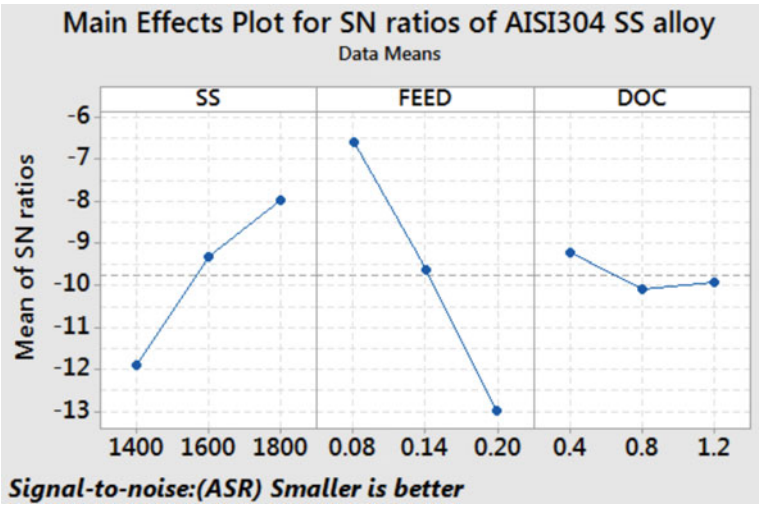


Fig. 2 Main effect plot for SR for AISI 304 SS alloy

considered response. Spindle speed increases surface roughness decreased while when feed increases surface roughness increased, drastically. Depth of cut has minimum effects on surface roughness.

4 Conclusion

Orthogonal array experimental design has been used for conduct the CNC turning operation on AISI 304 stainless steel. The effect of input parameter was optimized using ANOVA approach at 95% confidence level. This paper revealed that feed is

the significant parameter for surface roughness of work material. Least effect was found of depth of cut on CNC turning of work material.

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Chapter 25
Optimization for Sand Casting of SG Iron



Abhishek Mukhija and Surendra Kumar Saini

1 Introduction

Manufacturing processes play a significant role in manufacturing industries [1–4]. Casting is one of the essential process for manufacturing of automotive parts, space craft components, jewelry, and ornaments [5]. The motivation behind present research work is to diminishing of the casting defect and enhance production yield. Casting of mechanical components is a common activity, but quality of sand-casted parts is hampered mainly due to different defects. Each and every step in the sand molding process is very critical for production of good quality castings. Therefore, the best possible characterization and distinguish proof of a specific defect is the fundamental essential to address and control quality of casting. A standard quality management methodology has to be designed to achieve the optimum quality improvement through better control on the process. Patil et al. [6] observed that the improper control on different factor involved in casting practice leads to the defects in the casting and resulted in the imperfection. Siddaling Swami et al. [7] found that it was extremely hard to create defect-free castings. Different optimization techniques were used for optimization of parameters [8, 9]. Achamyeleh et al. [10] observed that Pareto chart is an exceptional kind of visual diagram that can be utilized to demonstrate the general recurrence of various problems. Soinski and Derda [11] experiences that ductile iron possesses high mechanical properties due to nodularity. Lekakh and Richards [12] observed that inclusion of pearlite in the matrix gives significant mechanical properties (i.e., strength and hardness). Gonzaga et al. [13] found that high hardness is not advantageous if material is under

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effect of the brittleness. But if material is under abrasion, high hardness is prescribed. Sama and Manogharan [14] studied integration of three-dimensional printing and sand casting. Kuo et al. [15] used nondestructive method to identify the casting defects in stainless steel. Prabhakar et al. [16] did simulation of solidification and melt flow for sand casting of lead sheet using computational fluid dynamic method. Preliminary literature review revealed that study of hardness variation during sand casting of spheroidal graphite (SG) iron have seldom found. Though SG iron (i.e., ductile cast iron) is a sort of cast iron, possess wide applications such as automotive components, impellers, agricultural equipment's, and machineries. Defect in sand-casted SG iron is variation of casting from its root specification. The variation of hardness values from the specified limit is identified as major sand-casting defect in SG iron. Therefore, objective of the present study is to control the hardness variation in SG iron during sand-casting process. Thus percentage of copper, silicon, and phosphorus has been varied in chemical composition of SG iron. Selection of optimum control parameters has been chosen using Taguchi methodology.

2 Experimentation

In sand castings, green sand molds are employed. The moisture presents in the sand push the sand particles to stick together when making molds blended with the clay. Bentonite clay, an absorbent aluminum phyllosilicate, and the sand combined to give the solid mold. The general composition of green sand is sand = 75-85%, bentonite clay = 5–11%, water = 2–4% and remaining = 3–5%. The procedure of sand casting is considered as one of the earliest procedure of manufacturing metallic parts. Sand castings of SG iron have been performed using L_8 orthogonal array at Hariom Precision Alloys (Private Limited) at Alwar, Rajasthan. Sand-casting process involves the pattern making, mold making, metal pouring, and shake out. Each and every steps in the sand molding process is very critical for production of good quality castings. Hardness of casted parts has been measured for the analysis. Hardness is defined as the ability of a material to resist plastic deformation, usually by indentation. Ductile iron is good material for metal castings due to its specific characteristics. However, microstructure and hardness variation of the chemical composition cause metallurgical defects in sand-casted parts. Thus, using orthogonal array, sand casting of SG iron have been done. In present research work, copper, silicon, and phosphorus have been taken as input control parameters and hardness of casted parts taken as response. Levels of selected control parameters are given in Table 1. Table 2 shows the measured values of hardness against experimental runs.

Table 1 Levels of control parameters

Control parameters (%)	Levels	
	I	II
Copper	0.047	0.327
Silicon	2.248	2.252
Phosphorus	0.022	0.023

Table 2 Hardness values corresponding to experimental runs

Sr. no.	Parameters (%)			Response
	Copper	Silicon	Phosphorus	Hardness
1	0.047	2.248	0.022	130
2	0.047	2.248	0.023	156
3	0.047	2.252	0.022	187
4	0.047	2.252	0.023	196
5	0.327	2.248	0.022	262
6	0.327	2.248	0.023	265
7	0.327	2.252	0.022	270
8	0.327	2.252	0.023	276

3 Optimization and Analysis

Using signal-to-noise (S/N) ratio analysis, significant control parameter is obtained. It means which control parameter has more influence on hardness of cast parts. Table 3 shows the optimization result for considered output (i.e., hardness). In Table 3, rank 1, 2, and 3 shows the order of significant control parameters. It means copper is significant control factor followed by silicon and phosphorus. Further analysis of variance (ANOVA) has also been performed to verify the order of significant control parameters. In Table 4, F-value represent that copper has more value followed by silicon and phosphorus. Hence, from Tables 3 and 4, it may be concluded that copper is significant control parameters for response parameter (i.e., hardness). Figure 1 shows the effect of cooper, silicon, and phosphorus on S/N ratio value of hardness of sand-casted part of SG iron. Percentage of copper varies from 0.047 to 0.327. Hence, signal-to-noise ratio of hardness is linearly increased. It is contrary in case of silicon and phosphorus. The fact is that copper is a pearlite promoter which improves the hardness values and minimizes the rejection. Also, copper reduces the ferrite content for pearlite development which improves strength and hardness through better pearlite formation. Second reason is that cooling rate relies upon the casting cross-sectional size. The thicker part has a more drawn out solidification time than the ones arranged at the leaner parts. Quick cooling rates related with thin sections support pearlite development, while slow cooling rates strengthen ferrite development which influences mechanical property and leads reduced hardness values.

Table 3 Optimization result

Levels	Copper	Silicon	Phosphorus
1	44.36	45.74	46.18
2	48.57	47.18	46.75
Delta	4.21	1.44	0.57
Rank	1	2	3

Table 4 ANOVA result

Source	DF	Seq. SS	Adj. SS	Adj. MS	F	P
Regression	3	22326.0	22326.0	7442.0	32.37	0.0028
Copper	1	20402.0	20402.0	20402.0	88.75	0.0007
Silicon	1	1682.0	1682.0	1682.0	7.317	0.0538
Phosphorus	1	242.0	242.0	242.0	1.052	0.3628
Error	4	919.5	919.5	229.9		
Total	7	23245.5				

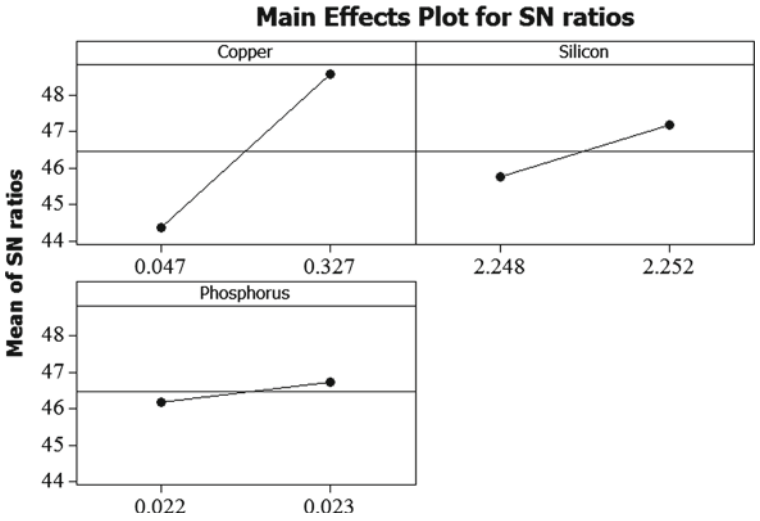


Fig. 1 Main effect plot for S/N ratio

4 Conclusion

Sand casting of SG iron have been done using orthogonal array experiment design methodology. Following conclusions are drawn from present work:

- Variation of hardness in sand-casted parts has identified as the major issue for the sand-cast SG iron rejection.

- Optimum control factor is selected using Taguchi and ANOVA method.
- Copper found as a significant control parameter followed by silicon and phosphorus on hardness of sand-casted parts of SG iron.
- High value (within ranges) of copper percentage is recommended to control the hardness variation in casted parts.

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An Elderly Fall Detection System Using Depth Images

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***Abstract*— In this proposed conceptual technique, we have collected the Microsoft Kinect depth images of elderly fall event. After collecting the necessary depth images the background subtraction algorithm has been used to subtract the background and retain the subject. Segmentation and feature selection process have been applied on various daily activity to train the fall detection model. The model has been train using decision tree. To ensure the fall confidence, ground truthing technique has been used.**

Keywords*— Elderly Fall Detection, Decision Tree, Computer Vision, Kinect

I. INTRODUCTION

As per World Health Organization (WHO), the aging is the major issue in among the old age people. It is estimated that one out of every three old age adult fall every year especially, those who have the age of 60 and above [**1**]. The number of elderly people above the age of 60 years is rapidly increasing especially in India. India is the second most populous country in the world that has approx. 1.36 billion people estimated in 2020. Whereas, 109 million people are over the age of 60 that is approx. 8% of total population and it is estimated that it will increase up to 20% till the year 2050 [**2**].

The major area of concern is the physical health of the elderly people. Recurrent fall is one of the major problem of the elderly people as they have inability to get up early and lying of prolonged period of time on floor due to sudden fall can lead serious health issues [**3**]. Elderly people especially who are living alone are in more risk as compared to others.

Recurrent fall of elderly people required medical assistance every time that can impact directly on their financial condition. There is immediately requirement of low cost automatic elderly fall detection system that could help to get assistance on time after fall. Many extensive methods have been applied for automatic fall detection among the elderly people [**4-5]**.

Some of them are wearable devices that are worked on sensors like accelerometer and some of them allow elderly people to manually operate the wearable devices when any incident of fall happened **[6-9]**. Wearable devices are insensitive to the environment and required periodic maintenance like batteries replacement or recharge which is some time forgotten by elderly people. The other disadvantage is to cause inconvenience in daily activity. Research studies indicate that elderly people are not prefer wearable devices instead they prefer non-wearable devices **[10].**

Number of researchers has also suggested the environmentally mounted sensors for elderly fall detection. They have used ambient devices such as vibration sensors, sound sensors, infrared motion sensors, pressure sensors, video based sensors, including traditional cameras and depth cameras in multiple place of room to record daily activity of elderly people. Recorded activity further processed to detect elderly fall and significant alarm provided without delay **[11-14].**

Using multiple devices significantly increase the cost of solution and putting many sensors in a room could bring health issues for elderly people. Another major issues with tradition video sensor is the breach in the privacy of the elderly people. However, researchers have been suggested that vision based environmentally mounted sensors are helpful by using appropriate privacy preserving techniques **[15].**

In this paper, we have proposed an automatic elderly fall detection technique for an individual home using depth camera. We have proposed the environmentally mounted Microsoft Kinect sensor for the elderly homes for automatic fall detection. We have collected the depth images of elderly fall events. After collecting the necessary depth images, the background subtraction algorithm has been used to subtract the background. Segmentation and feature selection have been done for various daily activities and fall to train the model. The model has been train using decision tree and to ensure the fall confidence, ground truthing is also used. Finally, we have processed the result for analysis.

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The paper has been organized as follows First, related work, Second, discussion on Microsoft Kinect sensor depth images, Third, methodology used for fall detection, Forth, results analysis, Fifth future work.

II. Related Work

There is an extensive study has been done on elderly fall detection system. Our study have found various elderly fall detection systems that have used different tools and techniques. We have categorized these studies in three parts First, sensor based, Second, radio signal based and Third, video based or vision based technology. Since, our work is based on vision based techniques so we will discuss it in more detail.

Sensor based fall detection systems are used the sensors such as accelerometer, and gyroscopes. These sensors are sensitive to sudden acceleration and can detect rapid motion changes like human fall [6-9]. These sensors are mostly human wearable but major disadvantage is that they require periodic maintenance like battery recharge or replace. This periodic maintenance are sometime ignored or forgotten by the elderly people. Therefor fall has not detected by these sensors.

Radio signal based fall detection system are used the Radio signals and built in accelerometer of smartphone. Whenever, elderly fall has been detect it tracked the elderly fall location and sent a short message service (SMS) and e-mail to set contact number on mobile [16-17]. The major disadvantage of these techniques is that elderly people have to carry their mobile phone every time with them to used accelerometer sensor which is some time impossible. This technique is used radio signal and it could be possible to delay the SMS.

Video based or vision based technique is used the standard imaging sensors for elderly fall detection. This technique has used different setup of the cameras such as single camera mounted on the wall. Some cameras are mounted on the ceiling and some are mounted on all four walls and ceiling to record three dimensional (3D) reconstruction of foreground objects [18-21]. However, Video based or vision based technique are having many limitations. Such as foreground extraction is difficult in color image due to variable lightening conditions and shadows [22].

Recording the video in low light or no light is impossible and we have required addition Infrared sensor that increase the setup cost [23]. In the case of single camera, modeling of 3D movement of the object is difficult and hence, it compromises the accuracy in the fall detection [18]. If we use multi-camera setup to capture 3D movement of object then it will increase the difficulty of calibration of the camera and it also increase the overall setup cost of fall detection system.

Due to these many issues, researchers have looked for an alternative of traditional camera setup that is cost effective as well as robust in term of fall detection. Recently, researchers have been focused on Microsoft Kinect depth imaging sensor to detect elderly falls.

Literature review indicate that Kinect sensor have been replaced the traditional cameras and became the most popular visual sensor for elderly fall detection. Kinect camera overcome the weakness of the traditional camera and can capture the 3D motion by using an infrared sensor and specialized microchip that make it less affected by the low lightning or no lightning conditions. Mastorakis et al. [24] have been used Kinect sensor to capture real time fall detection.

Gasparrini et al. [25] mounted Kinect sensor on-ceiling and set the camera face downwards to detect elderly fall based depth images. This kind of setup of Kinect sensor provides the privacy preserving fall detection in the indoor condition.

Although extensive work has been done but previous work have some limitation such as poor data collection in laboratory mode or limited fall pose. Other limitations are as poor feature selection and background separation. We have proposed a robust technique that can detect the fall accurately.

III. Methodology

In methodology section, we will describe fall detection technique that we have used in the study. Our methodology have been divided in seven sections- (a) Depth Image Acquisition (b) Background Subtraction (c) Ground Segmentation (d) Feature Selection (e) Fall confidence (f) Ground Truthing (g) Fall Detection as shown in figure-(1).

A. (a) Depth Image Acquisition

Depth images are acquire through continuous video of Microsoft Kinect sensor that are mounted on a wall in a laboratory.

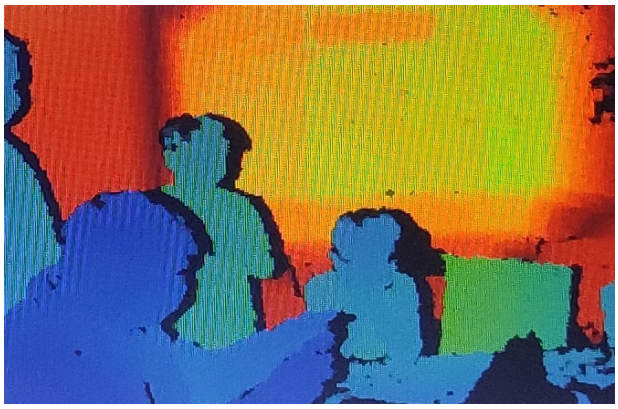


Figure 1 Depth Image from Kinect Camera

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B. (b) Background Subtraction

Background subtraction is a commonly used method for generating a foreground mask using static cameras. A dynamic background subtraction algorithm is used to subtract the background to get the object (Human). Object is further processed to get its maximum height, height from object center and height up to the object knees. These three parameters we have used in our study to get fall detection.



Figure 2 Background subtraction

C. (c) Ground Segmentation

Ground fall motion segmentation is necessary for elderly fall detection. Ground fall motion segmentation has been done to get feature extraction of different pose of fall. We have consider some fall motion as standing fall in backward, sideway, and forward fall. Sitting fall has considered as left side fall, right side fall, and falling from bed.

D. (d) Feature Selection

Feature has been selected from fall motion segmentation to accurately detecting the elderly fall. These features are the maximum, minimum and average vertical motion velocity. These features helped us to accurately identify the elderly fall.

E. (f) Fall Confidence

The features we selected in feature selection step is used as an input to the decision tree algorithm to check the fall accurately. A decision tree algorithm has been used for fall confidence.

F. (g) Ground Truthing

A manual ground truthing has been done to check actual fall with detected fall in the system. For this process, we have selected random events where we have doubt about actual fall.

G. (h) Fall Detection

After collecting data from ground truthing we have detected fall for every pose mention in the ground segmentation step using decision tree. The binary has been used and trained to classify the fall event. Cross validation technique has been used to validate the result. For cross validation sitting, lying and walking activities have been used.

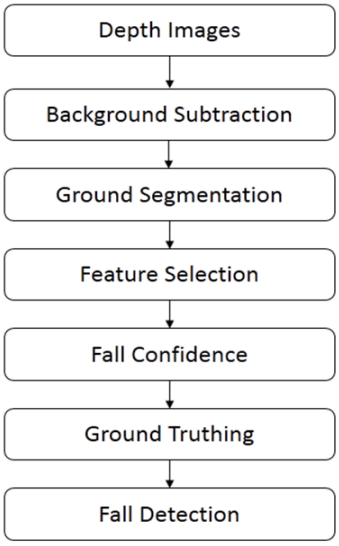


Figure 3 Flow Chart of Methodology

IV. Results And Discussion

In this section, we have discussed the expected results that we have achieved during the laboratory experiments of fall detection system. We have used volunteer to collect the fall data. The fall data have been collected as mention in the methodology section. The obtained results have been cross validated. Cross validation has been included the standing, sitting, lying positions and far distance (<4 meter) from camera. Result also cross validating with volunteer reported fall with fall detected by system. This ground truth is used to improve the performance of the technique. To calculate the accuracy of methodology, we have used accuracy, precision, specificity, and sensitivity as mentioned in eq. 1, 2, 3, and 4.

$$A_c = (T_p + T_n) / T_e \quad \text{---------- (1)}$$

$$P_r = (T_{po}) / (T_p + F_n) \quad \text{----------(2)}$$

$$S_p = T_n / T_{ne} \quad \text{----------(3)}$$

$$S_n = T_p / T_{po} \quad \text{----------(4)}$$

A_c = Accuracy
T_p =True positives
T_n = True negatives
T_e = Total number of events
P_r = Precision
T_{po} = Total positives
F_n = False negatives
S_p = Specificity
S_n = Sensitivity

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TABLE 1 FALL DETECTION RESULTS

Events	Falling	Sitting	Lying	Standing	Total
No. of Event	82	12	8	10	112
Tp	78	0	0	0	78
Fp	4	2	0	0	6
Tn	0	10	8	10	28

TABLE 2 PERFORMANCE OF PROPOSED TECHNIQUE

Metrics	Performance
A_c	94.64 %
P_r	97.5 %
S_p	93.33 %
S_n	95.12 %

We have presented a conceptual method of automatic fall detection system for elderly people using Microsoft Kinect camera. Results have been discussed in Table 1 and Table 2. The major issues with Microsoft Kinect are as the distance increased the resolution of depth image is decreased. Due to decrease resolution it is hard to calculate the background subtraction and segmentation of depth images.

V. FUTURE WORK

In the future work, we will include more realistic data and try to get actual data of elderly fall. Results will further improve against the realistic data. We will also compare our technique with state of art techniques having high accuracy.

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Chapter 19
Air Quality Status in Jaipur and Nearby Areas of Rajasthan



Harshit Tiwari, Meena Tekriwal and Rekha Nair

1 Introduction

Large number of industries and vehicles are creating problems to our environment by their effluents. It can be seen that many people are suffering from lungs related diseases. There is a significant variation in the pollution level in different areas of city in different time interval and weather conditions during sampling. The data given by CPCB (central pollution control board) shows high pollution levels at areas with large number of industries. The quality of air is divided into some easy sections like satisfactory or hazardous to make it understand easily; health related impacts are also mentioned. The amount of different gases and size of particles are measured by observers. Amount of nitrogen dioxide and sulfur dioxide and many more harmful gases are measured and analyzed. According to size of particle such as PM10, PM2.5, are measured and compare in different cities. Comparison of different cities of Rajasthan is made on basis of their pollution data in day and night and the latest data is provided by AQB (air quality bureau). Comparison is made on basis of different parameters in industrial and in residential area of a city.

Rajasthan is basically a dry area where high wind flows in day time and pollutants spread over very easily. Whereas in Kota there is a nuclear power plant near Chambal River which may be the cause of high pollution and due to that there is a high amount of ash in air near the power plant which is bad for health and for crops too.

As compared to 2008, pollution is very high nowadays due to industrial revolution and so the quality of air is decreased. Bhiwadi is one of the famous areas of Rajasthan for its industries with very high pollution levels. In this study, the analysis of concentration of various pollutants at Jaipur city which is the capital of Rajasthan and its nearby areas as there are lots of industries in these areas. The comparison in

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AQI of day and night time is done to show effect of vehicles. The particle size of the pollutants and its effects are being compared. The data available from last few years by central pollution Board are being studied.

2 Methodology

2.1 Study Areas

Air pollution data of last few years and current data was analyzed and reviewed of Jaipur and nearby cities. A comparison between them is made on basis of amount of air pollutants in form of PM to nitrogen dioxide and other particles. Data is in a tabular form as well as graphical form to understand it easily. Air quality index is one of the simplest forms to determine the quality of air this was started by environmental protection agency in the USA. Jaipur and Kota are selected because these have high population density and so many industries. Kota has a thermal power plant too.

2.2 Site Description

Residential as well as industrial areas are compared at different times. The areas are divided into two parts according to population the residential central city area and the outer city industrial area. Study is being made on to time basis daytime and nighttime analysis is made by reviewing all these research papers, and it is found that there is a major difference between the pollution of residential area and industrial area. Amount of air pollutants found in air nearby the industrial area is a little bit higher as compared to residential area but due to a good quality of airflow in Rajasthan and its dry atmosphere the air pollutants are also available in a good quantity or we can say in a hazardous level in residential areas too.

In reviewed research paper the recent is made on basis of 24 h the day and time data and nighttime data is measured separately in both residential as well as industrial area nearby the cities and in Kota especially the area nearby nuclear power plant is measured and analyses and it is found that there is a rise in temperature due to that power plant and it creates water pollution too.

In Rajasthan Bhiwadi is one of the very grand industrial areas of Rajasthan that is why there is a high amount of air pollution in Alwar district but other names of development there are several cases found that quality of air is neglected as well as their effect is also neglect on the residential areas or citizens by government too.

2.3 Monitoring and Analysis

To find out air quality index a high volume sample was used for monitoring the air quality at several locations of these different cities of Rajasthan. The measurement of air quality is made between period of 24 and 8 h, respectively the major parameters of air quality war measured in all these research and measure data related to these cities are reviewed. In this research, it is found that air pollutant is measured in night and day time of different areas of the cities and that is a major difference between day and night time pollutants in air.

Basic formula to find out air quality index

$$\mathrm{AQI} = 1\big/3\{\mathrm{SPM}/\mathrm{SPM\ Standard}\} + (\mathrm{NO_x}/\mathrm{NO_x\ standard}) \times 100 \qquad (1)$$

SPM	individual values of suspended particulate matter
SPM standard	standards of embedded air quality of suspended particulate matter
SO_2	individual values of Sulphur dioxide
SO_2 standard	standards of ambient air quality of Sulphur dioxide
NO_x	individual values of oxygen of nitrogen
NO_x standard	standards of embedded air quality of oxides of nitrogen.

2.4 Experimental Results and Analysis

See Tables 1, 2, 3 and Figs. 1, 2.

Table 1 Standard data by MOEF, Government of India for time-weighted average of annual 24 h

Pollutant	Concentration in ambient air		
	Industrial area ($\mu g/m^3$)	Residential rural and others ($\mu g/m^3$)	Sensitive area ($\mu g/m^3$)
Sulphur dioxide (SO_2)	80	60	15
	120	80	30
Oxides of nitrogen (NO_2)	80	60	15
	120	80	30
Suspended particulate matter (SPM)	360	140	70
	500	200	100
Respirable particulate matter (RPM)	120	60	50
	150	100	75
	1.5	1.00	0.75

Table 2 Air quality index in Jaipur and nearby areas in day time

Location	SPM ($\mu g/m^3$)	SO_2	NO_2	AQI
Kota	503.6	2.88	13.78	90.87
Jaipur	270.3	17.99	37.1	68
Ajmer	94.67	8.05	35.5	33.92
Dausa	83.45	6.01	14.23	22.34

Table 3 Air quality in Jaipur and nearby area in night time

Location	Air quality index at Jaipur and its nearby areas such as Kota, Ajmer, Dausa in night time			
	SPM ($\mu g/m^3$)	SO_2	NO_2	AQI
Kota	403.6	1.85	9.12	71.8375
Jaipur	101.35	9.99	27.06	32.32917
Ajmer	74.67	6.05	22.5	24.34083
Dausa	53.45	4.07	10.13	14.825

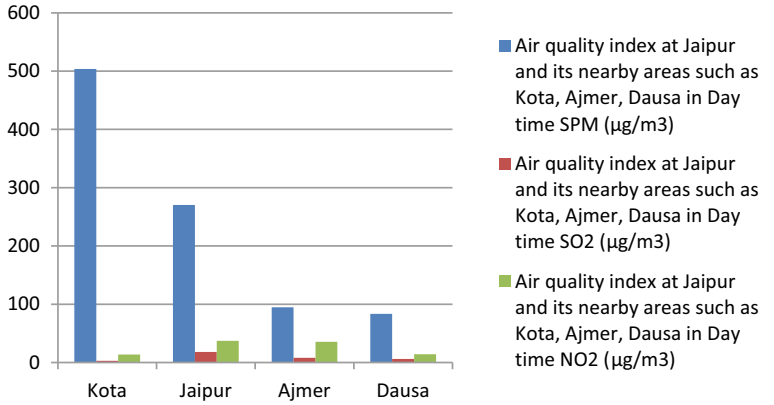


Fig. 1 Air quality in Jaipur, Ajmer, Kota in day time, compare different constituents of air

A: Air quality index in Jaipur and nearby area such as Dausa and Alwar SPM in day time

B: Air quality index in Jaipur and nearby area such as Dausa and Alwar NO_2 in day time

C: Air quality index in Jaipur and Rajasthan nearby areas such as Dausa and Alwar SO_2 in daytime.

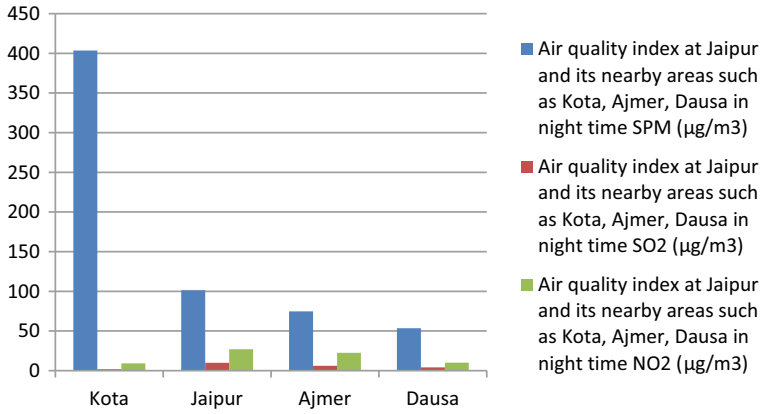


Fig. 2 - Air quality in Jaipur, Kota, Ajmer in night, compare different constituents of air

A: Air quality index in Jaipur and nearby areas such as Dausa and Alwar SPM in night time
B: Air quality index in Jaipur and nearby areas such as Dausa and Alwar SO_2 in night time
C: Air quality index in Jaipur and nearby areas Dausa and Alwar NO_2 in night time.

According to amount of air pollutants present in air AQI is divided into 6 parts good, satisfactory, moderately polluted, poor, very poor and severe. A Comparison between Air quality index of Jaipur and Kota is shown in a graphical form (Table 4; Fig. 3).

Air quality index in residential areas is at healthy (satisfactory) level and the air quality index for industrial area is healthy for sensitive groups and for commercial area such as the central area of city Jaipur is very unhealthy for every group. In Kota City the average night air quality index is found very bad and at day time it is found harmful for sensitive group in total city but an industrial area of Kota such as nuclear power plant the air quality index is found at hazardous level and a specific ash is found in air which is very harmful to human and for crop. Ajmer city, there is a minor difference between day and night air quality index so it means the air quality in Ajmer is approximately constant for every condition same as for Dausa.

Table 4 Comparative table of AQI in locations

Location	AQI (night time)	AQI (day time)
Kota	71.8375	90.87
Jaipur	32.32917	68.0
Ajmer	24.34083	33.92
Dausa	14.825	22.34

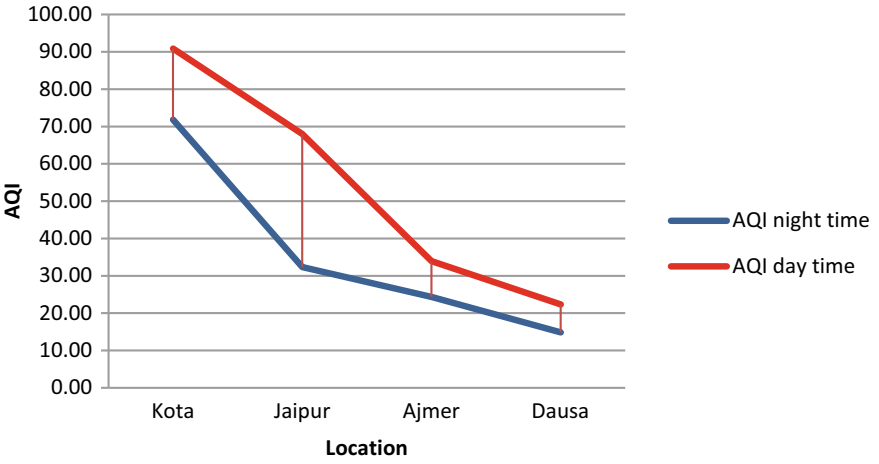


Fig. 3 - Air quality index comparison of different areas of Rajasthan

3 Conclusion

Analysis says that air quality in some areas of cities is very poor apart there are so many areas where the quality of air is good as compared to other areas. The air pollutants in air is higher in day as compared to night because of the less amount of vehicles travelling at that time. In industrial area, amount of air pollution is higher as compared to the residential areas. The government should apply strict laws for the industries and the vehicles should be improved and Electric vehicles should be promoted. Awareness programs should be run by government and NGOs. Tree plantation should be improved.

In Kota city there a very high amount of pollution found in nearby area of thermal power plant but then also the good efforts are going on by the Government of India to control air pollution and to stop harming our environment and to stop the airpollution-related disease in human. But there are still some lags and they should be improved.

4 Results

Based on the review of all of these papers we got the result that the average IQ during night in all these areas is under moderate reason that is why government should take quick actions related to air quality in Rajasthan. In these cities, the average air quality index in day time is approximately at sensitive for specific groups in all of the cities some areas are at very high pollution level. Some cities such as Ajmer and Dausa have low pollution level due to low industry and population and a good amount of forest. But the air quality level is decreasing rapidly.

5 Future Scope

Air quality in cities should be improved by applying these efforts

1. Government should make sure that regular checks of air pollution should be done every week.
2. To regulate amount of air pollutants in air as much as possible trees should be planted.
3. Strict action should be taken against those industries which are doing higher pollution as per standards and permission granted.
4. Uses of diesel vehicle and generator should be minimized, use of CNG driven vehicles should be encouraged. And eco-friendly technology should be developed such as hydrogen gas-operated vehicles.
5. Permission should be granted to industries according to current air quality of city.
6. To improve quality of air bicycling and public transport should be promoted.
7. There are so many research scopes in this field that a technology should be developed that can collect amount of carbon from our environment and can use that as a fuel.
8. Specific technologies related to industries of petrol and glass and heavy polluting manufacturing materials should be developed and they have a higher scope of research and a huge change can be there in the current technology.

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IoT Based Home Security System with Wireless Sensors and Telegram Messenger

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ABSTRACT

Crime rate in the society is increasing day by day. Due to increase in numbers of threats and intrusions in society, everyone needs a Hi-Tech security system to keep their belongings safe and secured. This paper aims at designing a home security system using Raspberry Pi along with USB Webcam as an image capturing unit to recognize the motion in unauthorized area. If any motion exists then it will send an image to mobile phone of relevant person via Telegram which has an amazing feature as Telegram Bot which provide APIs to build solutions which is compatible with Raspberry Pi IoT infrastructure. At the same time this system also sends information regarding hazards like LPG leakage or short circuit by sending message via Telegram Bot. A MQTT protocol is utilized for this purpose which depends on publish/subscribe paradigm. Node MCU is used as a sensor node where as raspberry pi 3 are utilized for sensor node network as a gateway. In addition to this, mosquitto is also used as a MQTT broker on raspberry pi 3 which collects information from different sensor nodes and send to the user via Telegram Bot.

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1. Introduction

Security system is an essential part for any organization, Banks and homes. The main aim is basically to protect individuals and property from various hazards such as fire, theft and loss. We have designed an IoT based security system that records and reports important things related to the home owner, such as intruder, LPG leakage and electric short-circuits. This system consists of both hardware and software units. The hardware requirements of this system are raspberry pi 3, USB webcam, PIR sensor, LPG sensor, current sensor and ESP8266 WiFi module where as for software requirements Raspbian OS (jessie), Python programming language for Raspberry pi, Arduino IDE for programming ESP8266 WiFi module are needed. PIR sensor and webcam are used to detect the presence of intruder which will be notified to the intended user using message and image captured by camera through mobile app telegram bot. The status of sensors can be read using MQTT protocol which is a machine to machine protocol especially used for device to device communication. Telegram is a free and open source social messaging app which provides services related to chatting and Bot. It will ring the alarm for any changes in home security device.

Closed Circuit Televisions (CCTV) are one of the most commonly used security system. These systems are highly influential in crime prevention, industrial processes, traffic monitoring, etc. It is a non-active monitoring device which requires constant and continuous human supervision. This investigation and monitoring is a complex task because all the recordings of the CCTV need to be watched and analyzed manually, which requires patience. This technique is quite costly and many times the recorded files get corrupted. The above said limitations of the passive surveillance systems attracted the researchers and academicians to develop a non-passive surveillance system. Most of the researchers have then utilized the advantages and benefits of Wireless Sensor Networks (WSN) for surveillance. The wireless connectivity of sensor nodes makes them useful in placing in any part of the buildings, thus it has an advantage of portability in deployment.

Some researcher(s) proposed the GSM/GPRS based wireless home security system in which Zigbee module for wireless transmission was used [Zhao,Yanbo, and Zhaohui Ye]. The new and improved features like camera, web server for uploading files, etc. are missing in this system as it mainly utilizes sensor based alerts. Beagle Board and Zigbee are used by few academician(s) to add improvement and reliability in security systems [Rakesh, V. S., P. R. Sreesh, and Sudhish N. George]. On account of on fire and intruder detections this system can send remote alerts which is further improved by

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methods like camera, GSM, FTP server etc. Live streaming and alert techniques like phone calls, SMS, e-mail, etc. are some of the missing features in this system.

Internet of Things approach for motion detection using Raspberry Pi was then proposed by some researcher(s) [Ansari, Aamir Nizam, Mohamed Sedky, Neelam Sharma, and Anurag Tyagi]. Users were alerted by sending e-mails and camera was fed by FTP server. This system also lacks on grounds of sensor alerts, SMS, phone calls, etc. Then, a fire alarm system using Arduino based of WSN was propounded which do not have features like camera, web server etc. [Muheden, Karwan, Ebubekir Erdem, and Sercan Vanin]. Few researcher(s) focused on surveillance technique using IP camera and Arduino board in which the user has the advantage of remote desktop using team viewer application [Kumar, Sushant, and S. S. Solanki]. The drawback of this system was it lacks user alerts and no notifications are sending to the intended user for a mishappening and hence continues monitoring of home was needed.

Some academician(s) described the security surveillance system using raspberry pi with the advantage of live streaming [S. Sruthy , Sudhish N George]. The main limitation with this was one need to type the IP address every time to watch the live video from webpage. One proposed an IoT based security surveillance system in buildings using Raspberry Pi with WiFi network connectivity. Upon detecting the face, the controller asks the camera to capture the event and it alerts the user by placing the live video of that event on webpage. This system does not send phone calls as alerts along with other sensor alerts such as detection of fire, gas, etc.

2. System Architecture

All In this paper, an IoT based home security system is propounded which utilizes IoT application for remote monitoring. In this, system will send the notification to android device, when an intrusion is detected, LPG leakage or electric short circuit in the house. The architecture of our proposed work is shown in Fig.1. given below.

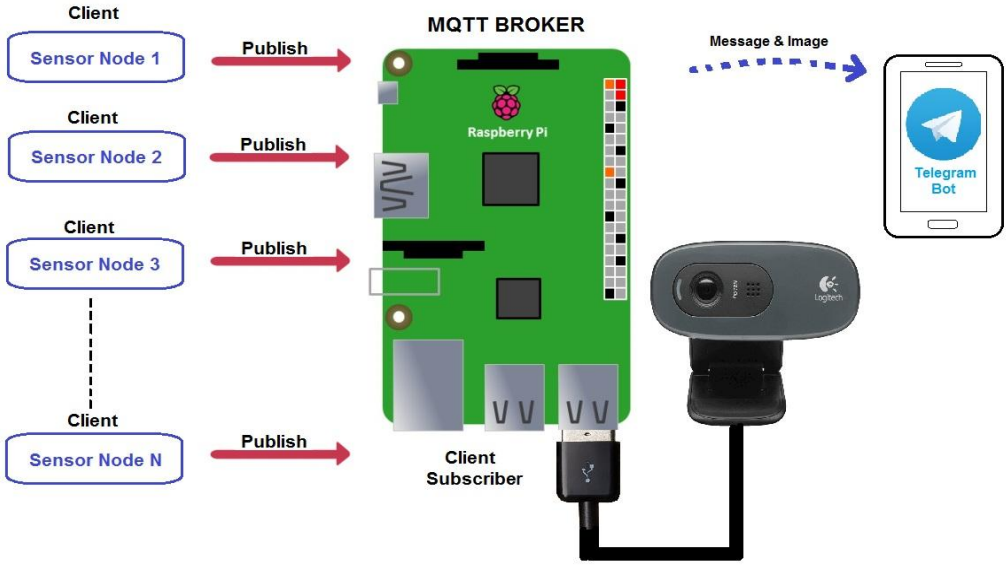


Fig. 1. Architecture Diagram

The architecture shows the usage of WiFi sensor nodes, USB webcam, Raspberry pi with Raspbian Jessie operating system installed on it and android phone with android application Telegram. Multiple sensor nodes are connected with the Raspberry pi via WiFi channel. MQTT protocol is used for communication. Sensor node contains sensor module like LPG sensor, PIR sensor, etc. WiFi module ESP8266 receives signal from the sensor and publish message accordingly to the Raspberry pi which acts as a server with MQTT Broker. A python script is written in the Raspberry pi to read messages as received from the sensor nodes using MQTT protocol. A decision is then taken and then a message is sent to the android phone using android application Telegram. Telegram is a non-profit cloud-based instant messaging service. Another python script is used in Raspberry pi to detect the motion using webcam and if the motion is detected then it sends the image(s) captured by webcam to the intended mobile phone using telegram application.

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3. Assembly of Different Modules

The System is integration of following modules.

- Sensor Nodes.
- Raspberry pi.
- Motion detection using webcam.
- MQTT Protocol.
- Telegram.

3.1 Sensor Node:

Three sensor nodes are used in this home security system-

- **PIR sensor node-** For detection of intruder or any motion Passive Infrared Sensor node is used which is shown in fig. 2 given below. A Passive Infrared Sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. On detection of living / moving things in the range the output of the PIR sensor goes high. This digital signal is read by WiFi module ESP8266-01 which publishes the message to MQTT.

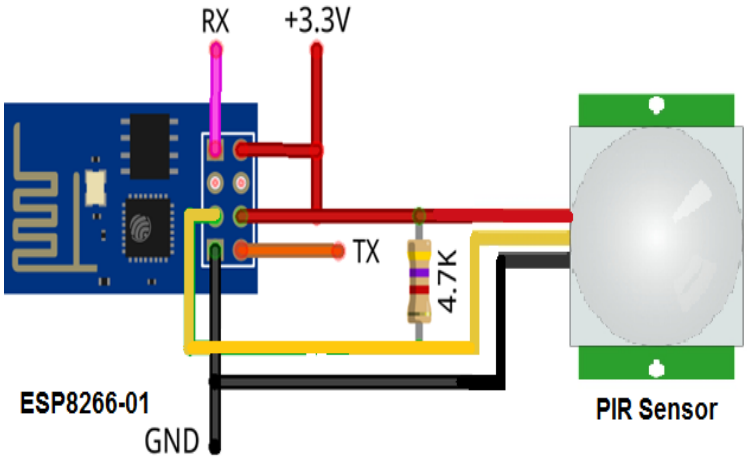


Fig. 2. PIR Sensor Node

- **LPG Leakage Detector**- On detection of LPG leakage, LPG sensor (MQ6) module gives digital high output which sets the collector voltage of NPN transistor to LOW. This signal is fed to GPIO pin of the WiFi module ESP8266 and then published on MQTT. Fig. 3. Shows the LPG Leakage Detector Node for LPG detection.

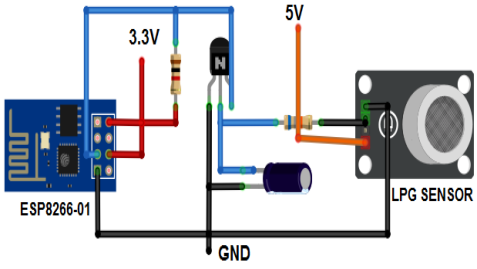


Fig. 3 – LPG Leakage Detector Node

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- **Over current or short circuit detection-** For detection of over current or short circuit in house wiring this node is used which is shown in fig. 4 given below. Current in house wiring is measured by current sensor module which uses IC ACS712 made by Allegro Micro Systems. It gives analog output voltage that is linearly proportional to the input current. The analog output of the current sensor is given to the analog input of the Node MCU WiFi module. This node can be connected to measure current in main line just after energy meter so that it can measure current for whole house wiring. As the current in the house wiring increases above certain predefined value, WiFi module publishes the message to MQTT.

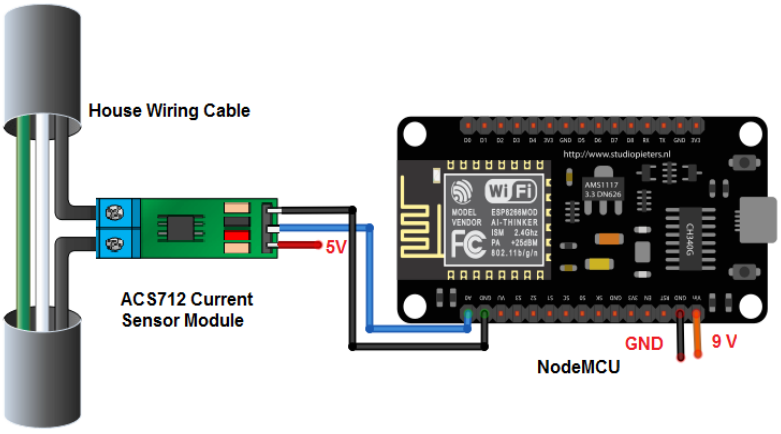


Fig. 4. Over current or short circuit detection Node

3.2 Raspberry pi:

Raspberry Pi is a credit card sized single board Computer whose source is open to all which uses a Broadcom BCM2837B0, SoC with a 1.4 GHz 64-bit quad-core ARM Cortex processor Cortex-A53 (ARMv8) along with 1GB SDRAM. It has 2.4 GHz and 5 GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE. It has 4 USB ports, one HDMI port for display and 40 pin headers for GPIOs. It also has a Micro SD port for loading operating system and storing data .

Motion detection using webcam is achieved by installing a software simpleCV on Raspberry pi. Scripts have been written in Python language to perform various tasks using Raspberry pi.

3.3 Motion Detection using Webcam:

In order to achieve motion detection some type of computer vision software is needed. Here in this system simpleCV software is used that is a simplified version of open source software OpenCV. SimpleCV can perform various arithmetic functions on images which is a very versatile feature. For instance, the difference of the two images is obtained by subtracting the two.

A script in python has been written to capture a still image from the webcam and then capture another image after half a second for motion detection. The two images are now to be compared against each other and hence system constantly checks for changes. In order to make changes more evident one must convert the same to grayscale, and then binarize the difference. In this the gray is removed and each portion of image is either black or white. SimpleCV is capable of utilizing NumPy matrix system in order to store the values of the pixels as an array for an image. Another feature of SimpleCV is the ability to use the NumPy matrix system to store all the image pixel values as an array. More calculations can be conducted on the images to obtain mean values. After obtaining the mean, set a threshold to ensure the crossing of changing values over the threshold. It is understood as motion is detected and the system saves the image .

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3.4 MQTT Protocol:

MQTT is an ISO standard messaging protocol designed by IBM for M2M (Machine to Machine) communication. MQTT stands for Message Queue Transport Telemetry protocol. It is used on top of the TCP/IP protocol. It is used to exchange small messages between several devices [P Gopi Krishna, K Sreenivasa Ravi, V.S.S Sailendra Kumar].

Publish / subscribe paradigm is utilized by MQTT along with traditional client-server model. It also uses Request / response paradigm. The messages sent from sender are routed to the receiver by an intermediate network element. The sender is unaware about the identity of the receiver in advance. The variable known as "topic" is the only link between the two i.e. sender and receiver [Matteo Collina, Marco Bartolucci, Giovanni Emanuele Corazza, Andy Stanford-Clark and Hong Linh Truong]. A MQTT network is shown in fig. 5 shown below. To receive data of certain topic the subscriber should also get authorized with the username and password and subscribe to the topic.

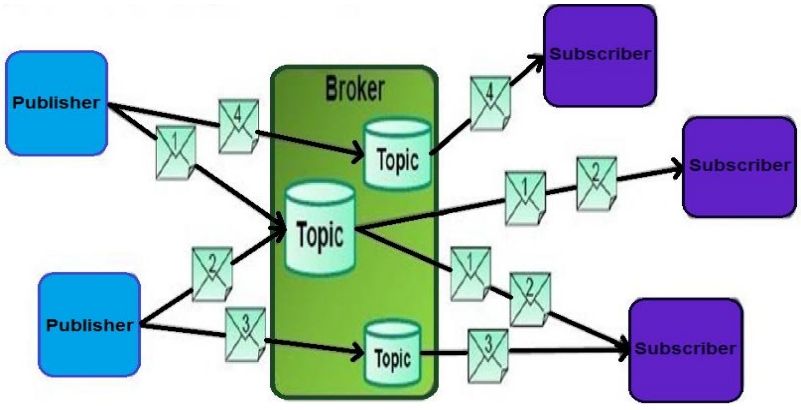


Fig. 5. Example of MQTT network

3.5 Telegram:

Telegram is a non-profit cloud-based instant messaging service. Telegram client apps are available for Android, iOS, Windows Phone, Windows NT, mac OS and Linux. Using it users can send messages and exchange photos, videos, stickers, audio and any other files [Leya Laiju, Sherin Shaju, Janet Jose, Willson Joseph C]. When any motion is detected by the system, it will capture the image / video using the camera and send it to the telegram application.

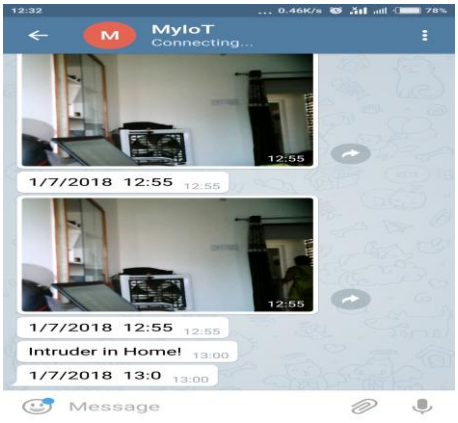


Fig. 6: Screenshot of User's Telegram Application

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The Telegram message notification sound immediately notify the user and hence one can view the image or message using the mobile application and he can take appropriate action instantly. When signals are received from sensor node, processor send message to the user via the telegram application. Along with image or message, system also sends date and time of incident so that the user may be informed about the time of incident (in case if he/she is not able to receive Telegram message instantly due to no network or any other reason). Fig. 6 given above shows the Screenshot of User's Telegram Application.

4. Conclusion

IoT based Home security system is a solution to problems like theft, fire (due to LPG leakage), short circuit(s) in house wiring, etc. On detection of LPG leakage, intruder or any short circuit in house wiring, system sends alert message on users mobile phone using Telegram app. Webcam provide a way by which user can get the information of intruder instantly with image and alert tone and hence it is possible to take immediate possible action. The Raspberry Pi is a fast processing platform for running all the process and building highly capable and reliable embedded systems. MQTT make possible to connect multiple sensor nodes with broker at a time. By using this feature any number of sensor nodes can be included in the system without changing core programming. IoT based Home Security System is very useful for the security against intruder, LPG leakage, short circuit protection. Fire detection node enables this system useful for banks, offices, etc.

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An Overview of Smart Identity Cards for Educational Institutions



Rupesh Acharya, Saroj Jakhar, Durgesh Kumar and Garima Mathur

Abstract In this modern era, a technological development is taking shape from universities to schools. This paper throws light on an automatic identification technology which has been used to diminish man force and time to input file or information manually. RFID (radio-frequency identification) is a wireless technology which is getting popularity among identification technologies due to its cost-effective maintenance, low cost, less weight and minimized size. RFID (radio-frequency identification) is one of wireless technology that incorporates the use of EM fields to automatically identify and trace tags attached to items/objects. Radio-Frequency Identification tag enables the schools/universities to oversee the student movement inside and outside of the premises.

Index Terms Radio-frequency identification · RFID tags · Smart card · Online student surveillance (OSS) · EAS

1 Introduction

In India technological development is taking shape from universities to schools. Innovation is bringing mechanization and an opportunity to ameliorate security to the premises in this twenty-first century. Radio-frequency identification is forming up to be an indispensable elementary unit for IoT. It was difficult to identify student's location and who profaned the authorized area. To overcome this Radio-Frequency Identification (RFID), one of wireless technology which is taken upon realizing the detonation of interest in this technology where its establishment in the legion application, including health [1], supply chain [2], construction [3] and library [4]. Radio-frequency identification (RFID) microchips are an identification device (wireless) that transmits a signal with data that was stored in the chip when powered by

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some nearby root. RFID systems perform function same as a lock and key, with the RFID chip performing as the key. Radio-frequency identification (RFID) chips have an identification code, instead of having a unique pattern that is read by the lock. RFID chips also pelt the identification code behind a series of encryption [5]. The RFID systems consist three main constituents to ensure its well-functioning which are coil or antenna, transceiver and RFID tag. The antenna will impart radio signal to activate the tag so the information or data could be written or read. The storage and extraction of the information or data use a special device which is called as RFID tag. RFID tag can be fastened anywhere on anything and even able to be fixed in the body of human beings. In this, RFID tags permit the management of school/college to oversee the manoeuvre of a student inside and outside of the campus. An individual who is not having the RFID card will activate the alarm and also able to notify the management of school/university regarding the student's availability utilizing an online surveilling system. When the RFID tags pass by way of the RFID reader in reading gamut tract, then the information or data from the RFID tags will be recorded to the database systems. The information will be conveyed online to the administration for pupil's supervision. This will repose the management to check the hostel student's availability and admittance the personal record of students.

2 History of RFID Development

"Identification Friend or Foe" system (IFF) was RFID's first application and it was deployed by the Britishers in World War (II) [6]. Reading units could ask tanks and fighter planes to determine whether to blitz as transponders were placed into them. In armies around the globe, this technology's heirs apparent are still utilized. EAS (Electronic Article Surveillance) was the RFID's first utilization for commercial purpose. It was evolved as a theft prevention system in the seventieth century.

Radio-frequency identification tags made its way into the farming for instance for animal tagging in late 1970. When some US states and Norway determined to utilize radio-frequency identification for the collection of toll taxes on roads in the eightieth century, RFID technology got the uplift. In addition to the collection of toll taxes, the following decade brought a huge number of new applications, such as money cards, gasoline cards, ski passes, etc. Auto-ID center was founded in 1999 at Massachusetts Institute of Technology. Development of a global standard for item-level tagging was the duty of Auto-ID center. After concluding the work on the EPC (Electronic Product Code), Auto-ID center was closed in 2003. Newly established EPCglobal Inc. pursues the work at the same time. First paper regarding Radio-Frequency Identification technology by Harry Stockman was the landmark paper, "Communication by Means of Reflected Power" in 1948 (October). In 1973, Radio-Frequency Identification first patent was issued for a passive radio transponder with memory (Fig. 1).

Fig. 1 RFID chip



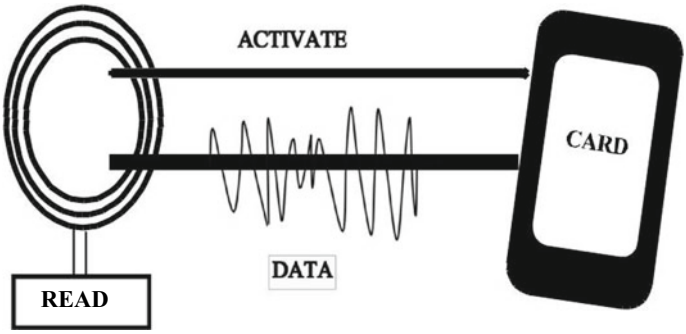


Fig. 2 Working of RFID

3 Principles of Radio-Frequency Identification

For an automatic identification and tracing motives, RFID employs a contactless wireless system that utilizes RF (radio-frequency) EM fields to transmit information from fastening tag to an item/object. Fundamental datum behind radio-frequency identification system is that one mark objects with tags. These tags hold transponder that discharges information legible by specialized Radio-Frequency Identification. Nearly all Radio Identification Frequency tags store some type of ID number, for instance, product stock-keeping unit (SKU) code or a consumer number. Reader fetches data regarding identification number from database and go on upon it accordingly (Fig. 2).

Depending upon the source of power, there are two general classifications in which radio-frequency identification tags falls that is active tag and passive tag.

3.1 RFID Active Tags

Active tags have their own source of power, it imparts powerful signal and reader can ingress them from further away. RFID active systems usually work better on large objects traced over great distance due to own source of power, which makes them

Fig. 3 Active RFID



costly and larger. Active tags which have less power are typically slightly bigger than a deck of cards (playing). RFID active tags persist temporarily inactive up till they arrive in the gamut of a receiver or can continuously transmit a signal. Due to the on-board source of power, active tags work on greater frequencies very often 455 MHz, 2.45 GHz, or 5.8 GHz—rest on the peruse gamut and memory demand application. Readers can impart or pass on information with RFID active tags over 20–100 m [7] (Fig. 3).

3.2 RFID Passive Tags

Furthermore, these types of tags are immensely less costly and new technologies continuously making them economical to consolidate into usual products and materials. In inclusion to their less cost, passive radio-frequency identification tags can also be utterly small. Present antenna technology extremities the smallest useful passive radio-frequency identification tag anent the quarter's size. As the size of tag increases, read range also increases. Currently, radio-frequency identification passive tags hold about 2 Kb of memory [8]. This is very small to contain much more intricate data than identification and history data. Technological development to the far side of RFID is continuously meliorating, so the data's amount and capacities of radio-frequency identification tags will rise over time, allowing tags to finally hold and transfer much more data (Fig. 4).

4 Comparisons Between RFID, Barcode and Quick Response Code

Radio-frequency identification, Barcodes and Quick Response (QR) codes are alike in reality that they are information gathering/collecting technologies, mean-

Fig. 4 Passive RFID



ing they automate data collection operation. However, they too vary materially in many regions. This segment predominantly throws light on the advantage of radio-frequency identification (RFID) over barcode and quick response (QR) code. Comparison between these three data collection technologies is given in tabular format (Table 1).

As per the above comparison between these three technologies, we can say that RFID-enabled smart identity cards are better than old-fashioned barcode-enabled identity cards. In India, education is one of the most indispensable sectors that requires for the execution of latest technologies. RFID-enabled smart identity cards used for the diverse motives and some of the advantages of smart identity card (RFID enabled) over barcode-enabled identity card in the educational sector are discussed in this paper.

Table 1 Comparison between RFID, barcode and quick response (QR) code

Features	RFID	Barcode	Quick response (QR) code
Updating	New data can be written on old tags	Unable to update	Unable to update
Tracking	Manual tracking not required	Required manual tracking	Required manual tracking
LOS (Line of site)	Does not required	Required	Required
Technology	Radio-Frequency	Laser (optical)	Laser (optical)
Read/write	Both	Read-only	Read-only
Read range	Active tags—up to 100 feet and passive tags—up to 30 feet	Several inches to feet	Several inches to feet
Identification	Items can uniquely identify	Items cannot uniquely identify	Items can uniquely identify, but up to certain limited value
Information potential	Greater than Barcode and QR code	Very less	Less
Automation	Data collected automatically	Hands-on operation required	Hands-on operation required

5 Online Surveilling System

To repose the management system to surveil the move of student and explore the student information nimbly, an online interface has been evolved. The system can be applied in everyplace to repose the management system to surveil the users, by using Matric Card embedded with RFID tags; where RFID system provides reprogramming, batch ingress and storage mass data which are superior then barcodes. Applying radio-frequency identification (RFID) can promulgate precision and operational efficiency. The purviews that can be used for the online student surveillance system is shown in Fig. 5 [9].

In general conception, we have presented RFID to recognize when an individual with RFID tags passes by way of the RFID reader, the information or data identification from the RFID tag will record move (i.e., time in/out and place) in the database system. Without authorization or permission, if the pupil profanes certain zone, the network will immediately trigger an alarm to the security and management of school/college by using Online Student Surveillance (OSS) system the identification of pupil and location can be found on the Online Student Surveillance system. The overseeing system operation is shown in Fig. 6.

6 Tighten Visitor's Security

Just assuring only that the visitors causally check in at the office is not more indispensable than safety. Fortifying the students is becoming growingly indispensable. Many schools/colleges utilize visitor management systems to meliorate safety and assured students against illegitimate outsiders and person posing as students. Department of security of schools/colleges must know who is on the premises at all the times. This can be nimbly done with the help of an interim RFID enabled identity card that bears track-and-trace technologies. Upon sign-in, school/college visitor software can also

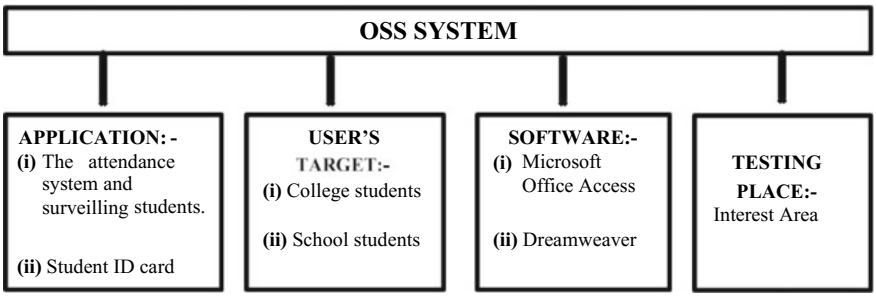


Fig. 5 The frame of theory in research of application of RFID smart card system as the information system of users [9]

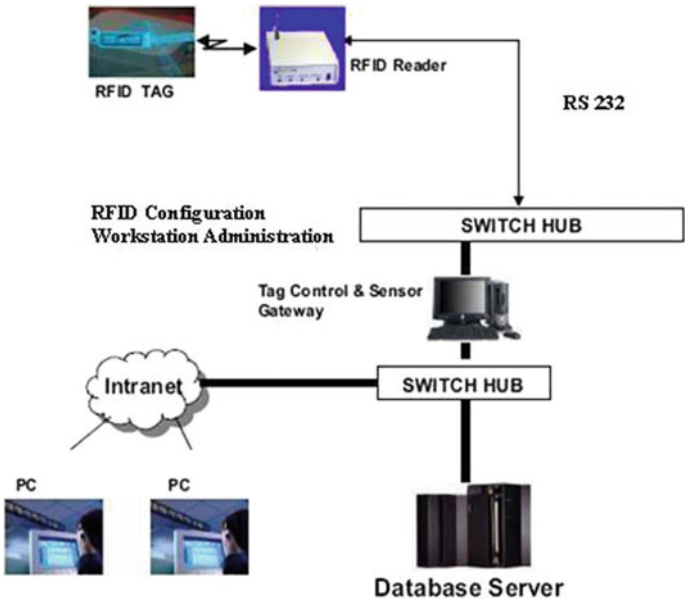


Fig. 6 OSS system architecture [9]

regulate if the visitor is a criminal or wanted by the law imposition or recorded in the sex offender database [10].

7 Access Control for Buildings

Optimum results are presented by RFID empowered identity cards for not only management of visitors, but ingress dominance for all individual, premises-wide. Providing a RFID smart identity cards to all pupils, staffs (teaching and non-teaching) and outsiders authorizes safety and security wing to dominance, who has access/approaches to where, when and what. Schools/Colleges premises can ameliorate hostel security, secure laboratories with valuable equipment, and assure R&D departments accomplishing specialized projects only yields ingress to those with right permits. With the help of RFID enabled smart identity card, management of schools/colleges can permit or deny physical access to students attending lectures in different buildings.

8 Conclusion

In this paper, an overview of smart identity cards for educational institutions has been discussed. Multipurpose smart identity cards proffer various simple and cost-effective modes for schools/colleges premises to elevate the level of safeguard and standard of education. Smart identity cards will proffer smart attendance system, which reduces manpower and surveilling of students can be nimbly done. In India, schools/universities can ameliorate competence and safeguard at the multiple stages due RFID-enabled smart identity cards which proffer better range and peruse performance. With the implementation of this smart identity cards in educational institutions, faculty, as well as the guardian of the students, will feel relax that their wards and schools/universities premises remain protected.

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"Efficiency improvement approach of InGaN based solar cell by investigating different optical and electrical properties"

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ABSTRACT

The basic destinations of setup of solar cell is to uplift it`s capability. IndiumGalliumNitride is a composition that has encountered expansive research since 2002 as a potential photovoltaic material. Fluctuations in the arrangement of InN and GaN inside InGaN, the band gap of this semiconductor material can be changed. Subsequently, a high-effectiveness solar cell can be conceivably created by having a few InGaN intersections [1][3][7]. The utilization of Silvaco Atlas as a reenactment apparatus can help in recognizing whether InGaN can be utilized for photovoltaics. The paper examines the effect of the temperature on InGaN solar cell gadgets developed with N-polar introductions in electronic and photovoltaic properties. The self-reliable model is utilized to decide the vitality band conduction. Indium gallium nitride and other PV materials offer the open door for restricted bandgap designing to coordinate spectra. The impacts of barometrical conditions, for example, mist concentrates, overcast cover, water vapor, and air mass have been appeared to cause varieties in spectral brilliance that changes PV framework execution because of both misrepresenting and underestimating. Structuring PV gadgets streamlined for unearthly brilliance of a specific area can result in enhanced PV framework execution [7][9]. The consequences of this strategy are outlined for the contextual investigation of solar ranches in the Indian areas and circle utilized.

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1. INTRODUCTION

Starting late, unique examinations on solar cells using III-nitrides semiconductors in the photovoltaic as one of its applications have been done. Among all of them the InGaN compound has a promising possibility as photovoltaic applications, since it Possesses the photovoltaic properties, for example, substantial absorption coefficient, high tolerance to radiation and high mobility, enabling more slender layers of material to retain the vast majority of the solar spectrum [10].The capability of choosing diverse solar photovoltaic (PV) materials to empower bandgap building to advance the absorption of the total solar spectrum is drawing nearer to the real world. For instance, indium gallium nitride (InxGa1−xN) composites are promising slender film PV materials for multijunction gadgets because of a tunable band gap from0.7eV to 3.4, which covers about the whole solar spectrum [3][6][7]. This guarantee has prompted an ongoing blast in logical enthusiasm for the material as essential material for multijunction cells and critical PV gadget effectiveness upgrades have just been accounted for. Band gap building gives a chance to not just give higher by and large transformation efficiencies of the reference AM1.5 spectra yet additionally tweak PV gadget structure for explicit geographic areas and microenvironments dependent on air conditions trademark to that specific area. In spite of the fact that the backs till difficulties, for example, stage isolation, indium vacillation, and absence of coordinated substrates in InxGa1−xN PV, there are no key impediments to the material framing high-proficiency PV gadgets Hypothetical work on InxGa1−xN has indicated potential efficiencies of 42% for a twofold intersection, 49% for a triple intersection, and 53% for a quad-layer PV gadget under sun brightening with an AM 1.5 spectrum. In any case, in genuine applications, the vitality change of solar cells relies upon both the amount and the unearthly attributes of solar radiation that the cells get and to what degree the intersection layer band gaps coordinate this solar radiation[6]. The spectrum lighting up a PV gadget can contrast significantly from the reference spectrum as it differs with climate, transiently, geologically, and from the commitments from the microenvironments in which the PV are sent. In this manner

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InxGa1−xN multijunction PV innovation and other comparative materials frameworks offer not just the open door for higher by and large transformation efficiencies of the reference AM1.5 spectra yet in addition the novel chance to improve PV cells geologically and for explicit microenvironments dependent on the nearby cools. In this paper, a model is given to reproduce ideal band gaps utilizing otherworldly information for various cools. This geographic microclimate frightfully settled solar motion is utilized to iteratively enhance the band gap for pair, triple, and quad-layer multi intersection Increasingly finished, the most imperative preferred standpoint of InGaN compound may be the immediate band gap vitality which can be balanced by the indium structure. Along these lines, the InGaN's vitality band gap can be tuned from 0.7eVto3.42eV, covering around the aggregate solar spectrum. The layers of InGaN solar cell can be kept utilizing the savvy methods, in 2007, Zhang et al. have displayed the execution of In0.65Ga0.35N single-intersection solar cell and accomplished a transformation proficiency of 20.284%. In 2008, Shen et al. have gotten for the comparable[10]. InGaN solar cell higher productivity (24.95%) because of the reception of the thickness of states (DOS) demonstrate, giving significantly more data about recombination/age in semiconductors than the existence time display, and disregarding the deformity impacts. The InGaN based solar cell displayed by Bouzid and Ben Machiche, for a small amount of piece of indium (x = 0.53), has reached24.88%conversion productivity. The equivalent solar cell was enhanced by achieving 25.16% effectiveness. Ben mous saetal. have recreated in 0.52 Ga 0.48 N utilizing AMPS-1D programming and distributed 22.99% productivity in 2013. As of late, in 2014, InGaN single-intersection solar cell was planned and numerically streamlined by Akter, displaying a high effectiveness of 25.02 %.

1.1. Literature Review

In the application field of solar cell, the latest developed candidate is III-nitride due to its characteristics and adjustable band gap. For InGaN, 0.77eV to 3.42eV is a band gap which can coordinate properly with solar spectrum Additionally, InGaN-related frameworks indicate numerous other fascinating properties. For example, critical coefficients for absorption, high transporter mobility, immersion speeds and a predominant radiation opposition [5][4]. This will improve all InGaN multi-intersection solar cells which has an adequacy bigger to fully theoretical conceivable and ideal indium structure which relied upon running from 0.6 to 0.7. For this thick layered InGaN with more in content will work. This isn't a simple assignment. Issues such the high in fuse, the meagerly dominant amid epitaxial development of thin InGaN films, the polarization and as doable the photovoltaic phenomenon transformation. The impact of temperature on the photovoltaic cell execution has been explored by various creators. The execution of the photovoltaic cell is set by the parameters who suggests that of short current thickness, circuit voltage (Voc) and fill issue (FF)[2][5]. The temperature selection influences these parameters and henceforward the execution of solar cells. it's been exhibited that the photovoltaic cell productivity diminishes with increasing temperature. during this work, utilizing a self-reliable model, the impact of oneself warming on the electrical phenomenon properties of the InGaN twofold hetero-structures is examined. To the extent the impact of polarization is concerned; this examination offers the chance of collection deeply effective Solar cells captivated with nitrides. In the present report, dialog on InGaN structures and gadgets developed on Si wafers will be completed. A heap of pressure diminishing InGaN cradle layers were become preceding testimony of GaN over Si, the complete details of typical layer structures are accounted for in our past report. Routine gadget manufacture to streamline the layer structures and gadget configuration is an exceptionally tedious process, and in this unique situation, an innovation PC supported plan (TCAD) apparatus is extremely useful which reproduces the gadget as indicated by gadget material science and analyze attributes of the gadget under the ideal condition.

2. MODELLING SIMULATION AND CALCULATION

2.1. Absorption coefficient

The absorption coefficient decides how far into a material light of a specific wavelength can infiltrate before it is assimilated. In a material with a low absorption coefficient, light is just inadequately ingested. The absorption coefficient relies upon the material and furthermore on the wavelength of light which is being assimilated. In Semiconductor materials absorption coefficient is calculated as light which has energy below the band gap does not have

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sufficient energy to excite an electron into the conduction band from the valence band. Consequently, this light is not absorbed. Absorption coefficient α of InGaN is given by

$$\boldsymbol{\alpha\ (InxGa1-xN)\ =\ \sqrt[10^5]{(Eph-\ Eg)\ +\ D(Eph-Eg)^2}}$$

Eph is the photon energy

C and$D$ are parameters dependent on the alloy composition

2.2. Refractive index

The material's refractive index is defined as a dimensionless number that portrays the quick propagation of light through it.

$$\boldsymbol{n=\frac{c}{v}}$$

here c is the light's speed in vacuum and v is the phase velocity of light in the medium. For instance, the refractive Index of water is 1.333, implying that light ventures 1.333 occasions as quick in vacuum as in water.

$$\boldsymbol{n(E)=\sqrt{A\left(\frac{E_{ph}}{E_g}\right)^{-2}\left\{2-\sqrt{1+\frac{E_{ph}}{E_g}}-\sqrt{1-\frac{E_{ph}}{E_g}}\right\}+B}}$$

(InxGa1−xN) = 13.55x+9.31 (1−x),

B (InxGa1−xN) = 02.05x+3.03 (1−x)

2.3 Conversion efficiency of the solar cell

The conversion efficiency of a photovoltaic (PV) cell, or sun-based cell, is the level of the sun powered vitality sparkling on a PV cell that is changed over into usable power. Enhancing this conversion efficiency is a key objective of research and helps make PV advances cost-aggressive with regular wellsprings of vitality.

$$n(\%)=\frac{\mathrm{I_{sc}}.\mathrm{V_{oc}}.\mathrm{FF}}{P_{in}}$$

2.4 Band Gap Energy

$$Eg(In_xGa_{1-x}N)=x.E_g^{InN}+(1-x).E_g^{GaN}-b.x.(1-x)$$

$$E_g(T_L)=E_{G300}(In_xGa_{1-x}N)+E_{g\alpha}\left[\frac{300^2}{300+E_{g\beta}}-\frac{T_L^2}{T_L+E_{g\beta}}\right]$$

$EG(x) = 3.42x + 0.77(1− x) −1.43x (1− x)$

Where EG is the band gap of InGaN, 3.42 eV is the GaN band gap, 0.77 eV is the InN band gap, 1.43 eV is the bowing parameter b, x is the Ga concentration, and (1-x) is the in concentration.

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2.5 Electron or hole mobility

The electron mobility describes how rapidly an electron can travel through a metal or semiconductor, when pulled by an electric field. That is comparable to amount for holes, called hole mobility. The term carrier mobility alludes as a rule to both electron and hole mobility[7][8].

$$U_o(N,T) = U_{min,i}\left(\frac{T}{300}\right)^{B1} + \frac{\left(U_{max,i} - U_{min,i}\right)\left(\frac{T}{300}\right)^{B2}}{1 + \left(\frac{N}{Nref\left(\frac{T}{300}\right)^{B3}}\right)^{\gamma\left(\frac{T}{300}\right)^{B4}}}$$

2.6 Open circuit voltage

Open-circuit voltage is the distinction of electrical potential between two terminals of a circuit when disengaged from any circuit. There is no external load associated. No external electric flow flows between the terminals. On the other hand, the open-circuit voltage might be thought of as the voltage that must be connected to a sun-based cell or a battery to stop the current

$$\mathrm{V_{oc}} = \frac{K_B T}{q} \ln\left(\frac{J_{sc}}{J_O} + 1\right)$$

3. STRUCTURE

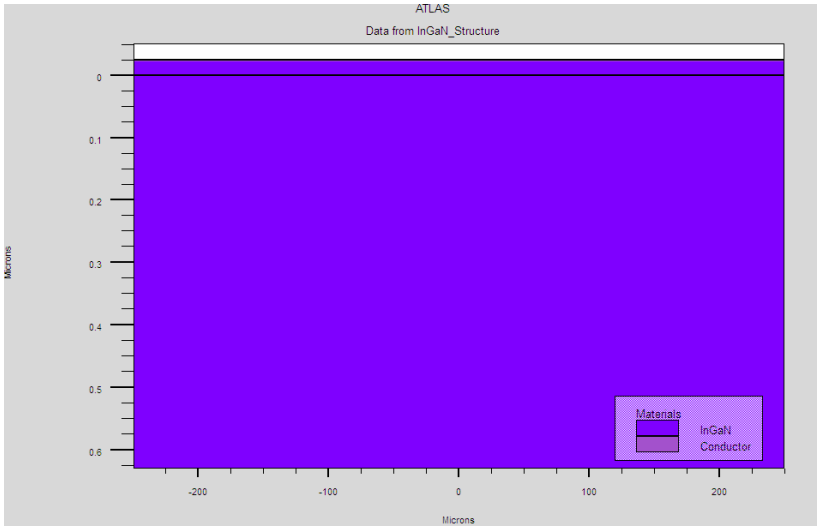


Figure 1 Substrate design of the photovoltaic panel

The generated design is the simulated design of the cell using the InGaN as the material substrate. The thickness of the substrate counts on the y axis in microns and so as the width on x axis in microns too. The design reveals the adjustment of conductor on the material by even less than a micron. This diagram shows the use of different type of material used for the efficient working of a solar panel.

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4. Properties

Table 1 Properties of the material

S.No	Specifications	Rating	Properties
1	Chemical Formula	InGaN	Chemical Properties
2	CAS No.	7440746	
3	Group	III-V	
4	Crystal Structure	Quantum heterostructures	
5	Band Gap Type	Direct	
6	Band Gap	2.5 eV	Electrical Properties
7	Electrical Resistivity (@675°C)	7.81 X 10^{-3} Ω cm	
8	Lattice Constant	4.360 Å	
9	Intrinsic Carrier Concentration	10^{18} cm^{-3}	
10	Electron Mobility	≤ 1000 $cm^2V^{-1}s^{-1}$	
11	Hole Mobility	47.3 cm2/Vs	
12	Modulus of Elasticity	57.9 GPa	Mechanical Properties
13	Shear Modulus	6.46 GPa	
14	Refractive Index (589 nm @ 293 K)	2.59	Optical Properties

5. Result

Solar spectrum at the Earth surface changes constantly depending on the weather and sun position. This results in the variation of φ(λ), QE(λ), α(λ) and thus the short-circuit currents J_{SC}i. As a result, the current densities Ji are not necessarily matched and the total current becomes lower[2][6]. These variations can be quantified using the average photon energy (APE) which is the ratio between the spectral irradiance G(λ) (the power density of the light source in a specific wavelength λ) and the total photon flux density[5].

Fig-2 shows the plot between the current flowing through the anode and the Voltage across the terminals which shows the variation of the anode current with respect to anode voltage.

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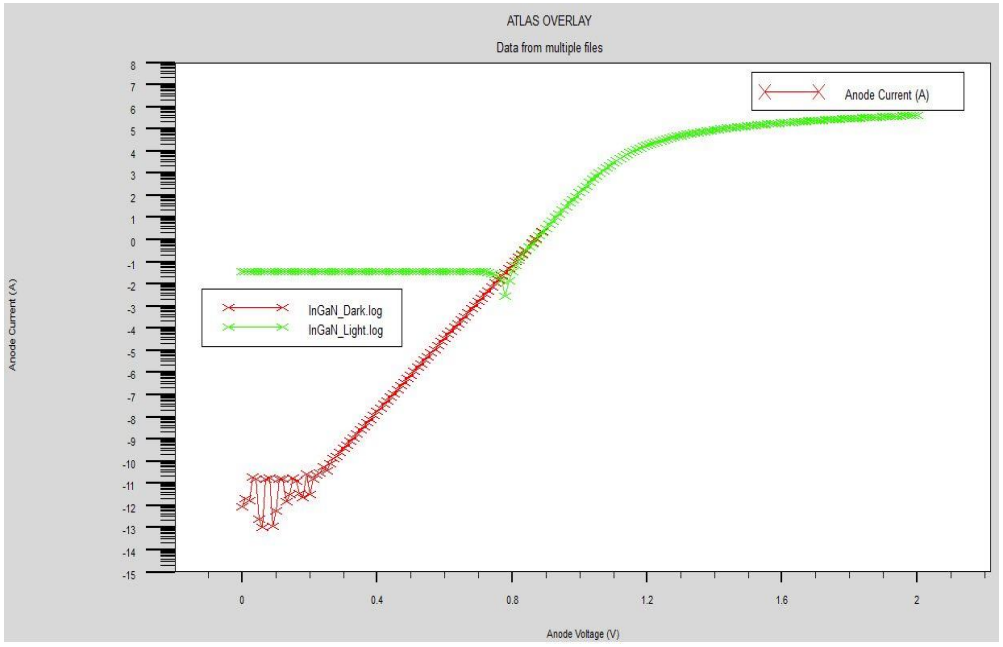


Figure 2 Plot between anode voltage and anode current on solar cell

Fig 2 shows the variation in anode voltage and anode current with the different intensities of light.

Figure 3 shows the plot between the anode current and the optical wavelength of the light falling on the cell.

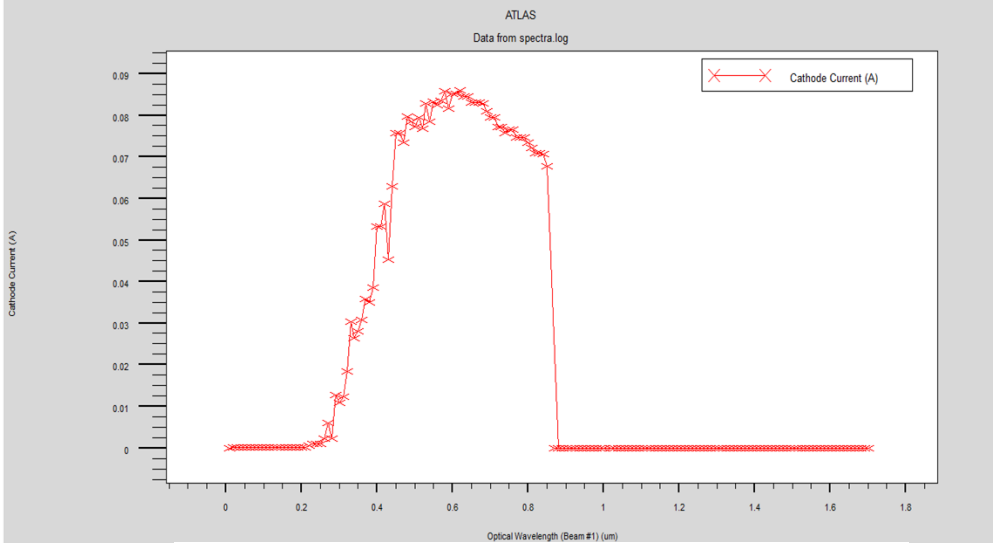


Figure 3 Plot between optical wavelength and cathode current.

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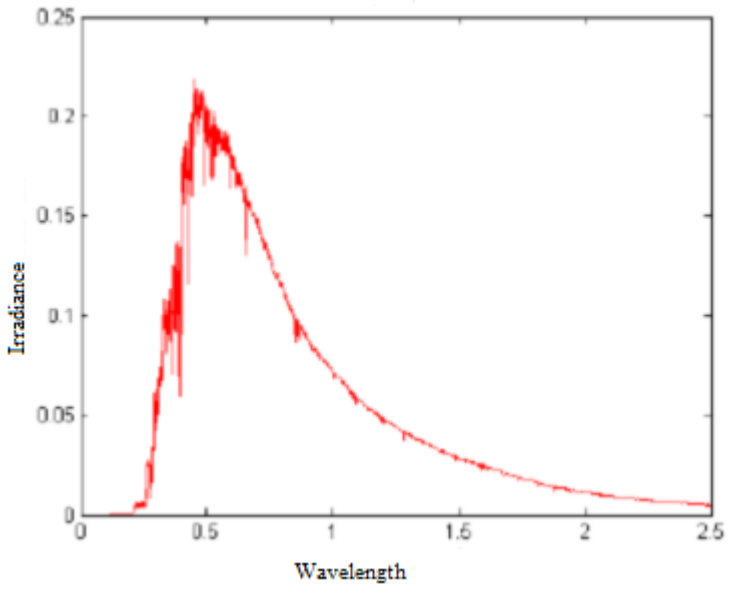


Figure 4 Spectrum Plot between wavelength and irradiance

In Fig 4, it is clearly noticed that the SC material having lower band gap than 4eV can extract the major part of solar spectrum

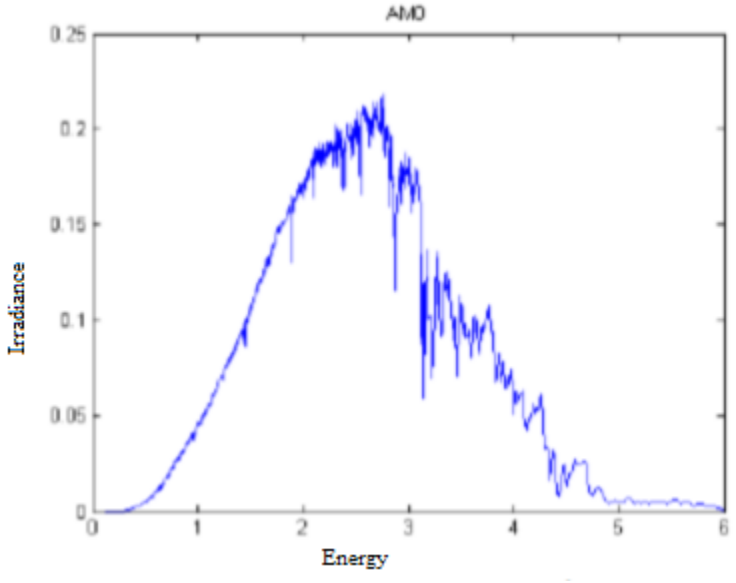


Figure 5 Spectrum plot between Irradiance and Energy

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Table 2 Efficiencies of four InGaN cells

Material	Isc (mA/cm2)	Voc (V)	Fill Factor	Efficiency
$In_{0.21}Ga_{0.81}N$	17.615	2.25	83.74%	24.34%
$In_{0.58}Ga_{0.44}N$	18.397	1.17	78.82%	12.37%
$In_{0.69}Ga_{0.33}N$	20.455	0.93	76.40%	10.54%
$In_{0.79}Ga_{0.23}N$	20.850	0.74	73.75%	08.21%

6. FUTURE SCOPE

As the efficiency of the solar cells are increasing now using the multilayer solar cell this can be proved the most important development in the field of solar energy.
The multilayer and multi material solar cell will be able to perform efficiently in wide range of time to produce more energy.
The variation in material will cause the solar cell to work for the wide range of bandwidth.

7. COCLUSION

The designing of the InGaN Solar module is providing higher efficiency then the conventional solar cell. In all the aspects including the wavelength efficiency the InGaN is above all.
While changing the material used in solar cell, we have increased the efficiency of solar cell by increasing the range of working hours and working for multiple bandwidth.
Band gap building for multijunction solar cells was done so as to enhance the solar collecting productivity by limiting occurrence radiation misfortunes. Spectral irradiance attributes because of winning environmental conditions were recreated to advance the bandgaps of 1-, 2-, 3-, and 4 intersection gadgets. The impact of the cools on the spectral brilliance is obvious from the outcomes and whenever overlooked can result in suboptimal measuring of solar frameworks amid the plan organize.
The photovoltaic parameters for the InGaN *p-n* single-intersection solar cell, for the instances of various doping fixations and distinctive thicknesses of each layer, has allowed accomplishing the best solar cell structure with ideal execution. In this paper, we have also contemplated the impact of the minority bearer lifetime and the velocity of surface recombination on the change productivity of the InGaN solar cell and it was discovered that, to limit the power misfortunes, the transporter lifetime ought to be enhanced by lessening the deformities thickness, and the velocity of surface recombination ought not surpass 103 cm·s−1. Finally, we have considered the electrical qualities vacillation of the single-intersection InGaN solar cell with the temperature variety, and we have seen a solid execution debasement with the expanding of the temperature; this is because of the temperature reliance of the physical parameters of the solar cell.
The examination on the different parts of electrical properties of InGaN developed on Si substrate has been done by Experiments as well as Software. The validation of the recreation of the gadget has been completed by experimental information. The outcomes demonstrate great understanding between experimental and mimicked ones. The gadgets were analysed as far as piezoelectric polarization, transconductance, burrowing, surface devices and spillage. The congruity of the transconductance bend guarantees about the intermingling of the calculation. The assention of experimental information and gadget regeneration demonstrated the reenactment unwavering quality that can be utilized for further analysis of the gadget.

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Performance Evaluation of Mobile Sink using Metaheuristic Optimization Techniques

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ABSTRACT

A wide range of applications uses the Wireless Sensor technology. In which sink node plays a significant role in the processing of data. In the different categories of WSN two varieties of sink node are utilized i.e. static sink node and mobile sink node. This research paper mainly focus on the performance evaluation of mobile sink node using metaheuristic optimization techniques e.g. Ant colony optimization, Antlion Optimization, Grey wolf optimization, Cuckoo search on the basis of following quality of services parameters total packet received, total packet dropped, packet delivery ratio, throughput, average end to end delay and energy consumed. Simulation results and analysis of data explored that GWO gives better results as compare to other techniques.

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1. Introduction

WSN is a collection of varieties of sensors, which collect data i.e. light, temperature, humidity and motion etc., by sensing their surrounding environment. Moreover, after collecting data from the environment, they send collected data to the specific node known as Sink. After that sink node processed data and executes suitable actions.

It was initially used by security applications like battleground observation and intrusion detection. Nowadays, WSN is popular in areas like environmental monitoring, observing the specific area, traffic control, home automation and health related applications. Components of sensing node are microprocessor, transceiver, sensing device and battery. WSN is a particular category of network which has different limitations such as calculation speed, low bandwidth, limited memory and energy source etc. following are the major restrictions:-

- Sensing nodes are activated on limited power source
- Frequent disconnections
- Nature of communication is broadcasting
- Dynamically changing topologies/routes due to mobility

Energy is basically utilized by exchange of data between nodes. Moreover, energy is also consumed by data sensing from surrounding environment and processing data. The major energy source is in the form of battery power. Power unit supplies the battery power to sensing node, that can't be recharged. When the limited power is utilized to cater the need of different functions of sensing node than there must be a need to properly consumed that energy because energy means life. If the energy is consumed properly only than the lifetime of network will be enhance otherwise it will be reduce. Obviously, it is the major concern regarding the sensor network's life, following two points must be considered in mind:-

- Save energy
- Proper utilization of energy

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Progression in the field of soft computing has drawn the attention of researchers to utilize the nature inspired algorithms for routing purpose. Such algorithms have been studied to solve many optimization problems e.g. GA has been implemented to upgrade the efficiency of development computerization framework. Correspondingly, PSO has been implemented to tackle different enhancement issues in assembling. It has been broadly investigated and furthermore has been generally implemented to take care of genuine issues.

Metaheuristic strategies have been generally used to support complex combinatorial improvement issues. The methodology of Metaheuristic may be classified in two different categories (1) based on solo explanation and (2) based on populace. In the most part, the pursuit procedure begins with one solo explanation. The solo explanation arrangement is upgraded through the span of emphasis while the populace based begins the pursuit procedure with an irregular starting populace and this populace is improved throughout cycles. Highlights of the inquiry procedure have two stages, investigation and misuse. Investigation intends to make different arrangements in order to investigate the hunt space while abuse intends to amass the inquiry in a neighbour hood look space.

Over the previous decade, fast advances in the development of remote Sensor Nodes have expanded the scope of uses of Wireless Sensor Networks to incorporate private, mechanical, business, human services and military applications. Trustworthiness of WSN is viewed as a standout amongst the most basic characteristics for modern applications. In such type of applications, the breakdown may cause dangerous impacts and therefore can't to tolerable. A solid WSN is defined as a system that have capacities to cover its inclusion of the focused on Region of Interest and its availability to the sink(s), all through its planned mission time.

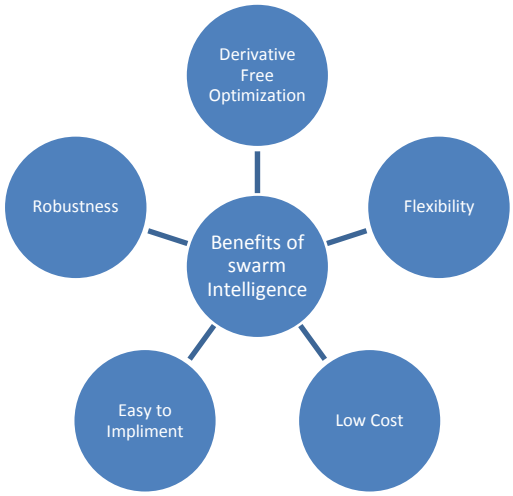


Figure 1.1: Benefits of swarm intelligence

With the development of modern measurement technologies, increasingly high accuracy is required in precision engineering. Inaccurate machine measurements can lead to the failure of entire systems and cause large economic losses.

Our main objective is to improve the performance with different metaheuristic optimization techniques. Section 1 introduced the topic and section 2 explains previous research work in this field. In Section 3, the optimizations Techniques are described along with their flow chart. Section 4 for proposed work and section 5 for results and analysis. Finally, the conclusions will be discussed in section 6.

2. Literature Review

Xingmei Wang et al. [2018] proposed another refresh procedure dependent on a versatile discrete swarm optimized algorithm is utilized to refresh the particle's situation as indicated by the dimension of impediment in order to accomplish a superior following outcome. At long last, the trial results exhibit that the proposed APSO can precisely total submerged target following. Contrasted with different algorithm, it has more following precision and quicker following velocity and it has a specific viability and flexibility. A. Y. Hatata and Alnufaie Lafi [2018] analyzed the three productive and ground-breaking meta-heuristic improvement frameworks to find the perfect estimation of the pickup streams, Ip, and time multipliers setting of the directional over current exchanges (DOC) with different DG invasion levels, goals, and accuse sorts and territories. These are an underground creepy crawly lion streamlining specialist (ALO), artificial safe structure, and atom swarm progression. The objective work is constraining unquestionably the working time of the DOC exchanges. The transient security of the allotment system is used as another basic sitting above the perfect coordination of the DOC exchanges. Two examination structures are considered to test the value of the proposed

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computations; they are IEEE-30 transport (movement territory) and down to earth 11-transport course system from Egyptian West Delta Distribution Utility.

Dong Lin et al. [2018] proposed NPACO calculation to take care of the bi-objective pathfinding issue. To begin with, in view of a planar safe information display, three distinctive seeking territory confined techniques are proposed and analyzed. Moreover, a hub simplification methodology is acquainted with improve hubs that exist in system branch circles, taking out the excess inquiry time in the branch circles. A short time later, we introduced the elitist ants and debilitated methodology for an ACO to beat the issue created by the effect of aggregated pheromone on the problematic way as well as applies procedure to a PACO for urban city pathfinding. At long last, the niching strategy is embraced to at the same time find and keep up different ideal answers for increment seek durability. The test results demonstrate that the NPACO with a limited as well as clear look region restores a Pareto ideal arrangement set that is consistently dispersed along the Pareto outskirts with low computational multifaceted nature [Dong Lin, Lingchao He, Xinxin Feng , and Wei Luo (2018)]. Jiamin Wei and Yongguang Yu [2018] introduced HCS calculation to get greater aspect arrangements as well as intermingling acceleration. Enlivened by the incredible efficiency of differential advancement, the introduced HCS gives two main transformation methodologies to completely abuse the area among the present populace. Besides, a hybrid administrator under self-versatile parameters control is acquainted with parity investigation as well as misuse capacity of the introduced two change methodologies.

Qiang Yang et al. [2018] investigated LLSO to settle vast scale advancement, which is still extensively difficult in developmental calculation. Firstly, a dimension based learning technique is presented, that isolates particles into various dimensions as indicated by their fitness qualities as well as handles particles in various dimensions in an unexpected way. At that point, another model determination technique is intended to haphazardly choose two prevalent particles from two distinctive larger amounts in the present swarm to control the learning of particles. The collaboration between these two procedures could bear the cost of incredible decent variety upgrade for the streamlining agent. Jian Zhao et al. [2018] displayed an enhanced double cuckoo seek calculation (IBCS) for tackling the unit responsibility issue. Another double refreshing component is acquainted with help the IBCS pick a correct pursuit course and a heuristic inquiry strategy dependent on a novel need rundown can keep it from being caught into nearby optima.

Lanyong Zhang et al. [2017] proposed a revised WPA through the foundation of submerged climate risk display under the state of independent submerged vehicle limitation. The way between the ways focuses is briefest, danger is insignificant, as well as vitality utilization is least without thought of sea flow. Reenactment results demonstrate that the modified WPA has a high rate of intermingling and great nearby pursuit ability in high-exactness, high-dimensional, and multi-crest work. Jia Guo and Yuji Sato [2017] clarified a couple shrewd no frills molecule swarm streamlining (PBBPSO) to adjust the investigation and misuse. Besides, a different cycle methodology is utilized in match insightful administrator to improve the decent variety of the swarm. Likewise, to check the execution of the proposed calculation, a lot of understood nonlinear benchmark capacities are utilized in the analysis.

Dina S. Deif and Yasser Gadallah [2017] depicted the issue of conveying a WSN with a specified least dimension of dependability at least sending expense is tended to. This issue is instituted the base cost dependability compelled sensor hub sending issue (MCRC-SDP). The MCRC-SDP is turned out to be NP-Complete. A subterranean insect province advancement calculation combined with a neighborhood seek heuristic is proposed as an answer. Hang Zhang et al. [2017] arranged a far reaching study and examination of different ACO-based steering conventions in MANETs. The basic duties of this examination include: 1) showing the ACO benchmarks as associated in controlling traditions for MANETs; 2) gathering ACO-based coordinating techniques researched in this paper into five essential classes; 3) assessing and differentiating the picked coordinating traditions from the perspective of structure and proliferation parameters; and 4) discussing open issues and future possible arrangement headings of ACO-based coordinating traditions.

Minlan Jiang et al. [2016] explained the support vector machine (SVM) to predict the dynamic measurement error of sensors. However, the performance of the SVM depends on setting the appropriate parameters. Hence, the CS calculation is embraced to improve the key parameters to keep away from the nearby least esteem which can happens when utilizing the conventional technique for parameter advancement. Linguo Li et al. [2016] presented the electro-attraction enhancement dependent on Kapur's entropy, standard GWO and fluffy entropy-based differential advancement calculation are tentatively contrasted and the proposed technique, separately. It demonstrates that FMDGWOA appreciates clear favorable circumstances in division quality, target capacity, and security.

Avoid Hung Tsai and Yu-Wen Chen [2016] identified the issue of nonlinear models and exhibited a novel fluffy strategy dependent on the subterranean insect state advancement calculation. Initial, a modified group legitimacy measure with a fluffy c-relapse display is adjusted to find fitting guideline quantities of the Takagi-Sugeno fluffy model. At that point, the subterranean insect province streamlining calculation is received and the filtered introductory participation work and the subsequent parameters of the fluffy model are gotten. Duangjai Jitkongchuen et al. [2016] recommended a calculation have more pack and have moved between them. The interruption based movement undertaking is used when the figuring is gotten in the adjacent perfect. The results are evaluated by a relative with the standard GWO estimation, PSO and DE algorithm on comprehended benchmark limits.

Pratyay Kuila et al. [2014] proposed two algorithms which depend upon PSO technique. The routing algorithm is extended with multi-purpose fitness work and a successful particle encoding framework. The algorithms to show their predominance regarding network life, utilization of energy, lifeless (dead) sensor nodes, and conveyance of aggregate information packages to the sink clustering algorithm is proposed by acknowledging energy protection by the adjustment of load. The introduced algorithms tested broadly and the outcomes are assessed with the

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current node. Xuxun Liu et al. [2014] clarified the new system of framework based inclusion with ease and availability ensure (GCLC), and suggest another pass on strategy, ACO-Greedy, to determine this inquiry. It relies upon the ACO with avaricious movement system that can quickly play out the full detailing, and obviously decrease the association cost. Furthermore, ACO-Greedy can energetically adjust the detecting/correspondence sweep to decrease the vitality opening issue and stretch the system lifetime. The reenactment results reveal that our made methodology reduce the course of action cost amazingly, just as viably change control utilization among sensor hubs and extend the life of system in framework based WSN.

Wei Yu and Zhiyong Wu [2013] introduced Ant Colony based better algorithm of LEACH protocol Fn-LEACH. Contrasted LEACH algorithm and Fn-LEACH to simulate and exhibits better outcomes in energy use, improving the life of network and unwavering quality, particularly in substantial scale network environment. Yong Lv [2012] talked about another routing methodology for WSN comprising of consistent nodes based an ACO algorithm that find the network and concentrate great routes, utilizing another variety of support learning. Simulation results exhibit that algorithm offers positive measures enabling node architects to adequately operate routing tasks.

Changhe Li et al. [2012] presented a calculation, called SLPSO, for worldwide improvement issues. In it, every molecule has a lot of four systems to adapt to various circumstances in the pursuit space. The participation of four systems is executed by a versatile learning structure at lone dimension, which can empower molecule to pick ideal methodology as per its very own nearby fitness scene. Xiaodong Li and Xin Yao [2012] proposed another pleasing coevolving molecule swarm optimizer (CCPSO) figuring attempting to address the issue of scaling up atom swarm headway (PSO) estimations in dealing with sweeping scale streamlining issues (up to 2000 authentic regarded factors). The proposed CCPSO2 develops the achievement of an early CCPSO that uses a feasible variable get-together methodology self-assertive social event. The test outcomes and examination recommend that CCPSO2 is an exceedingly engaged streamlining figuring for unwinding far reaching scale and complex multimodal progression issues.

Zulfiqar Ali and Waseem Shahzad [2011] considered different bio motivated and progression approaches including Neural Network, GP, PSO, EP and ACO utilized for the protocols of routing in ad hoc and WSN. Projected a probabilistic performance estimation structures and swarm (group) methodologies for protocol of routing. The estimation of performance highlights utilized for wireless as well as ad hoc routing algorithms are routing overhead, energy utilization, and route optimality. This examination gives critical investigation of ACO/PSO based algorithms with different others methodologies executed for the maximization of routing protocols in WSN. Selcuk Okdem and Dervis Karaboga [2006] presented a routing network and adjusted ACO algorithm with in this network to obtain a self-motivated and dependable routing protocol. Moreover, the proposed approach is actualized on smaller hardware equipment as a routing chip to propose sensor node originators a basic dealing of WSN routing activities. Testing of the above chip and its execution results are accomplished by utilizing Proteus program, which is a simulator program. The ACO approach and its equipment execution give the impression to present a promising clarification to node architects to oversee routing jobs adequately and productively.

3. Metaheuristic Optimization Techniques

The swarm approach is the one division of Metaheuristic that concentrates to examine about the collective way of thinking, which outcome from the nearby coordinated effort of the people with one another and with their atmosphere. A part of the typical metaheuristic optimization techniques is PSO, ACO. However, other streamlining methods are Cuckoo Search, Optimization of Gray Wolf and Antlion improvement.

3.1 Optimization of Ant Colony (ACO)

An algorithm of ant colony is utilized for discovering ideal lane from a beginning spot toward eatable material which based upon the conduct of ants looking for their nourishment. At the initial stage the type of movement an ant performs must be random. At the moment source of nourishment is discovered, group of ants start walking towards the colony while leaving the indicator on their way. These indicators work as benchmark for the others ants to locate the food source. Moreover, when they do, they at that point populate the way with their own particular indicators as they carry the nourishment rear. The path becomes more popular and more grounded enough since such a huge number of ants take after a similar path. Shorter paths will probably be more grounded in light of the fact that the ants fall pheromones each time they bring sustenance. In addition, meanwhile, a few ants are as yet looking for nearer nourishment sources randomly. A comparative approach can be utilized to discover best possible solution to represent the sales issue for voyaging. When the source of sustenance is spent, that route is not required further and gradually begins reducing. Cases of such frameworks incorporate computer networks, computerized reasoning and artificial intelligence simulations of specialists.

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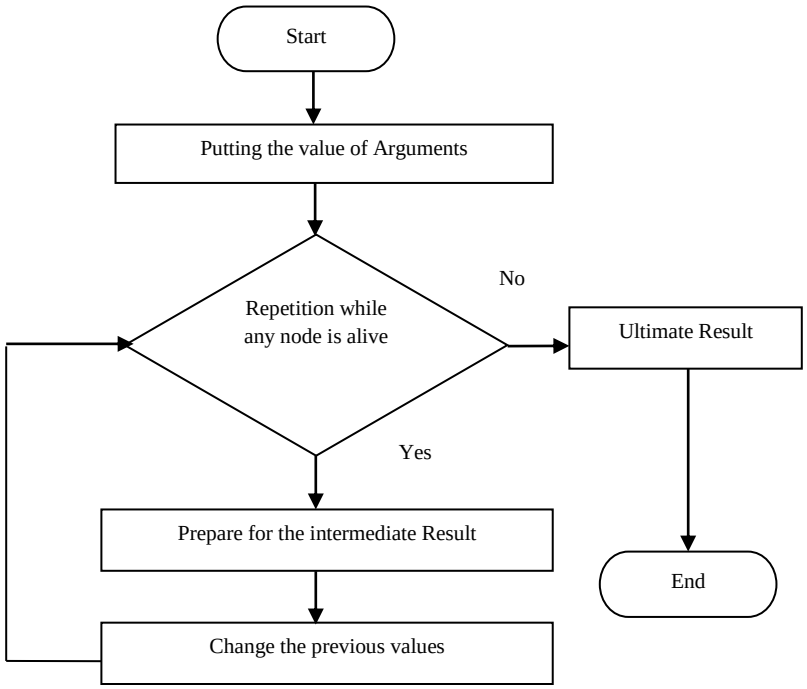


Figure 3.1: Flow chart of Ant Colony Optimization

Advantages

- Inherent parallelism
- Applied in various dynamic applications.
- Speedy detection of fine results by encouraging feedback.
- Quick react to the environmental changes.

3.2 Cuckoo Search Optimization

It is a motivated by nature, in light of the fascinating conduct of cuckoo species which keep their eggs in different winged creature's nest; it composes the worldwide investigation increasingly powerful. The easiest type of CS is as per the following: An egg is an answer and a home is a person of the populace; a not all that great arrangement could be supplanted by another one or other potential arrangements; the quantity of homes is fixed and equivalent to the measure of populace; and a surrendered home on behalf of an individual is supplanted by another one.

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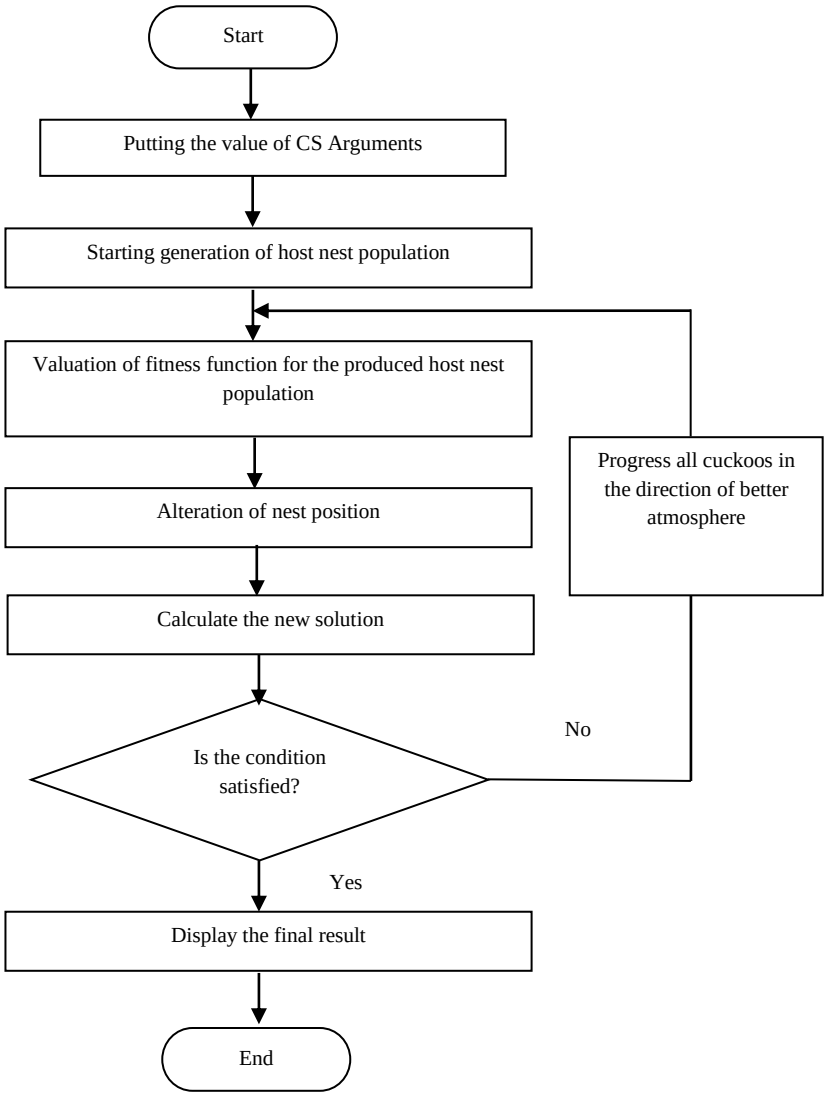


Figure 3.2: Flowchart of Cuckoo search

The standard CS complies with three precepts

- After laid an egg cuckoo bird positions it into the nest of other bird's nest.
- Nests with huge quantity of eggs are pass on to the next phases
- The hosting bird might find an outsider egg through a likelihood P$\alpha \in (0, 1)$, and throw away it or abandon the nest and manufacture another nest.

3.3 Optimization of Grey Wolf

The grey wolf optimizer (GWO) is one of the most recent bio-enlivened advancement. The primary idea is to recreate the activities of grey wolf by living in a group. It has a genuine community prevailing progressive system.

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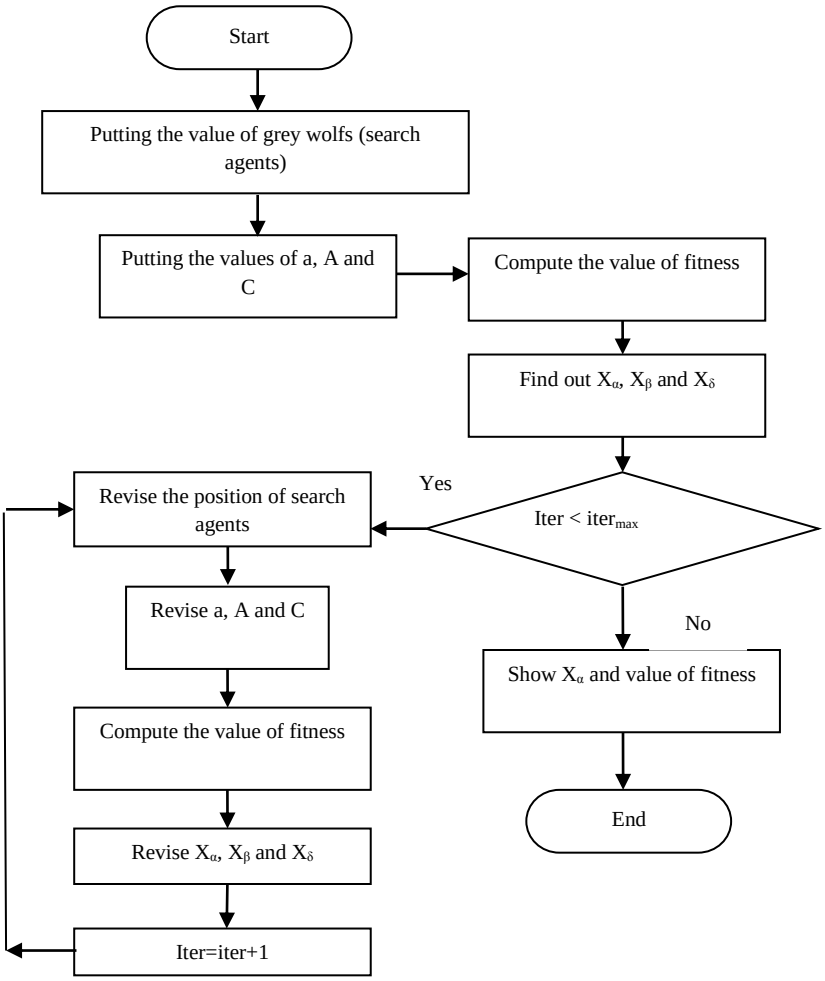


Figure 3.3: Flowchart of Grey Wolf Optimization

- Leaders are called the alpha which is the top rank. The alpha is in charge of settling on choices in a group. The alpha's choice determines the steadiness of grey wolf group.
- Assistant wolves are called as beta which is the second rank. Main job is to assist the alpha in basic leadership and different exercises.
- Some assistant wolves are called as delta which is the third rank. It includes sentinels, scouts, older folks, seekers and guardians. Sentinels secure and ensure the wellbeing of the group. Scouts are responsible for perception the limits of local area and cautioning the group, if there should be an occurrence of any peril. Skillful wolves are called older folks which are utilized as alpha or beta. Seekers support alphas and betas while chasing the prey and giving nourishment to group and guardians are in charge of thinking about the feeble, sick, and injured problems.
- The most minimal dimension rank is called omega. These need to agree to the various predominant wolves group. Now and again it is likewise the sitters in the group.

They have the capacity to hold the places of prey and to encircle them. The alpha plays an important role in the out the pioneer in the hunting.

3.4 Optimization of Antlion

It relates to computational exploration, which is geographically motivated. This method imitates the characteristic conduct of the Antlion creepy crawly. The existence cycle of Antlion creepy crawlies comprises of two primary stages: hatchlings and grown-up. The all out lifecycle can take around 3 years that generally happens in hatchlings. Approximately 25 to 45 days is the grown up life time. Its maturity time is utilized for replica and hatchlings for the purpose of chasing.

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An Antlion hatchling unearths a cone shaped snare inside the sand through moving above a pivoting pathway and tossing out the sand by its enormous scoop formed top. In the wake of exhuming the snare, the hatchling covered itself below the sand at the central point of cone like mechanism and sits fixed for prey to be caught inside the hole in the ground. The device is a splendidly tapered like shape with steep sides and its edges are pointed sufficient for an ant to fall inside the pit. At the point when the insect fall inside the pit, it endeavors to come out from the dividers of the hole in the ground to get away from it. At this stage antlion endeavors to get it by taking out the sands from the base of the hole and endeavoring to nibble the prey. In the process of drawing and demolishing the insect, it tosses the scraps as well as sand external side of the hole and set up the device for the purpose of chasing.

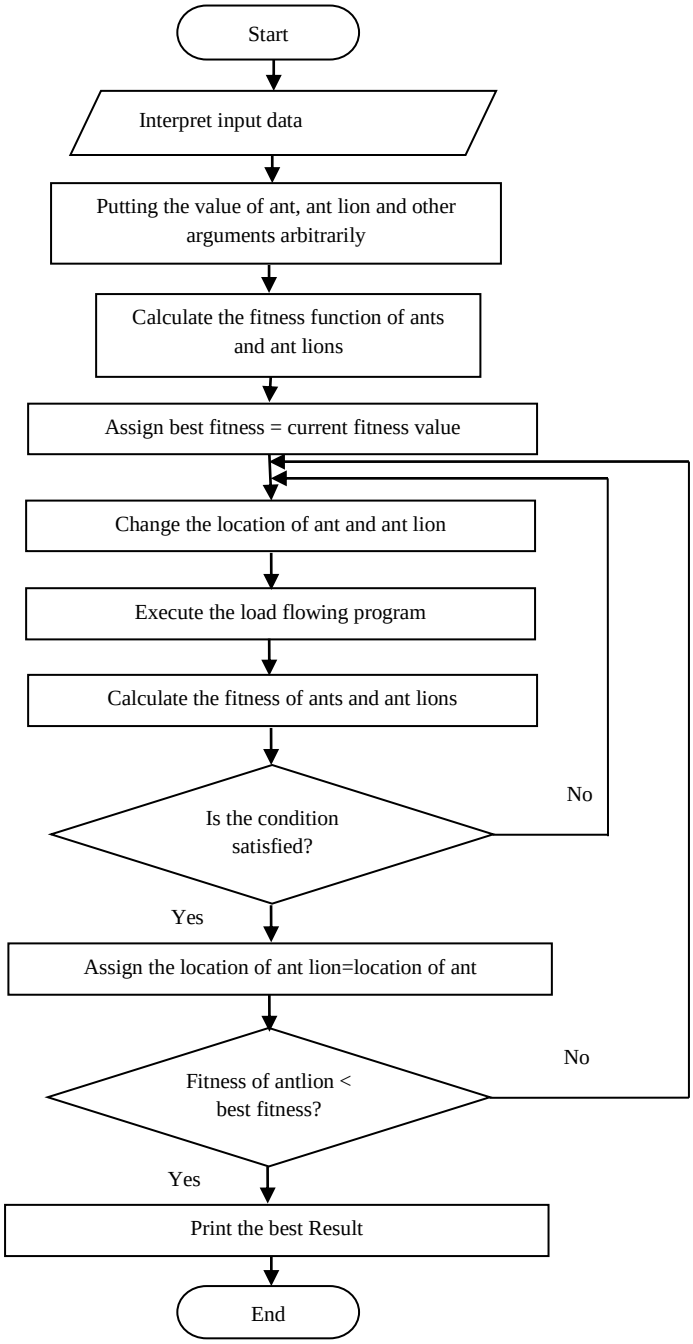


Figure 3.4: Flow chart of Antlion Optimization

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4. Proposed Work

Most of the researchers emphasized to increase the efficiency of WSN by improving the quality of services parameters and through the use of mobile sink. In this paper performance of mobile sink is evaluated on the basis of various metaheuristic optimization techniques e.g. Ant Colony Optimization, Grey Wolf Optimization, Antlion Optimization, and Cuckoo Search Optimization with the combination of following quality of service parameters i.e. total packet received, total packet dropped, packet delivery ratio, average end to end delay and energy consumed. Network simulator 2 is utilized with Ad hoc On-Demand Distance Vector (AODV) Protocol.

Table 4.1: Simulation Tool

S. No.	Parameter Name	Description
1	Channel type	Channel/Wireless Channel
2	Radio-propagation model	TwoRayGround/Propagation
3	Antenna type	Antenna/OmniAntenna
4	Network interface type	Phy/WirelessPhy
5	Interface queue type	Queue/DropTail/PriQueue
6	Link layer type	LL
7	Max packet in ifq	50
8	Number of mobile nodes	25,50
9	MAC type	Mac/802_11
10	Routing protocol	AODV
11	Sink Movement	Random
12	AgentTrace	ON
13	RouterTrace	ON
14	MacTrace	ON
15	MovementTrace	ON
16	Optimization Techniques	ACO, MALO, MGWO, CS

5. Results and Analysis

Results are analyzed and discussed with the help of following quality of services parameters total packet received, total packet dropped, packet delivery ratio, average end to end delay and energy consumed. Results are as follows:-

Table 5.1: Analysis for Total Packet received in various optimization techniques

OPTIMIZATION USED	ACO	ALO	GWO	CS
SCENARIO NO.				
1	6090	6974	7391	6774
2	5837	6974	7510	6839
3	6205	6974	6745	6908
4	5759	6974	7436	6392
5	5956	6974	7945	6539

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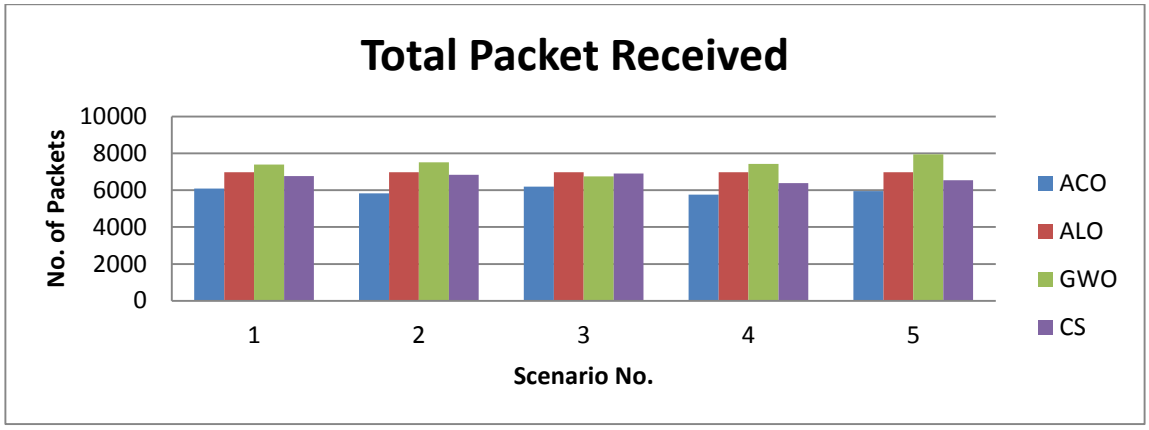


Figure 5.1: Comparisons of various optimization techniques on the basis of total packet received.

In the above figure, GWO received highest packets in four scenarios and ACO received lowest packets in all the scenarios. ALO at the second position only in third scenario it received highest packets and CS mostly at the third position. We can conclude that GWO has highest packet received and ACO has lowest packet received.

Table 5.2: Analysis for Total Packet dropped in various optimization techniques

OPTIMIZATION USED	ACO	ALO	GWO	CS
SCENARIO NO.				
1	4585	3566	3156	2858
2	4831	3566	3042	3714
3	4470	3566	3796	3642
4	4885	3566	3131	4174
5	4678	3566	2593	4013

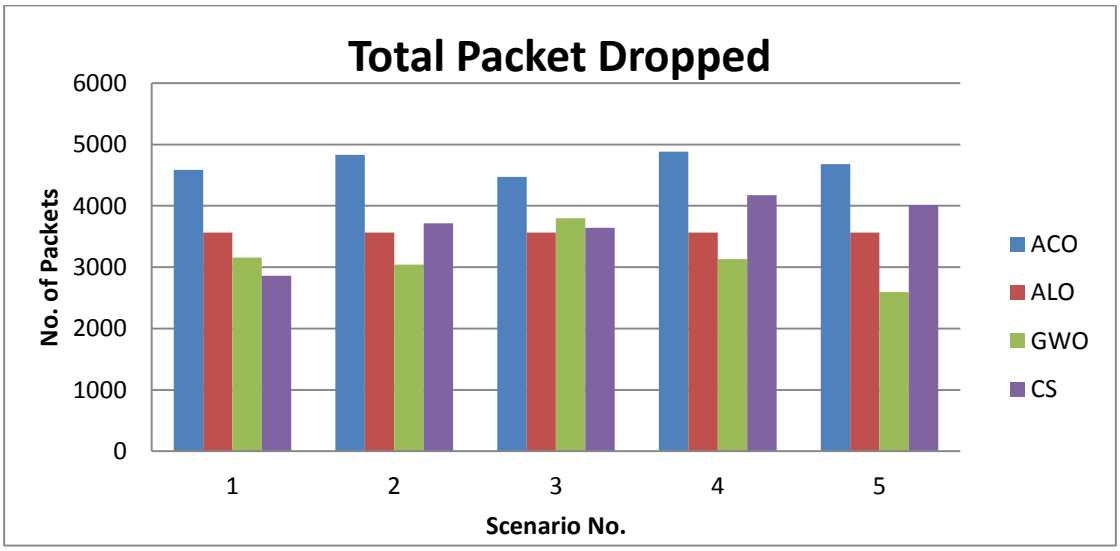


Figure 5.2: Comparisons of various optimization techniques on the basis of Total Packets dropped.

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In the above figure, ACO dropped highest packets in all the scenarios and GWO dropped lowest packets in three scenarios. CS at the second position only in first scenario it dropped lowest packets and ALO mostly at the third position. We can conclude that ACO has highest packet dropped and GWO has lowest packet dropped.

Table 5.3: Analysis for Packet Delivery ratio (PDR) in various optimization techniques

OPTIMIZATION USED	ACO	ALO	GWO	CS
SCENARIO NO.				
1	57.93%	66.34%	70.31%	63.77%
2	55.53%	66.34%	71.44%	65.06%
3	59.03%	66.34%	64.16%	65.72%
4	54.79%	66.34%	70.74%	60.81%
5	56.66%	66.34%	75.58%	62.21%

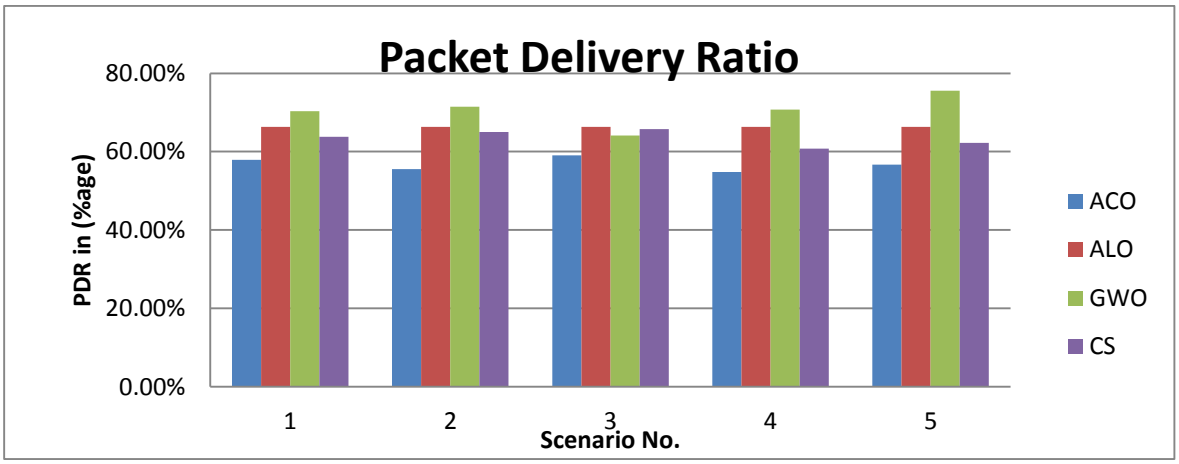


Figure 5.3: Comparisons of various optimization techniques on the basis of Packet Delivery Ratio (PDR)

In the above figure, GWO has highest packet delivery ratio in four scenarios and ACO has lowest packet delivery ratio in all the scenarios. ALO at the second position only in third scenario it has highest packet delivery ratio and CS mostly at the third position. We can conclude that GWO has highest packet delivery ratio and ACO has lowest packet Delivery ratio.

Table 5.4: Analysis for Throughput (Kbps) in various optimization techniques

OPTIMIZATION USED	ACO	ALO	GWO	CS
SCENARIO NO.				
1	3.0450	3.487	3.6955	3.3520
2	2.9185	3.487	3.7550	3.4195
3	3.1025	3.487	3.3725	3.4540
4	2.8795	3.487	3.7180	3.1960
5	2.9780	3.487	3.9720	3.2695

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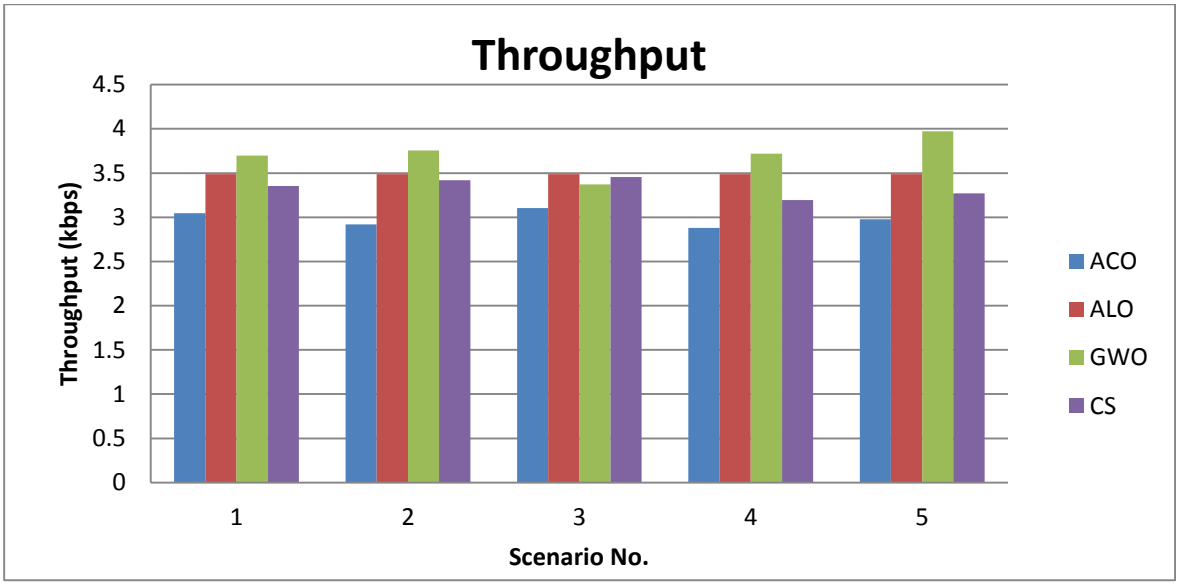


Figure 5.4: Comparisons of various optimization techniques on the basis of Throughput (Kbps).

In the above figure, GWO has highest throughput in four scenarios and ACO has lowest throughput in all the scenarios. ALO at the second position only in third scenario it has highest throughput and CS mostly at the third position. We can conclude that GWO has highest throughput and ACO has lowest throughput.

Table 5.5: Analysis for End to End delay in various optimization techniques

OPTIMIZATIO USED	ACO	ALO	GWO	CS
SCENARIO NO.				
1	0.6303	0.7364	0.4960	0.5171
2	0.6813	0.7364	0.3610	0.5486
3	0.8368	0.7364	0.4460	0.4077
4	0.7270	0.7364	0.5490	0.4969
5	0.6061	0.7364	0.3920	0.5950

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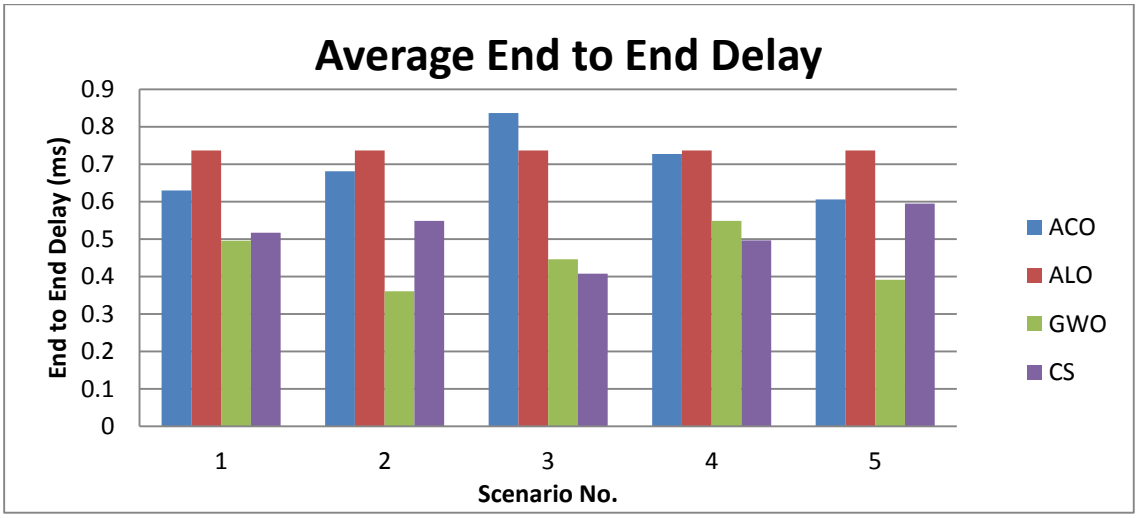


Figure 5.5: Comparisons of various optimization techniques on the basis of End to End delay.

In the above figure, ACO has highest average end to end delay in third scenario and at the second position in rest of the scenarios. GWO has lowest average end to end delay in three scenarios. ALO has highest average end to end delay in four scenarios and CS mostly at the third position. We can conclude that ALO has highest end to end delay and GWO has lowest end to end delay.

Table 5.6: Analysis for Consumed Energy in various optimization techniques

Optimization	Consumed Energy (j)
GWO	900.71
ALO	900.522
CS	900.348
ACO	900.174

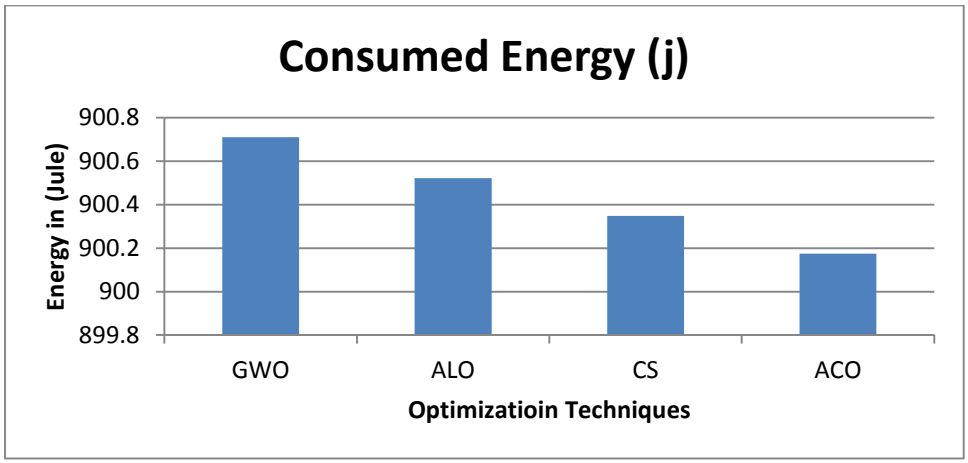


Figure 5.6: Comparisons of various optimization techniques on the basis of Consumed Energy.

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In the above figure, we can conclude that GWO has consumed highest energy. ALO at the second number and CS at the third position in energy consumption. ACO has lowest consumed energy.

6. Conclusion

In this paper performance of different metaheuristic optimization techniques are evaluated with network simulator 2. Results are compared on the basis of following parameters packets received, packets dropped, packet delivery ratio, throughput, average end to end delay and energy consumption. According to the packet received, GWO has highest packet received and ACO has lowest packet received. When compare on the basis of packet dropped, ACO has highest packet dropped and GWO has lowest packet dropped. However, comparison on the basis of packet delivery ratio shows that GWO has highest packet delivery ratio and ACO has lowest packet delivery ratio. In the case of throughput, GWO has highest throughput and ACO has lowest throughput. Average end to end delay analysis demonstrates ALO has highest end to end delay and GWO has lowest end to end delay. More energy is consumed by GWO and least energy consumption by ACO.

Simulation results and data analysis demonstrated that Grey Wolf Optimization (GWO) has highest packet received, highest packet delivery ratio as well as highest throughput as compare to others techniques. However, ACO has highest packet dropped and ALO has highest average end to end delay when evaluated with others. Moreover, highest energy is consumed by GWO and lowest energy consumption by ACO.

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Chapter 30
An Effective Duplicate Removal Algorithm for Text Documents



Amit Jha, Devendra Somwanshi and Mahesh Bundele

1 Introduction

The processes of detection and correction (or removal) of duplicate or inaccurate records from a database are called data cleansing or data cleaning or data scrubbing. There are many ways by which inconsistencies take place; it can be due to corruption in transmission or storage, or may be due to user entry errors, or may be due to different data dictionary definitions of similar entities in different stores. In data cleaning process to remove typographical errors or to validate and correct values through a known list of entities, there are many data cleansing solutions, some clean data by cross-checking with a validated dataset. A number of different activities can be involved in data cleaning such as harmonization of data, standardization of data, and data means, by using standard codes which change a reference dataset to a new standard. The problem of duplicate data removal has been considered a critical aspect of data cleaning. When data from distributed data sources is integrated, the same data in different data sources leads to non-redundant data. This requires the identification and removal of duplicate data that leads to redundant data.

2 Data Cleaning Techniques

Based on the existing duplicate records, identification algorithms SNM and MPN [1] were proposed as an improved algorithm which analyzes attributes and sorts the dataset multiple times to make duplicate records more clustered. The algorithm also gives a special weight to each attribute and introduces the concept of effective weight so that to make the comparison more accurate. A filtering mechanism was introduced

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to improve the efficiency of detection. Many current commercial tools support the extraction, transformation, and loading (ETL) [2, 3] of (possibly unclean) data into a trustworthy (cleansed) database. ProbClean [2] is another solution to efficiently support relational queries. It treats duplicate detection procedures as data processing tasks with uncertain outcomes. There are many defined techniques for data cleaning, some are as follows.

2.1 Parsing

To detect the syntax errors, parsing method is used in data cleansing. By parsing, lexical errors and domain errors can be rectified as it firstly takes sample set of values to deduce the format of the domain. Besides that, for anomaly detection, it generates discrepancy detector.

2.2 Data Transformation

Data transformation is another process of data cleansing in which first of all mapping of data is done from some given format, into a common scheme, which fit it according to the needs, and then it is transformed into the format expected. Standardization and normalization are the part of transformations before the mapping to remove irregularities in data.

2.3 Integrity Constraint Enforcement

Integrity is the major concern when data is modified by inserting, deleting, or updating something. If some integrity constraints are violated, then it is rejected during integrity constraint checking. Additional identified updates are to be added only to the original data if there is no violation in integrity constraint.

2.4 Duplicate Elimination

Duplicate elimination is an essential part of data cleansing. There are a number of methods in duplicate elimination, in every method. In each duplicate detection method, there must be an algorithm which detects the duplication in each entry [4–7].

3 Proposed Duplicate Removal Technique

A simple and new approach has been used to design the data cleaning system, especially for duplicate detection and removal which is shown in Fig. 1.

3.1 Duplicate Removal Algorithm

The data from the text file is read word by word and stored in the array list. The length of the array is calculated. In the process, each word/character in the array is compared with all other words/characters to detect the duplicates. If the duplicate is found, it is deleted and the count is maintained for the repeated number of words/characters. The modified array along with the duplicate information is saved.

- Read the data from the file and store it into the ArrayList.
- Calculate the length of ArrayList.
- Initialize variable i, j, and c with 0.
- Check the length of ArrayList
  - If length > i, go to step *v,* else
  - store the original ArrayList in file and go to step xi.
- $y = i + 1$
- While (j < length-1), go to step vii, else go to step x.
- Compare value of $a[i]$ with $a[j]$, if yes go to step viii, else increment j by 1 and go to step vi.
- Add duplicate element in new ArrayList and Delete duplicate element from the original ArrayList. Count the duplicate element by incrementing the value of c by 1.
- Increment value of j by 1.
- Calculate the new length of updated ArrayList and increment the value of i by 1 and goto step iv.
- End.

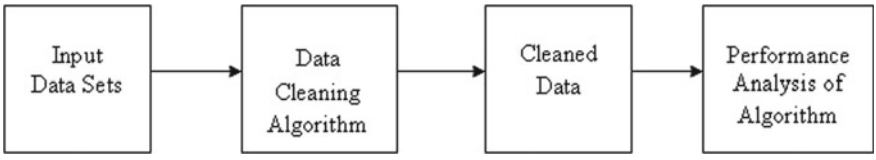


Fig. 1 Block diagram of the system

4 Different Experimental Scenarios

Different experimental scenarios are used to check the performance of our system.

Text Data: The data has only text values having some duplicate text data.

Numeric Data: The input data consists of numerical values with some duplicate numerical values.

Text and Numeric Data: The data is the combination of text and numerical values.

Text, Numeric, and Special characters: In this data file, there are text data, numeric data, and some special characters with duplicate data also.

For testing the algorithm for larger datasets, files with varying numbers of words from 10 to 23,598 including all data types were used.

5 Experimental Results

Our experiments were performed on jdk 1.5.0 installed on 2.1 GHz Intel Core i5 processor and Windows 7 Operating System.

5.1 Text Data

For testing the algorithm with text data, following 18 text words with four duplicates were tested and the screenshot displayed i.e. Fig. 2 shows that all the four duplicates are removed from original data.

Tarun ashish mohan tarun Amit Mehta Jangid ram atul Amit Lal shyam mohan kumar Babu verma purbey Atul

The total number of words before cleaning was 18 in which four words were duplicate ones. After applying our method, the result shows excellent result by removing duplicate words in the data.

5.2 Numeric Data

For testing the algorithm with numerical data, the string of following 20 numeric values with three duplicates was fed as input to the algorithm and the results are shown in Fig. 3.

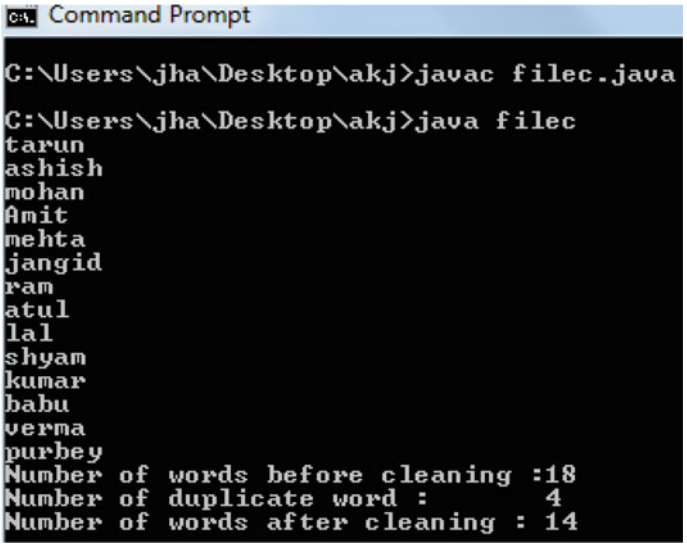


Fig. 2 Performance analysis on text data

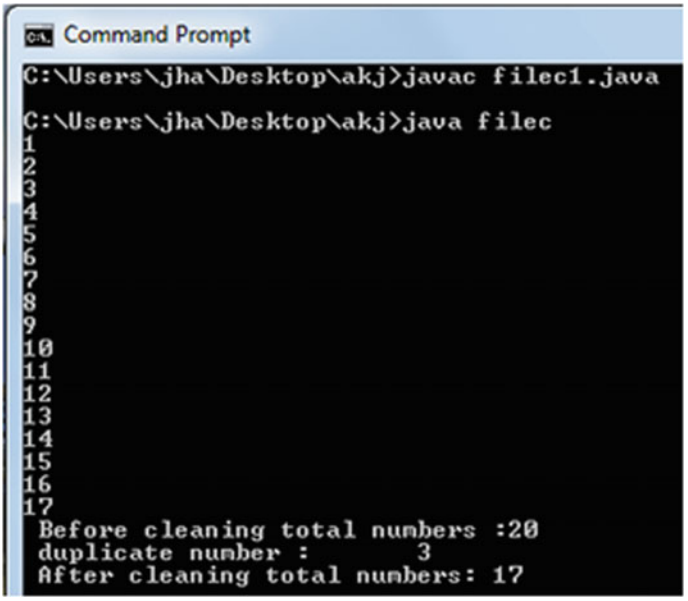


Fig. 3 Performance analysis on numeric data

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 1 2 3
Before cleaning total numbers: 20
Duplicate numbers: 03
After cleaning total numbers: 17

It shows that the algorithm works good with numerical data also.

5.3 Text and Numeric Data

For testing the algorithm with text and numeric values, a file containing 55 total numbers of text words and the numerical values was tested.

Ram Sumit Ram 5 16 Shyam Dheeraj Amit 6 17
Sita Sanjay Alap 7 18 Gita Garima Sumit 8 19 Manoj
Raj Dheeraj 9 20 Ravi Rajnish Garima 10 21 Amit Surendra
Manoj 11 22 Alap Shusil 1 12 23 Amit Shashi 2 13 24 Amit
Shyam 3 14 25 Amit Sita 4 15 26

In Fig. 4, results show that all the duplicates are removed and the system is performing well in this case.

Number of words and number before cleaning: 55
Numbers of duplicate word and number: 12
Number of words and number after cleaning: 43.

5.4 Text, Numeric, and Special Character Data

A file containing total 18 characters including text, numeric values, and special symbols was fed to the algorithm, and the test results show that five duplicates were removed which is shown in Fig. 5.

@ @ 1 # & 2 * sumit 3 $ raj4 % Amit 1 & raj2
Number of words, Number and Symbols before cleaning: 18
Numbers of duplicate: 05
Number of Data after cleaning: 13

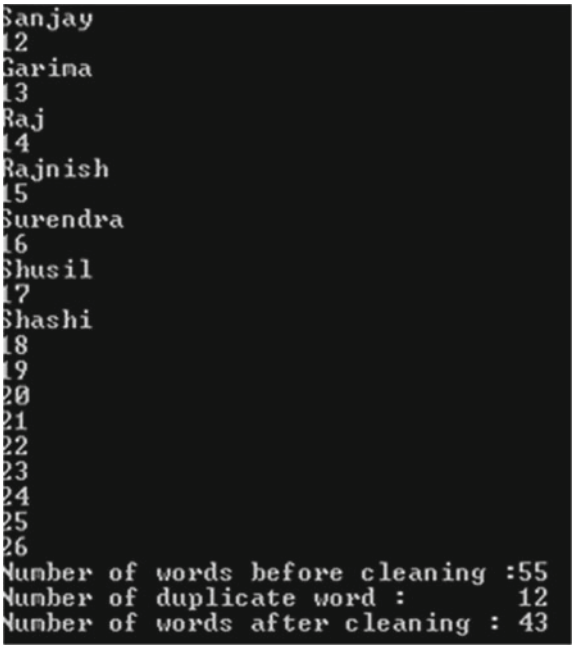


Fig. 4 Performance analysis on text and numeric data

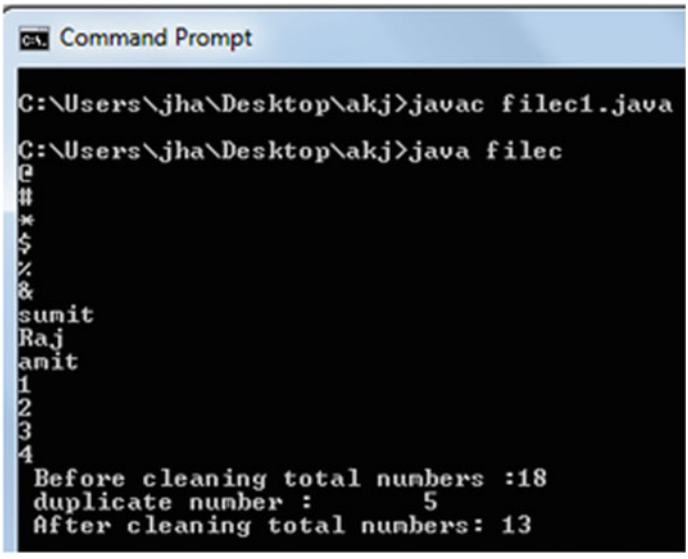


Fig. 5 Performance analysis on text, numeric, and special character data

Table 1 Performance analysis on varying numbers of words

File size	Number of duplicate words	Number of words after removing duplicates	Duplicate detection rate (%)
10	03	07	100
25	07	18	100
65	13	52	100
95	27	68	100
133	35	98	100
356	148	208	100
578	189	389	100
753	256	497	100
1243	365	878	100
1986	487	1499	100
2576	583	1993	100
3563	654	2909	100
4587	666	3921	100
5643	743	4900	100
6487	798	5689	100
7489	1008	6481	100
8734	1154	7580	100
9679	1678	8001	100
18,765	4563	14,202	100
23,598	5003	18,595	100

5.5 Performance Analysis on Varying Numbers of Total Words

To test the algorithm on a file that contained huge number of data, different size files are tested. The results are excellent as expected and shown in Table 1.

6 Conclusion

A data cleaning algorithm is presented in order to detect and remove duplicate data from text files having different data types in order to improve the quality of data. From the results, it could be found that the proposed algorithm could provide 100% correct duplicate detection rate in all the cases. The proposed concept can be extended for removal of other kinds of data impurities. This work presents testing with text files only, and hence, the algorithm can be modified for duplicate removal from other file formats such as xls, xlsx, doc, docx, and pdf.

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A review on mechanical and wear characteristics of particulate reinforced Al-alloy based MMC

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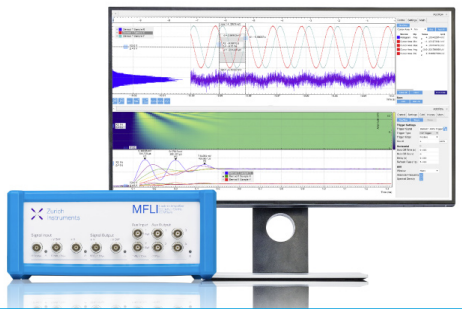
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A Review on Mechanical and Wear Characteristics of Particulate Reinforced Al-alloy based MMC

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Abstract. Aluminum (Al) alloy based Metal Matrix Composites (MMC's) are receiving more attention as a vital engineering material over a decade because they are characterized by their high specific strength, light weight, good corrosion resistance, low density and better wear resistance over monolithic materials like ferrous metal and its alloys respectively. Replacing ferrous-alloys (like steel) from aluminum alloys in making components are more in practice across the metal industries. However, later have lesser mechanical strength/properties. Therefore, researchers worldwide innovating Al-alloy based MMC's as they have better strength-to-weight ratio. Al-alloys based MMC's are preferred in many applications such as bearings, gears, seals, guides, piston rings, pistons, crankshafts, cylinder heads, brakes and clutches etc. The present work is a literature review of Al-alloy MMC's with particulate reinforcement and its influence on their Mechanical and Wears characteristics.

INTRODUCTION

A composite material is a macroscopic combination of two or more distinct materials such as binder and reinforcement that are insoluble in each other (do not lose their individual identities), thereby imparting best properties common to its ingredients. When we use metals as matrix phase in composites, they are called as Metal Matrix Composites (MMC). Thus, MMC are evolved as group of newly advanced materials characterized for their high strength/specific modulus, light weight, low coefficient of thermal expansion, good wear resistance, high specific stiffness, superior elevated temperature properties etc. Researchers are working actively to innovate such materials that could be substituted in place of monolithic materials, so as to enhance functional performance at lower cost. Aluminum and its alloys are now-a-days frequently replacing steel by the virtue of its unique combination of mechanical, physical and chemical properties [1]. The MMC based on Al-matrix are reported to incurred low fabrication cost in-relative-to MMC based on other metals like copper (Cu), zinc (Zn) etc. Such composites are preferred in many applications like bearings, gears, pistons, crankshafts, brakes and clutches [2-3]. In this paper, an attempt has been made to highlight use of alloy as matrix material in MMC and their mechanical/wear characteristics.

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LITERATURE REVIEW

Review Based on Mechanical Properties

The Al-alloys are vastly used by various material scientists as matrix material. They reinforced it with various ceramic particulates or fibers in order to enhance its mechanical properties. This section report such studies at length. The summary of previous studies based on mechanical behaviors is provided in Table 1.

TABLE 1. Previous studies on mechanical behaviors

Authors (Year)	Material	Preparation method	Testing Methods	Application
Chawla (2006)	Al 2080, SiC (20vol. %)	Sinter forging Hot pressing and Extrusion	Microstructure Strength test Fatigue test	Crankshaft, Engine Applications
Onat et al. (2006)	Al-4.5, Cu-3, Mg Alloy, SiC (5, 10,15 vol. %) 36μm Avg. size	Squeeze Casting	Hardness test Tensile test Strength test	Aerospace, Automotive Industry
Schubert et al. (2007)	Cu (CuCr0.8 powder in wt. %), size 10-15μm Synthetic diamond (50 vol. %) Grit of mesh 70/80 (177-210μm)	Powder Metallurgy	Thermo Physical XRD, TEM, EDS, SEM	Heat sink application, Electronic component packaging
Xia (2008)	Copper alloy Cu-4Sn-6Zn, Cu-6Sn-6Zn-3Pb, C fiber (6-18 vol. % in 3% each step).	Powder Metallurgy	Hardness test Density test Bending strength Friction Coefficient Wear Rate	Bearing Bushing
Okafor and Aigbodion (2010)	Al-4.5 Cu, Zrsio4 (5-25 wt. %), 2-15μm size.	Squeezed casting	Hardness test Porosity test Impact Energy Tensile Strength	Crankshaft, Brake drum, Cylinder block
Kumar and Swamy (2011)	Al6061, Fly Ash (2%, 4%, 6%, 8% wt.), E- glass (2%,6% wt.)	Stir casting	Tensile Strength, Compressive Strength test, Hardness	Automotive, Industrial application
Rao and Padmanabhan (2011)	LM 6 Al Alloy, B_4C (2.5%,5%,7.5% by wt.)	Stir casting	XRD, SEM Hardness test Compression test	Structural Applications
Kammer et al.(2012)	Al 7075, E-glass (1%,3%, 5% wt.), Fly ash(2%,4%,6%,8% wt.)	Induction furnace	Tensile strength Compressive strength	Gears and Shafts, Aircraft Fittings
Sharma (2012)	Al6061, SiC (2%,4%,6%,8% wt. size 15-30 μm), E-glass (2%,4%,6% wt. size 3-5 mm)	Vortex technique	Tension test Compression test Hardness test	Automotive industry
Verma et al.(2012)	Al 6063, Fly ash (3%, 6%, 9% wt.)	Stir casting	Vicker Hardness Fatigue Strength	Automotive Industrial Application
Boopathi et al. (2013)	Al 2024, [SiC (5%) + fly ash (10%)], [SiC (10%) + fly ash (10%)]	Stir casting	XRD, Optical Microscopy Hardness test Tensile test	Structural Applications
Hemalatha et al. (2013)	Al 6063, Al_2O_3 (3%, 6%, 9%) Varying mass.	Stir casting	Tensile test Hardness test	Structural component Automobiles
Anilkumar and Hebber (2011)	Al 6061, Fly ash (10%, 15%, 20% wt., size 4-25, 45-50 and 75-100 μm particle size)	Stir Casting	Tensile test Compression test Hardness test	Automotive industry

TABLE 1. Previous studies on mechanical behaviors (continued)

Authors (Year)	Material	Preparation method	Testing Methods	Application
Kumar and Devi (2013)	Al 6061, Cu (4%, 6%, 8%, 10% wt. variations)	Die casting process	Tensile Strength Hardness test Impact Strength Microstructure	Air Frame, Propulsion System, Damage Tolerance Application
Lokesh et al. (2013)	Al-4.5 wt % Cu Alloy, Fly ash (3, 6, 9, 12 wt. % with an applied pressure of 120 MPa. (size 49-60μm).	Gravity and Squeeze casting	Hardness test Tensile test Compression test Impact test	Automobile Rolling Application
Pydi et al. (2013)	Al, WC	Powder Metallurgy	SEM, XRD	Brake pads Bearings, Bushes, Piston Rings
Evangeline and Motgi (2014)	Al 6061 Alloys, SiC (3%-6% varying weight), Fly Ash (3%, 6% wt.) Red Mud (3%, 6% wt.)	Stir casting	Tensile test Impact test Wear Test	Automobile Aeronautical Industries
Prasanna et al. (2014)	Al alloy (LM25), [SiC 3% E-glass, 1%Red Mud (3, 6, 9%)], [SiC 3% E-glass (1%, 2%, 3%) Red Mud 3%], [SiC (3%, 6%, 9%) E-glass 1% Red Mud 3%]	Stir casting	Tensile test Ductility test Impact Strength Hardness test Microscopy	Automotive industry
Yellappa et al. (2014)	Al 7075 Alloy, E-glass (2%, 4%, 6% wt.)Fly ash (1%, 3%, 5% wt.)	Graphite Die casting	Tensile test Hardness test	Automobile, Bicycles Electronic Substrates
Sahraeinejad et al. (2015)	Al 5059 Alloy, Al_2O3, SiC, and B_4C with particle sizes of 130, 250, and 35 nm.	Stir Casting	Micro-Hardness test	Automotive industry
Shirvanimogh addamet al. (2016)	Al Matrix, B_4C, TiB_2 and $ZrSiO_4$	Stir Casting	Tensile test Hardness test	Automotive industry
Prasanna et al. (2017)	Al alloy 6061, (SiC15%), (SiC5%+FlyAsh10%) and (SiC5% + Neem leaf ash10%)	Stir Casting	Hardness test Micro-structural characterization	Structural Applications
Inegbenebor et al. (2018)	Aluminum (99.66% C.P), SiC (2.5%, 5%, 7.5%, 10% wt.) of 320 and 1200 grits.	Stir Casting	Young's modulus Hardness test	Industrial application

Chawla [4] worked with composite system comprises of Al 2080 reinforced with 20 vol. % SiC, fabricated by sinter forging and hot pressing/extrusion separately for automotive applications. It was reported that forged microstructure of the composite exhibited some preferential alignment of SiC particles perpendicular to the forging direction and such alignments are much better in extruded composite than sinter forging methods. The forged composite material reported to have slightly higher young modulus and strength but it shows least overall ductility. Stress concentration factor is observed to be lower using reinforcement in the composite system than neat one. Onat et al. [5] have reported work on fabrication and characterization of SiC (5%, 10%, 15 vol. %, avg. size 36 μm) and Al-4.5Cu-3Mg alloy composite system by direct squeeze casting. They reported that the failure in composites occur in both the matrix and particles simultaneously. This indicated that there is good bonding between matrixes and SiC particles and the fracture initiation did not occur at matrix particle interface. Strength, hardness and density reported to increases with volume fraction of SiC. Schubert et al. [6] used powder metallurgy methods for preparing composites of Cu (CuCr 0.8 powder in wt. %), size of 10-15 μm, synthetic diamond (50 vol. %), grit of mesh 70/80 (177-210μm). It was reported that thermal conductivity increased by the formation of composite. X-ray analyses reveals formation of Cr3Cr2 as the main reaction product in composite. Using Half peak width, a crystal size in the range 20-40 nm of the interfacial carbide can be estimated. TEM revealed nano-crystalline structure of the inter layer and an interlayer of 100 nm is clearly visible. EDS showed high Cr content in the carbide inter layer. These analyses confirm the continuous character of the thin carbide layer observed at fracture surfaces. Xia [7] also used

powder metallurgy methods for preparing composites of copper alloy Cu-4Sn-6Zn, Cu-6Sn-6Zn-3Pb C fiber (6-18 vol. % in 3% each step). It was observed from the analysis of different tests that the bending strength of carbon fiber/Cu-Sn-Zn increase with increasing content of C-fiber. Maximum bending strength occurs at 9% C-fiber, while hardness was 15 vol. %. C-fiber was very effective in reducing wear and friction of composite with 12 vol. % C-fiber. Friction coefficient of Cu-Sn-Zn was much lower than that of leaded copper under a constant load 50N.

Okafor and Aigbodion [8] have reported work on effect of ZrSiO4 (5-25 wt. %, 2-15 μm size) reinforcement on the microstructure and properties of as cast Al-4.5Cu matrix composite system synthesized by squeezed casting method. They concluded that hardness increases by 107.65%, apparent porosity increases by 34.23%, Impact energy decreases by 43.16% with increasing weight fraction of ZrSiO4. However, yield and tensile strength increases by 156.52% and 155.81% respectively up to maximum of 15 wt. % of reinforcement. Kumar and Swamy [9] reported mechanical properties of Al 6061, fly ash (2%, 4%, 6%, 8% wt.), and E-Glass (2%, 6% wt.) fiber reinforced hybrid MMC prepared by stir casting method. They observed improvement in the tensile strength up to 60-70% as well as hardness with weight fraction but improvement in compressive strength is marginal. Rao and Padmanabhan [10] have investigated mechanical properties of Al-alloy LM6 and B4C (2.5%, 5%, 7.5% wt.) composite system. Phase Identification was carried out using X-ray diffraction and microstructure analysis was done by SEM. They concluded that density decreases, hardness and compressive strength increases with reinforcement content.

Kammer et al. [11] used induction furnace process for making composite of Al 7075, E-glass (1%, 3%, 5% wt.) and Fly ash (2%, 4%, 6%, 8% wt.). An increase in ultimate tensile strength and compressive strength was observed due to presence of fiber as compare to base metal. Sharma [12] investigated mechanical properties of composite system prepared by vortex technique. The various composites prepared were Al 6061 + 2% SiC wt., Al 6061 + 4% SiC + 2% E-Glass wt., Al 6061 + 6% SiC + 4% E-Glass wt., Al 6061 + 8% SiC + 6% E-Glass wt. respectively. An increasing trend in tensile strength, compressive strength, hardness with proportion of SiC and E-glass was observed during test. Verma et al. [13] reported work on modeling of process variables for composite system consists of fly ash (3%, 6%, 9% wt.) and Al 6063 using neural network technique and fabricated by stir casting method. They observed increase in hardness and decrease in fatigue strength of Al6063/Fly ash composites with fly ash content. Boopathi et al. [14] investigated mechanical properties of Al-alloy 2024, reinforced with (SiC 5% + fly ash 10% wt.) and (fly ash 10% + SiC 10% wt.) by stir casting method. They reported significant decrease in density and elongation, increase in hardness and tensile strength relative to neat alloy. Microscopy showed that SiC and fly-ash particles were well distributed in Al Matrix and XRD showed negligible changes in contents of constituents. Hemalatha et al. [15] have reported work on the processing and synthesis of MMC by stir casting method. The MMC consists of Al 6063 reinforced by Al2O3 (3%, 6%, 9% wt.). They observed increase in tensile strength and hardness while decrease in density across the composition. Anilkumar and Hebber [16] prepared various composites of Al 6061, Fly ash (10%, 15%, 20% wt., for particulate size of 4-25, 45-50 and 75-100 μm. It was observed that tensile strength, compressive strength, and hardness increases with increasing wt. % of fly ash. Ductility decrease, wear rate decreased with the increase in particle size of fly ash. Kumar and Devi [17] studied mechanical characteristics of composite having Al-alloy 6061 and Copper (4%, 6%, 8%, 10% wt.). Die casting method was used for preparation of composite. Increasing trend in hardness, tensile strength, and impact strength of the composite were observed with weight fraction Cu particulates up to 8%, thereafter it reported to have decreasing trend.

Lokesh et al. [18] have investigated the work on characterization of Al-4.5wt.% Cu alloy reinforced fly ash (3%, 6%, 9%, 12% wt., size 49-60 μm) with an applied pressure of 120 MPa synthesized by gravity cast and squeezed casting methods separately. They observed that in either cases hardness, tensile strength and impact strength increases by weight fraction of fly ash, while density decreases. Microstructure shows the absence of micro porosity and grain refinement. Porosity in composite material are higher in case of gravity cast method then squeeze cast. Pydi et al. [19] used technique of powder metallurgy for making a composite of Al and WC. Tiny grain structure was observed as compare to pure Al. Impact resistance property increases, cracks and voids decreases. Evangeline and Motgi [20] reported mechanical properties of Al 6061, SiC (3%-6% wt.), fly ash (3%, 6% wt.) and red mud (3%, 6% wt.) prepared via stir casting method. They observed higher tensile strength, impact strength and wear resistance in composite system, comprises of Al-SiC-fly ash in comparison to Al-SiC-red mud composite system. Prasanna et al. [21] had reported work on mechanical properties of [SiC 3% + E-glass 1% + red mud (3%, 6%, 9% wt.), SiC 3% + E-glass (1%, 2%, 3% wt.) + red mud 3%, SiC 3%, 6%, 9% wt. + E-glass 1% + red mud 3%] reinforced Al-alloy LM25 composite system. They concluded that addition of reinforcing materials improves tensile strength, impact strength and reduces percentage elongation. Addition of E-glass minimizes the hardness. Microscopy shows that reinforced particles are nearly uniformly distributed. Yellappa et al. [22] prepared various samples of Al 7075 Alloy, E-glass (2%, 4%, 6% wt.), Fly ash (1%, 3%,5% wt.) using gravity die casting method. Improved tensile strength and Hardness was reported with increase in % of E-glass and Fly ash.

Sahraeinejad et al. [23] have investigated Al 5059 matrix reinforced with Al_2O3, SiC, and B_4C with particle sizes of 130, 250, and 35 nm respectively. They concluded that 11%, 20%, and 38% increases in yield strength compared to the matrix alloy for composites containing nano-scale Al_2O3, SiC, and B_4C, respectively. The average micro-hardness value within the stir zone was increased from 85 HV in the base material to a maximum of 170 HV in the B4C-reinforced composite. Shirvanimoghaddam et al. [24] have investigated the influence of processing temperature and inclusion of micron-sized B_4C, TiB_2 and $ZrSiO_4$ on the mechanical performance of Al matrix composites fabricated through stir casting. They concluded that maximum improvement is achieved due to addition of ZrSiO4 and TiB2, which has led to 52% and 125% increase in tensile strength and hardness respectively. Prasanna et al. [25] had reported work on mechanical and wear properties of (SiC15%), (SiC5%+FlyAsh10%) and (SiC5% + Neem leaf ash10%) reinforced with Al alloy 6061 composite material. They concluded that (SiC5% + Neem leaf ash10%) shows improvement in mechanical properties like hardness. The wear properties has been reduced and their Micro structural characterization shows uniform distribution of SiC and Neem Leaf ash in the composition. Inegbenebor et al. [26] investigated dispersion of SiC (2.5%, 5%, 7.5%, 10% wt.) of 320 and 1200 grits to Aluminum (99.66% C.P) as reinforcement and matrix respectively via stir casting technique. They concluded that silicon carbide of 1200 grits (3 μm) showed increased Young's modulus (E) and hardness of 1517.6 Mpa and 26.1 Hv values at 7.5% volume fraction silicon carbide.

Review Based on Wear Analysis

The material scientist across the world also studied wear characteristics of composite system consists of Al-alloys based matrix reinforced with various ceramic particulates or fibers. This section reported such studies at length. Table 2 provides summary of previous studies based on wear behaviors.

Tjong and Lau [27] used hot iso-static pressing method for preparation of Cu (pure powder, 50μm dia.),SiC (5,10,15 and 20 vol.%), 75 μm diameter composite. It was concluded that addition of SiC particles up to 20 vol.% appeared to improve the abrasive wear resistance under the applied load 15-55 N.Dry sliding wear also indicated that with 20 vol.% SiC exhibits lower wear loss compared to pure copper. Hardness increases and yield strength decreases with addition of SiC particles. Reihani [28] reported the work on the homogenous distribution of SiC (30 vol. %, size 16 / 2 μm) particulates in Al-alloy 6061 matrix via squeeze casting method. Higher strength and lower wear rates were observed in the composite material than neat one. Also, ductility of the composites observed to decrease with reinforcement content while wear resistance increases. Basavarajappa et al. [29] reported work on the influence of sliding speed on dry sliding wear behavior and the extent of surface deformation on hybrid metal matrix composite, namely Al 2219 / 15 wt.% SiC and Al 2219 / 15 wt.% SiC/ 3 wt.% graphite, all composites are fabricated by liquid metallurgy route. They concluded that the addition of SiC to Al 2219 alloy increases the wear resistance for a constant load 40 N, sliding speed 1.53 m/s, 3.46 m/s, 6.1 m/s respectively for a fixed sliding distance 5000 m. The addition of graphite further increases the wear resistance at all sliding speeds and avoids the occurrence of severe wear. The degree of subsurface deformation increases the sliding speed. Tang et al. [30] prepared composites of Pure Cu and Short C fiber (1-2mm) (9.3, 13.8, 17.9, 23.2 vol.%) using Cold press and sintering. Friction coefficient and wear weight loss decrease and micro hardness enhances with an increase in carbon fiber content. It was observed that compared to pure copper the wear resistance of Cu/CFs composite was improved. Both friction coefficient and wear mass loss increases with increasing of load and rotating speed respectively.

Haque et al. [31] investigated the effect of stirring speed and pouring temperature on the wear rate of Al 6061-Cu 4% reinforced with SiC particulate composite system by stir casting method. Gopalakrishnan and Murugan [32] have investigated the fabrication and wear characterization of Al-alloy 6061 matrix reinforced with titanium carbide (7% wt.) and Mg 1% wt. by stir casting method. They concluded that specific strength and wear rate increases by addition of TiC. They also observed increase in wear with load. They reported optimal wear rates when the stirring speed is 200-600 rpm, the same increases drastically at higher speed of 800 rpm. Also, the wear rates are observed to be stable across all stirring speed with pouring temperature 700-750°C, except at 800 rpm. The hardness and impact strength observed to be increases with reinforcement content. Alaneme and Olubambi [33] reported work on corrosion and wear behavior of rice husk ash (2%,3%,4% wt.), Al2O3 (6%, 7%, 8%,10% wt.) reinforced Al-Mg-Si alloy matrix hybrid composite system. They observed that corrosion rates increases with increase in weight % of rice husk ash. Coefficient of friction and wear rate increases with increase in rice husk ash weight %. Ghosh et al.

[34] reported work on tribological performance optimization of Al-alloy LM6 and SiC (7.5 wt.%, size 37 μm) composites fabricated by stir casting method. They observed decrease in wear depth and friction by 39% and 28% relative to neat one.

TABLE 2. Previous studies on wear behaviors

Authors (Year)	Material	Preparation method	Testing methods	Applications
Tjong and Lau (2000)	Cu (pure powder, 50μm dia.), SiC (5, 10, 15 and 20 vol. %), 75 μm dia.	Hot iso-static pressing	Abrasive wear Hardness test	Electrical sliding contacts, Railway overhead, Current Collection system
Reihani (2004)	Al 6061, 30 vol.% SiC, size (16-22μm)	Squeeze Casting	Mechanical Properties Wear Behavior	Structural application
Basavarajappa et al. (2006)	Al 219, 15 wt % SiC (25μm), 15SiC-3Gr	Liquid Metallurgy	Route Dry sliding wear	Piston, Driveshaft, Cylinder liners
Tang et al. (2008)	Pure Cu, Short C fiber (1-2 mm) (9.3, 13.8, 17.9, 23.2 vol. %)	Cold press and sintering	Electroplating Wear test.	Electrical packaging, Heat Exchanger, Electrical devices
Haque et al. (2012)	Al 6061, Cu 4%, SiC 5%	Stir casting	Hardness test Impact test SEM	Automobile application
Gopalakrishnan and Murugan (2012)	AA 6061, TiC (7 wt. %) Mg (1%, increasing the wettability)	Stir casting	Pin on Disc (wear test), Optical Microscopy	Transportation Military Structural application
Alaneme and Olubambi (2013)	Al-Mg-SI alloy, Rice husk ash (RHA 10% wt.), Alumina (2, 3, 4% wt.)	Open circuit Corrosion	Potential coefficient of friction, Wear behavior	Sports and Recreation Defense assemblies
Ghosh et al. (2013)	Al (LM6), SiC(7.5% by weight, 37μm)	Stir casting process,	Multi tribometer	Bearings and antifriction materials.
Mishra et al. (2014)	ZA-27, SiC(0-9 wt. %) in a step of 3% each	Stir casting	Erosion wear	Combustion chamber, Heat exchanger
Uzkut (2013)	Al 2011, SiC (7%,14%, 21%) size (64μm)	Vortex method	Sliding wear Hardness test	Crankshaft, Piston Cylinder liner
Radhika et al. (2014)	Al Si10Mg Alloy,3wt. % Graphite,9 wt. % alumina	Liquid Metallurgy,	Route Sliding Wear Test (Dry)	Piston, Brake drums, Crankshaft

Mishra et al. [35] investigated the erosive behavior of ZA-27 reinforced with SiC (0-9 wt. % with step of 3%) prepared via stir casting. They concluded that the erosive wear rate is influence more by impact velocity of erodent's and reinforcement content respectively in comparison to other factors. The wear rate decreases with reinforcement content. Uzkat [36] reported work on sliding wear behavior SiC (7%, 14%, 21% wt., size 64 μm) reinforced Al 2011 metal matrix composite. They observed increase in wear rate with the SiC particulate contents. Wear resistance decreases with the abrasive grit size of the emery used. Brinell hardness increases with increases the fraction of SiC. Radhika et al. [37] reported the work of optimization of dry sliding wear process parameters for aluminum hybrid metal matrix composite by liquid metallurgy route. They fabricated composite system comprises of Al-Si-10% Mg as matrix reinforced with graphite 3 wt.% and alumina 9 wt.%. They concluded that wear resistance increases with increasing load (10 N,20 N,30 N) and temperature (50°C, 100°C, 150°C) respectively and decreases with sliding velocity (1 m/s, 2 m/s,3 m/s) respectively.

CONCLUSION

The above literature review on mechanical and wear characteristics of alloy metal as matrix material with ceramic reinforcement reported to enhance mechanical and wear properties, therefore these could be used as substitute against the neat alloy wherever it applicable. Such composite system could be fabricated by stir casting, squeeze casting etc. Future research can be directed towards analyzing the thermo-mechanical behavior of Al alloy based MMC's.

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Study of Electromagnetic Radiation Effects on Human Body and Reduction Techniques

Rupesh Acharya, Durgesh Kumar and Garima Mathur

Abstract It is 2017 and mobile communication technology has completely engraved itself into our lives. Mobile communication technology usage has been quickly develop internationally in the last 10 years, which has ensued in concern of public about the harmful health effect of electromagnetic (EM) radiation that are discharged by cell phones. The exposure of electromagnetic radiation (EMR) has received an equitable share of participation in literature; however, this paper is one to represent the effects of the electromagnetic fields induced by cell phones on human body, plans related to electromagnetic vulnerability in mobile communication and present feasible ways of reducing the effects.

Keywords Epidemiological · EM radiation · Specific Absorption Rate (SAR) Mobile communication system

1 Introduction

In this modern era of technology, with the rapid development of information technology, more and more electronic devices/gadgets are invented, and the electromagnetic radiation of electronic devices/gadgets is getting more and more aid. Nowadays, the number of cell phone usage has been quickly expanded internationally in the last ten years, which has ensued in concern of public about the bad effects on health of electromagnetic radiation that are discharged by cell phones. Mobile phone technology has revolutionized the Indian telecommunication scenario; more than 100 crore people are using mobile phones. All in all, a major

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problem is the growing concern of public about the harmful effects on health of the interaction between EM radiation and the human body [1, 2]. A higher brain cancer peril showed by epidemiological studies in human being who had used handset for more than 10 years [3]. There is abundant experimental proof of alteration in brain activity of human brain caused by the mobile phone exposure [4]. Concerning the endocrine system, the hypothalamus-hypophysis-thyroid axis plays a staple function in profiles of human hormone which impacts the body emergence, progress, metabolism, and action of nervous system. It has been entrenched that even a petite alteration in thyroid hormone stratums flowing in the blood is ample to interpolate function of brain. It is (thyroid gland) one of the most vulnerable and vital organs and can be a target for any sort of EM radiation [5]. The Specific Absorption Rate (SAR) used as an indicator of EM radiation in the study of microwave biologic. The SAR caused by the human vulnerability to EM fields, and it is the standard criteria to measure or calculate the amount of EM radiation energy engrossed by the body's unit mass tissue. The expression Specific absorption rate (SAR) is defined as

$$\mathrm{SAR} = \frac{d}{dt}\left(\frac{dw}{dm}\right) = \frac{d}{dt}\left(\frac{dw}{\rho dv}\right) \tag{1}$$

In the actual measurement, the radiation power is not easy to obtain; therefore, the expression can be deformed as

$$\mathrm{SAR} = \frac{\sigma E^2}{\rho} \tag{2}$$

The electrical conductivity and density are known, so that if we know the electric field intensity the value of Specific Absorption Rate (SAR) will be measured or calculated. Specific Absorption Rate (SAR) is measured or calculated individually for different parts of body due to their pace of preoccupation. Thus, SAR metrics is further subdivided into

(1) Whole-Body Averaged Specific Absorption Rate (wbaSAR): It is elucidated as the ratio of power (total) enwrapped in the body and the mass of body. For regulative conformity, the wbaSAR is averaged over duration of 6 min. The Whole-Body Averaged SAR is expressed as

$$\text{Whole Body Averaged SAR} = \frac{1}{M}\int_R \sigma |E|^2 \delta v \tag{3}$$

where

M => mass (complete) of body
R => area of the body
V => volume of complete tissue of the body

(2) Organ-Specific Averaged Specific Absorption Rate (osaSAR): It is elucidated as mass average of the SAR in a specific tissue or organ in the body. Organ-Specific Averaged SAR is expressed as

$$\text{Organ Specific Averaged SAR} = \frac{1}{M_{organ}} \int_{organ} \sigma |E|^2 \delta v \tag{4}$$

3) Peak Spatial-Averaged Specific Absorption Rate (psaSAR): The utmost local Specific Absorption Rate mean over a particular tissue's mass, customarily 10 gm, above duration of 6 min is known as peak spatial-averaged SAR [6].

Specific absorption rate (SAR) measure unit is watt/kilogram and as stated by Telecommunication department of India, SAR value must be made available to the consumers at the point of sale.

2 Effects of Em Radiation on Human Body

When a human body comes in contact with EMR, it engrosses radiation, as human body is made up of 70% liquid. It is alike to that of cookery in the oven where the water in the food substance is made hot first. Microwave engrossment consequence is much more substantial by the parts of human body which comprise more liquids (blood, water, etc.), like brain which comprise of anent 90% water. Consequence is easily noticeable where the motion of the liquid is less, for instance, heart, eyes, brain, and etcetera. The higher molecular substances, water molecules, and proteins are the main corporeal to engrossment the EM radiation in the human body. When the surface of skin comes in the contact with EM radiation energy, the oil, water molecules, and other substances in skin start riveting the radiation energy. With the depth of the radiation energy in the skin, energy crumble in a very short distance, so the SAR in the skin layer minify is visible. The skull has low water content and mainly composed of minerals (calcium and phosphorus), so the absorption of EM radiation in the skull layer is very low. The amount of water in the brain tissue is comparatively high, and there is more molecular material in tissue of brain, which leads to the brain tissue absorption of EM radiation energy are obvious. After the EM radiation preoccupancy of the skin and skull, the radiation energy has certain attenuation, the SAR value in the layer of brain tissue was significantly lower than the layer of skin. The SAR value in the layer of brain tissue attenuation speed is greater than skin layer because the brain tissue electrical parameters are higher or greater than skin layer. In human head, the EM radiation engrossment is mainly concentrated on the skin and brain tissue, the engrossment rate on skull is very low. The water level in the human body is gradually loss, with the increase of the age, which leads to the electrical parameters decreases [7]. The electrical parameter of children and adolescents is higher than adult. Engrossment of EM radiation by an adult, 10-year-old and a 5-year-old child from mobile phone is shown in the Fig. 1. The yellow area at the base is the spot of mobile phone by the ear.



Fig. 1 EM radiation absorption from mobile phone based on age

2.1 Effect on Male Fertility

Electromagnetic radiation that is emitted by mobile phones can affect the man fertility. According to the American Society for Reproductive Medicine (2006) reported that utilization of mobiles by men is related with diminution in sperm count, quality of semen, viability, motility, and customary morphology and is associated to the time span of mobile use. Studies have established 30% sperm minify in intense users of mobile, in inclusion to harm of sperms. Average count of sperm was established to be at 59 million sperm per ml of seminal liquid compared to 83 million for men not regularly influenced to handset radiation [8]. Alike, the study established that motility—sperm's capability to swim—was influenced by handset transmission. Adult male who create calls for long duration had not many speedily motile sperm, 36.3% likened with 51.3% for adult male who create no calls. Cell phone also has an effect on sperm quality of men, when merely having handset switched ON in a pant as cell phones sporadically channelize information to mobile towers to establish contact. The radiation which is emitted by handset can also create DNA shatter in cells of sperm that can change in form or nature and cause cancer. Harm to DNA of sperm step-up the peril further and can move on the genetic changes to succeeding generations.

2.2 Effect on Ear

Tinnitus, popularly known as "Ringxiety"—is the psychological disorder of hearing illusory sound and sense of handset ring and it has been described amid millions of users of handset in the globe. Human beings with severe tinnitus may have problem hearing, working, or even sleeping. Radiation which is discharged by handset may harm the intricate operations of inner ear, and long-term and intense handset utilization for more than 4–5 years and for prolonged durations more than 30 min per day are at a greater peril of growing hearing loss, which cannot be transposed.

2.3 *Effect on Pacemaker*

EM radiation exposure from mobile phone can affect the pacemaker, impulse generators and Implantable Cardiovascular Defibrillators carrying patients. Mobile phone signals cause EM hindrance with the devices and interpose with its proper working. Signals generated by the functions as ringing, turning on, talk and hanging up, hold low frequencies components that can step in with the planted pacemakers causing them to begin to be arrhythmical which in harmful state may put the patient to death. Because of these reason, it is advisable do not keep the handset squarely above the implanted pacemakers (shirt's pocket). Handset should not be used with the left ear, if the pacemaker is planted in the left side. It should be used with right ear.

3 EMR Exposure Guidelines and Limits

For mobile telephony, the Global System for Mobile (GSM), 3G and 4G networks operate at the frequency range of 900–2600 MHz. The parceling of unalike frequencies is rigorously headed by International Telecommunication Union (ITU) and nationally by the pertinent regulatory authorities. EMR is categorized into ionizing and non-ionizing radiation as given in Fig. 2. EMR with enough energy to abolish densely bound electrons from the trajectory of an atom, hence making the atom to become ionized is called as ionizing radiation. EM radiation which do not have sufficient energy to ionize the atoms is called as non-ionizing radiation.

According to the 2011 report by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) arrived at a judgment that

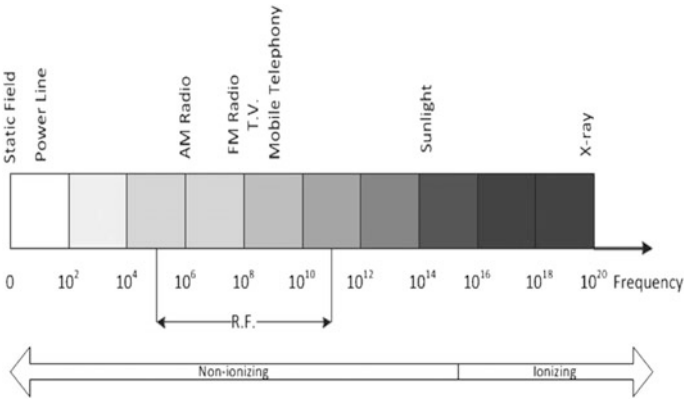


Fig. 2 Electromagnetic spectrum

electromagnetic radiation (EMR) is mayhap carcinogenic to people and categorized it as Group 2B, a class used when there is confined proof of carcinogenicity in people [9]. The electromagnetic radiation (EMR) vulnerability principles and limits have been established by several international and national agencies and adopted by the relevant regulatory authorities. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) gave the principles and limits in their report [10] and mobile phones in the market should not exceed this limit. These principles apply to both public and occupational exposure and are based on epidemiological studies and laboratory. Adults who are trained and having knowledge of the possible effects of EM exposure and take necessary safeguard are referred as occupational. And public vulnerability refers to the people of all ages. ICNIRP sets the SAR value of 1.6 w/kg which is actually for 10 g tissue over a period of 6 min [10]. Many people are not aware about the short-term and long-term possible effects of EM exposure on the human body, so it is required to make the people aware about this.

ICNIRP SAR exposure limits

	Public	Occupational
Whole-Body (w/kg)	0.08	0.4
Head (w/kg)	2	10

4 Em Radiation Reduction Techniques

For increasing the spectral efficiency and peak data rate, the IV back-to-back generations of handset have been designed. It is anticipated that other standard such as energy efficiency, latency, and electromagnetic radiation vulnerability will have an indispensable role in the design of handset in the fifth generation (5G). With increasing usage of cell phones by people over a longer duration of times, perturb anent the harmful health effects of electromagnetic radiation which are emitted by the mobile phones are rapidly growing.

As there is head-on connection between the transmit power, specific absorption rate, and electromagnetic radiation vulnerability. We present some techniques that have been shown to reduce the specific absorption rate or transmit power of mobile communication system. Following are the possible techniques which are used to reduce the electromagnetic radiation which is emitted from the mobile phones.

4.1 Specific Absorption Rate Shielding

It is a method of lessening the specific absorption rate with the minimal abasement of performance of antenna. This technique involves the use of ferrite material or metamaterial attachment between handset and head. Metamaterial is based on a special resonant characteristic of single cell which generates negative permittivity or negative permeability. It has been shown in [11] that the use of metamaterial reduces the SAR by 27–52% at 900 MHz and 1800 MHz, respectively, over 1 g of tissue with performance of antenna being less influenced. Ferrite material has very small conductivity which leads to smaller induced currents when uncovered to electromagnetic wave [12] and they abandon magnetic field part of an incident electromagnetic waves [13].

4.2 Control of Power

It is merely mentioned attuning the output transfer power level of base station or handset to maximized the accepted power of wanted signals, meliorate system potential, reduce interference, and in addition power consumption. Control of power focuses at lessening interference and transmits power level; it can also diminish in the action, electromagnetic vulnerability stratum.

4.3 Beam Forming

Typically, omnidirectional antennas have been used at base station of mobile communication system because antenna has no information regarding location of handset's utilizer and the environment's state. In order to arrive at the wanted mobile phone location omnidirectional antennas transmit maximum power. Beam forming is referred as process of using an array antenna in a specific direction. By aiming antenna rays in wanted directions, the interferences in the system and electromagnetic radiation to the not meant directions reduce with the help of beam forming. Nearly all of signal is aimed in assured direction, thus beam forming helps in ameliorating the SINR and reduction in transmit power [14]. Nowadays, adaptive/smart antenna technology is used. This antenna technique utilizes antenna's array that builds a ray for transference/acceptance toward each wanted handset utilizer in mobile communication system [14–16]. In beam forming, each handset utilizer's signal is multiplied by composite weights which conforms the magnitude and phase of the signal toward wanted destination (Fig. 3).

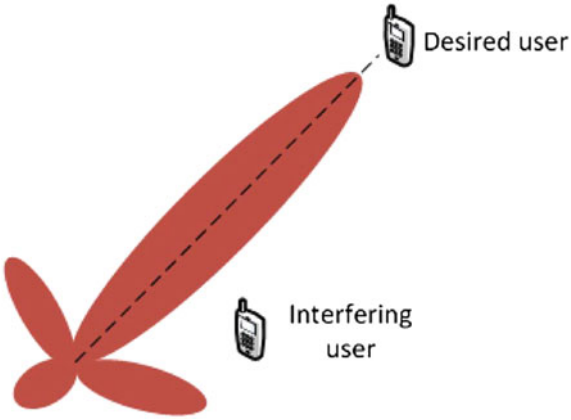


Fig. 3 Adaptive antenna system beam formation

4.4 Massive MIMO

MIMO stands for multi-input multi-output. Massive MIMO is an abstract idea by which a large number of antennas are positioned at the base station of mobile communication to treat a much lesser amount of handset customer. This leads to meliorate the energy productivity, spectral productivity, and lesser transfer power, which could lead to reduce electromagnetic radiation vulnerability stratums in system.

5 Conclusion

A comprehensive study of EM radiation effects on human body from handset has been done. We showed the effects of EMR on human body, EMR vulnerability guidelines and limits, reduction techniques in this paper.

According to my knowledge of the current scenario, there is serious perturb anent the harmful health effects of EMR of mobile phone in the surrounding. Even though the research work on harmful/bad health effects of EMR from handset is indecisive, there is small possibility of it being carcinogenic. The amount EMR vulnerability to handset's user rests on the mobile phone technology, distance of user from antenna, and duration of call or use of mobile.

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FIFTH GENERATION (5G) WIRELESS TECHNOLOGY "REVOLUTION IN TELECOMMUNICATION"

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Abstract:- After the up rise of 4G wireless mobile technology takes place; researchers, mobile operator industries representative, academic institutions have started to look into the advancement (technological) towards 5G communication networks due to some main demands that are meliorated data rates, better capacity, minimized latency and better QoS (Quality of Service). To established the 5G mobile communication technological foundation, various research works or projects entailing main mobile infrastructure manufacturers, academia and international mobile network operators have been introduced recently. Nevertheless, 5G mobile services to be made available for use, their architecture, and their performance have not been evidently explicated. In this paper, we represent thorough overview of 5G the next generation mobile technology. We mainly throws light on 5G network architecture, 5G radio spectrum, ultra-dense radio access networks (UDRAN), traffic offloading of mobile, cognitive radio (CR), software defined radio (SDR), software defined networking (SDN), mixed infrastructure, and 5G network impact on the society.

Index Terms:- 5G, Cognitive Radio (CR), 5G radio spectrum, Traffic offloading of mobile, FBMC

1. INTRODUCTION

From the last few years, we have noticed prodigious modification in the telecommunication's world. Now-a-days and in the coming future, to accomplish the presuppositions and difficulties of the coming era, mobile communication networks of today will have to develop in various manners. The on-going implementation of 4G mobile networks has encouraged some telecom industries to contemplate more advancement toward future fifth generation technologies and facilities. Fifth generation (5G) wireless technology with an advanced access technology called BDMA (Beam Division Multiple Access) and FBMC (Filter Bank Multi-Carrier Multiple Access) will straightforwardly superseded 4G wireless technology. By contemplating the instance of the BS (base station) communicating with the MS (mobile station), beam division multiple access (BDMA) technique conception is explicated. In this transmission, an orthogonal ray is distributed to each MS (mobile stations), & beam division multiple access technique will split that ray of antenna according to the MS (mobile stations), which in an analogous ameliorate the network's capacity [1]. A notion to switch towards fifth generation is based on drifts of current; it is often presumed that fifth generation mobile networks must resolved six problems that are not successfully resolved by fourth generation mobile communication networks i.e. higher data rate, massive device connectivity, higher capacity, less cost & consistent, Quality of Experience (QoE) and lower End-to-End latency [2]-[3]. The mentioned problems are succinctly shown in the figure 1 along with some possible facilitators to address them. Summary of the problems, facilitators to address problems, & design fundamentals for fifth generation (5G) mobile technology is shown in the figure 1 [4]. IEEE standard which are recently introduced i.e. IEEE 80211ac, 802.11ad, & 802.11af are very helpful and function as a fundamental units in the path towards fifth generation (5G) mobile communication networks [5]-[9].

2. NETWORK ARCHITECTURE OF 5G

Fifth generation mobile communication network is a new revolution in the world of telecommunication and by the year 2020, it would be available for use. Fifth generation (5G) mobile networks model is all internet protocol (IP) based model. In the 5G mobile network conception, it is an exceptional approach that the prime priorities of fifth generation (5G) mobile system are user terminals. The terminal has right or opportunity to approach unalike wireless technologies concurrently and it can also able to amalgamate some attributes from other technologies. Fifth generation (5G) mobile communication network is completely concentrated on portability of user as a handset or terminal smartly reacts to select vigorous plan of wireless to ingress wireless networks [10]. A general fifth generation (5G) mobile network architecture is shown in figure 2 and we will go through all the open systems interconnection (OSI) model layers shown in table 1 of fifth generation (5G) mobile communication network.

Table 1:- OSI Protocol Layer Stack of Fifth Generation (5G)

<table>
<tr><td>Application Layer</td><td rowspan="2">Application (services)</td></tr>
<tr><td>Presentation Layer</td></tr>
<tr><td>Session Layer</td><td rowspan="2">Open Transport Protocol (OTP)</td></tr>
<tr><td>Transport Layer</td></tr>
<tr><td rowspan="2">Network Layer</td><td>Upper Network Layer</td></tr>
<tr><td>Lower Network Layer</td></tr>
<tr><td>Data Link Layer</td><td rowspan="2">Open Wireless Architecture (OWA)</td></tr>
<tr><td>Physical Layer</td></tr>
</table>

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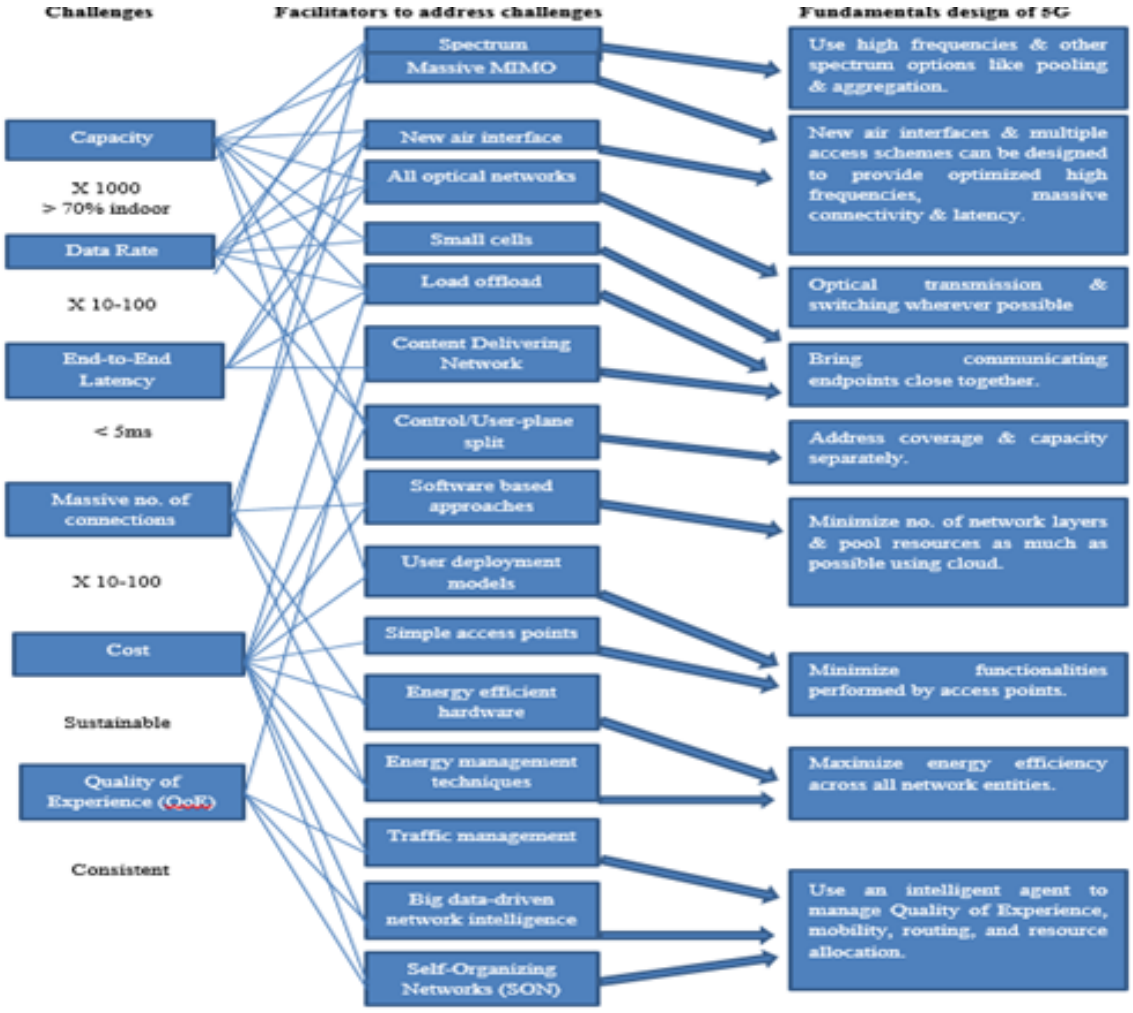


Figure 1:- 5G Mobile Network Challenges, Facilitators, & 5G Design Fundamental [4].

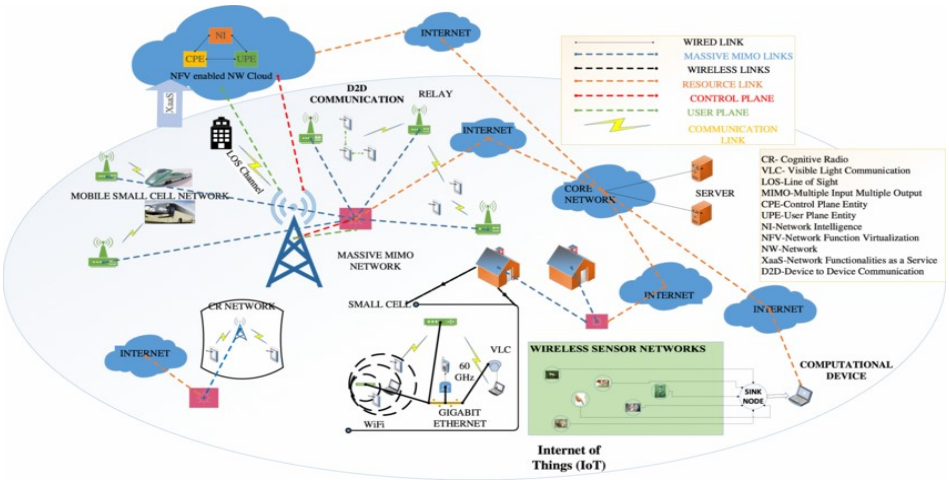


Figure 2:- General network architecture of fifth generation (5G) mobile technology [11]

2.1. PHYSICAL/MEDIUM ACCESS CONTROL LAYER

The uppermost two open systems interconnection (OSI) layers i.e. physical & medium access control layers are interpret as locus of network, in this instance of fifth generation (5G) these two layers elucidate as wireless technology and mobile network of 5G is being founded on open wireless architecture[10].

2.2. NETWORK LAYER

The network stratum is based on internet protocol (IP), as now-a-days there is no race on this stratum. The internet protocol version 4 (IPv4) is spread throughout the world & it has various issues such as confined address space & has not any actual prospect for quality of support (QoS) per flow. These problems are resolved in internet protocol version 6 (IPv6).

2.3. OPEN TRANSPORT PROTOCOL LAYER

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In the wireless connection transmission control protocol (TCP) retransmit the missing or impaired segments of transmission control protocol (TCP). In fifth generation (5G) mobile technology it is indispensable due to higher download speed & installed speed.

2.4. APPLICATION LAYER

Concerning the application, the eventual entreaty from the fifth generation mobile terminal is to furnish intelligent quality of service management over heterogeneity of systems. Parameters of quality of service such as losses, delay, reliability, jitter, and bandwidth will be keep in reserved in a database in the 5G handset with the goal to be utilized by intelligent algorithms running as system processes in the mobile terminal, which ultimately shall give the foremost wireless connection upon obligatory quality of service (QoS) & individual cost limitations.

3. RADIO SPECTRUM FOR FIFTH GENERATION (5G)

Usually, new frequency bands & broader spectral bandwidth per radio channel has been allocated to each generation of mobile communication networks. Fifth generation (5G) mobile communication networks will need a great extent of aggregative spectrum to make it possible for pliable bandwidth scaling & enlargement. In order to accomplish that, supplemental harmonic frequency bands must be assigned. In order to enhance the reprocess of frequency, the spectrum will be utilized on radio access technology (RAT) impartial fundament, preferably by implementing concept of cognitive radio (CR) to mini & big cells [13]. The supplemental spectrum for fifth generation may incorporate 100MHz of bandwidth under 1 gigahertz to meliorate rustic wireless broadband access & 500 megahertz of the band betwixt 1 & 5 GHz for increased high data efficiency [14]. The main 3GPP (3rd generation partnership project) frequency bands of 900 MHz, 1800 MHz, 2100 MHz, & 2600 MHz will be utilized for competence enhancement in Long-Term

Evolution Advanced and HSPA (high speed packet access). Following the World Radio Conference (WRC) in the year 2015, Long-Term Evolution Advanced will also depend on the frequency band of 700 MHz crossways the ITU Region 1 [15]. The vision for long-term is the confluence of broadband & broadcast facilities in joint multi-media networks covering the UHF (ultra-high frequency) band beneath 700 megahertz. In high capacity hotspot, deployments of small cell will play an indispensable role and the spectrum for that could get from the 3500 megahertz band, where as much as 400 megahertz of bandwidth is utilized for fastened satellite and broadband wireless access services. The consequence is that up to 1.5 gigahertz of the spectrum can be made obtainable by the year 2020, at the minimum 1 GHz will be the customary not divided spectrum & the remainder can be not locked through the use of new spectrum-apportioning techniques such as the misuse of TVWS (TV white spaces) through CR (cognitive radio). TV white spaces are big sections of the very high-frequency/ultrahigh-frequency spectrum that are now obtainable in geographic zones where the change over from the analogue to digital TV has been accomplished. Furthermore, the Long-Term Evolution time-division duplexing (TDD) service in the 3.5 gigahertz band, known as LTE-Hi, is also contemplated for hot-spot zones where coverage is not a requirement, & the maximal feasible output is needed. Additionally, unlicensed bands like 2.4 GHz, 5GHz, & 60 GHz proffer affordable spectrum choice for traffic offloading Frequency-domain possibilities anticipated for CR (cognitive radio) that can be utilized for fifth generation is recapitulates in table 2.

Table 2:- 5G cognitive radios spectrum possibilities [19]

Spectrum opportunity	Purpose	CR Function
54-698 Megahertz	TV Bands	Utilized beneath the carrier accumulation conception, i.e., using them as components carrier
2.7-2.9 Gigahertz	Bandwidth scaling from 2.7 to 3.4 gigahertz for improved pliable spectrum usage	Not identify clearly & definitely yet
3.4-3.6 Gigahertz Band 43	A smooth misuse of the Band 43 from WiMAX to LTE	Co-deployment on uppermost of the large layer of cell
3.6-3.8 Gigahertz	Neighboring carrier accumulation provision with the maximal 100 megahertz bandwidth	Carrier aggregation application
3.8-4.2 Gigahertz	Macro cell & mini cell layers' deployment, i.e., heterogeneous networks (HetNet)	Carrier aggregation within HetNet
60 Gigahertz unlicensed band	Small cell backhaul deployment	Not identify clearly & definitely yet

4. ULTRA-DENSE RAN

A new conception anticipated in the state of affairs of fifth generation (5G) is UDRANETs (Ultra-Dense Radio Access Networks) [20]. Ultra-Dense Radio

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Access Networks are envisioned as less power access nodes a few meters apart for within door regions. The prime aim of UDRANETs will be to offer an immensely high traffic capability over highly dependable low-range knots. Ultra-Dense Radio Access Networks will probably function in the frequency range of 10-100 GHz, which has continued virtually unutilized for mercantile cell-phone networks notwithstanding its prospective to give bandwidths of hundreds of megahertz. Modern communication & access technologies have to be flourished & systemized for this sort of systems, needing spectrum apportionment studies in millimeter waves [21].

5. TRAFFIC OFFLOADING OF MOBILE

Tablets, smartphone, & mobile broadband gadgets produce exceptionally enormous amounts of traffic. With the present cellular infrastructure, mobile operators companies are encountering great problems to work for such a massive growth of mobile traffic. Traffic offloading consists in utilizing complemented RAN (radio access networks) to convey information initially meant for mobile cellular networks, by that means reducing the blockage on each single radio link and respective backbone connection. Traffic offloading includes comprehensively various panaceas, which can be categorized as overlay and non-overlay panaceas; some of them are discussed in this paper.

5.1. COGNITIVE FEMTOCELLS

Traffic offloading of femtocell is being founded on the placement of mini, low-capacity mobile BS (base stations) at site or in other within doors regions, backhauled to the interior network of cellular system by a traditional cabled network. Among various advantages of this panacea is the actuality that femtocells are able to control both data & voice traffic with quality of service guarantee. Nevertheless, the utilization of similar spectrum as overlaying macro-cells entangles the search for obtainable mediums for femtocells in eminently crowed regions. Thus, intelligent intervention management utilizing CR (cognitive radio) and RRA (reservation random access) arrangement must be applied, basically in deployment schemata where the position of the femtocells is decided by the end users, example uncoordinated home evolved nodeB. The highly-unforeseeable intervention with macrocells needs strategic spectrum ingress within a hierarchical overlay system as follows: first, the information anent gamut scopes, which are afterwards exploited by the femtocells is given by a sensing method at the macrocell stratum [14]. .

5.2. Wi-Fi and White-Fi

By some mobile operators, non-overlay offloading of traffic by means of Wi-Fi networks has been beforehand carried out. Fundamentally, when a cell-phone terminal is in the locality of Wi-Fi hotspot, routing of data traffic is changed to utilize its radio interface. This panacea is pleasing as it permits ingress to a free, prohibited spectrum, as a result of that minimizing the inessential congestion in valuable, authorized frequency bands. Strategic associations betwixt mobile users & internet service providers (ISPs) require to be settled. Nonetheless, the Wi-Fi MAC (medium access control) protocol is not well-befitted for a dense traffic load and doesn't render quality of service (QoS) distinction. Therefore, this panacea is presently executed for best-attempt traffic exclusively, whereas voice facilities are still conveyed through core network of mobile. One vital problem is to enhance the network spectral performance by permitting more contemporaneous customers on Wi-Fi networks, preferably for both best-attempt & voice traffic. A feasible method of accomplishing this is to execute Wi-Fi frequency reprocess schemes with marginally overlapping channels (figure 3).

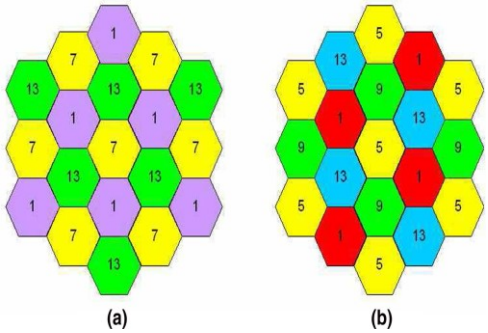


Figure 3:- Indoor multi cell Wi-Fi layout in which a BSS transmits Voice over Internet Protocol traffic in the key cell with a radius equivalent to 30 m. **[a]** Configuration with 3 non-overlapping channels (13 overlapping channels are assigned in Europe on the 2.4 gigahertz band), & **[b]** Configuration with 4 marginally overlapped channels [19]

5.3. ALTERNATIVE SOLUTIONS FOR OFFLOADING

World-wide Interoperability for Microwave Access can be contemplated as other offloading, but it is more appropriate for backhaul for massive Wi-Fi systems. Moreover, 3rd generation partnership project objection mobile networks have not contemplated interoperation with world-wide interoperability for microwave access until now; hence, supplemental standardization would be needed. In an authorized band of frequency, device-to-device communication is an underlay to mobile networks comparing with mobile ad-hoc networks (MANETs), which function in a similar way but in the unauthorized gamut. The future generation of mobile communication systems could influence offloading chances generated by the amalgamation of the aforesaid solutions & further that may be evolved in the future. Cognitive mobile-traffic offloading is an approach in which these solutions can be further prolonged through the utilization of CR. For example, an outdoor mesh network of white-Fi hotspots & Wi-Fi backhauled to the mobile network via world-wide interoperability for microwave access links or cabled broadband access can treat as an alternative of traffic offloading in fusing with device-to-device links & femtocells (figure 5).

6. COGNITIVE RADIO

Cognitive Radio pattern propounds an opportunistic use of the underutilized parts of authorized bands of frequency, i.e., spectrum holes, by unauthorized (secondary) operators & or the effectual allocation of

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the licensed-free gamut. For this purpose, cognitive cellular terminals must procure exact real-time information on transmittal opportunities through radio-frequency gamut examining to recognize the vacant radio bands or channels within the time-frequency resources table. IEEE standards such as IEEE 802.22, IEEE 802.11af, & IEEE 802.16h are focused at utilizing cognitive radio approaches to enable apportioning of the TV White Space gamut on a non-intervening fundament with ameliorated coincidence mechanisms. The 3rd generation partnership project long-term evolution quality has taken proviso to ease intervention palliation in over-layer systems. To cope or deal with interference problems in heterogeneous networks, EICIC (Enhanced Inter-cell Interference Coordination was developed in 3rd generation partnership project.

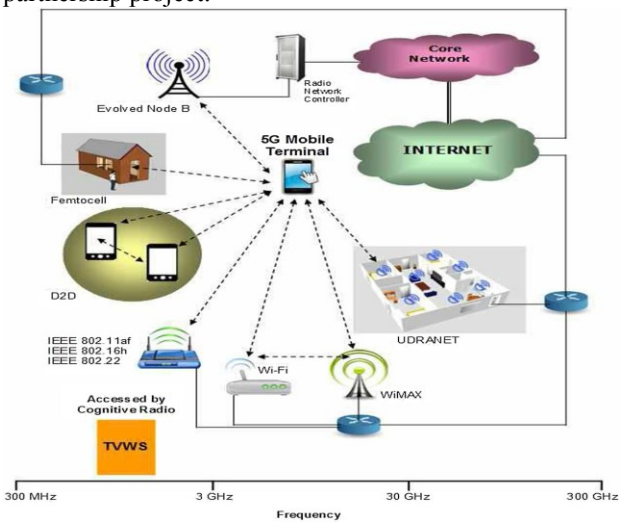


Figure 5 :-Traffic offloading approaches for fifth generation networks [19]

7. SOFTWARE DEFINED RADIO (SDR)

Infrastructure of future generation network must have an enough immense pliability in order to extend over dissimilar parameter of radio frequency settings in a vigorous & flexible approach to permit systematic management of spectrum. Platforms which are reconfigurable based on SDR will ease the vigorous air interface reconfiguration of the nodes of system by customizations of software, reflecting contemporary exigencies of traffic. The pliability of the radio frequency concatenations must be farther reflected in the baseband processing competencies, where the down-transmuted radio frequency signals are to be processed. As fifth generation networks will require to exploit underused bands of frequency to circumvent the anticipated crunch of spectrum, execution of cognitive radio on software-defined radio platforms should contemplate coaction & interoperation of multitudinous radio technologies, that is, through CRRM (Common Radio Resource Management). This signifies that a platforms which is reconfigurable ought to be competent to function at dissimilar power stratums, frequencies & channel bandwidths, coding stratagems & modulation, amending parameters of transference & features according to the specific restraints of the radio technology standards in utilization; these restraints incorporate undesired emanation in the functioning band, adjacent frequency leakage ratios, or intermodulation results. Encouraging software-defined radio advancement enterprises incorporate the GNU Radio, which is an open-source software advancement toolkit for the execution of software-defined radio on numerous programmable platforms such as USRP (Universal Software Radio Peripheral) boards, & the open BTS, which was not long ago utilized to exemplify the execution of a software-based GSM BS (base station) on the Raspberry Pi hardware platform [19].

8.SOFTWARE DEFINED NETWORKING (SDN)

The prime conceptions of software-defined networking incorporate the segregation of the control data plane & a programmable network. Both cognitive radio & software-defined radio technologies do not entail the control of the cellular core network of mobile, at the present phase of advancement. Up to now, no coordination of flows of traffic is feasible at the core network, that is, a handset cannot get numerous dissimilar flows of traffic from different enodeBs concurrently to enhance the rate of data. SDN is a revolutionary conception, aims at offering a coordination that has an international perspective of infrastructure of network, as a result of that easing a number of functionalities of networking. Packets of data passing via link devices (routers, switches, etc) are categorized into flows to make pre-flow transmitting decisions. A flow is illuminated by a set of corresponding regulations in twelve idiosyncratic fields of quintessential IP/Ethernet/User Datagram Protocol header (Layer 2 & Layer 3 addresses, ports, Virtual Local Area Network information etcetera). Every time a packet of data amalgamated to a particular flow gain access to a device, a counter is upgraded at the controller. This makes it feasible for the controller to have an international perspective of the status of each component of network. Thence, the controller can make the conclusion to transmit the traffic via a reduced crowded path, or utilize a radio channel that fleetingly undergoes a pleasant state to transmit the packet of data to the end user. Software-defined networking intends to hold up a much more desirable amalgamation of all prevailing wireless networks (2G to 4G, Wi-Fi, and etcetera) .It would be feasible to carry out a coherent handover, not merely within similar technology as already prevails, yet also athwart H-RATs. Furthermore, software-defined networking will considerably ease the management of disorganized deployments of huge amounts of mini cells in long-term evolution networks.

9. 5G IMPACT ON SOCIETY

From the social view, fifth generation networks have the capability to ameliorate the cell-phone broadband connections in rustic regions. The expenditure of wealth for installing a huge number of BS & the less ARPU (average revenue per user) [38] has deferred the wide-ranging coverage of rustic environments. By utilizing TV White Space & offloading of traffic elucidations, the placement of 5G networks in rustic regions will be feasible at a lesser budget thanks to

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further favorable propagation situations in the very high-frequency/ultrahigh-frequency gamut that unswervingly transform into littler base stations.

10. CONCLUSION

A comprehensive study of future fifth generation wireless technology has been done. We presented fifth generation network challenges, facilitators & design fundamental, network architecture along with OSI protocol stratum stack, 5G radio spectrum, ultra-dense radio access networks, traffic offloading of mobile, cognitive femtocell, Wi-Fi & White-Fi, alternative solution for offloading, cognitive radio, software-defined radio, software-defined networking, 5G impacts on the society in this paper. This paper is one which may be offering a better platform to prompt the industries representatives, academia, & researchers for better results of different sorts of issues & challenges in future fifth (5G) generation wireless networks.

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Dispersion Compensation for 40Gbps Optical Waveguide System by Using FBG

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***Abstract*-In optical system the reason of introduction of losses in the transmission system is that, during the transmission, the pulses travelling through the fiber changes its shape and broadens. If the data rate is increased to 40Gbps, dispersion occurs by the pulse broadeningand becomesindistinguishable at the receiver end. The purpose of this paper is to design a dispersion compensated system using FBG. The system performance is measured through the changes in the eye diagram and Qfactor. It was achieved by making variations in the parameters of FBG effective index from 1.4 to 1.5 and varying the FBG length from 1.5mm to 2.4mm the input power from 1dBm to 20dBm. Also variations were made in the input power 1dBm to 20dBm. The Qfactor achieved at the wavelength of 1554nm is 99.05 with the eye height of 0.5574.**

Keywords-FBG:FiberBragg grating, Qfactor: quality factor, EDFA: Erbium-doped fiber amplifier, Noise figure

I. INTRODUCTION

A basic optical system comprises of a transmitter which is used to convert electrical signal into a light signal, a channel which is optical fiber, and a receiver at which the light signal is transformed in the electrical signal[1]. Optical waveguide is prepared from a dielectric structure which is used to transport energy at a wavelength in the infrared or the visible section of the electromagnetic spectrum. Highly flexible fiber waveguides are used for optical communication. As these waveguides are composed of transparent dielectric material. For transmission of higher bit rates consumingless losses single mode fibre is used[2]. If the bit rate is increased to 40Gbps,losses and distortions are introduced in the fibre since the pulse starts tobroaden and overlaps each other, which in the end results in crosstalk and inter symbolic interference causing errors at the receiver end[3].

By using FBG at the receiver side of the optical fiber link the dispersion can be minimalized. It is one of the methods to reduce dispersion as in itdifferent wavelengths are reflected by the grating at different distance[4]. The pulses having large wavelength travels to a large distance and the pulses having short wavelength travels short distancebefore reflection. As a result by fibre bragg grating compresses the expended pulse[5].

II.FIBER BRAGG GRATING AS DISPERSION COMPENSATOR

One of the types of reflectors used in optical communication is FBG for reflectinga specific wavelength and transmitting all other light waves. There is an periodic variation of refractive index inside the transmitting medium in FBG[6]. It is either used as a wavelength specific reflector or usedfor blocking certain wavelengths.

Behind the operation of FBG, Fresnel reflection plays a significant role. According to it the light wave which is travelling between media consisting ofvariable refractive indices will either reflect or refract at the interface. Over a specific wavelength, the refractive index alternates. During refraction, a small amount of light is reflected[7]. This reflected signal merges coherently with the reflection of a particular wavelength having the grating period equal tonearly half of the wavelength of the input signal. The reflection occurs at the wavelength which is known asbragg wavelength which forms thebragg condition. The wavelengths satisfying the bragg condition gets affected and hence are reflected back. As a result of which a single large reflection comes into accounton the addition of many small coherent reflection from weakly reflecting mirrors[8]. The equation which links periodicity of grating and the bragg wavelength is subjected to the effective refractive index, n_{eff}, and is given by

$$\lambda_B = n_{eff}\,\Lambda$$

Where,λ_B= Bragg wavelength;Λ = Grating period;

n_{eff} = Effective refractive index of the transmitting medium.

III. SIMULATION WITH RESULTS AND DISCUSSION

Figure1. shows the block diagram of the systemconsistingof thetransmitter, transmission link and the receiver which forms a basic communication channel. An input signal of 1554nm wavelength and variable input power is supplied by CW laser which is then externally modulated at 40Gbps with an NRZ sequence.

Since the pulse tends to spread at the increased bit rate of 40Gbps therefore FBG is used for dispersion compensation. To minimise the fiber loss and amplification of the signal an optical amplifier is used which is represented by EDFA, after which the signal gets transmitted through photo detector at the receiver end. The metastable lifetime of EDFA was optimised to 42ms.

In optical communication,for a precise measurement of optical performance, dependence cannot be only on signal to noise ratio[10]. Quality factor is one of the other essential parameter which measures optical performance.

Table1. Shows the changes in the quality factor and noise figure made by simultaneously changing the FBG length.As

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the FBG length is increased the quality factor improves upto the value of 92.56 but if the length is further increased the Q factor starts decreases to 49.32. Simultaneously the noise figure reduces to 15.50 but after further decrease in length of FBG,noise figure again starts to increase showing the performance degradation of the system.

Table2. Shows the changes made by input power in the Qfactor measurement and in the eye height.Figure 2.Shows that the degree of distortion can be concluded by the vertical height of the eye diagram. Due to the distortion, it becomes difficult to distinguish the 1's and 0's signal as a result of which the height of the eye is reduced but as the distortion decreases the vertical height increases and hence representing the dispersion compensated system.It is found that this vertical height in the eye diagram pattern ranged between 0.0528 to 0.5774 when the input power was between 1dBm to 20dBm.also the Qfactor attained during the changes made in the input power ranged from 17.46 to 99.05.

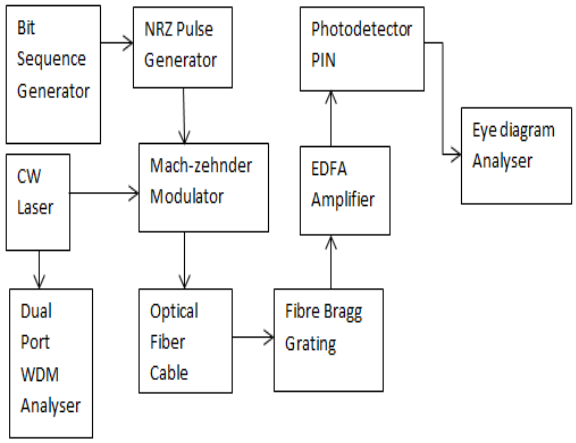


Fig.1. Block diagram of proposed system using FBG

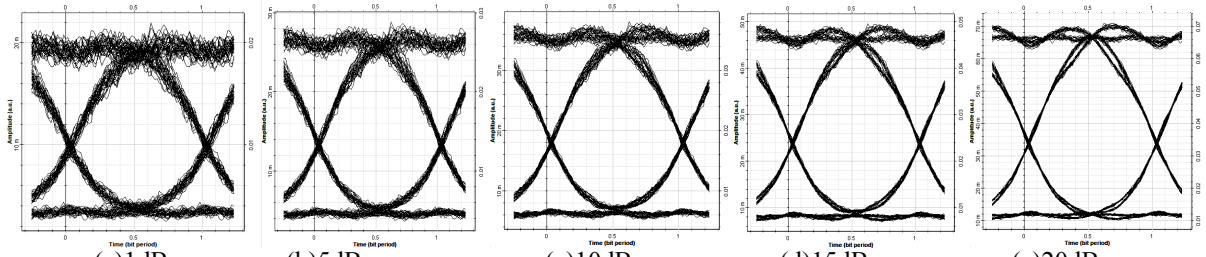


Fig.2. Analysis of eye diagram at different input power

TABLE I.OUTPUT READINGS TABULATED BY VARYING FBG EFFECTIVE INDEX

FBG length(mm)	Qfactor	Noise figure
1.5	25.94	18.407
1.6	24.0508	17.900
1.7	28.6727	17.430
1.8	34.6876	16.992
1.9	44.8107	16.584
2	62.23	16.201
2.1	84.303	15.84
2.2	92.56	15.50
2.3	71.761	15.98
2.4	49.320	18.88

TABLE II. OUTPUT READINGS TABULATED BY VARYING INPUT POWER

Input power (dBm)	Qfactor	Eye height
1	17.46	.0528
5	22.87	.1108
10	30.66	02267
15	43.115	.3816
20	99.05	.5774

Fig.3. shows the variation in the Qfactor for different FBG effective index. Here the changes in the Qfactor is visualises that when values in the effective index is increased with simultaneous increase in the FBG length the Qfactor first increases but it decreases when the FBG length is further increased.

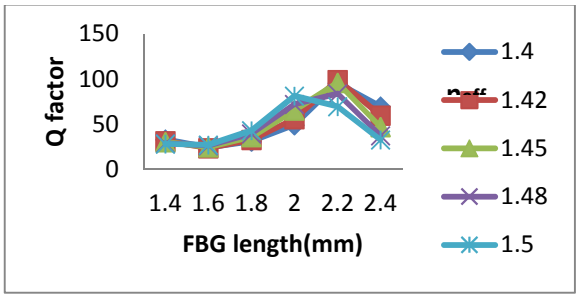


Fig. 3. Variation of Qfactor by varying FBG length and FBG effective index

Fig. 4.Shows the variation in the Qfactor for different FBG effective index with respect to optical fiber cable length. Here the changes in the Qfactor visualises that when values in the effective index is increased with simultaneous increase in the optical fiber length the Qfactor first increases but it decreases when the optical fiber length is further increased.

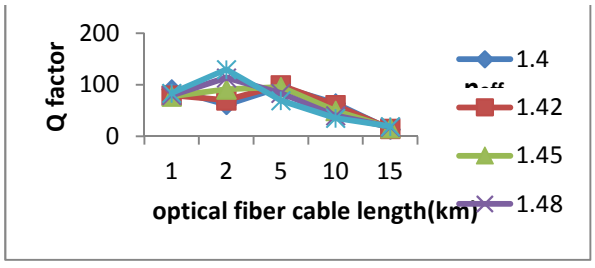


Fig. 4. Variation of Qfactor by varying optical fiber length and FBG effective index

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Table3. Shows the proposed system with the optimised simulated parameters. The parameters shown, provides the highest value in the quality factor and in the eye height and hence provides with the most dispersion compensated system for a bit rate of 40Gbps.

TABLE III. OW SYSTEM USING FBG PARAMETERS

Simulation parameters	Values
CW laser frequency	1554 nm
Reference wavelength	1554 nm
Bit rate	40Gbps
FBG length	2.2mm
FBG effective index	1.42
Fibre length	5km
EDFA metastable lifetime	42ms

IV. CONCLUSION

In this paper we analysed a dispersion compensatedsystem on the bit rate of 40Gbps and it was observed by the changes in Qfactor and the eye pattern .The wavelength which is compatible for this bit rate is 1554nm, it was optimised by making variations from 1545nm to 1555nm. It was found that the optimised input power is 20dBm and the optimum FBG effective index is 1.42 with the FBG length of 2.2mm. The maximum Qfactor attained was 99.05 having noise figure of 15.50.Also it was found that as the distortion reduced there was anincrease in the height of the eye pattern with the maximum height of the 0.5774. It was also perceived that the Qfactor decreased along with eye pattern height if the optimised values of the parameters were further increased. Implying the degraded performance of the system.

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Logarithmic Spiral Based Local Search in Artificial Bee Colony Algorithm

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Abstract. Artificial bee colony (ABC) algorithm is recent swarm intelligence based meta-heuristic that is developed to solve complex real problems which are difficult to solve by the available deterministic strategies. It mimics the natural behaviour of real honey bees while searching for food sources. The performance of ABC depends on the size of step during position update process, that is a combination of the arbitrary component ϕ_{ij} and a difference vector between the current solution and an arbitrarily identified solution. The high value of ϕ_{ij} and high difference between the vectors in the step generation process may generate the large size step which may leads to the skipping of true solution. Therefore, to avoid this situation a logarithmic spiral based local search strategy, namely logarithmic spiral local search (LSLS) is planned and incorporated with the ABC. The proposed hybridized ABC is named as logarithmic spiral based ABC (LSABC). To demonstrate the efficiency and accurateness of the LSABC, it is tested over 10 popular benchmarks functions and outcomes are equated with ABC, Modified ABC, and Best-so-far ABC. The reported results showed that the proposed LSABC is a new viable variation of ABC algorithm.

Keywords: Nature Inspired Algorithms · Swarm intelligence
Population based optimization algorithm

1 Introduction

Nature continuously provide some of the well planned way to solve the real life problems. The nature has progressed for the period of thousands of year elevating with innovative models, techniques and tools and established into well-defined disciplines of scientific aspire. Humankind has been continuously annoying to apprehend the nature from the time when by evolving some innovative techniques and tools day by day. The area of nature-inspired computing is a combination of computing science with knowledge from different streams like mathematics,

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biology, chemistry physics and engineering. The algorithms simulating processes in nature or inspired from some natural phenomenon are called Nature Inspired Algorithms (NIAs). According to the source of inspiration they are classified in different classes. Most of the NIAs are motivated by working of natural biological systems, swarm intelligence, physical and chemical phenomenon. For that reason, the name biology based, swarm-intelligence based, physics and chemistry based, according to their sources of stimulation. Basically main source of inspiration is nature and thus they called nature-inspired. More than hundred algorithms inspired by nature are now a day available and ABC is one of them. The ABC algorithm is capable to realize better results very quickly however like other stochastic population based approaches, it is not better in terms of exploration of search space. The performance of ABC algorithm is critically analyzed and concluded that it is better than some other NIAs most of the times [1,2] but it has some drawback also. It is revealed in study that original ABC [3] sometimes halt while inching ahead in the direction of the global optimum despite the fact the population has not converged to a local optimum [4]. It happens due to it's position update equation that is really good in exploration but pitiable at exploitation [5]. Thus it can be concluded that ABC has no proper balancing between exploration and exploitation process. For that reason these weaknesses require an amendment in position update process in ABC. To boost the exploitation, in this paper, a local search strategy namely, logarithmic spiral local search (LSLS) is anticipated and assimilated with ABC to magnify the exploitation potential of the ABC algorithm. The proposed LSLS is inspired from the equation of logarithmic spiral. The hybridized ABC algorithm is named as logarithmic spiral based ABC (LSABC) algorithm.

Financial system and growth of a country is highly reliant on the agricultural products. A large number of people are concerned in agricultural production where various categories of plants are cropped on a variety of lands based on the ecological circumstances. However, maintaining these plants suffers with a number of problems which are faced by the farmers such as plant diseases, quality of soil, selection of crop and many more. The plant diseases must be detected and prevented well on time to enhance the production. For that reason, an automated plant disease identification system can be very helpful for monitoring the plants. Leaves are primary part of the plants where the effect of a disease is generally visualized and may be identified for required prevention. Similarly in order to enhance productivity a farmer must be aware about quality of soil, so that he/she can use suitable seeds and pesticides. These two things, identification of plant diseases and prediction of soil quality can be easily done using LSABC. The LSABC may be used for clustering of images (images of plant leafs and different soil) while identifying different classes of leafs and soil.

2 ABC Algorithm

The ABC algorithm is invented by Dervis Karaboga in 2005 [3] inspired by extraordinary conduct of honey bees while piercing for food sources with best

characteristics. Analogous to natural honey bees the ABC algorithm divided all bees in three different groups according to their behavior and nature of task performed. The whole population composed of three types of bees: employed, onlooker and scout bee. The employed bees are accountable for searching for new food sources and providing useful information regarding food sources to bees that residing in hive (onlooker bees). Based on information received from employed bee, onlooker bees start exploiting these food sources. If a food sources exhausted due to exploitation it is considered as abandoned and replaces by scout bee. The bees are continuously trying to improve solutions using greedy search strategy till the termination criteria meet and memories the best solution established till now. The success of ABC algorithm depends on balance between these two processes. Initialization of swarm also play important role in deciding direction of solution search process. The ABC algorithm modified number of times to improve its performance like memetic search in ABC [6], levy flight ABC [7], modified gbest ABC [8], lbest gbest ABC [9], fitness based position update in ABC [10] and memetic search in ABC with fitness based position update [11]. The practical implementation of ABC is easy, and has only three parameters. The complete ABC algorithm spliced into three phases. The Algorithm 1 revealed the core steps of ABC algorithm.

Algorithm 1. ABC Algorithm

Parameter Initialization;
while Stopping criteria is not fulfilled **do**
Phase 1: New food source engendered using employed bee phase
Phase 2: Onlooker bee for apprising the food sources conditional to the quantity of nectar;
Phase 3: Scout bee for determining the new food sources in place of rejected food sources;
Phase 4: Remember the most feasible food source established till now;
end while
Yield the most favourable solution identified till now.

2.1 Steps of ABC Algorithm

Initialization: The first phase in ABC is initialization of parameters (Colony Size, Limit for scout bees and maximum number of cycles) and set up an initial population randomly using Eq. 1.

$$p_{ij} = LB_j + rand \times (UB_j - LB_j) \tag{1}$$

Where, $i = 1, 2, .., (Colonysize/2)$ and $j = 1, 2.., D$. Here D represent dimension of problem. p_{ij} denotes location of i^{th} solution in j^{th} dimension. LB_j and UB_j denotes lower and upper boundary values of search region correspondingly. $rand$ is a randomly selected value in the range (0, 1).

Employed Bee Phase: This phase try to detect superior quality solutions in proximity of current solutions. If quality of fresh solution is enhanced than present solution, the position is updated. The position of employed bee updated using Eq. 2.

$$V_{ij} = p_{ij} + \overbrace{\phi_{ij} \times (p_{ij} - p_{kj})}^{s} \tag{2}$$

Where, $\phi_{ij} \in [-1, 1]$ is an arbitrary number, $k \in 1, 2, .(Colonysize/2)$ is a haphazardly identified index such that $k \neq i$. In this equation s denotes step size of position update equation. A larger step size leads to skipping of actual solution and convergence rate may degrade if step size is very small.

Onlooker Bee Phase: The selection of a food source depends on their probability of selection. The probability is computed using fitness of solution with the help of Eq. 3.

$$Prob_i = \frac{fitness_i}{\sum_{i=1}^{colonysize/2} Fitness_i} \tag{3}$$

Scout Bee Phase: An employed bee become scout bee when the solution value not updated till the predefined threshold limit. This scout bee engenders new solution instead of rejected solution using Eq. 1.

3 Motivation

In most of the swarm based stochastic meta-heuristics, the potential to explore the divergent unidentified areas in the solution search region to identify the global optimum is denoted as the process of exploration, whereas the capability to process the information about the earlier good solutions to find best feasible solutions is termed as exploitation. When it comes down to it these two process (exploration and exploitation) are contradictory to each other in nature. It is essential to maintain proper balancing between these two process so that it may attain excelling performance while performing optimization.

The swarm in ABC update its position by the means of two essential processes: the process of exploration, which legitimize discovering diverse areas of the search reason, and the identification of best solution, that make sure the exploitation of the previous experience. Though, some research pointed out that the ABC sometimes not able to continue for the global optimum despite the fact that the swarm has not congregated to a local optimum [4]. It can be perceived that the process of solution searching in ABC is very efficient in exploration but not up to the mark in exploitation [5].

One of the simplest way to embellish the exploration potential of the swarm based algorithm is to increase the size of swarm [12,13]. In this way, to circumvent the condition of premature convergence annexation of certain peripheral budding solutions are useful in avoiding trapping into local optima and sometimes removal

of several individuals may help to accelerate the rate of convergence, if it is taking excessively large time to converge.

Further, the step size in position update equation of ABC has significant impact on the superiority of the updated solution. The high absolute value of ϕ_{ij} and large difference between current solution and arbitrarily chosen solution leads to large step size and it results in skipping the true solution and very small step size results in low convergence rate. A balanced step size can maintain proper balancing between exploration and exploitation potential of the ABC meanwhile. This balancing is not possible by hand as this step size involves some random component. For that reason, a self-adaptive strategy, which can adaptively modify the step size of an individual may also help for balancing the exploration and exploitation competencies of the algorithm.

The size of step during position update process in ABC is the combination of an arbitrary element ϕ_{ij} and a difference vector between the current solution and an arbitrarily identified solution. The high value of ϕ_{ij} and high difference between the vectors in the step generation process may generate the large step size which may leads to the skipping of true solution. Therefore, to avoid this situation and to embellish the exploitation competence of ABC algorithm, logarithmic spiral based local search strategy, namely logarithmic spiral local search (LSLS) is anticipated and assimilated with the ABC. The anticipated hybridized ABC is named as logarithmic spiral based ABC (LSABC). To demonstrate the efficiency and trustworthiness of the LSABC, it is implemented for 10 established benchmarks problems and equated with ABC, Best-so-far ABC, and Modified ABC. The reported results showed that the proposed LSABC is a new worthy variation of ABC algorithm.

4 Logarithmic Spiral Based ABC

A local search strategy inspired by the equation of logarithmic spiral is incorporated in basic ABC. A logarithmic spiral is a self-similar spiral curve which over and over again give the impression in nature [14]. As the solution search process of ABC algorithm is highly depends on a combination of random component ϕ_{ij} and a difference vector (refer Eq. 2). Hence, the high value of random component ϕ_{ij} and the difference vector results in more chances to avoid the actual solution. For that reason, a new approach is projected, which helps the current best solution in the swarm to exploit the search reasons in its locality in this article. The anticipated new local search algorithm is described in Algorithm 2.

The equation of logarithmic spiral is shown in Eq. 4. Logarithmic spiral is the locus of points analogous to the positions with time of a point moving away from a static point with a fixed speed beside a line which revolves with fixed angular velocity. Unvaryingly, in polar coordinates (r, θ) as designated by the Eq. 4 [14].

$$r = a \times e^{b\theta} \tag{4}$$

Here, a and b denotes some randomly generated positive real numbers while e is the base of natural logarithms. The parameter a used for turning the spiral,

whereas the distance between consecutive turnings controlled by b as depicted by Fig. 1.



Fig. 1. Logarithmic spiral represented on a polar graph [14]

In the anticipated local search the most feasible solution in the current population is eligible for location update. The location update equation is developed by taking inspiration from the logarithmic spiral as shown in Eq. 5.

$$x_{new} = x_{best} + \text{ step} \tag{5}$$

$$\text{where, step} = 2 \times sign \times U(0,1) \times (1 - \frac{Iter}{TI}) \times e^{\frac{sin(Iter)}{Iter}} \tag{6}$$

Here, x_{new} is the new location of the solution going to update, x_{best} denotes the highly fitted solution in the present population, $Iter$ is the local search iteration counter, TI denotes total iterations in local search, $sign$ is the addition or subtraction sign which is according to the fitness of the newly engendered solution. The step size is computed with the help of Eq. 6 which is developed by modification of logarithmic spiral equation. In this equation $a = 2 \times sign \times U(0,1) \times (1 - \frac{Iter}{TI})$ while $b = \frac{1}{Iter}$ and $\theta = sin(Iter)$. The step size is used to provide distance to the most suitable individual solution all along the local search process. The anticipated local search is elucidated in Algorithm 2.

In Algorithm 2, $U(0,1)$ denotes an arbitrary number that is evenly distributed in the range (0, 1) and D denotes the dimension of particular function.

Additional, the equation for position update in ABC algorithm is also improved. The original ABC updates the location of food sources using Eq. (2). The position update equation narrated by Eq. (2) is reformed as shown below with motivation from Gbest-guided ABC (GABC) [5] algorithm:

$$v_{ij} = p_{ij} + \phi_{ij}(p_{ij} - p_{kj}) + \psi_{ij}(p_{bestj} - p_{ij}),$$

here, ψ_{ij} is an arbitrarily generated evenly distributed number from 0 to C, with a positive constant C.

The pseudo-code of the newly anticipated hybridized LSABC algorithm is depicted in Algorithm 3.

Algorithm 2. Logarithmic Spiral Inspired Local Search Strategy

Input optimization function $Minf(x)$ and TI;
Identify the most feasible solution x_{best} in the population;
Initialize $Iter = 1$.
while $(Iter < TI)$ **do**
  Generate a new solution x_{new} as follows:
  Select a random dimension $j = U(1, D)$
  x_{new} is generated through equations 5 and 6;
  Compute $f(x_{new})$;
  if $f(x_{new}) < f(x_{best})$ **then**
    $x_{best} = x_{new}$;
  else
    $sign = -sign$;
  end if
  $Iter = Iter + 1$;
end while

Algorithm 3. Logarithmic Spiral Inspired Artificial Bee Colony (LSABC) Algorithm:

Parameter initialization;
while Stopping criteria **do**
  Step 1: Generation of new food sources using Employed bee phase.
  Step 2: Position of food sources updated using Onlooker bees phase depending on their nectar quality.
  Step 3: Scout bee phase to replace abandoned food sources with new food sources.
  Step 4: Identify the best solution;
  Step 5: Apply local search algorithm (LSLS) using Algorithm 2
end while
Print best solution.

5 Experiential Setup and Result Analysis

The performance of newly developed variant (LSABC) evaluated over ten unbiased standard problems and analysed here in terms of precision, efficacy and trustworthiness.

5.1 Considered Test Problems

A set of ten mathematical optimization problems (f_1 to f_{10}) with diverse degree of complexity are selected to confirm the efficiency of the planned LSABC algorithm. These functions are displayed in Table 1. All the selected functions are continuous in nature. These problems are minimization problems and solutions of the most of the functions does not exists on the origin, diagonal and axis.

Table 1. Test problems, AE: acceptable error

Objective function	Search range	Optimum value	D	AE
$f_1(x) = 1 + \frac{1}{4000}\sum_{i=1}^{D} x_i^2 - \prod_{i=1}^{n}\cos(\frac{x_i}{\sqrt{i}})$	$[-600\ 600]$	$f(\mathbf{0}) = 0$	30	$1.0E-05$
$f_2(x) = -\sum_{i=1}^{D-1}\left(\exp\left(\frac{-(x_i^2+x_{i+1}^2+0.5x_ix_{i+1})}{8}\right)\times \mathrm{I}\right)$ where, $\mathrm{I} = cos\left(4\sqrt{x_i^2+x_{i+1}^2+0.5x_ix_{i+1}}\right)$	$[-5\ 5]$	$f(\mathbf{0}) = -D+1$	10	$1.0E-05$
$f_3(x) = \sum_{i=1}^{D}(x_i-1)^2 - \sum_{i=2}^{D} x_ix_{i-1}$	$[-D^2\ D^2]$	$f_{min} = -\frac{(D(D+4)(D-1))}{6}$	10	$1.0E-01$
$f_4(x) = [1.5 - x_1(1-x_2)]^2 + [2.25 - x_1(1-x_2^2)]^2 + [2.625 - x_1(1-x_2^3)]^2$	$[-4.5, 4.5]$	$f(3, 0.5) = 0$	2	$1.0E-05$
$f_5(x) = 100[x_2 - x_1^2]^2 + (1-x_1)^2 + 90(x_4 - x_3^2)^2 + (1-x_3)^2 + 10.1[(x_2-1)^2 + (x_4-1)^2] + 19.8(x_2-1)(x_4-1)$	$[-10, 10]$	$f(\mathbf{1}) = 0$	4	$1.0E-05$
$f_6(x) = \sum_{i=1}^{11}[a_i - \frac{x_1(b_i^2+b_ix_2)}{b_i^2+b_ix_3+x_4}]^2$	$[-5, 5]$	$f(0.192833, 0.190836, 0.123117, 0.135766) = 0.000307486$	4	$1.0E-05$
$f_7(x) = \sum_{i=1}^{D-1}(100(z_i^2 - z_{i+1})^2 + (z_i-1)^2) + f_{bias}$, $z = x - o + 1$, $x = [x_1, x_2, ...x_D]$, $o = [o_1, o_2, ...o_D]$	$[-100, 100]$	$f(o) = f_{bias} = 390$	10	$1.0E-01$
$f_8(x) = \sum_{i=1}^{D} z_i^2 + f_{bias}$, $z = x - o$, $x = [x_1, x_2, ...x_D]$, $o = [o_1, o_2, ...o_D]$	$[-100, 100]$	$f(o) = f_{bias} = -450$	10	$1.0E-05$
$f_9(x) = a(x_2 - bx_1^2 + cx_1 - d)^2 + e(1-f)\cos x_1 + e$	$-5 \le x_1 \le 10, 0 \le x_2 \le 15$	$f(-\pi, 12.275) = 0.3979$	2	$1.0E-05$
$f_{10}(x) = (1 + (x_1+x_2+1)^2 \cdot (19 - 14x_1 + 3x_1^2 - 14x_2 + 6x_1x_2 + 3x_2^2)) \cdot (30 + (2x_1 - 3x_2)^2 \cdot (18 - 32x_1 + 12x_1^2 + 48x_2 - 36x_1x_2 + 27x_2^2))$	$[-2, 2]$	$f(0, -1) = 3$	2	$1.0E-14$

5.2 Experimental Setting

The newly developed LSABC algorithm is compared with basic ABC and its two most recent variants, namely, Best-So-Far ABC (BSFABC) [15], and Modified ABC (MABC) [16] for the purpose of assessment to evaluate the efficiency, robustness, and reliability. Simulation results of the newly developed LSABC algorithm and the considered algorithms are presented in terms of average number of function evaluations (AFE), mean error (ME), and success rate (SR) as mentioned in Tables 2, 3, and 4 respectively. Standard deviation (SD) also measured for analysis. The considered algorithms are examined with the following experimental setting:

- Population size $NP = 50$ [17,18].
- Food source count $SN = NP/2$,
- Simulation count/run =100,
- $C = 1.5$ [5],
- Total local search iterations $TI = 11$ (It was set through empirical experiments).
- The termination for ABC,MABC and BSFABC is set to maximum number of function evaluations = 200000 or permissible error (Table 1) whichever meets first.
- Parameter settings for ABC [3] , MABC [16] and BSFABC [15] are taken from their base papers.

5.3 Analysis of Experimental Results

To evaluate the efficiency, an AFE based comparison is carried out in Table 2. It can be easily observed from this table that the AFE of LSABC is less for most of the functions i.e. the newly developed LSABC is converge to optima faster than the other considered algorithms. Further, the Table 3 shows the results of successful runs over 100 simulations. A simulation is considered successful, if the algorithm achieves optima at the level of acceptable error as mentioned in Table 1. The Table 3 elucidate that the newly developed LSABC is more reliable for most of the benchmark functions in terms of success rate as compared to the considered algorithms. The robustness and accuracy of the newly developed LSABC algorithm is measured by the ME as shown in Table 4. This table show competitiveness of the purposed algorithm in terms of accuracy for the considered Test Problems (TP).

5.4 Statistical Analysis

The comparison of LSABC with ABC, BSFABC and MABC is done on the basis of AFE, SR, and ME. The results in Tables 2, 3, and 4 shows that LSABC is very effective for 7 test problems (f_2, f_4 to f_8, and f_{10}) while these problems are of different nature, After observing these results it may be concluded that LSABC is able to balance the process of exploitation and exploration very effectively. MABC outperforms LSABC over test function f_3 while BSFABC outperforms LSABC over test functions f_1 and f_9.

The boxplot [19] analysis of AFE for LSABC, ABC, BSFABC, and MABC have been presented in Fig. 2 to denote the distribution of outcomes. It is clearly visible through the boxplots analyses of the results as shown in Fig. 2 that LSABC outperforms the considered algorithms. While observing the boxplots of success rate, the median of LSABC is high whereas interquartile range is low

Table 2. Comparison based on AFE.

TP	ABC	BSFABC	MABC	LSABC
f_1	75764	142277	199760.11	128080.67
f_2	87819.17	126256.06	69666.93	65283
f_3	197438.91	199276.24	126357.7	132566.87
f_4	16725.62	52087.08	10092.62	5862
f_5	199418.75	157990.69	135452.33	32653
f_6	186553.17	134165	180813.31	78254
f_7	177795.25	188112.09	161638.38	158374
f_8	120259.59	13107.29	14687.36	8556
f_9	189072.01	4524.29	197588.96	21596
f_{10}	31073.92	16246.31	8992.24	5312

Table 3. Comparison of success rate out of 100 runs.

TP	ABC	BSFABC	MABC	LSABC
f_1	100	96	1	95
f_2	93	81	100	100
f_3	5	2	99	79
f_4	100	92	100	100
f_5	1	42	63	99
f_6	17	57	18	95
f_7	20	13	38	56
f_8	55	100	100	100
f_9	13	100	3	100
f_{10}	100	100	100	100

Table 4. Comparison of mean error.

TP	ABC	BSFABC	MABC	LSABC
f_1	8.05E−06	8.03E−06	1.07E−03	1.34E−05
f_2	2.36E−02	8.77E−02	8.40E−06	7.45E−06
f_3	9.44E−01	4.10E+00	1.02E−01	1.03E−01
f_4	8.46E−06	2.42E−05	4.96E−06	4.51E−06
f_5	1.58E−01	2.98E−02	1.15E−02	6.59E−03
f_6	1.87E−04	1.28E−04	1.92E−04	4.78E−05
f_7	7.95E−01	2.85E+00	6.68E−01	7.80E+00
f_8	9.35E−07	6.19E−15	5.12E−15	6.12E−15
f_9	3.24E−05	4.49E−14	9.18E−04	4.32E−14
f_{10}	1.95E−03	1.95E−03	1.94E−03	1.77E−03

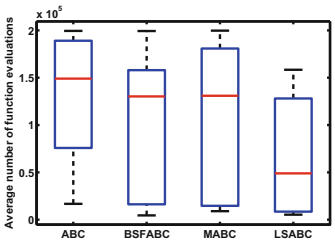


Fig. 2. Boxplots graph for AFE

as compared to the other considered algorithms which proves the reliability of the LSABC over the compared algorithms.

Further, some more statistical analyses, namely Mann-Whitney U (MWU) rank sum test [20] and Acceleration Rate (AR) test are done on the AFEs. As it is clear from the boxplots (refer Fig. 2) that the AFE's are not uniformly distributed, so the MWU Rank sum test is done at 5% level of significance ($\alpha = 0.05$) as shown in Table 5. The MWU rank sum test is applied for identification of the significant differences in function evaluations between LSABC-ABC, LSABC-MABC and LSABC-BSFABC. In Table 5, '+' symbol indicates the significant less function evaluations of LSABC, while '−' symbol indicates the significant high function evaluations of LSABC to the compared algorithm. The symbol '=' shows no significance difference of the function evaluations of the algorithms. The last row shows competitiveness of the proposed algorithm. As Table 5 contains 26 '+' signs out of 30 assessment. As a result, it can be declared that the outcomes of LSABC are significantly better than ABC, BSFABC and MABC over measured test problems.

Table 5. Comparison based on AFE and the MWU rank sum test [20].

TP	MWU rank sum test with LSABC		
	ABC	BSFABC	MABC
f_1	−	−	+
f_2	+	+	+
f_3	+	+	−
f_4	+	+	+
f_5	+	+	+
f_6	+	+	+
f_7	+	+	+
f_8	+	+	+
f_9	+	−	+
f_{10}	+	+	+

Further, a fair comparison in terms of the convergence speed is done through AR analyses on the AFEs of the considered algorithms. The AR is calculated by Eq. 7.

$$AR = \frac{AFE_{ALGO}}{AFE_{LSABC}}, \tag{7}$$

where, ALGO$\in$ {ABC, MABC, and BSFABC}. It is clear from Eq. 7 that the AR will be high for the algorithm having fewer AFEs and vice-versa. The calculated AR is presented in Table 6. While observing the Table 6, the value of AR is more

Table 6. Comparison of AR for LSABC with ABC, BSFABC, and MABC.

TP	ABC	BSFABC	MABC
f_1	0.591533445	1.110838974	1.559642919
f_2	1.345207328	1.933980669	1.067152704
f_3	1.489353335	1.503212982	0.953161978
f_4	2.853227567	8.885547595	1.721702491
f_5	6.10721067	4.838473953	4.148235384
f_6	2.383944207	1.714481049	2.310595113
f_7	1.12262903	1.187771288	1.020611843
f_8	14.05558555	1.531941328	1.716615241
f_9	8.754955084	0.209496666	9.149331358
f_{10}	5.849759036	3.058416792	1.692816265

than one for most of the function which shows that the newly developed LSABC is fast convergent algorithm as compared to the other considered algorithms.

6 Conclusion

Here a logarithmic spiral inspired local search algorithm assimilated in basic ABC algorithm to ameliorate its exploitation feature. The new local search is named as Logarithmic spiral based local search (LSLS) and variant of ABC is named as logarithmic spiral based ABC (LSABC). The performance of the newly anticipated LSABC is measured over 10 complex benchmark problems and results are compared with the ABC and its some state-of-art its variants. While statistical analyses of the results, it may be declared that the newly developed LSABC is an efficient variant of ABC and give a better trade of between exploration and exploitation abilities. In future LSABC may be implemented for multi variable function optimization. Further, LSABC may be implemented to classify the plant leaf and soil images into different categories.

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An Intelligent System for Clustering Using Hybridization of Distance Function in Learning Vector Quantization Algorithm

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***Abstract*— Artificial Neural Networks (ANNs) are human made information processing artifacts, and grown up vast in two-three decade. Neural Networks are highly parallelized dynamic system which accept output response as input and produce output. They have confirmed to be extensively beneficial in solving those problems which cannot be solved by using algorithmic procedures which are considered to be conventional, or possess a highly complex solution in area like prediction and classification of large data, image processing etc. Automation using ANNs in medical sector used to are carry out diagnoses of disease and prediction of disease etc. Proposed work focus on hybridization of distance functions for computing distance and increasing the prediction of diseases like Cancer, Diabetes, cancer. Proposed work is to train the data with hybrid function and get results with hybrid function on test data. We have used Supervised Learning Vector Quantization (LVQ) to apply this hybrid function because of its characteristic to work in two steps and used heuristic search technique. First is unsupervised step and another is supervised. We have also shown comparison tables in proposed work which distance function works best on the dataset by showing area under the curve measuring on MATLAB. The data sets for providing learning and examining are taken from medical science and increasing effectual identification of diseases like Cancer ,Diabetes by using data classification techniques, thereby modifying ANN algorithm to enhance their performance. We have also test the proposed algorithm on randomly generated dataset to maintain sustainability. of The whole experimental work is simulated using MATLAB 7.7.0 and showed that increasing the accuracy of data by using proposed hybridization of distance function .**

Keywords—Clustering, Artificial Intelligence, Neural Networks, Self Organizing feature MapLearning Vector Quantization, Voronoi vectors, Expert Systems, Hybrid System.

I. INTRODUCTION

As all accepted and surveyed selecting best algorithm is one of the most challenging part for data classification. Every algorithm has own characteristic and for data. Due to these challenges ,to obtain the best results of data classification developer needs to execute algorithms using multiple distance function. Clustering is a classification of data items, set of objects,observations in unsupervised way and separating the unrelated data. It is highly dependent task. Inadequate result of data classification can make wrong output. Various challenges for data like identification of distance measure, number of cluster, structure of database, types of attributes, initializing and other various challenges has been addressed by researchers. For better representations of the input, Artificial Neural Network (ANN) is widely used in clustering and used to learn patterns and relationship in data. The data can be result of researchers effort. The automation of classification and categorization through the use of computers is a common practice .So in this series proposed work also used the same concept to make a system for medical institutions with computer based record of patient can reduce unwanted practice, variation and can improve patient outcome for disease present or not [1].There are number of architectures in ANN designed for clustering. Learning Vector Quantization (LVQ) is one of them in it which aims to process large input vectors to smaller set and used the conventional Euclidean Distance Function**.** Based on study and experiment done the observed drawbacks of using conventional Euclidean Distance in algorithm is

1. If data is at origin then Euclidean Function performance may not be well.
2. Euclidean is commonly used to evaluate the region close around the objects in two or three-dimensional space.

LVQ categories the data in two phase. Data clusters are formed during phase one and grouping is done for clusters into classes during second phase . Classes are defined by target data in algorithm . In the first phase unsupervised learning algorithm known as Self-Organizing feature Map (SOFM) discovered by, Kohonen is used to fine classify the boundaries in a "supervised" way and developed methods for doing this. The methods provided are the modification over LVQ [2]. Neural Networks has ability to do work like a normal computer can do [3] and it is a power full tool in classification where formal analysis is not possible.

This work objective is to modify an ANN algorithm to enhance their performance. As all accepted choosing best algorithm is typically challenge. The intention behind research project is to find the one solution which can be utilize for the purpose of the distance calculation in pattern classification

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with LVQ**.** Analysis work target aims at conducting a comparative study between the implementations of proposed system implemented by using various distance function, and replacing with a proposed hybrid method.

II. LITERATURE SURVEY

As per theory, proposed in 1986 by Kohonen on Self Organizing feature Map, target of SOM is to encode a set of input vector {i} by finding a similar and smaller set of "prototypes."$\{w_{1(x)}\}$ that results in good estimation to the input space provided to algorithm initially. This estimation is used by supervised learning. This is the basic idea of vector quantization which aims to process large input vectors to smaller set. Learning Vector Quantization algorithm (LVQ) is a enhanced version of SOM, where the trainer is available and used when we have tagged input data.The class information/estimation obtained from the prototype is used to give supervision so that LVQ can relocate Voronoi vectors. The motive behind is to make best classifiers decision reason. Vernoi vectors are basically, a space representation on x ,y ,z ,w axis for classification and moving towards match class in space. For example, if we have a pattern that match for input vector let say **x**, and Vernoi vector let's say **w** satisfies, than vector **w** is moved towards the direction of input vector which is **x**, for current pattern. LQV is a two step process. The first step is feature choice/opting from input by applying SOM. Second step is to classify where to put this feature to individual classes [3,4,5].

The difference between one set to another set obtained by vector quantization is given by Euclidean measure is as

$$D = \sum_x \|\mathbf{X} - (W_{1(x)})\|^2, \quad (1)$$

Where **X = Input vectors**

W = Weight vector for output neuron (jth)

D = Distance between vectors

According to previous papers, LVQ has been proposed with various special cases as below mentioned.

Comparative study has been reported in[2]by presenting a intrusion detection model through hybrid system of LVQ improves the detection rate for dataset. Another approach presented in [3] is for optical Numeral Recognition with Principle Component Analysis(PCA). In this approach PCA perform better to produce coefficient vector of images. In the series of LVQ with special cases ,recognition of speech is proposed in [4] by LVQ with Time-Delay Neural Network achieve high recognition rate.A comparative study between implemtations of LVQ algorithm implemented using Euclidean distance function and Canberra distance function have been reported in [5] ,such as modified LVQ with Canberra distance function. Experimental results shows the improved method for distance calculation over traditional Euclidean Distance method *Fig. 2 ,Fig. 3* shows the simulation results proves the Canberra to perform better than conventional Euclidean function.In detail, Canberra distance function has been used in place of Euclidean distance method to find distance between points. Hybrid Evolution of genetic algorithm is also reported in [6] which use Particle Swarm Optimization for clustering. Proposed algorithm finds the refined initial centroid and provide geed optimization strategy with the drawback of more execution time as compared to k-means process.

III. DESIGN OF HYBRID FUNCTION

This paper proposed a hybrid function for LVQ algorithm. Basically proposed function is the integration of various distance functions, as motive to enhance the prediction of diabetes using LVQ code because LVQ able to predict diabetes prediction with more accuracy, and also it is more sensitize. Our approach is to collect the informative data and improving accuracy in such a way that the performance may high and computational cost remain less. In this paper, architecture has been introduced and an algorithm has been implemented using the MATLAB 7.7.0 tool.

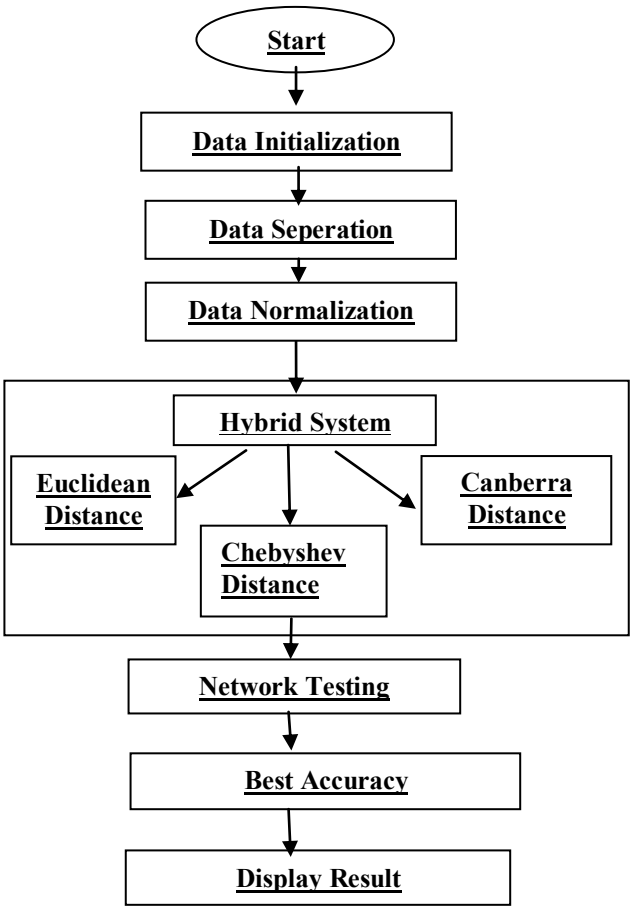


Fig.1. Hybrid LVQ Algorithm

In the data initialization block ,algorithm load data from input files through commands and split the data into training set and testing set and at the last in this data initialization block , set learning rate.

Data separation block include preprocessing of data in which all zero values are converted to non-zero value. Loaded or fetched data sometime may not be in the perfect order or it may not be very usable too for the language and the tool, so it becomes mandatory to pre-process all the collected data and reduce the redundant data, and then make it available for the

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further block set to use the data. Hence the normalization block is responsible for aforementioned task .

Hybrid Call is the core brain of algorithm. Hybridization consist of four different traditional distance calculation methods which are running over different equations and functions which are optimized to work within the specified condition .In this block , minimum distance is obtained and weight is updated accordingly as per traditional LVQ algorithm.

The criteria behind designing of such method and deployment in such a manner that is easily extendable and will be compactible with complex datasets having multivariate values or geological information data etc and make them ready to work with data in real scenario.

Canberra Distance Function :This distance function is introduced and developed by G.N. Lance and W.T Williams in 1966 and 1967 respectively. When we need to find distance between pairs of point, where data is around the origin, in vector space, we use Canberra Distance function [5].

Canberra Distance function gives 2 outputs as TRUE only in case, if input to function is in rectangular form, and gives FLASE in case where the data is not in rectangular form or if some computational error occur during calculation,

$$\mathbf{D}_{\text{Canberra}}(\mathbf{p},\mathbf{q}) = \sum_{i=0}^{n} \frac{|p_i - q_i|}{|p_i| + |q_i|} \qquad (2)$$

where, p and q are vectors for calculating distance.

Euclidean Distance Function : This distance function is also known as Minkowski distance. When we need to find distance between points on straight line, we use Euclidean distance Euclidean Distance must bear the properties that all elements must lies on diagonal must be zero, and triangle inequality must be followed. This function does not reduce redundancies. The equation for Euclidean distance is as follow,

$$\mathbf{D}_{\text{Euclidean}}(\mathbf{w},\mathbf{x}) = \mathbf{d}(\mathbf{x},\mathbf{w}) = \sqrt{\sum_{i=1}^{n} (x_i - w_i)^2} \qquad (3)$$

where, w and x are points in Euclidean space for calculating distance.

Chebyshev Distance Function: Chebyshev Distance is also known as maximum value distance and is computed as the absolute magnitude of the differences between coordinate of a pair of objects.

$$\mathbf{D}_{\text{Chebyshev}}(\mathbf{p},\mathbf{q}) = \max_i(|p_i - q_i|) \qquad (4)$$

where, p and q are points or vector space for calculating distance.

Proposed Distance Function (Hybrid Model): In our proposed model , we have find the maximum distance from Canberra , Chebyshev, Euclidean proceeds with finding the minimum of above calculated distance. This model is applied after calculating distance from equation(5) and (6).

$$\mathbf{D}_{\text{max1}} = \max_i(\mathbf{d}_{\text{Canberra}}, \mathbf{d}_{\text{Chebyshev}}) \qquad (5)$$

$$\mathbf{D}_{\text{max2}} = \max_i(\mathbf{d}_{\text{max1}}, \mathbf{d}_{\text{Euclidean}}) \qquad (6)$$

$$\mathbf{D}_{\text{min}} = \min_i(\mathbf{d}_{\text{max2}}) \qquad (7)$$

Minimum distance from point p to point q in vector space is given by (7) and provide a more accurate result as compared to traditional methods.

Working Algorithm:-

Input : Data set and point p and q.

Output : Minimum distance between two points.

1. Calculate distance by Canberra Distance function (1), Euclidean distance Function (2),and Chebyshev Distance Function (3).

2. Calculate the max from (4) and (5) between resultant distance from step 1.

3. Find the min from (6). The resultant distance will be minimum distance between point p and q.

IV. SIMULATION AND RESULT ANALYSIS

The whole simulation and experiment is carried out on Intel(R)core i3-4010U CPU and frequency of the system is 1.70GHz at 4GB RAM. Processer efficiency has the main part of conducting research and hence also result may can vary upto few digits. We have simulated the experiment and obtain the result, that proposed model has proven best accuracy and efficiency. We have perform experiment on Pima Indian Diabetes , Breast Cancer dataset , various sets of raw data.

In Diabetes dataset there are total 768 instances of data and total 9 attributes including last one class attribute listed in *Table I*. 500 instances out of 768 instance belongs to class 0 and remain 268 belongs to class 1 [1] [5].

Another dataset we have used is Breast Cancer multivariate dataset. Total 699 number of instances present in dataset. There are 10 number of attributes with one class attribute. The class value (2 has replaced with 0 and 4 has replaced with 1) as per acquired from UC Irvine Machine Learning Repository (UCI) listed in *Table II* [19].

To test the reliability and the sustainability of the algorithm and perseverance of results a various permutation and combinations of artificially generated dataset is also used as third dataset for measuring performance of algorithm in terms of accuracy and efficiency. Artificial data is generated using random integer function and stored in text file that is loaded to algorithm at the initialization time.

The proposed system trains the system with 0.01 learning rate over the data set with 100 iterations, and the data is divided into ratio of 90:10.In this ratio, 90%of the data set make use for training and 10%used for testing for diabetes, cancer and artificially generated data set .

Fig.3. shows the ROC curve and AUC area generated by existing methodology[5] while *Fig. 5.* shows simulation result by proposed methodology in paper over existing algorithm. Distance function used in *Fig.5.* were experimental results of finding more efficient distance function in comparison with proposed work of[5], as motive to beat performance of Canberra distance function has the drawback to run under aforementioned characteristic but the motive reached with proposed Hybridization in this paper .The experiment is also carried out on cancer dataset and artificially generated dataset The results are shown in *Fig.6.,to Fig.13.* and the conclusion

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is same as observed for pima diabetes dataset in the starting of paragraph.

TABLE I.

SNO	PARAMETERS(PIMA INDIAN DIABETES)	
	Recorded parameter	***Value***
1	Number of times patient pregnant	Numerical
2	Plasma-glucose concentration of Patient after 2 hours in an oral glucose tolerance test	Numerical
3	Patient's Diastolic blood pressure	Numerical
4	Triceps skin fold thickness (mm)	Numerical
5	2-Hour serum insulin (mu U/ml)	Numerical
6	Body mass index of patient (weight in kg/(height in m)^2)	Numerical
7	Diabetes pedigree function	Numerical
8	Age of patient	Numerical
9	Class (positive or negative)	Numerical

TABLE II

SNO	PARAMETERS(BREAST CANCER DATASET)	
	Recorded parameter	***Value range***
1	Sample Code Number of patient	Integer
2	Clump Thickness	Numerical(1 - 10)
3	Uniformity of cell Size	Numerical(1 - 10)
4	Uniformity of cell Size	Numerical(1 - 10)
5	Marginal Adhesion	Numerical(1 - 10)
6	Single Epithelial Cell Size	Numerical(1 - 10)
7	Bare Nuclie	Numerical(1 - 10)
8	Bland Chromatine	Numerical(1 - 10)
9	Normal Nucleoli	Numerical(1 - 10)
10	Mitose	Numerical(1 - 10)
11	Class	Benign(0), malignant(1)

A. Receiver Operating Characteistic (ROC) and Area Under the Curve(AUC) comparision with diabetes dataset

Fig. 2. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Euclidean Distance function.

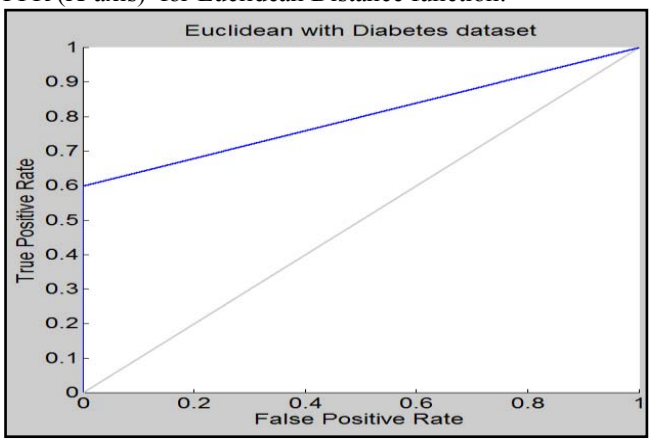


Fig. 2. Euclidean Distance ROC curve on Pima India Dataset

Fig.3. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Canberra Distance function. ROC curve is greater than ROC obtainted in Euclidean Distance. It shows conventional Canberra is more accurate than conventional Euclidean Distance as area under the curve is more.

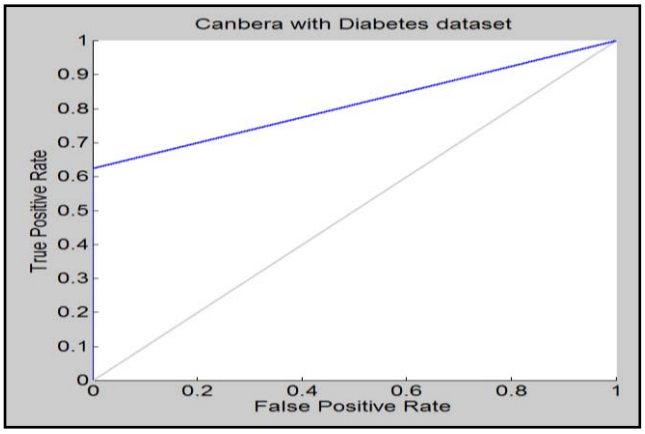


Fig. 3. Canberra Distance ROC curve on Pima India Dataset

Fig. 4. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Chebyshev Distance function. Here area under the curve obtained from Canberra Distance Function and Euclidean Distance Function is less then obtained from Chebyshev .

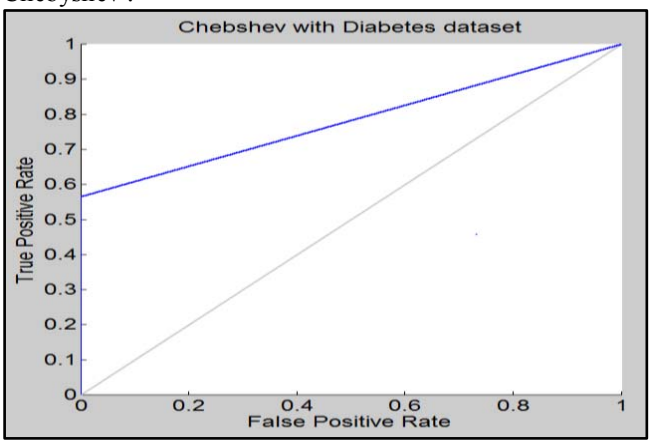


Fig. 4. Chebyshev Distance ROC curve on Pima India Dataset

Fig. 5.(Proposed Model) is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Hybrid Distance function. Here TPR is higher than TPR obtained from others.

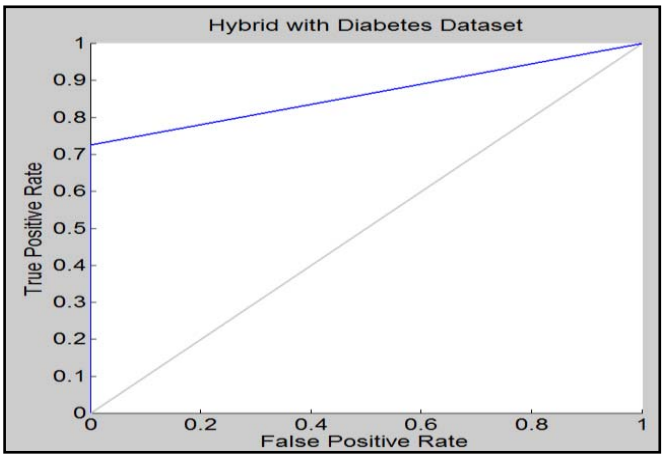


Fig. 5. Hybrid Distance ROC curve on Pima India Dataset

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B. *Receiver Operating Characteistic (ROC) and Area Under the Curve(AUC) comparision with cancer dataset*

Fig. 6. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Euclidean Distance function.

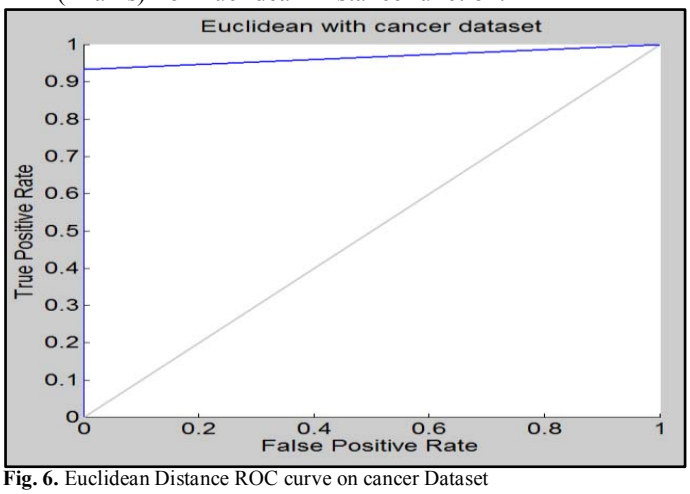


Fig. 6. Euclidean Distance ROC curve on cancer Dataset

Fig. 7. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Canberra Distance function. Here TPR rise up to more than TPR of Euclidean Distance ROC which is at x-axis. It shows Canberra Distance Function works more accurately compared to Euclidean Distance.

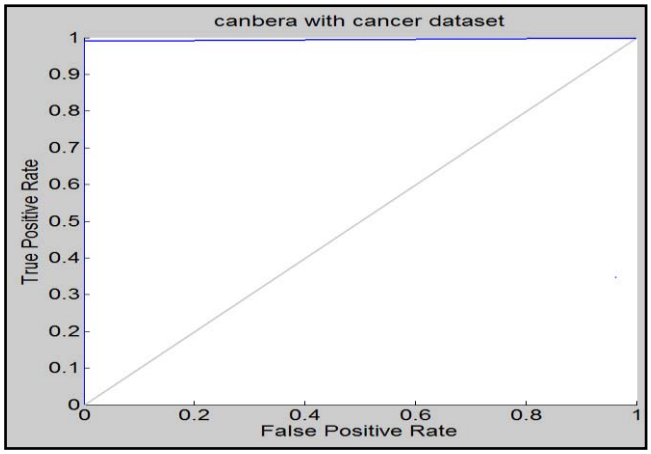


Fig. 7. Canbera Distance ROC curve on cancer Dataset

Fig. 8. is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Hybrid Distance function. It is shown ROC curve for proposed function is greater than conventional Canberra Distance Function, Euclidean Distance Function.

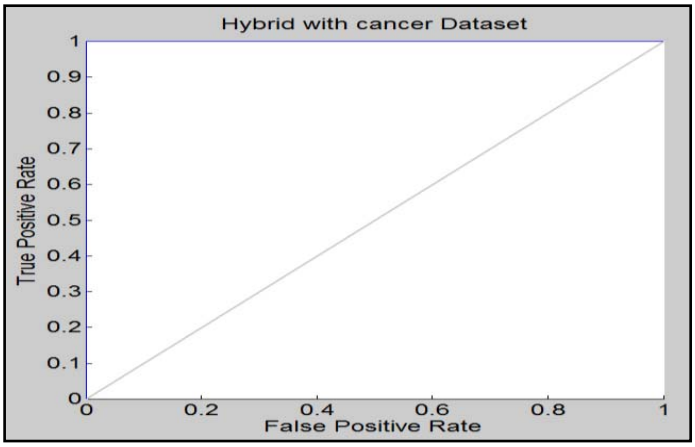


Fig. 8. Hybrid Distance ROC curve on cancer Dataset

Fig. 9 is the ROC curve plotted between TPR (Y-axis) and FPR (X-axis) for Chebyshev Distance function. Here TPR is less than TPR obtained from conventional Canberra Distance Function and Euclidean Distance Function and ploted ROC curve is small then Proposed function , Euclidean and Canberra Distance Function.

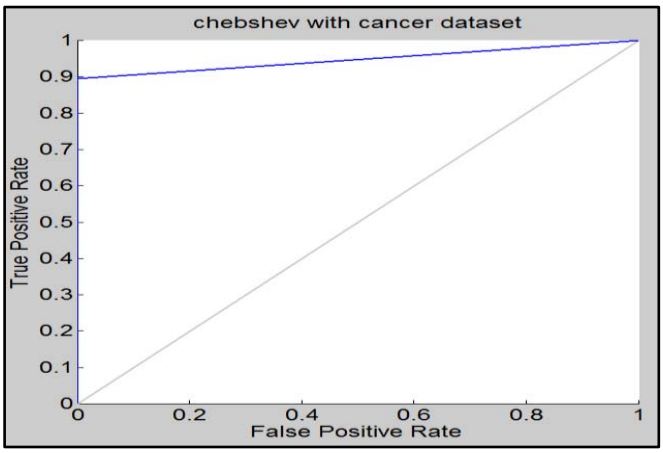


Fig. 9. Chebyshev Distance ROC curve on cancer Dataset

C. *Receiver Operating Characteistic (ROC) and Area Under the Curve(AUC) comparision with random generated dataset*

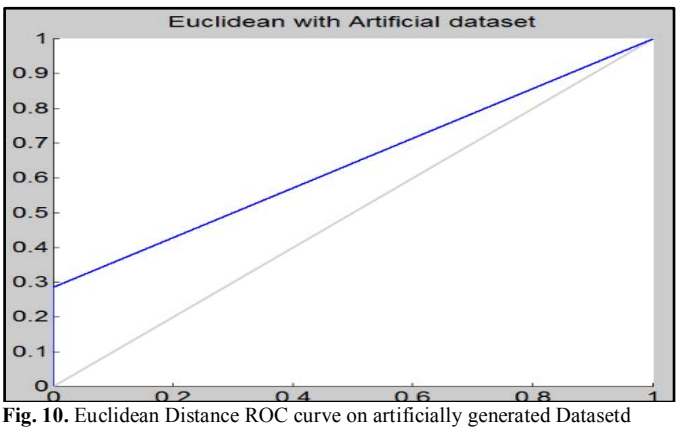


Fig. 10. Euclidean Distance ROC curve on artificially generated Datasetd

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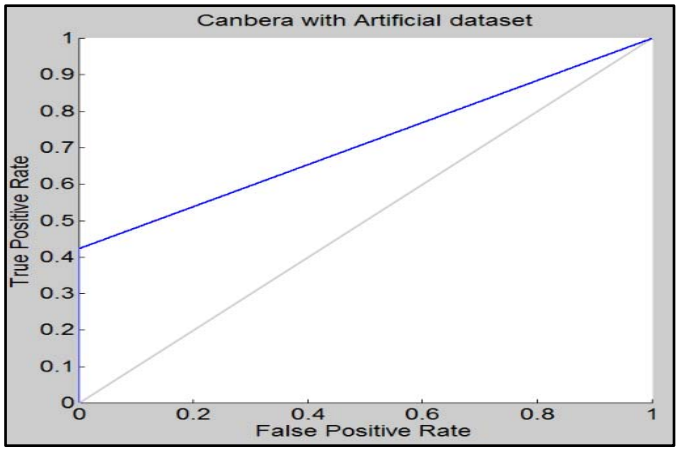


Fig. 11. Canberra Distance ROC curve on artificially generated Dataset

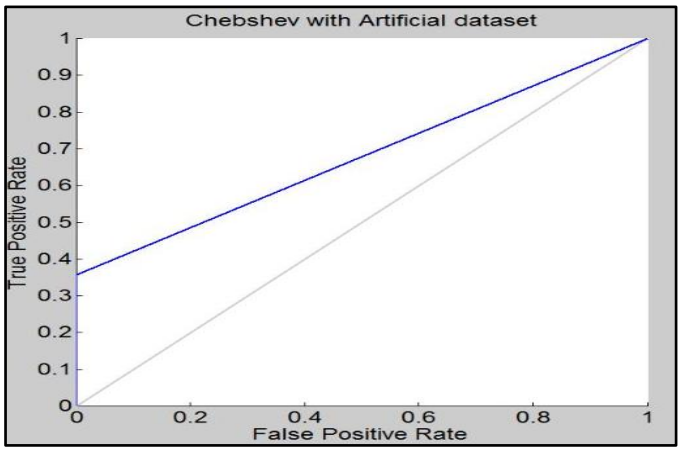


Fig. 12. Chebshev Distance ROC curve on artificially generated Dataset

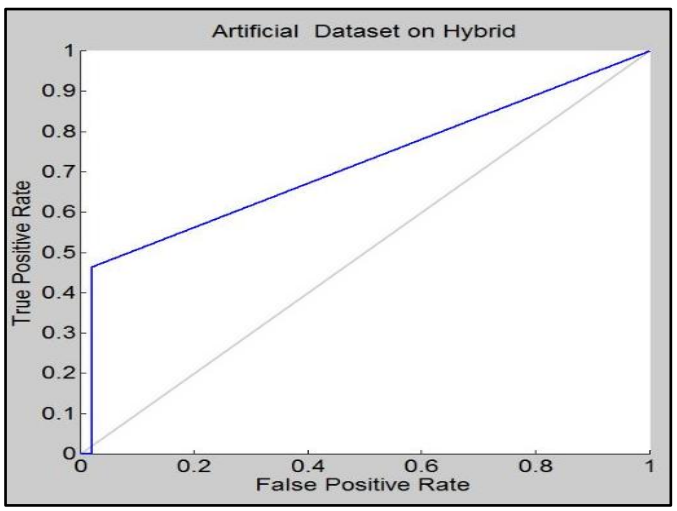


Fig. 13. Hybrid Distance ROC curve on artificially generated Dataset

In *Fig.13.*AUC recorded is greater than AUC recorded in Fig.10., Fig.11.,Fig.12. Simulation of experiment on artificial dataset shows only Canberra is not good option for replacing Euclidean distance but Chebyshev can also be the good option to replacement and Hybrid can be the best option. In the below figures negative represents the negative cases, positive represents the positive cases identified by system, FNR in below figures despites the False Negative Rate and TPR despites the True Positive Rate.

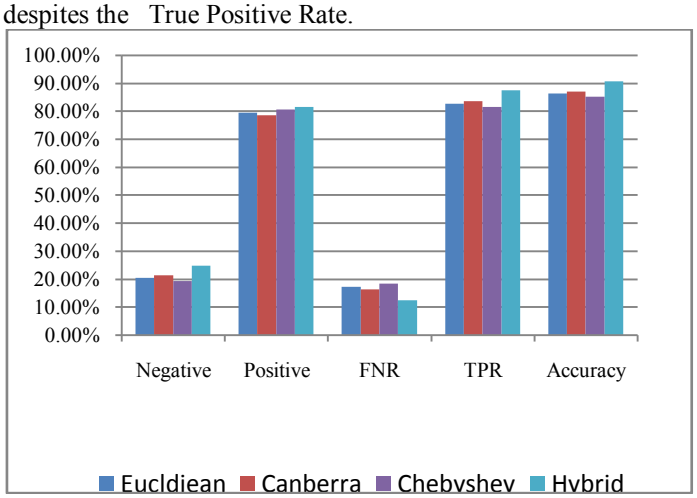


Fig. 10. Evaluation Result of confusion matrix on Pima Diabetes Dataset

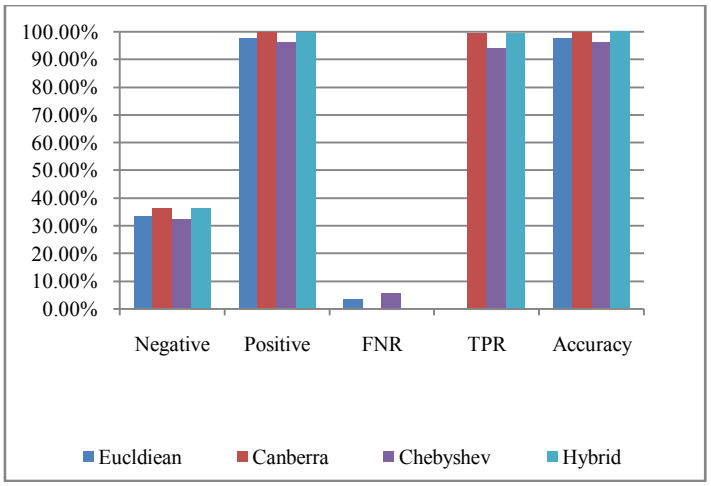


Fig. 11. Evaluation result of confusion matrix on Cancer Dataset

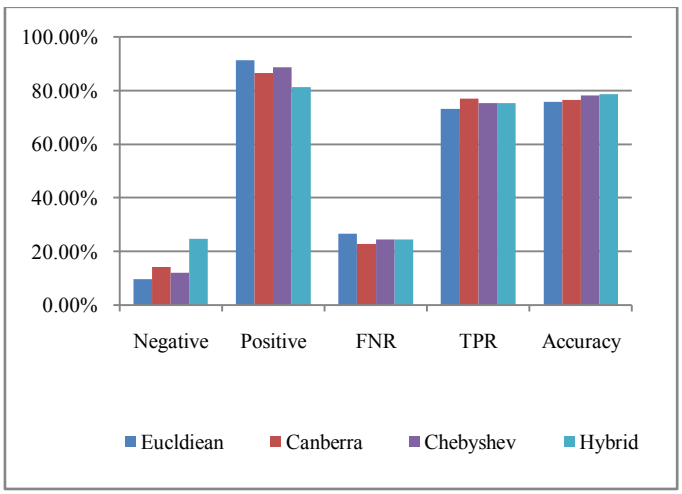


Fig. 12. Evaluation result of confusion matrix on Artificial Dataset

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From above *Fig.10.,Fig.11.* and *Fig.12.* ,accuracy of proposed distance function proves better and way than existing approaches of single function outcome and results are sustainable.*Fig.13.* shows Area under the Curve comparison of result values observed on confusion matrix.

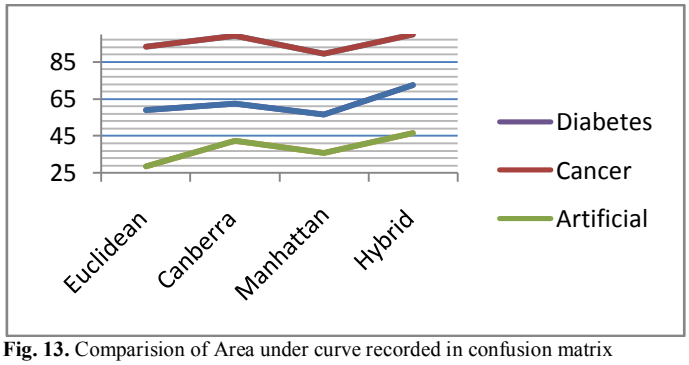


Fig. 13. Comparision of Area under curve recorded in confusion matrix

V. CONCLUSION, LIMITATION AND FUTURE SCOPE

The result from the above simulation and bar graph proves that proposed modification over LVQ denoted with violet is more accurate as compared to Canberra proposed by[5] denoted with red bar and conventional Euclidean distance denoted with sky blue bar and Chebyshev denoted with green bar. Proposed Hybrid LVQ performance is improved and best improvement is observed on categorical data. In the series of future improvement, sustainability analysis with respect to time of this research on big data, application of hybrid function for pattern classification, hybridization of different mining technique, speeding up will be done.

Acknowledgment

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Performance Assessment and Orientation Optimization of 100 kWp Grid Connected Solar PV System in Indian Scenario

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Abstract— **Yield and loss forecasting plays a significant role in efficient planning and operation of Solar PV system. We have designed equivalent model of 100 kWp solar PV system installed at Poornima university, Jaipur and simulated the developed model using PV Syst. Similar system has been simulated for three different geographical locations and performance parameters has been compared for the same. In addition to variation of site locations, the orientation of erection of system has been varied in two different strategies. Optimized value of fixed tilt based on latitude and solar irradiance were used for assessment of performance for Jaipur, Kolkata and Chennai. Further fixed tilt orientation has been replaced by two axis tracking with help of variation of tilt angle and azimuth angle of system. Observations and results of the presented work is important for understanding the effect of geographical locations and tilt angle optimization on performance parameters of plant.**

Keywords-Yield Forecasting, Loss Forecasting, PVsyst, Performance Ratio, Grid Connected Solar PV

I. INTRODUCTION

Today the critical situation of dwindling energy resources has risen which is mostly being faced by developing countries. There is a need to build a bridge in between power supply and energy demand to redress the constraint and to contribute in social and economic development. Now-a-days thermal power and hydel power are the major power resources in India and fuel is imported for their generations which reflect our dependency on the other nations.India should be independent in terms of power generation for its sustainable growth. India is endowed with rich renewable energy resources and its immense potential must be utilized for making power supply much more accessible, affordable and reliable. The most popular way of power generation from solar energy is the application of PV technology or PV system. The inherent property of doped Silicon limits the efficiency of PV module within 15-20 %. Such a low efficiency of PV system and its high initial investment discourages users for PV system instalment thus making it as an unattractive renewable energy resource.

PV module efficiency is generally determined by various factors such as installation design (exposure, orientation), geographical location (latitude, altitude), climatic condition (temp, wind speed), soiling, shading etc along with its manufacturing technology. Assessment of the effect of these alterable and unalterable factors will help in developing an array model which would efficiently predict the efficiency of PV module with less uncertainties thus enhancing its reliability.

Different seasonal behaviour of different PV technology under the influence of different factors has been analyzed in this paper.

The daily solar insolation in April or May with parts of Rajasthan and Gujarat receiving over 25100 kJ/m^2/day and decrease to about 16700 kJ/m^2/day (400 cal/cm^2/day) in winter months.In next section we have discussed the basic architecture of grid connected solar photovoltaic system and its design procedure in PV Syst.

II. GRID CONNECTED PV SYSTEM

Solar photovoltaic system consists of a PV array, inverters and other balance system components, such as a mounting system, a charge controller, cables, power transformers and suitable energy storage system. Selection of the component depends on the system and have been individually selected for each project. Given Figure 1.1 shows a schematic view of grid-connected photovoltaic system. [4]

In order to convert generated direct current by the solar array into alternating current. There are a number of inverters in the market either based on battery attached system or a network topology based system. Compatibility with solar array and optimized sizing is a major concern for efficient system design in solar photovoltaic system. Power and frequency rating of inverter must be noted in accordance to the system design. Other components of grid connected system includes mounting support, switches, cables, connectors and system monitoring assembly.

It should be noted that the use of DC cable must be minimal as it possesses high ohmic loss as well as high cost.Central inverters also need to have the matrix and the inverter fuse to protect the junction box between voltage overload toitself as an infinite energy storage, in which excess energy can be supplied to a power grid network. [5,6]

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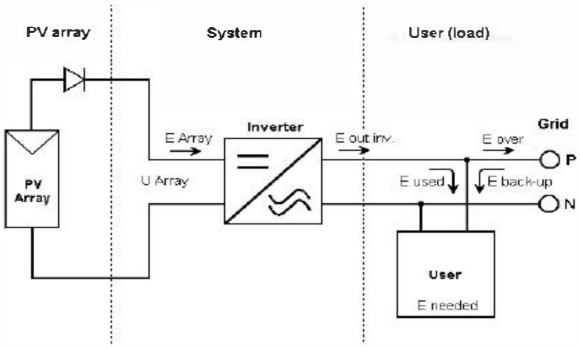


Fig.1.1 Grid Connected Solar PV System

III. SYSTEM SPECIFICATIONS

The research work has been carried out on 100 kWp grid connected solar photovolatic system. We have simulated equivalent model for grid connected system of 100kWp installed at Poornima University, Jaipur. Major building blocks of installed solar photovoltaic system can be classified as follows.

- Solar Panel
- Inverter
- Geographical location and Orientation

Solar Panel Specifications-Solar phtovoltaic module involved in design and installation of the system is manufactured by Vikram Solar with model number ELDORA 300

Model	**ELDORA300**
RatedPowerofPanel	300W
OpenCircuitVoltage	45.1V
ShortCircuitCurrent	8.74A
MaximumCurrent	8.05A
MaximumVoltage	37.28V
Efficiency	15.63%
FillFactor	76.13%
NOCT	45^0C
Numberof Panels	334

Table 1- Description of Solar Panel

The technical specifications of the module has been descripted in table1. Module is having efficiency of 15.63 % with NOCT of 45^o C. Detailed specification has been explained in table 1. There are total 334 panels which are being installed to form a PV array. We have simulated equailvalent model in software PV syst in order to analyze and assess the performance of 100 kW grid connected solar photovoltaic system.



Fig.1.2 Snapshot of Installed Solar PV Plant

There are total 334 panels in 100 kWp system which is distributed in 4 parallel string inverters. These panels are connected in series and parallel to form string and arrays in order to feed connected grid at specific voltage and current rating.

Inverter Specifications-Invereter incorporated in the given system is of sunny power (SMA) make with model number STP25000TL-30. Inverters are connected in string topology with each having rated power of 25 KW . There are four inverters connected in string topology with the photovoltaic array. The specifications of inverter is discussed in table 2.



Fig.1.3 String Inverters Connected at SPV System

Table 2- Description of Inverter

Model	**STP25000TL-30**
NumberofInverter	04
$V_{DC(Max)}$	1000V
$I_{DC(Max)}$	33A
$V_{DC(MPP)}$	390-800V
I_{SC}	43A
Power Rating	25kVA
$I_{AC(Max)}$	36.2A

Location, Orientation and Horizon-In this research we have simulated discussed 100 kWp system for three different locations. These locations are Jaipur, Chennai and Kolkata. Variation of geographical location helps in understanding the effect of irradiation distribution, ambient temperature and other metelogical variables on the performance parameters of

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installed system. Orientation corresponds to the variation in fixed tilt, seasonal tilt and two axis system which are respectively deployed to understand their imapct on performance of the proposed system.These three types of tilt orientations have been repsctively deployed to the proposed system.[9]

IV. SYSTEM DESIGN USING PVSYST

The design of system involves the flowchart of process of designing an equivalent project in PVSyst. The design of system involves the selsction of geographical sites and creation of meteo data for the respective site using synthetic hourly data. They are followed by orientation of module and integration of system components such as photovoltaic module, array, strings, inverters and coverters. In this section we have illustrated the design process adpoted for proposed 100 kW system.

Synthesis of Irradiation data-The irradiation data were obtained from NASA-SSE satellite data,release 6 as well as Meteonorm saatelite release.The obtained Irradiation data consitituted values of syntheticaly generated hourly values of ambient temperature, diffused, beam and global irradiation of Jaipur, Kolkata and Chennaifor span of one year as plotted in figure 1.4, figure 1.5 and figure 1.6 respectively. These data were saved in PVSyst for creating new geographical site.[5,2]

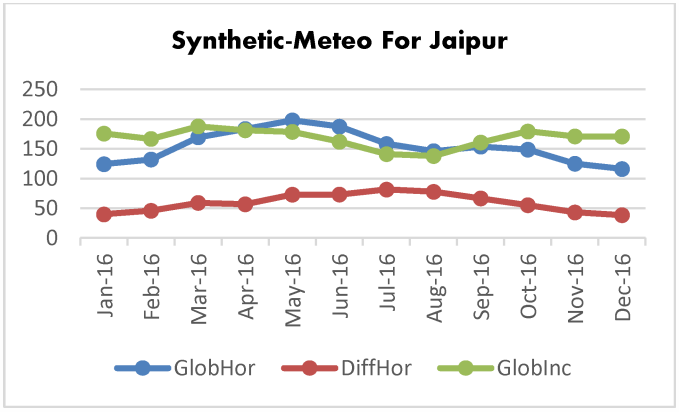


Fig. 1.4 Synthetic Generted Meteo Data for Jaipur

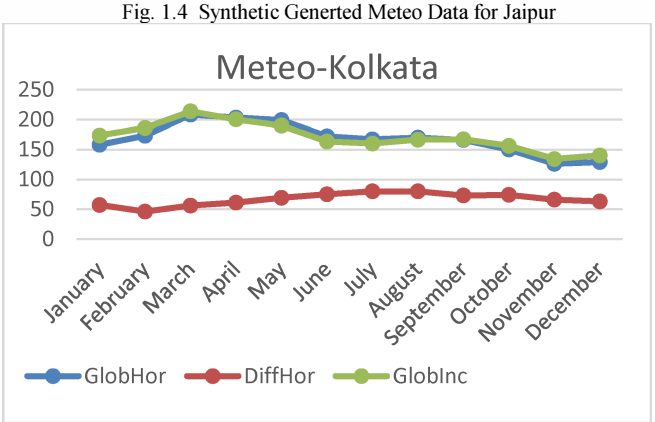


Fig1.5 .Synthetic Generted Meteo Data for Kolkata

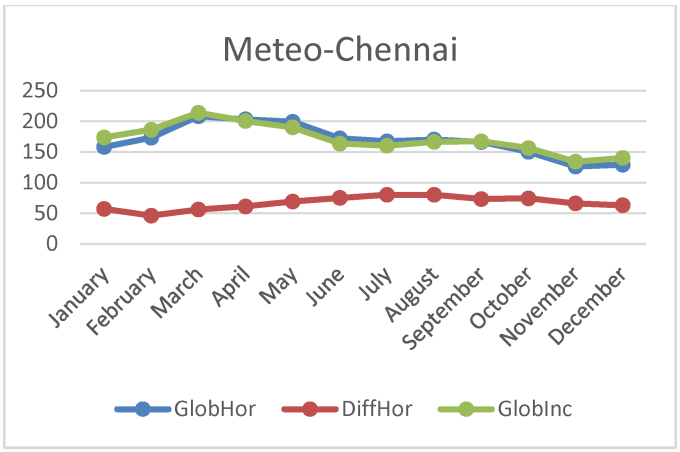


Fig.1.6 Synthetic Generted Meteo Data for Chennai

System design using datasheet-Using manufacturer datasheet of ELDORA-300, equivalent mathematical model of solar panel has been obtained in PV-Syst user defined library. These models were used in creating 100 kWp system for proposed photovoltaic power plant**.** Using manufacturer datasheet of Sunny Tri power 25000TL, equivalent mathematical model of inverter has been designed in PV-Syst user defined library. These inverters were used in creating 100 kWp system for proposed photovoltaic power plant**.** This process can be understood by analysis of figure 1.7 which is snapshot of system design tool of PV-Syst created for proposed system.[4]

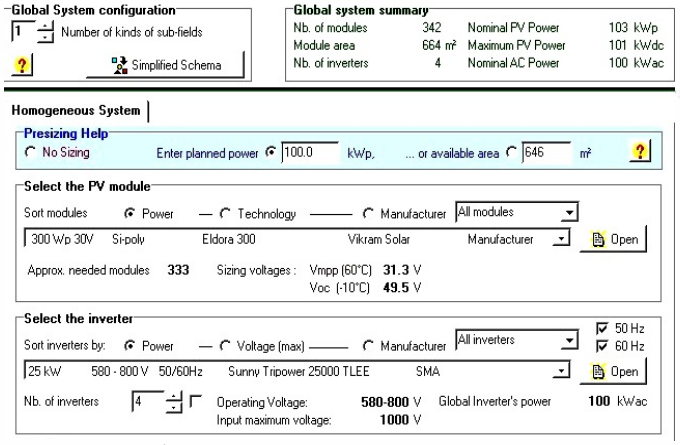


Fig.1.7 System Design Overview in PV Syst

Orientation and Horizon- In the proposed research we have simulated 100 kWp system for fixed tilt using tilt optimization with respect to latitude of concerned locations respectively. For improvement of performance and to improve spectral efficiency fixed tilt has been repalced by two axis tracting with variable tilt. This was done by help of tilt variation of PVsyst. These orientation was followed in order to create equivalent mathematical model and equivalent real time simulation of the present system in PV-Syst. Figure 1.8 and table 3 explains the selction of tilt angle and optimization of

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tilt angle in PV-Syst for proposed system.Table explains the values of fixed tilt and two axis tracking respectively.

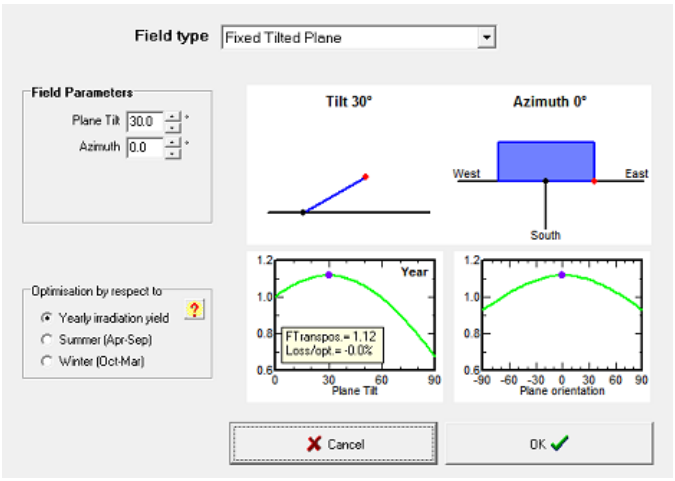


Fig.1.8 (a)Orientation with fixed tilt for System

Table 3- Selection of Orientation

Project Site	Type of Tilt Adjustment	
	Fixed Tilt	2 Axis Tracking
Jaipur	30 ^{0} (Using Latitude data)	Tilt -Min-10 ^{0} and Max- 80^0 Azimuth of -80 ^{0} to +80 ^{0}
Chennai	13 ^{0} (Using Latitude data)	Tilt -Min-10 ^{0} and Max- 80^0 Azimuth of -80 ^{0} to +80 ^{0}
Kolkata	22 ^{0} (Using Latitude data)	Tilt -Min-10 ^{0} and Max- 80^0 Azimuth of -80 ^{0} to +80 ^{0}

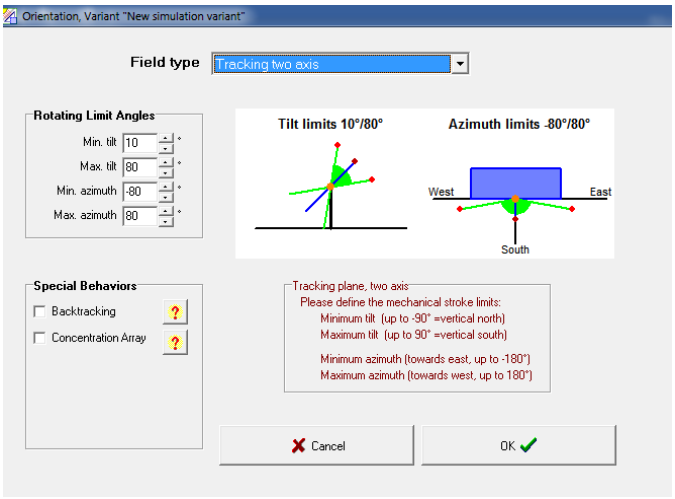


Fig.1.8(b) Orientation with tilt optimzation through two axis tracking

Interconnection of Invereter and Array-String inverter tolology similar to that of installed system at university has been considered for the simulation. There are 4 inverters each of 25 kW in order to realize equivalent mathermatical model of the installed system.Figure 1.9 explains the interconnection of inverters and panels in string topology which is finally connected to grid in order to interface with the bilateral net meter.[8]

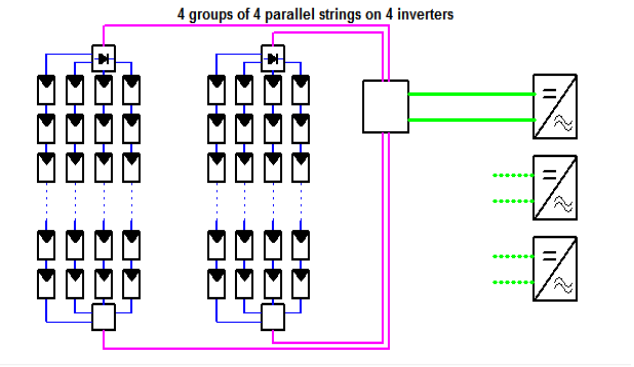


Fig.1.9 Inteconnection of Inverters in String Topology

V. SIMULATION

The overall simulation has been carried out on PVSyst 5.74. Simulation results for proposed 100 kWp system can be divided into following categories-

a) Yield Forecasting/Simulation
b) Losses Simulation
c) Performance Ratio
d) Generation by Inverters

These simulation is carried out first on monthly basis in order to obtain result of forecasted value for a complete year.

Yield Simulation-The yearly reference and final yield has been simulated using pv syst software for proposed system. The plot of yield has been characterized as normalized poroduction and main results.The unit of reference and final yield is in hours per day. Plot of simulation are explained in figure 1.10, figure 1.11 and figure 1.12 for Chennai, Jaipur and Kolkata respectively.

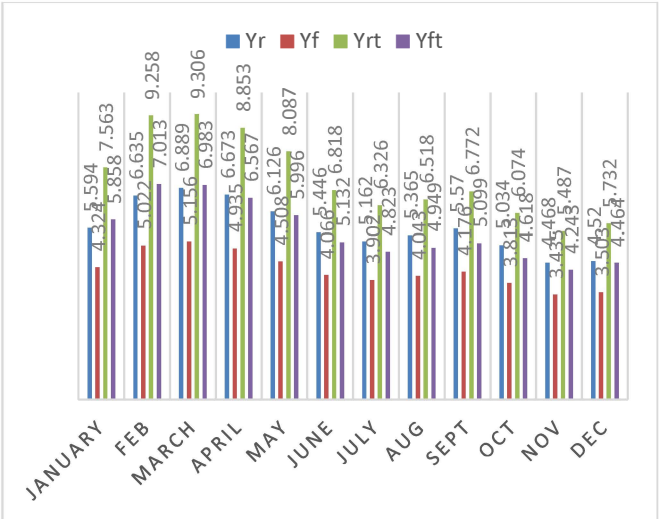


Fig.1.10 Reference Yield and Final Yield for Chennai with fixed tilt and two axis tracking (Yrt & Yft - ref & final yield with 2 axis tracking)

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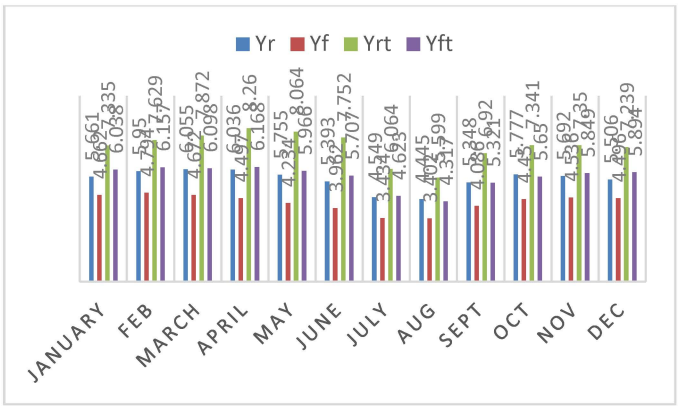


Fig.1.11 Reference Yield and Final Yield for Jaipur with fixed tilt and two axis tracking (Yrt & Yft - ref & final yield with 2 axis tracking)

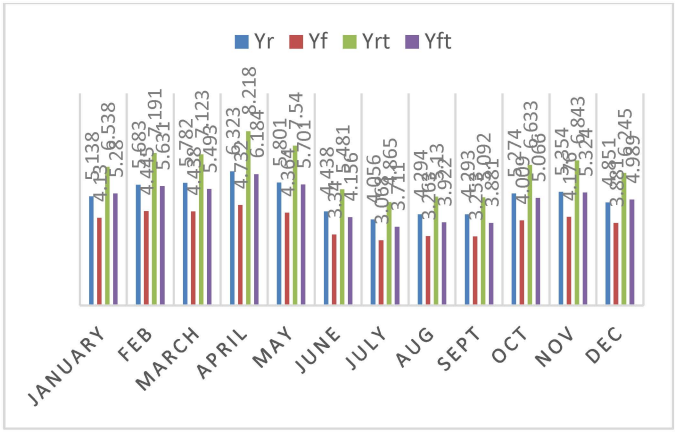


Fig.1.12 Reference Yield and Final Yield for Kolkata with fixed tilt and two axis tracking (Yrt & Yft - ref & final yield with 2 axis tracking)

Losses Simulation-Using PVSyst loss diagram for complete year has been simulated for installed system at chennai, Jaipur and Kolkata respectively. Loss diagram is useful in classification and calcultion of losses as well as to understand effect of parametric variation and system components on losses present in proposed system.[9]Plot of simulation of losses for a complete year are explained in figure 1.13, figure 1.14 and figure 1.15 for Chennai, Jaipur and Kolkata respectively.

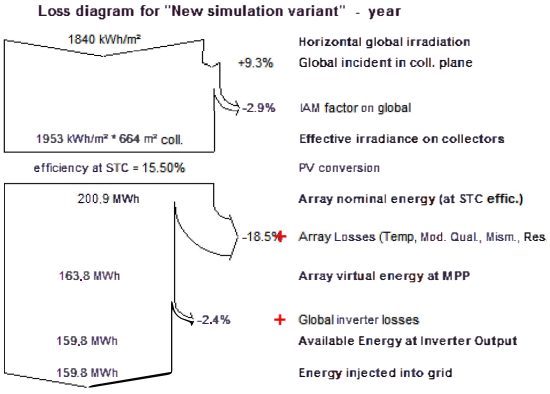


Fig.1.13 Forecasted loss diagram for Cheenai for a complere year

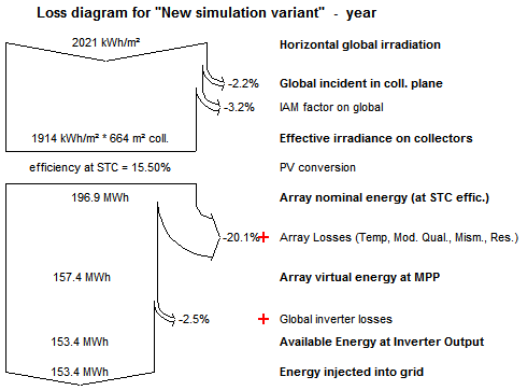


Fig.1.14 Forecasted loss diagram for Jaipur for a complere year

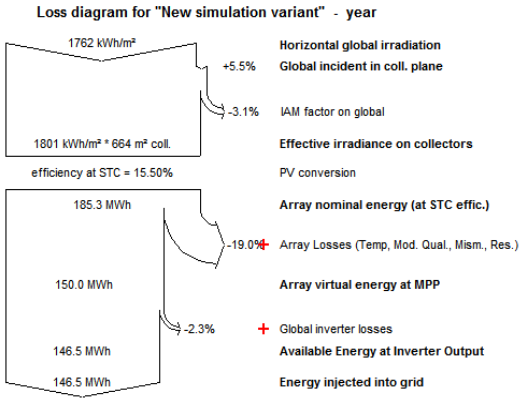


Fig.1.15 Forecasted loss diagram for Kolkata for a complere year

Performance Ratio-Performance ratio is defined as ratio of final yield to refernce yield which is calculated for three locations with fixed tilt orientation as well as two axis tracking based tilt optimization respectively.Figure 1.16, figure 1.17 and figure 1.18 explains the performance ratio of installed plant for three locations respectively. Varaition in perofrmance ratio has been discussed in graph by compartaive analysis of orientaions.

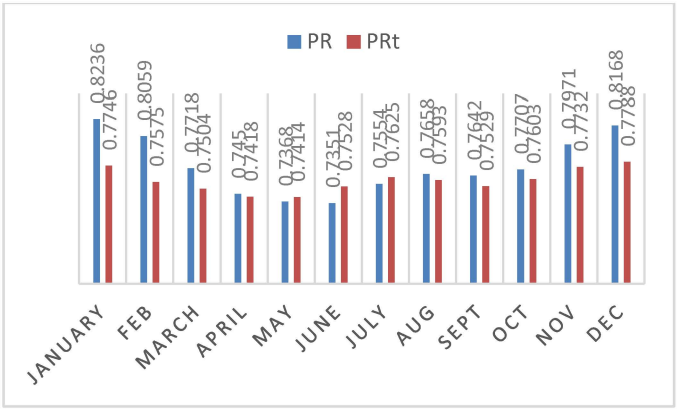


Fig.1.16Performance ratio for Chennai with fixed tilt and 2 axis tracking (Prt with 2 axis tracking)

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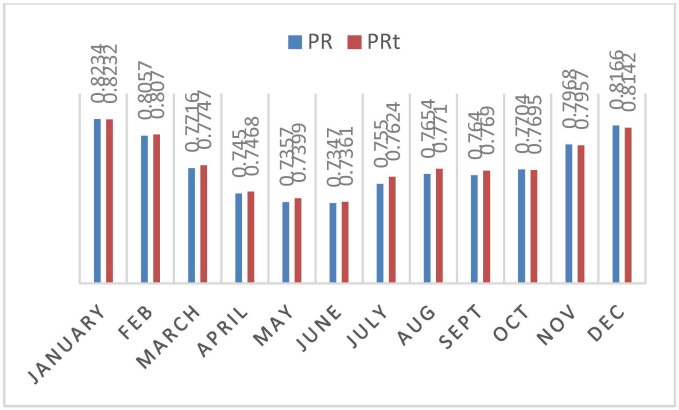


Fig.1.17Performance ratio for Kolkata with fixed tilt and 2 axis tracking (Prt with 2 axis tracking)

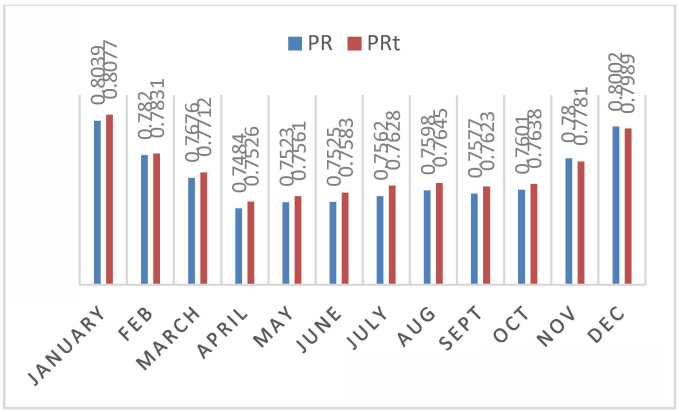


Fig.1.18Performance ratio for Kolkata with fixed tilt and 2 axis tracking (Prt with 2 axis tracking)

Generation Forecasting-Using PV syst forecasted values of yearly generation is calculated on basis of kWh/Month. We have also simulated forecasted value of generated power by Solar PV plant for April month calculated on the basis of kWh/day. The results are shown in figure 1.19 ,1.20 and 1.21.

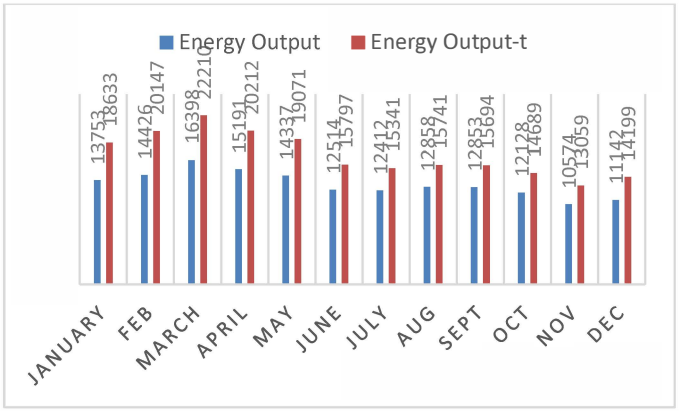


Fig.1.19Forecasted value of Energy injected to grid respectively with fixed tilt and two axis tracking for Chennai

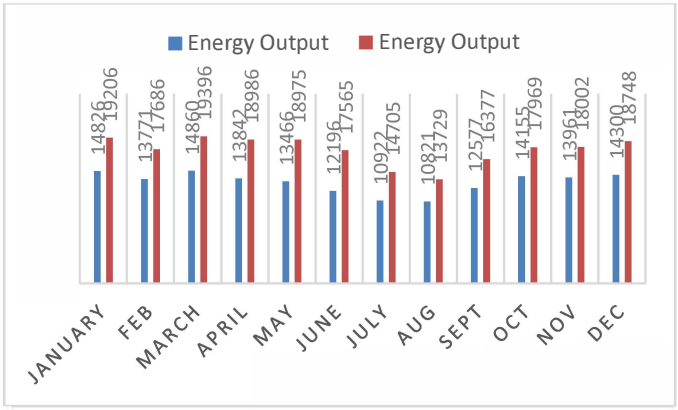


Fig.1.20Forecasted value of Energy injected to grid respectively with fixed tilt and two axis tracking for Jaipur

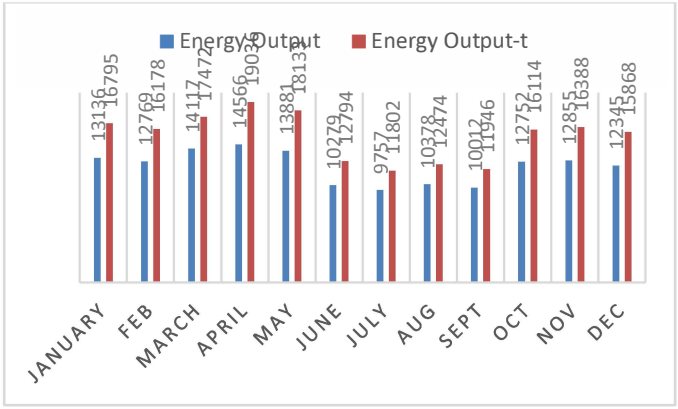


Fig.1.21Forecasted value of Energy injected to grid respectively with fixed tilt and two axis tracking for Kolkata

VI. RESULTS

Simulated results of performance assessment, yield forecasting and loss forecasting for installed 100 kWp grid connected solar photovoltaic system at have been obtaine. Performance parametrs such as Reference Yield, Final Yield , Energy injected to grid and performance ratio have been claculated for a complete year. These parameters were calculated with respect to a fixed tilt which was selected on basis of geographical sites.

Table 4- Summarized Analysis of Performance Parameters(Fixed Tilt)

Parameters	Chennai	Jaipur	Kolkata
PR	77.40 %	77.40%	76.83%
Reference Yield(Hours/Day)	5.6235	5.513917	5.10725
Final Yield (Hours/Day)	4.24025	4.26875	3.924917
Energy to Grid(kWH/ Year)	158586	159697	146847

Table 4 explains the result of performance parameters for three locations on fixed tilt orientation . It is evident that the performance of plant ar jaipur is comparatively better than those of Chennai and Kolkata . The difference in production forecast explains the impact of climatic conditions such as

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temperature, humidity, wind speed and distribution of solar irradiance.

Table 5Summarized Analysis of Parameters(Dual Axis Tracking)

Parameters	Chennai	Jaipur	Kolkata
PR	75.87%	77.57%	77.16%
Reference Yield(Hours/Day)	7.232833	7.285417	6.40825
Final Yield (Hours/Day)	5.47875	5.649	4.944833
Energy to Grid(kWH/ Year)	204793	211344	185000

Table 6- Comparative Analysis of Increase in Performance for Three Sites

Parameters	% Increase (Chennai)	% Increase (Jaipur)	% Increase (Kolkata)
PR	-2.06 %	0.12 %	0.39%
Reference Yield(Hours/Day)	29.10 %	32.12 %	25.49 %
Final Yield (Hours/Day)	29.00 %	32.35%	26.04%
Energy to Grid(kWH/ Year)	29.13 %	32.34 %	25.98%

Table 5 explains the improvement of performance of 100kWp power plant for selected locations when they are incorporated with two axis tracking system with optimization of tilt with respct to solar irradiance distribution. Significant increase in production and yield have been observed which justifies inclusion of the technology. Table 6 shows the percent increase in performance parameters with respect to fixed tilt orientation for three locations.

VII. CONCLUSION

In this paper equivalent model of 100 kWp grid connected system installed at Poornima University has been simulated successfully. Mathematical model using PV syst was used to generate forcasted values of paramaters.Similar system has been developed for three locations of India i.e. Jaipur, Kolkata and Chennai in order to understand the performance dependence on geographical locations. From results it is evident that the peroformance of plant is superior ar Jaipur followed by Chennai and Kolkata. In next part of reserarch the orientation of system was changed to fixed tilt to two axis tilt optimization based on meteorological data of geographical locations. With the inclusion of this technology significant improvement in operating efficiency have been observed.The performance of plant with respect to that of fixed tilt orientation improved by 29.13 % for Chennai, 32.34 % for Jaipur and 25.98% for Kolkata.Percent increase in final yield of plant have been increased as well with the inclusion of tilt optimization technology through two axis tracking system.Further this simulation can be extended to develop hardware equivalent model for implementation of tilt optimization and tracking system based on software based results for a similar or sclaed down project.

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A Novel Design of Multiband Minkowski Fractal Patch Antenna with Square Patch Element for X and Ku Band Applications

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Abstract—**This paper proposes the Minkowski fractal antenna with square patch element. The substrate used for this design is FR-4 the proposed design whose dielectric constant and thickness is 4.4 and 1.6 mm respectively. This antenna consists of four parts- patch, probe feed, substrate and ground plane. The square patch element is located centrally in the Minkowski fractal patch antenna. The parameters studied in the paper are resonant frequency, VSWR, Return Loss, Bandwidth, Radiation Pattern, Smith Chart and gain. The targeted frequency of this antenna is 8.8 GHz for Radio location application and WPAN (Wireless Personal Area Application). It can be used for several applications in X-band (ranges from 8-12 GHz) and Ku-band (ranges from 12-18 GHz). The antenna resonates at 8.8 GHz, 10.8 GHz, 13.02 GHz and 15.23 GHz. The maximum gain observed is near about 1.56 dBi. This proposed design is simulated using Computer Simulation Technology Microwave Studio (CST MWS) software.**

Keywords- Minkowski, Fractal, patch, Resonant Frequency, VSWR, Smith Chart and CST.

I. INTRODUCTION

In the present era of wireless communication, the research on antennas have dragged the attention of many scholars. The word "Fractal" is derived from Latin word "fractus" which means linguistically "broken" or "fractured". About 20 years ago, this term was firstly used by Benoit Mandelbrot (a French mathematician) in his book "The fractal geometry of Nature"[1]. Fractal shaped antennas possess some interesting features that exhibits and develop from their inherent geometrical properties[2].

A curved patch Minkowski fractal antenna results to multiple definite resonant frequency bands along with superior radiation characteristics[3]. As the number of fractal iteration increases, the number of operational bands are also increased with favourable matching of impedance for variety of wireless applications[4-6].

The performances of the Minkowski fractal patch antenna for different iterations have been explored. The X- band and Ku-band, as expounded by an IEEE standard, ranges from 8-12 GHz and 12-18 GHz respectively[7-8]. The geometry of suggested antenna is designed in such a way that it can be used for X-band microwave applications and Ku-band satellite applications[9-10]. These applications involve various wireless applications such as long-distance radio telecommunications, satellite communications, space communications, radar, terrestrial broadband and amateur radio[11-12].

This paper has been organized in four folds. A brief introduction of Minkowski shape along with its application is described in Section I. Section II deals with the design of proposed antenna and its geometry. Result has been analyzed in Section III. Section IV represents the closure of the research work.

II. ANTENNA DESIGN AND GEOMETRY In

this research paper, a Minkowski fractal patch antenna with square patch element has been designed. As the length and width of base shape (zero order) plays a salient role in determining the resonant frequency, we have specifically defined the geometry from zero to second order.

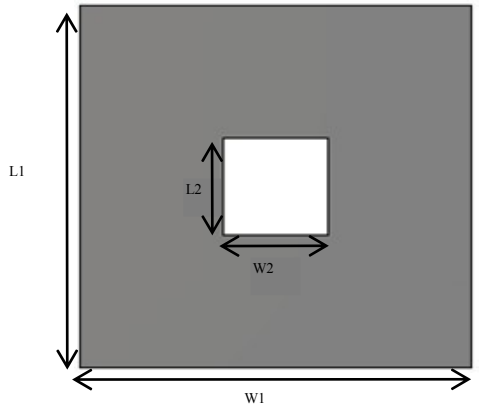


Fig. 1. Base shape of Minkowski fractal patch antenna with square patch element. (L1=15 mm; L2=4 mm; W1=15 mm; W2=4 mm)

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Here for the base shape or zero order, the sides taken for the square patch is 15 mm. The base shape is also called initiator which is shown in figure 1. The designed value of the antenna is simulated using CST 2011 Microwave suite software.

The first order design is being created from first iteration by removal of rectangular slots from each side of the proposed base shape of the fractal antenna. The first order shape of this antenna has been shown in figure 2.

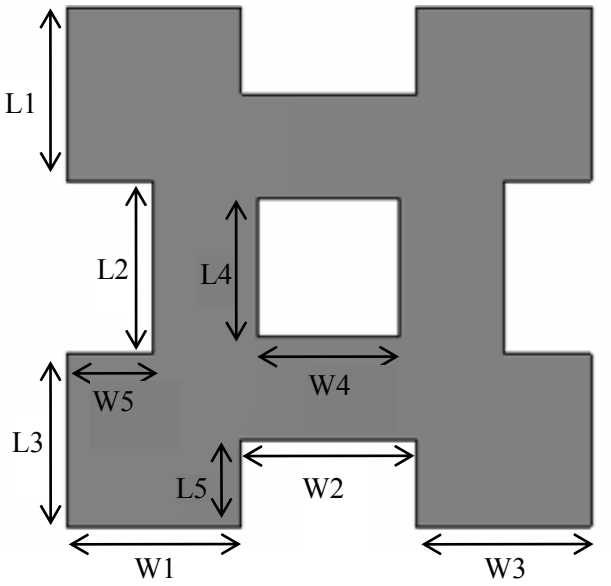


Fig.2. First order shape of Minkowski fractal patch antenna with square patch element. (L1=5 mm; L2=5 mm; L3=5 mm; L4=4 mm; L5=2.5 mm; W1=5 mm; W2=5 mm; W3=5 mm; W4=4 mm; W5=2.5 mm)

In second order, the same process is repeated and rectangular slots are being cut or iterated from each side of the proposed first order shape. The second order shape of this antenna has been shown in figure 3.

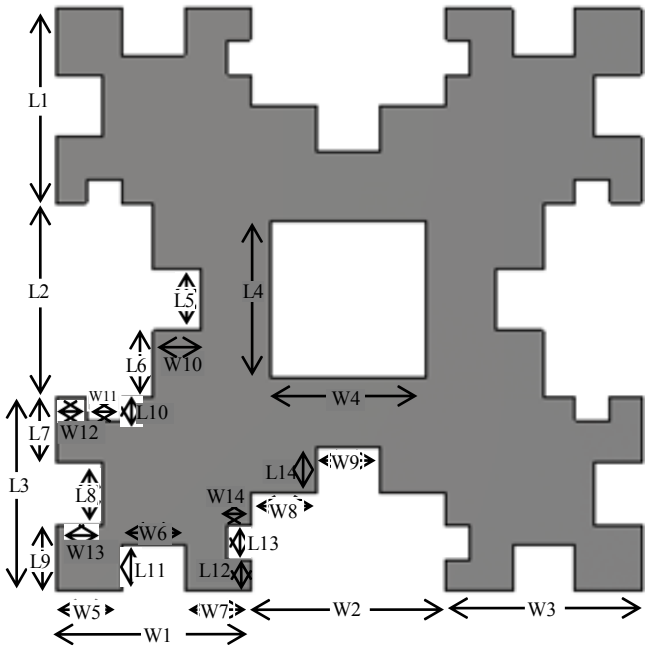


Fig.3. Second order shape. (L1=5 mm; L2=5 mm; L3=5 mm; L4=4 mm; L5=1.6 mm; L6=1.7 mm; L7=1.7 mm; L8=1.6 mm; L9=1.7 mm; L10=0.6 mm; L11=1.2 mm; L12=0.8 mm; L13=0.9 mm; L14=1.2 mm; W1=5 mm; W2=5 mm; W3=5 mm; W4=4 mm; W5=1.7 mm; W6=1.6 mm; W7=1.7 mm; W8=1.7 mm; W9=1.6 mm; W10=1.2 mm; W11=0.9 mm; W12=0.8 mm; W13=1.2 mm; W14=0.6 mm)

It is supported by 50 ohm probe feeding with point x=10.5 mm and y=5.1 mm concerning the patch dimensions.

III. RESULT ANALYSIS

On simulation of proposed geometry of the antenna, following performance parameters were obtained for base shape and the two iterations performed on the Minkowski fractal patch antenna with square patch antenna.

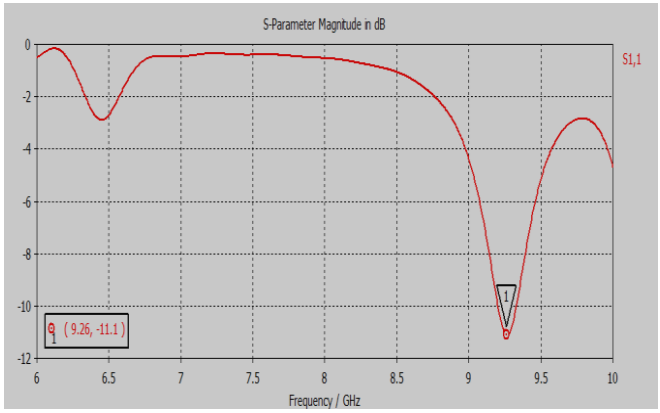


Fig. 4. Return Loss for Base shape.

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Figure 4 reveals that the antenna is resonating at 9.26 GHz having return loss of -11.1 dB. Since it is resonating at 9.26 GHz and resonant frequency is 8.8 GHz, iteration has been performed.

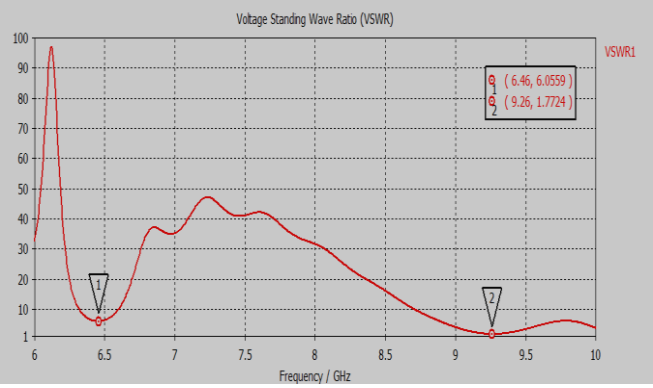


Fig. 5. VSWR of Base shape.

Figure 5 clearly exhibits that VSWR is 1.7724 at 9.26 GHz but it is not matched with the resonant frequency.

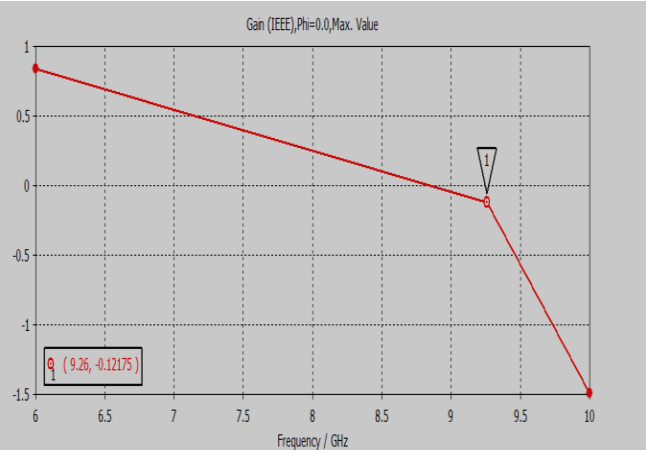


Fig. 6. Gain of Base shape.

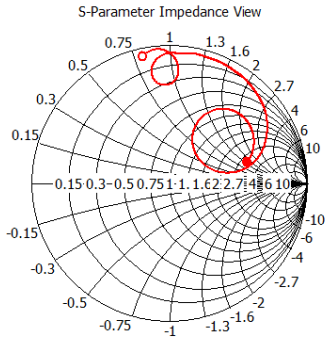


Fig. 7. Smith Chart of Base shape.

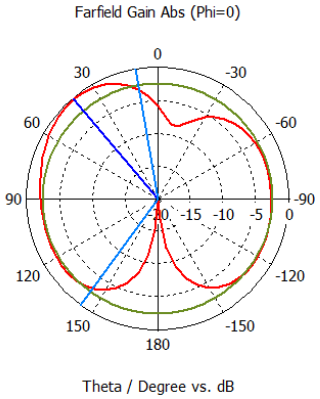


Fig. 8. Radiation Pattern of Base shape for f_r= 9.26 GHz.

Figures 6, 7 and 8 represent the Gain, Smith Chart and Radiation Pattern of the antenna. To improve these parameters, the first iteration has been done and performance parameters have been observed at the same feeding point with coaxial probe.

The first order antenna is evidently resonating at two different resonant frequencies 8.92 GHz and 11 GHz which has been justified in figure 9, constituting its dual band operation.

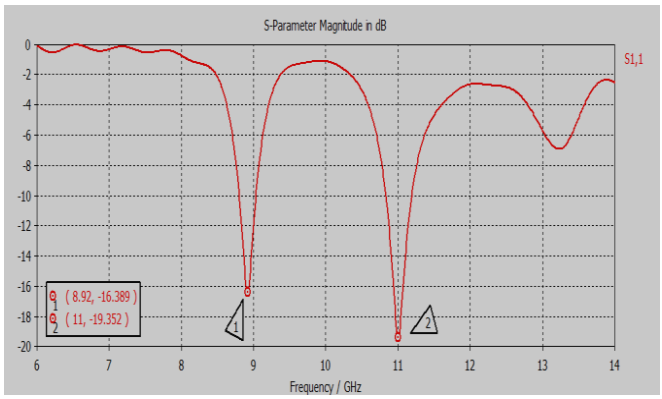


Fig.9. Return Loss for First order shape.

As shown in figure 9, a dual band behavior of antenna has been achieved with resonant frequencies at 8.92 GHz and 11 GHz having return losses -16.389 dB and -19.352 dB respectively.

Figure 10 displays the VSWR of the first order antenna which ranges from 1-2.

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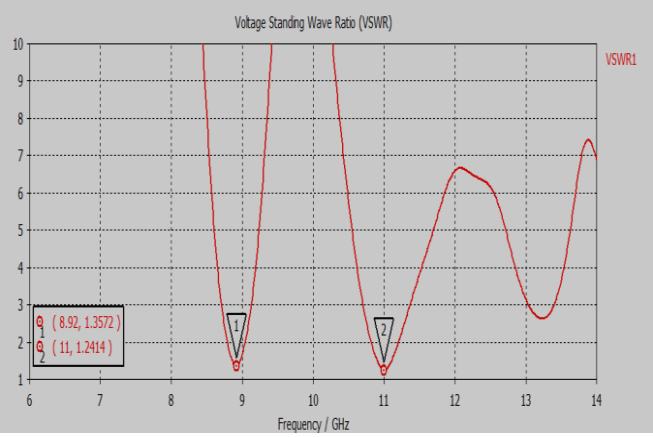


Fig.10. VSWR of First order shape.

Figure 10 justifies that VSWR is 1.35 and 1.24 at 8.92 GHz and 11 GHz respectively.

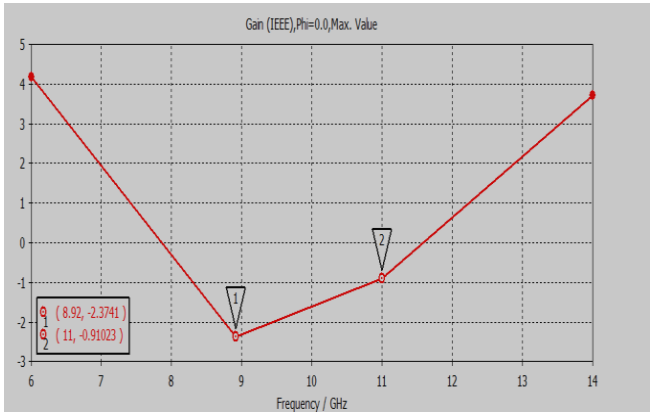


Fig.11. Gain of First order shape.

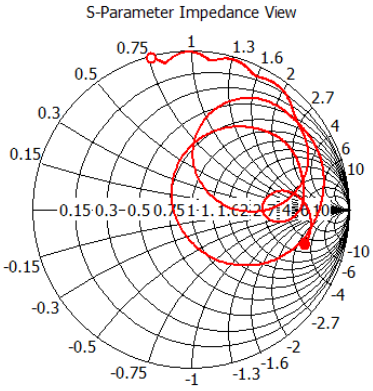


Fig.12. Smith Chart of First order shape.

Figures 11 and 12 represent the Gain and Smith Chart of the first order antenna.

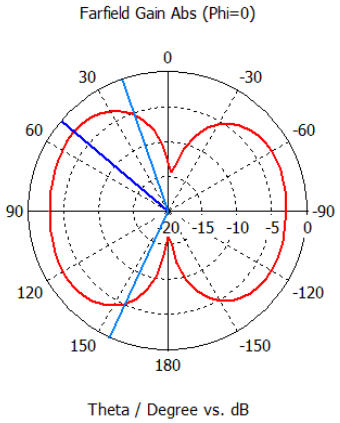


Fig. 13. Radiation Pattern of First order shape for f_r= 8.92 GHz.

Figure 13 represents the radiation pattern of the first order antenna at resonant frequency 8.92 GHz which seems to be bidirectional in nature.

To further improve these parameters, the second iteration has been done and performance parameters have been observed at the same feeding point with coaxial probe.

The second order antenna resonates at four different resonant frequencies 8.8 GHz, 10.8 GHz, 13.02 GHz and 15.23 GHz which has been represented in figure 14, thereby representing its quad-band operation.

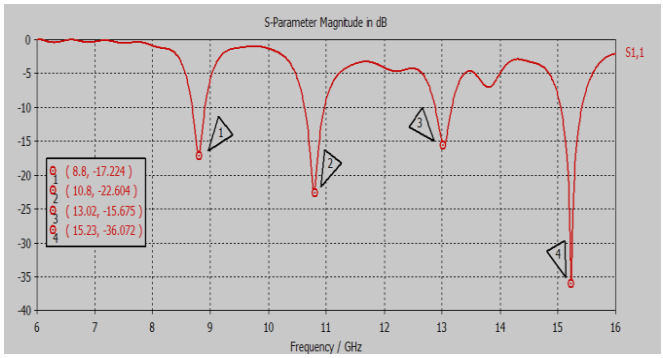


Fig.14. Return Loss for Second order shape.

Figure 14 manifests a multiband behavior of antenna with four different resonant frequencies at 8.8 GHz, 10.8 GHz, 13.02 GHz and 15.23 GHz having return losses -17.224 dB, -22.604 dB, -15.675 dB and -36.072 dB respectively.

Figure 15 presents the VSWR of the designed antenna which rests in the range from 1-2.

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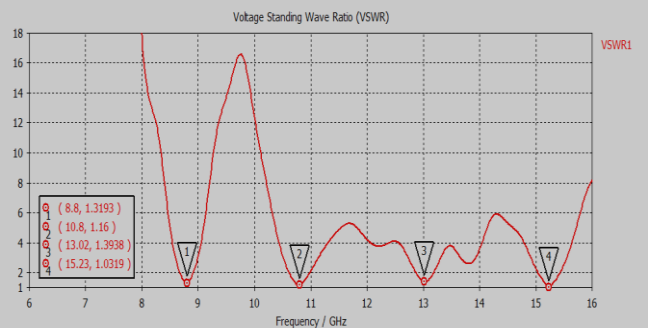


Fig.15. VSWR of Second order shape.

The above Figure 15 justifies that VSWR is 1.31, 1.16, 1.39 and 1.03 at 8.8 GHz, 10.8 GHz, 13.02 GHz and 15.23 GHz respectively.

Figure 16 shows the Gain of the second order shape of the antenna.

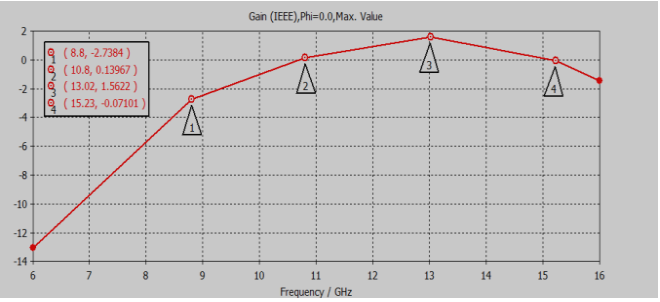


Fig.16. Gain of Second order shape.

From the above figure, we can see that the maximum gain observed is around 1.56 dBi.

Figure 17 represents the Smith Chart of the second order shape of the antenna representing its 50 Ω impedance matching.

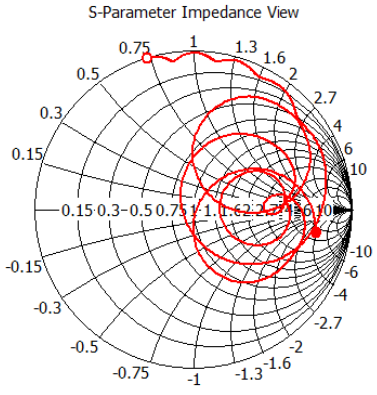


Fig.17. Smith Chart of Second order shape.

As justified in Figure 17, the antenna's performance has exactly been matched up with 50 Ω impedance (at feeding points x=10.5 mm and y=5.1 mm with respect to the patch measurements of the antenna).

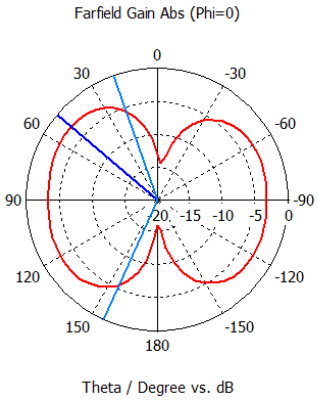


Fig.18. Radiation Pattern of Second order shape for f_r= 8.8 GHz.

Figure 18 represents the radiation pattern of second order shape at resonant frequency 8.8 GHz. The radiation pattern at 8.8 GHz discloses that antenna is adjacent to omnidirectional pattern and further rationalizes its suitability for multiple applications.

A comparative study of different performance parameters of the offered Minkowski fractal patch antenna has been given in Table I.

TABLE I COMPARATIVE TABLE OF MINKOWSKI FRACTAL PATCH ANTENNA

S.No.	Shape	Resonant Frequency (GHz)	Return Loss (dB)	VSWR	Gain (dBi)
1.	Base Shape	F_{r1}= 9.26 GHz	-11.1 dB	1.7724	-0.12
2.	I Order	F_{r1}= 8.92 GHz	-16.389 dB	1.3572	-2.37
		F_{r2}= 11 GHz	-19.352 dB	1.2414	-0.91
3.	II Order	F_{r1}= 8.8 GHz	-17.224 dB	1.3193	-2.73
		F_{r2}= 10.8 GHz	-22.604 dB	1.1603	0.13
		F_{r3}= 13.02GHz	-15.675 dB	1.3938	1.56
		F_{r4}= 15.23 GHz	-36.072 dB	1.0319	-0.07

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A comparative graph of Return Loss for Base Shape, first order and second order has been shown in Figure 19.

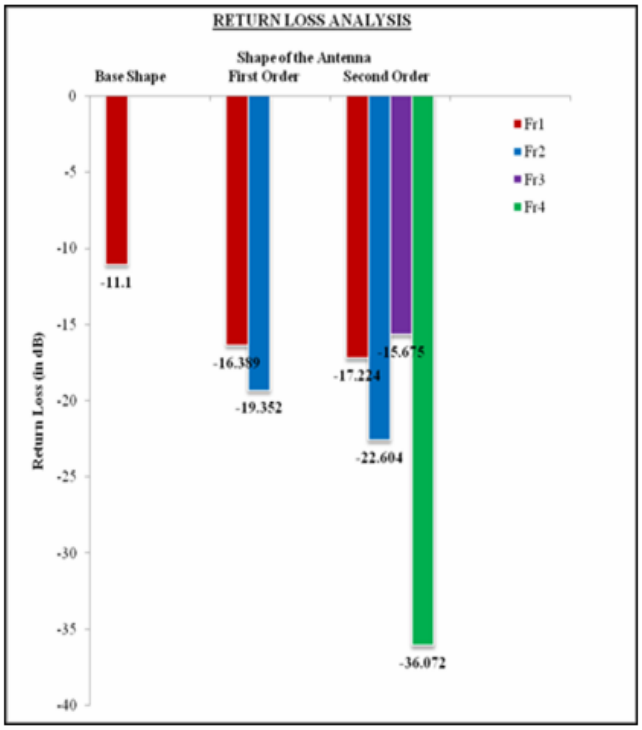


Fig.19. Comparative graph of Return Loss

From the above graph we can see that maximum return loss has been observed for second order which comes out to be the best as compared with the base shape and first order. For 8.8 GHz resonant frequency, the return loss is about -17.224 dB.

IV. CONCLUSION

A new multiband Minkowski fractal patch antenna with square patch element has been analyzed in this paper. This design expresses base shape, first order shape and second order shape with multiple slots on each side. Analysis in Sec III justifies its suitability for X band microwave applications and Ku band satellite applications.

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