



POORNIMA

COLLEGE OF ENGINEERING

Promoted by Shanti Education Society, Affiliated to Rajasthan Technical University & Approved by AICTE

Report on 6-days Short Term Training Program

- ♦ **TITLE AND DURATION:** “Artificial Intelligence & 5G Communication Technology” from April 26-May 1, 2021.
- ♦ **SPONSORS:** AICTE Quality Improvement Scheme (AQIS)
- ♦ **SUPPORTERS:** Nil.
- ♦ **ORGANIZERS:** Department of Electronics & Communication Engineering, Poornima College of Engineering, Jaipur.
- ♦ **OBJECTIVES:** The objective of general AI is to design a system capable of thinking for itself just like humans do. Currently, general AI is still under research, and efforts are being made to develop machines that have enhanced cognitive capabilities.
- ♦ **EXPECTED OUTCOMES:**
 1. Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.
 2. Design and develop symbiotic human–AI systems that balance the information processing power of computational systems with human intelligence and decision making.
 3. Explain the benefits, limitations, and tradeoffs of designing engaging and ethical conversational user interactions, including those supported by chatbots, smart speakers, and other AI-driven, voice-based technologies.
 4. Design and evaluate conversational interfaces for different users and contexts of use.

♦ BROCHURE / POSTER / LEAFLET / FLYER:

 **Six Days Short Term Training Programme (STTP) under AICTE-AQIS** 
on
Artificial Intelligence and 5G Communication Technology

April 26-May 1, 2021

Department of Electronics & Communication Engineering, Poornima College of Engineering
Cordially invite you to Inaugural Session

Resource Persons

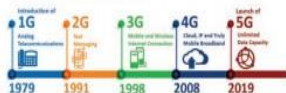
 Col. B Venkat Director (Faculty Development) AICTE, New Delhi Chief Guest	 Dr. Nagendra Prasad Pathak Professor, IIT Roorkee Guest of Honor	 Dr. Mahesh M. Bundeale Director & Principal PCE, Jaipur	 Ar. Rahul Singhi Director Poornima Group, Jaipur	 Mr. Pankaj Dhemla Vice Principal PCE, Jaipur	
 Dr. Upena. D. Dalal Professor and Ex-Head SVNIT Surat	 Dr. Rajveer S. Shekhawat Provost & Director Manipal University Jaipur	 Dr. M Lakshmi Professor SRM Institute Tamil Nadu	 Dr. Sudan Jha Professor Chandigarh University, Punjab	 Dr. Sandeep Kumar Associate Professor IIT Roorkee	
 Dr. Abhinav Kumar Associate Professor IIT Hyderabad	 Dr. Prabhat Kumar Upadhyay Associate Professor IIT Indore	 Lyla B.Das Associate Professor NIT Calicut	 Dr. Gaurang Patkar Associate Professor-HOD DBCE, Goa	 Dr. Udit Satija Assistant Professor IIT Patna	
 Dr. Rahul Pandya Assistant Professor IIT Dharwad	 Dr. Sanjeev Sharma Assistant Professor IIT BHU	 Dr. Sudharsan Assistant Professor NIT Trichirappalli	 Dr. Sandeep Joshi Assistant Professor BITS Pilani	 Dr. Asoke K Talukder Chief Science & Technology Officer SRIT Bangalore	
 Dr. Ritesh Kumar Saraswat Assistant Professor MLV Govt. College, Bhiwara	 Dr. Garima Mathur Convener, STTP	Monday, April 26, 2021, Time 11:00 AM onward			 Dr. Payal Bansal Coordinator, STTP
 To join the Inaugural Session on  Microsoft Teams					


Dr. Mahesh Bundeale
B.E., M.E., Ph.D.
Director
Poornima College of Engineering
ISI-0, FIICO Institutional Area
Shalpur, JAIPUR

SPEAKERS

- Dr. Nagendra Prasad Pathak**
Professor, IIT Roorkee
- Dr. Rajveer S. Shekhawat**
Provost & Director, Manipal University Jaipur
- Dr. Sudan Jha**
Professor, Chandigarh University, Punjab
- Dr. Abhinav Kumar**
Associate Professor, IIT Hyderabad
- Dr. Prabhakar Kumar Upadhyay**
Associate Professor, IIT Indore
- Lyfa B. Das**
Associate Professor, NITC
- Dr. Gaurang Patkar**
Associate Professor & Head of Department, DBCE, Goa
- Dr. Asoko K Talukder**
Chief Science & Technology Officer, SRIT Bangalore
- Dr. Sanjeev Sharma**
Assistant Professor, IIT BHU
- Dr. Siba Narayan Swain**
Assistant Professor, IIT Dharwad
- Dr. St. Subith Ali**
Assistant Professor, IIT Bhubaneswar, Odisha
- Dr. Udit Satija**
Assistant Professor, IIT Patna
- Dr. Rahul Pandya**
Assistant Professor, IIT Dharwad
- Dr. Sudharsan**
Assistant Professor, NIT, Tiruchirappalli
- Dr. Sandeep Joshi**
Assistant Professor, BITS Pilani
- Dr. Ritesh Kumar Saraswat**
Assistant Professor, M.L.V. Govt. College, Bhubaneswar

The Evolution of 5G



REGISTRATION AND FEE PARTICULARS

- Faculty/Research Scholars from Universities/ AICTE recognized Institutions are only eligible.
- No Registration Fees
- E-Certificates will be provided after successful completion of STTP
- Registration Link: <https://tinyurl.com/sxrv8dwe>

RESOURCE PERSONS

The resource persons will be from reputed institutions and industries in the area of communication such as IITs, NITs, and other premier institutes.

IMPORTANT DATES

Last date for Registration April 22, 2021
Intimation of selection by mail April 24, 2021
STTP Duration April 26 to May 01, 2021

CORRESPONDENCE

Dr. Garima Mathur
Head, Department Electronics & Communication Engineering,
Poornima College of Engineering, Jaipur
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✉ : dr.g.mathur@poornima.org



POORNIMA
COLLEGE OF ENGINEERING
ISI-6, RIICO Institutional Area, Sitapura, Jaipur
www.pce.poornima.org

Six Days Short Term Training Programme (STTP)
under AICTE-AQIS on

Artificial Intelligence and 5G Communication Technology

April 26 to May 01, 2021

Sponsored by



Organized by
Department of
Electronics & Communication Engineering



POORNIMA
COLLEGE OF ENGINEERING
Affiliated to RTU, Kota • Approved by AICTE & UGC under 2(f) • Accredited by NBA

POORNIMA COLLEGE OF ENGINEERING



Poornima College of Engineering (PCE), established as a brand of Technical Education in the year 2000, has its own glorious legacy of leading the young engineers to the mammoth sky of success. Its accomplishments forecast its journey through the hardships and its triumph over them one after another. PCE left no stone unturned since its establishment in turning the glorious vision into unbelievable reality providing the platform for knowledge and research and their practical implementations in different engineering professional prospects. Glorious glimpses of PCE:

- Highly recognized and renowned affiliated technical institution all over Rajasthan with built up area more than 3.5 lacs square feet
- Affiliated to RTU, Kota & approved by AICTE, New Delhi
- The most preferred NBA Accredited Engineering College with running of six specializations of Engineering at UG Level (CSE, ECE, EE, ME, IT, CIV) and two at PG level (CS & VLSI)
- The only institution permitted by RTU to admit FN/PIO/Gulf students & designated as centre of excellence by IBM
- An excellent institution building its rapport in all sectors of education, research and development

ABOUT THE DEPARTMENT

The Department of Electronics and Communication Engineering (ECE) was established in year 2003. National Board of Accreditation (NBA) accredited the ECE department in the year 2009, 2016 & 2018 for subsequent three years. It has intake capacity of 180. It also offers M. tech in VLSI Design with intake capacity of 18 students. The department has highly qualified committed and research oriented faculty members. The department has laboratories as per Rajasthan Technical University Syllabus with State-of-the-Art facilities in diversified fields such as Electronic Circuits, VLSI Design, DSP (Digital signal processing), Embedded Systems, Advanced Wireless Communication and Microwave etc. Research is being carried out in the areas of Antenna Design and Wireless Communication, and VLSI

design. The department also has to its credit three labs, (i) Microwave Engineering lab & (ii) Advance Antenna & Wireless Communication lab (iii) Advancement of Wireless and Optical Fiber Lab supported by MODROBS Grants of AICTE, New Delhi.

IETE Student Forum (ISF) of the Department has been recognized as Most Active ISF for session 2016-17 by IETE Rajasthan Center, Jaipur. The department also has state of the art lab facility for the value added IBM Career Education Programs for faculty members and students on emerging technologies such as IBM BlueMix for Cloud, IBM Cognos for Business Intelligence and IoT Application Development & Deployment using IBM BlueMix.

ABOUT STTP

The aim of this STTP is to enhance the AI research also overlaps with tasks such as robotics, control systems, scheduling, data mining, logistics, speech recognition, facial recognition and many others. Upgrading the new era in 5G to handle data from millions more IoT devices and install low-power sensors. 5G is not only important because it has the potential to support millions of devices at ultrafast speeds, but also because it has the potential to transform the lives of people around the world. Improvements in 5G technology can help make life better.

Course Modules

- Multiband and Multifunctional RF Integrated circuits & Systems for 5G and beyond
- Reinforcement Learning Application in 5G and Beyond Networks
- 6G Vision, Potential Technologies and Challenges
- WoT and AIoT Technologies for the Smart Connected World
- The Fundamental Principles of Deep Learning including Back Propagation
- Stochastic geometry analysis of 5G network
- Spectral- and Energy-Efficient Techniques for 5G and Beyond Wireless Networks
- AI Trending - from Local Data to 5G Communications
- Edge Analytics to Address Challenges of Smart Healthcare
- Automated grading of Oil Palm Fruits using Fuzzy Logic and Rough Set Theory
- Machine learning and Security
- IoT Device Localization
- Deep Learning-Based Wireless Communications
- Device-to-Device Communication in 5G Cellular Networks
- Antenna Design for Wireless Application with Implementation of Frequency Band Reconfigurability Characteristics
- Cellular Internet of Things

OBJECTIVES OF STTP

- To provide an exposure to the participants regarding current scenario in advanced communication technologies & their applications.
- To provide the knowledge of cutting edge researches and developments carried out/observed by the Eminent Speakers in advance communication domains (from IITs, NITs, other Esteemed Institutions & Industry), for products having immediate industrial applications for self-reliance of the Country.

PATRON

Dr. Mahesh M. Bunde
Principal & Director
Poornima College of Engineering, Jaipur

ADVISORS

Mr. Pankaj Dhemla
Vice Principal, Poornima College of Engineering, Jaipur

Dr. Rekha Nair
Dean, First Year, Poornima College of Engineering, Jaipur

Mr. Devendra Somwanshi
Registrar, Poornima College of Engineering, Jaipur

PROGRAM CHAIR

Dr. Garima Mathur
Head of Department ECE, Poornima College of Engineering

COORDINATORS

Dr. Payal Bansal
Associate Professor,
ECE, PCE

Mr. Tarun Mishra
Assistant Professor
ECE, PCE

PCE ORGANIZING COMMITTEE

Dr. Anila Dingra Associate Professor, ECE
Mr. Amit Kumar Jain Assistant Professor, ECE
Mr. Durgesh Kumar Assistant Professor, ECE
Mr. Manish Sharma Assistant Professor, ECE
Ms. Manisha Kumawat Assistant Professor, ECE

Dr. Mahesh Bunde
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Director
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Sitapura, JAIPUR

♦ PROGRAM SCHEDULE:



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Department of Electronics & Communication Engineering

Fourth AICTE-AQIS Sponsored Short Term Training Program (STTP) on Artificial Intelligence and 5G Communication Technology from April 26 – May 01, 2021

	11:00 AM	11:30AM – 01:00 PM	01:30 PM 03:00 PM	03:15 PM 04:45 PM
Monday (26.04.21)	Inaugural Session Chief Guest: Col. B. Venkat, Director (Faculty Development), AICTE, New Delhi Guest of Honour: Dr. Nagendra Prasad Pathak, Professor, IIT, Roorkee	Multiband and Multifunctional RF Integrated Circuits & Systems for 5G & Beyond Dr. Nagendra Prasad Pathak, Professor, IIT, Roorkee	5G Communication for IoT Dr. M Lakshmi, Professor, SRM Institute of Science & Technology, Tamil Nadu	Artificial Intelligence for Physical Layer Wireless Communications Dr. Upena. D. Dalal, Professor, SVNIT, Surat
	09:30AM -11:00 AM	11:30AM – 01:00 PM	01:30 PM – 3:00 PM	
Tuesday (27.04.21)	6G Vision, Potential Technologies and Challenges Dr. Rahul Pandya, Assistant Professor, IIT, Dharwad	WoT and AIoT: Technologies for the Smart Connected World Dr Asoke K. Talukder, Chief Science & Technology Officer, SRIT, Bangalore	The Fundamental Principles of Deep Learning including Back Propagation Lyla B.Das, Associate Professor, NIT, Calicut	
Wednesday (28.04.21)	Stochastic geometry analysis of 5G network Dr. Sudharsan, Assistant Professor, NIT, Truichirappalli	Spectral- and Energy-Efficient Techniques for 5G and Beyond Wireless Networks Dr. Prabhat Kumar Upadhyay, Associate Professor, IIT, Indore	AI Trending - from Local Data to 5G Communications Dr. Sudan Jha, Professor, Chandigarh University, Punjab	
Thursday (29.04.21)	Automated Grading of Oil Palm Fruits using Fuzzy Logic and Rough Set Theory Dr. Gaurang Patkar, Associate Professor & Head, DBCE, Goa	Edge Analytics to Address Challenges of Smart Healthcare Dr. Rajveer S. Shekhawat, Provost & Director, Manipal University, Jaipur	Reinforcement Learning Application in 5G and Beyond Networks Dr. Siba Narayan Swain, Assistant Professor, IIT, Dharwad	
Friday (30.04.21)	IoT Device Localization Dr. Udit Satija, Assistant Professor, IIT, Patna	Deep Learning-Based Wireless Communications Dr. Sanjeev Sharma, Assistant Professor, IIT, BHU	Device-to Device Communication in 5G Cellular Networks Dr. Sandeep Joshi, Assistant Professor, BITS, Pilani	
Saturday (01.05.21)	Antenna Design for Wireless Application with Implementation of Frequency Band Reconfigurability Characteristics Dr. Ritesh Kumar Saraswat, Assistant Professor, M.L.V. Govt. College, Bhilwara	Cellular Internet of Things Dr. Abhinav Kumar, Associate Professor, IIT, Hyderabad	Significance of Artificial Intelligence in Digitization and Automation: Digital India Perspective Dr. Sandeep Kumar, Associate Professor, IIT, Roorkee	

♦ INAUGURAL SESSION:



SHORT TERM TRAINING PROGRAM

On

Artificial Intelligence & 5G Communication Technology

April 26 to May 01, 2021

Sponsored by AICTE Quality Improvement Scheme (AQIS)

Organized by Department of Electronics & Communication Engineering,
Poornima College of Engineering, Jaipur



Date: April 26, 2021

Time: 11:00 – 11:35 AM

Venue: Online (MS Teams: <https://tinyurl.com/2y9wzkyt>)

O- Sheet Inaugural Session

S. No	Activity	Duration	Time
1.	Welcome of Dignitaries and Introduction of STTP by Dr. Payal Bansal , Associate Prof., ECE, PCE <ul style="list-style-type: none">• Col. B. Venkat, Director (Faculty Development), AICTE, New Delhi (Chief Guest)• Dr. Nagendra Prasad Pathak, Professor, IIT Roorkee (Guest of Honor)• Ar. Rahul Singhi, Director, Poornima Group• Dr. Mahesh Bundeale, Director & Principal, PCE• Mr. Pankaj Dhemla, Vice Principal, PCE• Dr. Garima Mathur, Professor & Head, ECE, PCE	03 Min	11:00 AM-11:03 AM
2.	Welcome address by Dr. Mahesh Bundeale , Director & Principal, PCE	05 Min	11:03 AM-11:08 AM
3.	Motivational Words by Ar. Rahul Singhi , Director, Poornima Group	05 Min	11:08 AM-11:13 AM
4.	Address by Guest of Honor Dr. Nagendra Prasad Pathak , Professor, IIT Roorkee	10 Min	11:13 AM-11:23 AM
5.	Inaugural Address by Chief Guest Col. B. Venkat , Director (Faculty Development), AICTE, New Delhi	10 Min	11:23 AM-11:33 AM
6.	Vote of Thanks by Dr. Garima Mathur , Professor & Head, ECE, PCE	02 Min	11:33 AM-11:35 AM


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♦ **DETAILS OF RESOURCE PERSONS:**



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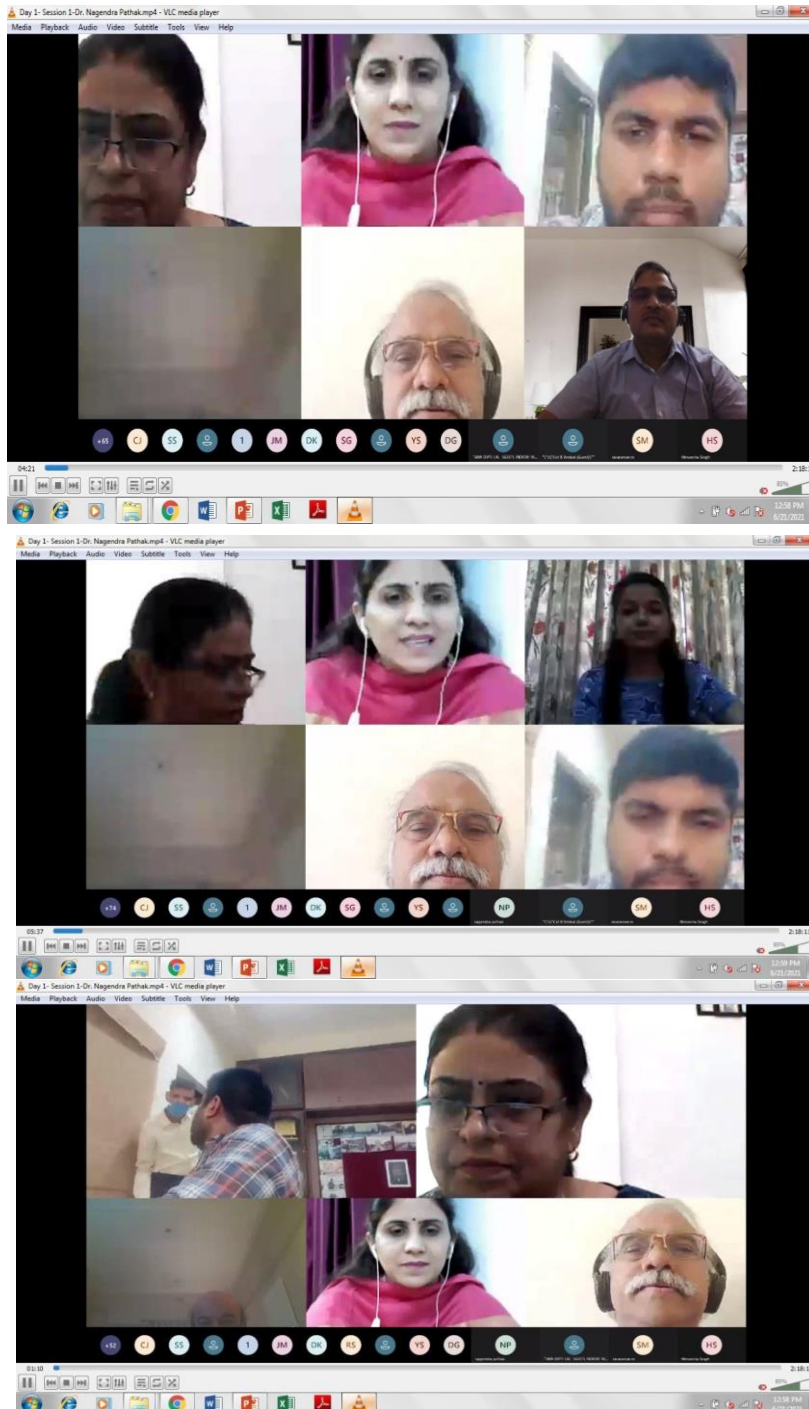
INAUGURAL SESSION ON 26 April 2021:-

Inaugural session witnessed the presence of Col. B. Venkat, Director (Faculty Development), AICTE, New Delhi (Chief Guest), Dr. Nagendra Prasad Pathak, Professor, IIT Roorkee (Guest of Honor), Dr. Mahesh Bunde, Director, PCE, Jaipur, Mr. Pankaj Dhemia, Vice Principal, PCE, Jaipur, Dr. Garima Mathur convenor of STTP & Dr. Payal Bansal Coordinator of STTP, PCE, participants along with the faculty members. The event started with the online inaugural ceremony in presence of chief guest, Guest of honour & Dr. Mahesh Bunde, Director PCE. Dr Garima Mathur addressed the participants about the STTP & Its area of learning and its content. In welcome address Dr. Mahesh M. Bunde, director, PCE, update the participants about the new techniques related to Artificial Intelligence. Dr. Pathak addressed the gathering with his knowledgeable words, &


Dr. Mahesh Bunde
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Jaipur, JAIPUR

then after Col. B. Venkat updated the participants about the new technologies to be on work. In last the inaugural session concluded by vote of thanks delivered by Dr. Payal Bansal (coordinator of STTP).

Glimpses of Inaugural session

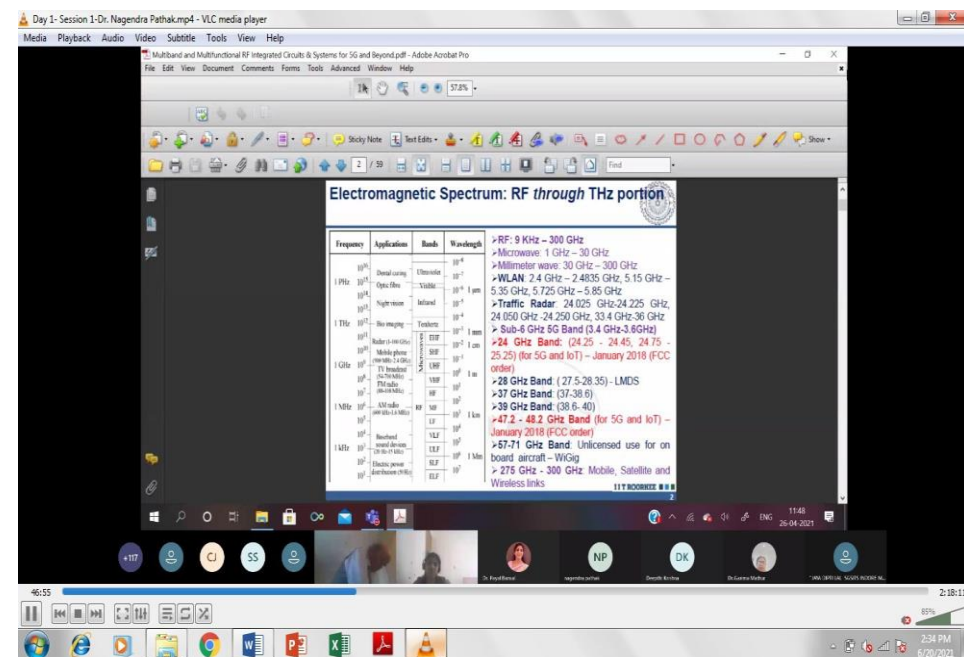
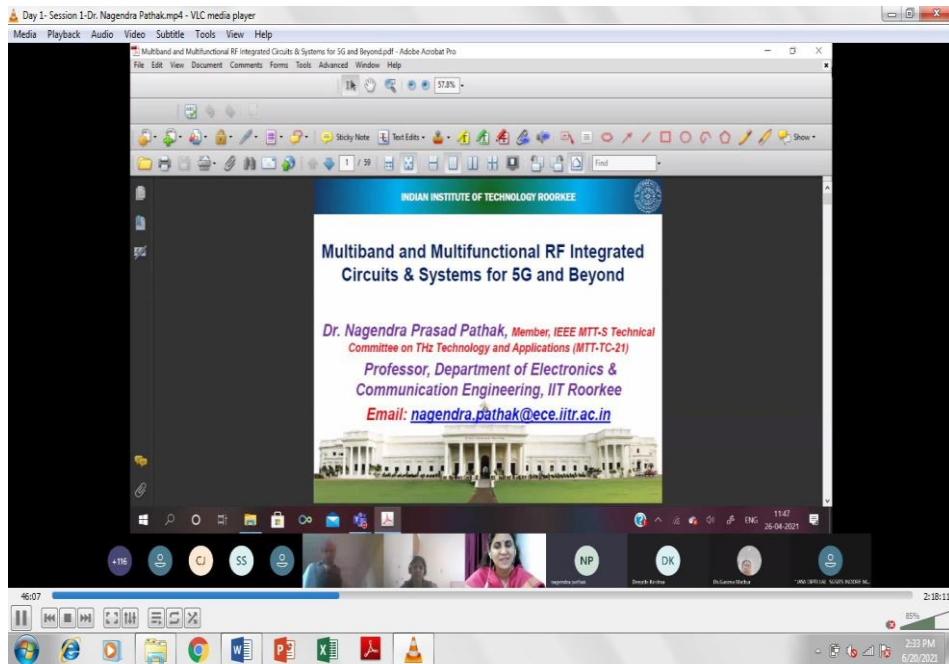


Expert Talk-1

Topic: Multiband and Multifunctional RF Integrated Circuits & Systems for 5G & Beyond

Resource Person: Dr. Nagendra Prasad Pathak, Professor

Venue: Ms Teams



Day 1- Session 1-Dr. Nagendra Pathak.mp4 - VLC media player

Electromagnetic Spectrum: RF through THz portion

Frequency	Applications	Bands	Wavelength
10^{14}	Dental curing	Ultraviolet	10^{-8}
10^{15}	Optic fibre	Visible	10^{-7}
10^{14}	Night vision	Infrared	10^{-6} 1 μ m
10^{11}	Bio imaging	Terahertz	10^{-4}
10^{11}	Radar (1-100 GHz)	EHF	10^{-3} 1 mm
10^{10}	Mobile phone (900 MHz-2.4 GHz)	SHF	10^{-2} 1 cm
10^9	TV broadcast (54-70 MHz)	UHF	10^{-1}
10^8	FM radio (88-108 MHz)	VHF	10^0 1 m
10^7	AM radio (540-1600 kHz)	HF	10^1
10^6	RF	MF	10^2
10^5	LF		10^3 1 km
10^4	VLF		10^4
10^3	Baseband sound devices (20 Hz-20 kHz)	ULF	10^5
10^2	Electric power distribution (60 Hz)	SLF	10^6 1 Mm
10^1	ELF		10^7

- > RF: 9 KHz – 300 GHz
- > Microwave: 1 GHz – 30 GHz
- > Millimeter wave: 30 GHz – 300 GHz
- > WLAN: 2.4 GHz – 2.4835 GHz, 5.15 GHz – 5.35 GHz, 5.725 GHz – 5.85 GHz
- > Traffic Radar: 24.025 GHz-24.225 GHz, 24.050 GHz-24.250 GHz, 33.4 GHz-36 GHz
- > Sub-6 GHz 5G Band (3.4 GHz-3.6GHz)
- > MM wave band

IEEE Journal of Microwaves, January 2021
IIT ROORKEE

Day 1- Session 1-Dr. Nagendra Pathak.mp4 - VLC media player

General concerns for Millimeter wave and THz Atmospheric loss and Free space propagation loss

Loss increases in proportion to square of distance, r , and frequency, f .

Losses = $4\pi f^2 A_p$
 A_p = Antenna aperture
 A_e = Effective area
 A_g = Antenna gain
 The above formula is valid when $G \gg 1$ (0 dB).

> In case of point to point link, free space loss can be compensated with antenna gain, which increases with frequency

> Free space loss = 134 dB for 1 Km @ 120GHz ($\lambda=2.5$ mm) which becomes 34 dB with 50dBi antenna for transmitter and receiver

Encyclopedia Britannica, Inc., 1998 T Nagendra, Thz communication systems, @OSA 2017
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Day 1- Session 1-Dr. Nagendra Pathak.mp4 - VLC media player

Motivation for using MM wave/ THz small cell Advantages and challenges

- > Bandwidth: Proportional to carrier frequency
 $B = \alpha f_0$ (Hz)
- > Coverage: Inversely proportional to carrier frequency
 $d_0 = \beta / f_0$ (meter)
- > Data rate per user $\approx O(f_0^3)$ (bps)
- > Communication data rate can be increased by using more BW or enhancing SNR
- > More BW available around higher carrier frequencies, to be used to increase data rate
- > For a given distance, received signal at higher carrier frequencies experience more attenuation due to small antenna size & higher atmospheric absorption; hence reduced SNR

IIT ROORKEE

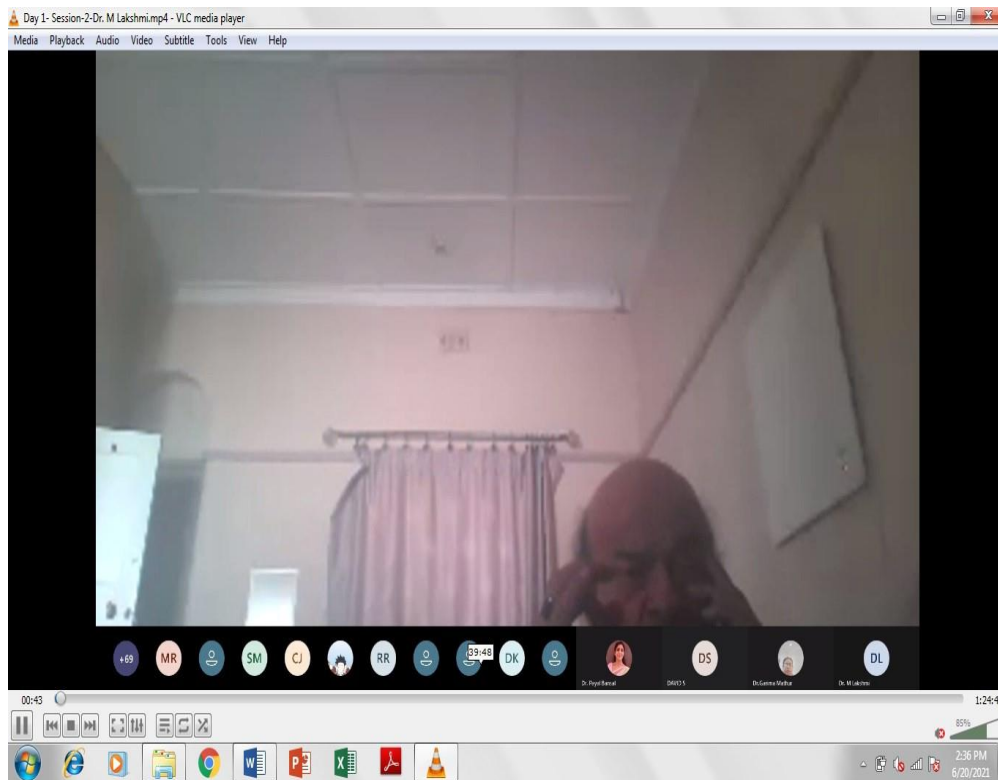
Expert Talk-2

Topic: 5G Communication for IoT

Resource Person: Dr. M Lakshmi, Professor

Venue: online

Memories of event



Day 1- Session-2-Dr. M Lakshmi.mp4 - VLC media player

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AICTE-AQIS Sponsored Short Term Training Programme (STTP) on Artificial Intelligence and 5G Communication Technology
ONLINE Mode

5G Communication for IoT
Dr. M Lakshmi
Professor, CSE Department
SRM University, Kattankulathur, Chengalpattu
Date : 26-04-2021

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What is 5G?

- 5G enables a new kind of network that is designed to connect virtually **everyone** and **everything** together including machines, objects and devices.
- 5G wireless technology is meant to deliver
 - higher multi-Gbps peak data speeds,
 - ultra low latency,
 - more reliability,
 - massive network capacity,
 - increased availability, and
 - a more uniform user experience to more users.
- Higher performance and improved efficiency empower new user experiences and **connects new industries**

26-04-2021

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4G AND 5G

3 Key Factors

1. High Band width



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6/20/2021


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4G AND 5G

3 Key Factors

1. High Band width
2. Low Latency



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4G AND 5G

3 Key Factors

1. High Band width
2. Low Latency
3. Dense Connection

26-04-2021

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Expert Talk-3

Topic: Artificial Intelligence for Physical Layer Wireless Communications

Resource Person: Dr. Upena. D. Dalal, Professor and Ex-Head

Venue: online

Day 1- Session-3 -Dr. Upena D.mp4 - VLC media player

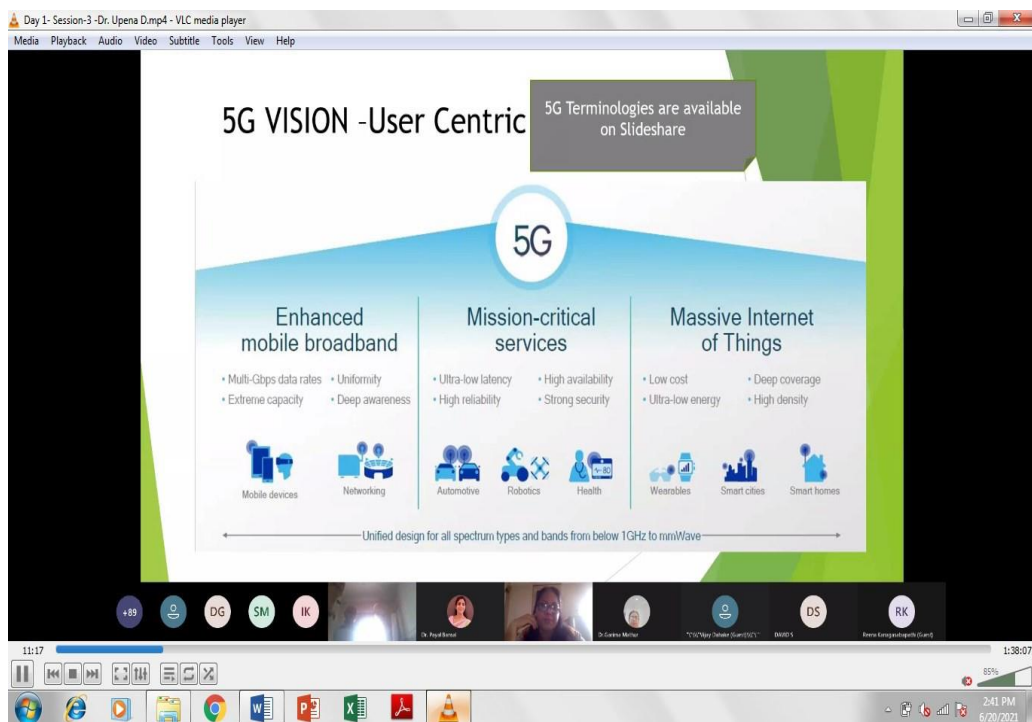
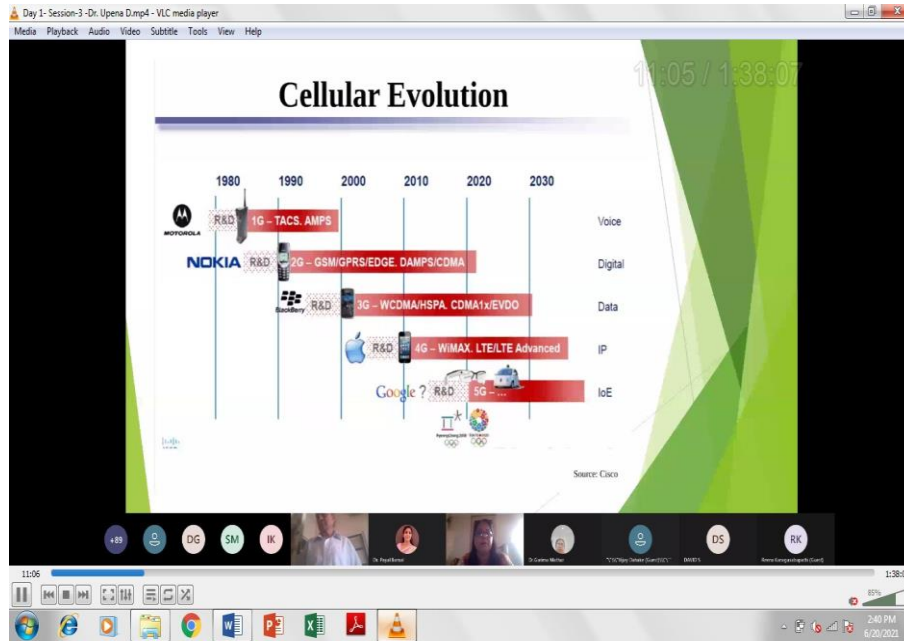
Artificial Intelligence for Physical Layer Wireless Communications

Expert lecture Prepared by
Dr Mrs Upena D Dalal

Presented at Poornima College of Engineering on 26th April 2021
As a part of STTP 26th April to 1st May 2021

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Day 1- Session-3 - Cr. Uperna D.mp4 - VLC media player

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5G Application Scenarios

14:14 / 1:38:07

The diagram illustrates various 5G application scenarios. On the left, a central 'Smart City' hub is connected to 'Smart Home Building' and 'Future Industry'. The 'Future Industry' section includes '3D voice_LiND', 'Work and play in cloud', 'Mission office application', and 'Self Driving'. On the right, a grid of images shows scenarios like 'Balanced Mobile Broadband', 'Super Bit Rate for eMBB', 'URLLC-Ultra-reliable low latency services', 'Energy efficient & Massive connections for mMTC', and 'High reliability and low latency MTC'. The source is cited as Qualcomm.

14:14

1:38:07

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REQUIREMENTS

17:58 / 1:38:07

The diagram lists the requirements for 5G. At the center is the 'Massive Internet of Things'. Surrounding it are several key requirements: 'Deep coverage' (To reach challenging locations), 'Strong security' (e.g. Health / government / financial trusted), 'Ultra-high reliability' (<1 out of 100 million packets lost), 'Ultra-low latency' (As low as 1 millisecond), 'Extreme user mobility' (Or no mobility at all), 'Deep awareness' (Discovery and optimization), 'Extreme data rates' (Multi-Gigabits per second), 'Extreme capacity' (10 Tbps per Km²), 'Ultra-high density' (1 million nodes per Km²), 'Ultra-low complexity' (10s of bits per second), and 'Ultra-low energy' (10+ years of battery life).

17:58

1:38:07

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IoT -> IoE

14:40 / 1:38:07

The diagram shows the transition from IoT to IoE. At the center is the 'Internet of Everything'. Surrounding it are four key components: 'Data' (Leveraging data into more useful information for decision making), 'People' (Connecting people in more relevant, valuable ways), 'Things' (Physical devices and objects connected to the Internet and each other for intelligent decision making, often called Internet of Things (IoT)), and 'Process' (Delivering the right information to the right person or machine at the right time).

14:40

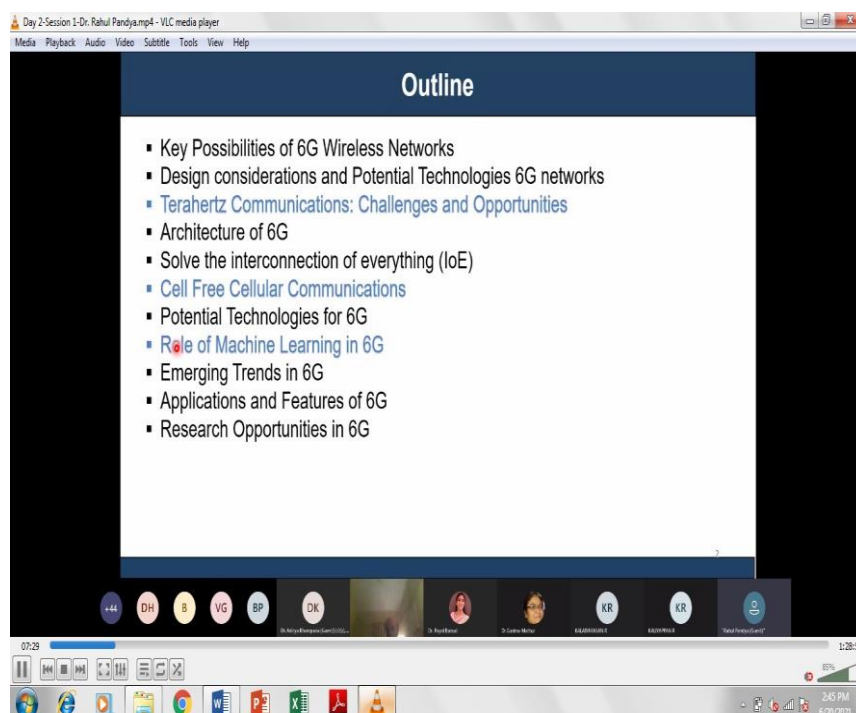
1:38:07

Expert Talk-4

Topic: 6G Vision, Potential Technologies and Challenges

Resource Person: Dr. Rahul Pandya, Assistant Professor

Venue: online



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Key Possibilities of 6G Wireless Networks (12/06/2021) 1:28:57

- A peak data rate of ≥ 1 Tb/s (100 times of 5G)
- A user-experienced data rate of 1 Gb/s (10 times of 5G)
- THz frequency range: 0.1 – 10 THz
- An spectrum efficiency of 5–10 times of 5G
- An energy efficiency of 10–100 times of 5G
- Ten times the connectivity density of 5G
- High throughput, network capacity
- Latency of 10–100 μ s
- High mobility
- Enhanced data security
- Ubiquitous connectivity
- AI integrated communication

IMT: International Mobile Telecommunications

Z. Zhang et al., "6G Wireless Networks: Vision, Requirements, Architecture, and Key Technologies," in IEEE Vehicular Technology Magazine, vol. 14, no. 3, pp. 28–41, Sept. 2019.

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Comparison of 6G with 4G and 5G Communication Systems

Issue	4G	5G	6G
Per device peak data rate	1 Gbps	10 Gbps	1 Tbps
E2E latency	100 ms	10 ms	1 ms
Maximum spectral efficiency	15 bps/Hz	30 bps/Hz	100 bps/Hz
Mobility support	Up to 350 km/hr	Up to 500 km/hr	Up to 1000 km/hr
Satellite integration	No	No	Fully
AI	No	Partial	Fully
Autonomous vehicle	No	Partial	Fully
XR	No	Partial	Fully
Haptic Communication	No	Partial	Fully

15:34 1:28:57

85%

2:46 PM 6/20/2021

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Design considerations and potential technologies 6G networks

Typical Scenarios: FeMSB, mMTC, URLLC, LDMTC, ELPIC

Applications: Holographic Verticals, IoT, Fully Automated Driving, Deep-Sea Sightseeing, Nanodevices

Technical Objectives: Peak Data Rate, User-Experienced Data Rate, Latency, Mobility, Connectivity Density, Area Traffic Capacity, EE, SE

Promising Techniques: THz Communication, SM-MIMO, LIS and Holographic BF, OAM Multiplexing, Laser and VLC, Quantum Communications and Computing, Blockchain-Based Spectrum Sharing, Molecular Communications and Internet of Nano-Things, Artificial Intelligence, Large-Dimensional Networks

Design Principles: Use Higher and Unlicensed Frequency Bands, Richer Spectrum Resources, Multiplex More Parallel Data Streams, Improve Data-Transmission Reliability, Improve Energy Efficiency, Improve Computing Efficiency, Provide Strong Security, Achieve Nanoscale Communications and Interconnection, Achieve Autonomous and Zero-Touch Networks, Innovate Network Design

Z. Zhang et al., "6G Wireless Networks: Vision, Requirements, Architecture, and Key Technologies," in IEEE Vehicular Technology Magazine, vol. 14, no. 3, pp. 28-41, Sept. 2019.

17:53 1:28:57

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Expert Talk-5

Topic: WoT and AIoT: Technologies for the Smart Connected World Resource

Person: Dr Asoke K Talukder, Chief Science & Technology Officer

Venue: online

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Web of Things (WoT) AI of Things (AIoT)

Technologies for the Smart Connected World

SRIT

Asoke K Talukder, PhD
Chief Science & Technology Officer
www.sritindia.com
www.srithealthcare.com

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07:29 1:39:26

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The Smart World Around Us

08:34 / 1:39:26

The diagram illustrates a smart world ecosystem centered around a 'Cloud and Services Platform'. It shows various smart components and their interconnections:

- SMART CITY:** Includes Integrated Operations Center, Smart Grid, Stadium, Connected Ambulances, and Intelligent Medical Devices.
- SMART HOSPITAL:** Includes Hospital Optimization and Commis Network Optimization.
- SMART HIGHWAY:** Includes Traffic Flow Optimization, Home Energy Management, and Intelligent Digital Signage.
- SMART FACTORY:** Includes Factory Optimization, Logistics Optimization, Automated Car System, and Connected Traffic Cameras.

Asoke K Talukder, 2021

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08:35 1:39:26

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10:15 / 1:39:26

Closer Look at Smart World

Asoke K Talukder, 2021

3

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Smart World Around Us

- Smart City
- Smart Healthcare
- Smart Hospital
- Smart Homes
- Smart Cars
- Smart Grid
- Smart Factory
- Smart Highway
- Smart Transport
- ...

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4

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Three Key Technologies

Artificial Intelligence (AI)



Programmable intelligence enabling devices to learn, reason, and process information like humans

5G Networks



5th generation mobile networks with extremely fast, near-zero latency for real-time data processing

Big Data Data Science



Volumes of data from numerous Internet-connected sources, that are too large for normal processing methods

Asoke K Talukder, 2021

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5

11:23 1:39:26

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World Perception of AI and IoT (2018)

HOW INDUSTRY PERCEPTIONS ON AI AND IOT HAVE CHANGED: 2016 TO PRESENT (2018)

Perception	AI: 2016	AI: 2018	IoT: 2016	IoT: 2018
IT IS CRITICAL TO MY COMPANY'S FUTURE SUCCESS	48%	52%	63%	69%
WE ARE ALREADY USING THE TECHNOLOGY	28%	27%	43%	57%
WE HAVE A SPECIFIC AND COMPREHENSIVE STRATEGY	16%	16%	31%	51%
THE TECHNOLOGY IS NOT WORTH THE INVESTMENT	17%	16%	27%	8%

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6

13:27 1:39:26

Windows taskbar icons: File Explorer, Edge, VLC, Word, PowerPoint, Excel, PDF, etc.

Expert Talk-6

Topic: The Fundamental Principles of Deep Learning including Back Propagation

Resource Person: Lyla B.Das, Associate Professor

Venue: online

The image displays two screenshots of a Zoom meeting. The top screenshot shows a slide titled "Internet of Things" with a bulleted list of points. The bottom screenshot shows a slide titled "Internet IPv4 & IPv6" with a bulleted list of points. Both slides are presented in a VLC media player window, and the Zoom interface is visible at the bottom of each screenshot.

Internet of Things

- The Internet of things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet
- Things have evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems
- Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things
- There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to address these concerns have begun including the development of international standards

Asoke K Talukder, 2021

Internet IPv4 & IPv6

- IPv4 is 32-Bit IP address whereas IPv6 is a 128-Bit IP address.
- IPv4 is a numeric addressing method whereas IPv6 is an alphanumeric addressing method.
- IPv4 binary bits are separated by a dot(.) whereas IPv6 binary bits are separated by a colon(:).
- IPv4 offers 12 header fields whereas IPv6 offers 8 header fields.
- IPv4 supports broadcast whereas IPv6 doesn't support broadcast.
- IPv4 has checksum fields while IPv6 doesn't have checksum fields
- IPv4 supports VLSM (Virtual Length Subnet Mask) whereas IPv6 doesn't support VLSM.
- IPv4 uses ARP (Address Resolution Protocol) to map to MAC address whereas IPv6 uses NDP (Neighbour Discovery Protocol) to map to MAC address

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Sensors in Smart Objects

- Smart city is infeasible without the deployment of sensors
- In the smart city, a sensor is used to measure the physical properties of any object, or situation
- The main sensors domains
 - Electronic sensors: environmental surveillance sensors, parking sensors, and speedometer sensors
 - Chemical sensors: carbon dioxide sensors, oxygen sensors, electronic nose and catalytic bead sensors
 - Smart grid sensors: efficient generation, transmission and distribution of power from the generating source to the end users
 - Biosensors: ionising and subatomic sensors
 - Smart Homes: Fire, Personal Safety,

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Connected Things or Objects

- Internet of Things (IoT)
 - Connecting "Things" (Objects and Machines) to the internet and eventually to each other
 - "Internet of things" was likely coined by Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Center, in 1999
- Cyber Physical Systems (CPS)
 - Integration of computation, networking and physical process

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18:45 / 1:39:26

Day 2-Session 2- Dr. ashok.mp4 - VLC media player

IoT Market & Applications

The diagram illustrates the IoT Market & Applications. At the center is a blue circle labeled "IoT architecture framework". Surrounding this central hub are various sectors and stakeholders, each represented by a colored circle or rectangle, connected to the central hub by arrows. The sectors include: Consumer equipment providers, Consumers, ICT infrastructure providers, Regulators, Logistics companies, Public transport companies, City authorities, Manufacturing industries, Automation equipment providers, Energy, Retail, Application developers, Utilities, Insurance companies, Healthcare, Home & Building, Appliances providers, Facility management, and Retail stores.

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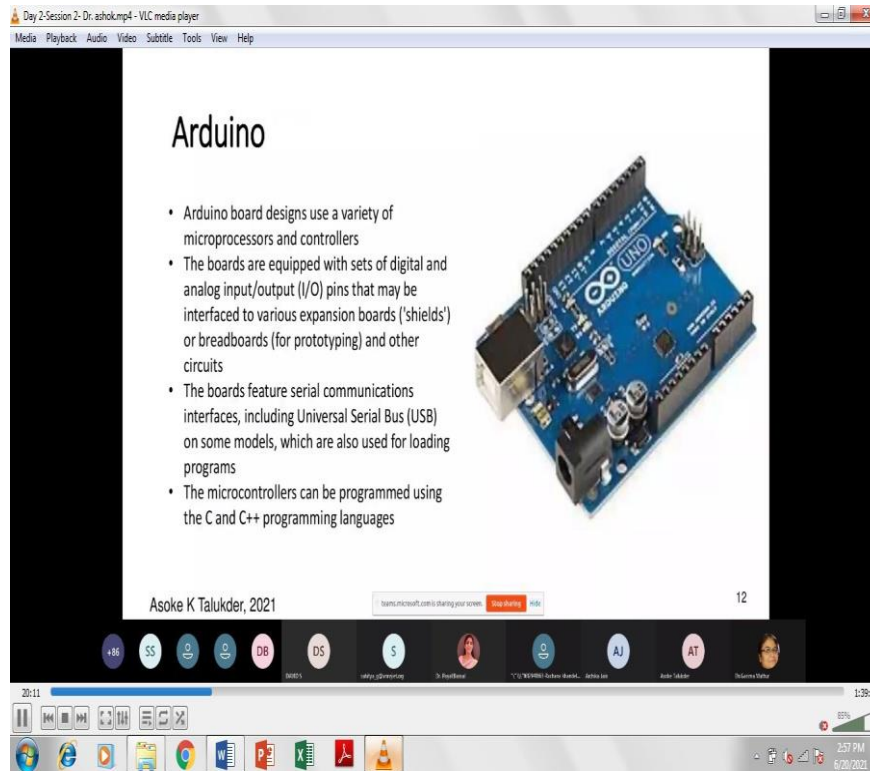
19:14 / 1:39:26

Expert Talk-7

Topic: Stochastic geometry analysis of 5G network Resource Person: Dr.

Sudharsan, Assistant Professor

Venue: Online



Expert Talk-8

Topic: Spectral- and Energy-Efficient Techniques for 5G and Beyond Wireless Networks

Resource Person: Dr. Prabhat Kumar Upadhyay, Associate Professor

Venue: online

Day-3-Session-2-Dr. Shaiddid.mp4 - VLC media player

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1 of 25

Deep Learning based power control

Dr. Shahid Mehrzaj Shah

Department of Electronics and Communication Engineering

December 9, 2020

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Dr. Shahid Mehrzaj Shah (NET Scopus)

Deep Learning based power control

December 9, 2020 1 / 25

02:25 1:00:40

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2 of 25

Outline

- Introduction
- Inference channel
- Introduction To Deep Learning
- Types of learning algorithms
- Training Deep neural network for SRM
- Structure of Deep neural network used for SRM
- Ensembling models
- References

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Dr. Shahid Mehrzaj Shah (NET Scopus)

Deep Learning based power control

December 9, 2020 2 / 25

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Introduction

- Information theoretic channel modelling of mobile communication networks provide good insight into the design of communication system.
- Channel models like Multiple access channel (Uplink), Broadcast Channel (Downlink), Relay Channel (Co-operative), Interference Channel are the most common examples.
- The capacity region of the multi-user interference channel is among the longest outstanding open problems in information theory
- It is computationally difficult to achieve efficient power control when the number of users is large
- For general multi-user Gaussian case, this problem is generally NP-hard, and has been investigated for decades.
- Power control for two user interference channel has been solved using usual optimization techniques
- The problem becomes computationally intractable when number of users increase.
- In practical 5G and Beyond 5G networks, the number of users are going to increase exponentially, while demanding very high data rates.

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Dr. Shaidid Murtaza Shah (NIT Srinagar) Deep Learning based power control December 9, 2020 3 / 25

03:10 1:00:40

Microsoft Whiteboard

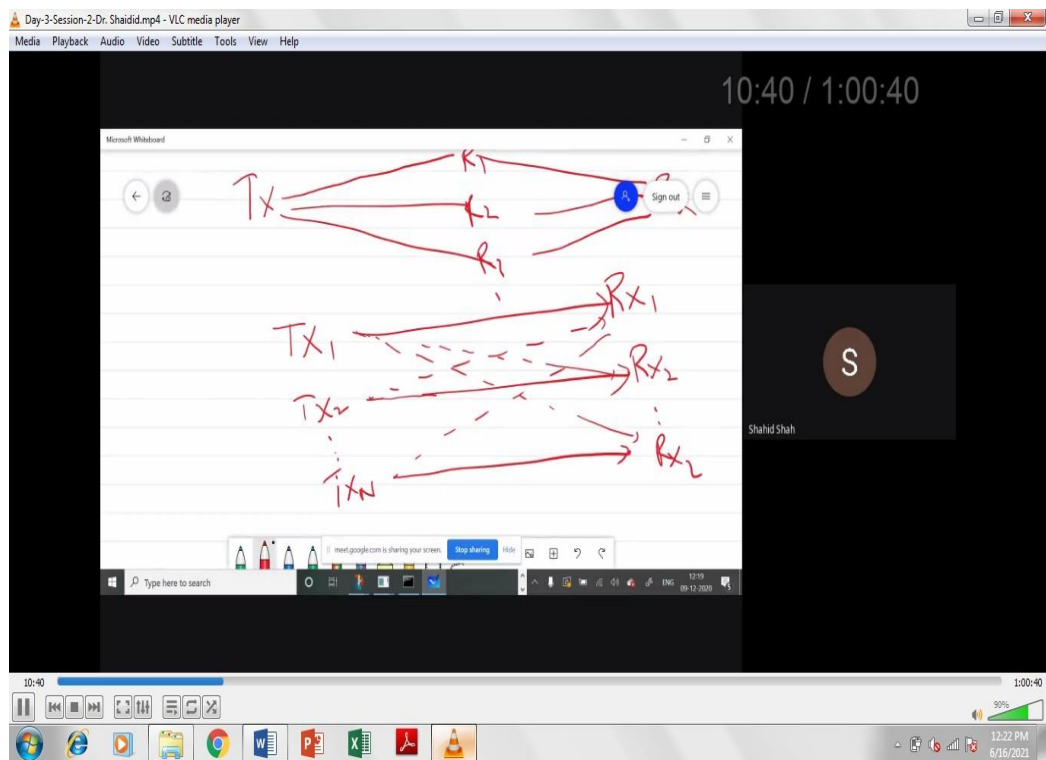
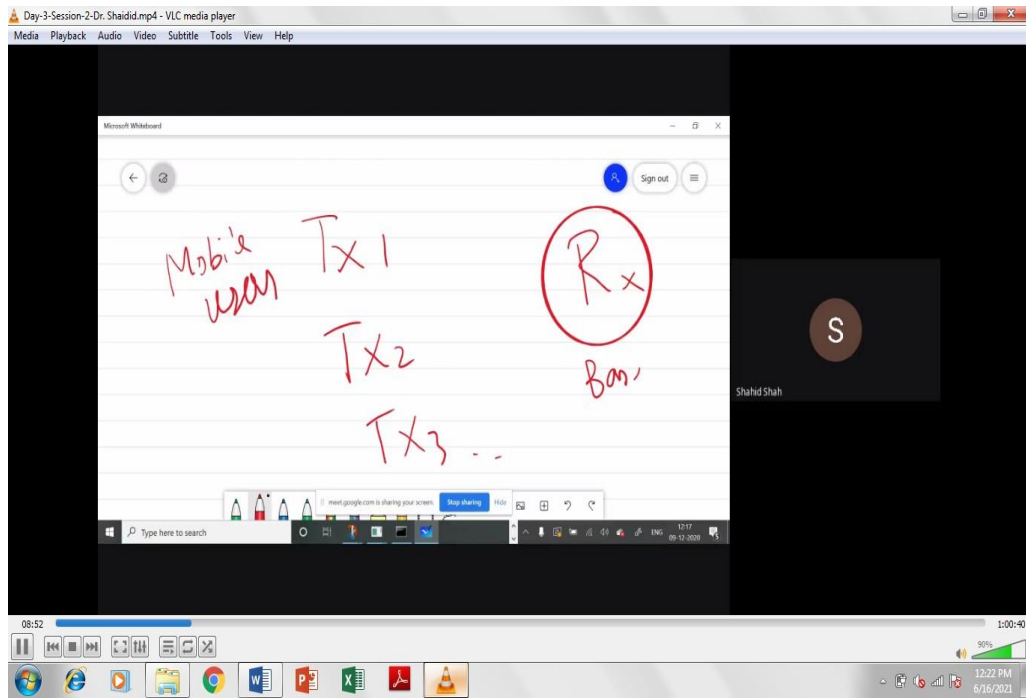
Handwritten diagram and notes:

Diagram: $T_x \rightarrow \text{Comm Channel} \rightarrow R_x$

Labels: $\{0,1\}$, X , $P_X(x)$, $P_{Y|X}(y|x)$, Y , $P_Y(y)$, $P(y=1|X=0)$, $P(y=0|X=0)$

Annotations: "error", "success", "channel"

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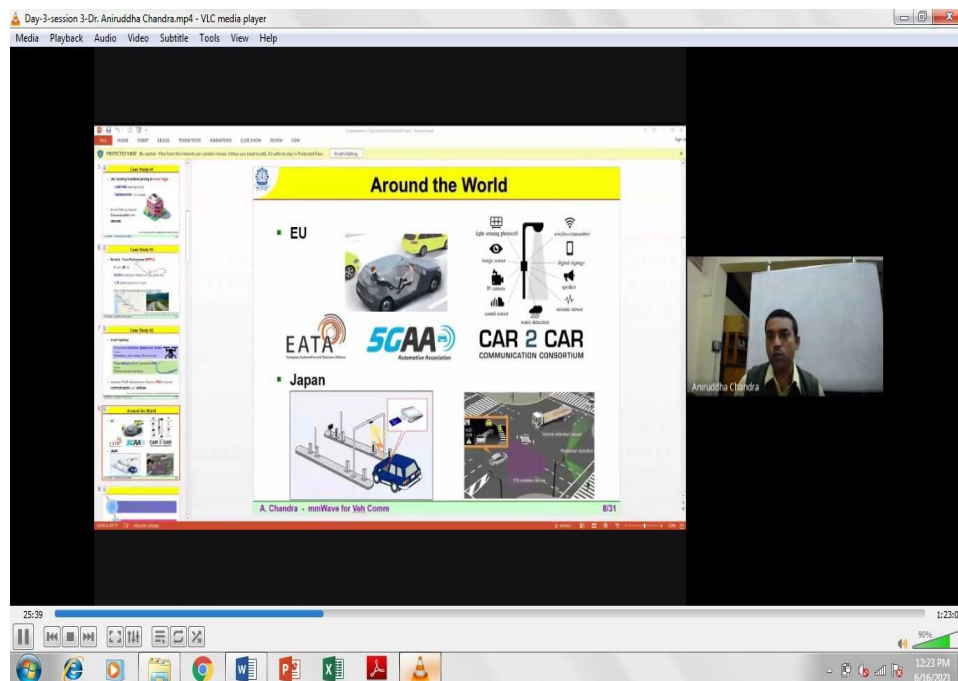
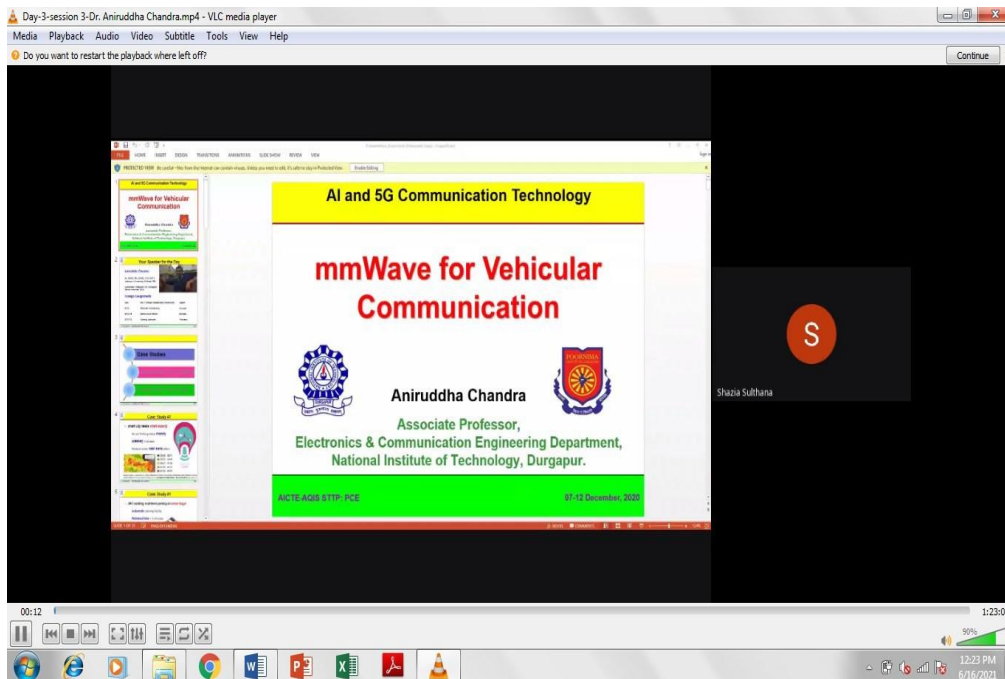


Expert Talk-9

Topic: AI Trending - from Local Data to 5G Communications

Resource Person: Dr. Sudan Jha, Professor

Venue: online



Day-3-session 3-Dr. Anirudha Chandra.mp4 - VLC media player

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40:47 / 1:23:05

Why mmWave?

Shannon-Hartley theorem (SISO):

$$C = B \times \log_2(1 + SNR)$$

capacity (bits/s) bandwidth (Hz) spectrum efficiency (bits/s/Hz)

Shannon-Hartley theorem (N x N MIMO):

$$C = N \times B \times \log_2(1 + SNR)$$

capacity (bits/s) no. of antennas (Hz) bandwidth (Hz) spectrum efficiency (bits/s/Hz)

A. Chandra - mmWave for Veh Comm

16/31

40:48

1:23:05

12:23 PM 6/16/2021

Expert Talk-10

Topic: Automated Grading of Oil Palm Fruits using Fuzzy Logic and Rough Set Theory.

Resource Person: Dr. Gaurang Patkar, Associate Professor – Head of Department
Venue: online

Role of AI in 5G

- 5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, **ultra low latency**, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users.
- The 5G network architecture and functionality will become complex while addressing the usecases:
 - Enhanced Mobile Broadband
 - Massive IoT
 - Mission critical infrastructure

1980
1G: Mobile voice calls

1990
2G: Mobile voice calls and SMS

2000
3G: Mobile web browsing

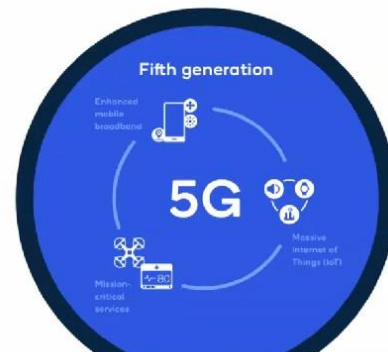
2010
4G: Mobile video consumption and higher data speed

2020
5G: Technology to enhance experiences and drive digitalization of industries

Type here to search

Role of AI in 5G

- Increased complexity in the management of a vast number of devices and huge data. AI and ML will help to reduce this complexity
- AI assists in making mobile networks more proactive and immediately responsive to the needs of customers.



Reinforcement Learning

- Reinforcement Learning is a feedback-based Machine learning technique in which an agent learns to behave in an environment by performing the actions and seeing the results of actions. For each good action, the agent gets positive feedback, and for each bad action, the agent gets negative feedback or penalty.
- **The agent learns automatically using feedbacks without any labeled data.** The agent interacts with the environment and explores it by itself. The primary goal of an agent in reinforcement learning is to improve the performance by getting the maximum positive rewards.

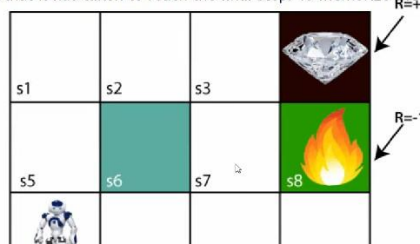
Maze Example

The maze is consisting of an S_0 block, which is a **wall**, S_1 a **fire pit**, and S_4 a **diamond block**.

The agent cannot cross the S_0 block, as it is a solid wall. If the agent reaches the S_4 block, then get the **+1 reward**; if it reaches the fire pit, then gets **-1 reward point**. It can take four actions: **move up, move down, move left, and move right**.

The agent can take any path to reach to the final point, but he needs to make it in possible fewer steps. Suppose the agent considers the path **S9-S5-S1-S2-S3**, so he will get the +1-reward point.

The agent will try to remember the preceding steps that it has taken to reach the final step. To memorize the steps, it assigns 1 value to each previous step.



Expert Talk-11

Topic: Edge Analytics to Address Challenges of Smart Healthcare

Resource Person: Dr. Rajveer S. Shekhawat, Provost& Director

Venue: online

Some examples of Reinforcement Learning

Self driving cars

Robotics

reinforcement learning

healthcare

education

transportation

energy

recommendation

business management

science

engineering

art

NLP

computer vision

robotics

games

Go, poker

sim-to-real

recognition

seq. gen.

finance

pricing, trading

portfolio opt.

risk mgmt

computer systems

topics in computer science

DTRs diagnosis EHR/EMR

proficiency est. recommendation education games

adaptive traffic signal control

adaptive decision control

Some examples of Reinforcement Learning

Self driving cars

Robotics

reinforcement learning

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topics in computer science

DTRs diagnosis EHR/EMR

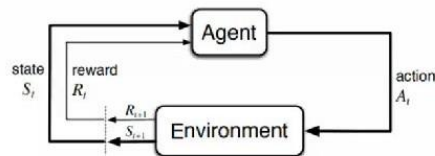
proficiency est. recommendation education games

adaptive traffic signal control

adaptive decision control

Terms used in Reinforcement Learning

- **Agent():** An entity that can perceive/explore the environment and act upon it.
- **Environment():** A situation in which an agent is present or surrounded by. In RL, we assume the stochastic environment, which means it is random in nature.
- **Action():** Actions are the moves taken by an agent within the environment.
- **State():** State is a situation returned by the environment after each action taken by the agent.
- **Reward():** A feedback returned to the agent from the environment to evaluate the action of the agent.
- **Policy():** Policy is a strategy applied by the agent for the next action based on the current state.



Markov Property

Markov Process is a memoryless process with a sequence of random states S_1, S_2, \dots, S_t that uses the Markov Property.

Markov Property: *Future is Independent of the past given the present.*

$$P[S_{t+1} | S_t] = P[S_{t+1} | S_1, \dots, S_t]$$

If the agent is present in the current state S_1 , performs an action a_1 and move to the state s_2 , then the state transition from s_1 to s_2 only depends on the current state and future action and states do not depend on past actions, rewards, or states.

Example: A Chess game, the players only focus on the current state and do not need to remember past actions or states.

Expert Talk-12

Topic: Reinforcement Learning Application in 5G and Beyond Networks

Resource Person: Dr. Siba Narayan Swain, Assistant Professor

Venue: online

Reward Function:

$$\mathcal{R}_s^a = \mathbb{E}[R_{t+1} \mid S_t = s, A_t = a]$$

State-action value function:

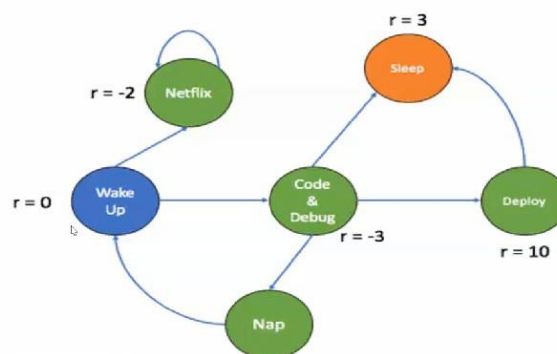
$$q_\pi(s, a) \doteq \mathbb{E}_\pi[G_t \mid S_t = s, A_t = a] = \mathbb{E}_\pi \left[\sum_{k=0}^{\infty} \gamma^k R_{t+k+1} \mid S_t = s, A_t = a \right].$$

This function specifies the **how good** it is for the agent to take action (a) in a state (s) with a **policy** π .

Basically, it tells us the value of performing a certain action(a) in a state(s) with a policy π .

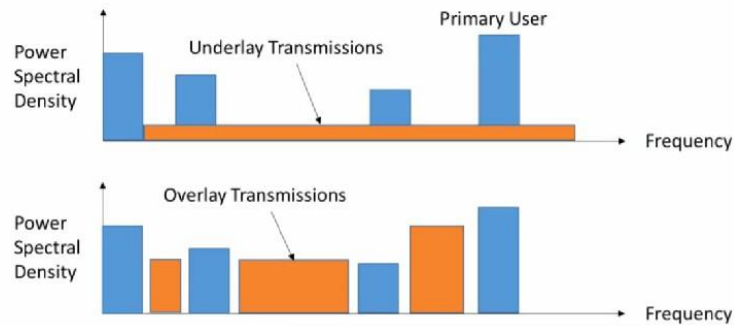
Example of Markov Decision Process

we can see that there are no more probabilities. In fact now our agent has choices to make like after waking up, we can choose to watch netflix or code and debug. Of course the actions of the agent are defined w.r.t some policy π and will be get the reward accordingly.

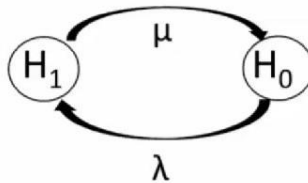


Dynamic Spectrum Access- Cognitive Radio

Overlay - SU transmits on PU channels in an opportunistic manner whenever PUs are not transmitting.



Temporal Behavior of Primary Users



- H1 - PU transmits
- H0 - PU does not transmit

The two states or hypotheses are linked by factors such as λ (arrival rate of PU) and μ (termination rate of the PU). The temporal behaviour of the PU transmission which comprises of the arrival and termination rates, is modelled as a random Poisson Exponential Process

Expert Talk-13

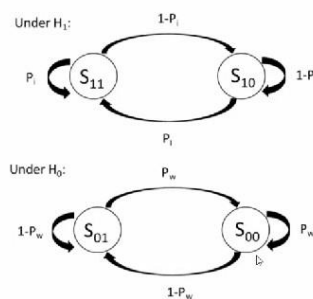
Topic: IoT Device Localization

Resource Person: Dr. Udit

Satija, Assistant Professor

Venue: online

SU modelled as Markov Decision Process (RL)



S_{00} - SU does not transmit | H_0

S_{01} - SU transmits | H_0

S_{10} - SU does not transmit | H_1

S_{11} - SU transmits | H_1

P_i = Probability of interference - simultaneous transmissions of PU and SU

P_w = Wastage Probability - due to false alarm

Q-Learning

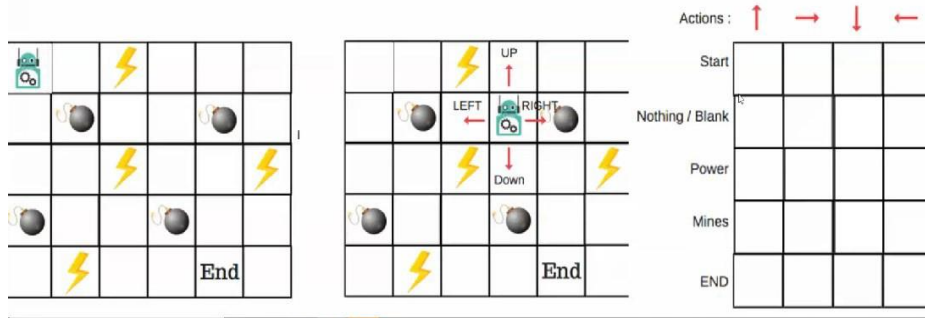
Q-Learning is a straightforward and model-free reinforcement learning algorithm adopted to define the values of transition probabilities and to find an optimal policy for a MDP.

The main objective of Q-learning is to learn the policy which can inform the agent that what actions should be taken for maximizing the reward under what circumstances.

It also converges to an optimal policy given a finite action-state MDP

Q - table

1. A Q-table or matrix is created while performing the Q-learning. The table follows the state and action pair, i.e., $[s, a]$, and initializes the values to zero. After each action, the table is updated, and the q-values are stored within the table.
2. The RL agent uses this Q-table as a reference table to select the best action based on the q-values.



Expert Talk -14

Topic: Deep Learning-Based Wireless Communications

Resource Person: Dr. Sanjeev Sharma, Assistant Professor

Venue: online



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Wireless Communication

```

graph LR
    Source[Source] --> Modulator[Modulator]
    Modulator --> Channel[Channel]
    Channel --> Demodulator[Demodulator]
    Demodulator --> Sink[Sink]
  
```

Impairments

- Noise: Gaussian or non-Gaussian
- Fading: small scale and large scale
- Interferences: MUI, ISI

Performance metrics

- Efficiency: power, spectral
- BER/SER: accuracy
- Latency
- Complexity: cost
- Processing power

- Simple system design- low complexity and power consumption
- Trade-off between system's simplicity and performance
- Manage: CIR's properties

Sanjeev Sharma (BT (BHU) Varanasi) International Mobile Access Technology, Future 5G 10 April, 2021 FCP, Poornima College of Engineering

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Motivation

1G	4G
<ul style="list-style-type: none"> Deployed in mid 1980 Voice services 	<ul style="list-style-type: none"> Deployed in 2010 Primarily data services
2G	5G
<ul style="list-style-type: none"> Deployed in 1990 Voice services 	<ul style="list-style-type: none"> 2020 Primarily IoT services
3G	Each Generation
<ul style="list-style-type: none"> Deployed in 2000 Primarily voice services 	<ul style="list-style-type: none"> Higher data rates New Technologies

- A two hour long movie example "Guardian of the galaxy"
 - 22-28 hours in 1G (300 kbps) one can go from New York to Sydney
 - 1.8 minutes in 4G (100 mbps)
 - 7 seconds in 5G (10 gbps)

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Motivation Contd...

	Latency	Throughput	Connections	Mobility	Network Architecture
5G	1 ms E2E Latency	10Gbps per Connection	1000K Connections Per km ²	500 km/h High Speed Railway	LNIP Ability Required
GAP	30~50X	100X	100X	1.5X	NFV/SDN
LTE	30~50 ms	100Mbps	10K	350Km/h	Inflexible

← Challenges because many of these requirements are conflicting →

- Diverse applications: mobile data traffic explosion

Sanjeev Sharma [BT (BHU) Varanasi] International Mobile Access Technology: Future 5G 10 April, 2021, 11:00 Poornima College of Engineering

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5G Application Scenarios Contd...

IoT Scenario

- Connect billions of devices to network: D2D, M2M
- Remote access to devices and sensors over a network
- Smart agriculture
- Smart building/home

Driving force of 5G

- Requirement from: Society, Environment, Economy, Users, Operators, Agriculture, etc.

Sanjeev Sharma [BT (BHU) Varanasi] International Mobile Access Technology: Future 5G 10 April, 2021, 11:00 Poornima College of Engineering

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How Must Networks Evolve for 5G?

Increase Network Throughput [bits/s/km²] for a Given Area

$$\text{Throughput} = \underbrace{\text{Cell Density}}_{\text{bits/s/km}^2} \cdot \underbrace{\text{Available Bandwidth}}_{\text{Hz}} \cdot \underbrace{\text{Spectral Efficiency}}_{\text{bits/s/Hz/cell}}$$

- Massive MIMO: higher spectral efficiency
- Higher order modulation schemes: higher spectral efficiency
- Millimeter-wave band: more spectrum
- Utilizing the unlicensed/licensed spectrum: spectrum sensing
- NOMA techniques: higher spectral efficiency

Sanjeev Sharma (BT (DHRU) Varanasi) | International Mobile Access Technology Course | 10 April, 2021, ECE, Poornima College of Engineering

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Expert Talk-15

Topic: Device-to Device Communication in 5G Cellular Networks

Resource Person: Dr. Sandeep Joshi, Assistant Professor

Venue: online

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Device-to-Device Communication in 5G Cellular Networks

BITS Pilani
Poornima College of Engineering, Jaipur, April 30, 2021
Dr. Sandeep Joshi

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Dr. Mahesh Bunde
Dr. Mahesh Bunde
B.E., M.E., Ph.D.
Director
Poornima College of Engineering
ISI-6, FIICO Institutional Area
Shilapura, JAIPUR

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5G Key Performance Indicators

These KPIs are derived from the three main 5G use cases:

- Enhanced Mobile Broadband (EMBB),
- Ultra-Reliable and Low Latency Communications (URLLC), and
- Massive Machine Type Communications (Massive MTC)

Ref: 5G Vision white paper, Samsung, 2015

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10:28 / 122:04

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How to achieve high data rates in 5G ?

- Extreme densification and offloading
 - Improves the area spectral efficiency (ASE)
 - ASE: more active nodes per unit area and Hz
- Cell shrinking
 - helps in spectrum reuse across a geographic area
 - reduction in the number of users competing for resources at each BS
- As the network densifies and the power-law path loss models hold the signal-to-interference ratio (SIR) is preserved

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10:31 / 122:04

Key technologies: 5G

- Millimeter wave

Beachfront Spectrum
Current Wireless Mobile Communication

Oxygen Absorption Band

Water Vapor Absorption Band

3GHz 54 GHz 99 GHz 99 GHz

(57-64) GHz (164-200) GHz

Available 252 GHz of Potential Bandwidth in Huge Chunks

Ref: Agrawal et al., IEEE Communications Surveys & Tutorials, 2016

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Key technologies: Millimeter wave

- Terrestrial wireless systems operate in microwave range of several hundred MHz to a few GHz; this range is full
- Idle spectrum does exist in the mm Wave range of 30–300 GHz (wavelengths 1–10 mm)
 - Considered suitable for short range communications
- Reasons for this spectrum being deemed unsuitable for mobile communications are
 - strong path loss, atmospheric and rain absorption
 - low diffraction around obstacles and penetration through objects
 - strong phase noise and exorbitant equipment costs
- Semiconductors are maturing, their costs and power consumption rapidly falling and other obstacles related to propagation are now considered increasingly surmountable

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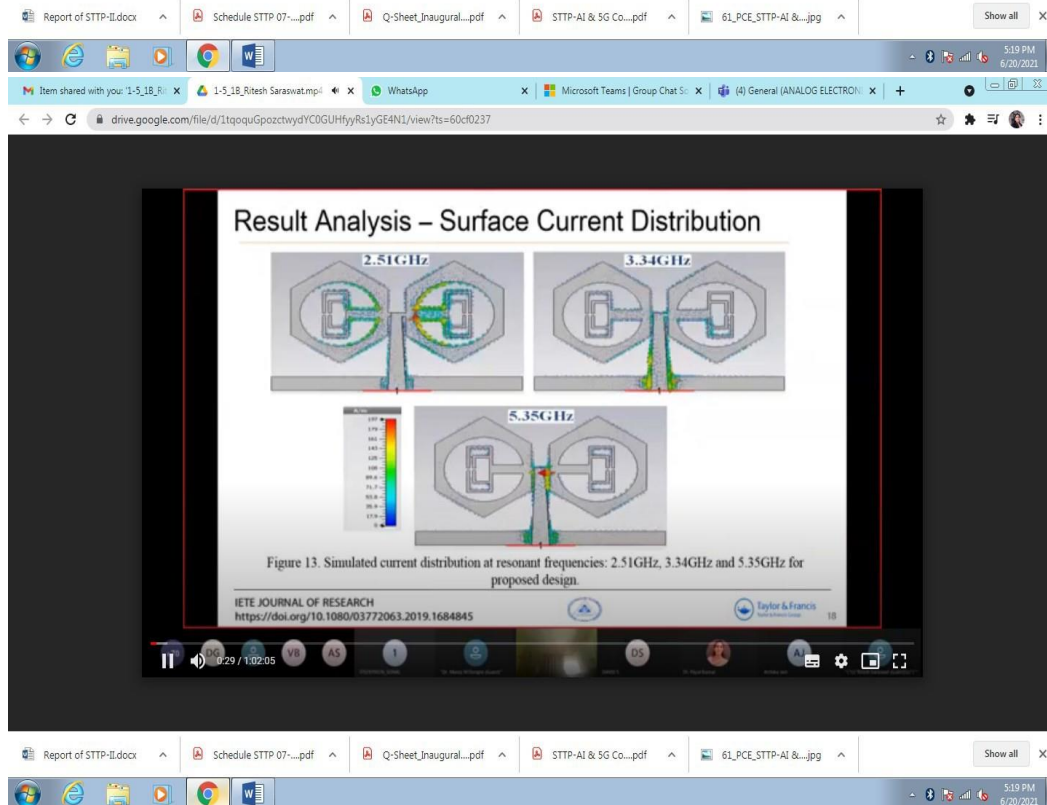
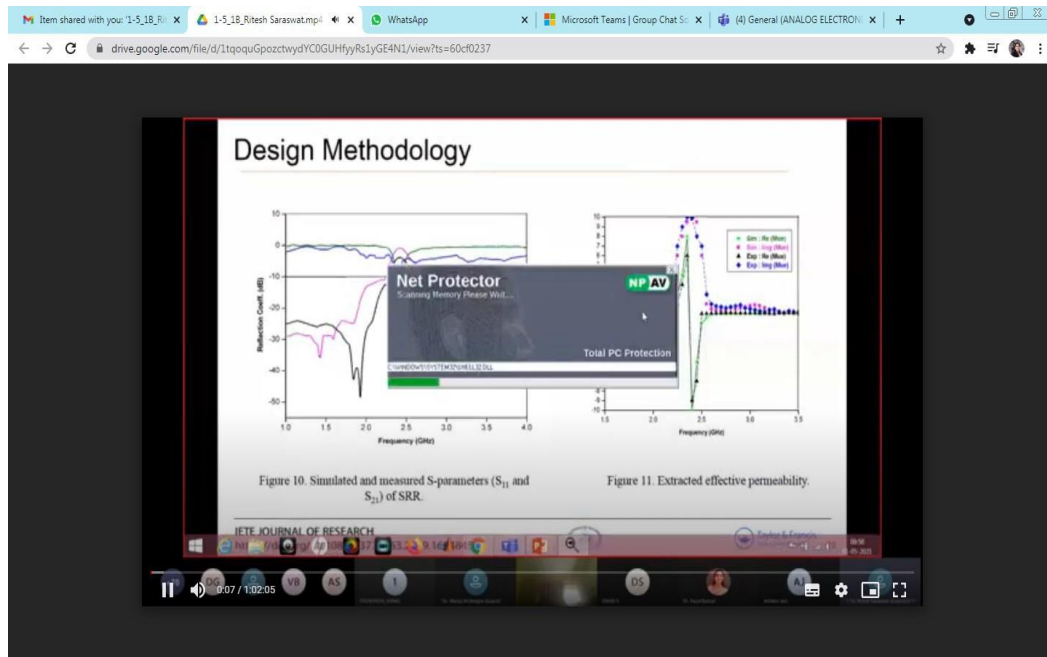
Expert Talk-16

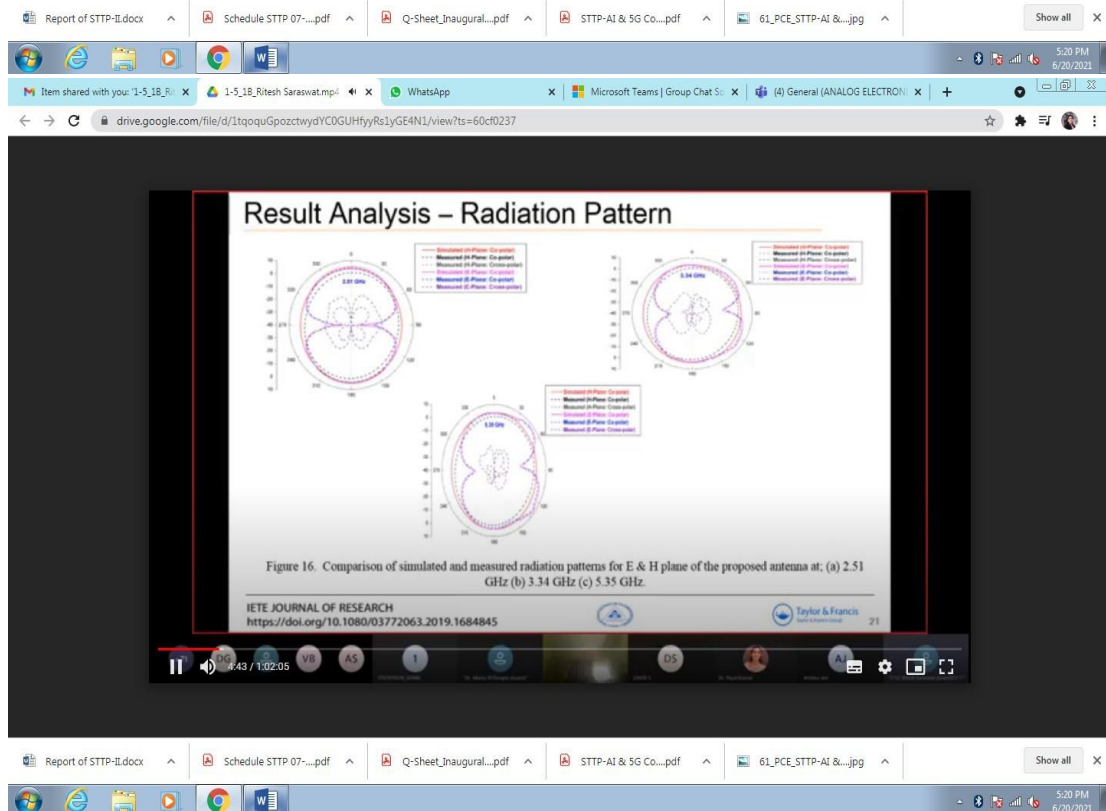
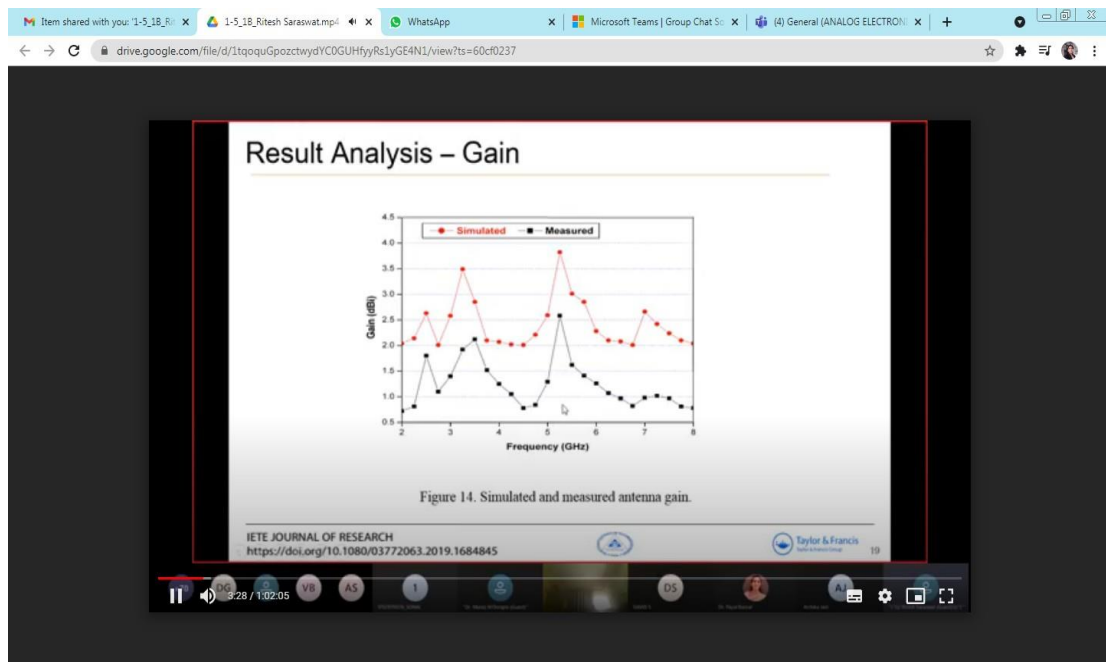
Topic: Antenna Design for Wireless Application with Implementation of Frequency Band Reconfigurability Characteristics

Resource Person: Dr. Ritesh Kumar

Saraswat, Assistant Professor Venue: online


Dr. Mahesh Bunde
B.E., M.E., Ph.D.
Director
Poornima College of Engineering
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Shalpur, JAIPUR





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Result Analysis – Reconfigurability

The proposed antenna represents the reconfigurability between wireless standards (WLAN & WiMAX) by PIN diode switches.

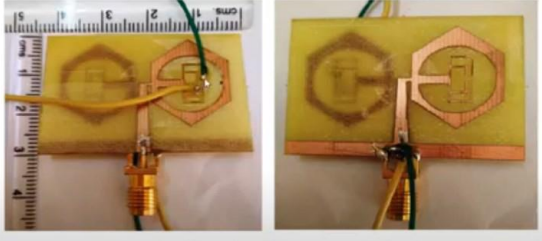


Figure 17. (a) Top view, (b) Bottom view of fabricated prototype.

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https://doi.org/10.1080/03772063.2019.1684845

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Design Methodology

Table 7: Different states of PIN diodes with frequency band (simulated and measured), covered bandwidth and wireless standards.

States	D ₁	D ₂	Frequency Bands (in GHz)		10-dB bandwidth (%)		Covered wireless WLAN & WiMAX standards
			Sim.	Meas.	Sim.	Meas.	
I	OFF	OFF	2.39- 2.57, 2.91- 3.75 & 4.87- 5.77	2.38-2.67, 2.94-3.76 & 4.95-5.81	7.26, 25.23 & 16.92	11.49, 24.48 & 15.99	2.4, 3.5 & 5 and 5.8 GHz Bands
II	ON	OFF	2.91- 3.76 & 4.86-5.75	3.12-3.65 & 5.08-5.78	25.49 & 16.78	15.66 & 12.89	3.5, 5 and 5.8 GHz Bands
III	OFF	ON	2.36-2.60 & 2.97-4.31	2.39- 2.56 & 3.05-4.15	9.68 & 36.81	6.87 & 30.56	2.4 & 3.5 GHz Bands

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https://doi.org/10.1080/03772063.2019.1684845

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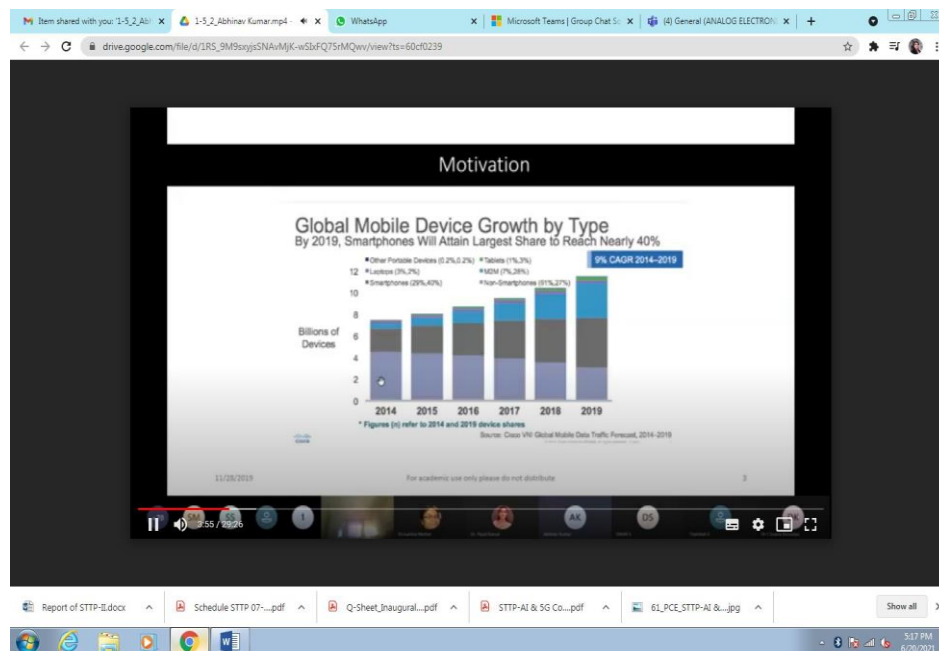
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Expert Talk-17

Topic: Cellular Internet of Things

Resource Person: Dr. Abhinav Kumar, Associate Professor **Venue: online**



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Outline

- 1) Motivation for Machine Type Communications
- 2) IoT Applications
- 3) Why Cellular IoT
- 4) eMTC
- 5) NB-IoT
- 6) Current Deployment
- 7) Open Challenges
- 8) Future Research Directions

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IoT Use Cases/Applications

TABLE 1. Overview of typical characteristics/requirements of IoT application.

Application	Application Domain	Tolerable Delay	Update Frequency	Data Rate
Structural Health [56]	Smart City	30 min	10 min	Low
Waste Management [56]	Smart City	30 min	1 hour	Low
Video Surveillance [57]	Smart City	Seconds	Real Time	High
Air Quality Monitoring [56]	Smart Home	5 min	30 min	Low
Monitoring and Supervision [49]	Industrial	Seconds or min	Seconds	Low
Closed loop control [49]	Industrial	Milliseconds	Milliseconds	Low
Interlocking and Control [49]	Industrial	Milliseconds	Milliseconds	Low
Patient's Healthcare delivery & Monitoring [57]	Healthcare	Low (seconds)	1 report per hour/day	High
Real-time emergency response & remote diagnostics [57]	Healthcare	Low (seconds)	Requires Ad-hoc emergency communication	High
Real-time management and accuracy of information across supply chain [57]	ITS	Low (seconds)	1 report per hour/day	High

- G. A. Akpakwa, B. J. Silva, G. P. Hancle and A. M. Abu-Mahfouz, "A Survey on 5G Networks for the Internet of Things: Communication Technologies and Challenges," in IEEE Access, vol. 6, pp. 3619-3647, 2018.

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IoT Requirements

- Low Device Cost
- Low Deployment Cost
- Long Battery Life
- Extended Coverage
- Security and Privacy
- Support Massive Number of Devices

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Motivation

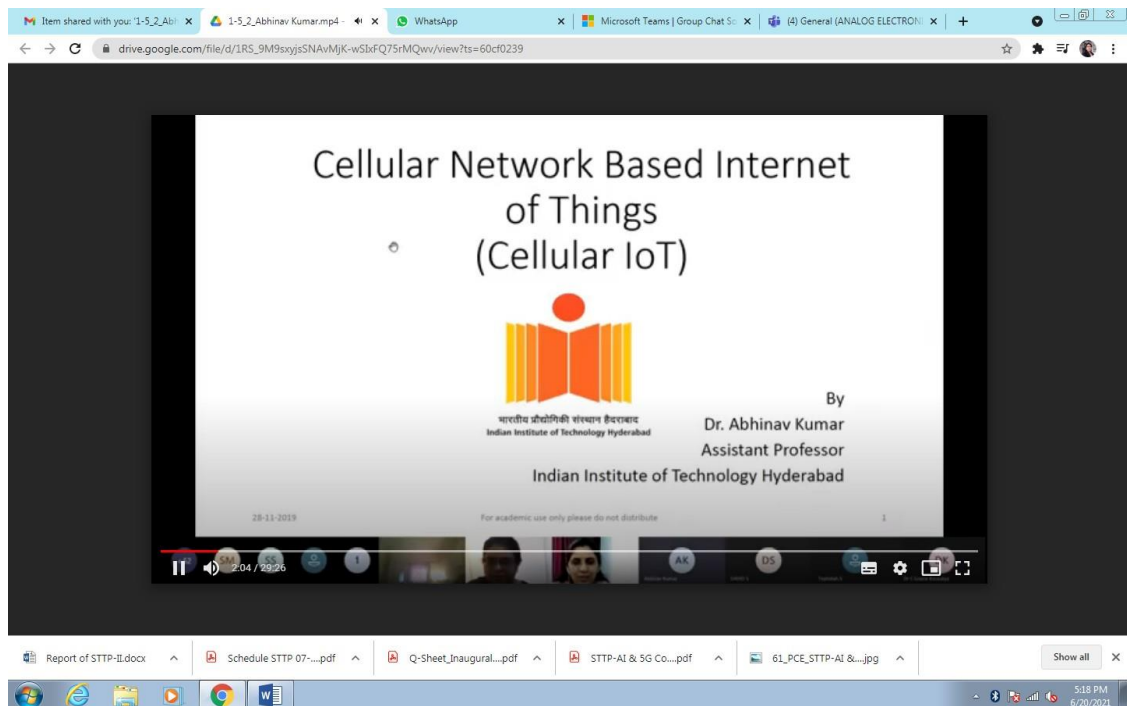
Global Mobile Data Traffic Growth / Top-Line

Global Mobile Data Traffic will increase 7-Fold from 2016-2021

Year	Exabytes per Month
2016	7 EB
2017	11 EB
2018	17 EB
2019	24 EB
2020	35 EB
2021	49 EB

Source: Cisco VNI Global Mobile Data Traffic Forecast, 2016-2021

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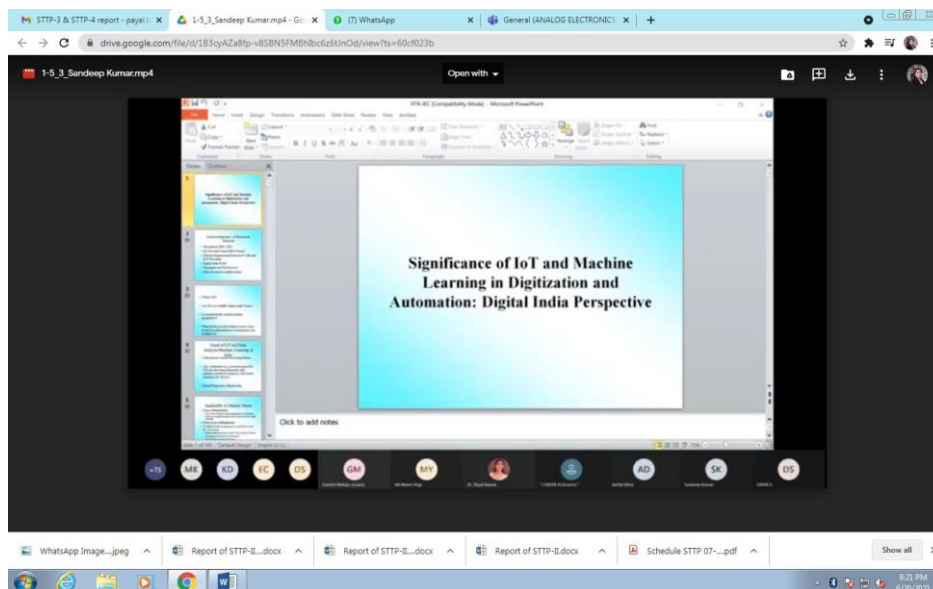


Expert Talk-18

Topic: Significance of Artificial Intelligence in Digitization and Automation: Digital India Perspective

Resource Person: Dr. Sandeep Kumar,

Associate Professor Venue: online



The screenshot shows a web browser window with a Google Drive link. The video player displays a PowerPoint presentation titled "Applicable in Generic Sense". The presentation content is as follows:

- Applicable in Generic Sense**
 - **Vision of Digital India**
 - The vision of Digital India programme is to transform India into a digitally empowered society and knowledge economy.
 - **Vision Areas of Digital India**
 - The Digital India programme is centred on three key vision areas:
 - Digital Infrastructure as a Core Utility to Every Citizen
 - Governance and Services on Demand
 - Digital Empowerment of Citizens

The video player interface includes a progress bar at 20:59 / 12:27:49 and a taskbar at the bottom showing the time 8:22 PM on 6/20/2021.

The screenshot shows a web browser window with a Google Drive link. The video player displays a PowerPoint presentation titled "Applicable in Generic Sense". The presentation content is as follows:

- Applicable in Generic Sense**
 - **Vision of Digital India**
 - The vision of Digital India programme is to transform India into a digitally empowered society and knowledge economy.
 - **Vision Areas of Digital India**
 - The Digital India programme is centred on three key vision areas:
 - Digital Infrastructure as a Core Utility to Every Citizen
 - Governance and Services on Demand
 - Digital Empowerment of Citizens

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The screenshot shows a web browser window with multiple tabs. The active tab is a Google Drive link to a video file. The video player displays a presentation slide with the title "Broadband highways". Below the title, there is a bulleted list:

- **Broadband for All – Rural**
- **Broadband for All – Urban**
- **National Information Infrastructure (NII)**
 - NII aims at integrating all ICT infrastructure components such as SWANs, NKN, etc.

The video player interface includes a progress bar, volume control, and a list of participants at the bottom. The browser's address bar shows the Google Drive file ID.

The screenshot shows a web browser window with multiple tabs. The active tab is a Google Drive link to a video file. The video player displays a presentation slide with the title "UNIVERSAL ACCESS TO MOBILE CONNECTIVITY". Below the title, there is a section with a photo of a woman and text:

Do you realise the significance of IT in your life? If you don't, just try living without your mobile phone or TV for a day

When you switch on your TV or pick up your mobile, you may not even realise you are using IT. When you book your Rail ticket, or withdraw money from bank, you probably are unaware about the presence of IT in that moment of your life. In fact, from dawn to dusk, IT constantly touches your life in obvious and not-so-obvious ways. Surprised? The reality is that information Technology, as an all-encompassing force, is changing the face of everything around us.

The video player interface includes a progress bar, volume control, and a list of participants at the bottom. The browser's address bar shows the Google Drive file ID.

Valedictory session:-

After Lunch valedictory session was held. Dr. Rajveer S. Shekhawat, Provost & Director, Manipal University Jaipur (Chief Guest) , Dr. Mahesh M Bundeale, Director, PCE, Jaipur, Mr. Pankaj Dhemla, Vice Principal, PCE, Jaipur, Dr. Garima Mathur, Dr. Payal Bansal Coordinator, PCE, participants and faculty members attended the session. It started with the felicitation of Chief Guest Dr. Rajveer S. Shekhawat, by Dr. Mahesh M Bundeale, Principal & Director, PCE, Jaipur. A brief report on worksop was presented by Dr. Payal Bansal, Valuable feedback was taken from the participants. The Certificate of participation was awarded to all the participants who successfully completed the Program. Dr. Mahesh M Bundeale congratulated the participants for taking keen interest in learning the new technologies in his address. He also appreciated the organizing team. Dr. Preetam Kumar said that active involvement of most prominent speakers and delegates and their innovative ideas will create a stimulating atmosphere for the further development of multi-disciplinary and convergent research in the area of network security and smart antenna. Dr. Payal Bansal, Associate Professor, ECE Deptt., PCE proposed the Vote of Thanks. At the end of sessiona group photograph was taken with the Dignitaries including participants.



AICTE
Six Days Short Term Training Program

On

Artificial Intelligence & 5G Communication Technology

April 26 – May 31, 2021

Organized by Department of Electronics & Communication Engineering,

Poornima College of Engineering, Jaipur



Date: May 31, 2021

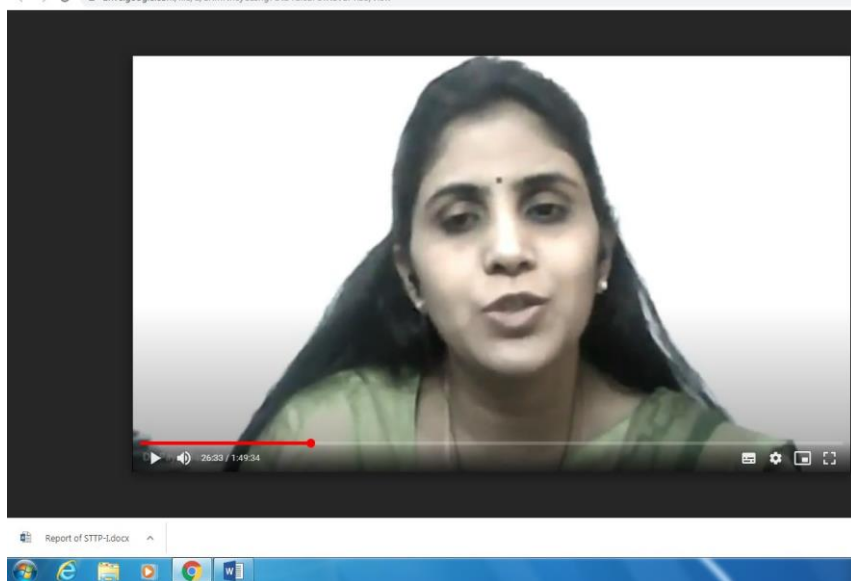
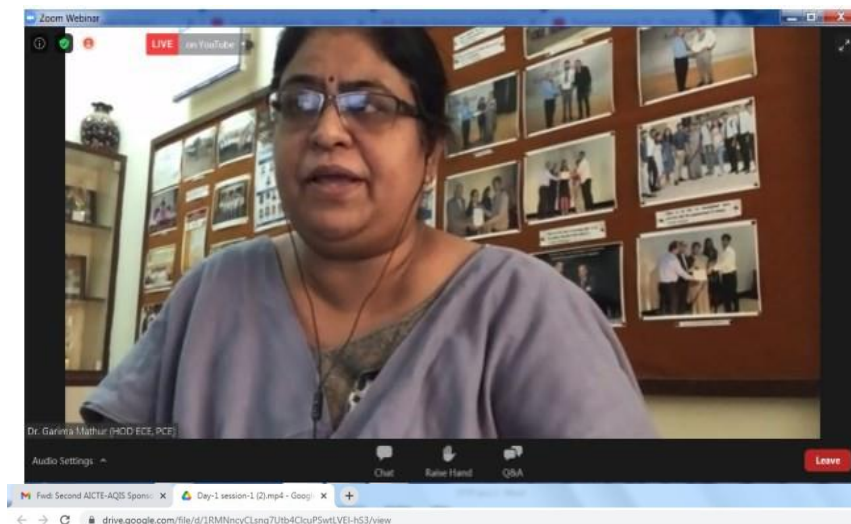
Time: 03:30 PM - 04:00 PM

Venue: Online

Q- Sheet Valedictory Session

S. No	Activity	Duration	Time
1.	Welcome of Dignitaries and Introduction of Refresher Program by Dr. Garima Mathur, Head & Professor ECE, PCE Dr. Rajveer S. Shekhawat, Provost & Director, (Chief Guest) Ar. Rahul Singhi, Director, Poornima Group Dr. Mahesh Bundeale, Director & Principal, PCE Mr. Pankaj Dhemla, Vice Principal, PCE	05 Min	03:30 PM - 03:35 PM
2.	Welcome address by Dr. Mahesh Bundeale, Director & Principal, PCE	05 Min	03:35 PM - 03:40 PM
3.	Motivational Words by Ar. Rahul Singhi, Director, Poornima Group	05 Min	03:40 PM - 03:45 PM
4.	Inaugural Address by Chief Guest Dr. Rajveer S. Shekhawat, Provost & Director	10 Min	03:45 PM - 03:55 PM
5.	Vote of Thanks by Dr. Payal Bansal, Associate Prof., ECE, PCE	05 Min	03:55 PM - 04:00 PM

Memories of Velidictory session



♦ LIST OF PARTICIPANTS:

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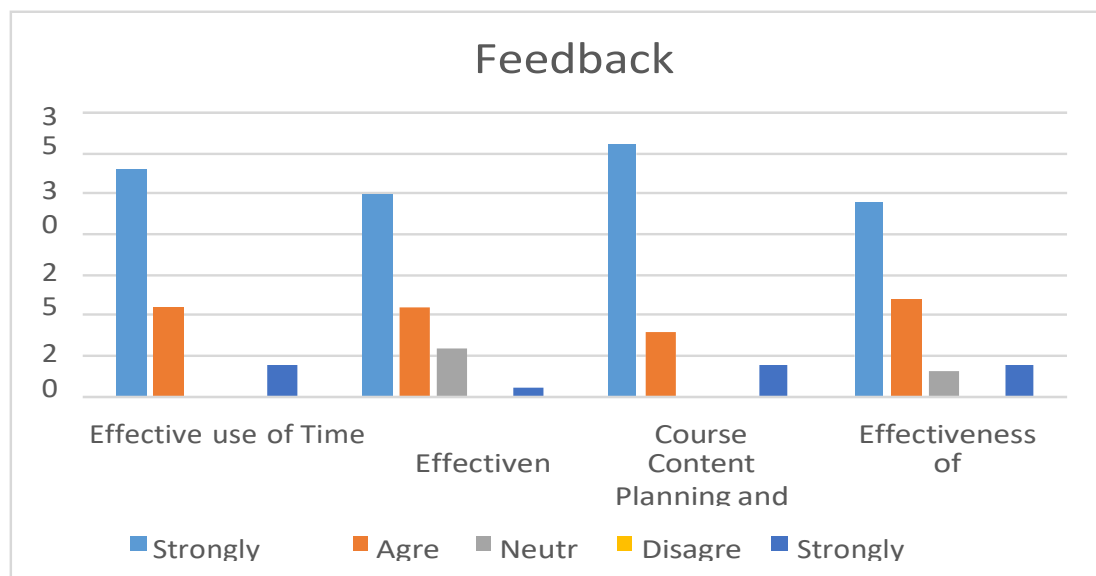
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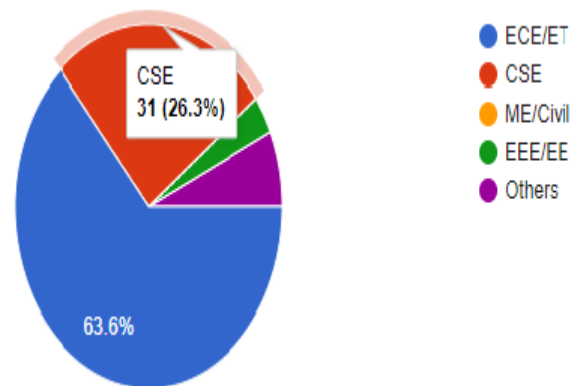
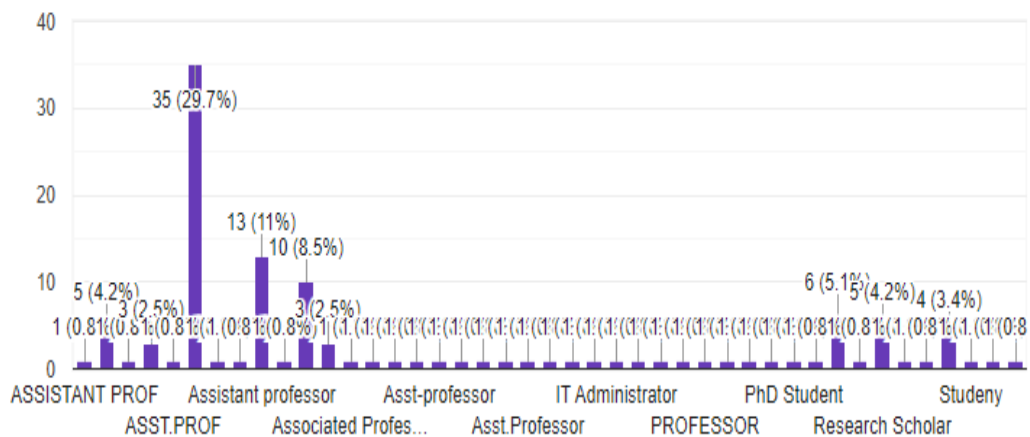
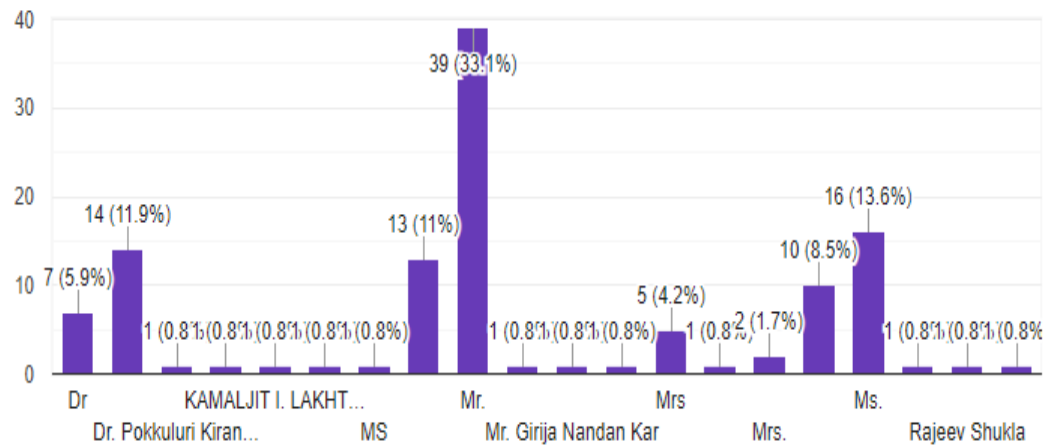
Virtual feedback and views shared by the participants about the FDP. The FDP has successfully fulfilled the objectives of the FDP set forth. All the participants in their oral feedback has given positive remarks in all respects and shown their satisfaction over all the arrangements and the time management.

♦ **FEEDBACK ANALYSIS:**

	Effective use of Time	Effectiveness of Theoretical Session	Course Content Planning and Organization	Effectiveness of Hands on Sessions
Strongly Agree	28	25	31	24
Agree	11	11	8	12
Neutral	0	6	0	3
Disagree	0	0	0	0
Strongly Disagree	4	1	4	4



♦ SWOT ANALYSIS:



♦ **BUDGET & ACTUALS: NIL**


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