



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 December 07-12, 2020.
- ♦ **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 catboats, smart speakers, and other AI-driven, voice-based technologies.
 4. Design and evaluate conversational interfaces for different users and contexts of use.


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

✦ BROCHURE / POSTER / LEAFLET / FLYER:

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

December 7-12, 2020

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


Dr. Manoj K. Shukla
Chief Guest
Pro-Vice Chancellor
HBT University, Kanpur


Yogesh Bhaskar
Guest of Honor
GM BSNL, Barmer


Dr. Mahesh M. Bunde
Director & Principal
PCE, Jaipur


Ar. Rahul Singhi
Director
Poornima Group, Jaipur


Mr. Pankaj Dhemla
Vice Principal
PCE, Jaipur

Resource Persons


Dr. Mithilesh Kumar
Professor
RTU, Kota (Raj.)


Dr. P. Prakasam
Professor & Head
VIT, Vellore


Dr. N. S. Rajput
Associate Professor
IIT, Varanasi


Dr. Sanjeev Kumar Raghuwanshi
Associate Professor
IIT Dhanbad, Jharkhand


Dr. Aniruddha Chandra
Associate Professor
NIT Durgapur


Dr. Harish Sharma
Associate Professor
RTU, Kota (Raj.)


Dr. Jaisheng Thangaraj
Assistant Professor
IIT Dhanbad, Jharkhand


Dr. Sam Darshi
Assistant Professor
IIT, Ropar


Dr. Seemanti Saha
Assistant Professor
NIT Patna


Dr. Surajit Kundu
Assistant Professor
NIT, Sikkim


Dr. Kuldeep Singh
Assistant Professor
MNIT, Jaipur


Dr. Shahid Mehraj Shah
Assistant Professor
NIT, Srinagar


Dr. Kiran Kumar Gurrula
Assistant Professor
NIT Andhra Pradesh


Dr. Chayan Bhar
Assistant Professor
NIT Warangal


Dr. Karan Verma
Assistant Professor
NIT, Delhi


Dr. Anirudh Agarwal
Assistant Professor
LNMIT, Jaipur


Mr. Vikas Sharma
Scrum Master
India Salesforce Practice

Monday, December 7, 2020, • Time: 9.30 AM onward

To join the Inaugural Session on

 **Google Meet**


Dr. Garima Mathur
Convener, STTP


Dr. Payal Bansal
Coordinator, STTP

 <p>POONINDRA COLLEGE OF ENGINEERING</p>	<p>The area of Interest design and Wireless Communication, and 3G/4G design. The department has two tie up with IITs (IIT Madras, IIT Bombay) Engineering and (i) Advanced Antenna & Wireless Communication (ii) Advancement of Wireless and Optical Fiber Link supporting MEMS/NB devices of IITCL, New Delhi.</p> <p>NTS Student Forum (NFS) of the Department has been recognized as Most Active NFS for session 2016-17 as NTS Regional Centre, Jaipur. The department has one of the best lab facility for the value added BBA Education Programs for faculty members and students on emerging technologies such as IBM iSkills for Cloud, IBM Cognos for Business Intelligence and SAP Application Development/Scripting/Programming IBM iSkills.</p>	<p>OBJECTIVES OF STTP</p> <ul style="list-style-type: none"> 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 worldwide by the eminent speakers in advance communication domains, from 4G, 5G, 6G, other advanced technologies & industry, for products having immediate industrial applications for well interest of the Country
<p>Poonindra College of Engineering (PCE), established as a branch of Technical Education in the year 2009, has its own glorious legacy of leading the young engineers to the pinnacle of its success. Its accomplishments towards its journey through the technology and its brought over from one after another PCE left its stone indelible mark its establishment in turning the graduates into well-versed ready providing the platform for knowledge and research and their practical implementation is different engineering professional projects, various groups of PCE.</p>	<p>ABOUT STTP</p> <p>The aim of this STTP is to enhance the R&D research and develop skill sets such as industry, control systems, scheduling, data mining, robotics, speech recognition, facial recognition and many others. Inspiring the new wave in 5G+ mobile data has millions, made for devices and mobile low-power network. 5G is not only important because of its the potential to support millions of devices at ultra-low speeds, but also because it has the potential to transform the face of people around the world. Improvements in 5G technology can help make the future.</p>	<p>PATRON</p> <p>Dr. Mahesh Bhatnagar Principal & Director Poonindra College of Engineering, Jaipur</p>
<ul style="list-style-type: none"> Highly recognized and renowned affiliated technical institutions at own PCE campus with laptop and internet 2.0 lab requirement Affiliated to IIT, Kota & approved by AICTE, New Delhi The most preferred BBA Accredited Engineering College with ranking of its specializations of Engineering at 101 Level (CDS, EDS, AS, MS, IT, CPE) and Best Placement (CS & EDS) The only institution permitted by IIT to admit High Potential students Admitted on basis of students by IIT Is excellent institution building its support in all sectors of education, research and development 	<p>Course Modules</p> <ul style="list-style-type: none"> Advanced for Communication Technology Real Time Project Based Design for High Speed Communication Systems State-of-the-art Networking (5G): Its context and standards in industry 4.0 and 5G Introduction to 5G communications Evolution of Telecommunication towards 5G and beyond Cooperation of 5G Multimedia applications Evolution of 5G Communication Technology from Internet Engineering to 5G Conventional Telecommunication Computer Networks Artificial Intelligence Based Cyber Control 5G network Artificial Intelligence in Cooperative 5G/6G (4G) Networks Cooperative Systems for 5G and beyond Security Issues with 5G/6G 5G/6G Keying and Cooperative 5G/6G Communication CRM and Artificial Intelligence 	<p>ADVISORS</p> <p>Mr. Pradyumn Sharma Vice Principal, Poonindra College of Engineering, Jaipur</p> <p>Dr. Rakesh Mehta Dean, First Year Poonindra College of Engineering, Jaipur</p> <p>Mr. Devendra Kumar Regulator, Poonindra College of Engineering, Jaipur</p>
<p>ABOUT THE DEPARTMENT</p> <p>The Department of Electronics and Communication Engineering (ECE) was established in the year 2009. Following Board of Accreditation (BoA) awarded by AICTE Jaipur in the year 2009, 2014 & 2017 for subsequent three years. It has intake capacity of 700. It also offers B.Tech in VLSI Design with intake capacity of 10 students. The department has highly qualified committed and research oriented faculty members. The department has laboratories as per Poonindra Technical University Agreement with State of the Art facilities as provided below: such as Electronics Circuits, 3D Design, 5G/6G design of signal processing, Embedded Systems, Advanced Wireless Communication and 5G/6G etc. The activities being carried out in</p>	<p>COORDINATORS</p> <p>Dr. Pooja Kaur Associate Professor, ECE, PCE</p> <p>Dr. Naveen Mishra Assistant Professor, ECE, PCE</p>	<p>STTP ORGANIZING COMMITTEE</p> <p>Dr. Anita Singh Associate Professor, ECE</p> <p>Mr. Anil Kumar Jain Associate Professor, ECE</p> <p>Mr. Chiragpal Sharma Associate Professor, ECE</p> <p>Mr. Mahesh Sharma Associate Professor, ECE</p> <p>Mr. Mahesh Kumar Associate Professor, ECE</p> <p>Mr. Jyoti Singh Associate Professor, ECE</p>

PROGRAM SCHEDULE:



POORNIMA

COLLEGE OF ENGINEERING

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

Department of Electronics & Communication Engineering

Third AICTE-AQIS Sponsored STTP on Artificial Intelligence and 5G Communication Technology from December 07-12, 2020

	9:30 AM	10:00 AM-11:30 AM	11:45 AM-01:15 PM	02:00 PM-03:30 PM
Monday (07.12.2020)	Inaugural Session Chief Guest: Dr. Manoj K. Shukla, Pro Vice Chancellor, Harcourt Butler Technical University, Kanpur & Guest of Honor: Mr. Yogesh Bhaskar, General Manager, BSNL, Barmer	Multiple Access Schemes in 5G Mobile Communication Dr. Manoj K. Shukla, Pro Vice Chancellor, Harcourt Butler Technical University, Kanpur	Time Sensitive Networking (TSN): It's Context & Standards in Industry 4.0 & 5G Dr. N. S. Rajput, Associate Professor, IIT Varanasi	Application of Machine Based Technique in the Physical Layer of Future Wireless Communication System Dr. Seemanti Saha, Assistant Professor, NIT Patna
Tuesday (08.12.2020)		Evolution of 5G Communication Technology from Antenna Engineer'S Perspective Dr. Surajit Kundu, Assistant Professor, NIT Sikkim	Evolution of Telecommunication Towards 5G & Beyond Dr. Jaisingh Thangaraj, Assistant Professor, IIT Dhanbad	CRM & Artificial Intelligence Vikas Sharma, Salesforce Scrum Master, Horizontal Digital
Wednesday (09.12.2020)		Convolutional Neural Network for Computer Vision Dr. Kuldeep Singh, Assistant Professor, MNIT Jaipur	Artificial Intelligence Based Power Control in B5G Network Dr. Shahid Mehraj Shah, Assistant Professor, NIT Srinagar	mm Wave for Vehicular Communication Dr. Aniruddha Chandra, Associate Professor, NIT Durgapur
Thursday (10.12.2020)		Artificial Intelligence in Cooperative Noma (5G) Network Dr. Kiran Kumar Gurrula, Assistant Professor, NIT Andhra Pradesh	Drone Base Stations for 5G & Beyond Dr. Chayan Bhar, Assistant Professor, NIT Warangal	Cooperation in IoT: A Multi-User Perspective Dr. Sam Darshi, Assistant Professor, IIT Ropar
Friday (11.12.2020)		Cellular Traffic Prediction Using Deep Learning Dr. P. Prakasam, Professor & Head, VIT Vellore	Security Issue With Mobile IP Dr. Karan Verma, Assistant Professor, NIT Delhi	Fiber Optics Based Devices for High Speed Communication Systems Dr. Sanjeev Kumar Raghuvanshi, Associate Professor, IIT Dhanbad
Saturday (12.12.2020)		Antennas for Communication Technology Dr. Mithilesh Kumar, Professor, RTU Kota	UAV Relaying Assisted Cooperative 5G Communication Dr. Anirudh Agarwal, Assistant Professor, LNMIIT Jaipur	Advances in Spider Monkey Optimization Algorithm Dr. Harish Sharma, Associate Professor, RTU Kota


Dr. Mahesh Bundele
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Shilapura, JAIPUR

INAUGURAL SESSION:



SHORT TERM TRAINING PROGRAM

On

Artificial Intelligence & 5G Communication Technology

December 7-12, 2020

Sponsored by AICTE Quality Improvement Scheme (AQIS)

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



Date: December 7, 2020

Time: 09:30 – 10:05 AM

Venue: Online (<https://meet.google.com/eaf-ufri-utt>)

Q- Sheet Inaugural Session

S. No	Activity	Duration	Time
1.	Welcome of Dignitaries and Introduction of STTP by Dr. Garima Mathur , Head & Professor ECE, PCE • Dr. Manoj K. Shukla Pro Vice Chancellor Harcourt Butler Technical University, Kanpur (Chief Guest) • Mr. Yogesh Bhasker , General Manager, BSNL, Barmer (Guest of Honor) • Ar. Rahul Singhi , Director, Poornima Group • Dr. Mahesh Bunde , Director & Principal, PCE • Mr. Pankaj Dhemla , Vice Principal, PCE	03 Min	09:30 AM-09:33 AM
2.	Welcome address by Dr. Mahesh Bunde , Director & Principal, PCE	05 Min	09:33 AM-09:38 AM
3.	Motivational Words by Ar. Rahul Singhi , Director, Poornima Group	05 Min	09:38 AM-09:43 AM
4.	Address by Guest of Honor Mr. Yogesh Bhasker (General Manager, BSNL), Barmer	10 Min	09:43 AM-09:53 AM
5.	Inaugural Address by Dr. Manoj K. Shukla Pro Vice Chancellor Harcourt Butler Technical University, Kanpur (Chief Guest)	10 Min	09:53 AM-10:03 AM
6.	Vote of Thanks by Dr. Payal Bansal , Associate Prof., ECE, PCE	02 Min	10:03 AM-10:05 AM

DETAILS OF RESOURCE PERSONS:



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Day 1: 7 December 2020:

Inaugural session witnessed the presence of Chief Guest Prof, Dr. Manoj K. Shukla, Pro Vice Chancellor Harcourt Butler Technical University Kanpur, Guest of honour Mr. Yogesh Bhasker. General manager BSNL Barmer ,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. Mnaoj addressed the gathering with his knowledgeable words,& then after Mr. Yogesh 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).

Glimpsics of Inaugural session



Expert Talk-1

Topic: Multiple Access Schemes In 5 G Mobile Communication

Resource Person: Dr. Manoj K. Shukla, Pro

Vice Chancellor

Venue: Online Via Google Meet

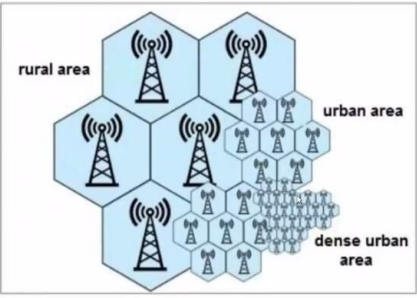
Dr. Manoj K. Shukla, Pro Vice Chancellor Delivered his talk on **Multiple Access Schemes In 5 G Mobile Communication**. He told us about the current radio, its applications etc. He also update about the new unique features bring some new challenges in the design of the new Trans receivers with 5G Communication. Also brief about the security aspects of the 5G & its BW, Its advantages, its speed etc.



day-1-Session-1-Dr. manoj.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Organization of Cells Within a Cellular Network



Cells vary in size

25:40 1:00:41

9:57 PM 6/14/2021

day-1-Session-1-Dr. manoj.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Multiple Access techniques

- Goal
allow many users to simultaneously share a communications resource
- Time Division Multiple Access (TDMA)
- Space Division Multiple Access (SDMA)
- Frequency Division Multiple Access (FDMA)
- Polarization Division Multiple Access (PDMA)
- Code Division Multiple Access (CDMA)
- Interleave Division Multiple Access (IDMA)
- Orthogonal Frequency Division Multiple Access (OFDMA)

27:40 1:00:41

9:58 PM 6/14/2021

day-1-Session-1-Dr. manoj.mp4 - VLC media player

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International Cocktail Party

- FDMA – Large room divided up into small rooms with limited microphones. Each pair of people takes turns speaking.
- TDMA – Large room divided up into small rooms with limited microphones. Certain pairs of people per room, however, each pair gets limited seconds to speak.
- CDMA – No small rooms. Everyone is speaking in different languages with own microphones. If voice volume is minimized, the number of people is maximized.

25:40 1:00:41

9:59 PM 6/14/2021

day-1-Session-1-Dr. manoj.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Disadvantages to using FDMA

- The presence of guard bands
- Requires tight RF filtering to minimize adjacent channel interference
- Maximum bit rate per channel is fixed
- Small inhibiting flexibility in bit rate capability
- Does not differ significantly from analog system
- If channel is not in use, it sits idle

34:00 1:00:41

9:59 PM 6/14/2021

day-1-Session-1-Dr. manoj.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

TDMA Details

- The incoming data from each source are briefly buffered and scanned to form a composite digital data stream $m_c(t)$.

37:10 1:00:41

9:59 PM 6/14/2021

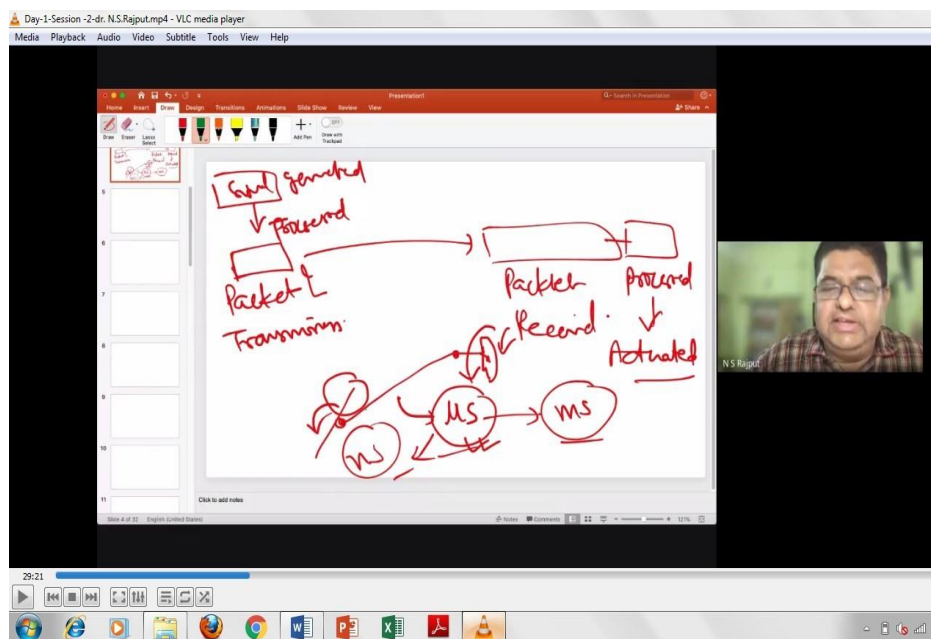
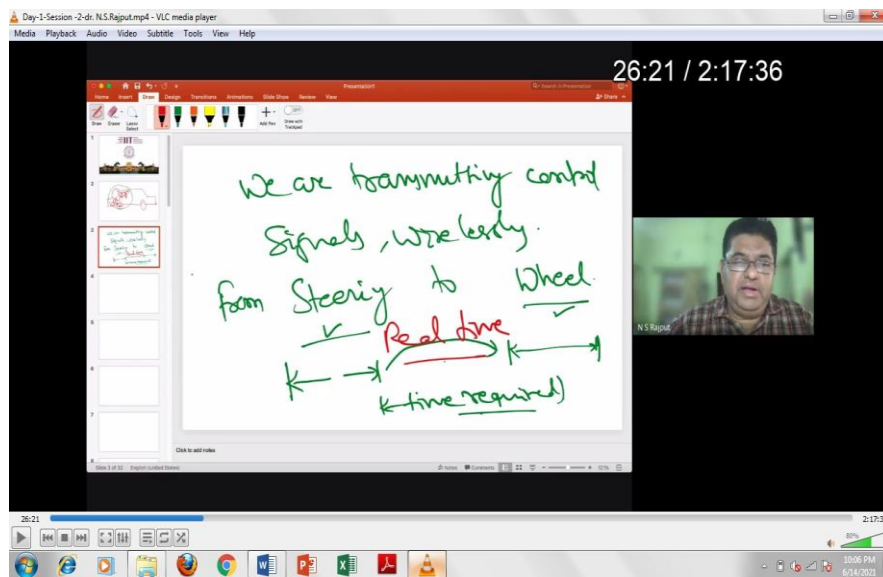
Expert Talk-2

Topic: Time Sensitive Networking (Tsn): It'S Context and Standards in Industry 4.0 And 5G

Resource Person: Dr. N. S. Rajput, Associate Professor

Venue: online

Memories of event



The screenshot shows a VLC media player window displaying a video lecture. The main content is a presentation slide with a diagram and handwritten notes. The diagram illustrates a network scenario with a central node labeled 'guaranteed service' and two peripheral nodes. A red circle highlights the central node, and a green circle highlights the peripheral nodes. Handwritten notes in red ink state: 'So, problem is with the N/w protocol'. The presentation software interface includes a toolbar with various drawing tools and a sidebar with a list of slides. A small video inset on the right shows a man speaking. The VLC player interface at the bottom shows the video is at 39:01 and 2:17:36.

The screenshot shows a VLC media player window displaying a video lecture. The main content is a presentation slide with handwritten notes and a diagram. The notes are written in green ink and include: '- leaky Bucket Algorithm)', 'Network Congestion', and 'Packets are forming queue'. The diagram shows a network node with multiple incoming arrows and a queue of packets. Handwritten notes in red ink state: 'Some packets are dropped'. The presentation software interface includes a toolbar with various drawing tools and a sidebar with a list of slides. A small video inset on the right shows a man speaking. The VLC player interface at the bottom shows the video is at 34:01 and 2:17:36.

Expert Talk-3

Topic: Application of Machine Based Technique In The Physical Layer Of Future Wireless Communication System

Resource Person: Dr. Seemanti Saha, Assistant Professor

Venue: online

Day-1-Session 3-Dr. Seemanti saha.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Defining Supervised Learning

- Goal: minimize average loss on the test pair (*generalization loss*)

$$L_p(\hat{t}) = E_{(x,t) \sim p_{xt}} [\ell(t, \hat{t}(x))]$$

[O. Simeone '18]

01:19 34:05

Day-1-Session 3-Dr. Seemanti saha.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Logistic Regression

- Parametric probabilistic model:

$$p(t=1|x, w) = \sigma(w^T \phi(x))$$

where $\sigma(a) = (1 + \exp(-a))^{-1}$ is the sigmoid function.

[O. Simeone '18]

02:00 34:05

Dr. Mahesh Bunde
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Day-1-Session 3-Dr. Seemanti saha.mp4 - VLC media player

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At the Edge: PHY

- Channel equalization in the presence of non-linearities, e.g., for **optical links** {regression}
- Algorithm deficit
- Distance weighted K-Nearest Neighborhood (DKNN) algorithm

[Wang et al. '16]

Seemanti Saha

14:16 34:05

80%

10:11 PM 6/14/2021

Day-1-Session 3-Dr. Seemanti saha.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

At the Edge: PHY

- Channel equalization in the presence of non-linearities, e.g., for **satellite links** with non-linear amplifiers {regression}
- Algorithm deficit

[Bouchired et al., 98]

Seemanti Saha

14:42 34:05

80%

10:11 PM 6/14/2021

Day-1-Session 3-Dr. Seemanti saha.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

At the Edge: PHY

- Channel decoding for high density parity check codes { classification }
- Leverage domain knowledge to choose the hypothesis class
- Deep Neural Network decoder is used

[Nachmani et al '16]

Legend:

- input neuron
- atanh+tanh neuron
- tanh neuron
- atanh neuron
- sigmoid neuron

Seemanti Saha

16:06 34:05

10:12 PM 6/14/2021

Expert Talk-4

Topic: Evolution Of 5G Communication Technology from Antenna Engineer'S Perspective

Resource Person: Dr. Surajit Kundu, Assistant Professor



Venue: online

Day-2-session-1-Dr. Surajit Kundu.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Evolution of 5G Communication Technology from Antenna Engineer's Perspective

STTP organized by Dept. of ECE, Poornima College of Engineering, Jaipur

Dr. Surajit Kundu
Dept. of Electronics and Communication Engineering
National Institute of Technology Sikkim

Surajit Kundu

03:12 1:31:05

10:54 PM 6/14/2021


Dr. Mahesh Bundele
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Day-2-session-1-Dr. Surajit Kundu.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

vyasa-prasadac chrutavan
etad guhyam aham param
yogam yogesvarat krsnat
saksat kathayatah svayam

By the mercy of Vyasa, I have heard these most confidential talks directly from the master of all mysticism, Krisna, who was speaking personally to Arjuna.

04:12

Windows taskbar icons: Internet Explorer, VLC, File Explorer, Chrome, Word, PowerPoint, Excel, PDF, VLC.

Day-2-session-1-Dr. Surajit Kundu.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

EARLY DAYS OF COMMUNICATION

Images illustrating early communication technologies:

- Gutenberg's press
- Alexander Graham Bell's Telephone 1876
- Sheet metal Telephone 1894

06:22

Windows taskbar icons: Internet Explorer, VLC, File Explorer, Chrome, Word, PowerPoint, Excel, PDF, VLC.

System tray: 80% battery, 10:15 PM, 6/14/2021.

Day-2-session-1-Dr. Surajit Kundu.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

James Clerk Maxwell
1831-1879

Nikola Tesla
1856-1943

Heinrich Rudolph Hertz
1857-1894

Jagdish Chandra Bose
1858-1937

Guglielmo Marconi
1874-1937

Maxwell had mathematically established that visible light is an EM phenomenon. Hertz generated electromagnetic waves having 66 cm wavelength which traveled through space and produced a spark at a distance. He carried out several experiments to show that these waves have similar properties as light.

Nikola Tesla: Inventor of Radio telegraphy, Alternating current, induction motors etc. Marconi used Tesla coils and earthing for his transmitters

Marconi made history when he transmitted the Morse code of "S" across the Atlantic, from Cornwall in England to Newfoundland in Canada on 12th December 1901.

10:15 PM
6/24/2021

Day-2-session-1-Dr. Surajit Kundu.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

COMMUNICATION NOW A DAYS

SPUTNIK 1 (1957)

ARYABHATA (1975)

CHANDRAYAAN-2 GSLV Mk-III

WEARABLE DEVICES

5G Communication: Networked society

10:16 PM
6/24/2021



Expert Talk-5

Topic: Evolution of Telecommunication Towards 5G And Beyond

Resource Person: Dr. Jaishing Thangaraj, Assistant Professor

Venue: online

1G Vs. 2G Vs. 3G Vs. 4G Vs. 5G (Contd.,)

- The aim of wireless communication is to provide high quality, reliable communication just like wired communication (optical fibre) and each **new generation** of services represents a big step (a leap rather) in that direction.
- This evolution journey was started in **1979** from 1G and it is still continuing to 5G.

Features	1G	2G	3G	4G	5G
Start Development	1979/1984	1980/1999	1990/2002	2000/2010	2010/2015
Technology	AMPS, NMT, TACS	GSM	WCDMA	LTE, WiMax	MIMO, mm Waves
Frequency	30 KHz	1.8 GHz	1.6 - 2 GHz	2 - 8 GHz	3 - 30 GHz
Bandwidth	2 kbps	14.4 - 64 kbps	2 Mbps	2000 Mbps to 1 Gbps	1 Gbps and higher
Access System	FDMA	TDMA, CDMA	CDMA	CDMA	OFDM, BDMA
Core Network	PSTN	PSTN	Packet Network	Internet	Internet

Dept of Electronics Engineering, Indian Institute of Technology (IIT), Hyderabad

Day-2-session-2-Dr. Jaisingh Thangaraj -Part-2.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Circuit Switching	Packet Switching
A single connection which also leads to a single path for establishing a connection between 2 points.	A packet is simply data that has been divided into smaller units along with a header, for ease of transfer containing signal information.
A circuit needs to be established to make sure that data transmission takes place.	Each packet containing the information that needs to be processed goes through the dynamic route.
A uniform path is followed throughout the session.	There is no uniform path that is followed end to end through the session.
It is most ideal for voice communication, while also keeping the delay uniform.	It is used mainly for data transmission as the delay is not uniform.
Without a connection, it cannot exist, as the connection needs to be present on a physical layer.	A connection is not necessary, as it can exist without one too. It needs to be present on a network layer.

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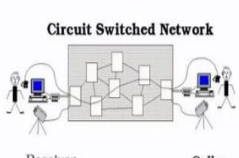
19:45 42:41

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Day-2-session-2-Dr. Jaisingh Thangaraj -Part-2.mp4 - VLC media player

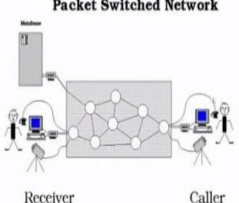
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Circuit Switched Network



Receiver Caller

Packet Switched Network



Receiver Caller

Dept of Electronics Engineering, Indian Institute of Technology (IITM), Mumbai

19:13 42:41

10:18 PM 6/14/2021

Day-2-session-2-Dr. Jaisingh Thangaraj -Part-2.mp4 - VLC media player

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Classification of Networks

```
graph TD; DN[Data Networks] --> WN[Wired Networks]; DN --> Wn[Wireless Networks]; WN --> E1[Electronic]; WN --> O1[Optical]; Wn --> E2[Electronic]; Wn --> O2[Optical];
```

1. Local Area Network
2. Wide Area Network
3. Metropolitan Area Network

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20:24 42:41

10:19 PM 6/14/2021

Day-2-session-2-Dr. Jaisingh Thangaraj -Part-2.mp4 - VLC media player

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Data Communication Networks

```
graph TD; DN[Data Networks] --> WN[Wireless Networks]; DN --> ON[Optical Networks]; WN --> AN[Ad Hoc Networks]; WN --> WSN[Wireless Sensor Networks]; WN --> MANET[MANET]; AN --> VAN[Vehicle Ad Hoc Networks]; AN --> SDN[Software Defined Networks]; ON --> TDM[TDM Networks]; ON --> WDM[WDM Networks]; ON --> EON[Elastic Optical Networks];
```

Dept of Electronics Engineering, Indian Institute of Technology (IITM), Chennai

38:54 42:41

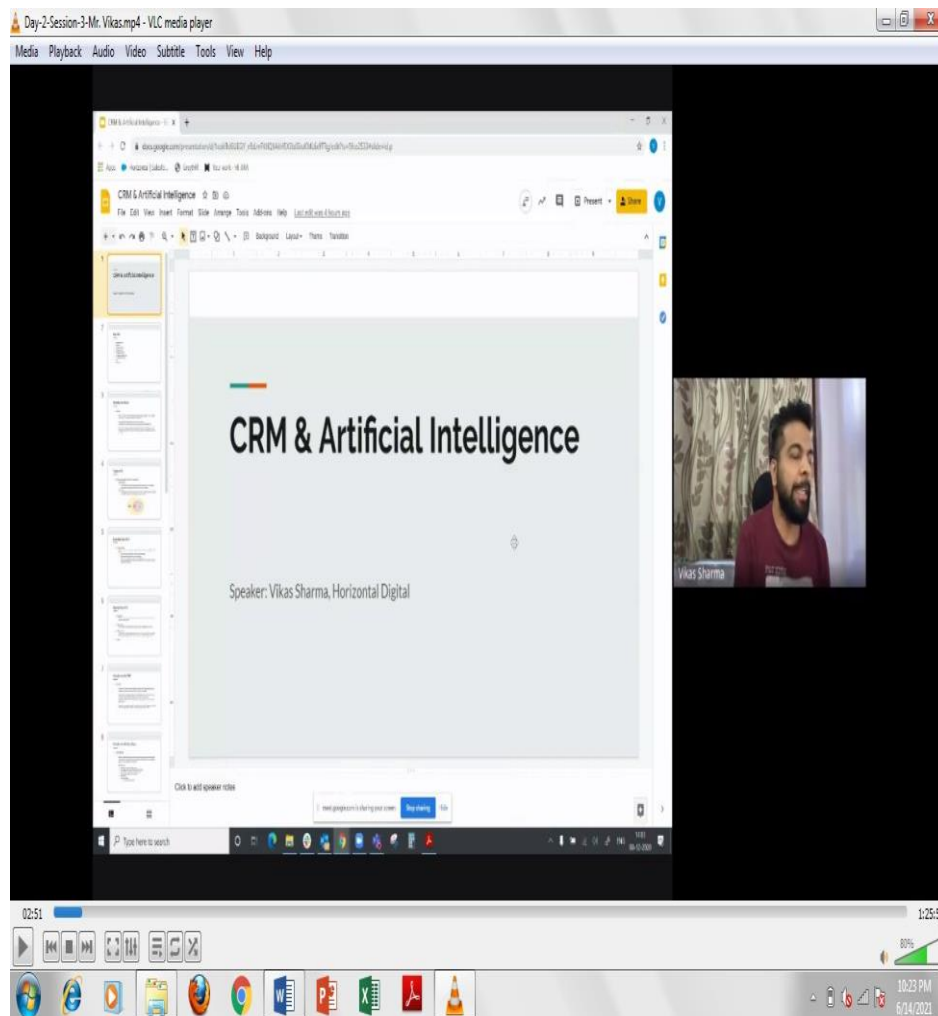
10:20 PM 6/14/2021

Expert Talk-6

Topic: Crm and Artificial Intelligence

Resource Person: Vikas Sharma, Salesforce Scrum Master

Venue: online



Day-2-Session-3-Mr. Vikas.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

CRM & Artificial Intelligence

Introduction to AI

- What is AI
 - A system with the ability to perform 'Get to Know' functions such as sensing, observing, learning, reasoning and solve problems, is considered as the Artificial Intelligence aka AI.
 - In a machine Artificial Intelligence exists when a machine has those ability. The benchmark for AI is the human level of observing, concerning reasoning, speech, and vision.
 - AI primarily works based on provided data i.e. to analyze the data and provide insights based on the data. In simple words, AI is a mechanism to deal with complex high volume data which is impossible to handle by a human being.

Click to add speaker notes

03:41 1:25:59

10:23 PM 6/14/2021

Day-2-Session-3-Mr. Vikas.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

CRM & Artificial Intelligence

Types of AI

- Artificial intelligence can be divided into three subfields:
 - Artificial intelligence
 - Machine learning
 - It is the mechanism that learn from examples and experiences, based on the idea that there exist some patterns in the data that can be identified and used for future predictions.
 - Deep learning
 - It is a subfield of machine learning concerned with algorithms inspired by computing system designed to simulate the way the human brain analyzes and processes information.

Click to add speaker notes

08:11 1:25:59

10:23 PM 6/14/2021

Day-2-Session-3-Mr. Vikas.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

15:21 1:25:59

10:23 PM 6/14/2021

Everyday Use of AI

- Am I already using AI?
 - Yes. Almost everyone who has a computer, smartphone, or other smart device is already using AI to make life easier:
 - Siri and Cortana act as your personal assistants using voice processing
 - Facebook recommends photo tags using image recognition
 - Amazon recommends products using machine learning algorithms
 - Google Maps suggests optimal driving routes using a combination of predictive models, forecasting, and optimisation techniques

Click to add speaker notes

10:23 PM 6/14/2021

Vikas Sharma

Day-2-Session-3-Mr. Vikas.mp4 - VLC media player

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19:01 / 1:25:59

19:01 1:25:59

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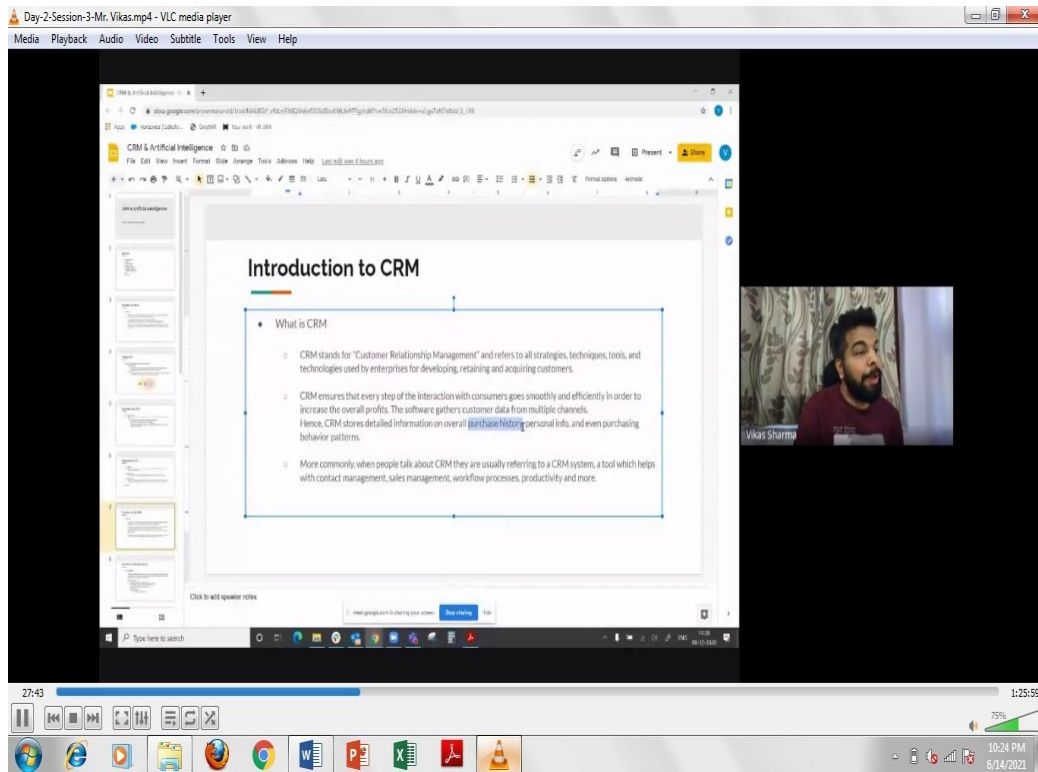
Application of AI

- AI in education:
 - AI can automate grading so that the tutor can have more time to teach. AI chatbot can communicate with students as a teaching assistant.
- AI in E-commerce:
 - AI is helping shoppers to discover associated products with recommended size, color, or even brand.
- AI in Entertainment:
 - We are currently using some AI based applications in our daily life with services such as Netflix or Amazon. With the help of ML/AI algorithms, these services show the recommendations for programs or shows.
- AI in CRM:

Click to add speaker notes

10:24 PM 6/14/2021

Vikas Sharma

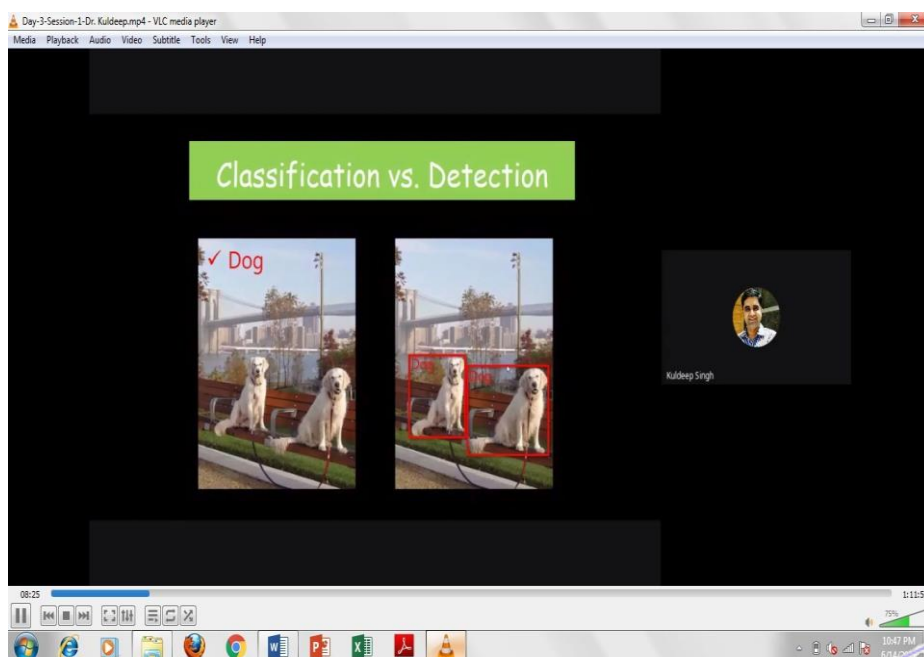


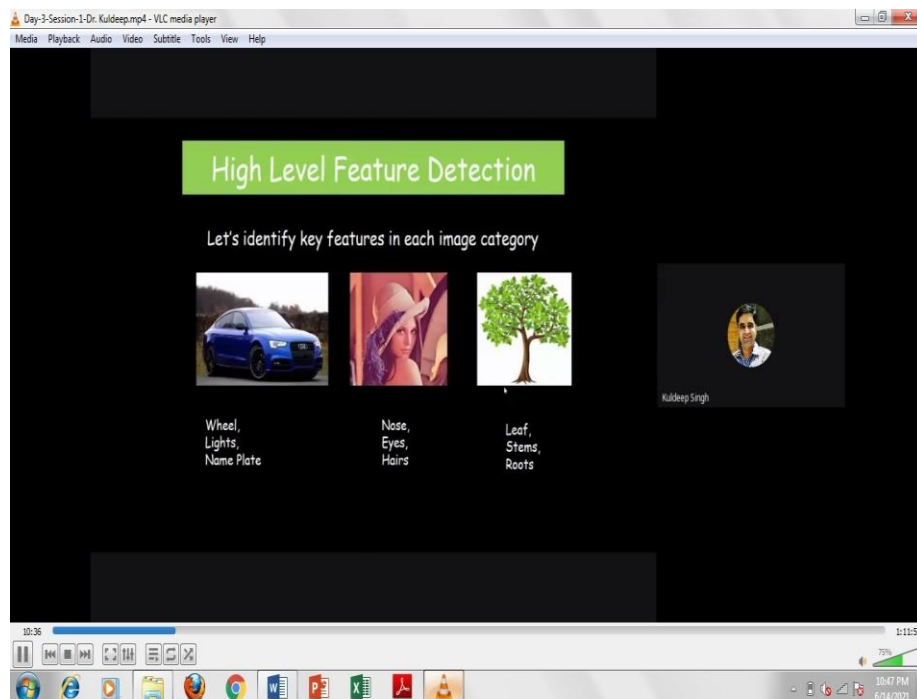
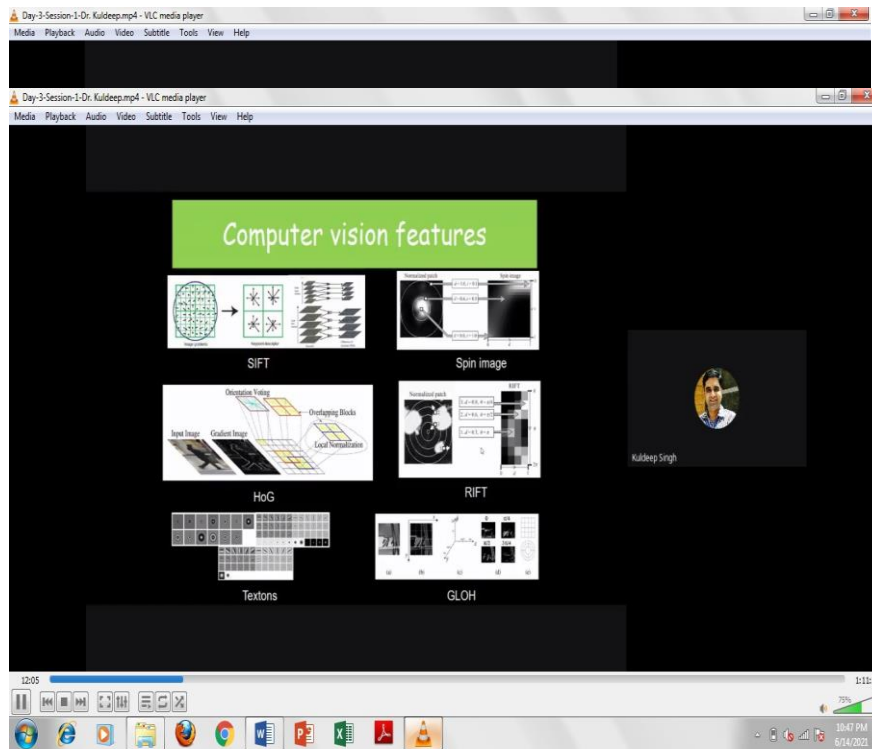
Expert Talk-7

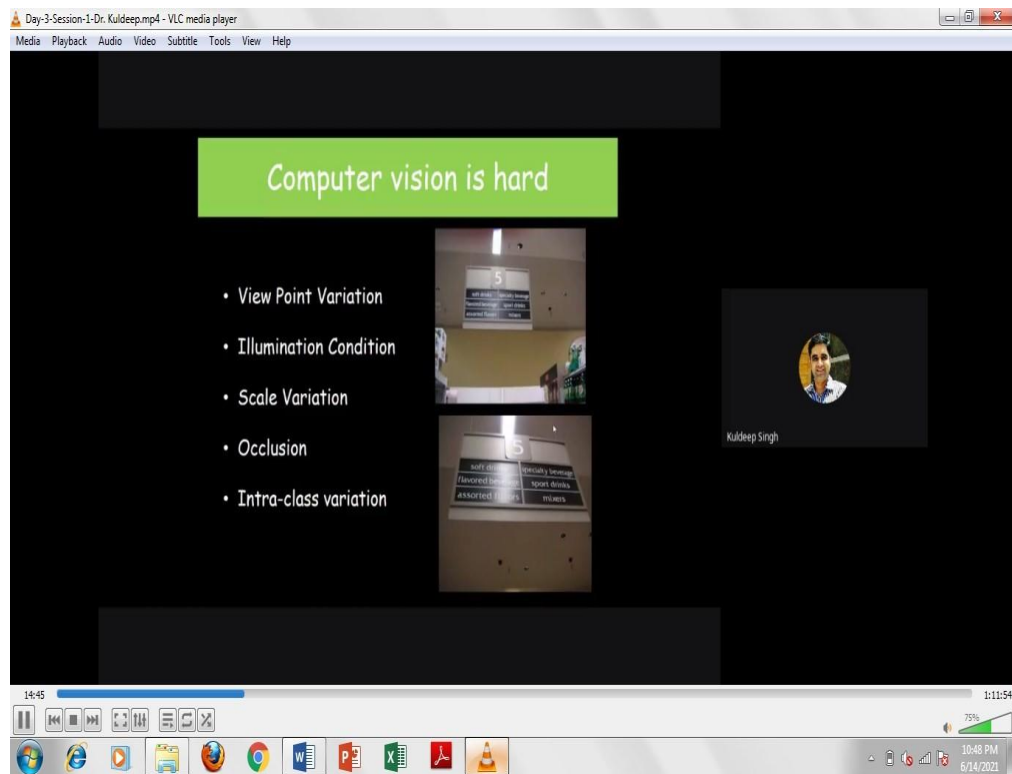
Topic: Convolutional Neural Network for Computer Vision

Resource Person Dr. Kuldeep Singh, Assistant Professor

Venue: online





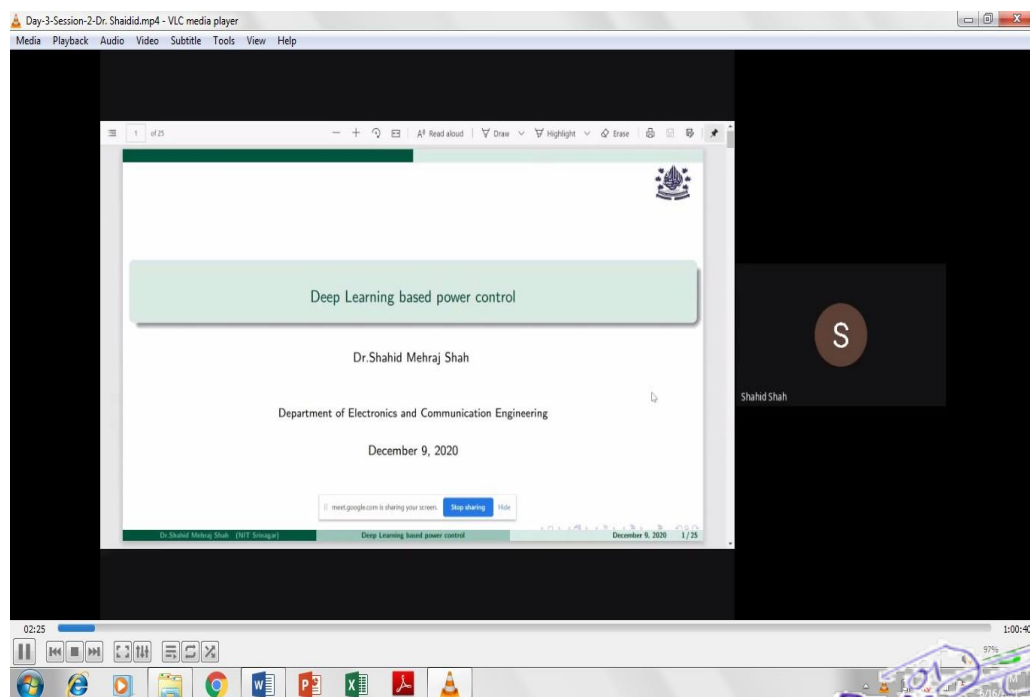


Expert Talk-8

Topic: Artificial Intelligence Based Power Control in B5G Network

Resource Person: Dr. Shahid Mehraj Shah, Assistant Professor

Venue: online



The image displays two sequential screenshots of a video lecture titled "Day-3-Session-2-Dr. Shaheed.mp4" played in a VLC media player. The lecture content is presented in a Google Meet window, which is sharing a screen from a presentation titled "Deep Learning based power control".

Top Screenshot (03:02 / 1:00:40): The presentation shows the "Outline" slide, which lists the following topics:

- 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

Bottom Screenshot (03:10 / 1:00:40): The presentation shows the "Introduction" slide, which contains the following text:

- 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.

Both screenshots show a taskbar at the bottom with various application icons (Windows, Edge, VLC, Word, PowerPoint, Excel, PDF, etc.) and a system tray on the right indicating the time as 12:21 PM on 6/16/2021.

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

Media Playback Audio Video Subtitle Tools View Help

Microsoft Whiteboard

Handwritten diagram illustrating a communication system:

```

    graph LR
      Tx[Tx] -- "old errors" --> Comm[Comm Channel]
      Comm --> Rx[Rx]
  
```

Labels and notes:

- X and $P_X(x)$ are written below Tx.
- Y and $P_Y(y)$ are written below Rx.
- Conditional probabilities are written below the channel:
 - $P_{Y|X}(y|x)$
 - $P(y=1|x=0)$
 - $P(y=0|x=0)$
- Arrows point from the channel to the conditional probabilities, with labels "channel" and "success".

06:01 1:00:40

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

Media Playback Audio Video Subtitle Tools View Help

Microsoft Whiteboard

Handwritten diagram illustrating a multi-transmitter communication system:

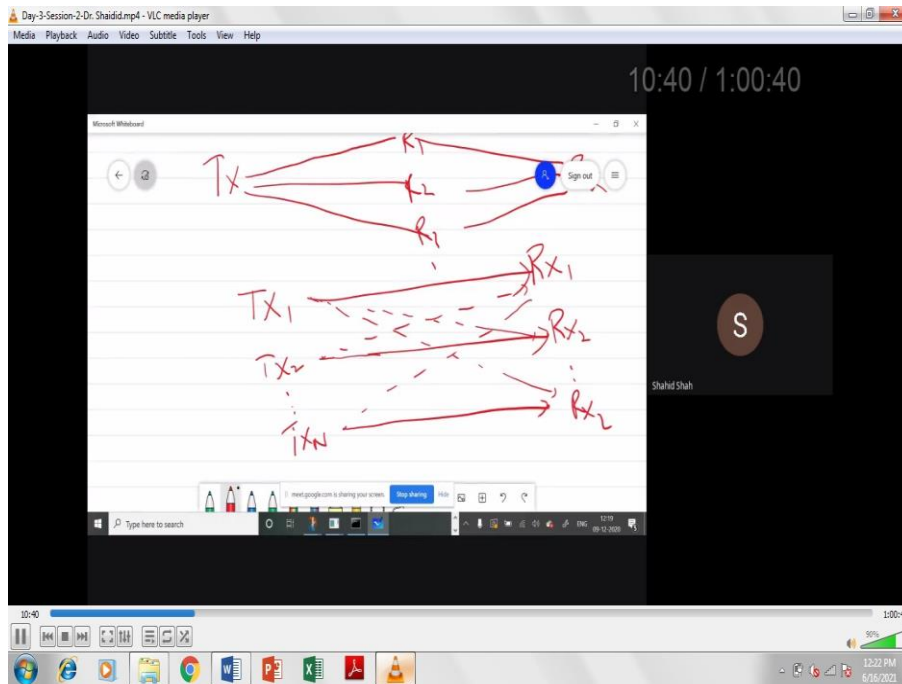
```

    graph LR
      Tx1[Tx1] --> Rx((Rx))
      Tx2[Tx2] --> Rx
      Tx3[Tx3 ..] --> Rx
  
```

Labels and notes:

- $Tx1$, $Tx2$, and $Tx3 ..$ are written in red.
- Rx is circled in red and labeled "Bom" below it.
- "Mobile user" is written in red next to $Tx1$.

08:52 1:00:40

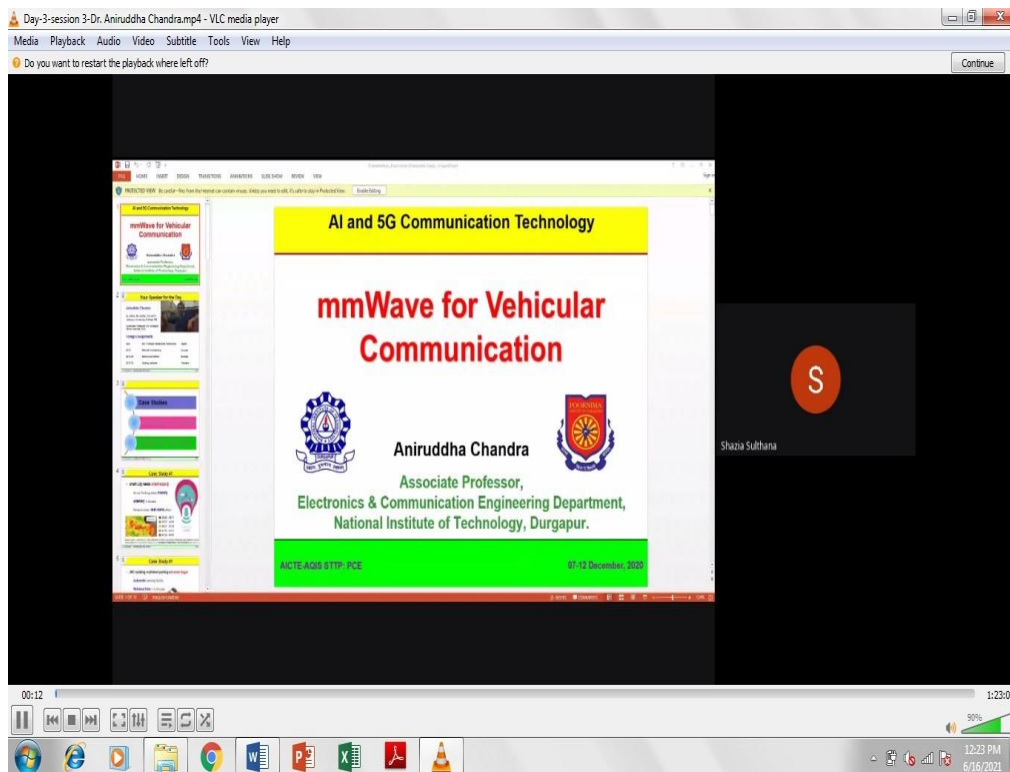


Expert Talk-9

Topic: Mmwave for Vehicular Communication

Resource Person: Dr. Aniruddha Chandra,

Associate Professor Venue: online



Day-3-session 3-Dr. Aniruddha Chandramp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

35:29 1:23:05

12:23 PM 6/16/2021

Around the World

- EU
 - 5GAA
 - CAR 2 CAR COMMUNICATION CONSORTIUM
- Japan

A. Chandra - mmWave for Veh Comm

1831

Day-3-session 3-Dr. Aniruddha Chandramp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

40:47 / 1:23:05

12:23 PM 6/16/2021

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

A. Chandra - mmWave for Veh Comm

1831

Day-3-session 3-Dr. Aniruddha Chandramp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

56:37 1:23:05

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Case Studies

- Introduction to mmWave
- mmWave for Veh Comm

A. Chandra - mmWave for Veh Comm

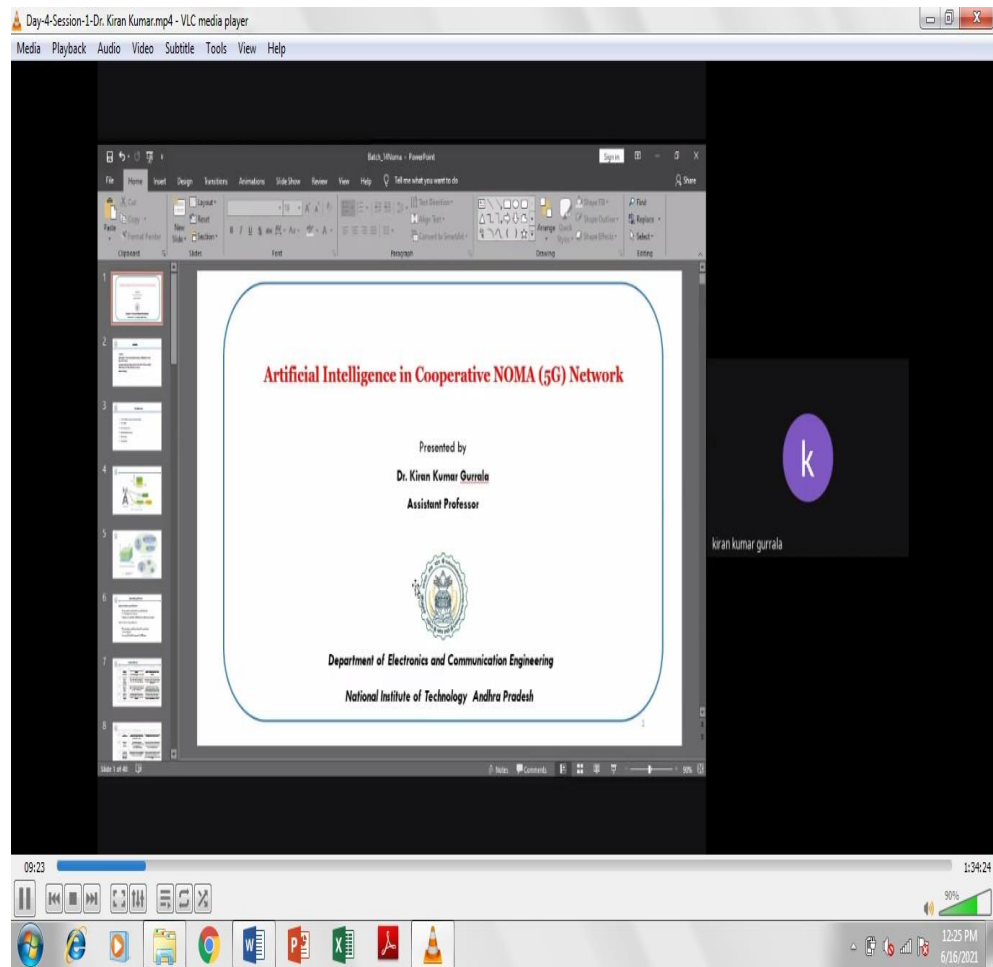
2101

Expert Talk-10

Topic: Artificial Intelligence in Cooperative Noma (5G) Network

Resource Person: Dr. Kiran Kumar Gurralla, Assistant Professor

Venue: online



Day-4-Session-1-Dr. Kiran Kumar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Batch_1\Kiran - PowerPoint

File Home Insert Design Transitions Animations Slide Show Review View Help Tell me what you want to do

Clipboard Clipboard Slides Slides Front Paragraph Paragraph Drawing Drawing Editing Editing

1 2 3 4 5 6 7 8

Outline

- Introduction
- Development of Efficient Power Allocation Schemes for NOMA based Wireless Cooperative Networks
- Performance Analysis and Power allocation for Multi Relay Wireless cooperative NOMA Networks with Diversity Combining strategies
- Research challenges

2

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Day-4-Session-1-Dr. Kiran Kumar.mp4 - VLC media player

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Batch_1\Kiran - PowerPoint

File Home Insert Design Transitions Animations Slide Show Review View Help Tell me what you want to do

Clipboard Clipboard Slides Slides Front Paragraph Paragraph Drawing Drawing Editing Editing

1 2 3 4 5 6 7 8

Introduction

- ✓ What is NOMA in wireless communication systems
- ✓ Why NOMA
- ✓ Basic relaying schemes
- ✓ Diversity Combining schemes
- ✓ Research gaps
- ✓ Future directions

3

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Day-4-Session-1-Dr. Kiran Kumar.mp4 - VLC media player

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33:02 / 1:34:24

Figure 1.2 Overview of NOMA downlink phase

33:03

1:34:24

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12:26 PM 6/16/2021

Day-4-Session-1-Dr. Kiran Kumar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

33:41

1:34:24

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12:26 PM 6/16/2021

The power allocation factors for x_1 and x_2 are a_1 and a_2 , the superimposed signal is then transmitted from base station(S) where P_s is source power.

The received signal at the i th relay is given by

$$y_{ri} = \sqrt{P_s} \left(\sqrt{a_1} x_1 + \sqrt{a_2} x_2 \right) + n_{ri} \quad (2.1)$$

The received signal at destination 1 (D1) from i th relay is given by

$$y_{rd} = \beta_i h_{i,d} y_{ri} + n_{rd} \quad (2.2)$$

The amplification factor at the relay i

$$\beta_i = \frac{\sqrt{P_s}}{\sqrt{P_s |h_{i,r}|^2 + N_0}} \quad (2.3)$$

By substituting β_i in equation (2.2) we obtain,

$$y_{rd} = \frac{\sqrt{P_s}}{\sqrt{P_s |h_{i,r}|^2 + N_0}} h_{i,d} \left(\sqrt{a_1} x_1 + \sqrt{a_2} x_2 \right) + n_{rd} \quad (2.4)$$

Day-4-Session-1-Dr. Kiran Kumar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

39:11 / 1:34:24

PowerPoint presentation content:

- (a) Illustration of Power Multiplexing NOMA: A 3D plot showing Power vs. Frequency for User n and User m.
- (b) Downlink NOMA Transmission: A diagram showing a Base Station (BS) transmitting a superimposed signal to User n and User m. SIC of User m signal is performed at User n, and User n signal detection is performed at User m.
- (c) Uplink NOMA Transmission: A diagram showing User n and User m transmitting signals to a Base Station (BS). SIC detection of User m and n is performed at the BS.

Legend: Non-cooperative NOMA (yellow arrow), Cooperative NOMA (blue arrow).

39:12

1:34:24

Windows taskbar: 12:26 PM, 6/16/2021

Expert Talk-11

Topic: Drone Base Stations For 5G And Beyond

Resource Person: Dr. Chayan Bhar, Assistant Professor

Venue: online

Day-4-Session-2-Dr. Chayan Bhar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

04:03 / 1:17:21

Network requirements from next generation networks

- (a) Network connectivity on the go: A diagram showing a car moving along a road with a base station.
- (b) Connectivity in locations with sporadic high-density of users: A photograph of a large stadium filled with people.
- (c) Connectivity to a group of highly mobile users: A photograph of a high-speed train.

Is 5G the solution?

Fig. 1. Requirements for future networks: (a) Network connectivity on the go (b) Connectivity in locations with sporadic high-density of users (c) Connectivity to a group of highly mobile users.

Chayan Bhar

04:04

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Windows taskbar: 12:26 PM, 6/16/2021

Day-4=Session-2-Dr. Chayan Bhar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Contents

- Network requirements for 5G
- Physical layer design objectives for drone-assisted networks
- Modelling user mobility behaviour
- Network design challenges for storage-as-a-service
- Current research directions in 5G networks
- Discussion and questions

06:33 1:17:21

Windows taskbar: File Explorer, Google Chrome, Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Adobe Reader, VLC media player

Day-4=Session-2-Dr. Chayan Bhar.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

07:47 / 1:17:21

Introduction

5th generation mobile network

Ultra-high speed downloads, with reliability, without lag, even in a crowded space, while on the move.

5G

Factory automation, energy distribution, road safety using IoT, telemedicine, sustainable networks

Massive MIMO with beam-forming

Low power antenna with high capacity backhaul/fronthaul

Drone base stations

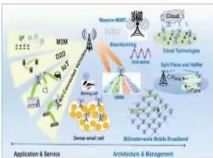


Fig. 2. Different use cases of 5G

- 10 Gbps data rate
- 1 ms latency
- 1000x bandwidth and 100 x users per unit area compared to 4G.
- 99.999% availability
- 100% coverage
- 90% reduction in network energy usage

07:48 1:17:21

Windows taskbar: File Explorer, Google Chrome, Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Adobe Reader, VLC media player

Day-4=Session-2-Dr. Chayan Bhar.mp4 - VLC media player

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15:29 / 1:17:21

Traffic types in the 5G communications

5G NR will deliver new levels of capacity and efficiency

- (a) eMBB**
 - Enhanced mobile broadband: Seamless user experience through high-speed data connectivity and high coverage.
- (b) mMTC**
 - Machine-to-machine type communications: Connect huge number of IoT type devices that generate small amounts of sporadically spread data.
- (c) URLLC**
 - Ultra-reliable low latency services: Mission-critical services that require low latency, high reliability and high availability.

Fig. 3. Traffic types proposed in 5G. (a) eMBB (b) mMTC (c) URLLC

Chayan Bhar

15:29 1:17:21

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Day-4=Session-2-Dr. Chayan Bhar.mp4 - VLC media player

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19:56 / 1:17:21

Access network: Cell-free networks to reduce handovers

- Front-haul link
- Mobile users
- EC
- CU
- AP-BS/OBS
- CPU

- Front-haul facilitates coherent processing
- Distributed massive MIMO
- TDD in the same time-frequency slot
- High coverage probability
- Beam forming, matched filtering-APs
- AP-CPU: power control coefficients and payload data

Fig. 4. (a) Schematic representation of a cell-free network and its performance (b) achievable rate per user (c) per-user downlink throughput

[1] H. Q. Ngo, et. AL, "Cell-Free Massive MIMO Versus Small Cells", IEEE Trans. On Wireless Comm., 2017.

Chayan Bhar

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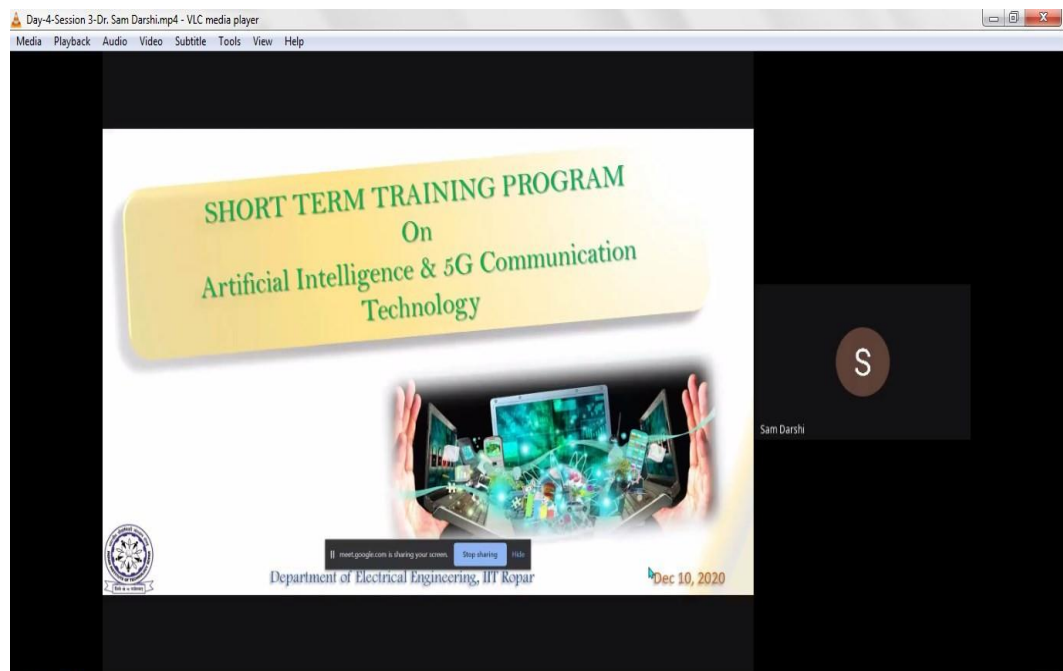
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Expert Talk-12


Topic: Cooperation In Iot: A Multiuser Perspective

Resource Person: Dr. Sam Darshi, Assistant Professor

Venue: online




The screenshot shows a VLC media player window displaying a presentation slide. The slide has a yellow header with the text "SHORT TERM TRAINING PROGRAM On Artificial Intelligence & 5G Communication Technology". Below the header is an illustration of hands holding a glowing, futuristic device. At the bottom of the slide, it says "Department of Electrical Engineering, IIT Ropar" and "Dec 10, 2020". To the right of the slide is a small circular icon with the letter 'S' and the name "Sam Darshi".



The screenshot shows a VLC media player window displaying a presentation slide. The slide has a yellow header with the text "Cooperation in IoT: A multiuser perspective". Below the header is an illustration of a multi-user IoT network with various devices and people. At the bottom of the slide, it says "Department of Electrical Engineering, IIT Ropar" and "Dec 10, 2020". To the right of the slide is a small circular icon with the letter 'S' and the name "Sam Darshi".

Day-4-Session 3-Dr. Sam Darshi.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

 **Guru Vandana**

In this digital age
Gururumma,
thank you for everything.
I search and you give me
unconditional sea of information

Google

meet.google.com is sharing your screen. Stop sharing Help


3

06:33 1:27:13

Windows taskbar: 12:31 PM 6/16/2021

Day-4-Session 3-Dr. Sam Darshi.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

 **A Different Perspective**

Following is an excerpt from Mark Zuckerberg's [recent testimony in US senate](#). It has useful lessons for those of us who are involved in or aspire to build technologies/products/services for variety of uses.

Highlighting in the following excerpt is mine.

But it's clear now that we didn't do enough to prevent these tools from being used for harm as well. That goes for fake news, foreign interference in elections, and hate speech, as well as developers and data privacy. We didn't take a broad enough view of our responsibility, and that was a big mistake. It was my mistake, and I'm sorry. I started Facebook, I run it, and I'm responsible for what happens here. So now we have to go through every part of our relationship with people and make sure we're taking a broad enough view of our responsibility. It's not enough to just connect people, we have to make sure those connections are positive. It's not enough to just give people a voice, we have to make sure people aren't using it to hurt people or spread misinformation. It's not enough to give people control of their information, we have to make sure developers they've given it to are protecting it too. Across the board, we have a responsibility to not just build tools, but to make sure those tools are used for good.

-Balwinder

meet.google.com is sharing your screen. Stop sharing Help

4

06:45 1:27:13

Windows taskbar: 12:31 PM 6/16/2021

Day-4-Session 3-Dr. Sam Darshi.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help




Figure 2. A team of humans and intelligent things. The team must work together to make effective, distributed decisions in a dynamic, disorienting, dangerous environment. (Source: Tien Pham [concept] and Evan Jensen [art], US Army Research Laboratory; used with permission.)


11

18:30 1:27:13

Day-4-Session 3-Dr. Sam Darshi.mp4 - VLC media player

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22:27 / 1:27:13



Example of connected things in daily life

12

22:28 1:27:13

Day-4-Session 3-Dr. Sam Darshi.mp4 - VLC media player

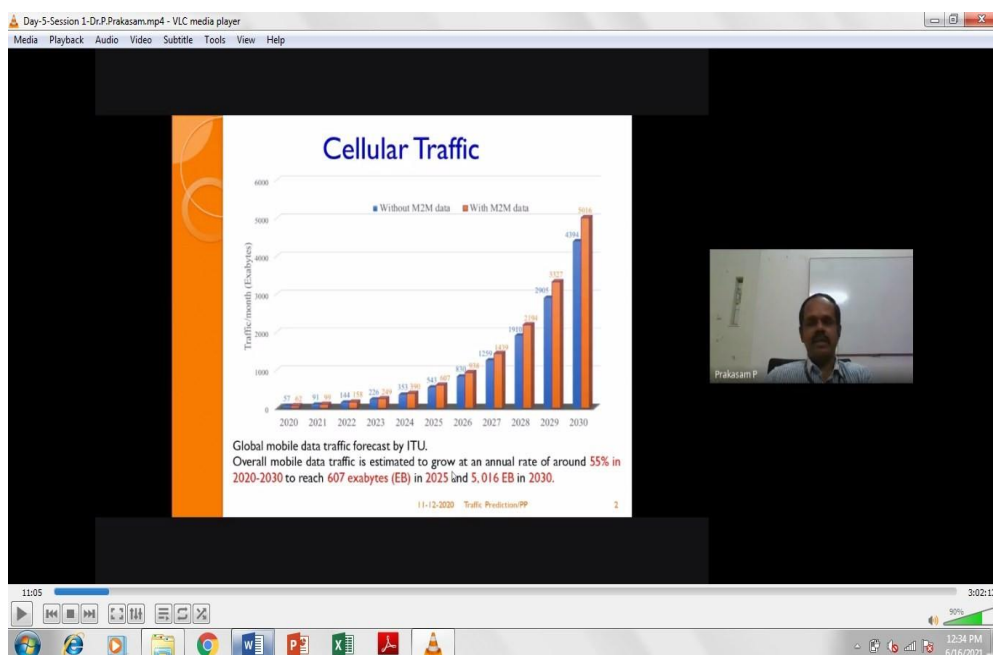
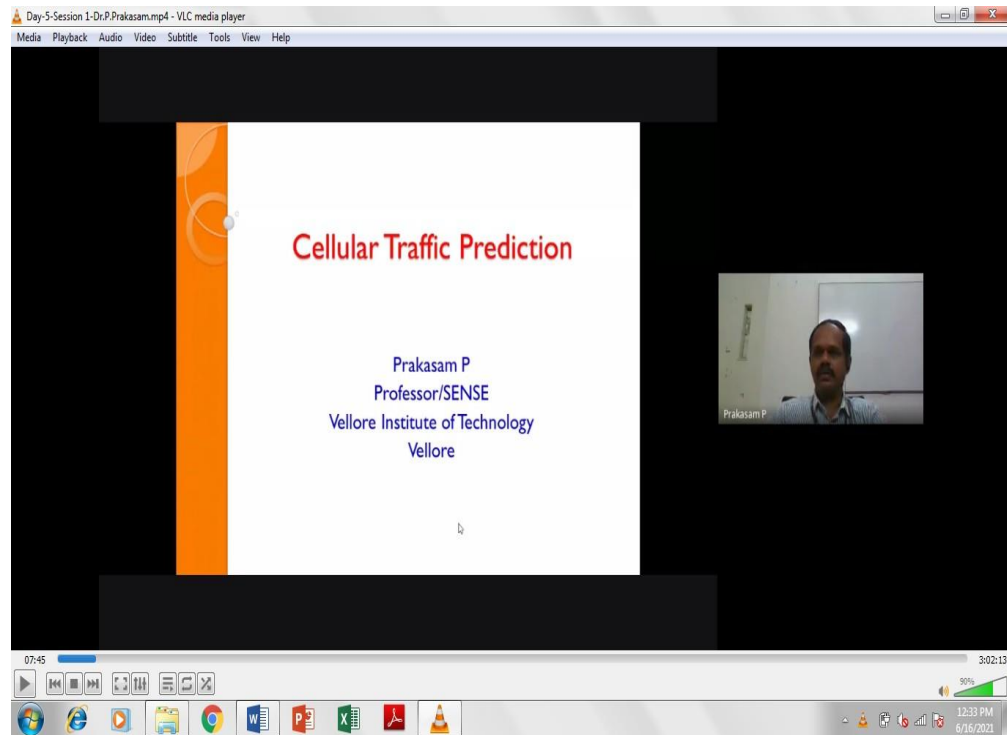
Media Playback Audio Video Subtitle Tools View Help

Expert Talk-13

Topic: Cellular Traffic Prediction Using Deep Learning

Resource Person: Dr. Prabhat Kumar Sharma, Professor & Head

Venue: online



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

Day-5-Session 1-Dr.P.Prakasam.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Challenges

- Due to the **data traffic demand** in cellular networks, improvements in **system spectral efficiency** are necessary.
- One possible solution is **increasing the base station deployment density**.
- In a relatively sparse deployment of **macro base stations**, adding another base station does not severely affect inter-cell interference, and solid cell splitting gains are easy to achieve.
- However, **site acquisition in a capacity limited dense urban area** can get prohibitively expensive.
- Challenges associated with the deployment of traditional macro base stations can be overcome by the utilization of base stations with lower transmit power, which are classified as **pico-cells, femto-cells and relay nodes**.

11-12-2020 Traffic Prediction/PP 5

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12:35 PM 6/16/2021

Prakasam P

Day-5-Session 1-Dr.P.Prakasam.mp4 - VLC media player

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Heterogeneous Networks

The diagram illustrates a Heterogeneous Network (HetNet) architecture. It features a central 'Trusted SBS' (Small Base Station) represented by a red arrow pointing to a central tower. Surrounding this are four types of cells: a 'Macro Cell' (large green circle), a 'Pico Cell' (small green circle), a 'Micro Cell' (medium green circle), and a 'Femto Cell' (small green circle). Each cell contains a mobile phone icon. The cells are interconnected, with the Macro Cell being the largest and the Femto Cell being the smallest. The diagram is enclosed in a dashed box.

11-12-2020 Traffic Prediction/PP 6

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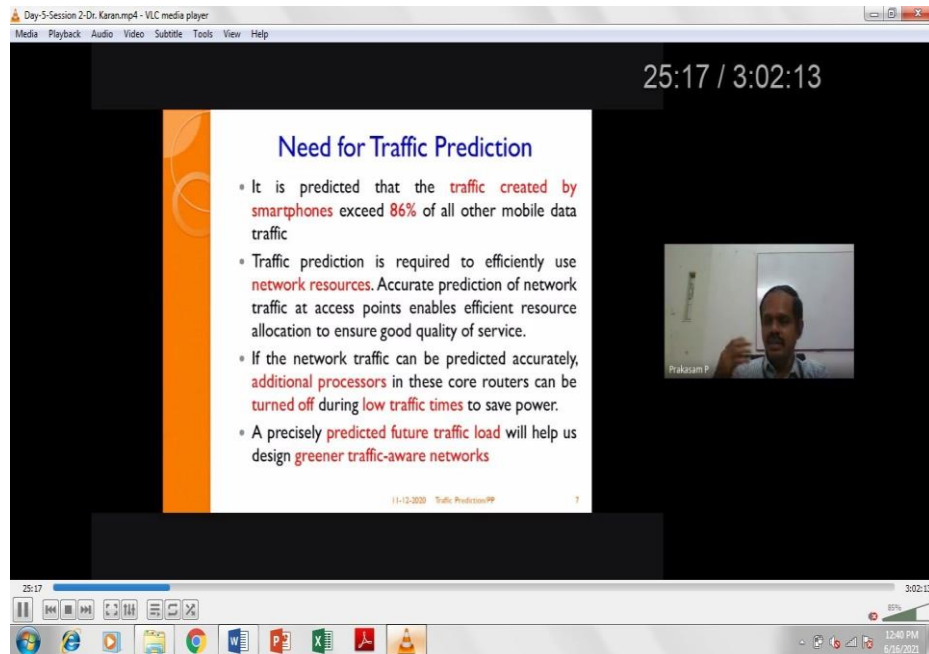
Prakasam P

Expert Talk-14

Topic: Security Issue with Mobile Ip

Resource Person: Dr. Karan Verma, Assistant Professor

Venue: online



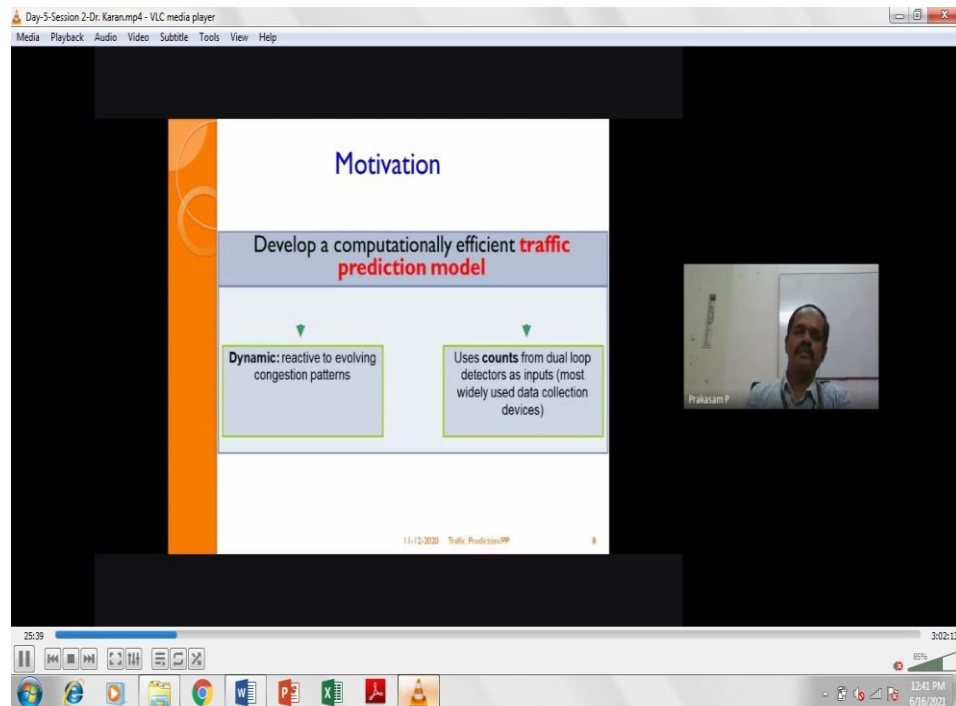
The screenshot shows a VLC media player window titled "Day-5-Session 2-Dr. Karan.mp4 - VLC media player". The main display area shows a presentation slide with the title "Need for Traffic Prediction". The slide content includes a bulleted list of points about traffic prediction and its benefits. A small video inset in the bottom right corner shows a man, presumably Dr. Karan Verma, speaking. The VLC interface includes a menu bar, a playback progress bar, and a taskbar at the bottom.

25:17 / 3:02:13

Need for Traffic Prediction

- It is predicted that the traffic created by smartphones exceed 86% of all other mobile data traffic
- Traffic prediction is required to efficiently use network resources. Accurate prediction of network traffic at access points enables efficient resource allocation to ensure good quality of service.
- If the network traffic can be predicted accurately, additional processors in these core routers can be turned off during low traffic times to save power.
- A precisely predicted future traffic load will help us design greener traffic-aware networks

11-12-2020 Traffic PredictionPP 7



The screenshot shows a VLC media player window titled "Day-5-Session 2-Dr. Karan.mp4 - VLC media player". The main display area shows a presentation slide with the title "Motivation". The slide content includes a diagram showing the development of a computationally efficient traffic prediction model, which is dynamic and reactive to evolving congestion patterns, and uses counts from dual loop detectors as inputs. A small video inset in the bottom right corner shows a man, presumably Dr. Karan Verma, speaking. The VLC interface includes a menu bar, a playback progress bar, and a taskbar at the bottom.

Motivation

Develop a computationally efficient traffic prediction model

- Dynamic: reactive to evolving congestion patterns
- Uses counts from dual loop detectors as inputs (most widely used data collection devices)

11-12-2020 Traffic PredictionPP 8

Day-5-Session 2-Dr. Karan.mp4 - VLC media player

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34:42 / 3:02:13

Lessons Learned

- Estimating experienced & predicted traffic is much more difficult than determining instantaneous travel times
- Estimation and Prediction involves
 - Forecasting future conditions on the freeway
 - Modeling the temporal & spatial evolution of congestion in the freeway section
- Implemented models should be able to provide experienced & predicted traffic

11-12-2020 Traffic PredictionPP 11

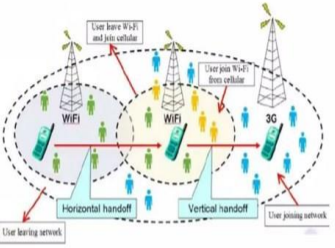
34:42 3:02:13 85% 12:41 PM 6/16/2021

Day-5-Session 2-Dr. Karan.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

31:44 / 3:02:13

Prediction - Handoff

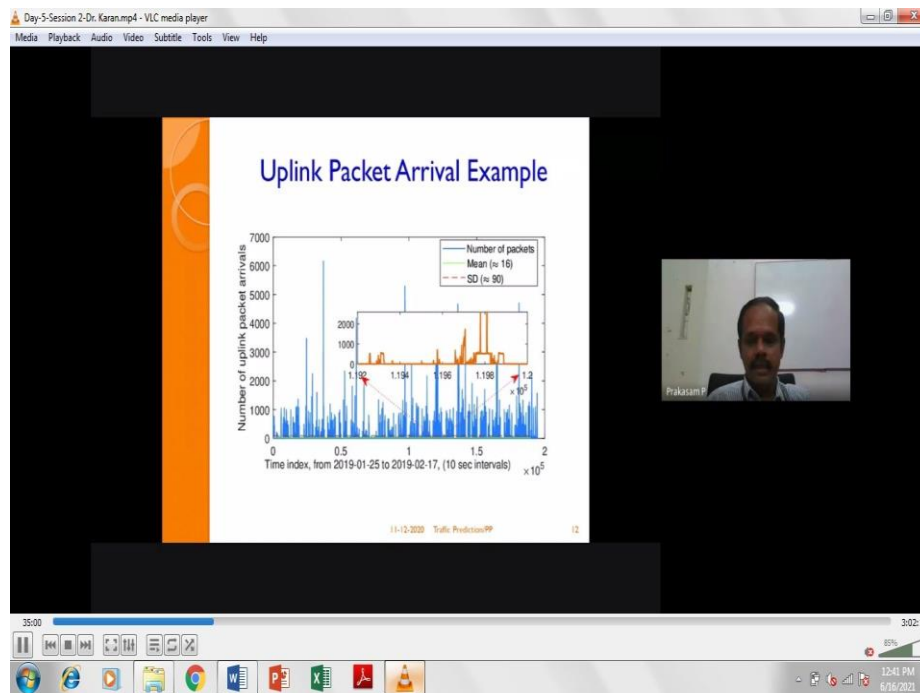


The traffic prediction can be estimated using the monitoring of the handoff mechanism also. The frequent handoff of a large number of users is monitored. One of the particular base stations is identified to measure cellular traffic.

However, these methods have a stringent limitation, since each and every time the base station should be searched which leads to overloading of the system.

11-12-2020 Traffic PredictionPP 10

31:45 3:02:13 85% 12:41 PM 6/16/2021



Expert Talk-15

Topic: Fiber Optics Based Devices For High Speed Communication Systems

Resource Person: Dr. Sanjeev Kumar Raghuwanshi, Associate Professor

Venue: online

AICTE-AQIS Sponsored Short Term Training Program (STTP)
07th - 12th December 2020

Talk on:
Artificial intelligence and 5G Communication technology
By
Dr. S. K. RAGHUWANSHI
Associate Professor
Department of Electronics Engineering,
IITISM, Dhanbad, (India).

Talk at:
Poornima College of Engineering
Department of Electronics and Communication Engineering
Sitapura, Jaipur (Rajasthan)

Sponsored by:
AICTE-AQIS

04:59 12:43 PM 6/16/2021

The screenshot shows a video player window titled "Day-5-session-3-Dr. Sanjeev.mp4 - VLC media player". The main content is a Google Meet interface. In the center, a presentation slide titled "HISTORY" is displayed. The slide lists the following milestones:

- 1880 Alexander G. Bell, Photo phone, transmit sound waves over beam of light
- 1930: TV image through uncoated fiber cables.
- Few years later image through a single glass fiber
- 1951: Flexible fiberoptic: Medical applications
- 1956: The term "fiber optics" used for the first time
- 1958: Paper on Laser & Maser

On the right side of the Meet interface, there are video feeds of participants: Dr. Garima Mathur (EC-PCE), Priya Singh, and Sanjeev raghuwanshi. The bottom of the screen shows the Windows taskbar with various application icons and a system clock indicating 12:43 PM on 6/16/2021.

The screenshot shows a video player window titled "Day-5-session-3-Dr. Sanjeev.mp4 - VLC media player". The main content is a Google Meet interface. In the center, a presentation slide titled "OPTICAL FIBER" is displayed. The slide lists the following properties and comparisons:

- Communication system with light as the carrier and fiber as communication medium
- Propagation of light in atmosphere impractical: water vapor, oxygen, particles.
- Optical fiber is used, glass or plastic, to contain and guide light waves
- Capacity
 - Microwave at 10 GHz with 10% utilization ratio: 1 GHz BW
 - Light at 100 Tera Hz (10^{14}) with 10% utilization ratio: 100 THz (10,000 GHz)

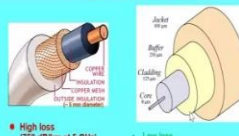
On the right side of the Meet interface, there are video feeds of participants: Dr. Garima Mathur (EC-PCE), Priya Singh, and Sanjeev raghuwanshi. The bottom of the screen shows the Windows taskbar with various application icons and a system clock indicating 12:43 PM on 6/16/2021.

Day-5-session-3-Dr. Sanjeev.mp4 - VLC media player

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COAX VS. FIBER



- High loss (700 dB/km at 5 GHz)
- Large, heavy
- Bandwidth: DC-20GHz

- Low loss (0.2 dB/km at $\lambda = 1.5 \mu\text{m}$)
- Thin, lightweight
- Bandwidth: 187-230 THz (or $\lambda = 1.3-1.6 \mu\text{m}$)

13:29 1:17:14

Day-5-session-3-Dr. Sanjeev.mp4 - VLC media player

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FIBER VS. COPPER

- Optical fiber transmits light pulses
 - Can be used for analog or digital transmission
 - Voice, computer data, video, etc.
- Copper wires (or other metals) can carry the same types of signals with electrical pulses

14:19 1:17:14

Expert Talk-16

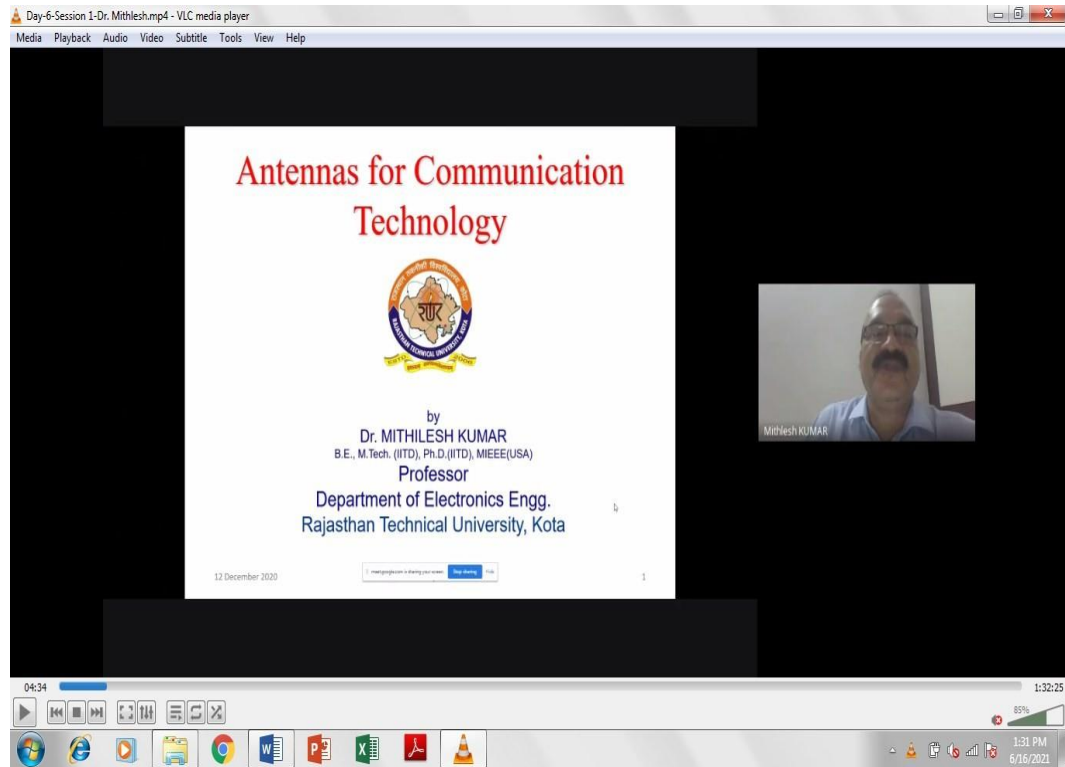
Topic: Antennas For Communication echnology

Resource Person: Dr. Mithilesh

Kumar, Professor

Venue:

online



Day-6-Session 1-Dr. Mithlesh.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

05:23 / 1:32:25

Communication Technology

- The transmission and reception of signals is accomplished with **Antennas**.
- Antennas are electrical devices that transform the electrical signals to radio signals in the form of Electromagnetic (EM) Waves and vice versa.
- These EM Waves propagates through space.
- Both transmitter and receiver consists of an antenna.

12 December 2020

Mithlesh KUMAR

05:24 1:32:25

85%

2:24 PM 6/17/2021

Day-6-Session 1-Dr. Mithlesh.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

07:17 / 1:32:25

Wireless Communications

- Terrestrial Mobile Telephony--- 0.8~1GHz
 - GSM- Global System for Mobile Communication
- Personnel Communication Services (PCS)--- 0.9~2.2GHz
 - Cellular telephone, paging
- Satellite Communications--- 1~6 GHz, 12/14 GHz
 - Multimedia broadcasting, Handheld voice and data communication.
- Wireless LANs--- ISM band: 0.9~0.928GHz, 2.4~2.8GHz and 5.7~5.8 GHz
 - Communication between Computers, between buildings and within a building

12 December 2020

Mithlesh KUMAR

07:18 1:32:25

85%

2:24 PM 6/17/2021

Day-6-Session 1-Dr. Mithlesh.mp4 - VLC media player


Media Playback Audio Video Subtitle Tools View Help

Mobile Telephony

- 1G Mobile Telephony Analog → Digital
- 2G Mobile Telephony kbps → Mbps
- 3G Mobile Data Mbps → Gbps
- 4G Mobile Broadband Data Differentiation
- 5G Mobile Everything

12 December 2020 6

07:57 1:32:25 85% 2:25 PM 6/17/2021



Day-6-Session 1-Dr. Mithlesh.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

Mobile Telephony

5G wireless, on the other hand, is expected to operate in different bands depending on the application and performance requirements

EVOLUTION OF WIRELESS TECHNOLOGY

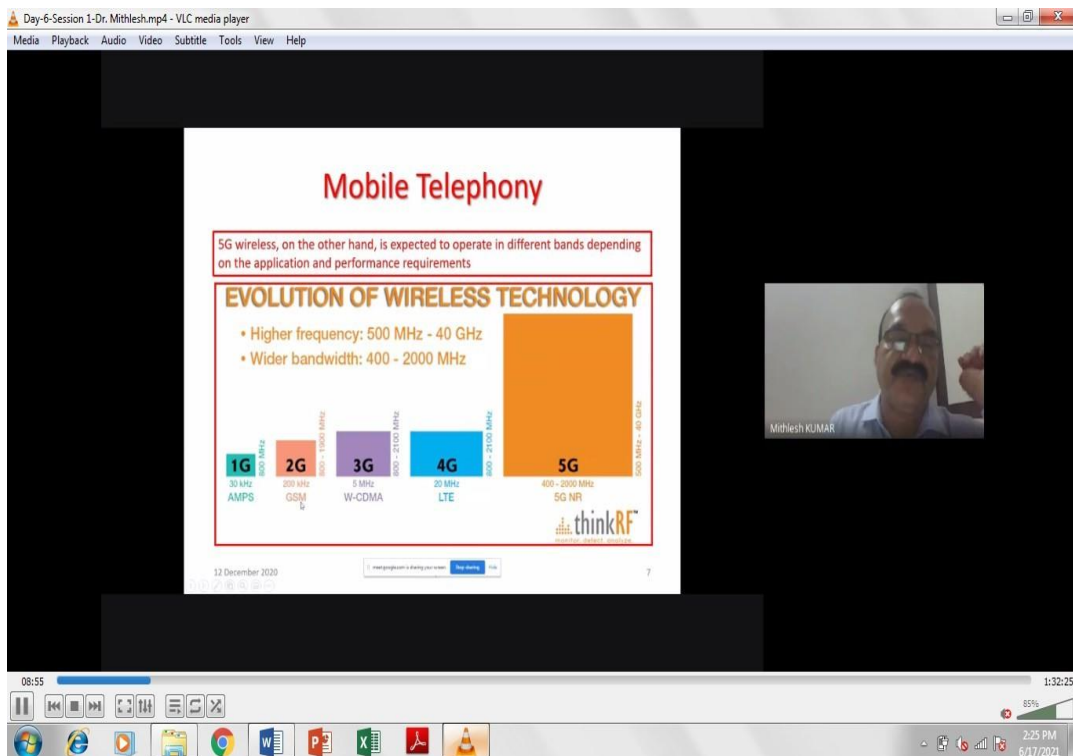
- Higher frequency: 500 MHz - 40 GHz
- Wider bandwidth: 400 - 2000 MHz

Generation	Frequency Range	Standard
1G	30 kHz	AMPS
2G	125 kHz - 1.25 MHz	GSM
3G	5 MHz - 20 MHz	W-CDMA
4G	20 MHz - 200 MHz	LTE
5G	400 - 2000 MHz - 40 GHz	5G NR

thinkRF

12 December 2020 7

08:55 1:32:25 85% 2:25 PM 6/17/2021



The screenshot shows a VLC media player window titled "Day-6-Session 1-Dr. Mithlesh.mp4". The main content is a presentation slide titled "Mobile Telephony" in red. The slide lists three bullet points: "After years of research and testing, 5G wireless networks are being deployed in cities around the world.", "Leveraging mmWave frequencies well above previously used bands, 5G wireless promises rapid speeds, wide bandwidths, near real-time latencies, and extremely high capacities.", and "However, these high-frequency signals create unique challenges for mobile operators, RF equipment providers, researchers, and RF engineers conducting RF analysis in the field." A small video inset on the right shows Dr. Mithlesh Kumar. The VLC player interface at the bottom shows a progress bar at 09:33 and a system tray with various application icons.

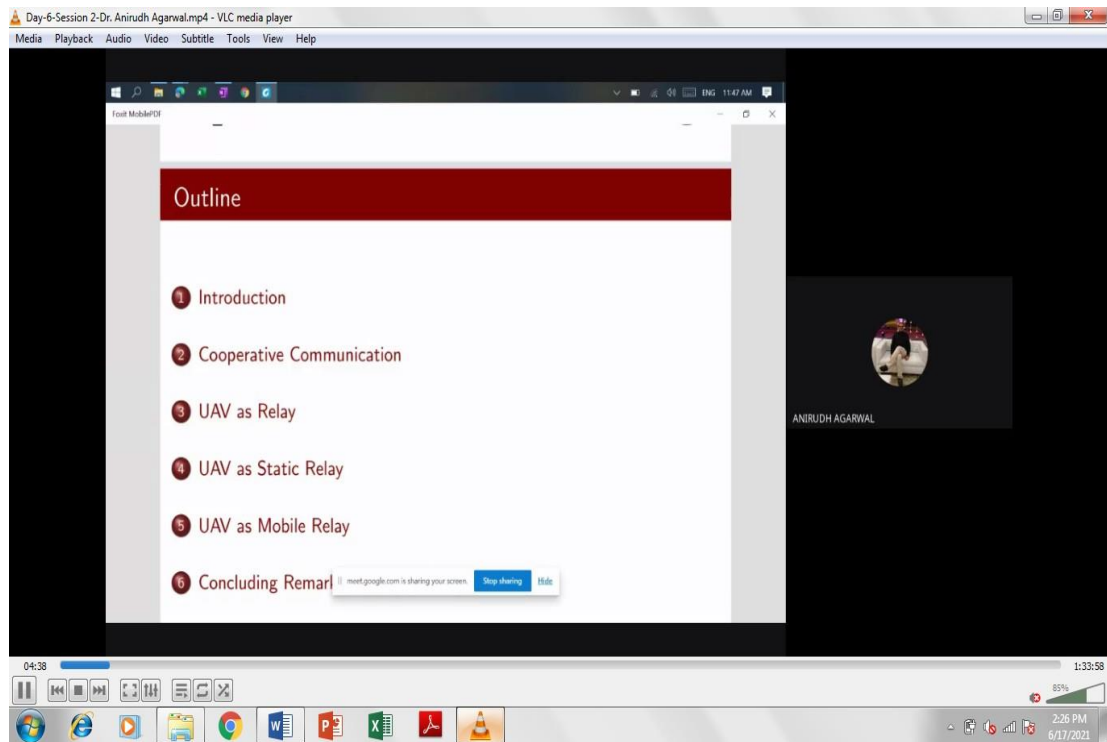
Expert Talk-17

Topic: Uav Relaying Assisted Cooperative 5G Communication

Resource Person: Dr. Anirudh Agarwal, Assistant Professor

Venue: online

The screenshot shows a VLC media player window titled "Day-6-Session 2-Dr. Anirudh Agarwal.mp4". The main content is a presentation slide titled "UAV Relaying Assisted Cooperative 5G Communication" in white text on a red background. Below the title, it lists "Dr. Anirudh Agarwal", "Assitant Professor, Dept. of ECE, The LNMIIT Jaipur, India", and "AICTE-AQIS Sponsored STTP Artificial Intelligence & 5G Communication Technology". Logos for AICTE and LNMIIT are visible at the bottom. A small video inset on the right shows Dr. Anirudh Agarwal. The VLC player interface at the bottom shows a progress bar at 03:57 and a system tray with various application icons.



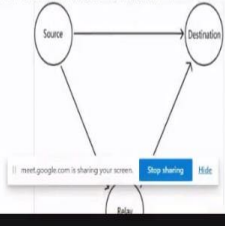
Day-6-Session 2-Dr. Anirudh Agarwal.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

05:07 / 1:33:58

Introduction

- In a simple single user wireless communication scenario, there is a source (S) which sends data towards destination (D), via direct path.
- If direct path S-D is blocked/ lost, there is a need of a transceiver between S and D,
 - which receives info from S
 - and transmits that info to D.
- Such a transceiver is known as "RELAY".



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ANIRUDH AGARWAL

05:08 1:33:58

Windows taskbar icons: Internet Explorer, VLC media player, Google Chrome, Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Adobe Reader, VLC media player.

System tray: 85% battery, 2:26 PM, 6/17/2021.

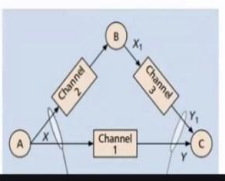
Day-6-Session 2-Dr. Anirudh Agarwal.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

07:16 / 1:33:58

Relay-based Communication

- Relay-based communication systems exploit the broadcast nature of the wireless medium and allow nodes to jointly transmit information through relaying to improve the transmission capacity and the performance.
- In the below figure, all nodes operate in the same band, so the system can be decomposed into a broadcast channel from the viewpoint of the source and a multiple access channel from the viewpoint of the destination.



ANIRUDH AGARWAL

07:16 1:33:58

Windows taskbar icons: Internet Explorer, VLC media player, Google Chrome, Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Adobe Reader, VLC media player.

System tray: 85% battery, 2:27 PM, 6/17/2021.

Day-6-Session 2-Dr. Anirudh Agarwal.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

07:50 / 1:33:58

Font: MobilePDF

- Relay-based communication systems exploit the broadcast nature of the wireless medium and allow nodes to jointly transmit information through relaying to improve the transmission capacity and the performance.
- In the below figure, all nodes operate in the same band, so the system can be decomposed into a broadcast channel from the viewpoint of the source and a multiple access channel from the viewpoint of the destination.

ANIRUDH AGARWAL

07:50 1:33:58

2:27 PM 6/17/2021

Day-6-Session 2-Dr. Anirudh Agarwal.mp4 - VLC media player

Media Playback Audio Video Subtitle Tools View Help

13:12

Cooperative Communication

- Relay cooperates with Source and Destination, giving rise to Cooperative Communication among S, R, and D.
- In general, Relay node uses following two methods for cooperation:
 - Decode-and-forward (DF)
 - Amplify-and-forward (AF)

ANIRUDH AGARWAL

13:12 1:33:58

2:27 PM 6/17/2021

Expert Talk-18

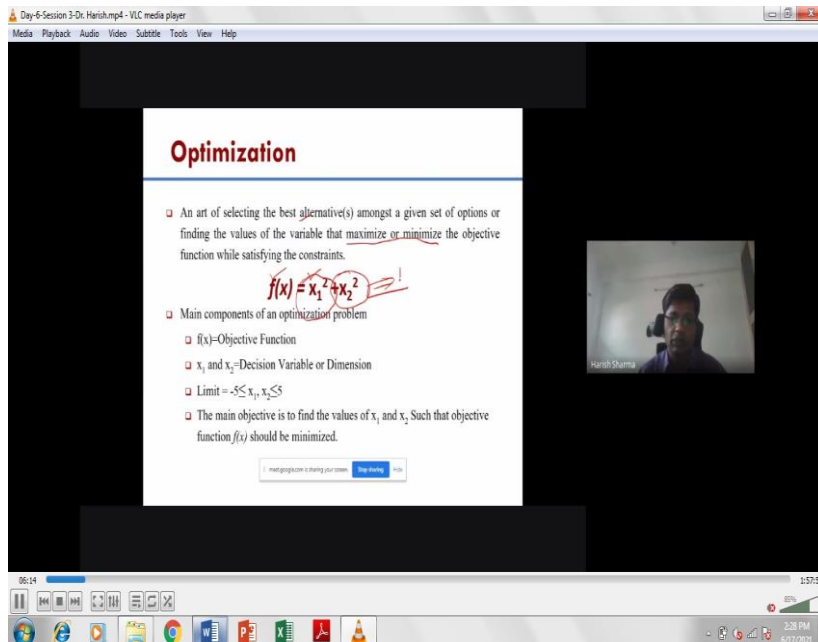
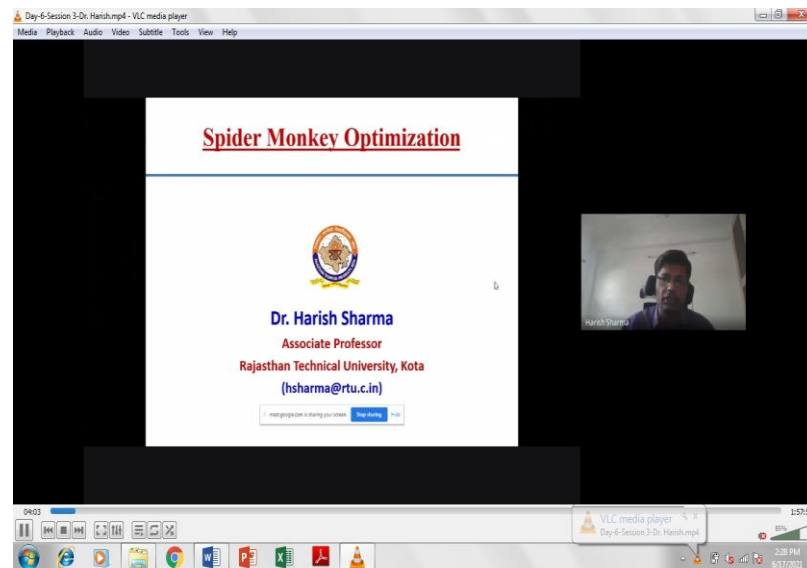
Topic: Advances in Spider Monkey Optimization Algorithm

Resource Person: Dr. Harish

Sharma, Associate Professor

Venue:

online



Random initialization of solutions

$s_1 = (3, 4) + (1, 3) = 12$

Handwritten notes: $f(x) = x_1^2 + x_2^2$, $f(s_1) = 3^2 + 4^2 = 25$, $f(s_2) = 1^2 + 3^2 = 10$, $f(s_3) = 2^2 + 1^2 = 5$, $f(s_4) = 4^2 + 2^2 = 20$, $f(s_5) = 1^2 + 1^2 = 2$, $f(s_6) = 3^2 + 2^2 = 13$, $f(s_7) = 2^2 + 3^2 = 13$, $f(s_8) = 4^2 + 3^2 = 25$, $f(s_9) = 1^2 + 4^2 = 17$, $f(s_{10}) = 3^2 + 3^2 = 18$.

Figure: Random initialization of Solutions in search space

December 12, 2020

Some Basic Terminology in NIA

Complexity: Number of function Evaluations

Exploration: Exploration is the process of visiting entirely new regions of a search space.

Exploitation: Exploitation is the process of visiting those regions of a search space within the neighborhood of previously visited points.

Stagnation: Stagnation refers to a situation in which the optimum seeking process stagnates before finding a globally optimal solution.

Handwritten notes: $f(x) = x_1^2 + x_2^2$, $f(s_1) = 3^2 + 4^2 = 25$, $f(s_2) = 1^2 + 3^2 = 10$, $f(s_3) = 2^2 + 1^2 = 5$, $f(s_4) = 4^2 + 2^2 = 20$, $f(s_5) = 1^2 + 1^2 = 2$, $f(s_6) = 3^2 + 2^2 = 13$, $f(s_7) = 2^2 + 3^2 = 13$, $f(s_8) = 4^2 + 3^2 = 25$, $f(s_9) = 1^2 + 4^2 = 17$, $f(s_{10}) = 3^2 + 3^2 = 18$.

December 12, 2020

Valedictory session:-

After Lunch valedictory session was held. Dr. Harish Sharma, Associate Professor, RTU Kota Chief Guest, Dr. Mahesh M Bunde, Director, PCE, Jaipur, Mr. Pankaj Dhemla, VicePrincipal, 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. Harish Kumar, by Dr. Mahesh M Bunde, 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 Bunde congratulated the participants for taking keen interest in learning.

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

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 session a group photograph was taken with the Dignitaries including participants.



AICTE
Six Days Short Term Training Program
On



Artificial Intelligence & 5G Communication
Technology

December 07 - 12, 2020

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

Date: December 12, 2020

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 <ul style="list-style-type: none">• Dr. Harish Sharma, Associate Professor, (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


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

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. Harish Sharma, Associate Professor	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 Valedictory



ession



♦ **LIST OF PARTICIPANTS:**

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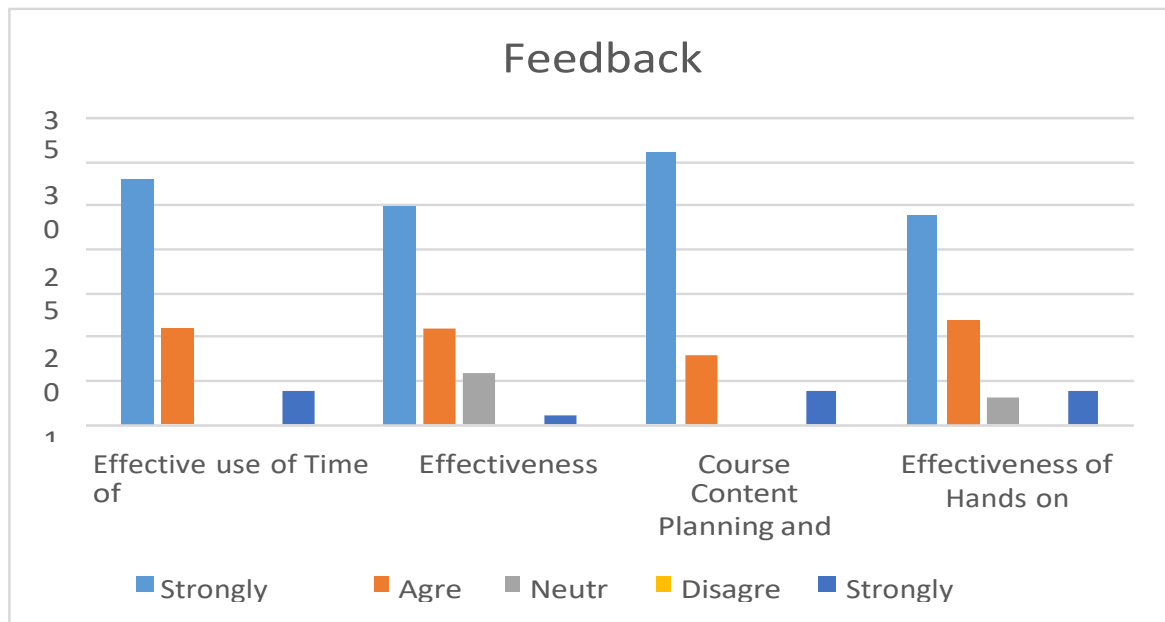
Poornima College of Engineering - Artificial Intelligence & 5G Communication Technology

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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:**

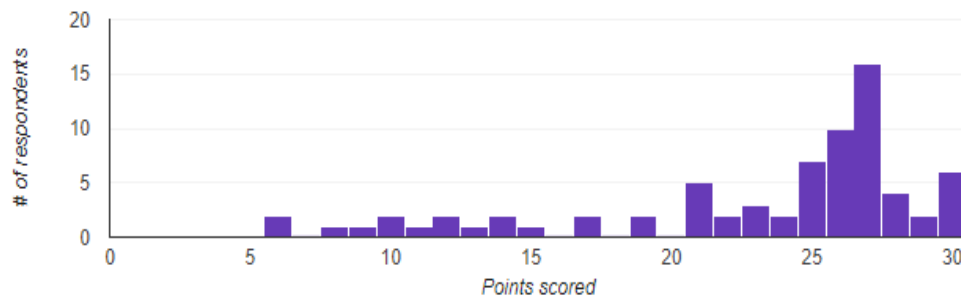
	Effective use of Time	Effectiveness of Theoretical Session	Course Content Planning and Organization	Effectiveness of Hands on Sessions
Strongly Agree	28	25	31	24
Agree	11	11	8	12
Neutral	0	6	0	3
Disagree	0	0	0	0
Strongly Disagree	4	1	4	4



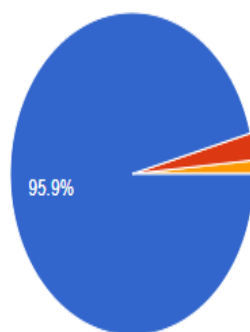
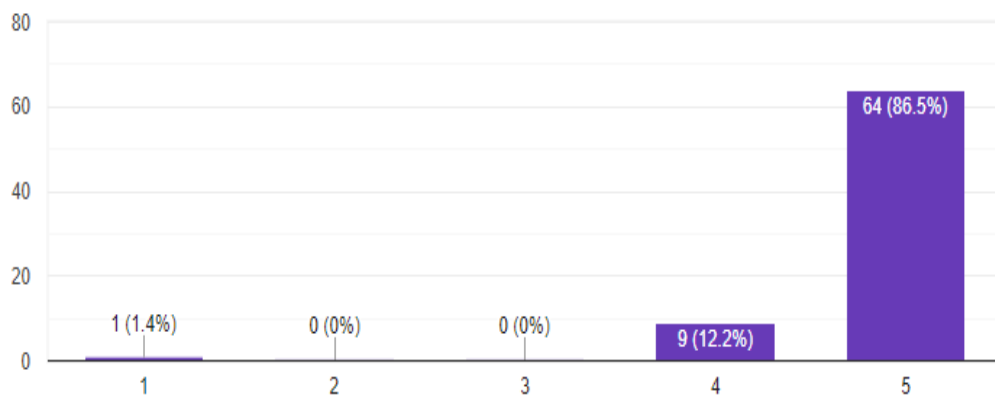
♦ SWOT ANALYSIS:

Average 22.91 / 30 points	Median 26 / 30 points	Range 6 - 30 points
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Total points distribution



How satisfied were you with the STTP content?



● Yes
● No
● Maybe

♦ BUDGET & ACTUALS: NIL