



**DON BOSCO INSTITUTE OF TECHNOLOGY, MUMBAI**

**DEPARTMENT OF ELECTRONICS AND  
TELECOMMUNICATION ENGINEERING**

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**Report of Two Half-Day Symposium on: '5G: The Catalyst  
to Digital Revolution**

**Topic:** Two Half-Day Symposium "5G: The Catalyst to Digital Revolution"

**Date:** 8<sup>th</sup> & 9<sup>th</sup> October 2021

**Time:** 11:00 a.m. - 2:45 p.m.

**Venue:** Zoom Meeting (Online Platform)

**Speaker:**

8<sup>th</sup> October 2021 :

- i. **Mr. Hermes Joel** (Founder & Director, Taranga Systems Ltd., Leicester, United Kingdom)
- ii. **Dr. Jaume Anguera** (Founder and CTO, Ignion. Associate Professor, Universitat Ramon Llull, Barcelona, Spain)

9<sup>th</sup> October 2021 :

- i. **Dr. SaiDhiraj** (Principal Research Engineer, WiSig Networks. Adjunct Assistant Professor, IIT Hyderabad, India)
- ii. **Dr. Jasmin Grosinger** (Associate Professor & DL Institute of Microwave & Photonic Engineering Graz University of Technology Graz, Austria)

**No. of participants attended:** 74

### **Description:**

- IEEE-DBIT-MTTS Student Chapter organized a Two Half-Day Symposium on “5G: The Catalyst to Digital Revolution” on 8<sup>th</sup> & 9<sup>th</sup> October 2021 from 11 a.m. to 2:45 p.m. on both days.
- The Symposium commenced with the inauguration ceremony on 8<sup>th</sup> October 2021 at 11:00 am with a prayer by Fr. Mario followed by the introduction to the program highlights by Dr. Ashwini Kotrashetti. The inauguration session concluded with a welcome address by Principal Dr. Prasanna Nambiar by 11:30 am.

### **➤ Day1: Mr. Hermes Joel**

- Following the inauguration, at 11:30 am Ms. Poonam C. introduced Mr. Hermes Joel, scheduled to deliver the session on “5G NR Point to Point systems Architecture - An Introduction”
- Mr. Hermes Joel explained the following points in great depth covering all the intricate details in a brief and lucid manner :
  - i. Introduction to 5G Digital Revolution.
  - ii. Point to Multi-Point network Architecture
  - iii. 5G New Radio(NR) P2P/PMP Base Station Architecture .
  - iv. Real World 5G Antennas field installation with practical considerations.
  - v. Insights on practical antennas used for Potential 5G NR P2P and PMP Applications.

Following this, Mr. Hermes Joel advanced to the Q&A round with the participants wherein he answered all the queries paying scrupulous attention to details. Mr. Hermes’s session concluded with the proposal of vote of thanks by Ms. Poonam C. at 12:45 pm.

## ➤ Day1: Dr. Jaume Anguera

- The participants dispersed for a lunch break at 12:45 pm and assembled back at 1:30 pm for Dr. Jaume Anguera's talk on "Antenna Booster Technology -5G perspective in Design of IoT Devices embedding Antenna Boosters".
- Ms. Freda Carvalho formally introduced the speaker following which Dr. Jaume Anguera took over the session and covered the following points in great depth:
  - i. Addressed terms like Antenna, Microwave, RF, Wireless systems and the applications of antennas in IoT, Smart cities, Smart agriculture, fleet management, etc.
  - ii. Emphasized importance for electronics engineers to learn about Antenna Booster Technology.
  - iii. Fundamentals of Antenna Booster Technology
  - iv. Methodology to design wireless devices with antenna boosters, wireless devices (eg. IoT) embedding antenna boosters covering from single band to multi-band applications either using passive and active matching network-based architectures.
  - v. Introduced the concept of virtual antenna and explained its importance to be a game changing technology due to modularity, versatility, miniature size, efficient performance and all this with no need for customization.

Following this, Dr. Jaume Anguera advanced to the Q&A round with the participants wherein he answered all the queries assiduously pointing out every feature of the concept he covered while replying. Dr. Jaume's session concluded with the proposal of a vote of thanks by Ms. Freda Carvalho. at 02:45pm . With Dr.Jaume Anguera's talk, the session concluded for the day.

## ➤ **Day2: Dr. SaiDhiraj Amuru**

- On 9<sup>th</sup> October 2021, the Symposium commenced at 11:30 am sharp with Ms. Namita Agarwal introducing Dr. SaiDhiraj Amuru, scheduled to conduct a talk on “India's 5G Journey”. The session covered the following dimensions in detail :
  - i. Journey of 5G in India starting from 2016 till present.
  - ii. DoT allocation of spectrum for 5G trials to telecom operators and also mapped its results till date.
  - iii. Present Indian Perspective of 5G and ways to bridge the 5G digital divide which holds the potential to transform the fate of remote Indian villages.
  - iv. India’s efforts in standardization at ITU, 3GPP, and TSDSI.
  - v. The various R&D efforts are being supported by various government organizations to steer India’s 5G journey forward to the future.

Following this, Dr. SaiDhiraj advanced to the Q&A round with the participants wherein he answered all the queries diligently. Dr. SaiDhiraj’s session concluded with the proposal of vote of thanks by Ms.Namita Agarwal at 12:45 pm.

## ➤ **Day2: Dr.Jasmin Grosinger**

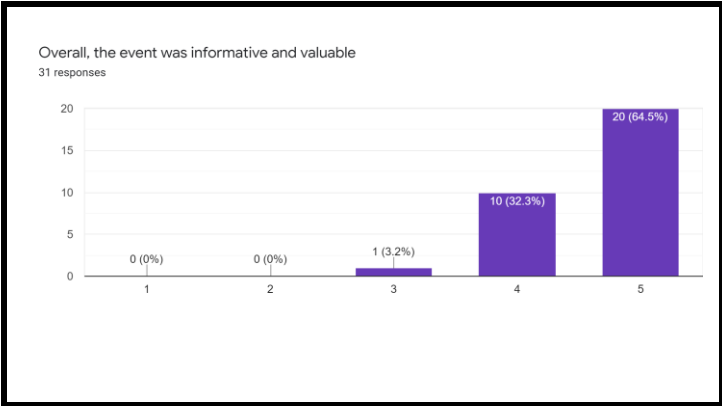
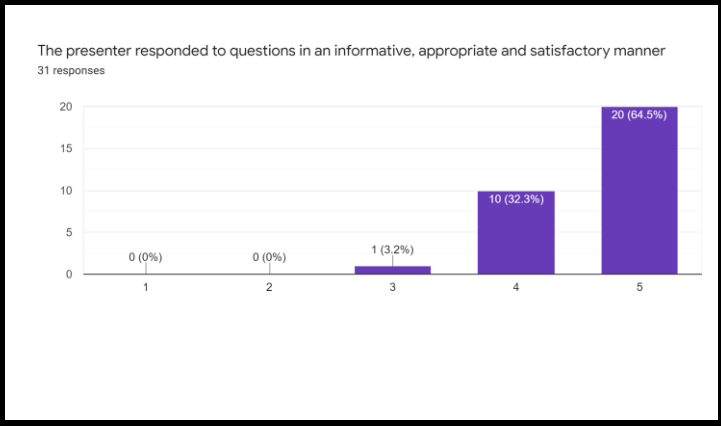
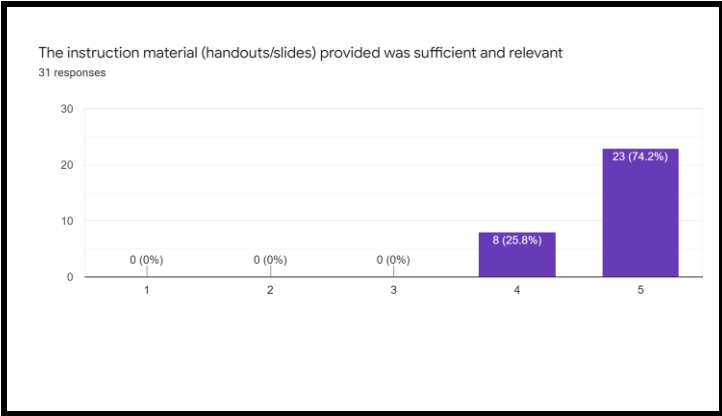
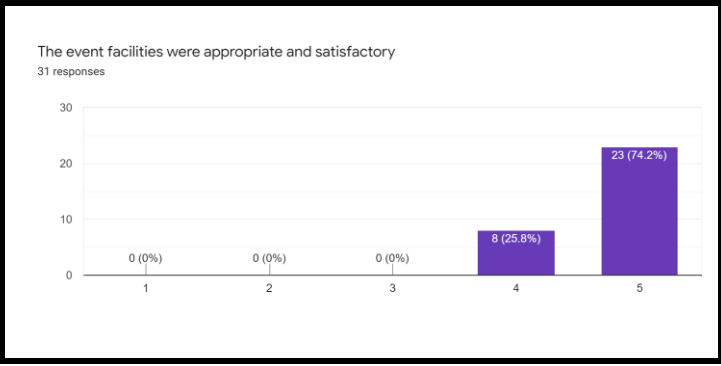
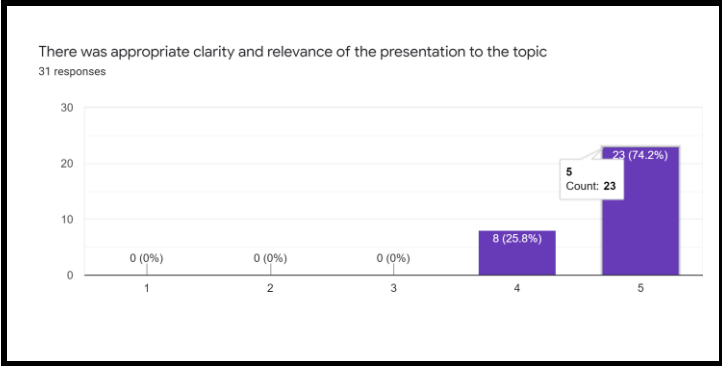
- Ms. Gejo George introduced the next speaker at 12:45 pm, Dr. Jasmin Grosinger for delivering talks on “RF Design for Ultra-Low- Power Wireless Communication in the Next Generation of 5G IoT Devices”. Dr.Jasmin Grosinger explained the following aspects in great detail:
  - i. Introduced the concept of the development of miniaturized IoT nodes that operates in harsh climatic conditions.
  - ii. Provided insights on how issues between IoT sensors and 5G deployments are solved in mass deployments.
  - iii. Need for effective miniaturizing of components to improve ultra-low power operation of IoT nodes avoiding batteries so as to lower eco-toxicity..
  - iv. Important for engineers to apply ultra-low-power operation of IoT nodes and to avoid batteries due to battery replacement.
  - v. Solutions for robust ultra-low power wireless communication based on HF and UHF RFID technologies

Following this, Dr. Jasmin Grosinger advanced to the Q&A round with the participants wherein he answered all the queries with meticulous care and effort, catering to every aspect of the question asked. Mr. Jasmin’s session concluded with the proposal of vote of thanks by Ms. Gejo George at 02:00 pm.

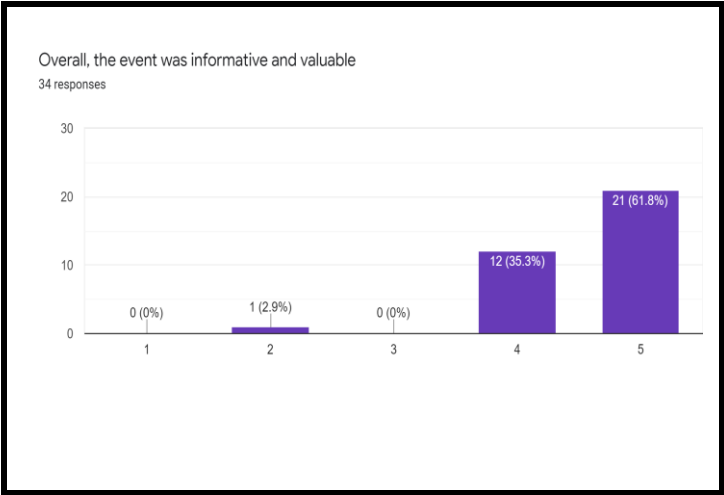
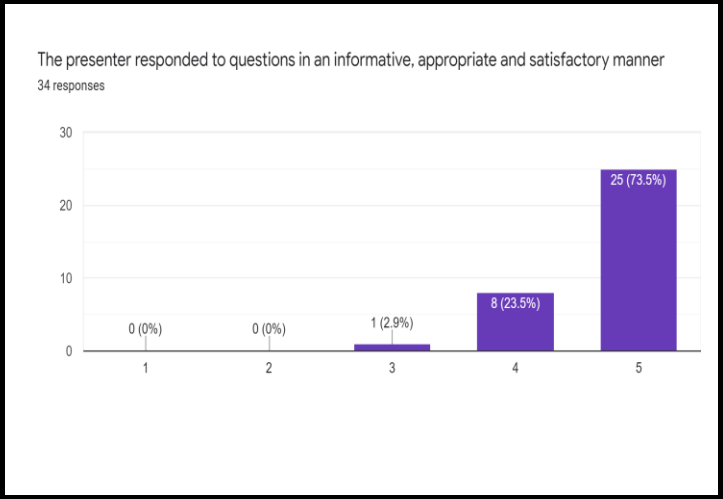
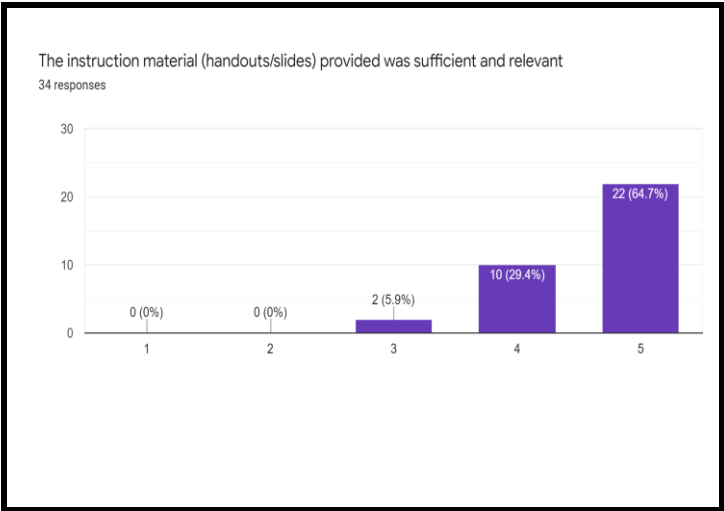
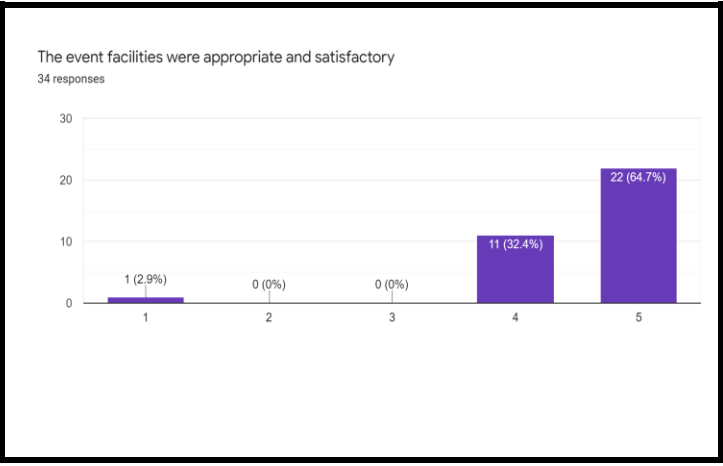
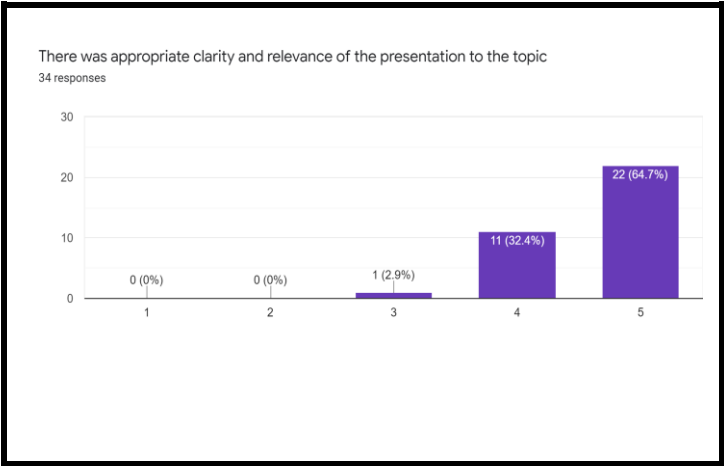
- The Two Half-Day Symposium concluded with the valedictory event where Dr. Ashwini Kotrashetti proposed the final vote of thanks, thanking all the speakers for shelling their valuable time from their busy schedule to deliver quality content and also the students for their participation and cooperation which rendered the event a grand success. The participants were told to give verbal feedback for the symposium, which was very encouraging and motivating for the student chapter to organize similar events in future. Finally, feedback forms were circulated amongst the students to make suggestions for further improvement.

Feedback Analysis:

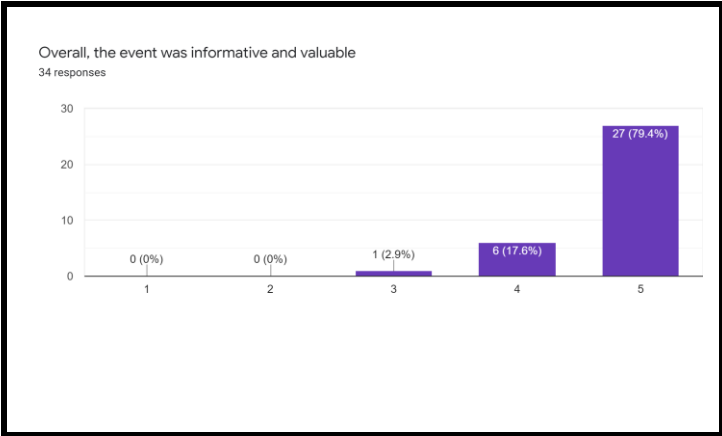
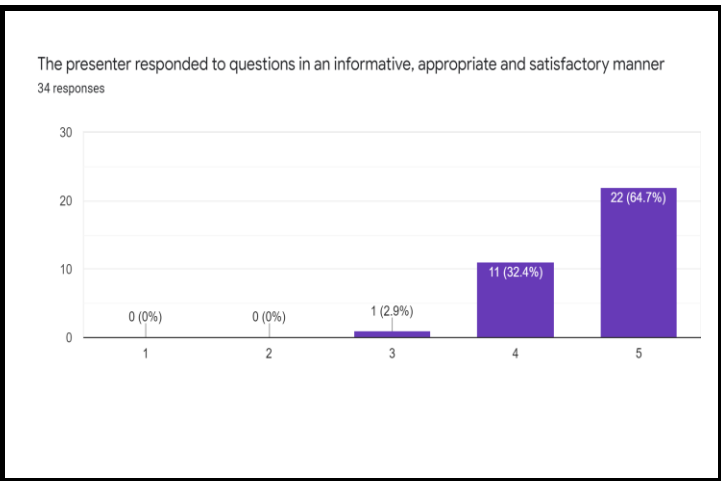
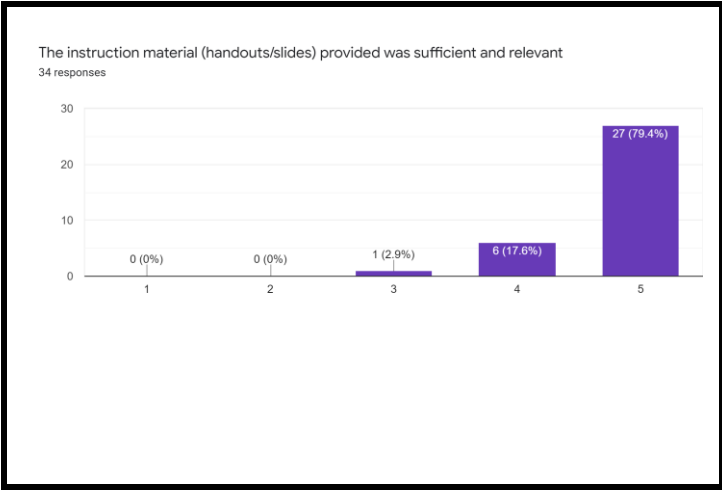
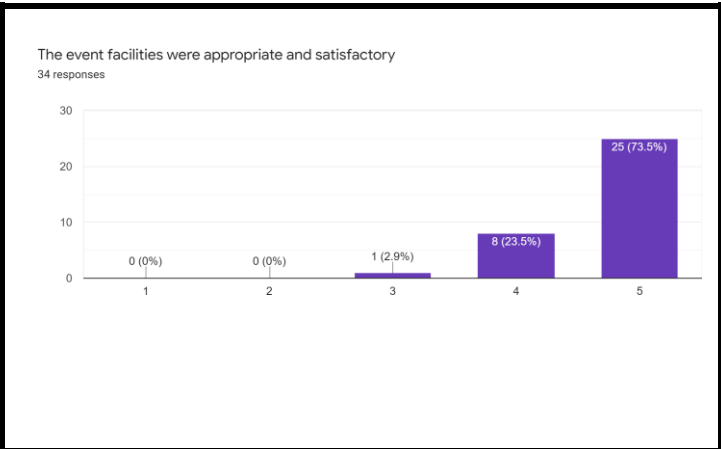
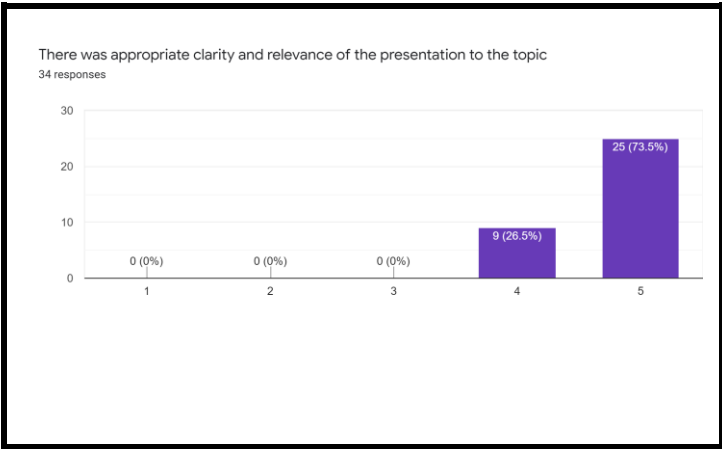
Day1: Mr. Hermes Joel



# Day1: Dr.Jaume Anguera

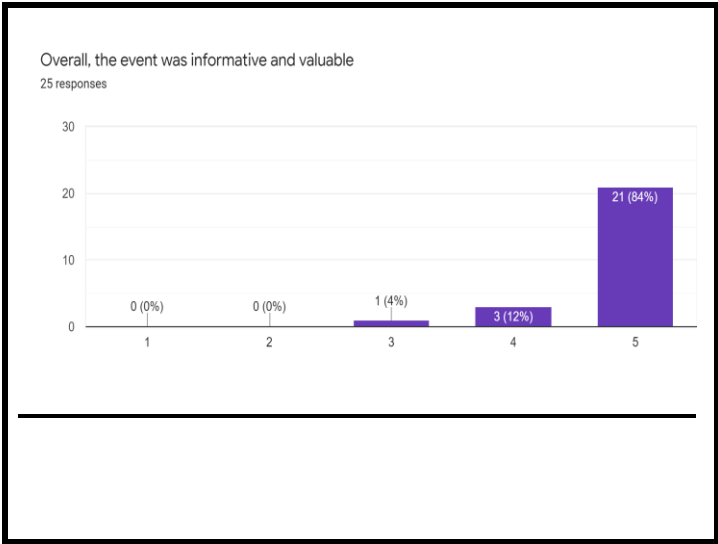
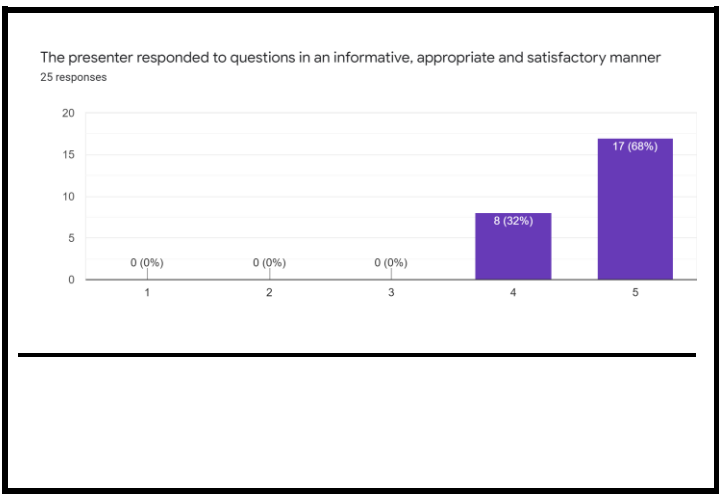
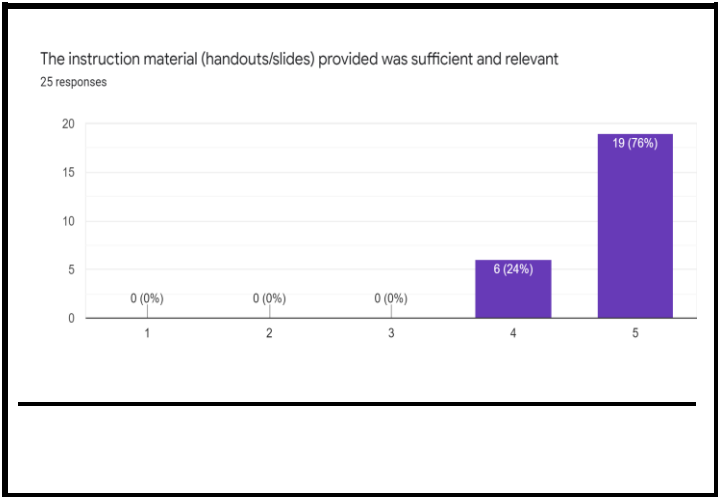
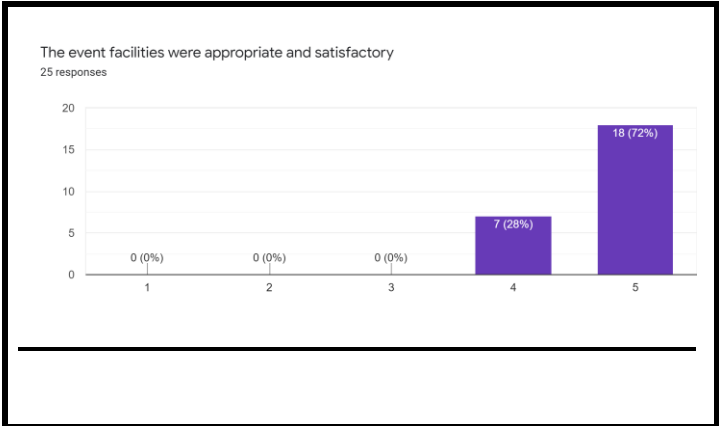
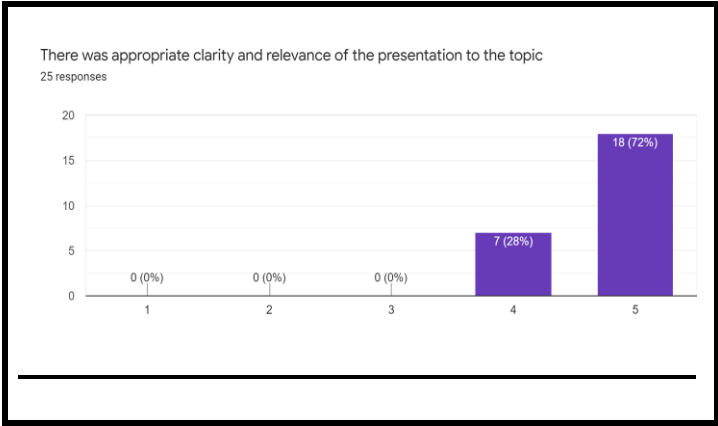


Day2: Dr. SaiDhiraj Amuru





Day2: Dr.Jasmin Grosinger



## Feedback Summary:

From the above analysis, we can infer that the overall reception to the Two Half-Day Symposium "5G: The Catalyst to Digital Revolution" was quite positive and the participants found the sessions to be very interesting, informative and extremely efficient as it made a successful attempt to demystify convoluted concepts easy enough to be understood by a student. Further, many participants were quite optimistic about attending such similar sessions in the future.

## Event Poster:

The poster is for a symposium titled "5G: A Catalyst to Digital Revolution". It is organized by the Don Bosco Institute of Technology, Mumbai, Department of Electronics & Telecommunication Engineering, in collaboration with IEEE - DBIT - MTTS Student Chapter. The event is split into two days: the 8th of October 2021 (11:00 AM - 2:45 PM) and the 9th of October 2021 (11:30 AM - 2:45 PM). The poster features four speakers, each with a circular portrait and their respective titles and affiliations.

**Don Bosco Institute of Technology, Mumbai**  
Department of Electronics & Telecommunication Engineering  
IEEE - DBIT - MTTS Student Chapter Presents

**Symposium On "5G: A Catalyst to Digital Revolution"**  
**MEET THE SPEAKERS**

**8th October 2021  
11:00 AM - 2:45 PM**

**Dr. Jaume Anguera**  
Founder and CTO, Ignion Associate  
Professor, Universitat Ramon Llull,  
Barcelona, Spain

**Mr. Hermes Joel**  
Founder & Director, Taranga Systems  
Ltd., Leicester, United Kingdom

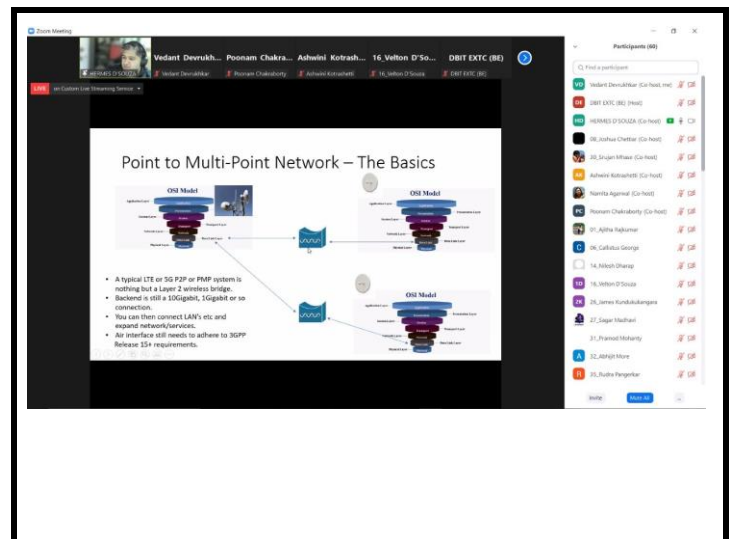
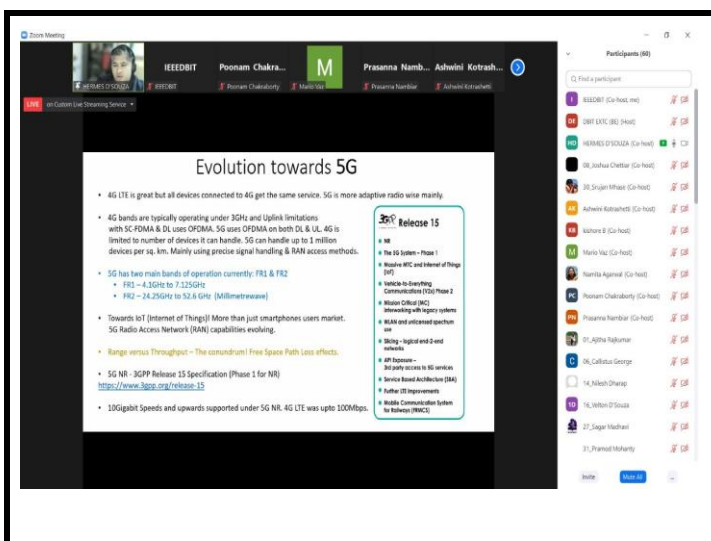
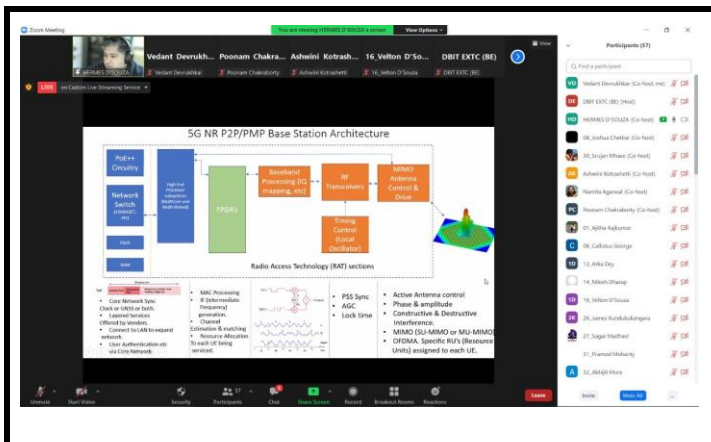
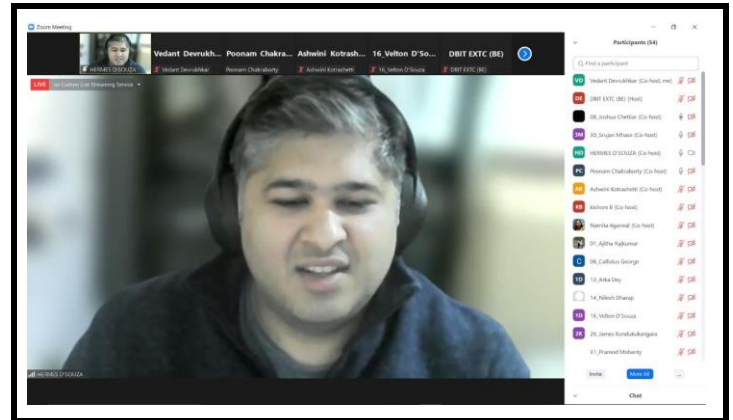
**9th October 2021  
11:30 AM - 2:45 PM**

**Dr. Jasmin Grosinger**  
Associate Professor & IEEE MTTS DL  
Institute of Microwave & Photonic Engineering  
Graz University of Technology Graz, Austria

**Dr. SaiDhiraj Amuru**  
Principal Research Engineer, WiSig  
Networks. Adjunct Assistant Professor,  
IIT Hyderabad, India

# Event Photographs :

## Day 1: Mr. Hermes Joel



## Day 1: Dr. Jaume Anguera

**5G perspective in Design of IoT Devices embedding Antenna Boosters**

**Dr. Jaume Anguera**  
IEEE Fellow, Founder and CTO Ignion  
Associate Professor at Ramon Llull University (Barcelona, Spain)

The slide features the Ignion logo and a portrait of Dr. Jaume Anguera. The background is yellow with a blue border. The Zoom interface shows participants on the right and a list of names at the top.

The screenshot shows a close-up of Dr. Jaume Anguera speaking. The background is a white wall with a large Ignion logo. The Zoom interface shows participants on the right and a list of names at the top.

**Table of Contents**

1. Why Antenna Booster Technology
2. Architecture
3. Fundamentals of Antenna Booster Technology
4. Design of Antenna Systems with Antenna Booster Technology
  - Single band
  - Multi band
  - MIMO
  - Reconfigurable
5. Matching Network Synthesis
6. Comparing to other technologies
7. Conclusions

The slide features a 3D rendering of an antenna booster component. The Zoom interface shows participants on the right and a list of names at the top.

**About Virtual Antenna™**

Virtual Antenna™: the latest generation of **miniaturized multiband, multiband chip antenna** components for cellular IoT

- Off-the-shelf**: Ready to be delivered as-is with no need for customization.
- Up to 10 times smaller**: A booster can be 5"mm" providing the same connectivity.
- Versatility**: A phone can be designed with several architectures yet still using the same component.
- Modular**: Modules or standard building blocks can be reused in the design of multiple devices.
- Multiband**: A single antenna provides connectivity in 3G, 4G and 5G bands.
- Full performance**: The same performance as a much smaller, off-the-shelf and versatile component.

The slide features a 3D rendering of Virtual Antenna components. The Zoom interface shows participants on the right and a list of names at the top.

**Antenna Booster Technology: 5G Perspective in Design of IoT Devices Embedding Antenna Boosters**

**Dr. Jaume Anguera**, IEEE Fellow  
IEEE Distinguished Lecturer  
Founder and CTO at Ignion  
Associate Professor at Universitat Ramon Llull  
Barcelona, Spain  
[Jaume.anguera@ignion.io](mailto:Jaume.anguera@ignion.io), [jaume.anguera@salle.url.edu](mailto:jaume.anguera@salle.url.edu)

Symposium on "5G: A Catalyst to Digital Revolution"  
IEEE - Don Bosco Institute of Technology, Mumbai - MTSS

The slide features a 3D rendering of an antenna booster component. The Zoom interface shows participants on the right and a list of names at the top.

**Introduction**

Antennas are needed in a large set of wireless devices (~0.4GHz-10.6GHz)

- Mobile/IoT
- Parking Sensors
- Fleet Management
- Smart meters
- Smart Home
- Smart City
- Smart agriculture
- Smart whatever

The slide features a 3D rendering of various wireless devices and antennas. The Zoom interface shows participants on the right and a list of names at the top.



## Day 2: Dr. SaiDhiraj Amuru

Zoom Meeting

Participants (42)

Dr. SaiDhiraj Amuru  
Principal Research Engineer,  
WiSig Networks,  
Adjunct Assistant Professor,  
IIT Hyderabad, India

- Design and development for 4G and 5G algorithms
- Adjunct Assistant Professor, at IIT Hyderabad
- The Exemplary Reviewer award for 2019 IEEE Wireless Communications Letters journal.
- Won the Best Paper Award at COMSNETS 2020.
- Involved in 3GPP 5G NR Layer-1 standardization activities representing Samsung R & D, India
- Research activities related to applications of machine learning for wireless communications problems at Samsung.
- Worked on radio frequency drivers for its modem chipsets at Qualcomm
- Qualstar awards for excellent performance

100% Polluted air 118° 20°C 29-10-2021

Zoom Meeting

Participants (47)

### Present Indian Perspective

- 5G, IoT Technology ownership and control is critical to National Interest
  - Intimately tied with National Security
- Enhancing Current R&D capabilities – domestic manufacturing and export oriented
- Big thrust on IP/IPR creation
- Influence standards - Alignment of Indian requirements with Global ones
  - TS/SD/3GPP/ITU

Bridging the 5G digital divide: How indigenously developed technology can reach remote Indian villages

100% Polluted air 122° 20°C 29-10-2021

Zoom Meeting

Participants (47)

Source: Ericsson June 2021 report

Mobile broadband subscriptions currently make up 83 percent of all mobile subscriptions.

Figure 4: Mobile subscriptions by region and technology (percent)

India

In the India region, 4G subscriptions are forecast to rise from 686 million in 2020 to 836 million in 2026, increasing at a CAGR of 3 percent. 4G remained the dominant technology in 2020, accounting for 61 percent of mobile subscriptions. The technology will continue to be dominant, representing 66 percent of mobile subscriptions in 2026, with 5G being phased out by that time. 5G will represent around 29 percent of mobile subscriptions in India at the end of 2026, estimated at about 339 million subscriptions. The number of smartphone subscriptions was 818 million in 2020 and is expected to grow at a CAGR of 7 percent, reaching over 1.2 billion by 2026. Smartphone subscriptions accounted for 72 percent of total mobile subscriptions in 2020 and are projected to constitute over 98 percent in 2026, driven by rapid smartphone adoption in the country.

100% Polluted air 118° 21°C Light rain 29-10-2021

Zoom Meeting

Participants (45)

### Status of current technologies – story until 2018

Traditional rural model used in ITU and 3GPP

Parameter	Config A	Config B
Carrier Frequency	700 MHz	4 GHz
Inter-site distance	1732 m	1732 m
Device deployment	50% indoor, 50% outdoor (in car) Randomly and uniformly distributed over the area	50% indoor, 50% outdoor (in car) Randomly and uniformly distributed over the area
UE speeds of interest	Indoor users: 3 km/h; Outdoor users (in-car): 120 km/h; 500 km/h for evaluation of mobility in high-speed case	Indoor users: 3 km/h; Outdoor users (in-car): 120 km/h; 500 km/h for evaluation of mobility in high-speed case

- Till IMT-2020, ITU did not have a rural use case that suited to rural needs of developing countries.
- Hence, the IMT advanced technology development (such as 4G LTE) did not meet rural requirements in countries like India.
  - Recall the GP distribution shown earlier

100% Light rain 118° 21°C 29-10-2021

Zoom Meeting

Participants (47)

Shashikant Patil

100% Polluted air 114° 21°C 29-10-2021

Zoom Meeting

Participants (46)

### Where do we go from here?

#### DoT allocates spectrum for 5G trials to telecom operators

19/10/2020 10:06:07

ARTICLES

DoT allocates spectrum for 5G trials to telecom operators

NEW DELHI: The department of telecom (DoT) has allocated spectrum to telecom operators to start 5G trials in the country, according to the DoT.

100% Polluted air 114° 21°C 29-10-2021

## Day 2: Dr. Jasmin Grosinger

## Passive UHF RFID Sensor tags

State-of-the-art UHF RFID system

- Amplitude modulation of the backscattered signal for tag ID transfer
- Sensor add-on for passive RFID chips
- Additional modulation in amplitude/phase of the backscattered tag signal via additional impedance states

Participants (48)

1	Andreas Kuehner (RWTH Aachen)	✓
2	Andreas Kuehner (RWTH Aachen)	✓
3	Andreas Kuehner (RWTH Aachen)	✓
4	Andreas Kuehner (RWTH Aachen)	✓
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46	Andreas Kuehner (RWTH Aachen)	✓
47	Andreas Kuehner (RWTH Aachen)	✓
48	Andreas Kuehner (RWTH Aachen)	✓

Chip

ID ... Identification number  
Z ... impedance

The screenshot shows a Zoom meeting interface. The main window displays a presentation slide titled "Passively Sensing". The slide content is as follows:

Tag w/ additional sensor circuitry	Tag w/o additional sensor circuitry
<p>UHF RFID sensor tags</p> <p>One temperature sensor tag</p>	<p>Water filling level sensor tag</p>
<p>UHF RFID sensor tags</p> <p>Magnetic field sensor tag</p>	<p>Signal pattern-based sensor tag for water filling level monitoring</p>

Below the slide, there is a video feed showing a person's hands holding a small electronic device, likely a sensor tag, near a container of water.

At the bottom of the screen, there is a list of participants:

- Arshad Aslam (Co-host)
- Freda Carvalho (Host)
- Jasmin Gossinger (Co-host)
- Dr. Alpha Kulkarni (Co-host)
- Dr. James Kundakumar (Co-host)
- Arshad Kulkarni (Co-host)
- Gopi George (Co-host)
- Nandini Agrawal (Co-host)
- Rohaan Chakraborty (Co-host)
- Dr. Nishu Dhang
- Dr. Shikharaj Kataraj
- Dr. Prasad Mohanty
- Dr. Chaitanya Moudam
- Dr. Rudra Pargatkar
- Dr. Sushant Singh
- Dr. Mayagelana James

The meeting title is "Zoom Meeting" and the URL is "https://us02nczccg.zoom.us/j/91051234567". The meeting ID is "91051234567". The meeting name is "Zoom Meeting". The meeting URL is "https://us02nczccg.zoom.us/j/91051234567". The meeting ID is "91051234567". The meeting name is "Zoom Meeting". The meeting URL is "https://us02nczccg.zoom.us/j/91051234567". The meeting ID is "91051234567".

Zoom Meeting

Participants (10)

Active speaker: [Avatar]

Freda Carvalho [Avatar] Ashwini Kotrash... Poonam Chakra... [Avatar]

10:00

## Signal Pattern-Based Sensor Tags

**Challenge:** Setup independence, i.e., correct detection although tag signal amplitude and phase changes

**Solution:** Pronounced tag signal pattern versus water filling level (water canister full or empty)

25 Jasmin Griesinger, Graz University of Technology

10/9/2021

Zoom Meeting

You are viewing Jaemin Gosingger's screen

Participants (40)

## Conclusions

RF design solutions to reliable miniaturized wireless communication and sensor systems to solve sustainability issues on environmental and economic levels

- Ultra-low-power wireless communication
- High level of integration

RF design challenges for wireless systems

- Highly miniaturizing
- Passively sensing (battery-assisted ultra-low-power operation)
- Robustly operating (harsh application/metal environments)
- Rapid testing (specific application environments)

J. Gosingger, et al., HF RFID Tag Chip Impedance Measurements, IEEE Transactions on Instrumentation and Measurements, submitted.

D. Shetty, et al., Sub-Microwatt CMOS Rectifier for a Fully Passive Wake-Up Receiver, IEEE Transactions on Microwave Theory and Techniques, 2021.

G. Sadi, et al., Software Defined RFID Readers, IEEE Microwave Magazine, Vol. 22, No. 3, 2021.

L. Götschacher and J. Gosingger, UHF RFID Sensor System Using Tag Signal Patterns: Prototype System, IEEE Antennas Wireless Propagation Letters, 2019.

P. Greiner et al., A System-on-Chip Crystal-less Wireless Sub-GHz Transmitter, IEEE Transactions on Microwave Theory Techniques, 2018.

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Participants (40)

## Read Range Extension

### Booster antennas

- Read range extension
  - No galvanic contacts (mechanical robustness, reduced costs)
  - Individual application-specific antenna design for one tag product
  - Small performance reduction
- Increase of effective tag antenna area
  - Large pickup antenna: concentrates reader energy
  - Coupling structure: alternative transmit-receive part of miniaturized tag

H. Reinisch, et al., A Multifrequency Passive Sensing Tag with On-Chip Temperature Sensor and Off-Chip Sensor Interface Using EPC HF and UHF RFID Technology, IEEE J. Solid-State Circuits, 2011.

W. Pachter, et al., A Novel ID Packaging Concept for RF Powered Sensor Grains, IEEE ECTC, 2014.

Jaemin Gosingger, Graz University of Technology

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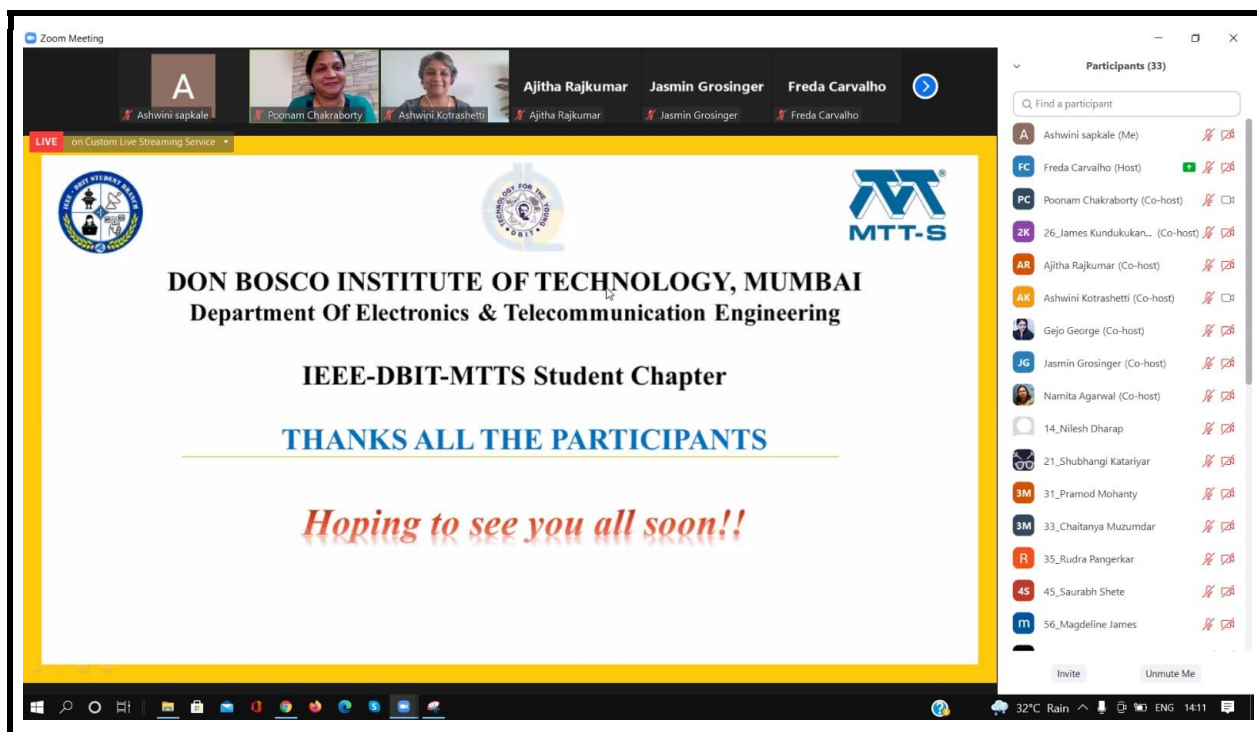
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