

DATE: 4/4/2021

Event Coordinator(s)

1. Prof. Smita Pawar

Time & Place:

3rd April 2021

10:00 am to 1:00 p.m.

Google Meet

Department:

**Electronics and
Telecommunication
under XIE-ISF**

No. of participant:

104 Students

**All Branches and all
Year**

OBJECTIVE:

Prof. Smita Pawar from Electronics and Telecommunication department had organized a workshop on “Next Generation Wireless Network” under XIE ISF.

The objective was to have hands-on session on

- 1) Software Defined Radios and SoC RF Transceiver IC and its design considerations.
- 2) Discussion on Low cost SDR setup creation using commercially available components.

SCOPE:

- Introduction to SDR.
- Applications of SDR.
- Commercially available SDR.
- Most Commonly used SDR by hobbyists.
- RTL-SDR and Introduction to SDR#.
- Possibilities of RTL-SDR.
- Introduction to SoC, SoB, CoB, SoM.
- Commonly used RF SoC and SoM used in IoT applications. (ESP, STM32, NRF24).
- Introduction to LoRa.
- Commonly used RF Sub-GHz SoC Transceivers.
- ISM Band RF Transceivers.
- Selection of RF-Microcontroller for a Specific Application.
- Design Considerations.

RESOURCE PERSONS:

Mr. Rahul Dhebri, Associate Hardware Design Engineer, Aumnatic Systems.

OUTCOME:

The workshop was an interactive session, where students asked their doubts, queries, questions about the technologies of Wireless network and career scope.

Students understood the concept of SDR, LoRa, ISM bands, commercially available hardware, Software to simulate, Research and application area. 162 students registered for the workshop and 104 attended.

IETE Students members from BE EXTC were the **students co-ordinator** for the workshop and responsibilities shared by them are:

Event Poster: Ms. Serena Matla

Event Messgae: Ms. Sanjana Khairnar and Divij Pawar

Event Certificate design: Mr. Armaan khan

Vote of Thanks: Mr. Preetam Lobo

Overall it was a good co-ordination and a successful event.

EVENT POSTER:



The poster features a blue background with a subtle pattern. At the top left is the IETE logo. The main text is centered and reads: 'Xavier Institute of Engineering Mahim Mumbai 400016 Department of Electronics and Telecommunication Engineering IETE Students' Forum (ISF) Presents Workshop On "Next Generation Wireless Network"'. Below this, there is a central image of a hand holding a smartphone with a network diagram overlaid. To the left of the image is the date 'Date: 3rd April, 2021' and to the right is the time 'Time: 9:45am - 1:15pm'. Below the image is a circular portrait of Mr. Rahul Dhebri, with the text 'Resource person: Mr. Rahul Dhebri, Associate Hardware Design Engineer, Aumnatic Systems.' to his left. To the right of the portrait is the text 'Registration is Free' and a QR code with the text 'Scan To Register' above it. At the bottom right, it says 'IETE E-certificate will be provided to all the participants on successful completion of the workshop and a quiz.'

Xavier Institute of Engineering
Mahim Mumbai 400016
Department of Electronics and Telecommunication Engineering

IETE Students' Forum (ISF)
Presents Workshop
On
"Next Generation Wireless Network"

Date: 3rd April, 2021 Time: 9:45am - 1:15pm

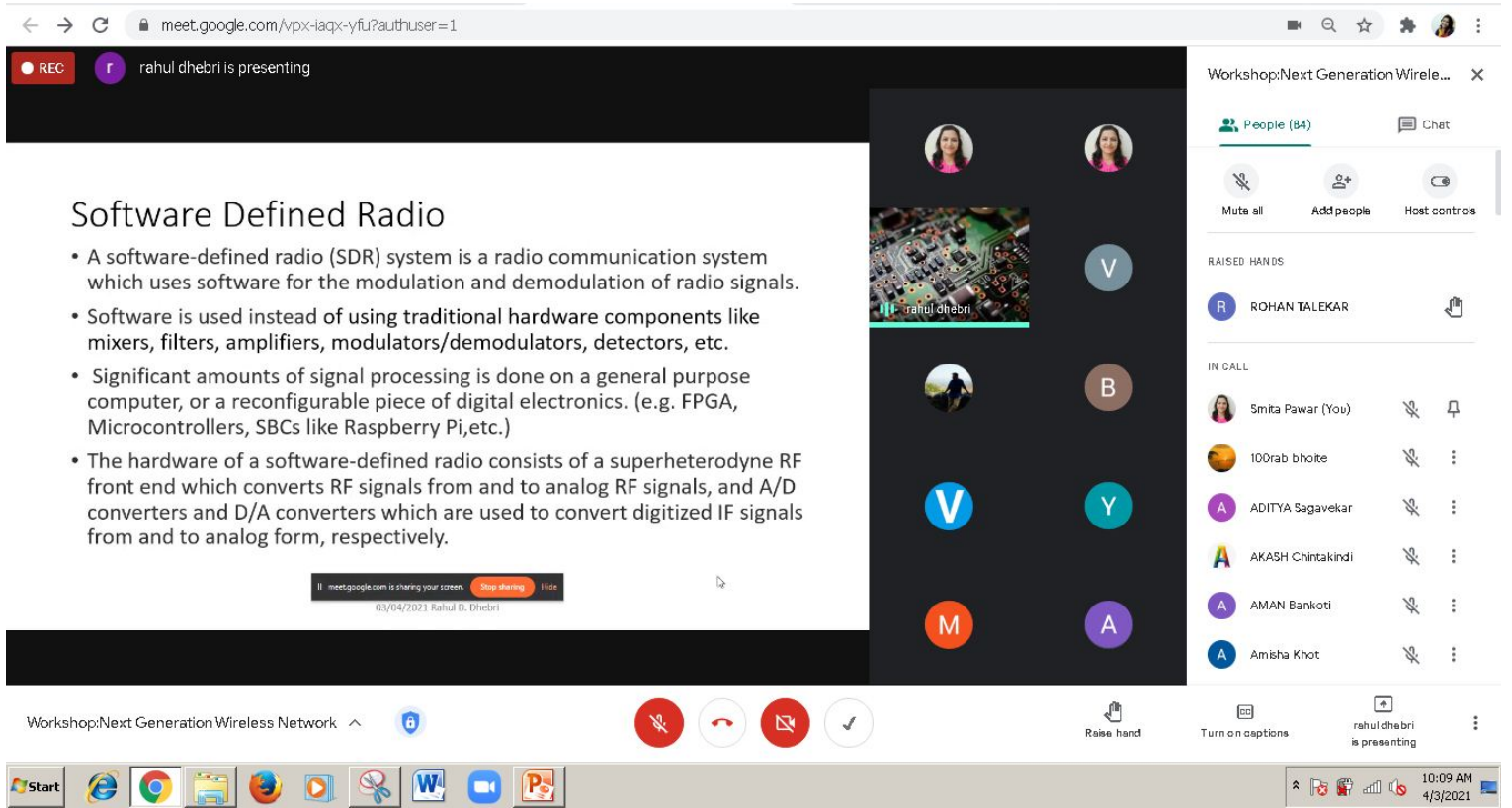
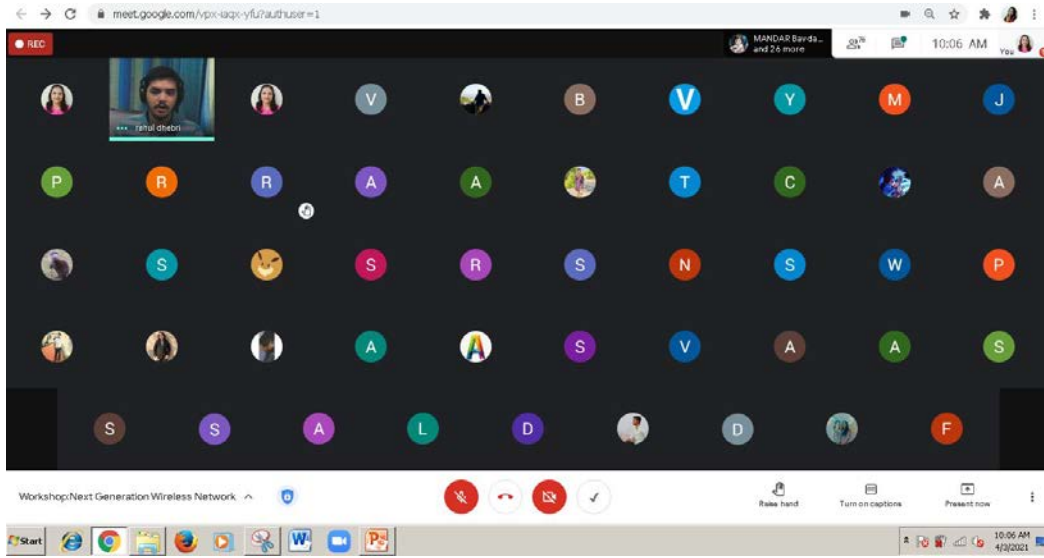
Scan To Register

Registration is Free

Resource person:
Mr. Rahul Dhebri,
Associate Hardware Design
Engineer, Aumnatic Systems.

IETE E-certificate will be
provided to all the
participants on successful
completion of the workshop
and a quiz.

PARTICIPATION SCREENSHOT:



meet.google.com/vpx-laqx-yfu?authuser=1

REC rahul dhebri is presenting

SDR Receiver Block Diagram

The diagram illustrates the SDR Receiver Block Diagram. It starts with an Antenna connected to an RF Tuner. The RF Tuner outputs an Analogic Signal at Intermediate Frequencies to an ADC. The ADC outputs Digital Samples at Intermediate Frequency to a DDC block. The DDC block contains a Digital Mixer, a Low-Pass Filter, and a Digital Osc. The DDC outputs Digital Samples at baseband to a DSP block. The DSP block outputs Digital Samples at baseband. A legend indicates that the DDC and DSP blocks are Digital Components.

Workshop:Next Generation Wirele...

People (88)

- Shubham Gaddam
- SHUBHAM Salunke
- Smita Pawar
- SOHAM Desai
- Sohan Ranadive
- Spencer Lobo
- SUDESH MANJREKAR
- Swapnil Desai
- SWARASHREE Salvi
- TANMAY Gokarn
- TANMAY Keny

Workshop:Next Generation Wireless Network

10:12 AM 4/3/2021

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REC rahul dhebri is presenting

SDR Transmitter Block Diagram

The diagram illustrates the SDR Transmitter Block Diagram. It starts with a DSP block that outputs Samples at Baseband to a DUC block. The DUC block contains an Interpolation Filter, a Digital Mixer, and a Digital Osc. The DUC outputs Digital Samples at Intermediate Frequencies to a D/A Conv. block. The D/A Conv. block outputs to an RF Conv. block. The RF Conv. block outputs to a Power Amplifier block. The Power Amplifier block outputs to an Antenna. A legend indicates that the DUC and RF Conv. blocks are Digital Components.

Workshop:Next Generation Wirele...

People (87)

- Shubham Gaddam
- SHUBHAM Salunke
- Smita Pawar
- Sohan Ranadive
- Spencer Lobo
- SUDESH MANJREKAR
- Swapnil Desai
- SWARASHREE Salvi
- TANMAY Gokarn
- TANMAY Keny
- TANVI Bhabal

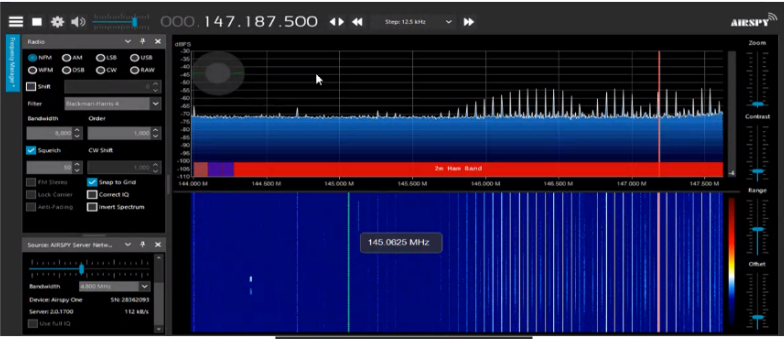
Workshop:Next Generation Wireless Network

10:14 AM 4/3/2021

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REC rahul dhebri is presenting HARSH Sawant and 73 more 10:18 AM You

Commonly used SDR Receiver Software



Workshop:Next Generation Wireless Network

03/04/2021 Rahul D. Dhebri

Raise hand Turn on captions rahul dhebri is presenting

10:18 AM 4/3/2021

meet.google.com/vpx-laqx-yfu?authuser=1

REC rahul dhebri is presenting TEJAS Rabad and 73 more 10:22 AM You

Advantages of Software Defined Radios

- One equipment for all needs.
- Able to achieve very high levels of performance.
- Software-defined radios can be reconfigured "on-the-fly,"
- Provides flexibility It could be a cordless phone one minute, a cell phone the next, a wireless Internet gadget the next, and a GPS receiver the next.
- Software-defined radios can be quickly and easily upgraded with enhanced features.
- They Support OTA Updates.
- Software-defined radios can talk and listen to multiple channels at the same time.

Workshop:Next Generation Wireless Network

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Raise hand Turn on captions rahul dhebri is presenting

10:22 AM 4/3/2021

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REC rahul dhebri is presenting

SARTHAK PATIL and 72 more 10:26 AM You

Applications of Software Defined Radios

- Smart radios or cognitive radios (CRs)
- Spread Spectrum
- UWB Communication
- Software defined antennas
- Wireless mesh network
- Military
- Amateur Radio Operators and **Hobbyists**

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10:26 AM 4/3/2021

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rahul dhebri is presenting

Ayushi Singh and 77 more 10:42 AM You

RECEIVING WEATHER SATELLITE IMAGES

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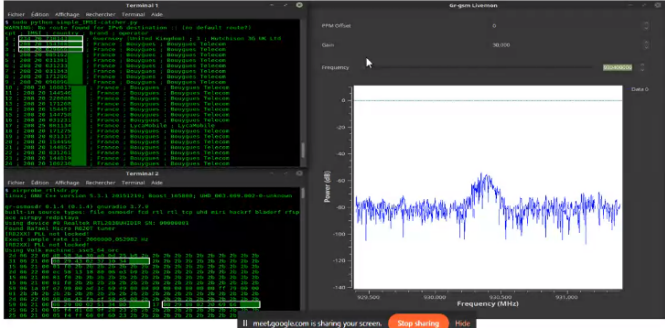
10:42 AM 4/3/2021

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rahul dhebri is presenting

10:45 AM

IMSI CATCHER



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10:45 AM 4/3/2021

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rahul dhebri is presenting

10:46 AM

Commercially available SDRs

- HackRF One
- YARD Stick One
- SDRPlay
- KiwiSDR
- NESDR Mini
- NESDR Nano
- NooElec NESDR
- **RTL-SDR R820T2 RTL2832U**

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10:46 AM 4/3/2021

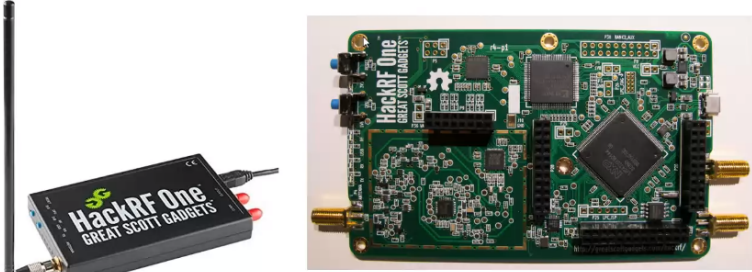
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rahul dhebri is presenting

TANMAY Gokam and 75 more

10:47 AM

HackRF



Shivam Shrivastav has left the meeting

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03/04/2021 Rahul D. Dhebri

Participants: V, B, M, Y, A, J, P, J, R, T, A, A

Actions: Raise hand, Turn on captions, rahul dhebri is presenting

Workshop:Next Generation Wireless Network

Start, Chrome, Edge, Word, Teams, PowerPoint

10:47 AM 4/3/2021

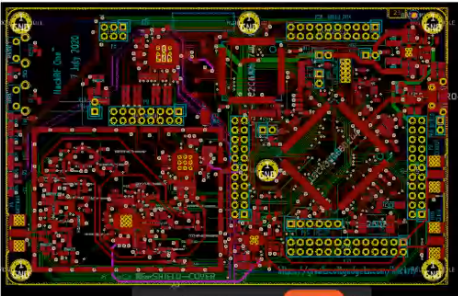
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rahul dhebri is presenting

Atharva Deherkar and 73 more

10:49 AM

HackRF One PCB Layout in KiCAD



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03/04/2021 Rahul D. Dhebri

Participants: V, B, M, Y, A, J, P, J, R, T, A, A

Actions: Raise hand, Turn on captions, rahul dhebri is presenting

Workshop:Next Generation Wireless Network

Start, Chrome, Edge, Word, Teams, PowerPoint

10:49 AM 4/3/2021

meet.google.com/vpx-laqx-yfu?authuser=1

rahul dhebri is presenting

Falguni Ghatge and 71 more

10:50 AM

rahul dhebri is presenting

Workshop:Next Generation Wireless Network

10:50 AM 4/3/2021

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rahul dhebri is presenting

Workshop:Next Generation Wirele... X

People (98)

Chat

Let everyone send messages

RANA (ai) 10:02 AM
Good morning m'am

BEWA Nela 10:07 AM
No xx

Send a message to everyone

PRIVA, Harsha has left the meeting

RTL-SDR

- IMPROVED FRONT END DESIGN (REDUCING IN-HARMONIC LEAKS)
- REDESIGNED THERMAL LAYOUT (IMPROVES VOLTAGE REGULATION)
- ENTIRE PCB REDESIGNED FOR LOWER NOISE
- BETTER LDO (LOW NOISE AND LOWER VOLTAGE OPERATION)
- 5V LINE FERRITE CHOKER
- 4.5V BIRD TEE (IMPROVED CONTROL)
- RES2012
- 100PM TCKO
- SM4 FEMALE CONNECTOR
- ADDITIONAL ESD PROTECTION
- DIRECT SAMPLING CIRCUIT ENABLING RECEPTION OF NEGATIVE SIGNALS
- CLK SELECTOR JUMPER
- GPIO EXPANSION PORTS
- USB BY CHARGE (REMOVED USB MISO)
- STANDARD/OTHER BRAND RTL-SDR


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10:54 AM 4/3/2021

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rahul dhebri is presenting

RTL-SDR



Workshop:Next Generation Wireless Network

10:55 AM 4/3/2021

Chat: Workshop:Next Generation Wire...
People (95)
Let everyone send messages: ON
RAHA Galwad 10:02 AM
Good morning ma'am
SEIWA Inadar 10:07 AM
No sir

AMAN Bankoti has left the meeting

03/04/2021 Rahul D. Dhebri

Keep hand Turn on captions rahul dhebri is presenting

Start

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rahul dhebri is presenting

SiP, PoP, SoC, SoM, CoM, SBC

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11:21 AM 4/3/2021

video: Thomas and 79 more

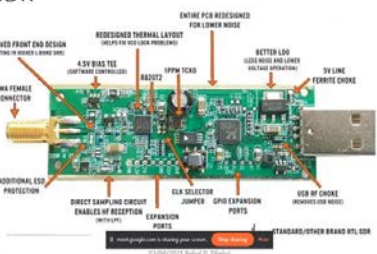
Keep hand Turn on captions rahul dhebri is presenting

Start

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rahul dhebri is presenting

RTL-SDR



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11:25 AM 4/3/2021

Elvis Dolva and 79 more

Keep hand Turn on captions rahul dhebri is presenting

Start

Diagram labels:
- IMPROVED FRONT END DESIGN (REDUCES TO ORDER 10dB LOSS)
- SMA FEMALE CONNECTOR
- ADDITIONAL ESD PROTECTION
- DIRECT SAMPLING CIRCUIT (ENABLES HF RECEPTION)
- EXPANSION PORTS
- USB BY CHINESE (IMPROVES OVER NOISE)
- 4.5V BIAS TEE (SUPPORTS CONNECTORS)
- REDESIGNED THERMAL LAYOUT (HELPS PREVENT OVERHEATING)
- 100V TCRs
- ENTIRE PCB REDESIGNED FOR LOWER NOISE
- BETTER LDO (LOWER NOISE AND LOWER INDUCTIVE IMPEDANCE)
- 5V LINE
- FERRITE CHOKES
- ELK SELECTOR JUMPER
- SMD EXPANSION PORTS
- USB BY CHINESE (IMPROVES OVER NOISE)
- STANDARDS/OTHER BRAND RTL-SDR

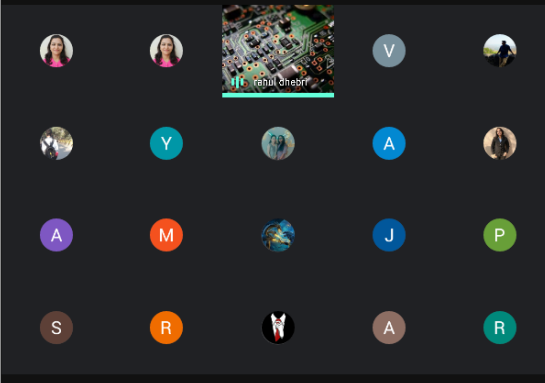
meet.google.com/vpx-laqx-yfu?authuser=1

rahul dhebri is presenting

11:23 AM

System-In-A-Package (SiP)

- A system in package (SiP) contains several ICs (chips).
- An example SiP can comprise several chips—such as a specialized processor, DRAM, flash memory—combined with passive components—resistors and capacitors—all mounted on the same substrate.
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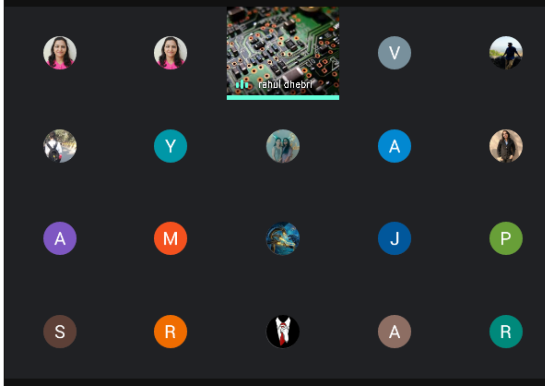
Workshop:Next Generation Wireless Network

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rahul dhebri is presenting

Package-On-A-Package (PoP)

- A Package-on-a-Package stacks single-component packages vertically, connected via ball grid arrays.
- Packages can be discrete components (memory, CPU, other logic) or a System-in-a-Package stacked with another package for added or expanded functionality.



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11:24 AM 4/3/2021

raahul dhebri is presenting

11:26 AM 4/3/2021

PoP

The diagram illustrates a Package on Package (PoP) structure. It shows two substrates stacked on top of each other. The top substrate has a mold region containing a die, which is connected to the bottom substrate via bonding wires. Solder balls are used to attach the substrates to a common base. Labels include: Mold Region, Die, Bonding Wire, Substrate, and Solder Ball.

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Workshop:Next Generation Wireless Network

11:26 AM 4/3/2021

System-On-A-Chip (SoC)

- SoC is equivalent to a computer package inside a chip
- A System-on-a-chip (SoC) is a microchip with all the necessary electronic circuits and parts for a given system, such as a smartphone or wearable computer, into a single integrated circuit (IC).
- An SoC integrates a microcontroller (or microprocessor) with advanced peripherals like graphic processing unit (GPU), Wi-Fi module, or coprocessor.
- It may contain digital, analog, mixed-signal, and often radio-frequency functions – all on a single substrate.
- Advantages of an SoC is that it is usually cheaper, smaller, easy to scale, and even more energy efficient
- A good example of an SoC is the Raspberry Pi

03/04/2021 Rahul D. Dhebri

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rahul dhebri is presenting

System-On-A-Chip (SoC)

200 PROCESSOR

- ARM Cortex A5 with Quad CPUs up to 1.4GHz for high performance
- Adreno 203 for advanced graphics
- Hexagon QDSP5 for ultra low power applications
- Integrated 802.11n, BT3.0, USB 2.0 Multi-SIM QSD5, QSD4 Single Platform for CDMA & UMTS
- 720p capture and playback
- Up to 8.0 megapixel camera
- HD 720p display
- Integrated IZat GPS support

0 SAMA Shaikh has left the meeting

11:28 AM 4/3/2021

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rahul dhebri is presenting

SoM

Nvidia Jetson Nano for AI

11:31 AM 4/3/2021

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rahul dhebri is presenting

Single Board Computers (SBCs)

- A single-board computer (SBC) is a complete computer built on a single circuit board, with a microprocessor(s), memory, input/output (I/O) and other features required for a functional computer.
- Single-board computers were made as demonstration or development systems, for educational systems, or for use as embedded computer controllers.
- Examples of popular SBCs are Raspberry Pi boards, Nvidia Jetson, Beaglebone, and several others.

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rahul dhebri is presenting

Common RF transceiver IC/Modules

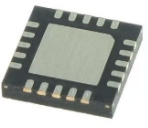
- NRF24L01 SoC (2.4Ghz)
- ESP8266 (2.4GHZ Wi-Fi)
- ESP32 (2.4GHZ Wi-Fi Bluetooth)
- STM32WL5X(150-960MHz)
- AX-SFAZ(900MHz)

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rahul dhebri is presenting

11:38 AM

NRF24L01+ 2.4GHz ISM Band



- 4*4mm QFN Package
- Wireless Mouse, keyboards and remotes
- Advanced Media center remote controls
- VoIP headsets
- Game controllers
- Sports watches and sensors
- RF remote controls for consumer electronics
- Home and commercial automation
- Ultra low power sensor networks
- Active RFID
- Asset tracing systems


03/04/2021 Rahul D. Dhebri

Participants: You, Smita Pawar, rahul dhebri, VANRAJ Pard..., ROHIT Prasad, Keval Meher, Yash Dekate, HARSHITA Gu..., Alex K.R., PRIYA Harsh..., AMAN Bankoti, MANAS Mishra, VISHAL Maml..., ADIT DESHMU..., PRANAV Desh..., Kunal Gupta, Rahul Joshi, Meet Kevadiya, Raghuveer De..., RUSHIKESH R...

Workshop:Next Generation Wireless Network

11:40 AM 4/3/2021

ESP32 2.4GHZ WiFi+BT



- Xtensa® single-/dual-core 32-bit LX6 microprocessor(s)
- 802.11 b/g/n
- 802.11 n (2.4 GHz), up to 150 Mbps
- 4 x virtual Wi-Fi interfaces
- Bluetooth 4.2 BR/EDR BLE dual mode controller
- Synchronous Connection-Oriented/Extended (SCO/eSCO)
- CVSD and SBC for audio codec
- Bluetooth Piconet and Scatternet
- Multi-connections in Classic BT and BLE
- Simultaneous advertising and scanning


03/04/2021 Rahul D. Dhebri

Participants: Spencer Lobo and 76 more, You, Smita Pawar, rahul dhebri, VANRAJ Pard..., ROHIT Prasad, Keval Meher, Yash Dekate, HARSHITA Gu..., Alex K.R., PRIYA Harsh..., AMAN Bankoti, MANAS Mishra, VISHAL Maml..., ADIT DESHMU..., PRANAV Desh..., Kunal Gupta, Rahul Joshi, Meet Kevadiya, Raghuveer De..., RUSHIKESH R...

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rahul dhebri is presenting

ESP32 2.4GHZ WiFi+BT



- Xtensa® single-/dual-core 32-bit LX6 microprocessor(s)
- 802.11 b/g/n
- 802.11 n (2.4 GHz), up to 150 Mbps
- 4 x virtual Wi-Fi interfaces
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- Synchronous Connection-Oriented/Extended (SCO/eSCO)
- CVSD and SBC for audio codec
- Bluetooth Piconet and Scatternet
- Multi-connections in Classic BT and BLE
- Simultaneous advertising and scanning

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Arman Khan and 79 more

11:42 AM

You




Grid of participants: You, Smita Pawar, rahul dhebri, VANRAJ Pard..., RDHIT Prasad, Kaval Meher, Yash Dekate, Ayushi Singh, Alex K.R., PRIYA Harsha, AMAN Bankoti, MANAS Mishra, VISHAL Maml..., ADIT DESHMU..., PRANAV Desh..., Kunal Gupta, Rahul Joshi, Meet Kevadiya, Raghuveer De..., RUSHIKESH R...

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rahul dhebri is presenting

STM32WLE5X

The world's first LoRa® SoC

- Ultra-low power multi-modulation wireless STM32WLE5x microcontrollers
- Based on an Arm® Cortex®-M4 core running at 48 MHz, and a sub-GHz radio based-on Semtech SX126x
- Open platform supporting LoRa®, (G)FSK, (G)MSK and BPSK modulations.

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Ayushi Singh and 79 more

11:42 AM

You

Grid of participants: You, Smita Pawar, rahul dhebri, VANRAJ Pard..., RDHIT Prasad, Kaval Meher, Yash Dekate, ARJUN Shisho..., Alex K.R., PRIYA Harsha, AMAN Bankoti, MANAS Mishra, VISHAL Maml..., ADIT DESHMU..., PRANAV Desh..., Kunal Gupta, Rahul Joshi, Meet Kevadiya, Raghuveer De..., RUSHIKESH R...


Meet - Workshop:Next

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rahul dhebri is presenting

Manishkumar Sivanujan... and 79 more

11:44 AM



Workshop:Next Generation Wireless Network

11:44 AM 4/3/2021

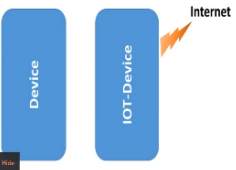
rahul dhebri is presenting

Negalakshmi Ravi and 79 more

11:45 AM

What is LoRa

- Long Range, Low Power, Low Data Rate
- PHY Radio Protocol for IoT
- Derivative of Chirp Spread Spectrum Modulation
- Proprietary to Semtech.
- Standards defined by the Lo-Ra Alliance.



Workshop:Next Generation Wireless Network

11:45 AM 4/3/2021

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Feedback for Workshop- EXTC - Google Forms docs.google.com

11:48 AM

raahul dhebri is presenting

Low Power Wide Area Network = LPWAN

Bandwidth

Wide Area ↔ Low Power

BHARAT Gupta has left the meeting

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Workshop:Next Generation Wireless Network

11:50 AM 4/3/2021

raahul dhebri is presenting

Start

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MOHIT PATIL and 74 more

11:50 AM 4/3/2021

raahul dhebri is presenting

What is LoRaWAN

- LPWAN for IoT
- Open, non-proprietary standard
- Adaptive data rate scheme
- Multiple levels of encryption
- Supports time slot scheduling of device transmission

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rahul dhebri is presenting

Sohan Ranadive and 74 more

11:53 AM

LoRaWAN comparison

	802.11n	4G	LoRaWAN
Throughput	< 300 Mb/s	20 Mb/s imho	< 1 Mb/s
Range	100 ... 200 m	2 ... 10 km	20 km and more!
Battery life	Days	Days	Years!

"imho," Journal for unschientific data, 22(2017), P. 4

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03/04/2021 Rahul D. Dhebbri

Workshop:Next Generation Wireless Network

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rahul dhebri is presenting

TANMAY Gokam and 73 more

11:53 AM

LoRaWAN Infrastructure Overview

The diagram illustrates the LoRaWAN infrastructure. On the left, multiple orange squares represent 'end devices' connected to several blue hexagons labeled 'GW' (Gateways). These gateways connect to a central blue circle labeled 'Network Server'. Above the network server, text indicates 'NOC, CRM, billing, ...'. Below the network server, a blue box labeled 'IBM LRSC' is shown. To the right of the network server, two green boxes labeled 'Application router' are connected to two green diamonds labeled 'App'. A dashed line labeled 'IP communication (TCP/IP, MQTT, ...)' connects the application routers to the applications.

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03/04/2021 Rahul D. Dhebbri

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LoRa Frequency Allocation

	Europe	North America	China	Korea	Japan	India
Frequency band	867-868MHz	902-928MHz	470-510MHz	920-925MHz	920-925MHz	865-867MHz
Channels	10	84 + 8				
Channel BW Up	125/250kHz	125/500kHz				
Channel BW Dn	125kHz	500kHz				
TX Power Up	+14dBm	+20dBm up (+30dBm allowed)	In addition by Technical Committee	In addition by Technical Committee	In addition by Technical Committee	In addition by Technical Committee
TX Power Dn	+14dBm	+27dBm				
SF Up	7-12	7-10				
Data rate	250bps-50kpbs	900bps-21 kbps				
Link Budget Up	155dB	154dB				
Link Budget Dn	155dB	154dB				

Workshop:Next Generation Wireless Network

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LoRaWAN: Network Server (NS)

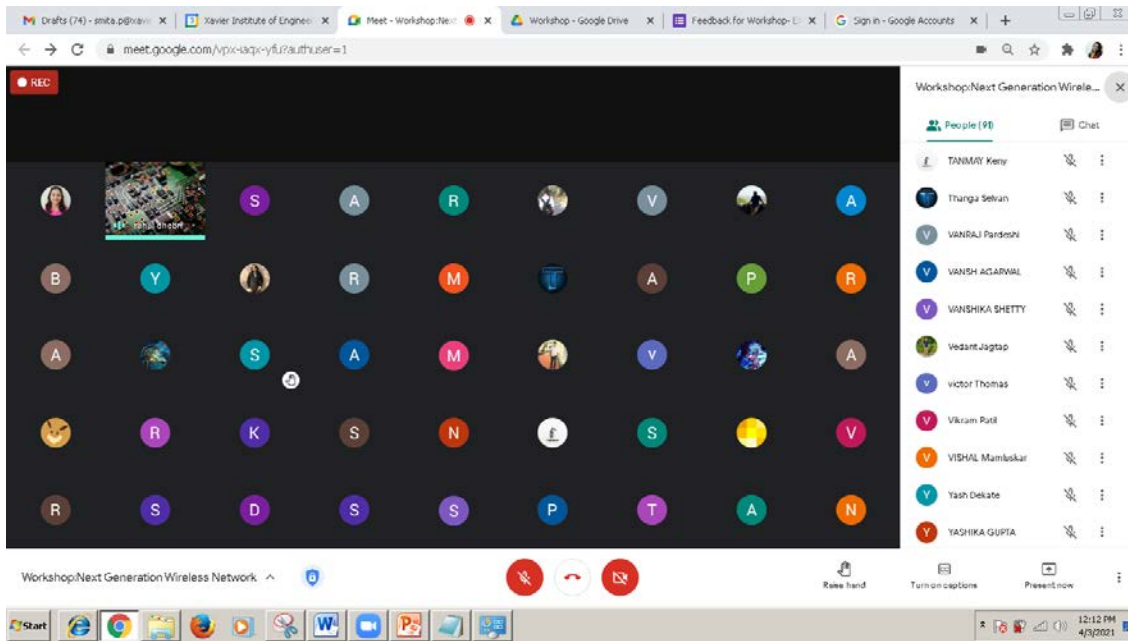
Workshop:Next Generation Wireless Network

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rahul dhebri is presenting

RF Transceivers for Projects

Workshop:Next Generation Wireless Network



FEEDBACK:

Meet Kevadiya: It was an informative session

Swarashree Salvi: Would like to attend more such workshops

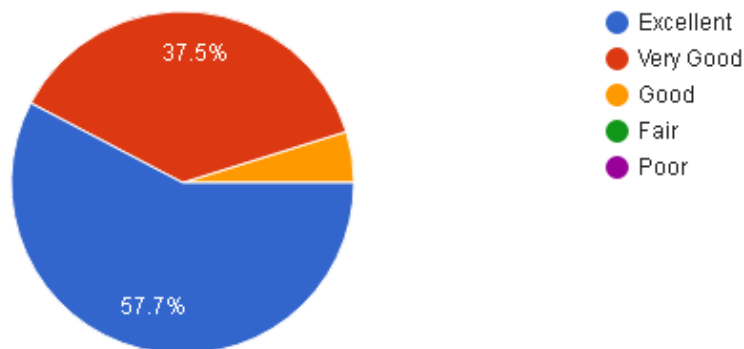
Rohit: would have been better to have a physical session

Elvis Dsilva: Pretty cool lecture would like to attend an actual offline workshop which could be more informative and fun

Vanraj Pardeshi: Session was overwhelming. Thank you for giving such an amazing knowledge

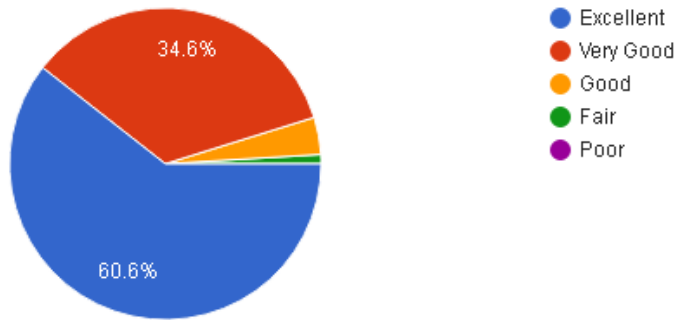
How was the overall organization of the session?

104 responses



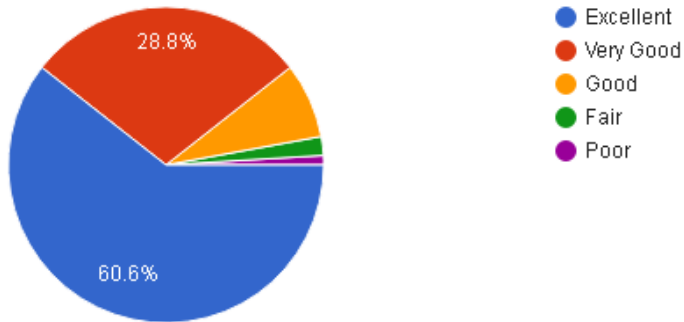
How relevant was the content discussed by the speaker?

104 responses



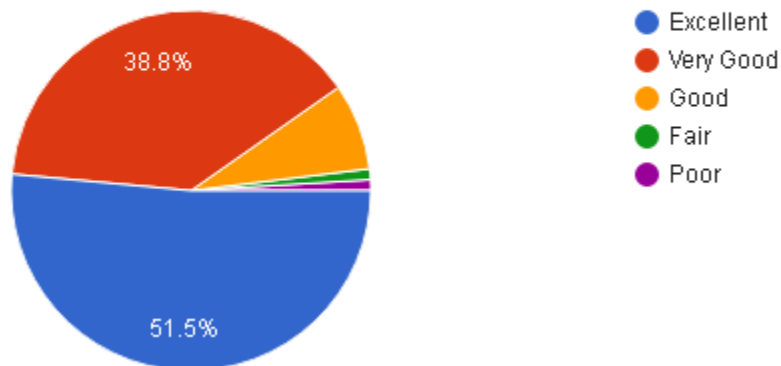
Are you satisfied with the time and venue/platform?

104 responses



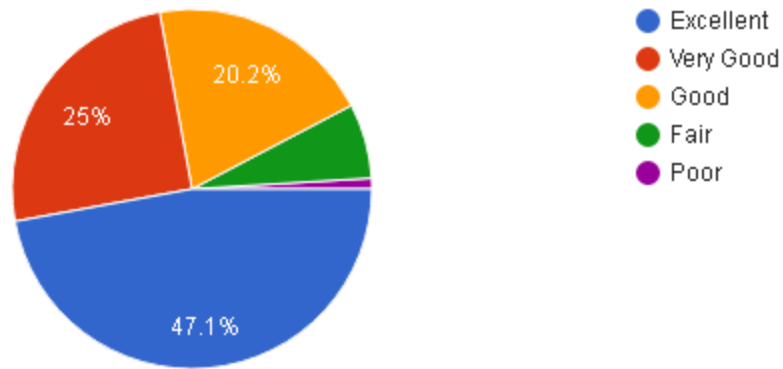
How much interesting this session was for you?

103 responses



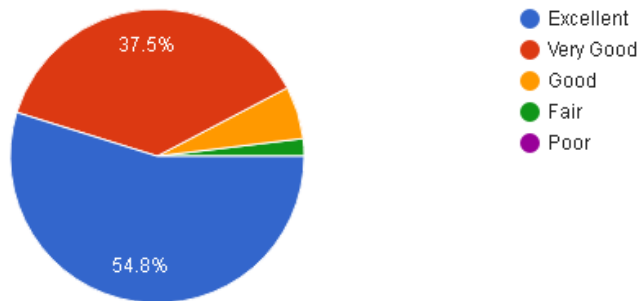
How was your preparation about the topic before the guest lecture?

104 responses



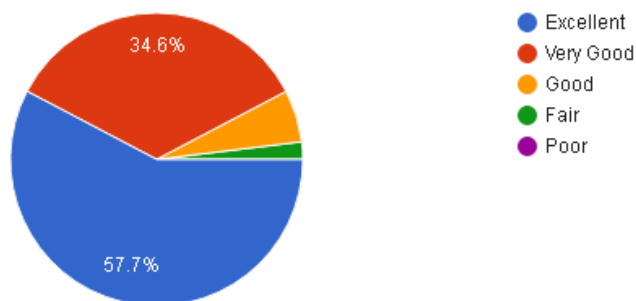
Did the lecture cover what you were expecting?

104 responses



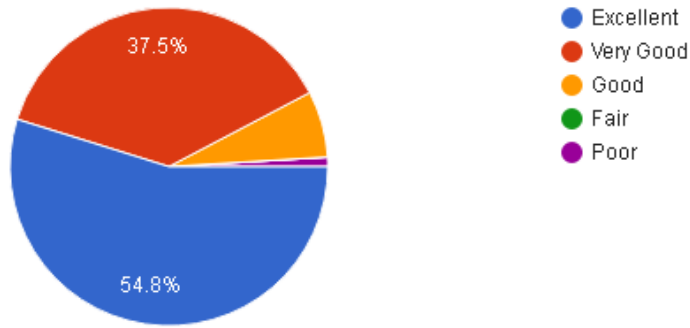
How much this session was useful from the knowledge and information point of view

104 responses



Overall effectiveness of the session

104 responses



CERTIFICATE FORMAT:



Prof. Smita Pawar
Workshop In charge

Dr. Vidya Sarode
HoD, EXTC

Fr. Fabian Barreto, SJ
XIE ISF Coordinator