



RV COLLEGE OF ENGINEERING®
 (Autonomous Institution affiliated to VTU, Belagavi)
**DEPARTMENT OF ELECTRONICS AND
 TELECOMMUNICATION ENGINEERING**
 RV Vidyaniketan Post, 8th Mile, Mysuru Road,
 BENGALURU- 560059, KARNATAKA, INDIA.

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THE EDITORIAL

World Telecommunication and Information Society Day (WTISD) has been celebrated annually every 17 May since 1969, marking the founding of ITU and the signing of the first International Telegraph Convention in 1865. The purpose of WTISD is to help raise awareness of the possibilities that the use of the Internet and other Information and Communication Technologies (ICT) can bring to societies and economies, as well as of ways to bridge the digital divide. The theme proposed for WTISD-2022 is “Digital Technologies for Older Persons and Healthy Ageing”.

The ageing of the global population will be the defining demographic trend of the 21st century - yet our societies struggle to see the opportunities that this trend can unfold. Telecommunications and ICTs have a role to play in achieving healthier ageing, but also in helping people build *smarter cities*, combat age-based discrimination at the workplace, ensure financial inclusion of older persons, and support millions of caregivers across the world.

The proposed title for the National Conference - 2022 is “Digital Technologies for Smart Cities”. This event focuses on bringing different stakeholders to have a dialogue about the ICT sector contribution to smart and sustainable cities.

Smart cities promote ideas that cater to the rapid urbanisation problems. The key highlights include:

- Smart garbage segregation in metropolitans.
- Traffic lights that receive updates through sensors and are enabled with real-time monitoring.
- EVs and cars with over-the-air updates to stay connected.
- Street lights that utilise energy and power optimally.
- Smart infrastructure-periodic charging stations with world class technological features. and many more.

These technologies leverage sustainable development with increased efficiencies. It also provides an enriched lifestyle to the citizens and the society. Technology trends such as Artificial Intelligence, Internet of Things, Blockchain and 5G, paved the way for a digital community with cities that are smart along with being intelligent and sensible.

SPECIAL POINTS OF INTEREST

- The Editorial
- About the Department
- Blockchain Technology
- Remote Collaboration Using Augmented Reality Videoconferencing
- Multi-Physics Modeling of RF Circuits
- Role of Machine Learning in the ASIC Design
- Cognitive Radio
- Emerging Nanotechnology-Enabled AI
- Metaverse in Medical Domain
- Artificial Intelligence in Telecommunication
- Beyond 5G in Internet of Things
- Multi-Viewpoint and Overlays in the MPEG OMAF Standard
- WTISD - 2021 Celebrations
- Alumni meet 2021

The Editorial Committee

Faculty Editors:

Dr. K. Sreelakshmi
 Prof & HoD, ETE
Dr. Roja Reddy B.
 Associate Professor
Dr. Premananda B.S.
 Associate Professor
Prof. Viswvardhan Reddy K.
 Assistant Professor

Student Editors:

Shaswat Valivati-1RV19ET051
 VI Sem, UG
Abdur Rehman-1RV19ET003
 VI Sem, UG
Rachana P. Rao-RVCE21MDC002
 I Sem, PG DC



[Image Courtesy: Clustering Smart City Services: Perceptions, Expectations, Responses]

Department Activities:

Workshops/Conference Organized

- 5 days Hands on Workshop on Future of 5G with SDR, during 4th to 8th April 2022 under the IEEE RVCE SPS student chapter in association with DSCE, Bengaluru
- 5 days online Workshop on VLSI Circuits Simulation during 28th March to 1st April, 2022, Dept. of ETE, RV College of Engineering, Bengaluru.
- IEEE International Conference on Computational Systems and Information Technology, for Sustainable Solutions (CSITSS-2021) during 16th to 18th December 2021, RV College of Engineering, Bengaluru, (Dept. of CSE, ISE, MCA, ECE and ETE) and Florida International University, Miami, USA .
- Skill Development programme on CCTV Installation and Maintenance, during 8th to 12th November, 2021. Dept. of ETE & CSE, RV College of Engineering, Bengaluru.
- 5 days online Hands on workshop on 5G wireless Communication Systems during 25th October to 29th October 2021 under the IEEE RVCE SPS Student Chapter.

Webinars/Invited talks Organized:

- Audio Representation and Compression by Mr. Ashok Magadam from Saranyu Technologies, Bengaluru on 25/02/2022.
- MMIC Design by P.Sreenivasa Rao from Astrome Technologies Pvt.Ltd. on 31/12/2021.
- India Vision 2050 for Sustainable Net zero Approach by Mr. A. T. Kishore from Vidhya Sangha Technologies Pvt. Ltd. on 16/12/2021.
- Integrated Terrestrial and Nonterrestrial Communication by Dr. Navin Kumar from Amrita School of Engineering on 16/12/2021.
- AI driving 5G Advanced & 6G by Dr. M .H. Kori on 16/12/2021.
- Recent Trends in Broadband Communications by Dr. Ravishankar S. on 16/12/2021.
- Private 5G Networks by Mr. Abhijeet Choudary from Niral Networks on 24/08/2021.
- ASIC in Today's World by Mr. Chethan C.S. from Intel Corp on 12/06/2021.
- Technology Trends for 5G and IoT based Use cases by Mr. Visweshwar Hegde from Telstra on 12/08/2021 .
- Road Map to Career in ML by Mr. Kumar Kaushik from Ureka Inc. on 10/07/2021.

ABOUT THE DEPARTMENT

Department of Electronics and Telecommunication Engineering started in the year 1992. Now Dept. has one U.G. and two P.G. programs. Moreover the department is recognized as a research center under VTU to carry out M.Sc. (Engg.) and Ph. D.

Programs Offered

♦ U.G. Program:

Bachelor of Engineering in Electronics and Telecommunication Engineering with an intake of 60 under gone multiple cycles of Accreditation.

♦ P.G. Programs:

Master of Technology in Digital Communication Engineering with intake of 36, accredited by National Board of Accreditation, New Delhi.

Master of Technology in RF & Microwave Engineering with intake of 18, accredited by NBA, New Delhi.

The department has a total of 22 teaching faculty members, out of which 10 are Ph. D holders, 12 are pursuing PhD and competent technical and support staff.

Research Facilities

Department developed industry based labs such as Keysight (Advanced RF and Wireless Communication Lab), Tejas networks, and CCTV Research Lab to strengthen U.G., P.G. projects and Research activities. The details of the research labs are listed as follows:

1) RVCE-Keysight Advanced RF and Wireless Research Lab:

FACILITIES AVAILABLE	TECHNOLOGIES SUPPORTED
• Agilent Vector Signal Analyzer: EXA 7 GHz	• GSM/GPRS/EGPRS
• 24 Systems loaded with Keysight EDA Tools	• WCDMA/HSDPA/HSUPA/HSPA+
• Agilent MIMO Baseband Generator PXB	• AMPS/IS95A-B/IS2000/EVDOA-B
• Agilent Mixed Signal Oscilloscope, 4 Ch, 4 GSa/s with 16 Digital Channels	• WLAN/BT/ZigBee/RFID/WiMax/LTE
• Agilent Vector Signal Generator: MXG 6 GHz	• MIMO
• R&S Vector Network Analyzer: 13.6 GHz	• DC-HSDPA
• Software Defined Radio Kits	• SDR, Cognitive Radio

2) RVCE-Tejas Optical Research Lab:

FACILITIES AVAILABLE	TECHNOLOGIES SUPPORTED
• Tejas 1600C SDH Optical Transport equipment	• SONET
• Tejas 3301 CWDM Equipment with ROADM facility	• SDH
• RXT2380RxT2.5G Test set up	• WDM
• RXT2380 SW 25G Test set up	• CWDM
	• DWDM
	• Packet transport

3) CCTV Research Lab:

IR PTZ Camera	2MP, 20x Full HD Recording -150 Mtr
Body Worn Camera	2 MP Full HD Recording
IR Network Bullet Camera	2MP Full HD Recording - 40Mtr
Wi-Fi Bullet Camera	2MP Full HD Recording
Outdoor CPE Access point	5GHz 300Mbps 23dBi with Dual Polarized Directional Antenna
Mini bullet IP cameras	2MP fixed lens 3.8mm
NVR	8 channel, 1 TB HDD
Work Station	Dell, Intel® Core™ i9,RAM- 32GB (2x16GB) DDR4, Storage - 512GB, 4TB 5400rpm SATA 3.5" HDD,

ABOUT THE DEPARTMENT....

Faculty Membership of Professional Bodies

Sl. No.	Faculty Name	Association	Membership Detail
1	DR. K. SREELAKSHMI	IEEE/IETE	No. 93879876/ F-144426
2	DR. H.V. KUMARASWAMY	IEEE/IETE	No. 97518487/ F-131347
3	PROF. P. NAGARAJU	IEEE/IETE	No. 97518449/ F-131353
4	DR. K. NAGAMANI	IEEE/IETE	No. 94839025/ F-502973
5	DR. R. BHAGYA	IEEE/IETE	No. 95663275/ F-502679
6	DR. B. ROJA REDDY	IEEE/IETE	No. 94817651/ F-230094
7	DR. PREMANANDA B.S.	IEEE	No. 92328975
8	DR. K. SARASWATHI	IEEE	No. 92375938
9	DR. SHANTHI P.	IEEE	No: 95654327
10	PROF. MOHANA	IEEE	No. 95188416
11	PROF. K. VISWAVARDHAN REDDY	IEEE	No. 90514368
12	DR. RANJANI G.	IEEE / IETE	No. 96931775/ F -191965

U.G. Rank Holders (2016—2020 Batch):

Sl. No.	USN	Name of the student	Rank	CGPA
1	1RV17TE027	NIKHIL K.J.	I	9.34
2	1RV17TE021	MANASA BURAVALLI	II	9.30
3	1RV17TE030	PRADHYUMNA P.	III	9.25
4	1RV17TE023	MARIA BENCY	IV	9.20
5	1RV17TE019	KAVERI PATIL	V	9.06
6	1RV17TE035	PRIYANKA HOLLA B.G.	VI	9.00

P.G. Rank Holders (2018-2020 Batch):

M.Tech. in Digital Communication

Sl. No.	USN	Name of the student	Rank	CGPA
1	1RV19LDC08	DEPTHI DATTA	I	9.42
2	1RV19LDC03	B. HEMA PRIYA	II	9.38
3	1RV19LDC24	RASHMI B.S.	III	9.17

M.Tech. in RF and Microwave Engineering

Sl. No.	USN	Name of the student	Rank	CGPA
1	1RV19LRF05	NISHANTH PARAMESH	I	9.67
2	1RV19LRF04	NAMRATA MARIGOUDAR	II	8.64
3	1RV19LRF06	PRUTHWI K.	III	8.16

Project Grants Received from Funding Agencies:

Modernization of Wireless Communication Laboratory with full-fledged testing and Characterization of passive and active circuits for 5G and Allied technologies by **Modernization & Removal of Obsolescence.**

Dr. K. Sreelakshmi
Dr. K. Nagamani
Dr. B. Roja Reddy

IEEE EXECOM:

Dr. Nagamani K.

SPS Bangalore Section and Sensors Council Chapter Bangalore Section

Dr. Premananda B.S.

ITS Bangalore Section.

BoE in other Institutions:

Dr. H.V. Kumaraswamy
Prof. P. Nagaraju
Dr. K. Nagamani
Dr. Premananda B.S.

Ph.D. Doctoral Committee Member in other Institutions:

Dr. G. Sadashivappa
Dr. K. Sreelakshmi
Dr. H.V. Kumaraswamy
Dr. K. Nagamani
Dr. Premananda B.S.
Dr. R. Bhagya
Dr. B. Roja Reddy

Senior IEEE Members:

Dr. K. Sreelakshmi
Dr. K. Nagamani
Dr. B. Roja Reddy
Dr. Premananda B.S.
Dr. Shanthi P.

Faculty/Student Publications:

International Journal: 08
International Conference: 35

ಯಶಸ್ವಿ ಬದುಕಿಗೊಂದು ಚೆಂದದ ಸೂತ್ರ; ಹೊತ್ತು ಮಾಗುವ ಮುನ್ನ ನಿಮ್ಮನ್ನು ನೀವು ಅರಿಯಿರಿ!

ಇತರರ ಕಷ್ಟ ನೋಡಿ ನಗುವಿನೊಂದಿಗೆ ಕಾಲ ಕಳೆದವರು ಮುಂದೊಂದು ದಿನ ಅಳುವ ಸಂದರ್ಭ ಖಂಡಿತವಾಗಿಯೂ ಬರುತ್ತದೆ " ಕರ್ಮಫಲ ಅನ್ನೋದು ಅದಕ್ಕೇ" ಈ ಮಾತನ್ನು ನಾನು ಯಾವತ್ತೂ ನಂಬುತ್ತೇನೆ. ಹೀಗಾಗಿ ಯಾವತ್ತೂ ಬೇರೆಯವ ಬದುಕಿನ ಬಗ್ಗೆ ಕಥೆ ಕಟ್ಟುವ ವ್ಯಕ್ತಿ ನೀವಾಗಿದ್ದಲ್ಲಿ ಇಂತಹ ಕಾರ್ಯದಿಂದ ದೂರವಿರಿ. ಇತರರ ಸಾಧನೆಯಲ್ಲಿ ಖುಷಿಪಡುವುದನ್ನು ಕಲಿಯಿರಿ. ಏನಾದರೂ ಸಾಧನೆ ಮಾಡಿದಲ್ಲಿ ಅದರ ಕುಂದು ಕೊರತೆ ಯನ್ನು ಹುಡುಕುತ್ತಾ ಹೋದಲ್ಲಿ ನೀವು ಅಲ್ಲಿಯೇ ಇರುತ್ತೀರಿ. ಸಾಧಿಸುವವರು ಮುಂದೆ ಸಾಗುತ್ತಿರುತ್ತಾರೆ. ನಷ್ಟ ಅನುಭವಿಸುವುದು ನೀವು ಒಮ್ಮೆ ಯೋಚಿಸಿ. ಬದುಕು ನದಿಯಂತಿರಬೇಕು ಕಷ್ಟ ಬಂದಾಗ ಎದುರಿಸಿ ಮುಂದೆ ಸಾಗುತ್ತಾ ಧೈರ್ಯದಿಂದ ಎದುರಿಸಬೇಕು. ಯಾವೊಂದು ಕಾರಣಕ್ಕೂ ಜೀವನದಲ್ಲಿ ನಡೆದ ಒಂದು ಕಠಿಣ ಘಟನೆಯನ್ನು ನೆನಪಿಸಿಕೊಂಡು ಅತ್ಯಮೂಲ್ಯವಾದ ಜೀವನವನ್ನು ಹಾಳು ಮಾಡದಿರಿ. ನಿಮ್ಮ ಬದುಕಿನ ಏಳು ಬೀಳಿಗೆ ನೀವು ಕಾರಣ ಕರ್ತರಾಗುತ್ತೀರಿ. ಕಷ್ಟವನ್ನು ಸರಿಪಡಿಸುವ ಬಗ್ಗೆ ನಿಮ್ಮ ನಿಲುವಿರಲಿ. ಬೇರೆಯವರು ನಿಮ್ಮ ಬಗ್ಗೆ ಏನು ಯೋಚಿಸುತ್ತಾರೆ ಎನ್ನುವುದನ್ನು ಬಿಟ್ಟುಬಿಡಿ. ಇಂತಹ ಯೋಚನೆಯಲ್ಲಿ ನೀವು ವಿಫಲರಾದರೆ ಮುಂದೆ ಬದುಕಿನ ಸಂಪೂರ್ಣ ಪರಿಶ್ಕೆಯಲ್ಲಿ ನೀವು ಸೋತು ಹೋಗುತ್ತೀರಿ. ಕಷ್ಟ ಸರಿಪಡಿಸುವ ದಾರಿ ಹುಡುಕಿ , ಕೊರಗಿ ಪ್ರಯೋಜನವಿಲ್ಲ. ಕಾಲ ಹರಣ ಮಾಡುತ್ತಾ ಆಗಿ ಹೋದ ವಿಚಾರವನ್ನು ಮಾತಾಡಿ ಸಮಯ ವ್ಯರ್ಥ ಮಾಡದಿರಿ. ತಮಗೆ ಸಂಬಂಧ ಪಡದ ವಿಚಾರದ ಬಗ್ಗೆ ಇಲ್ಲ ಸಲ್ಲದನ್ನು ಒಂದು ಉತ್ತಮ ಕತೆಗಾರರಂತೆ ಸಿನಿಮಾದ ರೀತಿಯಲ್ಲಿ ಕಥೆ ಯನ್ನು ಪೋಣಿಸುವುದು. ಒಂದು ಕ್ಷಣವೂ ಯೋಚಿಸುವುದಿಲ್ಲ ನಾವು ಬೇರೆಯವರ ಬದುಕಿನ ಬಗ್ಗೆ ಮಾತಾಡುತ್ತಿರುವುದು ಮುಂದೆ ನಮ್ಮ ಬದುಕಲ್ಲೂ ಈ ರೀತಿಯ ಘಟನೆ ಆಗಬಹುದು ಎನ್ನುವ ಒಂದು ಚೂರು ಪರಿವೆಯಿಲ್ಲದೆ ಮಾತನಾಡುತ್ತಾರೆ ನಮ್ಮ ಜನರು, ಇಂತಹ ಜನರಿಂದ ದೂರ ಇರಿ. ಪ್ರತಿಯೊಬ್ಬರ ಬದುಕಲ್ಲಿ ಏಳು ಬೀಳುಗಳಿರುತ್ತದೆ. ಅವರವರ ಪುಸ್ತಕದ ಪುಟ ಬೇರೆ ಬೇರೆಯಾಗಿರುತ್ತದೆ. ಬದುಕಿನ ಕಷ್ಟಕಲಸದ ಹುಡುಕಾಟ, ಮಕ್ಕಳ ಮದುವೆ, ಹಣಕ್ಕಾಗಿ ಪರದಾಟ, ಮಕ್ಕಳ ಶಿಕ್ಷಣ, ಪ್ರತಿಯೊಬ್ಬರ ಬದುಕಿನ ಕಷ್ಟ ವಿಭಿನ್ನವಾಗಿರುತ್ತದೆ. ಅವರವರಿಗೆ ತಮ್ಮ ಬದುಕು ಒಂದು ಸಿನಿಮಾದ ಹಾಗೆ ಅನಿಸಬಹುದು. ಉತ್ತಮ ಶೀರ್ಷಿಕೆಯೊಂದಿಗೆ ನಮ್ಮ ಪುಸ್ತಕದ ಪುಟದ ಬರಹಗಾರರು ನಾವಾಗಿರಬೇಕು. ಬೇರೆಯವರು ನಮ್ಮ ಜೀವನದ ಬಗ್ಗೆ ಅವರಿಗೆ ತೋಚಿದಂತೆ ಬರೆಯಲು ಅವಕಾಶ ನೀಡಬಾರದು. ನೀವು ನೆನಸಿದ ಹಾಗೆ ನಿಮ್ಮ ಬದುಕನ್ನು ರೂಪಿಸಲು ಸಾಧ್ಯ ವಿಲ್ಲ. ಆದರೆ ಸಾಧಿಸುವ ಛಲ ಇದ್ದರೆ ಎಲ್ಲವೂ ಸಾಧ್ಯ.

ಪದ್ಮಪ್ರಿಯ ಸಿ. ಜಿ., ಕಛೇರಿ ಸಿಬ್ಬಂದಿ

Blockchain Technology

Over the past few years, you have consistently heard the term 'blockchain technology' probably regarding cryptocurrencies, like Bitcoin. Blockchain technology is a structure that stores transactional records, also known as the block, of the public in several databases, known as the "chain," in a network connected through peer-to-peer nodes. Typically, this storage is referred to as a 'digital ledger'. Every transaction in this ledger is authorized by the digital signature of the owner, which authenticates the transaction and safeguards it from tampering. Hence, the information of the digital ledger contains is highly secure.

Blockchain is a combination of leading technologies which includes Cryptography keys which consist of two keys – Private key and Public key. These keys help in performing successful transactions between two parties. Each individual has these two keys, which they use to produce a secure digital identity reference. This secured identity is the most important aspect of Blockchain technology. In the world of cryptocurrency, this identity is referred to as 'digital signature' and is used for authorizing and controlling transactions.

The digital signature is merged with the peer-to-peer network; a large number of individuals who act as authorities use the digital signature in order to reach a consensus on transactions, among other issues. When they authorize a deal, it is certified by a mathematical verification, which results in a successful secured transaction between the two network-connected parties. So, to sum it up, Blockchain users employ cryptography keys to perform different types of digital interactions over the peer-to-peer network. The main advantage of blockchains is the level of security it can provide, and this also means that blockchains can protect and secure sensitive data from online transactions. For anyone looking for speedy and convenient transactions, Blockchain technology offers this as well. In fact, it only takes a few minutes, whereas other transaction methods can take several days to complete. There is also no third-party interference from financial institutions or government organizations, which many users look at as an advantage.

Dr. Nagamani K., Dr. Bhagya R., Sneha S. (IV Sem. M.Tech. DC)

Student Achievements:

- Sumukha S. Srivatsa, 1RV19ET055 is selected for MITACS Globalink research Fellowship titled Pedersoli Reinforcement learning for Automatic Data Augmentation at Montreal, Canada.
- Arnav Singh participated in Street play competition in MOOD INDGO 2021, IIT Bombay.
- Mithun P. got elite NPTEL Certification for the course Problem Solving through Programming in C.
- Nipun Sagiraju 1RV20ET035 won 2nd place for the designing of RLC circuits competition called Dare to Design conducted by NITK.
- A.M. Anjana Sundari participated in the world level IEEE ComSoc Student Competition Communications Technology Changing the World.
- A.M. Anjana Sundari received a Honorary mention (one out of top 14 projects) for the project Hands-free Operation for Public Elevators (H.O.P.E.) for COVID - 19.
- Ananya Maiya and Meghana G. received the appreciation certificate from WIRIN for Executing project on "Design and Implementation of Wi-Fi Enabled V2V Communication System" in 2021.
- Sharmada K. (IV Sem PG DC), participated in VTU inter college Bangalore zone Volleyball tournament held at NMIT and Kabaddi tournament held at KSIT, Bengaluru.

Invited Talks Delivered by Faculty:

- Dr. R. Bhagya, Communication Protocols in Electric Vehicles on 15th Jan. 2022, organized by IETE, Bengaluru.
- Mr. Rakesh K.R., Hands-on experience on Augmented Reality on 29th March 2022 at RVITM, Bengaluru.
- Dr. K. Nagamani, Academic Activities planned under IEEE SPS 2022, Requirements and Future plan, on 5th March 2022 at IISc, Bengaluru.



Remote Collaboration Using Augmented Reality Videoconferencing

Augmented Reality (AR) Videoconferencing System is a novel remote collaboration tool combining a desktop-based AR system and a videoconference module. The AR applications are superimposed on live video background displaying the conference parties' real environment and merging the natural face-to-face communication of videoconferencing. This form of AR's interaction capabilities with distributed virtual objects uses tangible physical artifacts.

The system design based on concurrent video streaming, optical tracking and 3D application sharing. It yields superior quality compared to pure video streaming with successive optical tracking from the compressed streams. The system's collaborative features with a volume rendering application allows users to display and examine volumetric data simultaneously and to highlight or explore slices of the volume by manipulating an optical marker as a cutting plane interaction device.

A desktop AR based videoconferencing system is shown in Fig. which is against the use of video-see-through head mounted display (HMD). The HMDs prevents bidirectional videoconferencing, as participants will be seen wearing HMDs that cover a significant part of their face. Video acquisition and marker-based tracking (with the AR Tool Kit software) is done simultaneously from a single camera placed at the top of the screen in a videoconferencing configuration. Application content is placed on tangible optical markers held by the user.

Application manipulation is performed with a combination of markers and mouse/keyboard input. Since the physical space of local and remote participant is not shared, two views per workstation is provided: One showing the local user in a kind of mirror display, and the other showing the remote user. Both views contain the same application objects and the state of objects is synchronized, i.e., modifications will be reflected simultaneously in both views. The application sharing is based on an exchange of user input and system response messages while videoconferencing uses streaming transmission of video information. Typically, the video must be drastically compressed to meet the available bandwidth requirements, and as a consequence the resulting image quality is moderate.

Hardware setup: Desktop-based augmented reality setup for each client consists of a 1.5GHz PC with 512MB RAM and NVIDIA Quadro4 graphics card, a flat-panel LCD monitor, a lightweight Point Grey FireWire camera flexibly mounted on the top of the monitor and pointing at the user and numerous optical markers, AR Tool Kit software for getting tracking information from the optical markers.

Videoconferencing module: The videoconferencing module, OpenH323 is an open-source protocol stack incorporating a set of communication protocols developed by the International Telecommunications Union (ITU). Microsoft NetMeeting and Cisco Routers are used to transmit and receive audio and video information over the Internet. This system is superior to a video-only solution due to: significantly better image quality, stereo rendering capability for the overlaid 3D objects, interaction capabilities with the virtual objects, no duplicate calculation of tracking data, more precise tracking information as it is extracted from the higher-quality local video.

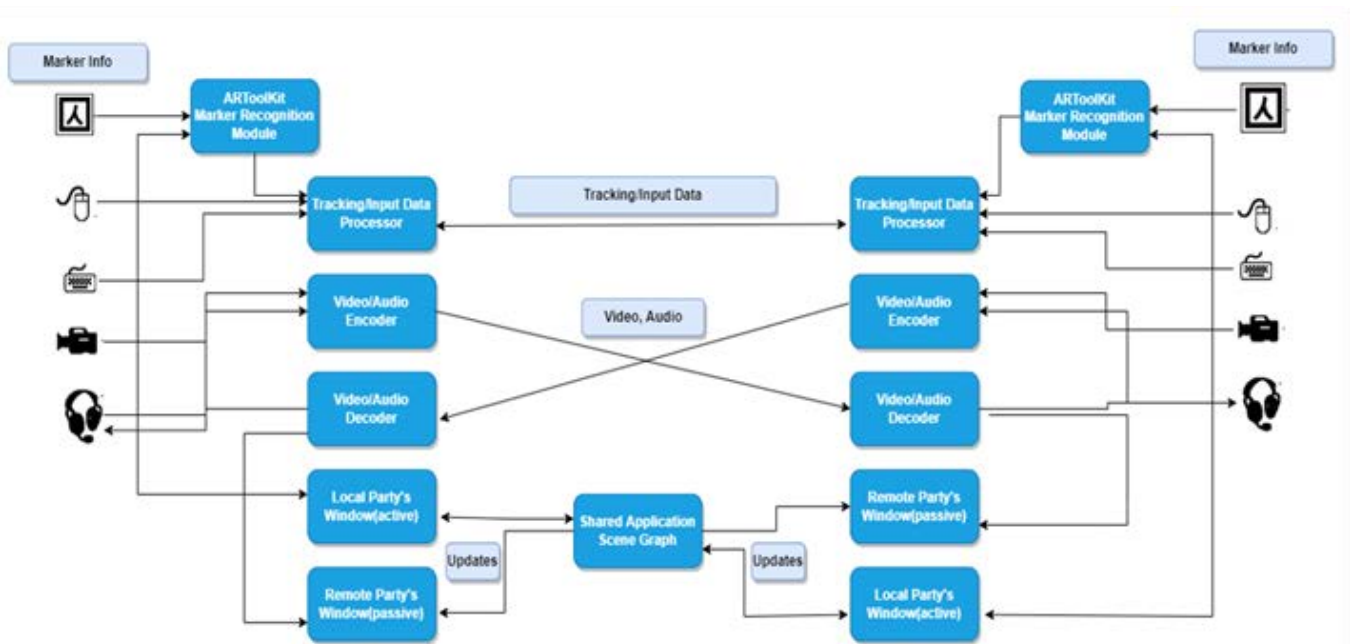


Fig. AR videoconferencing system architecture

[Courtesy: Barakonyi, Istvan. "Remote Collaboration Using Augmented Reality Videoconferencing" Proceedings of Graphics Interface]

Dr. Saraswathi K. and Shruthi S. (IV Sem. M.Tech. DC)

Best Paper Award:

- Varadi Rajesh, Umesh Parameshwar Naik, and Mohana "Quantum Convolutional Neural Networks (QCNN) Using Deep Learning for Computer Vision Applications," 2021 International Conference on Recent Trends on Electronics, Information, Communication & Technology-RTEICT, 27th and 28th Aug. 2021.
- Skanda C., Srivasta B., and Premananda B.S., "Design of Compact and Energy Efficient Banyan Network for Nano Communication, 2021 IEEE International Conference on Distributed Computing, VLSI, Electrical Circuits and Robotics -DISCOVER, 19th and 20th Nov. 2021.

Multi-Physics Modeling of RF Circuits

Multi-physics is defined as the coupled processes or systems involving more than one simultaneously occurring physical field and the studies of and knowledge about these processes and systems. Multi-physics refers to simulations that involve multiple physical models or multiple simultaneous physical phenomena. The implementation of multi-physics usually follows the following procedure: identifying a multi-physical process/system, developing a mathematical description of this process/system, discretizing this mathematical model into an algebraic system, solving this algebraic equation system, and post-processing the data.

The abstraction of a multi-physical problem from a complex phenomenon and the description of such a problem are usually not emphasized but very critical to the success of the multi-physics analysis. This requires identifying the system to be analyzed, including geometry, materials and dominant mechanisms. The identified system will be interpreted using mathematics languages (function, tensor, differential equation) as computational domain, boundary conditions, auxiliary and governing equations. Discretization, solution and post-processing are carried out using computers. Therefore, the above procedure is not much different from those in general numerical simulation based on the discretization of partial differential equations.

Power transistors for wireless infrastructure applications have become increasingly complex over the past two decades, from a single die mounted in the package to sophisticated multi-chip modules, as shown in Fig. modern high-power devices have total gate widths of several hundred millimeters, achieved by connecting many gate fingers in parallel. The packaged transistors are further complicated by in-package matching networks, comprising several bond wire arrays connecting metal-oxide semiconductor (MOS) capacitors, and other passive circuit elements, to create the matching networks. The 200-W transistor in Fig. contains almost 250 individual bond wires. Market demands for increased power and efficiency show no sign of abating, and more circuit functions are expected to be integrated within the package. The complexity of the design and construction of high-power microwave transistors continues to increase. Despite this increasing complexity of the power transistor device, the compact models that are provided by the device manufacturer are often simplified, reducing the arrays of bond wires and capacitors to a few lumped components and ignoring distributed effects. This has the benefit of reducing the model to only a few essential ports, simplifying the model extraction and speeding up the circuit simulation. Apart from a few notable exceptions, the internal operation of the packaged transistor is described only coarsely, and the voltages and currents are only available at a few nodes of interest, effectively obscuring the detailed internal operation of the packaged device.

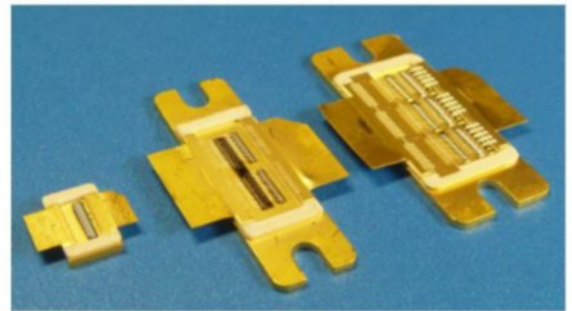


Fig. Photograph showing the increasing complexity of high-power transistors

Dr. Shanthi P.

Role of Machine Learning in the ASIC Design

With the CMOS technology being downscaled constantly, the design complexity of VLSI is increasing, due to which the design cycle of a chip is also getting longer. To enable faster and more efficient functioning of the chip design cycle, the concept of Machine Learning (ML) can be used. ML is a class of algorithms that automatically extract information from datasets or prior knowledge. The applications of ML in VLSI can be dated back to the 90's but has gained traction recently due to the recent breakthroughs and the complexity of the designs. When looking at it from the most generic perspective, it is used to reduce the design time and cost of production. ML-based solutions can be categorized according to their learning paradigms: supervised learning, unsupervised learning, active learning, and Reinforcement Learning (RL). The difference between supervised and unsupervised learning is whether or not the input data is labelled.

ML methods have a great potential to generate high quality solutions to many NP-complete problems (problems which do not have one definite solution), which are highly prevalent in the EDA domain. Traditional methods consume more time and resources to solve these problems as they have to solve every problem from the beginning without the knowledge of accumulations. But in case of ML based algorithms, the focus is mainly on extracting the patterns or features which can be reused in similar situations, which avoids repetitive complicated analysis.

Till date, the only disadvantage that the supervised ML algorithm had was the shortage of datasets to train the ML model. With the advent of the RL concept, even that issue can be resolved. RL uses its own experience to learn with the help of a dataset. It uses a system of rewards, based on which when the favourable outcome is obtained, the rewards are increased, and when unfavourable outcomes are obtained, the rewards are taken back. Based on the target set initially for the rewards, if the threshold is matched, then the RL operation is successful. This can be mainly used in the placement and routing stage of the ASIC Design Flow.

Logic synthesis is an optimization problem with multiple constraints, which requires accurate solutions. By using ML methodologies such as Dynamic Neural Network (DNN), and RL are major improvements in terms of runtime as well as Quality of Results (QoR) can be seen. In the case of physical design, the applications are very vast. In the placement stage the algorithms such as Support Vector Machines (SVM), Graph Convolution Network (GCN) can be used to train, predict, and evaluate potential datapaths and make placement decisions.

Contd...

Generative Adversarial Network, Multivariate Adaptive Regression Spline (MARS), Linear Discriminant Analysis (LDA), K-Nearest Neighbours (KNN), Random Forest (RF) are the set of algorithms that can be used in the routing stage to predict routing congestion, routability of a given placement, wire-length, circuit performance after placement stage, detailed routing result after global routing, to predict and optimize clock tree and to model sign-off timing analysis. The algorithms of XGBoost, CNN, GAN can be used to predict the incremental static IR drop, dynamic IR drop, electro-migration induced IR drop, and the bump inductance.

Considering the above aspects of usage of ML algorithms at different stages of the ASIC design flow, it is imperative that major scope for improvement is there in terms of runtime and efficiency of the design. This can pave the way for multiple innovations in the area concerning EDA tools which in turn replace their algorithms which used conventional logic with the algorithms developed using the ML techniques mentioned above.

Dr. Premananda B.S. and Aneesh Bharadwaj (Alumni)

Cognitive Radio

The concept of Cognitive Radio was introduced in 1999 by Joseph Mitola. He proposed to use the reconfiguration possibilities provided, by the software to transform static radio equipment into dynamic radio equipment able of adapting their parameters such as modulation, transmission power or the frequency bands used. In today’s world, use of wireless devices has increased significantly with the advances in wireless technology. Huge amount of spectrum is required to support this increasing number of wireless devices.

Cognitive Radio (CR) is an intelligent wireless communication system capable of learning from the environment. It allows reusing of the radio resources available by users called Secondary Users (SUs) without creating harmful interference with licensed users. It consists of an intelligent radio system that automatically detects the available channels in its environment and changes the transmission parameters. The idea of CR is to share the spectrum by allowing unlicensed users (SUs) to use the spectrum space available and not used by licensed users or Primary Users (PUs) without interfering with PUs communication and not compromising with degradation in their Quality of Service.

CR technology draws the attention of the telecommunications community and tends to be a futuristic and an attractive technology in communication networks. To reach the promises of the CR, it must go through three stages: the first consists of Spectrum Sensing that is the most important step in initiating communication. It consists in detecting the unused spectrum (or white spaces) to share it without any interference with PUs. Spectrum Management is the function that allows the SU to decide, which the best frequency band that meets its requirements through analysis, then a decision on the appropriate spectrum. Spectrum Mobility is a process that a CR user changes its operating frequency using the spectrum dynamically.

A CR network can provide intelligent multiuser communication system, it will adapt according to the environmental variations, that perceives the radio scene and it can control communications through proper allocation of resources. The cognitive network can plan, decide and act based on the perceived current network conditions. Cognitive networks functionality depends on the software adaptable network to implement the actual network and allows the cognitive process to adapt the network. The CR is useful for other purposes such as home environment, TV vacant bands usage, messaging devices and other non-real time communications systems.



Fig. Cognitive Technology (Image Courtesy-Wipro)

Dr. Nagamani K., Dr. Bhagya R. and Rahithi Y. (IV Sem. M.Tech. DC)

Placement Statistics of UG students:

Number of eligible students : 58
 Number of offers made: 66
 Number of students placed: 40
 Number of students with open dream package: 19
 Number of students with dream package: 25

Placement statistics of PG students:

Placed DCE: 10
 Internship: 17
 Placed RF&MWE: 03
 Internships: 06

Students Participation in NCC:

- Thanmayee Reddy K.
- Samudyata A.
- D.R. Upendra Shetty
- Prajwal R.
- Aishwarya R.
- Harshitha B.
- Drithi Ranganath
- Vismaya

Prajwal R. of III Sem B.E. student have been in the process of selections for Youth Exchange Program of NCC. One among the 22 got selected for the final all India Interview from Karnataka and Goa Directorate.

Our Few Recruiters



Emerging Nanotechnology-Enabled AI (ENAI)

Conventional approaches for Artificial Intelligence (AI) models, even the hardware-based directions, are inefficient because they rely on several layers of abstraction. In comparison, new directions with emerging technology can often bypass these layers by directly implementing the conceptual computational frameworks of AI in the physical layer. An important aspect of Emerging Nanotechnology-Enabled AI (ENAI) are the various nanodevices which, through their physical characteristics such as electrical, magnetic, and optical behavior, provide strong foundations to the design and development of ENAI and associated circuit directions. They are broadly classified into four main categories: Memristive, Magnetoelectric, Nanophotonic, and emerging three-terminal devices.

Memristor devices are two-terminal passive nanoscale devices with pinched hysteresis voltage/current characteristics. Two main types namely drift memristors and diffusive memristors (Fig. a and b). Memristor devices are used in Phase-change memory devices (Fig. c). Magnetoelectric devices (Fig. d and e) are characterized by a multi-layer stack of magnetic materials and insulators. They operate on the principle of the misalignment in the polarization of electronic spin in different metal layers separated by the insulating layer. Nanophotonic devices are devices that perform non-linear operations on light. Few examples which have been used in ENAI systems are Quantum-dot LEDs and single photon avalanche detectors. This bias voltage modifies the sensitivity of the nonlinearity of the devices, making them useful in optical AI architectures.

Magnetic tunneling junctions are categorized under Magnetoelectric devices. This family of devices typically consists of two magnetic layers separated with an insulator (Fig. d). One layer is permanently magnetized in a fixed axis. The other layer's magnetization is adjusted with various techniques to achieve different resistance values.

Domain wall devices are also magnetoelectric nano-devices utilize the existence of more than one domain of magnetization within the same ferromagnetic bulk. The boundary at which the various domains intersect is known as a domain wall Fig. e. Changing the position of domain wall changes the impedance provided by the device, and the domain wall position is static absent external sources. Applications of these devices include contiguous nonvolatile memory, as synaptic elements in neuro-morphic architectures.

Emerging three-terminal/Multi-terminal Devices- provide more control over the conduction modulation mechanism and offer more degrees of freedom enabling more complex behavior. Devices such as MoS₂ FETs with impressively small inverse sub-threshold slope are used in low power applications. Other examples are Carbon Nanotube transistors (CNT), Nanoparticle organic memory field-effect transistors, Organic electrochemical transistors, and Ferroelectric FETs. Re-evaluating the utility of nanodevices from being an efficient way to off-load some compute operation to being critical foundations to complete AI models leads to the emergence of new and efficient architectures that are as close to the mathematical framework of their AI models as possible. Some of the applications are in CNN, GPU's, FPGA's, PCM devices and many more.

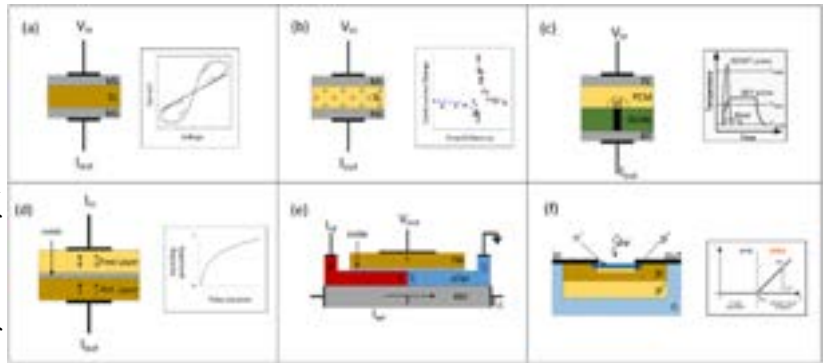


Fig. Emerging nanodevices and their characteristics: (a) Drift Memristor; (b) Diffusive Memristor; (c) Phase-change Memory; (d) Magnetic Tunneling Junction; (e) Magnetic Domain-wall device; and (f) Single-photon Avalanche Detector

Abdur Rehman (VI Sem. B.E.) and Dr. Premananda B.S.

Metaverse in Medical Domain

In this era, technology is rapidly changing the way people interact with the physical world around us. Metaverse is a concept of a persistent, online, 3D universe that combines multiple different virtual spaces. This can be future iteration of the internet and the metaverse will allow users to work, meet, game, and socialize together in these 3D spaces and it is often described as a hypothetical iteration of the Internet as a single, universal virtual world that is facilitated by the use of Virtual Reality (VR) and Augmented Reality (AR) headsets. The metaverse will be driven by augmented reality, with each user controlling a character or an avatar. Looking into the future, other large tech companies are also targeting the creation of a metaverse, including Microsoft, Apple, and Google. The decentralized aspects of the blockchain industry is letting small players participate in the metaverse's is starting to incorporate Web3 technology enabled through blockchain technology (like Non-Fungible Token (NFTs) and Cryptos). Facebook is one of the loudest voices for the creation of a unified metaverse. Facebook's ownership of social media, communication, and crypto platforms gives a good start.

The use of AR in the healthcare sector has a significant impact on the training and improvement of future medical professional's skills and knowledge bases. Surgical assistive tools use technology like the Microsoft HoloLens that surgeons utilize to help them with and speed surgical procedures. AR headsets are utilized to see vital real-time patient data such as heart rate, body temperature, blood pressure, and breathing rate and in addition to pre-operative images from CT, MRI, and 3D scans. Future metaverse activities in Healthcare domain: remote surgery, telepresence, augmented reality surgery, 3D human anatomy models for education, visualization diagnosis, planning, architectural design for healthcare facilities, preventive medicine patient education, haptic aided rehabilitation, visualization of massive medical databases, treatment planning, medical therapy, pain control, psychotherapy through VR for virtual patients and surgery simulation. Realization to reach the point of a metaverse is unsure. But in the meantime, world can already experience metaverse-like projects and continue to integrate blockchain more into our daily lives.

Pavan M. and Sneha S. (IV Sem. M.Tech. DC), Dr. B. Roja Reddy

Artificial Intelligence in Telecommunication

Artificial Intelligence (AI) and Machine Learning (ML) are two important telecom trends impacting the industry. They are disrupting and transforming businesses. Telecommunication industry players can leverage these technologies to improve the customer experience, enable self-service, improve equipment maintenance, and reduce operational costs at the same time. The prominent role of telecommunications is to extract the meaningful information from the received data which has been collected by IoT sensors and devices. At the same time, the expansion and complications in the internet has increased the need for higher data rates and lower latencies, prompting new solutions for internet connection management. Many startups working to resolve numerous problems related to telecommunications using Artificial intelligence.

The different problems faced by telcos nowadays include: Poor network management (considering the global traffic), Lack of data analytics, high costs, crowded marketplaces. All these problems can be significantly overcome by AI and machine learning algorithms. AI is the superset of Machine learning and deep learning and also includes some algorithms to solve numerous problems in data science related aspects.

As shown in Fig., AI is contributing 10% of its innovations and trends to the telecommunication industry and still it is emerging. AI is the one technology that learns with high experiences on datasets (which can be input given to the system or the output received from the system) and also this technology involves supervised and unsupervised learning i.e., learning through prior experiences and also without prior knowledge.

Just half a decade ago customers were making a hard struggle to get solutions to their problems as they had to wait for a long time to connect with the customer care executive. Number of folks call a telecom service provider with distinguished reasons, few call to get a new connection, few to know their bill or information about their active packs etc., and few to raise a complaint. In early days the reason for calls was unknown till an executive answers a call and then escalating calls to the expertise made even calls lengthier and hectic. Predictive analytics, powered by AI, enable telecom companies to leverage data, sophisticated algorithms and advanced ML ability to forecast future results by building on historical data. AI algorithms use data-driven techniques to monitor the current condition of equipment and predict equipment failure based on the analysis of previous patterns. This makes it possible to proactively fix issues with equipment like power lines, data center services, cell towers and also the various devices that are placed in the homes of the customers.

Fraud detection with the help of machine learning is one of the best boons to the industry. This is an era where technological growth has also given an open invitation to fraudulent and theft. To get rid of this issue and sort fake profiles out, machine learning is designed with a self-decision making technology which incorporates an outstanding algorithm as per that it detects fake profiles, illegal access, and suspicious activities over its network.

Big data tools and applications become more available and sophisticated, the future of AI in the telecom industry will continue to develop. Employing AI, telcoms can expect to continue accelerating growth in this highly competitive space.

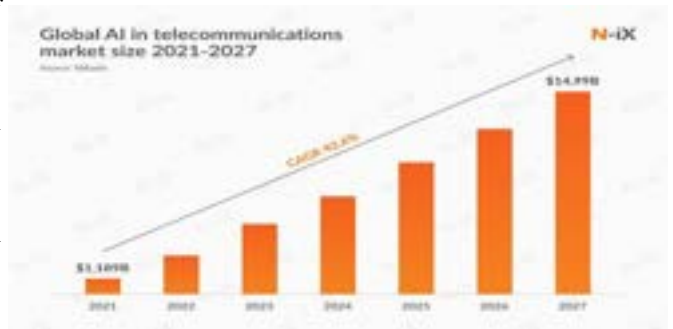


Fig. Growth of AI in Telecommunications Market

Dr. Bhagya R., Dr. Nagamani K., Upendra Shetty D.R. (VI Sem. B.E.)

Beyond 5G in Internet of Things

The current and future wireless communication systems, 4G, 5G, beyond 5G and 6G are mixtures of many frequency spectrums which need more and more data rates. Currently, 5G bands at Sub-6 GHz and mm-wave bands have been officially assigned by the Federal Communication Commission (FCC) to be used for 5G mobile communication to improve data rates. The Multiple-Input Multiple-Output (MIMO) can further enhance data rates by increasing the number of antennas. In IoT communication, microwave Sub-6 GHz and mm-wave bands will be combined to access high data rates in large geographical coverage areas as shown in Fig.

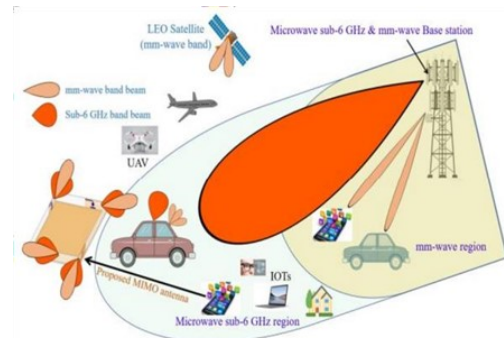


Fig. Integrated Sub-6 GHz and mm-wave bands in IoT

The Sub-6 and mm-wave MIMO antenna design utilizing the concept of a shared aperture antenna which operates with wider antenna beam width at Sub-6 GHz and with a sharp directive antenna beam at mm-wave band. The sharp directive beam with high gain is important in sending and receiving high-frequency signals at mm-wave bands. Additionally, high gain is required to mitigate high path loss at mm-wave bands.

Shared aperture or common aperture antennas have attracted considerable attention and interest recently. The microwave Sub-6 GHz and mm-wave bands are proposed to satisfy the requirements of compact size, operating band and directive radiation patterns at both bands. To achieve the above requirement the dual-band tapered slot-antenna is used and targeting 3.6 GHz and 28 GHz bands for 5G/5BG applications.

Dr. Bhagya R., Dr. Nagamani K., Vishnupriya P.B. (IV Sem. M.Tech. DC)

Multi-Viewpoint and Overlays in the MPEG OMAF Standard

Recent developments in immersive media have made possible the rise of new multimedia applications and services that complement the traditional ones, such as media streaming and conferencing. Omnidirectional video (360-degree video) is enabling one of such new services that are progressively made available also by large media distribution portals (e.g., YouTube).

The Moving Picture Experts Group (MPEG) has developed the Omnidirectional Media Format (OMAF) second edition, or version 2 with the aim of creating a standardized solution for 360-degree video streaming, which is close to completion. The major new features of OMAFv2, compared to the first version, include (but are not limited to) the capability of using overlays and multiple omnidirectional cameras situated at different physical points (i.e., viewpoints).

MPEG OMAFv2 defines an overlay as a visual media (video, image, or timed text) that is rendered over an omnidirectional video or image or over a viewpoint. In the presence of an overlay, the visual media on which it is overlaid is referred to as background visual media. OMAFv2 provides a framework to indicate the number of overlays present and active in the omnidirectional system. Additionally, it provides the capability and flexibility to control different overlay features namely spatial, temporal, interactivity, and inherent properties.

Omnidirectional cameras typically capture subjects with sufficient details if they are close to it. Subjects which are further away from the camera appear with lower details. OMAFv2 has incorporated support for multiple viewpoints switching that address the need to enable high quality content capture. This provides the possibility of experiencing any subject or event of interest from a different perspective. Consequently, there is a possibility to create content based on the content creator storyline paradigm, as well as the user preference driven switching behaviour.

In conclusion the main functionalities of these two features, multi-viewpoint and overlays make the new OMAFv2 standard even more appealing for content producers, service providers and device manufacturers.

Shaswat Valivati (VI Sem. B.E.) and Dr. Premananda B.S.

WTISD - 2021 Celebrations

To mark the celebrations of “World Telecommunication and Information Society Day –WTISD-2021” a two day national conference on “Digital Transformation and Challenges” was planned during 17th and 18th May, 2021. The theme proposed for WTISD-2021 by ITU is “Accelerating Digital Transformation in challenging times”.

National conference is an annual event of the institution to spread awareness, research opportunities for serving the society and enhancing technical interaction among Faculty, Researchers and Students. But this year due to the pandemic, the celebrations were postponed and limited to two events.

The events conducted are release of Tarangavani, the department newsletter where the faculty and students articles and their achievements and department activities are published and award of Arunodaya scholarship to beneficiaries, which is given to eligible UG and PG students every year by the department. The events took place on 08/09/2021.

Celebrations of the World Telecommunication and Information Society Day: **(08/09/2021)**



Release of Tarangavani Newsletter

Arunodaya Scholarship

UG students:

Sl. No.	USN	Name of the students	Semester
1	1RV19ET017	D. R. UPENDRA SHETTY	V
2	1RV19ET046	SAGAR H. M.	V
3	1RV18TE022	LAXMAN CHANDRASHEKAR DIXIT	VII
4	1RV18TE023	M. POOJA	VII

PG students:

Sl. No.	USN	Name of the students	Semester
1	1RV20LDC09	HEMALATHA R. V.	III M.Tech. DC
2	1RV20LRF03	AKSHATA BALLOLAD	III M.Tech. RFME



Distribution of Arunodaya scholarship to beneficiaries



Arunodaya scholarship beneficiaries

Online Alumni Meet 2021

An online alumni meet was conducted on 25th September, 2021 at 10:30 AM, by Department of Electronics and Telecommunication Engineering through Cisco Webex platform.

Alumni had joined the meet along with alumni office bearers and faculties.

Alumni of UG and PG (DC and RFME) had attended the meet via online and shared their experiences and achievements after their graduation. They gave suggestions and inputs for curriculum revision and motivated the graduate students.



DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VISION

Imparting quality education in Electronics and Telecommunication Engineering through focus on Fundamentals, Research and Innovation for Sustainable Development.

MISSION

1. Provide comprehensive education that prepares students to contribute effectively to the profession and society in the field of Telecommunication.
2. Create state-of-the-art infrastructure to integrate a culture of research with a focus on Telecommunication Engineering Education.
3. Encourage students to be innovators to meet local and global needs with ethical practice.
4. Create an environment for faculty to carry out research and contribute in their field of specialization, leading to Center of Excellence with focus on affordable innovation.
5. Establish a strong and wide base linkage with industries, R&D organization and academic Institutions.