A Report on Three Days International Workshop on
"Advances in Electron Device Technology for IoT and Communication"
Organised by Department of Electronics and Communication Engineering
in collaboration with IEEE Communication Society, Hyderabad
April 22nd to April 24th 2024

Report Submitted by: Mr. T. Manivannan, Assistant Professor, ECE
Coordinators of the event: Mr. T. Manivannan, Assistant Professor, ECE & Mr. E. Aravindraj, Assistant Professor, ECE, MITS
Total Participants: 150 Students
Mode of Conduct: Hybrid Mode
Report Received on 07.05.2024

The Three-day workshop titled "Advances in Electron Device Technology for IoT and Communication" organized by the Department of Electronics and Communication Engineering, MITS, in collaboration with the IEEE Communication Society, Hyderabad Section commenced with registration at 10:00 AM on April 22nd, 2024, in Scaleup Classroom. The Inauguration began at 10:15 AM with a welcome address by Mr. E. Aravindraj, Assistant Professor/ECE. This was succeeded by an Inaugural address from Dr. S. Rajasekaran, Head of the Department/ ECE, at 10:20 AM., and a keynote speech by Dr. C. Kumar, Assistant Professor/ECE and IEEE Comm. Society Chairman, Hyderabad Section, at 10:30 AM. Dr. C. Yuvaraj, Principal, MITS provided Presidential addressed at 10:40 AM. Ms. P. Thousifa, III yr ECE Students, MITS presented an elaborate profile and introduced Dr. Narasimhulu Thoti at 10.45AM.

Dr. Narasimhulu Thoti, Post Doctorial Researcher, University of Oulu, Finland delivered the special address at 10:50 AM. The Chief Guest and Principal, MITS were felicitated with a flower bouquet at 10:55 AM., and Closing Remarks were given by Mr. E. Aravindraj, Assistant Professor/ECE, concluding the inaugural session at 11:00 AM.

Figure 1: Inaugural Ceremony

Figure 2: Welcoming and Felicitating the Chief Guest Dr. Narasimhulu Thoti Post Doctorial Researcher, University of Oulu, Finland

Day 1: April 22nd, 2024 (Session 1 _ Forenoon)

Resource Person: Dr. Narasimhulu Thoti, Post Doctorial Researcher, University of Oulu, Finland (Physical)

Topic: Introduction to Devices and Technologies for emerging Applications

Dr. Narasimhulu Thoti, a distinguished expert in semiconductor devices and technologies, delivered an insightful lecture on "Introduction to Devices and Technologies for emerging Applications" to the exciting field of emerging applications and the devices that drive them. Dr. Narasimhulu Thoti covered the foundational concepts and cutting-edge technologies driving innovation in various fields. It typically includes an overview of the latest developments in semiconductor devices, materials science, and advanced technologies that are enabling emerging applications such as Internet of Things (IoT), communication systems, and biomedical devices. The goal of this introduction is to familiarize students and professionals with the foundational concepts and latest advancements in devices and technologies that are shaping the future of various industries.

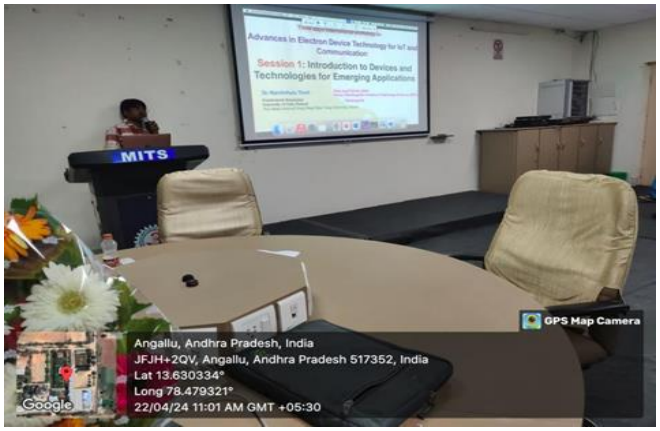

Figure 3: Resource Person: Dr. Narasimhulu Thoti, Post Doctorial Researcher, University of Oulu, Finland (Day 1_Session 1)

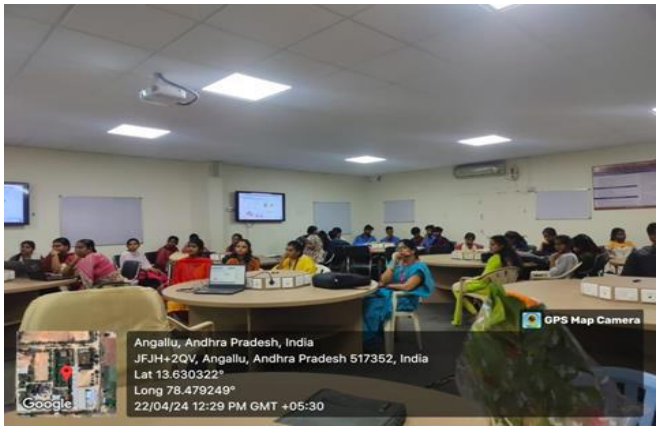

Figure 4: At Day 1 - Session 1: Introduction to Devices and Technologies for emerging Applications

Day 1: April 22nd, 2024 (Session 2 _ Afternoon)

Resource Person: Dr. Muthuraman Elangovan, Senior Data Plane Engineer, Atayalan, Taiwan (Online)

Topic: Accelerating 5G Data Traffic Performance Using Programmable Hardware

Dr. Muthuraman Elangovan's lecture focused on accelerating 5G data traffic performance using programmable hardware. This topic is crucial as 5G networks continue to expand globally, demanding higher speeds and lower latency. Programmable hardware offers a unique solution to meet these demands by allowing for flexible and efficient data processing. Dr. Elangovan provided an overview of the increasing data traffic in 5G networks due to the proliferation of connected devices and bandwidth-intensive applications. He discussed the challenges faced in managing and processing this vast amount of data, including the need for higher speeds, lower latency, and greater flexibility. Dr. Elangovan explained how programmable hardware, such as field-programmable gate arrays (FPGAs) and programmable network processors, can be used to accelerate data processing in 5G networks. The insights gained from Dr. Elangovan's lecture are expected to have a significant impact on future research and development efforts in the field of 5G networks. The use of programmable hardware is likely to become more widespread as network operators seek to optimize their infrastructure and deliver an enhanced user experience.

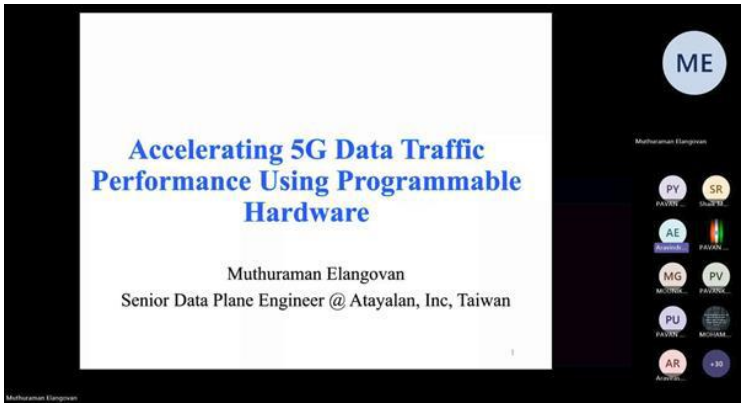

Figure 5: Resource Person: Dr. Muthuraman Elangovan, Senior Data Plane Engineer, Atayalan, Taiwan (Day1 _ Session 2)

Day 2: April 23rd, 2024 (Session 1 & 2_Forenoon & Afternoon)

Resource Person: Dr. Narasimhulu Thoti, Post doctorial Researcher, University of Oulu, Finland (Physical)

Topic 1: Novel semiconductor device options for IoT to RF applications (FN _ Session 1)

Topic 2: Negative capacitance technology for energy-efficient applications (AN _ Session 2)

In Day 1 – Session 1, Dr. Narasimhulu Thoti's lecture focused on exploring novel semiconductor device options for applications spanning from the Internet of Things (IoT) to Radio Frequency (RF) applications. The talk aimed to introduce innovative semiconductor devices that are driving advancements in these fields. Dr. Thoti provided an overview of IoT and RF applications, highlighting the diverse range of devices and systems encompassed by these technologies. He discussed the specific requirements of semiconductor devices for IoT and RF applications, including low power consumption, high efficiency, and compatibility with wireless communication standards. Thoti highlighted future trends in semiconductor device development for IoT and RF applications, including the integration of multiple functions into a single device and the use of advanced materials for improved performance.

Figure 6: Resource Person: Dr. Narasimhulu Thoti, Post doctorial Researcher, University of Oulu, Finland (Day 2 _ Session 1)

Figure 7: At Day 2 - Session 1: Novel semiconductor device options for IoT to RF applications

In the Day 2 – Session 2, Dr. Narasimhulu Thoti's lecture focused on Negative Capacitance (NC) technology and its potential for energy-efficient applications. The talk aimed to introduce this innovative technology and its implications for future electronic devices. Dr. Thoti provided an overview of Negative Capacitance (NC) technology, explaining the concept of negative capacitance and how it can be used to improve the energy efficiency of electronic devices. He discussed the principles behind negative capacitance, including the use of ferroelectric materials to achieve a voltage amplification effect that can reduce the operating voltage of electronic devices. Thoti highlighted the potential applications of negative capacitance

technology in energy-efficient electronics, such as low-power processors, memory devices, and energy harvesting systems. Dr. Narasimhulu Thoti's lecture provided valuable insights into negative capacitance technology and its potential for energy-efficient applications. His expertise in this emerging field has shed light on innovative solutions that can drive advancements in electronic devices and contribute to a more sustainable future.

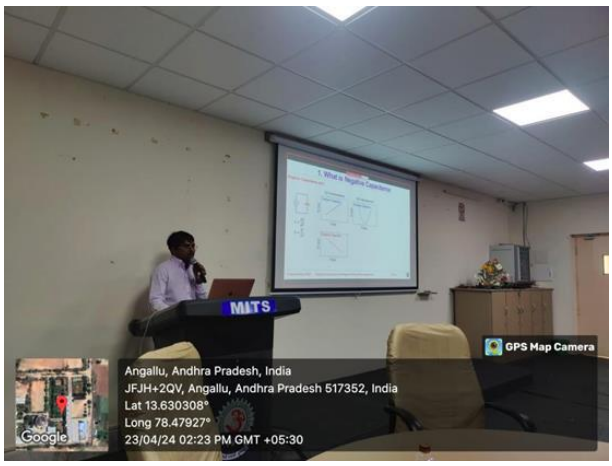

Figure 8: Resource Person: Dr. Narasimhulu Thoti, Post doctorial Researcher, University of Oulu, Finland (Day 2 _ Session 2)

Figure 9: At Day 2 - Session 2: Negative capacitance technology for energy-efficient applications

Day 3: April 24th, 2024 (Session 1)
Resource Person: Dr. Narasimhulu Thoti, Post Doctorial Researcher, University of Oulu, Finland (Physical)
Topic: Semiconductor device technology for low and high- performance applications

Dr. Narasimhulu Thoti's lecture focused on semiconductor device technology and its applications in both low and high-performance scenarios. The talk aimed to provide an overview of the advancements in semiconductor devices that cater to diverse performance requirements. Dr. Thoti provided a brief introduction to semiconductor devices, highlighting their importance in modern electronics and the principles behind their operation. He discussed semiconductor devices tailored for low-performance applications, such as simple logic circuits, sensors, and power management units. These devices are optimized for low power consumption and cost-effectiveness. Dr. Thoti also covered semiconductor devices designed for high-performance applications, such as microprocessors, memory chips, and high-speed communication devices. These devices are optimized for speed, efficiency, and high data throughput. He highlighted recent technological advancements in semiconductor devices, such as the use of advanced materials, novel device structures, and innovative manufacturing processes, to meet the demands of both low and high-performance applications.

Figure 10: Resource Person: Dr. Narasimhulu Thoti, Post doctorial Researcher, University of Oulu, Finland (Day 3 _ Session 1)

Figure 11: At Day 3 - Session 1: Semiconductor device technology for low and high- performance applications

Day 3: April 24th, 2024 (Session 2)
Resource Person: Dr. Grande Naga Jyothi, Assistant Professor in Dept. of ECE, MITS, Madanapalle (Physical)
Topic: Hardware Architecture for Machine Learning

Dr. Grande Naga Jyothi's lecture focused on hardware architecture for machine learning, providing insights into the design considerations and challenges in developing hardware for efficient machine learning algorithms. Dr. Jyothi provided a brief overview of machine learning, highlighting its importance in various applications such as image recognition, natural language processing, and autonomous systems. She discussed the specific hardware requirements for machine learning, including high computational power, parallel processing capabilities, and efficient memory management. Dr. Jyothi introduced different types of hardware architectures used in machine learning, such as CPU, GPU, FPGA, and specialized AI accelerators. She explained the strengths and limitations of each architecture in handling machine learning algorithms. Dr. Jyothi highlighted the challenges in designing hardware for machine learning, such as optimizing for different types of algorithms and ensuring compatibility with evolving machine learning frameworks.

Figure 12: Resource Person: Dr. Grande Naga Jyothi, Assistant Professor in Dept. of ECE, MITS, Madanapalle (Day 3 _ Session 2)

Figure 13: At Day 3 - Session 1: Semiconductor device technology for low and high- performance applications

Valedictory Ceremony:

Mr. E. Aravindraj, Assistant Professor, Dept. of ECE, MITS anchored and summarized the workshop in the valedictory ceremony. The Dr. P. Ramanathan, Vice Principal (Academics), MITS, graced the valedictory ceremony and congratulated all the participants on their completion of Workshop. Dr. S. Rajasekaran, Head of the Department/ ECE, thanked IEEE Communication Society, MITS Management and Principals & Managements of external participants for sending them to attend the 3 Day Workshop. Later, we took feedback from the participants to get suggestions and improvements for the future events. Mr. T. Manivannan, Coordinator proposed the vote of thanks.

Figure 14: Valedictory of the Workshop

Figure 15: Honoured the resource person with a memento and a shawl

Outcome of the Workshop, participants will be able to:

- Expert Lectures: Renowned experts in the field of electron device technology delivered insightful lectures on a wide range of topics, including semiconductor device physics, advanced device technologies, and machine learning for device modelling.
- Interactive Discussions: The workshop facilitated interactive discussions and Q&A sessions, allowing participants to exchange ideas, share their research findings, and seek advice from experts. This collaborative environment fostered a sense of community among attendees and encouraged networking opportunities.
- Future Directions: The workshop concluded with a discussion on future directions in electron device technology, highlighting emerging trends such as the use of novel materials, integration of artificial intelligence, and advancements in device modelling techniques. Participants were encouraged to explore further in their research and academic pursuits.
- Impact: The workshop had a significant impact on the participants, providing them with valuable knowledge and skills that can be applied to their academic and professional endeavours. Participants expressed appreciation for the opportunity to learn from experts in the field and engage in hands-on activities, stating that it enhanced their understanding and passion for electron device technology.