Report on

Distinguished Lecturer Talk on Signal Processing for Integrated Sensing and Communications

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Acknowledgment –

We would like to extend our heartfelt gratitude to **Dr. Kumar Vijay Mishra**, Senior Fellow at the United States DEVCOM Army Research Laboratory, for taking the time to share his valuable insights with our student community during the expert talk on "**Signal Processing for Integrated Sensing and Communications (ISAC)**". His vast experience, inspiring journey, and cutting-edge knowledge provided a rare and enriching opportunity for everyone in attendance.

We are deeply thankful to the **School of Technology, PDEU** and **IEEE Gujarat Section** for their constant support and encouragement in organizing such impactful academic events. A special thanks to the **IEEE Gujarat Section, IEEE Geoscience and Remote Sensing Society Gujarat Section Chapter, IEEE Signal Processing Society Gujarat Section Chapter, IEEE Microwave Theory and Techniques Society (MTT-S) / Antennas and Propagation Society (AP-S) Gujarat Section Joint Chapter, IEEE Signal Processing Society Student Branch Chapter PDEU**, **IEEE Antennas and Propagation Society Student Branch Chapter PDEU**, and **IEEE Student Branch PDEU** the for their collaborative efforts in making this session a success.

We also acknowledge the presence and involvement of our esteemed faculty members, student volunteers, and all the attendees whose enthusiasm made the event truly interactive and memorable. Through all their enthusiasm and spirit of learning, we continue to drive the success of our initiatives.

This report aims to document and reflect upon the expert talk. It outlines the event proceedings, speaker highlights, key takeaways for students, and the overall impact of the session.

Event Overview –

On 25th July 2025, Pandit Deendayal Energy University (PDEU) hosted an insightful expert talk on “Signal Processing for Integrated Sensing and Communications (ISAC)”, delivered by the globally acclaimed researcher and Senior Fellow at the U.S. Army DEVCOM Army Research Laboratory, Dr. Kumar Vijay Mishra.

The session was organized through a collaborative effort by:

- School of Technology, PDEU
- IEEE Gujarat Section (R00163)
- IEEE Geoscience and Remote Sensing Society Gujarat Section (GRSS GS) (CH10640)
- IEEE MTT-S/AP-S Gujarat Section Joint Chapter (CH10477)
- IEEE SPS Gujarat Section Chapter (CH10641)
- IEEE Signal Processing Society Student Branch Chapter PDEU (SPS SBC) (SBC10501E)
- IEEE Antennas and Propagation Society Student Branch Chapter PDEU (APS SBC) (SBC10501F)
- IEEE Student Branch PDEU (STB10501)

Student Branch -

Held from 2:00 PM to 3:00 PM at the PDEU campus in Gandhinagar, the event witnessed enthusiastic participation from students, faculty, and aspiring researchers. Dr. Mishra’s session explored the forefront of radar and communication system integration, mm-Wave and THz technologies, and their growing relevance in smart cities, autonomous systems, and next-gen wireless infrastructure.

This expert talk gave students and faculty a rare chance to interact directly with one of the top minds in signal processing. It wasn’t just about learning; it was about sparking curiosity and opening doors to what the future of technology could look like. The event truly reflected the shared effort of all the IEEE chapters and the university to build a learning space that’s practical, future-driven, and deeply connected to real-world research.

Date and time of the event: 25th July, 2025 2:00 pm to 3:00 pm

Venue of the event: C202, C-block, Pandit Deendayal Energy University

Total Participant count: 75

Speaker's Introduction –

Kumar Vijay Mishra (S'08-M'15-SM'18) obtained a Ph.D. in electrical engineering and M.S. in mathematics from The University of Iowa in 2015, and M.S. in electrical engineering from Colorado State University in 2012, while working on NASA's Global Precipitation Mission Ground Validation (GPM-GV) weather radars. He received his B.Tech. *summa cum laude* (Gold Medal, Honors) in electronics and communication engineering from the National Institute of Technology, Hamirpur (NITH), India in 2003. He is a Senior Fellow at the United States DEVCOM Army Research Laboratory; Research Scientist at the Institute for Systems Research, The University of Maryland, College Park under the ARL-ArtIAMAS program; Technical Adviser to Singapore-based automotive radar start-up Hertzwell and Boston-based imaging radar startup Aura Intelligent Systems; and honorary Research Fellow at SnT - Interdisciplinary Centre for Security, Reliability and Trust, University of Luxembourg. Previously, he had research appointments at the Electronics and Radar Development Establishment (LRDE), Defence Research and Development Organization (DRDO) Bengaluru; IIHR - Hydroscience & Engineering, Iowa City, IA; Mitsubishi Electric Research Labs, Cambridge, MA; Qualcomm, San Jose; and Technion - Israel Institute of Technology.

Dr. Mishra has served as the Distinguished Lecturer (DL) of various societies: IEEE Communications Society (2023-2024), IEEE Aerospace and Electronic Systems Society (AESS) (2023-2024, 2025-2026), IEEE Vehicular Technology Society (2023-2025, 2025-2027), IEEE Geoscience and Remote Sensing Society (2024-2025). He has been a Virtual DL of IEEE Future Networks Initiative (2022) and Traveling Lecturer of Optica (2025-). He is the recipient of the IEEE Signal Processing Society Pierre-Simon Laplace Early Career Technical Achievement Award (2024), Special Mention for the IEEE AESS M. Barry Carlton Award (2023), IET Premium Best Paper Prize (2021), IEEE T-AES Outstanding Editor (2021, 2023, 2024), U. S. National Academies Harry Diamond Distinguished Fellowship (2018-2021), American Geophysical Union Editors' Citation for Excellence (2019), Royal Meteorological Society Quarterly Journal Editor's Prize (2017), Viterbi Postdoctoral Fellowship (2015, 2016), Lady Davis Postdoctoral Fellowship (2017), DRDO LRDE Scientist of the Year Award (2006), NITH Director's Gold Medal (2003), and NITH Best Student Award (2003). He has received Best Paper Awards at IEEE MLSP 2019 and IEEE ACES Symposium 2019. Dr. Mishra is Chair (2023-2026) of the International Union of Radio Science (URSI) Commission C, Chair (2025-) of IEEE AESS Technical Working Group on Integrated Sensing and Communications (ISAC-TWG), and Vice-Chair (2021-present) of the IEEE Synthetic Aperture Standards Committee, which is the first SPS standards committee. He has been Chair (2023-2025) of the IEEE SPS Synthetic Apertures Technical Working Group. He has been an elected member of three technical committees of IEEE SPS: SPCOM, SAM, and ASPS, and IEEE AESS Radar Systems Panel. He is Editor-in-Chief of *River Rapids Series in Radar Systems, Signal Processing, Antennas and Electromagnetics* (2025-). He has been Senior Area Editor of *IEEE Transactions on Signal Processing* (2024-), Associate Editor of *IEEE Transactions on*

Aerospace and Electronic Systems (2020-) and *IEEE Transactions on Antennas and Propagation* (2023-). He has been a lead/guest editor of several special issues in journals such as *IEEE Signal Processing Magazine*, *IEEE Journal of Selected Topics in Signal Processing*, *IEEE Journal on Selected Areas in Communications*, and *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*. He is the lead co-editor of several books on signal processing and radar: *Signal Processing for Joint Radar-Communications* (Wiley-IEEE Press, 2024), *Next-Generation Cognitive Radar Systems* (IET Press Electromagnetics and Radar Series, 2023), *Advances in Weather Radar Volumes 1, 2 & 3* (IET Press Electromagnetics and Radar Series, 2023), and *Handbook of Statistics 55: Multidimensional Signal Processing* (Elsevier). His research interests include radar systems, signal processing, remote sensing, and electromagnetics.

About the talk –

Dr. Kumar Vijay Mishra's expert session on "Signal Processing for Integrated Sensing and Communications (ISAC)" was a deep dive into the future of radar and wireless communication systems, where sensing and communication are no longer separate worlds, but tightly integrated for next-gen applications.

Opening with real-world references from shows like For All Mankind, Dr. Mishra made sure the session remained accessible and exciting for students. He explained how modern vehicles, equipped with cameras, radar, LiDAR, and onboard software, generate vast amounts of data, and how this data explosion demands more intelligent spectrum management. But with limited bandwidth and increasing demand, the challenge becomes: how do we transmit more, sense better, and still avoid interference?

Using Shannon's capacity formula as a guide, he broke down the tradeoffs between bandwidth, signal-to-noise ratio, and data throughput. He highlighted how higher bandwidth increases resolution (particularly in LiDAR), but also comes with cost and spectrum limitations. In contrast, radar, especially in the mm-Wave and microwave spectrum, offers a more practical alternative, but its resolution remains limited unless new solutions like dual-blind deconvolution and joint radar-communication system design are explored.

Dr. Mishra walked the audience through advanced signal models and optimization techniques, such as Atomic Norm Minimization (ANM) and SDP formulations, which help solve the challenge of sensing and communicating simultaneously over the same hardware and spectrum. The talk also introduced the idea of distributed and collaborative ISAC, where multiple sensing and communication nodes can work together seamlessly, crucial for scenarios like autonomous vehicles, smart cities, and future 6G systems.

The talk not only opened new technical insights but also inspired students to think of radar and wireless communication not as separate tools, but as allies in solving some of the world's most complex connectivity problems.

Student Learnings & Takeaways –

Dr. Kumar Vijay Mishra's session gave students a rare chance to learn directly from a global expert in the field of signal processing. The talk helped students see how the subjects they study, like communication systems, radar, and signal processing, are used in real-life technologies such as smart cities, autonomous vehicles, and future 6G networks.

Here are some key points students learned:

- What Integrated Sensing and Communication (ISAC) means and why it's important for future technologies.
- How radar and communication systems can be combined to work through the same hardware and frequency.
- The challenges of limited bandwidth and how to still transmit high-quality data without interference.
- How higher frequencies like mm-Wave and THz can improve performance, but also bring their own set of limitations.
- New technical ideas like Atomic Norm Minimization and dual-blind deconvolution, which help improve both sensing and communication at the same time.

More than just learning theory, students were inspired to think differently to look at engineering problems in a more connected and creative way. It encouraged many to explore interdisciplinary research and showed how innovation happens when we break down boundaries between fields

Closing note –

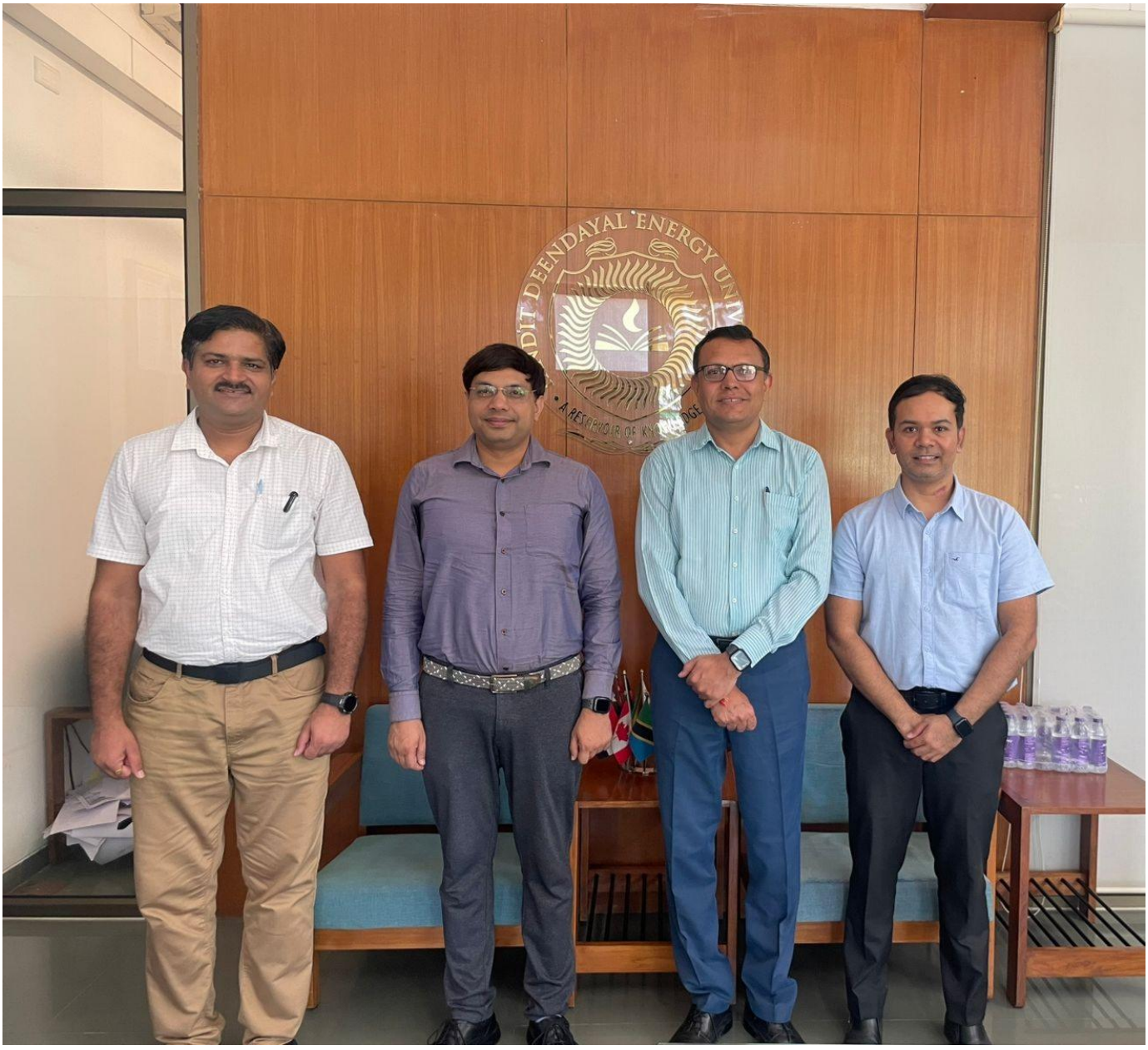
This expert talk was a valuable experience for everyone involved. Dr. Mishra not only shared advanced technical knowledge but also made sure students could relate to it through real-world examples. His way of explaining complex topics in a simple, engaging manner made the session both educational and inspiring.

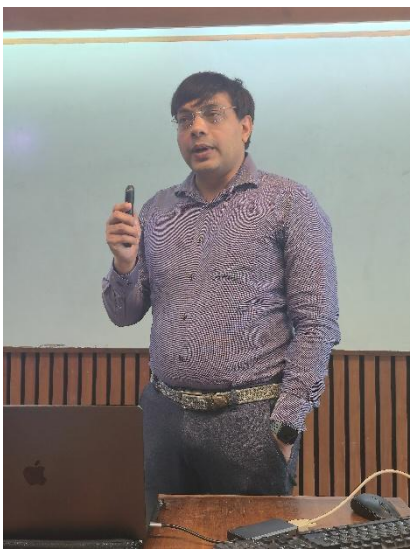
The event showed how important it is to bring students and experts together to discuss the latest trends in technology. It was a great example of how our university and IEEE chapters work together to give students access to global knowledge and career-shaping insights.

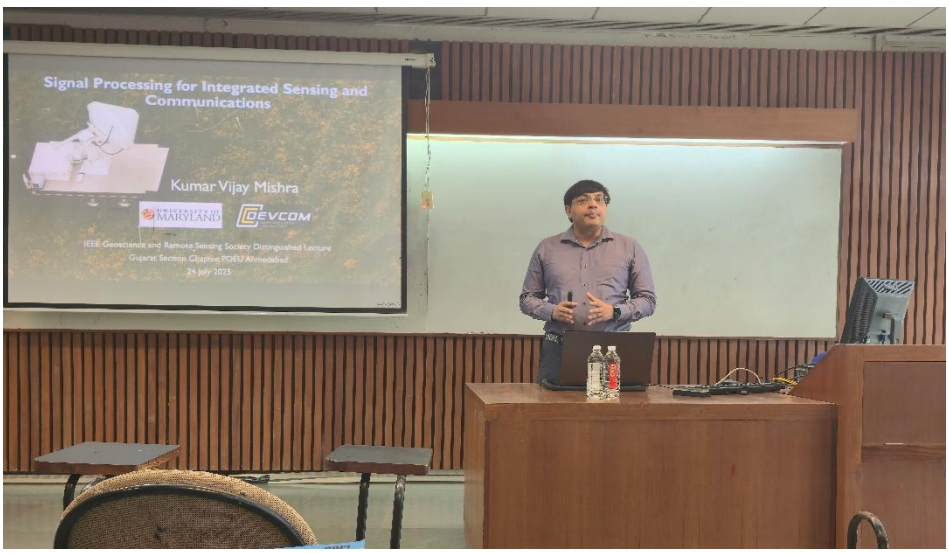
We thank all the organizers, faculty members, student volunteers, and attendees who made this event successful. It reminded us why learning beyond the classroom is so important and how such sessions can spark ideas that shape the future.

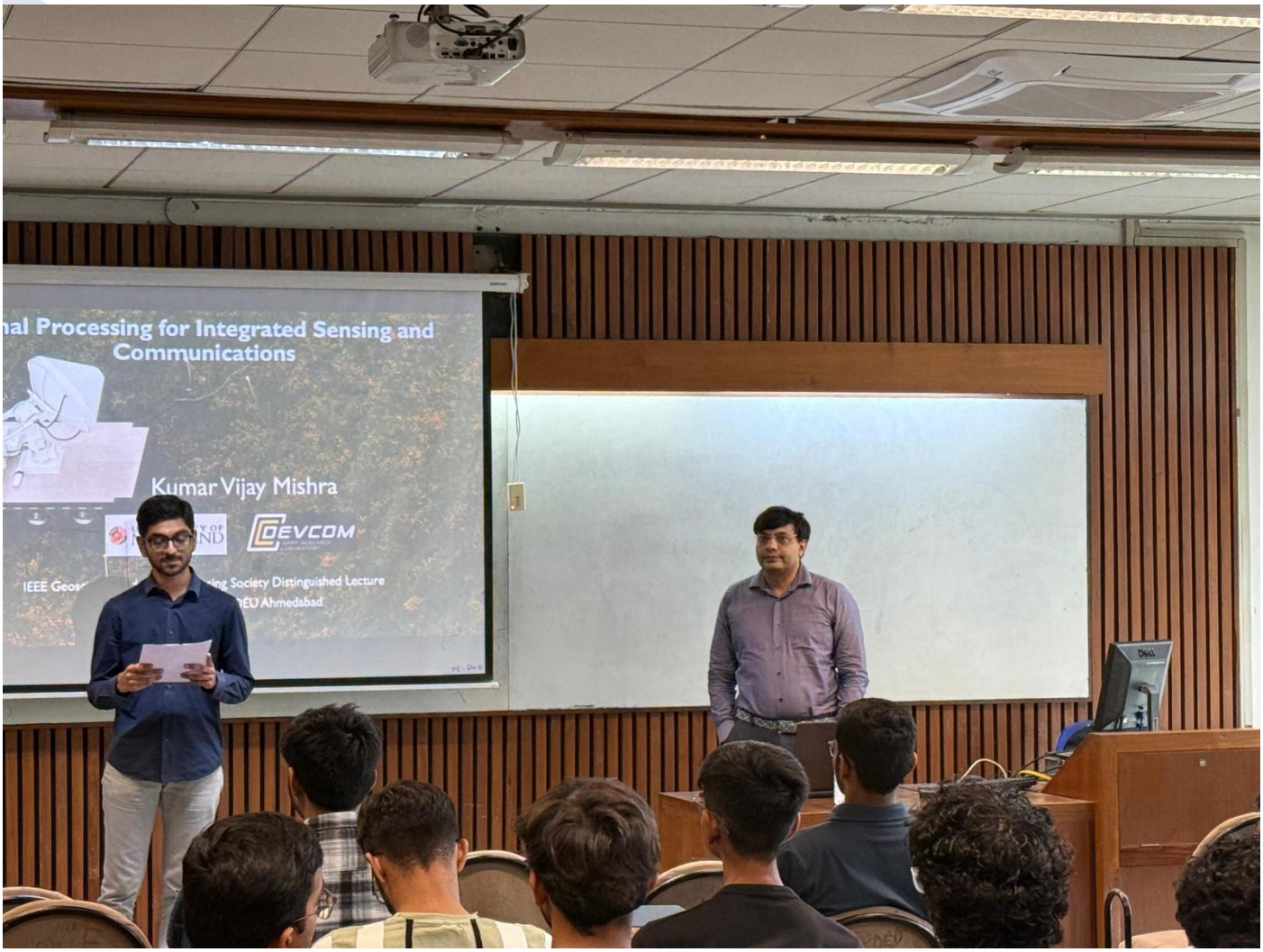
Report prepared by: Yagna Khokhariya, Heer Padiya

Visual Highlights –





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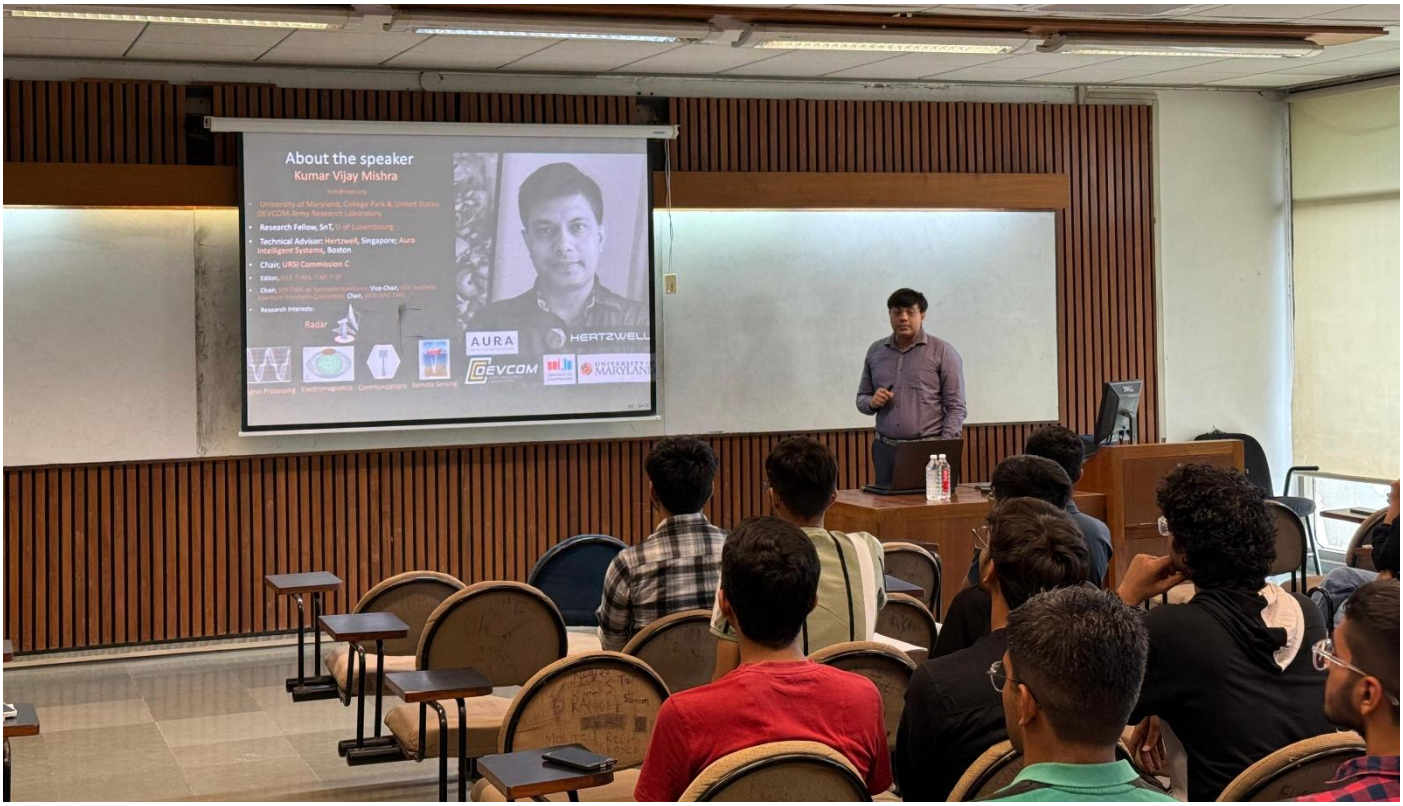
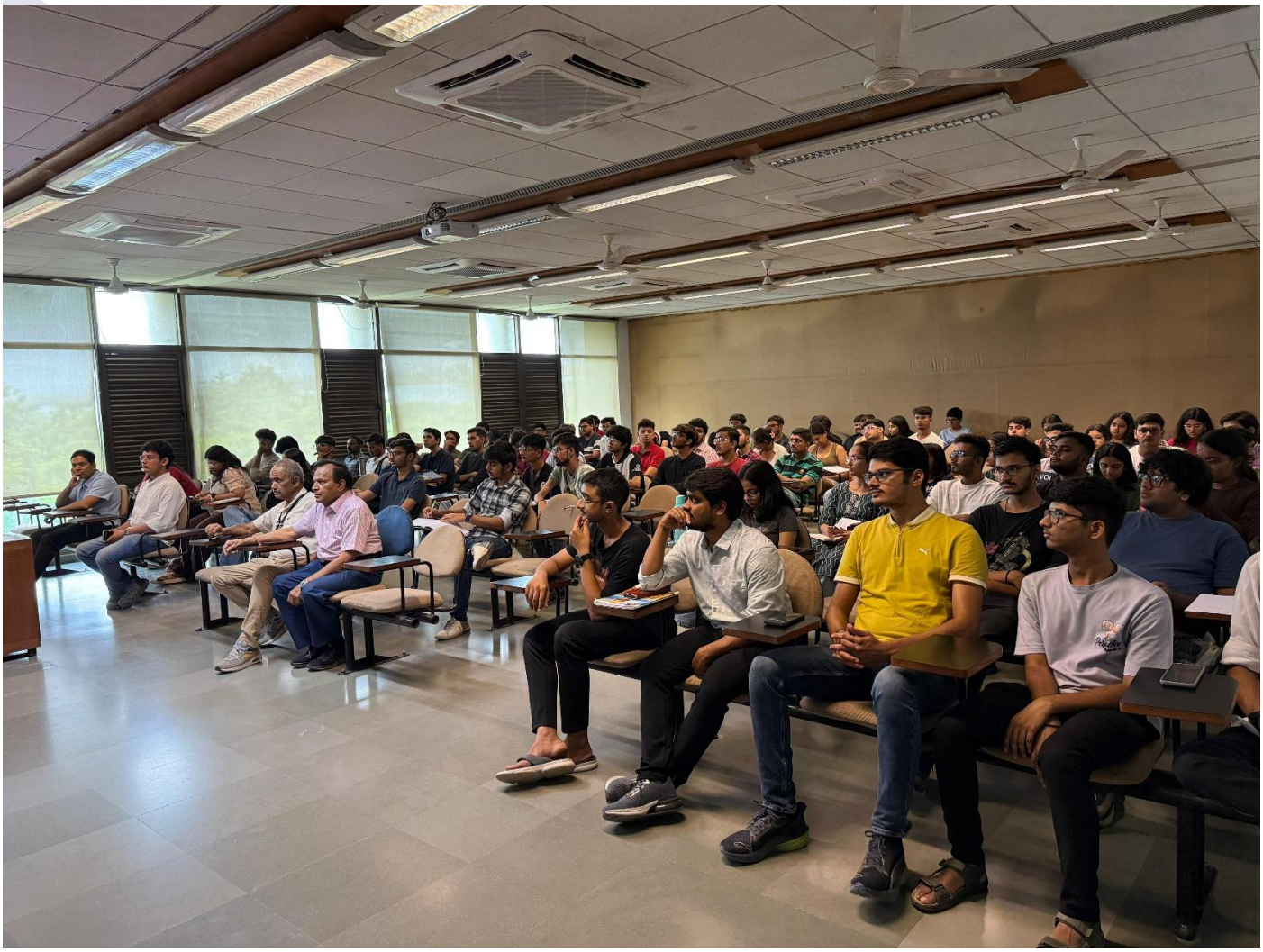
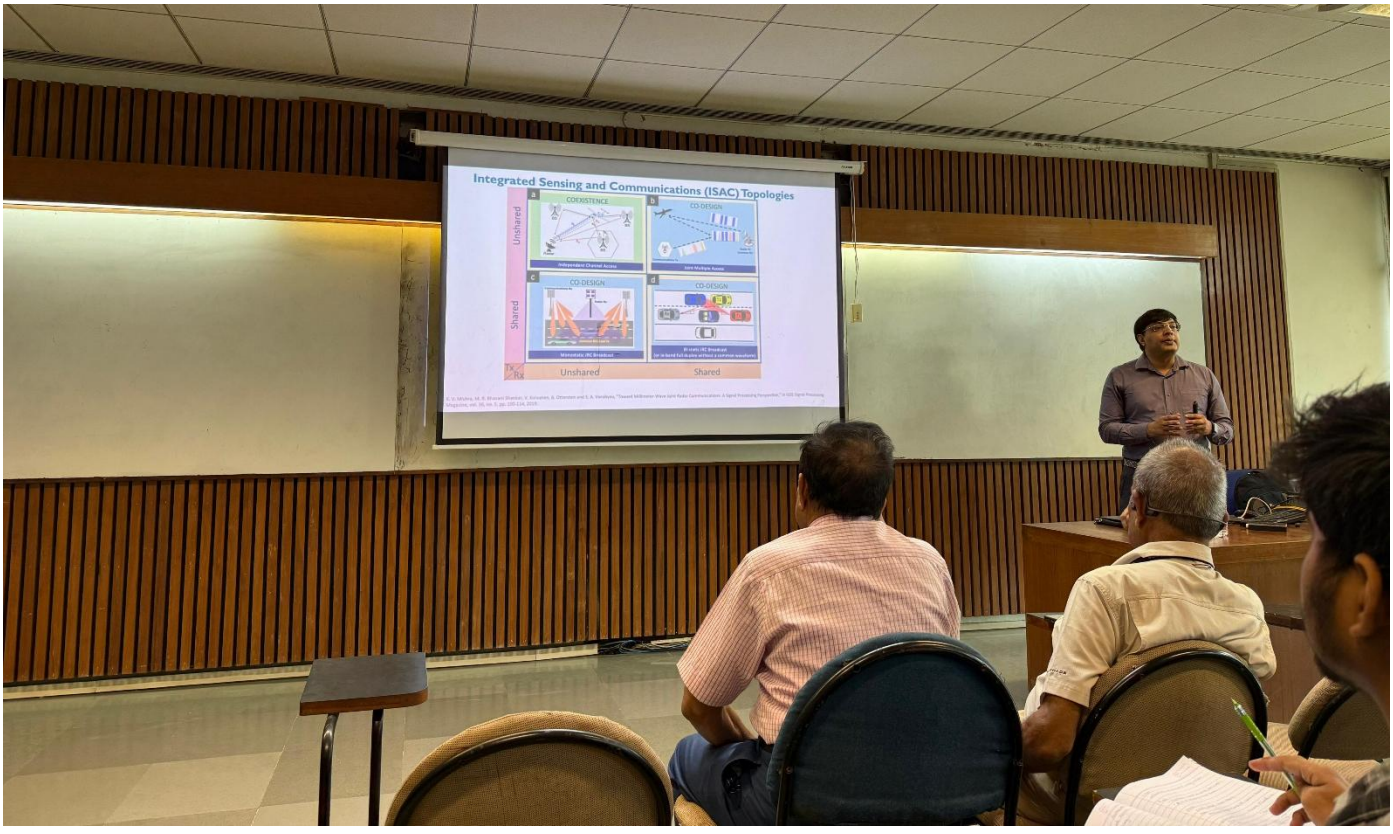
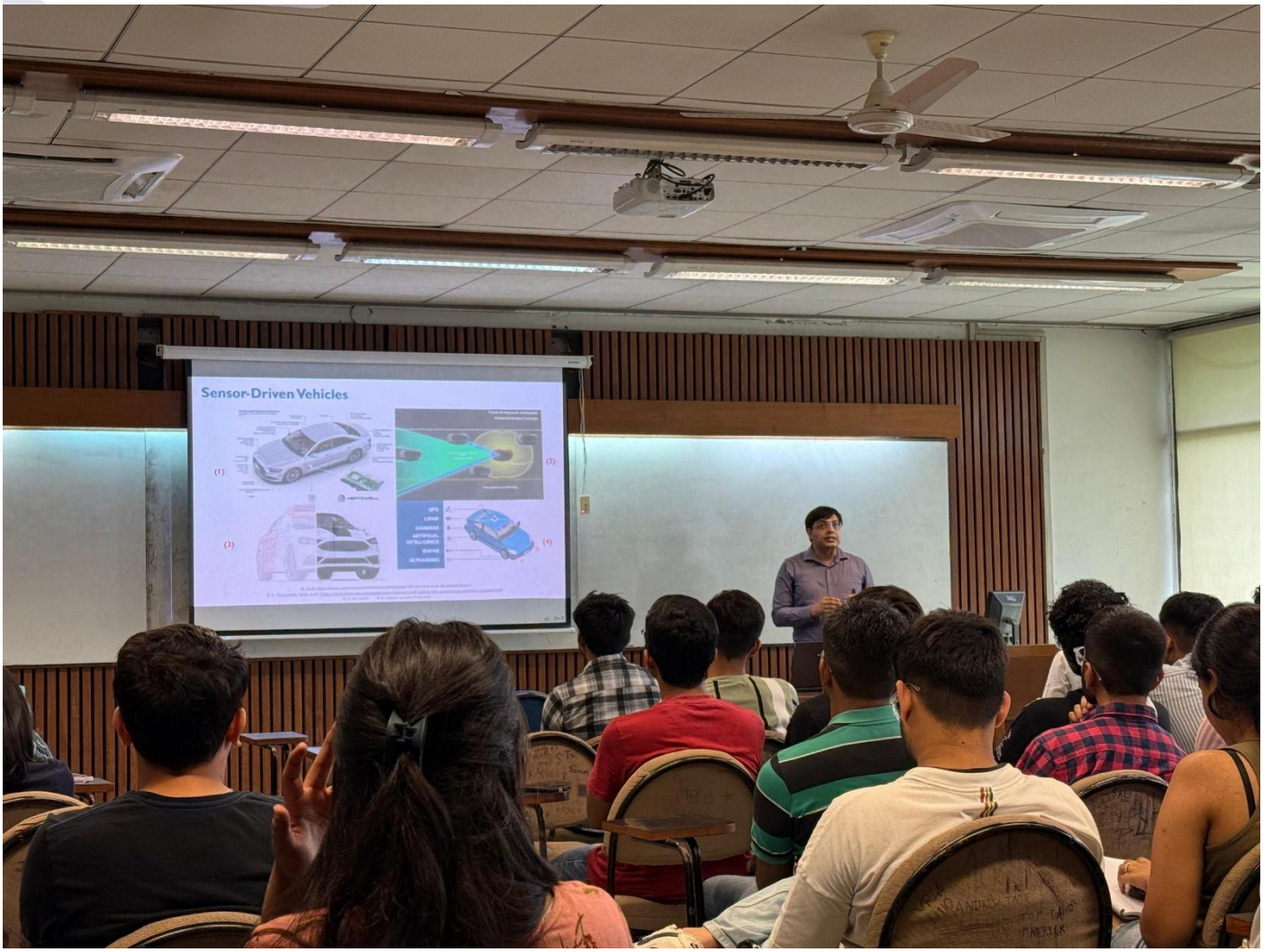
Kumar Vijay Mishra
DEVCOM

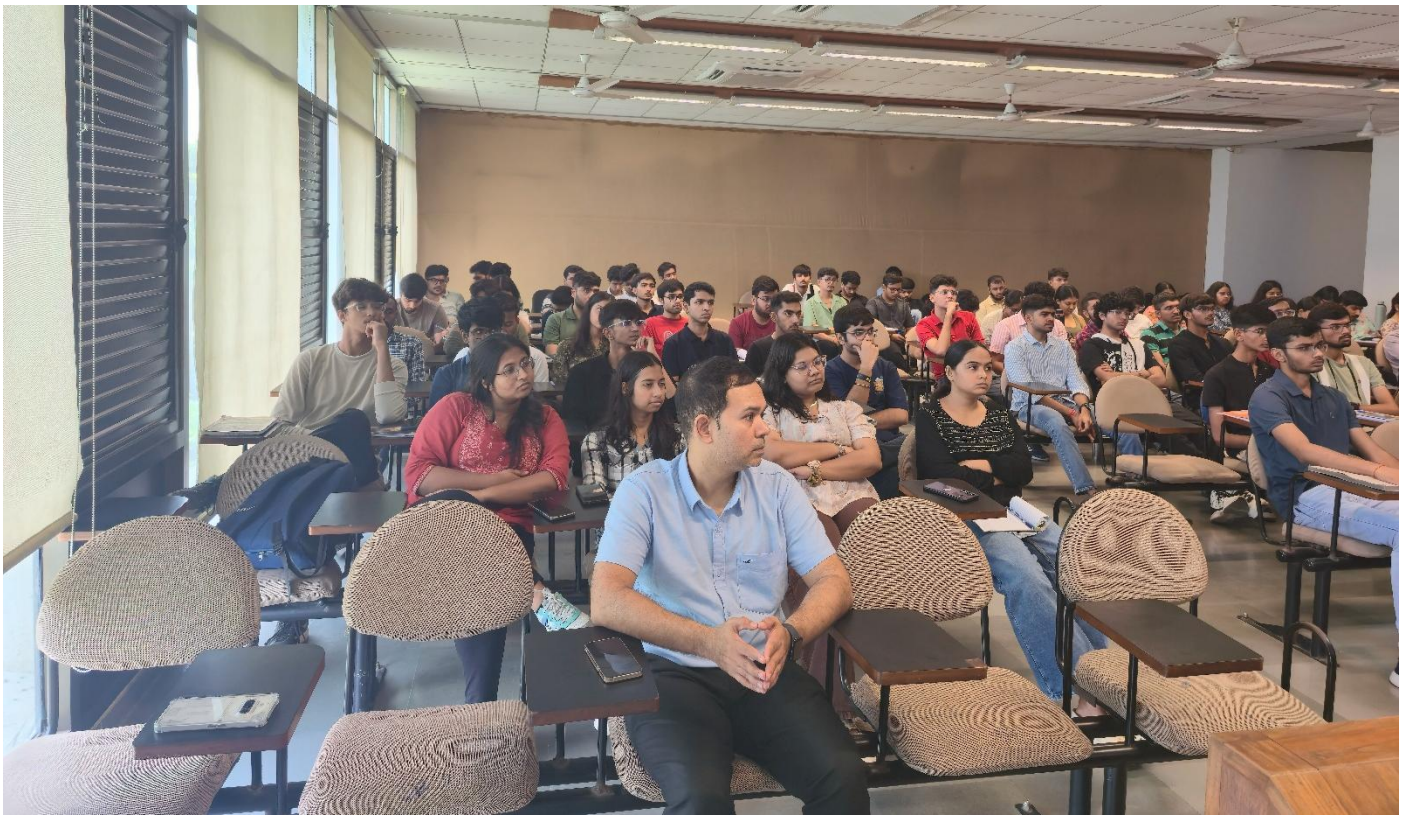

About the speaker
Kumar Vijay Mishra
Research Interests:
Radar
AURA
HERTZWELL
DEVCOM

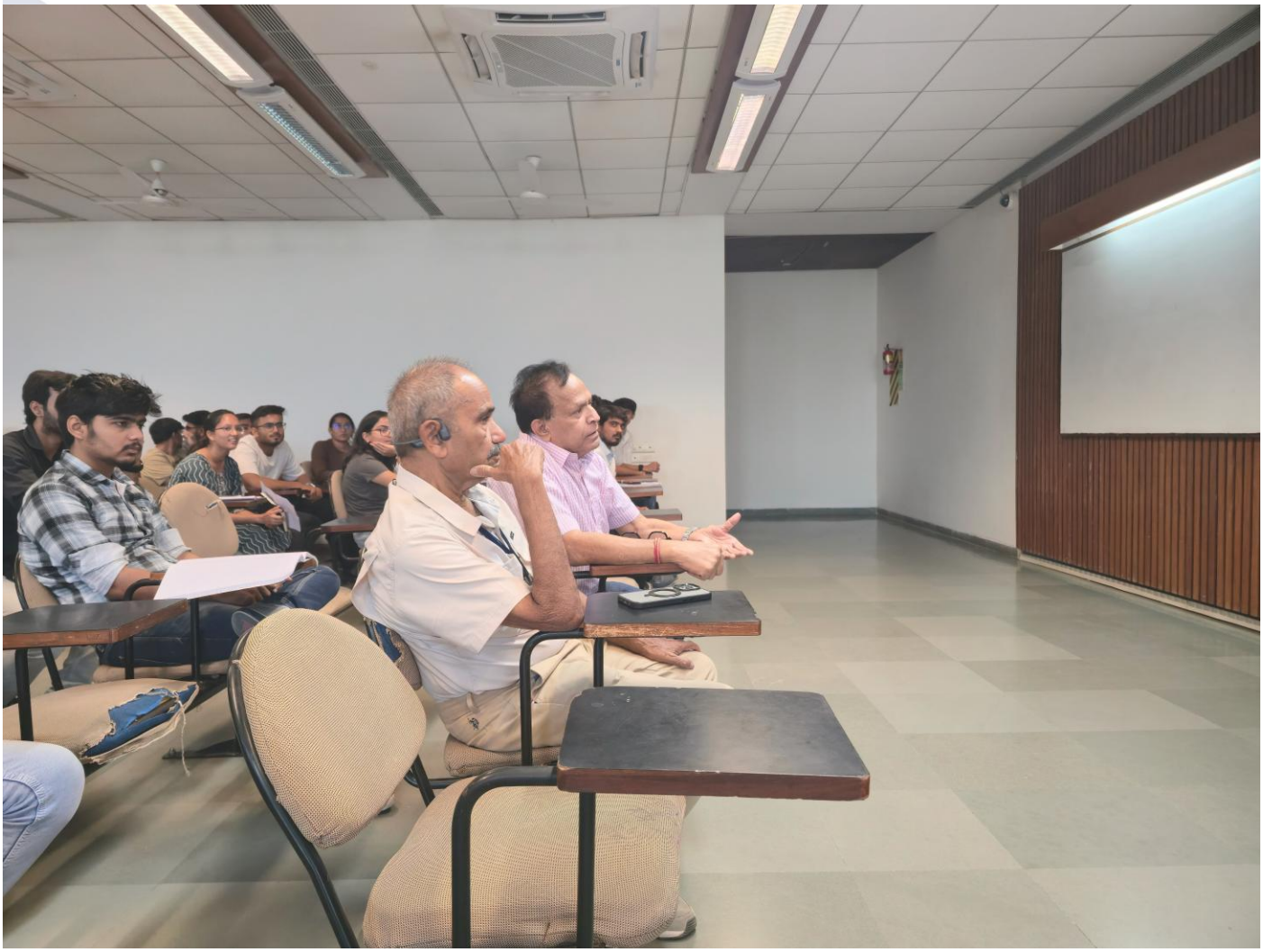
IEEE Gujarat Section | IEEE Signal Processing Society PANDIT DEENDAYAL ENERGY UNIVERSITY STUDENT BRANCH CHAPTER | IEEE Signal Processing Society GUJARAT CHAPTER | IEEE GRSS Geoscience and Remote Sensing Society | PANDIT DEENDAYAL ENERGY UNIVERSITY "A RESERVOIR OF KNOWLEDGE" | MTT-S Gujarat Section Joint Chapter | IEEE AP-S STUDENT BRANCH CHAPTER PDEU | IEEE Student Branch PDEU

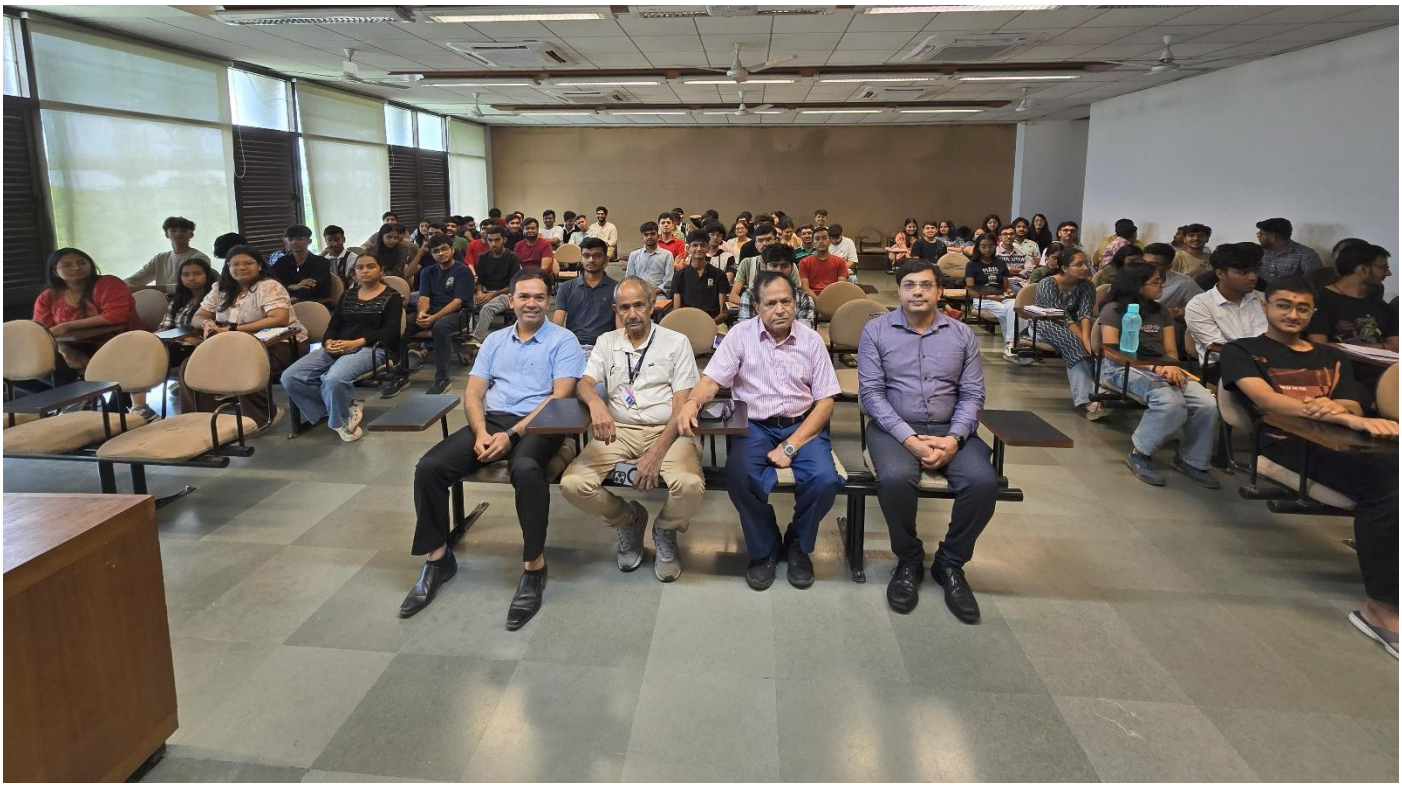


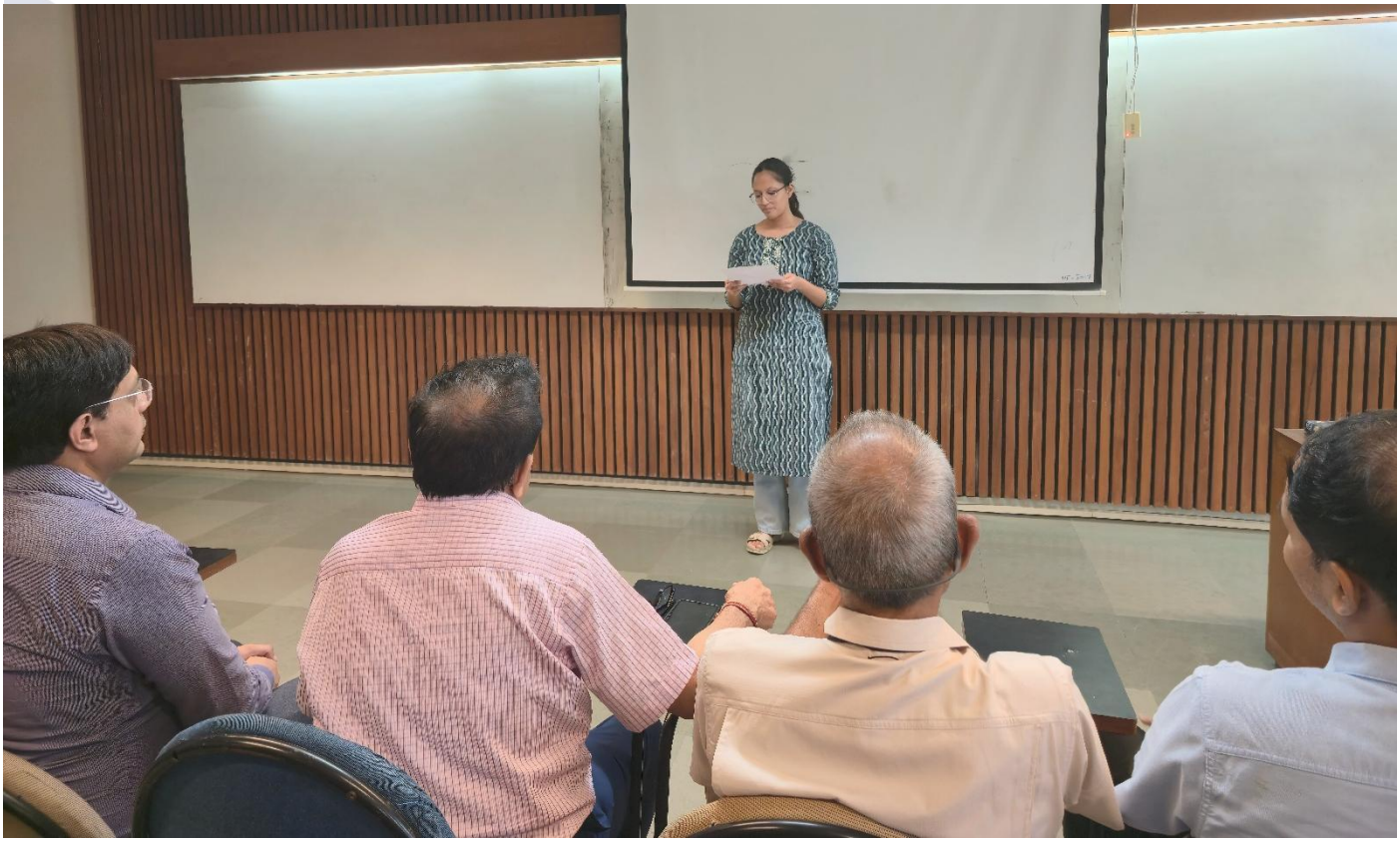


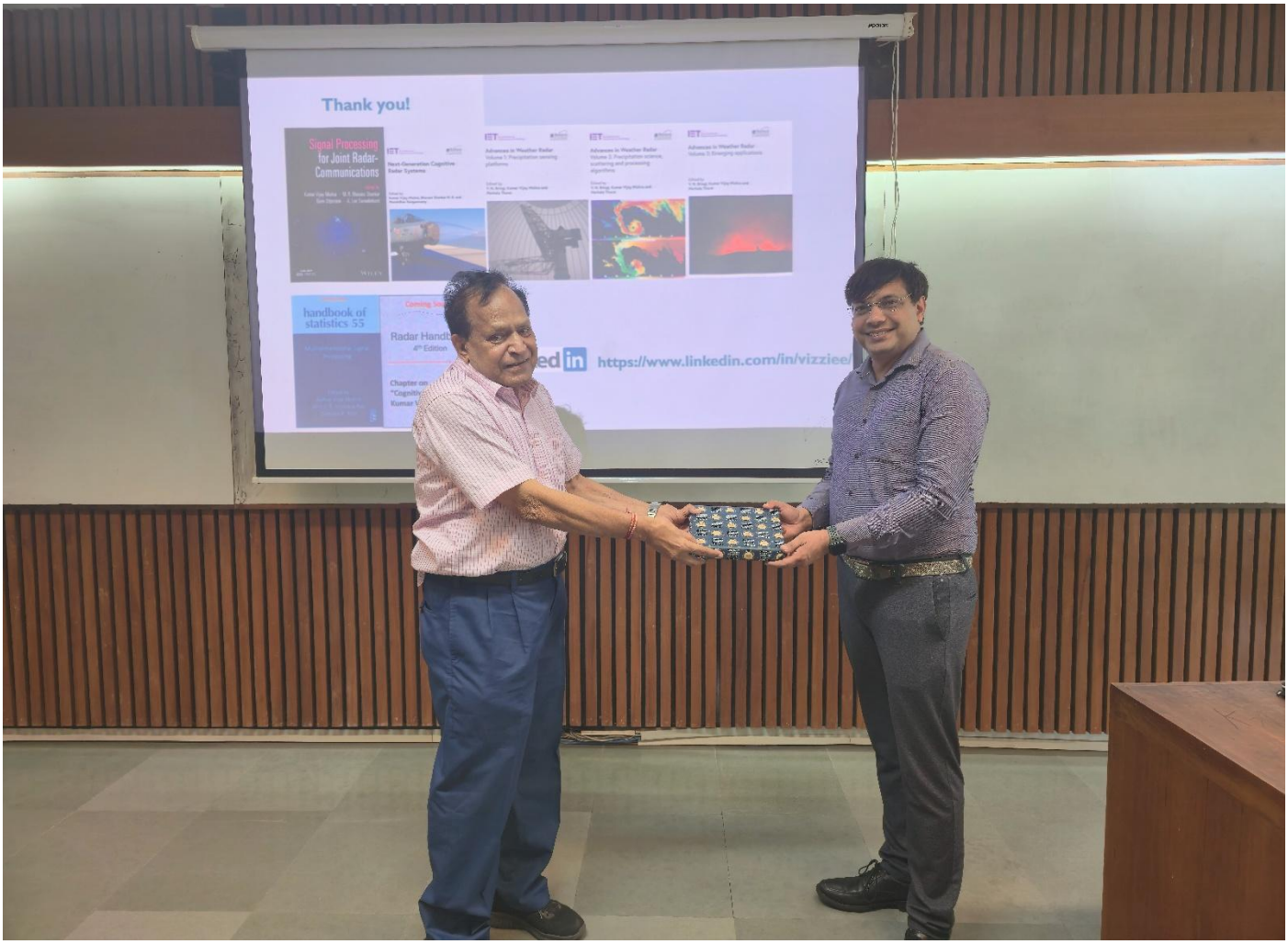

Sensor-Driven Vehicles










Thank you!
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