

# CIRCUIT TIMES

*The official newsletter of Department of ECE*



**Autonomous Institution, Affiliated to  
Anna University, Chennai  
Approved by the AICTE, Accredited by NAAC**

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## **VISION OF THE DEPARTMENT**

To excel in offering value based quality education in the field of Electronics and Communication Engineering, keeping in pace with the latest developments in technology through exemplary research, to raise the intellectual competence to match global standards and to make significant contributions to the society.

## **MISSION OF THE DEPARTMENT**

To provide the best pedagogical atmosphere of highest quality through modern infrastructure, latest knowledge and cutting edge skills.

To fulfill the research interests of faculty and students by promoting and sustaining in house research facilities so as to obtain the reputed publications and patents.

To educate our students, the ethical and moral values, integrity, leadership and other quality aspects to cater to the growing need for values in the society.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):**

**PEO1:** Create value to organizations as an EMPLOYEE at various levels, by improving the systems and processes using appropriate methods and tools learnt from the programme.

**PEO2:** Run an organization successfully with good social responsibility as an ENTREPRENEUR, making use of the knowledge and skills acquired from the programme.

**PEO3:** Contribute to the future by fostering research in the chosen area as an ERUDITE SCHOLAR, based on the motivation derived from the programme.

## **PROGRAMME SPECIFIC OUTCOMES (PSOS):**

**PSO1:** Graduates will gain the high-level competency to design and develop various communication systems involving current emerging technologies.

**PSO2:** Graduates would be able to plan, design, analyze, evaluate and choose the proper communication techniques to meet the global demand in the field of modern communication systems.

## FACULTY ARTICLE

## Recent Advancements in Radar Systems

**Mr.P.Muthukumaran, M.E., (Ph.D),**

*Assistant Professor, Department of Electronics and Communication Engineering,  
Sri Venkateswara College of Engineering (Autonomous), Sriperumbudur*

### INTRODUCTION

The term RADAR was coined in 1940 by the United States Navy as an acronym for radio detection and ranging. A device or system consisting usually of a synchronized radio transmitter and receiver that emits radio waves and processes their reflections for display and is used especially for detecting and locating distant objects such as aircraft, ships, missiles etc., The most commonly used bands used today for radar are the L-band through the KU- band or 1 – 18 GHz. Short-range automotive radar systems use the very high W-band frequencies in the 75+ GHz range.

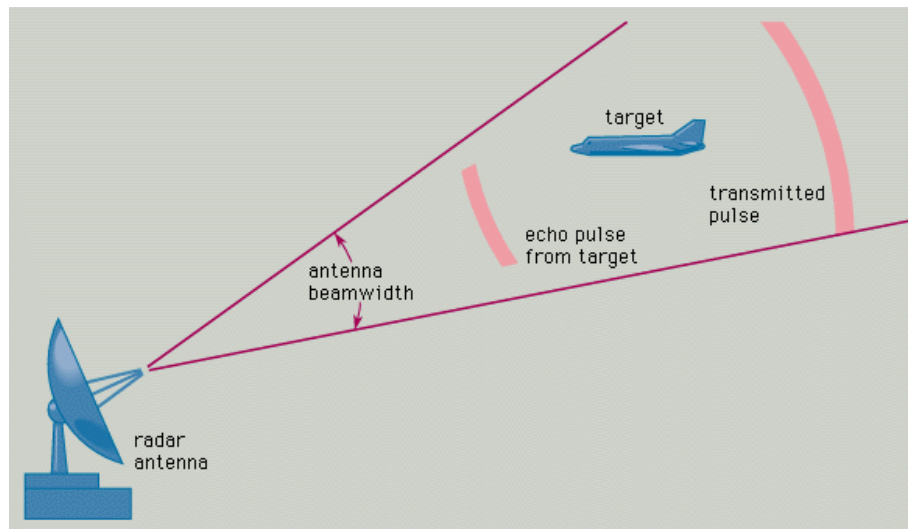


Figure 1 Operation of RADAR antenna

### FUNDAMENTALS OF RADAR

The Figure 1 shows the basic parts of a typical radar system. The transmitter generates the high-power signal that is radiated by the antenna. In a sense, an antenna acts as a “transducer” to couple electromagnetic energy from the transmission line to radiation in space, and vice versa. The duplexer permits alternate transmission and reception with the same antenna.

The receiver selects and amplifies radar echoes so that they can be displayed on a television-like screen for the human operator or be processed by a computer. The signal processor separates the signals reflected by possible targets from unwanted clutter. Then, on the basis of the echo's exceeding a predetermined value, a human operator or a digital computer circuit decides whether a target is present. During the early days of radar, target tracking was performed by an operator marking the location of the target "blip" on the face of a cathode-ray tube (CRT) display with a grease pencil. Manual tracking has been largely replaced by automatic electronic tracking, which can process hundreds or even thousands of target tracks simultaneously. The system control optimizes various parameters on the basis of environmental conditions and provides the timing and reference signals needed to permit the various parts of the radar to operate effectively as an integrated system. Further descriptions of the major parts of a radar system are given below.

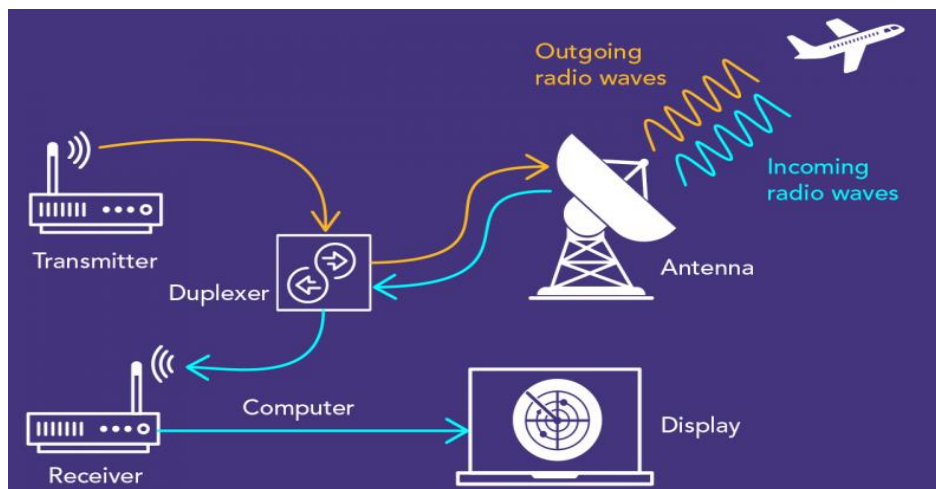


Figure 2 Mechanism of Duplexer antenna

A radar system is made up of five main parts. These are the transmitter, antenna, duplexer, receiver and display.

- a) The transmitter uses a magnetron to produce short pulses of radio waves.
- b) The antenna sends or transmits the waves out into the air. When the waves hit an object they reflect, or bounce back, to the same antenna. The antenna picks up reflected waves during breaks or pauses between transmissions.
- c) Because the antenna has the job of both sending and receiving radio waves, radars have a part called a duplexer. A duplexer helps to switch the antenna back and forth between transmitting and receiving.

- d) Information from the antenna is sent to the receiver. A computer in the receiver processes the reflected waves to make sense of them. By measuring how long it takes the waves to return, the receiver can tell how far away the object is. The receiver can also identify how fast an object is moving and where a moving object is headed. Sometimes radars are also able to detect how big the object is. For example, S-band radar can detect rain drops but not clouds whose droplets are too small.
- e) The information from the receiver is then shown on a display, or screen, for people to see.

## **ADVANCEMENTS OF RADAR**

### **a) Active Electronically Steered Array (AESA)**

In prior decades, phased array antennas greatly improved the form factor and performance of conventional radar. A more recent enhancement is enabled by greater DSP and computational methods. Active electronic beam steering (or beamforming), leverages the performance benefits of phased array antennas and introduces active steering, greatly reducing the maintenance costs and failure rates of mechanically steered radar antennas while increasing radar scanning speed and accuracy.

AESA radar is in high demand for the retrofit, upgrade and replacement of legacy radar technology. In the latest breed, the transmit/receive (TR) modules can be configured to operate either independently or in clusters. This enables the generation of multiple beams operating at different frequencies in order to devote scanning resources dynamically and intelligently. This highly adaptable configuration helps to reduce the probability of intercept compared with passive array radars. Additionally, directional reception and frequency agility reduce susceptibility to jamming. The modular AESA design also enhances reliability, as any failures in the TR modules will not disable the whole system and repairs/maintenance can readily be accomplished by swapping modules. TR modules for AESA radars are essentially highly capable software-defined radios (SDR) that can also be configured for radio communication with extremely high data rates. The highly directional beamforming capability also provides communication security by confining communication to receivers within the beam's focused path. AESA radar antennas typically have maximum scanning angles less than 120 degrees. An example is Raytheon's self-funded prototype designed as an upgrade to the Patriot Missile system.

**b) MIMO**

In order to reduce the size, weight, power and cost (SWAP-C) of AESA radars and increase scalability, researchers are developing sophisticated techniques that leverage sparsely populated arrays that are combined to form larger virtual arrays using multiple-input multiple-output (MIMO) technology for 5G wireless communications.

MIMO radar leverages spatial diversity with multiple separate transmit and receive antennas that use computational algorithms to calculate radar reflections and achieve compound resolution. MIMO radar systems might outperform analogous conventional phased-array radar systems.

Though this has yet to be conclusively demonstrated, there are applications where the SWAP-C benefits of compact sparsely populated MIMO antenna arrays might enable high precision radar capabilities where a phased-array radar would be too costly, heavy, large or power consuming to be deployable; for example, on SWAP-C restricted platforms such as a small UAS, satellite or rapidly deployable mobile radar station.

Some recent research has shown potential improvements in synthetic aperture radar (SAR) MIMO radar systems for ground moving target indication (GMTI) applications that have exceeded phased-array radar target geolocation accuracy for fast and slow moving targets with fewer false alarms and potentially higher jamming resistance.

**c) ULTRA-WIDE BANDWIDTH MILLIMETER WAVE RADAR**

To avoid the spectrum congestion at lower microwave frequencies, and to achieve high-precision and high resolution capabilities many applications have moved beyond 20 GHz. Fortunately, at millimeter wave frequencies there are several frequency bands that are designated with 0.5 GHz, 1 GHz and even 4 GHz of available bandwidth.

Radiation at millimeter wave frequencies tends to suffer higher atmospheric losses, but is more directional than at sub-6 GHz microwave frequencies.

**d) RADAR DESIGN AND FABRICATION**

Many of the latest advancements and applications of radar technology may have been possible with legacy radar technology; however, the SWAP-C benefits and advances of digital computation have enabled a more rapid adoption in the growing radar industry. New fabrication techniques and semiconductors are being developed to spur further growth.

## CONCLUSION

Fielding of radar systems that meet the latest demands of the modern battle space and a diverse range of new radar applications requires advanced technologies and techniques from digital and RF/microwave hardware, to simulation software and test systems. All levels of radar design and implementation are changing to accelerate next generation system development. This is pushing the boundaries of RFIC and monolithic microwave integrated circuit (MMIC) design, DSP techniques, material science and testing.

## FUTURE RADAR SYSTEMS

Recent advances in RF, microwave, digital and software technology will allow the development of software-defined Radar sensors (SDRS) in the near future. The functionality and system parameters of Radar sensors for remote sensing applications will no longer be implemented in hardware, but instead in downloadable software. Software-defined SAR (SD-SAR) is especially suited for these developments.

## REFERENCES

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2. E. Brookner, "Radar and Phased Array Breakthroughs," *Microwave Journal*, Vol. 58, No. 11, November 2015.
3. Eurofighter AESA Antenna, ILA Berlin Air Show, April 24, 2014, Wikimedia Commons, [commons.wikimedia.org/wiki/File:ILA\\_Berlin\\_2012\\_PD\\_193-Detail-2.jpg](https://commons.wikimedia.org/wiki/File:ILA_Berlin_2012_PD_193-Detail-2.jpg).
4. A. Hassanien, M. G. Amin, Y. D. Zhang and F. Ahmad, "High-Resolution Single-Snapshot DOA Estimation in MIMO Radar with Co-Located Antennas," *IEEE Radar Conference*, May 2015.
5. Alan J. Fenn, Donald H. Temme, William P. Delaney, and William E. Courtney "The Development of Phased-Array Radar Technology," *Lincoln Laboratory Journal*, Volume 12, Number 2, 2000 321.



## FACULTY PARTICIPATION

(Seminar/FDP/STTP/Workshop/Online Course/Conference):

- **Dr.D.Menaka, Mr.S.P.Sivagnana Subramanian** attended an Internal Auditor Training Program from 07.02.2024 to 08.02.2024 focusing on ISO 21001:2018 Implementation.



- **Dr.T.J.Jeyaprabha, Mr.L.K.Balaji Vignesh** attended One Day Webinar on the topic of “Funding Opportunities for Research” organized by IETE Chennai Center on 09.02.2024
- **Dr.R.Priyadharshini** attended Five Days Online Faculty Development Program (FDP) On “Research Trends in Optical Communication and Biophotonics” organized by School of Electronics Engineering (SENSE), Vellore Institute of Technology, Chennai from 16.02.2024 to 20.02.2024



- **Mrs.S.M.Mehzabeen** attended Six Days Online Faculty Development Program (FDP) On “**Emerging Technology in Artificial Intelligence**” organized by Jeppiaar Institute of Technology, Chennai from 19.02.2024 to 24.02.2024



- **Dr.T.J.Jeyaprabha, Mrs.R.Kousalya, Mr.L.K.Balaji Vignesh** attended Five Days Online Short Term Training Program (STTP) On “**Recent Trends and Applications in the Internet of Things**” organized by Department of Information Technology, Sri Venkateswara College of Engineering (Autonomous), Sriperumbudur from 27.02.2024 to 02.03.2024

#### **FACULTY PROPOSAL SUBMISSION:**

- **Dr.R.Gayathri, Dr.M.Kavitha and Mrs.S.M.Mehzabeen** applied proposal for the R & D Project Proposals to Bureau of Indian Standards on the topic of “**Development of smart sensor probe-based method for rapid detection of freshness of dressed chicken under Food and agriculture**”

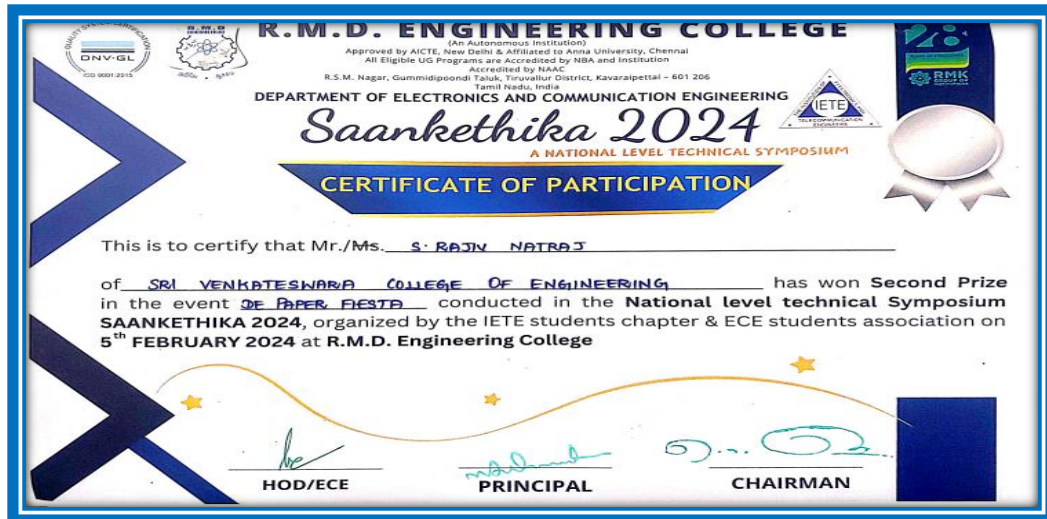
#### **STUDENT PARTICIPATION (Co-curricular Activities/Extra-curricular Activities):**

- Around 55 ECE students participated in various technical events conducted at SVCE, CEG Anna University, Rajalakshmi Engineering College and R.M.D Engineering College.

#### **STUDENT ACHIEVEMENTS:**

- **Ms.R.Srimathi (II Year)** participated in a 5 Days Non-Technical event “**INFINITUS' 24**” conducted by the “**Engineering Without Borders (EWB)**” club of SVCE from 05.02.2024 to 09.02.2024 and emerged as the **Winner on the Final round awarded with a rolling trophy, Cash prize of Rs1000.**

- Mr.S.Rajiv Natraj (II Year) secured second prize with a cash award of Rs.1500 for paper presentation in the National level technical symposium SAANKETHIKA 2024 held at R.M.D Engineering College, Chennai on 05.02.2024



- Abishek M, Jai, Aadithya M, Kaamesh KC, Harini S (II Year) secured **First prize** in the **I-cube National level Technical event** conducted by SVCE Science club on 17.02.2024
- Mr.S.Rajiv Natraj (II Year) secured **second prize with a cash award of Rs.2000** for **poster presentation** titled **“IoT enabled remote in SITU Process Monitoring of Plasma Arc Machining”** in the **National Seminar on Sustainability in Information Technology** held at **Madras Institute of Technology** from 21.02.2024 to 22.02.2024.



- **Ms.Mrdulla V Naarayan (IV Year)** has bagged Certification of Appreciation from IETE Center during IETE Students Day Celebration for being an active student volunteer for IETE activities during the year 2023-24.



### EXTERNAL ACADEMIC AND ADMINISTRATIVE AUDIT:

- The External Academic and Administrative Audit (EAAA) was conducted by SVCE, Internal Quality Assurance Cell and the department audit was reviewed by Dr.A.Rajkumar, Professor, Department of Electronics and Communication Engineering, Rajalakshmi Engineering College, Chennai on 16.02.2024



### NPTEL PARTICIPATION:

- Around **30 Final Year ECE students** participated in various NPTEL Courses like **Programming in Java, Introduction to Internet of Things, The Joy of Computing using Python** and secured **Elite and Silver Grade** in the period of July-October 2023.

### FACULTY ACHIEVEMENTS:

- Dr.T.J.Jeyaprabha acted as Judge for **ICube Hackathon 3.0** organized by Science Club of SVCE from 16.02.2024 to 17.02.2024
- Dr.T.J.Jeyaprabha acted as Reviewer for the journal “Recent Advances in Electrical & Electronic Engineering” during February 2024.
- Dr.T.J.Jeyaprabha acted as Reviewer for Informatics and Smart Engineering Systems (INSES2024) organized by Loyala ICAM College of Engineering and Technology during February 2024.
- Dr.T.J.Jeyaprabha acted as Reviewer for H.K.E. Society's S.L.N. College of Engineering, Raichur, Karnataka organized **Second IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS-2024) during 23<sup>rd</sup> & 24<sup>th</sup> February 2024** in association with IEEE Bangalore Section and IEEE North Karnataka Subsection.



- Dr.T.J.Jeyaprabha acted as Reviewer for the Third IEEE International Conference on Mobile Networks and Wireless Communications (ICMNWC 2023) @SSIT, Tumkur.



### ALUMNI ACTIVITIES:

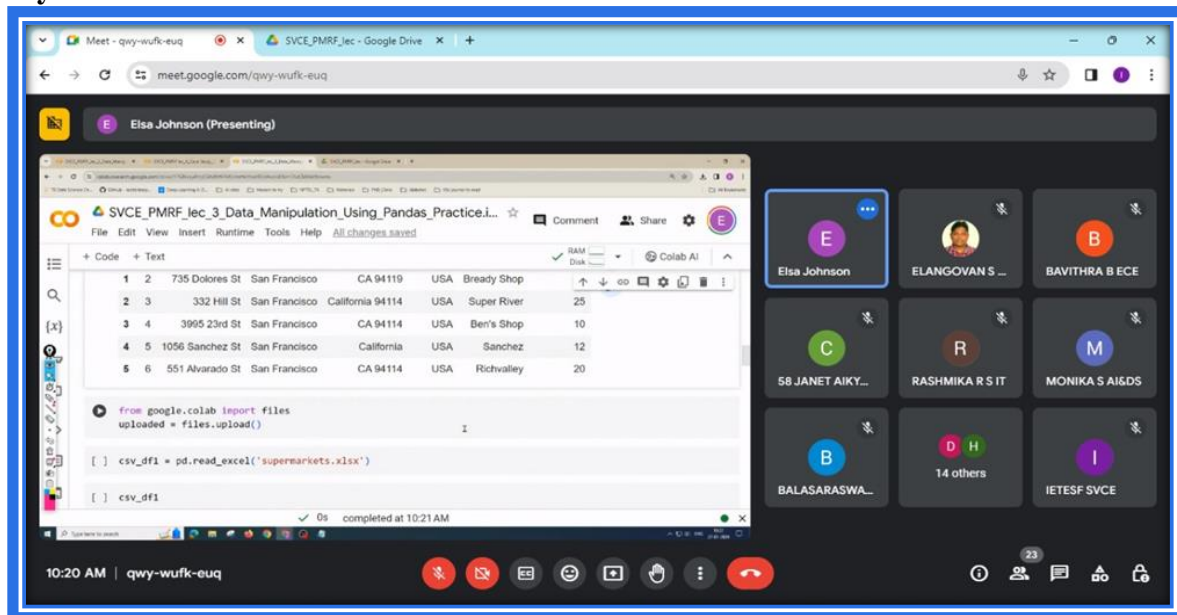
- **Mr.B.Nandakumar (2017 Batch ECE alumnus) Software Development Engineer, Walmart** delivered a Guest Lecture on “**Engineering in Retail Industry**” to II Year ECE Students on 20.02.2024



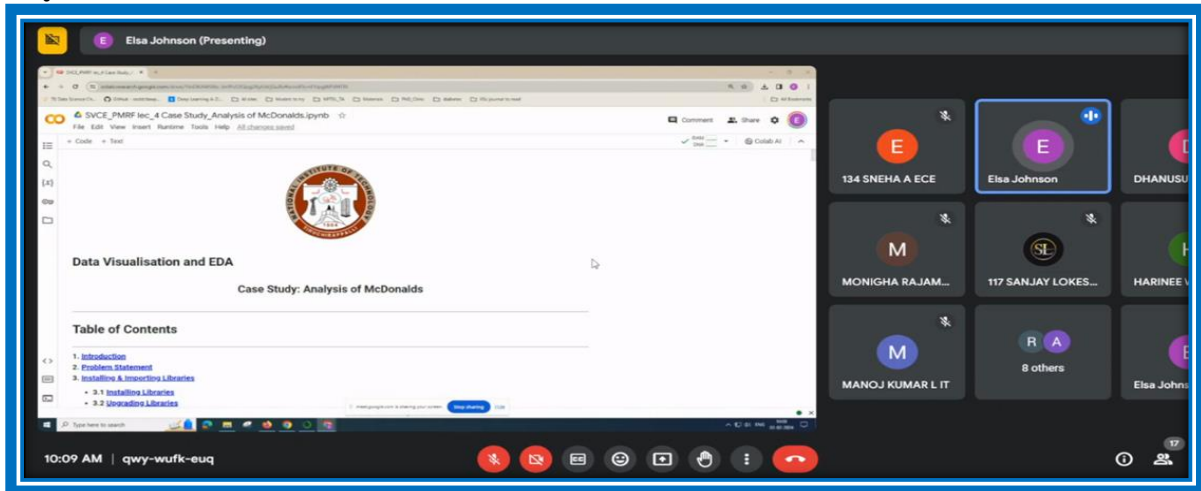
### EVENTS ORGANIZED:

- Webinar cum Workshop Series on Data Analytics and Machine Learning using Python. It is a 5-weekend series conducted online for students by Ms. Elsa Sharu Johnson, PM Research Fellow, Department of Instrumentation and Control, NIT duration of 13/01/2024, 20/01/2024, 27/01/2024, 03/02/2024 and 10/02/2024.

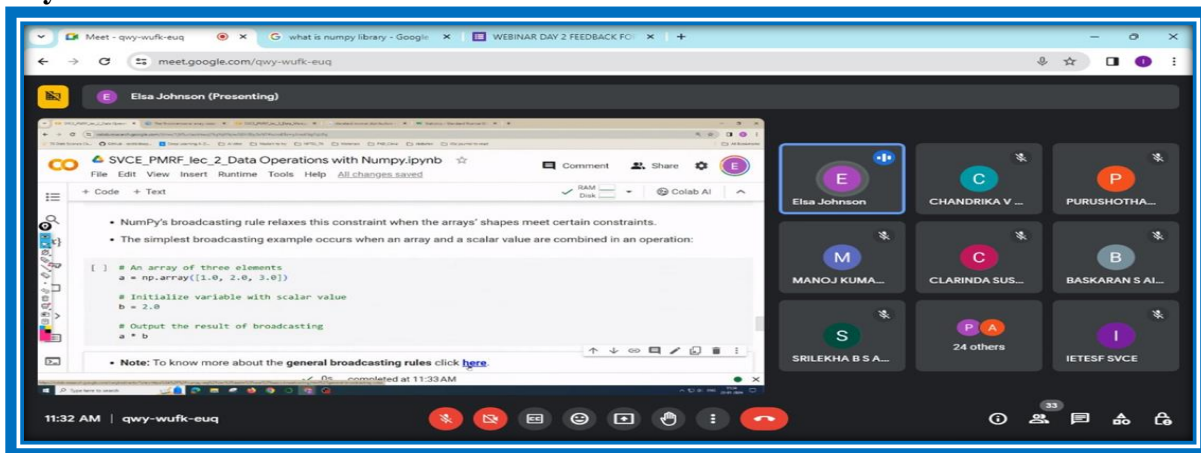
#### Day 3:



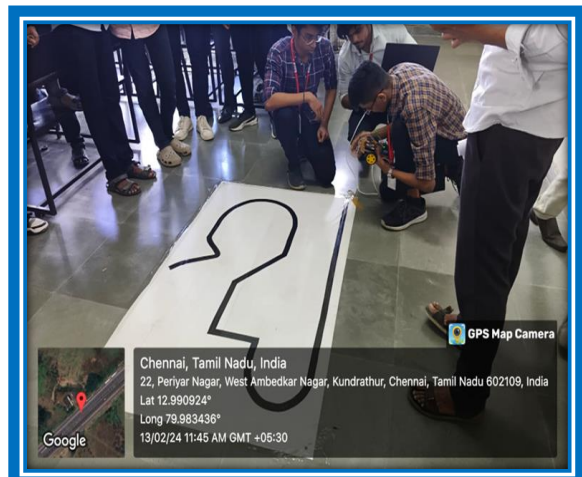
Day 4:



Day 5:



- On account of IETE Students Day, The Trackbot – Line Follower Robot Competition was conducted in association with IETE Chennai Center on 13/02/2024 at our campus by IETE Students Forum of SVCE.





- The Department of ECE organized a guest lecture on “**Machine Learning-An Introduction on Career Path**” in association with IETE Students Forum on 27.02.2024 from 9.00 a.m to 11 a.m at Function Hall, SVCE for II Year ECE Students. The session was handled by **Mr.S.Lingesh, Python Developer, Simmer, Chennai**. The event was really interactive and students gained more programming skills and knowledge in Python used in Machine Learning Applications. The event was organized by Dr.T.J.Jeyaprabha, Associate Professor/ECE, Mr.L.K.Balaji Vignesh, Assistant Professor/ECE and Dr.K.Kavitha, Assistant Professor/ECE under the guidance of Dr.S.Ganesh Vaidyanathan, Principal and Dr.G.A.Sathish Kumar, HOD/ECE.





- The Department of ECE organized a guest lecture on “VLSI Design and System Verilog- Recent Trends and Job Opportunities” in association with IETE Students Forum on 29.02.2024 from 1.00 p.m to 3.00 p.m at Function Hall, SVCE for III Year ECE Students. The session was handled by **Venkatesh Rajakutti, Design Engineer, Tessolve Semiconductors Private Limited, Bengaluru**. The event was organized by Dr.T.J.Jeyaprabha, Associate Professor/ECE, Mr.S.Elangovan, Assistant Professor/ECE under the guidance of Dr.S.Ganesh Vaidyanathan, Principal and Dr.G.A.Sathish Kumar, HOD/ECE.



### INDUSTRY INSTITUTE INTERACTION:

- The Industry Institute Interaction meeting with executives of M/s. HL Mando was held on 28th February, 2024, at HL Mando Office, Irungattukottai, Sriperumbudur. Attendees included Dr. S. Ganesh Vaidyanathan (Principal), Dr.K R. Santha (Vice Principal), Dr. S. Muraleedharan (Chief Placement Officer), Dr.R.Ramesh (Dean - Academics), Dr. K. S. Badrinathan (Dean – Educational Development), Dr.J.Venkatesan (HoD/ Auto), Dr. G. A.Sathish Kumar (HoD/ECE), Dr.S.Ramesh Babu (HoD/ Mech), Dr.M.Mohandass (Assistant HoD/Mech).



## **EDITORIAL BOARD**

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**AP/ECE**

## PROGRAMMES OFFERED BY THE DEPARTMENT

- B.E. in Electronics and Communication Engineering
- M.E. in Communication Systems
- Ph.D / MS (by Research)

## TOP RECRUITERS

