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EEE ASSOCIATION

ELECTRICAL AND ELECTRONICS ENGINEERING

VOLTRIX

ANNUAL MAGAZINE

2025-26

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Chettinad
College of Engineering & Technology
Accredited by NBA, Approved by AICTE and Affiliated to Anna University

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VOLTRIX

ANNUAL MAGAZINE 2025-26

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The Academic Year 2025–2026 has been marked by remarkable progress and meaningful accomplishments. Throughout the year, the department has remained committed to delivering quality technical education while fostering innovation, ethical values, leadership, and lifelong learning. Through a wide range of academic activities, laboratory innovations, industrial visits, value-added courses, seminars, workshops, faculty development programmes, technical competitions, and outreach initiatives, our students have gained valuable knowledge and practical experience that prepare them to meet the evolving demands of the engineering profession.

This edition of VOLTRIX captures the journey of our department during the academic year. It features messages from the management and department leadership, reports on departmental activities, student achievements, faculty accomplishments, research initiatives, technical articles, project highlights, alumni contributions, and memorable moments from various events conducted throughout the year. Every page reflects the dedication, enthusiasm, and collaborative spirit of our students, faculty members, alumni, and industry partners.

In today's rapidly evolving technological landscape, Electrical and Electronics Engineering plays a vital role in shaping sustainable development through innovations in renewable energy, smart grids, electric vehicles, industrial automation, artificial intelligence, embedded systems, Internet of Things (IoT), robotics, and intelligent power systems. As technology continues to transform society, our department remains focused on equipping students with the knowledge, technical competence, and problem-solving skills required to address real-world challenges and contribute meaningfully to the nation's technological advancement.

VOLTRIX also celebrates the creativity and talents of our students beyond academics. Along with technical knowledge, the magazine reflects their enthusiasm in co-curricular and extracurricular activities, leadership initiatives, social responsibility programmes, and community engagement. These experiences contribute to the holistic development of future engineers who are not only technically proficient but also socially responsible and ethically grounded.

The Department of Electrical and Electronics Engineering extends its sincere appreciation to the Management, Principal, faculty members, students, alumni, industry experts, and all contributors whose continuous support and dedicated efforts have made this publication

possible. Their commitment to excellence continues to inspire us to achieve greater milestones.

As you explore the pages of VOLTRIX 2025–2026, we hope you will witness the spirit of innovation, the pursuit of excellence, and the collective achievements that define our department. May this magazine inspire every reader to embrace knowledge, nurture curiosity, and contribute towards building a smarter, greener, and more sustainable future.

"Powering Innovation, Energizing the Future"

PRINCIPAL MESSAGE

It gives me immense pleasure to present VOLTRIX 2025–2026, the Annual Magazine of the Department of Electrical and Electronics Engineering, Chettinad College of Engineering and Technology. This magazine is a reflection of the department's unwavering commitment to academic excellence, innovation, research, and the holistic development of its students. Education is the foundation upon which the future of society is built.

The Department of Electrical and Electronics Engineering has consistently demonstrated excellence through its dedicated faculty, enthusiastic students, and strong industry-oriented approach. The department has organized numerous seminars, workshops, value-added courses, industrial visits, technical competitions, and research activities during the academic year. These initiatives have significantly enhanced students' technical competence, practical exposure, and professional confidence, preparing them to meet the challenges of the rapidly evolving technological world.

This edition of VOLTRIX beautifully captures the remarkable achievements, memorable events, research contributions, technical articles, and creative talents of our students and faculty members. Every page reflects the passion, perseverance, and collaborative spirit that define the department. I congratulate the editorial team for their dedicated efforts in bringing together this wonderful compilation of knowledge and achievements.

As we move towards a future driven by renewable energy, smart technologies, automation, artificial intelligence, and sustainable engineering solutions, I encourage our students to remain curious, innovative, and committed to lifelong learning. Let this magazine serve as a source of inspiration, motivating every reader to pursue excellence with integrity, dedication, and a sense of social responsibility.

I extend my heartfelt appreciation to the Head of the Department, faculty members, students, alumni, and all contributors whose sincere efforts have made this publication a grand success. I wish the Department of Electrical and Electronics Engineering continued growth and greater accomplishments in the years ahead. My best wishes to the editorial team and everyone associated with VOLTRIX 2025–2026.

Dr. (Mrs.) A. Punitha
Principal
Chettinad College of Engineering and Technology

HOD MESSAGE

It is with great pride and immense satisfaction that I present VOLTRIX 2025–2026, the Annual Magazine of the Department of Electrical and Electronics Engineering, Chettinad College of Engineering and Technology. The field of Electrical and Electronics Engineering is continuously evolving with ground-breaking advancements in renewable energy, electric mobility, smart grids, industrial automation, artificial intelligence, robotics, embedded systems, and the Internet of Things. As educators, our responsibility extends beyond imparting technical knowledge—we strive to cultivate innovation, analytical thinking, ethical values, leadership qualities, and a spirit of lifelong learning among our students.

During the academic year 2025–2026, our department has actively organized seminars, workshops, faculty development programmes, industrial visits, value-added courses, technical symposiums, certification programmes, research activities, and community outreach initiatives. These academic and co-curricular activities have provided our students with opportunities to enhance their practical skills, strengthen their technical competencies, and prepare themselves for successful professional careers. VOLTRIX is a reflection of these collective efforts. It showcases departmental milestones, faculty achievements, student accomplishments, technical articles, innovative projects, research contributions, and memorable events that highlight the vibrant academic culture of our department.

I hope this magazine inspires every reader to pursue excellence, embrace innovation, and contribute positively to society through engineering and technology. I sincerely appreciate the unwavering support of our Management and Principal in fostering an environment of academic excellence and innovation. My heartfelt congratulations go to the faculty members, students, editorial team, alumni, and all contributors whose dedication and teamwork have made this edition of VOLTRIX a meaningful and memorable publication.

I encourage our students to continue exploring new technologies, developing creative solutions, and upholding the highest standards of professionalism and ethics. May VOLTRIX 2025–2026 serve as a lasting record of our achievements and an inspiration for future generations of engineers.

Dr. M. Senthil Kumar
Professor & Head
Chettinad College of Engineering and Technology

BOARD OF EDITORS MESSAGE

Greetings!

It is with immense pride and great pleasure that we present VOLTRIX 2025–2026, the Annual Magazine of the Department of Electrical and Electronics Engineering, Chettinad College of Engineering and Technology. VOLTRIX is more than just an annual publication—it is a celebration of knowledge, innovation, creativity, and the collective achievements of our department. This edition captures the memorable moments, academic accomplishments, technical excellence, research contributions, and vibrant student activities that have shaped the academic year 2025–2026. It reflects the enthusiasm, dedication, and collaborative spirit of our students, faculty members, alumni, and well-wishers.

This edition features departmental activities, technical articles, faculty and student achievements, research highlights, industrial interactions, project innovations, co-curricular and extracurricular accomplishments, and memorable events conducted throughout the academic year. Every page reflects the hard work, determination, and aspirations of our department. We express our sincere gratitude to the Management, Principal, Head of the Department, faculty members, students, alumni, and all contributors for their unwavering support and valuable contributions in making this publication a success. We also extend our heartfelt appreciation to every member of the editorial team whose commitment and meticulous efforts have transformed ideas into this meaningful publication.

We hope VOLTRIX 2025–2026 serves as a source of inspiration, motivation, and knowledge for every reader. May it continue to document our journey, celebrate our accomplishments, and encourage future generations to innovate, excel, and contribute towards building a technologically advanced and sustainable world.

Happy Reading!

Mrs. P. Thenmozhi
Assistant Professor

Dr. S. Ragul
Assistant Professor

Board of Editors
VOLTRIX 2025–2026
Department of Electrical and Electronics Engineering
Chettinad College of Engineering and Technology

ABOUT CHETTINADTECH

The Chettinad College of Engineering and Technology is promoted by the Rani Meyyammai Achi of Chettinad Charitable Trust. The promoters of the college have over 90 years of experience in education. The sponsoring trust comprises of eminent personalities who have excelled as leaders in the field of education. With over 90 years of experience in education, especially technical education, the Rani Meyyammai Achi of Chettinad Charitable Trust has been imparting quality technical education at an affordable price to the students in the rural areas.

The college, located in the district of Karur in Tamil Nadu was started in the year 2007. It is approved by the All India Council for Technical Education, New Delhi and is affiliated to the Anna University, Chennai. For over a decade, the college has been committed to delivering quality technical education to the student community. Considered to be one of the top engineering colleges in Tamil Nadu, it has excellent infrastructure which provides growth opportunities for students to excel in their respective disciplines in the fields of engineering, technology and management. The college works towards moulding students into all-rounders with good interpersonal skills and effective soft skills to make them confident to embrace challenges of the future.

90 YEARS
Excellence in Education

VISION OF THE INSTITUTE

To holistically develop competent and responsible Engineers and Managers as future leaders by providing an enriching, safe and joyful learning environment where students feel empowered.

MISSION OF THE INSTITUTE

1. To impart knowledge and the skills through active learning, industrial exposure and innovative project development.

2. To develop leaders through effective mentoring, SMART goal setting and providing a joyful and safe learning environment.

3. To facilitate research in Engineering and Technology and encourage independent learning

COURSES

S.NO	COURSE	SEATS
1.	Artificial Intelligence & Data Science	60
2.	Information Technology	60
3.	Computer Science and Engineering	60
4.	Electronics and Communication Engineering	60
5.	Electrical and Electronics Engineering	60
6.	Mechanical Engineering	60
7.	Master of Business Administration	90

ABOUT EEE

The Department of Electrical and Electronics was established in the year 2008 with the aim of combining modern teaching methods with inter-disciplinary knowledge, human values and professional ethics. The department offers a unique blend of theory and practice. It provides a quality learning environment, in terms of state-of-the-art facilities, sharing and widening of knowledge through MoU with relevant industries and interacting with experts from academia and industry.

The department is well equipped with state-of-the-art laboratories such as the Electrical Machines Lab, Electric Circuits Lab, Control Systems Lab, Measurement and Instrumentation Lab, Engineering Practices Lab, Power Electronics Lab, Power System Simulation Lab and Electric Drives and Controls Lab. To improve practical and simulation skills, MAT LAB Software with all tool boxes has been provided. Power World Simulator, MI Power, PSpice and MultiSim software programmes have been provided to improve the designing ability of the students.

VISION OF THE DEPARTMENT

To create a thriving community where enduring student relationships flourish, fostering a culture of innovative idea development, socially responsible, and ethically driven engineers in the electrical industry.

MISSION OF THE DEPARTMENT

1. To nurture students, enabling them to effectively confront professional challenges and emerge as outstanding engineers and technocrats.
2. To provide a holistic and comprehensive education that ensures total quality, encompassing broad exposure and value additions.
3. To engage in research within the realm of Electrical and Electronics Engineering, addressing the needs of the industry, scientific community, and society at large.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Find employment in Core Electrical and Electronics Engineering and service sectors.

PEO 2 Get elevated to technical lead position and lead the organization competitively.

PEO 3 Enter into higher studies leading to post-graduate and research degrees. Become consultant and provide solutions to the practical problems of core organization.

PEO 4 Become an entrepreneur and be part of Electrical and Electronics product and service industries.

PROGRAM OUTCOMES (POs)

PO 1 **ENGINEERING KNOWLEDGE:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2 **PROBLEM ANALYSIS:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3 **DESIGN/DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 **CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 **MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6 **THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 **ENVIRONMENT AND SUSTAINABILITY:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO 8 **ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 **INDIVIDUAL AND TEAM WORK:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 **COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 **PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12 **LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 Ability to understand the principles and working of electrical components, circuits, systems and control that are forming a part of power generation, transmission, distribution, utilization, conservation and energy saving. Students can assess the power management, auditing, crisis and energy saving aspects.

PSO 2 Ability to apply mathematical methodologies to solve problems related with electrical engineering using appropriate engineering tools and algorithms.

PSO 3 Ability to use knowledge in various domains to identify research gaps and hence to provide solution which leads to new ideas and innovations.

DEPARTMENT FACULTY

Dr. M. Senthilkumar
Professor & Head/EEE

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Assistant Professor/EEE

Mrs. A. Bhuvaneswari
Assistant Professor/EEE

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Assistant Professor/EEE

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Assistant Professor/EEE

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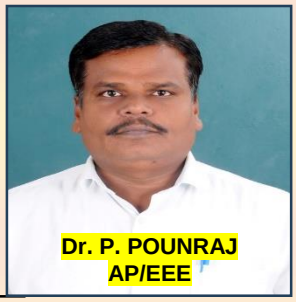
PROF/EEE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III-EEE


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IV-EEE

Programme Name: PLC and SCADA Value-added Certification Course

Date: 06-08-2025 to 08-08-2025

Class & No. of Participants: III EEE & 35

Venue: G Block EEE Computer Lab

External Trainer Name: Ms. Madhu Bala, Embedded and PLC Developer

Description:

The Department of Electrical and Electronics Engineering organized a Value-Added Certification Course on PLC and SCADA from 6th to 8th August 2025 for the 3rd year EEE students. The sessions were handled by Ms. Madhu Bala, Embedded and PLC Developer, at the G Block EEE Computer Lab, with 35 students actively participating. The programme aimed to enhance students practical skills in industrial automation, combining theory with real-time applications.

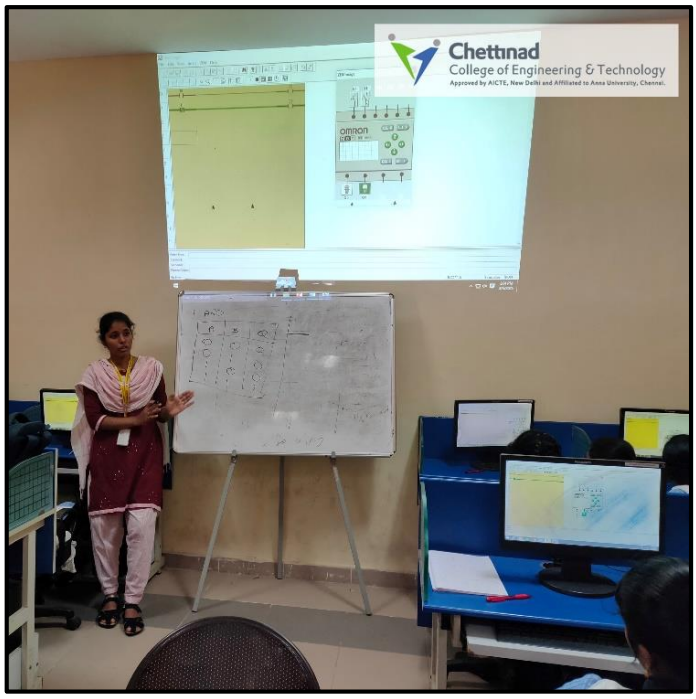
Day 1 began with an introduction to Programmable Logic Controllers (PLCs), including pin diagram explanation, relay logic operations using Normally Open (NO) and Normally Closed (NC) contacts, and PLC software installation. Students learned to create sample ladder logic programs, understand latching and memory coils, and work with different timers and counters. The day also included simulation projects such as School Bell, Car Parking, Snacks Vending Machine, Power Bank Task, and Warehouse Lamp Control System.

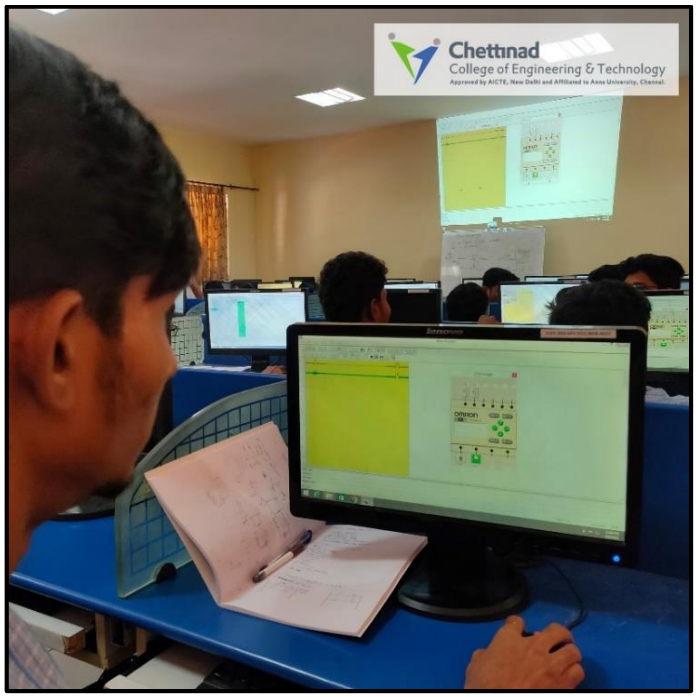
Day 2 introduced Supervisory Control and Data Acquisition (SCADA) systems, covering SCADA basics and an overview of Wonderware InTouch. Students practiced tag creation, menu and wizard functions, graphic designing, input/output mapping, symbol factory usage, page navigation, location movement, and percentage fill features. Practical SCADA projects included Tank Level Control and Automatic Bottle Filling.

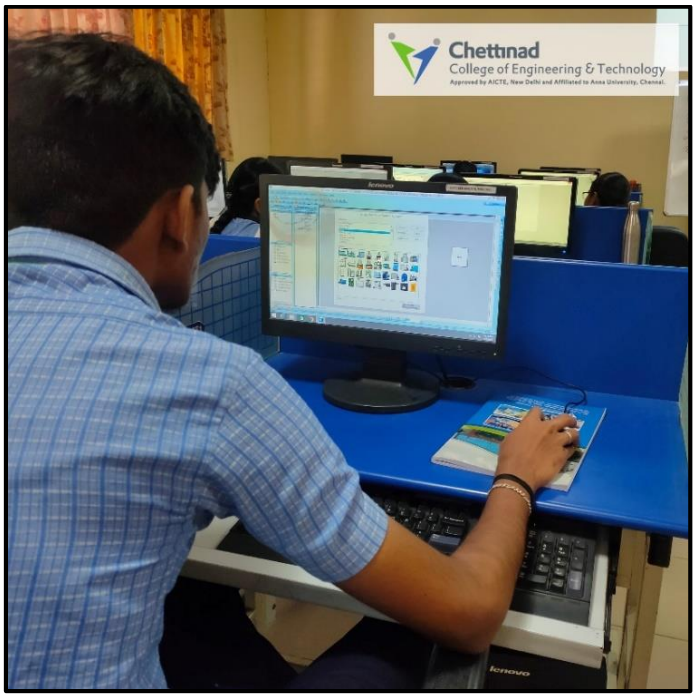
Day 3 focused on advanced application design. Students learned to create real-time and historical trends, design application alarms, develop PLC-based control systems, and integrate them with OMRON PLCs for testing and execution.

By the end of the three-day programme, students were able to understand automation workflows, troubleshoot PLC systems, and design basic SCADA screens. The training enriched their technical competency and prepared them for future opportunities in the automation and manufacturing sectors.

Event Photos:







Program Name: IEI – All India Seminar on "Green India Mission" at ChettinadTech

Date: 22-08-2025 to 23-08-2025

Number of Participants: 121

Venue: Chettinad College of Engineering and Technology, Karur

Description:

The Institution of Engineers (India), in collaboration with the Department of Electrical and Electronics Engineering, Chettinad College of Engineering and Technology, Karur, organized a two-day All India Seminar on "Green India Mission" on 22nd and 23rd August 2025. The event brought together experts, academicians, and students to deliberate on sustainable development and environmental conservation. The seminar was inaugurated on 22nd August. Dr. S. Dharmalingam, National Council Member, IEI (India), welcomed the gathering and highlighted the seminar theme, emphasizing the National Action Plan on Climate Change and the need to expand forest and tree cover.

The Chief Guest, Dr. R. Elankovan, Additional General Manager & Head–HSE, BHEL Tiruchirappalli, in his address, outlined the aims of the Green India Mission. He stressed initiatives such as the Green Credit Programme, Harit BHEL, and Miyawaki forests, urging participants to take a pledge towards a greener future. Delivering the Presidential Address, Dr. A. Punitha, Principal of ChettinadTech, emphasized the relevance of the UN Sustainable Development Goals (SDGs) and highlighted the green energy activities initiated at ChettinadTech.

As part of the seminar, students actively participated in Paper and Poster Presentations. A total of 73 students from ChettinadTech and 48 students from external colleges showcased innovative ideas related to renewable energy and environmental sustainability. The Valedictory Function on 23rd August featured Dr. S. Dharmalingam as the Chief Guest. Mr. P. Pandi, Assistant Professor/EEE and Coordinator, presented the seminar report, summarizing the two-day proceedings. Finally, ChettinadTech faculty Dr. M. Senthilkumar, Professor/EEE, proposed the Vote of Thanks, expressing gratitude to all contributors. The event concluded with the distribution of prizes and certificates to the winners of Paper and Poster Presentation competitions.

The two-day seminar brought together academicians, industry experts, researchers, and students, who deliberated on green energy practices, afforestation strategies, carbon neutrality, and sustainable development. The event concluded with a collective commitment to continue Green India initiatives and to strengthen the role of engineers in addressing environmental challenges. The seminar served as a remarkable platform for creating awareness, sharing knowledge, and motivating young minds to contribute towards a sustainable and green India.

Event Photos:

Programme Name: Batch 18 - Fresher Welcome Party

Date: 04-09-2025

Venue: C Block Seminar Hall

Organized by: Second-year EEE Students

Department: Electrical and Electronics Engineering

Description:

The Department of Electrical and Electronics Engineering hosted a lively and memorable Freshers Welcome Party for Batch 18 students on 04th September 2025 at the C Block Seminar Hall. The event was organized by the second-year EEE students, who took great effort to ensure that their juniors felt warmly welcomed into the department. The programme began with a heartfelt welcome speech, setting a cheerful tone for the occasion. The hall soon filled with energy as the stage came alive with vibrant dance performances, which received loud cheers and applause from the second-year students. To further engage the gathering, the organizers conducted a variety of fun games that created a spirit of joy, laughter, and healthy interaction between juniors and seniors. The activities helped strengthen the bond among the students and made the event even more enjoyable. Adding to the festive atmosphere, refreshing juice and snacks were served, giving everyone a chance to relax and interact informally. The celebration concluded with a memorable group photo session, capturing smiles, happiness, and the togetherness of the EEE family. The Batch 18 Freshers Welcome Party was not just a programme but a celebration of new beginnings. It reflected the unity, enthusiasm, and vibrant culture of the department, leaving behind memories that will be cherished by both juniors and seniors alike.

Event Photos: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Program Name: Energy Audit

Date: 15-09-2025 to 20-09-2025

Venue: Government Hospital, Kulithalai

Student Members (III EEE): 1. P. Karthikeyan, 2. R. Rohith, 3. S. Bharathi, 4. R. Samyuktha, 5. S. Sureka 6. G. Mythili

Convener: Dr. M. Senthil kumar, Prof./EEE

Supervisor: Mr. K. Boopathi, Senior Lab Technician

Objective:

- The Energy Audit aimed to evaluate the electrical energy consumption pattern of the Government Hospital, Kulithalai, identify areas of energy wastage, and suggest practical measures to improve energy efficiency and conservation.

Description:

The Department of Electrical and Electronics Engineering organized an Energy Audit at the Government Hospital, Kulithalai, from 15th to 20th September 2025. The primary objective was to analyze the hospital's electrical energy usage, identify inefficiencies, and propose measures for effective energy conservation. The audit team conducted a detailed load survey covering lighting, air conditioning systems, medical and office equipment, and pumping systems. Power and energy readings were measured using portable digital instruments to assess actual consumption patterns.

The audit found that air-conditioning and lighting loads contributed the most to overall consumption. The measured average power factor was 0.85, indicating a scope for improvement through reactive power compensation. The Energy Audit team suggested several steps to improve energy efficiency at the Government Hospital, Kulithalai.

They recommended replacing all lights with LED fixtures and installing occupancy sensors in corridors and waiting areas to reduce wastage. Air conditioners should be set to 24°C and maintained regularly for better performance. To improve the power factor above 0.95, installing automatic power factor correction (APFC) panels was advised. Water pumps should be operated during off-peak hours to lower electricity costs. A 10 kW rooftop solar system was proposed to use renewable energy, and staff should be encouraged to save energy through awareness programs and display boards.

Outcome:

- The Energy Audit provided hands-on experience for students in measuring and analyzing energy parameters. The proposed recommendations are expected to reduce the hospital's monthly energy cost by 20–25% and enhance overall operational efficiency.
- This initiative showcased the department's commitment to sustainable energy practices and served as a valuable step toward real-world application of classroom knowledge.

Energy Audit Photos:


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ஆக்ஸிஜன் ஜெனரேட்டர்
நிலையம்
கொள்ளளவு : 21 m³/hr
உபயதாரர் :
செட்டிநாடு சிமெண்ட்
கார்ப்பரேஷன் பிரைவேட் லிமிடெட்.
புலியூர், கரூர் மாவட்டம்.
(பெருநிறுவன சமூக பொறுப்புணர்வு திட்டத்தின் கீழ்)
Chettinad
College of Engineering & Technology
Capacity : 21 m³/hr
Donated By :
Chettinad Cement
Corporation Private Ltd.
Pulyur, Karur Dist.
(Under Corporate Social Responsibility Scheme)

Program Name: Book Free Day

Date: 17-10-2025

Class: 2nd Year, 3rd Year and Final-Year

Venue: ChettinadTech Campus

Program Objectives:

1. To enhance students' creativity, communication, and problem-solving skills through fun-filled interactive games.
2. To encourage teamwork, leadership, and collaboration among students of different year levels.
3. To develop students' quick thinking, decision-making, and innovation abilities through technical and non-technical challenges.
4. To promote a sense of peer appreciation and self-confidence by engaging students in participatory and reflective activities.

Description:

The Department of Electrical and Electronics Engineering organized a vibrant and engaging event titled "Book Free Day" on 17th October 2025, exclusively for Second-Year, Third-Year, and Final-Year students. The event aimed to provide students with a refreshing break from their regular academic routine, encouraging teamwork, creativity, and critical thinking through a series of interactive games and activities.

For the Second-Year students, the day began with exciting contests such as Rapid Fire (Electro Quiz), Identify & Connect, and Trash to Treasure, where students showcased their technical knowledge, logical reasoning, and innovative thinking by creating useful items from recyclable materials. The Third-Year students enthusiastically participated in Tech Challenge, Think Fast, and Guess from the Picture, which tested their quick decision-making, technical understanding, and visual interpretation skills. The Final-Year students took part in dynamic sessions including Role Play, Peer Appreciation Circle, Problem-Solving Challenge, and Leadership Task, designed to enhance communication, empathy, analytical ability, and leadership qualities.

The event fostered a lively and collaborative environment, allowing students to explore their creative and intellectual potential beyond textbooks. It strengthened team spirit, built confidence, and promoted a culture of joy in learning. The Book Free Day was truly a memorable and rejuvenating experience that reflected the department's commitment to holistic student development.

Program Outcomes for Students:

- Students developed improved team coordination and leadership qualities through group-based activities.
- Participants enhanced their critical thinking and analytical skills while tackling time-bound challenges.
- Students gained confidence in public speaking and interpersonal communication during role-play and peer appreciation sessions.
- The event fostered a creative and innovative mindset, motivating students to think beyond textbooks.
- Students experienced a sense of community, motivation, and positive engagement, contributing to their overall personal and professional growth.

Participants Feedback:

The "Book Free Day" received an overwhelming and positive response from students across all year levels. Participants appreciated the refreshing break from academic routines and expressed that the activities were both fun and intellectually stimulating. Many students remarked that the event fostered a strong sense of collaboration, communication, and bonding among peers. They appreciated the department's effort in organizing such a lively and well-structured program that balanced learning with enjoyment. Overall, students described the Book Free Day as a memorable, motivating, and refreshing experience that rekindled their enthusiasm for learning beyond the classroom.

Faculty Organizer's Feedback:

The faculty organizers expressed great satisfaction with the successful conduct of the "Book Free Day" event held on 17th October 2025. They appreciated the enthusiastic participation and energetic involvement of students from the Second, Third, and Final Years, which made the program lively and impactful. The faculty observed that the activities encouraged students to think creatively, collaborate effectively, and communicate confidently in a non-academic environment. Overall, the organizers felt that "Book Free Day" was a valuable and meaningful initiative that strengthened student–faculty relationships, nurtured creativity, and promoted experiential learning.

Book Free Day Photos:

Program Name: EEE Association Inauguration & Guest Lecture

Guest Speaker: Mr. R. Lakshmanan, Managing Director, Dhronav Info Tech, Namakkal

Date: 07-11-2025

Participants: I Year – IV Year

Venue: C Block Seminar Hall

Program Objective

- To formally inaugurate the EEE Association for the academic year 2025–26 and introduce the newly elected office bearers.
- To expose students to the recent developments in Smart Automation and IoT applications in the electrical industry.
- To bridge the gap between academic learning and industrial practices through expert interaction.
- To motivate students to develop innovative projects and solutions aligned with modern industrial trends.
- To foster leadership, teamwork, and organizational skills among student association members.

Description:

The Department of Electrical and Electronics Engineering, Chettinad College of Engineering and Technology, Karur, organized the EEE Association Inauguration for the academic year 2025–26 along with a Guest Lecture on the topic "Smart Automation in Electrical Industry using IoT" on 7th November 2025 at the C Block Seminar Hall. The event commenced with the traditional lighting of the Kuthuvizhakku, followed by the welcome address delivered by a student representative. The program witnessed the introduction of the AEEE Association Office Bearers for the academic year 2025–26, who took charge of organizing various technical and co-curricular activities for the department. The list of proposed events and programs for the year was also presented during the inauguration by EEE association coordinator Mr. P. Pandi, AP/EEE.

The highlight of the event was the guest lecture delivered by Mr. R. Lakshmanan, Managing Director, Dhronav Info Tech, Namakkal, on the topic "Smart Automation in Electrical Industry using IoT." He elaborated on the recent advancements in IoT-based automation systems and their applications in the electrical industry. The session provided valuable insights into smart industrial practices, energy management, predictive maintenance, and the role of IoT in improving system reliability and operational efficiency. Students from first year to final year of the EEE department actively participated in the program. The lecture was followed by an interactive session, where students clarified their doubts and gained practical exposure to industrial automation concepts.

The program concluded with a vote of thanks, expressing gratitude to the management, principal, faculty members, and the guest speaker for their support and contribution to the successful conduct of the event. The inauguration and guest lecture served as an inspiring beginning for the departmental activities of the academic year 2025–26, motivating students to enhance their technical knowledge and professional skills in the evolving field of Electrical and Electronics Engineering.

Event Photos:

Program Name: PROJECT EXPO - TECHNOBATTLE'25

Date: 23-12-2025

Participants: II Year – IV Year

Venue: EEE Workshop Laboratory

Description:

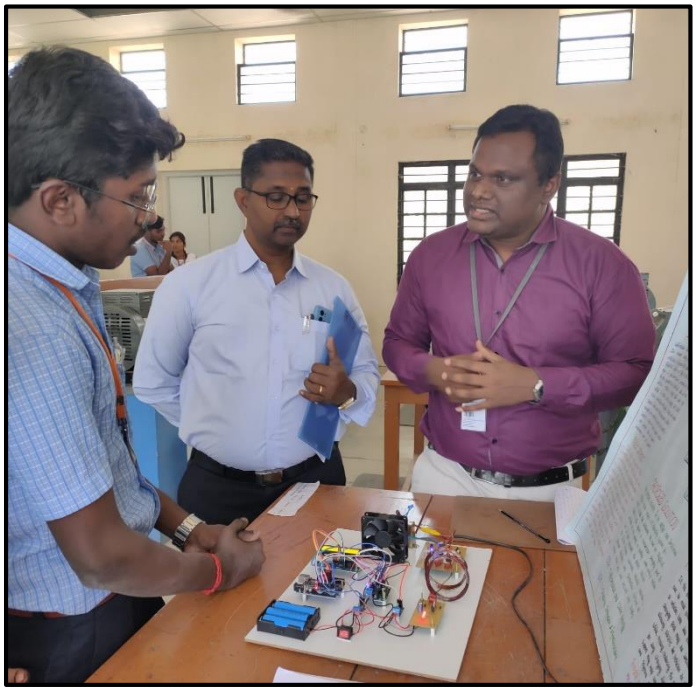
TECHNOBATTLE'25, the Mini Project Expo of Chettinad College of Engineering and Technology, was conducted successfully with active participation from all departments. The event served as a vibrant platform for students to demonstrate their innovation, technical knowledge, and practical problem solving skills through mini projects. Our department student submitted 35 projects to display for external and internal jury's evaluation.

The projects covered a wide range of emerging and core engineering domains including Internet of Things, Embedded Systems, Renewable Energy Systems, Electric Vehicles, Power Systems. This clearly reflects the strong alignment of student projects with current industry and societal needs. All projects were evaluated using a structured and transparent evaluation process focusing on innovation, technical depth, implementation quality, and presentation skills. The evaluation also contributed to department-wise performance and overall championship results.

The major outcomes of TECHNOBATTLE'25 include enhanced hands-on learning, improved teamwork and communication skills, exposure to emerging technologies, encouragement of innovation culture, and identification of promising projects for further development and competitions.

In conclusion, TECHNOBATTLE'25 was successfully organized and achieved its intended objectives. The success of this event is the result of the continuous support from the Respected Principal, Respected Admin, management, the dedicated efforts of the organizing committee and faculty coordinators, the valuable contribution of the jury members, and the enthusiastic participation of our students.

Project Expo Photos:



Programme Name: Value-Added Course on "Simulation of Electrical Systems using MATLAB"

Target Group: II Year B.E. Electrical and Electronics Engineering (EEE) Students

Time: 9.00 AM to 4.15 PM

Date: 05-01-2026 to 06-01-2026

Organized by: Association of Electrical and Electronics Engineering – ELECTRA & IEI Student Chapter

Resource Persons: Dr. M. Senthil Kumar, Prof/EEE, Dr. R. Boopathi, AP/EEE, Mrs. P. Thenmozhi, AP/EEE

Venue: EEE Computer Lab(G04)

Description:

A Value-Added Course on "Simulation of Electrical Systems Using MATLAB" was organized by the Department of Electrical and Electronics Engineering for second-year EEE students from January 5 to January 6, 2026. The course sessions were led by our department internal faculty members Dr. M. Senthil Kumar, Prof./EEE, Dr. R. Boopathi, AP/EEE, and Mrs. P. Thenmozhi, AP/EEE faculty members of the Department of Electrical and Electronics Engineering. The program primarily focused on introducing students to the fundamentals of MATLAB and Simulink for electrical system simulation.

The course emphasized the modeling, analysis, and performance evaluation of electrical and electronic systems using MATLAB and Simulink environments. Mathematical models of electrical systems were developed in MATLAB based on governing equations, while Simulink was used to represent these models through functional blocks such as sources, gains, integrators, and scopes. This approach enabled effective time-domain analysis and visualization of system responses. The value-added course enhanced students' understanding of theoretical concepts through practical simulation, improved their analytical skills, and provided hands-on experience in using MATLAB tools for solving real-world electrical engineering problems.

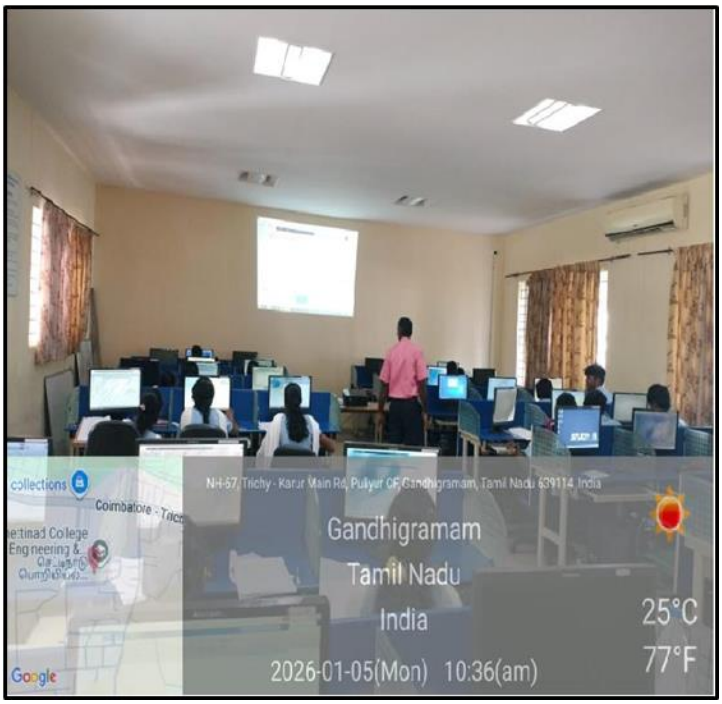
SDG Mapping:

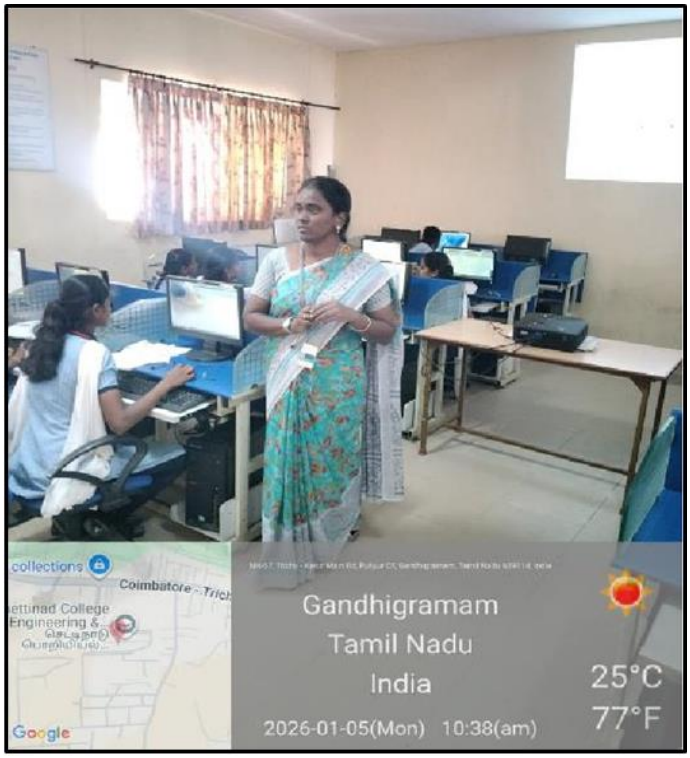
The Value-Added Course on Simulation of Electrical Systems Using MATLAB contributes to the following United Nations Sustainable Development Goals (SDGs) by promoting technical education, innovation, and sustainable engineering practices.

SDG 4 – Quality Education: Enhances students' technical competency through skill-based learning. Promotes practical, industry-relevant education using modern simulation tools.

SDG 9 – Industry, Innovation, and Infrastructure: Encourages the use of modern engineering tools (MATLAB & Simulink).

Value-Added Course Photos:





Programme Name: Technical Activity on “Simulation of power system faults and relay coordination”

Target Group: III Year B.E. Electrical and Electronics Engineering (EEE) Students

Date: 22-01-2026

Activity Incharge: Dr. M. Senthil Kumar, Prof/EEE

Venue: EEE Computer Lab(G04)

Description:

The Department of Electrical and Electronics Engineering organized a Technical Activity on "Simulation of Power System Faults and Relay Coordination" for III Year EEE students on 22nd January 2026 at the EEE Computer Laboratory. The activity provided students with hands-on experience in simulating various power system faults, including single line-to-ground, line-to-line, double line-to-ground, and three-phase faults, using simulation software

Students also learned the principles of protective relay coordination by analyzing fault conditions and configuring relay settings for effective fault isolation. The session enhanced their practical understanding of power system protection, improved analytical and simulation skills, and strengthened their ability to interpret fault analysis results. A total of 31 students actively participated in the activity, demonstrating excellent involvement and technical competence.

Activity Photos:

Programme Name: Peer Learning on "Energy Audit and Energy Conservation"

Target Group: II & III Year B.E. Electrical and Electronics Engineering (EEE) Students

Date: 23-01-2026

Venue: G Block Seminar Hall

Description:

The Department of Electrical and Electronics Engineering organized a Peer Learning Session on 23rd January 2026 at 3:30 PM in the C Block Seminar Hall. The session was conducted by Karthikeyan P and Rohith R, III Year EEE students, on the topic "Energy Audit and Energy Conservation." The presenters shared their knowledge on the significance of energy auditing, methods for identifying energy losses, and practical energy conservation techniques in residential, commercial, and industrial sectors.

The interactive session encouraged active participation, collaborative learning, and technical discussions among students. It enhanced awareness of sustainable energy management practices while strengthening communication, presentation, and peer-to-peer learning skills. The program successfully promoted a culture of knowledge sharing and inspired students to adopt energy-efficient solutions in engineering applications.

Programme Name: Technical Activity on “Load frequency control using MATLAB”

Target Group: III Year B.E. Electrical and Electronics Engineering (EEE) Students

Date: 29-01-2026

Activity Incharge: Mrs. P. Thenmozhi, AP/EEE

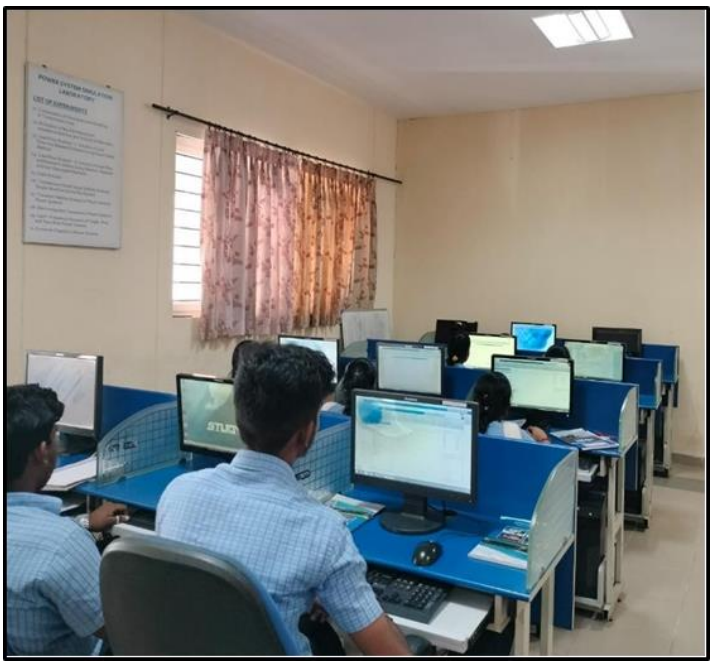
Venue: EEE Computer Lab(G04)

Description:

The Department of Electrical and Electronics Engineering organized a Technical Activity on "Load Frequency Control using MATLAB" for III Year EEE students on 29th January 2026 at the G Block Computer Laboratory (G04). The activity provided practical exposure to the concept of Load Frequency Control (LFC) through MATLAB/Simulink simulations. Students developed a single-area LFC model by integrating governor, turbine, and generator blocks and analyzed system performance under varying load disturbances.

They observed important response characteristics such as frequency deviation, settling time, and steady-state error, gaining a deeper understanding of power system stability and control. The hands-on session enhanced students' simulation skills, analytical thinking, and confidence in using MATLAB for real-time power system studies. A total of 33 students actively participated, making the activity highly interactive and outcome-oriented.

Activity Photos:



Programme Name: Technical Contest on "EV Design Challenge"

Target Group: II & III Year B.E. Electrical and Electronics Engineering (EEE) Students

Time: 2.15 PM to 4.15 PM

Date: 10-03-2026

Coordinator: Dr. R. Boopathi, AP/EEE

Venue: Electrical Machines Lab

Description:

On 10th March 2026, the Department of Electrical and Electronics Engineering organized a Technical Contest on "EV Design Challenge" for II and III Year EEE students. The event was organized at the Electrical Machine Laboratory to provide a practical and technical learning environment for the participants. A total of 66 students participated in the contest, including 35 students from III Year EEE and 31 students from II Year EEE, showing enthusiastic involvement in the activity. The main objective of the contest was to encourage students to develop innovative ideas and technical knowledge in Electric Vehicle (EV) design and sustainable transportation technologies. Students participated individually and in teams and presented their creative EV design concepts and innovative technical solutions related to Electric Vehicle technology. Their presentations included ideas related to EV structure, battery management systems, energy-efficient design, and charging infrastructure. The contest presentations were evaluated by our ChettinadTech internal jury member, Dr. B. Balasubramanian, AP/MECH., who assessed the participants based on innovation, feasibility, technical content, and presentation skills. Finally, he announced the results and congratulated the winners of the EV Design Challenge contest. The First Prize was awarded to the II Year EEE team of J. Preetha and P. Deepika, and the Second Prize was secured by the III Year EEE team of Patrick Joswa J, Rohith R, and Yeshwanth S.

Technical Contest Photos:

Programme Name: Industrial Visit

Target Group: I & III Year B.E. Electrical and Electronics Engineering (EEE) Students

Dates of Visit: 13-03-2026 & 14-03-2026

Places Visited: 1. Wonderla Amusement Park – Power Plant, Kochi, Kerala.

2. Masco Tea Factory, Vagamon, Kerala.

Industrial Visit Objectives:

- To understand the working principles of power generation and distribution systems in amusement parks.
- To study industrial automation, safety mechanisms, and energy management practices.
- To gain knowledge about tea processing techniques and industrial machinery used in manufacturing.
- To bridge the gap between theoretical learning and industrial applications.
- To enhance students' technical skills, teamwork, and professional awareness.

Outcomes of the Visit:

- Students gained practical knowledge of electrical systems used in large-scale operations.
- Improved understanding of industrial safety standards and maintenance practices.
- Exposure to real-time automation and control systems.
- Awareness of interdisciplinary applications of electrical engineering in different industries.

Description:

The Department of Electrical and Electronics Engineering organized a two-day industrial visit on 13th and 14th March 2026 for 68 students from I Year and III Year, accompanied by 5 faculty members. The visit aimed to provide practical exposure to industrial operations and enhance students' understanding of real-time engineering applications. On the first day, students visited the power plant section of Wonderla Amusement Park in Kochi. The visit provided valuable insights into the electrical infrastructure required to operate large-scale amusement rides. Students observed the functioning of diesel generator sets, transformers, distribution panels, and control systems that ensure a reliable and continuous power supply. The technical staff explained how electrical loads are managed efficiently across different rides and how backup systems automatically take over during power interruptions. The importance of safety mechanisms such as protective relays, circuit breakers, and grounding systems was also demonstrated. Additionally, students gained exposure to automated control systems used for ride operations, highlighting the role of electrical engineering in ensuring safety, precision, and efficiency.

On the second day, students visited the Masco Tea Factory in Vagamon, where they learned about the complete tea production process. The visit covered all stages, including withering, rolling, fermentation, drying, grading, and packaging. Students observed various industrial machines such

as conveyors, rolling machines, dryers, and sorting equipment. The role of motors, temperature control systems, and electrical drives in maintaining consistent production quality was explained. The factory personnel also emphasized quality control procedures, hygiene standards, and efficient resource management practices followed in the industry.

Overall, the industrial visit provided a comprehensive learning experience by exposing students to both power systems in entertainment industries and process-based manufacturing in agro-industries. It helped students connect theoretical knowledge with practical applications, thereby enhancing their technical competence and industrial awareness.

Industrial Visit Photos:

Programme Name: CSIR Sponsored Two Days National Level Seminar on "Empowering India's EV Revolution: Sustainable Technologies and Policy Directions for Seamless Grid Integration"

Date: 19-03-2026 to 20-03-2026 (2 Day)

Venue: C Block Seminar Hall

Resource Persons:

1. Dr. S. Albert Alexander
   Associate Professor, VIT University, Vellore
2. Dr. N. S. Raghavendra Rao
   Senior Engineer, Intertek India Pvt. Ltd., Bengaluru
3. Dr. R. Manikandan
   Manager, Albonair India Pvt. Ltd., Chennai
4. Dr. R. Boopathi
   Assistant Professor/EEE, ChettinadTech, Karur

No. of Participants: 69

Description:

The two-day CSIR-sponsored National Level Seminar on "Empowering India's EV Revolution: Sustainable Technologies and Policy Directions for Seamless Grid Integration," organized by the Department of Electrical and Electronics Engineering at Chettinad College of Engineering and Technology, Karur, on 19th and 20th March 2026, successfully brought together experts, academicians, and participants to discuss advancements in electric vehicle (EV) technologies and their integration with modern power systems. The seminar commenced with an inaugural function led by Dr. S. Albert Alexander of VIT University, Vellore, who emphasized the significance of EVs, smart grids, and sustainable energy solutions, while the Principal, Dr. A. Punitha, encouraged active participation and knowledge sharing.

The technical sessions covered a wide spectrum of topics, beginning with Dr. Alexander's comprehensive insights into EV classifications, battery technologies, Vehicle-to-Grid (V2G) systems, policy frameworks, and socio-economic considerations for equitable EV adoption. The second session by Dr. N. S. Raghavendra Rao focused on grid modernization, power management strategies, industry standards, and sustainable business models such as charging-as-a-service and battery swapping, highlighting practical challenges in EV deployment. On the second day, Dr. R. Manikandan discussed consumer behavior, market transformation, global best practices, public transport electrification, environmental sustainability, and circular economy approaches, while also identifying key research priorities for India's EV ecosystem.

The final session by Dr. R. Boopathi emphasized the role of power electronics in ensuring grid stability and power quality, addressing issues such as harmonics, voltage fluctuations, and load demand through advanced solutions like smart converters, active filters, and coordinated charging.

The seminar concluded with a valedictory function where achievements were highlighted, certificates were distributed, and participants expressed positive feedback on the knowledge gained. Overall, the seminar provided a comprehensive platform for understanding technological innovations, policy directions, industry practices, and research opportunities essential for advancing India's EV revolution and achieving sustainable, efficient grid integration.

Event Photos:

CSIR-INDIA
सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

Programme Name: ELECTRA - EEE Association Logo Reveal

Date: 19-03-2026

Venue: C Block Seminar Hall

Chief Guest: Dr. S. Albert Alexander, Associate Professor from the School of Electrical and Electronics Engineering, VIT University

Description:

The Department of Electrical and Electronics Engineering proudly marked a significant milestone with the successful unveiling of the ELECTRA - EEE Association Logo and Official Promo Reveal Video on 19th March 2026. This momentous occasion symbolized the spirit of innovation, unity, and technological excellence that defines ELECTRA. The event was graced by our esteemed reveal chief guests, Dr. S. Albert Alexander, Associate Professor from the School of Electrical and Electronics Engineering, VIT University, Vellore, and Dr. A. Punitha, Principal of Chettinad College of Engineering and Technology, Karur. Their presence added great value to the occasion, inspiring students and faculty with their insightful thoughts and encouragement.

The newly revealed ELECTRA logo, creatively designed by Mr. M. Vasanthprakash, AP/EEE, stands as a powerful representation of energy, innovation, and the forward-thinking vision of the EEE community. The official video beautifully captured the association's mission, achievements, and future aspirations, showcasing the excellence and unity within the department. The event witnessed enthusiastic participation from students, faculty members, and guests, making it a vibrant and memorable celebration. It marks the beginning of a new chapter filled with technical excellence, collaboration, and innovation under the ELECTRA banner. With this launch, ELECTRA embarks on an inspiring journey to empower future engineers, foster creativity, and drive technological advancements in Electrical and Electronics Engineering.

ELECTRA Association Logo

Programme Name: Technical Activity on "Troubleshoot IoT"

Target Group: III Year B.E. Electrical and Electronics Engineering (EEE) Students

Date: 02-04-2026

Activity Incharge: Dr. R. Boopathi, AP/EEE

Venue: EEE Computer Lab(G04)

Description:

On April 2nd, 2026, a technical activity was conducted on the topic "Troubleshoot IoT." The main objective of this activity was to train students in identifying, analyzing, and rectifying faults in IoT based systems.

During the session, students:

- ✓ Checked sensor faults such as soil moisture, temperature, and humidity sensor errors.
- ✓ Diagnosed wiring and power supply issues in IoT circuits.
- ✓ Troubleshot Arduino / ESP8266 programming errors.
- ✓ Solved Wi-Fi and cloud platform connectivity issues.
- ✓ Tested data transmission between devices and dashboards.
- ✓ Worked in teams to restore faulty IoT systems successfully.

Activity Photos:

Programme Name: Technical Activity on "Amrita Vishwa Vidyapeetham Virtual Lab(Anderson's Bridge)"

Target Group: II Year B.E. Electrical and Electronics Engineering (EEE) Students

Date: 21-04-2026

Activity Incharge: Mr. M. Vasanthprakash, AP/EEE

Venue: EEE Computer Lab(G04)

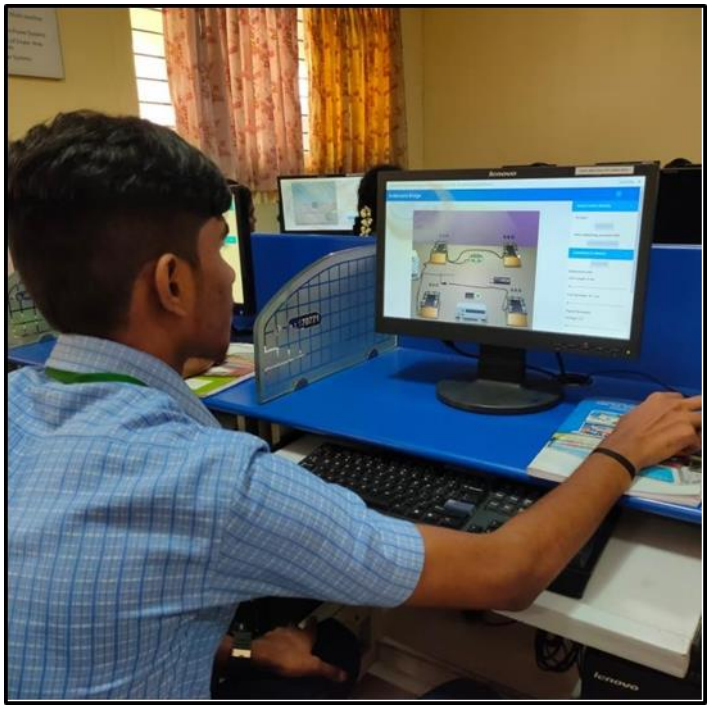
Description:

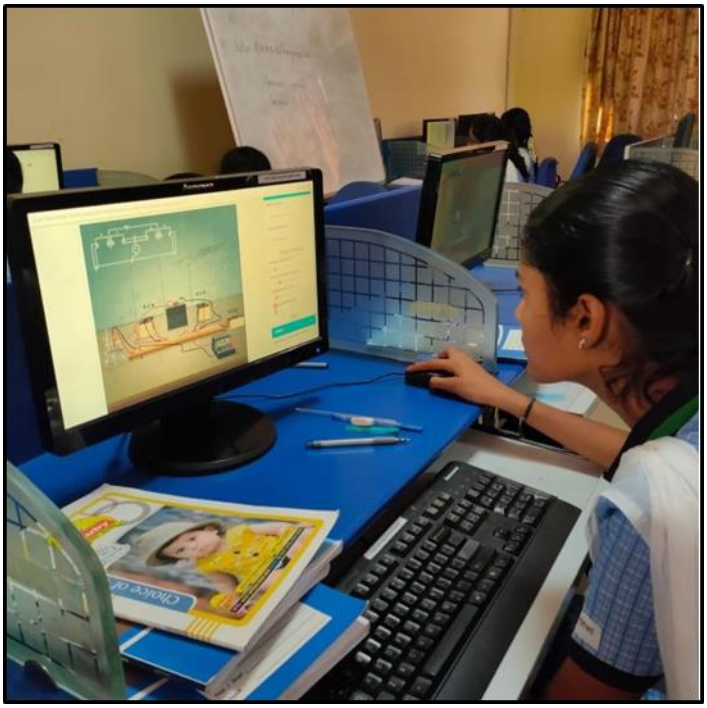
On April 21st, 2026, an interactive virtual lab session was conducted for 2nd year EEE students using the Amrita Virtual Lab platform. The primary objective of this activity was to provide hands-on exposure to the "Anderson's Bridge" experiment in a simulated environment. This activity helped students understand to determine the self-inductance of the coil (L) and calculate the value of inductive reactance (X_L) of the coil at a particular frequency. The "Anderson's Bridge" experiment provided a clear visualization of how capacitance varies under bridge balance conditions. Students actively engaged with the simulation, demonstrating curiosity and critical thinking while performing the experiment. The virtual interface was user-friendly, allowing students to explore various parameters and understand the underlying concepts at their own pace.

Through the virtual simulation, students were able to:

- Observe and record how capacitance varies with different connections of standard capacitance.
- Analyze the behavior of conductors and semiconductors under the capacitive reactance X_C.
- Calculate the unknown capacitance using simulated readings and graphs.

Activity Photos:





Programme Name: Batch 15 – Farewell Function

Organizing Department: Electrical and Electronics Engineering

Date: 30-04-2026

Venue: G Block Seminar Hall

Description:

The Department of Electrical and Electronics Engineering of Chettinad College of Engineering and Technology organized a heartfelt Farewell Function for the outgoing final year students (Batch 15) on 30th April 2026 at the G Block Seminar Hall. The event was gracefully organized by the III Year EEE students along with the department faculty members to honor the seniors and celebrate their memorable academic journey. Function commenced with a warm welcome address, followed by inspiring speeches from faculty members who shared their valuable thoughts, encouragement, and best wishes for the graduating students.

The juniors expressed their gratitude and admiration towards their seniors through heartfelt speeches, cultural performances, fun activities, and memorable presentations that reflected the strong bond shared within the department. The farewell event created a joyful and emotional atmosphere as students recollected their experiences, achievements, friendships, and memorable moments spent in the department. Various entertaining games and interactive sessions added enthusiasm and excitement to the celebration.

The final-year students shared their experiences and conveyed their sincere thanks to the faculty members and juniors for organizing the event. The program concluded with the exchange of wishes, group photographs, and a vote of thanks, making the farewell function a memorable occasion for everyone present. The Department of Electrical and Electronics Engineering Wishes Batch 15 great success and a bright future in all their endeavors.

Programme Name: Industrial Training (Exclusively for ChettinadTech Third-year students)

Organizing Department: Electrical and Electronics Engineering

Duration: 15 Days

Date: 10-06-2026 to 24-06-2026

Venue: Chettinad Cement Corporation Ltd, Puliyur C.F, Karur

Description:

The Department of Electrical and Electronics Engineering successfully organized a 15-day Industrial Training Programme for the third-year students of Chettinad College of Engineering and Technology from 10th June 2026 to 24th June 2026. The training was conducted at Chettinad Cement Corporation Ltd., Puliyur C.F., Karur, providing students with an excellent opportunity to bridge the gap between academic learning and industrial practice. The primary objective of the programme was to expose students to real-world industrial operations, electrical systems, maintenance practices, and automation technologies employed in one of the leading cement manufacturing industries.

Throughout the training period, students observed various stages of the cement production process and gained practical insights into the functioning of electrical equipment, power distribution systems, motor control centers, substations, transformers, switchgear, and industrial safety practices. Industry experts and experienced engineers from Chettinad Cement Corporation conducted interactive sessions on preventive and predictive maintenance, troubleshooting techniques, electrical protection systems, energy management, and process automation. Students also learned about the role of instrumentation and control systems in ensuring efficient plant operations. Guided visits to different production units enabled them to understand how theoretical concepts studied in the classroom are applied in large-scale industrial environments.

The programme also emphasized workplace discipline, safety regulations, teamwork, and professional ethics, helping students develop the skills and confidence required for their future careers. Hands-on exposure to industrial equipment and discussions with practicing engineers enhanced the students' technical knowledge and provided valuable insights into current industry practices and technological advancements. The Department of Electrical and Electronics Engineering expresses its sincere gratitude to the management and technical team of Chettinad Cement Corporation Ltd., Puliyur C.F., Karur, for extending their support and providing an enriching learning experience. The industrial training programme proved to be highly beneficial, equipping students with practical knowledge, industry exposure, and professional competencies that will contribute significantly to their academic growth and career development.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Programme Name: Value-Added Course on “Embedded Systems Programming using Arduino IDE

Organizing Department: Electrical and Electronics Engineering

Duration: 3 Day

Date: 29-06-2026 to 01-07-2026

Venue: EEE Workshop

Description:

The Department of Electrical and Electronics Engineering successfully organized a three-day Value-Added Course on "Embedded Systems Programming using Arduino IDE" exclusively for the second-year EEE students from 29th June 2026 to 1st July 2026 at the EEE Workshop. The programme was designed to equip students with practical knowledge of embedded systems and hands-on experience in programming microcontroller-based applications using the Arduino platform.

The course aimed to strengthen students' understanding of embedded system fundamentals while introducing them to the concepts of hardware interfacing, sensor integration, and real-time programming. Through a series of interactive sessions and practical demonstrations, participants learned the architecture of Arduino boards, the Arduino IDE environment, digital and analog input/output operations, serial communication, and the development of embedded applications.

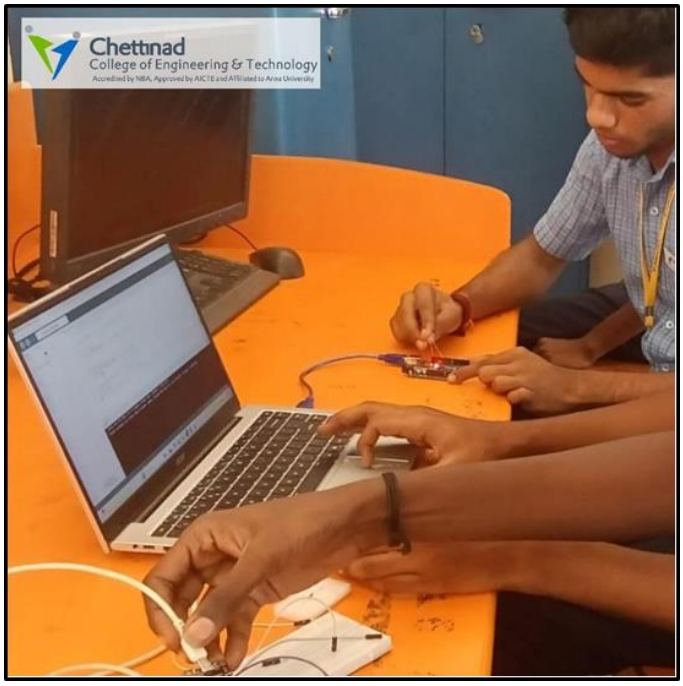
The training adopted a hands-on learning approach, enabling students to write, compile, and upload programs to Arduino development boards. Students carried out various experiments involving LEDs, push buttons, sensors, buzzers, and other peripheral devices. They also explored concepts such as PWM control, analog signal processing, and interfacing techniques that are widely used in automation, robotics, and Internet of Things (IoT) applications. The resource persons guided students in developing simple real-time embedded projects, encouraging logical thinking, problem-solving, and debugging skills.

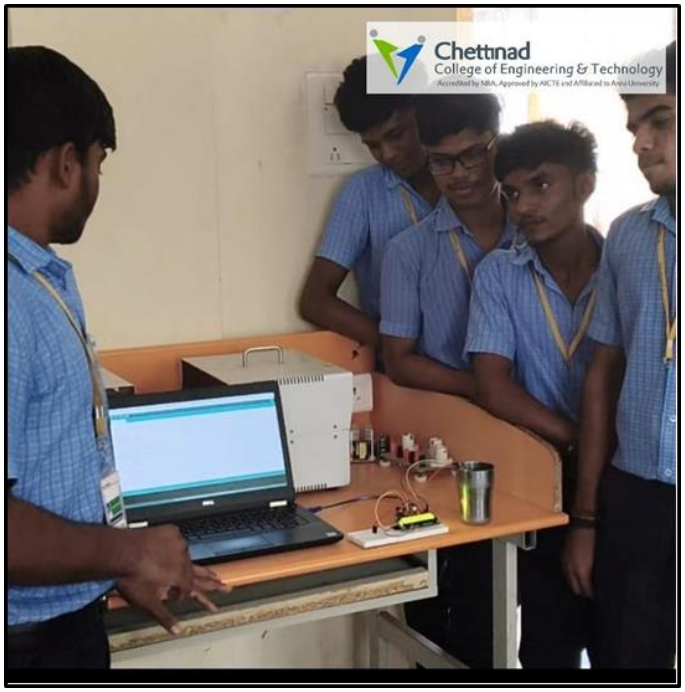
The practical sessions enhanced the participants' confidence in designing and implementing embedded solutions while providing exposure to industry-relevant tools and programming practices. The programme also highlighted the growing applications of embedded systems in smart homes, industrial automation, healthcare, automotive electronics, and consumer devices.

The Value-Added Course proved to be an enriching learning experience for the participants, bridging the gap between theoretical concepts and practical implementation. By the end of the programme, students had acquired the fundamental skills required to develop basic embedded system applications and gained a strong foundation for pursuing advanced technologies such as IoT, robotics, and intelligent control systems. The Department of Electrical and Electronics

Engineering remains committed to organizing such skill-oriented programmes that enhance students' technical competencies and improve their industry readiness.

Session Photos:

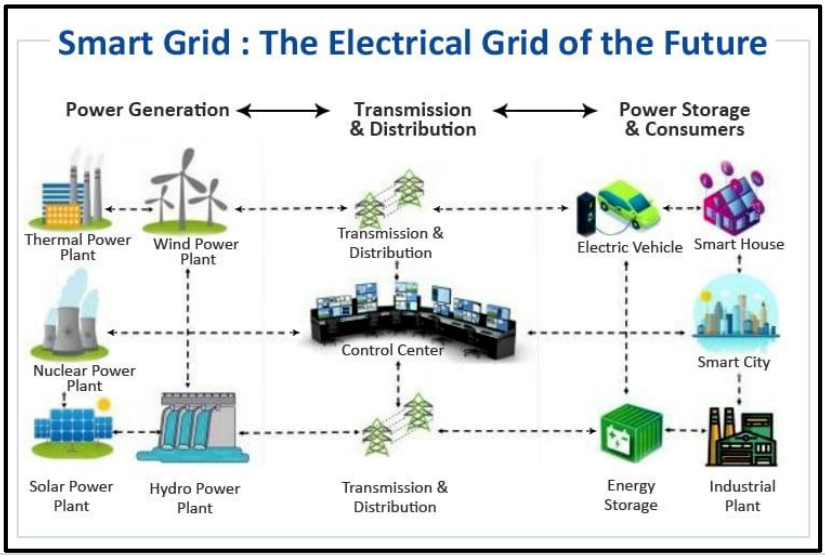




The Future of Smart Grids: Building an Intelligent Power Network

Electricity has become one of the most essential resources for modern life. From homes and hospitals to industries and transportation, every sector depends on a reliable supply of electrical power. However, the conventional power grid was designed decades ago and faces several challenges such as increasing electricity demand, integration of renewable energy sources, aging infrastructure, and power quality issues. To overcome these challenges, the concept of the Smart Grid has emerged as one of the most significant advancements in electrical engineering. A smart grid is an advanced electricity network that uses digital communication, automation, sensors, and intelligent control systems to monitor and manage the generation, transmission, distribution, and consumption of electricity. Unlike the traditional power grid, which allows only one-way communication from the power station to consumers, a smart grid enables two-way communication between utility providers and consumers. This makes the electrical network more efficient, reliable, secure, and environmentally friendly.

One of the major advantages of smart grids is their ability to integrate renewable energy sources such as solar and wind power. Since renewable energy generation depends on weather conditions, smart grids continuously monitor power generation and automatically balance supply and demand. This ensures a stable and uninterrupted power supply while reducing dependence on fossil fuels. Smart meters are another important component of the smart grid. These digital meters provide real-time information about electricity consumption, allowing consumers to monitor and manage their energy usage effectively. Utility companies can also detect power outages quickly, reduce electricity theft, and improve billing accuracy.



Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) are transforming smart grid technology. Intelligent sensors installed across the power network continuously collect operational data, enabling predictive maintenance and early fault detection. This minimizes equipment failures, reduces maintenance costs, and improves the reliability of the electrical system. Electric vehicles (EVs) are becoming an integral part of future smart grids. Through Vehicle-to-Grid (V2G) technology, EV batteries can not only consume electricity but also supply power back to the grid during peak demand. This innovative concept improves grid stability while promoting sustainable transportation.

Although smart grids offer numerous advantages, challenges such as cybersecurity, high implementation costs, data privacy, and infrastructure modernization must be addressed. Continuous research and technological innovation are making smart grids more secure, affordable, and efficient. In India, initiatives such as smart city projects, renewable energy expansion, and digital transformation are accelerating the adoption of smart grid technologies. These developments will play a vital role in achieving energy security, reducing carbon emissions, and ensuring sustainable economic growth.

In conclusion, smart grids represent the future of electrical power systems. By combining advanced communication technologies, intelligent automation, renewable energy integration, and data-driven decision-making, they are transforming the way electricity is generated, distributed, and consumed. For aspiring electrical engineers, understanding smart grid technology is essential to building a cleaner, smarter, and more sustainable energy future.

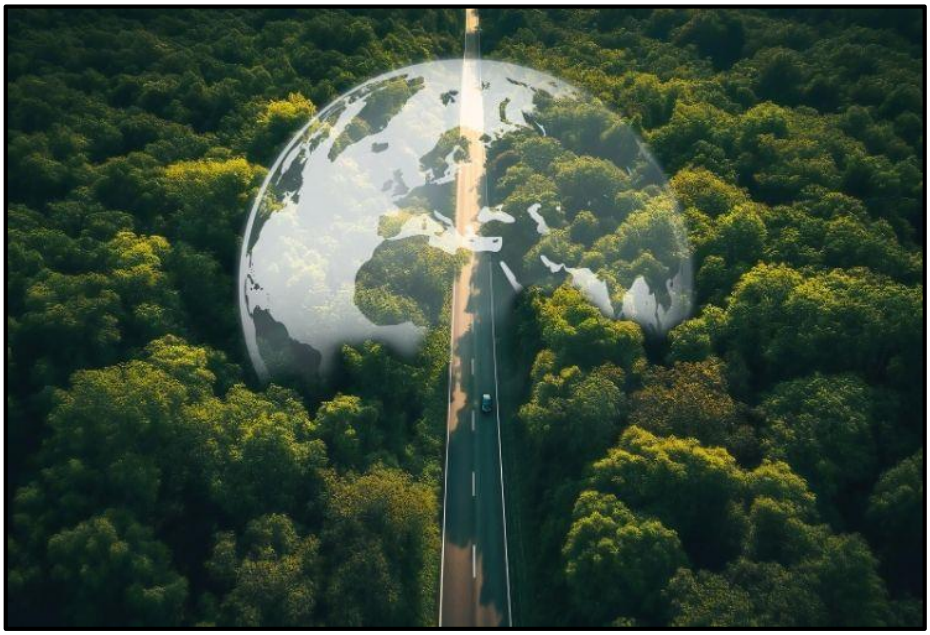
Mr. C. Vignesh
Final-Year EEE
Chettinad College of Engineering and Technology

Electric Vehicles: Driving Towards a Sustainable Future

Electric Vehicles (EVs) are transforming the global transportation sector by offering an environmentally friendly alternative to conventional petrol and diesel vehicles. As concerns about climate change, air pollution, and fossil fuel depletion continue to grow, EVs have emerged as one of the most promising solutions for sustainable mobility. Governments, industries, and researchers across the world are investing heavily in EV technology to build a cleaner and greener future. An electric vehicle is powered by one or more electric motors that receive energy from rechargeable batteries instead of internal combustion engines. Lithium-ion batteries are the most commonly used energy storage systems due to their high energy density, long life, and fast charging capabilities. Modern EVs are equipped with Battery Management Systems (BMS) that monitor battery health, temperature, and charging conditions to ensure safe and efficient operation.

One of the greatest advantages of EVs is their contribution to environmental protection. Since electric vehicles produce zero tailpipe emissions, they significantly reduce air pollution and greenhouse gas emissions in urban areas. Moreover, when powered by renewable energy sources such as solar and wind, EVs contribute to a nearly carbon-neutral transportation system. Another major benefit is energy efficiency. Electric motors convert nearly 90% of electrical energy into mechanical energy, whereas conventional engines convert only about 30–40% of fuel energy into useful work. This results in lower operating costs, reduced maintenance requirements, and improved performance.

India has taken significant initiatives to promote electric mobility through schemes like FAME (Faster Adoption and Manufacturing of Electric Vehicles), battery manufacturing incentives, and the expansion of charging infrastructure. Several automobile manufacturers are introducing affordable EV models, making sustainable transportation more accessible to the public. Despite these advantages, EV adoption still faces challenges such as limited charging infrastructure, battery replacement costs, charging time, and the availability of raw materials for battery production. Researchers are addressing these issues by developing solid-state batteries, ultra-fast charging technologies, wireless charging systems, and battery recycling methods.



Vehicle-to-Grid (V2G) technology represents another exciting advancement. Through V2G, electric vehicles can supply stored energy back to the electrical grid during peak demand, thereby supporting grid stability and renewable energy integration. Electrical engineers play a crucial role in the design of electric motors, power electronics, battery management systems, charging stations, and intelligent energy management systems. As EV technology continues to evolve, new opportunities will emerge in manufacturing, research, software development, and renewable energy integration.

The future of transportation belongs to electric mobility. With continuous technological innovation and supportive government policies, electric vehicles are expected to become the primary mode of transportation, contributing to cleaner cities, improved public health, and sustainable economic development.

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Artificial Intelligence in Electrical Engineering

Artificial Intelligence (AI) is revolutionizing the field of Electrical and Electronics Engineering by enabling machines to learn, analyze, and make intelligent decisions. AI combines machine learning, neural networks, computer vision, and data analytics to solve complex engineering problems with greater accuracy and efficiency. One of the major applications of AI is in power system operation. Modern power grids generate enormous amounts of operational data from sensors, smart meters, substations, and renewable energy plants. AI algorithms analyze this data to forecast electricity demand, predict equipment failures, detect faults, and optimize energy distribution.

Predictive maintenance has become increasingly popular in electrical industries. Instead of performing maintenance at fixed intervals, AI continuously monitors equipment conditions and predicts failures before they occur. This reduces downtime, maintenance costs, and unexpected breakdowns. Renewable energy systems also benefit from AI. Since solar and wind power depend on weather conditions, AI models forecast energy generation based on historical weather data. These predictions help utilities efficiently balance electricity supply and demand. Industrial automation is another area where AI plays a significant role. AI-powered robots perform repetitive tasks with high precision while ensuring safety and productivity.

AI is also transforming electric vehicles. Advanced Driver Assistance Systems (ADAS), autonomous driving technologies, intelligent battery management, and route optimization all rely on artificial intelligence. Despite its tremendous advantages, AI presents challenges including cybersecurity risks, ethical concerns, privacy issues, and the need for skilled professionals. Engineers must ensure that AI systems remain transparent, secure, and reliable. For electrical engineers, AI opens exciting opportunities in smart grids, robotics, renewable energy, industrial automation, embedded systems, and intelligent control. Artificial Intelligence is not replacing engineers—it is empowering them to design smarter, safer, and more efficient electrical systems that improve the quality of life worldwide.

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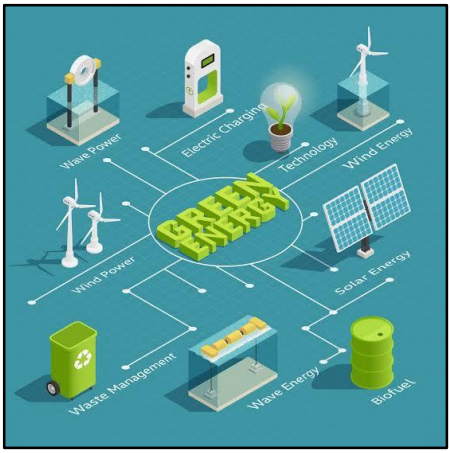
Renewable Energy: Powering a Greener Tomorrow

The growing demand for electricity and the environmental impact of fossil fuels have accelerated the global transition towards renewable energy. Renewable energy refers to energy generated from naturally replenishing sources such as sunlight, wind, water, biomass, and geothermal heat. These resources offer clean, sustainable, and environmentally friendly alternatives to conventional energy generation.

Solar energy has become one of the fastest-growing renewable technologies worldwide. Photovoltaic (PV) panels convert sunlight directly into electricity without producing harmful emissions. Advances in solar cell efficiency and decreasing installation costs have made solar power increasingly affordable for homes, industries, and utility-scale power plants. Wind energy is another major contributor to clean electricity generation. Modern wind turbines capture kinetic energy from moving air and convert it into electrical energy using advanced generators and power electronic converters. Offshore wind farms have further increased electricity generation capacity.

Hydropower remains one of the oldest and most reliable renewable energy sources. Water stored in dams flows through turbines, generating electricity efficiently with minimal greenhouse gas emissions. Small hydroelectric projects also provide sustainable electricity for rural communities. Biomass energy converts agricultural waste, organic materials, and biodegradable waste into electricity and biofuels. This not only generates renewable energy but also reduces waste disposal problems.



One of the biggest challenges in renewable energy is its intermittent nature. Since sunlight and wind availability depend on weather conditions, energy storage systems such as lithium-ion batteries, pumped hydro storage, and hydrogen energy storage are becoming increasingly important. Electrical engineers contribute significantly to

renewable energy through power electronics, inverter technology, smart grids, battery management systems, and energy management software. Their expertise enables efficient integration of renewable energy into existing electrical networks.

India has made remarkable progress in renewable energy through large-scale solar parks, wind farms, rooftop solar installations, and ambitious clean energy policies. These initiatives support the country's vision of energy security and environmental sustainability. The future of renewable energy lies in hybrid power systems, intelligent energy management, AI-based forecasting, and advanced storage technologies. Continued research and innovation will further reduce costs and improve efficiency.

Renewable energy is not only an environmental necessity but also an economic opportunity. It creates employment, promotes technological innovation, and ensures sustainable development for future generations. By embracing clean energy technologies, we can build a healthier planet and a brighter future.

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Internet of Things (IoT) in Smart Homes and Industries

The Internet of Things (IoT) is one of the most transformative technologies of the 21st century. It connects physical devices to the internet, allowing them to collect, exchange, and analyze data in real time. From smart homes and healthcare to agriculture and manufacturing, IoT is revolutionizing the way people live and work. For Electrical and Electronics Engineers, IoT offers exciting opportunities to develop intelligent, connected, and energy-efficient systems. A typical IoT system consists of sensors, microcontrollers, communication networks, cloud computing, and data analytics. Sensors gather information such as temperature, humidity, light intensity, pressure, and motion. This data is transmitted through Wi-Fi, Bluetooth, Zigbee, LoRa, or 5G networks to cloud platforms, where it is processed and analyzed. Users can monitor and control connected devices remotely using smartphones or computers.

One of the most visible applications of IoT is in smart homes. Smart lighting systems automatically adjust brightness based on occupancy or daylight. Intelligent thermostats optimize heating and cooling, reducing energy consumption. Smart security systems include surveillance cameras, motion detectors, biometric locks, and alarm systems that provide real-time alerts to homeowners. Voice-controlled assistants further enhance convenience by allowing users to control appliances through simple voice commands. In industries, Industrial IoT (IIoT) has become a cornerstone of Industry 4.0. Smart sensors continuously monitor machines and production lines, providing valuable insights into equipment performance. Predictive maintenance helps industries identify faults before equipment fails, reducing downtime and maintenance costs. Automated inventory management, quality inspection, and production scheduling improve operational efficiency and product quality.

IoT also plays a significant role in energy management. Smart meters provide real-time electricity consumption data, enabling consumers to optimize energy usage. Utility companies use IoT-enabled

smart grids to detect faults, balance electricity demand, and integrate renewable energy sources efficiently. In agriculture, IoT-based irrigation systems monitor soil moisture, weather conditions, and crop health, enabling farmers to use water and fertilizers more efficiently. Similarly, healthcare benefits from wearable devices that monitor heart rate, blood pressure, oxygen levels, and other vital signs, allowing doctors to provide timely medical care.

Despite its numerous benefits, IoT faces challenges such as cybersecurity risks, data privacy concerns, interoperability issues, and network reliability. Engineers must develop secure communication protocols and robust encryption methods to protect sensitive information. The future of IoT is closely linked with Artificial Intelligence (AI), Edge Computing, and 5G technology. These advancements will enable faster data processing, improved automation, and more intelligent decision-making.

For students of Electrical and Electronics Engineering, learning IoT opens doors to careers in automation, embedded systems, smart energy, healthcare technology, and industrial control systems. As billions of devices become interconnected, IoT will continue to shape a smarter, safer, and more sustainable world.

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The Rise of Robotics in Industrial Automation

Robotics has transformed modern industries by increasing productivity, improving quality, and enhancing workplace safety. Industrial robots perform repetitive, complex, and hazardous tasks with remarkable precision and speed. As manufacturing becomes increasingly automated, robotics has become an essential component of Industry 4.0. An industrial robot typically consists of mechanical arms, actuators, sensors, controllers, and intelligent software. Electrical engineers play a vital role in designing motor drives, control systems, sensors, and embedded electronics that enable robots to function accurately. One of the greatest advantages of robotics is precision. Robots perform tasks with consistent accuracy, reducing production errors and improving product quality. They operate continuously without fatigue, significantly increasing manufacturing output. Robots are widely used in automobile manufacturing for welding, painting, assembly, and material handling. Electronics industries utilize robotic systems for printed circuit board (PCB) assembly and precision component placement. In food processing, pharmaceutical manufacturing, and logistics, robots improve hygiene, speed, and operational efficiency.

Collaborative robots, known as Cobots, represent a new generation of automation. Unlike traditional industrial robots that work within safety cages, cobots are designed to safely interact with human workers. Computer vision enables robots to identify objects, inspect product quality, and navigate complex environments. AI-powered robots continuously improve their performance by learning from operational data. The future of robotics includes humanoid robots, autonomous factories, medical robots, agricultural automation, and space exploration. As technology advances, robotics will continue to revolutionize industries while creating safer and more efficient workplaces.

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Energy Storage Systems: The Key to Clean Energy

As the world moves towards renewable energy, efficient Energy Storage Systems (ESS) have become increasingly important. Solar and wind power are clean and sustainable, but their electricity generation depends on weather conditions. Energy storage allows excess electricity to be stored and supplied whenever needed, ensuring reliable and uninterrupted power. Energy storage systems improve grid stability, reduce power fluctuations, and support renewable energy integration. They are essential for electric vehicles, smart grids, residential solar systems, and industrial power backup.

Lithium-ion batteries are currently the most widely used storage technology because of their high energy density, long cycle life, and fast charging capabilities. The power electric vehicles, smartphones, laptops, and large-scale battery energy storage systems. Emerging battery technologies such as Solid-State Batteries, Sodium-Ion Batteries, and Flow Batteries promise improved safety, lower costs, and longer operating life. Researchers are also exploring hydrogen energy storage and super capacitors for specialized applications.

Battery Management Systems (BMS) play a critical role in ensuring safe battery operation. A BMS continuously monitors battery voltage, current, temperature, and state of charge, preventing overcharging, overheating, and deep discharge. Energy storage is vital for renewable energy plants. During sunny or windy periods, excess electricity is stored instead of being wasted. During cloudy weather or peak demand, stored energy is supplied back to the electrical grid.

Electric vehicles also rely heavily on advanced battery technologies. Continuous research aims to improve battery capacity, reduce charging time, and extend battery lifespan. Fast-charging stations and battery swapping technologies are making EV adoption more convenient. Large-scale energy storage supports national power grids by balancing electricity supply and demand. Pumped hydro storage, compressed air energy storage, flywheels, and thermal storage complement battery technologies for grid-scale applications.

Although battery costs continue to decrease, recycling and sustainable disposal remain important challenges. Engineers are developing environmentally friendly recycling methods to recover valuable materials such as lithium, nickel, and cobalt. Electrical engineers contribute to battery design, power electronics, charging systems, energy management software, and renewable energy integration. Their innovations are enabling cleaner, more reliable, and sustainable power systems. Energy storage will become one of the most critical technologies for achieving global carbon neutrality. By combining renewable energy with efficient storage solutions, future power systems will become cleaner, smarter, and more resilient.

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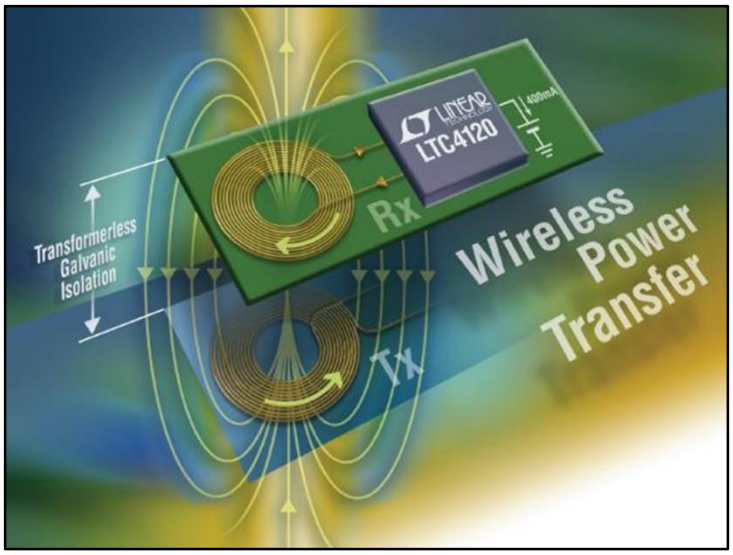
Wireless Power Transmission: A Step Towards Cable-Free Energy

Imagine charging your smartphone, laptop, or even your electric vehicle without plugging in a cable. This is the promise of Wireless Power Transmission (WPT)—a technology that transfers electrical energy from a power source to a device without physical wires. Once considered science fiction, WPT is now becoming a practical reality and is expected to play a major role in future electrical systems. Wireless power transmission is based on electromagnetic principles. The most common technique is electromagnetic induction, where alternating current flowing through a transmitter coil creates a magnetic field. A nearby receiver coil captures this magnetic field and converts it back into electrical energy to power or charge a device. This principle is already used in wireless charging pads for smartphones, smartwatches, and earbuds.

For longer distances, magnetic resonance coupling provides greater flexibility. Both transmitter and receiver operate at the same resonant frequency, enabling efficient energy transfer even when the coils are not perfectly aligned. Researchers are also exploring microwave and laser-based power transmission for specialized applications such as satellites, drones, and remote sensors. Wireless charging is becoming increasingly popular in the automotive industry. Electric vehicle manufacturers are developing charging systems that allow EVs to recharge simply by parking over a charging pad. Future smart roads may even enable vehicles to charge while driving, significantly reducing charging time and extending driving range.

Healthcare is another field benefiting from WPT. Medical implants such as pacemakers and insulin pumps can be powered wirelessly, reducing the need for surgeries to replace batteries. Industrial robots, automated guided vehicles, and underwater monitoring systems also utilize wireless power to improve operational flexibility. The advantages of wireless power transmission include greater convenience, reduced cable clutter, improved safety, lower maintenance, and increased reliability. It is particularly useful in environments where wired connections are difficult or hazardous.



However, several challenges remain. Energy transfer efficiency decreases with distance, system costs are relatively high, and electromagnetic interference must be carefully managed. Ongoing research focuses on improving efficiency, increasing transmission range, and establishing international standards. Electrical engineers play a central role in designing high-frequency converters, resonant circuits, control systems, and power electronics required for wireless energy transfer. Advances in semiconductor devices, materials, and communication technologies continue to accelerate the development of WPT systems.

Wireless power transmission has the potential to transform the way electricity is delivered in homes, industries, healthcare, and transportation. As research progresses, cable-free energy systems may become an integral part of everyday life, making electrical devices more convenient, efficient, and user-friendly.

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Green Hydrogen: The Fuel of the Future

The global search for clean and sustainable energy has brought Green Hydrogen into the spotlight. Hydrogen is the most abundant element in the universe and has enormous potential as a clean fuel because it produces only water when used. Green hydrogen, produced using renewable energy, is expected to play a crucial role in achieving carbon neutrality and reducing dependence on fossil fuels. Hydrogen can be produced through several methods. Green hydrogen is generated by electrolysis, a process in which electricity splits water into hydrogen and oxygen. One of the major advantages of hydrogen is its high energy content. It stores more energy per unit mass than conventional fuels and can be used in fuel cells to generate electricity efficiently. Fuel cells combine hydrogen with oxygen from the air to produce electricity, heat, and water without harmful emissions. Green hydrogen has applications in transportation, power generation, industrial manufacturing, and energy storage. Hydrogen-powered buses, trucks, trains, and ships are already being tested in several countries. Industries such as steel, cement, and fertilizers can replace fossil fuels with hydrogen to significantly reduce carbon emissions. During periods of excess solar or wind generation, surplus electricity can be used to produce hydrogen. The stored hydrogen can later be converted back into electricity during periods of high demand or low renewable generation.

India has launched the National Green Hydrogen Mission, aiming to become a global hub for hydrogen production and exports. Despite its potential, green hydrogen faces challenges including high production costs, storage difficulties, transportation infrastructure, and the need for improved electrolyzer technology. Electrical and Electronics Engineers contribute to hydrogen technology through renewable energy integration, power electronics, control systems, electrolyzer design, and fuel cell development. Their expertise is essential for building a reliable hydrogen economy.

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Cybersecurity in Smart Power Systems

As electrical power systems become more digital and interconnected, cybersecurity has become a critical concern. Modern smart grids rely on intelligent sensors, communication networks, cloud computing, and automation systems to monitor and control electricity generation and distribution. While these technologies improve efficiency and reliability, they also introduce new cyber threats that can disrupt power system operations. Today's smart grids use advanced technologies such as SCADA (Supervisory Control and Data Acquisition), IoT devices, smart meters, and remote monitoring systems. These interconnected systems generate valuable operational data but also create potential entry points for cyberattacks. Cyber threats may include malware, ransomware, phishing attacks, denial-of-service attacks, unauthorized access, and data theft. A successful attack on a power grid could interrupt electricity supply, damage equipment, compromise consumer data, and cause significant economic losses. One of the most important cybersecurity measures is strong authentication. Multi-factor authentication, secure passwords, and role-based access control help prevent unauthorized access to critical infrastructure. Encryption ensures that communication between devices remains confidential and protected from interception.

Firewalls, intrusion detection systems, antivirus software, and continuous network monitoring further strengthen system security. Artificial Intelligence is increasingly being used to detect abnormal network behavior and identify cyber threats before they cause damage. Regular software updates, employee awareness programs, and cybersecurity training are equally important. Human error remains one of the leading causes of cyber incidents, making education and best practices essential components of cybersecurity. The future smart grid will integrate Artificial Intelligence, blockchain, cloud computing, and quantum-safe encryption to create highly secure energy networks.

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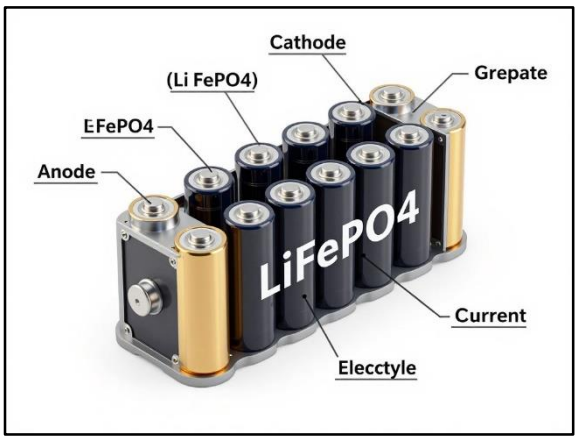
The Rise of $LiFePO_4$ Batteries in Modern Inverter Technology

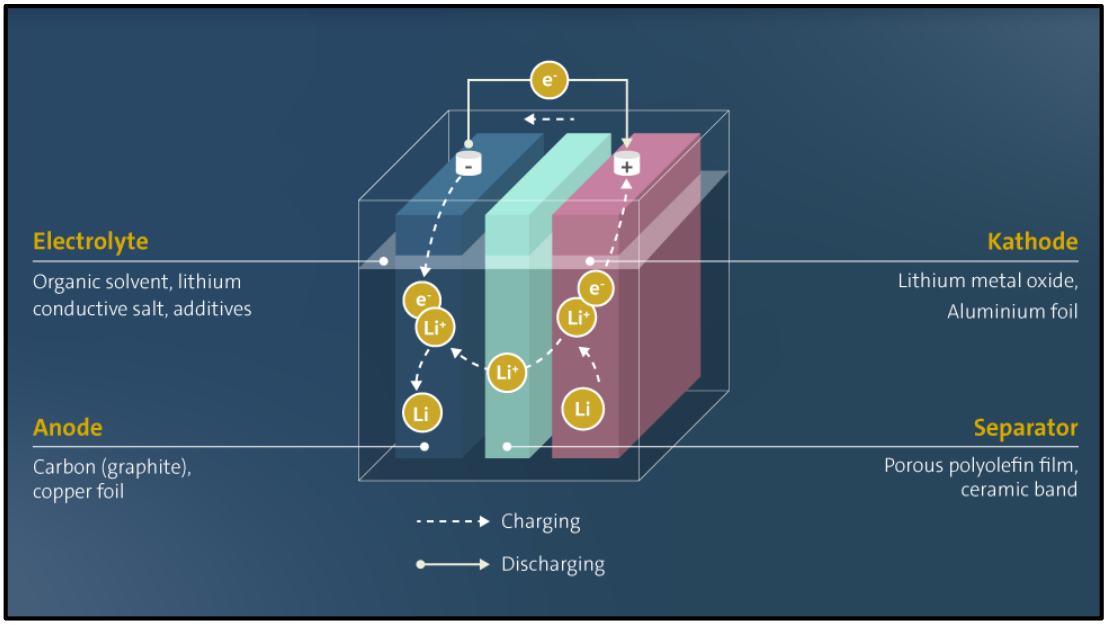
Introduction



Power interruptions and increasing electricity demand have made inverter systems an indispensable part of modern electrical infrastructure. Traditionally, inverter systems relied on lead-acid batteries because of their affordability and widespread availability. However, lead-acid batteries suffer from several limitations, including shorter lifespan, high maintenance requirements, lower efficiency, and environmental concerns. The rapid advancement of lithium battery technology has revolutionized energy storage. Among various lithium chemistries, Lithium Iron Phosphate ($LiFePO_4$) has gained remarkable popularity due to its exceptional safety characteristics, thermal stability, long cycle life, and excellent charging performance. Today, $LiFePO_4$ batteries are becoming the preferred energy storage solution for smart homes, solar power plants, electric vehicles, telecommunications, hospitals, data centers, and industrial backup systems.

Understanding $LiFePO_4$ Battery Technology

$LiFePO_4$ is a lithium-ion battery chemistry that uses Lithium Iron Phosphate ($LiFePO_4$) as the cathode material and graphite as the anode. Unlike conventional lithium-ion batteries that use cobalt-based cathodes, $LiFePO_4$ offers superior thermal stability and significantly reduces the risk of overheating and thermal runaway.



A typical $LiFePO_4$ battery consists of:

- Positive electrode ($LiFePO_4$)
- Negative electrode (Graphite)
- Electrolyte
- Separator
- Battery Management System (BMS)

The Battery Management System continuously monitors voltage, current, temperature, state of charge, and state of health, ensuring safe and efficient battery operation.

Why $LiFePO_4$ Batteries are Ideal for Modern Inverters?

1. Exceptional Cycle Life

One of the biggest advantages of $LiFePO_4$ batteries is their extremely long operational life. While conventional lead-acid batteries typically last between 500 and 1,000 charge-discharge cycles, $LiFePO_4$ batteries can deliver 4,000–8,000 cycles, depending on operating conditions. This significantly lowers replacement costs over the lifetime of an inverter system.

2. High Energy Efficiency

$LiFePO_4$ batteries provide charging and discharging efficiencies of 95–98%, compared to approximately 70–85% for lead-acid batteries. Higher efficiency translates into reduced energy losses, lower electricity costs, and better utilization of renewable energy.

3. Fast Charging Capability

Modern inverter systems often require rapid battery charging after power restoration. $LiFePO_4$ batteries support high charging currents, allowing batteries to recharge much faster than conventional lead-acid batteries while maintaining excellent performance and battery health.

4. Enhanced Safety

Safety is one of the strongest advantages of $LiFePO_4$ chemistry. These batteries exhibit outstanding thermal stability and are highly resistant to overheating, fire, and explosion. This makes them particularly suitable for residential buildings, educational institutions, hospitals, and commercial facilities.

5. Maintenance-Free Operation

Unlike flooded lead-acid batteries, $LiFePO_4$ batteries require virtually no maintenance. There is no need for periodic water refilling, electrolyte monitoring, or terminal cleaning. This feature greatly reduces maintenance costs and operational downtime.

6. Lightweight and Compact Design

$LiFePO_4$ batteries possess a much higher energy density than lead-acid batteries, enabling compact and lightweight inverter designs. This simplifies installation and reduces space requirements.

Parameter	Lead-Acid Battery	LiFePO4 Battery
Cycle Life	300 - 500 cycles	2000 - 5000+ cycles
Depth of Discharge (DoD)	50%	80 - 100%
Weight	Heavy	Lightweight (~1/3rd)
Charging Time	Slow	Fast
Maintenance	Required	Maintenance-free
Efficiency	80 - 85%	95 - 98%
Safety	Moderate	High (thermally stable)

Applications in Modern Inverter Systems

$LiFePO_4$ batteries are rapidly replacing conventional batteries across various applications:

- Residential backup power systems
- Rooftop solar inverter installations
- Commercial UPS systems
- Industrial uninterrupted power supplies
- Telecom towers
- Hospital emergency power systems
- Data centers
- Electric vehicle charging infrastructure
- Smart microgrids

Their compatibility with hybrid solar inverters has accelerated the adoption of renewable energy systems worldwide.

Integration with Renewable Energy

The increasing deployment of solar photovoltaic systems has created a growing demand for efficient battery storage. $LiFePO_4$ batteries perfectly complement renewable energy because they can efficiently store excess solar energy generated during the day and supply electricity during nighttime or power outages. When integrated with intelligent Energy Management Systems (EMS), $LiFePO_4$ batteries optimize energy consumption, reduce grid dependency, and improve overall system reliability. They also support peak-load management and demand response strategies in smart grids.

Challenges

Despite their numerous advantages, several challenges remain:

- Higher initial investment compared to lead-acid batteries
- Requirement of sophisticated Battery Management Systems
- Dependence on lithium supply chains
- Need for advanced recycling infrastructure
- Performance degradation under extreme environmental conditions

However, continuous research and large-scale manufacturing are steadily reducing battery costs while improving overall performance.

Future Trends

The future of inverter technology is closely linked with intelligent battery systems. Emerging developments include:

- AI-based Battery Management Systems
- Cloud-connected smart energy monitoring
- Solid-state lithium batteries
- Vehicle-to-Home (V2H) energy integration
- Smart microgrids with distributed battery storage
- Second-life battery applications
- Advanced battery recycling technologies

These innovations will further enhance the efficiency, intelligence, and sustainability of future inverter systems.

Conclusion

$LiFePO_4$ battery technology has become a transformative force in modern inverter systems by offering outstanding safety, exceptional cycle life, superior efficiency, and minimal maintenance. As renewable energy adoption continues to grow, these batteries will play an increasingly important role in ensuring reliable and sustainable energy storage. For Electrical and Electronics Engineers, understanding $LiFePO_4$ technology is essential for designing next-generation inverter systems capable of supporting smart homes, renewable energy integration, electric mobility, and intelligent power networks. The rise of $LiFePO_4$ batteries represents not merely an advancement in battery chemistry, but a significant milestone in the global journey toward clean, efficient, and sustainable energy solutions.

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Smart PV Panel Health Monitoring: Ensuring Reliable and Efficient Solar Energy Generation

Introduction

Solar photovoltaic (PV) systems are expanding rapidly as industries, institutions, homes, and utilities move toward clean and sustainable electricity. Although PV modules have no moving parts, their energy output can gradually decline because of dust accumulation, partial shading, hotspots, cell cracks, connector failures, moisture ingress, ageing, and electrical faults. A small defect in one module can reduce the performance of an entire string and may remain unnoticed when conventional inspection is performed only at long intervals. PV panel health monitoring continuously observes electrical and environmental behaviour, identifies abnormal operating conditions, estimates degradation, and supports maintenance before energy loss becomes severe. Modern systems combine sensors, thermal inspection, IoT communication, cloud dashboards, and artificial intelligence to transform a conventional solar plant into an intelligent, condition-aware energy asset.

Understanding PV Panel Health

The health of a PV panel describes its ability to convert available solar irradiance into electrical power compared with its expected performance under the same operating conditions. A healthy module exhibits predictable voltage, current, power, temperature, and efficiency characteristics. Deviations can indicate soiling, shading, mismatch, electrical disconnection, bypass-diode problems, hotspots, or long-term degradation.

Key Parameters Used for PV Health Monitoring

Parameter	Purpose
PV Voltage & Current	Detect abnormal electrical behaviour and mismatch
Output Power	Compare actual and expected generation
Solar Irradiance	Measure available solar energy
Module Temperature	Identify overheating and thermal loss
Thermal Pattern	Locate hotspots and damaged cells
Health Index	Summarize overall operating condition

Smart Sensing and IoT Monitoring

Voltage and current sensors measure PV electrical output, while irradiance and temperature sensors capture environmental conditions. A microcontroller or data logger acquires the measurements and transfers them through Wi-Fi, cellular, LoRa, Ethernet, or another suitable link. Operators can then view generation, historical trends, alarms, and health indicators remotely.

AI-Based Fault Detection

Machine-learning models learn relationships among irradiance, temperature, voltage, current, and expected power. Incoming measurements that deviate from learned healthy behaviour can be flagged as anomalies and classified according to probable fault type. This enables condition-based maintenance instead of relying only on fixed inspection schedules.

Thermal Imaging for Hotspot Detection

Infrared thermography reveals localized temperature rise that may be difficult to identify through electrical measurements alone. Hotspots can be associated with cracked cells, defective interconnections, shading, bypass-diode faults, or severe mismatch. Repeated thermal inspection helps locate modules requiring detailed examination and supports early intervention before damage progresses.

Environmental Monitoring

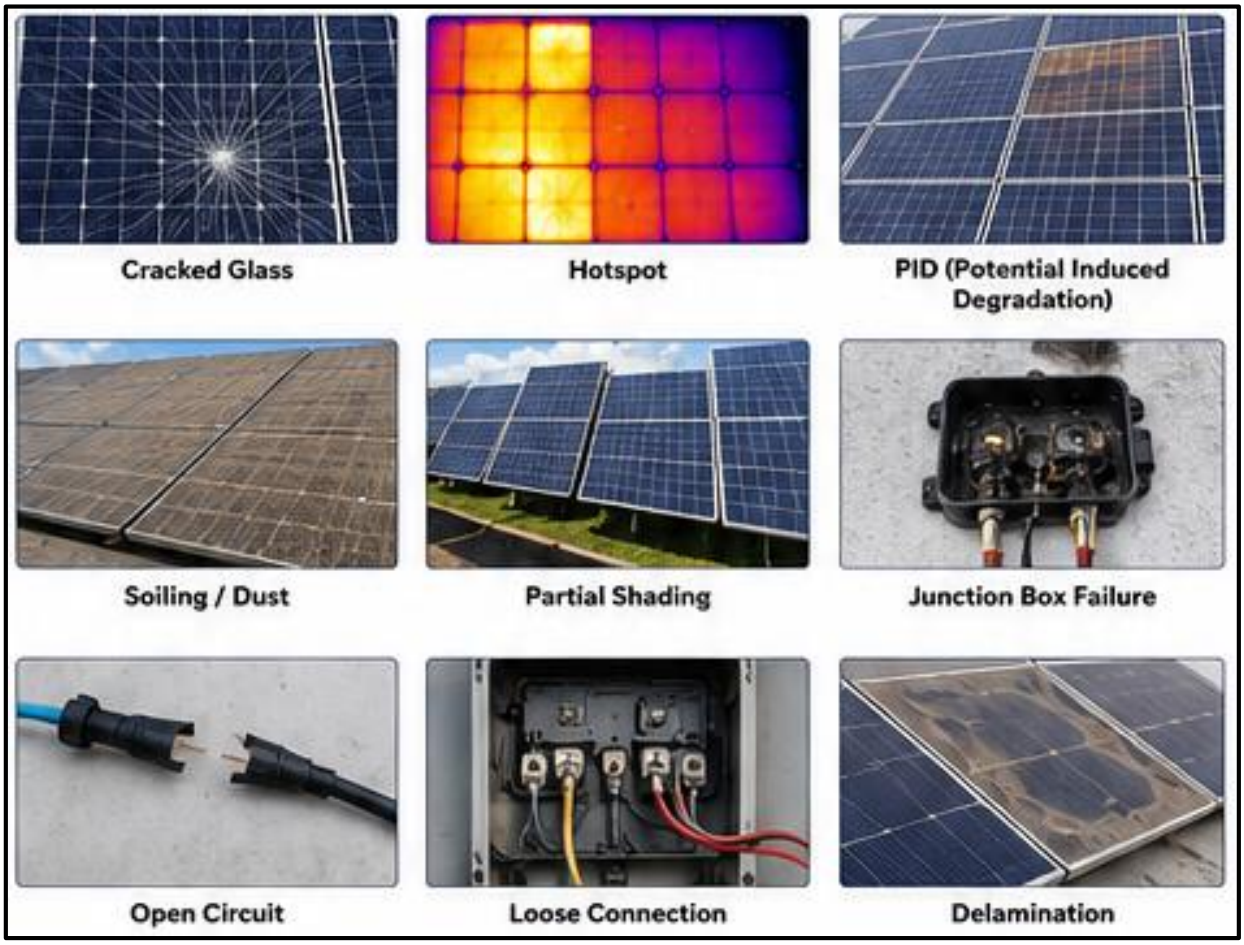
PV output is strongly influenced by irradiance, module temperature, ambient conditions, humidity, wind, and rainfall. Environmental sensing allows the monitoring algorithm to distinguish genuine faults from normal weather-related variation. This normalization is essential for reliable health assessment and performance benchmarking.

Benefits of Continuous Health Monitoring

Continuous monitoring helps identify underperforming modules early, improves energy yield, reduces unnecessary manual inspection, and supports safer plant operation. Historical data also assist warranty assessment, degradation tracking, performance benchmarking, and replacement planning.

Common PV Panel Problems Detected

Typical problems include cracked glass or cells, hotspots, potential-induced degradation, dust and soiling, partial shading, junction-box failure, open-circuit conditions, loose connections, and delamination. Combining electrical measurements with visual and thermal evidence improves diagnostic confidence.



Applications

PV health-monitoring technology can be applied to rooftop installations, educational campuses, industrial captive plants, utility-scale solar farms, solar-powered irrigation systems, microgrids, EV charging stations, telecom sites, and remote standalone systems. The same concept can scale from a small rooftop array to thousands of modules by combining local sensing with centralized analytics.

Challenges

Practical implementation must address sensor calibration, changing weather, reliable communication, differentiation of temporary shading from true faults, module-level monitoring cost, availability of representative AI training data, cybersecurity, and integration with existing inverter or SCADA platforms. Robust diagnosis should therefore use persistent patterns and multiple indicators rather than a single abnormal measurement.

Future Trends

The future of PV maintenance is moving from periodic inspection toward autonomous and predictive monitoring. Emerging developments include AI-based degradation prediction, digital twins, drone-based thermal inspection, edge AI, automated cleaning triggered by measured soiling loss, module-level IoT sensing, cloud-connected fleet monitoring, and integration of weather forecasting with predictive health analytics.

Conclusion

Smart PV panel health monitoring is becoming essential for reliable solar energy systems. By continuously observing voltage, current, power, irradiance, temperature, and other condition indicators, monitoring platforms can identify deterioration before it becomes a major energy or maintenance problem. The integration of IoT, thermal inspection, cloud computing, and artificial intelligence further enables automated fault detection and predictive maintenance. For Electrical and Electronics Engineers, PV health monitoring connects renewable-energy engineering, sensors, embedded systems, communication, data analytics, and AI. As solar installations expand, intelligent condition monitoring will play a major role in maximizing energy yield, improving safety, reducing maintenance cost, and extending the useful operating life of photovoltaic assets.

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Industry 4.0-Enabled Intelligent Hybrid Solar Dryer: Revolutionizing Sustainable Food Processing

Abstract

Food preservation plays a vital role in ensuring food security, reducing post-harvest losses, and enhancing agricultural sustainability. Traditional open-sun drying methods are inexpensive but suffer from contamination, weather dependency, inconsistent drying, and quality degradation. The integration of Industry 4.0 technologies with hybrid solar drying systems has led to the development of intelligent solar dryers capable of autonomous operation, real-time monitoring, predictive control, and energy optimization. By combining renewable energy with digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), cloud computing, sensors, and automation, Industry 4.0-enabled hybrid solar dryers offer an efficient, hygienic, and environmentally friendly solution for modern agricultural processing.

Introduction

Agriculture continues to be the backbone of many developing economies, including India. A significant percentage of fruits, vegetables, spices, medicinal plants, and food grains are lost after harvesting due to inadequate preservation techniques. Drying is one of the oldest and most effective food preservation methods, as it removes moisture from agricultural products and inhibits microbial growth. Conventional sun drying is highly dependent on weather conditions and often exposes food products to dust, insects, birds, and environmental contaminants. Mechanical dryers provide better performance but consume large amounts of electrical energy and increase operating costs. A Hybrid Solar Dryer combines solar thermal energy with auxiliary heating sources such as electrical heaters, biomass, or heat pumps to ensure continuous drying even during cloudy weather or at night. Integrating this system with Industry 4.0 technologies transforms it into an intelligent, automated, and energy-efficient drying platform.

What is Industry 4.0?

Industry 4.0 represents the fourth industrial revolution, characterized by intelligent manufacturing through interconnected digital technologies. It integrates cyber-physical systems, IoT, cloud computing, Artificial Intelligence, big data analytics, robotics, and automation to create smart and autonomous industrial processes.

Key technologies include:

- Internet of Things (IoT)
- Artificial Intelligence (AI)
- Machine Learning
- Cloud Computing
- Edge Computing
- Smart Sensors
- Wireless Communication
- Digital Twin Technology
- Data Analytics
- Human–Machine Interfaces (HMI)

These technologies enable real-time decision-making, predictive maintenance, remote monitoring, and optimized energy utilization.

Hybrid Solar Dryer Architecture

An Industry 4.0-enabled intelligent hybrid solar dryer typically consists of:

- Solar air collector
- Drying chamber with multiple trays
- DC/AC exhaust fans
- Auxiliary electrical heating system
- Temperature and humidity sensors
- Solar photovoltaic panel
- Battery energy storage
- IoT controller (ESP32, Raspberry Pi, or PLC)
- Wi-Fi/4G communication module
- Cloud monitoring platform
- Mobile application
- AI-based control algorithm

The controller continuously collects environmental and drying data, analyzes operating conditions, and automatically regulates airflow, heating power, and drying duration to achieve optimal drying performance.

Working Principle

During sunny hours, solar collectors convert sunlight into thermal energy, heating the incoming air before it enters the drying chamber. Temperature and humidity sensors continuously monitor drying conditions.

The IoT controller processes sensor data and controls fans, dampers, and auxiliary heaters. If solar radiation decreases, the intelligent controller automatically activates the backup heating system to maintain the desired drying temperature. The entire drying process can be monitored remotely through a cloud-based dashboard or smartphone application, allowing users to observe temperature, humidity, moisture removal, energy consumption, and drying progress in real time.

Role of Artificial Intelligence

Artificial Intelligence significantly enhances dryer performance through intelligent decision-making. AI algorithms can:

- Predict drying completion time.
- Optimize airflow for different crops.
- Estimate moisture content.
- Reduce unnecessary energy consumption.
- Detect abnormal operating conditions.
- Improve product quality through adaptive control.

Machine learning models continuously learn from previous drying cycles, making future operations increasingly efficient.

Advantages of Intelligent Hybrid Solar Dryers

Compared to traditional drying systems, intelligent hybrid solar dryers offer numerous advantages:

- Reduced post-harvest losses
- Improved food hygiene
- Faster and uniform drying
- Reduced energy consumption
- Continuous operation during cloudy weather
- Real-time monitoring and remote control
- Higher product quality
- Lower greenhouse gas emissions
- Predictive maintenance
- Increased operational reliability

These benefits make the technology suitable for farmers, food industries, research laboratories, and rural entrepreneurship.

Applications

Industry 4.0-enabled hybrid solar dryers are widely applicable for drying:

- Fruits
- Vegetables
- Spices
- Medicinal herbs
- Tea leaves
- Coffee beans
- Fish
- Meat
- Grains
- Flowers

The technology is particularly valuable in rural regions where renewable energy can reduce dependence on unreliable grid power.

Challenges

Despite their significant advantages, several challenges remain:

- High initial installation cost
- Need for reliable internet connectivity
- Requirement for skilled operators
- Cybersecurity concerns
- Maintenance of sensors and communication devices
- Limited awareness among small-scale farmers

Government support, technological advancements, and cost reductions are expected to accelerate adoption in the coming years.

Future Prospects

Future intelligent solar dryers are expected to incorporate:

- Digital Twin technology
- Blockchain-based food traceability
- AI-powered image processing for product quality assessment

- Autonomous robotic material handling
- Cloud-based predictive maintenance
- Integration with smart agriculture platforms
- Renewable energy microgrids
- Carbon footprint monitoring
- Edge AI controllers
- Self-learning optimization algorithms

These innovations will enable fully autonomous food processing systems capable of maximizing productivity while minimizing energy consumption.

Conclusion

Industry 4.0-enabled intelligent hybrid solar dryers represent a significant advancement in sustainable agricultural technology. By combining renewable solar energy with IoT, Artificial Intelligence, automation, and cloud computing, these systems provide an efficient, hygienic, and environmentally responsible solution for food preservation. For Electrical and Electronics Engineers, this technology offers exciting opportunities in embedded systems, renewable energy integration, industrial automation, intelligent control, sensor networks, and smart agriculture. As global demand for sustainable food processing continues to increase, intelligent hybrid solar dryers will play an essential role in reducing food waste, improving energy efficiency, and supporting climate-resilient agriculture. The convergence of Industry 4.0 and renewable energy demonstrates how engineering innovation can address real-world challenges while contributing to food security, rural development, and environmental sustainability.

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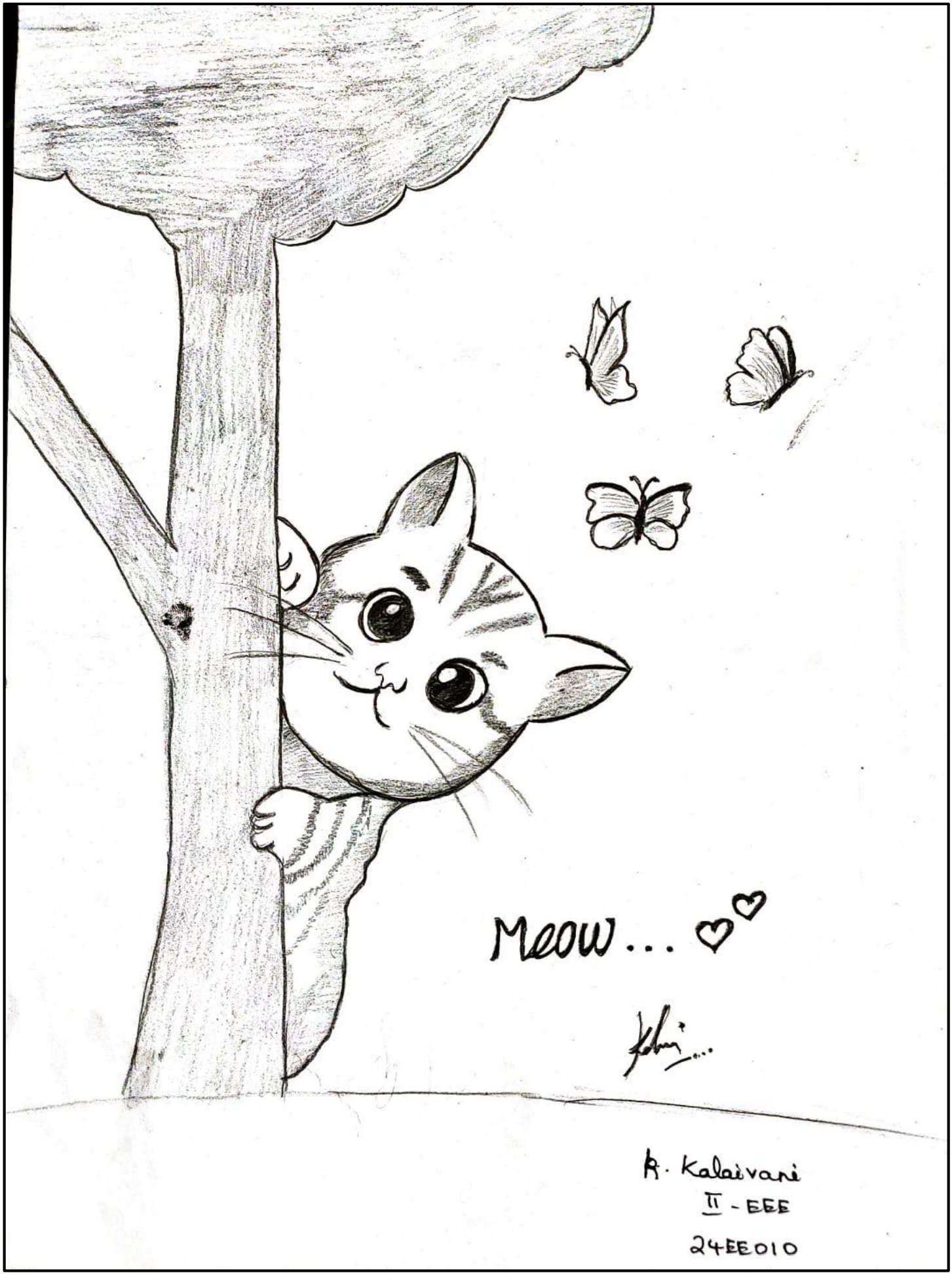
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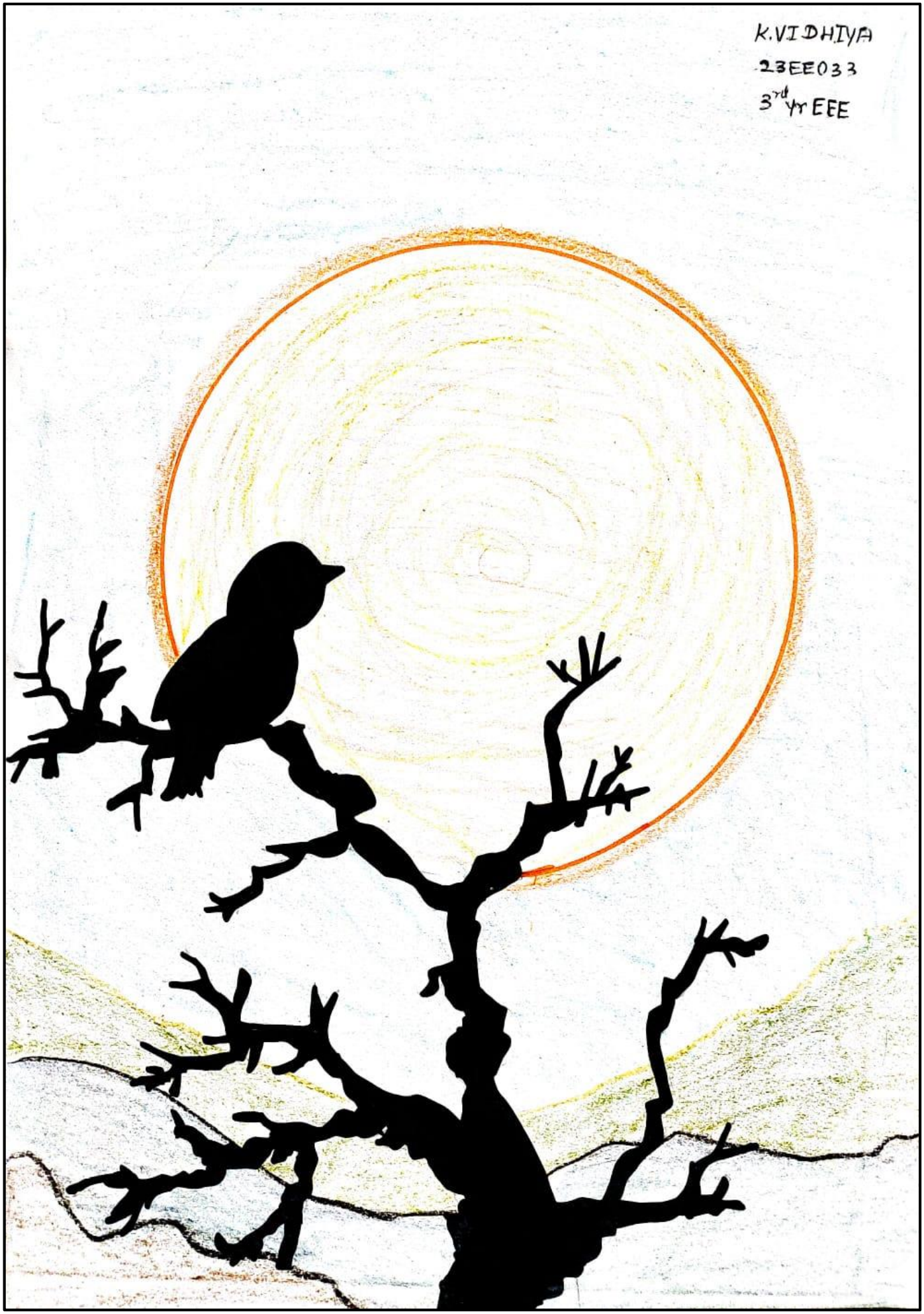
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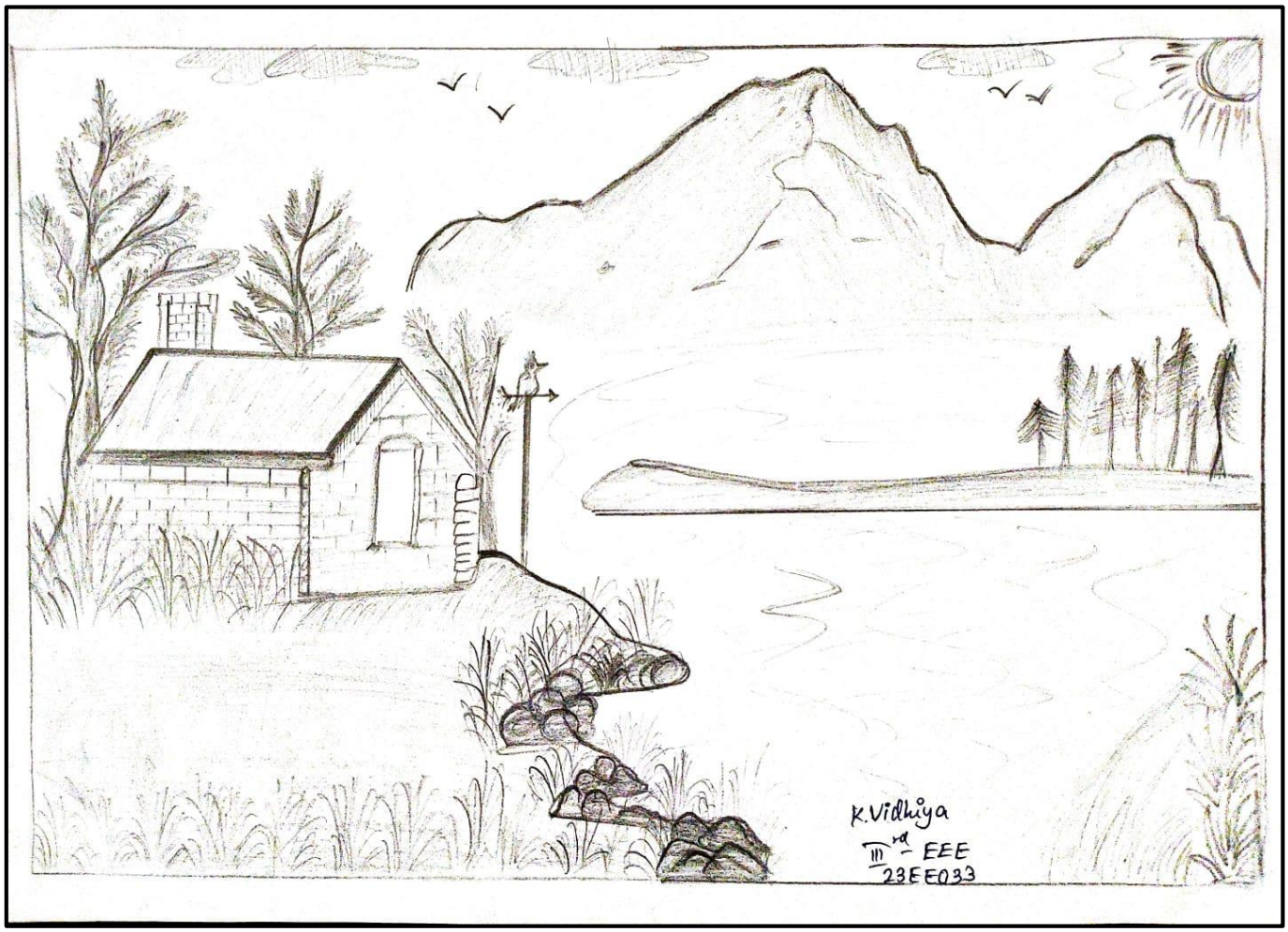
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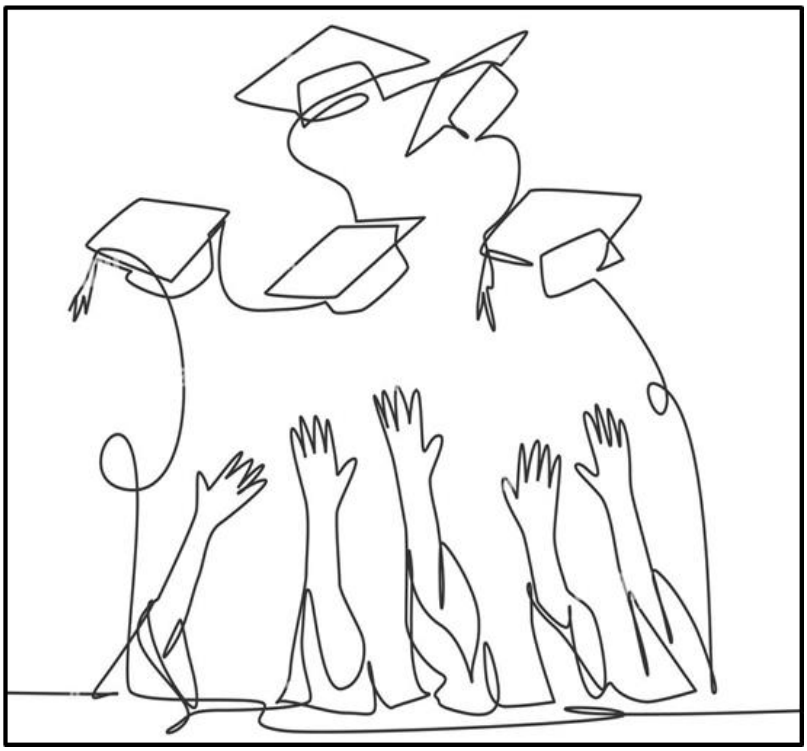

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Thank You for Being a Part of VOLTRIX 2025–26

As we conclude this edition of VOLTRIX – Annual Magazine 2025–26, we extend our heartfelt gratitude to every reader for your valuable time, encouragement, and support. This magazine reflects the collective efforts, creativity, technical knowledge, and enthusiasm of our students, faculty members, and contributors. Your interest and appreciation inspire us to continue fostering innovation, academic excellence, and professional growth within the Department of Electrical and Electronics Engineering.

We sincerely thank our Management, Principal, Head of the Department, Faculty Members, Student Contributors, Editorial Board, Design Team, and everyone who contributed directly or indirectly to the successful publication of this magazine.
We hope the articles, achievements, innovations, and memories shared in these pages have informed, inspired, and motivated you.

Your feedback and suggestions are always welcome as we strive to make future editions even more meaningful and engaging.

Thank you for reading.

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