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2024-2025

TECH WORLD



**"IGNITING INNOVATION,
POWERING THE FUTURE: THE
SPARK OF ELECTRICAL
ENGINEERING!"**

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FROM THE CHAIRMAN'S DESK



Shri Anil Kumar Agarwal
Chairman

Congratulations to the Department of Electrical Engineering on the remarkable launch of the 1st Issue of the 6th Volume of our magazine! This milestone stands as a testament to the department's unwavering pursuit of innovation and academic distinction. I commend our visionary faculty and talented students for their relentless efforts in advancing cutting-edge research and contributing transformative ideas to the engineering landscape. Each page of this edition embodies curiosity, collaboration, and creativity—values that define our community.

To all readers: immerse yourselves in this treasure trove of insights, and let it fuel your passion for discovery. Continue pushing boundaries, for the future of engineering lies in your hands.

FROM THE DIRECTOR'S DESK



Prof. (Dr.) Surya Prakash Tripathi
Director

"Innovation distinguishes between a leader and a follower."

— Steve Jobs

It is an immense honor to introduce the Department of Electrical Engineering's Odd Semester 2024–2025 magazine, TECH-WIRED. This publication serves not only as a platform to celebrate academic excellence but also to ignite the latent writing talents of students by exploring cutting-edge advancements in technical research. Designed as both an invaluable resource and a skill-enhancing tool, this magazine empowers learners to bridge theoretical knowledge with practical innovation.

The TECH-WIRED 2024–2025 edition marks another milestone for the department, building on the legacy of its predecessors. By fostering collaboration, creativity, and technical proficiency, it offers students a unique opportunity to refine their expertise while cultivating teamwork—a cornerstone of modern engineering. Moreover, this endeavor embodies the vision of an extraordinary pioneer, philosopher, and inspiration to young minds, whose words resonate deeply: "Education is the passport to the future, for tomorrow belongs to those who prepare for it today."

"Do not go where the path may lead, go instead where there is no path and leave a trail."

— Ralph Waldo Emerson

With my good wishes and great success for the future.

FROM THE HEAD OF DEPARTMENT'S DESK



Mr. K.P.YADAV

**Assistant Professor and Head
Dept. of Electrical Engineering**

On behalf of our dedicated students and accomplished faculty, it is my privilege to welcome you to the distinguished Department of Electrical Engineering at RRIMT. Our institution prides itself on a dynamic faculty team—seasoned scholars and industry practitioners, many of whom hold credentials from India’s premier universities. Their blend of academic rigor and real-world insight ensures an environment where innovation thrives. To nurture growth, we offer curated workshops, specialized trainings, and collaborative programs, empowering both students and staff to refine their skills and stay ahead in evolving technical landscapes.

I am thrilled to announce the launch of our semester magazine, TECH-WIRED—a platform poised to spark curiosity and collaboration. This initiative reflects our commitment to fostering creativity, sharing knowledge, and celebrating breakthroughs in electrical engineering. By bridging ideas and inspiring action, TECH-WIRED will amplify the voices of our academic community, driving forward the ethos of innovation that defines us.

Message from Magazine Faculty Coordinator



Mr. Mahtabul Haque
Assistant Professor
Dept. of Electrical Engineering

A heartfelt congratulations to the members of the ELECTRIX Society for spearheading the creation of the 2024–2025 odd-semester magazine, TECH-WIRED. This edition is a vibrant celebration of ingenuity, blending technical expertise with artistic expression. It is an honor to unveil this platform, where electrical engineering students transcend equations and circuits to share articles, poetry, and reflections on campus life, global challenges, and their philosophical musings. The magazine shatters stereotypes, proving that analytical minds are equally adept at weaving narratives and sparking imaginative discourse.

The eco-conscious design of TECH-WIRED—crafted with sustainability at its core—mirrors our commitment to a greener future, merging innovation with responsibility. Collaborating with the editorial team has been a joy, witnessing raw ideas evolve into polished gems of insight. My deepest gratitude extends to our visionary Chairman, Director, HODs, faculty, and staff for their unwavering support, and to every contributor who poured passion into these pages.

May this magazine ignite curiosity and camaraderie among readers. Dive into its stories, for they are testaments to the boundless potential of our students.

DEPARTMENT VISION

(Statement)

To emerge as centre of excellence in the field of electrical engineering to enhance the technical and professional skills of the students and make them competent enough to cater the multidisciplinary needs of the academia, industry and society with strong moral and ethical values.

DEPARTMENT MISSION

(Statement)

M1- To provide an environment for effective teaching-learning process with incorporation of multi-disciplinary approach to develop competent electrical engineers..

M2- To strengthen the students technically & professionally in electrical engineering domains using state of art technology which leads to successful employability, higher education and entrepreneurship..

M3- To foster an inspiring atmosphere which induces a passion for lifelong learning with incorporation of human values and ethics.

PROGRAM OUTCOMES

(Statement)

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 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.
- 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.
- 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)

(Statement)

PSO1:- The ability to analyze, design and develop systems that generate, transmit and utilize electrical energy in an efficient way.

PSO2:- The ability to be proficient in use of automation Technology required to implement electrical engineering practice.

Program Educational Objectives (PEOs)

(Statement)

PEO1:-The graduates will analyse, design and develop tools, applications and systems based on electrical engineering principles to solve real life problems of industry and society.

PEO2:-The graduates will have the capability of working individually as well as in teams with effective communication skills, leadership quality, ethical values and an instinct for lifelong learning.

PEO3:- The graduates will have the potential for higher education, research and entrepreneurship in the field of electrical engineering and related domains.

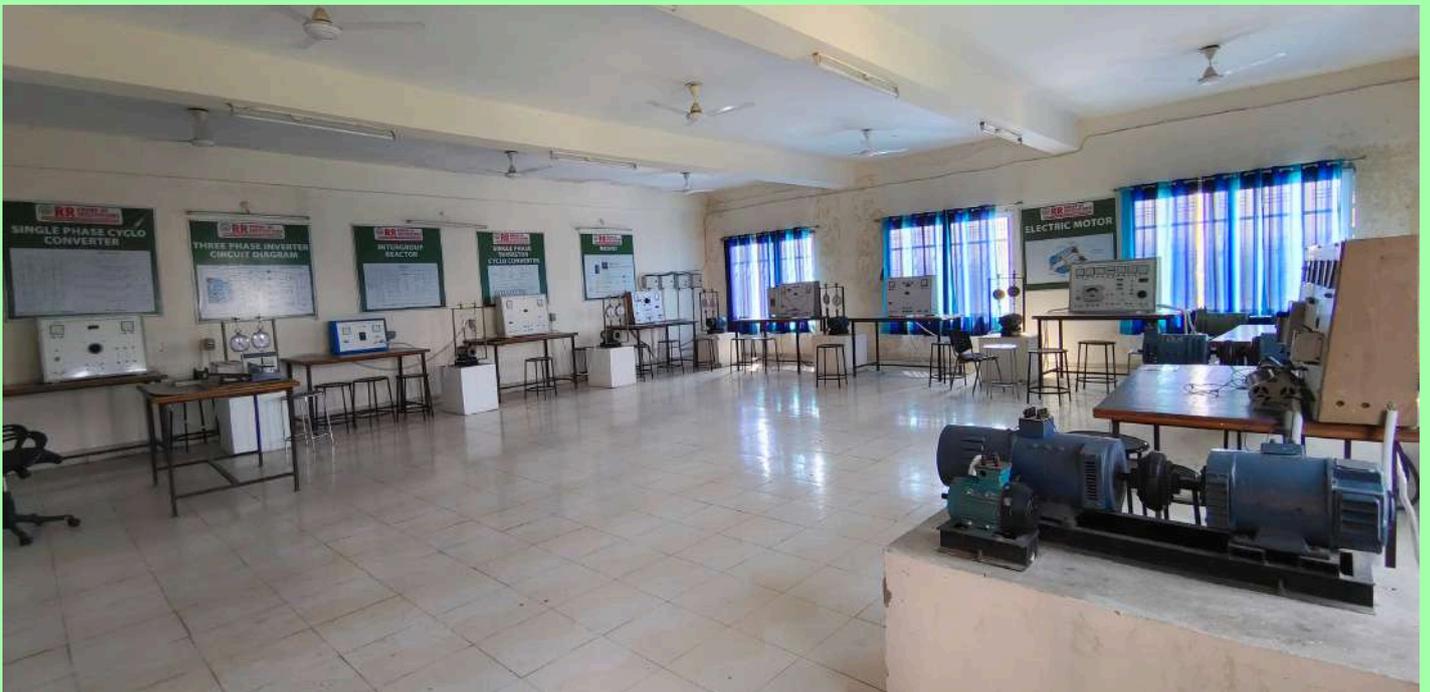
ABOUT DEPARTMENT OF ELECTRICAL ENGINEERING

The Electrical Engineering Department at R.R. Institute of Modern Technology, Lucknow stands out with its exceptional offerings:

- 1. Expert and Dedicated Faculty:** The Electrical Engineering Department at R.R. Institute of Modern Technology takes pride in its accomplished faculty, renowned for their leadership in specialized domains. Combining profound academic expertise with a student-centric approach, these educators deliver rigorous instruction and individualized mentorship, fostering both intellectual growth and practical skill development.
- 2. Departmental Commitment:** Our mission centers on cultivating future innovators in electrical engineering through a dynamic, interdisciplinary curriculum. By integrating theoretical foundations with hands-on learning and industry-aligned projects, we prepare students to navigate evolving technological landscapes and emerge as leaders in their careers.
- 3. Cutting-Edge Learning Infrastructure:** Our department features advanced laboratories and technology-enhanced classrooms outfitted with high-definition projection systems and interactive tools. These facilities are designed to bridge theoretical concepts with real-world applications, enabling dynamic, multisensory learning experiences. From experimental exploration in labs to collaborative problem-solving in smart classrooms, our infrastructure supports innovation and creativity.
- 4. Advanced Simulation Resources:** Aligned with evolving industry standards, our department integrates industry-leading simulation software and computational platforms into the curriculum. These tools empower students to engage in predictive modeling, digital prototyping, and real-time analysis of intricate electrical systems. By mastering these technologies, learners refine their troubleshooting expertise, develop critical thinking, and gain hands-on proficiency in designing solutions for tomorrow's engineering challenges.
- 5. Industry-Driven Curriculum Design:** Our program's academic framework is proactively revised to mirror advancements in electrical engineering, incorporating breakthroughs in automation, renewable energy, and smart systems. Through collaboration with industry partners, we embed cross-disciplinary insights and emerging sector demands into coursework. This agile approach equips students with a forward-looking skill set, fostering adaptability and empowering them to lead in a rapidly evolving technological landscape.

6. Research-Intensive Ecosystem: The department cultivates a culture of academic inquiry by embedding research at the core of the student experience. Through structured mentorship programs and collaborative projects, learners partner with faculty to explore pioneering innovations in areas such as smart grids, embedded systems, and AI-driven automation. These initiatives not only deepen theoretical understanding but also hone skills in experimental design, critical analysis, and scholarly communication—equipping students to contribute meaningfully to academic discourse and technological innovation.

7. Dynamic Professional Development Initiatives: The department facilitates experiential learning through curated knowledge-exchange platforms, including hands-on workshops, expert-led guest lectures, and industry immersion programs. Partnering with global academia and leading tech enterprises, these initiatives bridge academic and professional realms. Students gain insights into emerging domains like IoT integration and sustainable energy solutions, grounded in current industry practices. Direct engagement with thought leaders and cross-sector collaboration cultivates a multidimensional perspective, empowering graduates with an adaptive mindset and strategic networks to thrive in global engineering ecosystems.



At the Electrical Engineering Department of R.R. Institute of Modern Technology, we are dedicated to cultivating tomorrow's engineering leaders through a transformative academic ecosystem. By merging rigorous theoretical frameworks with industry-aligned projects, collaborative research, and multifaceted learning pathways, we equip students with the intellectual agility and adaptive expertise to pioneer solutions for global technological challenges. Our mission is to shape not just skilled professionals, but visionary innovators poised to drive sustainable progress in electrical engineering and beyond.

DEPARTMENTAL ACTIVITIES



UPPCL SUBSTATION VISIT



The ELECTRIX Society of the Electrical Engineering Department (EED) organized a one-day industrial visit to the 33/11 KV UPPCL Substation in Bakshi Ka Talab, Lucknow, on April 3, 2024, for third-year B.Tech students. The visit aimed to deepen students' understanding of high-voltage power transmission and distribution systems. Participants engaged in a comprehensive exploration of critical infrastructure, including transformers, circuit breakers, isolators, and switchgear, while gaining practical insights into substation operations, system protection mechanisms, control and monitoring protocols, maintenance procedures, safety regulations, and grid integration strategies.



The event was expertly guided by faculty mentors Mr. Lalit Singh and Mr. Mahtabul Haque, whose expertise enriched the students' learning experience. This immersive excursion successfully connected classroom theory with industrial practices, fostering a deeper appreciation for electrical engineering and inspiring innovation among attendees.



UPNEDA VISIT



The ELECTRIX Society of the Electrical Engineering Department (EED) orchestrated an educational visit to the UPNEDA Solar Power Plant in Lucknow on July 19, 2024, offering third-year B.Tech students an in-depth exploration of solar energy systems. The visit encompassed critical themes such as photovoltaic technology fundamentals, solar panel installation and maintenance, electrical system design, grid integration protocols, energy storage solutions, real-time monitoring frameworks, environmental sustainability practices, safety standards, and regulatory compliance.



Dhawa, Uttar Pradesh, India
 W22x+c89, Dhawa, Uttar Pradesh 226028, India
 Lat 26.90109° Long 81.048283°
 06/12/24 11:36 AM GMT +05:30



Dhawa, Uttar Pradesh, India
 W22x+c89, Dhawa, Uttar Pradesh 226028, India
 Lat 26.900842° Long 81.048407°
 06/12/24 11:40 AM GMT +05:30

Students engaged in interactive sessions with UPNEDA engineers, gaining firsthand insights into the technical intricacies of solar power generation, transmission efficiency, and large-scale renewable energy management. The event was expertly guided by faculty mentors Mr. Lalit Singh and Mr. Mahtabul Haque, whose leadership ensured a seamless integration of academic concepts with industrial applications



This immersive experience proved instrumental in bridging theoretical knowledge with practical implementation, fostering a renewed zeal for renewable energy engineering among participants. By observing cutting-edge solar technologies and operational methodologies, students solidified their understanding of sustainable energy systems while envisioning their roles in advancing the sector.



WORKSHOP ON "DRONE TECHNOLOGY "

ElectriX Society Soars High with Drone Technology Workshop"
By Mr. Piyush Thakur (APSD)



On 24th October 2024, the Electrical Engineering Department's ElectriX Society transformed the campus into a hub of aerial innovation with their highly anticipated Workshop on **Drone Technology**. The event drew students, faculty, and tech enthusiasts eager to explore the mechanics, assembly, and thrill of piloting drones.

Workshop Highlights

1. Understanding Drone Diversity

The workshop kicked off with an enlightening session on types of drones. Participants learned how drones vary in design and purpose, from compact multi-rotor drones used for photography to robust fixed-wing UAVs deployed in agriculture and logistics. The segment highlighted how advancements in drone tech are reshaping industries like disaster response, environmental monitoring, and delivery services.



2. Building a Drone: From Components to Completion

The heart of the workshop was the drone assembly module. Attendees rolled up their sleeves to build functional drones from scratch. Guided by experts, they connected components like brushless motors, Li-Po batteries, gyroscopes, and flight controllers. For many, this was their first glimpse into the intricate balance of hardware and software that keeps drones airborne.



3. Taking Flight: Mastering the Joystick

The crowd-favorite segment was the live flight demonstration. After a briefing on aerodynamics and safety protocols, volunteers took turns piloting drones using joysticks. The session covered:

- Basic maneuvers: Hovering, ascending, and directional turns.
- Advanced techniques: Obstacle avoidance and precision landing.
- Troubleshooting mid-flight errors.



4. Interactive Q&A and Networking

The workshop concluded with an interactive panel where industry professionals addressed questions on drone regulations, career opportunities, and ethical challenges. Students left with not just technical knowledge but also a clearer vision of how drones will dominate future engineering landscapes.



Why This Workshop Mattered

Skill Development: Bridged theory and practice for aspiring engineers.

Networking: Connected students with drone startups and researchers.

Inspiration: Ignited curiosity about UAVs' role in sustainable development.

WORKSHOP ON "INTRODUCTION TO MATLAB"

ElectriX Society Sparks Innovation with MATLAB Workshop

On December 14, 2024, the ElectriX Society of the Electrical Engineering Department ignited a spark of curiosity and technical prowess among students with its immersive Workshop on "Introduction to MATLAB". Led by industry expert **Dr. Varun Srivasatav**, the event offered a deep dive into the versatile world of MATLAB, equipping participants with tools to tackle matrix operations and circuit simulations—an essential skillset for budding engineers.



Dr. Varun Srivasatav, a seasoned MATLAB specialist with over a decade of experience in computational engineering, kicked off the session by demystifying MATLAB's role in academia and industry. "MATLAB isn't just software—it's a gateway to solving real-world engineering problems," he emphasized. His presentation covered MATLAB's applications in signal processing, control systems, and AI, highlighting its relevance in cutting-edge fields like renewable energy and robotics.



Hands-On Learning: From Theory to Practice

The workshop transitioned into an interactive lab session where students rolled up their sleeves to code. The first challenge? Matrix Multiplication—a fundamental operation in algorithms and data analysis. Under Varun’s guidance, participants learned to write efficient scripts, experimenting with loops and vectorization techniques to optimize performance.



Next, the focus shifted to Basic Circuit Simulation Design. Attendees modeled simple circuits using MATLAB’s Simulink toolbox, visualizing voltage drops, current flows, and component interactions. For many, this was their first taste of virtual prototyping. “Seeing Kirchhoff’s laws come alive on-screen was mind-blowing,” shared second-year student Daksh Patel.



Why MATLAB Matters

The workshop underscored MATLAB’s importance as a cross-disciplinary tool. From aerospace to biomedical engineering, its ability to handle complex computations and simulations makes it indispensable. Varun also shared tips for leveraging MATLAB’s vast library of toolboxes and online community resources.

Student Takeaways

Participants left buzzing with enthusiasm. “I finally understand how coding integrates with hardware design,” remarked attendee Rohan Kumar. Others praised the balance between lectures and hands-on practice, calling it a “confidence booster” for future projects.

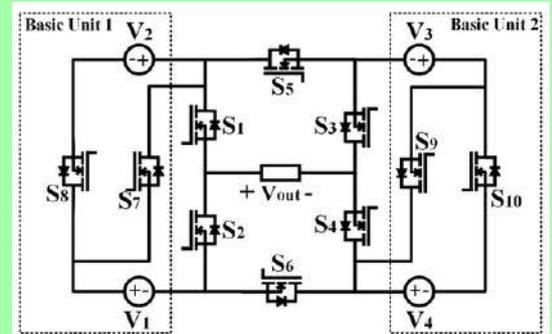
TECHNICAL ARTICLE

Unveiling the 33-Level Asymmetrical Inverter: A Leap in Power Conversion Technology

Introduction

In the era of renewable energy and electric vehicles, efficient power conversion systems are critical. Multilevel inverters (MLIs) have emerged as a cornerstone technology, enabling high-power applications with minimal harmonic distortion. Among these, the 33-level asymmetrical inverter stands out for its ability to deliver superior performance with fewer components. This article explores its design, advantages, and applications, shedding light on why it's a game-changer for modern power systems.

By Monu Radheshyam Prajapati
4th Year EE
(2203610209010)



What Are Multilevel Inverters?

Multilevel inverters synthesize a stepped AC voltage from multiple DC sources, producing a near-sinusoidal waveform. They reduce Total Harmonic Distortion (THD) compared to traditional two-level inverters, making them ideal for grid integration, motor drives, and industrial applications. MLIs are categorized as:

Symmetrical: All DC sources have equal voltage.

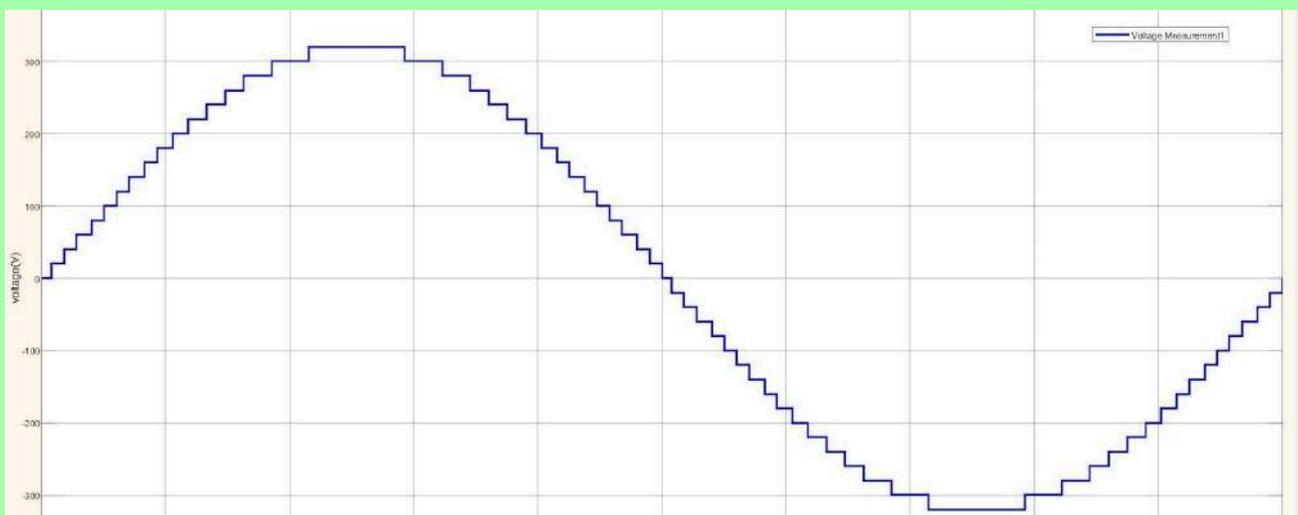
Asymmetrical: DC sources have unequal voltages, enabling more output levels with fewer components.

The 33-Level Asymmetrical Inverter: Structure and Operation

The 33-level asymmetrical inverter typically employs a cascaded H-bridge (CHB) topology, where each H-bridge is fed by a DC source of unequal magnitude. By strategically selecting voltage ratios (e.g., 1:3:9), the inverter exponentially increases output levels. For example:

Three H-bridges with voltage ratios $V_1:V_2:V_3=1:3:9$, can generate 27 distinct voltage levels.

Adding a fourth H-bridge or optimizing switching angles extends this to 33 levels, enhancing waveform granularity.



ADVANTAGES OF THE 33-LEVEL CONFIGURATION

Reduced Harmonic Distortion: With 33 steps, the output closely mimics a sine wave, slashing THD to <5%, meeting grid standards without bulky filters.

Lower Switching Losses: Higher voltage blocks reduce switching frequency per device, improving efficiency.

Scalability: Fewer components compared to symmetrical MLIs (e.g., 33 levels with 4 bridges vs. 16 bridges in symmetrical designs).

Fault Tolerance: Isolated DC sources allow continued operation even if one bridge fails.

APPLICATIONS

Renewable Energy: Smooth integration of solar/wind power into grids.

Electric Vehicles (EVs): Efficient motor drives with reduced electromagnetic interference.

Industrial Motor Drives: Precise speed control for heavy machinery.

Smart Grids: Enhanced power quality in distributed energy systems.

CHALLENGES AND INNOVATIONS

Complex Control Algorithms: Managing switching states for 33 levels requires robust controllers (e.g., FPGA-based systems).

Voltage Imbalance: Uneven loading of DC sources necessitates active balancing circuits.

Cost of Isolation: Multiple DC sources increase system cost, though advancements in modular designs are mitigating this.

FUTURE DIRECTIONS

AI-Driven Control: Machine learning for real-time optimization of switching patterns.

Wide-Bandgap Semiconductors: SiC or GaN devices to enhance efficiency and thermal performance.

Hybrid Topologies: Combining asymmetrical MLIs with flying capacitors or neutral-point clamping.

CONCLUSION

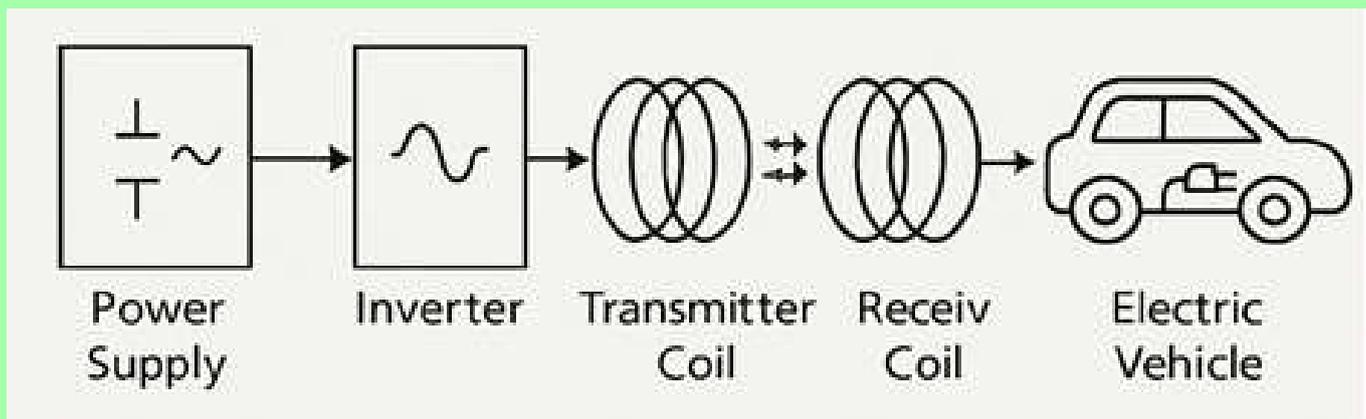
The 33-level asymmetrical inverter represents a paradigm shift in power electronics, balancing efficiency, cost, and performance. For engineering students, this technology offers fertile ground for research—whether in control algorithms, topology design, or integration with renewables. As the world transitions to greener energy, mastering such innovations will be key to shaping the future of power systems.

Wireless Power Transfer for EV Charging Using Resonant Inductive Coupling

By
Mizan Miyan (2203610200022)
& Neeraj Chauhan (2203610200023)
3rd Year EE

INTRODUCTION

With the rapid rise of electric vehicles (EVs), the need for efficient and convenient charging systems has grown significantly. Traditional plug-in chargers suffer from wear, require manual operation, and are prone to environmental damage. Wireless Power Transfer (WPT) offers a contactless alternative, improving durability and user experience. Among WPT methods, Resonant Inductive Coupling (RIC) is notable for its efficiency and moderate range, ideal for EVs. RIC enables energy transfer through magnetically coupled coils resonating at the same frequency. This paper explores the design, simulation, and application of RIC-based wireless EV charging for smarter, more reliable transportation systems.



LITERATURE REVIEW :

Wireless Power Transfer (WPT), particularly through Resonant Inductive Coupling (RIC), has attracted significant attention for electric vehicle (EV) charging over the past two decades. Kurs et al. (2007) pioneered the concept by demonstrating efficient mid-range energy transfer via strongly coupled magnetic resonators, achieving 40–60% efficiency over nearly 2 meters without physical contact. This landmark study laid the foundation for practical RIC applications in EV charging.

Hui et al. (2014) advanced this work by highlighting key aspects such as resonant frequency tuning, coil alignment, and electromagnetic compatibility (EMC), identifying coil misalignment and the need for high-Q resonators as major challenges. The SAE J2954 standard, introduced by the Society of Automotive Engineers, established interoperability and safety guidelines, including power levels up to 11 kW and a standardized frequency of 85 kHz, enabling industry-wide adoption.

Covic and Boys (2013) focused on system-level issues, including electromagnetic interference, coil displacement, and thermal effects in power electronics. Meanwhile, Choi et al. (2015) explored dynamic wireless charging for moving vehicles, offering transformative possibilities for highways and public transport systems.

CASE STUDY: URBAN PARKING LOT DEPLOYMENT

A pilot deployment in a metropolitan parking lot demonstrated the feasibility of RIC-based charging. Each slot included an embedded transmitter coil, and EVs equipped with a compatible receiver could initiate charging upon alignment. User feedback highlighted convenience and reduced physical handling.

SIMULATION AND RESULTS:

Simulation of the WPT system was performed using MATLAB/Simulink. The results demonstrate:

Efficient power transfer (~90%) at 10 cm distance

Power output of 3.3 kW suitable for Level 2 EV charging

Minimal losses and effective frequency tuning.

APPLICATIONS AND FUTURE SCOPE:

Integration into smart parking lots, roads, and garages.

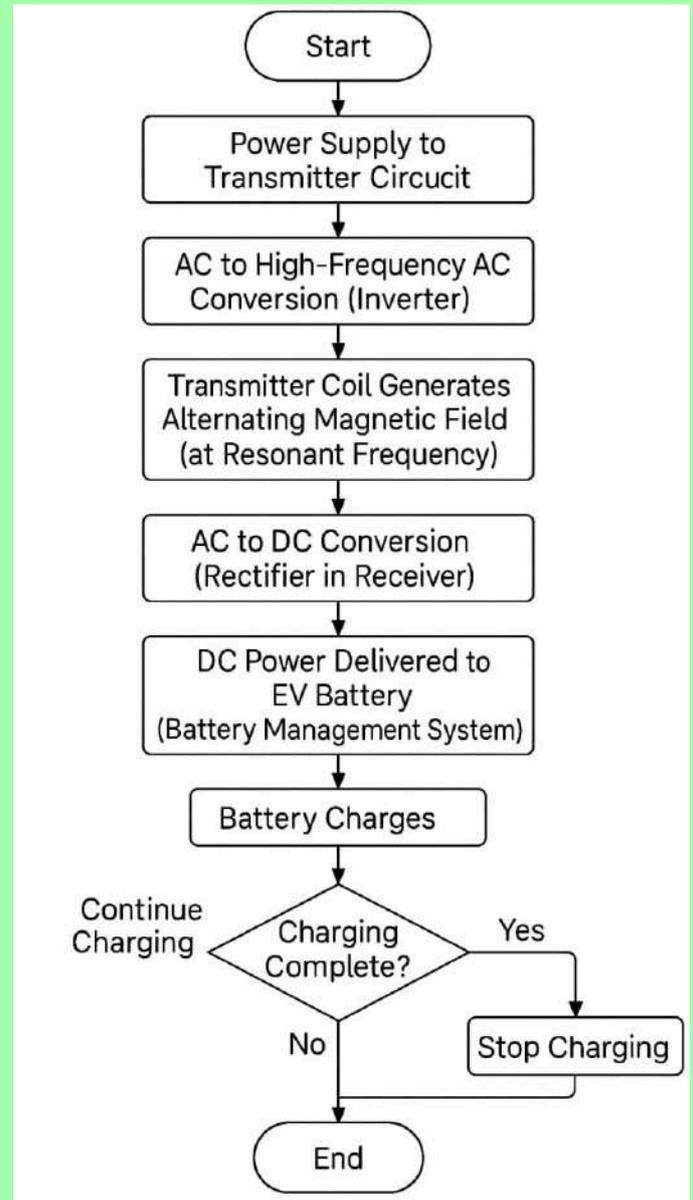
Dynamic charging while EVs are in motion.

Improvements in alignment detection and adaptive resonance tuning.

CONCLUSION:

Wireless Electric Vehicle (EV) charging using Resonant Inductive Coupling (RIC) offers a promising and efficient alternative to conventional plug-in systems. This technology provides several advantages such as enhanced user convenience, reduced mechanical wear, increased safety through electrical isolation, and potential integration into automated and smart mobility infrastructures.

Through this paper, we demonstrated how RIC operates on the principle of magnetic resonance between two tuned coils, enabling mid-range energy transfer with high efficiency. The detailed system design, hardware selection, and simulation outcomes show that an optimized RIC-based WPT system can deliver more than 85% efficiency at a practical coil separation distance suitable for parking environments. The case study involving an urban parking lot validates the technology's real-world applicability and user acceptance.



Wireless Power Transfer Systems for Electric Vehicle Charging: Technologies, Challenges, and Future Prospects

By

Dev Narayan Prajapati (2203610200014)
& Deepak Kasaudhan (2203610200013)

3rd Year EE

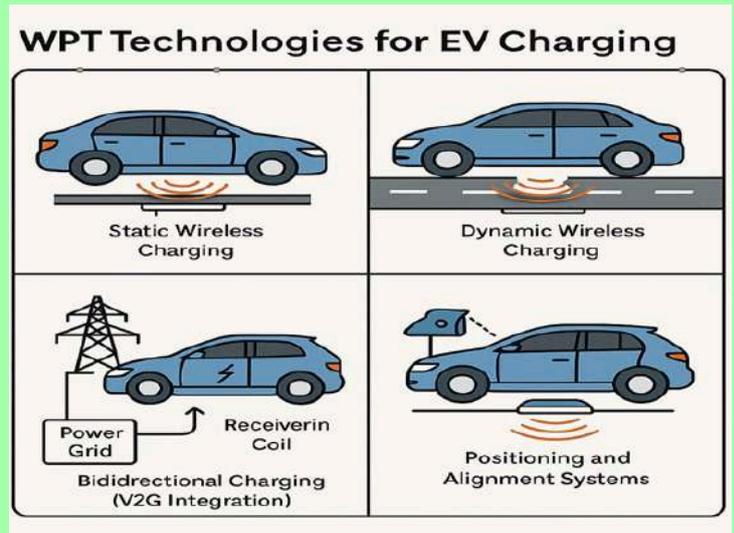
Wireless Power Transfer (WPT) presents a transformative solution for Electric Vehicle (EV) charging, overcoming limitations of plug-in systems like inconvenience and safety risks. Utilizing electromagnetic fields (primarily inductive/resonant coupling), WPT enables contactless energy transfer for both stationary (static) and moving (dynamic) vehicles, enhancing convenience and enabling extended range.

However, significant challenges impede widespread adoption. Key technical hurdles include efficiency losses from coil misalignment/air gaps and electromagnetic interference (EMI) concerns. High infrastructure costs, especially for dynamic charging requiring road modifications, and the lack of universal standards are major economic and scalability barriers. Safety regulations for prolonged EMI exposure also need resolution.

Despite these obstacles, WPT holds immense future potential. Advancements in AI energy management, integration with smart grids/renewables, and synergy with autonomous driving could revolutionize EV infrastructure. Realizing this potential requires collaborative innovation across industry, government, and academia to address technical, cost, and regulatory gaps, accelerating the transition to sustainable transportation.

WPT TECHNOLOGIES FOR EV CHARGING

Wireless Power Transfer (WPT) technologies for Electric Vehicle (EV) charging have evolved rapidly over the past decade, offering efficient, safe, and user-friendly alternatives to traditional plug-in systems. These technologies are primarily based on inductive power transfer (IPT) and magnetic resonant coupling, with various configurations and implementations suited for both static and dynamic charging. This section discusses the key components, classifications, and real-world technologies used in WPT systems for EVs.



3.1 Static Wireless Charging

Static WPT refers to charging when the vehicle is stationary—typically parked in a garage, parking lot, or designated charging bay. This is currently the most mature form of wireless EV charging.

Example: WiTricity's DRIVE II system delivers up to 11 kW of power with over 90% efficiency. Qualcomm Halo has demonstrated efficient static charging systems for cars and public transport.

3.2 Dynamic Wireless Charging

Dynamic WPT allows an EV to charge while in motion over a specially designed roadway embedded with transmitter coils.

Challenges: High infrastructure cost. Complex control systems to manage segment activation and billing. Road durability and maintenance issues.

Pilot Projects: Electreon (Israel) implemented a dynamic charging test track in Tel Aviv. KAIST (Korea) developed the On-Line Electric Vehicle (OLEV) system for buses.

3.3 Bidirectional Charging (V2G Integration)

Modern WPT systems are evolving to support Vehicle-to-Grid (V2G) capabilities, where EVs can send electricity back to the grid during peak demand.

Key Technologies: Integration with smart grids. Power electronics capable of bidirectional flow. Real-time communication between the vehicle and grid operator. This transforms EVs into mobile energy storage units, contributing to grid stability and efficient energy use, especially when coupled with renewable energy sources.

3.4 Positioning and Alignment Systems

Efficient wireless charging relies on precise alignment between the transmitter and receiver coils. Misalignment can significantly reduce efficiency and cause energy losses.

Solutions: Electromagnetic field sensors. Automated parking systems with alignment guides. Wireless communication protocols (e.g., Bluetooth or ZigBee) to assist vehicle docking.

3.5 Safety and EMI Considerations

To ensure public safety and regulatory compliance, WPT systems incorporate: Shielding to limit electromagnetic field (EMF) exposure. Foreign object detection (FOD) to identify and shut down if a metal object interferes. Standards like SAE J2954 and IEC 61980 to regulate design, safety, and interoperability. In summary, WPT technologies for EV charging offer scalable, efficient, and futuristic alternatives to plug-in systems. While static charging is commercially viable today, dynamic charging represents the next frontier, promising continuous, on-the-go energy supply. The evolution of these technologies, along with smart grid integration and international standardization, will define the future of wireless EV infrastructure.

CHALLENGES AND LIMITATIONS OF WPT FOR EV CHARGING

Wireless Power Transfer (WPT) for EVs faces significant hurdles. Technical challenges include high sensitivity to coil misalignment and air gaps, drastically reducing efficiency. Electromagnetic Interference (EMI) poses safety risks to electronics and biological systems, requiring strict compliance with standards. High infrastructure costs, especially for dynamic charging road modifications and onboard receivers, are a major barrier. Lack of global standardization hinders interoperability between vehicles and chargers. Power levels are generally lower (3.3 kW–11 kW) than wired DC fast chargers, limiting charging speed. Environmental factors like snow or dirt accumulation can impair performance. Dynamic charging adds complexity, demanding precise vehicle-road coordination and sophisticated control systems. Addressing these issues is critical for widespread adoption.

HIGHEST ATTENDANCE RECORD

S.No.	Semester	Roll Number	Students Name	% Attendance
1	1st	2403610200006	AMAN KUMAR	100
2	1st	2403610200031	KARAN KUMAR	100
3	1st	2403610200040	PREM KUMAR	100
4	1st	2403610200059	SUDHANSHU	100
5	1st	2403610200066	VIKAS KUMAR	100
6	1st	2403610200069	YUSUF KHAN	100
7	3rd	2303610200008	ANIKET SINGH	99.21
8	1st	2403610200049	RISHABH PANDEY	99.18
9	1st	2403610200053	SACHIN MADDHESIYA	99.18
10	1st	2403610200060	SURAJ	99.18
11	3rd	2303610200018	DAKSH PATEL	98.43
12	1st	2403610200032	KASIM AHMAD	98.36
13	1st	2403610200034	LAKSHAY PATEL	98.36
14	1st	2403610200068	VIVEK SINGH	98.36
15	1st	2403610200021	AYUSH SINGH YADAV	97.54
16	1st	2403610200036	MOHAMMAD SAAD	97.54
17	1st	2403610200043	RAJNISH	97.54
18	1st	2403610200048	RAVI CHAURASIYA	97.54
19	1st	2403610200063	SUSHIL KUMAR VISHWAKARMA	97.54
20	5th	2203610200016	GULSHAN KUMAR	96.84
21	1st	2403610200003	ADITYA KUMAR YADAV	95.9
22	1st	2403610200016	ARVIND GUPTA	95.9
23	1st	2403610200035	MANTU KUSHWAHA	95.9
24	1st	2403610200057	SHIVAM	95.9
25	1st	2403610200061	SURAJ	95.9

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1st Year



RAGHUVENDRA KUMAR
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