

# प्रवाह

PROBAHO'23



DEPARTMENT OF ELECTRICAL ENGINEERING

## EDITORIAL TEAM



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Department of Electrical Engineering  
B.P Poddar Institute of Management & Technology



**B. P. Poddar Institute of Management & Technology**  
**Department of Electrical Engineering**

**VISION**

To emerge as a knowledge hub for higher learning and research in Electrical Engineering.

**MISSION**

- To create a conducive quality teaching –learning environment to make the student assimilate thorough knowledge in Electrical Engineering.
- To create a platform for building confidence among faculties and students by exchanging their views through research, interactive sessions with industry and by the use of modern tools.
- To adopt a goal driven teaching learning method to foster innovative entrepreneurship skills in student community with expertise in different engineering domains.
- To enable students to become authorities in the field of Electrical Engineering along with sustainable and environment friendly technologies to meet the societal needs.



**B. P. Poddar Institute of Management & Technology**  
**Department of Electrical Engineering**

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO 1:** Acquire adequate physical, analytical and technical knowledge of Electrical Engineering and allied fields to curate solutions which effectively address the challenges posed by dynamic work environments.

**PEO 2:** Inculcate self- assurance, collaborative spirit, critical thinking and acumen for innovation towards gaining a competitive edge in research and development as well as in entrepreneurial ventures.

**PEO 3:** Imbibe professional ethics and the attitude to bank on sustainable and eco-friendly practices only, for the wellbeing of society at large.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

**PSO 1:** The students will enhance their knowledge and acquire skills on Power System, Measurement and Control, Signal Processing Techniques and Automation to contribute in the field of Electrical Engineering and evolving domains like Renewable Energy Systems, Intelligent Systems, Health care and e-mobility sectors and emerge as successful entrepreneurs as well.

**PSO 2:** The students shall apply their knowledge to pursue successful careers with Academia and R & D Laboratories across the globe, endorsing clean and eco-friendly technologies.

## ACKNOWLEDGEMENT

The publication of the 18th edition of Probaho has been made possible through the collective effort, encouragement, and support of many individuals associated with the Department of Electrical Engineering. We take this opportunity to express our sincere gratitude to the Head of the Department and all the respected faculty members for their constant guidance and inspiration throughout the preparation of this magazine.

We are equally thankful to the respected faculty members and students whose enthusiasm, creativity, and contributions have added great value to this edition. Their participation reflects the vibrant spirit of our department.

—From the Editors

## To the Readers

Probaho is a Bengali word meaning “flow”. Nearly two decades ago, in the year 2005, when the first departmental magazine was conceived by our seniors, the idea behind adopting this name was that it beautifully reflects the philosophy of life—a journey that constantly moves forward with time, carrying experiences, ideas, and aspirations along the way.

In the course of our academic lives, we too have been a part of this continuous flow. The classrooms, laboratories, and corridors of the Electrical Engineering Department have witnessed countless moments—from curiosity and discovery to struggle and success. Assignments, projects, late-night preparations before examinations, and lively discussions with friends have all contributed to making this journey meaningful and enriching.

Over the years, the world around us has changed rapidly. Technology has transformed the way we learn, communicate, and create. The year 2022–23 stands as a phase of adaptation and growth, where innovation continues to influence both our academic and personal lives. Yet, even in this fast-moving modern age, the importance of creativity, expression, and shared ideas remains unchanged. In the constant race of life, there are always individuals who pause to create something meaningful. Probaho is a collection of such efforts—reflections of thoughts, imagination, and knowledge from the students and faculty of our department.

Creating an identity is never easy, and preserving it through generations is even more challenging. Our seniors initiated the journey of Probaho, and today we continue that flow with dedication and gratitude. We hope this edition reflects the spirit, creativity, and memories of our department, and inspires future batches to carry this legacy forward.

**Sougata Roy Chowdhury**  
*(Member of Editorial Team  
Electrical Engineering)*

## HOD'S COLUMN

I am very happy to share that the Department of Electrical Engineering, B.P. Poddar Institute of Management & Technology has brought out its annual magazine "Probaho" for 2022-23. It is a platform for the students to explore their talent. The magazine is not only informative but also has a great educational value. College magazine always portrays the thoughts, ideas, dreams, creative writings and aspirations of young minds and it is a platform that provides exposure and freedom to express your views.

The theme of this year's magazine is of my personal interest. I also feel that the advancement in space technology is our National Pride. Among many space science projects The Chandrayaan programme also known as the Indian Lunar Exploration Programme is an ongoing series of outer space missions by ISRO for the exploration of the Moon. The program incorporates a lunar orbiter, an impactor, a soft lander and a rover spacecraft. The idea of a lunar scientific mission was first raised in 1999 during a meeting of the Indian Academy of Sciences (IAS) which was then carried forward by the Astronautical Society of India (ASI) in 2000.

### **Chandrayaan-1**

It was launched by ISRO in October 2008, and operated until August 2009. Chandrayaan-1 was successfully launched aboard the PSLV rocket. After earth bound maneuvers and trans lunar injection, Chandrayaan-1 entered the lunar orbit on 10 November, making India the fifth nation to orbit the Moon. Four days later, on 14 November, the Moon Impact Probe (MIP) impacted near the Shackleton crater, in the lunar south pole, this made India the fifth country to reach the lunar surface. The MIP made the most significant discovery by confirming the existence of water on the Moon.

### **Chandrayaan-2**

On 22 July 2019, Chandrayaan-2 was finally launched on LVM3 putting an end to several roadblocks that hit the mission during the decade. After orbit-raising maneuvers and finally the trans lunar injection, Chandrayaan-2 attained lunar Orbit on 20 August. On 6 September 2019, during the descent to the surface, the contact with the lander was lost after it crash-landed.

### **Chandrayaan-3**

With the Chandrayaan-2 orbiter already operational and the need of demonstrating landing capabilities, Chandrayaan-3's orbiter carried only a single payload and for its main purpose served as a propulsion module for carrying Vikram to the Moon.

Chandrayaan-3 was launched on 14 July 2023 aboard LVM3 and on 16 August 2023, the composite attained a final lunar orbit of 113 km × 157 km (70 mi × 98 mi). A day later, the orbiter separated from the lander and began its independent operations with SHAPE. The orbiter, also known as the Propulsion Module (PM) of Chandrayaan-3, was moved from its orbit around the Moon to an orbit around Earth.

Chandrayaan-3's Vikram lander had undergone major changes after its predecessor crash landed. There were now four instead of five main engines that provided 800 N (180 lbf) of thrust and had slew rate changing capabilities, unlike previously when the centrally mounted fifth engine lacked the capability. This enabled the lander to control the attitude and thrust during all phases of descent. The attitude correction rate was also increased from Chandrayaan-2's 10°/s to 25°/s with Chandrayaan-3. An additional laser Doppler velocimeter (LDV) was equipped that allowed attitude measurements in all three directions. The impact legs were made larger and stronger relative to Chandrayaan-2. The Chandrayaan programme has been vastly regarded as successful, especially with the discovery of lunar water.

I heartily congratulate the Members of the Editorial Board and students for their tireless efforts and wish them all the best. I appreciate the hard work and efforts in bringing out “Probaho” .



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## EXPLORING THE EVOLUTION OF POLYMER-BASED INSULATION TECHNOLOGIES

The reliability and efficiency of high voltage (HV) insulation systems depend heavily on the selection of suitable dielectric materials. Over the years, extensive research has been conducted to identify and enhance materials capable of withstanding electrical, thermal, and environmental stresses. Materials such as RTV silicone rubber (RTV SR), HTV silicone rubber (HTV SR), polyethylene (PE), polypropylene (PP), cross-linked polyethylene (XLPE), epoxy resin (ER), and polyvinyl chloride (PVC) have been widely studied for their dielectric performance in HV applications.

### **PVC and Surface Performance Evaluation**

Polyvinyl chloride has been examined for its insulating performance by evaluating key parameters such as electrical surface resistance, hydrophobicity, and diffusion characteristics in saline environments. Such investigations provide insight into PVC's behavior under contamination conditions, helping determine its suitability for HV insulation systems.

### **Polypropylene in HVDC Cable Applications**

Polypropylene, a thermoplastic polymer, has gained attention in HVDC cable insulation. Its recyclability, ease of processing, high melting temperature, and flexible electrical and mechanical properties make it a strong candidate for sustainable insulation solutions.

### **Epoxy Resin and Network Modification**

Epoxy resin is extensively used in HV systems due to its superior electrical and thermal properties. Research efforts have focused on enhancing its dielectric performance by modifying the epoxy network, including the introduction of alkyl branches into the base matrix. Such structural modifications significantly improve thermosetting material performance.

### **XLPE: The Industry Standard for Power Cables**

Over the past three decades, cross-linked polyethylene has become the preferred insulation material for power cables used in both distribution and transmission systems. Its excellent heat deformation capacity and strong dielectric properties have made it the most widely used insulation for voltage ranges from low voltage up to extra high voltage levels. Studies have explored its morphological structure, thermal endurance, electrical tree growth behavior, and overall dielectric performance.

### **Rise of Polymeric Insulators in Outdoor Applications**

In recent years, polymeric insulators have gained a competitive edge over traditional porcelain and glass insulators. Their lighter weight, enhanced vandal resistance, and superior

contamination performance make them highly suitable for outdoor HV systems.

### **Rise of Polymeric Insulators in Outdoor Applications**

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### **Silicone Rubber and PDMS in HV Systems**

Polydimethylsiloxane (PDMS), a widely used silicone polymer, has demonstrated desirable properties for HV applications. Silicone rubber (SR), in particular, has become a popular material for outdoor insulators due to its hydrophobic nature and durability.

RTV SR coatings have proven to be especially effective in contaminated environments. Studies indicate that such coatings can last for a decade or more with minimal maintenance, significantly reducing water washing requirements even in challenging conditions.

### **The Nano-Revolution in Dielectric Engineering**

With the emergence of nanotechnology, the fabrication of nano-dielectrics has become a transformative advancement in insulation engineering. Researchers have focused on enhancing the dielectric properties of silicone rubber and other polymers by incorporating nano-scale fillers.

### **Nano-Fillers for Enhanced Performance**

The addition of fillers such as Alumina Trihydrate (ATH), silica ( $\text{SiO}_2$ ), aluminum powder, and barium titanate ( $\text{BaTiO}_3$ ) has shown promising results. These additives help minimize material erosion at dry band arcing sites by reducing hot spot temperatures. Combinations such as aluminum and barium titanate further increase relative permittivity, making the material suitable for electrical stress grading applications in HV bushings.

Polymer nanocomposites have demonstrated the potential to produce more compact insulation systems, thereby reducing equipment costs and enhancing reliability. Improvements have been observed in hydrophobicity, electrical conductivity, permittivity, and thermal conductivity when nano or micro fillers are incorporated into SR matrices.

### **Graphene, Titania, and Advanced Nanocomposites**

The incorporation of high aspect ratio barium titanate fibers and graphene platelets into polymer composites has resulted in enhanced dielectric constants. Similarly, adding alumina and titania nano-fillers significantly improves tracking and erosion resistance with minimal changes in permittivity and dielectric loss.

Nano titanium dioxide ( $\text{TiO}_2$ ) has been shown to influence electrical tree propagation in silicone rubber-based nanocomposites. Improved bonding between nano  $\text{TiO}_2$  and the polymer matrix reduces tree growth speed while increasing partial discharge magnitude.

Silicon dioxide nanoparticles improve tracking and erosion resistance in both new and aged silicone rubber samples. However, filler concentration plays a critical role—while moderate levels enhance performance, excessive filler loading may degrade electrical properties, particularly in thermally aged materials.

### HTV Silicone Rubber and Environmental Durability

HTV SR has proven to be an excellent insulating material for outdoor applications due to its superior hydrophobicity and resilience against environmental and electrical stress. Research has examined its thermal stability, organic composition, and behavior under pollution, arid climatic aging, and combined thermal and electrical stress.

The replacement of conventional silica fillers with nano-sized  $\text{TiO}_2$  in liquid HTV silicone rubber has demonstrated optimized performance at specific filler loadings. Detailed dielectric response studies over wide frequency and temperature ranges further highlight the versatility of filled HTV SR composites.

Additionally, superhydrophobic nano-composite coatings developed through spray coating techniques have shown promising dielectric behavior across broad frequency ranges.

### Polymer Nanocomposites Beyond Silicone Rubber

Research extends beyond silicone rubber to other polymer systems:

- Magnesium oxide nanoparticles added to PVDF enhance breakdown strength and energy density.
- Nickel oxide nanoparticles have been characterized for dielectric behavior across varying temperatures and frequencies.
- Polypropylene nanocomposites with magnesium oxide fillers show improved insulation at lower filler concentrations.
- $\text{SiO}_2$  nanoparticles influence thermal, mechanical, and DC electrical properties in recyclable HVDC cable insulation materials.
- Nano-coated fillers affect electrical conductivity in polyethylene-based HVDC insulation.
- PVC nanocomposites containing nano- $\text{SiO}_2$  and nano- $\text{TiO}_2$  demonstrate improved AC breakdown voltage and dielectric stability, with optimal performance at specific filler percentages.

Advanced computational techniques such as feed-forward neural networks have also been applied to optimize SR/ $\text{TiO}_2$  nanocomposites for mechanical and electrical stability.

### Coating Technologies and Field Performance

Silicone rubber coatings have become widely used in coastal and polluted areas where flashover risks are high due to saline contamination. RTV SR coatings over ceramic insulators provide long-term protection and enhance service life. From an economic perspective, replacing damaged coatings is often more practical than recoating.

Studies have examined:

- Anti-icing performance of semi-conductive SR coatings
- Influence of coating thickness on leakage current and dry band arcing
- Behavior of liquid and HTV silicone rubber under acid rain conditions

Effects of uniform and non-uniform pollution on coated insulators. Results indicate that while leakage current may be independent of coating thickness, thicker coating can intensity dry band

discharges. Moreover, HTV SR generally exhibits better degradation resistance than liquid silicone rubber under harsh environmental exposure.

### **Current Trends and Future Outlook**

Comprehensive research in recent years has focused on incorporating conductive and semi-conductive nano-fillers into silicone rubber matrices. These modifications have led to improvements in electrical, thermal, hydrophobic, and erosion-resistant properties.

While silicone rubber is widely used as a stress grading material or coating for ceramic and glass insulators, recent studies have explored millable HTV SR coatings applied directly over porcelain insulators. Investigations into pollution performance, electric field distribution, and temperature distribution around coated insulators provide deeper understanding of real-world operational behavior.

### **Conclusion**

The evolution of dielectric materials for high voltage insulation systems reflects a continuous effort to enhance reliability, efficiency, and environmental resilience. From traditional polymers like PVC and XLPE to advanced nano-engineered silicone rubber composites, material innovation continues to drive progress in power transmission technology.

As nanotechnology and material science advance further, the development of multifunctional dielectric materials capable of simultaneously improving electrical, thermal, and mechanical properties remains a promising direction for the future of high voltage insulation systems.

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## ARTIFICIAL INTELLIGENCE AND THE FADING OF HUMAN EMOTIONS

The present era is often called the age of technology. Every day, new innovations are making the world faster, smarter, and more dependent on machines. Scientific and technological advancements have undoubtedly made human life easier, but at the same time, they have also deeply influenced the way



people think, live, and interact with society. At the center of this technological revolution stands Artificial Intelligence (AI). What was once only a concept of science fiction has now become an inseparable part of modern life.

Today, AI is capable of thinking, analyzing data, making decisions, and even understanding human language. From voice assistants on smartphones to self-driving cars, medical diagnosis systems, smart surveillance, and online recommendation platforms, AI is being used almost everywhere. In education, healthcare, business, communication, entertainment, and research, artificial intelligence is helping people perform tasks more quickly and efficiently.

However, amidst this rapid advancement, an important question gradually arises—are humans becoming too dependent on technology? Is AI slowly reducing human creativity, emotions, and the ability to think independently? In many cases, people now rely on machines instead of using their own imagination and reasoning. Earlier, writing an article, creating artwork, or solving a problem required personal effort and creativity. Today, many people can generate answers within seconds using AI tools.

The greatest strength of human beings is the ability to think, imagine, and learn through mistakes and experiences. Creativity is born from emotions, struggles, and personal understanding. But excessive dependence on technology is slowly affecting

this natural process. Many students nowadays rely heavily on AI for assignments, projects, presentations, and even creative writing. While this certainly makes work easier and faster, it can also reduce analytical thinking, originality, and the habit of deep learning.

There was a time when people gained knowledge through books, meaningful discussions, and personal experiences. People expressed emotions in their own words and spent time reflecting on ideas. In today's digital world, however, human attention spans are becoming shorter. Social media platforms and AI-driven systems constantly provide quick information and instant entertainment, making people less patient and less interested in deep thinking or meaningful conversations.

The influence of AI is especially visible in the world of digital content and social media. Today, countless images, songs, videos, and articles seen on online platforms are entirely AI-generated. Sometimes it becomes difficult to distinguish between what is real and what is artificial. In 2023, AI-generated images and deepfake technology became major topics of discussion worldwide. Several incidents showed how human faces and voices could be manipulated to spread misinformation. These examples highlighted not only the extraordinary capabilities of AI but also the risks associated with its misuse.

AI is also changing human habits and lifestyles. Earlier, people spent their leisure time reading books, writing diaries, or engaging in long conversations with friends and family. Today, many people spend hours scrolling through short digital content. The habit of receiving instant information is gradually reducing patience and the ability to think deeply.



As technology advances further, people are becoming more attracted to virtual interactions than real emotional connections.

Still, technology itself is not the enemy of humanity. If used wisely, AI can become one of the greatest tools for human progress. In healthcare, AI is helping doctors detect diseases more accurately. In agriculture, it is improving productivity and resource management. AI is also assisting scientists in research and helping authorities predict natural disasters more efficiently. Therefore, the problem does not lie in technology

itself, but in how humans choose to use it.

Artificial Intelligence may perform tasks like humans, but it cannot truly feel emotions. A machine can generate poetry, compose music, or create artwork, but it cannot experience love, pain, joy, or empathy the way humans do. Human emotions, imagination, and creativity are what truly distinguish people from machines.

The future will undoubtedly become more technology-driven, and AI will continue to evolve rapidly. But amidst all this progress, humanity must not lose its emotional depth, creativity, and individuality. Technology should assist human beings, not replace the essence of being human. The real challenge of the future will be maintaining a balance between technological advancement and human values. Because in the end, technology may change the world, but it is human emotions, imagination, and compassion that truly give meaning to civilization.

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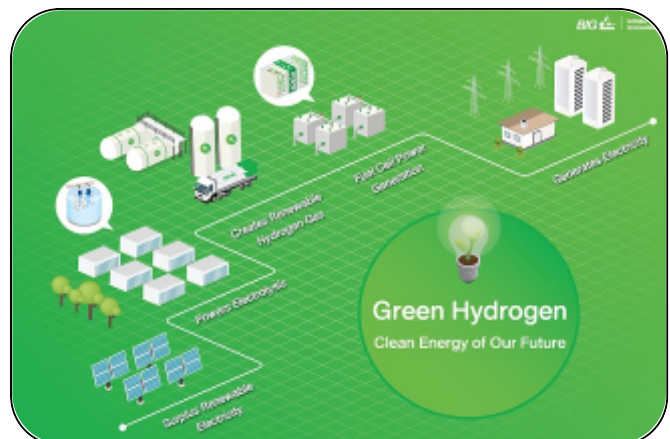


## GREEN HYDROGEN: THE FUEL OF THE FUTURE

### Introduction

The world today is facing a serious energy challenge driven by increasing energy demand, depletion of fossil fuel reserves, and environmental concerns. For decades, conventional fuels such as coal, oil, and natural gas have supported industrial development. However, their extensive use has resulted in severe environmental consequences, including air pollution, greenhouse gas emissions, and climate change.

Climate change is no longer a distant concern but a global reality. Rising temperatures, extreme weather events, and melting glaciers have forced governments and industries to search for cleaner energy alternatives. In this transition toward sustainable energy, hydrogen has emerged as a promising energy carrier. Among its various forms, green hydrogen is considered one of the cleanest fuels because it is produced using renewable energy without generating carbon emissions.



### What is Green Hydrogen?

Green hydrogen is hydrogen gas produced by splitting water into hydrogen and oxygen using renewable electricity generated from sources such as solar, wind, or hydro power. This process is known as electrolysis. Since renewable electricity is used and no fossil fuels are involved, green hydrogen is considered a zero-carbon fuel.

### Types of Hydrogen

Hydrogen can be produced using different methods:

- Grey Hydrogen – Produced from natural gas through steam methane reforming and releases

large amounts of CO<sub>2</sub>.

- **Blue Hydrogen** – Similar to grey hydrogen but with carbon capture and storage technology to reduce emissions.
- **Green Hydrogen** – Produced using electrolysis powered by renewable energy with zero carbon emissions.

Among these, green hydrogen is considered the most sustainable option.

### Production and Working Principle

The production of green hydrogen is based on the electrolysis of water, an electrochemical process that separates water into hydrogen and oxygen.

### Electrolysis Process

The basic steps involved are:

- **Water Supply:** Purified water is supplied to the electrolyzer.
- **Renewable Electricity:** Power from solar panels or wind turbines is provided to the system.
- **Electrolyzer Operation:** The device contains an anode, cathode, and electrolyte.
- **Chemical Reaction:** Electricity splits water into hydrogen and oxygen.
- **Gas Collection:** Hydrogen is collected, purified, and stored while oxygen may be released or used in industries.

### Types of Electrolyzers

- **Alkaline Electrolyzers** – Mature technology and relatively low cost.
- **PEM (Proton Exchange Membrane) Electrolyzers** – Higher efficiency and faster response.
- **Solid Oxide Electrolyzers** – Operate at high temperatures and offer high efficiency.

### Applications of Green Hydrogen

Green hydrogen can transform multiple sectors of the economy.

### Power Generation and Energy Storage

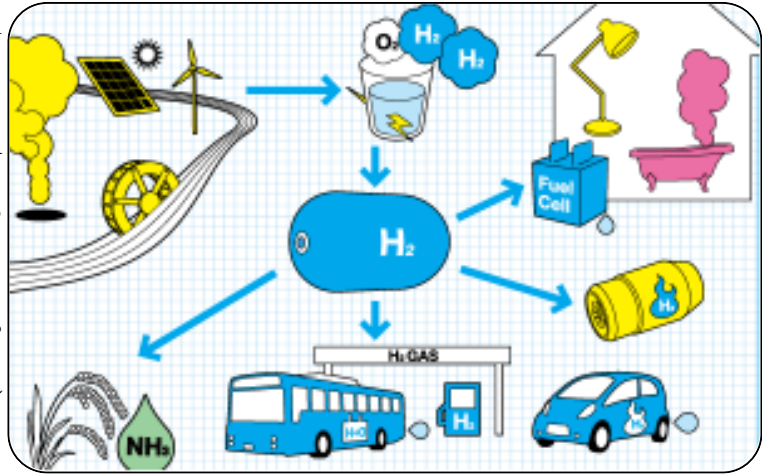
Hydrogen can be produced using different methods:

- Converts excess renewable electricity into hydrogen.
- Enables long-term energy storage.
- Helps stabilize renewable power grids.

Another major application is in the transportation sector. Hydrogen fuel cells can generate electricity by combining hydrogen with oxygen, producing only water as a by-product. This technology is particularly suitable for heavy vehicles such as buses, trucks, trains, and potentially aircraft, where battery solutions may be less efficient.

Green hydrogen can also play a vital role in decarbonizing heavy industries.

In the steel industry, hydrogen can replace coal in the production process, significantly reducing carbon emissions. Similarly, the fertilizer industry relies heavily on hydrogen for ammonia production, and replacing grey



hydrogen with green hydrogen could greatly reduce the environmental footprint of agriculture.

### Advantages of Green Hydrogen

Green hydrogen offers several advantages as a clean energy solution. It produces zero greenhouse gas emissions during both production and use, making it an important tool for combating climate change.

Hydrogen also has a high energy content per unit mass, which makes it suitable for heavy-duty transportation and industrial applications. Additionally, it can help improve energy security, as countries can produce hydrogen using their own renewable resources instead of relying on imported fossil fuels.

Another important advantage is sector coupling, where hydrogen connects electricity generation, transportation, and industrial systems into an integrated clean energy network.

### Challenges and Limitations

Despite its potential, several challenges remain:

#### Power Generation and Energy Storage

Hydrogen can be produced using different methods:

- **High production cost** due to expensive electrolyzers and renewable electricity.
- **Storage and transportation difficulties** because hydrogen has low volumetric density.
- **Infrastructure limitations**, including lack of pipelines and refueling stations.
- **Water requirements** for large-scale hydrogen production.

### Future Scope and Global Initiatives

Many countries are investing heavily in green hydrogen as part of their long-term climate strategies. Europe is focusing on hydrogen-based industrial decarbonization, while Japan and South Korea are promoting hydrogen-powered mobility solutions. Australia aims to become a global exporter of hydrogen using its abundant renewable energy resources.

India also has enormous potential for green hydrogen development due to its strong solar and wind resources, growing energy demand, and expanding industrial sector. National initiatives aim to promote green hydrogen in transportation, fertilizer production, steel manufacturing, and export-oriented hydrogen markets.

### Conclusion

Green hydrogen represents a transformative solution in the transition toward sustainable energy systems. By enabling clean energy storage, reducing industrial emissions, and supporting low-carbon transportation, it has the potential to reshape the global energy landscape. Although challenges related to cost, infrastructure, and technology remain, continuous research, falling renewable energy prices, and strong policy support are accelerating its development.

As the world moves toward a carbon-neutral future, green hydrogen is expected to become a key pillar of the global energy economy, offering a cleaner, safer, and more sustainable path forward.

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## UNSPOKEN - WHAT STAYED UNSAID

Unspoken words upon the tongue,  
half-born, half-held, forever young,  
they tremble where the silences stay,  
then quietly, they slip away.

Between two glances, still and slow,  
a thousand quiet meanings flow,  
no sound is made, no voice is raised,  
yet something lingers, deep and dazed.

A pause, a breath, a fleeting gaze,  
a moment lost in silent haze,  
what could be said is left behind,  
yet echoes softly in the mind.

For unspoken things are never gone,  
they hum beneath, they linger on,  
like distant songs we almost hear,  
still close enough, yet not quite near.

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## OVERTHINKING: MY BRAIN'S FULL-TIME JOB

There is a version of me that exists only at 2 a.m.

She lies awake, staring at the ceiling, replaying conversations that ended hours ago. She rewrites sentences she already spoke, wondering if a different word could have changed everything. She imagines outcomes that will probably never happen and yet, somehow, they feel real enough to hurt.

That version of me is an overthinker.

Overthinking isn't just thinking too much. It's turning small moments into big questions. It's reading between the lines that were never written. It's asking "what if" so many times that reality starts to blur with imagination.

What if I said something wrong?

What if they misunderstood me?

What if I'm not enough?

And just like that, a simple moment becomes a storm.

In college, where life is supposed to be about discovering who we are, overthinking quietly becomes a shadow that follows us everywhere. In classrooms, it whispers, "You're not smart enough." In friendships, it asks, "Do they really care?" In dreams, it questions, "What if you fail?"

It's exhausting carrying a mind that refuses to rest.

But here's the strange thing: overthinking often comes from caring too much. We overanalyse because we value people, opportunities, and our own self-worth. We want to get things right. We want to be understood. We want to matter.

And maybe... that's not entirely a bad thing.

The problem isn't that we think deeply. The problem is that we don't know when to stop.

Not every silence is awkward.

Not every mistake is permanent.

Not every thought is true.

Sometimes, peace lies in letting things be unfinished, unsaid, imperfect.

Maybe the goal isn't to silence our thoughts completely; that's impossible. Maybe the goal is to learn how to sit with them without letting them control us. To understand that just because a thought exists doesn't mean it deserves our belief.

Because at the end of the day, life isn't happening inside our heads. It's happening out there in messy conversations, spontaneous laughter, unexpected chances.

And if we spend all our time overthinking, we might just miss it.

So here's a small reminder, for myself and for anyone whose mind feels a little too loud:

It's okay to think.

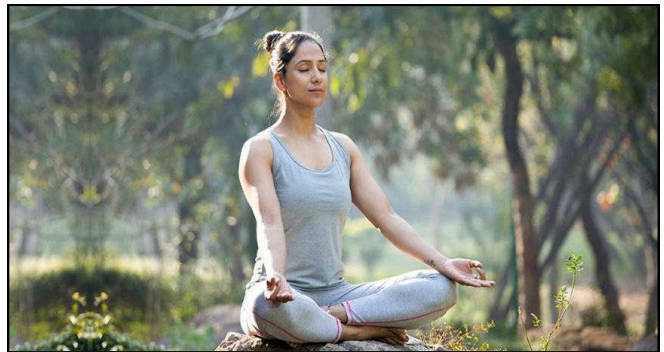
Just don't let your thoughts think for you.

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Dr. Sutapa Mukherjee  
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## LIVING WITH THE SCREEN — AND LEARNING TO LIVE BEYOND IT



For many software professionals, the workday begins with a screen and quietly ends with one. Morning emails blur into lines of code, meetings stack one after another, and before one realizes it, daylight has slipped away. The body remains still, but the mind races continuously. Over time, this way of working begins to leave subtle signals—stiffness in the neck, a dull ache in the lower back, restless sleep, unexplained anxiety. These signals are often ignored, dismissed as “part of the job,” until they become impossible to overlook.

The first and most fundamental shift needed is a return to movement—not as a separate fitness goal, but as a natural part of the workday itself. The human body was never designed to remain motionless for hours. Even brief moments of standing, stretching, or walking can reset circulation and calm the nervous system. A short walk between coding sessions, standing while reviewing code, or simply stretching the spine and shoulders allows the body to release the tension it quietly accumulates. Over time, these small acts of movement can significantly reduce pain, fatigue, and mental fog.

Beyond casual movement, deliberate physical activity plays a deeper role in restoring balance. Exercise does more than strengthen muscles; it directly influences brain chemistry. A brisk walk, a gym session, swimming, or yoga stimulates the release of endorphins and serotonin—chemicals that naturally elevate mood and counter anxiety.

Many professionals notice that on days they move their bodies, their thinking becomes clearer, their patience improves, and their emotional responses soften. Physical activity becomes not

another obligation, but a mental reset button in an otherwise cognitively demanding life.

Equally important is how the eyes and brain interact with screens. Continuous screen exposure places the nervous system in a state of constant alertness. The eyes strain, the brain stays stimulated, and true rest becomes elusive. Allowing the eyes to periodically disengage from the screen—by looking into the distance, stepping outdoors, or simply closing them for a moment—gives the nervous system permission to slow down. In the evenings, reducing screen time helps the brain recognize that the day is winding down, supporting deeper and more restorative sleep.

Mental health, often the most neglected aspect, deserves conscious care. Anxiety and panic do not appear overnight; they build quietly when the mind is never allowed to pause. Practices such as mindful breathing, meditation, or even a few minutes of stillness between tasks can make a profound difference. These moments of awareness help regulate the stress response and prevent the mind from spiraling into constant urgency. For some, speaking with a counselor or therapist becomes an essential step—not as a sign of weakness, but as an act of maintenance, much like servicing a high-performance machine before it breaks down.

Work structure itself also needs reflection. Many software professionals operate in an “always on” mode, responding to messages late at night and carrying unresolved problems into sleep. Establishing boundaries—clear start and end times, protected breaks, and realistic expectations—creates psychological safety. When the brain knows that rest is guaranteed, it performs better during work hours. Organizations that encourage such boundaries often find that productivity improves rather than declines.

Nutrition and hydration quietly shape mental resilience as well. Long hours in front of the computer often lead to skipped meals, excessive caffeine, and irregular eating patterns. Stable blood sugar and proper hydration support focus, emotional stability, and sustained energy. Foods that nourish the brain—whole grains, fruits, vegetables, healthy fats—become allies in maintaining mental clarity rather than afterthoughts in a rushed day.

Finally, there is the restorative power of sunlight, nature, and human connection. Stepping outdoors, even briefly, exposes the body to natural light that supports serotonin production and circadian rhythm regulation. Conversations that are not about deadlines or bugs, laughter shared with friends or family, and engagement in hobbies unrelated to screens all help re-anchor the individual in the real world. These moments remind the brain that life exists beyond code and deadlines, offering emotional grounding and perspective.

### A Sustainable Way Forward

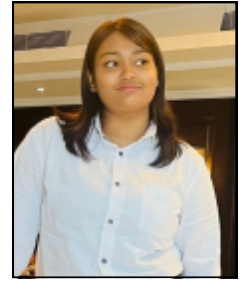
The software industry will continue to grow, and coding will remain a cornerstone of modern life. The challenge is not the work itself, but the way it is performed. When long hours of sitting, relentless screen exposure, and mental overdrive go unchecked, they gradually undermine both physical and psychological health. Anxiety, panic, burnout, and neurochemical imbalance are not personal failures—they are predictable outcomes of an unsustainable routine.

By reintroducing movement, respecting mental limits, nurturing the body, and consciously disconnecting at times, software professionals can reclaim balance. Sustainable productivity is not achieved by pushing harder, but by working in alignment with human biology. When physical health, mental well-being, and emotional resilience are protected, the very same professionals become more creative, focused, and fulfilled.

In the end, technology is meant to serve human life—not quietly diminish it.

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## WE DIDN'T WIN THE TROPHY, BUT WE WON HEARTS

October 2022, me slogging through my second year of college, when a casual whisper hit the corridors - girls' throwball tournament, kicking off early 2023. For most, just another event to scroll past. But for me? It was my shot at a comeback.

After years of not playing - thanks to Boards and COVID and everything it took away. I finally had a chance to return to the sport I loved. The excitement wasn't just about playing again. It was about representing my department. Competing. Feeling that rush again.

But building a team? That was the real challenge.

There weren't enough girls in my department. Across all years, the numbers were low and even fewer were willing to play. Still, I started asking around, convincing people one by one.

From my year, there was me, Prithika, Juhi, and Yaminy. From the first year, Tanushka and Debangsi. From third year, Sunayana di, Nandini di, and Chayanika di.

We were a team on paper.

In reality, we were beginners.

Except for me and Juhi, no one had a sports background. That meant starting from scratch - teaching how to catch, how to throw, understanding rules, learning positions. Every practice felt like starting from zero.

And yet, they showed up.

From far distances, after long days, tired but determined - they showed up. Slowly, effort turned into improvement. Improvement turned into confidence.

We were becoming a team.

Then came the setback.

Tanushka fractured her finger.

For a moment, everything felt uncertain. We already had limited players, and now we were losing one. I thought about giving up.

But the team didn't let me.

No one wanted to quit. Not even Tanushka. A month later, she returned and with her, our motivation came back stronger.

We practiced every day from January to February. And within a month, something incredible happened - we were ready.

Maybe not perfect.

But ready to fight.

Then comes Match Day.

Our first match was against CSE. Nerves took over. It was our first time, and somewhere along the way, things slipped. And then, in the middle of it all -

I got injured.

A ligament tear in my left hand.

Standing there, in pain, I felt like I had let my team down. But there was no time to stop. Our next match against BCA was right in front of us.

I wrapped my hand. Put ice on it. And stepped back onto the court.

But I knew something, I couldn't rely on my catches anymore.

So I made a decision.

I would finish the match with my serves.

The first set ended 15-8.

We were in control.

My team helped a lot. Despite me losing many catches they never blamed me.

The second set?

15 - 0.

Point after point, serve after serve - I kept going. I didn't give the game a chance to come to my weakness. I turned it into my strength.

Took every point from my serves only.

And just like that, we won the match 2 - 0.

That victory wasn't just about the scoreline. It was about proving to myself and to my team that even when things go wrong, we can still find a way to win.

The next day brought the semi-final.

My mom scolded me and told me not to go because of my hand injury.

But how can I leave my team to fight alone?

I showed up. With bandages in my hand

Electrical vs IT.

And on the other side was Disha - one of my close friends. Someone I had once taught throwball to. Now, we stood on opposite sides of the court.

Three sets. Endless deuces. Scores tied again and again. What should have ended at 25 stretched beyond 35. Every point felt like it could decide everything.

It felt like a final. Everyone was so invested in that match.

But we lost.

By a margin so small, it almost didn't feel real.

Tears came - mine, and everyone's.

It hurt. We were so close.

But even in that moment, there was something stronger than disappointment.

Pride.

Because we weren't supposed to reach here. We were a team built from scratch, trained in just a month, filled with players who had never played before.

And yet, we stood there - fighting till the very last point.

We didn't win the trophy.

We won hearts. Hearts of our friends who came to cheer for us. Hearts of every player there who thought we can't give a strong fight to the other team. Hearts of the teachers who came to see.

We won a bond that will never fade.

And that day, through tears and smiles, we made a promise -

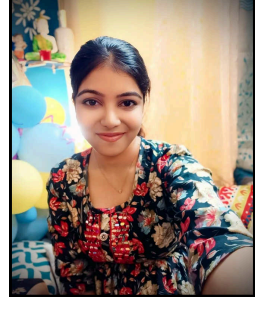
\*Next time, we'll win.\*

Because some teams are remembered for their trophies.

Ours will always be remembered for its heart.



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## আমার ছোটকু

তুই ছিলিস কদিনেরই যখন আমি তোকে দেখি  
 মিটমিটিয়ে চেয়ে ছিলিস আমি ভাবলাম একি !  
 ছোট্ট একটা বাব্বর মধ্যে শুয়ে ছিলিস তুই,  
 মন করছিল আদর করে তোকে একটু ছুঁই।



ছোট্ট ছোট্ট হাত তোর আর ছোট্ট ছোট্ট পা,  
 গুটি গুটি পায়ে হাঁটতি তুই, সারাটা বারান্দা।  
 ছোট্ট দুটো কান তোর আর এতটুকুন লেজ  
 তুই কোলে থাকলে মনে হত এ কেমন আলাদাই আমেজ।

তাও আমার মনে আজ ও এত ক্লেশ,  
 কেন চলে গেলি ছোটকু, ফেলে স্মৃতির রেশ?  
 খেলার সাথী কেউ নেই আজ, নিব্বুম কোণটা ঘরে,  
 তোর ওই নরম গায়ের গন্ধ আজও আমার মনে পড়ে।

খাবার খালাটা পড়ে আছে ঠিক আগের মতই রাখা,  
 তোকে ছাড়া আজ বারান্দাটা বড়ই নিব্বুম, ফাঁকা।  
 ডাকলে পরে আসবি না আর অভিমানে বুঝি?  
 অন্ধকারে আজও আমি তোর ওই মিটিমিটি চোখ খুঁজি।

হয়তো তুই ভালোই আছিস কোনো তারার দেশে,  
 হঠাৎ করে আসিস না হয় আমার স্বপ্নে এসে।



-Debangsi Biswas, 1<sup>st</sup> Year Student  
Department of Electrical Engineering

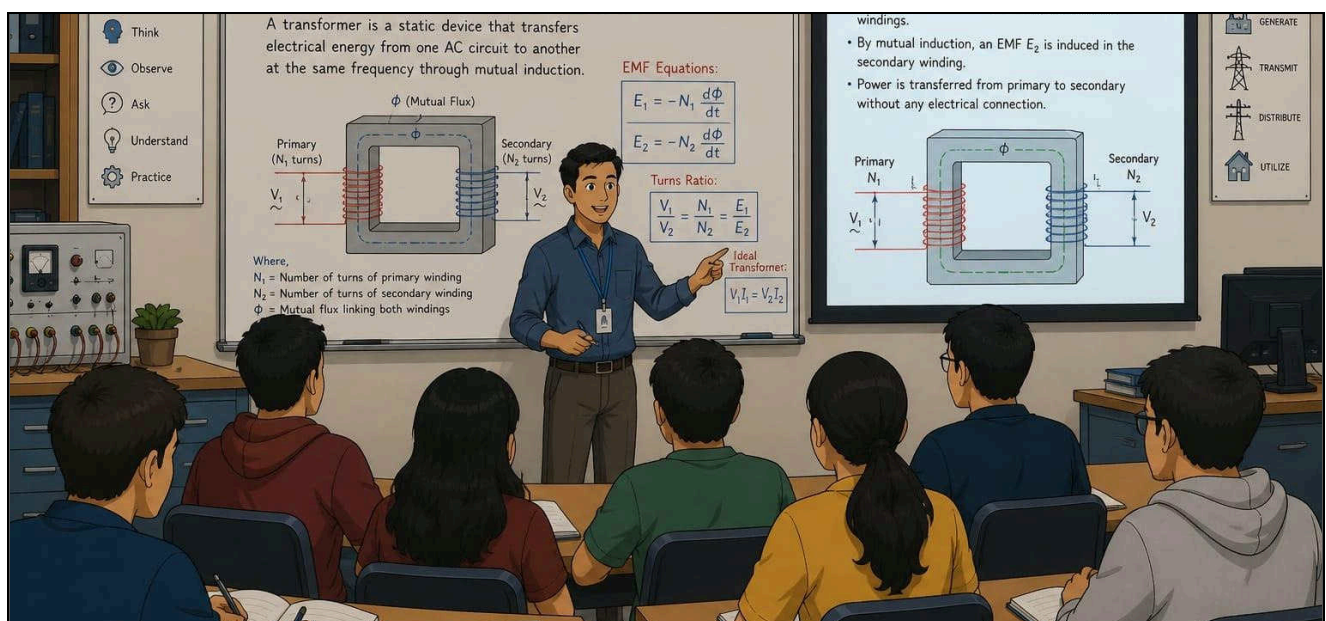
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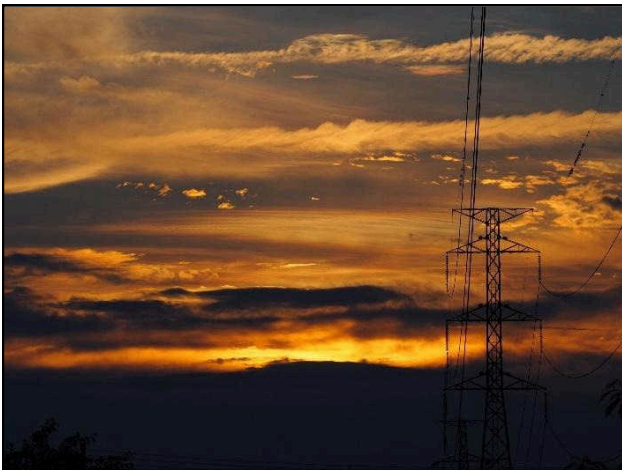
## QUIETER CLASSROOMS, LOUDER NEED FOR POWER: AN EDUCATOR'S PERSPECTIVE ON ELECTRICAL ENGINEERING

In recent years, a gradual yet noticeable change has emerged within engineering education. Electrical Engineering, once regarded as one of the most sought-after disciplines, is witnessing a decline in student enrolment. Classrooms that previously echoed with curiosity, discussion, and intellectual energy now appear quieter. Yet, outside these academic spaces, the demand for electrical power and technological advancement continues to grow at an unprecedented pace. This contrast highlights a compelling paradox: while fewer students are choosing Electrical Engineering, the world's dependence on it has never been greater.

As an educator in the field of Electrical Engineering, I have had the privilege of observing how this discipline influences both individual growth and societal development. Electrical Engineering is not merely a technical subject—it is the foundation of modern civilization. From the simplest household appliance to complex industrial systems, electricity is an invisible force that sustains our daily lives. The uninterrupted supply of electrical energy enables communication, healthcare, transportation, education, and countless other sectors to function seamlessly.



The scope of Electrical Engineering is both vast and dynamic. It begins with the generation of electricity using diverse energy sources, including thermal, hydroelectric, nuclear, solar, and wind power. Each method involves sophisticated technologies and careful planning to ensure efficiency and sustainability. Once generated, electricity must be transmitted over long distances through high-voltage transmission lines and distributed safely to homes, industries, and institutions. Electrical engineers play a crucial role in designing, operating, and maintaining these systems, ensuring that power is delivered reliably and economically.



In addition to power systems, Electrical Engineering is deeply embedded in the advancement of modern technology. Industrial automation, driven by electrical control systems and robotics, has revolutionized manufacturing processes, improving efficiency and precision. The transportation sector is undergoing a significant transformation with the rise of electric vehicles, which promise reduced emissions and sustainable mobility. Communication networks, including mobile and internet technologies, rely heavily on electrical and electronic principles. Even cutting-edge domains such as artificial intelligence, machine learning, and the Internet of Things are built upon electrical engineering concepts like signal processing, sensors, and embedded systems.

In today's world, sustainability has become a global priority, and Electrical Engineering stands at the forefront of this movement. The transition from conventional fossil fuels to renewable energy sources requires innovative solutions for energy generation, storage, and distribution. Smart grid technologies are being developed to optimize energy consumption, reduce losses, and integrate renewable sources efficiently. Electrical engineers are not only responsible for creating these systems but also for ensuring that they are accessible, reliable, and environmentally friendly.

Despite these vast opportunities and contributions, the declining interest in Electrical Engineering among students is a matter of concern. Many students are increasingly drawn to newer fields that appear more aligned with current trends, such as computer science, data science, and artificial intelligence. While these disciplines are undoubtedly important, it is essential to recognize that they are closely interconnected with Electrical Engineering. Without a solid understanding of electrical systems and hardware, the full potential of these emerging technologies cannot be realized.

From a teacher's perspective, Electrical Engineering is not limited to theoretical knowledge or mathematical analysis. It is a discipline that nurtures critical thinking, creativity, and problem-solving abilities. In the classroom, students are encouraged to explore concepts through experiments, simulations, and real-world applications. They learn to design circuits, analyze systems, and develop solutions to complex engineering challenges. These experiences not only build technical competence but also confidence and a sense of responsibility.

Teaching Electrical Engineering also offers a unique opportunity to inspire students by connecting academic concepts with real-life applications. When students understand how their learning translates into practical solutions—such as powering a village, improving industrial efficiency, or developing sustainable energy systems—they begin to appreciate the true value of the discipline. This realization can serve as a powerful motivator, encouraging them to pursue careers that contribute meaningfully to society.

The quieter classrooms, therefore, should not be interpreted as a decline in the importance of Electrical Engineering. Instead, they should be viewed as a call to action for educators, institutions, and policymakers. There is a need to bridge the gap between perception and reality by creating awareness about the significance and potential of this field. Innovative teaching methods, industry collaborations, internships, and hands-on training can play a vital role in attracting and retaining students. In conclusion, while the number of students enrolling in Electrical Engineering programs may fluctuate, its relevance remains constant and indispensable. The world continues to rely on electrical power for its growth and sustainability, and this dependence will only increase in the future. As educators, we have a responsibility to guide, motivate, and inspire the next generation to recognize the importance of this field. By doing so, we can ensure that Electrical Engineering continues to power not only our homes and industries but also the dreams and aspirations of future innovators.

The classrooms may grow quieter, but the need for power and for those who understand it will always be loud and clear.

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## APPLICATION OF AI AND ML IN ELECTRICAL ENGINEERING

### Abstract

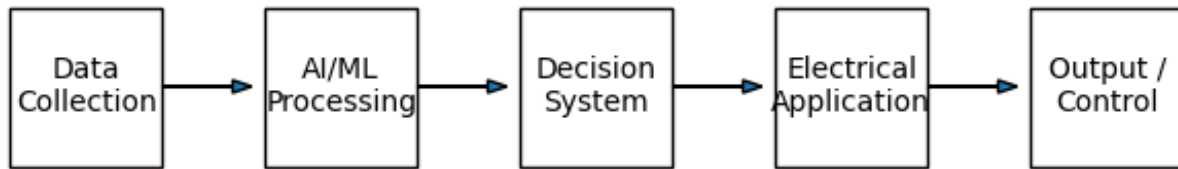
Artificial Intelligence (AI) and Machine Learning (ML) are rapidly transforming electrical engineering by enabling intelligent monitoring, predictive control, adaptive operation, and automated decision-making across power systems, machines, and industrial applications. Traditional electrical systems were designed using deterministic mathematical models, but modern infrastructures generate enormous volumes of operational data that can be processed more effectively through data-driven algorithms. AI techniques such as neural networks, fuzzy logic, and genetic algorithms are increasingly used to solve nonlinear and complex engineering problems. Machine learning allows systems to identify hidden patterns in electrical data, predict future operating conditions, and optimize system responses without explicit reprogramming. Major Applications of AI and ML in Electrical Engineering, includes smart grids, fault diagnosis, renewable energy forecasting, predictive maintenance, electric vehicles, industrial automation, and intelligent control.

### Introduction

Electrical Engineering has entered a new era where digital intelligence complements conventional power and control theories. Power generation, transmission, and utilization systems today produce massive streams of sensor data through SCADA systems, IoT devices, smart meters, and digital relays. Conventional methods often struggle to process these datasets in real time. AI and ML solve this limitation by converting raw electrical measurements into actionable intelligence.

Artificial Intelligence refers to computational systems capable of copying human reasoning, pattern recognition, and decision-making. Machine Learning is a subset of AI in which algorithms learn from historical data and improve performance automatically. In Electrical Engineering, AI supports complex nonlinear analysis where exact physical models become difficult or expensive to derive.

The integration of AI and ML is particularly important because electrical systems now demand reliability, self-correction and sustainable operation. From transformer fault detection to renewable energy scheduling, AI enables faster and more accurate decisions than conventional rule-based methods.



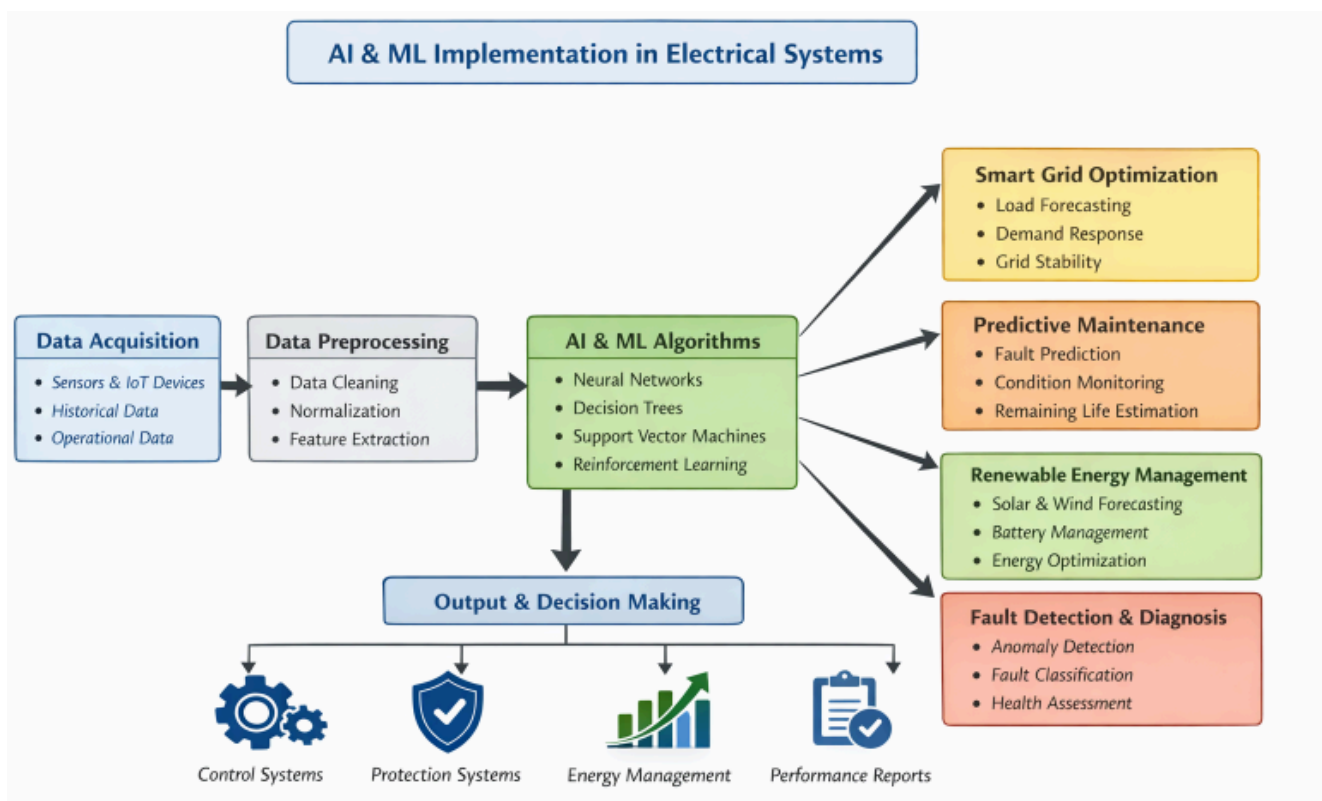
### Basic AI–ML Framework in Electrical Systems

The general implementation framework starts with data collection from sensors, meters, relays, and monitoring devices. These data are preprocessed and sent to an AI or ML engine. The trained model identifies patterns, predicts conditions, and sends optimized commands to controllers or operators.

The framework typically includes:

- Signal acquisition
- Data preprocessing
- Feature extraction
- Model training
- Decision output
- Control execution

This architecture is now widely used in digital substations, intelligent drives, and industrial automation systems



## AI/ML Applications in Electrical Engineering

AI/ML has a vast and diverse range of applications across the field of Electrical Engineering, enhancing its capabilities in many innovative ways. It makes the Electrical systems more smarter more efficient, and able to learn on their own. Some fields of applications are listed below--

### 1. Smart Grid Applications

A smart grid is one of the most important AI-driven developments in Electrical Engineering. It integrates communication, sensing, and intelligent control into power networks. AI improves grid performance through dynamic load balancing, fault prediction, and energy demand forecasting.

Machine learning algorithms analyze historical consumption data to predict hourly and seasonal demand. Utilities use this information for generation scheduling and load dispatch. Neural networks are particularly effective because electrical demand depends on nonlinear factors such as weather, holidays, industrial behavior, and human activity. AI also supports self-healing grids. If a transmission fault occurs, intelligent systems isolate the affected zone and restore power through alternate routes automatically. This reduces outage duration and improves reliability.

Smart controllers adjust reactive power compensation devices and tap-changing transformers based on real-time voltage conditions.

### 2. Fault Detection and Diagnosis

Fault diagnosis is one of the most important applications of AI/ML in Electrical Engineering. Equipment failures in transformers, motors, generators, and transmission lines can cause major operational losses if not detected early.

Power transformers use insulating oil. When faults occur inside the transformer, the oil decomposes and produces gases. These gases dissolve in the oil and can be analyzed to detect faults. Transformer diagnosis often uses this dissolved gas analysis(DGA) data. These gases dissolve in the oil and can be analyzed to detect faults. Machine learning models classify internal faults by identifying gas concentration patterns.

Motor fault diagnosis uses vibration, current and temperature data. AI identifies bearing faults, rotor bar defects, and insulation degradation.

Transmission line protection also uses AI-based classifiers that detect whether a fault is line-to-ground, line-to-line, or three-phase. Compared with conventional relays, AI improves classification speed and fault location accuracy.

### 3. Renewable Energy Integration

Renewable energy introduces uncertainty because solar and wind generation depend strongly on environmental conditions. AI helps electrical engineers manage this variability. Solar forecasting uses irradiance, cloud cover, temperature, and historical

output data to estimate future power generation. ML models improve dispatch planning and battery coordination. Wind forecasting uses wind speed, atmospheric pressure, and turbine operational history to estimate future output. Accurate forecasts help grid operators maintain frequency stability.

AI also optimizes battery charging and discharging schedules in hybrid renewable systems. This improves storage utilization and reduces power fluctuation.

#### 4. Control System, Electrical Machines and Drives

Conventional PID controllers may not perform optimally when parameters change, but AI-based adaptive controllers learn better responses. Fuzzy logic controllers are widely used in induction motor speed control. Neural networks estimate torque and flux without requiring complete machine models.

In Electric traction systems, AI improves acceleration smoothness, regenerative braking control, and energy recovery.

#### 5. Electric Vehicles and Charging Systems

Electric vehicles depend heavily on intelligent battery management. ML predicts battery state of charge, state of health, and thermal behavior.

Charging stations use AI to schedule charging based on grid demand and electricity tariff. This avoids peak overload. Route optimization in EVs also uses machine learning by considering traffic and battery condition.

Future vehicle-to-grid systems will use AI to decide when EV batteries should return power to the grid.

#### **Challenges and Future Scope of AI/ML**

Despite strong benefits, AI implementation faces challenges such as high-quality data requirements, cybersecurity risks, and model interpretability. Electrical engineers must also validate AI outputs carefully because critical systems require high reliability.

Future research will focus on self-healing power systems which can detect faults, isolate affected sections and restore supply. AI supports autonomous substations, global sustainability goals. Smart factories use AI for Fault detection, Energy optimization & Process control.

#### **Conclusion**

AI and ML are now driving the advancement of Electrical Engineering. They improve reliability, efficiency, predictive capability, and automation across almost every domain of power and energy systems. Smart grids, renewable integration, predictive maintenance, and intelligent drives clearly demonstrate how data-driven intelligence enhances traditional Electrical Engineering methods. As Electrical infrastructure becomes more digital, AI competence will become an essential skill for future engineers.

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## BEFORE THE WORLD SAW

A quiet man in London's haze,  
He spent his nights in cinema's glow.  
Through silver screens and studied gaze,  
He learned the truths few come to know.  
While city streets surrendered sleep,  
He traced each frame with patient art,  
Where fleeting images run deep  
And mirror life's unspoken heart.  
What seemed at first a passing phase,  
An idle drift through reels and light,  
Became the craft that shaped his ways  
And turned his vision into sight.  
From distant lands to native soil,  
He brought those stories, rich and grand,  
Transforming years of silent toil  
Into a voice for his own land.

Atreyee Chakraborty

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## EUREKA

We all know the story. Don't we ? So , what is this EUREKA probably ? The Greek word 'Eureka' is often described as an exclamation. An Eureka or an Eureka moment is actually a magical epiphany or a moment of sudden and great revelation or realization, also known as an "Aha!" moment, the sudden clarity we feel at solving a puzzle or finally understanding a previously unsolicited concept. Now come again , the thing is where did this word come from ? So , we know science is all about facts and discoveries, with some of the remarkable breakthroughs coming from seemingly everyday occurrences and experiences. One of the oldest and well-known tales revolves around Archimedes' legendary "Eureka!" moment.

The classic "Eureka" story about Archimedes comes from a problem he was asked to solve by King Hiero II of Syracuse. The king had commissioned a crown made of pure gold, but he suspected the goldsmith might have mixed in cheaper silver. The challenge was quite tricky, Archimedes had to figure out whether the crown was pure gold without tampering it; thus he couldn't melt it down or reshape it. Archimedes struggled with this for a while. Then, according to the famous account, the breakthrough came when he was stepping into a bath. As he got in, he noticed the water level rising and some water spilling over. That observation triggered the key insight; an object displaces a volume of water equal to its own volume. That meant he could measure how much water the crown displaced and compare it with the displacement of a same weight piece of pure gold. Since silver is less dense than gold, a crown mixed with silver would displace more water than pure gold of the same mass. With this discovery of realising how to measure volume using water displacement , he immediately hopped out of the bath and ran naked into the streets to tell the king, shouting loudly 'Eureka! Eureka!' I have found it! I have found it! , in delight. We don't stop with Archimedes , as per history says even Sir Issac Newton and Galileo Galilei experienced eureka moments in their own specific ways , but what is not mentioned is that there are numerous people who all have experienced eureka moments in their own world. It might be in their very simple ways , even in their everyday occurrences.

Now , what happens in the brain during a ' eureka moment ' ?

Scientists have found through research that the rush of excitement that came with the moment of eureka was produced by an influx of dopamine into a part of the brain called the nucleus accumbens. The nucleus accumbens was active throughout the process of problem-solving, but particularly so at the moment of insight. This part of the brain, in the basal forebrain, is part of the dopamine network that is triggered when we receive a reward. In other words, more scientifically to express it can be worded like :

Firstly , when someone is struggling with a problem, the brain is actively processing in a focused, analytical mode mainly involving the prefrontal cortex, which handles the logic and reasoning . If the solution doesn't come up, the brain immediately shifts gears rather than giving up. When relaxing or taking a break, a different network that is the default mode network (DMN) becomes more active. This network quietly explores connections, memories, and patterns in the background. At some point of time, the brain finds a new connection that resolves the problem. Just before the insight reaches awareness, there's a brief burst of high-frequency neural activity (gamma waves), especially in the right temporal lobe, which is associated with the pattern recognition and integrating distant ideas. That's the "aha" ignition point. Then comes the feeling of the brain's reward system which releases dopamine, giving that rush of clarity, certainty, and even excitement. That's why Eureka moments feel so satisfying because they are chemically reinforced. So in simple terms, it's not random inspiration rather hormonal signalling to the rest of the brain information about emotion, memory processes, and levels of alertness.

Now let us know about EUREKA more , Eureka is also known as insight, which is a psychological term that attempts to describe the process in problem solving when a previously unsolvable issue becomes suddenly clear and obvious. Eureka goes through four different stages that are preparation, incubation, illumination, and verification. Suppose we wanted to activate the process for a personally important challenge. First, we need to work for a prolonged time on the issue with stable mental energy and emotional involvement. After some time, you'll have some low processed solutions but intuitively feels as if they're not the right solution. Now we move to the second step of the process that is known as incubation. We let go of our challenge and commit its resolution to the subconscious realm. We begin focusing on something else and doing other things. Then, probably when we least expect it, the breakthrough idea comes to us suddenly in a Eureka moment known as illumination. In the final stage that is known as verification, we then work on all the details of our breakthrough idea to be able to share it with others so that they understand what it's all about and what solution we propose.

Lastly, the thing that we need to know about the Eureka moment is that aha! moments are indeed satisfying in part because they feel so right; all the pieces of a puzzle appear to fit in the exact right place with barely little conscious effort. But can we trust such sudden solutions? It is not easy to say that insight is always the best strategy. There are many difficult questions which often need several different strategies to arrive at a correct or perfect solution but there may not be a perfect solution to a problem. So , we may or may not trust insights but we can continue with our life doing our required needs. But we can say everyone , literally everyone can experience eureka moments in any or other ways in their life. However, the Eureka moment is truly a beautiful feeling indeed. It is the feeling of success or victory. The success of finding the most desired thing in the most unexpected way when being in a very conscious way.

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## Abstracts of the published paper in 2022-23

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**1. Title: Optimal switching scheme of thyristor-controlled LC compensator to enhance the power quality in unbalance distribution system**

**Author: Anushree Roy, Sudipta Debnath and Subhra De**

**Published: 28 th March 2023 in Springer Electrical Engineering**

**Abstract:**

This study presents a low-cost thyristor-controlled LC compensator scheme for the improvement of overall power quality in the distribution system. The parameters of the compensator have been designed and optimal triggering angles for thyristor switching have been obtained for reducing the unbalanced condition and harmonic injection at a high power factor. Compared to the traditional static VAr compensator schemes, the proposed technique can significantly reduce the harmonic injection into the system. The particle swarm optimization technique has been applied to compute the optimal triggering angles, and different aspects of the power quality factor have been assessed through rigorous simulations. Power quality assessment has been further validated through an experimental setup in the laboratory. Finally, a comparison of the proposed scheme with other similar schemes has been carried out to highlight its efficacy.

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## **2. Title- Electrical Characterization of XLPE Embodied With Copper Oxide Nanoparticles**

**Author- Argha Kamal Pal, Arrco Banerjee, Abhijit Lahiri**

**Paper- 2023 IEEE 8th International Conference for Convergence in Technology (I2CT)**

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### **Abstract:**

For electrical insulation purposes, polymer composite materials have gained huge attention. Their performance improves especially if they are embodied with nano/micro fillers. In this study, Cross-Linked Polyethylene (XLPE) has been incorporated with Copper Oxide (CuO) nanoparticles, and their electrical characterization has mainly been highlighted.

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*“Years Will Pass, Memories Will Remain.”*



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