



MANGALAM
COLLEGE OF ENGINEERING

Inspire | Imbibe | Innovate

TECHNICAL MAGAZINE
2023-24

ELECTROVISION

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING





MANGALAM COLLEGE OF ENGINEERING

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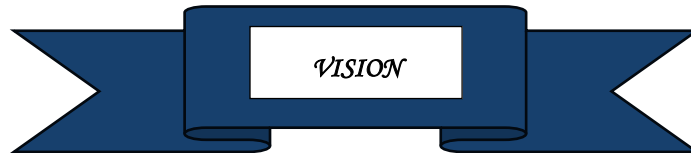
TECHNICAL MAGAZINE



Mangalam College of Engineering

Mangalam Hills, College Rd, Vettimukal P.O,

Ettumanoor, Kerala 686631

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

To excel as a premier department in education and research, supporting our students to shape their dreams of becoming employable and committed engineering professionals.



Relentlessly strive to create vibrant learning environment, provide state of the art laboratory facilities, and actively engage in research and live up to high moral and ethical standards.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Apply the fundamental knowledge to identify, analyze and solve various real time problems (complex problems) in Electrical Power Systems which comprises of control and protection circuits, power electronic circuits, etc.

PSO 2: Apply emerging technologies along with modern software tools (like MATLAB, PLC, ECAD etc) for designing, simulating and analyzing electrical as well as electronic system to engage in lifelong learning.

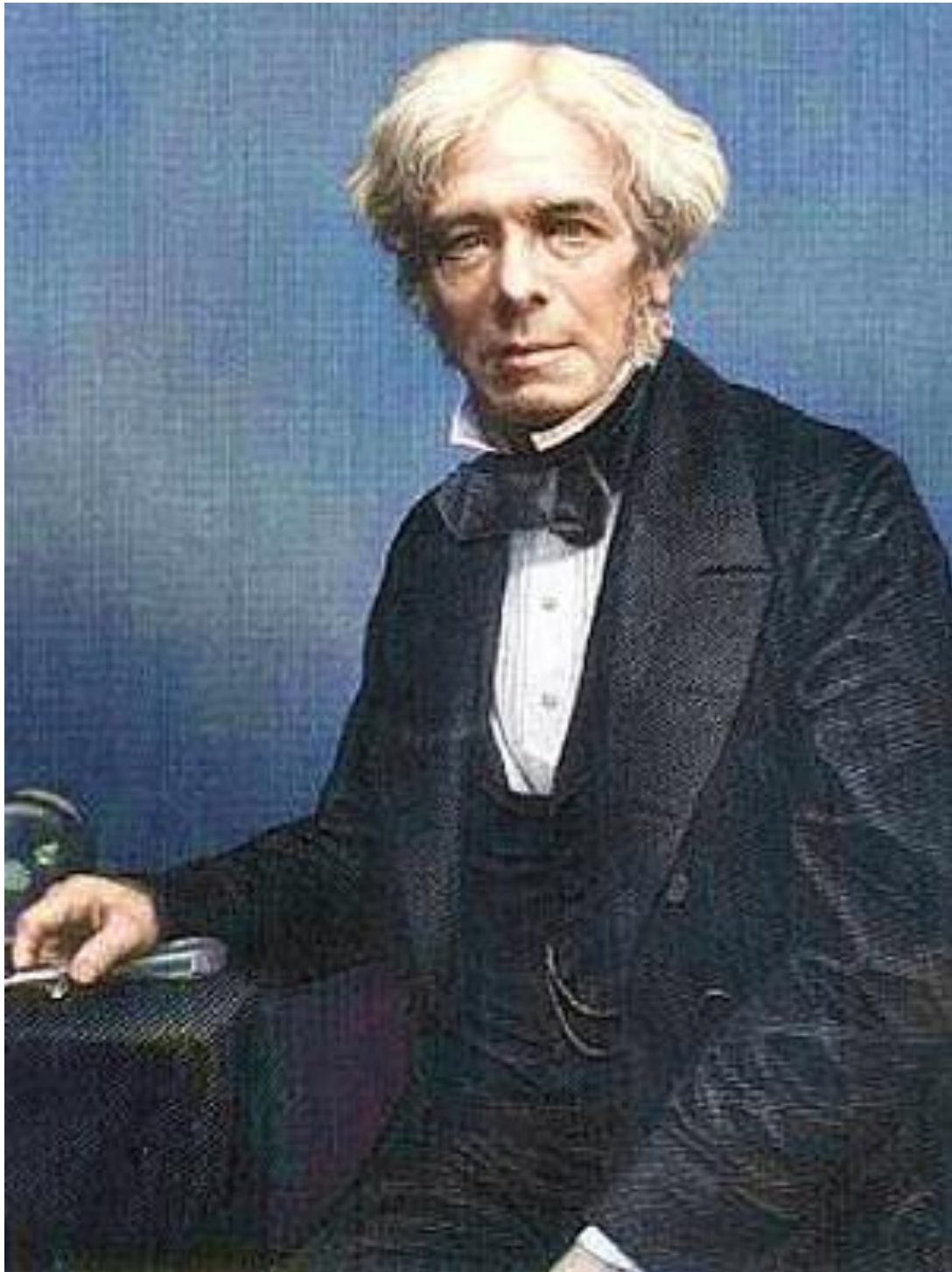
PSO 3: Able to utilize project management techniques and sustainable engineering for developing projects related to electric vehicles, smart power grids, automatic controllers, control and protection circuits, energy management and savings, embedded systems etc.

PROGRAMME EDUCATION OBJECTIVES (PEO)

PEO 1 [Focus: Domain Knowledge and Practical Implementation Skills]: The graduates will have foundation in science, maths and management to interpret core electrical engineering subjects and ability in designing, formulating and solving experimental projects through simulation and hardware.

PEO 2 [Focus: Employability, Leadership, Team work, Communication Skills and Professional studies and pursue lifelong learning. The graduate will be employable with capabilities like communication skills, working with and building teams, upholding moral and ethical values.

PEO 3 [Focus: Life Long Learning and Higher Studies]: The graduates will be equipped for higher Practice]:



Michael Faraday

(22 Sep 1791 - 25 Aug 1867)

"Electricity is often called wonderful, beautiful; but it is so only in common with the other forces of nature."

MAGAZINE EDITOR

It gives me immense pleasure to present this edition of the EEE Department Technical Magazine, a platform that showcases the technical brilliance, innovative spirit, and academic endeavors of our students and faculty. In an era where Electrical and Electronics Engineering is shaping the future through advancements in electric mobility, smart grids, automation, and renewable energy, this magazine serves as a window into our department's continuous pursuit of excellence.

Each article, project, and idea featured here reflects the vibrant learning environment and the commitment of our department to stay aligned with industry trends and research. I hope this issue ignites curiosity, encourages collaboration, and inspires all readers to keep exploring the ever-evolving world of electrical engineering.

Mrs. Preethi Sebastian

Assistant Professor

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MESSAGE FROM CHAIRMAN

It is with great pride and pleasure that I extend my warmest greetings to all readers of this edition of our departmental technical magazine.

At Mangalam College of Engineering, the Department of Electrical and Electronics Engineering has always been at the forefront of academic excellence, research innovation, and holistic student development. We are committed to equipping our students with strong theoretical foundations, practical skills, and the adaptability required to thrive in a rapidly evolving technological landscape.

This magazine is a testament to the creativity, dedication, and intellectual vitality of our students and faculty. It reflects the vibrant academic culture of our department, showcasing insightful articles, innovative projects, and noteworthy achievements that highlight the spirit of inquiry and passion for engineering that defines our EEE community.

I would like to congratulate the editorial team, student contributors, and faculty coordinators for their commitment and hard work in making this publication a reality. I am confident that this magazine will serve not only as a platform for knowledge sharing but also as a source of inspiration for all aspiring engineers.

Wishing you all success, growth, and continued excellence in every endeavor

With warm regards,.

Dr. Biju Varghese,

Chairman, Mangalam educational institutions



MESSAGE FROM THE PRINCIPAL

It gives me great pleasure to pen a message for the technical magazine published by the Department of Electrical and Electronics Engineering at Mangalam College of Engineering.

The role of technical education today goes far beyond the classroom. It involves nurturing inquisitive minds, fostering innovation, and encouraging students to apply their knowledge to real-world challenges. The Department of EEE has consistently upheld these ideals, providing a dynamic environment where academic rigor and practical exposure go hand in hand.

This magazine stands as a proud reflection of the department's academic spirit, technical competence, and commitment to excellence. It showcases the collective efforts of students and faculty, bringing forth a diverse range of articles, project highlights, and creative expressions. I am particularly pleased to see the department encouraging young minds to document their insights and discoveries, which is vital in building confidence and a research-oriented mindset.

I congratulate the Head of the Department, faculty members, editorial team, and all the students who have contributed to this publication. May this magazine inspire all readers to explore, innovate, and achieve greater heights in the field of Electrical and Electronics Engineering.

Wishing the department continued success in all its future endeavors.

Warm regards,

Dr. Vinodh P Vijayan

M.Tech., Ph.D.



MESSAGE FROM THE HOD

It gives me immense pleasure to present this edition of our departmental technical magazine, a platform that reflects the academic zeal, technical prowess, and creative energy of the students and faculty of the Department of Electrical and Electronics Engineering.

In today's rapidly evolving technological world, the role of electrical and electronics engineers is more critical than ever. From powering the world to driving innovations in automation, smart systems, and renewable energy, the opportunities are vast and inspiring. At Mangalam College of Engineering, our department is committed to preparing students to meet these challenges with confidence, integrity, and innovation.

This magazine serves not only as a chronicle of departmental activities and achievements but also as an avenue for students to express their technical insights, research initiatives, and innovative ideas. It is heartening to see the enthusiasm with which our students engage in projects, competitions, and academic pursuits beyond the classroom.

I extend my heartfelt congratulations to the editorial team, contributors, and faculty coordinators who have worked diligently to bring out this magazine. Let this be a source of motivation for all our students to continue exploring, learning, and contributing meaningfully to the engineering world.

With best wishes,

Dr. Honey Baby

Associate Professor & HoD

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Smart Grid Technology and Its Future

Anandhu Praveen

MLM20EE008

💡 *Empowering the Next Generation of Energy Systems*

The world today relies on electricity more than ever before from powering industries to charging electric vehicles and running smart homes. However, traditional power grids are struggling to meet the growing demand for reliable, clean, and efficient energy. This challenge has led to one of the most revolutionary developments in the energy sector the **Smart Grid**.

What is a Smart Grid?

A **Smart Grid** is an upgraded version of the conventional electrical grid that uses **digital communication, sensors, and automation** to intelligently monitor and manage the generation, transmission, and distribution of electricity. Unlike traditional grids, which allow only one-way power flow (from the utility to consumers), smart grids enable **two-way communication** — allowing utilities and consumers to exchange information in real-time.

⚙️ Key Features

- Real-time monitoring and control of electricity flow
- Integration of renewable energy sources such as solar and wind
- Smart meters for accurate consumption tracking
- Automatic fault detection and self-healing systems

🌍 Why Smart Grids Matter

Smart grids are the backbone of a **sustainable and energy-efficient future**. By enabling renewable energy integration, they reduce carbon emissions and support the shift toward green energy. They also empower consumers to manage their energy usage, helping reduce wastage and save costs. In the event of a power fault, smart grids can quickly isolate the affected area and restore supply — enhancing reliability and minimizing downtime.

The Road Ahead

The future of smart grids is intelligent and interconnected. With the rise of **Artificial Intelligence (AI), Machine Learning (ML)**, and **Blockchain**, the next generation of smart grids will be capable of **predictive maintenance, real-time analytics, and peer-to-peer energy trading**. Imagine a neighbourhood where homes equipped with solar panels can sell excess power directly to nearby consumers — that's the power of future smart grids! These innovations will also play a vital role in **electric vehicle integration, smart cities**, and achieving global **net-zero emission goals**.

Conclusion

Smart Grid Technology is redefining the way we produce, distribute, and consume electricity. It promises a more **reliable, resilient, and eco-friendly energy ecosystem** — one that not only powers homes but also empowers. As the world embraces digital transformation, smart grids will light the way to a cleaner and smarter future.

Wireless Power Transmission

1. Introduction

The demand for wireless technologies has extended beyond data communication to include power transmission. Wireless Power Transmission eliminates the need for traditional conductors, reducing energy losses and maintenance issues associated with physical connections. The concept was first demonstrated by **Nikola Tesla** in the early 20th century through his experiments on resonant inductive coupling. Today, WPT has evolved into practical applications such as wireless charging of smartphones, electric vehicles, and implanted medical devices.

2. Principle of Wireless Power Transmission

Wireless Power Transmission is based on **electromagnetic induction** and **resonant coupling**.

The main methods include:

- **Inductive Coupling:** Used in short-range charging pads for devices like smartphones and electric toothbrushes.
- **Resonant Inductive Coupling:** Used for medium-range power transfer with higher efficiency.
- **Microwave Power Transmission (MPT):** Converts electrical energy into microwaves for long-distance transmission to remote areas or space-based applications.
- **Laser-Based Power Transmission:** Uses laser beams to deliver power to distant receivers with high accuracy.

Advantages of WPT

- **Convenience:** Eliminates the need for plugs and cables.
- **Safety:** Reduces risks of electric shocks and short circuits.
- **Durability:** Minimizes wear and tear due to the absence of physical connectors.
- **Mobility:** Enables charging on the move, especially for electric vehicles and drones.
- **Clean Energy Integration:** Facilitates efficient transmission of renewable energy from remote sources.

4. Applications

1. **Consumer Electronics:** Wireless charging for smartphones, laptops, and wearables.
2. **Electric Vehicles (EVs):** Dynamic wireless charging while driving on WPT-enabled roads.
3. **Medical Implants:** Powering pacemakers and other biomedical implants without surgery for battery replacement.

4. **Industrial Automation:** Cable-free robots and machinery for flexible manufacturing.
5. **Space Applications:** NASA's research on **Space-Based Solar Power (SBSP)** aims to collect solar energy in space and beam it to Earth.

5. Challenges and Limitations

Despite its advantages, WPT faces technical and economic challenges:

- **Efficiency Losses:** Energy loss during transmission over distance.
- **Alignment Sensitivity:** Precise positioning required for optimal power transfer.
- **Health and Safety Concerns:** Exposure to high-frequency electromagnetic fields.
- **High Initial Cost:** Implementation of WPT infrastructure can be expensive.

Integration of Renewable Energy into Power Systems

1. Introduction

Electric power systems worldwide are undergoing a significant transformation due to the increasing adoption of renewable energy sources (RES). Unlike conventional fossil-fuel-based generation, renewables are clean, abundant, and environmentally friendly. However, they are also intermittent and variable, depending on natural conditions like sunlight and wind speed. The integration of these sources into power systems aims to ensure energy security, reliability, and sustainability. With advanced technologies such as smart grids, energy storage systems, and real-time monitoring, the goal of a renewable-driven power network is becoming more achievable.

2. Need for Renewable Energy Integration

- **Environmental Protection:** Reduces greenhouse gas emissions and air pollution.
- **Energy Security:** Decreases dependence on imported fossil fuels.
- **Economic Growth:** Creates new industries and green jobs.
- **Sustainability:** Promotes long-term availability of energy resources.

3. Methods of Integration

Integrating renewable energy into the grid involves several technical approaches:

1. **Distributed Generation (DG):** Small-scale generation units such as rooftop solar panels connected directly to local distribution networks.
2. **Microgrids:** Localized grids that can operate independently or in connection with the main grid, ensuring energy availability even during outages.
3. **Hybrid Systems:** Combination of multiple renewable sources (e.g., solar–wind hybrid) with storage solutions to stabilize output.
4. **Energy Storage Systems:** Technologies like **batteries, pumped hydro, and flywheels** that store excess energy for later use.
5. **Smart Grids:** Digitalized networks that use sensors, automation, and data analytics to balance generation and demand in real time.

4. Challenges in Integration

Despite rapid progress, renewable integration faces key challenges:

- **Intermittency:** Power generation depends on weather and time of day.

- **Grid Stability:** Variability in renewable output can affect frequency and voltage regulation.
- **Storage Limitations:** Current energy storage technologies are expensive and limited in capacity.
- **Infrastructure Needs:** Modernization of transmission and distribution systems is essential.
- **Policy and Regulation:** Lack of uniform policies and incentives can hinder large-scale adoption.

5. Solutions and Innovations

To address these challenges, various technologies and strategies are being developed:

- **Advanced Forecasting:** AI-based prediction of solar and wind output improves grid planning.
- **Energy Storage Expansion:** Development of cost-effective battery technologies like **lithium-ion** and **solid-state batteries**.
- **Demand Response Systems:** Adjusting consumer demand based on grid conditions.
- **Flexible Grid Design:** Upgrading infrastructure to accommodate bidirectional power flow.
- **Government Policies:** Initiatives such as feed-in tariffs, renewable purchase obligations (RPOs), and net metering encourage wider adoption.

Conclusion

The integration of renewable energy into power systems is a crucial step toward a cleaner and more resilient energy future. While challenges remain, advancements in technology, policy, and infrastructure are paving the way for efficient and reliable renewable-based power grids. A global commitment to innovation and sustainability will ensure that renewable energy becomes the backbone of modern power systems.

Dynamic Wireless Charging for EV

Dynamic Wireless Charging (DWC) is an advanced technology that enables electric vehicles (EVs) to charge their batteries while in motion, eliminating the need for frequent stops at charging stations. This innovative system operates on the principle of electromagnetic induction, where power transmitter coils embedded beneath the road surface transfer energy wirelessly to receiver coils installed on the vehicle. The concept addresses major challenges associated with electric mobility, such as limited driving range, long charging durations, and heavy battery dependence.

By allowing continuous energy transfer, DWC significantly enhances the convenience and efficiency of electric transportation. It also enables the use of smaller batteries, reduces downtime, and supports sustainable energy integration through renewable sources like solar and wind power. However, challenges such as high infrastructure cost, efficiency losses, and the need for standardized systems remain.

Ongoing pilot projects in countries such as South Korea and Sweden demonstrate the practical feasibility of this technology. As advancements in smart grids, power electronics, and intelligent transportation systems continue, Dynamic Wireless Charging is expected to revolutionize the EV industry, paving the way for uninterrupted, eco-friendly, and future-ready transportation networks worldwide

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Solar Based Grass Cutter Robot

The Solar-Based Grass Cutter Robot is an innovative and eco-friendly solution designed to automate grass cutting using renewable solar energy. This system aims to reduce manual labor, operational costs, and environmental pollution caused by fuel-powered lawn mowers. The robot operates through a solar panel that converts sunlight into electrical energy, which is stored in a rechargeable battery and used to power DC motors for movement and blade rotation. A microcontroller controls the robot's operations, while sensors enable obstacle detection and autonomous navigation.

The design emphasizes sustainability by eliminating the need for fossil fuels, making it ideal for use in gardens, parks, agricultural fields, and remote areas without an electrical supply. The system operates silently, ensuring minimal noise pollution. However, challenges such as limited efficiency during cloudy conditions and battery constraints remain. Future developments may include GPS navigation, AI-based control, and IoT integration for enhanced performance.

Overall, the Solar-Based Grass Cutter Robot represents a perfect combination of automation and renewable energy utilization. It promotes environmental conservation, energy efficiency, and technological advancement, contributing to a cleaner and smarter future in agricultural and domestic maintenance systems.

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Smart Irrigation System

A **Smart Irrigation System** is an advanced and automated method designed to optimize water usage in agricultural and landscaping applications. It uses modern technologies such as sensors, microcontrollers, and Internet of Things (IoT) to monitor soil moisture, temperature, and humidity in real time. Based on these parameters, the system automatically controls the water flow, ensuring that plants receive the right amount of water at the right time. This not only conserves water but also improves crop yield and reduces manual intervention.

The system typically consists of **soil moisture sensors**, a **microcontroller unit (like Arduino or Raspberry Pi)**, a **water pump**, and a **solenoid valve**. When the soil moisture level drops below a pre-set threshold, the controller activates the pump to irrigate the field, and once optimal moisture is achieved, it automatically turns off. Solar panels can also be integrated to power the system, making it more energy-efficient and suitable for remote agricultural areas.

By utilizing automation and IoT technology, the Smart Irrigation System addresses critical issues like water scarcity and inefficient irrigation practices. It promotes sustainable farming by minimizing water wastage and maximizing productivity, representing a vital step toward modern, eco-friendly agriculture.

Authors

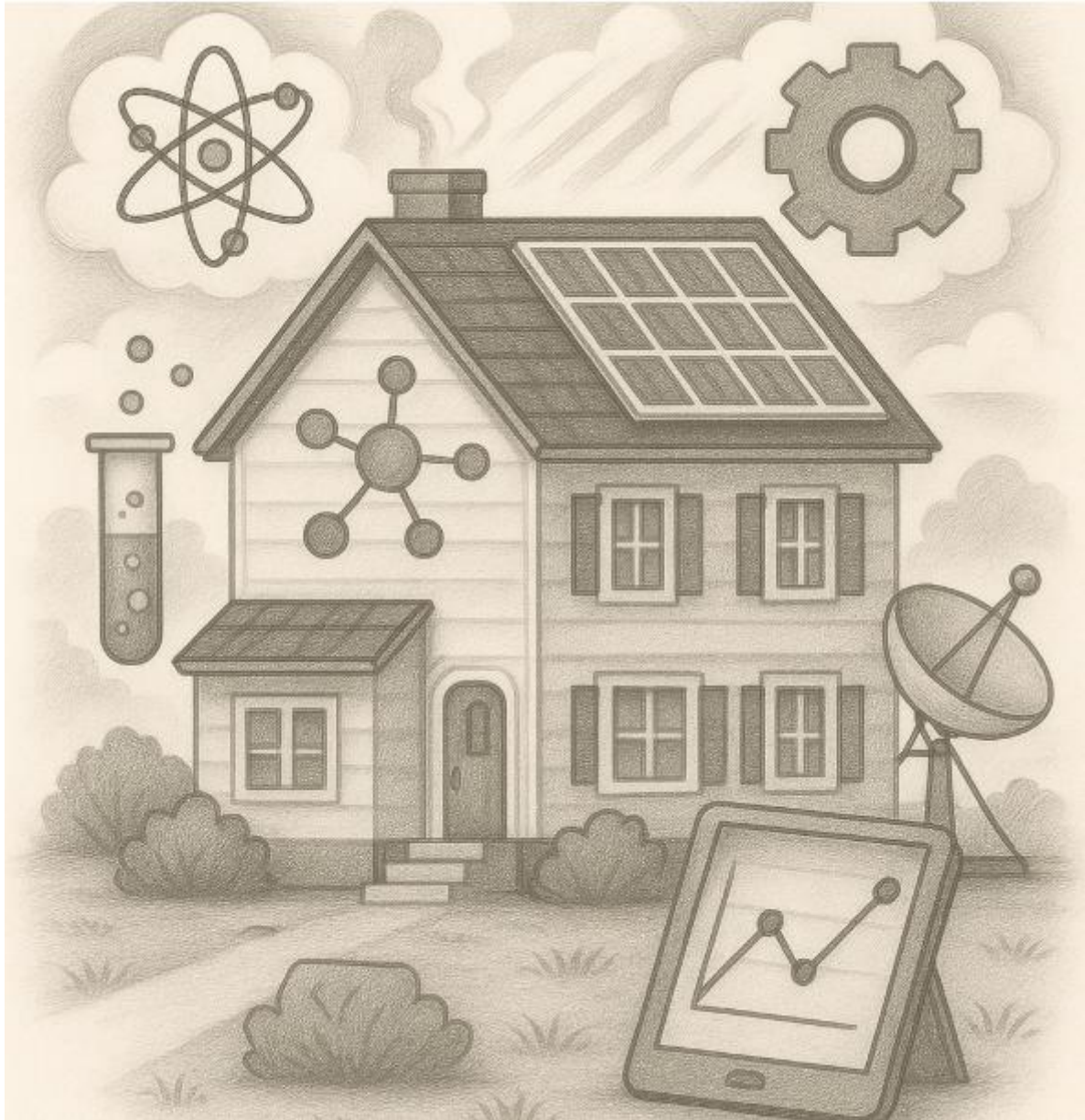
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ARTS CORNER



AKASH VARMA

S8 EEE

ശാസ്ത്രത്തിന്റെ വീട്

മരങ്ങളായ് വളരുന്ന ചിന്തകളിൽ
വിജ്ഞാനത്തിന്റെ മുളച്ചിലുകൾ പിറക്കുന്നു,
സൂര്യന്റെ കിരണങ്ങളാൽ മിന്നുന്ന മേൽക്കൂരയിൽ
സോളാർ കിരണങ്ങൾ സ്വപ്നങ്ങൾ വിതറുന്നു.

പുസ്തകങ്ങൾ പൂവായി വിരിയുന്ന മൂറികളിൽ
കുട്ടികളുടെ ചിരി കാറ്റായ് പായുന്നു,
താരകങ്ങൾ പോലെ മിനുങ്ങുന്ന കണ്ണുകളിൽ
ഭാവിയുടെ പ്രകാശം പ്രതിഫലിക്കുന്നു.

ഈ വീട് ശാസ്ത്രത്തിന്റെ പാടശാല,
കൈകളിൽ കണക്ക്, മനസ്സിൽ ഭൗതികം—
പ്രകൃതിയോട് ചേർന്ന മനുഷ്യന്റെ സ്വപ്നം,
വിജ്ഞാനത്തിന്റെ തീരമെന്നൊരാശയം.

ALISHYA PHYLIP

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