MANGALAM
COLLEGE OF ENGINEERING
विश्वं ज्ञानस्त्रे प्रतिष्ठितम्।
Inspire | Imbibe | Innovate

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

# ELECTROVISION

MAGAZINE
2024-2025

# DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## *TECHNICAL MAGAZINE*

Mangalam College of Engineering

Mangalam Hills, College Rd, Vettimukal P.O,

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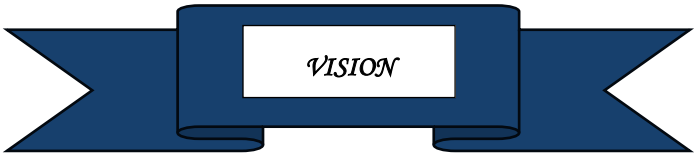
# MANGALAM
# COLLEGE OF ENGINEERING

## 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.

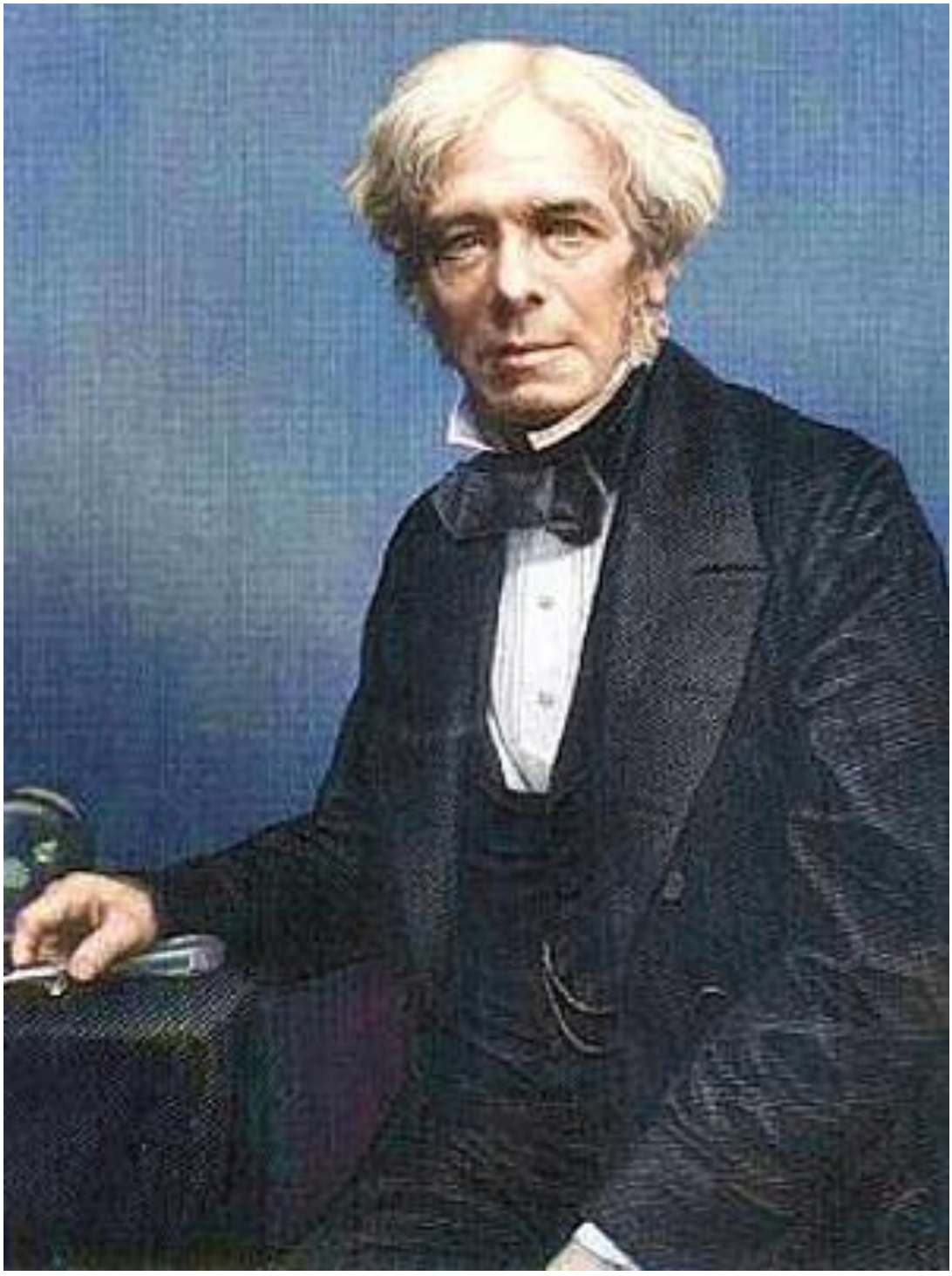
PSO 3: Able to utilize project management techniques and sustainable engineering for developing projects related to electric vehicles, smart power grids, automatic controllers, control and protection circuits, energy management and savings, embedded systems etc.

# 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 before you the latest edition of the EEE Department Technical Magazine of Mangalam College of Engineering — a humble yet vibrant platform to showcase the talents, ideas, and innovations of our students and faculty.

In the ever-evolving landscape of electrical and electronics engineering, staying informed and inspired is crucial. This magazine is a curated collection of insightful articles, emerging technologies, creative projects, and thought-provoking perspectives that reflect both academic depth and industry relevance. Whether it's renewable energy, electric vehicles, smart grids, or embedded systems, our contributors have touched upon the pulse of what shapes the future of technology.

This issue is not just a compilation of technical content; it is a reflection of our department's dedication to curiosity, research, and excellence. I extend my heartfelt thanks to every student, faculty member, and contributor who brought this publication to life with their passion and effort.

Let this magazine spark new ideas, ignite innovation, and continue to build a strong bridge between learning and real-world application.

Warm regards,

*Mr. Arun Chandrakumar K*

*Assistant Professor*

# TECHNICAL MAGAZINE COMMITTEE

## Chief-Editor:

Dr. Honey Baby

*Associate Professor & HoD*

## Editor:

Mr. Arun Chandrakumar K

*Assistant Professor*

## Student-Coordinators:

**ANJANA SANTHOSH**

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**ABHINAV P B**

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**THOMAS SEBASTIAN**

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# MESSAGE FROM CHAIRMAN

It is with great pride and joy that I extend my heartfelt congratulations to the Department of Electrical and Electronics Engineering on the publication of its technical magazine.

In today's rapidly evolving technological landscape, the role of Electrical and Electronics Engineering is more critical than ever. From powering our homes to enabling cutting-edge innovations in automation, renewable energy, and communication systems, the contributions of this discipline are vast and transformative. A publication like this not only showcases the academic and technical capabilities of our students and faculty but also reflects their passion, creativity, and commitment to excellence.

This magazine stands as a testament to the intellectual vibrancy of the EEE Department. It offers a platform for knowledge sharing, encourages research and innovation, and fosters a spirit of collaboration and curiosity. I am pleased to see our students and faculty engaging in such meaningful academic endeavors, which are essential for shaping the engineers and leaders of tomorrow.

I congratulate the editorial team, all contributors, and the department faculty for their dedication and hard work in bringing out this valuable publication. May this magazine continue to grow as a source of inspiration and knowledge.

Wishing the EEE Department continued success in all its future pursuits.

**Dr. Biju Varghese,**

**Chairman, Mangalam educational institutions**

# MESSAGE FROM THE PRINCIPAL

It gives me immense pleasure to extend my warmest greetings to the Department of Electrical and Electronics Engineering on the publication of this edition of the department's technical magazine.

The field of Electrical and Electronics Engineering continues to be at the forefront of technological innovation, driving progress across sectors such as energy, automation, communication, and smart systems. This magazine serves as a dynamic platform for our students and faculty to share their technical insights, research findings, innovative Innovations, and creative ideas with a wider audience.

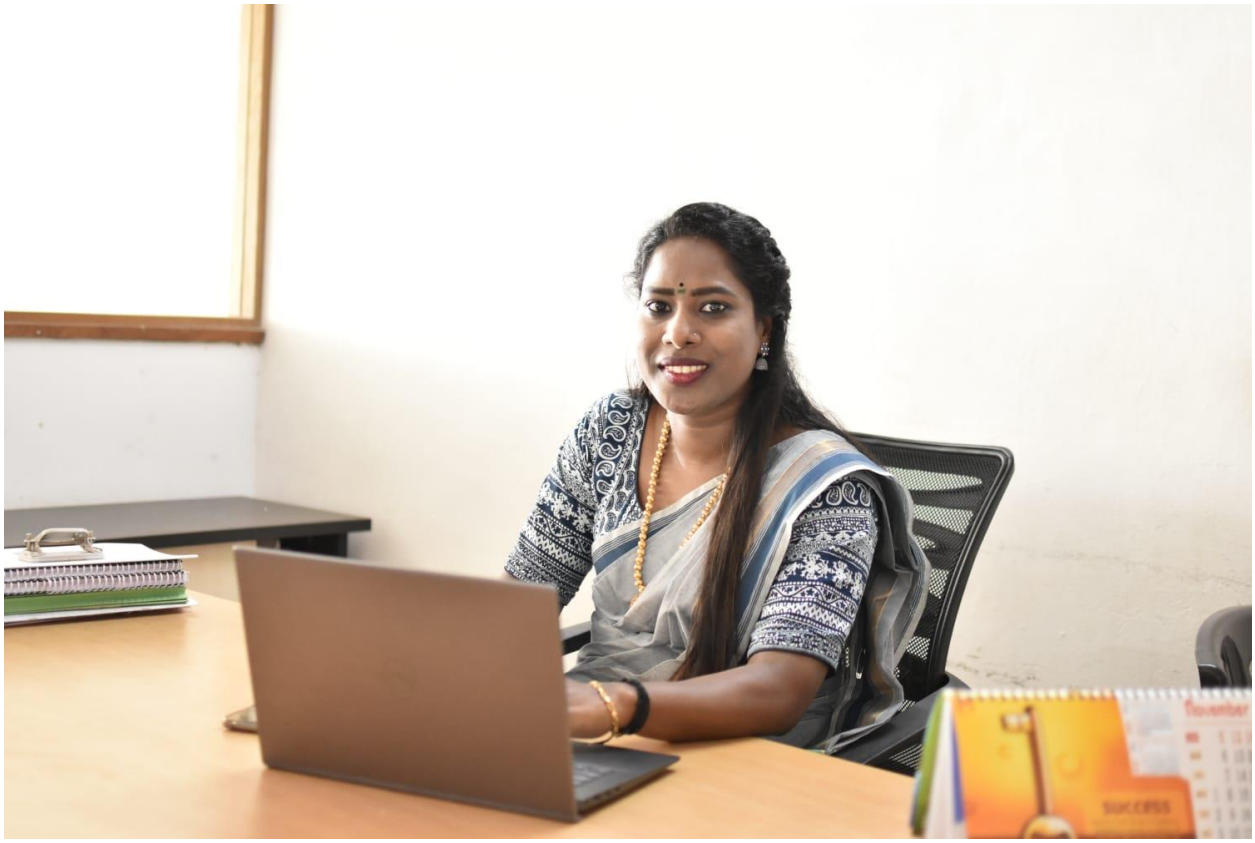
I commend the department for encouraging a culture of inquiry, experimentation, and academic excellence. Initiatives like this magazine play a vital role in nurturing analytical thinking and technical writing skills among students—an essential aspect of engineering education.

I congratulate the editorial team, contributors, and faculty coordinators for their dedicated efforts in bringing out this publication. I am confident that the content will inspire readers, stimulate innovation, and reflect the vibrant academic environment of the department.

Wishing the EEE Department continued success in all its future endeavors.

**Dr. Vinodh P Vijayan**

M.Tech., Ph.D.



# MESSAGE FROM THE HOD

It gives me immense pleasure to present this edition of the technical magazine published by the Department of Electrical and Electronics Engineering.

The aim of this magazine is to provide a platform for students and faculty to showcase their technical knowledge, innovative ideas, research initiatives, and creative thinking. In a world increasingly driven by technology, the field of Electrical and Electronics Engineering continues to play a pivotal role in shaping sustainable and intelligent systems for the future.

This publication reflects the intellectual spirit of our department. It highlights not only academic excellence but also the passion and determination of our students and faculty members to push boundaries and explore new frontiers in technology.

I take this opportunity to appreciate the efforts of the editorial team, student contributors, and faculty coordinators for their dedication and enthusiasm. I am confident that this magazine will serve as a source of inspiration and knowledge for all readers, while also fostering a culture of innovation and continuous learning.

Wishing everyone success in their academic and professional journeys.

Dr. Honey Baby

Associate Professor & HoD

# CONTENTS

ANJANA SANTHOSH

MLM21EE005

# Multi-Level Inverter Topologies For High Power Applications

Multi-level inverters (MLIs) are becoming increasingly important due to their ability to deliver high-quality output waveforms with lower harmonic distortion. This research paper focuses on evaluating recent advancements and current challenges related to MLIs in demanding power applications. Key issues addressed include voltage balancing, switching losses, and thermal management, all of which significantly impact the reliability and efficiency of these systems. The paper wraps up by highlighting recent initiatives aimed at resolving these challenges, such as enhanced control methods, innovative designs for auxiliary components, and advanced cooling techniques. It also emphasizes practical considerations for implementing MLIs in high-power applications while examining current trends and future directions. One specific area of focus is a high-power multi-level inverter derived from a 5-level T-Type inverter, intended for electric trucks and cars. This new design presents several advantages over traditional configurations like Neutral Point Clamped, Flying Capacitor, and Cascaded H-Bridge. Key benefits include fewer components, reduced weight and cost, a more compact size, and the utilization of a single DC voltage source for each phase. This topology is adaptable and can be configured for any desired odd number of voltage levels. Furthermore the latest trends in ML Is are aimed at medium voltage applications within industrial drives, reflecting the increasing interest in MLI technologies for high-power applications in the energy sector.

**ABHINAV P B**

LMLM21EE024

# Artificial intelligence in solar energy: Mitigating the impact of sudden weather changes on solar energy production

Renewability constitutes an essential characteristic of sustainable development, while in the case of solar power, this is added with the lowest possible adverse impact on the environment and is scalable. Generation in solar energy is intrinsically weather-dependent meaning concentration of sudden cloud cover, storms, and temperature alterations may create fluctuations in power output, which directly impacts the stability of the grid and may pose to be power imbalances. This seminar discusses how the infusion of artificial intelligence will improve the predictability and stability of solar energy in the power grid.

AJ-based techniques, especially machine learning and deep learning, improve advanced forecasting capabilities by taking in large datasets, historical weather data, satellite images, and real-time environmental inputs. Accurate predictions for weather and solar generation help energy operators predict such fluctuations and take proactive measures to ensure grid stability. It also maximizes the usage of the energy storage by holding reserve energy when produced at overcapacity and releasing it swiftly when production decreases, helping to balance supply and demand. Also, Al applications in smart grids enable autonomous, real-time tuning of the parameters of the grid that make it more resilient to abrupt changes in solar power. In this seminar, we will review recent development in Al applications related to predictive maintenance, optimization of energy storage, and secure transactions of energy via blockchain with respect to transparency in distributing energy.Al contributes the most to an infrastructure of solar power which is a lot more resilient and adaptive. This is mainly because with better forecasting that allows adaptive management of grids and energy storage, it makes sure to pave its way toward dependable solar energy supplies. Thus, a balanced grid ensures the reliability of the source, therefore making the overall renewable energy strong and sturdy against all sustainability goals for energy sources.

THOMAS SEBASTIAN

LMLM21EE027

# Floating solar photovoltaic on dam reservoirs

Floating solar PV offers a novel approach to harnessing solar energy by installing solar panels on the surface of water bodies, such as reservoirs behind dams. This method not only generates renewable electricity but also provides benefits such as reduced land use and minimized evaporation from the water surface. The study explores various aspects of floating solar PV technology, including system design, floating platform stability, and performance metrics. Key advantages discussed include the dual use of existing reservoir infrastructure, the potential for improved solar panel efficiency due to the cooling effect of water, and the reduction in water loss from evaporation. The paper also addresses technical and operational challenges, such as the effects of water quality and wave action on system longevity, and the integration of floating PV with existing hydropower operations. Economic and environmental impacts are evaluated, demonstrating that floating solar PV can be a viable and complementary solution for increasing renewable energy capacity while optimizing water resource utilization.

# Solar Powered Rover for Security Surveillance and Rescue Operation

Solar powered rover for security surveillance and rescue operation is a state-of-the-art IoT-based device designed for rescue operations, hazard environment scanning, and military surveillance. The rover has a solar panel and lithium-ion battery to ensure power supply at all times and longer operation life. A Wi-Fi camera module with motion detection and two-way audio transmission provides real-time video streaming for situational awareness. The rover possesses various environmental and security sensors integrated to detect anomalies effectively. The MQ-2 gas sensor detects the presence of harmful gases, the microwave radar (RCWL-0516) detects movement and obstacles, and the metal detector detects metallic objects, which is crucial in landmine detection in military applications. Whenever any of these sensors detect a deviation, GPS and GSM modules automatically report the corresponding location coordinates via SMS to a registered number, hence making instant reports available for response emergencies. Sensor values are also communicated in real-time to Firebase to enable remote tracking and examination.

For enhanced mobility and flexibility across different types of terrain, the rover features a six-wheel drive system powered by gear motors and motor drivers. The TerraResQ mobile app is used for wireless motion control, allowing remote operation from anywhere in the world through Firebase. This flexible system is of high value for search-and-rescue, disaster relief operations, exploration of hazardous terrain, and military reconnaissance. The solar-powered feature, real-time IoT connectivity, multi-sensor fusion, and automatic alert capabilities of the rover render it an intelligent and economical solution for mission-critical operations with increased safety and situational awareness

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# Auto Finish: Multifunctional Spray Painting And Coating Machine

Automated machines have become indispensable assets in the construction industry, leveraging. Intelligent control to expedite operations while enhancing accuracy. Their adoption is particularly beneficial in environments fraught with dirt and danger, where human labor faces formidable challenges. Compared to conventional manual painting methods, this automated solution ensures consistent coating quality while reducing time and labor costs. Traditional automatic wall painting machines available in the market are priced above 28 lakhs, making them inaccessible for small and medium-scale users. Various factors contribute to this scarcity, including the perilous conditions encountered in tasks such as working at heights or navigating congested urban sites. Moreover, evolving societal attitudes towards job prestige, influenced by educational attainment, have further exacerbated the shortfall in construction labour. This Innovation investigates the viability of automatic wall painting machines as a solution to these pressing challenges. By delving into their capabilities and potential applications, it aims to develop a cost-effective alternative that can be implemented in residential, commercial, & industrial settings. Automatic spray painting emerges as a particularly promising avenue, offering efficiencies in both speed and precision while minimizing human exposure to hazardous environments. Furthermore, the versatility of these machines renders them adaptable to a myriad of scenarios, from large-scale Innovations to intricate interior work in urban settings. It provides an innovative yet affordable solution for the painting industry, bridging the gap between manual and expensive automated systems. Its efficiency, affordability, and adaptability make it a promising alternative for professional painters, contractors, and industries looking to optimize their painting processes. By harnessing the power of automation, stakeholders stand to not only mitigate labour shortages but also enhance overall productivity and safety standards with affordable machinery. As the construction landscape continues to evolve, embracing innovative solutions like automatic wall painting machines is essential to meet the demands of a rapidly changing world.

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# Eco-Filament: Sustainable 3d Printing From Recycled Plastics

The increasing environmental concerns of plastic waste have fueled attempts to seek alternative sustainable options in various industries. This Innovation looks at a green method of 3D printing through the creation of filament from recycled polyethylene terephthalate (PET) plastic. The aim is to reduce reliance on fresh materials and reduce the carbon footprint of producing filament. This entails gathering discarded PET bottles, which are washed, shredded, and processed into 3D printing filament through extrusion. Major areas of study encompass improving the extrusion process to obtain high-quality filament and assessing the performance. of the recycled filament in 3D printing. The findings show that recycled PET filament can produce equivalent mechanical properties to traditional filaments, presenting it as a sustainable and alternative option. This approach not only assists in addressing the plastic waste problem but also encourages the use of the concept of a circular economy in the 3D printing sector...

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# Iot Based Solar Powered Air Purifier With Air Quality Monitoring System

This Innovation targets on loT-Based Solar Powered Air Purifier with Air Quality Monitoring System. The system is powered by a solar panel as the main power source, complemented by a battery storage unit to facilitate constant power supply. A collection of sensors such as an MQ-135 gas sensor, a DHT11 temperature and humidity sensor, and a dust sensor, coordinate to sense air quality in real time. The collected data is handled by an Arduino nano, which allow the operation of the fan according to levels of pollution. The utilization of buck and boost converters ensures the power supply is managed effectively, making sure that all the components are run stably.

Among its strongest features is an IoT monitoring system, under which the usage becomes. possible by simply monitoring the air quality in the remote system and sending reports directly to online access. Sensor results are also shown through an LCD display located nearby, such that the air status is perceived with instantaneous notifications. The system is configured to automatically switch on the fan and filtration system when pollution increases above a threshold that is considered safe, rendering it an independent and smart air purification system. The use of IoT technology not only improves monitoring but also provides data analysis to evaluate long-term air. quality.

This solar powered air purifier, cost-effective process of air cleaning that reduces reliance on conventional electricity. Portability allows utilization in homes, schools, offices where air quality must be enhanced. By combining renewable power with smart automation, this system presents a environmentally friendly approach to combating air pollution with a healthy lifestyle.


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# An Iot Integrated Home Automation With Smart Security System

This Innovation aims at creating an overall IoT-based smart home automation system that is integrating convenience, energy efficiency, and security, a smarter solution for managing daily chores of the home. With the system, householders are able to control and monitor appliances at a distance through a special mobile app, which includes lights, plug points, and door locks. This feature facilitates increased convenience and ease of control over home devices, offering the user the freedom to control his home appliances from anywhere in the world, which increases comfort and efficiency. The innovation of note in the system is the addition of an ampere sensor, which allows monitoring of power usage in real-time. Through monitoring the energy consumption of the connected devices, consumers can maximize their use patterns, minimizing wasteful power consumption and maximizing overall energy efficiency. The system also sends notifications when anomalies or defects, like overloads or short circuits, are identified so that users may take preventive actions. This instantaneous feedback is instrumental in efficient management of energy use and ensuring the appliances are kept within safe thresholds, ultimately resulting in reduced electricity bills and better sustainability..

Along with the feature of energy monitoring, the system has a solenoid gas valve that provides additional safety to the home. Gas leaks are a major danger, especially to homes that rely on natural gas or LPG for cooking and heating. The gas leak detection feature of the system automatically closes the solenoid valve to cut off the gas supply in the event of a leak, minimizing the risk of explosion or fire, This automatic action provides an added layer of protection that is not possible with conventional gas leak detectors. Security is yet another fundamental part of this system. The solenoid door lock that supports IoT provides remote locking and unlocking of doors for homeowners, and this is done with an additional level of convenience and comfort.

This aspect serves to ensure the doors are safe even when the homeowner is outside the house. To supplement this, the system features smart notifications that alert the users of unauthorized entry or movement, assisting in keeping the home secure at all times. In general, the loT-based home automation system proposed in this Innovation combines energy management, security, and safety features to provide a more efficient, secure, and convenient living space.

Through the use of real-time monitoring, automatic response, and remote-control functions, this system provides an innovative solution for contemporary homes, improving quality of life while minimizing energy consumption and providing safety. The integration of these attributes makes the system a necessary tool for homeowners who want to build wiser, more sustainable homes.


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