

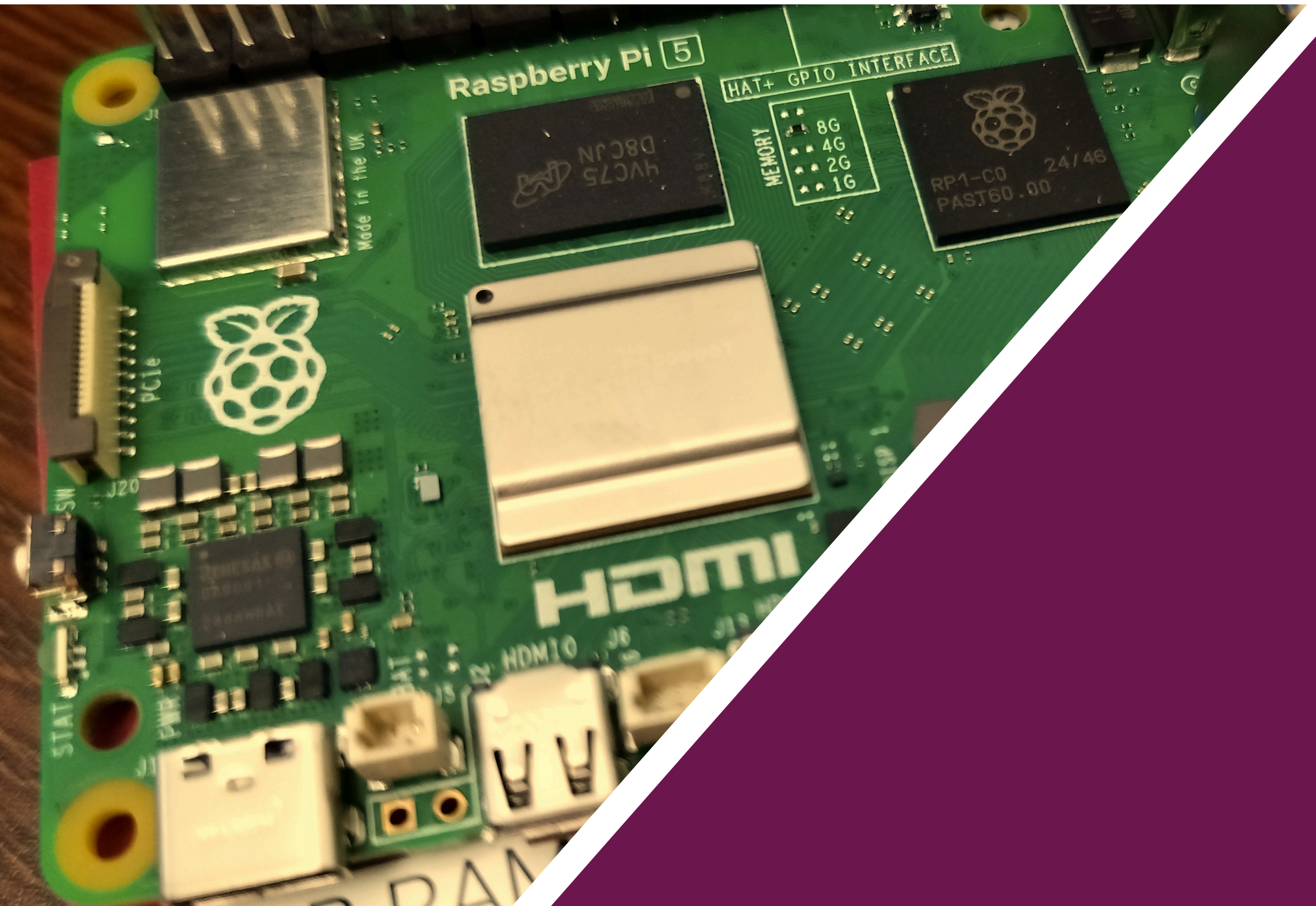


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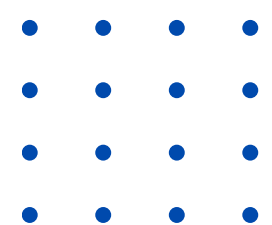
EESEE 2025

10TH ELECTRICAL ELECTRONICS SYSTEMS ENGINEERING EXHIBITION 2025

VOLUME 1



FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
JOHOR BRANCH
PASIR GUDANG CAMPUS



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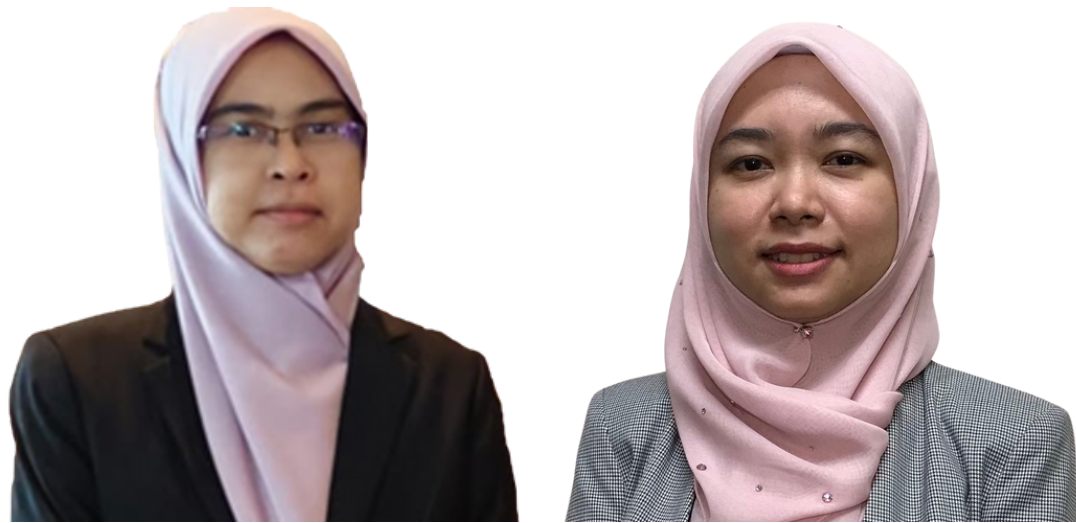
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FOREWORD BY THE PROGRAM CHAIR



Greetings from the Electrical, Electronics, and Systems Engineering Exhibition 2025 (EESEE 2025).

As the Program Chairs, it is our great pleasure to present this compilation of extended abstracts, showcasing the remarkable projects developed by our final-semester students from the Diploma in Electrical Engineering (Power) and Diploma in Electrical Engineering (Electronics) programs at Universiti Teknologi MARA, Cawangan Johor, Pasir Gudang Campus.

This exhibition marks a significant milestone in our students' academic journey, representing the culmination of years of dedication, perseverance, and learning. It also serves as an essential step toward the successful completion of their diploma studies. The projects featured this year are centered on the theme *Engineering Excellence: Bridging Technology and Life*, reflecting current trends and innovations in the engineering field.

This extended abstract book highlights not only the students' technical expertise but also their creativity, problem-solving skills, and ability to engage meaningfully with peers and industry professionals. Within these pages, you will find a diverse range of projects that embody a unique blend of knowledge, innovation, and practical application.

We warmly invite you to explore this collection, which celebrates the achievements of our aspiring engineers. Welcome once again to the Electrical, Electronics, and Systems Engineering Exhibition 2025. May the insights shared here inspire and pave the way for the next generation of innovative engineers.

Warm regards,

Dr. Fatimah Khairiah binti Abd Hamid

Dr. Atiqah Hamizah binti Mohd Nordin

Program Chairs

Electrical, Electronics, and Systems Engineering Exhibition 2025 (EESEE 2025)



Automated Sun Tracking Solar Panel for Residence

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ABSTRACT

This study presents the design and simulation of an Automated Sun Tracker Solar Panel system aimed at enhancing energy efficiency for residential applications. The system integrates Node MCU microcontroller technology with photoresistors for light detection, current sensors for power monitoring, and a Liquid Crystal Display (LCD) for real-time data visualization. Employing Internet of Things (IoT) functionality via a Wi-Fi module, the system enables remote monitoring and control. Using Proteus simulation, the Node MCU processes sensor inputs to dynamically adjust the orientation of the solar panel using servo motors for optimal sunlight exposure. Additional features include Light-Emitting Diodes (LEDs) for operational status alerts and intelligent motor control to maximize energy output. The IoT connectivity further extends system versatility by allowing real-time tracking of performance metrics such as power output and efficiency. This scalable and cost-effective solution demonstrates significant potential for improving residential energy sustainability and accessibility. By addressing challenges in renewable energy utilization, the proposed system contributes to global efforts in reducing carbon footprints and promoting sustainable living.

KEYWORDS: Sun Tracker, Node MCU, WiFi module, Liquid Crystal Display

PRODUCT DESCRIPTION

The final product in the design is an advanced sun tracker solar panel system which is more environmental and contributes to increasing the conversion efficiency of solar energy for residential applications. It makes use of dynamically connected LDRs and servo motors within the system for tracking the sun during its position throughout the day in keeping the solar panel oriented correctly for maximum energy input. The system is based on the ESP8266 microcontroller, driving two-axis tilting and rotation, which can increase energy output more than a stationary panel. The efficiency and status of the system in real time are displayed on an LCD I2C display. There are also red and green LEDs showing operation states. Compact, the system is cost-effective for residential rooftops, small-scale solar farms, and educational demonstrations. It has inbuilt sustainability to ensure a reduction of energy dependence on conventional sources, therefore fostering the adoption of renewable energy resources—a key feature of the current global drive in the fight against climate change. This smart solution combines advanced automation, energy efficiency, and user friendliness in a practical and effective renewable energy system.

BLOCK DIAGRAM / FLOWCHART / SCHEMATIC DIAGRAM / PCB LAYOUT

Figure 1 shows the block diagram of the Automatic Sun Tracker Solar Panel for Residence project. ESP8266 Node MCU will be the main component and work as the brain of this project for the entire time, controlling the other components by inserting the coding of this project. The system's architectural framework is illustrated in a comprehensive block diagram, outlining the fundamental components of this project system.

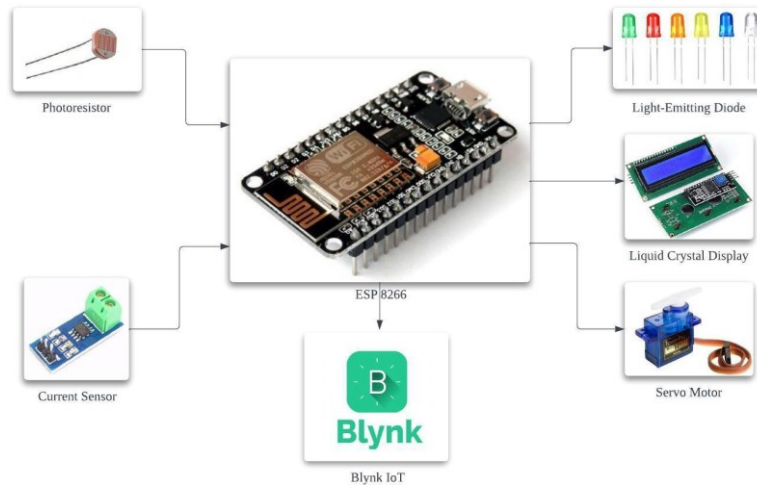


Figure 1 : Block Diagram of Automatic Sun Tracking Solar Panel for Residence

Figure 2 shows a flowchart describing the operation of an Automated Sun Tracker Solar Panel System. The process starts with inputs from light-dependent resistors (LDRs) and a current sensor. The microcontroller initializes and compares LDR values to adjust the servo motors, aligning the solar panel towards maximum sunlight. If no light is detected, the system holds its position and displays data such as efficiency and power output on an LCD. The system integrates Blynk IoT for real-time monitoring, enabling efficient solar tracking and energy optimization.

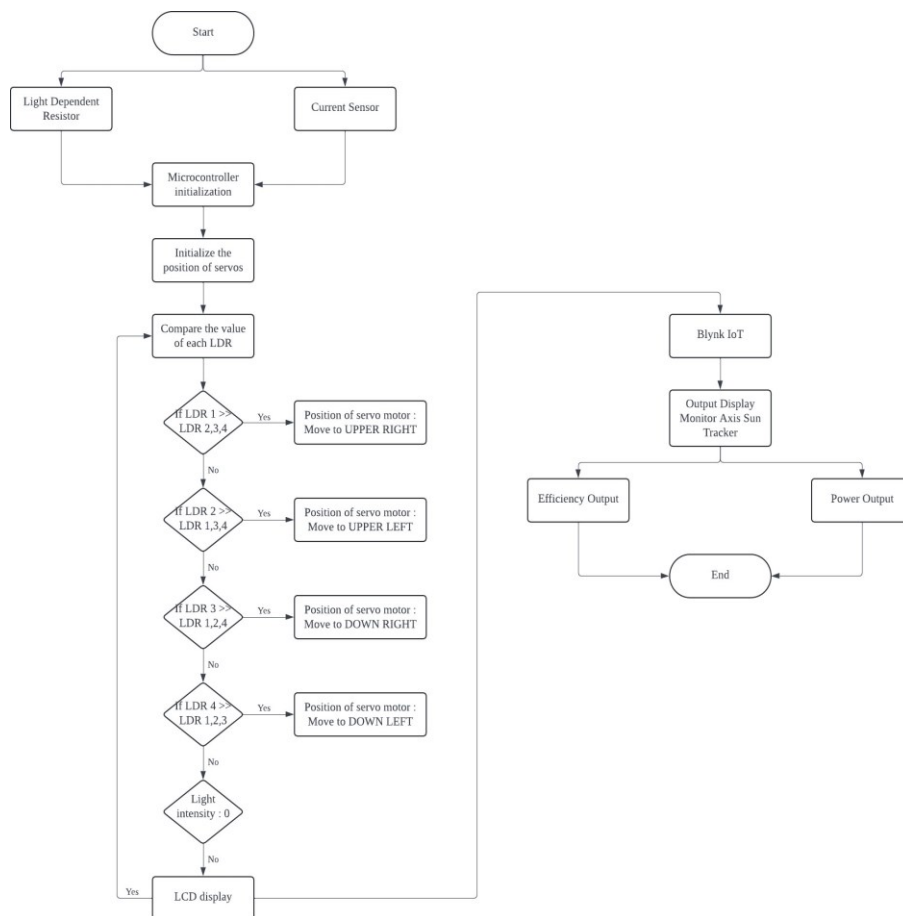


Figure 2 : Flowchart of Automated Sun Tracking Solar Panel for Residence

Figure 3 shows a schematic diagram representing the wiring of an Automated Sun Tracker Solar Panel System using an ESP32 microcontroller. Four light-dependent resistors are connected to analog inputs to detect sunlight intensity. Two servo motors are linked to control the panel's movement along two axes. An I2C LCD is used to display system outputs such as power and efficiency, while red and green LEDs indicate system status. The setup integrates resistors for LED operation and proper wiring for all components to ensure seamless tracking and monitoring.

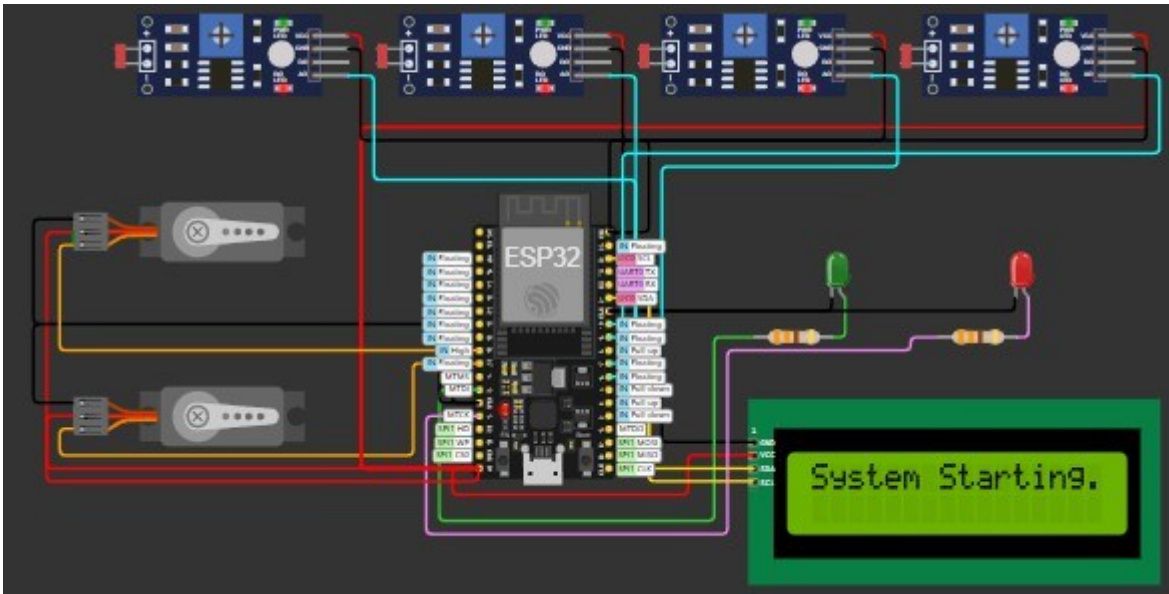


Figure 3 : Schematic Diagram of Automated Sun Tracking Solar Panel for Residence

Figure 4 shows a printed circuit board layout designed for an Automated Sun Tracker Solar Panel system. It features connections for four light-dependent resistors to detect sunlight intensity, an ESP8266 microcontroller for processing, and interfaces for servo motors to adjust the solar panel's position. The layout includes connections for LED indicators red and green and a battery power source. The PCB design ensures organized and efficient routing of components for reliable operation of the sun tracking system.

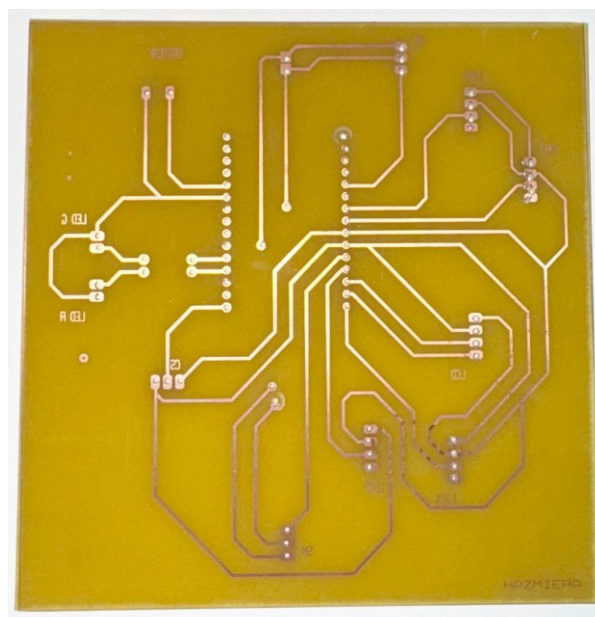


Figure 4 : Printed Circuit Design of Automated Sun Tracking Solar Panel for Residence

NOVELTY AND UNIQUENESS

The novelty and uniqueness of the Automated Sun Tracker Solar Panel System is that for the first time, it attempts to develop an efficient way to have maximum solar energy with precision and intelligence in tracking. This is unlike what happens in static solar panels. Hence, it uses LDRs to track light intensity from multiple directions and changes the angle of the solar panel automatically, using servo motors for capturing maximum energy. This uniqueness of the system also encompasses IoT technology integration using the Blynk software for real-time monitoring, remote control, and logging of data on the system in a very accessible and user-friendly manner. It also involves an LCD I2C display for immediate feedback on power output, efficiency, and system status for maximum transparency and ease of operation. This is an interesting project, putting together renewable energy generation with advanced automation and IoT connectivity to provide a practical smart-efficient solution for residential solar power installations for independence from energy supply and environmental conservation.

BENEFIT TO MANKIND

The Automated Sun Tracker Solar Panel System brings a lot of benefits to humans by encouraging the use of renewable energy and increasing the conversion efficiency of solar power. With the exact tracking of the sun, this system increases energy capture, thus decreasing the consumption of non-renewable energy sources, which leads to a cleaner and greener environment. It will enable households and small businesses to reduce their electricity costs and carbon footprints, thus helping people and businesses become more energy-independent and environmentally conscious. This project will also bring awareness about renewable energy solutions and encourage people to move toward green technologies. This innovation is important in the advancement of a sustainable future, as it solves some of the global challenges facing humanity in relation to climate change and energy scarcity.

COMMERCIALIZATION POTENTIAL

The Automated Sun Tracker Solar Panel System has excellent commercialization potential as there is a steadily increasing demand for effective and feasible energy solutions around the globe. Equipped with the intelligent tracking of the sun's path during the day, it increases the quantity of energy tapped from the sun and amplifies the capture of traditional fixed solar panels. Such systems have wide appeal to both residential and commercial or industrial markets. Besides that, with IoT integration for real-time monitoring and control for example, using Blynk comes modern convenience and functionality to make the system very attractive to the tech-savvy customer or one interested in renewable energy. Besides, affordability and scalability are in place to make it appropriate for wide diffusion in both developed and developing regions. This is because the project addresses the pressing need for energy efficiency and sustainability. Thus, it may accelerate the usage of renewable energy, reduce dependence on fossil fuels, and enable the attainment of global energy and environmental objectives.

CONCLUSION

In conclusion, the automated sun tracker solar panel system is thus one of the most effective and innovative solutions for the utilization of maximum solar energy both at residential and commercial levels. The system will orient the solar panel equipped with LDRs, servo motors, and IoT technology for utmost improvement in energy efficiency compared to the traditional fixed ones during the daytime. The integration of any IoT platform, such as Blynk, enables the user to monitor and control the system in real time hence making the system more usable and user-friendly. This project contributes toward the SDGs of the world by facilitating the use of renewable energy, reducing carbon footprints, and reducing energy costs. It holds much promise, being scalable, cheap, and adaptable, in addition possibly to contribute much to a large-scale greening and sustainable future of mankind.

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