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SMART SOLAR PANEL MONITORING SYSTEM FOR REAL-TIME PERFORMANCE AND ENERGY OPTIMIZATION

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Abstract:- The use of solar energy has increased significantly over the world. They are well-liked due to their endlessness and purity. It also stands out for being low maintenance. Yet, ifa little issue with the panel or circuit is not identified promptly, it could cost a lot to maintain. Another challenging task is finding the flaw inside the vast solar field. This study examines the viability of employing IOT for real-time fault detection. Reducing the maintenance expense and detection time, Panel temperature, light intensity, and current are monitored and maintained continuously, respectively, using temperature, light, and current sensors. In the proposed study to maintain the standard level of voltage, battery voltage is constantly monitored to meet the industrial need and to increase the life span. The study also aims to measure efficiency concerning the increase and decrease in power levels. Further, the study involves a cleaning system that can be integrated into the solar panel to clean the dust layer accumulated on the panel. Cleaning dust is an important factor in solar panel maintenance to improve efficiency and reduce corrosion. The novelty of the system lies in the comprehensive approach towards solar panel maintenance through the integration of IoT technology, smart cleaning systems, and rigorous analysis of efficiency factors.

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1. INTRODUCTION

1.1 GENERAL

The increasing demand for renewable energy sources has prompted the development of solar power systems as an alternative source of electricity. Solar power systems harness the energy from the sun's radiation and convert it into electricity that can be used to power homes, businesses, and industries. Despite their benefits, solar power systems are subject to various factors that can affect their efficiency and reliability. For instance, the efficiency of solar panels decreases when their temperature increases, while the power output is also affected by the intensity of sunlight and weather conditions. To address these challenges, monitoring systems have been developed to measure and optimize the performance of solar power systems. IoT based solar power monitoring systems have emerged as a popular solution to

monitor solar power systems in real-time. These systems measure critical parameters such as current, voltage, power, solar panel temperature, and light intensity, and continuously analyse the data to detect and address any issues that may affect the performance of the solar power system.

2. LITERATURE SURVEY

2.1 EXISTING SYSTEM

Traditional solar panel and battery maintenance methods typically involve periodic manual inspections and maintenance checks, which can be time-consuming, labor-intensive, and may not detect issues promptly, leading to reduced efficiency and potential downtime.

2.2 PROPOSED SYSTEM

The proposed system utilizes IoT technology for continuous monitoring and maintenance of solar panels and batteries, enabling real-time data collection and analysis to proactively identify and address issues, thereby enhancing efficiency, reducing maintenance costs, and ensuring optimal performance.

3. BLOCK DIAGRAM

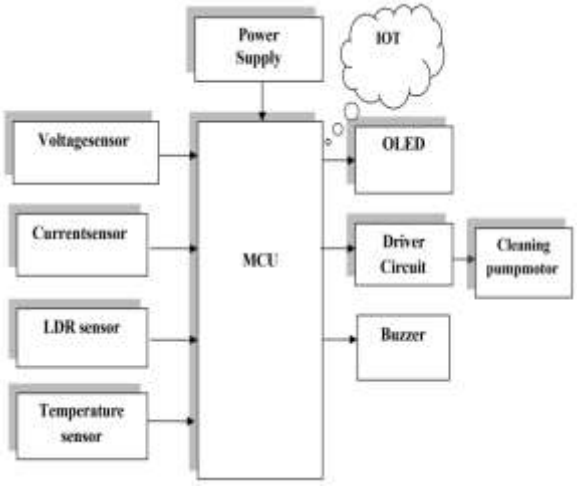

FIG: 1 Block diagram

3.1. HARDWARE COMPONENTS

- Regulated power supply.
- Voltage sensor
- Current sensor
- LDR sensor
- Temp sensor
- Micro controller.
- IOT

3.2. SOFTWARE REQUIREMENTS:

- Raspberry Pi Pico
- Embedded C

4. IMPLEMENTATION (WORKING PROCEDURE)

This study examines the viability of employing IOT for real-time fault detection. Reducing the maintenance expense and detection time, Panel temperature, light intensity, and current are monitored and maintained continuously, respectively, using temperature, light, and current sensors. In the proposed study to maintain the standard level of voltage, battery voltage is constantly monitored to meet the

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5. CIRCUIT DIAGRAM

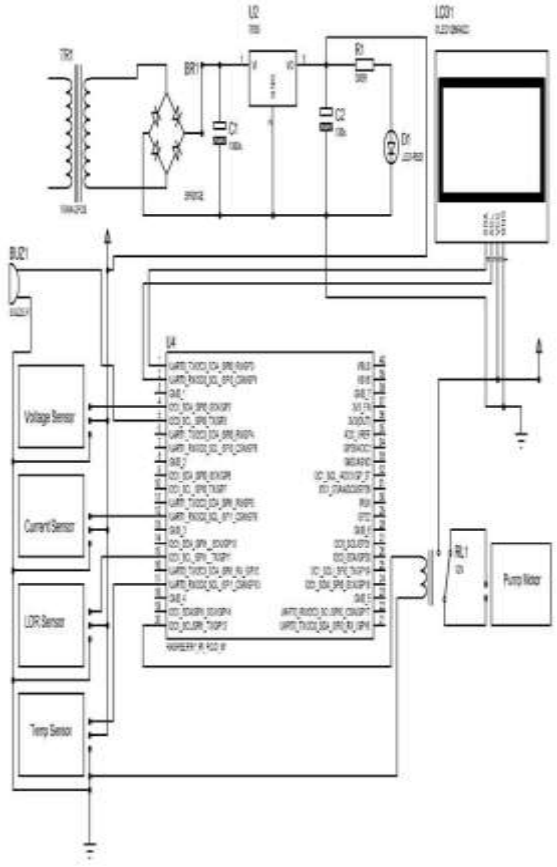

Fig : 2. circuit diagram

6. RESULT

This project is well prepared and acting accordingly as per the initia specifications and requirements of our project. Because of the creative nature and design the id of applying this project is very new, the opportunities for this project are immense. The practical representation of an experimental board is shown below:

Fig:3. Project Model

7. CONCLUSION

The IoT-based solar power monitoring system is an innovative project that provides real-time monitoring and analysis of various parameters of a solar panel. The system has several advantages, including efficient energy management, improved solar panel performance, reduced maintenance costs, and increased system reliability. The system's hardware components include the solar panel, voltage sensor, current sensor, microcontroller, LCD display, and other components. The software modules of the system include the Blynk mobile application and the computer program. The microcontroller acts as a bridge between the hardware components and the software modules, processing and displaying the collected data. The system's working is straightforward, with the solar panel generating electrical energy that is measured by the voltage and current sensors. The microcontroller processes and displays the collected data on the LCD display, the Blynk mobile application, and the computer program. The system continuously monitors and updates the data, providing real-time analysis and monitoring of the solar panel's performance. The IoT-based solar power monitoring systemhas several advantages, including efficient energy management, improved solar panel performance, reduced maintenance costs, and increased system reliability. The system can also help users make informed decisions regarding their energy consumption and reduce their carbon footprint. In conclusion, the IoT-based solar power monitoring system is a valuable tool for efficient energy management and real-time monitoring of solar panel performance. The system's ability to continuously measure and analyze various parameters of the solar panel can help improve its performance, reduce maintenance costs, and increase system reliability. It can also help users make informed decisions regarding their energy consumption and contribute towards sustainable development.

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