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DESIGN OF SOLAR PANEL MONITORING SYSTEM USING CONTROLLER &IOT

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Abstract:- The growing use of solar energy has created a need for effective monitoring systems to ensure maintenance and optimal performance. This project presents the design and implementation of an IoT and microcontroller-based solar panel monitoring system that enables remote monitoring and management of parameters like voltage, current, temperature, and power output. Featuring real-time data collection, the system uses a microcontroller to interface with sensors and transmit data wirelessly to a cloud platform. By leveraging IoT technologies, it ensures seamless communication between solar panels and users. The project details system design, hardware, sensor integration, communication protocols, and software. Experimental results confirm the system's effectiveness in tracking performance, detecting issues, and improving energy efficiency. Its scalability, flexibility, and costeffectiveness make it suitable for commercial, industrial, and residential solar applications. In addition, the system facilitates predictive maintenance by identifying anomalies early. This approach enhances the lifespan and reliability of solar power systems.

1. INTRODUCTION

1.1 GENERAL

Over the past decade, the demand for reliable and abundant power from renewable energy sources has grown significantly. Renewable energy now plays a crucial role in addressing the nation's energy crisis. The government has taken steps to reduce dependence on conventional energy and is encouraging the use of sustainable sources like hydro and solar power. Among these, solar energy stands out as a vast and inexhaustible resource. Solar trackers are devices designed to align solar panels or concentrators toward the sun to maximize energy capture. In this project, a Light Dependent Resistor (LDR) is used to detect sunlight intensity and help maintain alignment with the sun. Accurate solar tracking is essential to ensure that maximum solar radiation is collected and directed toward the energy absorber. With the rising global population and energy demands, enhancing the efficiency of solar power systems is more important than

ever. At the same time, IoT (Internet of Things) technologies-driven by advancements in hardware, software, and connectivity, enable smart monitoring and control of devices. Using IoT, this project presents a simple and cost-effective solution for managing a dual-axis solar tracking system to evaluate and improve its performance.

2. LITERATURE SURVEY

2.1 EXISTING SYSTEM

The existing solar panel monitoring systems generally use standalone controllers and sensors to track performance, but they often lack real-time remote monitoring, data analysis, and automated alerts. These systems usually require manual inspection and limited integration with external devices or platforms.

2.2 PROPOSED SYSTEM

The proposed system integrates IoT (Internet of Things) technology with solar panel controllers to enable real-time monitoring, data collection, and remote access. The system will allow users to track performance, receive automatic alerts, and analyze data through a web or mobile application, improving efficiency and reducing the need for manual intervention.

3. BLOCK DIAGRAM

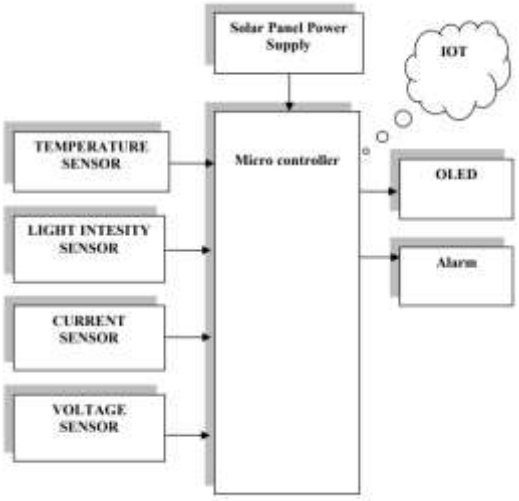

FIG: 1 Block diagram

3.1. HARDWARE COMPONENTS

- Regulated power supply.
- Micro controller.
- Voltage sensor
- Current sensor
- Temperature sensor

3.2. SOFTWARE REQUIREMENTS:

- Embedded C

4. IMPLEMENTATION

This project presents the design and implementation of an IoT and microcontroller-based solar panel monitoring system that enables remote monitoring and management of parameters like voltage, current, temperature, and power output. Featuring real-time data collection, the system uses a microcontroller to interface with sensors and transmit data wirelessly to a cloud platform. By leveraging IoT technologies, it ensures seamless communication between solar panels and users. The project details system design,

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5. CIRCUIT DIAGRAM

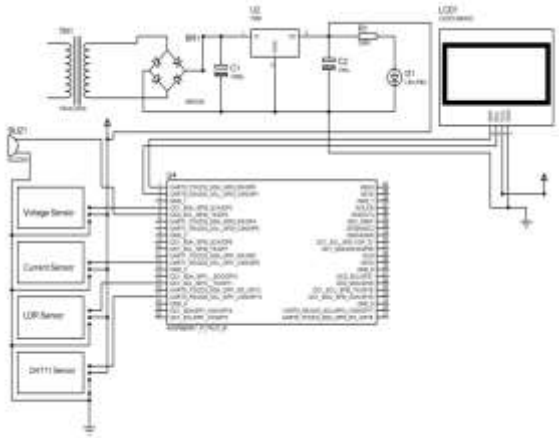

Fig circuit diagram

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 outcomes of this project were obtained using Light Dependent Resistors (LDRs) in both the solar tracking system and the fixed panel setup. The performance of the LDRs was influenced by the intensity of sunlight they received. The proposed dual-axis solar tracker, controlled by a PIC microcontroller, automatically follows the sun's position to optimize solar energy capture. Compared to single-axis or fixed systems, the dual-axis tracker delivers higher current output and improved efficiency. The primary goal of this project was to design and implement a dual-axis solar tracking system using five LDR sensors to estimate the sun's position accurately. The system significantly enhances the efficiency of solar panels, operates automatically, and requires minimal maintenance at a low cost. Due to its dual-axis nature, it can achieve maximum efficiency over time. This solar tracking system can be installed in various environments as it is not highly affected by weather conditions. It is suitable for a wide range of applications, including vehicles, residential areas, industrial facilities, and institutions. For large-scale installations, the system should be designed with stronger mechanical support. Power consumption can also be reduced by improving the system's design.

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