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Dual Axis Rotating Solar Panel using Internet of Things

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Abstract: *The creation of a dual-axis solar monitoring system that incorporates IoT (Internet of Things) innovations is the main topic of this study. Solar power is a clean, efficient, and renewable energy source. Solar trackers that shift photovoltaic panels in the direction of the sun can boost their energy production. This paper describes the outline and development of a dual-axis solar tracker system driven by an IoT Arduino microcontroller driving unit. A BH1750 light sensor that measures ambient light is also a part of the system. With the aid of this sensor, the solar panels may be angled optimally for optimum exposure to the sun. The system also includes an Internet of Things (IoT) monitoring system that uses an Arduino to display data like voltage and current and the electricity produced by the solar panels. This system's objectives are to increase solar panels' effectiveness and give consumers an easy way to track the operation of their solar energy systems.*

Keywords: Dual- axis Solar Panel, Internet of Things

I. INTRODUCTION

The need for reliable, abundant electrical energy produced by renewable energy sources has increased during the past ten years. In the country's energy crisis, renewable energy is crucial. The government started encouraging individuals to adopt renewable energy sources like solar and hydropower to reduce the use of conventional sources of energy. One source of renewable energy is solar electricity. Solar energy is a huge, limitless source of power.

A solar tracker is a device designed to orient solar panels or reflectors towards the sun, maximizing the amount of solar energy captured. By accurately positioning the panels to track the sun's movement, solar trackers can increase solar energy production by up to 30%. The ability to track the sun in both horizontal and vertical directions is known as a dual-axis system and offers even higher efficiency than single-axis systems. IoT technology can be integrated into solar tracking systems to enable remote monitoring and control, further improving efficiency and productivity. Batteries can then be used to store the power produced by solar panels for later use.

Solar Tracking Systems:

An overview of solar tracking systems is given in this section, along with information on their kinds, parts, and operating principles. The distinctions between single-axis and dual-axis tracking systems are highlighted, with a special emphasis on the higher energy yield that dual-axis trackers accomplish. The significance of precise sun monitoring and its effect on energy production are also covered.

This section examines how Internet of Things (IoT) technology is incorporated into solar energy systems. It explores the possible advantages of utilizingIoT for solar tracking systems' monitoring, regulation, and data processing. We study several IoT-enabled parts and their functions in a dual-axis solar tracker system.

Dual-Axis Solar Tracking System:

Dual-axis tracking solar panel systems are the subject of this section. It gives a general overview of the mechanical and electrical parts, including the communication modules, motors, controllers, and sensors. We examine existing research investigations and projects that use dual-axis solar trackers, emphasising design factors, control schemes, and performance assessments.

This section investigates how Internet of Things technology is used in dual-axis solar trackers. It looks at how real-time monitoring, data collection, and remote control are made possible by the IoT. In IoT-enabled solar tracking systems, the use of cloud computing, wireless communication protocols, and data processing is explored.

II. LITERATURE REVIEWS

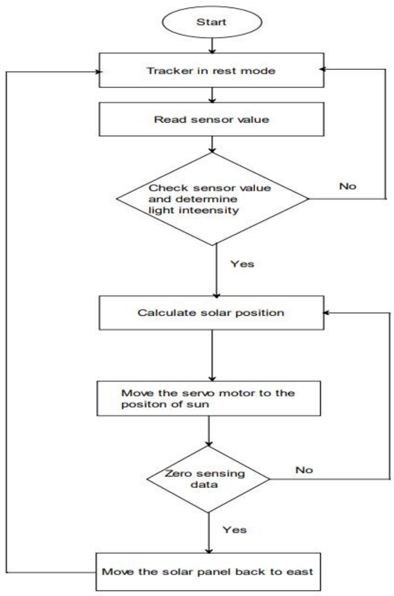
Solar panels use light to generate electricity. Since the sun was considered the most potent source of light accessible, it was given the name "Sol". These devices are referred to as photovoltaic, which can refer to "light electricity" in various contexts. PV cells, sometimes referred to as solar cells, use the photovoltaic phenomenon to absorb solar energy and induce the passage of energy among two distinct layers that possess varying charges.

Solar panels are composed of solar cells that use semiconductor materials like silicon to convert sunlight into electricity. Although individual solar cells produce only a small amount of electricity, when grouped together over a large surface area, they can provide significant power. For maximum efficiency, solar panels must be oriented directly towards the sun. The development of solar cell technology can be traced back to the 1839 research of French physicist Antoine-Cesar Becquerel, who observed the photovoltaic effect while experimenting with a solid electrode in an electrolyte solution.

In 1883, Charles Fritts is credited with creating the first true solar panel according to Encyclopaedia Britannica.Crystalline silicon and gallium arsenide are two of the most popular semiconductor components used to make solar panels. Gallium arsenide is primarily employed in photovoltaic applications, whereas silicon crystals, which are less costly, are used in things like microelectronics. The largest solar manufacturing plant in the world, with a goal of producing up to 1.5 GW of electricity annually, will be built in Singapore, according to plans revealed by the Norwegian Renewable Electricity Corporation (REC).

This may contemporaneously give energy to millions of homes. In discrepancy, the world generated only 2 GW of solar panels in 2016. The stellar energy converting unit consists of up of an array of it's plate, an upgraded eggbeater, a single phase inverter, a inbound interspersing current power force, and a microcontroller- grounded control unit.

2.1 Flowchart:



III. METHODOLOGY

The methodology for a dual-axis rotating solar panel using IoT can be summarized as follows:

- Design and hardware selection: Determine the specifications and requirements of the solar panel system, including power output, panel size, and tracking accuracy. Select suitable solar panels, motors, sensors, and microcontrollers that can be integrated with IoT technology.

- Assembly and installation: Build the mechanical structure to support the solar panels and rotating mechanism. Install the sensors for tracking sunlight and the motors for panel movement. Ensure proper wiring connections between the components.
- IoT integration: Connect the microcontroller or IoT device to the internet, allowing it to communicate and receive commands remotely. Choose a suitable IoT platform or cloud service for data monitoring and control.
- Create or use a sun tracking algorithm to determine the best location for the solar plates as per the orientation during daylight. This method may make use of information from the built-in sensors, such as GPS coordinates or light intensity.
- Data acquisition and analysis: Continuously collect data from the sensors, such assunlight intensity, panelposition, and power output. Analyze this datato monitor the performance of the solar panel system and identify any anomalies or inefficiencies.
- Remote control and monitoring: Implement a user interface, such as a mobile app or web portal, to enable remote control and monitoring of the solar panel system. Users should be able to adjust panel positions manually or automatically, monitor power generation, and receive notifications or alerts.
- Maintenance and optimization: Regularly inspect and maintain the mechanical components, sensors, and motors to ensure proper functioning. Continuously monitor the system's performance and analyze the data to identify opportunities for optimization and efficiency improvements.
- Safety considerations: Implement safety features to protect the system from extreme weather conditions, such as high winds or hail. Ensure that the rotating mechanism has appropriate limit switches or safety sensors to prevent damage or accidents.
- Scalability and expansion: Design the system with scalability in mind, allowing for the addition of more panels or integration with other renewable energy sources. Consider the potential for integrating energy storage systems or grid connectivity.

By following these steps, you can create a dual-axis rotating solar panel system using IoT technology, enabling remote monitoring, control, and optimization for increased energy efficiency and convenience.

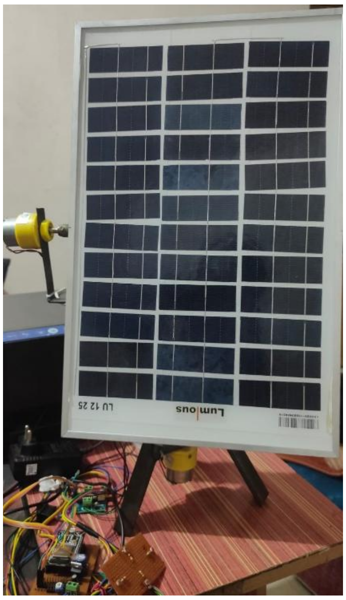


Image of our developed module Dual Axis Solar Panel

IV. CONCLUSION

The literature review concludes by summarizing the key findings and insights gained from the existing research on dual-axis solar tracker systems using IoT. It emphasizes the potential of these systems for increasing energy production and efficiency in solar energy systems. Additionally, it identifies areas for further research and development to overcome the existing challenges and improve the performance of such systems.

V. ACKNOWLEGDEMENT

In order to successfully design and deploy the Dual Axis Solar Tracker utilizing IoT, we would like to convey our heartfelt gratitude to everyone who helped. The following individuals and groups deserve our deepest appreciation for their efforts, without which this project could not have been finished:

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3. Internet of Things (IoT) Platform Suppliers: We would like to thank the suppliers of the Internet of Things (IoT) platforms and technologies that we used in our project. We were able to effectively track and manage the movement and operation of the solar tracker thanks to their sturdy and dependable platforms.
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