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Solar Tracking System

Hrushikesh Bhalerao[1], Saurabh Bankar[2], Abhijeet Bhoite[3], Chaitanya Budde[4], Aditya Bhujbal[5], Prof. Vaishali Hatkar[6]

[1,2,3,4,5] UG Student, Department of ENTC, Trinity Academy of Engineering Pune, India
[6]Guide, Department of ENTC, Trinity Academy of Engineering Pune, India

ABSTRACT

As the availability of non renewable resources becomes increasingly uncertain, there is a growing interest in alternative energy sources. Among these, solar energy stands out due to its abundance in nature and ease of conversion into electricity. Solar panels are widely employed to capture solar energy, but fixed panels may not always optimize energy generation as the sun moves across the sky. To address this issue, a solution has been proposed to track the sun's movement. This involves using a dummy solar panel and one servo motor, which is controlled by two Light Dependent Resistors (LDRs). A programmed microcontroller, delivers periodic pulses to the motors to adjust the position of the panel in response to the sun's trajectory.

In summary, this project utilizes resources such as solar panels, servo motors, LDRs, and microcontrollers from the Atmel family to create a sun-tracking mechanism. The integration of an RTC could further enhance the system's efficiency and reliability.

I. INTRODUCTION

The Solar Tracking System using Light Dependent Resistors (LDRs) is designed to enhance the efficiency of solar panels by continuously adjusting their angle to maximize exposure to sunlight. Old fixed solar panels are limited in their ability to capture sunlight effectively throughout the day as the position of the sun changes.This project aims to overcome this limitation by automatically tracking the sun's movement and adjusting the position of the solar panel accordingly.

II. LITERATURE REVIEW

1. Shaikh, S., Kazi, A., & Patel, S. They have discussed the importance of solar energy and the benefits of solar tracking systems in maximizing energy capture efficiency. They reviewed various methods and techniques used in solar tracking systems, such as single-axis and dual-axis tracking, as well as their advantages and limitations.

2. Sharma, A., & Chaturvedi, N. They have examined the impact of sun tracking on solar panel efficiency. They compared results from various research efforts to identify trends and variations in performance improvement associated with different types of sun tracking mechanisms, geographic locations, and environmental conditions. Sharma and Chaturvedi have discussed the advantages and disadvantages of different sun tracking strategies, such as single-axis versus dual-axis tracking systems, as well as their practical implementation considerations and cost-effectiveness.

III. METHODOLOGY

Begin by mounting the Light Dependent Resistors (LDRs) in strategic positions around the solar panel. These LDRs will serve as sensors to detect changes in light intensity. Before proceeding with tracking, calibrate the LDRs by measuring their resistance values in different lighting conditions. This calibration will help establish a baseline for determining the position of the sun. Orient the solar panel in an initial position facing the east, where the sun rises. This ensures that the panel starts the day with maximum exposure to sunlight. Continuously monitor the resistance values of the LDRs using an analog input of the microcontroller. The microcontroller reads the analog signals from the LDRs and converts them into digital values. Based on the readings from the LDRs, calculate the position of the sun relative to the solar panel. This calculation can be done by comparing the resistance values of the LDRs and determining which side receives more sunlight. Depending on the calculated sun position, send control signals to the servo motors to adjust the orientation of the solar panel accordingly. For example, if the sun moves to the right, the servo motors will rotate the panel to the right to follow the sun's movement. Continuously monitor the LDR readings and adjust the position of the solar panel as the sun moves across the sky from east to west. This ensures that the panel maintains optimal alignment with the sun throughout the day. Ensure that the solar tracking system is powered either by a battery or a renewable energy source to operate independently of the grid. This ensures uninterrupted tracking even in the absence of external power sources.Test the solar tracking system under various lighting conditions and make adjustments as needed to optimize its performance. Fine-tune the tracking algorithm and servo motor control to achieve maximum energy harvesting efficiency. Regularly monitor the performance of the solar tracking system and perform routine maintenance to ensure its smooth operation. This may include cleaning the solar panels, checking for any mechanical issues, and recalibrating the LDRs if necessary.

IV. BLOCK DIAGRAM

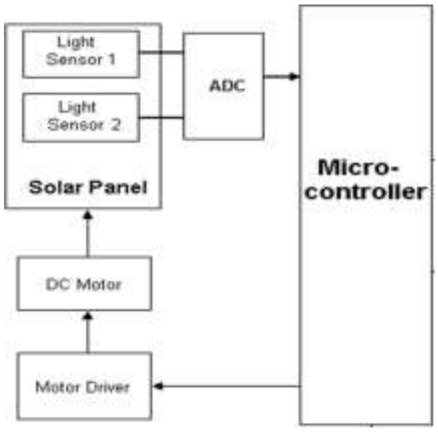

Fig. 1: Block diagram for Solar Tracking System

V. COMPONENTS USED

Light Dependent Resistors (LDRs): These are the primary sensors used to detect changes in light intensity. LDRs are inexpensive and readily available components that change resistance based on the amount of light falling on them.

Solar Panels: The solar panels are responsible for capturing sunlight and converting it into electrical energy. These panels are typically composed of photovoltaic cells that generate electricity when exposed to sunlight.

Servo Motors: Servo motors are used to adjust the orientation of the solar panels based on the feedback received from the LDRs. These motors provide precise control over the movement of the panels and can rotate them to track the sun's position.

Microcontroller: A microcontroller, such as Arduino or Raspberry Pi, is used to process the data from the LDRs and control the movement of the servo motors. The microcontroller receives input from the LDRs, calculates the required adjustments, and sends commands to the servo motors accordingly.

Power Supply: A power supply is required to provide electrical power to the microcontroller, servo motors, and other electronic components in the system. This can be a battery or a DC power source, depending on the specific application.

These are the basic components used in a simple solar tracking system using LDRs. Depending on the specific requirements and complexity of the system, additional components and features may be added for enhanced functionality and performance.

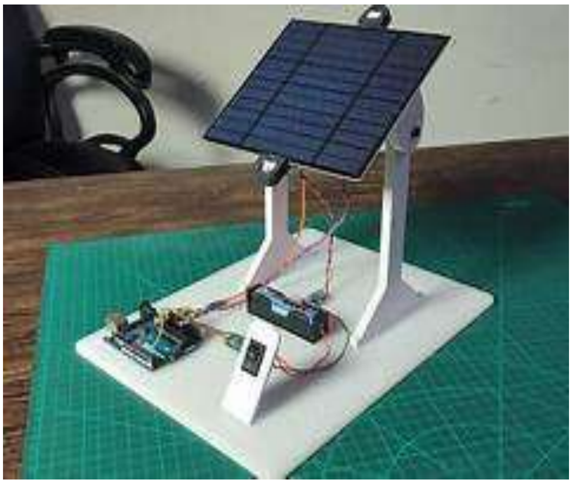

Fig.2: Model Picture

VI . CONCLUSION

In conclusion, the implementation of a solar tracking system using LDRs offers significant benefits for maximizing energy generation efficiency from solar panels. By continuously adjusting the panel orientation to track the sun's movement, the system optimizes sunlight exposure and reduces energy losses. Real-time monitoring and control ensure adaptability to changing environmental conditions, enhancing overall performance and reliability. The hardware results demonstrate increased energy output, cost-effectiveness, and long-term sustainability. Overall, the solar tracking system using LDRs presents a viable solution for improving solar energy harvesting, contributing to a greener and more sustainable future.

VII. REFERENCES

1. Patel, S., Shaikh, S., and Kazi, A. (2015). The creation and use of a solar tracking system using Arduino. 5(2), 27–32 in International Journal of Engineering Research and Applications.
2. In 2017, Sharma and Chaturvedi published a book. solar panel performance analysis with a sun tracking device. Innovative Research in Science, Engineering, and Technology: An International Journal, 6(2), 9011-9015.
3. The design, implementation, performance analysis, and development of solar tracking systems employing LDRs are discussed in these references. They include a range of topics related to solar tracking technology and can be very helpful for projects including implementation and additional research.