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SOLAR TRACKING SYSTEM USING ARDUINO

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ABSTRACT

This work presents a single-axis solar tracker system using Arduino for optimized energy generation. Light Dependent Resistors (LDRs) detect sunlight intensity, and an Arduino controls servo motors to adjust the solar panel towards the maximum light source. This approach aims to increase solar panel efficiency by maintaining optimal alignment with the sun throughout the day.

Keywords: Single Axis, Solar Tracker, Arduino, Energy, Servo Motor, Solar Panel.

I. INTRODUCTION

Solar energy is a clean and abundant renewable resource. However, the efficiency of solar panels depends on the angle at which they receive sunlight. As the sun moves across the sky throughout the day, a fixed solar panel won't be directly facing the sun all the time. This is where solar tracking systems come in. A solar tracking system uses sensors and motors to automatically adjust the position of a solar panel throughout the day. This ensures the panel remains perpendicular to the sun's rays, maximizing the amount of sunlight it captures.

II. METHODOLOGY

Light Sensors: Light-dependent resistors (LDRs) are commonly used sensors. They change their resistance based on the intensity of light they receive. By strategically placing LDRs around the solar panel, the Arduino can compare their readings and determine the direction of the strongest sunlight.

Microcontroller (Arduino): The Arduino acts as the brain of the system. It reads the data from the LDRs, analyzes it, and sends control signals to the motors.

Motors: Depending on the design, one or two motors (usually servo motors) are used to adjust the tilt of the solar panel. By controlling the rotation of the motors, the Arduino can precisely position the panel for optimal sunlight reception.

III. MODELING AND ANALYSIS

There are two main types of solar tracking systems based on the number of axes they rotate on: single-axis and dual-axis. Single-axis systems are simpler and more common for hobbyist projects. They typically rotate the solar panel along a horizontal axis, tracking the sun's east-west movement. Dual-axis systems offer more precise tracking by adjusting the panel on both horizontal and vertical axes, following the sun's position throughout the day. These are more complex but can achieve higher efficiency gains.

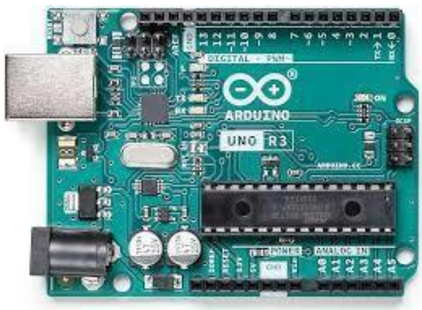

Figure 1: Arduino Board

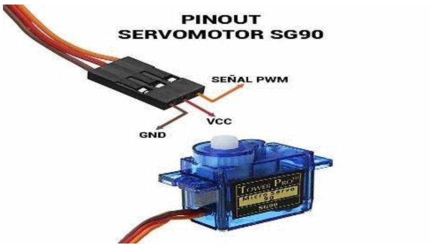

Figure 2: Servo Motor

IV. RESULTS AND DISCUSSION

Result of this project is, when light falls on the LDR, its resistance varies and a potential divider circuit is used to obtain corresponding voltage value (5v) from the resistance of LDR. The voltage signal is send to the Arduino microcontroller. Established on the voltage signal, a corresponding PWM signal is send to the servo motor which causes it to rotate and to end with attains a position where intensity of light falls on the solar panel is maximum.

V. CONCLUSION

Solar tracking systems with Arduino offer a compelling solution to maximize the energy output of solar panels. By utilizing Arduino's programmability and affordability, these systems can be built relatively cheaply and effectively. Studies have shown that even simple single-axis trackers using light-dependent resistors (LDRs) can increase energy production by up to 20% compared to fixed panels. More complex dual-axis trackers with advanced algorithms can achieve even greater efficiency gains. While the added complexity of a tracking system requires some initial investment, the potential increase in energy generation can lead to significant cost savings over time. Additionally, Arduino-based systems offer a great educational platform for learning about solar energy, electronics, and programming.

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