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Sun Tracking using Solar System Arduino

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Abstract: *In this paper, a solar tracking system using Arduino Uno is designed and built. The system collects free energy from the sun stores it in the batteries and then converts this energy to the respective alternating current. It makes the energy usable in normal homes as an independent power source.*

Keywords: 1 x Arduino Uno, x Servo motor, x Solar panel 2 x LDR,x 10k Resistor

I. INTRODUCTION

Solar energy is a renewable and sustainable resource that has gained importance in the pursuit of clean energy. Solar panels are widely used to convert sunlight into electrical energy. However, fixed solar panels only capture sunlight at optimal angles for a limited period during the day. A sun-tracking solar system can significantly improve energy collection by adjusting the orientation of the solar panel to always face the sun.

II. LITERATURE REVIEW

Existing Technologies:

- Review of Due to the scarcity of fossil fuels, scientists are now research alternative energy sources. Solar energy is one of the renewable energy sources available. Solar panels that convert solar light to electrical current based on the photoelectric effect are one approach to turn solar energy into electricity.
- Development of low-cost, low-power sensors for broader deployment in agriculture and environmental monitoring.
- Review of calibration methods and challenges in sensor accuracy.

III. METHODOLOGY

The methodologies used in we are using the LDR sensor to detect the light (sun) intensity and servo motors for automatic rotation of the panel using the Arduino microcontroller. The Arduino Uno board controls the motor as per the output of the LDR sensor. You can also use the potentiometer to operate this panel manually

Hardware component related in
Servo Motor (SG90):

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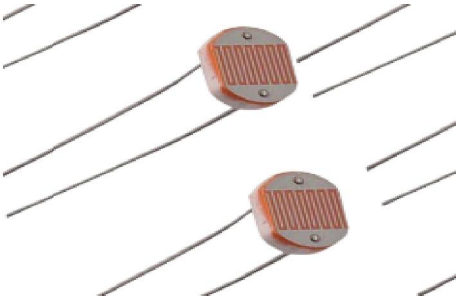
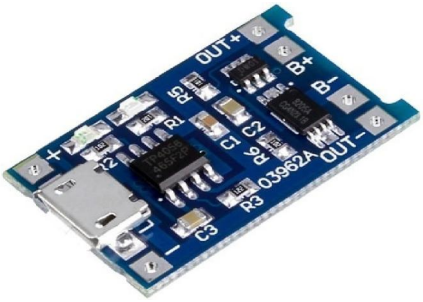
LDR Sensor with 10k Resistor:



18650 Batteries:

TP4056 Charging Circuit:



IV. WORKING PRINCIPLE

1. Light Detection by LDR Sensor
2. Signal Processing in Arduino
3. Servo Motor Movement
4. LDR sensor is a input & output stream

It is the solar tracker revolves around the interaction between light detection, signal processing, and mechanical movement.

V. RESULTS

1. Increased Solar Efficiency

A well-designed sun-tracking system can improve energy output by 30-50% compared to fixed solar panels.

2. Real-Time Sun Tracking

The system continuously adjusts the panel's angle based on light sensor (LDR) readings.

Smooth tracking with minimal delay ensures optimal positioning.

3. Power Consumption vs. Gain

The stepper/servo motors consume power, but the energy gained from tracking generally outweighs the losses.

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VI. CONCLUSION

1. The sun-tracking solar system using Arduino is an innovative solution aimed at increasing the efficiency of solar panels by enabling them to follow the sun's movement.
2. The implementation of a sun-tracking solar system using Arduino significantly enhances the efficiency of solar panels by ensuring they are always aligned with the sun's position. Compared to fixed panels, this system can increase energy output by 30-50%, making it a practical and cost-effective solution for maximizing solar power generation..
3. While the system improves performance, challenges such as power consumption by motors, sensor accuracy, and environmental factors (e.g., cloudy weather, wind loads) must be addressed.
4. Optimizing motor movement, using efficient tracking algorithms, and integrating MPPT technology can further improve the system's reliability and effectiveness.

VII. ACKNOWLEDGMENT

I would like to express my sincere gratitude to everyone who contributed to the successful completion of this Arduino-based Sun Tracking Solar System project.
Firstly, I extend my heartfelt thanks to my mentors, instructors, and guides for their valuable insights, encouragement, and technical support throughout this project. Their expertise and guidance played a crucial role in shaping the development and implementation of this system.
I would also like to acknowledge the contributions of my peers, friends, and colleagues who provided constructive feedback and assistance during the design and testing phases. Their support and collaboration were instrumental in overcoming challenges and refining the system.
Authors: Mr. Tamke Narayan Shankar

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[3]. Conference proceedings that highlight recent advancements in solar technology.
[4]. Web resources for up-to-date industry information and guidelines.
[5]. Technical standards that inform the design and safety protocols for solar installations.