Automatic Solar Tracker System

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Outline

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Abstract

The goal of the automated solar tracking system project is to increase the efficiency of solar panels by keeping them always facing the sun. By maintaining a constant alignment with the sun's position throughout the day, solar panels' efficiency and output may be maximized with the use of an automated solar tracking system. This method allows solar panels to harness more of the sun's energy and generate more power by following its path across the sky. The project combines hardware and software elements to optimize solar panel performance and harness clean, renewable energy from the sun more effectively. It represents a step towards sustainable energy solutions and contributes to a greener future.

Introduction

- Automatic solar tracking systems offer a significant advancement in solar panel technology by optimizing energy generation through continuous alignment with the sun's position.

- These systems greatly outperform stationary ones in terms of energy production because to their ability to dynamically modify the angle of solar panels to maximize sunlight absorption.

- The benefits of automatic solar tracking systems, such as improved efficiency and increased energy production, make them valuable in both large-scale solar power plants and smaller residential or commercial installations.

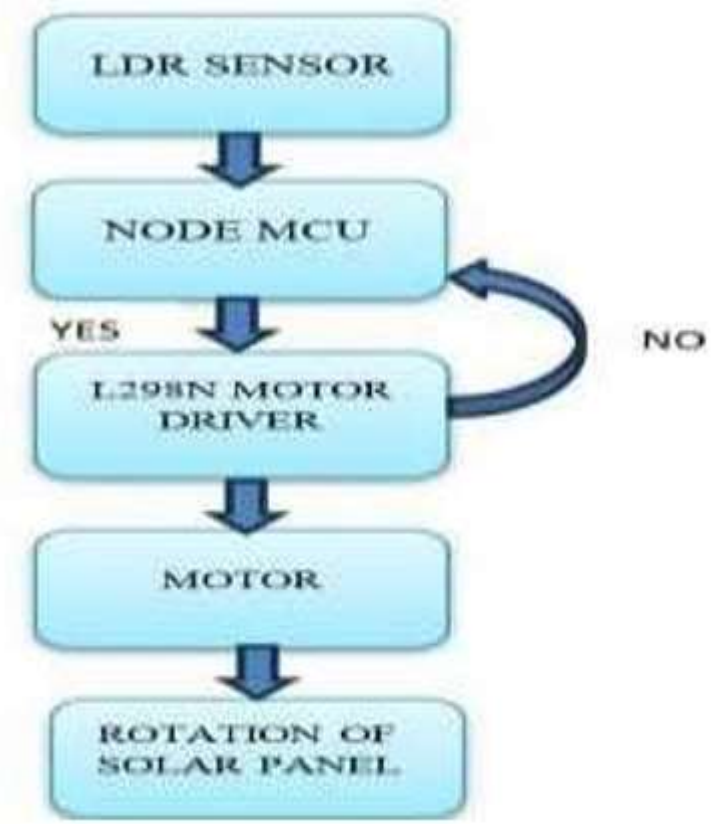
- The use of automatic solar tracking systems helps to increase the use of solar power and the shift to cleaner, more environmentally friendly energy sources since renewable energy is essential for reducing climate change and establishing a sustainable future.

Existing Work

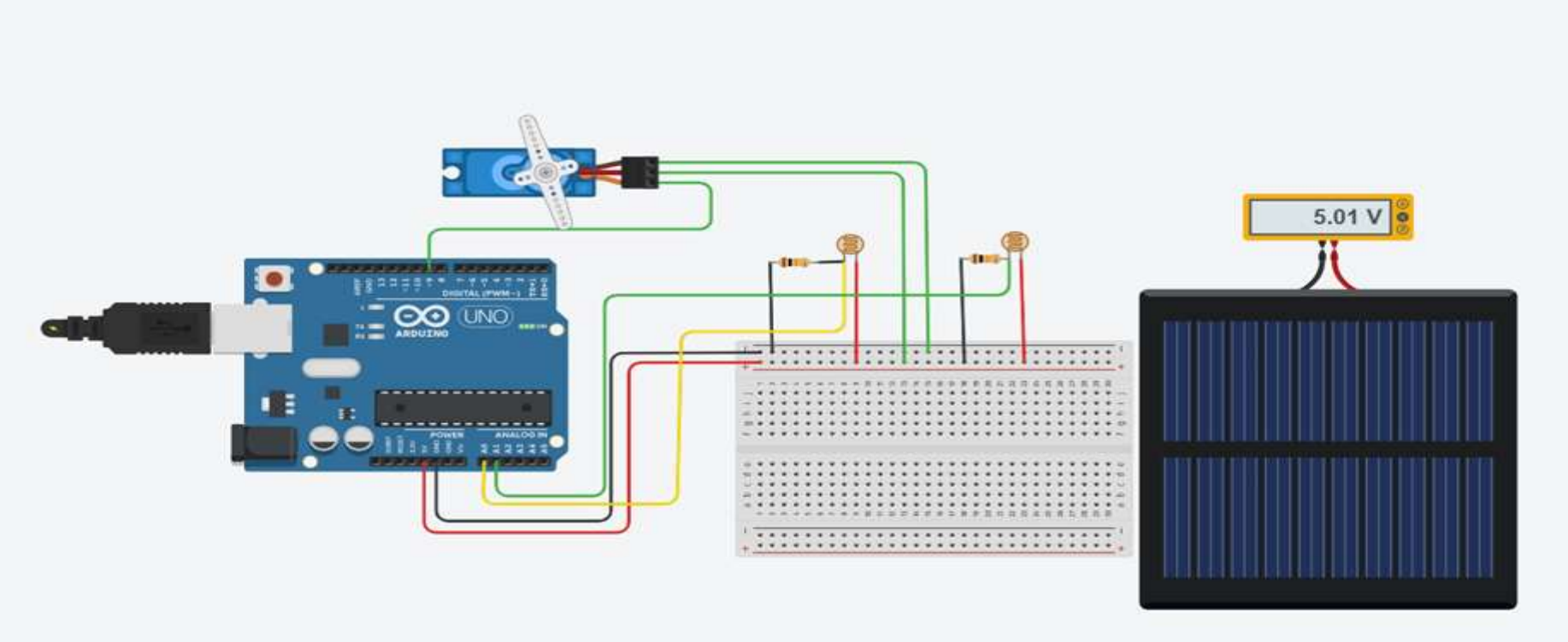
- **increased Energy Yield:** Dual-axis trackers boost energy yield by 30-45% over fixed panels.
- **Microcontroller-Based Systems:** Cost-effective Arduino and Raspberry Pi systems are widely used.
- **LDR Sensors:** Light-dependent resistors are common for sun position detection.
- **GPS Tracking:** GPS enhances accuracy, especially in dynamic weather.
- **Weather Protection:** Some systems incorporate protective measures. These guard against extreme weather conditions.
- **Self-Cleaning:** Automated cleaning mechanisms reduce dust. They also minimize maintenance requirements.

Methodology

- **Light Detection:** Strategically placed LDRs detect sunlight intensity from different angles for accurate tracking.
- **Microcontroller Control:** An Arduino microcontroller processes sensor data and activates servo motors.
- **Servo Motor Activation:** servo motor control horizontal and vertical angles for precise sun tracking.
- **Feedback Loop:** Continuous adjustment based on real-time sunlight intensity ensures optimal alignment.
- **Calibration & Testing:** System is calibrated and tested under various conditions for reliability.



Circuit Diagram



Literature review

1.Publication:

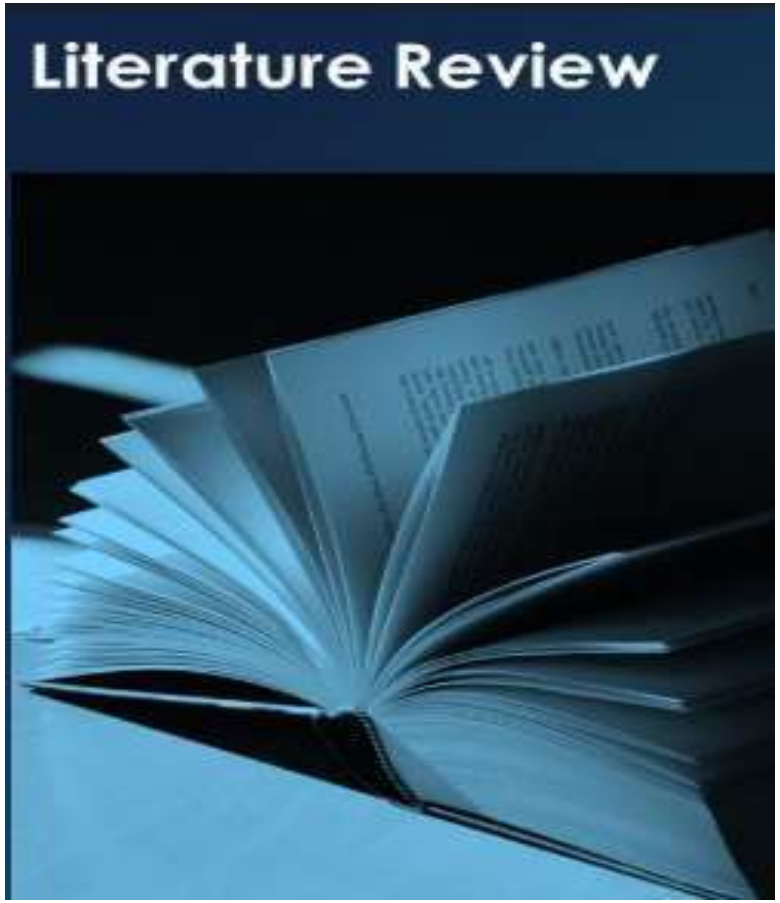
- 2014 - "Design and Fabrication of Single Axis Solar Tracking System" by Ashwin R.

2. Introduction:

- Solar tracker systems improve solar panel efficiency by following the sun's movement.
- It ensures maximum sunlight absorption, increasing power generation.
- Used in residential, commercial, and industrial solar power systems.

3. Objective:

- To enhance solar panel efficiency by adjusting panel orientation.
- To reduce energy losses due to improper sun alignment.
- To develop cost-effective and automated solar tracking mechanisms.



Literature review

4. Technology:

- Used Single-Axis Tracking: Adjusts panels based on the sun's position. Microcontrollers (Arduino, PIC, etc.)
- Sensors (LDR, Photovoltaic Sensors): Detect sunlight intensity.
- Motors (Servo, Stepper, DC Motors): Rotate the panels.
- IoT & AI Integration: Smart tracking and real-time monitoring.

5. Limitations:

- High initial installation and maintenance cost.
- Requires precise calibration for optimal performance.
- Weather dependency affects tracking accuracy.

Conclusion

- An automatic solar tracker system enhances the efficiency of solar energy production by adjusting the position of solar panels to follow the sun's movement throughout the day.
- This maximizes the exposure of the panels to sunlight, improving energy capture and overall system performance.
- By reducing energy loss and increasing output, it provides a cost-effective solution for optimizing solar power generation, particularly in areas with varying sunlight angles.

Future scope

- **Higher Efficiency:** Continued advancements will further boost energy capture, improving the overall performance of solar power systems.
- **Cost Reduction:** As technology improves and manufacturing scales up, the cost of solar trackers will decrease, making them more affordable for residential and commercial applications.
- **Smart Integration:** Solar trackers will be integrated with smart grid technology, allowing for real-time data monitoring and optimized energy distribution.
- **Wider Adoption**: The growing focus on renewable energy and sustainability will drive the use of solar trackers in both small-scale and large-scale solar farms globally.

Thank You!