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Automatic Solar Tracking System

Rajlxmi Patil[1], Vedshree Chavan[2], Saloni Rajmane[3], Shreya Patil[4], Prof. Smita D. Salunkhe[5]

Student, Department of HA, Rajarambapu Institute of Technology, Islampur, India[1]

Student, Department of HA, Rajarambapu Institute of Technology, Islampur, India [2]

Student, Department of HA, Rajarambapu Institute of Technology, Islampur, India[3]

Student, Department of HA, Rajarambapu Institute of Technology, Islampur, India[4]

Guide, Department of HA, Rajarambapu Institute of Technology, Islampur, India[5]

Abstract: Solar energyhas become an increasingly important and popular renewable energysource. Byusing a solar tracking system, we can produce an abundance of energy and improve the efficiency of solar panels. The solar panel's efficiency lies in its perpendicular proportionality with the sun's rays. Although cheaper options are also available, its installation charge is high. A prototype solar panel is discussed in this paper based on the sun's rays as the reason for its design and construction. Arduino is used as the main control circuit. As a result of the programming of this device, the LDR sensor, when it detects sun rays, will provide direction to the Servo Motor in order to move the solar panel. Consequently, the solar panel is positioned so that it can receive the maximum amount of sunlight. Solar energy has become an increasingly important and popular renewable energy source. By using a solar tracking system, we can produce an abundance of energy and improve the efficiency of solar panels. The solar panel's efficiency lies in its perpendicular proportionality with the sun's rays. Although cheaper options are also available, its installation charge is high. A prototype solar panel is discussed in this paper based on the sun's rays as the reason for its design and construction. Arduino is used as the main control circuit. As a result of the programming of this device, the LDR sensor, when it detects sun rays, will provide direction to the Servo Motor in order to move the solar panel. Consequently, the solar panel is positioned so that it can receive the maximum amount of sunlight.

I. INTRODUCTION

Automation is the use of technology to perform tasks without human intervention, leveraging various technologies such as sensors, actuators, and computers. An automatic solar tracking system is a specific application of automation that enhances the efficiency of solar energy collection by adjusting the position of solar panels to follow the sun’s trajectory throughout the day. Automatic solar tracking systems are designed to maximize solar energy capture by continuously orienting solar panels toward the sun. This system can be applied in various settings, including rural areas, where access to renewable energy is crucial for sustainability and energy independence. The Automatic Solar Tracking System (ASTS) aims to enhance the efficiency of solar energy generation by dynamically adjusting the orientation of solar panels to follow the sun's path across the sky. By employing sensors and motorized systems, the ASTS can increase energy capture by up to 30% compared to stationary installations.

II. PROBLEM DEFINITION

The angle of solar panels in real-time to follow the sun from sunrise to sunset, thereby maximizing energy capture and improving efficiency.

Challenges of Automatic Solar Tracking System: -

- Cost: The initial investment for automatic solar tracking systems can be high, making it difficult for individuals, schools, and rural communities to justify the expense.
- Technical Complexity: The design, installation, and maintenance of solar tracking systems require specialized knowledge and skills, which may not be readily available in many areas.

III. METHODOLOGY

Connect the hardware:

- Connect the Light Sensors:
  - Connect the output pin of the first LDR to Arduino Uno analog pin **A0**.
  - Connect the ground pin of the first LDR to a ground (GND) pin on the Arduino Uno

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- Connect the Dc Motor:
  - 1. Connecting the DC Motor to Motor Driver (L298N/L293D)
  - 2. Connecting LDR Sensors to Arduino.
  - 3. Connecting the Motor Driver to Arduino.

- Connect the Power Supply:
  - Ensure that the power supply for the servos is capable of providing sufficient current, and connect it to the servo motors' VCC pins while keeping the grounds common with the Arduino.

- Connect the Charge Controller:
  - Ensure you have your solar panels, charge controller, battery, and load.
- Connect the Solar Panels to the Charge Controller:
  - **Positive Terminal:** Connect the positive terminal of the solar panel to the positive input terminal of the charge controller (often labeled as "Solar In" or "PV+").
  - **Negative Terminal:** Connect the negative terminal of the solar panel to the negative input terminal of the charge controller (labeled as "Solar In" or "PV-").

- Connect the Ardiuno uno:
- Power Connections:
  - **Power Supply:** Connect the Arduino Uno to a power source using a USB cable or an external power adapter (typically 7-12V).
- Connect the Light Sensors:

LDR1:

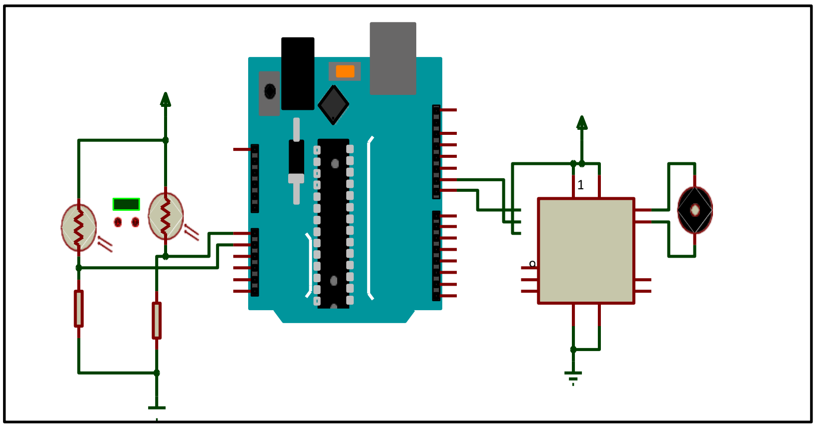
- Connect the output pin of the first LDR to A0.
- Connect the ground pin of the LDR to GND.
- Connect the VCC pin to 5V. LDR2:

- Connect the output pin of the second LDR to A1.
- Connect the ground pin of the LDR to GND.

IV. ARCHITECTURE

A. System Architecture

The architecture in the image represents an embedded system design. It features a microcontroller (possibly an Arduino or ATmega-based board) at the centre, connected to various components. This kind of architecture is often used in automation projects, such as solar tracking systems, temperature control systems, or smart devices.



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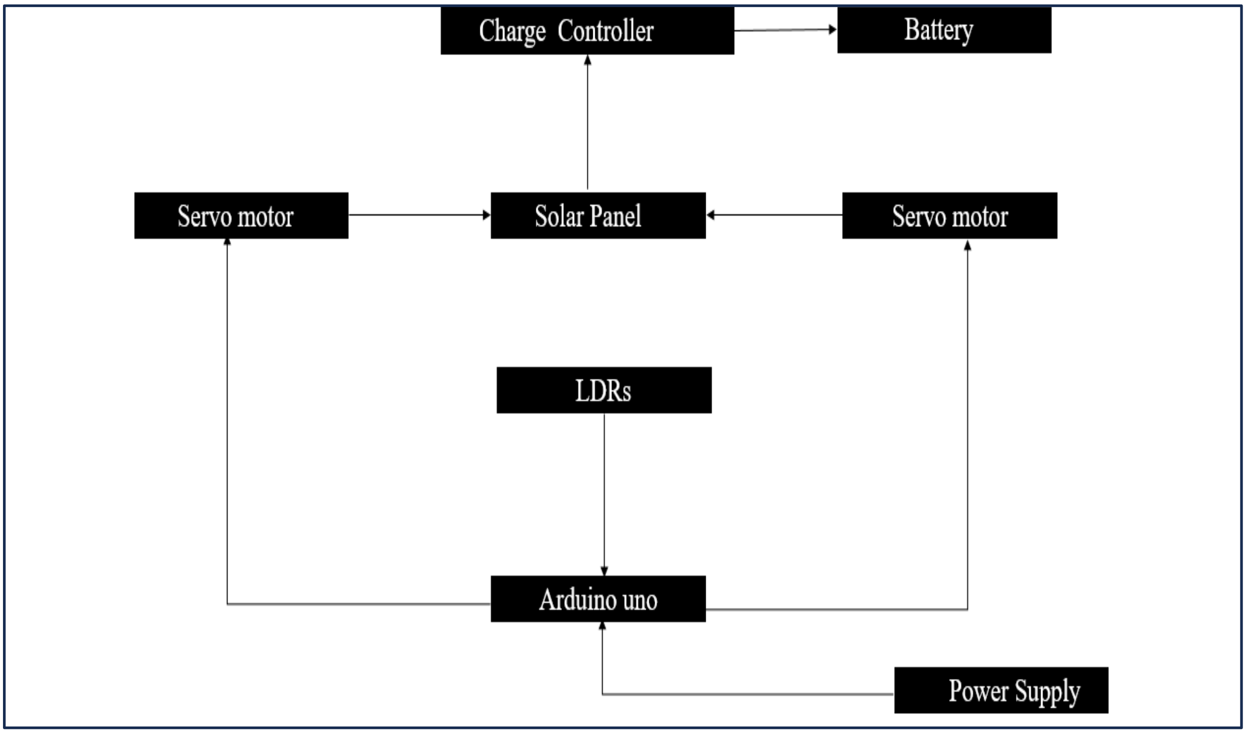
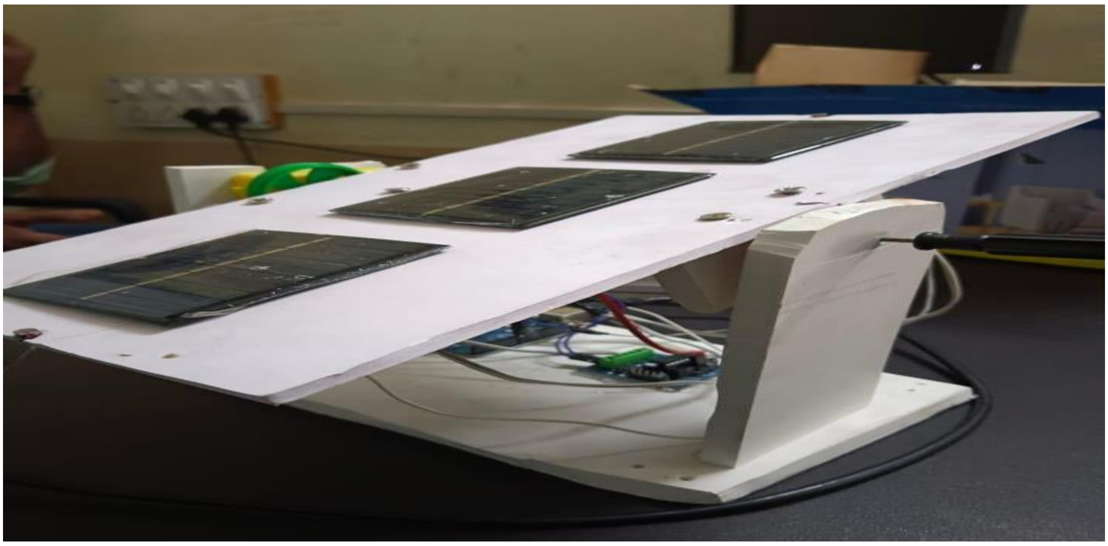
B. Block Diagram



C. Design and implementation



V. RESULTS

The following results were obtained from testing the Automatic Solar Tracking System prototype using a DC motor. The system's performance was evaluated based on power output, tracking efficiency, and response time compared to a fixed solar panel.

A. Power Output Comparison

- The system was tested under different sunlight conditions, and the power generation of the tracking solar panel was compared with a fixed solar panel.
- Observation: The solar tracking system improves energy efficiency by 20-40%, particularly in the morning and evening

when the sun’s position changes rapidly.

B. Motor Response and Power Consumption

- Observation: The DC motor operates efficiently, adjusting the panel with minimal power consumption.

C. Tracking Accuracy and Stability

- The system tracked the sun with an accuracy of ±3°, ensuring precise alignment.
- The LDR sensors correctly detected sunlight intensity differences, triggering smooth panel adjustments.
- During cloudy conditions, the system remained stable and adjusted only when a significant light change was detected.

VI. CONCLUSION

The automatic solar tracking system successfully increased energy capture efficiency. The project demonstrates the feasibility of a low-cost tracking solution. The Automatic Solar Tracking System enhances energy efficiency by continuously aligning solar panels with the sun's position, maximizing power generation throughout the day. This system significantly improves energy output compared to fixed panels, making solar energy more sustainable and cost-effective. This system is a step forward in advancing green energy technology, contributing to a more sustainable and eco-friendly future,

REFERENCES

[1]. A Mohamad, H Mhamdi, NAM Amin, M Izham, NA Aziz and SY Chionh Published under licence by IOP Publishing Ltd Published under licence by IOP Publishing Ltd

[2]. Journal of Physics: Conference Series, Volume 2051, 7th International Conference on Applications and Design in Mechanical Engineering (ICADME 2021) 23rd August 2021, Perlis, Malaysia

[3]. SOLAR TRACKING SYSTEM Vaijantee Wakchaure1, Joel Jagtap2, Prof. Lakshmi Raba B. 3

[4]. N.Othman,M.I.A.Manan,Z. Othman, S.A.M.AlJunid, “Performance Analysis of Dual-axis Solar Tracking System”, IEEE International Conference on Control System, Computing and Engineering, 29 Nov. - 1 Dec. 2013, pp 370-375.

[5]. www.youtube.com