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SUN TRACKING SOLAR PANEL

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ABSTRACT: The demand for renewable energy sources has increased significantly in recent years, and solar energy has emerged as a promising solution to meet these requirements. Solar panels, which convert sunlight into electricity, play a crucial role in harnessing solar energy. However, the efficiency of solar panels heavily depends on their orientation relative to the sun. To address this limitation, sun tracking systems have been developed to optimize the positioning of solar panels throughout the day.

This abstract presents an overview of a sun tracking solar panel system designed to enhance energy efficiency by accurately tracking the sun's position in the sky. The proposed system utilizes advanced sensors and control mechanisms to dynamically adjust the orientation of solar panels to maximize solar exposure.

KEYWORDS: Solar energy, PV panel, latitude, Passive, servo motor.

I.INTRODUCTION

Nowadays the energy deficiency problems faced by the world, more especially the third world countries, are urging researchers to find an alternative energy source that would complement the conventional fossil fuel. The alternative energy sources include solar, nuclear and wind. Solar energy is the energy generated by harnessing the power of the solar radiation. It is the cleanest source of energy which can pollute the climate the least.

The utilization of solar energy as a sustainable and renewable power source has gained immense popularity in recent years. Solar panels, also known as photovoltaic (PV) panels, are the primary devices used to convert sunlight into electricity. However, the efficiency of solar panels is heavily dependent on their orientation relative to the sun. Traditional fixed solar panel installations often fail to optimize solar exposure, resulting in suboptimal energy production.

SINGLE AXIS SOLAR PANEL

Single-axis solar tracking systems follow the solar by moving in a single axis (vertical or horizontal). Generally, the inclination angle is adjusted manually at certain intervals during the year and automatic movement is provided in the east–west direction. Single-axis solar tracking systems are moved on the vertical or horizontal axis depending on the solar trajectory and the weather condition.

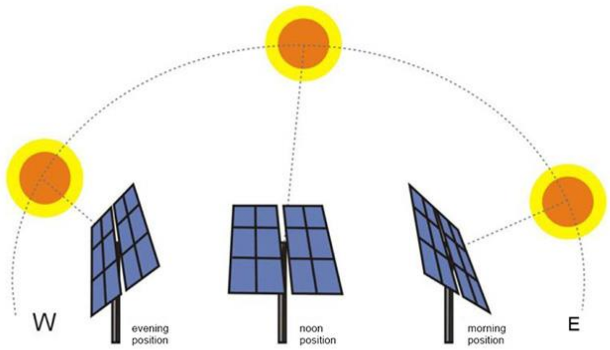

FIG.1

II.METHODOLOGY

Single-axis solar panels are designed to track the sun's movement along a single axis, usually the horizontal axis. The

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tracking mechanism allows the panels to follow the sun's east-to-west path across the sky, optimizing their orientation for maximum solar exposure throughout the day. The working principle of single-axis solar panels involves several key components and processes:

1.Sun Position Sensing: The system incorporates sun position sensors or photodiodes to continuously monitor the sun's position in the sky. These sensors detect the sunlight intensity and direction, providing real-time data about the sun's location relative to the solar panels.

2. Control System: A control system receives input from the sun position sensors and processes the information to determine the optimal position for the solar panels. The control system utilizes algorithms and mathematical calculations to calculate the sun's position and generate commands for adjusting the panel's orientation.

3. Tracking Modes: Single-axis solar panels typically operate in one of two tracking modes: azimuth tracking or elevation tracking.

a) Azimuth Tracking: In azimuth tracking mode, the solar panels rotate around a vertical axis to follow the sun's east-to-west movement. The control system calculates the required azimuth angle based on the sun's position and commands the actuators to rotate the panels accordingly.

b) Elevation Tracking: In elevation tracking mode, the solar panels adjust their tilt angle to maximize the solar exposure. The control system determines the optimal tilt angle based on the sun's elevation angle, which changes throughout the day. The actuators then adjust the tilt of the panels to maintain the desired angle.

4.Power Supply: The tracking system requires a power supply to operate the control system and motorized actuators. This can be achieved using a dedicated solar panel or by connecting the tracking system to the same power source as the main solar panel array.

5.Real-Time Adjustment: The control system continuously receives updates from the sun position sensors, allowing it to make real-time adjustments to the panel's orientation. This ensures that the solar panels remain aligned with the sun's position as it moves across the sky.

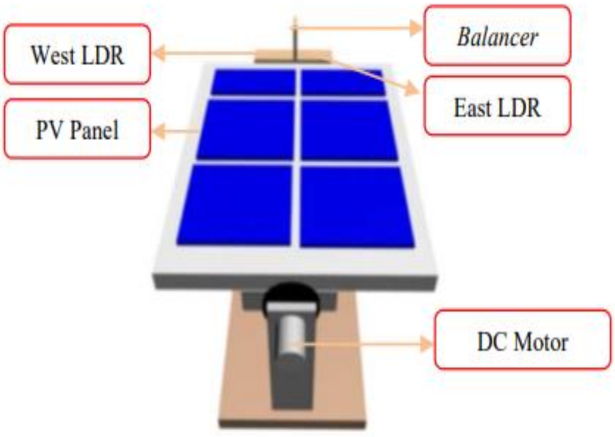

FIG.2

the working principle of single-axis solar panels involves continuous monitoring of the sun's position and real-time adjustment of the panel's orientation. By dynamically tracking the sun's movement, single-axis solar panels optimize solar exposure, resulting in improved energy generation and increased overall efficiency.

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A. CIRCUIT DIAGRAM AND COMPONENTS

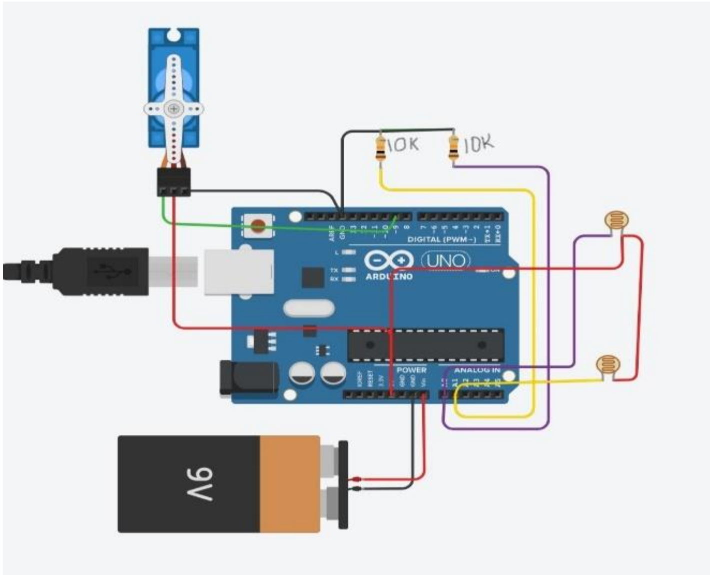

FIG.3

2.LDR

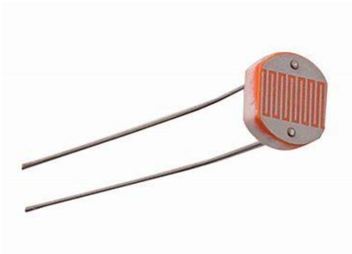

FIG.4

The LDRs act as sensors, providing feedback to the control system, which typically includes an Arduino Uno board. By measuring the resistance of the LDR, the system can determine the intensity of sunlight falling on the panel.

3.RESISTOR

FIG.5

Resistor may be employed for voltage/current limiting, voltage dividers, signal conditioning, or other general circuitry requirements.

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4.SOLAR PANEL

FIG.6

the maximum amount of sunlight possible. The solar panels are typically fixed to a mounting structure that is capable of adjusting its position based on the movement of the sun. This movement is facilitated by motors or actuators controlled by a tracking system.

5.SERVO MOTOR

FIG.7

A servo motor is a type of rotary actuator that allows for precise control of angular position. It consists of a motor, a feedback sensor (such as a potentiometer or an encoder), and a control circuit

***SOFTWARE**
1.ARDUINO IDE

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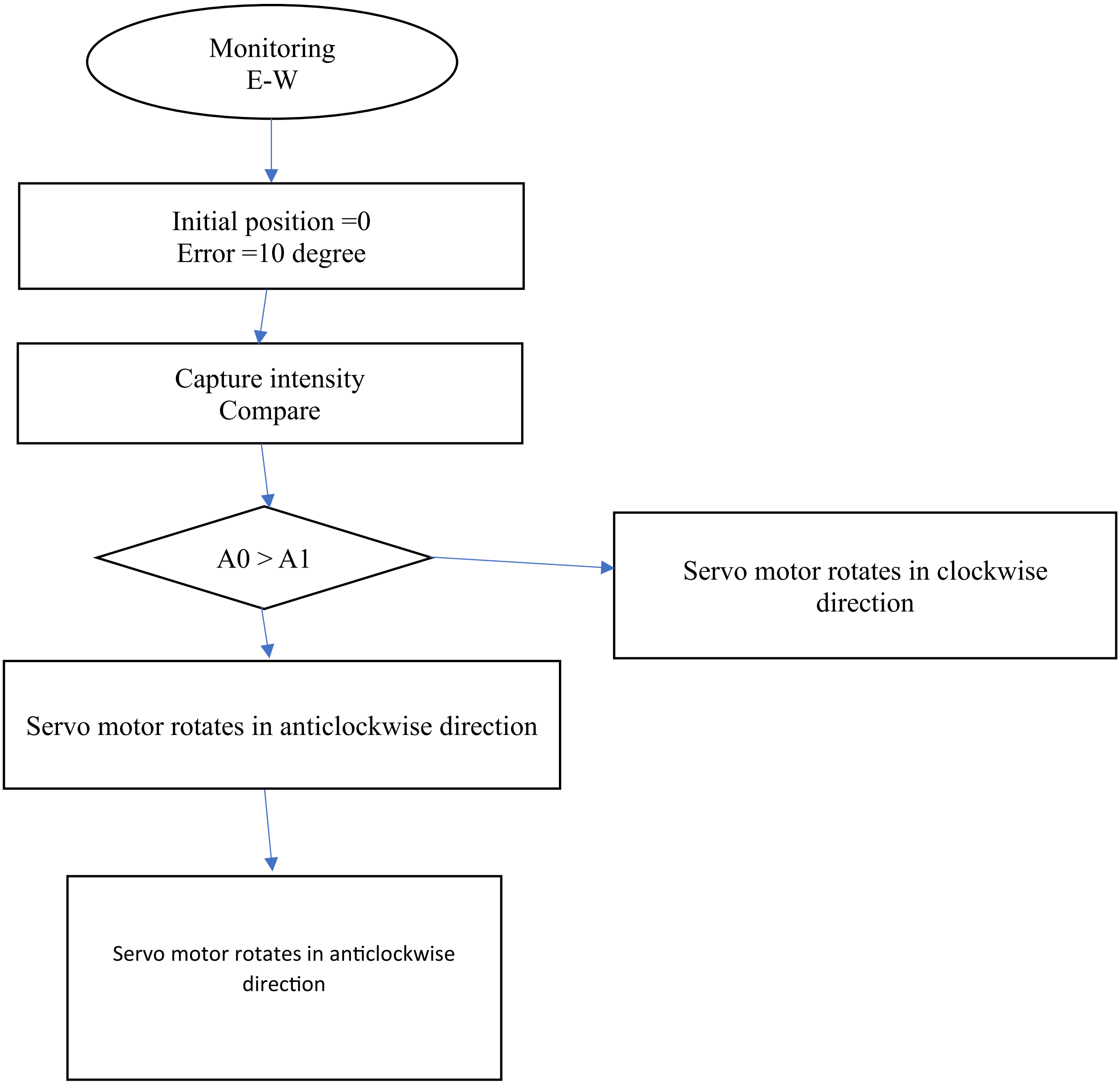
FIG.8

Arduino IDE offers a user-friendly and comprehensive development environment for programming Arduino boards. Its simplicity, extensive library, community support, and compatibility with Arduino hardware make it a popular choice for beginners and experienced users alike.
Arduino Uno is often utilized in sun tracking solar panel systems to enhance the efficiency of solar energy collection.

B. FLOW CHART



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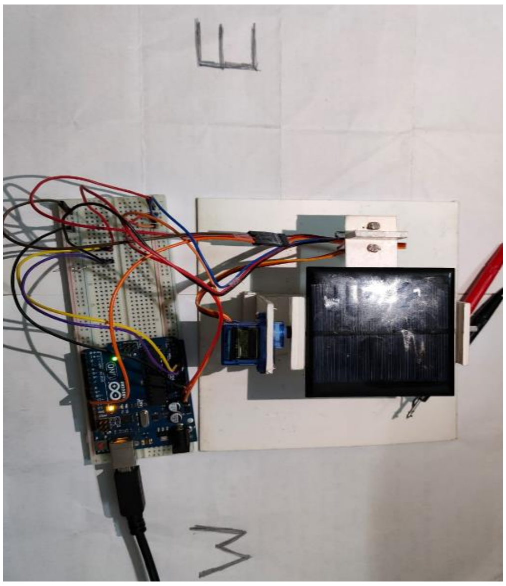
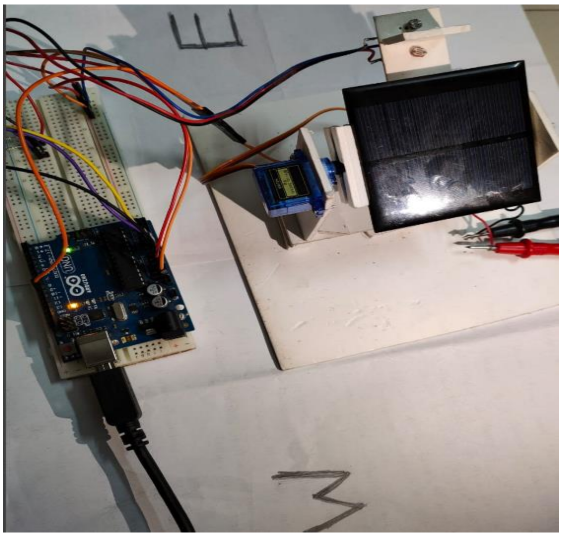
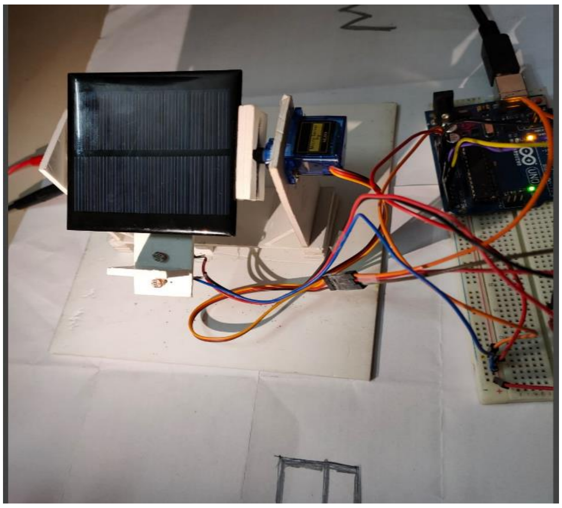
C. ASSEMBLING SINGLE AXIS PANEL







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III.CONCULSION

Single-axis solar panels have demonstrated several benefits. Firstly, they significantly increase energy output compared to fixed installations, typically by 30% to 40%, resulting in improved efficiency and productivity. This enhanced energy generation contributes to the overall viability and economic viability of solar power systems.

Tracking mechanisms, offer a compelling solution for maximizing solar energy generation. The dynamic adjustment of the panel's orientation along a single axis allows it to accurately follow the sun's path across the sky, optimizing its exposure to sunlight throughout the day.

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