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Study of Rotating Solar Panel System

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Abstract - The scarcity of energy is currently the most emergent problem. Conventional energy sources are not only insufficient, but they also contribute significantly to air pollution. Global attention is shifting to renewable energy sources as a means of reducing dependency on conventional energy sources. The use of solar energy as a reliable source of green energy is growing significantly. Solar cells, which convert solar energy into electricity, are pricey and ineffective. The solar tracking gadget is used to improve solar cell performance by keeping an eye on the sun. This study provides a microcontroller-based design strategy that makes the most of solar electricity by tracking the sun all day long. Throughout the day, the solar tracker moves with the sun, from east to west.

Throughout the day, the solar tracker moves with the sun, from east to west. Controlling the solar panel to track the sun like a sunflower increases the amount of energy captured. The solar tracking system is a mechatronic device that combines mechanical, electrical, and software components. Standard photovoltaic solar panels (PV), a deep cycle rechargeable battery, a battery charger, a servo motor, a light-dependent resistor, and a "Arduino Uno" microprocessor are the primary parts of the solar tracking system. Light-dependent resistors are used by the solar tracker as sensors.

Index Terms - Photovoltaic Cell, Solar Tracking, Microcontroller, Servo motor, Arduino Uno , Breadboard;

I. INTRODUCTION

A solar tracker, also known as a rotating solar panel, is a cutting-edge tool created to maximize the effectiveness of solar energy generation by continuously lining up the solar panel with the sun. To make sure that the solar panels receive the most solar radiation possible, these systems detect the sun's movement throughout the day using cutting-edge tracking technology.

Rotating solar panels have several advantages over fixed solar panels. First, it increases energy production by up to 15-25% compared to fixed installations [1]. This efficiency gain is especially beneficial in areas with high solar radiation, such as areas with long sunshine hours or is as close to the equator.

However, bear in mind that rotating the solar panel needs some planning. Compared to permanent PV systems, requires more sophisticated tracking methods and upkeep. Moving elements might also raise the system's initial cost and complexity. Thus, the decision to employ rotating solar panels is based on a number of variables, including the budget for the project, the required level of energy, and the availability of solar resources.

In general, rotating solar panels are a cutting-edge technology that maximizes solar energy harvesting and raises the overall effectiveness of photovoltaic systems. These devices will be crucial in harnessing solar energy potential and easing the transition to a more sustainable and environmentally friendly future as the importance of renewable energy increases.

II. PURPOSE

The purpose of a rotating solar system, or solar tracker, is to optimize the efficiency and output of solar energy generation. It achieves this by continuously adjusting the position of the solar panels to track the movement of the sun throughout the day.

The main purpose of a rotating solar system is to increase the amount of sunlight that the solar panels receive. By aligning the panels directly towards the sun`s rays, the system maximizes the absorption of solar radiation, resulting in higher energy production. This is particularly beneficial in areas with a high solar resource, as it allows for the capture of a greater amount of solar energy.

A rotating solar system also helps reduce the effects of shadows. As the sun crosses the sky, shadows from objects such as buildings, trees, and nearby structures can obstruct solar panels and reduce their efficiency. A rotating system continuously tracks the position of the sun, allowing it to adjust the position of the panels to avoid shading and to receive direct sunlight for as long as possible [2].

Another purpose of rotating the solar system is to improve the overall performance of the solar system. By optimizing panel placement, these systems can ensure a more even and stable power delivery throughout the day. This is of particular value in applications where a stable and reliable power supply is essential, such as grid-connected solar power plants and off-grid systems for remote locations.

III. EXPERIMENTAL FLOW CHART

The solar panel rotates according to the rotation of the sun. This rotation is done so that the solar panel faces the sun and follows the sun's path through the atmosphere to maximize photon capture. The rotation angle of the solar panel is 0°-90° in the morning. The rotation angle at noon is 90°. Afternoon rotation angle is between 90° and 180°. In Fig 1 the experimental flowchart has been shown.

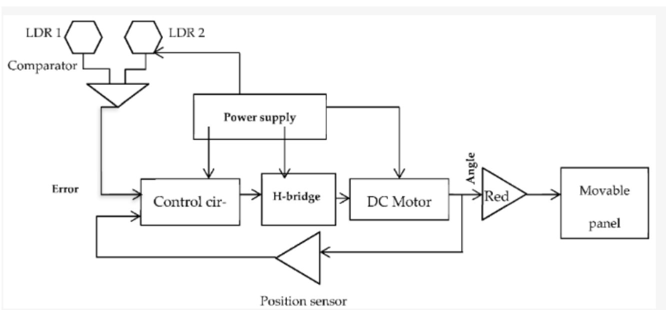

Fig 1: Experimental Flowchart

IV. WORKING PRINCIPAL

Configure a solar panel for sun monitoring with four LDRs, a solar panel, a servo motor, and an Arduino UNO microcontroller. A light dependent resistor is mounted on the roof. When light hits a light-based resistor, it produces a low resistance. The panel rotates towards the sun thanks to the attached servo motors. The panels are constructed so that the light from both sides of the LDR is compared and the panel is compared to the side with the highest intensity, i.e. the side with the highest intensity [4]. The panel rotates at a constant angle with a servo motor. If the light intensity on the right side of the LDR is high, the screen shifts to the right, and if the light intensity on the left side of the LDR is high, the screen shifts to the left. At noon the sun is in front and both panels have the same amount of light. In such cases the panel is constant and has no rotation. The proposed method uses a position sensing unit to determine the rotational position of the sun. This way you can determine which direction the motor will rotate to move the shaft in the desired direction. Light-based resistors produce low resistance. The panel rotates towards the sun to the attached servo motors. The panels are constructed so that the light from both sides of the LDR is compared and the panel is compared to the side with the highest intensity, i.e. the side with the highest intensity. The panel rotates at a constant angle with a servo motor. If the light intensity on the right side of the LDR is high, the screen shifts to the right, and if the light intensity on the left side of the LDR is high, the screen shifts to the left [5] . At noon the sun is in front and both panels have the same amount of light. In such cases the panel is constant and has no rotation.

The proposed method uses a position sensing unit to determine the rotational position of the sun and which direction the motor should rotate to move the shaft to the desired position. East-west monitoring compares the analog values of the LDR, and when the left side of the LDR has more light, the servo moves in that direction.
The main function of a DC motor is to observe light. The up-down movement of the sun is tracked by the DC motor of the upper panel holder, and the east-west movement of the sun is tracked by his DC motor of the lower panel holder. These DC motors and sensors are connected to a microcontroller that controls the DC motors based on sensor data. Light-detecting receptors (LDRs) detect the presence of light [3]. This system rotates left and right to change the direction of the sun's movement. In the afternoon the motor rotates clockwise. In the morning the motor rotates counterclockwise. In the morning, when sunlight reflects off the solar panel, the servo motor rotates counterclockwise. It conveys information about the rotation of the sun. The rotation of the solar panel is controlled by a microcontroller.

The solar panel is turned around in any such manner that it faces the sun and traces its course through the atmosphere, maximizing photon capture. The sun`s rays fell perpendicularly at the panels as a result. To increase the sun battery's charging time with the aid of using eating as many photons as possible. The sun`s vicinity is sensed with the aid of using the function sensor, which feeds the information to the manipulate circuit. The manipulate circuit decodes the indicators from the vicinity sensor, compares the real function of the automobiles to the preferred function, and controls the route of rotation of the DC automobiles thus to obtain the preferred function. The angular orientation of the servo motor is determined with the aid of using the heartbeat frequency.
Certain circuits use control pulses to generate a DC reference voltage that corresponds to the desired direction or speed of the motor. It also refers to a converter that converts pulse width to voltage. When this converter pulse goes high, the capacitor starts charging evenly. The charge on the capacitor is delivered to the buffer amplifier in short pulses. The duration of the pulse then determines the desired voltage applied to the error amplifier to achieve the desired velocity or position.

The microcontroller read this data and made a comparison between them and then decided on the movement direction of the DC motors. In Figure 2. The final output has been shown.

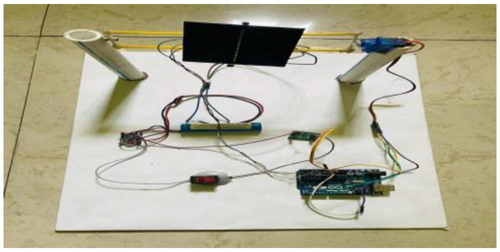

Figure 2: Final Output

V. CONCLUSION

The "Arduino Uno" microcontroller was used in this analysis to suggest a sun monitoring solar energy device. The angular direction of the servo motor is determined by the pulse frequency. A light sensor detects the movement of the sun and sends it to the microcontroller, which rotates the solar panel. A program in the microcontroller monitors the timing of the sun monitor and database theory and correlates this with the location closest to direct sunlight. This method is more reliable than conventional sensor-sun monitoring systems due to the ease of angle monitoring and the simplicity of the circuitry without considering errors caused by adjustments to external conditions.

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