# Dual Axis Solar Tracker Using Microcontroller

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## Abstract:

A type of energy known as renewable energy is derived from ongoing natural processes and from the energy of natural processes that have been transformed into usable forms. Any form of energy produced by the sun is referred to as solar energy. Solar panels are used to harness this energy and turn it into power. When the sun's rays are incident on a solar panel at a correct angle, it operates at itsmost efficient level. The sun's rays will only ever strike on a typical household solar panel at a correct angle during a specific period of the day because they are fixed in a stationary position. A solar tracking system is a dual-axis spinning device that tracks the sun's movement throughout the day in order to direct the sun's beams so that they strike the solar panels perpendicularly. The panel's productivity is increased as a result. A solar tracking system was created that uses LDRs in the shape of a voltage divider circuit to sense sunlight and activate a stepper motor that rotates the panel along two axes perpendicular to the sun's rays. This design was tested next to a fixed solar panel. Everyhour, readings from both panels were recorded. The tracking panel outperformed the stationary panel in terms of productivity because it produced more power per hour. The panel could be moved manually or automatically using the sensors and the Blynk user interface.

Keywords: **Solar system, Solar tracking.**

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## 1. INTRODUCTION

The biggest problem for the next 50 years will be finding enough energy to meet the world's increasing demand. The greenhouse effect has contributed to erratic climatic shifts and subsequent global warming. Few nations still rely on fossilfuels to provide power, which releases greenhouse gases that can have a negative influence on thepopulation of people and animals. People are focusing on renewable energy sources as a result of global environmental pollution and rising fossil fuel prices. According to scientific forecasts, duringa period of 30 years, the consumption of fossil fuelswould fall by 80% and the consumption of non- fossil fuels will increase by 50%. According to statistics, the supply of fossil fuels will run out by 2080. Therefore, a non-conventional source of energy must be the main source.

The amount of solar energy that the world receives each year—16 x 1018 units—is 20,000 times more than what humans need to survive. About 1 kW/m2 of energy is radiated from the sun on a sunny day. The efficiency of a polycrystalline solar panel ranges from 15 to 22%. However, if the panel's orientation towards the sun can be appropriately altered throughout the day, its efficiency can be raised greatly. Solar panel costs have dropped by 30 to 40% over the past five years, and they continue to decline.

A servo motor has been used in place of a stepper motor or a permanent magnet DC motor with gearing in order to lower the cost of the system. A servomotor, which consists of a motor and a sensor, controls its final position and motion using position feedback. A closed-loop servomechanism is employed. It uses power to rotate to the desired position, but then it stops and rests, in contrast to stepper motors, which use power to lock into and maintain the desired position. For the same functionality, the servo-motor consumes less energy.

Therefore, the purpose of this paper is to develop an automatic microcontroller-based solar tracker

with a hybrid algorithm that can precisely locate the sun's position in order to maximize the use of solar energy. To assess the proposed solar tracker's performance in the local climate, experiments were carried out.

## 2.METHODOLOGY

The essential part of a dual axis solar tracker is a microcontroller, which includes one or more CPUs, a memory, and programmable input/output peripherals. Other elements include:

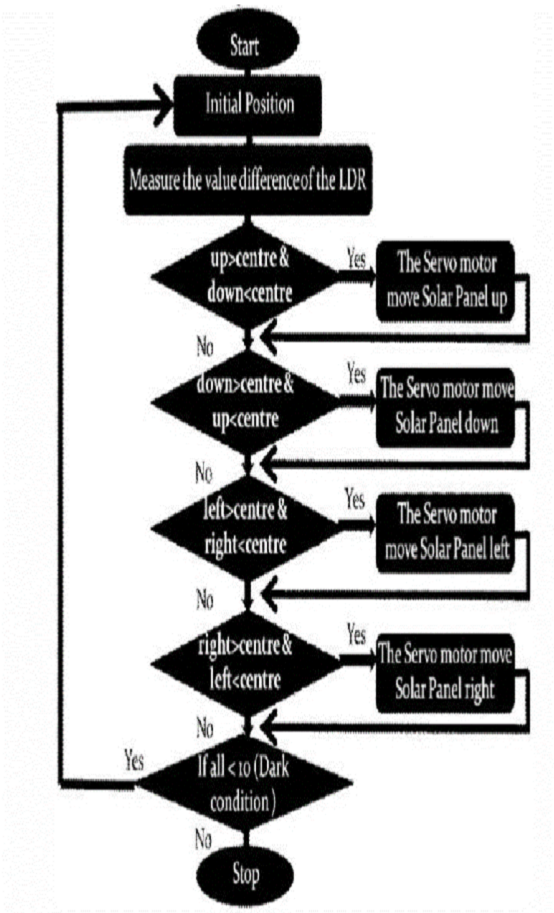
LDR Motor driver Resistors for solar panels

LED display with Servo motor

The primary element utilised in this is a single-board microcontroller, an affordable device that has one or more CPUs, memory, and programmable input/output peripherals. Light-dependent resistors (LDRs), servo motors, and a solar panel make up the other key parts. Figure 1 illustrates the methods used. LDRs are used in the solar tracking system to control light. The system's input is provided via a microcontroller that is coupled to four LDR. Using the internal analog-to-digital converter, the analogue value of the LDR is turned into a digital signal (Pulse Width Modulation).

As can be seen, this circuit design makes use of three LDRs: L1, L2, and L3. They are powered by the microcontroller's 5V pin. Three separate resistors, R1, R2, and R3, each with a 220 Ohm value, are linked to the outputs of three LDRs. They then proceed to the microcontroller's three input pins. L On the other hand, the battery orpower source needed to activate the servo motors (M1 and M2) is shown. Two servo motors' pulses are coupled to a microcontroller's output pin.)

Since 180 degree servo motors are used, it calibrates the servo motors to their 90 degree position first. They can therefore turn 90 degrees in both the clockwise and anticlockwise directions from their starting point. The microcontroller determines whether there is a difference in intensity between the left and right LDR pair as well as between the upper and lower LDR pair once the LDR readings have been taken. Depending on whether the panel is tilted towards the greatest irradiance, the servo motors move either clockwise or anticlockwise. The flowchart outlines the reasoning behind programming the microcontroller. The panel tilts down to a servo motor angle of 50 degrees if the lower LDRs are more intense than the upper ones. The panel tilts up to 130 degrees of the vertical servo motor angle if the opposite occurs. The motor does not rotate and the panel remains fixed vertically if there is no change in intensity between the upper and bottom pairs ofLDRs. When there is a difference between the rightand left set of LDRs, the horizontal servo motor turns. The panel tilts leftward by 10 degrees of the servo motor angle if the intensity of the left pair is higher than that of the right pair. The panel tilts towards the right up to a 179 degree servo motor angle if the opposite occurs. The motor does not rotate, keeping the panel stationary horizontally if the intensity on the left and right set of LDRs is the same.



## 3. ELECTROMECHANICAL SYSTEM

| Components | Units |
|---|---|
| Solar Plate | 1 |
| Microcontroller | 1 |
| LDR | 4 |
| Servo motor | 2 |
| Resistors | 8 |
| Motor Driver | 1 |
| LED SCREEN | 1 |

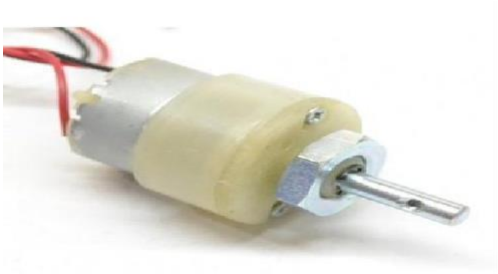


Fig : *Servo Moter*

Fig:- *Microcontroller*

*Fig:- LDR*

Light-dependent resistors (LDRs), a microcontroller, a servo motor, a steppermotor and driver, a current sensor (ACS712), and a solar panel with a supporting metallic servo bracket are all included in the proposed solar tracker. The stepper motor on one driver rotates in the north and south directions, while the servo motor on the other driver rotates in the east and west directions in this electromechanical system. The microprocessor automatically adjusts the motors to correct the solar panel position as shown below. The solar panel generates a voltage proportionate to the intensity of the sunlight, while the LDRs detect system misalignment and provide signals to the microcontroller.

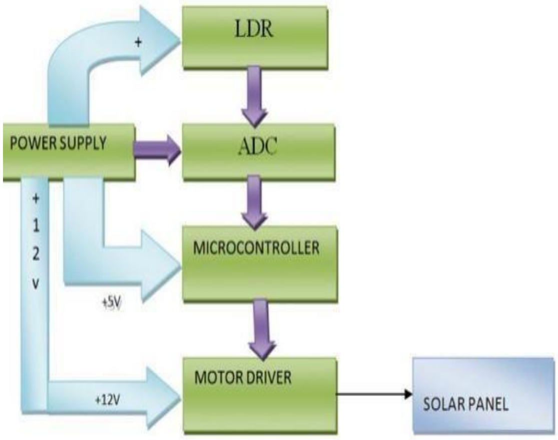
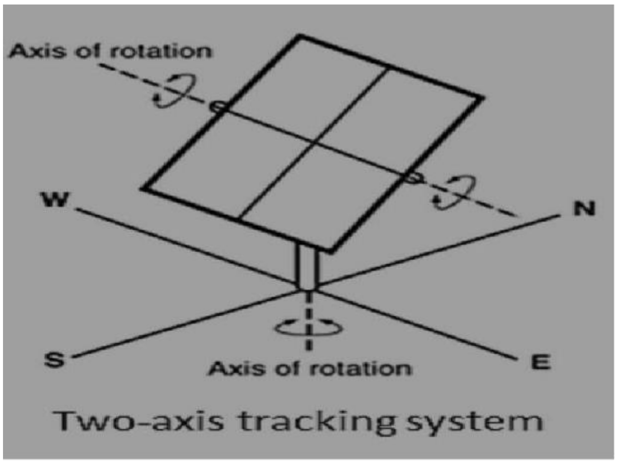



*Fig-Implementation of Dual Axis Solar Tracker Using Microcontroller*



## *4.* RESULT

The project has offered a technique of tracking the sun's location with the use of microcontroller and LDR sensors. It specifically demonstrates how to set a solar panel at the location of highest light intensity in order to maximise the production of solar cells. The straightforward control mechanism of the developed solar tracker is an appealing feature.

It is abundantly visible that the suggested dual axis tracker has a significant performance gain, perfectly aligns with the sun's direction, and monitors the sun's movement. The experimental findings unequivocally demonstrate the superiority of dual axis trackers over single axis trackers and fixed systems. Dual axis solar trackers provide excellent power capture rates over the whole observation period, which maximises the conversion of solar irradiance into electrical energy production.

As a result, it develops a method for efficiently using solar energy, which aids in the construction of smart homes. Due to the widespread usage of solar energy worldwide, even a 1% increase in efficiency over stationary planes will result in a significantincrease in net power production. So, regardless of how much a tracker improves efficiency, it is always appreciated.

## 5.CONCLUSION

To boost solar panel efficiency, a dual axis solar tracking solar panel powered by microcontroller has been developed and successfully put into use. Compared to the current permanent mount and single axis sun tracker, the suggested dual axis solar tracker is more efficient. With the aid of amicrocontroller board, the proposed solar tracker that automatically tracks the sun to capture the greatest solar power was successfully completed. The microcontroller board's implementation costs are inexpensive, and its implementation is straightforward. The experimental system conclusively demonstrates that the suggested system successfully follows the sun in both favourable and unfavourable weather situations. When compared to the current system, the efficiency of the solar panel is significantly improved during various times of the day.

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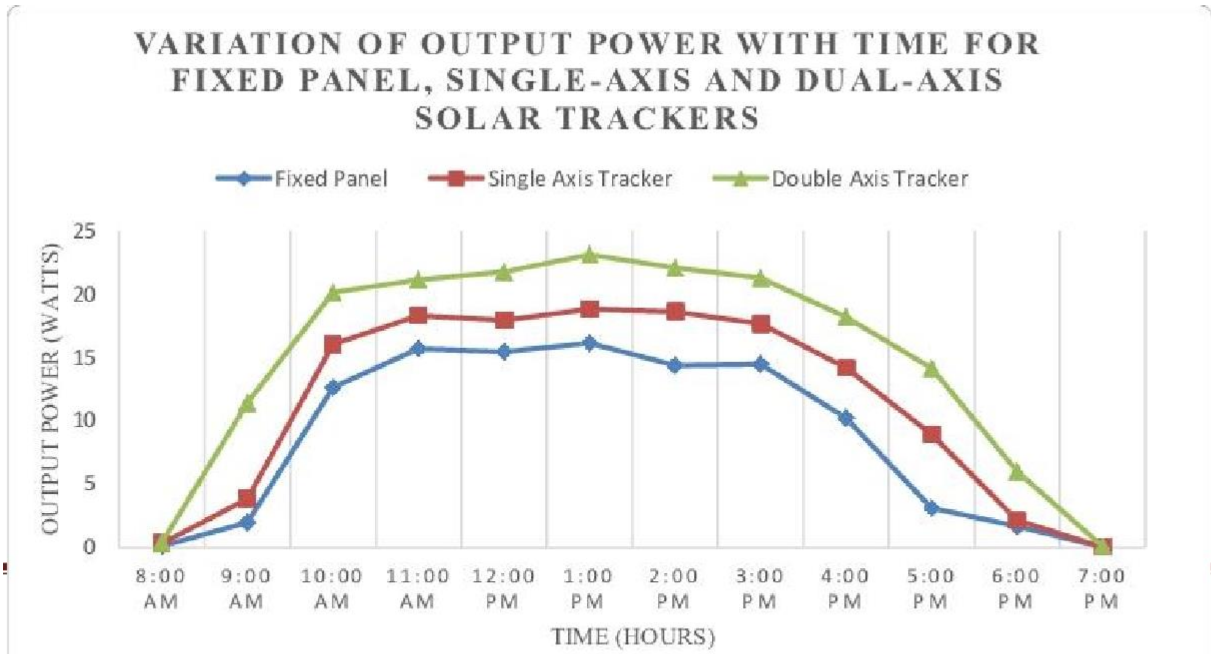

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