Dual Axis Solar Tracker

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Abstract— **This paper describes the development and demonstration of a dual-axis solar tracker system based on light-dependent resistors (LDR). The system was designed with an Arduino Uno, LDR sensor, and servo motors aiding the rotating motion, built using laser-cut MDF sheets for base structure.**

Keywords— **Arduino Uno, LDR sensor, servo motors, MDF sheets**

I. Introduction

In today's world, generating and using renewable sources of energy in an effective way is a need. Solar energy is the most common form of energy available to us. Using Solar panels (photovoltaic cells) to use this energy is a common way. We often use solar panels which are fixed at some axis at a particular level. But sun changes its position every second throughout the day, which may not align with the orientation of the solar panel. To overcome this, we can, however design a system that tracks the Sun's course throughout the day and positions itself in both the X and Y axes for the most effective surface alignment of solar panels for maximum energy production.

II. Aim

To design a system that tracks the Sun's course throughout the day and positions itself in both the X and Y axes for the most effective surface alignment of Solar panels for maximum energy production.

III. Theory

A. Servo motor

A servo motor is a type of motor that is designed to take input and work accordingly. It works on the feedback system. When a signal is given it first processes it then passes the signal further and then works by moving the shaft.

Fig 1 – servo motor

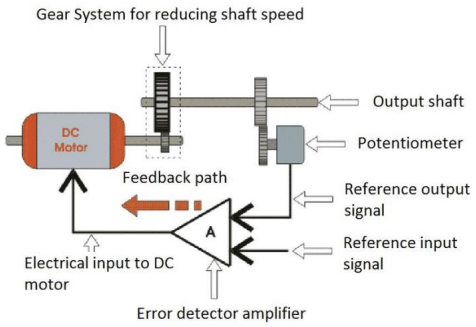


Fig 2 – Working of servo motor

B. LDR sensor

Light Detecting Resistor is a device made of semiconductor which changes its resistance according to the intensity of light. If the intensity of the light is higher then the resistance of LDR will be lower and because of this the output voltage will be higher. If the intensity of light is low, the resistance of LDR will be high and because of this the output voltage will be high.

Fig 3 – LDR sensor

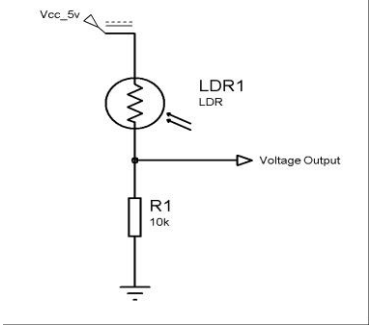


Fig 4 – Working of LDR sensor

C. Arduino UNO

Arduino UNO is a microcontroller board. It consists of both analog and digital pins. It has 14 digital and 6 analog pins. It is programmed by Arduino IDE and code is uploaded via USB type B cable. Once programmed it remembers the program and works accordingly.

Fig 5 – Arduino UNO

IV. Materials Required

A. Arduino UNO
B. LDR sensors
C. 10 kohm resistors
D. Jumping wires
E. MDF sheet

V. Working Principle

This project works on the principle that when a solar panel is fixed at a particular angle, its capacity to generate electricity when the sun is in opposite direction is low. So, if we rotate the solar panel in such a way that it always faces sun, then our problem will be resolved as the solar panel will always produce the maximum intensity. So, we are using the motors to rotate the solar panels according to the command given by the LDR sensor.

VI. Procedure

A. Connect the positive end of the LDR sensors to the 5V and the other end of the terminal to 10 k ohm resistor.
B. The other end of the resister is grounded.
C. The common end of resistors and LDR is then connected to the analog pins A0, A1, A3 and A4 respectively.
D. Servo motor 1 is connected to the pin 9 which provides us the data about LDRs present at pin A0, A1.
E. Servo motor 2 is connected to the pin 10 which provides us the data about LDRs present at pin A3, A4.
F. Connect the other two ends of servo motor with ground and 5 V.

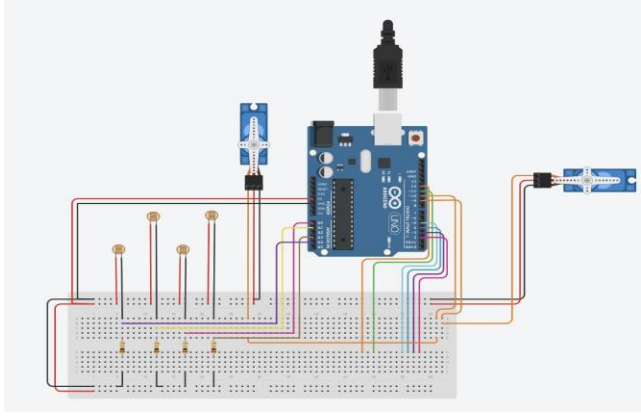


Fig 6 – Circuit diagram

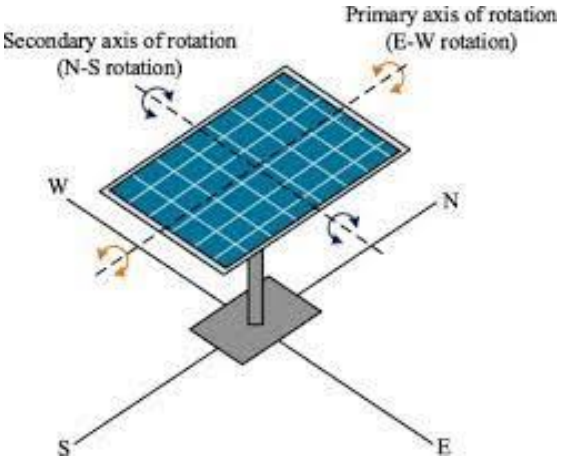
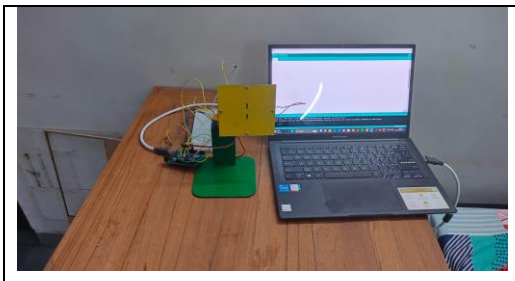


Fig -7 Idea of model

VII. Result

As we know that the electricity produced by the circuit will be maximum if the intensity of light falling on all regions is high. When we were fixing the solar panel, we were reducing the ability of solar panel to produce the electricity. This system will make sure that the plates always get good amount sunlight. If we will be rotating the solar panel then we are making sure that the solar panel always faces the sun and can produce the maximum amount of energy.



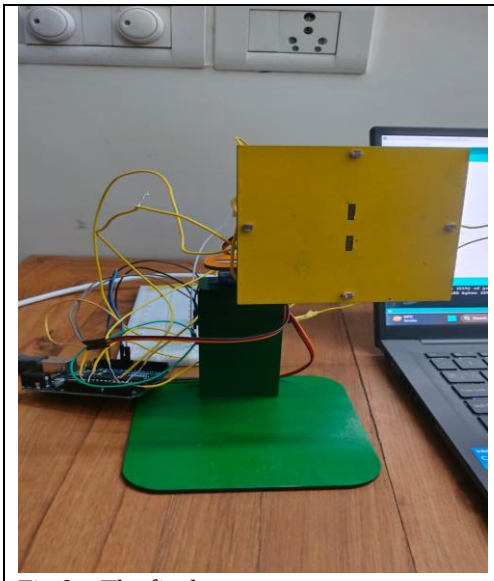
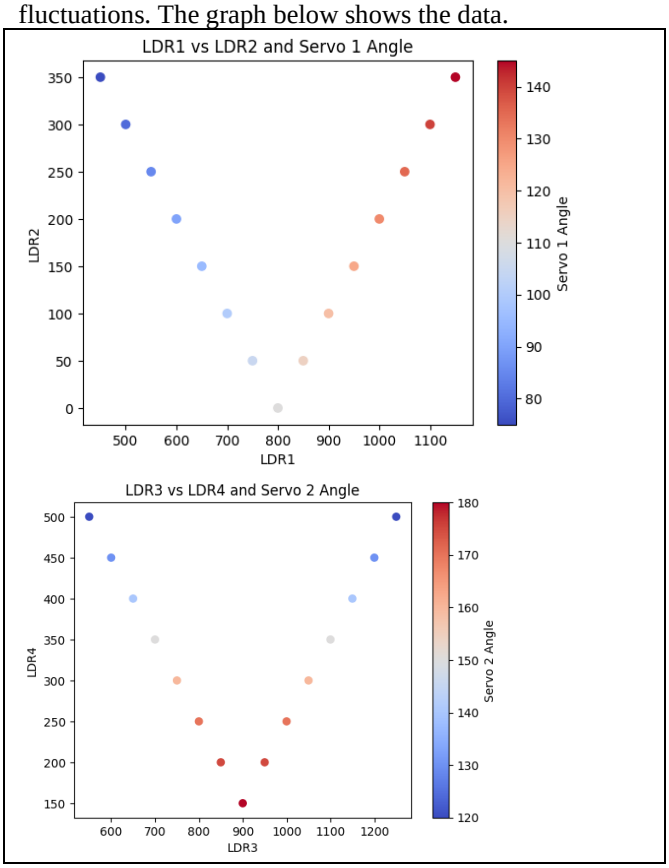


Fig 8 – The final prototype

VIII. Observations

The solar tracker trackers the position of sun and moves sets the position of solar panel accordingly. This happened because of LDR sensor. It created a voltage difference and acc to code the model moved where there were voltage fluctuations. The graph below shows the data.



From the graph we can see that when the LDR is responding we are able to see the servo motor rotating.

IX. Conclusions/Discussion

In this project, Dual Axis Solar Tracker, we've created a small prototype of a solar tracker that follows the light source's brightest point so that the solar panel's output voltage is at its highest there. This project is having high potential because it helps us to generate more electricity in less time and money as this model just increases the efficiency of the panel by making it face light all time.

We finally finished our project after many trials and errors, and we are happy to have contributed to society. Now, there are few flaws in this project, just like every other experiment.

A. Because we were using normal wires instead of the jumping wires many times when the pins were connected in Arduino, they were short circuited.
B. Since the wiring was outside the support block, many times the wires had stopped the functioning of the motor.
C. Since LDR is very sensitive to light, it was constantly in motion.
D. Since the area of plate used in this experiment was small and not heavy, the experiment worked with low power motors. But in real life, we need high power motors.
E. There were many problems in fixing the wiring and thinking how to make model rotate in both the axis.
F. If the circuit and controlling unit is placed below the solar panel then there are high chances, we will damage the wires due to weather.
G. For checking we are going on the correct track we used the serial monitor to read how the angle of the arm is changing with the change in voltage because of LDR and if we check this on a large scale, we will use more data and need more people to check the proper functioning.
H. To check whether the tracker is working or not we can use photodiode and see its response. If the intensity of light receives by it has very less fluctuations and it is almost constant then our model is working properly.

X. Acknowledgment

We would like to thank our Teaching assistant Parul mam , Professor Arup, and Lab staff for guiding us throughout this project and helping us.

XI. References

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