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. The system was designed with an Arduino Uno and LDR sensor, combined with an LCD screen and servo motors aiding the rotating motion, built using laser-cut MDF sheets for a platform and structure.**
Keywords— Arduino Uno, LDR sensor, servo motors, LCD screen, MDF sheets

I. Introduction

In this day and age, generating energy efficiently is a must, since power consumption rises exponentially day by day. One form of energy generation is solar energy, involving photovoltaic cells that convert light energy to electricity. The sun changes its position with respect to a single point throughout the day, which may or may not align with the orientation of the solar panels. To combat this, however, we can make a system that tracks the pathway of the Sun throughout the day, and align itself in both X and Y axes for the most efficient surface alignment for energy generation.

II Working principle

- Resistance of LDR depends on intensity of the light and it varies according to it. The higher is the intensity of light, lower will be the LDR resistance and due to this the output voltage lowers and when the light intensity is low, higher will be the LDR resistance and thus higher output voltage is obtained.
- A potential divider circuit is used to get the output voltage from the sensors (LDRs).The circuit is shown here.

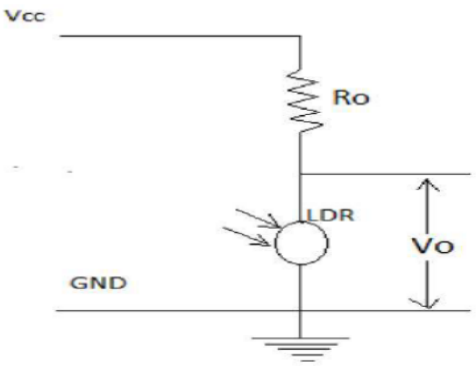


Fig. 1: Working of LDR.

The LDR senses the analog input in voltages between 0 to 5 volts and provides a digital number at the output which generally ranges from 0 to 1023.

Now this will give feedback to the microcontroller using the arduino software(IDE).

The servo motor position can be controlled by this mechanism which is discussed later in the hardware model.

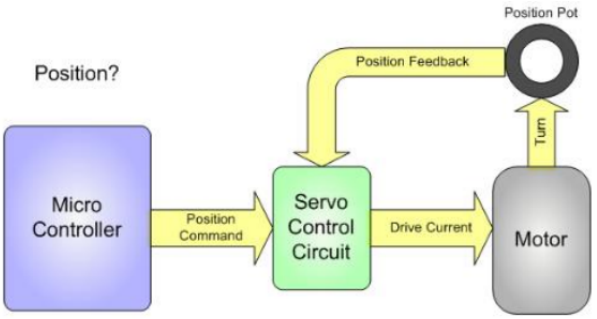


Fig. 2: Working Mechainsm

The tracker finally adjusts its position sensing the maximum intensity of light falling perpendicular to it and stays there till it notices any further change.

BASIC CIRCUIT DIAGRAM

An overview of the required circuit for the Dual-axes solar tracker is shown here. The 5V supply is fed from an USB 5V dc voltage source through Arduino Board.

Servo X :Rotates solar panel along X direction
Servo Y: Rotates solar panel along Y direction

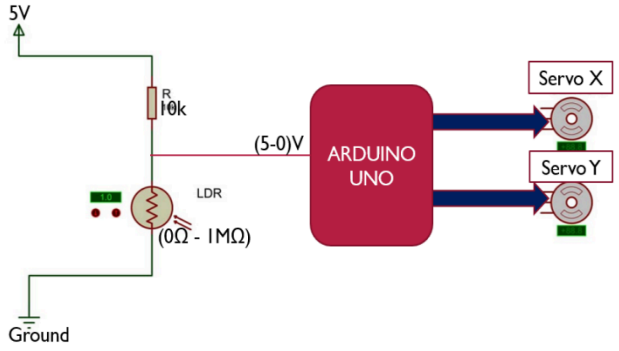


Fig. 3: Schematic of the prototype

II. Description of the Prototype

Our prototype consist of following components.

It consists of fout ldr sensors , four 10k ohm resistors,one

1k ohm resistor , an lcd display, an adapter for power supply.and connecting wire.

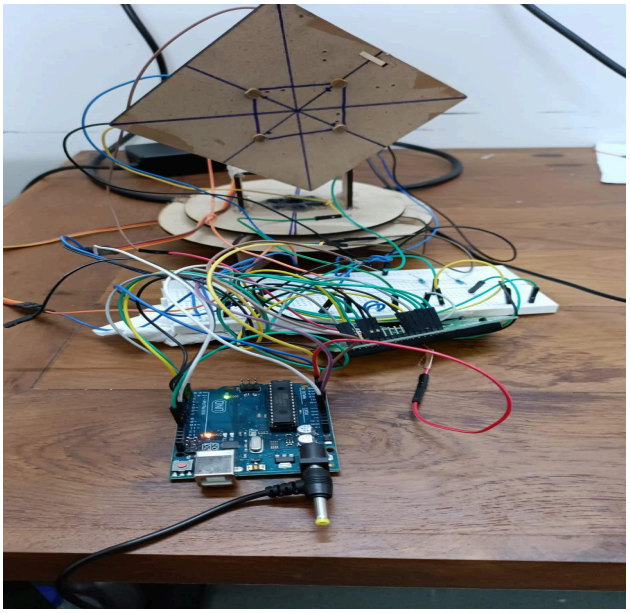
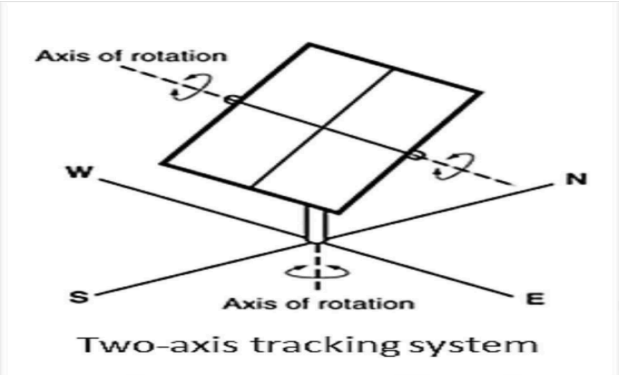


Fig. 2: Photograph of the solar detector

The Arduino Uno board was taken to store the data collected and process it to power the servo motors accordingly. Other boards would have done a similar job, hence we thought it was best to go forward with ARduino Uno. The remaining equipment choices were based on the equipment that would be available in our labs.These sensors will detect the intensity of light falling on them and accordingly produce the voltage. We measure these voltage values through Arduino analog signals detecting pins.



➢ The dual axis solar tracker is device which senses the light and positions towards the maximum intensity of light. It is made in such a way to track the light coming from any direction.

➢ To simulate the general scenario of the Sun's movement, the total coverage of the movement of the tracker is considered as 120˚ in both the directions.

➢ The initial position of both the servo motors are chosen at 90˚i.e, for east-west servo motor as well as for north-south servo motor.

➢ The position of the tracker ascends or descends only when the threshold value is above the tolerance limit.

III. Observation

- The panel in this dual axis solar tracker adjusts its position in response to the amount of source light that is directed perpendicularly towards it.
- The project's goal has been attained. This was made possible by using light sensors, which can gauge how much sunlight is coming into contact with the solar panel. When there is a large discrepancy in the values produced by the LDRs, a servo motor is used to actuate the panel so that it is approximately perpendicular to the sun's rays.
- The voltage divider circuit used in the input stage's design allows it to provide the necessary range of illumination in both bright and low-light situations.
- To account for these modifications, the potentiometer was modified.
- Due to the fact that their resistance changes with light, LDRs were discovered to be the most appropriate for this project.
- They are affordable and easily accessible.
- For instance, temperature sensors would be expensive.
- A microprocessor in the control stage uses voltages from the LDRs to decide what should be done.

- The microcontroller is configured to make sure the servo motor moves in response to the created mistake by sending a signal to it.
- The drive circuitry, which mostly included the servo motor, was the last stage.

IV. Conclusions

In this project, Dual Axis Solar Tracker, we've created a demo model of a solar tracker to follow the light source's brightest point so that the solar panel's output voltage is at its highest there. We finally finished our project after many trials and errors, and we are happy to have contributed to society. Now, this project has a few flaws, just like every other experiment.

(i) Because the circuit components were worn out from the speed of one of the axes of rotation's movement, it had stopped functioning.

(ii) The plane of the LDR sensors moved erratically as a result of diffused light sources.

There were few resources used to complete this project. The circuitry was kept user-friendly, basic, and straightforward.

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