EC Project Report

Sun Tracking Solar Panel:

Sriramchandher - 200744
Varsha Rani - 201087
Mohammad Farhan - 200603
Section B, Table No- 5

Table of Contents:

1. INTRODUCTION

The sun-tracking solar panel works on the differential lighting of the two LDRs (light sensors) which are attached on either side of the solar panel. It is a significant model to increase efficiency over the typical stationary solar panel models.

2. Principle of Working

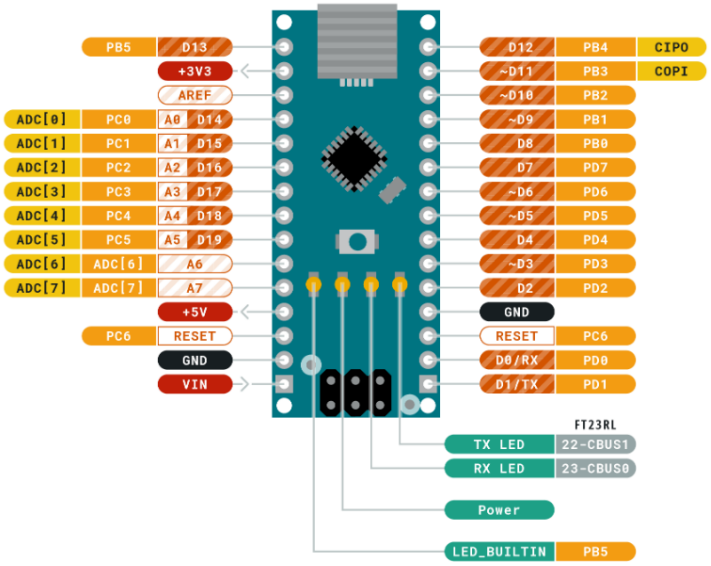
The sun-tracking solar panel consists of 2 LDRs, solar panel and a servo motor. The LDRs provide low resistance when light falls on them. The motor connected to panel rotates in the direction of light. It is arranged in such a way that it rotates towards the LDR which receives more light intensity and when there is no light, the panel moves to its initial position

3. **Components Required**
    - Arduino Nano
    - Solar Panel
    - Servo Motor Sg90
    - LDRs - 2
    - Breadboard
    - Connecting wires
    - Arduino cable
    - Jumper wires
    - Resistors - 10kohm x 2

4. **Solar Panel**

Solar panel source of energy is sunlight and it converts it into electricity. Application of solar energy collection is used in Agriculture and solar water heating systems.
The efficiency of the module depends on the area of the panel given the same output. Most application needs multiple solar modules as single solar module produces very less power.
Thus we require a method to capture energy in more efficient manner.

5. **Arduino Nano**
   Pin Diagram:



Specifications:

Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash Memory	32 KB of which 2 KB used by bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog IN Pins	8
EEPROM	1 KB
DC Current per I/O Pins	40 mA (I/O Pins)
Input Voltage	7-12V
Digital I/O Pins	22 (6 of which are PWM)
PWM Output	6
Power Consumption	19 mA
PCB Size	18 x 45 mm
Weight	7 g
Product Code	A000005

6. LDR

LDR- (Light Dependent Resistor) is also known as a photoresistor, photocell, or photoconductor. It is a particular kind of resistor whose resistance fluctuates according to the quantity of light incident on its surface. The resistance changes when the resistor is illuminated. These resistors are frequently employed in circuits where the need to detect the presence of light exists. For instance, the LDR can be used to switch the light ON or OFF depending on whether it is in the light or the dark. A typical light-dependent resistor has a resistance in the dark of 1 MOhm and a resistance in the light of a few KOhms.

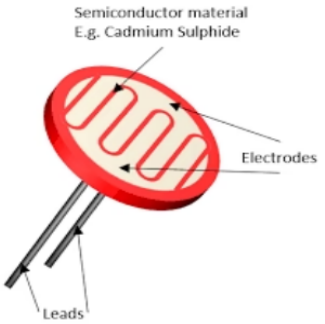
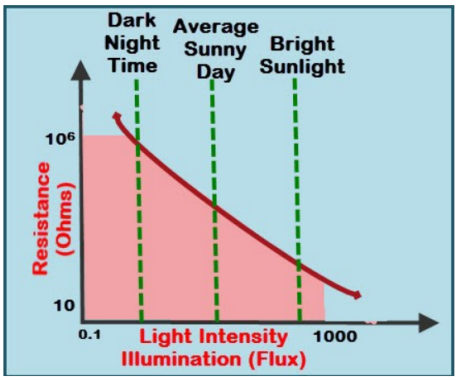


Fig. 2. Components of LDR Sensor



Light Intensity vs LDR Resistance

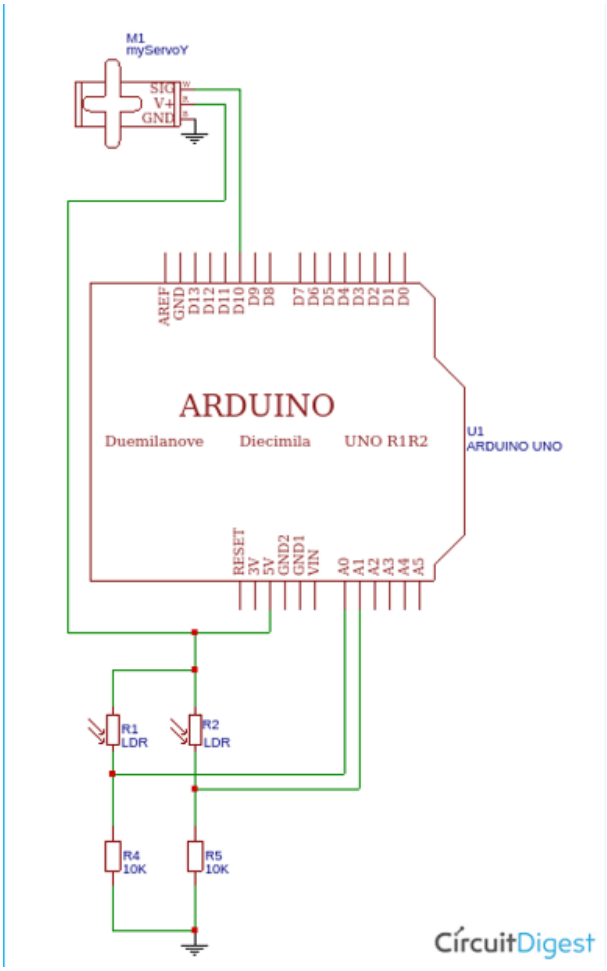
7. Servo Motor

A servo motor is powered by a DC source- either by an external power supply or micro-controller.

Specifications:

- Weight: 9 g.
- Dimension: 22.2 x 11.8 x 31 mm approx
- Stall torque: 1.8 kgf·cm
- Operating speed: 0.1 s/60 degree
- Operating voltage: 4.8 V (~5V)
- Dead band width: 10 µs
- Temperature range: 0 ºC – 55 ºC
- Extent of rotation : 180 degrees

8. Circuit Diagram

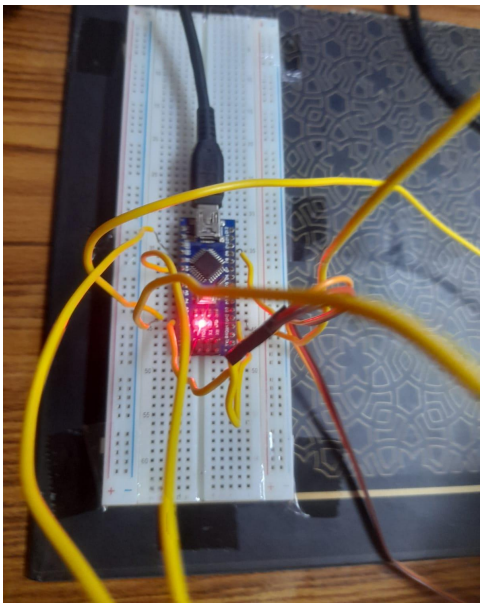


9. Arduino Code

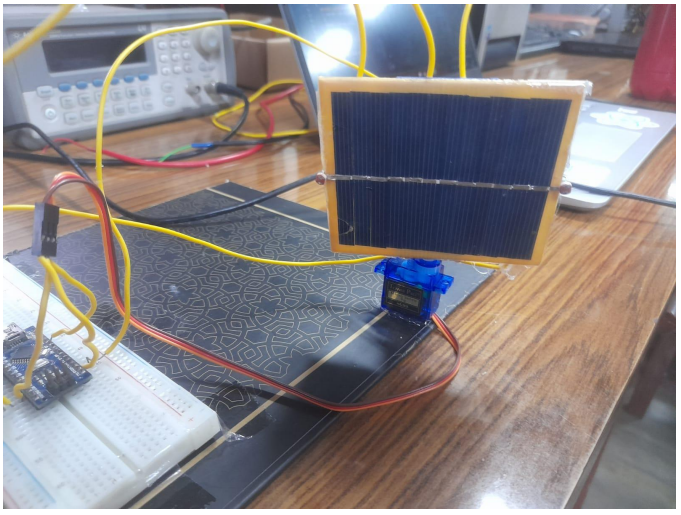
```
#include <Servo.h>
Servo servohori;
int servoh = 0;
int servohLimitHigh = 140;
int servohLimitLow = 60;

int ldrl = 1;
int ldrr = 2;
void setup ()
```

```
 {
  servohori.attach(10);
  servohori.write(0);
  Serial.begin(9600);
  delay(500);
 }

void loop()
{
  servoh = servohori.read();
  int l = analogRead(ldrl);
  int r = analogRead(ldrr);

  if (l >r)
  {
    servohori.write(servoh -1);
    if (servoh > servohLimitHigh)
    {
    servoh = servohLimitHigh;
    }
    delay(10);
  }
  else if (r > l)
  {
    servohori.write(servoh+1);
    if (servoh < servohLimitLow)
     {
     servoh = servohLimitLow;
     }
    delay(10);
  }
  else
  {
    servohori.write(servoh);
  }
  delay(50);
}
```

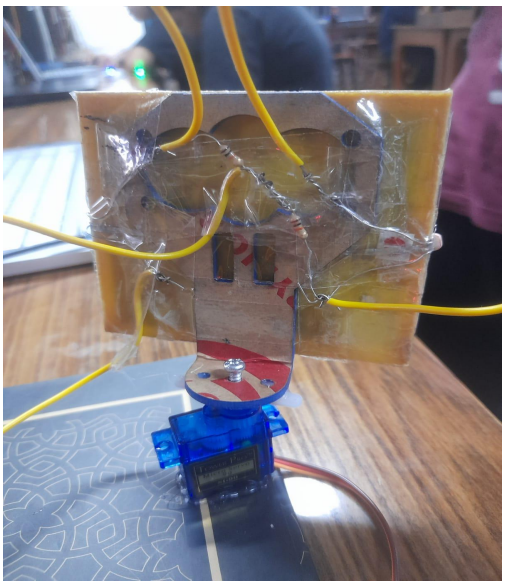
10. Model setup



Wiring connections of the arduino on the breadboard



The two LDRs are attached on either side of the solar panel



The solar panel is mounted on the servo motor for the purpose of single axis rotation

11. Working Demonstration

Below video shows the working demo of the project;
https://drive.google.com/drive/folders/1EvkZLt9NgROsivFtzQ7uk921PL3PfCT

It works as expected, when the light source is focused on one sensor, the panel rotates towards that side and vice versa.

12. Advantages of Sun-tracking solar panels

- Increased Energy Production: Sun-tracking solar panels can generate up to 25% more energy compared to fixed solar panels because they are always positioned to capture the maximum amount of sunlight throughout the day.
- Improved Efficiency: By constantly adjusting their position, sun-tracking solar panels maintain their optimum angle of incidence with the sun, reducing the amount of energy that is lost due to reflection or shading.
- Greater Flexibility: Sun-tracking solar panels can be installed in a wider range of locations than fixed solar panels since they do not need to be placed at a specific angle or direction to the sun.
- Longer Lifespan: Since sun-tracking solar panels generate more energy, they can help reduce the workload of the panels and thus extend their lifespan.

- Better Return on Investment: While sun-tracking solar panels are generally more expensive to install, they can generate more energy over their lifetime, providing a better return on investment than fixed solar panels in some cases.

13. Limitations of the model

- Higher Cost: Sun-tracking solar panels are generally more expensive than fixed solar panels due to their complex tracking systems and additional components.
- Higher Maintenance: Sun-tracking solar panels have more moving parts, which require regular maintenance and can increase the chances of mechanical failures.
- Limited Durability: Due to the additional mechanical parts and their exposure to wind and weather, sun-tracking solar panels may have a shorter lifespan than fixed solar panels.
- Complex Installation: Sun-tracking solar panels require more time and expertise to install compared to fixed solar panels. Additionally, their installation may be restricted by factors such as site size and land availability.
- Less Suitable for Residential Use: Sun-tracking solar panels are typically not used for residential applications due to their higher cost, complexity, and limited space availability.

14. Conclusion

This model helps in maximising the energy absorption and increases the efficiency upto 20 times. Thus this project makes this process of harnessing solar energy more efficient and hence smarter.