Arduino Based Undergraduate Project:

Sun Tracking Solar Panel

Under Guidance of:

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1. INTRODUCTION

Solar energy is an unlimited source of energy which if harnessed properly can substitute the conventional sources of energy, mankind has been using since long time. This project has been designed keeping this in view in mind to make the harnessing of solar energy more efficient. Sun Tracking Solar Panel Using Arduino project is based on Arduino controller board which controls the various activities in the project.

A solar panel which is incident to the sun can gather more amount of solar energy in proper orientation when it is attached to a motor. This motor is electrically connected to the controller board. The system periodically checks the availability of solar energy from one horizon to other horizon. In the scan it checks which direction has maximum incident solar energy and hence the incident sun and positions the solar panel in that direction. In this way maximum power that can be harnessed with the Solar Panel.

For this project [1 -10] has been studied for better understand of such Sun Tracking Panel system.

2. COMPONENTS REQUIRED

1. Servo Motor (SG-90)
2. Solar panel (10×10 cm^2)
3. Arduino Uno
4. Two LDR's (Light Dependent Resistor)
5. Two10K resistors
6. Battery (6 to 12V)
7. Capacitor (optional)

3. CIRCUIT DIAGRAM

The circuit diagram is shown in Figure 1. In this the LDR's are working as light detectors. LDR's is the light sensitive device, its resistance decrease when the light falls on it and that's why these are used in light detector circuits. The two LDR's are placed at the edges of the solar panel and the servo motor is used to rotate the solar panel. The servo will move the solar panel towards the LDR

whose resistance will be low, mean towards the LDR on which light is falling, that's why it will keep following the light. And, if the same amount of light falls on both the LDR the servo will not rotate.

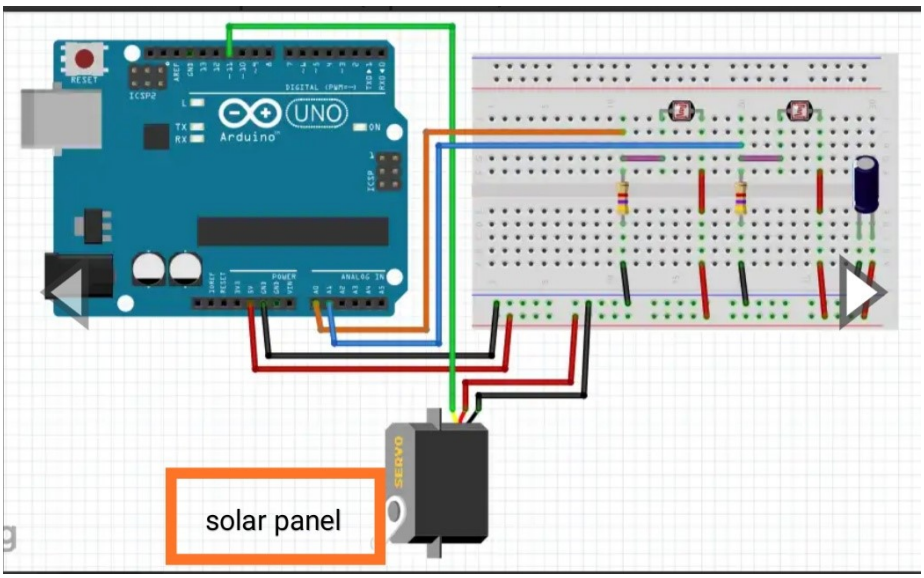

Figure 1: Overall circuit schematic of Arduino sun tracking solar panel

4. HARDWARE AND SOFTWARE

4.1 HARDWARE

Arduino is powered by the 9 V battery and all the other parts are powered by the Arduino. Arduino recommended input voltage is from 6 to 12 volts but you can power it within the range of 6 to 20 volts which is the limit. Try to power it within the recommended input voltage. So connect the positive wire of the battery to the Vin of the Arduino and the negative wire of the battery to the ground of the Arduino. Next connect the servo to the Arduino. Connect the positive wire of the servo to the 5 V of Arduino and ground wire to the ground of the Arduino and then connect the signal wire of Servo to the digital pin 9 of Arduino. The servo will help in moving the solar panel. Now connect the LDRs to the Arduino.

4.2 SOFTWARE INCLUDING ALGORITHM

The Algorithm of the overall system is shown in Figure 2. The software is designed based on the Algorithm which helps in running the system without failure.

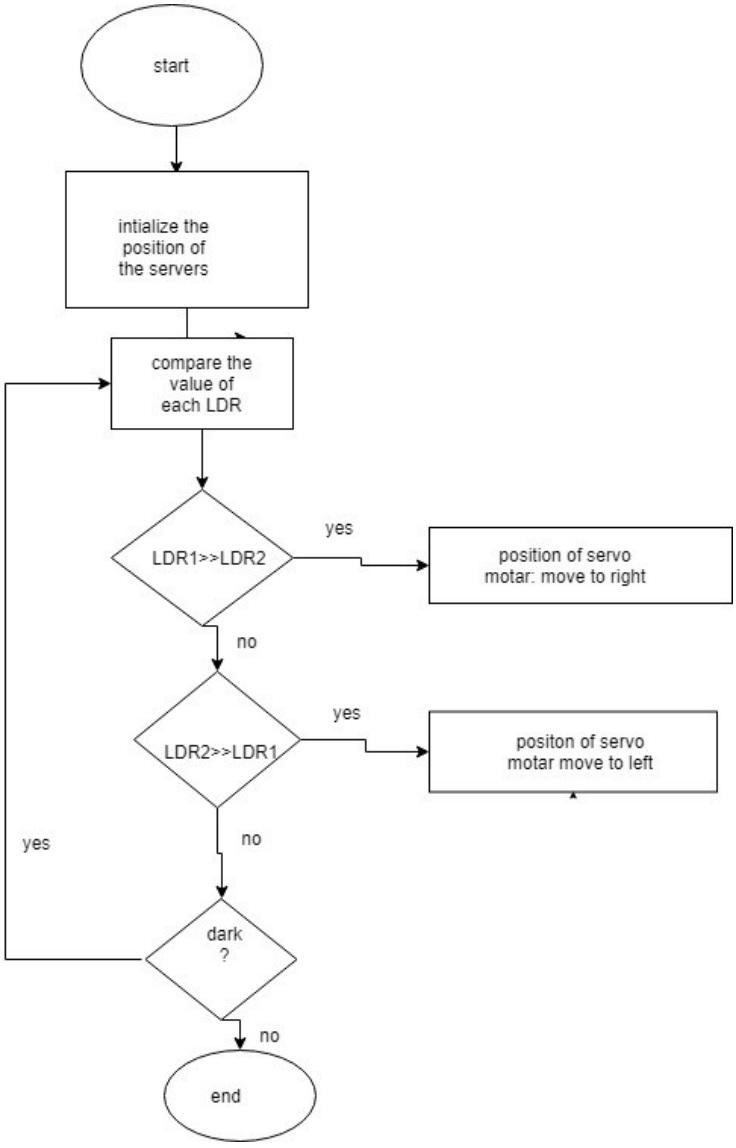

Figure 2: The Algorithm on which software works

Inside the code we use the "pos" variable to set the initial position of the servo to 90, the mid position. The 2 LDRs are connected to pin A0 and A1 on the board. The "tolerance" variable is used for allowing a small tolerance otherwise the solar panel would be continuously adjusting its position. In the setup() function we set the pins were the LDR are connected as INPUTs and position the servo motor at 90° then wait for a 2 seconds before the code execution inside the loop(). In the loop() we read the values received from our 2 sensors and adjust the solar panel based on these values**.**

```
#include <Servo.h>
```

```
Servo myservo;

int pos = 90;   // initial position

int sens1 = A0; // LRD 1 pin

int sens2 = A1; //LDR 2 pin

int tolerance = 2;

void setup()

{

  myservo.attach(9);  // attaches the servo on pin 9 to the servo object

  pinMode(sens1, INPUT);

  pinMode(sens2, INPUT);

  myservo.write(pos);

  delay(2000); // a 2 seconds delay while we position the solar panel

}

void loop()

{

  int val1 = analogRead(sens1); // read the value of sensor 1

  int val2 = analogRead(sens2); // read the value of sensor 2

if((abs(val1 - val2) <= tolerance) || (abs(val2 - val1) <= tolerance)) {

    //do nothing if the difference between values is within the tolerance limit
```

```
  } else {
    if(val1 > val2)
    {
      pos = --pos;
    }
    if(val1 < val2)
    {
      pos = ++pos;
    }
  }
  if(pos > 180) { pos = 180; } // reset to 180 if it goes higher
  if(pos < 0) { pos = 0; } // reset to 0 if it goes lower
  myservo.write(pos); // write the position to servo
  delay(50);
}
```

5. CONSTRUCTION AND TESTING

Our construction is based on Do it Yourself (DIY) method, hence all the arrangement are make shift and can be replaced with better design, when needed.

First of all, take a small piece of cardboard and make a hole at one end. We insert the screw in it to fix it with the servo motor. Now fix two small pieces of cardboard with each other in a T-shape with help of glue or hot gun and place solar panel on it. Then attach the bottom side of the V-shape

to the other end of small piece of cardboard in which you made a hole in first step**.** Now insert the screw in the hole you made on card board and insert it through the hole into the servo. The screw comes with the servo motor, now place the servo on another piece of cardboard. The size of the cardboard should be larger enough so that you can place a Arduino Uno, a breadboard and a battery on it. Attach the LDRs on the two sides of the solar panel with the help of glue. Make sure you have soldered the wires with the legs of the LDR's. You will have to connect these with the resistors later on. Now place the Arduino, battery and the breadboard on the cardboard and make the connection as described in the Circuit diagram and Explanation section below. The final prototype is shown in Figure 3.

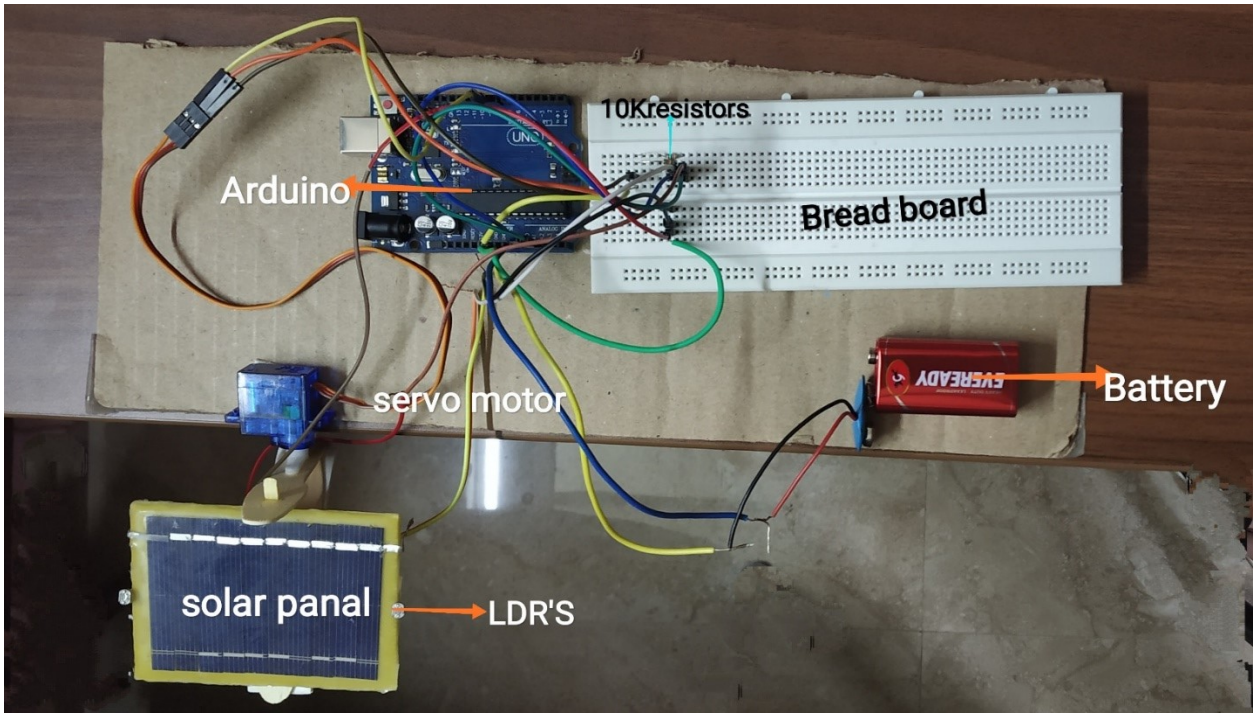

Figure 3: The setup of the Sun Tracking Solar Panel using Arduino

First we take the final outcome of our project in the dark area of our room. Then we take flash light of our mobile phone and flash it on the solar panel. The servo motor will rotates the solar panel in the direction of LDR whose resistance is less that is LDR on which intensity of light is more.

6. WORK PLAN

Table 1: GNATT chart of work plan for Arduino based sun tracker solar panel

Delivery					
Testing					
Integration with IDE					
Coding – Arduino IDE					
Hardware Analysis					
Problem Identified					
Literature Survey					
Modules	Sept. 15 - Sept. 30	Oct. 1 – Oct. 15	Oct. 16 – Oct. - 30	Nov. 1 – Nov 15	Nov. 16 – Nov. 19

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