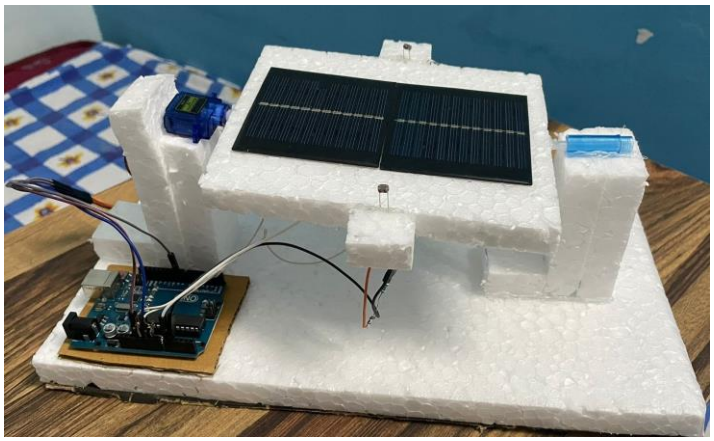


SINGLE AXIS SOLAR TRACKING SYSTEM

Prepared by:

Shekhar Singh(20EEB232)

Abhishek Bhardwaj(20EEB233)

Ahsan Waseem(20EEB262)

Table of Contents

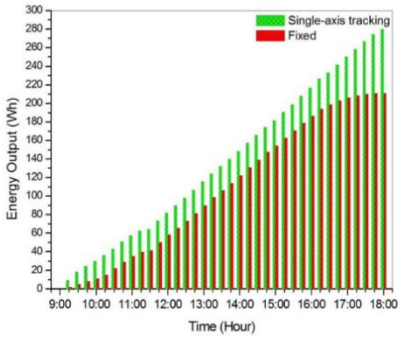
Introduction

Motivation

India's electricity sector is dominated by fossil fuels, in particular coal, which produced about three quarters of country's electricity. This is the non-renewable form of energy, eventually it will be depleted. For this reason it is important to seek renewable sources of energy for they are cleaner, easier to use, require less maintenance, and will always be available. This project focuses on solar energy, which is a renewable form of energy. It is estimated that solar energy will become the largest source of electricity by the year 2050. For this reason there should be a larger investment in harnessing solar energy. Generally solar energy can be produced through solar concentrated panels or solar photovoltaic (SPV) panels. First time silicon solar cells efficiency was about 20% in year of 1985 whereas there has been uniform rise in the solar cells efficiency. Most of the solar cells still work lower than 45%. The efficiency of the solar cells can be increase by maximum power point tracking technique. This technique also reduces the cost factor. In this technique, operator can get maximum power point on the solar panels by which get maximum efficiency which result in enhanced power output. These trackers can be single or dual axis. Single axis trackers act according to the sun light and they have proved their quality through 38% more generation than the stationary panels. Dual axis trackers identified sunlight from both axis so these are more efficient than single axis trackers but they have higher manufacturing cost.

Objective

The objective of this mini project was to design a single axis solar tracker. The project is the Arduino based single axis solar tracking system. This system consists of three subsystems - Mechanical system- platform for tracking system , Electrical system- PV system, servo motor, resistor , Control system-Arduino, LDR.



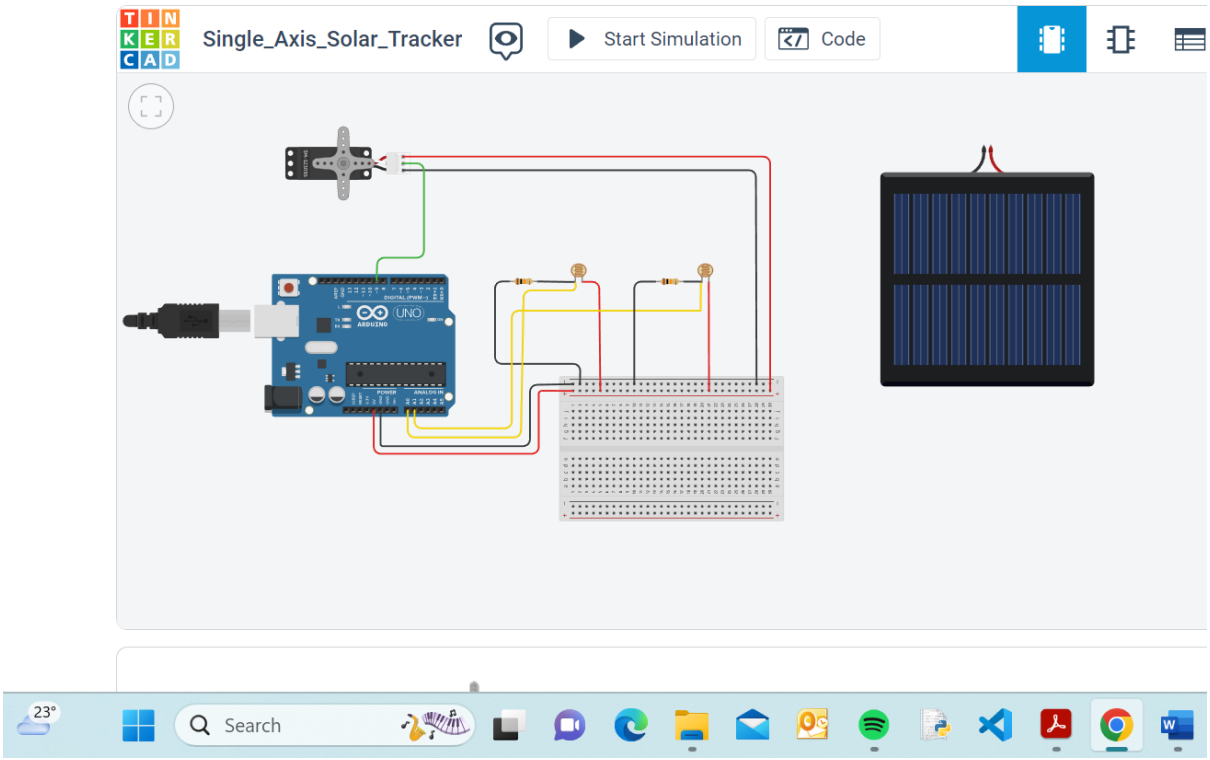
Total energy output from single-axis tracking and fixed solar panel on a clear sky day

Project Overview

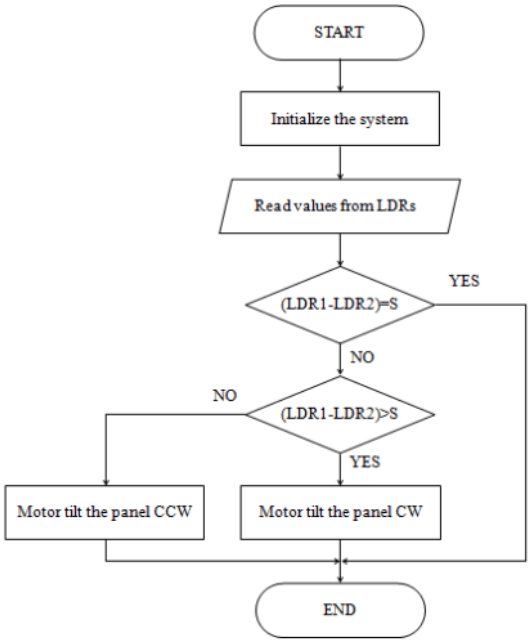
Renewable energy sources, such as solar power, are becoming increasingly popular. In order to maximize the energy output of a solar panel, it is important to ensure that it is always facing the sun. This can be achieved using a solar tracking system that follows the path of the sun throughout the day.

The system consists of an Arduino board, LDR , a servo motor, and a solar panel. The LDR is used to detect the position of the sun and send a signal to the Arduino board. The Arduino board will process the signal and send a command to the servo motor to adjust the position of the solar panel. The solar panel will be mounted on the servo motor and will move in a single axis to track the sun's path.

The simulation of this tracking system was performed on Tinkercad software.



Circuit diagram of single axis tracking system

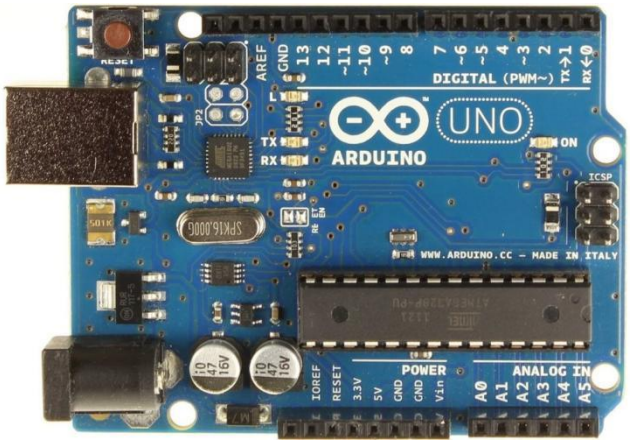


Program flowchart of the solar tracking

Tools Used

Arduino UNO

The Arduino UNO is a microcontroller board based on the atmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICPS header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an ac-to-dc adapter or battery to get started.

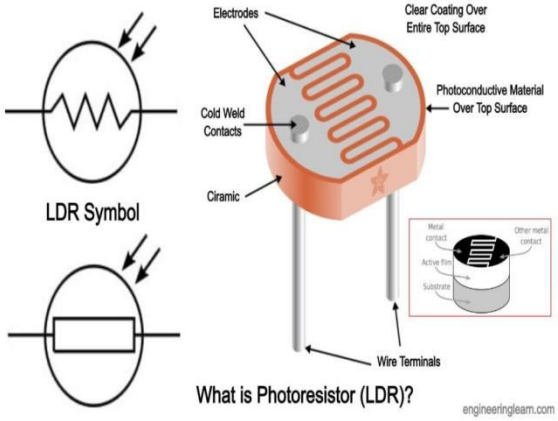


Servo Motor

Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire the rotor will turn to the desired position.

Light Dependent Resistor (LDR)

Light dependent resistor (LDR) is also called a photo resistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases.



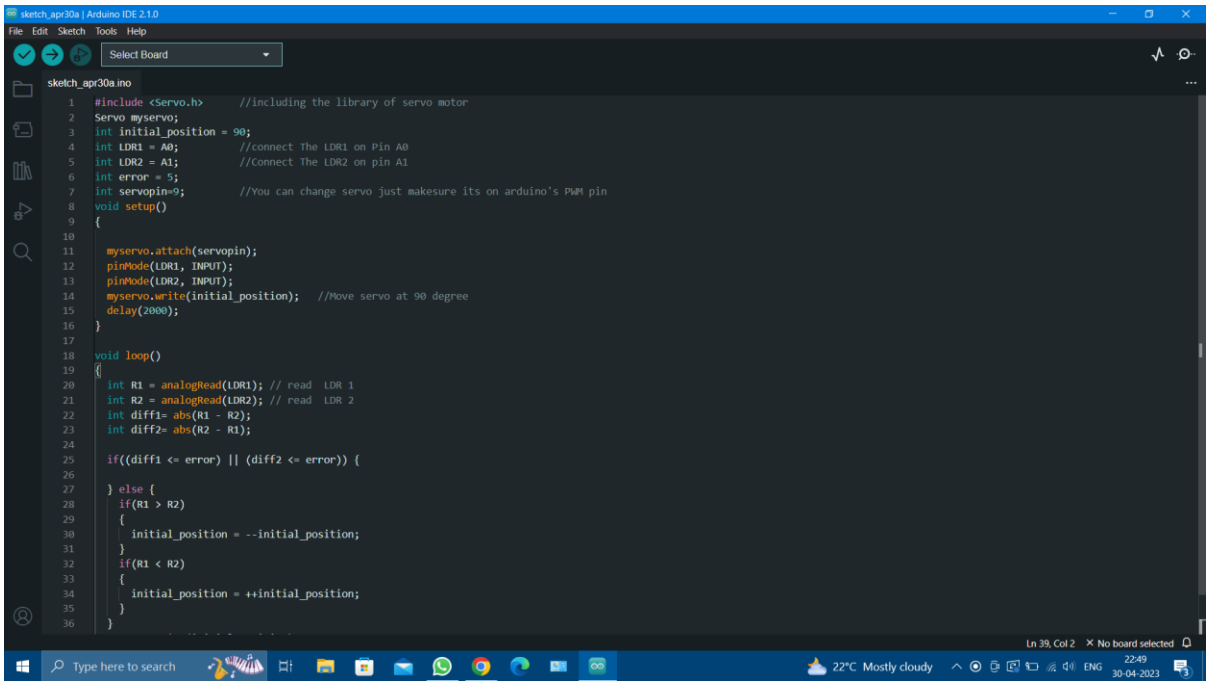
Solar Panel

A solar cell, or photovoltaic cell, is an electronic device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Individual solar cell devices are often the electrical building blocks of photovoltaic modules, known colloquially as solar panels.

Tinkercad

Tinkercad is a online 3D modelling program that runs in a web browser. It is a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry.

Arduino Code




```
#include <Servo.h>      //including the library of servo motor

Servo myservo;

int initial_position = 90;
```

```
int LDR1 = A0;         //connect The LDR1 on Pin A0
int LDR2 = A1;         //Connect The LDR2 on pin A1
int error = 5;
int servopin=9;        //You can change servo just makesure its on arduino's PWM pin
void setup()
{

  myservo.attach(servopin);
  pinMode(LDR1, INPUT);
  pinMode(LDR2, INPUT);
  myservo.write(initial_position);   //Move servo at 90 degree
  delay(2000);
}

void loop()
{
  int R1 = analogRead(LDR1); // read  LDR 1
  int R2 = analogRead(LDR2); // read  LDR 2
  int diff1= abs(R1 - R2);
  int diff2= abs(R2 - R1);

  if((diff1 <= error) || (diff2 <= error)) {

  } else {
    if(R1 > R2)
    {
      initial_position = --initial_position;
```

```
    }
    if(R1 < R2)
    {
      initial_position = ++initial_position;
    }
  }
  myservo.write(initial_position);
  delay(100);
}
```

Conclusion

The single axis solar tracking system is an efficient technology that maximizes the enrgy output of solar panels by continuously adjusting their position to follow the sun’s movement. The project report has demonstrated that the system has the potential to significantly increase the energy efficiency of solar power systems.

Furthermore, the implementation of the single axis solar tracking system is relatively straightforward and cost effective. The system can be further optimized and scaled for larger installations to provide more clean and sustainable energy. With the growing demand for renewable energy sources, the single-axis solar tracking system can play a significant role in meeting the world's energy needs.

References

- https://ieeexplore.ieee.org/document/8596874
- https://ieeexplore.ieee.org/document/6820643
- https://techatronic.com/single-axis-solar-tracker-project-tutorial/