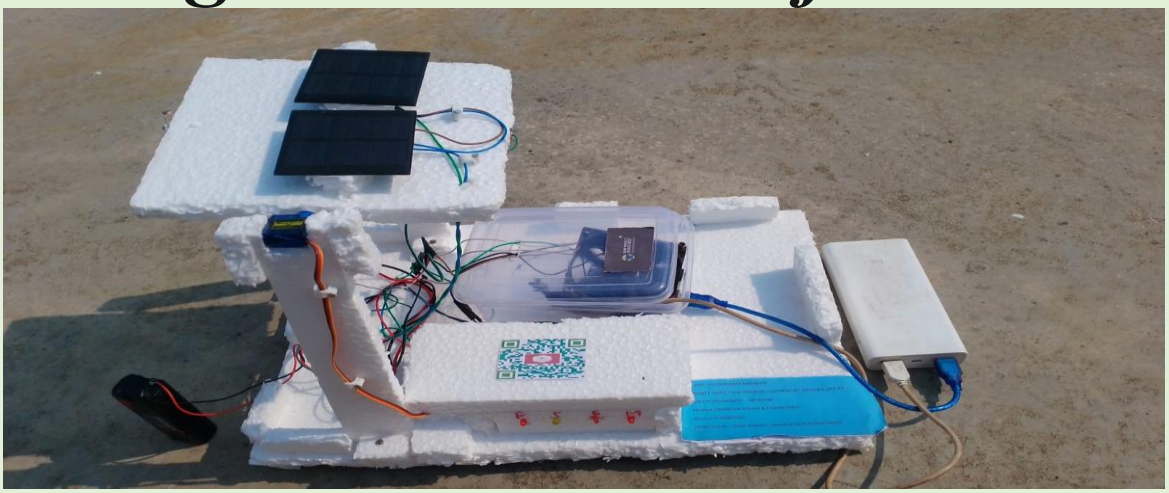
# *Sun Tracking Solar Panel Using Arduino Project #1*



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## INTRODUCTION :-

**The biggest crisis we are heading into is the climate change due to excessive use of fossil fuels and to overcome these issues, we have only one solution that is utilizing Renewable Energy. Renewable energy is a type of energy that is harnessed from the nature without causing ill effects to the environment. One of the most prominent kind of renewable energy is solar energy. Solar radiation from the sun is collected by the solar panels and converted into electrical energy. The output electrical energy depends on the amount of sunlight falling on the solar panel.**

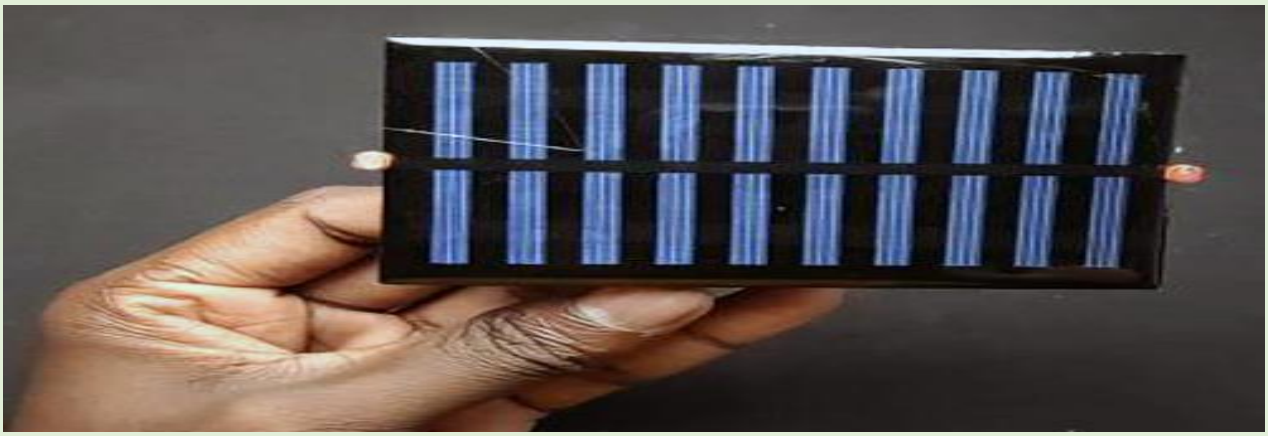
**Traditionally, solar panels are fixed and the movement of sun over the horizon means that the solar panel does not harness maximum energy most of the time. In order to maximize the power from the solar panel, the panel should face the sun all time. In this project, we will make a sun tracking system which will help the solar panels to generate maximum power. In some of our previous articles, we have built simple system to track power generated from solar panel and other solar energy related projects. You can check those out if you are looking for more projects on solar power.**

## How does a Solar Tracker Works?

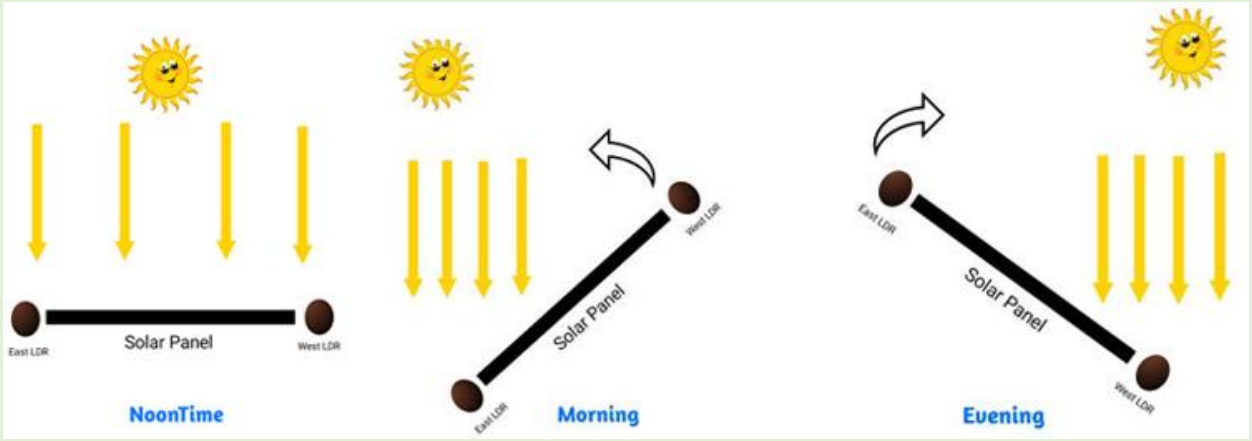
**You must be wondering how does it work? As discussed earlier, the solar panel should face the sun to harness maximum power. So, our system has two steps, first is to detect the position of sun and second is to move along with it.**

### Detecting the position of the Sun:-

***We measure the intensity of light with LDRs using Arduino and compare the intensity of light falling on both LDRs. The LDRs are placed on the edges of the solar panel as shown in the figure below.***

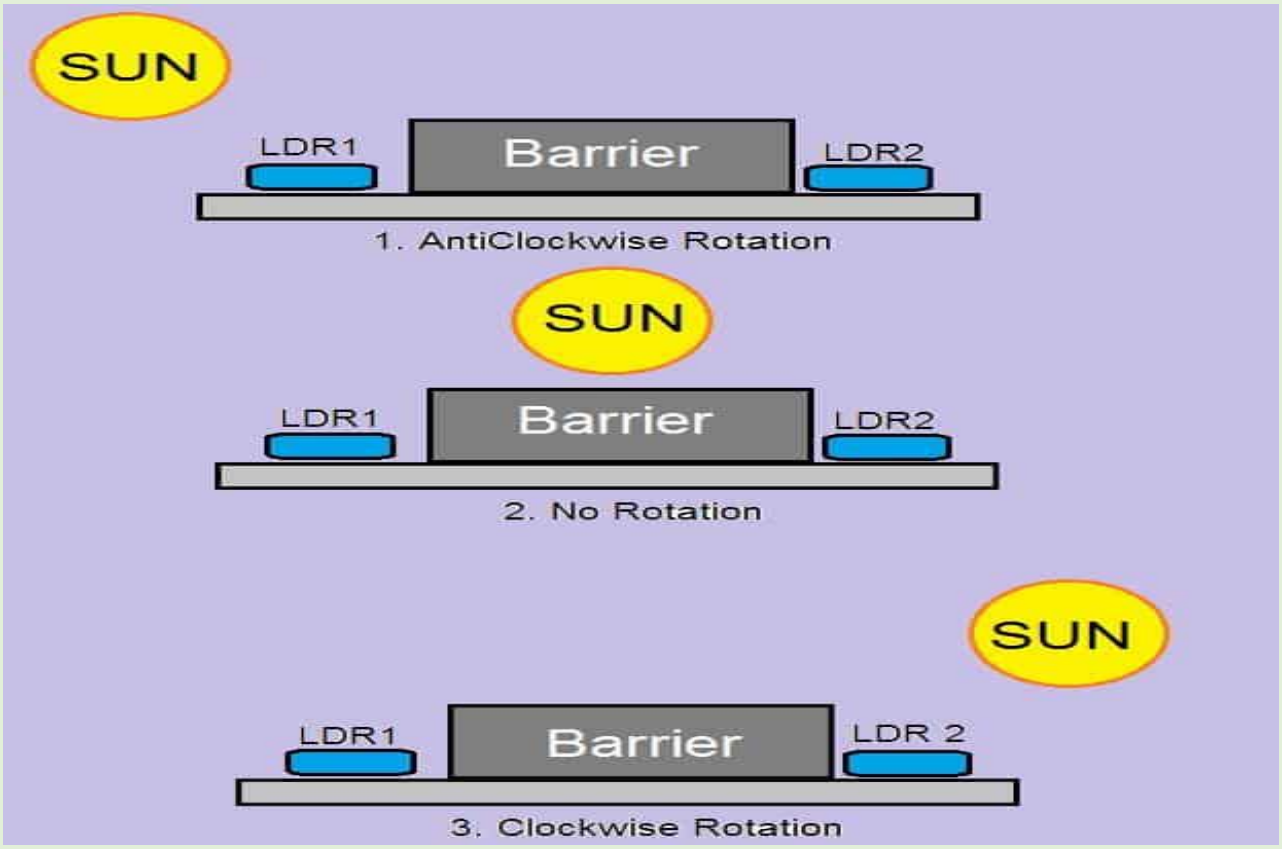


***Based on the intensity of light on the LDR, we give the signal to the servo motor to cause the movement. When the intensity of the light falling on the right LDR is more, the panel turns towards the right and if the intensity is higher on the left then the panel slowly turns towards the left side.***




***Consider a scenario of a beautiful winter morning, the sun rises from east side and therefore it has more light intensity than the west side, so the panel moves towards to east side. Throughout the day it will track the sun and by the evening, sun***

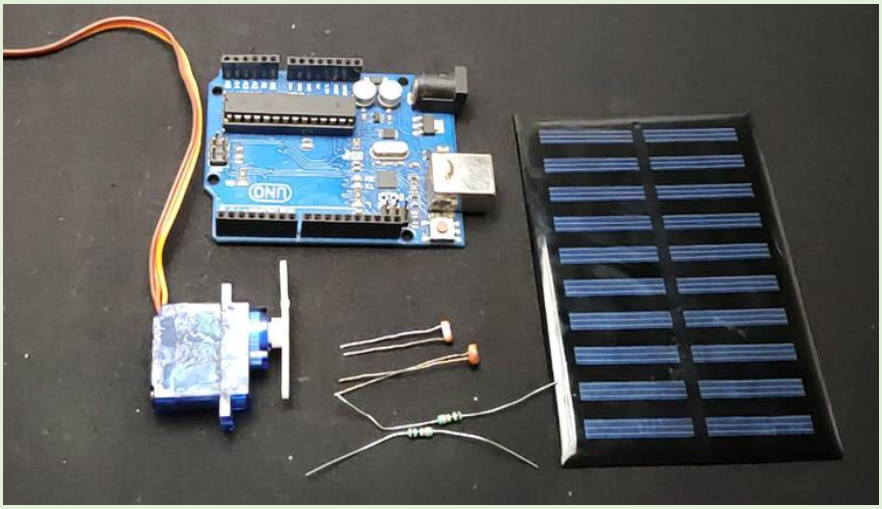
***has moved towards the west, hence it will have more intensity than the east direction so the panel will face the west direction.***




## Components Required for Making the Solar Tracker :-

- **1 x Arduino Uno**
- **1 x Servo motor**
- **1 x Solar panel**
- **2 x LDR**

- **2 x 10k Resistor**
- **Jumper wires**



- **Servo Motor :-**

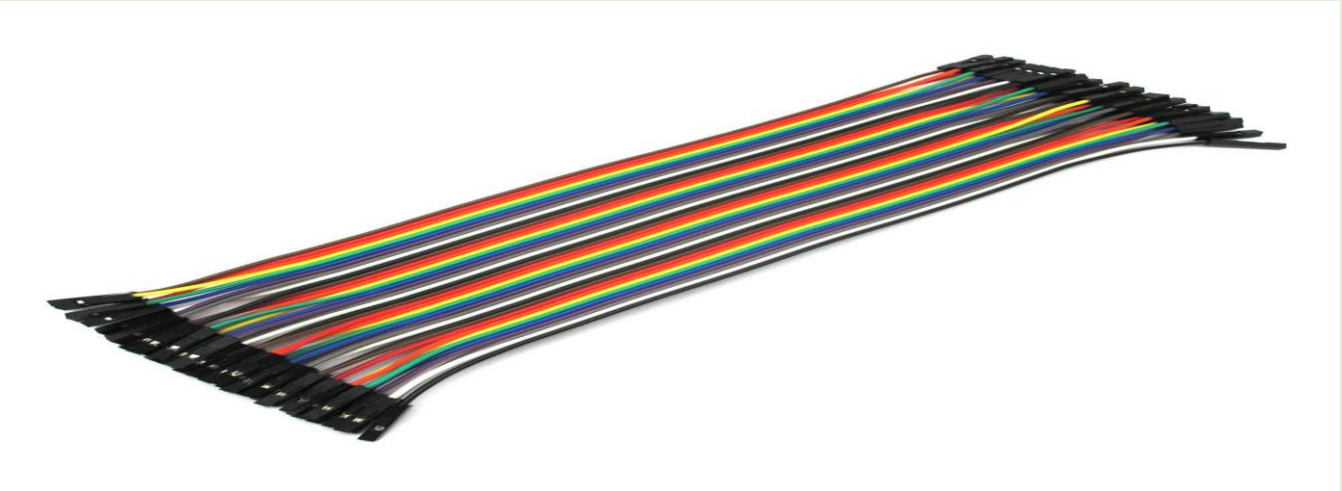

**Servo motor is used to rotate the solar panel. We are using servo motor because we can control the position of our solar panels precisely and it can cover the whole path of sun. We are using a servo motor that can be operated with 5volt.**

- **Light Dependent Resistor (LDR):-**

**A light-dependent resistor is made from semiconductor material having light-sensitive properties and hence are very sensitive to light. The resistance of LDR changes according to the light that falls on it and it is inversely proportional to the intensity of light. That is resistance of the LDR will increase at high-intensity light and vice versa.**

- **Jumper Wire:-**

**A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with ...**



- **Solar Panel:-**

**A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.**

- **Arduino Uno R3 board:-**

**The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010.[2][3] The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers as the Leonardo board.[5][6] The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino**

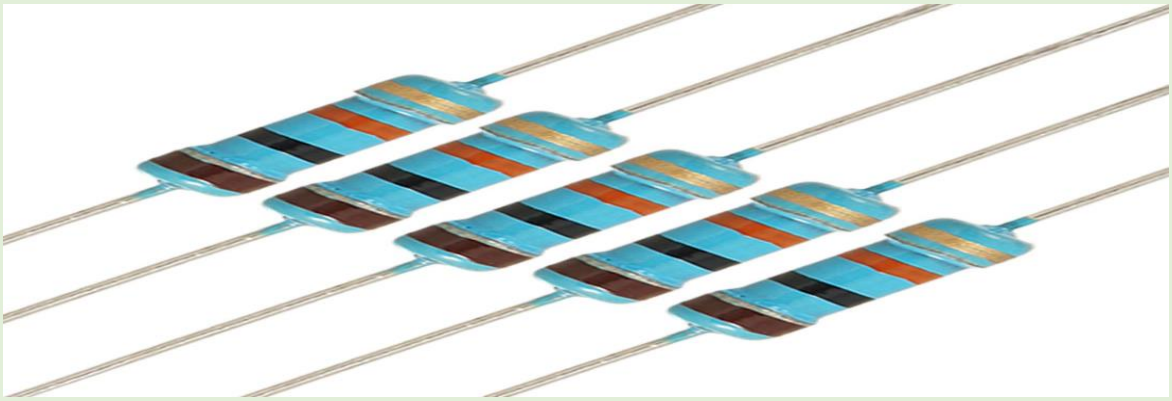
**website. Layout and production files for some versions of the hardware are also available.**


- **Battery/Power Source:-**

**A battery is a source of electric power that consists of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. Batteries convert chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation. It is used for give power to Arduino board.**

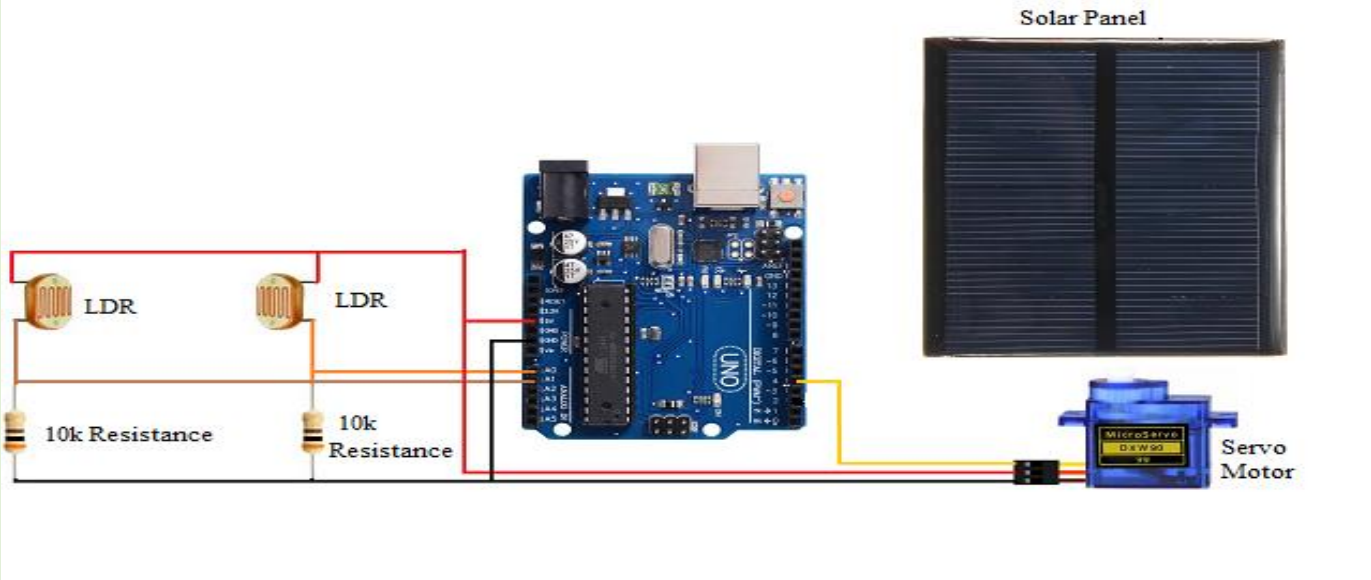

- **10k Register:-**

  **A 10k resistor is a fundamental electronic component that plays a vital role in circuits by limiting the flow of electric current. Its resistance value is 10,000 ohms. These resistors are identified by a color code, typically brown-black-orange-gold, where each color represents a digit or multiplier.**



- **Diagram Of Solar Tracker :-**

**The connection of the circuit is very straightforward. Here, I used an Arduino Uno as controller and connected the 2 LDRs to analogue pin A0 and A1 respectively. Pin 9 of Arduino is connected to the servo motor. Since, we have used a 5V servomotor, we don't require any external power supply because all the components can easily be powered the Arduino itself. All the connections are shown in the figure below.**




## Advantages of solar tracking system:-

- In the same amount of space, solar trackers generate more electricity than a fixed solar system, which makes them ideal for optimizing land usage.
- There are two kinds of solar trackers, such as single-axis and dual-axis. A suitable solar tracker can be installed according to the Installation size, local weather, degree of latitude, electrical requirements, etc.
- Solar trackers generate more electricity than their stationary solar systems due to direct exposure to solar rays.
- Also, the tracker system does not require long-term maintenance because of the advancements in technology and reliability of mechatronics.

- **In certain states, some utilities offer time-of-use (TOU) rate plans for solar power. This utility will purchase the power generated during the peak time of the day at a higher rate. The solar tracking technology is utilized to enhance energy gains during these peak periods.**
- **Types of solar tracking system:-**

  **As per the mode of motion, the solar tracking system is classified into two types:**

  1. **Single-axis solar tracking system**
  2. **Dual-axis solar tracking system**

  **There are two horizontal axes and one vertical axis for a moving surface. The surface rotates around each axis to get the right angle for receiving the maximum sunlight.**

  **The surface is adjusted around a single axis in a single-axis tracking system. When using a dual-axis tracking system, the surface rotates simultaneously around two axes.**

**Project Source Code (Arduino R3 IDE):-**

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

#define LDR_1 A0
#define LDR_2 A1

int pos = 90;
int Resistance = 20;

void setup(){
myservo.attach(4);
pinMode(LDR_1, INPUT);
pinMode(LDR_2, INPUT);

myservo.write(pos);

delay(1000);
}

void loop(){
int value_1 = analogRead(LDR_1);
int value_2 = analogRead(LDR_2);

if((abs(value_1 - value_2) <= Resistance) || (abs(value_2 - value_1) <= Resistance)) {

}else {
if(value_1 > value_2)
{
pos = pos+1;
}
if(value_1 < value_2)
{
pos = pos-1;
}
}

if(pos > 180) {pos = 180;}
if(pos < 0) {pos = 0;}
myservo.write(pos);
delay(50);

}
```

# Conclusion :-

**A solar panel tracking system was designed and implemented. The aim of the solar panel tracking system is to track the positon of the sun for better efficiency of the solar panel has shown in the experimental results. This work can be executed on an industrial scale which be beneficial to developing countries like Nigeria and Sub-Sahara Africa countries. Our recommendation for future works is to consider the use of more sensitive and efficient sensors which consume less power and which are also cost effective. This would increase the efficiency while reducing cost. I hope this article helps you understand the concept of a solar tracking system, its importance, and the prototype of a sun-tracking solar panel using Arduino Uno. Similarly, you can implement a real-time-based solar tracker at home.**

# REFERENCE:-

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# *CERTIFICATE OF PARTICIPATION*


## CERTIFICATE FOR GREAT PROJECT #1


Thank you