A PROJECT REPORT

ON

"ARDUINO SOLAR TRACKER"

Submitted in partial fulfillment of the requirements for the award of the

3 YEAR DIPLOMA

IN

ELECTRONICS& TELECOMMUNICATION ENGINEERING

By

ELECTRONICS & TELECOMMUNICATIONS ENGINEERING DEPARTMENT

GOVERNMENT POLYTECHNIC COLLEGE, ITARSI.

[June 2022]

CANDIDATE'S DECLARATION

We here by declare that the work carried out in this report titled **'ARDUINO SOLAR TRACKER'** is presented on behalf of partial fulfillment of the requirement for the award of the diploma in Electronics & telecommunications Engineering submitted to the department of Electronics & Telecommunication Engineering GOVERNMENT POLYTECHNIC COLLAGE, ITARSI M.P. Under the supervision and guidance of **Mr. Bhupendra Jothe**, **Mrs. Pallavi Narware**, **Mr. Ramkumar Uikey** [**H.O.D - E.T.**], **Mr. Lokendra Singh Banafer**, **Mr. Manish Varyani**, **Mr. Lakhan Kori.**

We have not submitted the matter embodied in this report for theawardof any otherdegreeordiploma.

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Date: Place: Itarsi

CERTIFICATION

This is to certify that the above statement made by the candidate is correct to the best of our knowledge and belief.

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CONTENT

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DIAGRAM & VISUALS

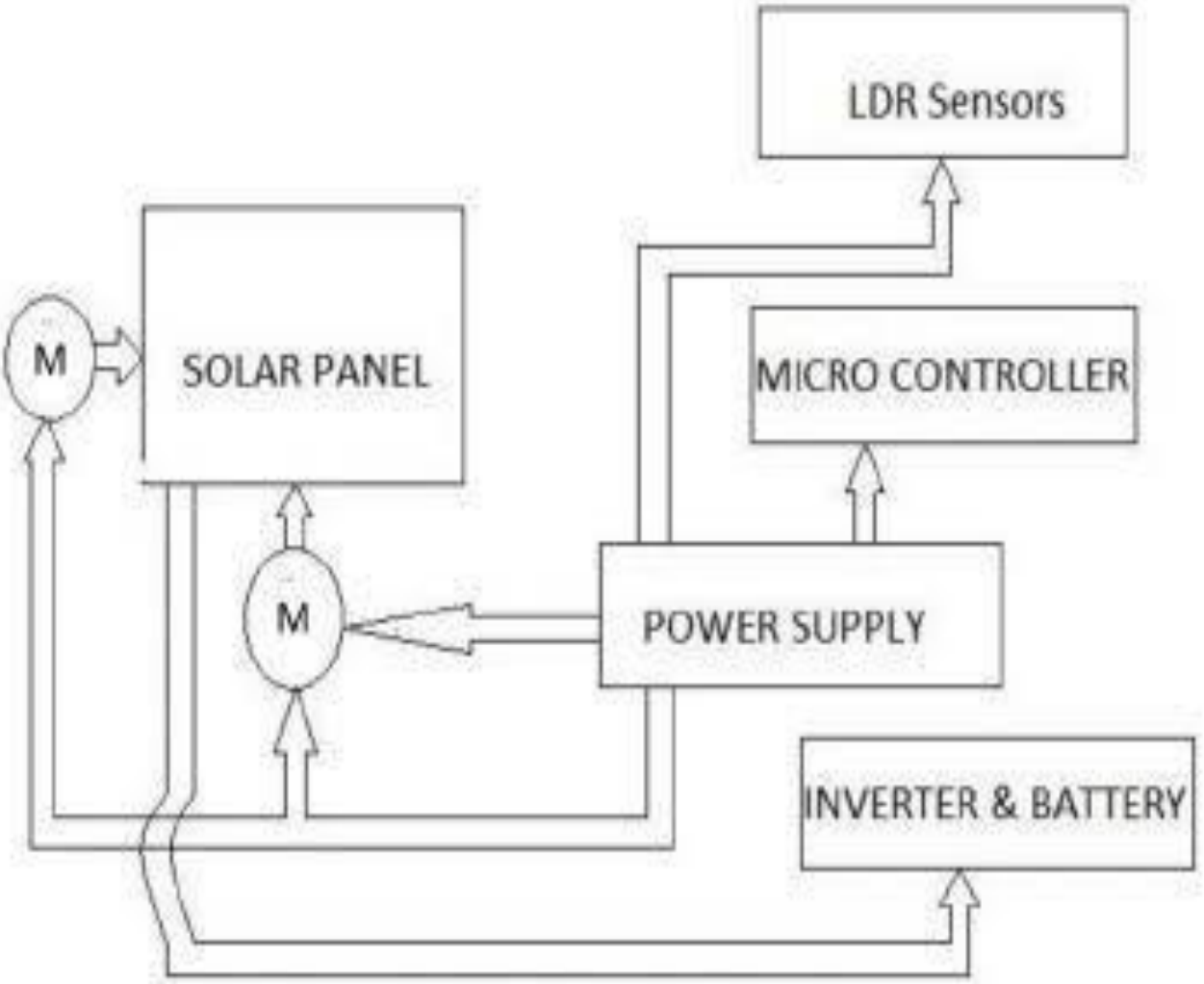
INTRODUCTION

Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. As such, it is vital that those in engineering fields understand the technologies associated with this area. Our project will include the design and construction of a microcontroller-based solar panel tracking system.

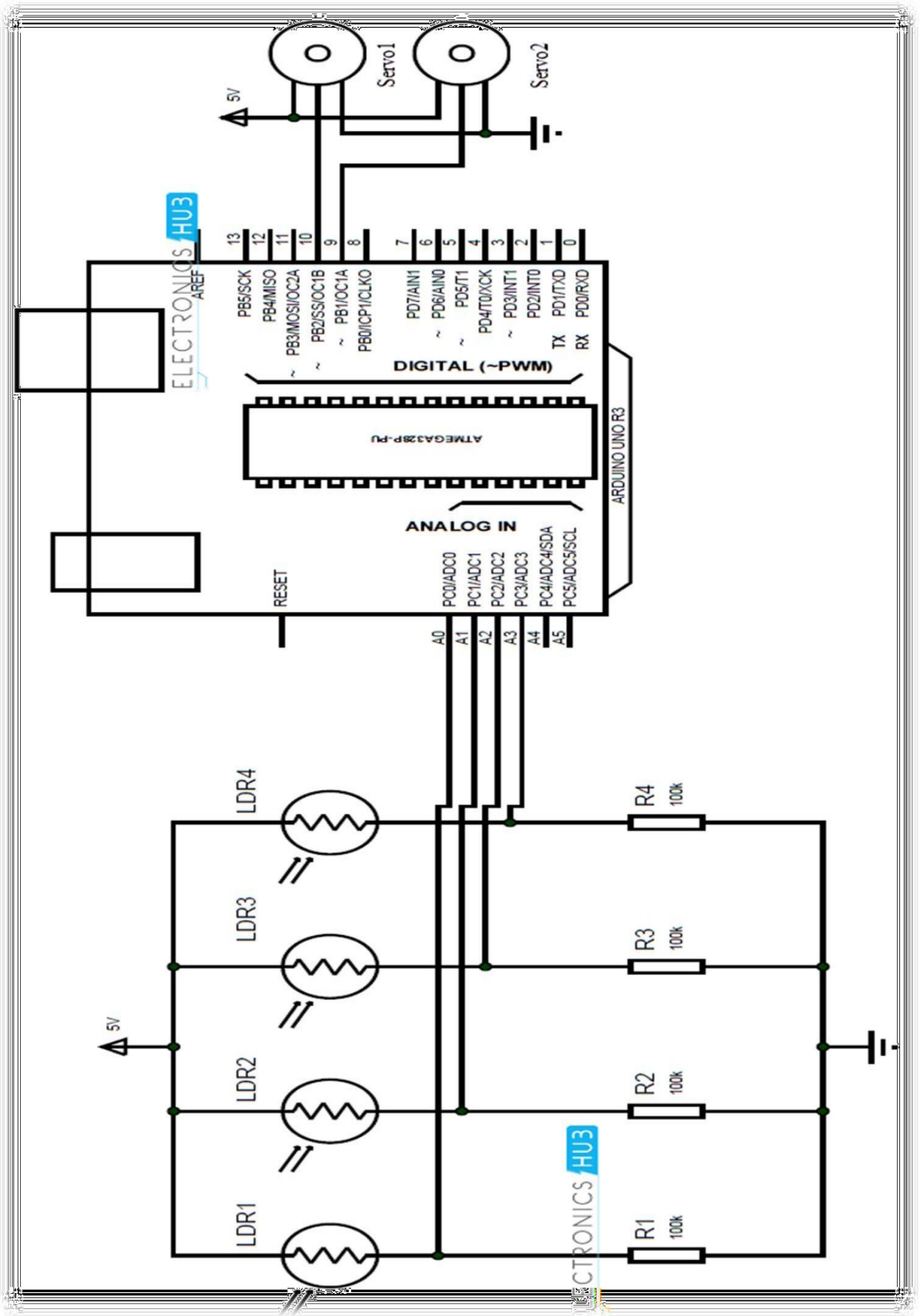
"In modern solar tracking systems, the solar panels are fixed on a structure that moves according to the position of the sun."

Solar tracking allows more energy to be produced because the solar array is able to remain aligned tothe sun. The aim of this solar tracker project is tokeep the solar photovoltaic panel perpendicular to the sun through out the year in order to make it more efficient. Solar Tracker is a device which follows the movement of the sun as it rotates from the east to the west every day. Solar trackers can increase the output of solar panels by 20-30% which improves the economics of the solar panel project. The energy contributed by the direct beam drops off with the cosine of the angle between the incoming light on the panel.

BLOCK DIAGRAM



CIRCUITDIAGRAM



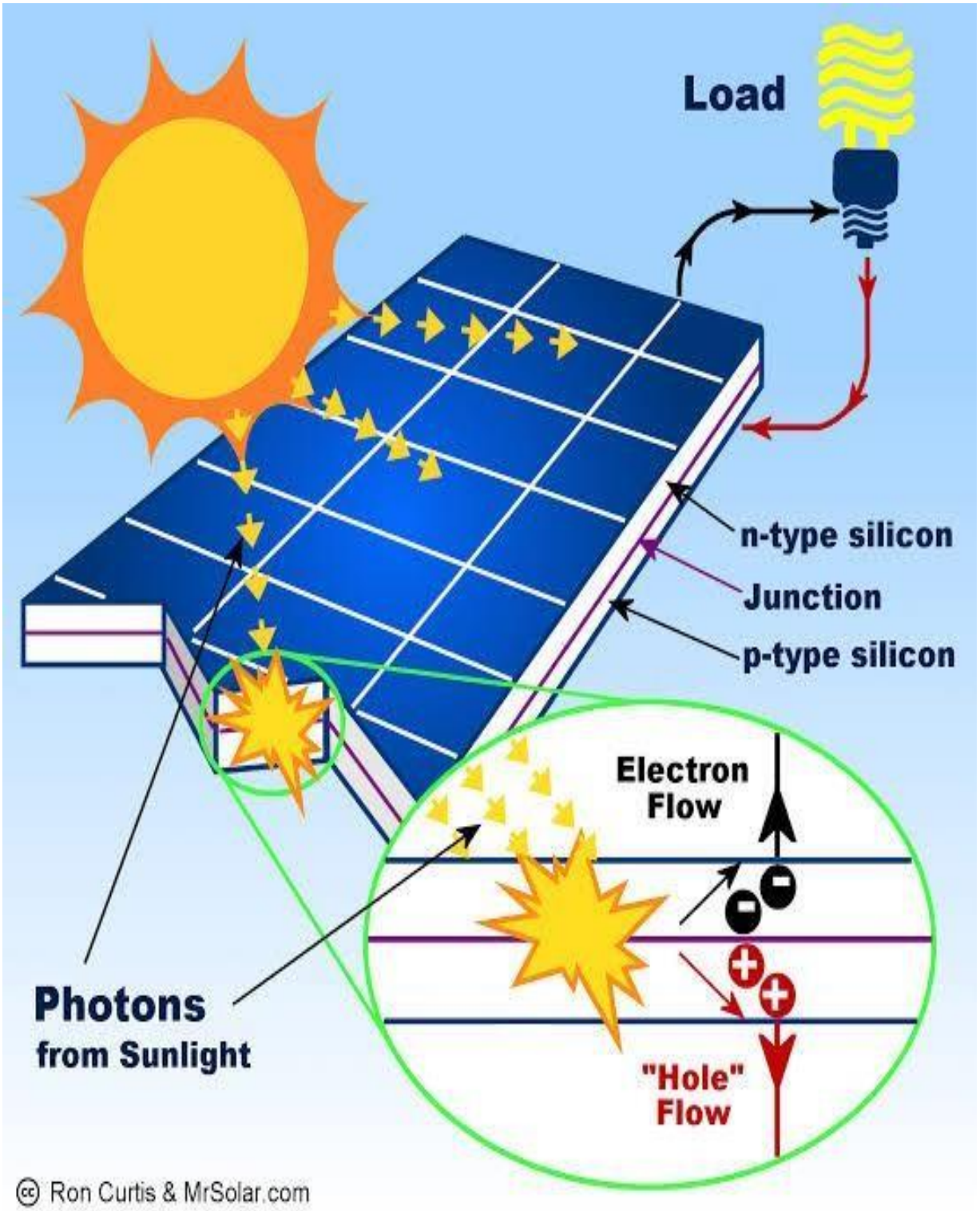
COMPONENTS REQUIRED

- **Arduino Uno R3**
- **Solar Panel**
- **Servo Motor x2**
- **LDR x4**
- **Resistor x4 (100K ohm)**
- **Jumper Wire**

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pin that may be interfaced to various expansion boards (shields) and other circuits. 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 BUS B cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7and 20 volts.

SOLAR PANEL


Load
n-type silicon
Junction
p-type silicon
Electron Flow
Photons from Sunlight
"Hole" Flow
© Ron Curtis & MrSolar.com

SOLAR PANEL

The smallest unit of a solar power device is a solar cell.A solar panel is created by several solar cells. The basic electricity generation unit of the solar photovoltaic system shapes solar cells. In fact, solar cells are large-area semiconductor diodes. Because of the photovoltaic effect, light energy (photon energy) is converted into electric current. Solar cells are also called photo voltaic cells. Solar energy begins with the sun. Solar panels (also known as "PV panels") are used to convert light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads. When the sun shines onto a solarpanel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow.

Applications:

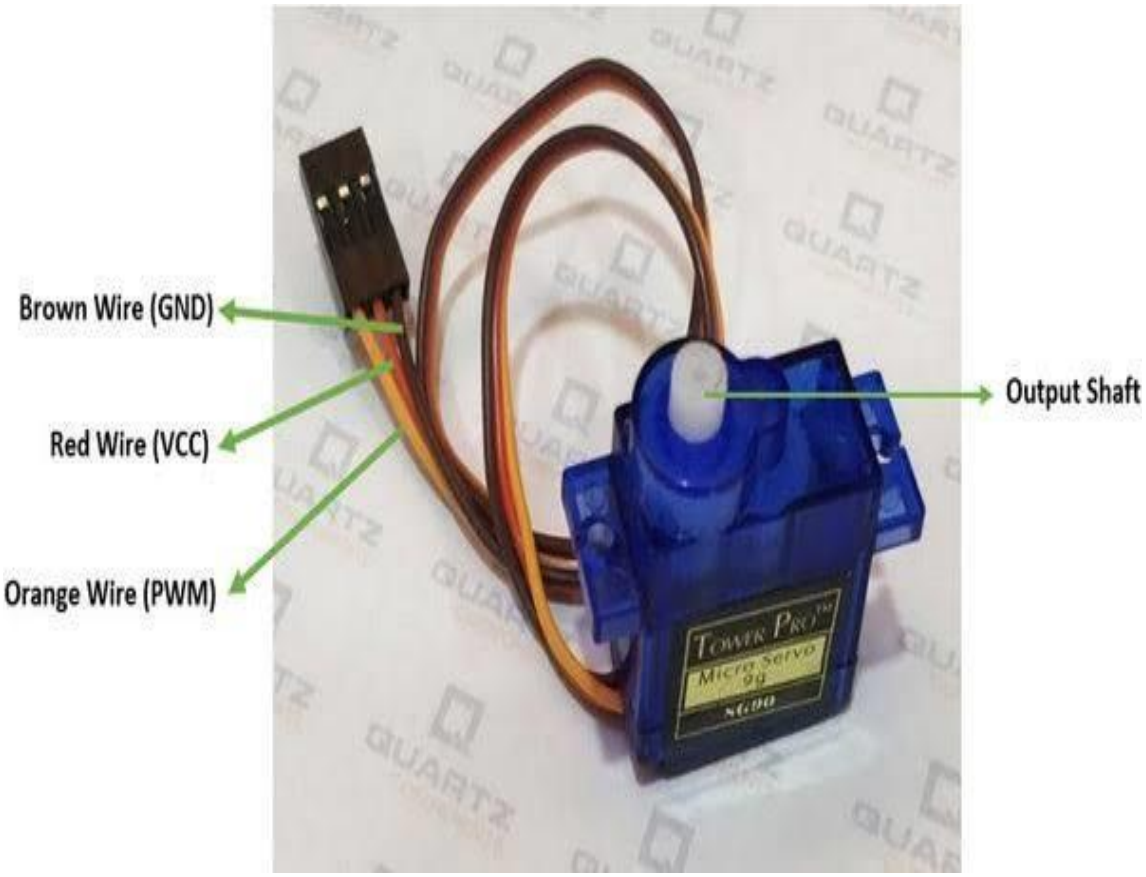
1) Transportation

2) Solar cells in calculators

3) Solar cell panels

4) Solar Panels on Roof

SERVO MOTOR

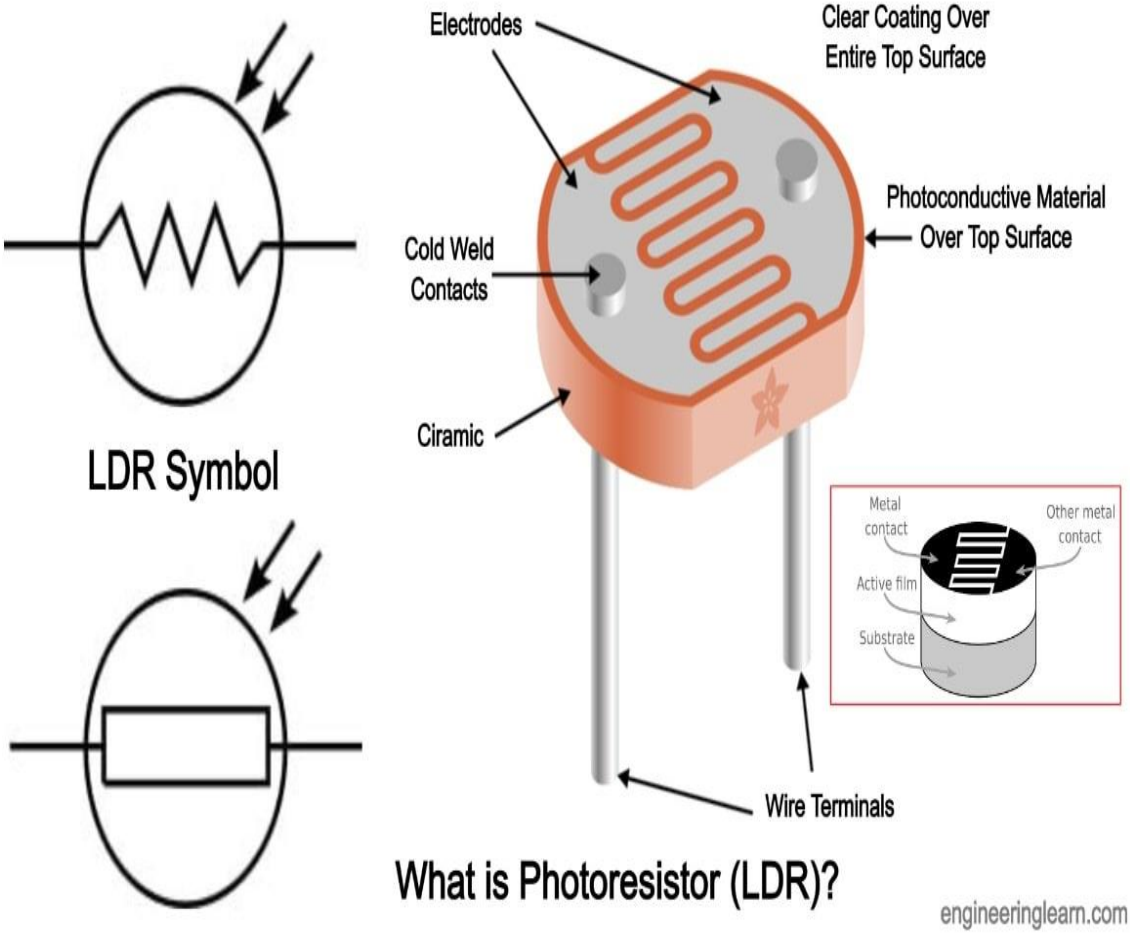


A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servo motors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

LDR


Electrodes
Clear Coating Over
Entire Top Surface
Photoconductive Material
Over Top Surface
Cold Weld
Contacts
Ciramic
Metal
contact
Other metal
contact
Active film
Substrate
Wire Terminals
LDR Symbol
What is Photoresistor (LDR)?
engineeringlearn.com

LDR

- A Light Dependent Resistor (LDR) is also called a photo resistor or a cadmium sulfide (CdS) cell. It is also called a photo conductor. 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.
- **Applications-**

  1) Light varying sensor circuit
  2) Light and dark activated switching circuit
  3) Camera light meters
  4) Street lights
  5) Clock radios
  6) Light beam alarms
  7) Reflective smoke alarms
  8) Outdoor clocks

- **Construction of an LDR**

  The construction of an LDR includes a light-sensitive material that is placed on an insulating substrate like ceramic. The material is placed in a zigzag shape in order to get the required power rating and resistance. The area of zigzag separates the metal-placed areas into two regions.

RESISTOR

Resistor is an electrical component that reduces the electric current. The reistor's ability to reduce the current is called resistance and is measured in units ofohms. (Symbol of ohms - Ω). If we make an analogy towater flow through pipes, the resistor is a thin pipe thatreducesthe waterflow.

Types-

1) Linear resistors

A) Fixed resistors:

- Carbon composition resistors
- Wirewound resistors
- Thin film resistors
- Thick film resistors

B) Variable resistors:

- Potentiometers
- Rheostats
- Trimmers

2) Non-linearresistors

- Thermisters
- Varisters
- Photoresistors

Color Coding of Resistors

Resistors may not display the value outside but resistorcolor pattern through their resistance can be calculated.PTH (plated-through-hole) resistors use a color-codingsystem (which really adds some flair to circuits), andSMD (surface-mount-device) resistors have their ownvalue-markingsystem.

Color Code

Black 0

Brown 1

Red 2

Orange3

Yellow 4

Green5

Blue 6

Violet7

Grey8

White9

Tolerance in Resistors

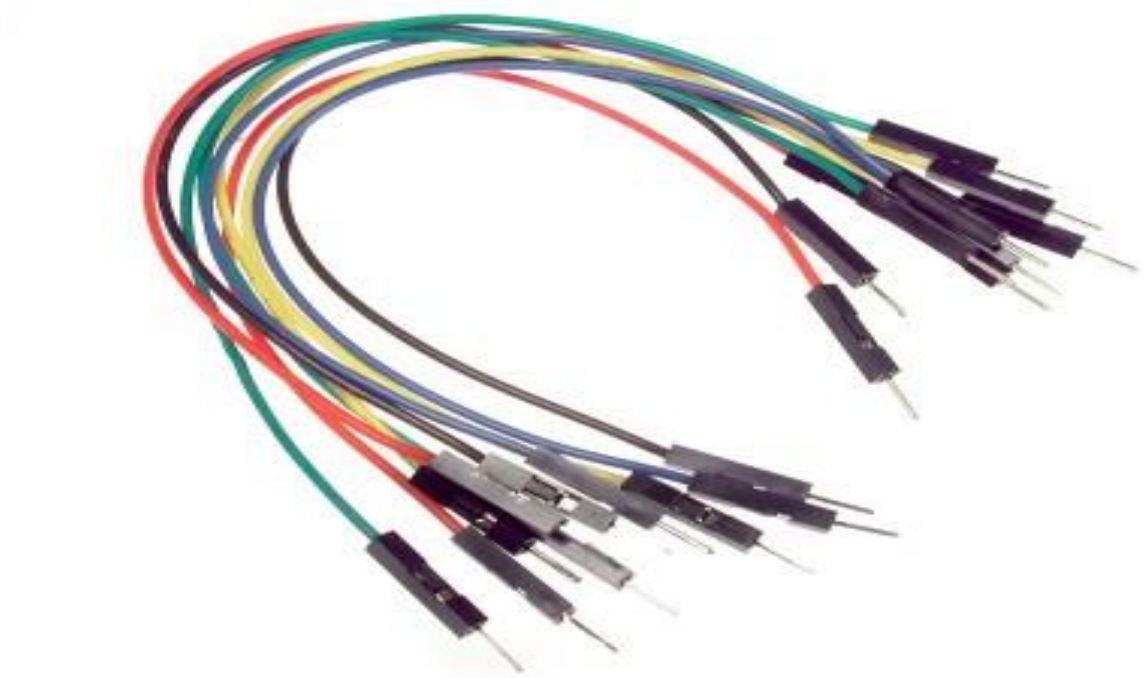
Brown ±1%

Red ±2%

Gold±5%

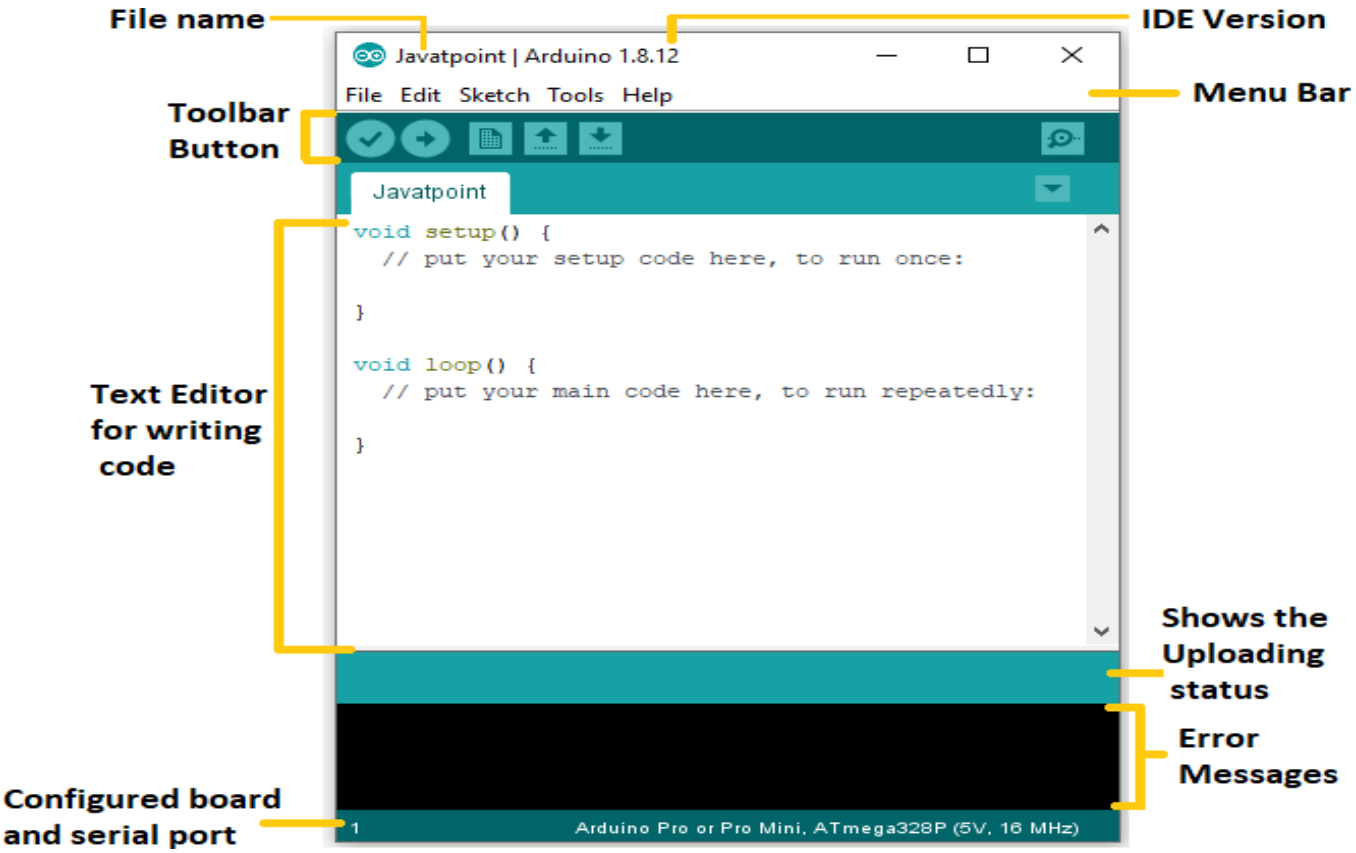
Silver±10%

JUMPERWIRE



Jumper wires are simply wires that have connect or pin sat each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other proto typing tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

SOFTWARE: ARDUINO IDE



The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a tool bar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

PROJECT CODE

```
1  #include<Servo.h>
2  //definingServos
3  Servoservohori;
4  intservoh=0;
5  intservohLimitHigh=160;
6  intservohLimitLow=20;
7
8  Servoservoverti;
9  intservov=0;
10 intservovLimitHigh=160;
11 intservovLimitLow=20;
12 //AssigningLDRs
13 intldrtopl=2;//topleftLDRgreen
14 intldrtopr=1;//toprightLDRyellow
15 intldrbotl=3;//bottomleftLDRblue
16 intldrbotr=0;//bottomrightLDR
   orange
17
```

```
18  voidsetup()
19  {
20    servohori.attach(10);
21  servohori.write(0);
22    servoverti.attach(9);
23    servoverti.write(0);
24    delay(500);
25  }
26
27  voidloop(
28  {
29  servoh=servohori.read();
30    servov=servoverti.read();
31    //capturinganalogvaluesofeachLDR
32    inttopl=analogRead(ldrtopl)
33  inttopr=analogRead(ldrtopr);
34    intbotl=analogRead(ldrbotl);
35  intbotr=analogRead(ldrbotr);
36    //calculatingaverage
37  intavgtop=(topl+topr)/2;
    //averageoftopLDRs
```

```
38    intavgbot=(botl+botr)/2;
      //averageofbottomLDRs
39    intavgleft=(topl+botl)/2;
      //averageofleftLDRs
40    intavgright=(topr+botr)/2;
      //averageofrightLDRs
41
42    if(avgtop<avgbot)
43    {
44      servoverti.write(servov+1);
45    if(servov>servovLimitHigh)
46      {
47    servov=servovLimitHigh;
48      }
49    delay(10);
50    }
51    elseif(avgbot<avgtop)
52    {
53      servoverti.write(servov-1);
54      if(servov<servovLimitLow)
55    {
```

```
56    servov=servovLimitLow;
57    }
58    delay(10);
59    }
60    else
61    {
62      servoverti.write(servov);
63    }
64
65  if(avgleft>avgright)
66    {
67  servohori.write(servoh+1);
68      if(servoh>servohLimitHigh)
69  {
70      servoh=servohLimitHigh;
71  }
72      delay(10);
73    }
74    elseif(avgright>avgleft)
75  {
76      servohori.write(servoh-1);
```

```
77      if(servoh<servohLimitLow)
78       {
79        servoh=servohLimitLow;
80       }
81      delay(10);
82    }
83  Else
84    {
85  servohori.write(servoh);
86    }
87  delay(50);
88  }
89
```

WORKING

LDRs are used as the main light sensors. Two servo motors are fixed to the structure that holdsthe solar panel. The program for Arduino is uploaded to the microcontroller. The working of the project is as follows.

LDRs sense the amount of sunlight falling on them. Four LDRs are divided into top,,bottom,left and right.

For east – west tracking, the analog values from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light, the vertical servo will move in that direction.

If the bottom LDRs receive more light, the servo moves in that direction. For angular deflection of the solar panel, the analog values from two left LDRs and two right LDRs are compared. If the left set of LDRs receive more light than the right set, the horizontal servo will move in that direction. If the right set of LDRs receive more light, the servo moves in that direction.

ADVANTAGES OF

SOLAR TRACKING SYSTEM

- On 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 and electrical requirements.
- Solar trackers generate more electricity than their stationary solar system 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 system is used to maximize the energy gains during these peak time periods.

CONCLUSION

Hope this file helps you to understand the concept of a Solar tracking system, it's importance and the prototype of a sun-tracking solar panel using Arduino Uno. Similarly, you can implement the real-time based solar tracker at your home.

REFERENCES

- https://www.electronicshub.org
- https://www.arduino.cc
- https://youtu.be/X0z3px5KgEs
- https://www.amazon.in/
- https://www.flipkart.com
- https://www.google.co.in