

# **SOLAR TRACKER WITH PANEL CLEANER**

**A Project and Thesis submitted in partial fulfillment of the requirements  
for the Award of Degree of  
Bachelor of Science in Electrical and Electronic Engineering**

**BY  
MIM HOSSAIN**

**ID: 153-33-2965**

**SAJAL**

**ID: 153-33-2986**

Supervised By

**Dr. A K M Alomgir**

Associate Professor

Department Of EEE



**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING  
FACULTY OF ENGINEERING  
DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

**DECEMBER 2018**

# APPROVAL

This project titled “**SOLAR TRACKER WITH PANEL CLEANER**”  
Submitted by MIM HOSSAIN and SAJAL to the Department of Electrical and  
Electronics Engineering, Daffodil International University , has been accepted as  
satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in  
Electrical and electronics Engineering and approved as to its style and contents .The  
presentation has been held on.

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---

**Professor**  
**Professor and Dean**  
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---

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Daffodil International University

---

**Assistant Professor**  
Department of EEE  
Daffodil International University

# DECLARATION

We hereby pronounce that, this project has been finished by us under the supervision of **Dr. A K M Alomgir**, Associate Professor, Department of EEE, and Daffodil International University. We Also announce that neither this undertaking nor any piece of this task has been submitted somewhere else for honor of any degree.

**Supervised by:**

---

**Dr. A K M Alomgir**  
Associate Professor  
Department of EEE  
Daffodil International University

**Submitted by:**

---

**MIM HOSSAIN**  
Id. 153-33-2965  
Department of EEE  
Daffodil International University

---

**SAJAL**  
Id: 153-33-2986  
Department of EEE  
Daffodil International University

Dedicated to

**Our Parents**

**III**

# ACKNOWLEDGEMENT

At first we are greatly praise to almighty Allah for successful completion of our undergraduate project.

We want to thanks our Project Supervisor Associate Professor Dr. A K M Alomgir for his encouragement and for giving us permission to involve with this Power related project. We have done our project according to his direction. We are also grateful to our respected teachers. We thank all staffs of our departmental lab for their help during working period. We are extremely grateful to our parents, family member and friends for their support, constant love and sacrifice.

Finally, we beg pardon for our unintentional errors and omission if any.

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# ABSTRACT

Presently sunlight based power is a power that is client is expanding step by step. Since store and assets both are being secured. Also, some common assets like petroleum derivatives is consider as momentary assets since it is assessed will completed in next 30 years. In light of this circumstance, sustainable power source like sun powered vitality is basic to person after the regular assets is wrap up. The truth of the matter is, ordinary sun powered board control framework is stationary, implies the sun based board won't continually looking to the bearing of sun, this make the light force falling on the sun oriented board isn't in most extreme dimension so the sun based board won't generally work in its greatest execution.

This paper exhibits a novel strategy which will naturally follow the sun's position and as needs be alter the course of the sun based board to get the greatest yield from the sun powered cell with the assistance with Arduino Mini Pro, LDR sensor and DC servo engine. This strategy empower the sun based board work in most extreme execution in light of the fact that the light force falling on the board will be in greatest power level in all taxing day. A sun oriented tracker is planned and tentatively tried. The data and configuration detail are appeared in the report.

# CHAPTER 1

## CHAPTER CONTENTS

This chapter explains the overview of this project which includes the information of the list below:

- 1.1 Introduction to the project
- 1.2. Project Objective
- 1.3. Problem statement
- 1.4. Methodology

## **1.1 Introduction to the project:**

Normally, solar panels are static and don't pursue the development of the sun. Here is a sun oriented tracker framework that tracks the sun's development over the sky and attempts to keep up the sun powered board opposite to the sun's beam, guaranteeing that the most extreme measure of daylight is occurrence on the board for the duration of the day till night.

Photovoltaic is the field of innovation and research identified with the use of sun powered cells as sun oriented vitality. Sun oriented cells have numerous applications. Singular cells are utilized for driving little gadgets, for example, electronic adding machines. Photovoltaic exhibits create a type of sustainable power, especially valuable in circumstances where electrical power from the network is inaccessible, for example, in remote region control frameworks, Earth-circling satellites and space tests, remote radiotelephones and water siphoning applications. Photovoltaic power is likewise progressively sent in matrix tied electrical frameworks.

Sun powered Energy has been the power supply of decision for Industrial applications, where control is required at remote areas. Most frameworks in individual uses require a couple of kilowatts of intensity. The precedents are fueling repeater stations or microwave, TV and radio, telemetry and radio phones. Sun oriented vitality is additionally as often as possible utilized on transportation flagging e.g. beacons and progressively in street traffic cautioning signals. Sun orienteer's extraordinary advantage here is that it is very solid and requires little upkeep.

While the output of sun based cells relies upon the power of daylight and the edge of occurrence, it intends to get greatest effectiveness; the sun oriented boards must stay before sun amid the entire day. However, because of revolution of earth those boards can't keep up their position dependably before sun. This issue results in decline of their effectiveness. In this manner to get a consistent yield, a mechanized framework is required which ought to be skilled to always turn the sun oriented board. The Solar Tracking System is made as a model to take care of the issue, referenced previously. It is totally programmed and keeps the board before sun where we get greatest output.

## **1.2 Project Objectives:**

Project objectives are fundamentally the mission, reason or standard that can achieve inside the normal calendar. There are two principle objectives must be accomplished toward the finish of the undertaking, which are:

(a).To structure and develop a programmed sunlight based following framework where this framework will adjust and orientate the situation of sun powered board as indicated by light force falling on it to keep the surface of the sun based board constantly opposite to the sun position so light falling on the sun oriented board will be in most extreme dimension x and y.

(b).To join sun powered charger with the sun based tracker framework so the sunlight based charger can worked in most extreme execution. At last increment the aggregate effectiveness of a nearby planetary group.

## **1.3 Problem Statement:**

The issue of the Earth-wide temperature support is stopping any fooling around starting late. Thusly, the enthusiasm of the perfect imperativeness or endless is keep extending. The nearby planetary framework is using .Daylight as source, convert the sun based radiation into electrical imperativeness is one the noticeable maintainable power source nowadays.

The principle motivation behind this task is to charge the little electronic gadgets by utilizing sun based charger framework and expand the effective of sun powered board by making sunlight based tracker framework.

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The interest and utilization of the battery-powered battery is keep increment in most recent couple of years because of hardware gadgets, for example, mp3 player, advanced cell and tablet are getting famous. The client will require one to two hour to energize their battery in home which control source is non-sustainable power source. A sun powered charger can enhance the condition since it is utilizing absolutely free and clean vitality in the charging procedure, conveyed numerous advantages to client and furthermore condition.

Moreover, the execution of the sunlight based board is essentially relies upon its proficient, its execution won't enhance except if a higher effective sun oriented board was concocted. Furthermore, the greater part of the sunlight based board is stationary; it will dependably face to just a single course while the situation of the sun keeps change in day. Thus, the force of daylight falling on the sun powered board won't generally in largest amount, this lead to negative impact of the execution of sun based board. A sun powered following framework will enhance the execution of sun based board.

By consolidating the sun powered charger and the sunlight based following framework, the sun oriented charger can be worked in most extreme execution.

## **1.4 Methodology:**

Methodology is actually the general guideline to the execution of project. It incorporates some investigation of the standards or the rules that may incorporate into the undertaking and investigation of the potential strategies that will be utilized in the venture. It gives an arrangement to the person who will do the task where it will indicate arranging exercises.

As a matter of first importance, exchange with the supervision has been made to dialog about the potential last year venture title. At that point, writing audit was made. The proposition of the undertaking is made to recognize the venture objective, venture degree and issue articulation of the task. Inside the proposition, the stream graph must be unmistakably proclamation since well arranging of time is the key achievement of the venture. From that point onward, venture continues to reenactment, equipment and mechanical development. Investigating has been made to take care of the potential issue of the model. Model can be concluded after every one of the issues has been comprehended.

# **CHAPTER 2**

## **SYSTEM DEVELOPMENT**

### **CHAPTER CONTENTS**

This chapter explains the overview of this project which includes the information of the list below:

#### 2.1 System Development

## 2.1 SYSTEM DEVELOPMENT:

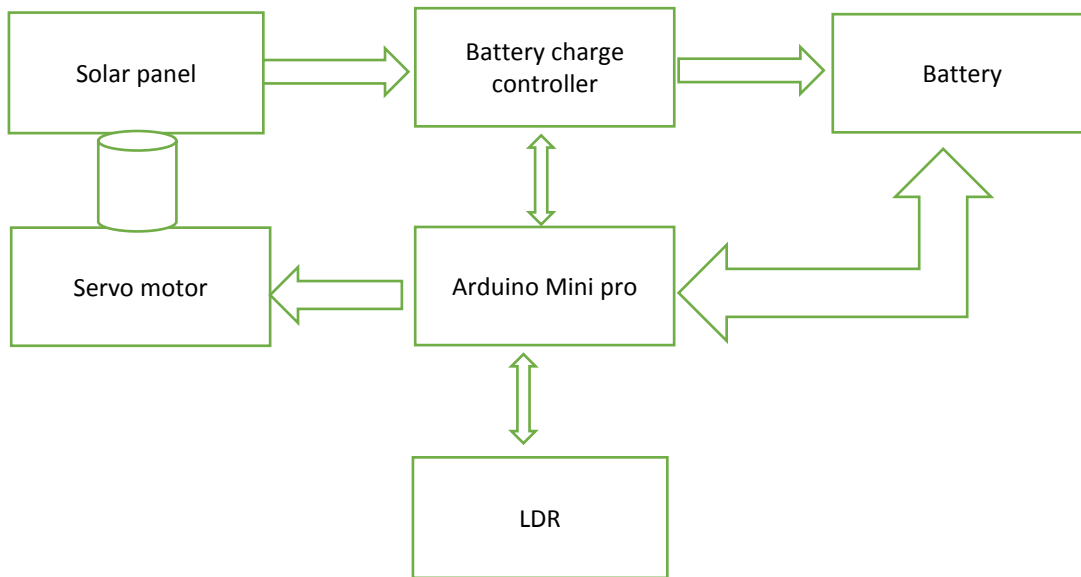


Fig 1: System development:

Connecting the battery charging controller with the solar panel here and connecting the battery and the battery from Arduino Mini Prand Arduino Mini Pro connecting to LDR and Servo. The servo operate by programing coding.

A sun based cell, now and again called a photovoltaic cell, is a gadget that changes over light vitality into electrical vitality. A solitary sunlight based cell makes a little measure of vitality (around 5 volts DC) so they are typically gathered together in a coordinated electrical board called a sun oriented board. Daylight is a to some degree diffuse type of vitality and just a bit of the light caught by a sunlight based cell is changed over into power.



Daylight is comprised of parcels of vitality called photons. At the point when the photons strike the semi-conductor layer (normally silicon) of a sun based cell a bit of the photons are consumed by the material instead of skipping off of it or experiencing the material. At the point when a photon is consumed the vitality of that photon is exchanged to an electron in a molecule of the cell making the electron escape from its typical position. This makes, generally, an opening in the iota. This opening will pull in another electron from a close-by particle currently making one more entire, which thusly is again filled by an electron from another iota.

One of the issues with sun based power is that the yield of the sun oriented board is variable. These galaxies are intended to extricate the greatest measure of intensity accessible from the sunlight based boards and store it in the battery. These sunlight based charge controllers likewise shield your boards from releasing through the batteries after the sun goes down.

Discussing the structure of sun based board battery chargers, sunlight based board battery charger producers utilize thin film second era innovation to make these gadgets. This is to exploit the adaptable idea of this sort of sunlight based cell innovation. Sun based battery chargers utilized on vessels and on water can be found in waterproof models. Sun oriented boards used to catch and change over vitality from the sun into electrons are offered in different volts degrees; a sun based board battery charger is accessible from 2 watt to 30 watt go.

Table 1: Voltage and Current Specification

Discrete Components	Ratings
Battery Voltage	1.5+1.5 VDC
Solar	6 watt
Servo motor	5v
Voltage across terminals (Arduino)	5v

A LDR (Light ward resistor), as its name recommends, offers obstruction because of the surrounding light. The opposition diminishes as the power of occurrence light increments, and the other way around. Without light, LDR displays an opposition of the request of mega- ohms which diminishes to couple of hundred ohms within the sight of light. It can go about as a sensor, since a fluctuating voltage drop can be acquired as per the shifting light. It is comprised of cadmium sulfide (CdS). A LDR has a crisscross cadmium sulfide track. It is a reciprocal gadget, i.e., leads in the two bearings in same form.

# **CHAPTER 3**

## **DESIGN AND WORKING PRINCIPLE**

### **CHAPTER CONTENTS**

- 3.1. Equipment's
- 3.2. Description of each Equipment's
- 3.3. Circuit diagram
- 3.4. Proposed assembly for the solar tracker
- 3.5. Proposed assembly for Solar Tracker Circuit diagram:
- 3.6. Operating principle
- 3.7. Flow chart and coding

### 3.1 Equipments:

Name	Model / Value	Quantity
Arduino Mini Pro	328-5v/16MHz	2
Servo Motor	5v	3
Light Dependent Resistors	----	4
Resistance	10K	4
Solar Panel	6w	1
Boost Module	3v to 5v	1
USB Module		1
Charge Controller		1
Project Board		1
Battery	1.85v	2

## **3.2.Description of each Equipments:**

### **3.2.1.Arduino Mini Pro:**

#### **3.2.1.1 Features:**

Every one of the 14 advanced sticks on the Pro Mini can be utilized as an information or yield, utilizing pin Mode,

Advanced Write, and computerized Read capacities. They work at 3.3 or 5 volts (contingent upon the model.

Each stick can give or get a most extreme of 40 mA and has an inside draw up resistor (Separated as a matter of course) of 20-50 ohms. Likewise, a few pins have particular capacities.

- RAW- For providing a crude (unregulated) voltage to the board.
- VCC- The directed 3.3 or 5 volt supply.
- GND- Ground pins.

### 3.2.1.2 Diagram:

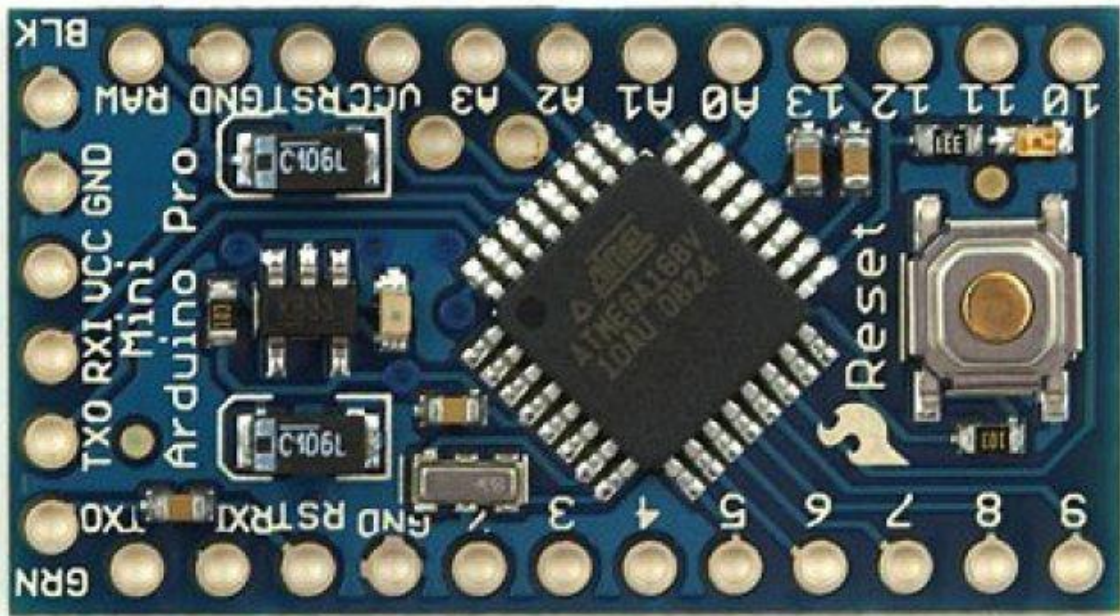


Figure 02: Arduino Mini Pro

### 3.2.1.3 Description:

The Arduino Pro Mini is a microcontroller board reliant on the ATmega168 (datasheet). It has 14 automated information/yield pins (of which 6 can be used as PWM yields), 6 basic wellsprings of data, an on-board resonator, a Reset catch, and openings for mounting pin headers. A six stick header can be related with a FTDI connection or Sparkfun breakout board to give USB power and correspondence to the board. The Arduino Pro Mini is proposed for semi-unending foundation in articles or shows. The board comes without pre-mounted headers, allowing the use of various types of connectors or direct fixing of wires. The stick organize is impeccable with the Arduino Mini. There are two type of the Pro Mini. One continues running at 3.3V and 8 MHz, the other at 5V and 16 MHz The Arduino Pro Mini was organized and manufactured by SparkFun Electronics..

#### **Summary**

Microcontroller -ATmega168

Operating Voltage- 3.3V or 5V (depending on model)

Input Voltage- 3.35 -12 V (3.3V model) or 5 - 12 V (5V model)

Digital I/O Pins- 14 (of which 6 provide PWM output)

Analog Input Pins- 6

DC Current per I/O Pin- 40 mA

Flash Memory- 16 KB (of which 2 KB used by boot loader)

SRAM- 1 KB

EEPROM- 512 bytes

Clock Speed 8 MHz (3.3V model) or 16 MHz (5V model)

### 3.2.1.4 Applications:

- The Uncertain 7 Cube – The Pro Mini is the brains of this fun riff on the magic 8-ball.
- MP3 Player Shield Music Box – This project uses an Arduino to control the MP3s and motors, but it'd be interesting to swap that out for a Pro Mini.
- Mario the Magician's Magical Lapel Flower – This project uses a Pro Micro to control the magical flower, but that could be swapped out for a Pro Mini too.
- Interactive Hanging LED Array– Create a giant LED array driven by the Arduino Pro Mini.

### 3.2.1.5 Advantages:

The greatest favorable position of Arduino is its prepared to utilize structure. As Arduino arrives in a total bundle shape which incorporates the 5 v controller, a burner, an oscillator, a smaller scale controller, sequential correspondence interface, LED and headers for the associations. You don't need to consider developer associations for programming or some other interface. Simply plug it into USB port of your PC and that is it. Your progressive thought will change the world after only couple of expressions of coding.



## 3.2.2 SERVO MOTOR:

### 3.2.2.1 SERVO MOTOR Description:

A servomotor is a rotational actuator or straight actuator that considers exact control of precise or direct position, speed and quickening. It comprises of a reasonable engine coupled to a sensor for position criticism. It likewise requires a moderately refined controller, frequently a devoted module structured explicitly for use with servomotors.

Servomotors are not an explicit class of engine despite the fact that the term servomotor is frequently used to allude to an engine appropriate for use in a shut circle control framework.

### 3.2.2.2 Diagram of Servo:

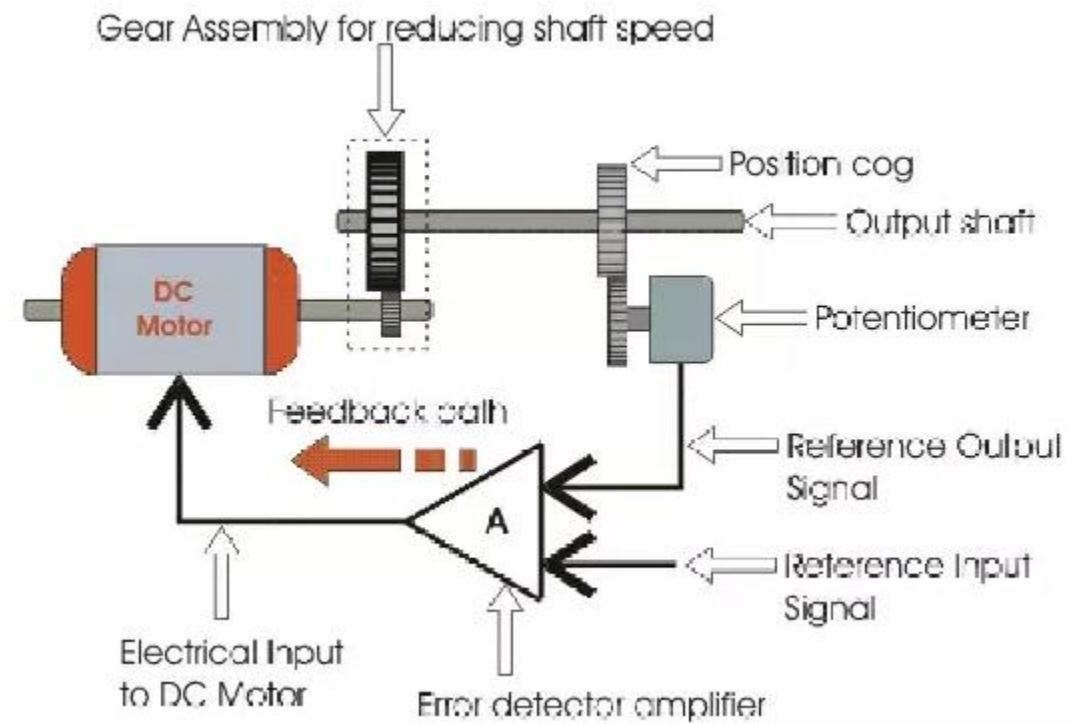


Figure 03: DC servo motor

### **3.2.2.3 Working of servo motor:**

A servo comprises of a Motor (DC or AC), a potentiometer, adapt gathering and a controlling circuit. Above all else we use equip get together to lessen RPM and to build torque of engine. State at beginning position of servo engine shaft, the situation of the potentiometer handle is with the end goal that there is no electrical flag created at the yield port of the potentiometer. Presently an electrical flag is given to another info terminal of the blunder indicator enhancer. Presently distinction between these two signs, one originates from potentiometer and another originates from other source, will be handled in input system and yield will be given in term of blunder flag. This mistake flag goes about as the contribution for engine and engine begins pivoting. Presently engine shaft is associated with potentiometer and as engine turns so the potentiometer and it will create a flag. So as the potentiometer's precise position changes, its yield criticism flag changes. After at some point the situation of potentiometer comes to at a position that the yield of potentiometer is same as outer flag given. At this condition, there will be no yield motion from the intensifier to the engine contribution as there is no distinction between outer connected flag and the flag created at potentiometer, and in this circumstance engine quits turning.

### 3.2.3 LIGHT DEPENDENT RESISTOR (LDR):

#### 3.2.3.1 LIGHT DEPENDENT RESISTOR (LDR) Description:

A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

#### 3.2.3.2.LDRDiagram:

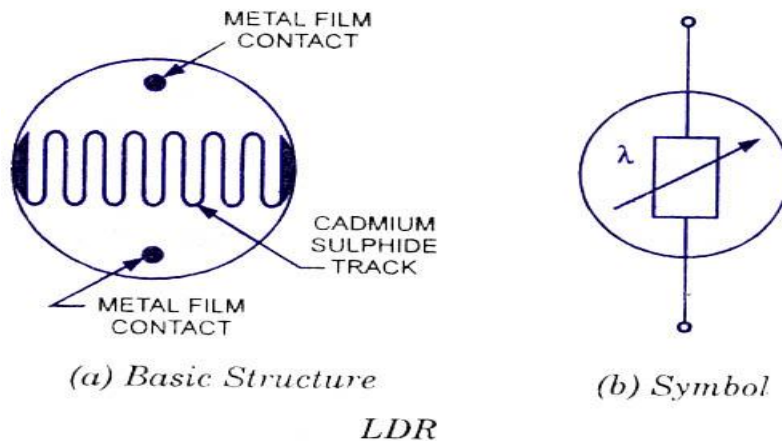


Figure 04: Resistance Diagram

**3.2.3.3 Working of LDR:** It is moderately straightforward the nuts and bolts of how a LDR functions without diving into entangled clarifications. It is first important to comprehend that an electrical flow comprises of the development of electrons inside a material. Great conductors have an expansive number of free electrons that can float in a provided guidance under the activity of a potential distinction. Separators with a high opposition have not very many free electrons, and in this way it is difficult to make them move and thus a current to stream.

A LDR or photoresistor is made any semiconductor material with a high opposition. It has a high

Obstruction on the grounds that there are not very many electrons that are free and ready to move

- Most by far of the electrons are bolted into the precious stone cross section and unfit to move.

Consequently in this state there is a high LDR opposition. As light falls on the semiconductor, the light photons are consumed by the semiconductor grid and a portion of their vitality is exchanged to the electrons. This gives some of them adequate vitality to break free from the precious stone grid with the goal that they would then be able to direct power. This outcomes in a bringing down of the opposition of the semiconductor and thus the general LDR resistance. The process is dynamic, and as increasingly light sparkles on the LDR semiconductor, so more electrons are discharged to lead power and the obstruction falls further.

### 3.2.4 Solar Panel:

#### 3.2.4.1 Features:

Type: Photo Electric Cell

Watt: 6

Volt: 3v

#### **3.2.4.2 .Working Principle of Solar Panel:**

Photovoltaic specifically convert sun oriented vitality into power. They deal with the rule of the photovoltaic impact. At the point when certain materials are presented to light, they ingest photons and discharge free electrons. This wonder is called as the photoelectric impact. Photovoltaic impact is a technique for creating direct flow power dependent on the rule of the photoelectric impact.

In view of the standard of photovoltaic impact, sun oriented cells or photovoltaic cells are made. They convert daylight into direct flow (DC) power. In any case, a solitary photovoltaic cell does not deliver enough measure of power. Accordingly, various photovoltaic cells are mounted on a supporting casing and are electrically associated with one another to frame a photovoltaic module or sun powered board. Normally accessible sun oriented boards extend from a few hundred watts (state 100 watts) up to couple of kilowatts (at any point knew about a 5kW sun powered board). They are accessible in various sizes and distinctive value ranges. Sun powered boards or modules are intended to supply electric power at a specific voltage (state 12v), however the flow they create is specifically reliant on the episode light. Starting at now obviously photovoltaic modules create DC power. Yet, for the majority of the occasions we require AC control and, thus, sun oriented power framework comprises of an inverter as well.

### **3.2.4.3 Advantage of solar Panel:**

1. Solar power is without contamination and makes no ozone depleting substances be transmitted after establishment.
2. Reduced reliance on remote oil and petroleum derivatives.
3. Renewable clean power that is accessible each day of the year, even overcast days deliver some power.
4. Return on venture not at all like paying for service bills.
5. Virtually no support as sun powered boards last more than 30 years.
6. Creates occupations by utilizing sun powered board makers, sun based installers, and so forth and thus helps the economy.
7. Excess power can be sold back to the power organization if framework intertied
8. Ability to live network free if all power produced gives enough to the home/building.
9. Can be introduced essentially anyplace; in a field to on a building.
10. Use batteries to store additional power for use during the evening.
11. Solar can be utilized to warm water, control homes and building, even power vehicles.
12. Safer than conventional electric flow.

### 3.2.5 DC Boost Module:

#### 3.2.5.1 Description of Dc Boost Module:

This is a small DC - DC boost module that converts a 3v power source to standard 5V, making it capable of supplying power to an Arduino microcontroller and other small electronic devices that use a 5v input. It integrates a PFM DC-DC boost control chip.

#### 3.2.5.2 Description of Dc Boost Module Diagram:

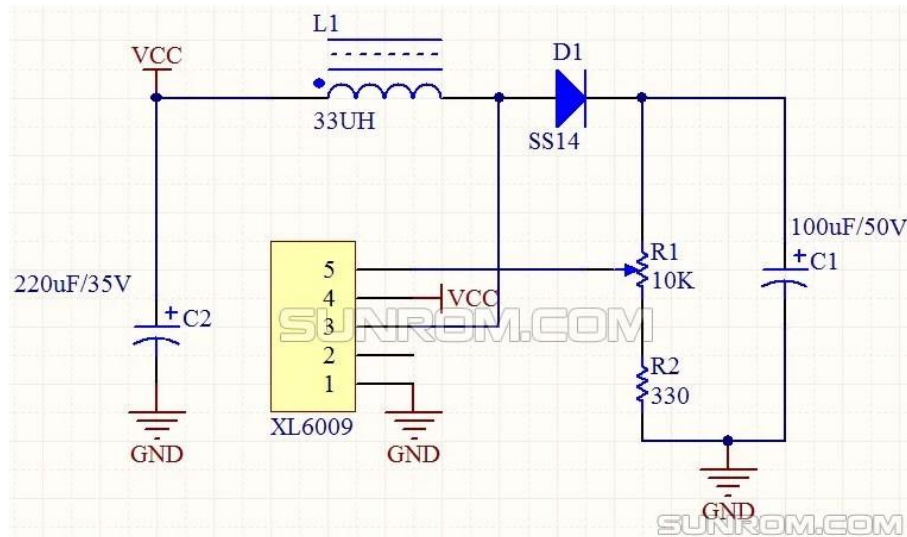


Fig:5 Dc Boost Module

#### 3.2.5.3 Working of Dc Boost Module:

In this project DC boost modules have been used for made to 5 volts from 3.5 volts. Because of the requirement of 5 volts needed to operate the SARVO motor. that's why here used dc boost module.

## 3.2.6 Resistance:

### 3.2.6.1 Resistance Description:

At the point when electrons course through a knob or another conductor, the conductor does offers some deterrent to the current. This block is called electrical obstruction. The more drawn out the conductor higher the opposition. The littler its zone the higher its obstruction.

Every material has an electrical resistance and it is the reason that the conductor give out heat when the current passes through it.



Figure 07: Resistance

Resistance is the restriction that a substance offers to the stream of electric flow. It is spoken to by the capitalized letter R. The standard unit of obstruction is the ohm, now and then worked out as a word, and now and again symbolized by the capitalized Greek letter omega. At the point when an electric flow of one ampere goes through a segment crosswise over which a potential distinction (voltage) of one volt exists, at that point the obstruction of that segment is one ohm. As a rule, when the connected voltage is held steady, the flow in an immediate flow (DC) electrical circuit is conversely corresponding to the obstruction. On the off chance that the obstruction is multiplied, the current is sliced down the middle; if the opposition is split, the current is multiplied. This standard likewise remains constant for most low-recurrence - -exchanging current (AC) frameworks, for example, family utility circuits. In some AC circuits, particularly at high frequencies, the circumstance is progressively mind boggling, in light of the fact that a few segments in these frameworks can store and discharge vitality, and in addition disseminating or changing over it.



The electrical opposition per unit length, region, or volume of a substance is known as resistivity. Resistivity figures are frequently determined for copper and aluminum wire, in ohms per kilometer. Opposition to AC, but not to DC, is a property known as reactance. In an AC circuit, the resistance and reactance combine vector ally to yield impedance.

## **3.2.7 Others Equipment's:**

### **3.2.7.1 Project Board Description:**

A cutting edge solder less breadboard attachment comprises of a punctured square of plastic with various tin plated phosphor bronze or nickel silver composite spring cuts under the apertures. The clasps are regularly called tie focuses or contact focuses. The quantity of tie focuses is regularly given in the particular of the breadboard.

The dividing between the clasps (lead pitch) is regularly 0.1 inches (2.54 mm). Coordinated circuits (ICs) in double in-line bundles (DIPs) can be embedded to straddle the centerline of the square. Interconnecting wires and the leads of discrete parts, (for example, capacitors, resistors, and inductors) can be embedded into the staying free openings to finish the circuit. Where ICs are not utilized, discrete parts and interfacing wires may utilize any of the gaps. Regularly the spring cuts are evaluated for 1 ampere at 5 volts and 0.333 amperes at 15 volts (5 watts). The edge of the board has male and female dovetail scores so sheets can be cut together to shape a substantial breadboard.

### **3.2.7.2 Charge Controller:**

A charge controller or battery controller restricts the rate at which electric flow is added to or drawn from electric batteries. It anticipates cheating and may ensure against overvoltage, which can lessen battery execution or life expectancy, and may represent a danger.

### **3.2.7.3 USB Charge Module:**

Here USB Module used for output line. Anything from here can be charge like Mobile, Mp3, and Tab etc.

### **3.2.7.4 Switch and DC jack:**

Switch used for ON/OFF. DC jack used as external charging port.

### **3.2.7.5 Pan and Tilt Arm:**

Arm is two-axis Pan/Tilt positioner of new generation. This a servo driven manipulator is designed especially for short range systems with low weight, which do not demand rotation in the azimuth and the elevation with a very high angle speed.

### **3.2.7.6 Cleaner Brush:**

Cleaner Brush is used for always clean the solar panel. In this project An Arduino Mini Pro and a Servo Motor used for cleaner. The cleaner servo start after a certain time and cleaner brush will clean the solar panel.

### **3.2.7.7 Battery Pack:**

Battery used for Power saving and Power supply. Here used 2 pcs 1.85v dc battery.

### 3.3 Circuit diagram:

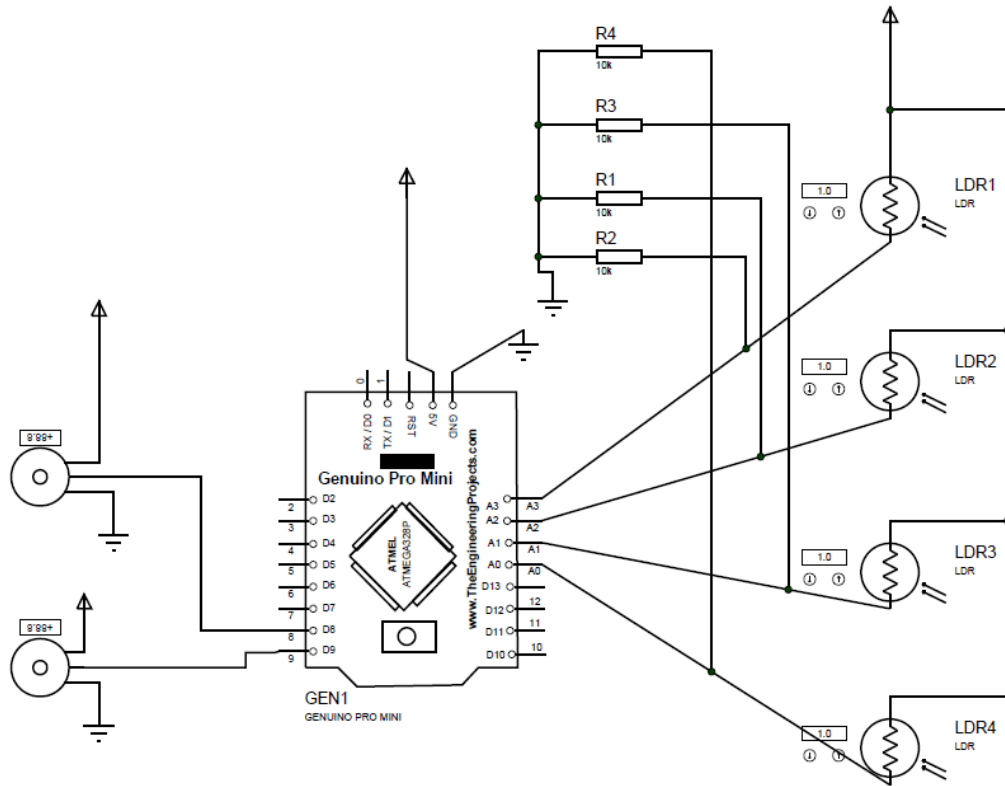


Figure 08: Solar Tracker Circuit diagram.

### 3.4 Solar tracker with panel cleaner:

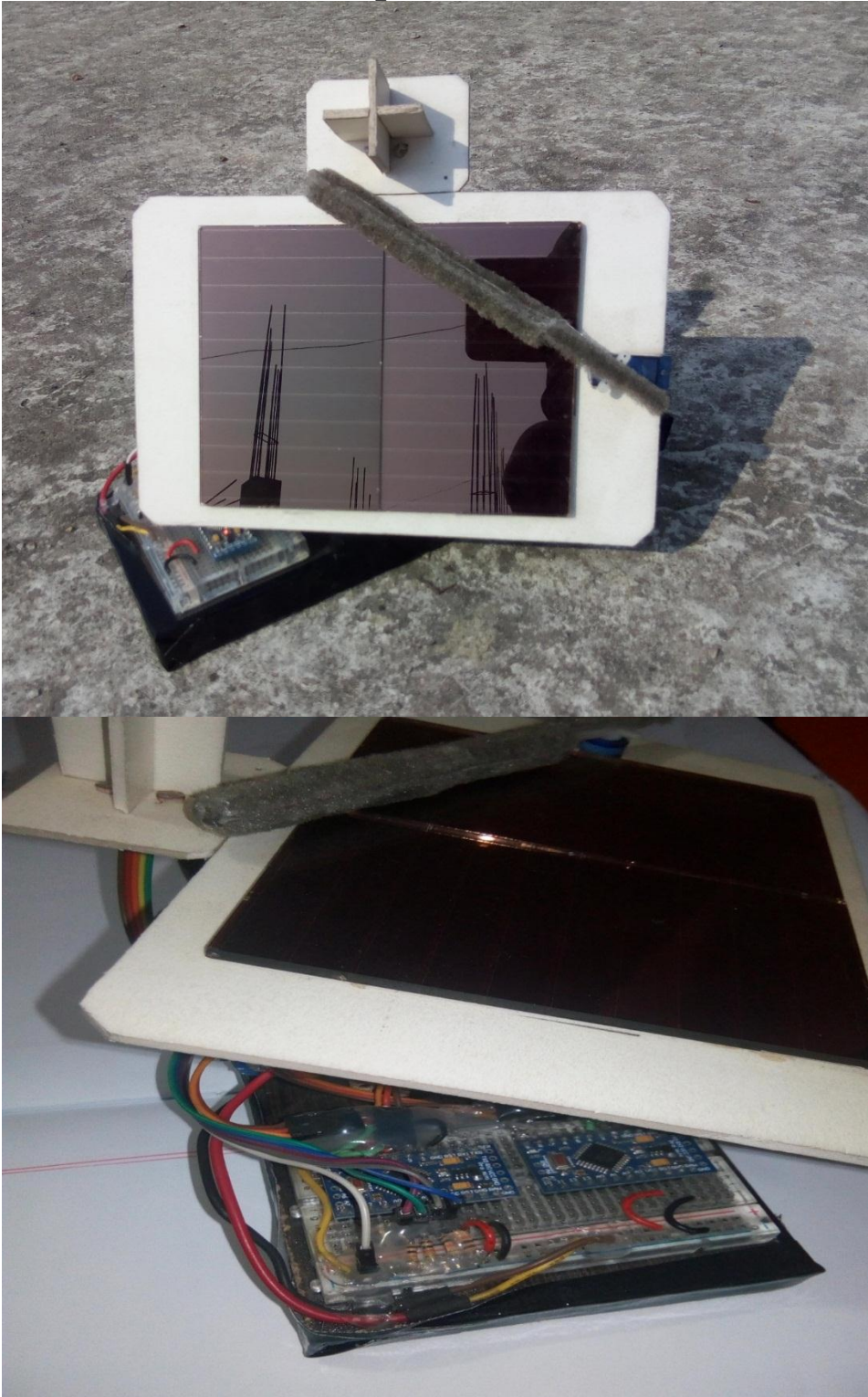


Figure 06: Proposed assembly for the Solar Tracker with Panel Cleaner

### **3.6 Working principle:**

Here the circuit of the solar tracker. The solar tracker comprises Arduino Mini pro, servo motor driver and a few discrete components. Light-dependent resistors LDR1 through LDR4 are used as sensors to detect the panel's position relative to the sun. These provide the signal to motor driver to move the solar panel in the sun's direction. LDR1, LDR2, LDR3 and LDR4 are fixed at the edges of the solar panel along the X axis and Y axis connected to Arduino Mini pro pin A0, A1, A2, and A3 respectively. Presets R1, R2, R3, and R4 are set to get low output at pins A0, A1, A2, and A3 respectively.

When LDR1 receives more light than LDR2, LDR3, LDR4 it offers lower resistance. Then the Solar panel move to sun's axis from own position. Then in the same way all LDRs work again.

When LDR3 receives more light than LDR4, it offers lower resistance than LDR4, giving a low input to comparators A0 and A1 respectively. Then Y Axis will be work. Which will track the sun to 45 degree angle.

When the sun is in the 45 degree angle from the ground, the solar panel will be in 45 degree angle along the right sun, and when the sun is in the 90 degree angle from the ground, the solar panel will be in the 90 degree angle along the straight side of the sun. So that the sun will always be tracked.

## Circuit Diagram of Solar Panel Cleaner:

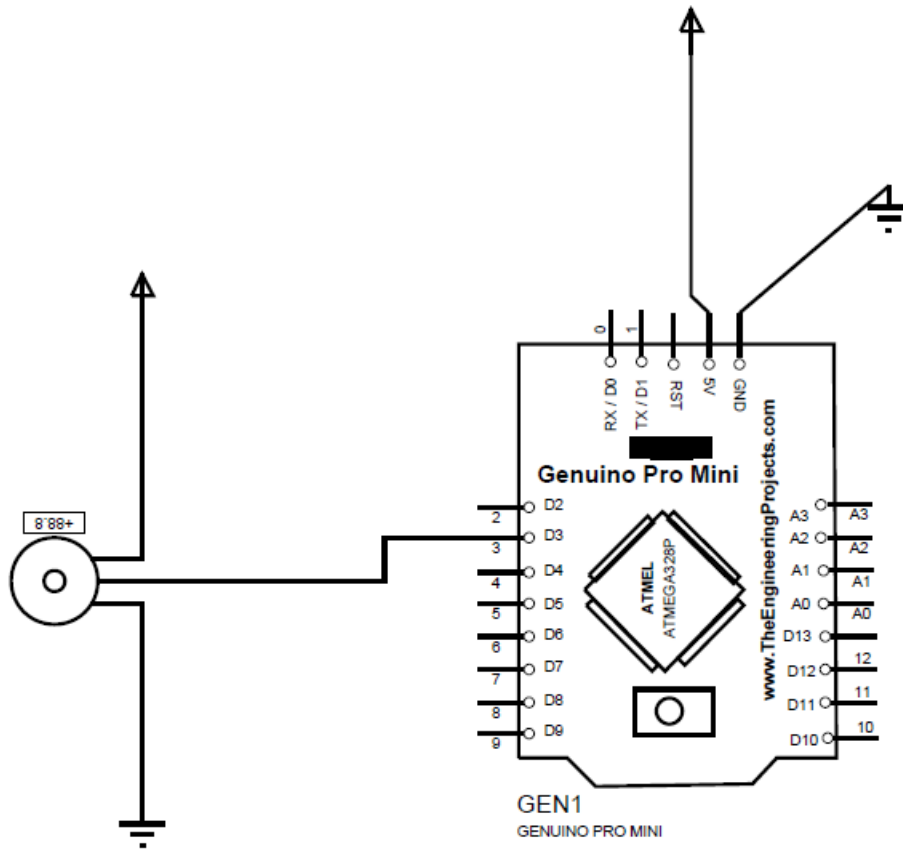


Fig 8: Circuit Diagram of Panel cleaner

### Working of Panel cleaner:

Here a cleaner is used with solar panels, which is operated by a servo motor with Arduino Mini Pro, it will clear the solar plate after a specific time. So, there will no dirt in the solar panel. So the solar panel will not be interrupted to accept the charge.

### 3.7 Flow chart:

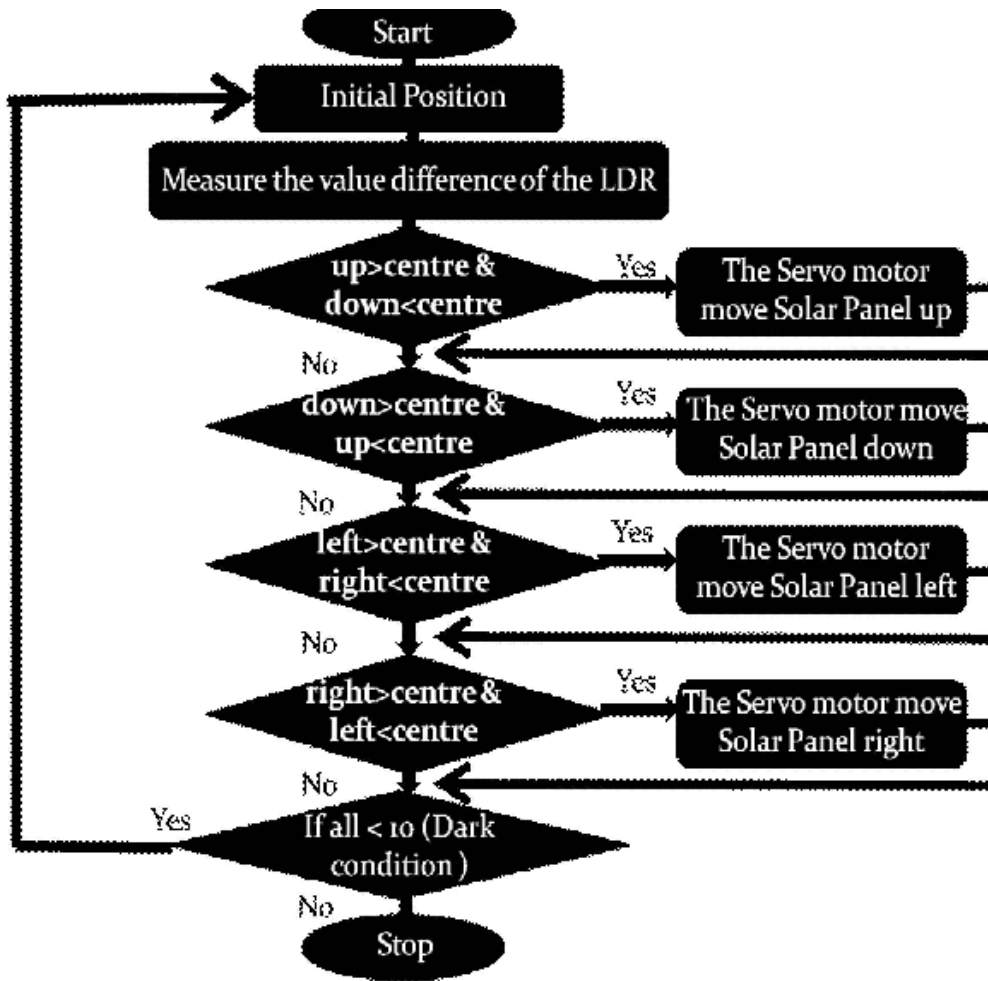


Fig 10: Flow chart



### 3.8 Program coding for Solar tracker:

```
#include <Servo.h> // include Servo library
Servo horizontal; // horizontal servo
int servoh = 90; // stand horizontal servo

Servo vertical; // vertical servo
int servov = 90; // stand vertical servo

// LDR pin connections
// name = analogpin;
int ldrlt = 0; //LDR top left
int ldrrt = 1; //LDR top right
int ldrl = 2; //LDR down left
int ldrr = 3; //ldr down right

void setup()
{
  Serial.begin(9600);
  // servo connections
  // name.attach(pin);
  horizontal.attach(9);
  vertical.attach(10);
}
void loop()
{
  int lt = analogRead(ldrlt); // top left
  int rt = analogRead(ldrrt); // top right
  int ld = analogRead(ldrl); // down left
  int rd = analogRead(ldrr); // down right

  int dtime = analogRead(4)/20; // read potentiometers
  int tol = analogRead(5)/4;

  int avt = (lt + rt) / 2; // average value top
  int avd = (ld + rd) / 2; // average value down
  int avl = (lt + ld) / 2; // average value left
  int avr = (rt + rd) / 2; // average value right

  //int dvert = avt - avd; // check the difference of up and down
  //int dhoriz = avl - avr; // check the difference of left and right
  if (-1*tol > dvert || dvert > tol) // check if the difference is in the tolerance else change vertical
  angle
  {
    if (avt > avd)
```

```

{
servov = ++servov;
if (servov > 180)
{
servov = 180;
}
}
else if (avt < avd)
{
servov = --servov;
if (servov < 0)
{
servov = 0;
}
}
vertical.write(servov);
}
if (-1*tol > dhoriz || dhoriz > tol) // check if the difference is in the tolerance else change
horizontal angle
{
if (avl > avr)
{
servoh = --servoh;
if (servoh < 0)
{
servoh = 0;
}
}
else if (avl < avr)
{
servoh = ++servoh;
if (servoh > 180)
{
servoh = 180;
}
}
else if (avl == avr)
{
// nothing
}
horizontal.write(servoh);
}
delay(dtime);}

```

### 3.9 Coding for Panel Cleaner:

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

```
Servo myservo; // create servo object to control a servo  
// twelve servo objects can be created on most boards
```

```
int pos = 0; // variable to store the servo position
```

```
void setup() {  
  myservo.attach(3); // attaches the servo on pin 9 to the servo object  
}
```

```
void loop() {  
  for (pos = 80; pos <=145; pos += 1) { // goes from 0 degrees to 180 degrees  
    // in steps of 1 degree  
    myservo.write(pos); // tell servo to go to position in variable 'pos'  
    delay(50); // waits 15ms for the servo to reach the position  
  }  
  for (pos = 145; pos >= 80; pos -= 1) { // goes from 180 degrees to 0 degrees  
    myservo.write(pos); // tell servo to go to position in variable 'pos'  
    delay(50); // waits 15ms for the servo to reach the position  
  }  
  delay(10000);  
}
```

# **CHAPTER 4**

## **PERFORMANCE ANALYSIS**

### **CHAPTER CONTENTS**

This chapter explains the overview of this project which includes the information of the list below:

- 4.1. Calculating Output
- 4.2. General output
- 4.3. Solar tracker output
- 4.4. Comparison of two output
- 4.5. Result
- 4.6. Future Scope

## 4.1 Calculated output:

Here we have use dc servo motor of 5 V dc, to rotate the solar panel dual axis.

The circuit takes 10mA at 5V dc. So, the required Power=  $10\text{mA} \times 5\text{V} = 50\text{mW}/\text{sec}$ .

For 6 sec, the required power= $50 \times 6 = 300\text{mW} = 0.3\text{W}$ .

In a day the panel moves east to dual axis.

If the solar tracker is used here, the battery 90% charge will be charged from 9am to 4pm. If the solar tracker is not used here, then 50 percent charge will be charged from 9am to 4pm. that's mean 40 % more power we will get if we use solar tracker.

So, the solar tracker will help collect more than 40 percent charge.

## 4.2 General output:

Time of day	Battery charging level by %
8:30 AM	3%
9:30 AM	7%
10.30A.M	10%
11.30 A.M	15%
12.30 PM	20%
1:30 P.M	30%
2: 30 P.M	40%
3: 30 P.M	45%
4: 30 P.M	50%
5: 30 P.M	53%

### 4.3 Solar tracker output:

Time of day	Charging level by %
8:30 A.M	3%
9:30 A.M	5%
10:30 A.M	10%
11:30 A.M	20%
12:30 PM	30%
1:30 P.M	40%
2:30 P.M	55%
3:30 P.M	70%
4:30 P.M	80%
5:30 P.M	90%

#### **4.4 Comparison of two output:**

General Output at 5:30 pm=53% charged

Solar tracker output at 5:30 pm=90% charged.

Comparison of two output:  $90-53= 37\%$

#### **4.5 Result:**

**Solar trucker usage will be available at 37 percent charge over the same time.** Each Project is never entire as new things are found out further changes should be possible. Therefore we have endeavored to make a computerized sun oriented following framework which will build the proficiency of the sun powered board framework accessible. In spite of the fact that there is higher introductory cost included we have endeavored to make the framework financially savvy .This is only the starting, we can add diverse upgrades to make the framework progressively effective so it will work round the year. The sun powered boards utilizing this framework contrasted and the framework pervasive at present has numerous favorable circumstances.

In the present framework, sunlight based boards utilized are stationary which gives less yield and henceforth decline the effectiveness. Yet, by making utilization of tracker sunlight based boards we can expand effectiveness of close planetary system.

1. The administrator impedance is insignificant since the framework is mechanized this expands proficiency of the stationary nearby planetary group.
2. Each task will show signs of improvement than past one as training can make us impeccable.



## **4.6 Future Scope:**

There are dependably remains an unending extent of enhancement to a framework plan. It's solitary the time and monetary limitations that force a limit on the improvement.

Following are the couple of upgrades that may increase the value of the framework.

The Solar Tracker can be used at all places where the sunlight is not present all day long , so that the battery can be charged faster, resulting in solar power can be almost fully absorbed in many industries. So we will be able to fully utilize the solar power. If such a project is implemented in the future, it will be better to use solar power and solar power can be fully utilized, so I think it is the best way to use solar energy.

# **CHAPTER 5**

## **COST ANALYSIS**

### **CHAPTER CONTENTS**

This chapter explains the overview of this project which includes the information of the list below:

5.1 Cost sheet

## 5.1 Cost sheet: Solar Tracker with cleaner:

Name	Model / Value	Quantity	Purchase Price Tk
Arduino mini pro		2	600
DC Servo motor	5v	3	540
Pan and tilt arm		1	105
Light Dependent Resistors		4	40
Resistance	10K	4	8
Boost module	3.7v to 5v	1	100
Battery	1.85v +1.85v	2	200
Charge controller		1	100
Project board		1	150
Others			200
Total			2043

# **CHAPTER 6**

## **CONCLUSION**

### **CHAPTER CONTENTS**

This chapter explains the overview of this project which includes the information of the list below:

6.1 Future work.

6.2 Conclusion.

## **6.1 Future work:**

There are always remains an infinite scope of improvement to system structure.

It's solitary the time and budgetary requirements that force a limit on the improvement.

Following are the couple of improvements that may increase the value of the framework.

If such a project is implemented in the future, it will be better to use solar power and solar power can be fully utilized, so I think it is the best way to use solar energy.

## **6.2 Conclusion:**

A Solar tracker is planned utilizing the new guideline of utilizing little sun based cells to work as self-altering light sensors, giving a variable sign of their relative edge to the sun by distinguishing their voltage yield. By utilizing this technique, the sunlight based tracker can be fruitful in keeping up a sun oriented cluster at an adequately opposite point to the sun. Sunlight based following is by a long shot the most straightforward technique to expand in general effectiveness of a sun oriented power framework for use by residential or business clients. By using this basic plan, it is workable for a person to build the gadget themselves.

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