Sun Tracking Solar Panel

Project Report submitted in partial fulfilment of the requirement for the degree

of

BACHELOR OF TECHNOLOGY

in

Electronics and Communication Engineering

By

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Certificate

Candidate's Declaration

I hereby declare that the work presented in this report entitled "**Sun Tracking Solar Panel**" in partial fulfilment of the requirements for the award of the degree of **Bachelor of Electronics and Communication Engineering** submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat, is an authentic record of my own work carried out over a period from January 2019 to May 2018 under the supervision of Dr Vikas Baghel (Assistant Professor, Department of Electronics & Communication Engineering).

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

(Student Signature)

Ayush Goel, 151071

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This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)

Dr Vikas Baghel

Assistant Professor (Senior Grade)

Dept. Electronics and Communication Engineering

Dated:………………..

ACKNOWLEDGEMENT

I would like to thank everyone that has contributed to the development of this project, which is the final chapter of my Bachelor education in Electronics and Communication at Jaypee University of Information Technology, Waknaghat, Solan.

I thank my supervisor Dr. Vikas Baghel, for his guidance and valuable advice during this ongoing development of the project. I would also like to thank our parents who provided us with the opportunity to study in this university and enlightened our life and career.

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ABSTRACT

Recent years have a denoted a major increase in technological advances. This report presents the 'sun tracking solar panel' using Aurdino Uno. The system we are proposing requires less hardware than the systems presented earlier. We tend to use 2 solar panels of 6v each, LDR sensor, battery and a stepper motor. Stepper motor helps in tracking the axis of the sun and keeps the panel in direction of the sun all day long. The 2 solar panels of 6v each are used which rotate along the direction of sun with the help of stepper motor which is using initial code information we provided in Arduino Uno to activate the LDR sensors used, thus these LDR sensors give system the information about the best possible movement to be made in order to charge the solar panels. The designed system increases the energy generation efficiency of the solar cells.

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

In past ten years, many of residential around the world used electric solar system as a sub power at their houses. This is because solar energy is an unlimited energy resource, set to become increasingly important in the longer term, for providing electricity and heat energy to the user. Solar energy also has the potential to be the major energy supply in the future. Solar tracker is an automated solar panel that actually follow the Sun to increase the power.

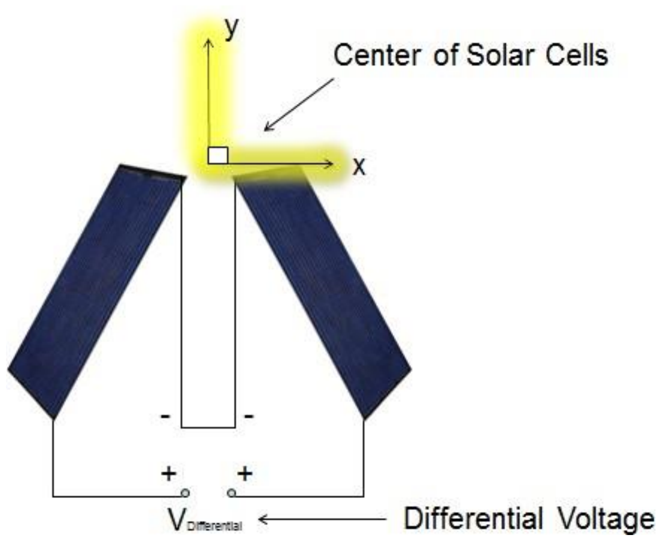

Fig 1.1: Differential Voltage of Solar Cells

The difficulty was in finding the best light detecting circuit part.An important criterion for this would be being able to adjust voltage levels based on the smallest amount of rotation of the components while mounted to the solar panel.

The sun position in the sky varies both with equipment over any fixed position. One well-known type of solar tracker is the heliostat, a movable mirror that reflects the moving sun to a fixed location, but many other approaches are used as well Active trackers use motors and gear trains to direct the tracker as commanded by a controller responding to the solar direction. The solar tracker can be used for several application such as solar cells, solar day-lighting system and solar thermal arrays.

The solar tracker is very useful for device that needs more sunlight for higher efficiency such as solar cell. Many of the solar panels had been positioned on a fixed surface such as a roof. As sun is a moving object, this approach is not the best method. One of the solutions is to actively track the sun using a sun tracking device to move the solar panel to follow the Sun. With the Sun always facing the panel, the maximum energy can be absorbed, as the panel is operating at their greatest efficiency.

The main reason for this project is to get the maximum efficiency for the solar cells. Although there are many solar trackers in the market, the price is expensive and unaffordable because the market for solar tracker is still new and only certain countries use the solar tracker such as USA and South Korea. The large scale solar tracker that normally used is not suitable for the residential use. As a result, this project will develop a Sun tracking system specially designed for residential use for a low cost solar cell.Previous researchers and used LDR and photodiode as sensors respectively. Meanwhile and used DC motor with gear and steeper motor respectively. Those projects have disadvantages and some of the disadvantages are high cost during development, difficult to control motor speed and difficult to design because using microprocessor.

CHAPTER-2

Literature Survey

2.1 Introduction

Among the sustainable power sources is electrical sun oriented vitality from the Sun can be saddled utilizing sunlight based boards or sun based cells to change over sun based light into electrical flow. Most photovoltaic cells utilize photoelectric impact. This is a procedure by which electrons are discharged from certain materials, for example, a metal, because of being struck by photons. A few substances, for example, selenium, are especially vulnerable with this impact and whenever utilized in sun oriented cells, they can create some electric potential through photoemission. Sun beams come in type of UV-light, a type of electromagnetic radiation and once they fall of sun oriented board surface made of materials, for example, silicon, the illumination is retained and changed over into electrical vitality through photograph discharge. Most extreme assimilation happens when the sunlight based boards and sun oriented cells legitimately face the Sun, with the goal that the sun's beams fall oppositely on the ingestion surface. This assimilation and transformation may not be ideal given that the sun oriented boards and sun powered cells are mounted in fixed positions for the most part on housetops with inclinations. For suitable sun based vitality age utilizing single establishment, its proficiency must be improved and thusly different sunlight based following strategies are conceived to intently follow sun development amid the day.

2.2 TYPES OF SOLAR TRACKERS AND SOLAR TRACKING TECHNIQUES

Modern solar tracking methods can be classified into the following categories:

3.2.1 Single Axis Solar Tracking System

This is strategy is normally utilized for sun oriented trackers expected to be utilized in the tropics where the center is to follow the point of elevation (edge of tilt) of the sun along a solitary hub. A solitary straight actuator is utilized, for example, an engine to drive the board as indicated by sun developments. A lot of two LDRs on inverse sides of the sun based board might be utilized to quantify the power of the sun based illumination by estimating the voltage drop crosswise over them which is then looked at by a drive circuit until the two LDR voltages are equivalent and the movement of the board is ceased. Along these lines, the sunlight based board is constantly situated, regularly to sun light.

Fig 2.1:single axis solar tracking system

2.3 Dual Axis Solar Tracking System

This technique is for the most part intended for territories outside the tropics or zones past 10°N and 10°S of Equator. In this strategy, both edge of azimuth and point of Tilt of the sun oriented tracker are utilized to follow the sun developments consistently. Thusly, a lot of two actuators, for the most part engines is utilized to move the sun powered board in like manner by accepting voltage control signals from a lot of four LDRs (two on inverse sides of sun based board) and when the voltage drop on all the four LDRs is equivalent then the board is encountering the greatest sun oriented illumination and in this way the movement stops. This guarantees the sun powered board is at right edges with daylight consistently.

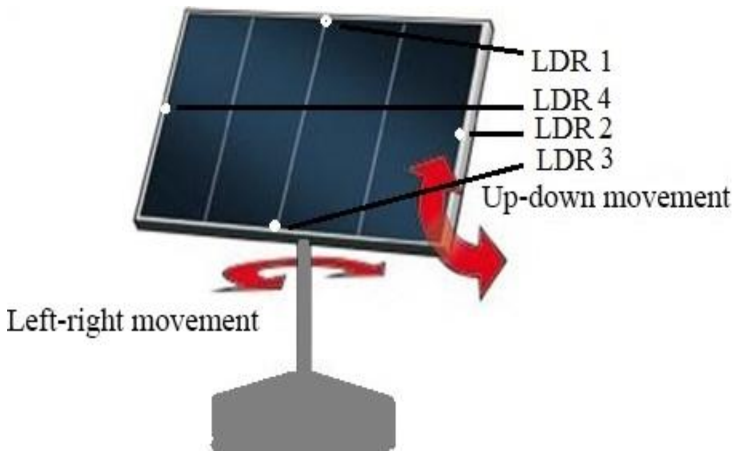

Fig2.2:dual axis solar tacking system

2.3 Active Solar Tracking

This system includes the persistent and steady observing of the sun's situation all through daytime and when tracker is exposed to murkiness it stops or rests as indicated by its structure. This should be possible utilizing of light touchy sensors, for example, photograph resistors(LDRs) whose voltage yield are contribution to a microcontroller which at that point drive actuators (engines) to alter the sunlight based boards position.

2.4: Passive Solar Tracking

This strategy includes trackers that decide the Sun's situation by methods for a weight awkwardness made at two finishes of the tracker. This irregularity is brought about by sun powered warmth making gas weight on a low breaking point packed gas liquid that is headed to the other side or the other which at that point moves the structure.

2.5 previous research

After doing thorough writing review, the inspiration of the undertaking is chosen. In the writing standard diary papers and books are alluded.

In the paper[1]," IMPLEMENTATION OF A PROTOTYPE FOR A TRADITIONAL SOLAR TRACKING SYSTEM" by Nader Barsoum distributed in the 2009 Third UKSim Euro-pean Symposium on Computer Modeling and Simulation depicts in detail the structure and development of a model for sun oriented following framework with two degrees of opportunity, which recognizes the daylight utilizing photocells. The control circuit for the sun based tracker depends on an Arduino. This is modified to recognize the daylight through the photocells and afterward impel the engine to position the sun based board where it can get most extreme daylight. This paper is tied in with moving a sun powered board alongside the heading of daylight; it utilizes a rigging engine to control the situation of the sunlight based board, which gets its information from an Arduino. The goal is to structure and execute a computerized, twofold hub solartracking instrument utilizing installed framework configuration so as to streamline the efficiency of in general sunlight based vitality yield.

In the paper[2] entitled," Design and Construction of an Automatic Solar Tracking System by Md. Tanvir Arafat Khan, S.M. ShahrearTanzil, Rifat Rahman, S M Shafiul Alam distributed in sixth International Conference on Electrical and Computer Engineering ICECE 2010, 18-20 December 2010, Dhaka, Bangladesh depicts an Arduino based structure system of an au-4.

Sun Tracking Solar System tomatic sun powered tracker. Light needy resistors are utilized as the sensors of the sunlight based tracker. The structured tracker has exact control instrument which will give three different ways of controlling framework. A little model of sun based following framework is likewise developed to execute the structure approach displayed here. In this paper the plan approach of an Arduino based basic and effectively modified programmed sun based tracker is exhibited. A model of programmed sunlight based tracker guarantees practicality of this plan approach.

Sun Tracking Solar System In the paper[3] entitled," Microcontroller-Based Two-Axis Solar Tracking System" by Lwin Oo and Nang Kaythi Hlaing distributed in Second International Conference on Computer Research and Development depicts to create and execute a model of two pivot sun powered following framework dependent on a PIC microcontroller. The allegorical reflector or illustrative dish is built around two feed width to catch the suns vitality. The focal point of the illustrative reflector is hypothetically determined down to an infinitesimally little point to get very high temperature. This two pivot auto-following framework has additionally been developed utilizing PIC 16F84A microcontroller. The get together programming language is utilized to interface the PIC with two-hub sun oriented following framework. The temperature at the focal point of the explanatory reflector is estimated with temperature tests. This auto-following framework is controlled with two 12V, 6W DC apparatus box engines. The five light sensors (LDR) are utilized to follow the sun and to begin the activity (Day/Night task). Time Delays are utilized for venturing the engine and achieving the first position of the reflector. The two-pivot sunlight based following framework is developed with both equipment and programming executions. The plans of the apparatus and the allegorical reflector are painstakingly considered and absolutely determined.

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COMPONENTS USED

The real piece of this hardware framework is the arduino. All theoperations are constrained by it. With the assistance of arduino, you can adjust the sun based board as indicated by the power of the daylight. Another segment is the battery-powered battery which is utilized to store vitality which is gotten from the board. The reason for the charge control is to control the charging of the battery. Small scale controller unit gets the status of the battery by the charge control unit. It has two sensors, each made up of LDR. Two LDRs establish on unit and are put at the Two corners of the board. LDR faculties the power of daylight and controller gets the yield. Control unit chooses in which course the board must be turned to get most extreme daylight. Another unit of the sensor additionally comprises of LDRs and utilized for the control of lightning load. The board can be pivoted in the ideal bearing by the server engine.

S No.	**Component names**	**Component description**	**Number Of Quality**
1.	LDR SENSOR		2
2.	DIODE	IN4007(d1)	1
3.	LED	3mm	2
4.	ELECTROLYTIC CAPACITORS	1000uF	1,4
5.	CERAMIC CAPACITORS	33pf	2

6.	RESISTOR	0.1Uf	7
7.	RESISTOR ARRAY	10K	1
8.	RESET SWITCH	4 Pins	1
9.	CRYSTAL OSCILLATOR	11.0592Mhz	1
10.	LCD	16*2	1
11.	VOLTAGE REGULATOR	7805IC	1
12.	SOLAR PANEL	6 watts	2
13.	MOTOR	12 Volts,10 rpm	1
14.	WIRE	5m	2
15.	LEAD ACID BATTERY	6 Volts	2
16.	FEMALE CONN.	Db9	1

3.1 solar panel

Sun based boards are made out of photovoltaic cells (which is the reason producing power with sunlight based boards is likewise called sun powered PV) that convert the sun's vitality into power.

Photovoltaic cells are sandwiched between layers of semi-leading materials, for example, silicone. Each layer has distinctive electronic properties that stimulate when hit by photons from daylight, making an electric field. This is known as the photoelectric impact – and it's this that makes the flow expected to deliver power.

Sun powered boards produce an immediate flow of power. This is then gone through an inverter to change over it into an exchanging current, which would then be able to be channeled into the National Grid or utilized by the home or business the sun oriented boards are connected to.

Fig3.2:Solar Panel

3.2 LDR Sensor

At the point when exposed to light vitality, a Photoconductive light sensor will change its physical property. Photograph Resistor is a typical sort of photoconductive gadget. Photograph resistor is a semiconductor gadget that utilizes light vitality to control the progression of electrons and in this way the progression of current in them.

The most widely recognized kind of photoconductive cell is a Light Dependent Resistor or LDR. As the name infers, a Light Dependent Resistor is a semiconductor gadget that changes its electrical obstruction relying upon the nearness of light. A Light Dependent Resistor changes its electrical obstruction from a high estimation of a few thousand Ohms in obscurity to just a couple of several Ohms when light is episode on it by making electron – gap combines in the material.

The most widely recognized material used to make a Light Dependent Resistor is Cadmium Sulfide (CdS). Different materials like Lead Sulfide (PbS), Indium Antimonide (InSb) or Lead Selenide (PbSe) can likewise be utilized as the semiconductor substrate.

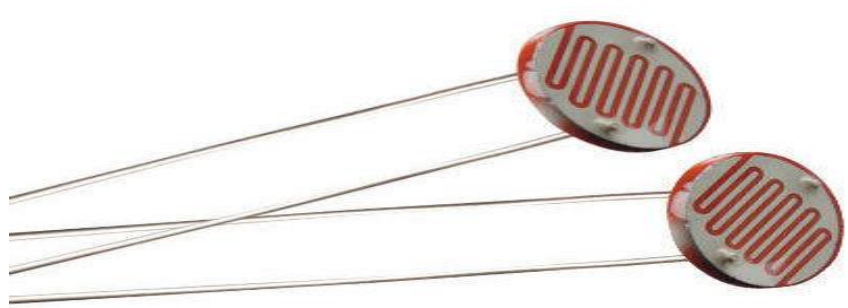


Fig 3.3 LDR sensor

Cadmium Sulphide is used in Photo resistors that are sensitive to near infrared and visible light. The reason it is used is because of its close resemblance of its spectral response curve to that of the human eye. It can be controlled by a simple, light source like a flash light and the peak sensitive wavelength of Cadmium Sulphide material is about 560 nm to 600 nm in the visible spectral range.

3.3 Servo Motor

A servomotor 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 servomotors.

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.

Fig 3.4: servo motor

A servomotor is a closed loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

3.4 Arduino

Arduino is an open-source stage utilized for structure gadgets ventures. Arduino comprises of both a physical programmable circuit board (frequently alluded to as a microcontroller) and a bit of programming, or IDE (Integrated Development Environment) that keeps running on your PC, used to compose and transfer PC code to the physical board.

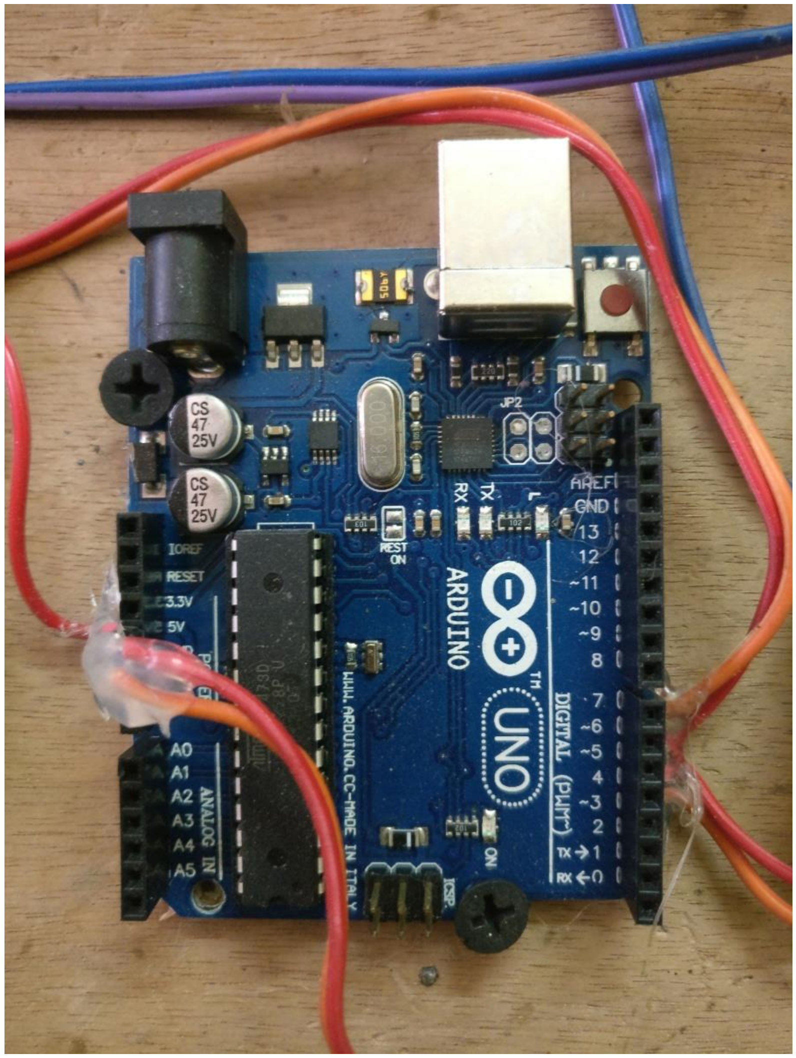


Fig 3.5: Arduino

The Arduino stage has turned out to be very prevalent with individuals simply beginning with hardware, and all things considered. Not at all like most past programmable circuit sheets, the Arduino does not require a different bit of equipment (called a developer) so as to stack new code onto the board - you can basically utilize a USB link. Furthermore, the Arduino IDE utilizes an improved variant of C++, making it simpler to figure out how to program. At last, Arduino gives a standard structure factor that breaks out the elements of the small scale controller into an increasingly available bundle.

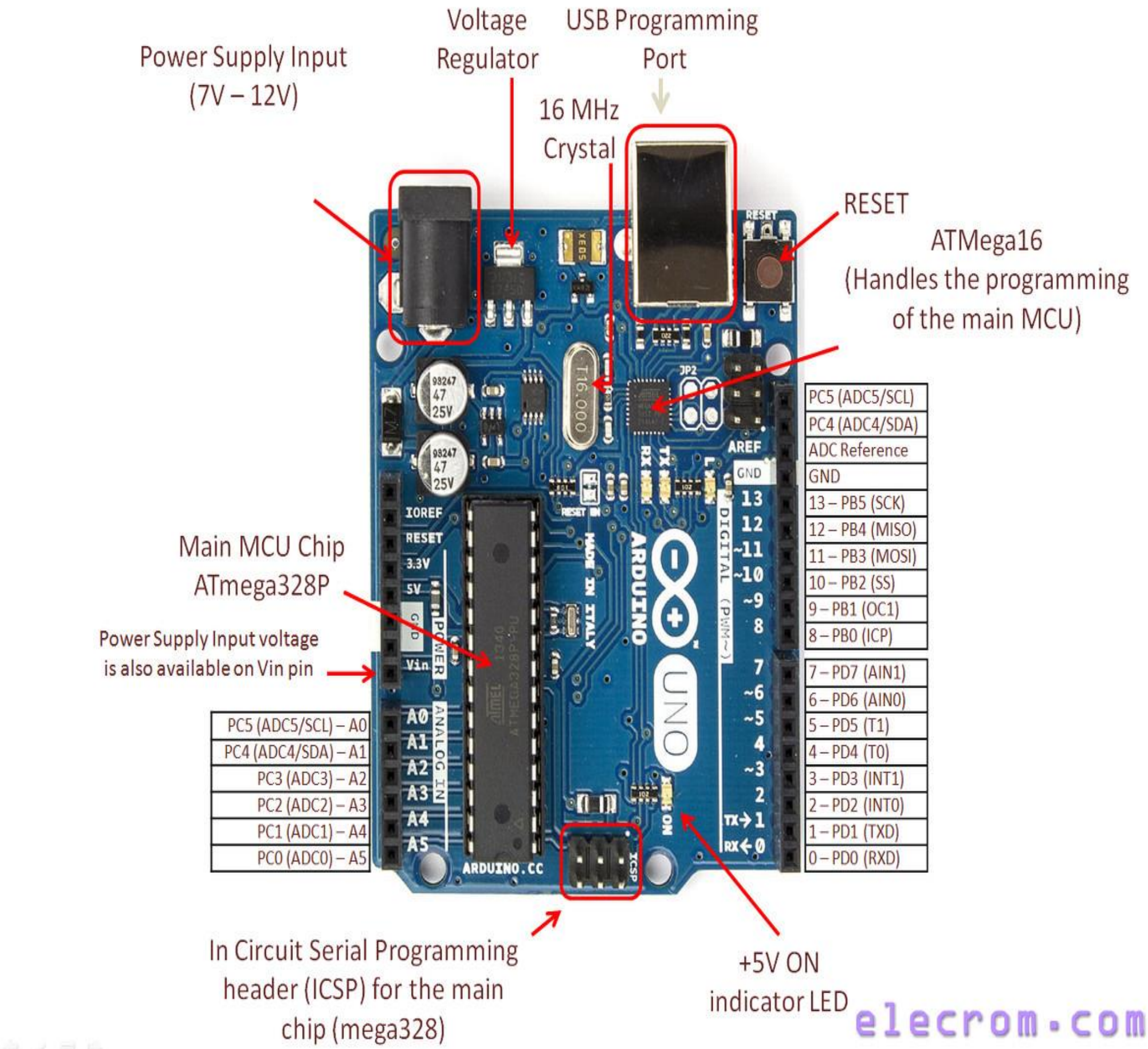


Fig 3.6: arduino pin diagram

CHAPTER-4

WORKING

Two LDR sensors are used both placed at opposite ends of the solar panels placed over a bridge tube connected with servo motor. We use two 9v batteries connected to servomotor and arduino separately. The LDR sensors follow a decrease in resistance indicating the falloff light over them. As soon as any of the LDR sensors respond to the light the servo motor gets activated using the initial programming information present in the arduino and rotates the bridge tube in the direction of that particular LDR which has responded to the light. If the light falls over both the LDR sensors equally than there will be no movement in the bridge tube done by the servo motor. Hence, the solar panels gets charged and provide us an output i.e illuminates a LED.

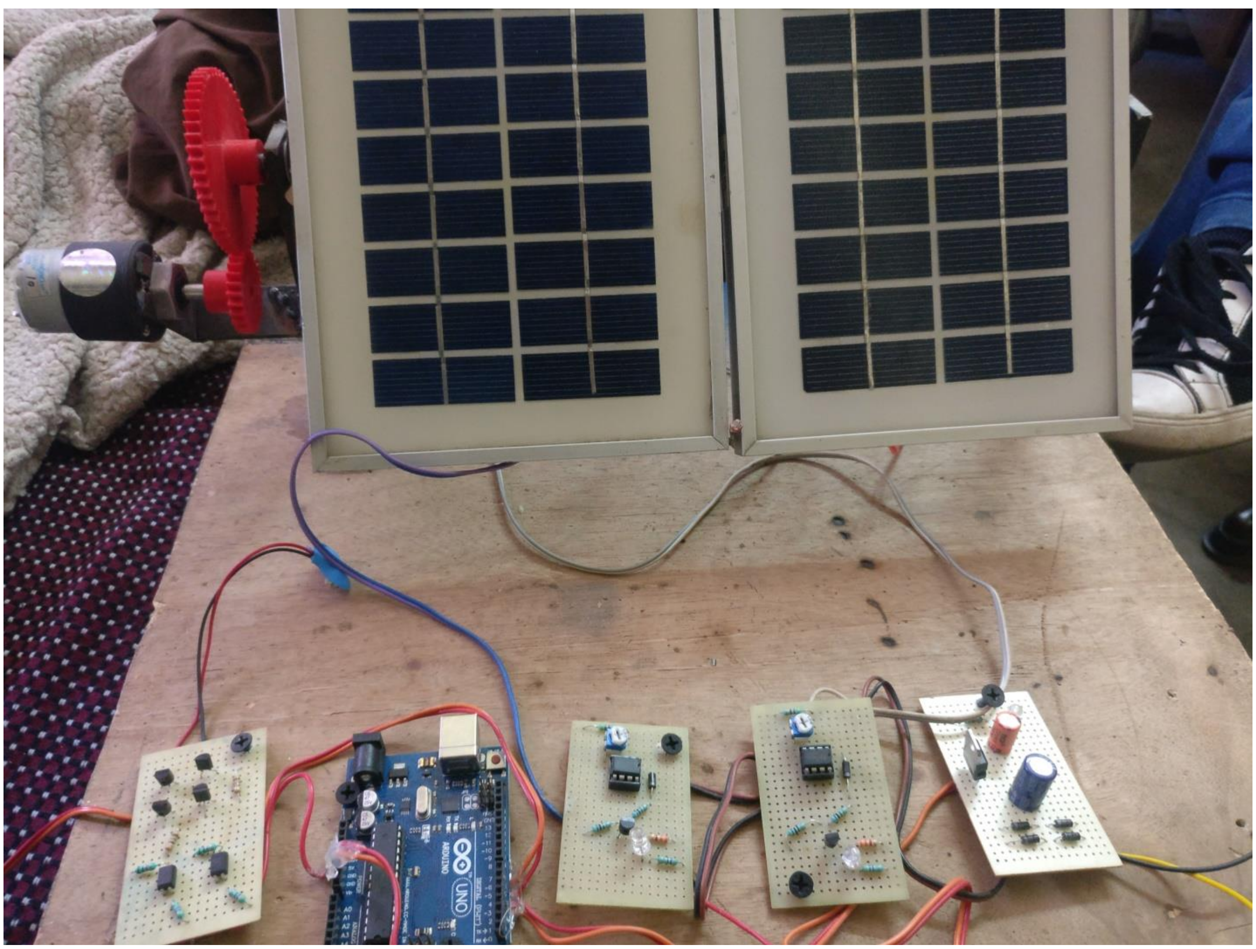


Fig 4.1:

```
#include <Servo.h>
//defining Servos
Servo servohori;
int servoh = 0;
int servohLimitHigh = 160;
int servo hLimitLow = 20;

Servo servoverti;
int servo v = 0;
int servovLimitHigh = 160;
int servovLimitLow = 20;
//Assigning LDRs
int ldrtopl = 2; //top left LDR green
int ldrtopr = 1; //top right LDR yellow

 void setup ()
 {
servohori.attach(10);
servohori.write(0);
servoverti.attach(9);
servoverti.write(0);
delay(500);
 }

void loop()
{
servoh = servohori.read();
servov = servoverti.read();
  //capturing analog values of each LDR
  int topl = analogRead(ldrtopl);
  int topr = analogRead(ldrtopr);
  int botl = analogRead(ldrbotl);
```

```
  int botr = analogRead(ldrbotr);
  // calculating average
  int avgtop = (topl + topr) / 2; //average of top LDRs
  int avgbot = (botl + botr) / 2; //average of bottom LDRs
  int avgleft = (topl + botl) / 2; //average of left LDRs
  int avgright = (topr + botr) / 2; //average of right LDRs

  if (avgtop<avgbot)
  {
Servo verti.write(servov +1);
    if (servov>servovLimitHigh)
     {
servov = servovLimitHigh;
     }
delay(10);
  }
  else if  (avgbot<avgtop)
  {
Servo verti.write(servov -1);
    if (servov<servovLimitLow)
  {
Servov  = servovLimitLow;
  }
Delay (10);
  }
  else
  {
servoverti. write(servov);
  }

  if (avglef t>avgright)
  {
```

```
servohori. write(servoh +1);
   if (servoh>servohLimitHigh)
   {
Servoh  =  servohLimitHigh;
   }
Delay (10);
  }
  else if  (avgright>avgleft)
  {
servohori.write(servoh -1);
   if  (servoh<servohLimitLow)
    {
servoh = servohLimitLow;
    }
delay(10);
  }
  else
  {
servohori.write(servoh);
  }
delay(50);
          }
```

CHAPTER-5

RESULTS

The framework is concentrating on the controller structure. The developed framework has been tried and a few information from equipment estimation have been gathered and talked about. Run of the mill sun oriented board has been utilized and the reason just to demonstrate the structured framework can work in like manner. Accordingly the encompassing impacts, for example, climate condition are not genuinely considered amid equipment testing.

5.1SOLAR CELLS TEST RESULTS

As stated previously the angle between solar cells was tested for several different angles and it was determined that an angle of 50 degrees between cells would create the greatest voltage difference and therefore greatest light sensitivity.The data collected for this experiment can be seen.The plot below shows seven different angles between cells ranging from 90 degrees to 30 degrees between cells.The x-axis represents the angle of the light in one-degree increments,and the y-axis represents the differential voltage produced.

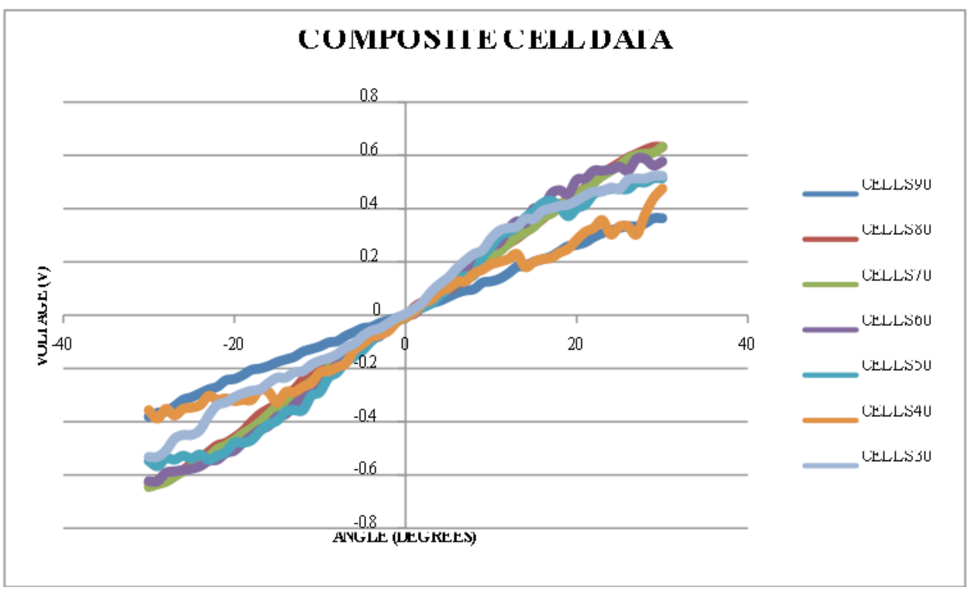


Figure 4.1: Composite Solar Cell Data

The goal hear is to find the cell difference angle that has the greatest rate of change(the greater the rate of change the more sensitive).Most importantly it should have a large rate of change around the zero degrees on the x-axis.Consider all the cell difference angles at once is difficult to determine the one with the greatest rate of range,so the following graphs show each individual difference angle plot with the best fitting curve line super imposed on top.

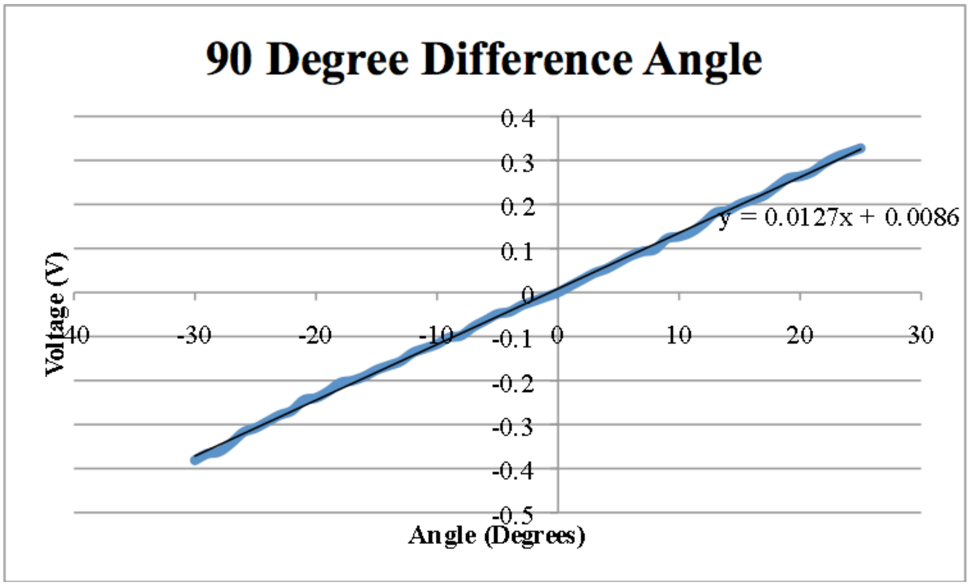


Figure 4.2: 90 Degree Difference Angle

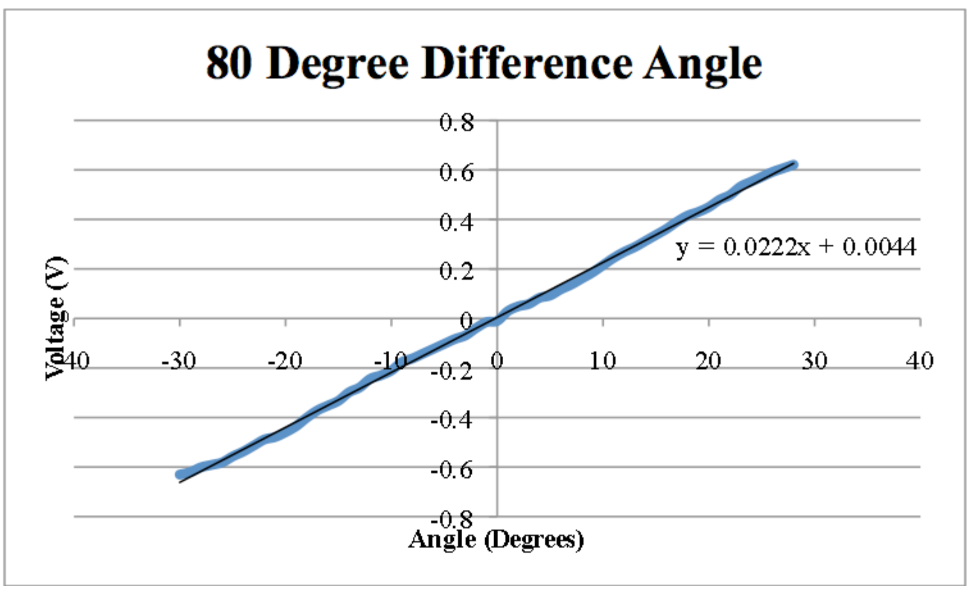


Figure4.3: 80 Degree Difference Angle

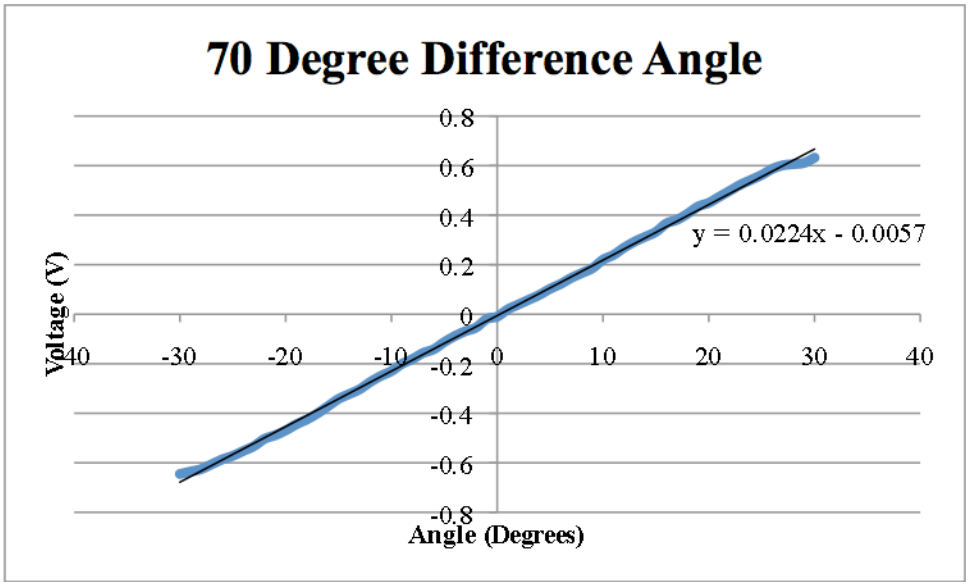


Figure4.4: 70 Degree Difference Angle

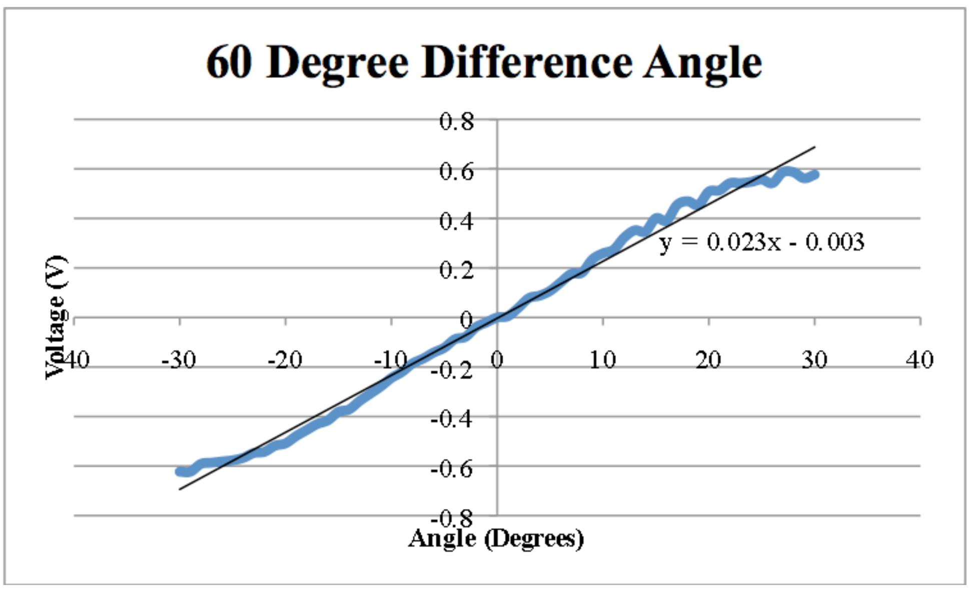


Figure4.5: 60 Degree Difference Angle

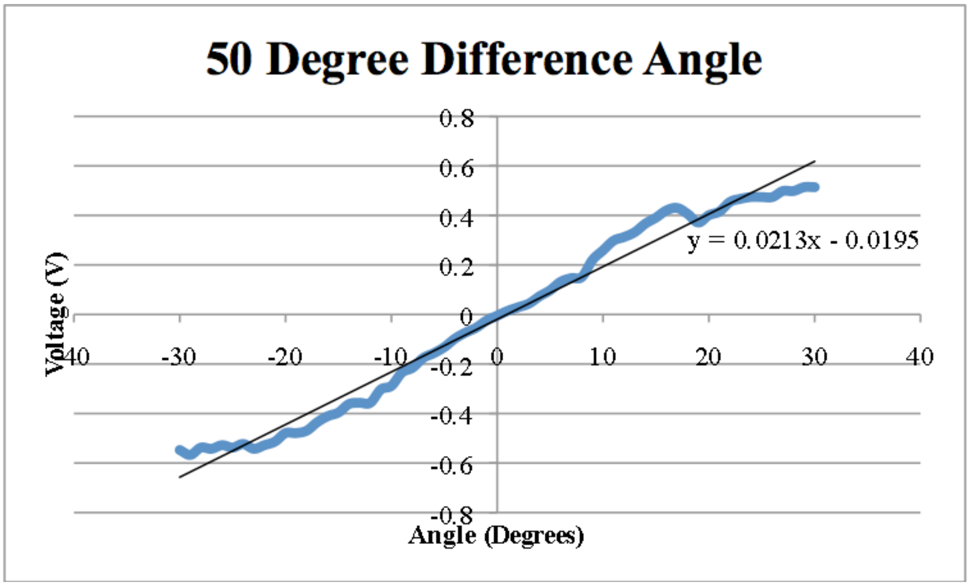


Figure4.6: 50 Degree Difference Angle

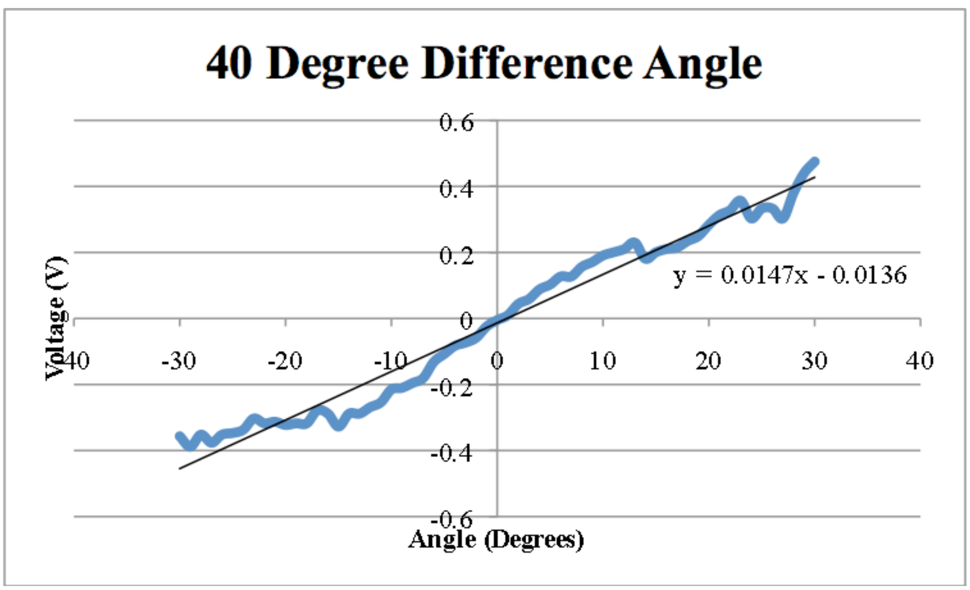


Figure4.7: 40 Degree Difference Angle

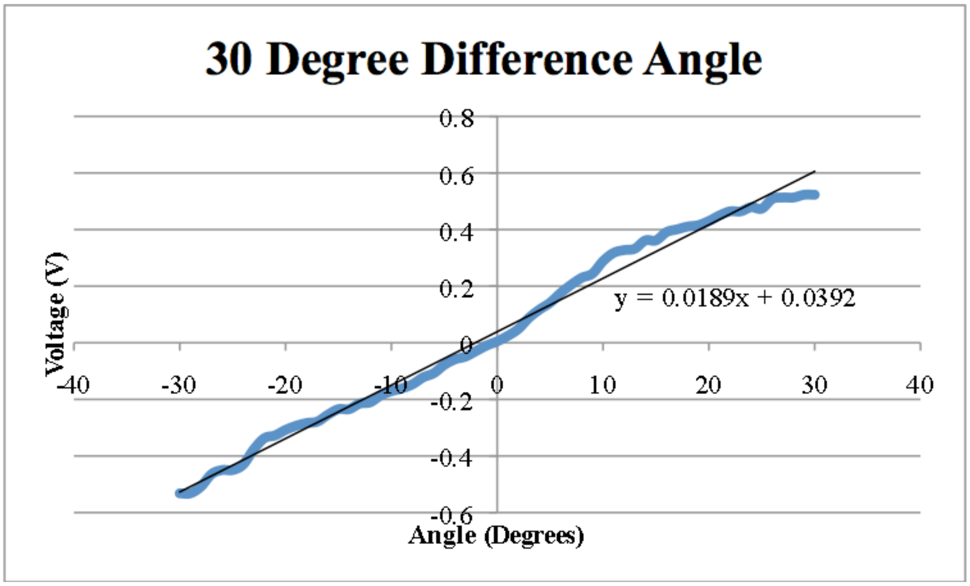


Figure4.8: 30 Degree Difference Angle

With the exception of 50 degrees and 40 degrees difference angle each of the previous plots is with in 0.1 V of its best fitting curve. For this reason the plots of as mallerrangeofanglesisshowninthefollowingplotstoseeifagreaterrateofchangeisseen.

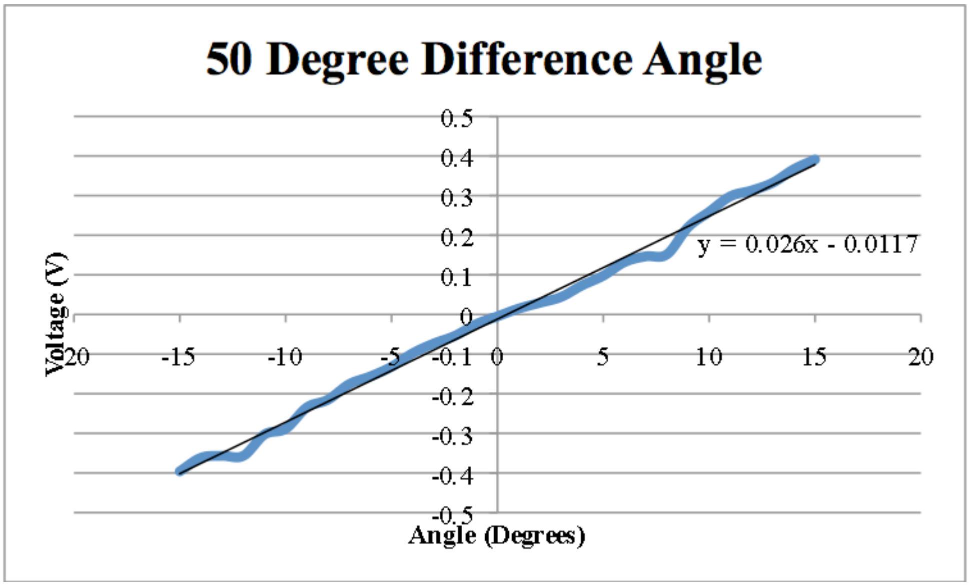


Figure 4.9: 50 Degree Difference Angle

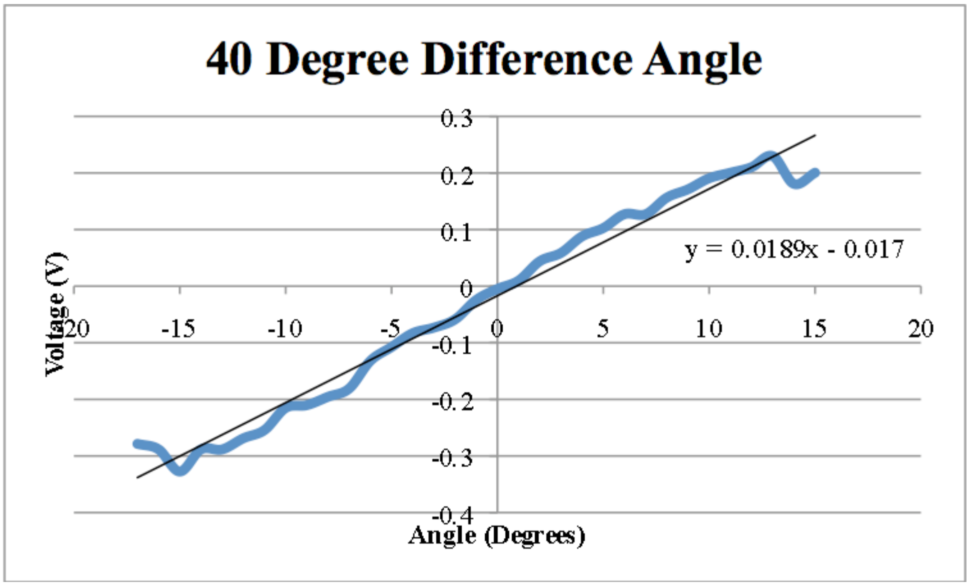


Figure 4.10: 40 Degree Difference Angle

The greatest slope for any of the cells is at 50 degrees as seen from the graphs.Most importantly the solar tracker must have the most sensativity around zero degrees so that small degrees of error can be corrected when a small change in the lights position occurs.

Next the light dependent resistors were tested for their sensativity. The following graphs were produced. The first are the composite voltage plots:

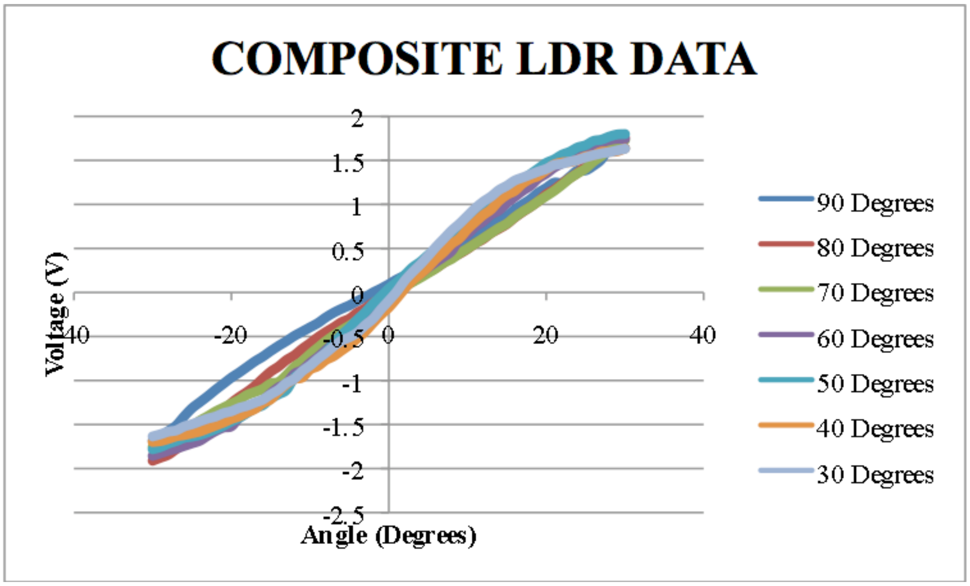
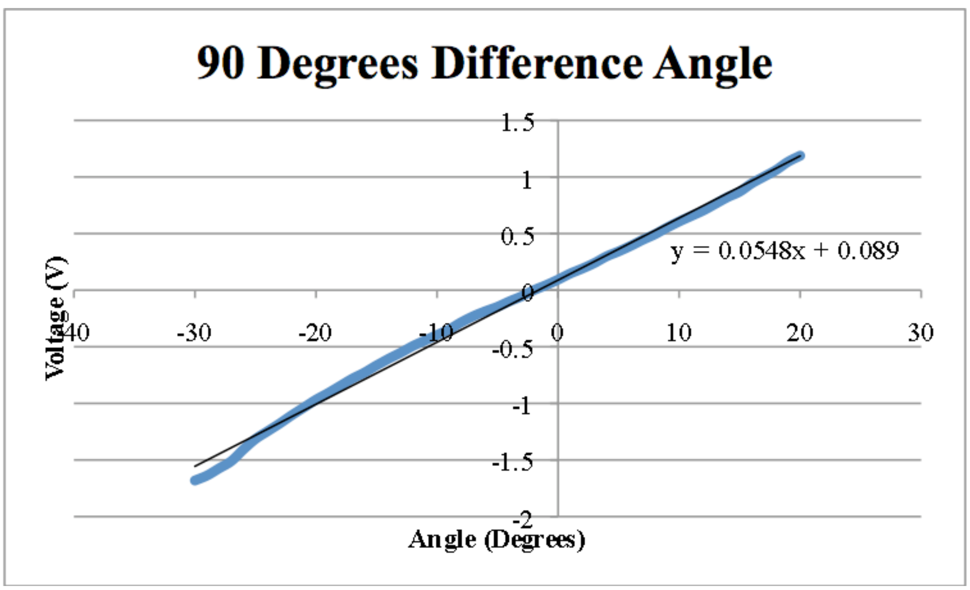


Figure 4.11: Composite LDR Data



Next are the indivdual plots which show the best fitting curves for each.The actual collected data is show in the appendix:

Figures 4.12: 90 Degree Difference Angle

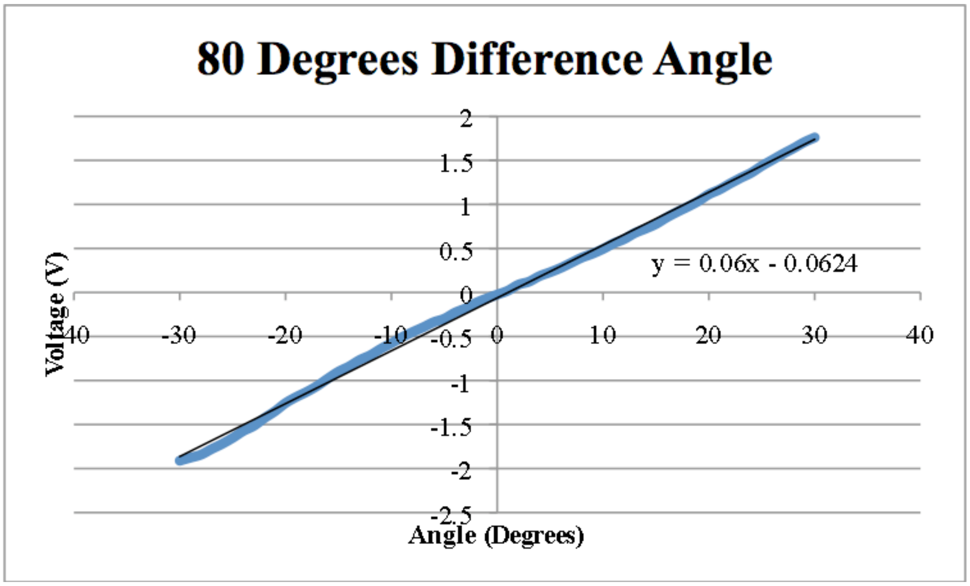


Figure4.13:80DegreeDifferenceAngle

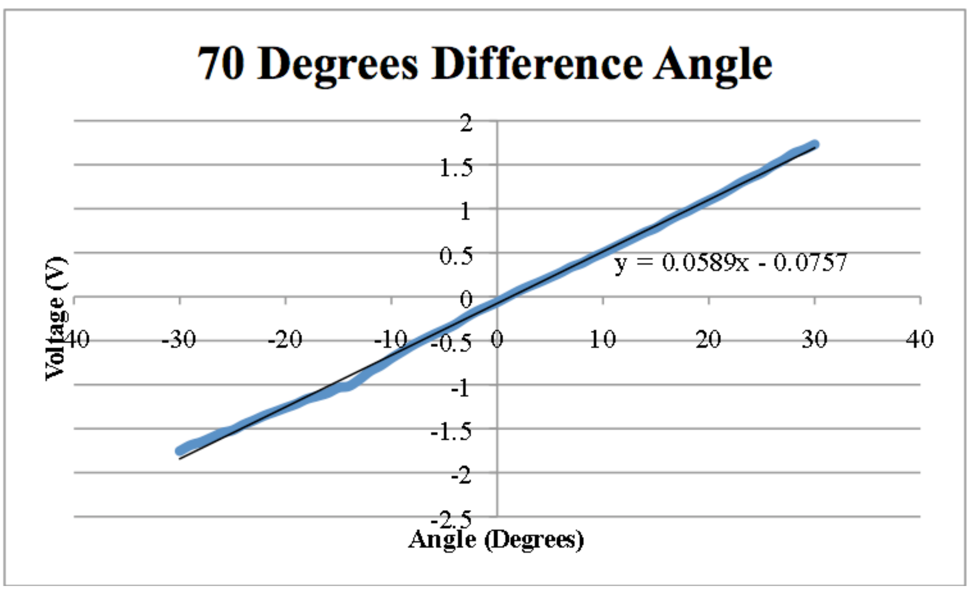


Figure4.14:70DegreeDifferenceAngle

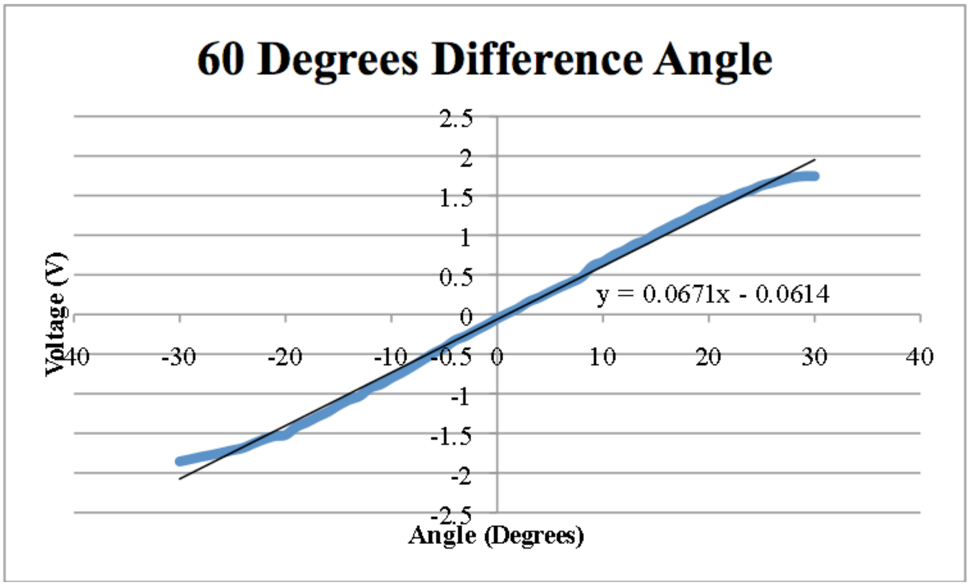


Figure 4.15:60DegreeDifferenceAngle

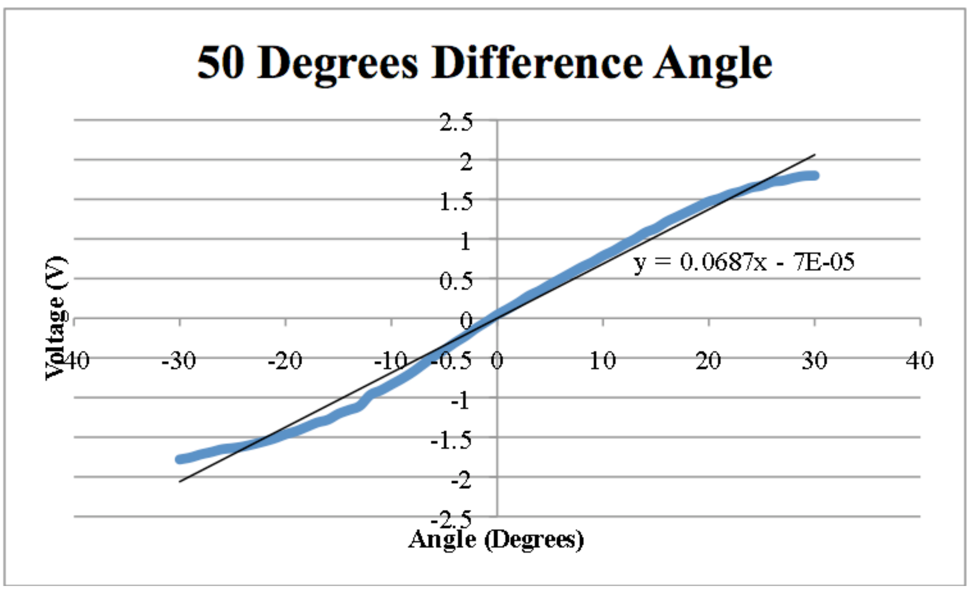


Figure 4.16:50DegreeDifferenceAngle

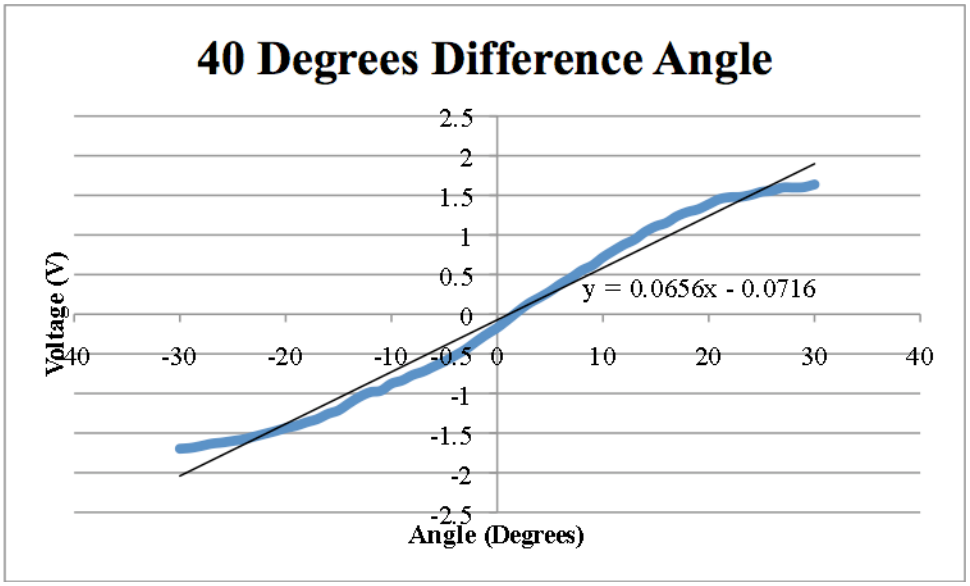


Figure 4.17:40DegreeDifferenceAngle

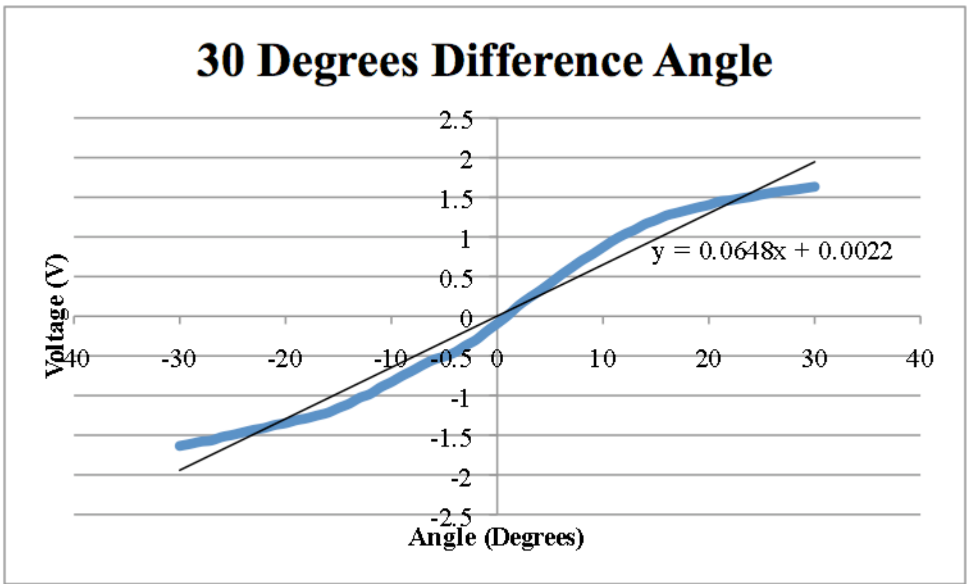
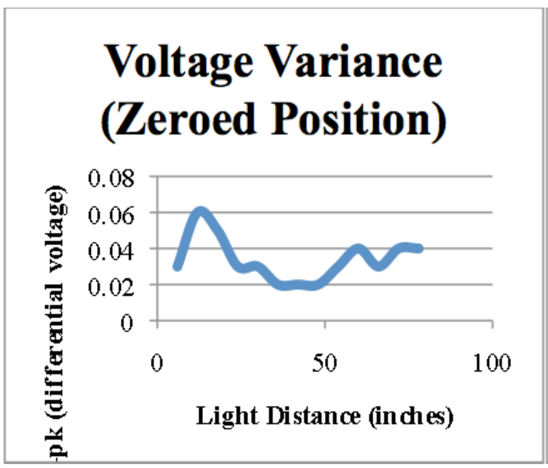


Figure 4.18:30DegreeDifferenceAngle

As can be seen from the graphs above the slope increasesas the difference angle decreases,but as the slope increases this area of increased sensativity narrows.In the figure above the area of greatest sensativity narrows down to-15 to 15 degrees around the zeroed position.For this reason 30 degrees would be the best option if LDRs were used because it has this steps lope.

The slope be low and above-15 and 15 degrees respectfully are unimportant because the error for the solar tracker should never get to this point.

Finally the photodiodes were tested for their light sensativity. The experiments produced widely varying AC voltage values for the differential voltages it was determined that photodiodes were choice.The plots below show the voltage variation ranges for a difference angle of ninety degrees between cells under the same conditions as the other light dependent circuit elements. These plots were done for the light atanangle of zero degrees and thirty degrees around the cells as the light was moved from six to seventy-eight inches from the photodiodes. This was done to see if a difference in the light distance could make the voltage more constant.



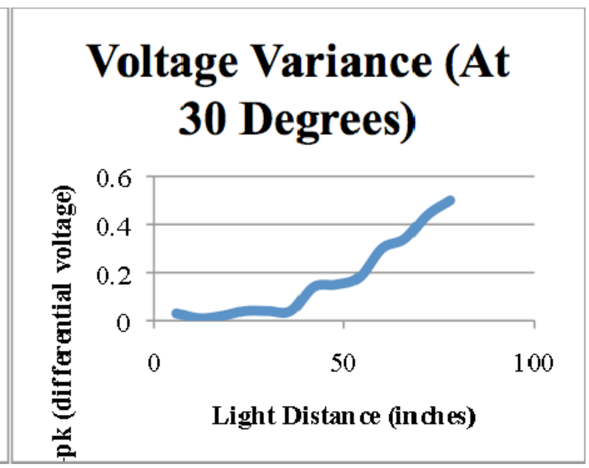


Figure4.19:Zeroed Position

Figure4.20:Thirty Degrees

5.2 SOLAR CELL DATA

angle	cells 90	cells 80	cells 70	cells 60	cells 50	cells 40	cells 30
-30	-0.3812	-0.6305	-0.6452	-0.623	-0.5474	-0.3568	-0.532
-29	-0.3666	-0.6207	-0.6354	-0.623	-0.567	-0.3886	-0.532
-28	-0.3617	-0.6012	-0.6256	-0.5914	-0.5376	-0.3519	-0.5083
-27	-0.3421	-0.5914	-0.6061	-0.5865	-0.5425	-0.3763	-0.4643
-26	-0.3177	-0.5816	-0.5865	-0.5816	-0.5279	-0.3519	-0.4497
-25	-0.3079	-0.5572	-0.5718	-0.5767	-0.5376	-0.347	-0.4497
-24	-0.2933	-0.5376	-0.5523	-0.567	-0.523	-0.3372	-0.4301
-23	-0.2786	-0.5132	-0.5327	-0.5474	-0.5425	-0.303	-0.3763
-22	-0.2688	-0.4888	-0.5034	-0.5425	-0.5279	-0.3177	-0.3372
-21	-0.2444	-0.479	-0.4888	-0.5181	-0.5132	-0.3128	-0.3275
-20	-0.2395	-0.4594	-0.4692	-0.5083	-0.479	-0.3226	-0.3079
-19	-0.2248	-0.435	-0.4448	-0.479	-0.479	-0.3177	-0.2933
-18	-0.2053	-0.4008	-0.4252	-0.4545	-0.4692	-0.3177	-0.2835
-17	-0.2004	-0.3715	-0.4008	-0.4301	-0.435	-0.2786	-0.2786
-16	-0.1906	-0.3519	-0.3715	-0.4154	-0.4106	-0.2884	-0.2542
-15	-0.176	-0.3324	-0.3421	-0.3812	-0.3959	-0.3275	-0.2346
-14	-0.1662	-0.2981	-0.3226	-0.3715	-0.3617	-0.2884	-0.2346
-13	-0.1564	-0.2786	-0.303	-0.3372	-0.3568	-0.2884	-0.2151
-12	-0.1369	-0.2439	-0.2737	-0.3079	-0.3568	-0.2688	-0.2102
-11	-0.1271	-0.2297	-0.2493	-0.2786	-0.303	-0.2542	-0.1857
-10	-0.1173	-0.2102	-0.2297	-0.2444	-0.2884	-0.2151	-0.1711
-9	-0.1026	-0.176	-0.2004	-0.2199	-0.2346	-0.2102	-0.1613
-8	-0.0978	-0.1613	-0.1808	-0.1857	-0.2151	-0.1955	-0.1466
-7	-0.0782	-0.1417	-0.1564	-0.1662	-0.176	-0.1808	-0.1222
-6	-0.0635	-0.1222	-0.1417	-0.1417	-0.1564	-0.132	-0.1075
-5	-0.0489	-0.1026	-0.1124	-0.1222	-0.132	-0.1075	-0.0782
-4	-0.044	-0.0831	-0.088	-0.088	-0.0978	-0.0831	-0.0587

-3	-0.0293	-0.0684	-0.0684	-0.0782	-0.0733	-0.0733	-0.0489
-2	-0.0196	-0.0391	-0.0538	-0.0391	-0.0538	-0.0587	-0.0293
-1	-0.0098	-0.0147	-0.0196	-0.0196	-0.0244	-0.0244	-0.0098
0	0	-0.0098	-0.0098	0	-0.0049	-0.0049	0.0049
1	0.0147	0.0293	0.0196	0.0049	0.0147	0.0098	0.0244
2	0.0293	0.0489	0.0391	0.0391	0.0293	0.044	0.0489
3	0.044	0.0587	0.0587	0.0782	0.044	0.0587	0.088
4	0.0538	0.0831	0.0782	0.088	0.0733	0.088	0.1173
5	0.0684	0.0929	0.1026	0.1075	0.0978	0.1026	0.1417
6	0.0831	0.1173	0.1222	0.1417	0.132	0.1271	0.176
7	0.0929	0.1369	0.1466	0.176	0.1466	0.1271	0.2053
8	0.0978	0.1613	0.1662	0.1808	0.1515	0.1564	0.2297
9	0.1222	0.1857	0.1857	0.2346	0.2199	0.1711	0.2444
10	0.1271	0.2151	0.2199	0.259	0.259	0.1906	0.2884
11	0.1369	0.2444	0.2395	0.2737	0.2981	0.2004	0.3177
12	0.1564	0.2688	0.2688	0.3226	0.3128	0.2102	0.3275
13	0.1808	0.2884	0.2933	0.3519	0.3324	0.2297	0.3324
14	0.1857	0.3128	0.3128	0.347	0.3666	0.1808	0.3617
15	0.2004	0.3372	0.3324	0.4008	0.391	0.2004	0.3617
16	0.2102	0.3617	0.3666	0.391	0.4203	0.2102	0.391
17	0.2199	0.391	0.3812	0.4545	0.4301	0.2151	0.4008
18	0.2395	0.4154	0.4057	0.4692	0.4057	0.2346	0.4106
19	0.259	0.4301	0.435	0.4545	0.3715	0.2493	0.4154
20	0.2639	0.4497	0.4497	0.5083	0.4008	0.2835	0.4301
21	0.2737	0.479	0.4741	0.5132	0.4154	0.3128	0.4497
22	0.2933	0.4985	0.4985	0.5425	0.4545	0.3275	0.4643
23	0.3079	0.5327	0.523	0.5425	0.467	0.3568	0.4643
24	0.3177	0.5523	0.5425	0.5474	0.4741	0.303	0.479
25	0.3275	0.5718	0.5621	0.5572	0.4741	0.333	0.4741

26	0.334	0.5914	0.5865	0.5425	0.4741	0.333	0.5083
27	0.334	0.6061	0.6012	0.5865	0.4985	0.303	0.5132
28	0.345	0.6207	0.6061	0.5865	0.4985	0.38	0.5132
29	0.364	0.632	0.6109	0.5621	0.514	0.44	0.523
30	0.364	0.632	0.632	0.5767	0.514	0.475	0.523

5.3 LDR DATA

angle	90 Degrees	80 Degrees	70 Degrees	60 Degrees	50 Degrees	40 Degrees	30 Degrees
-30	-1.6813	-1.911	-1.7546	-1.8556	-1.7808	-1.6975	-1.6353
-29	-1.6373	-1.8768	-1.6898	-1.8273	-1.7563	-1.6877	-1.6104
-28	-1.5738	-1.8426	-1.6532	-1.7976	-1.7166	-1.6632	-1.5808
-27	-1.5103	-1.7791	-1.6013	-1.7729	-1.6868	-1.6337	-1.5664
-26	-1.4076	-1.7204	-1.5482	-1.7434	-1.6521	-1.6193	-1.5222
-25	-1.3148	-1.652	-1.5182	-1.7136	-1.6375	-1.5995	-1.4964
-24	-1.2463	-1.5738	-1.4558	-1.6838	-1.6177	-1.5785	-1.4637
-23	-1.1779	-1.5152	-1.4057	-1.6264	-1.5873	-1.5453	-1.4324
-22	-1.1046	-1.4272	-1.3516	-1.5743	-1.5532	-1.5106	-1.4089
-21	-1.0362	-1.349	-1.3079	-1.5347	-1.5137	-1.4762	-1.3712
-20	-0.9677	-1.2561	-1.2631	-1.52	-1.4639	-1.4366	-1.349
-19	-0.9091	-1.1877	-1.2198	-1.4207	-1.4241	-1.4068	-1.3116
-18	-0.8456	-1.129	-1.1636	-1.3616	-1.3695	-1.3622	-1.2865
-17	-0.782	-1.0606	-1.1303	-1.2927	-1.3146	-1.3231	-1.251
-16	-0.7283	-0.9775	-1.0942	-1.2294	-1.2799	-1.2577	-1.2167
-15	-0.6647	-0.8993	-1.0348	-1.1461	-1.2053	-1.213	-1.1571
-14	-0.6061	-0.8407	-1.0166	-1.0779	-1.1562	-1.1238	-1.104
-13	-0.5523	-0.7674	-0.9384	-1.0299	-1.1068	-1.042	-1.0283
-12	-0.4936	-0.7136	-0.8456	-0.9268	-0.9677	-0.9835	-0.98
-11	-0.4448	-0.6403	-0.782	-0.8814	-0.9091	-0.9653	-0.894
-10	-0.3959	-0.5767	-0.6989	-0.8013	-0.8358	-0.876	-0.8298
-9	-0.347	-0.5083	-0.6256	-0.7331	-0.7625	-0.8362	-0.753
-8	-0.2835	-0.4497	-0.5523	-0.6549	-0.6794	-0.7674	-0.6858
-7	-0.2297	-0.3959	-0.4888	-0.5718	-0.5816	-0.7234	-0.6118
-6	-0.1857	-0.3372	-0.4301	-0.4888	-0.4839	-0.6598	-0.5474
-5	-0.1466	-0.2981	-0.3763	-0.4203	-0.4008	-0.5963	-0.5085
-4	-0.0978	-0.2297	-0.3177	-0.3275	-0.3079	-0.523	-0.4557
-3	-0.0538	-0.1808	-0.2395	-0.2737	-0.2248	-0.4448	-0.3715

-2	0	-0.1173	-0.1711	-0.2004	-0.1271	-0.347	-0.2981
-1	0.044	-0.0684	-0.1173	-0.132	-0.044	-0.2542	-0.1906
0	0.0929	-0.0244	-0.0635	-0.0538	0.044	-0.1711	-0.0929
1	0.1466	0.0196	0	0.0147	0.1173	-0.0684	0.0098
2	0.1906	0.088	0.0635	0.0782	0.1955	0.0391	0.132
3	0.2395	0.1222	0.1173	0.1613	0.2835	0.1369	0.2297
4	0.2981	0.1857	0.1662	0.2151	0.347	0.2102	0.3177
5	0.3421	0.2297	0.2199	0.2835	0.4252	0.2884	0.4154
6	0.391	0.2786	0.2737	0.347	0.4985	0.3812	0.5181
7	0.4448	0.3372	0.3372	0.4057	0.5718	0.4594	0.6109
8	0.4936	0.3959	0.3812	0.4741	0.6452	0.5523	0.7038
9	0.5523	0.4399	0.4448	0.6109	0.7087	0.6158	0.782
10	0.6061	0.4936	0.4985	0.6647	0.7869	0.7185	0.87
11	0.6549	0.5572	0.5572	0.7478	0.8504	0.8016	0.958
12	0.7038	0.6061	0.6158	0.8065	0.9286	0.8798	1.0313
13	0.7625	0.6745	0.6745	0.8847	0.9971	0.9433	1.0899
14	0.8211	0.7234	0.7331	0.9335	1.0802	1.0411	1.1632
15	0.87	0.7771	0.782	1.0166	1.1339	1.1095	1.2121
16	0.9433	0.8504	0.8553	1.085	1.217	1.1535	1.2708
17	1.002	0.914	0.9189	1.1535	1.2805	1.2366	1.305
18	1.0606	0.9726	0.9726	1.2121	1.3441	1.2903	1.3392
19	1.1339	1.0362	1.0362	1.2952	1.4076	1.3245	1.3734
20	1.1877	1.1144	1.0948	1.349	1.4712	1.3881	1.4027
21	1.2463	1.1681	1.1535	1.4174	1.5103	1.4516	1.4467
22	1.2463	1.2366	1.2219	1.4663	1.564	1.4761	1.4614
23	1.3148	1.3001	1.2952	1.5249	1.5982	1.4809	1.4858
24	1.3866	1.3587	1.3539	1.5689	1.6471	1.5054	1.5054
25	1.3866	1.437	1.4076	1.6276	1.6716	1.5445	1.5347
26	1.439	1.5054	1.4858	1.6618	1.7204	1.5591	1.5591
27	1.5103	1.5738	1.5494	1.7009	1.7351	1.5982	1.5787

28	1.6373	1.6373	1.6276	1.7302	1.7693	1.5982	1.5934
29	1.6373	1.7058	1.6716	1.7449	1.7937	1.6031	1.6129
30	1.6373	1.7595	1.7302	1.7449	1.7986	1.6373	1.6325

CHAPTER-6

CONCLUSION

The sun tracking solar panel system is proposed here is quite efficient and reliable for the proper solar energy used. The proposed system works according to the sunrays falling over on either of the two LDR sensors attached at two different ends of the solar panel. The system performs its task quite efficiently and moves the solar panels in desired direction of the sunlight.

In this report we made a comprehensive review about various solar power prediction systems, as well as its organizational structure. And tells how the system is able to track and follow the Sun intensity in order to get maximum power. The system only focuses in tracking of Sun intensity. These systems can be applied in the residential area for alternative electricity generation especially for non-critical and low power appliances. In this contest, small concentration systems present many performance issues and there are limitations in manufacturing quality.

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