One Axis Solar Panel Tracker

A Project submitted in partial fulfilment of the requirements for the Award of Degree of Bachelor of science in Electrical and Electronic Engineering

By

Name: Md. Rashedul Islam

(ID: 152-33-2750)

Supervised by

Dr. M. Shamsul Alom

Professor and Dean

Department of EEE

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FACULTY OF ENGINEERING

DAFFODIL INTERNATIONAL UNIVERSITY

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Certification

This is to certify that this project and thesis entitled "One Axis Solar Panel Tracker" is done by Md. Rashedul Islam, ID No: 152-33-2750 under my direct supervision and this work has been carried out by him in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on September 2018.

Signature of the Candidates **Signature of the Supervisor**

Name: Md. Rashedul Islam
ID #: 152-33-2750

Professor Dr. M. Shamsul Alam
Professor and Dean
Department of EEE, DIU

Dedicated to

My parents

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LDR	Light Dependent Resistor
DC	Direct Current
TXD	Data Transfer
RXD	Data Receiver

ACKNOWLEDGEMENT

First of all, I give thanks to Allah and I would like to express my gratitude to Professor Dr. M. Shamsul Alam, Professor and Dean, who was my supervisor, for his constant guidance in the implementation of this project. I just particularly thank him for his commitment and unrelating effort to see me do all the assignments appertaining to this project. He was always available for consultation and in the implementation of the project. i particularly thank him for his insight, his advice and help towards the overall success of this project. Without his encouragement, I am not sure if the project would have been implemented. Finally, I would also like to thank my friends and classmates with whom we spent sleepless nights at times when trying to get some concepts right. My classmate Shariful was one such person. My good friend Al-Amin was very instrumental in helping with the software part for which I was not too well conversant. Finally, I was able to come up with a working project.

ABSTRACT

Solar energy is becoming a very important way of renewable energy resources. Through solar tracking, this process can generate more energy due to the solar panels being able to maintain a longer profile in the sun's rays. Although the primary cost of setting up tracking systems is very high, there are also cheap options offered over time. This project discusses the design and construction of a prototype for a solar tracking system that has a freedom axis. Light dependent resistance (LDR) is used for sunlight detection. Control circuit is based on an ATMega328P microcontroller. It was programmed to detect sunlight through LDRs before actuating the servo to the position of the solar panels. Solar panels are placed where it is able to get maximum lighting. As compared to other motors, the servo motors are able to maintain their torque at high speed. They are also more efficient with efficiencies in the range of 80-90%. Servos can supply roughly twice their rated torque for short periods. They are also quiet and do not vibrate or suffer resonance issues. The characteristics of performance and solar panels are specifically analyzed. One way to increase the efficiency of solar panels is to use tracking while spending costs. By tracking, the sun exposure will increase in the panel, so it will increase the power output. Trackers can be dual or single axis tracker. Dual trackers are more effective because they track sunlight From Both characters. One axis tracking system is used. It is cheaper, less complex and still achieves the necessary skills. The system is useful for the cost of using the system and the solar panel, the system is useful. The increase in electricity is sufficient and so small increase costs are increased. The cost of maintenance cannot be high.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Extensive use of renewable energy sources for the production of electric fossil fuels, and environmental concerns caused by rapid electrical power reduction. Power technology variable currency. As a whole fabric of society in the space of energy, I know it will reduce the effects of a 24-hour cutting effect in a city's electricity supply, it shows that I am particularly dependent on energy strength. To stop the computer and elevator work, hospitals have a care and maintenance level sink to sink and go out to the light. With population increasing, an average of 2% is faster, more energy is needed. Improved lifestyle and energy demand have increased together and the chaotic industrialized economy, which holds 25% of the world's population, supplies 75% of the world's electricity. The use of new photovoltaic solar cells has emerged as an alternative measure to manage renewable green energy, energy conservation and demand-direction. Renewable energy is the only hope and it is the latest research field that wants to create an effective marketing system for an effective solar panel charging system, which prevents current flow from controlling the flow and taking additional voltage and increasing life

1.2 Solar energy

Solar energy is energy sources that I get from the sun. It is clean and very available in everywhere. In this process, the heat energy reflections deformed by the sun can be focused on a small area. This heat can be used to raise steam and electric power turbine can be produced with the combination of options. Another way, in solar cells light energy is directly converted into electrical energy. In this cell are Semiconductors (silicon alloys and other materials). These solar cells are called photovoltaic cells or PV device

1.3 Problem Identification

In the day our natural resources are reduced. So, if we cannot implement any alternative for them, then the future of our next generation will be even more serious. Our future is closely closed with the use and use of modern technology. Therefore, through the technological advances, the first and the maximum conditions for the development of our country provide the necessary electricity. In this way, solar power can be one of the many options that can be solved in various ways by the power problems.

1.4 Objectives of the project

Today most of the energy comes from fossil fuels such as coal, oil and natural gas. These energy sources are irregular. This means that if I use them all then I will not get much more in my life. Fossil fuels emit carbon dioxide in air in the air, contributing greatly to global climate change. Because of fossil fuels can run out and are bad for the environment, it is important that I start switching other energy sources like renewable energy sources. Solar energy is one of the most available renewable energy sources.

Some points of objective below

- To introduce Renewable Energy (RE) as an alternative solution for power.
- Practice Product oriented training.
- To uninterrupted power supply
- Promote solar energy production and uses in Urban, Sub Urban, and Rural area.
- To control the home DC solar system automatically.
- Design and Improvement of DC solar system.
- The load of national grid will be lessening resultantly

1.5 Advantages of Solar Energy

- PV panels provide clean-green energy. No harmful greenhouse gases are emitted during the generation of electricity with PV panel shares, thus solar PV is environmentally friendly. The energy supplied by the nature of solar energy - it's free and lots
- Solar energy can be provided almost anywhere in sunlight. Photovoltaic panels, through photoelectric phenomenon, produce electricity in a direct electricity generation way.
- Operating and maintenance costs for PV panels are lower than other renewable energy systems, almost cash

1.6 Disadvantages of Solar Energy

- As a renewable energy source, there is a problem with solar energy; May be cloudy or rainy in the night of shining.
- As a result, solutions to solar power panels and less reliable, unpredictable solutions.
- Solar panel efficiency is relatively less (14% -25%) than the level of efficiency of other renewable energy systems.
-

1.7 Project overview

This project paper is divided into five chapters:

In the first chapter entitled “Introduction” that discussed about the theme, intention, and overview of the project.

In the Second chapter entitled “History of solar energy” that discussed about the invention of solar energy, works on solar project, solar energy of Bangladesh, installed and ongoing project of Bangladesh.

In the third chapter entitled “Hardware and project design” that discuss about the all hardware, hardware implementation, project design, project block diagram and circuit diagram.

In the fourth chapter entitled “Calculations Results and Discussions” that discuss about the calculation, project output analysis results, cost analysis and discussion.

In the fifth chapter entitled “Conclusion and future work”

1.8 Project Outline

Chapter 1 introduction

Chapter 2 literature reviews

Chapter 3 project description

Chapter 4 hardware development

Chapter 5 results and discussions

Chapter 6 conclusions

CHAPTER 2
LITERATURE REVIEWS

2.1 Introduction

Solar energy is a form of energy produced by sunlight and thermal power. The most common way to combine energy from the sun is the photovoltaic (PV) panel - you saw large, mirror-like panels on the roof, handheld solar devices and even spacers.

2.2 History of Solar Energy

In the 19th century, the development of life-style, society, workplace etc. needed electric power and still. Scientists have done very little to improve the power sector. In 1832, Alexander Becquerel discovered that some materials were produced lightly when faced with light.

William Gils Adams, who invented in 1876, produced a solid material with his student Richard Evans Day - selenium-lightning power. Selenium photolyte cells convert electricity into 1 to 2% efficiency. Photovoltaic or short-term PV describes the term sunlight as a transformation of electricity: photos, light-related meanings and voltaic money production voltage. The concept of electricity from sunlight took more than 100 years, more than just a test.

2.3 Birth of PV cell

The first conventional photovoltaic cells were produced in the late 1950's, and in the 1960s, it was thought that they were used to supply electric power to earth-carrying satellites. In the 1970s, PV modules helped to reduce production, performance and

quality improvements, and many opportunities were opened for PB Ring remote land, including navigational aids, signals, telecommunication equipment and other important, low power demand. In the 1980s, photovoltaic calculators became a popular energy source for consumer electronic devices, including watches, radios, lanterns and other small battery charging applications. After the power crisis of the 1970s, the important efforts of developing PV power systems for residential and commercial use, stand alone, and remote applications for connectivity applications. During the same period, for international applications for PV systems to power rural health clinics, refrigeration, water pumping, telecommunications, and off-grid households increased dramatically, and remain a major portion of the present world market for PV products. Today, the industry's production of PV modules is growing at approximately 25 percent**6**annually, and major programs in the U.S., Japan and Europe are rapidly accelerating the implementation of PV systems on buildings and interconnection to utility networks.

2.4 Photovoltaic system

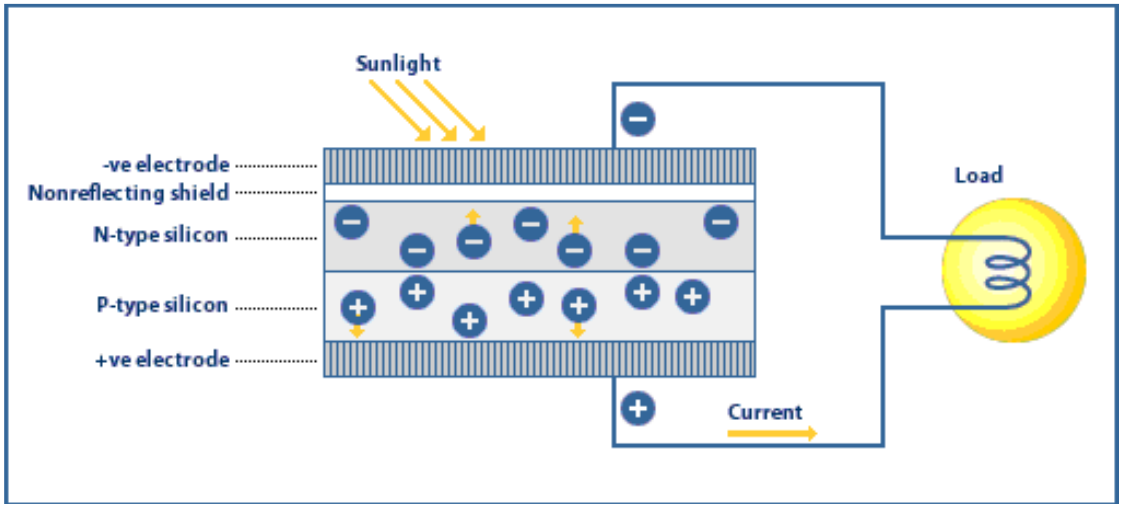

Figure 2.1: Photovoltaic system

2.5 Timeline of Solar energy history

- 1839 - Alexandra Edmond Becquerel observes the photovoltaic effect via an electrode in a conductive solution exposed to light.
- 1887 - Heinrich Hertz investigates ultraviolet light photoconductivity and discovers the photoelectric effect
- 1888-91 – Aleksandr Stoletov creates the first solar cell
- 1905 - Albert Einstein published a paper explaining the impact of the photo on a quantum basis.
- 1954 - Bell Labs announces the invention of the first practical silicon solar cell. These cells have about 6% efficiency.
- 1960 - Hoffman Electronics creates a 14% efficient solar cell.
- 1988 - Dy-Sensitized Solar Cells Made by Michael Garrell and Brian O'Ragan. The electrochemical cell of this photo works from a organic compound inside the cell and costs more than half of silicon solar cells.
- 1989 - Reflected solar collector is first used with solar cells1999 - Total worldwide installed photovoltaic power reaches 1,000 megawatts.
- 2012 - 3D PV-cell with 30% more energy efficiency

2.6 Works on solar technology around the world

Our country has huge work on solar technology, research, thesis, implementation, design consideration and improvement, such as the sick. Many of my companies are doing business, implementation and research on solar technology. Worldwide students are working with the solar system. Students of Pennsylvania State University design and imitate a distribution photovoltaic system as a thesis for their university. Again, Raja Mandal Technology University has established PV system for their universities for the development of solar power projects compared to Aburi Thailand. Scientists from Korea and California are working to develop solar panels, such as scientists have created a new way to increase the efficiency of plastic solar panels. They make them more competitive on traditional solar panels.

2.7 Sundial building, China

Figure 2.2: Largest solar power building in China

Completed for the fourth world solar city conference in 2014, this sun-shaped building in China's Shandong province has 50,000 square feet of solar panels. And inside it offers impressive, multiple exhibition centers, scientific research facilities and a mix of 807,293 square feet in a hotel. But what really makes this building stand out is its incredible ability skills. The conference center is almost fully powered by renewable energy and about 30% more efficient than China's national standards.

2.8 Tura nor planet solar boat

Figure 2.3: Largest solar boat

Tour Planet is a wonderful one of solar yacht design and energy efficiency. Designed by LOM Ocean Design, the 100-foot-long Catamaran 38,000 individual photovoltaic solar panels are the world's largest solar vessels and total solar cells of 5,300 square feet. Solar energy is designed to show more without a hostage, the ship has set many world records. In May 2012, the ship became the first solar electric vehicle to circumnavigate the world and recently broke its own trans-Atlantic crossing record - it is the 26-day journey leading up to 22 days, 12 hours and 32 minutes. And due to its availability, many small and largest solar projects were introduced. Table 2.1 Top 10 countries will generate electricity by PV system 2015 [10] The ability to add total power of capacity (megawatts) to power (China) is 43,530 15,150 Germany 39,700 1,450

- Japan 34,410 11,000
- United states 25,620 7,300
- Italy 18,920 300
- India 10,000 2,000
- United Kingdom 8,780 3,510
- France 6,580 789
- Spain 5,400 56
- Australia 5,070 935

2.9 Solar energy of Bangladesh

The government of Bangladesh takes a vision that Bangladesh will be digital country within2021. Develop of power sector is more important to complete the vision. As our maximum power station base on natural resources and it is limited and it is running low. The government takes some step to improve renewable energy sources and solar energy is one of important one. The goal of the government ensures electricity all over the country in reasonable and affordable price. And that’s why the renewable energy policy 2009, the government is committed to facilitate both private and public sector investment in renewable energy projects. Bangladesh power Development Board (BPDB) implemented three solar projects Juraichori Upazila, Barkal Upazila and Thanchi Upazila of Rangamati District under the Hill Electrification board.

2.10 Major project of solar energy in Bangladesh

- 2.82 kW at Chairman Banglo, BPDB
- 32.75 kW at WAPDA Building, Motijheel.
- 6 kW at Agrabad BidyutBhaban, Chittagong.
- 1.8 kW at Cox's BPDB Rest House.
- 37.5 kW Solar Roof Top System on15th floor of Bidyut Bhaban.
- 3 kW at PC Pole Factory, Chittagong.
- 3 kW at Khagrachori BPDB Rest House.
- 2.16 kW at Sawndip power House and Rest House.
- 2.16 kW at Sales & Distribution Division, Hathajari.
- 3.12 kW at Sales & Distribution Division, Fouzdarhat.
- 3.12 kW at Sales & Distribution Division, Rangamati.
- 1.6 kW Solar Panel System at Titas 50 MW Peaking Power Plant.
- 1.6 kW Solar power System at t Baghabari 50 MW Peaking Power Plant
- 1.6 kW Solar Power System at Bera 70 MW Peaking Power Plant.
- 1.5 kW Solar Power System at Chittagong Power Plant.
- 3.5 kW Solar Power System at Ghorashal Power Plant.
- 4 kW Solar Power System at Khulna Power Station.
- 1.6 kW Solar Power System at Faridpur 50 MW Peaking Power Plant.
- 1.6 kW Solar Power System at Gopalagonj 100 MW Peaking Power Plant.
- 2 kW at Sales & Distribution Division, Bakolia.

2.11 Ongoing project of solar energy in Bangladesh

- 650 KW (400 kW load) Solar Mini Grid Power Plant at remote Haor area of Sullahupazila in Sunamgonj district under Climate Change Trust Fund (CCTF)on turnkey basis.
- 8 MW Grid Connected Solar PV Power Plant at Kaptai Hydro Power Station, at Rangamati on turnkey basis.
- 3 MW Grid Connected Solar PV Power Plant at Sharishabari, Jamalpur on IPPbasis.
- 30 MW Solar Park Project adjacent to new Dhorola Bridge, Kurigram on IPPbasis.
- Solar Street Lighting Projects in seven (7) City Corporations of the country.

CHAPTER 3
ANALYSIS AND SIMULATION

3.1 Introduction

An axis solar panels tracker is a device that follows the speed of the sun. Using solar trackers increases the amount of solar energy received by the solar energy collector and improves heat / electricity power output. This chapter contains the full details of the project.

3.2 Building the project

The project is about making two axis solar panel tracker that can be working robotic system. The Solar Tracker is a device which follows the movement of the sun. I used four LDR Light Dependent Resistor (LDR). They are light sensitive devices. They are also called as photo conductors. The working principle of an LDR is photo conductivity, that is nothing but an optical phenomenon. When the light is absorbed by the material then the conductivity of the material reduces. I use two servo motor. Servos are controlled by sending an electrical pulse of variable width.

A servo motor can usually only turn 90° in either direction for a total of 180° movement. I use to Arduino Nano. The Arduino Nano is there for controlling automatically. Layers are made of liquid crystals, which have the power to change the direction of their voltage when the voltage is applied to them. It creates an area that looks dark. Device circuits in various areas are controlled by whatever voltage is controlled. I used solar panel, Arduino Nano, resistor, servo motor, bread board. The main objectives of this project are to investigate a newly.

3.3 Flowchart of this project

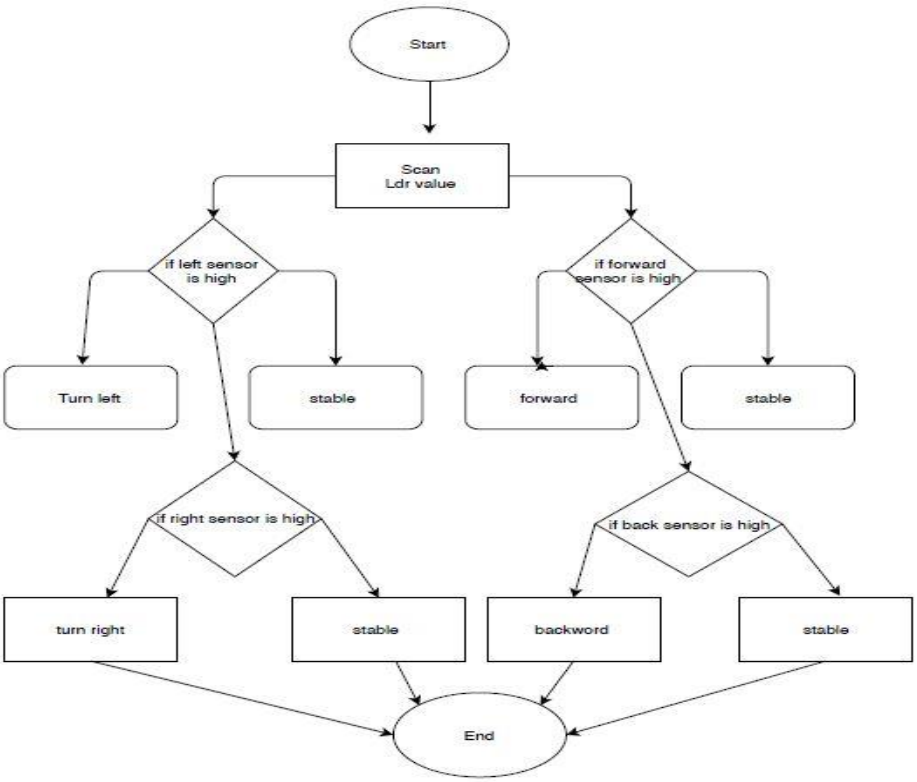

Figure 3.1: Flowchart of this project.

3.4 Block diagram of this project

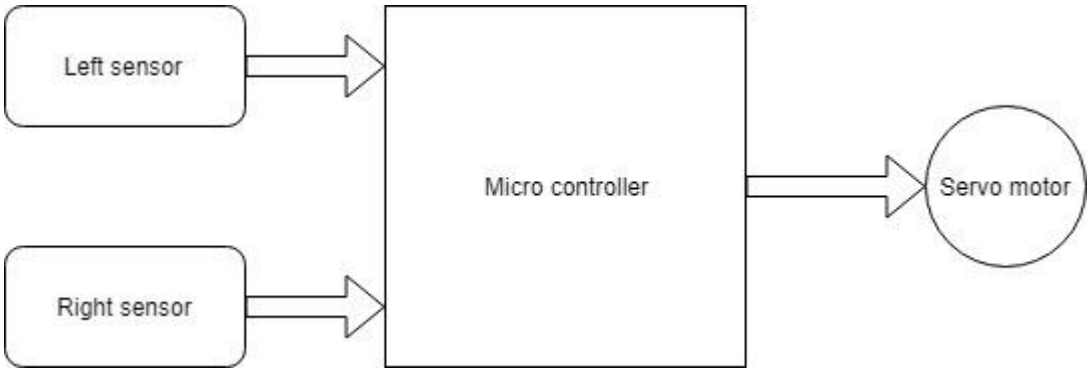

Figure 3.2 Block diagram of this project

3.5 Tracking principle

Several different methods have been proposed and used for tracking the location of the sun. Above all, the maximum method to detect the light intensity of the resisting surface is by using an LDR (light dependent resistor). Proper and effective use of LDR also reduces the overall cost of the system. LDR resistance significantly decreases with increasing illumination. A LDR illumination plot can be followed in the general resistance.

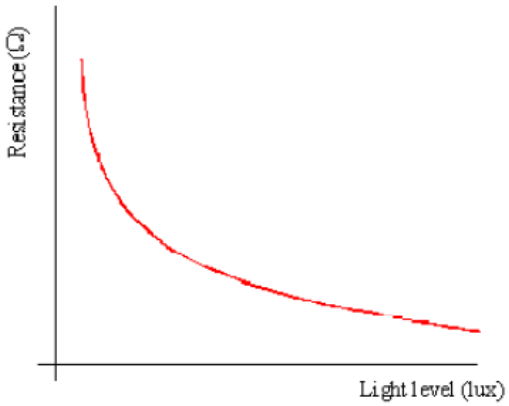

Figure:3.3 the variation of the resistance in function of the light intensity.

3.6 Working principle

The hardware setup for the larger application of this project is to set up LDR on a large curvature page. The procedure should be done so that any two LRRs should be active at the same time. And DC motor will follow the bit pattern, so the solar panels connected to the DC motor shaft will always face the sun face. The combination of LDR in the solar panel movement plays an important role. Actually, these combinations of signals are fed to the microcontroller and this directs the motor connected to driver. The required bit pattern for motor is shown in Table1.

LDR 1	LDR 2	LDR 3	LDR 4
1	1	0	0
0	1	1	0
0	0	1	1
1	0	0	1

Table 3.1: Desired Bit Patten

When the stepper motor gets the last bit order of the table, the stepper motor moves to its original position and will follow these steps again, the sun will start from the next day. The dc power from battery is given as an input to the Inverter, which converts it into an alternating power so that it can be used with ease by home appliances and for Industrial purpose also.

3.7 Circuit Diagram & Description

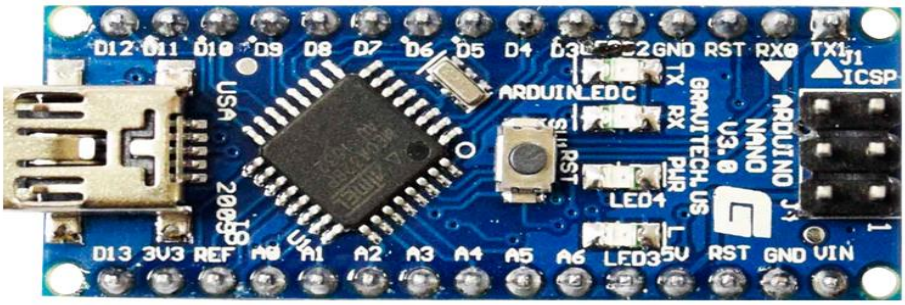

Figure 3.4. Arduino Nano

An automated one axis solar tracking system by using Arduino is proposed. Here microcontroller ATmega328 controls the solar panel's movement which rotates and follows the motion of the sun anywhere in sky. There are three limit switches used in the circuit. Among which two are attached to the solar panel to mark its maximum angular positions in the east and west. The limit switch's status is read by microcontroller and the maximum angular position in either direction is indicated. When this position has been reached the panel should not be driven any further. And third limit switch is used to mark its angular position horizontally (i.e.360º). As the plane of the panel is always kept perpendicular to the direction of the sun, maximum amount of thermal energy can be obtained from the solar panel.

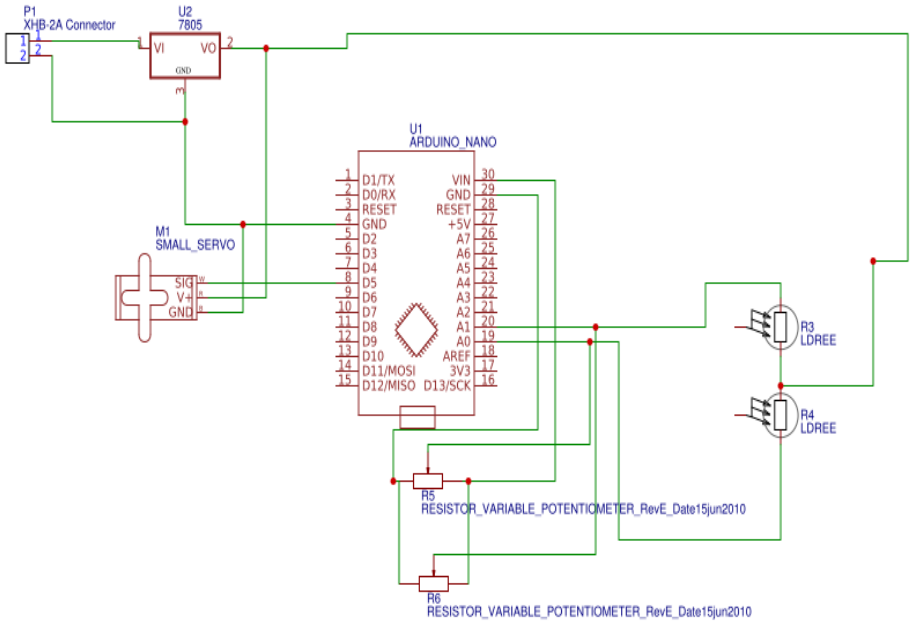

Figure: 3.5 Circuit diagram of this project

Arduino is open-source electronics prototyping platform based on flexible, usable hardware and software. It is specially designed for artists, designers, hobbies, and anyone interested in creating interactive objects or environments. Arduino accepts an input signal from different sensors to understand the environment and controls motor, lamp and other types of actuators and can influence its surroundings. The microcontroller mounted on the board can be program in this chapter has discussed about principle of digital automatic ac voltage regulator. It has included block diagram, circuit diagram and physical appearance of this project. It has also explained operating system of the project and should physical input/output screen result.

Med using Arduino programming language (based on cable) and Arduino development environment.

3.8 SPECIFICATION

Arduino Nano	
Architecture	AVR
Operating voltage	5V
Flash memory	32 KB of which 2 KB used by bootloader
SRAM	2KB
Clock Speed	16MHz
Analog IN Pins	8
EEPROM	1 KB
DC Current per I/O Pins	40 mA (I/O Pins)
Input Voltage	7-12 V
Digital I/O Pins	22 (6 of which are PWM)
PWM Output	6
Power Consumption	19mA
PCB Size	18x45mm
Light	7 g
Product Code	A000005

Table: 3.2 list of Specification

3.9 Summary

In this chapter has discussed about principle of two axis solar panel. It has included block diagram, circuit diagram and physical appearance of this project. It has also explained operating system of the project.

CHAPTER 4
HARDWARE DEVELOPMENT

4.1 Introduction

The demand for electricity and its price is constantly increasing. Solar power has become the preferred choice to increase the electricity demand due to the sunlight, terrorism, and the availability of free electricity, due to limitations, abundance and durability. Photovoltaics are a solid-stable instrument that produces electricity only from sunlight, without any maintenance and silent maintenance, no significant reduction in pollution and material resources. However, it is expensive to install, but it can save more energy in the long term and reduce costs.

4.2 Light Dependent Resistor (LDR)

This axis tracking system is used as a sensor for the development of Light Dependent Resistant (LDR). LDR resistance decreases with light intensity. Two 12-volt full guard stopper motors are used for solar panels rolling. In this dual axis I am using four LDRs to detect light intensity. The dual axis tracking system needs to track the sun movement accurately. The sun always faces the panel, absorbing the maximum power, the panel can be absorbed with maximum efficiency. The main purpose of this paper is to improve the gain of the sun by proper tracking. The daily speed appears in the sun from east to west, but during the course of the east-west direction, the annual speed of the sun is 23.5 degrees Celsius. So, the solar panel's most efficient single axis tracking system is not being used. The L293D mechanical information in this project is used for binary data.

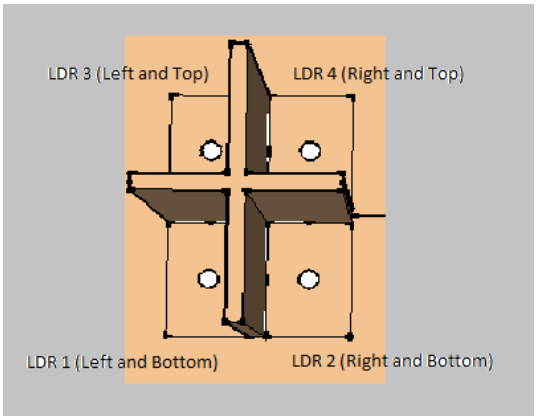

Figure. 4.1. Light Dependent Resistor (L

4.3 Servo motor

Servo motors are used for various applications. They are normally small in size and have good energy efficiency. The servo circuitry is built inside the motor unit and comes with a position able shaft that is fitted with a gear. The motor is controlled with an electric signal that determines the amount of shaft movement.

Figure 4.2. servo motor

4.3.1 Components of the servo motor

Servo has three main elements inside; A small DC motor, a potentiometer and a control circuit. Gears control wheel is used for motorcycle. As the motor rolling, the control circuit can accurately control the amount of movement and the required direction, so that the resistance of the Pentameter changes.

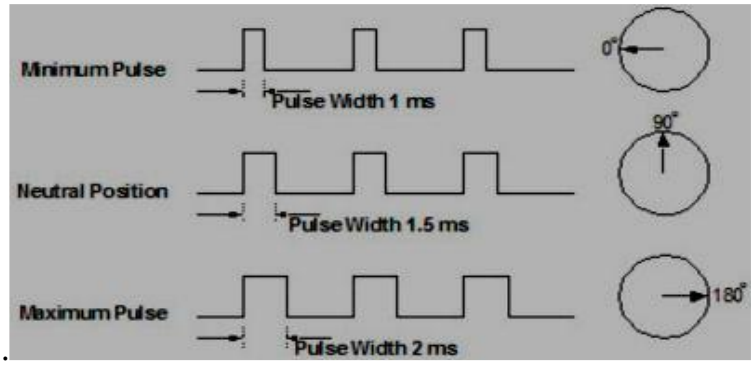

Figure 4.3. Variable pulse width control servo position

If the motor seat is at the desired position, the motor power supply is closed. If the shaft is not in the correct position, then the motor is in the right direction. The desired location signal is sent through the electrical pulse via the cable. The ratio of motor velocity between the actual position and the desired position. Therefore, if the motor is near the preferred position it becomes gradual. Otherwise, it is activated quickly. This ratio is known as control.

4.3.2 How the servo is controlled

Servos are transmitted through control wires, or by sending pulse width modulation (PWM) electrical pulse. There is minimum pulse, maximum pulse and repeat rate. Servos can generally turn only 90 degrees in both directions for 180-degree movement. The neutral position of the motor is defined in such a manner that the probability of rotation on either side of the clock and the clockwise side of the clock is the same amount on the server. The position of the PW Shafts sent to the motorcycle will be determined and the desired positions will be positioned according to the pulse transmitted by the Rotary Control Cable. The server motor will determine the pulse length after every 20 milliseconds to see a pulse and determine how far the motor will turn. For example, a 1.5-meter pulse motor turns 90 degrees position. If the pulse is less than 1.5 meters then it will move up to 0 degrees and the long pulse will move up to 180 degrees. This is shown below.

4.4 AVR Development Board:

The Auto Voltage Regulator (AVR) function is used to maintain stable voltage and power line conditioning for equipment under various conditions, even when the utility input voltage, frequencies, or system loads vary widely. There are all opposite copper, multiple pressures, triple shield separator transformers, and each phase has a separate contrast parallel electronic switch for 7-bit tight voltage regulation. Phase current will start to change any necessary tap change to zero for zero recognition. With the normal city zero current crossing acquisition, linear device will be used for line synchronization to prevent phase shift error. System microprocessor is controlled.

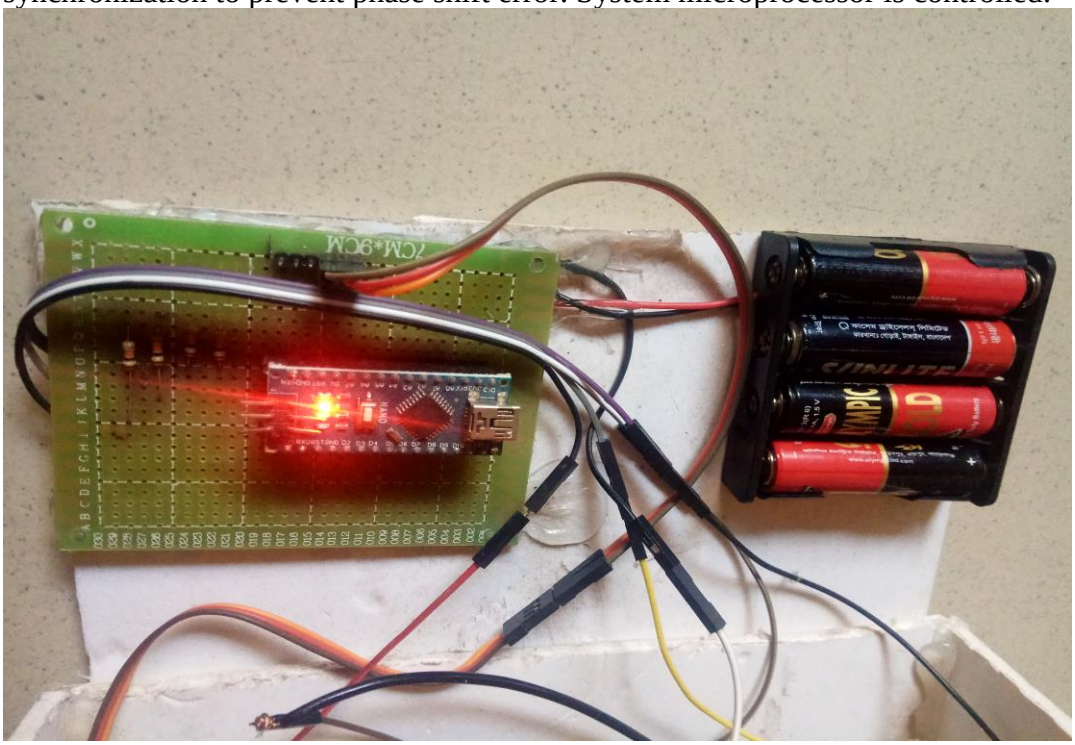

Figure 4.4: AVR boar

4.5 Solar panel

Solar Photovoltaic Panel Adapters to a Solar Trailer Sun The position of the sun in the sky varies between season and day when the sun goes across the sky. Solar powered devices work best when pointing to the sun or pointing to the sun, so the solar system enhances the effectiveness of tools such as the expense of extra function expenditure. I can change the direct sunlight to electricity using solar cells. Every day, light hits your roof solar panels with photos. Solar panels convert those photons into direct current electrons. The electron flows through the solar panel and into an inverter and other electrical protection devices. Inverter transition current or "AC" power to change the "DC" power. AC Power is used as an electric, your television, computer and toast when plugged into the wall outlet. A Net Energy Meter keeps track of all the energy your solar system produces. You will go back to the electrical grid through any solar energy meter that you do not use simultaneously with the production. On night or cloudy days, when your system does not produce more than your building's needs, you use electricity from the grid as normal. Your utility will give you "net" for a specific billing period and will provide you with the dollar credit for an extended period of time. You can carry your bill credit for one year.

4.5.1 Horizontal axle solar tracker

Within this type of tracking system, a long horizontal tube is mounted on the tube and the sun moves through the day to track the speed of the sun. Since they are not enlightened on toxic arrows, they are not effective during the winter break, but during the spring and summer these tracking systems are very productive when the solar path is high in the sky. High characters in device are less effective. The underlying strength of the structure and simplicity of the basic facilities system. Due to horizontal features, Excel panels can be installed compactly without the panels of the panel, and it is easily accessible to clean. For active devices, multiple panel panels can be used for single control and motor activation.

4.5.2 Vertical axle solar tracker

Regular or height angle tracking. Suitable for high height of tracker with permanent or permanent angle. For this reason, the visible solar path is not particularly high in the high latitudes, but in the summer, long continuous sunlight arrangements with such tracking systems travel through a long arrow and the panel is mounted vertically in a vertical axis.

Figure 4.5. Solar Panel

4.6 Vero board

The main and best strip boards discovered by Vero, there is a range of prototyping boards with Copper Tracks and elements pole with euro card and non-euro card size measurements are observed. The product is available as single- or double-sided copper and bare board without copper.

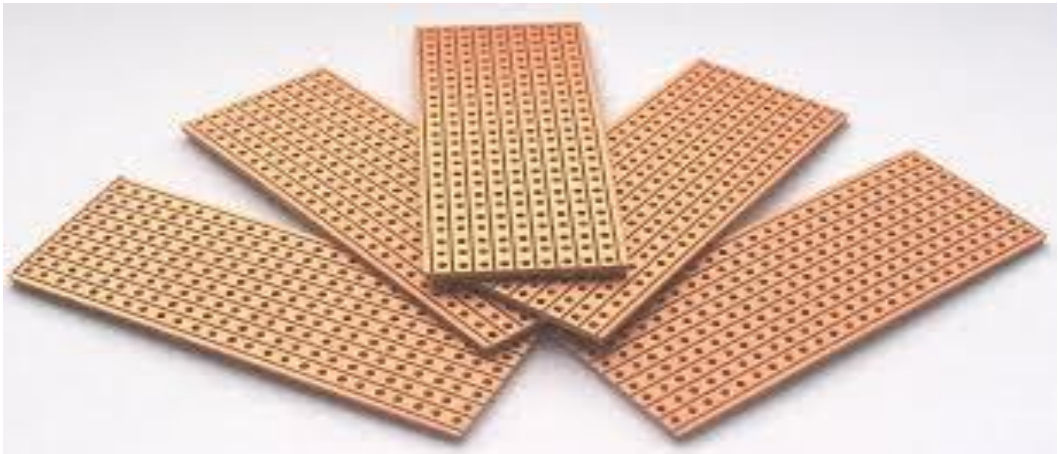

Figure 4.6. Vero board

4.7List of components

Serial No	Parts name
1.	ARDUINO NANO
2.	SERVO MOTOR
3.	DC POIR SUPPLY
4.	VERO BOARD
5.	LDR
6.	RESISTOR
7.	WIRES REQUIRED
8.	BATTERY CONNECTOR
9.	PVC SHEET
10.	GLUE
11.	SOLDERING IRON

Table 4.1: List of components

4.8 Summary

The chapter describes about some important equipment that related to the project. Describes of all equipment like microcontroller, LDR, servo motor, solar panel, resistor, capacitor, Vero board, crystal and also LCD monitor that works properly use for show data read related this project.

CHAPTER 5

DISCUSSIONS

5.1 Introduction

This chapter will present all the results and calculations and relevant discussions.

5.2 Performance Analysis

The system got gotten from LDRs for solar tracking systems and panels
That's a specific position. The results recorded four days record and tabulated, recorded. The output of LDRs is dependent on the light intensity of reducing them on the surfaces. Arduino has a serial that communicates with digital pin 0 (RX) and 1 (TX) as a computer through a computer via USB. Arduino environment can be used to communicate with Arduino board built on serial monitor. To collect the results, a code was written that was possible to collect data from LDR per hour. In the given interim period, the price received from two LDRs will be read and recorded.

5.3 My project

After connect all equipment according to the circuit I had created the body structure following to the other experimental example from the internet. after preparing the body structure and connection of the circuit I prepared a logic program with the help of C++ program by Adriano. After complete the program I uploaded the program to the Microcontroller. Then I interface the software and hardware part. After complete all the program and body with interface I had tried to experiment it is it work or not. I see that my project working perfectly.

My project picture is given below:

Figure 5.1: My project picture.

5.4 My Project work according to the light angle

Our project rotates solar panel according to the sun light rotational angle it can rotate horizontally and vertically with 360 degree. Here one of the pictures of work of this

project work with Light is given below:

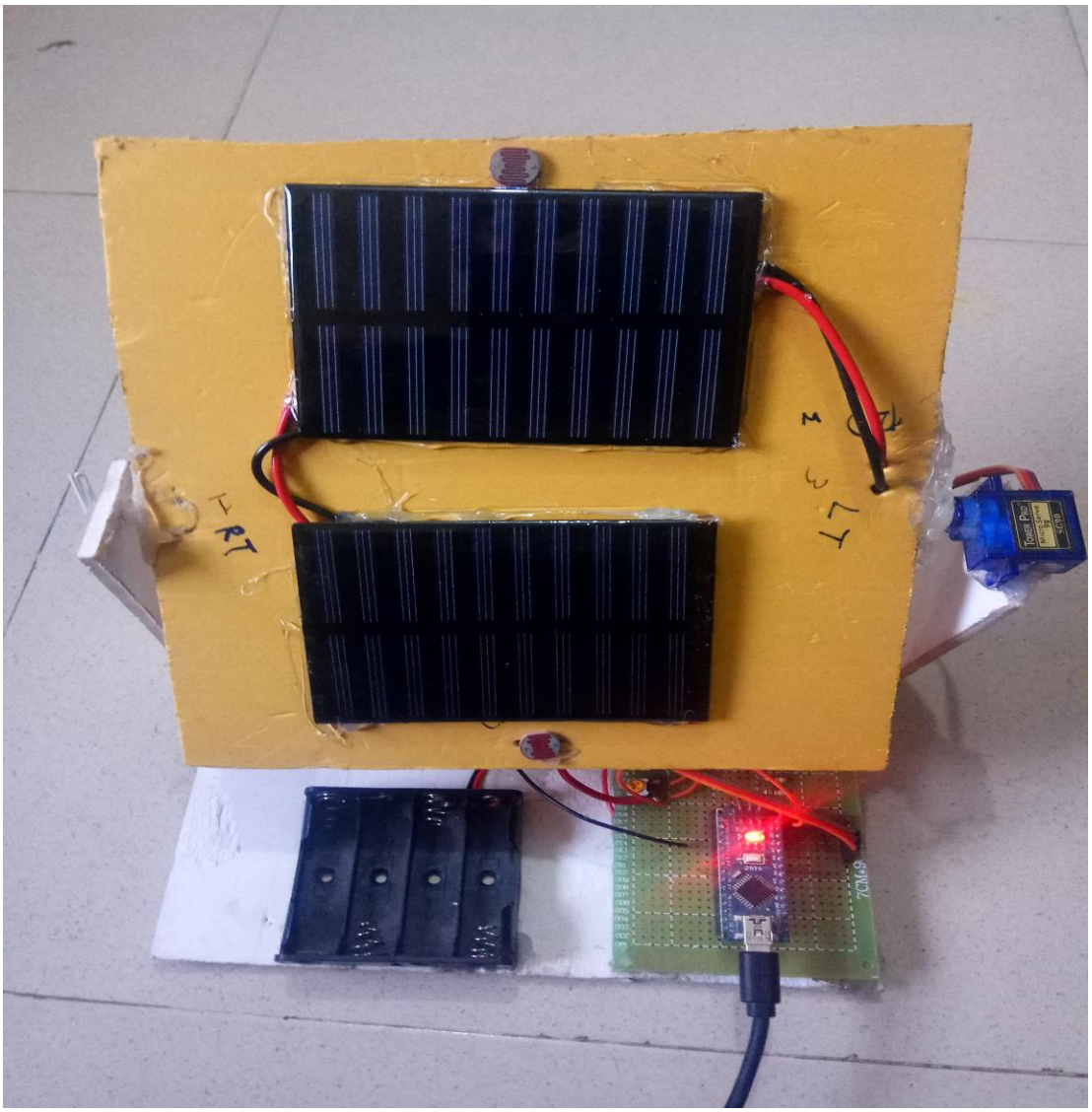

Figure 5.2: Project movement work with light movement

5.5 Discussion

From turning, it is seen that the maximum sunlight happened almost noon,
The maximum value received 1200 hours and 1400 hours. In the morning and late evening, the intensity of the sunlight decreases and the obtained values are obtained in less time. After sunset, the tracking system is closed for energy conservation. It is switching back in the morning.

5.6 Summary

In this chapter has discussed about result and discussion. With our project I became successful to demonstrate with regarding the objectives of the project. At last completing this chapter the project is ready to use.

CHAPTER 6

CONCLUSION

6.1 Conclusions

My project is working perfectly. It was a taste many times. I think my project can help to get people back. It can be used for scientific use, industrial use. A hybrid dual axis solar tracking system is presented in design, implementation, and test research. The performance of the advanced system was compared to the static and continuous dual-axis solar tracking system. This task shows that the hybrid A-axis solar tracking system can assure high power generation compared to static panels, as it is constantly sick of low power consumption compared to one axis solar tracking system.

6.2Limitations of the Work

Mention few limitations or challenges faced in my work. In this project, I have faced few problems as like as

1. Solar trackers are slightly more expensive than their stationary counterparts, due to the more complex technology and moving parts necessary for their operation. Depending on the size and location of the project.
2. Trackers are a more complex system than fixed racking. This means that typically more site preparation is needed, including additional trenching for wiring and some grading.

6.3 Future works

To provide secondary system for power supply, the government is taking various projects to implement solar panels. But for the time being, all the projects are collecting solar energy and preserving them in DC batteries instead of using the power to support an area through the grid.
In many developed countries, the solar array is connected to and with the grid; Energy is distributed around. This technology has not yet come to my country.

Also, those grids are supported by the running arrays of solar panels so that the maximum output can be cropped. But unfortunately, all the panels currently used in my country are all fixed arrays and thus the sun changes its condition. The solar home system imported from the sun tracker from abroad will be even more expensive.
My prototype needs DC sources to work but if it does not get any option for it, it will be very unexpected. So, I have to make this model better so that it can run motor and consumers at the same time without the need for external power supply.
Also, I have been planning to apply the whole system to a larger scale and more efficiently (both in commercial and economic) and looking forward to seeing how effective and useful it is in our country. If my country is in a serious energy crisis and I do not immediately do anything immediately, then it can expect an incredible level emergence. Being a sunny country, I can use this rarely used form of energy for our own benefit.

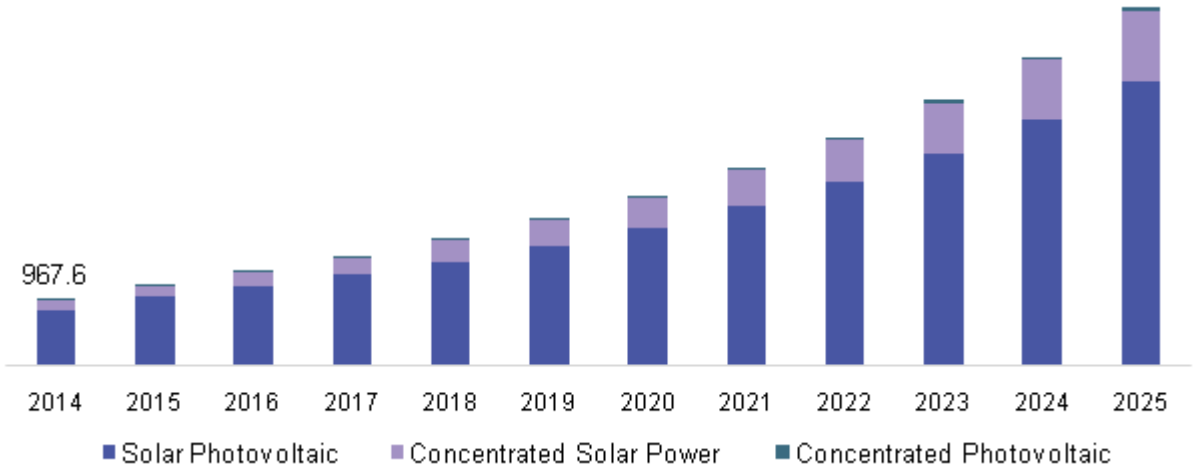

Figure 6.1 Future work

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APPENDIX

Project Code:

```
#include <Servo.h>

#define rdPin A4
#define ldPin A5

#define servoPin A0

Servo myservo;
int pos = 180;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  myservo.attach(servoPin);
  pinMode(rdPin, INPUT);
  pinMode(ldPin, INPUT);
  myservo.write(pos);

}

void servoLd(int posMax){

  for (pos = pos; pos >= posMax; pos -= 1) {
    myservo.write(pos);
    delay(15);
  }
}

void servoRd(int posMax){
```

```
  for (pos = pos; pos <= posMax; pos += 1) {
    myservo.write(pos);
    delay(15);
  }

}

void loop() {

  // put your main code here, to run repeatedly:

  int rdVal = analogRead(rdPin);
  int ldVal = analogRead(ldPin);

  Serial.print(rdVal);
  Serial.print("--");
  Serial.println(ldVal);


  if ((rdVal >= 60 && rdVal <= 69) && (ldVal >=75 && ldVal <=89)){

   if(pos > 120){
     servoLd(120);
   }else{
     servoRd(120);
   }
  }
  else if(rdVal < 50 ){
    if(ldVal > 70){
      servoRd(180);
    }
  }
```

```
  else if(ldVal < 50 ){
    if(rdVal > 60){
      servoLd(80);
    }
  }


  delay(200);


}tracker.write(trackerPos);  //Move the tracker to the Ist
}
}
delay(508);
}
```