IoT Based Solar Tracker System for Maximum Power Gain

BY

Md. Sunzid Alam
ID: 183-15-2260
AND

Md. Mahfuzur Rahman
ID: 183-15-2234

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Tajim Md. Niamat Ullah Akhund
Lecturer
Department of CSE
Daffodil International University

Co-Supervised By

Zakia Sultana
Lecturer
Department of CSE
Daffodil International University

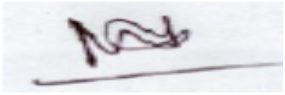
DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

APPROVAL

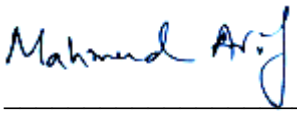
This Project titled IoT Based Solar Tracker System for maximum Power Gain submitted by **Md. Sunzid Alam, ID No: 183-15-2260** and **Md. Mahfuzur Rahman ID No: 183-15-2234** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 19.0.09.2021

BOARD OF EXAMINERS



_____

Dr. Md. Ismail Jabiullah **Internal Examiner**
Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



_____

Arif Mahmud **Internal Examiner**
Assistant Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

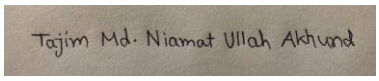
_____

Dr. Mohammad Shorif Uddin **External Examiner**
Professor
Department of Computer Science and Engineering
Jahangirnagar University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Tajim Md. Niamat Ullah Akhund, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

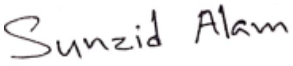


Tajim Md. Niamat Ullah Akhund
Lecturer
Department of CSE
Daffodil International University

Co-Supervised by:

Zakia Sultana
Lecturer
Department of CSE
Daffodil International University

Submitted by:



Md. Sunzid Alam
ID: -183-15-2260
Department of CSE
Daffodil International University

Md. Mahfuzur Rahman
ID: -183-15-2234
Department of CSE
Daffodil International University

ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project/internship successfully

We really grateful and wish our profound our indebtedness to **Supervisor Tajim Md. Niamat Ullah Akhund, Lecturer**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of **"Solar Tracker System"** to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project

We would like to express our heartiest gratitude to **Dr. S.M Aminul Haque**, **Associate Professor & Associate Head,** Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

This research paper discusses the implementation of Solar Panel Orientation Strategy and the implementation of IoT (Internet of Things) for remote monitoring. Solar energy, in abundance, is environmentally friendly and it is a renewable energy. To maximize the efficiency of the solar panel, it is perpendicular to the solar radiation emitted from the sun. This can be achieved by rotating the solar tracker with the sun throughout the day. It is perpendicular to the solar radiation emitted from the sun. This is achieved by rotating the solar tracker all day with the sun. The position of the sun is determined by its direction and angle of elevation. Nowadays the world is moving towards a new technology called the Internet of Things and everything is available on the Internet. This angle information is available on the Internet, which makes this solar tracker precise, easy and perfect for tracking. It can monitor the location of the solar tracker at any time.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

Introduction

1.1 Introduction

Currently, there are more applications to run that use solar energy, so we need a device like this that gives maximum power from the sun. So we need a device like this that gives maximum power from the sun. Solar panels basically take solar energy from the sun to use for protection and convert it into electrical energy. However, if we keep the solar panels fixed in a certain direction, we will not be able to take full advantage of solar energy during the day. Solar panels should rotate with the sun in order to get maximum power output. There are basically two types of solar trackers, one is single axis and the other is dual character tracker. Single axis trackers basically follow the sun from east to west and are at the best angles. Calculations show that the duration of electrical output from a single-axis solar tracker is on average 30 percent higher than that of a solar panel. The dual-axis solar tracker basically detects the position of the sun based on the solar direction of the sun and the angles of the solar altitude. The solar azimuth is measured between the position of an observer and the vertical plane of the sun. However, altitude is measured between the horizon and the center of the sun, and the output is 61.7% higher than on the designated panel.

1.2 Motivation

It is noteworthy that solar energy is an important field that pollutes the environment around the world and we want to make the best use of it to reduce the use of fossil fuels. However, the high initial cost of solar power has limited its widespread use for many poor countries. So, the aim now is to increase solar energy efficiency by reducing higher initial costs. For this reason, the solar tracker system is presented as a solution to the solar system for the best use of incidental solar power. The solar tracker is an automatic control system that directs the absorbing surface directly to the sun.

For PV panels, the solar tracker is considered a complementary system. In other systems, however, they will be useless without solar tracking such as parabolic trot, parabolic dish and central receiver.

1.3 OBJECTIVE

- Our main goal is to achieve maximum use of solar energy through solar panels.
- This project helps the equipment produced through solar energy to get the most automatic solar energy by increasing the efficiency of the system.
- The solar panel will automatically look for the sun from east to west to achieve the maximum intensity of light.

1.4 FEATURES

Solar tracking gives grid operators the opportunity to perfect efficiency from sunlight at all times of the day. Fixed-panels are highly efficient for general-purpose energy collection, but a single-axis or dual-axis solar tracking system can increase the annual output of solar power by about 30 percent. In the future we want to create better communication between these two places - where electricity is being generated and where it is being used. We can help protect the environment for people now and in the future by producing our solar energy. Reducing the amount of fossil fuels requires the generation of electricity in the solar system, which in turn reduces the visibility that contributes to global warming.

1.5 Expected Outcome

• Solar trackers are capable of producing much more electricity than their stationary competitors due to the direct collision of solar rays.

• There are many types of solar trackers such as single axis and dual character solar. Tracker that can help you find the right fit for your more diverse work site. Installation size, local weather messages and electrical requirements s and all the important considerations that can affect the type of solar tracker that works best for you.

• Solar trackers generate approximately the same amount of electricity required for a fixed risk. Which makes them favorable for land use.

• Some utilities in certain states offer a period of use for solar power. Which means a higher rate of electricity generated at the end of the day can be purchased. This shows that it is beneficial to generate a lot of electricity at the top of the day. Using a tracking system can help maximize energy gain during this peak period.

1.6 SOCIAL IMPACT

Solar panels are able to achieve the maximum heat of the sun to generate electricity in our homes and cities due to technological innovations in solar energy. However, solar energy has use of many social benefits. When companies decide to facilitate and manage solar power, the projects help eliminate numerous jobs or unemployment. Increasing the number of jobs created by the development and operation of solar energy panels will result in more people looking for jobs and contributing to the country's economy. Also, solar energy production costs less than burning fossil fuels. Solar energy is a more effective measure than burning fuel in power generation. This is because energy generation from solar panels pollutes the environment very little. Cities or regions that use electricity using solar energy can enjoy clean air in the region, which will result in healthier citizens and workers.

1.7 REPORT LAYOUT

Our main goal is how to get the maximum temperature from the sun using the solar tracker system. In normal solar panels we get the temperature on one side of the sun. But we can achieve maximum temperature from the sun by tracking the solar panels.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Solar energy is an energy that can be identified by the huge potential of transformative inequality energy among the promised renewable energy sources. We need solar energy for our daily life on this earth. Through this we can generate electricity by making maximum use of solar energy. Its maintenance cost is very low and clean silent and reliable with small environmental impact. Solar tracker systems will make us much more economically advanced. With its help we will get uninterrupted electricity service in industries, factories, offices. It will affect our economy. After reading some papers we came to know that the purpose of this chapter is to provide a brief knowledge about solar panel tracker.

2.2 Background study

The authors [1] Solar energy is an energy that can be identified by the huge potential of a transformative inequality energy among the promised renewable energy sources. We need solar energy for our daily life on this earth. Through this we can generate electricity by making maximum use of solar energy. Its maintenance cost is very low and clean silent and reliable with small environmental impact. Solar tracker systems will make us much more economically advanced. With its help we will get uninterrupted electricity service in industries, factories, offices. It will affect our economy. After reading some papers we came to know that the purpose of this chapter is to provide a brief knowledge about solar panel tracker. The authors [2] solar energy management in micro grid using IoT-based reliable controls. Real-time retrieval of logical information from online sources. Offline algorithms will not be able to detect the position of the original sun. Electronic circuit is called maximum PowerPoint Trackers (MPPT) is designed to run PV. In other works, it was proposed to deal with extended conductive algorithms with partial shading conditions (PSC). It basically uses Vera to detect the input voltage and current tone PSC. It has reliable control and internet resource efficiency. IT related things Each device is connected to each other and abstraction is established between them in the cloud infrastructure. The internal PID is linear due to the configuration of the people. This work is basically supported by Butt Flat Blue Sky Recharge. In some sample instances, delays up to 120 MS can be quite large due to network medical control signal delays. Scheme for 18 faculties of engineering and information technology. The authors [3] Monitoring solar power consumption with Ad fruit cloud using The Internet of Things makes our day-to-day activities more easy and comfortable, also saving our time, money and energy/fuel. Generally, a solar panel or

plants are monitoring by human. In this paper they originally proposed an IT-based monitoring system. so that anyone can monitor their plants or solar panels from anywhere of the world. People will can see the current voltage, power supply storage etc. statistics virtually. Few sensors are attached to their proposed system to sense the conditions and Arduino will analyze the data which are received from these sensors about parameters. It also has a Wi-Fi section by which you can connect the mobile. The authors [4] IoT-based dependable control management of solar energy in micro grids: Solar energy age requires effective checking and the board in moving towards advances for net zero energy structures. In this paper they originally proposed an IT-based monitoring system. This paper presents a reliable control framework that relies on the Internet of Things to control and deal with the sustainable nature of energy flows collected by solar-based boards within a micro grid. The sensors around the data for ideal control include weather-related information, as well as regular retrieval from online sources. For framework adaptation to non-critical failure across the entire circulated control framework including various regulators, trustworthy regulators are created to rule and streamline the following exhibition Maximum display of photovoltaic catch sunlight based diffusion and keep up framework strength and dependability continuously in spite of disappointments of at least one repetitive regulators because of an issue with correspondence, equipment or online protection. Test results have been obtained to determine the validity of the proposed method. The authors [5] IoT based dual character solar tracking system. Eco-friendly and a completely renewable energy. There is no internet data available that is cheap for this solar power and accurate for tracking. It's time to monitor the condition of solar trucks from anywhere. There are currently many more applications for running using solar energy So that requires a device gives the most That energy from the sun. Converts solar energy from the sun into electrical energy. the position of the sun is first calculated using mathematical formulas. The position of the sun obtained from GPS and the position of the solar cover can be used for offline calculations. It can be uploaded and monitored on the Internet. Sun plexus web These sensors and experiments are uploaded to the Internet by looking for the position of the sun throughout the day and can be monitored as Internet access at anytime from anywhere. Which shows the risk of solar tracker and which of Azimuth solar tracker. The authors [6] Hybrid energy system using IoT. Power Wi-Fi module is a smartphone whose personal computer and this system uses solar and wind through a website very efficiently. The operation is cheap and flexible. Sourav PV Cell Photovoltaic cells receive light energy from the sun and photovoltaic effects convert it into electricity. In almost all cases photovoltaic cells are used in other systems to increase speed. This windmill is a machine that converts wind energy into wind energy with the help of a rotating blade called a blade. In both circuit making and control to reduce pressure under power source overload. It shows errors and processes when saving and exporting code. Because DC current works on all components. Systems can be used to control the power supply in the home using relays. The authors [7] the main purpose of

this project is using Arduino iot monitoring system through solar truckers. Tackles and follows the most effective technology of systems by improving the efficiency of solar panels. This helps the movement of the system. Solar panels can be further improved to detect sunlight so that maximum power can be collected from the solar panels. There are four light dependent resistors to develop this project. The IoT monitoring system works to store data on such a website. The project has monitored the effectiveness of the Solar Tucker system using Internet of Things. The information from the sensor is converted to analog digital data and to compare the information to the solar position the Arduino UNA must be read directly to the panel in the direction of the sun's rays and produces more. Dual of solar trucks have been successfully developed. The Solar Tucker can make a game changer in our world and it is safer to use because it has no pollution. This research is partly funded by RMC. The authors [8] Renewable power generation has become the biggest attraction in cleaning solar photovoltaic systems. Acquisition of system data and display of smart phone applications. In recent years, solar power has become the world's largest source of environmentally friendly energy. Several factors can contribute to PV-generated motor power. Usually PV systems are located at remote or high locations so, the system is more necessary to ensure an efficient monitoring power supply efficiency. There are some disadvantages to this method such as time consuming and wiring complications. Shows different applications of use in different PV systems. The paper describes how the system is able to measure the current voltage and temperature values of solar TV panels and the intensity of sunlight received by the panels. The proposed monitoring system could be a promising solution for real-time monitoring and intelligent remote monitoring of solar TV systems, the paper said. The authors [9] One of the titles of the present time is the practice of electrical energy and its generation. It is used in a variety of ways, such as in solar systems used in industry and at home, to absorb as much energy as possible from the sun and convert it into electrical energy. More sustainable and environmentally friendly technology can be used only if the advanced technology of this project is used. Electricity is generated by combining photovoltaic cells powered by the sun. The project has K-hybrid designed panels with solar plates on one side and Kipait electric plates on the other. Detects rainwater humidity. We can test the results wherever we are, but we need to have an understanding of the benefits of the Internet. The need for electricity is a part of our daily lives. The authors [10] of all the renewable energy sources, solar energy is the only one that has gained its popularity and importance. We produce a lot of energy through fast solar tracking systems. Makes the efficiency of solar panels much more efficient. And the panel with the sun’s vertical proportional sun rays is lagging behind its efficiency. Realize the cheap alternative to providing high installation charges of economics. This project discusses all about the design and construction process of the prototype of the solar tacking system which has a single room independence. Give direction to the DC motor The solar panel is going to rotate in any way The medium is placed with this solar panel in such a way that the maximum amount

of sunlight can be obtained. Compared to other motors, DC motor is the simplest and most beautiful one and its speed is sufficient. We can program it to change the direction despite the fact that it is only rotating in one direction as far as exceptional programming is concerned. The production of silicon was witnessed by solar cells with 20% efficiency. Types of solar cells are provided with high efficiency but they are very expensive to buy. It can be accessed to increase the efficiency of solar panels. Tracking is being done to meet the stated purpose while reducing costs. Tracking helps expand the panel towards the sun with increased power output. Its dualism can be singular as far as sunlight tracking from the axis is concerned. The duality with other people increases. The authors [11] solar energy has quickly become a very important renewable energy resource. Solar Tacking It will be possible to generate more energy from solar so that the panel can maintain a vertical profile of the subjects. If the sun is the initial cost of installing tracking. The system has a high enough body that over time has been proposed for light dependent resistive detection. Solar panels are where it is able to receive the lightest. As with other motors, servo motors are able to maintain their talk at high speeds. Trackers can be dual and character trackers. Giant tracker tasks are more efficient because they track sunlight from both sides. This project is designed for any power and portable application. Therefore, it is only suitable for use in rural areas. Moreover, its effectiveness increases the output power collected by sunlight. Basically servo motor driving ultraviolet sensors are through these. The authors [12] Here dual axis solar tracker systems are more efficient because they both use sunlight tracker characters. The voltage and current generated are used for other purposes and are monitored by the Things pack app. Light dependent resistor LDR is used to detect sunlight. Solar panels are where it is able to receive the best. Compared to other motors DC motors can increase the efficiency of the output power collected by sunlight and store it in a battery to maintain the governor with their development at a high speed capable. Also all the sensor data is pushed through the caudate using the Wi-Fi modem. Using which the Things pick app users are pushed to the end of the data. This paper basically contains the hardware in the design and implementation of the two-sided cosmos tracking system to increase the efficiency of the solar panels of this proposed system. It is fully automated and ensures minimal maintenance at low cost since it is the most efficient duration of an efficient system. The authors [13] IoT has developed into a separate research center since the development of Internet technology and other communications. IT Center Media optimizes a number of tools such as radio frequency and identifies networks and other smart objects that allow people to easily communicate with all devices connected to the Internet network. Can be controlled and read where there is an internet network. The study used an LDR sensor to control the functionality of the proposed solar system. The results of this study indicate that the value of the voltage generated is much larger than that of the static government as the dynamic solar cell tracker stands. Four LDR sensors have been used to allow the sun to understand the devices as a call output. To maximize sunlight absorption, we need to

study more harmonious relationships and increase the design of the tracker and the power of the motor. The author [14] A sunlight-based structure is a solar photovoltaic-based instrument module and solar heat collection affects the sun. By considering the surroundings, all the strategies can be employed in the powerful control of philosophy and various additional benefits in various research work through maintainable methods. Acts as a victory. Through this we can take on new challenges. Infrastructure and radio frequency detection and sensor network technologies in the object of communication with the machine meet a new challenge. Through this we can derive energy from solar radiation solar panel monitoring module for efficient method. Here the module can be an agreement so it can be worked as a low power consumption project. There are many reasons. And through this, the power problem of remote areas is going to be alleviated a lot. The authors [15] In this study we basically discuss the implementation through ID and the adaptation of the solar panel from any location is remotely monitored. Solar energy is environmentally friendly and it seems that in solar panels it should be perpendicular to the rays emitted from the sun to maximize the efficiency of a fully renewable energy. This is largely due to the fact that the solar tracker rotates with the sun all day, taking in much higher temperatures. Nowadays the world is moving towards progress and through it many new things are being made possible. And internet data can be obtained through this tracking system which is accurate for precise tracking of this solar truck. It can basically monitor the position of the government from anywhere. This proposed solar tracker is reliable and accurate and is able to give maximum yield during the entire operation. With increasing technology, it will be a better competitive solution for solar energy and energy production. In the future we can apply photovoltaic modules for maximum energy extraction from this strategy. The authors [16] In this study we can basically sensing the position of the sun and determine the position at two primary and secondary levels. In the early stages the sensation is transmitted through the earth's relation to the earth and in the second stage it is transmitted through direct sensing to determine the azimuth and altitude as the output. This technology has also been designed on an automated solar tracking system and placed on mechanical structures with advanced gear configurations using light dependent resistors and DC. Based on this, Sun Geometry is implemented through Arduino Controller. This makes the solar tracking system more reliable and efficient. It is the most versatile system as it can be installed anywhere with high power guarantee and can be very profitable. The sensor warns the user if the parameter is above a certain limit. It can be used for remote monitoring and ensures maximum output.

CHAPTER 3

REQUIREMENT ANALYSIS AND METHODOLOGY

3.1 Introduction

This is a research paper used to select strategies and observe the process. Below are some details about this research too. We have used these components to implement our project.

1. Solar panel (6v-12)
2. Arduino
3. LDR
4. Servo Motor
5. Bread board
6. Contacting wires
7. Arduino data cable

In this chapter we will discuss the essential particles of our project. The main part we have used here is servo motor, Adriano, LDR, Solar panel etc. We also use C++ programming language. We will discuss the details of all the tools in detail.

3.2 Solar panel (6v-12)

A solar panel is a device used to absorb and convert sun rays Description: A collection of solar or photovoltaic cells, which are used to generate electricity with a solar panel through photovoltaic effects.

Fig. 3.2 Solar Panel (6v-12)

3.3 Arduino

Arduino is an open source electronics platform based on accessible hardware and software. Arduino is able to read inputs - it sends messages to the sensor - and converts the message to the sensor as output - activates the motor. A variety of microprocessors and controllers are used in Arduino board design. Boards equipped with a set of digital and analog input / output pins can be made on interface various expansion boards and bread boards for other circuits. There is serial communication between the boards. The microcontroller can be programmed using the C and C ++ programming languages, using a standard API known as the "Arduino language".

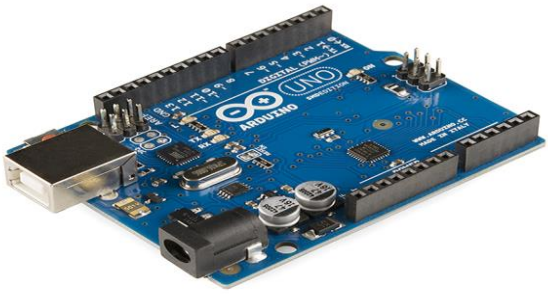


Fig. 3.3 Arduino

3.4 LDR

LDR is a material that is resistant to changes in the intensity of light falling on it. It allows use in light sensitive circuits. This is a simple LDR. The function of LDR is photoconductivity; it is nothing but optical happening. Its conductivity when light is absorbed by the material reduction. Electrons in its valence band when light falls on the LDR material conductor bands interested.

Fig. 3.4 LDR

3.5 Servo Motor

A rotary actuator that allows precise control of the angular position, velocity and acceleration of the servo motor. A sensor is attached to the positioning process and consists of a suitable motor. Servomotor control Speed control and motor position signal based on a response Maximum initial servo loop speed Most servo systems require location control In addition to speed control, control is usually provided by adding a position loop-in cascade or series with a speed loop.

Fig. 3.5 Servo Motor

3.6 Bread board

A breadboard looks like a rectangular plastic board that is very slightly open. These holes allow you to easily adjust electronic components such as batteries, switches, resistors, and electronic components to prototype an LED. The purpose of the breadboard is to quickly connect electricity between the components like resistors, LED, capacitors etc. So that you could be test your circuit permanently first. Breadboard has many small sockets and a few groups of sockets that are electrically connected to each other.

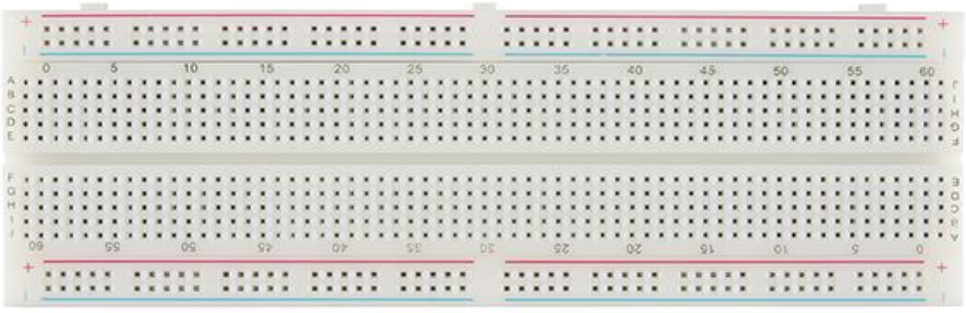


Fig. 3.6 Bread board

3.7 Contacting wires

The connecting wire helps the electric current to travel from one point of the circuit to another because a medium of electricity is needed through which it can be moved. Connecting wires are made of copper or aluminum. A wire metal is an adaptable strand, normally round and hollow fit. Cables are used to establish electrical conductivity between two devices in an electrical circuit. They have insignificant resistance to the current.

Fig. 3.7 Contacting wires

3.8 Arduino data cable

The microcontroller board is based on an Arduino unit. It has 14 digital input output pins that can be used as 6 PWM outputs, 6 analog inputs, 16 MHz ceramic resonator, USB connection, power jack, ICSP header and a reset button.

Fig. 3.8 Arduino data cable

C# programming language: -

We are using C# Programming Language. This programming language will have arduino UNO microcontroller board setup and from there our solar panel system will work.

3.9 System Architecture

In this project we have used some instruments through which we can achieve maximum power of solar. Here we use a battery that supplies power to our Arduino. We will give Arduino power from the battery. And then Arduino will automatically read the data from the LDR sensor to see which side the sun is actually on.

We used two LDR sensors.

Sunlight falls on this LDR sensor.

Or the value of resistance decreases when the sun shines. The more sunlight there is, the lower the value of the resistance. And the lower the light, the higher the value of resistance. Again, when the light does not fall at all, the value of resistance increases a lot. So based on the quality of the resistance, our Arduino can understand which direction the sun is actually giving more heat. The information about the direction of the sun is sent to Arduino. And based on this information, Arduino will operate the servo motor. And following this information, the servo motor rotates the solar panel where the sun's heat is highest.

After all, it is understood that the servo motor will automatically rotate the solar panel where the temperature is higher. So that the solar panel can achieve maximum power. Basically this is how we can achieve maximum power through solar tracker.

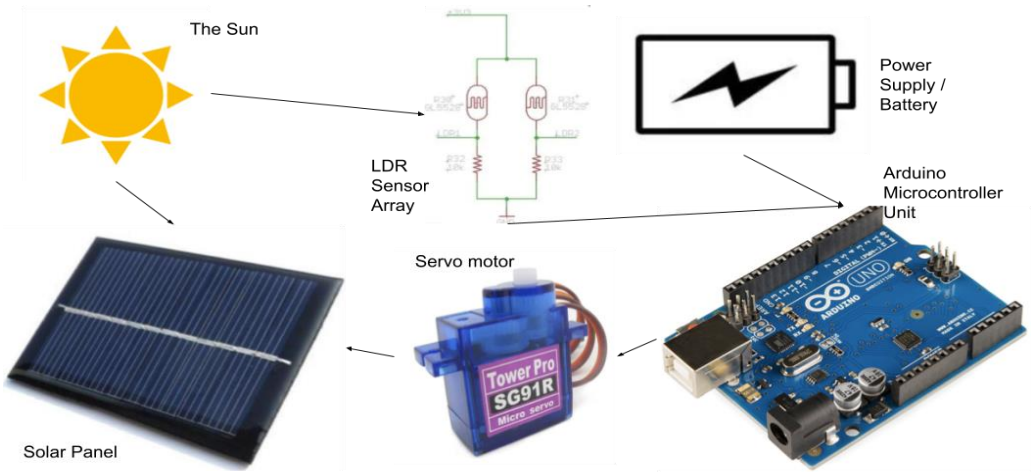


Fig. 3.9 Solar Tracker System Architecture.

3.10 Instruments details

Battery/Power supply

A battery is a power source that consists of one or more electronic chemical cells with external connections to power electrical devices. Here we use a battery that supplies power to our Arduino

Arduino

The open source electronic prototyping platform enables users to create interactive electronic objects. Arduino will automatically read data from the LDR sensor.

LDR Sensor

At the point when the light level reductions, the opposition of the LDR increments. As this resistance increases with the other registers, it also increases the voltage across the LDR. We used two LDR sensors. Sunlight falls on this LDR sensor.

Servo Motor

Able to control any electric motor parameters such as position and speed are called a servo motor. This information based on, Arduino will operate the servo motor. And following this information, the servo motor rotates the solar panel where the sun's heat is highest.

Solar panel

A panel designed to retain the sun's beams as a source of power or warmth energy. The servomotor will automatically turn this solar panel in the direction where the temperature is higher. So that the solar panel can achieve maximum power.

3.11 Algorithm

We are using the algorithm in this solar tracker system which we are using C++ Program Language to control and it will be given Arduino setup and it will control the solar panel. The simplified algorithm of the system is as follows:

Step1 - Start.

Step2 – We will power the Arduino from the battery.

Step3 – The Arduino LDR sensor will read the data.

Step4 – By reading the data, Arduino can understand which way the sun is.

Step5 – After finding out which way the sun is; Arduino will signal the servo motor.

Step6 – The solar panel will follow the servo motor and move in the direction the sun is going.

Step7 – We will achieve the maximum power

Step8 – Again we will go back to step3 and continue to read the data of the LDR sensor and the solar panel will move accordingly.

3.12 Solar Tracker System Hand Flow Chart

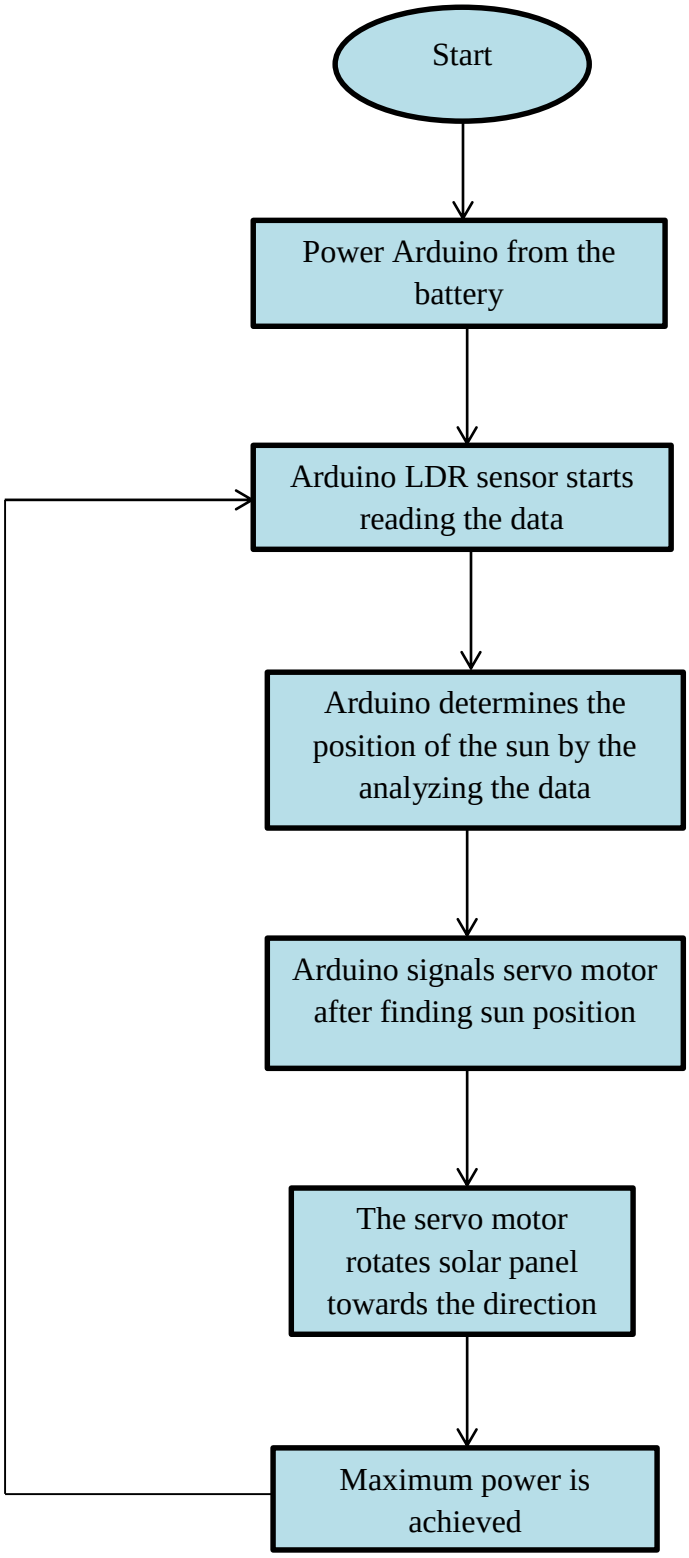


Fig. 3.12 Solar Tracker System Hand Flow Chart

CHAPTER 4

OUTPUT RESULTS ANALYSIS AND DISCUSSION

4.1 Introduction

When we are interested in reading some data from a solar tracker system we conduct an operation based on a specific algorithm. But how can we achieve the highest outcome results number.

4.2 Output Results Analysis

In our experiments, we conducted a total of 2000 tests. 1000 without solar tracker, and 1000 with solar tracker. From the 1000 tests, we have got 90% power gain with the solar tracker. While power gain from 1000 tests without solar tracker is 50%.

During the testing of the solar tracker, we also measured three other factors which are associated with the tracker.

1. Movement of the servo motor
2. LDR sensing
3. Solar Panel Movement (SPM)

Movement of the servo motor observed is 95%. LDR sensing observed is 98%, SPM observed is 92%. We also observed that the solar panel works best when it is facing south. Because this would help most exposure from the sun as it moved from east to west. The peak performance hours observed is between 9a.m till 12p.m. This was when the sun shows its highest illumination. The measurements were taken from a place where there was nothing blocking maximum sunlight from reaching the panel.

Features	outcome
movement of servo	95%
LDR sensing	98%
SPM	92%
PG_with_solar tracker	90%
PG_withOut_solar tracker	50%

Fig. 4.2 Output Results Analysis

4.3 Features Statistical Analysis

In this chapter we will mainly work on result analysis. And we will discuss here how we have succeeded in doing these realistic tasks.

Our first feature here is the Movement of Servo which means we can rotate the servo as much as we can. When we go to work here, we see that after operating the servo motor for a hundred times, we are able to turn the servo motor properly 95 times. The remaining 95 times we were able to rotate the servo motor properly.

Here we have used two LDR sensors to understand where the sun is actually giving more heat to work. Through this Arduino can easily understand where the sun is giving more heat and turning the solar panel in that direction. Here we are working with India sensors. Saw that 98 times LDR within 100 times is able to give data properly.

The next thing we did was to turn the motor solar panel around based on the LDR data. Here we have seen that based on LDR data, our solar panel can rotate 92 times in about 100 times the direction the sun gives higher temperature. And in this work we have succeeded 92 percent in 100 times.

Here we are basically working on whether the LDR sensor can sense the sun properly and whether our solar panel is rotating accordingly. And we've been 92 percent successful from here.

Now the analysis that we will do is normal. If our solar panel was directly facing the sun, then we would get the temperature as much as we could. We would only get the temperature in the east or west. This means that we do not get the maximum fifty percent temperature of the solar panel. But now by using this solar truck, our solar system

automatically rotates in the direction where the sun gives higher temperature. As a result, we can achieve maximum 90% heat. It is understood that it is possible to achieve maximum 90% temperature by using solar trucker instead of using solar trucker.

And we've done realistic research to see how much temperature can be achieved without the use of solar trackers, which shows that we get the temperature on either side of the sun, either east or west. So with the exception of solar trackers, we can't achieve maximum 50 percent of the temperature properly through solar alone.

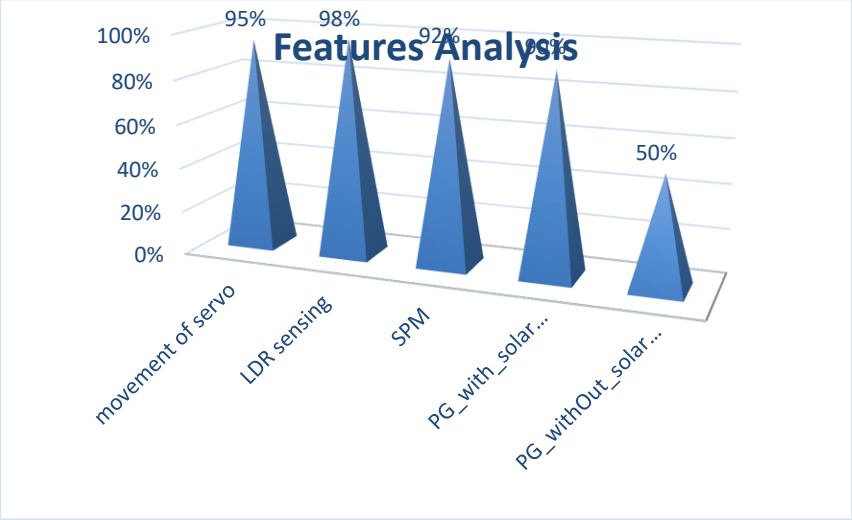


Fig. 4.3 Features Statistical Analysis

4.4 The Output of This project

In this chapter we have shown an output of this project. Through this we have presented the latest work of the project and this is a picture of the output of our project. In this project we have basically tried how solar panels can achieve maximum power and we have succeeded. Using solar tacking systems, solar panels can gain a lot of power from the sun, which can give a very good output. By doing this, the activities of solar panels in Zaire also increased many times more than before. If you use this solar tack in the future, it is possible to reduce a lot of pressure on electricity. There are now many rickshaw-vans in our neighboring countries that use solar panels. With a single solar tacking system, we can do a lot of work with solar panels and we have been able to do that. If we can use solar trekking properly, we will benefit in many ways in the future.

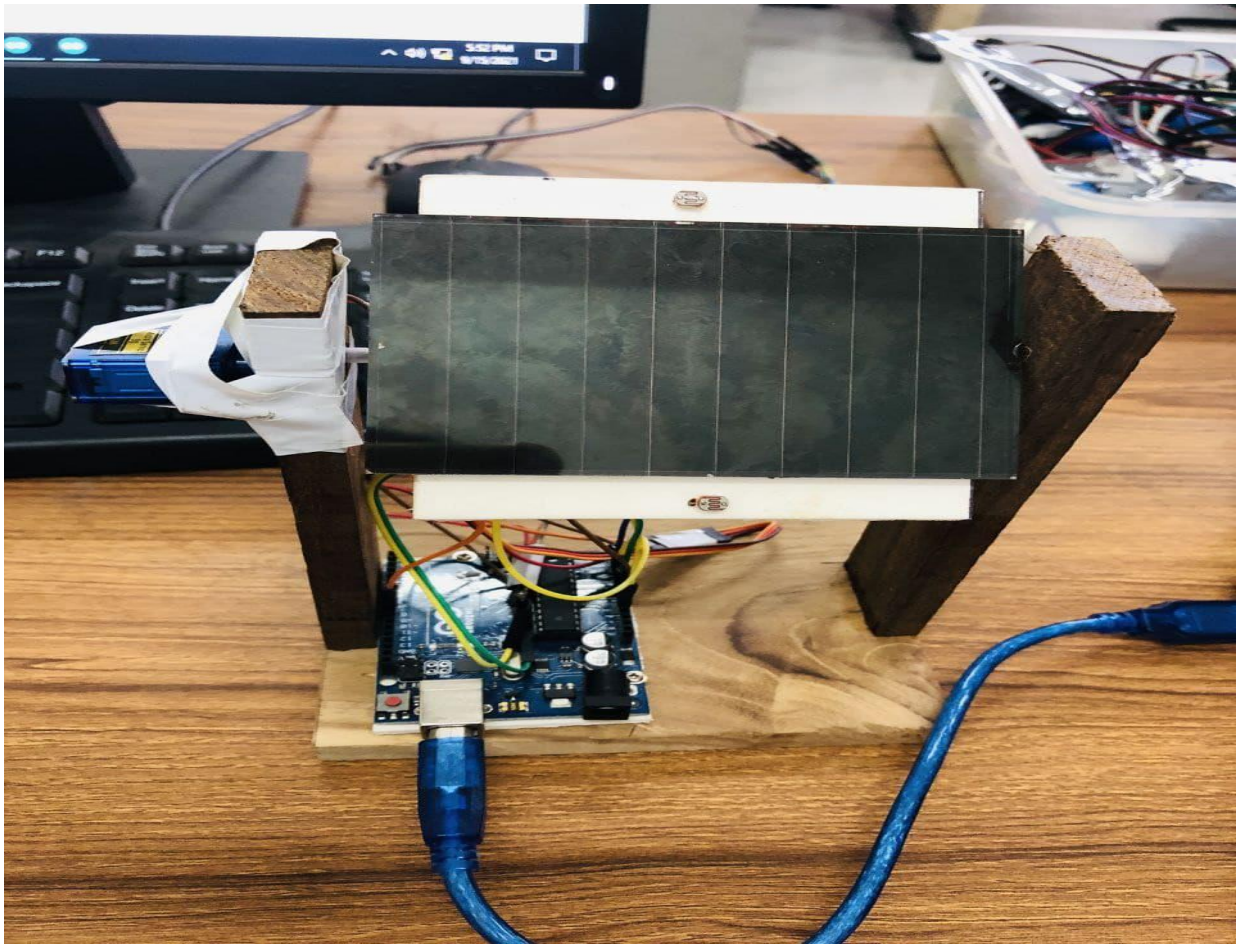


Fig. 4.4 The Output of This project

CHAPTER 5

FUTURE WORK AND CONCLUSION

5.1 Future work

With a route map there is a very easy way to get to the solar industry which shows solar spending by half by 2030. There is already a move toward high-efficiency modules that can produce 1.5 times more energy than similar-sized models today, using a technology called the using tandem silicon cell.

Advances in technology in the coming years will ensure how much solar energy will actually be available to people and at what affordable prices. Will have a positive impact on the environment and climate change.

There are also new production innovations coming down the pipeline that will reduce the amount of expensive materials used to make solar cells, such as silver and silicon.

Another important opening is that we need to recharge on how to better integrate solar into our home business and power systems, which means making greater use of better power electronics and low-cost digital technology.

5.2 Conclusion

In this project we have basically worked on how to get the most out of the sun through solar tracking.

Solar gets heat from one side of the normal sun. But through this tracking, our solar panel will rotate in the direction where the sun will heat up. And as long as the sun gives heat, solar panels can also get heat. Which will be able to achieve maximum heat from the sun. To do this we used some equipment such as batteries, Arduino, LDR sensors, servo motors, solar panels. The battery we used in the beginning gives power to Arduino so that Arduino can work in a dynamic way. Arduino can read data from LDR sensors automatically after receiving power. And understand which side the sun is actually on. In this project we have used two LDR sensors to absorb sunlight. And the more sunlight falls on this LDR sensor, the lower the value of its resistance decreases. And when the light falls less, the value of resistance gradually increases.

So based on the value of resistance, Arduino can actually understand where the sun is giving off more heat and where the sun is located. Through the resistance of this LDR sensor, it sends information to Arduino about where the sun is actually located and based on this information, Arduino operates servo motors. As a result, this servomotor rotates according to the position of the sun and the servomotor rotates automatically in any direction of the sun. And our solar panel key is connected to this servo motor. So that the solar panel rotates wherever the sun is. As a result, the solar panel can achieve the maximum amount of heat throughout the day. Basically this is how we can easily achieve maximum temperature through solar tracker.

REFERENCES

[1] Adhya, S., Saha, D., Das, A., Jana, J. and Saha, H., 2016, January. An IoT based smart solar photovoltaic remote monitoring and control unit. In 2016 2nd international conference on control, instrumentation, energy & communication (CIEC) (pp. 432-436). IEEE.

[2] Phung, M.D., De La Villefromoy, M. and Ha, Q., 2017, August. Management of solar energy in microgrids using IoT-based dependable control. In 2017 20th international conference on electrical machines and systems (ICEMS) (pp. 1-6). IEEE.

[3] Vinodhkumar, R. and John, S., 2020, August. IoT based dual-axis solar tracking system. In IOP Conference Series: Materials Science and Engineering (Vol. 912, No. 3, p. 032024). IOP Publishing.

[4] Ali, M. and Paracha, M.K., 2020. An IoT Based Approach for Monitoring Solar Power Consumption with ADAFRUIT Cloud. Int. J. Eng. Appl. Sci. Technol, 4(9), pp.335-341.

[5] Sritoklin, A., Malee, W., Prugsanantanatorn, A., Sapaklom, T., Ayudhya, P.N.N., Mujjalinvimut, E. and Kunthong, J., 2018, October. A Low Cost, Open-source IoT based 2-axis Active Solar Tracker for Smart Communities. In 2018 International Conference and Utility Exhibition on Green Energy for Sustainable Development (ICUE) (pp. 1-4). IEEE.

[6] Srivastava, P., Bajaj, M. and Rana, A.S., 2018, March. IOT based controlling of hybrid energy system using ESP8266. In 2018 IEEMA Engineer Infinite Conference (eTechNxT) (pp. 1-5). IEEE.

[7] Said, M.N.A.M., Jumaat, S.A. and Jawa, C.R.A., 2020. Dual axis solar tracker with IoT monitoring system using arduino. International Journal of Power Electronics and Drive System (IJPEDS), (1), pp.451-458.

[8] Priharti, W., Rosmawati, A.F.K. and Wibawa, I.P.D., 2019, November. IoT based photovoltaic monitoring system application. In Journal of Physics: Conference Series (Vol. 1367, No. 1, p. 012069). IOP Publishing.

[9] Shaikh, S.A., Ali, M., Ali, R., Memon, S.H. and Khan, N., 2020. Design of Solar Tracking System Using Piezoelectric Effect for Multi-Power Generation Based on IoT. International Journal of Electrical Engineering & Emerging Technology, 3(2), pp.30-33.

[10] TRICAHYONO, R.W. and Kholis, N., 2018. Sistem monitoring intensitas cahaya dan daya pada dual axis solar tracking system berbasis IoT. Jurnal Teknik Elektro, 7(3).

[11] Sarker, M. M., Shah, M. A. I., Akhund, T. M. N. U., & Uddin, M. S. (2016). An approach of automated electronic voting management system for bangladesh using biometric fingerprint. International Journal of Advanced Engineering Research and Science, 3(11), 236907.

[12] Satu, M. S., Howlader, K. C., Akhund, T. M. N. U., Huq, F., Quinn, J. M., & Moni, M. A. (2018). Bioinformatics Approach to Identify Diseasome and Co-morbidities Effect of Mitochondrial Dysfunctions on the Progression of Neurological Disorders. bioRxiv, 483065.

[13] Sarker, M. M., & Akhund, T. M. N. U. The roadmap to the electronic voting system development: a literature review. International Journal of Advanced Engineering, Management and Science, 2(5), 239465.

[14] Satu, M. S., Howlader, K. C., Akhund, T. M. N. U., Quinn, J. M., & Moni, M. A. (2019, December). Comorbidity effects of mitochondrial dysfunction to the progression

of neurological disorders: insights from a systems biomedicine perspective. In 2019 22nd international conference on computer and information technology (ICCIT) (pp. 1-7). IEEE.

[15] Akhund, T. M. N. U., Mahi, M. J. N., Tanvir, A. H., Mahmud, M., & Kaiser, M. S. (2018, December). ADEPTNESS: Alzheimer's disease patient management system using pervasive sensors-early prototype and preliminary results. In International Conference on Brain Informatics (pp. 413-422). Springer, Cham.

[16] Akhund, T. M. N. U., Jyoty, W. B., Siddik, M. A. B., Newaz, N. T., Al Wahid, S. A., & Sarker, M. M. (2020, July). IoT Based Low-Cost Robotic Agent Design for Disabled and Covid-19 Virus Affected People. In 2020 Fourth World Conference on Smart Trends in Systems, Security and Sustainability (WorldS4) (pp. 23-26). IEEE.

[17] Akhund, T. M. N. U., Siddik, M. A. B., Hossain, M. R., Rahman, M. M., Newaz, N. T., & Saifuzzaman, M. (2020, June). IoT Waiter Bot: A Low Cost IoT based Multi Functioned Robot for Restaurants. In 2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)(ICRITO) (pp. 1174-1178). IEEE.

[18] Akhund, T. M. N. U., Newaz, N. T., & Hossain, M. R. (2020). Low-Cost Remote Sensing IoT based Smartphone Controlled Robot for Virus Affected People.

[19] Akhund, T. M. N. U., Snigdha, S. R., Reza, M. S., Newaz, N. T., Saifuzzaman, M., & Rashel, M. R. (2020, May). Self-powered IoT-Based Design for Multi-purpose Smart Poultry Farm. In International Conference on Information and Communication Technology for Intelligent Systems (pp. 43-51). Springer, Singapore.

[20] Hasan, M. A., & Akhund, T. M. N. U. An approach to Create IOT based Automated Smart Farming System for Paddy Cultivation.

[21] Akhund, T. M. N. U. Study and Implementation of Multi-Purpose IoT Nurse-BoT.

[22] Akhund, T. M. N. U., Sagar, I. A., & Sarker, M. M. Remote Temperature Sensing Line Following Robot with Bluetooth Data Sending Capability.

[23] Satu, M. S., Akhund, T. M. N. U., & Yousuf, M. A. (2017). Online Shopping Management System with Customer Multi-Language Supported Query handling AIML Chatbot. Institute of Information Technology, Jahangirnagar University.

[24] Akhund, T. M. N. U., & Rahman, M. H. Bat banisher: An approach to create a high frequency ultrasound system to protect agricultural field from bats (Doctoral dissertation, PhD thesis, Sep. 16, 2019. doi: 10.13140/RG. 2.2. 27643.67362).

[25] Akhund, T. M. N. U. Remote sensing IoT based android controlled robot. Methodology, 9(11).