AUTOMATIC SOLAR TRACKING SYSTEM

A PROJECT REPORT ON

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Submitted By

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under the esteemed guidance of

Mrs. P M Laghima

Assistant Professor

Electronics & Communication Engineering

JULY 2022

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In partial fulfilment of the requirements for the award of the degree

of
Bachelor of Technology
in
Electronics Communication Engineering
of

APJ Abdul Kalam Technological University

JULY 2022

Department Electronics and Communication Engineering
College of Engineering, Pallippuram P O, Cherthala,
Alappuzha Pin: 688541

DECLARATION

We undersigned hereby declare that the project report "**Automatic Solar Tracking System**", submitted for partial fulfilment of the requirements for the award of degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by us under supervision of **Mrs. P M Laghima**. This submission represents our ideas inour own words and where ideas or words of others have been included, We have adequately and accurately cited and referenced the original sources. We also declare that we have adheredto ethics of academic honesty and integrity and have not misrepresented or fabricated any dataor idea or fact or source in our submission. We understand that any violation of the above willbe a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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C E R T I F I C A T E

This is to certify that, the project report titled **AUTOMATIC SOLAR TRACKING SYSTEM** is a bonafide record of the **ECD334 PROJECT** presented by **ASHISH SEBASTIAN** (CEC19EC010), **ANAKHA JAYAN** (LCEC19EC025), **HARIDAS V N** (LCEC19EC026), **KARTHIK P** (LCEC19EC027), Sixth Semester B. Tech. Electronics & Communication Engineering students, under our guidance and supervision, in partial fulfilment of the requirements for the award of the degree, **B. Tech. Electronics & Communication Engineering** of **APJ Abdul Kalam Technological University.**

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Mrs. P M Laghima	**Mrs. P M Laghima**	**Mr. Ashok Kumar T**
Assistant Professor	Assistant Professor	Assistant Professor
ECE	ECE	ECE

Content

ACKNOWLEDGEMENT

This work would not have been possible without the support of many people. First and the foremost, we give thanks to Almighty God who gave us the inner strength, resource and ability to complete our project successfully.

We would like to thank **Dr. Vinu Thomas**, The Principal, who has provided with the best facilities and atmosphere for the project completion and presentation. We would also like to thank HoD **Mr. Ashok Kumar T** (Assistant Professor, Electronics and Communication Engineering), our project guide and coordinator **Mrs. Laghima P M** (Assistant Professor, Electronics and Communication Engineering) for the help extended and also for the encouragement and support given to us while doing the project.

We would like to thank our dear friends and faculties for extending their cooperation and encouragement throughout the project work, without which we would never have completed the project this well. Thank you all for your love and also for being very understanding.

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ABSTRACT

Solar panel has been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a stand-alone system or as a large solar system that is connected to the electricity grids. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of the sun's location and positioning of the solar panel are important. The goal of this project is to design an automatic tracking system, which can locate position of the sun. The tracking system will move the solar panel so that it is positioned perpendicular to the sun for maximum energy conversion at all time. Photoresistors will be used as sensors in this system. The system will consist of light sensing system, Arduino UNO, Servo motor, and a solar panel. This prototype generated much better efficiency in conversion of solar energy.

Keywords : *Solar panel, Arduino UNO, Servo motor, Photoresistors*

List of Figures

Chapter 1

INTRODUCTION

1.1 Introduction About the Project

Nowadays, Solar energy is considered to be the future of renewable energy source. The main reason for this is the environmental climate change caused by the excessive use of non-renewable energy sources. This resulted in the formation of clouds of dust and smoke on outer hemisphere this phenomenon is known as greenhouse effect and this causes rapid increase in the temperature of earth surface, we call it global warming. This condition is most suitable for solar power generation. We all know that the solar sell works on the intensity of sunlight. When sunlight intensity increases gradually the solar cells absorbs more energy, thus more gets converted to electrical energy. But still there are some drawbacks in the existing system. The solar panels are stationary but the sun is not, due to the rotation of the sun. This problem results in decrease of their efficiency. Thus to obtain a constant output, an automated system is required which should be capable of rotate solar panel to obtain maximum sunlight.

The Automatic Solar Tracking System have a rotating solar panel that makes it different from conventional solar power generation system. The main components in automatic solar tracking system is the Photoresistor (LDR), the servo motor and Arduino UNO. The LDRs are placed on the both sides of panel.

When the solar energy falls on the Solar panel, the LDRs placed on the panel sense light intensity and gives the data to the Arduino. With the help of data obtained the program is executed in the Arduino and then servo motor works accordingly. The servo motor rotates the solar panel to certain angle which the panel can absorb maximum amount of solar energy from the sun. Further process is same as that of conventional solar power generation system.These rotating panel helps to get maximum intensity light thorough the day and thus the efficiency in producing electrical energy is much more than the conventional system. The implementation is easy and can be placed anywhere in the surface to obtain maximum output.

1.2 Aim of the Project

- To consume maximum solar energy
- To attain maximum efficiency in electrical energy production by maximum utilization of the solar energy.
- A system which can constantly produce electricity without collapsing the ecosystem and also to reduce environmental pollution.

Chapter 2

LITERATURE SURVEY

2.1 Different methodologies reviewed

This paper [1] describes the complete design and construction of a microcontroller based automatic solar panel tracking system. The solar panel track sun light based on its intensity. The System architecture made up of a LDR sensor senses maximum solar power which is being given to the Arduino which digitizes the LDR output. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum. Due to rotation of earth, panels can't maintain their positionalways in front of sun. An automated system is required which should be capable to constantly rotate solar panel. A unique feature of this system is that instead of taking the earth as its reference, it takes sun as a guidance.

This paper [2] explain about the effects of global warming and how can we take advantage from this effect like how the Solar energy is used for electrical energy generation. Solar tracking System is based on AVR microcontroller, which is a brain of the complete system. This controller will monitor and control the intensity and rotation respectively. This system is more cost effective and efficient. System installation is easy. But the trackers are complex than the fixed solar systems.

This paper [3] includes a solar array, solar frame and two actuators, and also it is a dual-axis solar tracker capable in extreme weather conditions.it has mechanically linked solar trackers ina large configuration of solar array, so that they can operate in unison way. This solar observethe radiation and send to the photovoltaic cell to convert the power from AC to DC. And it as a moveable technology of solar panels to expose with sun throughout the day.

This paper [4] describe that the targets to reduce carbon emission and to secure energy supply. It measures a change in the energy supply system leading to smart grids for the required innovation. The key feature in the smart grid application is the demand side service offered to designated parties by smart-automation system. And also the fundamentals on research of smart home energy management system and shows the idea of its utilization for demand side management and simulation experiment of low voltage grid with distributed sources.

2.2 Modification Done

In this project, rather than the pre-existed system, we have introduced a switch and battery charge level indicator with 4 different colour LED's (Red, Yellow, Blue and Green). The switch is for the ON/OFF of the charging of battery. If we want to charge the battery then we ON the switch. When the switch is in the ON position the charging gets started and get charged until the switch is OFF. By this we can turn switch OFF when battery is completely charged. This helps to avoid the over-charging of battery and also it gives more life span to battery.

Another added part is Battery level indicator with 4 different colour LED's (Red, Yellow, Blue & Green). These areused for the indication of battery charge levels. Each represents percentage of battery charge. When only red light is shown, it's battery is low that is it has only 25 percentage or below of battery charge. Red and yellow shows it has 50 percentage likewise Red, yellow and blue shows 75 percentage of Battery charge. When all the 4 LED's gets lit up, the battery completed its charging. This system helps us to understand the percentage of battery charge and we can avoid over charging of battery.

Chapter 3

DESIGN

3.1 Design Descriptions

3.1.1 Block diagram

The system is Arduino based variable and compactable system with single axis solar tracking system. The Arduino receives the data from the two LDR sensors based on the data received, the solar panel is rotate to the position where maximum amount of solar energy can be consumed with the help of servo motor.The battery is used to store the electricity produced from the solar panel. This stored energy can be used for the working of this system.

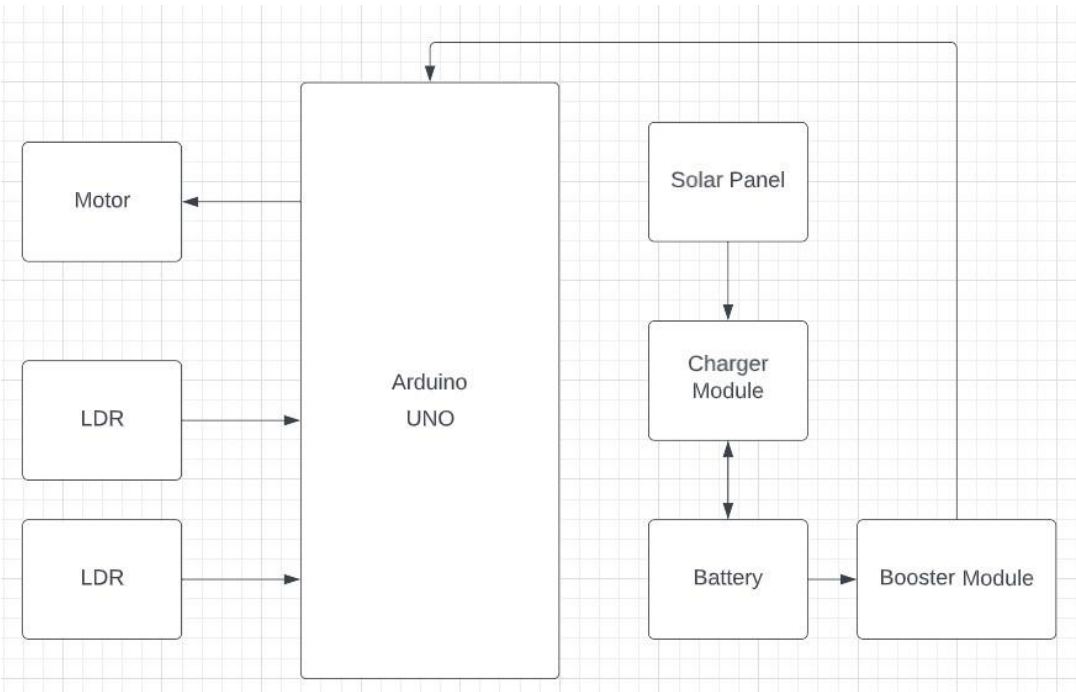

Fig 3.1 Block Diagram

3.1.2 Flow Chart

Firstly, the whole system initialize. The intensity of the light is calculated using LDRs. The obtained value is send to Arduino. The movement of solar panel is based on the values read in the LDR. The difference between the value obtained from those two LDR and compared. If the difference between the values is lesser than a given sensitivity value, there is no need for the panel to rotate. Or if the measured difference between the set of sensors is greater than the sensitivity value, then check which value obtained from LDR is greater. If the value obtained from first LDR is greater then the panel rotate to clockwise direction. Otherwise panel rotates in counter clockwise direction. The Arduino drives the servo motors according to the data obtained.

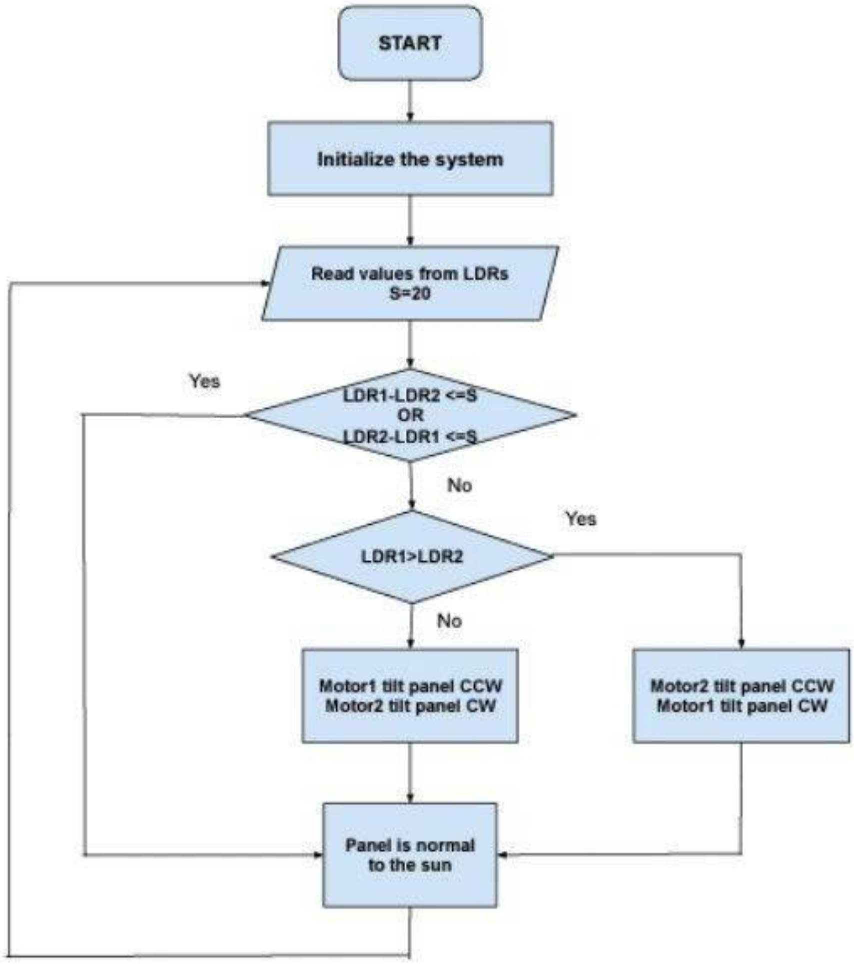

Fig 3.2 Flow chart

3.1.3 Circuit Diagram

In this circuit diagram, there are three parts in the control systems; LDR sensor, Arduino and servo motor. The light sensor composed the fixed resistor and light dependent resistor. Supply voltage is 5V and the voltage of LDR cannot be connected directly to the controller. So voltage divider method is applied to read the voltage of the LDR. The LDR sense the sunlight and send the data to the microcontroller. The microcontroller drives the servo motor to change the direction depend upon the light intensity. The solar panel tracks the sunlight to have the maximum power. The charge controlleris used to control the voltage charging to the battery.

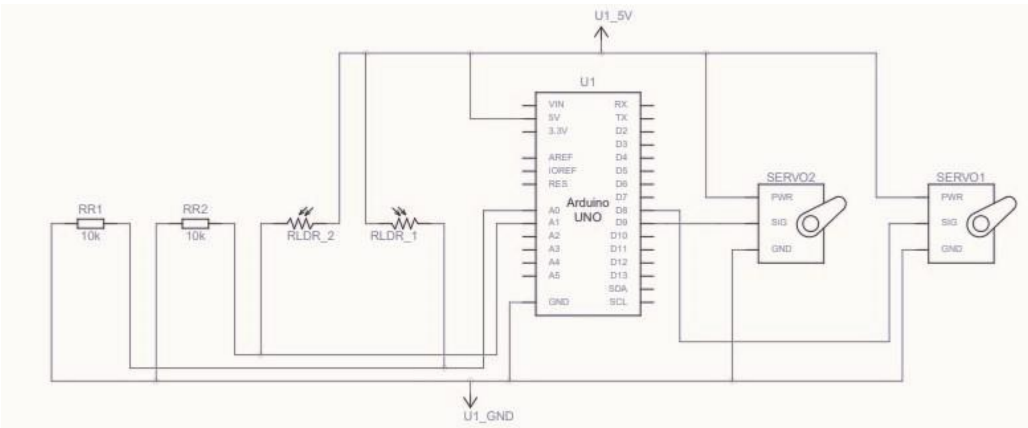

Fig 3.3 Circuit Diagram

3.1.4 Battery Level Indicator

Battery Level Indicator indicates the status other battery just by glowing the LED’s. It uses four different colour LED’s (Red, Yellow, Blue & Green), Resistors and Diodes. The input is given as the present charge in the battery and LED’s will glow according to the input. The battery level indicator consists of very less component and thus occupies a very less space.

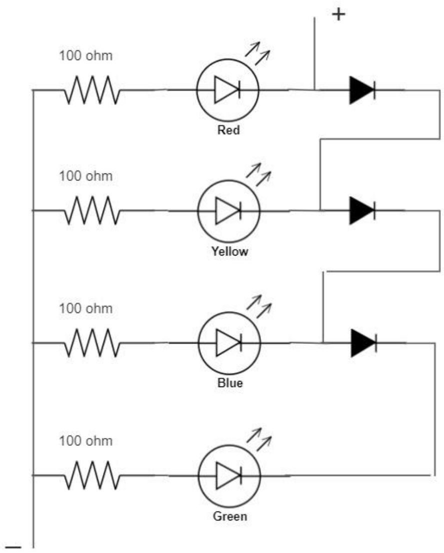

Fig 3.4 Circuit Diagram of Battery Level Indicator

3.2 Component List

3.2.1 LDR Sensor

A photo resistor or light-dependent resistor (LDR) are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. It is one type of resistors whose resistance varies depending on the amount of light falling on it’s surface. It exhibits photoconductivity.

The light sensor composed of a fixed resistor and light dependent resistor(LDR). The LDR cannot be connected directly to the microcontroller. The voltage divider method is applied to read the voltage of LDR.

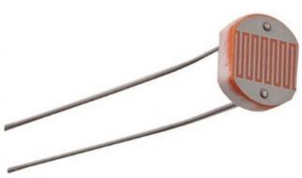

Fig 3.5 LDR Sensor

3.2.2 Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. The Arduino Uno has a number of facilities for communicating with a computer. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board.
As Arduino UNO is based on ATmega328P Microcontroller, the technical specifications of Arduino UNO are mostly related to the ATmega328P MCU.
A brief overview about some important specifications of Arduino UNO.

MCU	ATmega328P
Architecture	AVR
Operating Voltage	5V
Input Voltage	6V – 20V (limit) 7V – 12V (recommended)
Clock Speed	16 MHz
Flash Memory	32 KB (2 KB of this used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Digital IO Pins	24 (of which 6 can produce PWM)
Analog Input Pins	6

MCU i.e., ATmega328P, used on the Arduino UNO Board. There are three different memories available in ATmega328P. They are:

- 32 KB of Flash Memory
- KB of SRAM
- 1 KB of EEPROM
- 0.5 KB of the Flash Memory is used by the bootloader code.

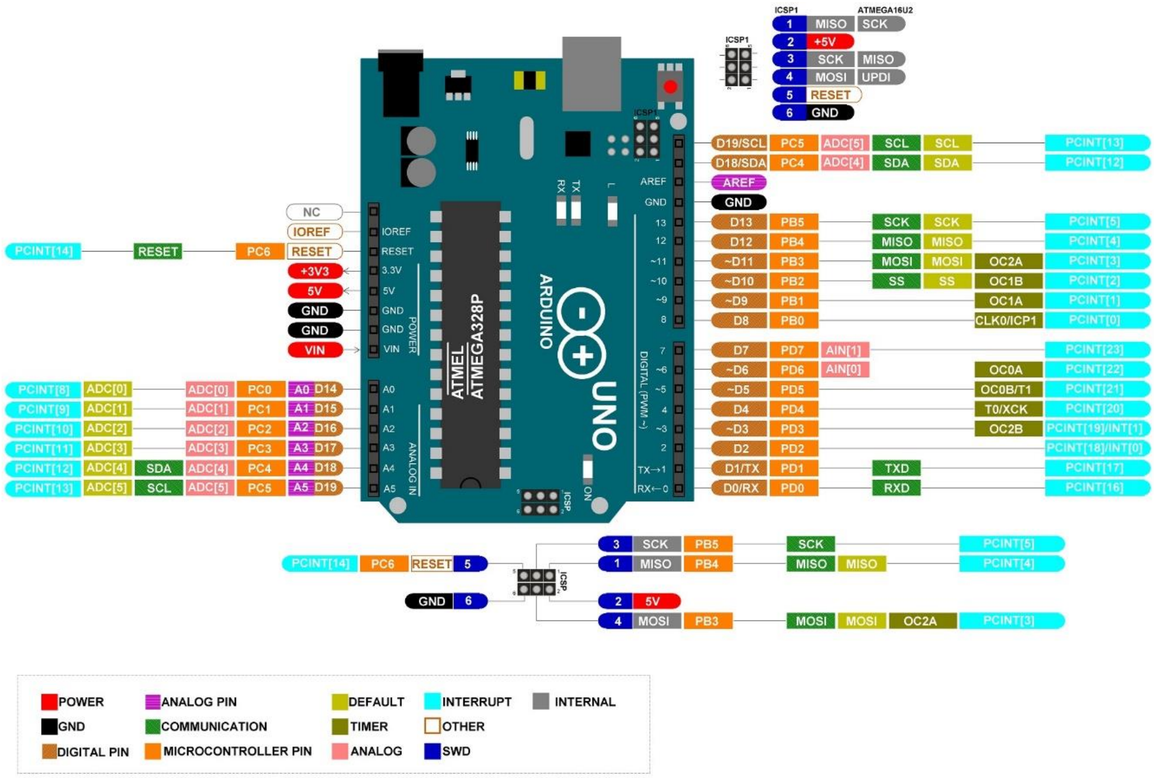

Fig 3.6 Arduino UNO

3.2.3 Servo Motor

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision.

Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the board. The signal pin is typically yellow or orange and should be connected to PWM pin on the board.

Fig 3.7 Servo Motor

3.2.4 LiPo Battery Charger Module

TP4056 is a Li-Ion charging and discharging module with a microUSB port. The module protects the lithium-ion battery to overcharge and over-discharge. It is a complete constant voltage/current linear charger of a single cell. It monitors the cell during charging and discharging and after a critical value, it disconnects the circuit.

Features

- Onboard charging indication
- Red light: charging
- Greenlight: fully charged
- Mini USB interface
- Adjustable charging current
- 1% linear charging method
- Suitable for single 3.7V and 18650 cell

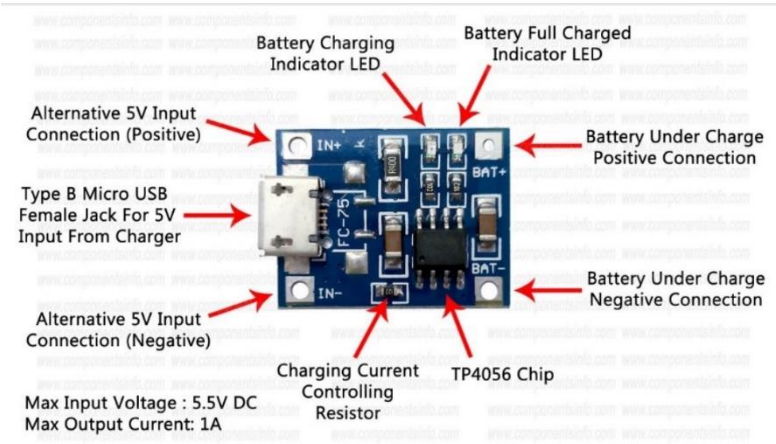

Fig 3.8 LiPo Battery Module

3.2.5 Switch

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another.

Fig 3.9 Switch

3.2.6 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines etc.

Fig 3.10 Resistor

3.2.7 PCB Board

A printed circuit board (PCB; also printed wiring board or PWB) is a medium used in electrical and electronic engineering to connect electronic components to one another in a controlled manner.

3.2.7 Battery

The 18650 battery is a model of rechargeable battery of lithium of 3.7 volts. These rechargeable batteries are very similar to AA batteries but a little bit bigger size. These 18650 batteries also called Li-ion batteries.

3.2.8 Solar Panel

A solar cell panel, solar electric panel, photo-voltaic (PV) module or solar panel is an assembly of photo-voltaic cells mounted in a framework for generating energy. Solar panels use sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array. Arrays of a photovoltaic system supply solar electricity to electrical equipment. Depending on the type of panel, 5 to 19 % of the light energy can be converted into electricity. As the technology is constantly being improved, the output should increase further. Using solar panels you can convert sunlight, which is free and inexhaustible, into electricity. This conversion is achieved thanks to the so-called “semiconductor” material from which each solar cell is made. A solar panel generates direct current. To be able to use this current in the home or place the surplus on the grid, it has to be converted to alternating current of 230 V. This is done by the converter,which is integrated into the electrical circuit close to the solar panels.

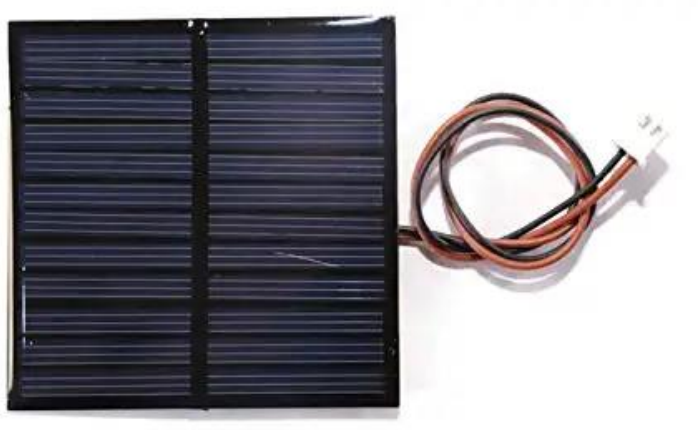

Fig 3.11 Solar Panel

3.2.9 USB DC 3.7V to DC 5V step up boost module

This is DC-DC Boost Module (3.7V~5V) to 5V 600mA USB Step-up Board 5V Output. Great Step-up Module with 3.7-5V input, output 5V for many digital devices, so this is really a great module for designing a portable charger. Useful for your USB charger projects and onboard USB device supply solutions. (ie. GoPro cameras)

You can supply it with single-cell LiPO or an AA size batter or others. Two AA batteries can output a current of 500 ~ 600mA, a single AA battery power supply can output 200mA current supply, great for mobile phones camera, single-chip, digital products supply.

The module adopts a high-performance imported chip, performance is superior to the common module. Work with indicator light. Take the USB female, a wide range of Uses. A single AA battery power supply can output a current up to 200~300 ma. Work from battery voltage as low as 3.7V, allowing you to maximize battery use. If your USB device is critical on 5V operation you can use this module.

Fig 3.12 USB DC 3.7V to DC 5V step up boost module

3.2.10 Estimated Cost

Based on the cost of component we have estimated the cost of our project this figure may vary since the project is not complete.

COMPONENT	USAGE	PRICE
LDR Sensor	Light Sensor	Rs. 14/- (2 nos.)
Arduino UNO R3	Main Part	Rs. 499/-
Servo Motor	Rotation of panel	Rs. 350/- (2 nos.)
TP4056 Li-ion Lithium Battery Charging Module	Charging Module	Rs. 375/-
Switch	Power Controller	Rs. 5/-
Resistor	Electrical Resistance	Rs. 2/- (2 nos.)
PCB Board	Conductive board	Rs. 15/-
Lithium-ion 18650 rechargeable cell 3.7V	Power Source	Rs. 10/-
18650 Cell Holder	Holding cell	Rs. 40/-
Diode IN4007	Electric Switch	Rs. 12/- (3 nos.)
Solar Panel	Sunlight Receiver	Rs. 175/-
USB DC 3.7V to DC 5V step up boost module	DC Booster	Rs. 100/-
LED’s	Indication	Rs. 4/- (4 nos.)

Fig 3.13 Estimated Cost

3.3 Working of Project

The overall circuit diagram is illustrated. There are three parts in the control systems; LDR sensor, microcontroller and servo motor. The LDR sense the sunlight and send the data to the microcontroller. The microcontroller drives the servo motor to change the direction depend upon the value difference on LDR sensors. The solar panel tracks the sunlight to have the maximum power. The charge controller is used to control the voltage charging to the battery.

Case 1: Sun is in the left side

Light on LDR1 is high because the position of the sun is near to LDR2 so solar panel moves anti-clockwise.

Fig 3.14 Anti Clockwise Rotation of Panel

Case 2: Sun is in the right side

Light on LDR2 is high because the position of the sun is near to LDR1 so the solar panel move clockwise.

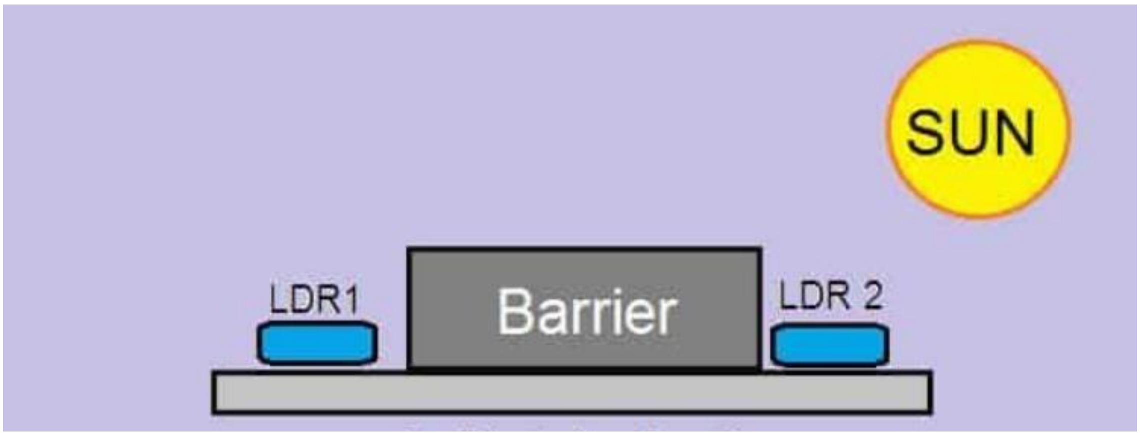

Fig 3.15 Clockwise Rotation of Panel

Case 3: Sun in the centre

Light on both LDRs are equal because position of the sun is perpendicular to the panel, so the panel will not rotate in any direction.

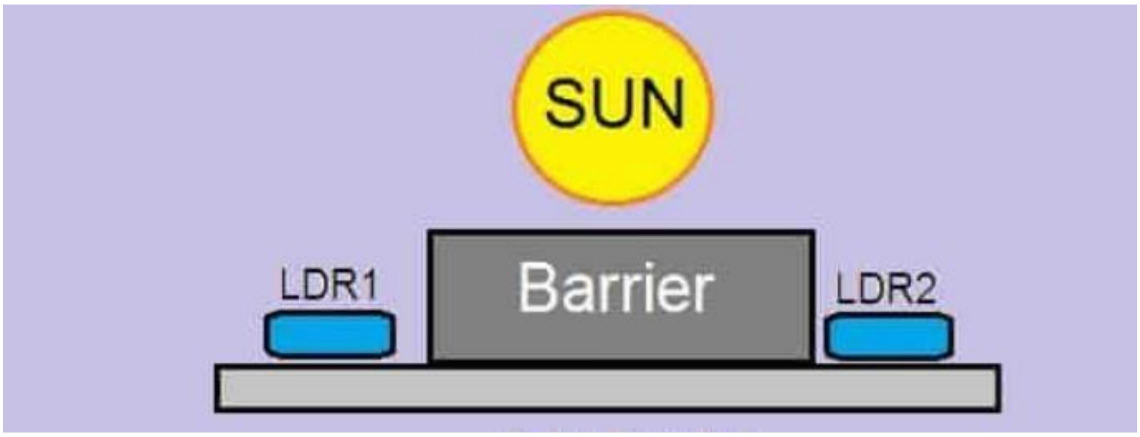

Fig 3.16 No Rotation of Panel

3.4 Simulation and Compiling

To simulate and compile the code, Arduino Integrated Development Environment or Arduino IDE is software is used. The figure below shows the succeeded test result of the compiled code.

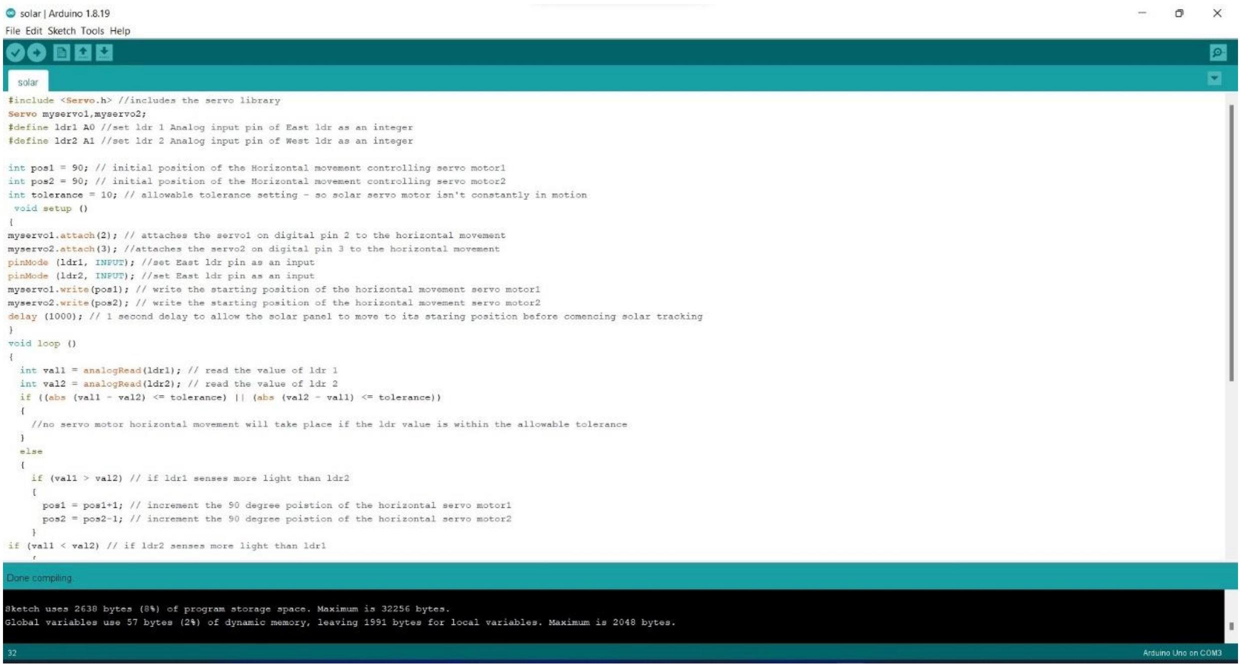

Fig 3.17 Test result of Compiled Code

The simulation of circuit is done in Tinkercad. Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. The circuit is designed in the Tinkercad and the program is added. The figures given below shows before and after the simulation of circuit. Circuit can be tested by starting simulation. Here the value of LDR's can be changed, according to the difference in the LDR value as a result both Servo motors rotates and the result is observed.

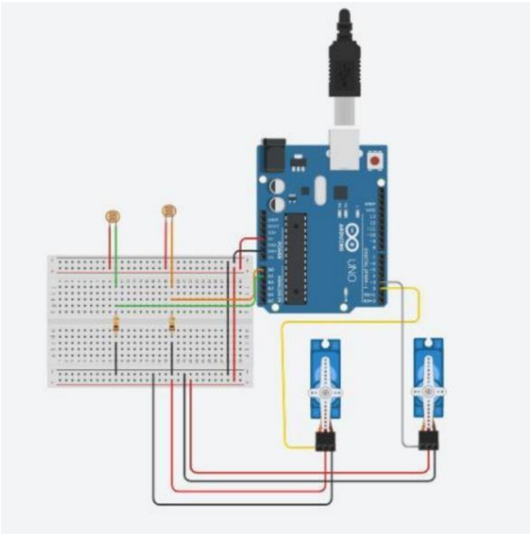

Fig 3.18 Simulation image before Test

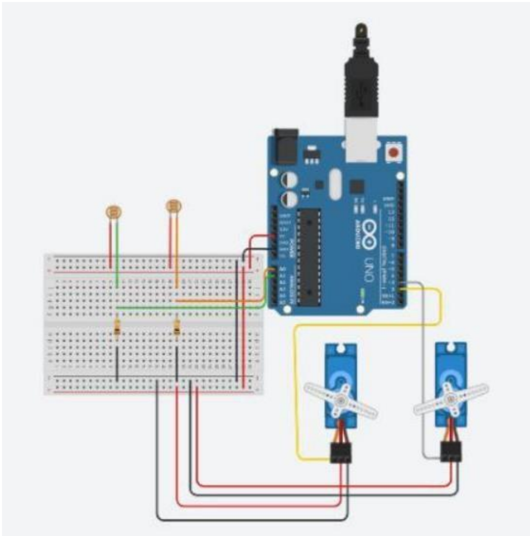

Fig 3.19 Simulation image after Test

3.5 Program code

```
#include <Servo.h>  //includes the servo library
Servo myservo1,myservo2;

#define ldr1 A0  //set ldr 1 Analog input pin of  East ldr as an integer
#define ldr2 A1  //set ldr 2 Analog input pin of  West ldr as an integer

int pos1 = 90;  // initial position of the Horizontal movement controlling servo motor1
int pos2 = 90;  // initial position of the Horizontal movement controlling servo motor2
int tolerance = 10;  // allowable tolerance setting - so solar servo motor isn't
                        constantly in motion
```

```
void setup ()
{
  myservo1.attach(2); // attaches the servo1 on digital pin 2 to the horizontal
                         movement
  myservo2.attach(3);  //attaches the servo2 on digital pin 3 to the horizontal
                         movement
 pinMode (ldr1, INPUT); //set East ldr pin as an input
 pinMode (ldr2, INPUT); //set West ldr pin as an input
 myservo1.write(pos1);  // write the starting position of the horizontal movement
                          servo motor1
 myservo2.write(pos2);  // write the starting position of the horizontal movement
                     servo motor2
 delay (1000);  // 1 second delay to allow the solar panel to move to its staring
                  position before comencing solar tracking
}
void loop ()
{
  int val1 = analogRead(ldr1);  // read the value of ldr 1
  int val2 = analogRead(ldr2);  // read the value of ldr 2
  if ((abs (val1 - val2) <= tolerance) || (abs (val2 - val1) <=
tolerance))
  {
       //no servo motor horizontal movement will take place if the ldr value is within the
       allowable  tolerance
  }
  else
  {
       if (val1 > val2)  // if ldr1 senses more light than ldr2
       {
            pos1 = pos1+1; // increment the 90 degree poistion of the horizontal
                             servo motor1
            pos2 = pos2-1; // decrement the 90 degree poistion of the horizontal
```

```
                                  servo motor2
        }

        if (val1 < val2)  // if ldr2 senses more light than ldr1

        {
                pos1 = pos1-1;  //decrement the 90 degree poistion of the horizontal
                                  servo motor1

                pos2 = pos2+1;  //increment the 90 degree poistion of the horizontal
                                  servo motor2
        }
    }

    if (pos1 > 180 && pos2 < 0)
    {
        pos1 = 180;
        pos2 = 0;
    }  // reset the horizontal postion of the motor1 to 180 and motor2 to 0 if it tries to move
       past these point
    if (pos1 < 0 && pos2 > 180)
    {
        pos1 = 0;
        pos2 = 180;
    }  // reset the horizontal postion of the motor1 to 180 and motor2 to 0 if it tries to move
       past these point
    myservo1.write(pos1);  //write the starting position to the horizontal motor1
    myservo2.write(pos2);  //write the starting position to the horizontal motor2

    delay (500);

}
```

Chapter 4

IMPLEMENTATION

The design and interfacing of all the components are shown below

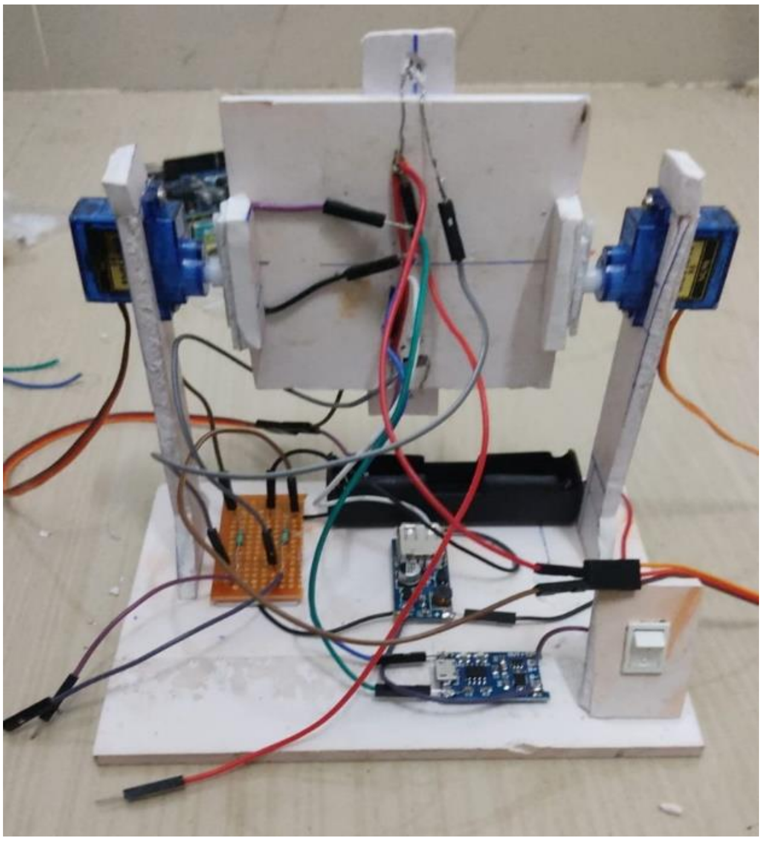

Fig 4.1 Setup of the system

Using Arduino IDE program is compiled and upload to Arduino UNO. In order to rotate the solar panel two servo motor is attached in both sides servo motor rotates the solar panel on the basis of input received from Arduinoboard. Input is received from the LDR sensor placed at the end of solar panel. When the system turned on the whole system initializes and solar panel adjust to an initial position which already set in the program which is uploaded. According the value obtained from the LDR the solarpanel rotates according to the position of sun which is maximum sunlight can be obtained. The obtained solar energy is converted into solar energy and store the energy into LiPo Battery using charge module. This stored energy can be used as power supply to the entire system with the help of dc to dc step up boost module.

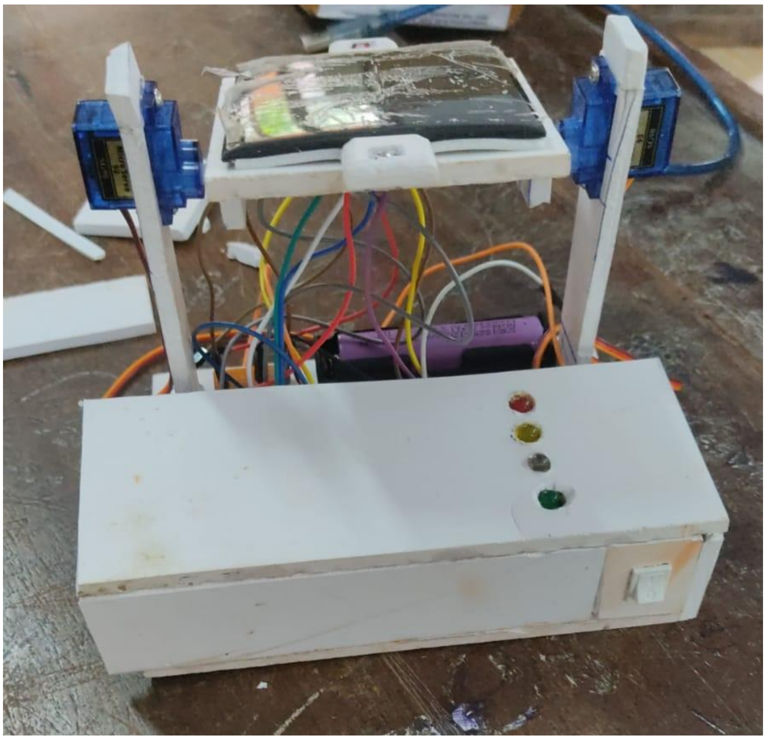

Fig 4.2 Implementation of the Project

Chapter 5

CONCLUSION

An Arduino UNO board based Automatic Solar Tracking System was designed and constructed in the current work. From experimental result it is proved that Automatic Solar trackers are more efficient than fixed panels. LDR light sensors were used to sense the light intensity of the sun with the help of the photovoltaic cells. The servo motor had enough torque to drive the panel. Servo motors are noise free and are affordable. The compact, cost effective and reliability of this solar tracker is intended to suitable for the rural usage. The purpose of renewable energy from this work offered advance in idea to help the people. This system can be designed to provide electricity to the entire home by changing solar panel, using more efficient sensors and designing the charge controller. Solar car and solar motorbike can be developed and can reduce environmental pollution to a certain extent. This will also help in minimal use of non-renewable resources from the environment.

REFERENCES

1. Kumar Lokhande 2014. "AUTOMATIC SOLAR TRACKING SYSTEM", International Journal of Core Engineering & Management (IJCEM), Volume 1, Issue 7.
2. R.Z. Wang, T.S. Ge, "Advances in Solar Heating and Cooling," Woodhead Publishing, 2016.
3. Ying-Tung Hsiao, China-Hong Chen, "Maximum Power Tracking for Photovoltaic Power System," Conference Record of the 2002 IEEE Industry Applications Conference. 37th IAS Annual Meeting.
4. Juan Reca-Cardeña, Rafael López-Luque, Chapter 9- Design Principles of Photovoltaic Irrigation Systems, "Advances in Renewable Energies and Power Technologies", Elsevier Science, 2018.