

**DUAL AXIS SUN TRACKING WITH MPPT CHARGER CONTROLLER FUNCTION  
FOR INCREASE THE EFFICIENCY OF SOLAR SYSTEM**

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

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## **APPROVAL**

This Project titled “**DUAL AXIS SUN TRACKING WITH MPPT CHARGER CONTROLLER FUNCTION FOR INCREASE THE EFFICIENCY OF SOLAR SYSTEM**” submitted by Md. Rifat Nime, Mukshit Md Omar Faraque and Hemel Dev, ID No: 172-15-10156, ID No: 171-15-9425 and ID No: 172-15-10154 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.

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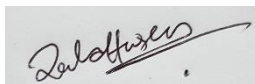
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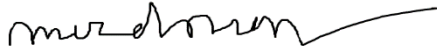
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We hereby declare that; this project has been done by us under the supervision of **Mst. Eshitha Khatun, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been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

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## ACKNOWLEDGEMENT

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

We grateful and wish our profound indebtedness to **Supervisor Mst. Eshita Khatun, Lecturer,** Department of CSE, Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of “Internet of things” to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts, and correcting them at all stages have made it possible to complete this project.

We would like to express our heartiest gratitude to the Almighty Allah and Head, Department of CSE, for his kind help to finish our project and also to other faculty members and the staff of the CSE department of Daffodil International University.

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

Finally, we must acknowledge with due respect the constant support and patients of our parents. We appreciate and admire it with respect and gratitude.

## Abstract

The project deals with the use of different energy resources for power generation which may be used to supply power in a domestic application. solar power may be a very large, inexhaustible source of energy and Green Energy System. solar power features a major advantage for no impure outlets but the problem related to solar is a smaller amount efficiency and high cost. the facility from the sun intercepted by the world is approximately  $1.8 \times 10^{11}$  MW, which is many thousand folds larger than this consumption rate on the world of all commercial energy sources. Solar tracking systems are often used as an influence generating method from sunlight. This method of power generation is straightforward and is taken from natural resources. This needs only maximum sunlight to get power. This project presents for power generation and sensor-based solar tracking system to utilize the utmost solar power through the solar array by setting the equipment to urge maximum sunlight automatically in real-time. This proposed system is tracking for the max intensity of sunshine. When there's a decrease in the intensity of sunshine, this technique automatically changes its direction to urge maximum intensity of sunshine. The proposed method is to style an electronic circuit to sense the intensity of sunshine and control the DC motor driver for the panel movement and construct a Buck-Boost converter to intensify and step down the voltage and store the utmost utilized output voltage in the lead-acid accumulator.

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# CHAPTER 1

## Introduction

### 1.1 Introduction

The necessity for environmentally friendly power is that the power source which appears from regular assets like light, wind, downpour, tides, and energy heat. These assets square measure inexhaustible and could be normally renewed. In this way, for every single reasonable capacity, these assets considered, contemplated to be endless will be lessening standard petroleum products. The planet's energy crash has given a restored impulse to the growth and advancement of uncontaminated sustainable power sources. Mechanisms of Clean Development (CDMs) square measure are being received from associations the whole way across the planet. Besides expediently reducesing stores of petroleum derivatives inside the planet earth, another significant issue working against non-renewable energy sources is that the contamination related to their ignition. In qualification, environmentally friendly power sources square measure known to be plentiful cleaner and turn out energy while not the unsafe impacts of contamination, rather than their ordinary partners.

### 1.2 Motivation

We all know that electricity has made by burning fossil oil or gas. By this process, we generate lots of carbon-di-oxide. This is very bad for our environment. Day by day we are facing many kinds of natural problems like earthquakes, tornadoes, etc. every country is getting tensed about this. But as we all knew that electricity is must be needed for our daily life. We cannot live a day without using electricity. For that, we need to generate electricity. But the making process of electricity is pretty much problematic for our environment. So, for solving this, renewable energy can be a working solution. Renewable energy has many different options like solar, wind, sea tide, etc. But among all of this solar is the cheapest and user-friendly system. And also, if we think about our country, we can see that solar is the most available renewable energy source for us. Also, our country is a developing country. So still now many people have no access to electricity. So, we want a build a cheap portable energy solution for them.

### **1.3 Objectives**

The task plans to use the most extreme sun-oriented force through the sun-powered cluster. For this, an advanced-based programmed sun global positioning framework and MPPT circuit are being proposed. The sunlight-based cluster follows the sunlight from east-side to west-side consequently as long as the ideal power of daylight. Photovoltaic age framework by and large uses an embedded controller-based charge regulator associated with accumulator and freight. A charge regulator which is included with charge utilized, which is deal with appropriate charge voltage on the battery by the idea of burden electrical resistance coordinating. Furthermore, the insert voltage from the sun-based board, regulator of the charge controls the charge to the battery forestalling cheat. Besides utilizing an embedded controller-based plan we or anyone can handle the two activities with more smart control and accordingly increment the productivity of the framework.

### **1.4 Expected outcomes**

We expect that this framework will build the productivity of the close planetary system. And also beneficial for the poor people and the environment. After completing this project, it will be beneficial for our country. Normal conventional solar system uses 30% of the sun. And the efficiency is very low. Also, in the conventional solar system solar panel works normally from the morning 9/10 am to noon 2 pm. Because it is the peak time of a day. After this solar panel cannot extract power from the sun. Because in the conventional solar system panel can't move towards the sun. But in our system panel will track the sun and extract the power all day long. Also, in a conventional solar system, the charge controller isn't working efficiently. Normally waste the power of the sun. But in our system, we are using an MPPT Charge controller. This will help the system extract more power.

## CHAPTER 2

### Background Study and Research Objective

#### 2.1 Introduction

Sustainable power is energy that is earned from illimitable assets, a human is as a rule renewed on someone's timescale, just as carbon-neutral sources like light of the sun, wind, rainstorm, tidalwater, surge, and geothermic temperature. The committee commonly conjointly bodiless biomass, whose carbon impartial standing is underneath conversation.

#### 2.2 Different Kinds of Renewable Energy

##### 1. SUNLIGHT BASED POWER

Sun oriented energy is generally utilized in 2 significant manners by which. Right off the bat, the caught heat is generally utilized as star nuclear power, with applications in region warming. Another distinction is that the change of episode radiation to power, that will be that the preeminent usable sort of energy. This might be accomplished with the assistance of star electrical wonder cells or with concentrating elective energy plants.

##### 2. WIND POWERS

Wind turbines are typically acclimated with saddle the energy available in air currents. Present day turbines fluctuate as long as around 600kilo Watt to 5Mega Watt of weigh up power. Since the violence yield is likewise the activity of the 3D square of air speed, it will increment rapidly with expansion in open breeze speed.

### 3. MINUSCULE HYDROLYSIS

Hydrolysis inductions up to 10Mega Watt are contemplated little hydrolysis and considered environmentally friendly power sources. These include changing the P.E. of water store in dams for usable power which is using by water turbines.

### 4. BIOMASS

Plants keep the power of the sun through the strategy of synthetic activity. On burning, these plants unharness the cornered power. Along these lines, biomass functions as a characteristic battery to store the sun's power and yield it on the need.

### 5. GEOTHERMAL

Geothermal energy is that the nuclear power that is created and inside among the layers of the globe. The angle so created gives ascend to the unending actual wonder of heat from the center to the outside of the planet. This angle is ordinarily used to warm water to give superheated steam and use it to run steam turbines to incite power. The first weakness of warmth is that it's constantly limited to districts near structural plate limits, albeit of this innovation on going headways have semiconductor diode to the proliferation.

### 2.3 Sustainable power Use Across The Globe

The latest thing across created financial system tips the measurements for Renewable Energy. Throughout the previous three years, a continent or other large body of land of North America and Europe have accepted extra sustainable power limits when contrasted with plain force ability. Sustainable represented human resources of the new placed in power ability in Europe in 2009 and almost two-hundredth of the yearly force creation.

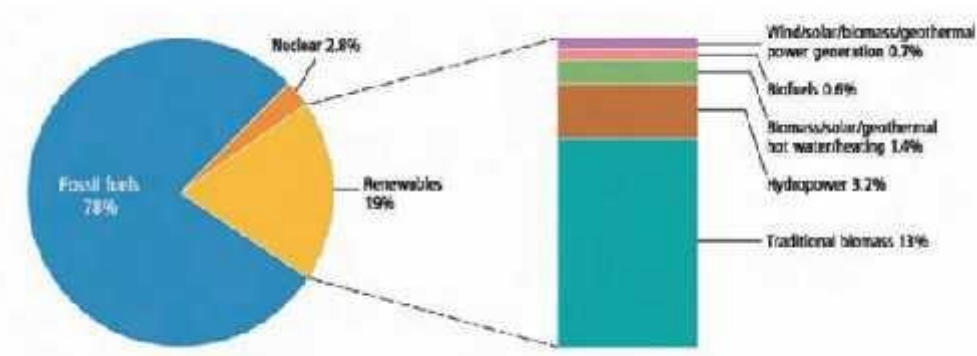


Fig2.3.1 Energy utilization design

As are frequently seen from figure, air and biomasses possess a genuine portion of the present sustainable power utilization. Late headways in sunlight based photovoltaic innovation and steady brooding of activities in nations like Germany and Spain have brought around huge development inside the sunlight-based photovoltaic market additionally, which is projected to outperform other sustainable power sources inside the coming next years. Fourteen by 2009, very eighty-five countries had some arrangement focus to understand a foreordained portion of their force limit through sustainable way. This was an ascent from around forty five nations in 2005. The greater part of the objectives additionally is extremely eager, arriving inside the scope of thirty to ninety percent portion of public creation through inexhaustible. Essential strategies are the electronic control Union's objective of accomplishing twenty percent of all out power through sustainable by 2020 and India's Solar Mission which is name Nehru, through which India intends to supply 20Giga Watt sunlight-based force continuously in 2022.



## 2.4 Renewable Energy Across Bangladesh

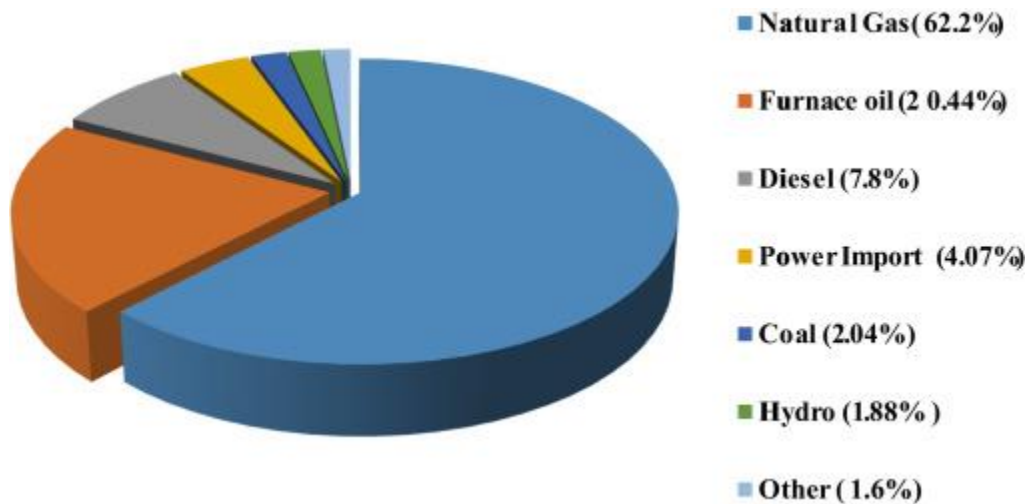


Figure 2.4.2 Bangladesh Power Consumption

From the above figure we can see the power consumption of our country. Till now our country is fully depends on gas and coal-based power generation. Almost sixty-three percent of our power comes from natural gas-based power plant. And then almost five percent power we import from other countries.

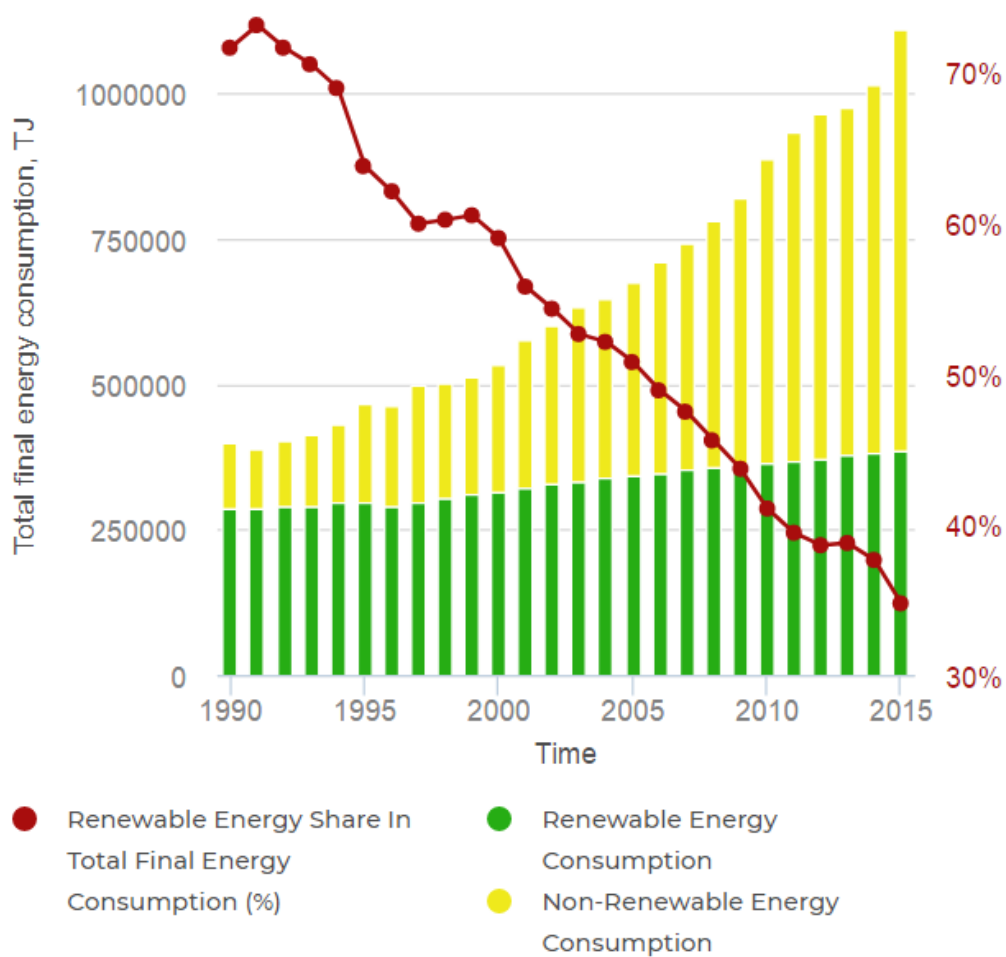


Figure 2.4.3 Renewable energy share graph

We can see the rise of renewable energy in Bangladesh. But the rise is very little.

## CHAPTER 3

### Analysis Related Work

#### 3.1 Introduction

To continue the real undertaking, we need to explore and research about the as of now exist task to additional methodology. This is known as foundation study. In foundation study it assists us with perceiving about the limits of the current project and furthermore urge us to carry out those impediments in our undertaking. Additionally, it gives the possibility of not to separate the copyright issues in future. For this reason's foundation study is the must to execute any improvement project. In doing foundation study we additionally analyze, reprimand with other related work in this field and went to the profundity of the undertaking. We partition the part in certain fragments like related works, examination works, extent of the issue and difficulties.

#### 3.2 Related Work

Studies show that a sun-based cluster changes over 30-40% of energy occurrence consequently to power. A Max point Tracking calculation is imperative to broaden the effectiveness of the sunlight-based cluster.

There are various strategies for MPPT like Perturb and Observe (slope climbing strategy), Incremental conductance, Fractional short Current, Fractional circuit Voltage, Fuzzy Control, Neural Network Control and so on Among every one of the techniques Perturb and notice (P&O) and Incremental conductance are most customarily utilized because of their straightforward execution, lesser opportunity to follow the MPP and various other a few monetary reasons.

Under abruptly evolving climate (an irradiance level) as MPP changes perpetually, P&O accepts it as an alteration in MPP because of the annoyance rather than that of irradiance and by and large terrains up in scheming a wrong MPP. In any case, this disadvantage gets kept away from in a reformist electrical wonder technique because the algorithmic guideline takes 2 examples of voltage and flow to ascertain MPP. Nonetheless, instead of higher strength, the edifices of the algorithmic principle are exceptionally contrasted with the past one and hence the value execution

will slightly increase. Consequently, we've to alleviate with a trade between an intricacy and a power.

In nineteen eighty-three Daniel A Pritchard had given the design, development and an analysis based on star tracking system of a micro-computer. After that, in 1990 Dutta and Saxena, A Konar and A.K. Mandal in nineteen ninety-one and A Zseroual in nineteen ninety seven they studied several topics like star chase appeared using the microchip for an absorption electro-optical sensor for sun finding. In nineteen ninety-one to manage a DC motor a microcontroller system is used as a base for an automatic sun tracking system by F Huang in twenty thousand one it's used as a base for the GHU objective tracking controller by Eftichios Courtois. In nineteen ninety nine a PC-based system of a logic controller design and an implementation to regulates of a sun tracking system that had given by Hasan A. Yousef. To produce the motion of the PV panels in two axes and the chasing system was driven by two permanent magnet Direct Current motors. In twenty thousand, Chee Yee Chong had given the technique architectures for way of fusion. They had given fully different approaches for fusing a track state calculation with compared their action performance by simulations and theoretical analysis. They had to build multiple sensing elements that will provide them a far better performance than using a single sensor.

Numerous examinations for a novel point reason following (MPPT) a regulator for an electrical wonder (PV) an energy a change framework was arranged by Yeong Chau Kuo in 2001, Also in two thousand two TSE, K. K & nbsp; then in 2003 Henry & nbsp; Shu Hung & nbsp; Changings; in 2004 Kohayashi & nbsp; Z G Piao; Kimiyoshi & nbsp; projected a star global positioning framework in 2003, an abuse DC engines, uncommon engines like stepper engines, servo engines, ongoing actuators to work moving components, it had been exceptionally costly. Also A. A. Khalil, had introduced a sun a pursuit framework in 2003. This pursuit framework easy to execute and proficient for an elective energy assortment. Numerous ways were projected to comprehend the objective of the greatest reason following (MPPT), and accordingly, the dynamic sun the pursuit plot with none lightweight sensors.

In 2005 S Armstrong had broadened a quantitative extent of the practicality MPPT power, at that point a vector procedure was used to follow the course and a method of the sun for the length of a day. Moreover, in 2006 Rong Jong Waihad had given a system related to an electrical miracle (PV) an age structure with an accomplice in a nursing an adjustive development for trouble method and overflowing of everyday presence sun a pursuit the peak topic.

Cemil Sungur had given the electromechanical arrangement of an electrical wonder (PV) a board pursue the sun exploitation Programmable Logic Controls (PLC) in 2007. Numerous FPGA-based PV frameworks the fluffy MPPT control was anticipated, A. Mellit, A Messai portrays the equipment execution of two-inputs one-yield computerized representative rationale Controller (FLC) on a Xilinx FPGA an exploitation VHDL language in 2009, Cheng, Ze; Also in 2010 Yang, Hongzhi; Ying Sun had arranged simple, reliable techniques.

In this project we'll construct an efficient system with embedded controller having an honest response with improved efficiency which may be achieved by implementing a microcontroller based automatic solar tracking system with maximum point tracking.

Out of the many MPPT algorithms, Perturb and observe (P&O) algorithm is usually used for increasing the efficiency of photovoltaic system thanks to its simpler implementation, high reliability and better efficiency.

## CHAPTER 4

### System Implementations

#### Part-A: Solar Cell and Their Characteristics

##### 4.1 Introduction

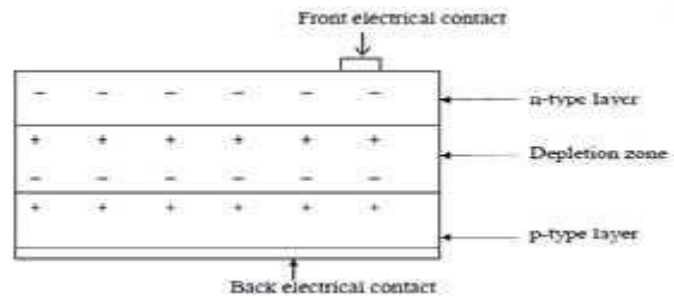
Solar cells or photovoltaics' right now furnish one among the main long length power gives, since a regular electric cell produces. Be that as it may, three watts at near a zero.5-volt DC, cells ought to be associated in an arrangement equal setup to an inventory sufficient force for highly-octane appeal. Cell are coordinated in a modules and these module-are associated as clusters. Modules-may have top summit powers output began from a couple of watts, relay on upon the implicit an appeal, to very thirty hundred watts. Ordinary cluster yield power is relay on the hundred-watt kilowatt extent, albeit a force unit exhibits do be present.

##### 4.2 Structure of Solar Cell

A photo voltaic cell turn in sunlight into current, whom is that the constitutional process referred to as photoelectric effect. Light which shines on a PV cell, could also be reflected, absorbed, or passed through; however, only absorbed light generates electricity

One single layer is Associate in nursing "n-type" semiconductor with Associate in nursing abundance of electrons, that suffer a heart attack (-) electrical charge. The elective layer is additionally a semiconductor "p-type" with Associate in Nursing wealth of openings that have an electrical positive (+) charge. Albeit every material territory unit electrically nonpartisan, n-type nuclear number 14 has overabundance electrons and p-type nuclear number 14 has abundance openings. Sandwiching these together makes a contact at their interface, accordingly Associate in nursing electrical field. Figure: 3.1, shows the contact of a PV cell. At the point when p-type and n-type nuclear number 14 acquire contact, overabundance electrons move from the n-type angle to the p-type aspect. The outcome is the development of charge on the n-type aspect of the interface and of charge on the p-type feature that builds up Associate in nursing electrical field at the whole interface. The electrical field powers the electrons to move from the semiconductor toward the

negative surface to hold flow. Simultaneously, the openings move the n-type aspect of the interface and of charge on the p-type feature that builds up Associate in nursing electrical field at the whole interface. The electrical field powers the electrons to move from the semiconductor toward the negative surface to hold flow. Simultaneously, the openings move at spans the alternate way, towards the positive surface, any place they anticipate approaching electrons.



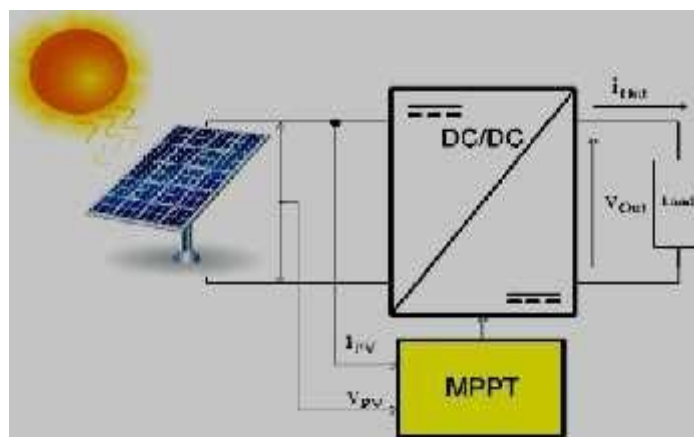
## Part-B: Highest Power Point Tracking

### 4.3 Introduction

Most extreme reason pursuit of times referenced as MPPT, MPPT is partner electronic framework that works with the actual marvel (PV) modules, and it's a style that empowers the modules to supply all the force they are able to do. MPPT is certainly not a mechanical framework that "actually moves" the modules to understand them reason straightforwardly at the movement of sun. MPPT is a totally electronic framework that fluctuates the electrical operational motivation behind the modules, consequently as that the module's square measure ready to convey most out their force. If any force gathered from the modules then it made out there as an expanded battery charging current. The MPPT square measure generally used to relate to a mechanical framework, two frameworks square measure absolutely all totally unique.

The Sunlight Peak power finder might be a microprocessor chip controlled DC to DC venture down converter utilized by the sun oriented energy framework to charge a 12v battery. The upper sun oriented cluster voltage of the charging voltage of the battery so it steps directly down. The chip attempts to augment watts contribution from the sun based exhibit by controlling the progression down proportion to remain the sunlight based cluster working at its highest peak point.

$$(\text{Peak Solar Panel Watts}) / (\text{Battery Voltage}) = \text{MPPT Amps (i.e. } 240W/12V = 20A)$$





#### **4.4 Techniques Of MPPT**

An ordinary sun oriented exhibit changes simply 30 over to 40 percent of the episode sun based illumination into power. The great point following strategy is utilized to upgrade the effectiveness of the close planetary system. Reliable with MPT (maximum power transfer) strategy, the yield force of the circuit is most extreme when the source power impedance equal with the heap impedance. Inside the source side a buck converter is associated with a sunlight based battery to build up the yield voltage. By changing the obligation pattern from buck converter fittingly by using PWM signal, so the source impedance is coordinated immediately of the heap impedance. There were different MPPT procedures were proposed.

#### **4.5 Different MPPT Strategies**

There were many customary strategies for MPPT. Here seven of them are presented.

These 7 strategies are:

1. Perturbation and Observation strategy;
2. Consistent Voltage strategy;
3. Incremental Conductance strategy;
4. Open Circuit Voltage strategy;
5. Current Short Circuit strategy;
6. Monitoring Temperature strategy;
7. Thermal Parametric strategy;

From these strategies, the Perturbation and Observation (P&O) and IncCond techniques were broadly utilized despite the fact that they need a few issues like the swaying around MPP and disarray by quickly changing air atmosphere conditions.

Into this paper MPPT calculation of perturb and observes is utilized. During this technique the regulator changes the voltage just barely from the array and count amount of energy, power, if the facilities increments, further changes in the course are attempting to power not increments. This is regularly called the P&O technique. Cause of basic execution and value adequacy, it's the chief generally utilized MPPT strategy.

## Part-C: Solar Tracking

### 4.6 Solar Tracking Principle

Consistent star pursuit alludes to the technique for moving an electrical marvel board, optic reflector or star concentrator with a related force producing payload in such in any case, that the bolts and reflector chase to the field mechanical wonder of the sun's development all through the entire a day-time cycle. All through thusly, star accumulates gathering, or a star reflector ideally mirrors the sun oriented energy towards the sun based force generator or energy gadget. The capacity producing gadget are normally a nuclear power gadget or component based for the most part engaged electrical marvel (CPV) kind framework.

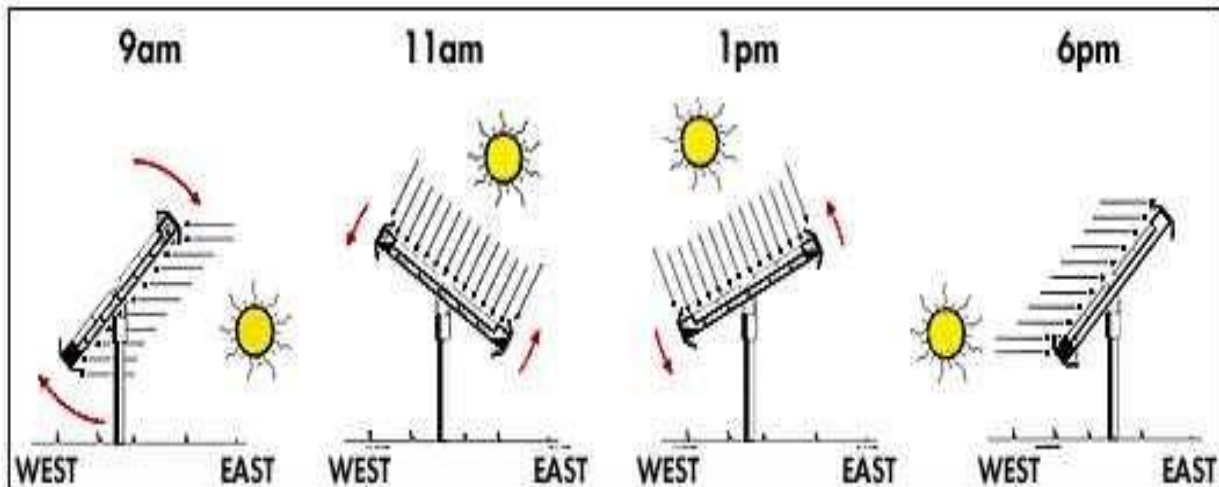


Fig 4.6.1 Following of sunlight based board with course of sun

### **4.6.1 Description**

This technique is an impact producing technique from daylight. This strategy for power age is simple and is taken from common assets. This necessities just, greatest daylight to get power from sources. This task helps for get power age by fitting the hardware to encourage greatest daylight consequently. This method is following for max power of daylight. When there's lessening in power of daylight, this strategy naturally adjusts its bearing to ask most extreme force of daylight.

Solar path tracker device is generally a device onto which sun oriented boards are fitted in which path the movement of the sun towards to the sky guaranteeing that the most extreme measure of daylight strikes the boards for the duration of the day. In wake of discovering the light, the finder will endeavor to explore by the path guaranteeing the least complex daylight was identified. Here the solar path tracking system is shaped as a model to unwind matter. Totally programmed and keeps the panel board ahead of sun until that apparent. Exceptional element of this strategy is that in position of accepting the world as its relevance, it acknowledge the sun as managing power source. Its dynamic sensors continually screen light and turn the board towards the heading where the force of daylight is greatest. When power service produced from this cycle, then it's put away during a lead with corrosive battery and is shaped to charge a crisis light and is framed to gleam during obscurity time.

### **4.7 Azimuthal Sun Angle Tracking Formulae**

When sun point plots for the azimuth point (and height), point would now be able to be wanting to decide the sun based following pace and pack proportion prerequisites. In figure underneath, It had been noticed that the fractional differential of the sunlight based way development point bends (incline at each pinnacle point) compares to the sun powered following velocity (degrees each minute). The sun way on azimuthal pivot normally pass quicker, and consequently the mark of greatest sun path development velocity are frequently recognized on the diagram.

Sun based azimuth and rise angle points of day time sun way for a specific topographical area with the slope value of the azimuthal law curve addressing the very apex of sun development velocity superimposed. Anyone can decide the velocity of the sun in perimeter like degrees each moment by utilizing the parameters that got from the figure (at the motivation behind most extreme slope) in the recipe given in Equation below:

$$SunSpeed(\text{degree}/\text{min}) = \frac{\Delta_{SunAngle}(\text{degrees})}{\delta_{time}(\text{minutes})} \dots (6.1)$$

Figures the velocity of the sun in degrees each a moment(60 seconds). Notwithstanding, to match the velocity of the sun to the engine (motor), we would like to change over the sun velocity to cycles each a moment (the rpm or RPM). As yet alluding to the figure on the most elevated of 1 would thus be able to confirm the speed of the sun on, fire up by isolating by 360 degrees as in the equation VI. 2 underneath:

$$SunSpeed(\text{rpm}) = \frac{SunSpeed(\text{degree}/\text{min})}{360^\circ} \dots (6.2)$$

To decide this base has required the movement velocity for a following engine, one can utilize a condition six.3 with the sun speed (rpm, decided in a condition six.2) as follows: Sun Speed (rpm) \* Gear the quantitative relation = Min Motor Shaft (rpm)..... (6.3) where the Gear proportions have decided as follows:

$$Gear_{ratio} = \frac{(Motor\ input\ speed)}{(Gearbox\ output\ speed)} \dots\dots(6.4)$$

On the off chance that the engine (motor) and gearbox blend can't arrive at the base required speed determined in Equation 6.3, at that point a unique stuff proportion (gearbox or the transmission framework) or higher speed engine should be chosen realizing that one can decide the most extreme precise velocity of the sun in rpm (Equation 6.2), one can on the other hand decide the base required cyclic engine velocity for the inflict stuff proportion that is most sensible or pragmatic. This makes it conceivable to pick a common sunlight based following gearbox or transmission at that point select an engine with adequate velocity to fill the need in Equation 6.3.

In such manner, Equation 6.5 are frequently wont to relate the velocity of the engine and pack drive latitude to the possible cyclic velocity of the sun powered global positioning framework pivot. Inside a specific rpm range, this equation is powerful to work out the rotational speed of the tracker on one or the other hub to the engine beam rpm and thusly stuff proportion of dispatch subsequently pivot or gearbox, and it is very convenient when the engine velocity fixed or if the engine gear raise can only handle.

$$\text{SunTrackerSpeed}(rpm) = \frac{\text{MotorShaft}(rpm)}{\text{Gear}_{\text{ratio}}} \dots(6.5)$$

A typical practical example by utilizing equation 6.5, we'll show the best approach to process the rotational speed of the sunlight based following hub beam (rpm) from engine beam velocity (rpm) and thusly the action gear proportion value.

## Part-D: System Description

### 4.8 Block Diagram of System

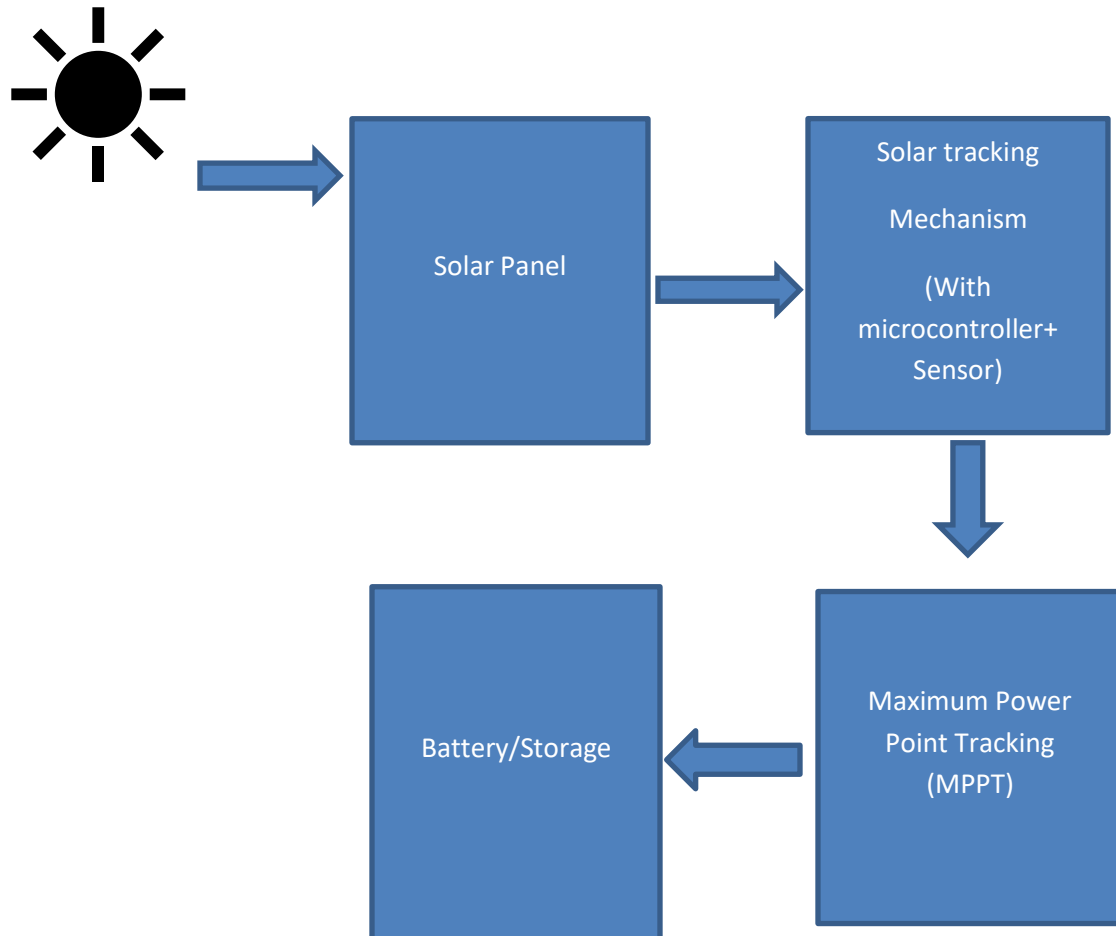


Figure 4.8.1 Block Diagram of System

#### **4.9 Technical Specification of System**

- Charging Voltage is constant 12V
- Automatic Solar Tracking
- LDR based Sun tracking function
- MPPT Charging Function
- Direct load connection function
- Operating current 10Amp Max
- Diode Protection for reverse voltage
- Led indication function

#### **4.10 Required Component**

For Solar Tracker

1. Arduino
2. LDR(Light Dependent Resistor)
3. 10 Kilo Ohm Resistor
4. Servo Motor

For MPPT

1. Arduino
2. Acs712 Current Sensor
3. Buck Converter
4. Irfz44n Mosfet
5. 1n5818 Diode
6. 1n4841 Diode
7. 0.1 uf capacitor
8. 470 uf capacitor
9. 10 uf capacitor
10. 1 uf capacitor
11. 2.2 kilo ohm resistor
12. 82 kilo ohm resistor



13. 1 kilo ohm resistor
14. 20 kilo ohm variable resistor
15. 33 uH inductor
16. Led
17. 20\*4 Lcd Display
18. I2C Display Module
19. Meal Header
20. Female Header
21. Vero Board

#### **4.11 Arduino Ide**

The Arduino Integrated Development Environment - or Arduino programming (IDE) - contains a word processor for composing code, a book reassures, a message field, a toolbar with catches for normal capacities, and an advancement of menus. It connects with the Genuino and Arduino equipment to rotate programs and describe with them. Arduino IDE is associate degree offer programming bundle that stay inside the primary exploit for composing and conglomeration the code within the Arduino Module. It is a lawmaker Arduino bundle programming, making code accumulation too clear that also a regular separate with no past specialized data can consider to working the plunge with the instructing philosophy. Arduino programs square measure isolated into three fundamental parts: Structure, Values (factors and constants), and Functions.



Figure 4.11.1 Arduino Ide

#### 4.12 Proteus

It is a code suite bearing designed, reenactment yet as PCB thinking of. ISIS is that the code will not to draw planned and recreate the circuits continuously. The reproduction licenses human access all through run time, hence giving constant reenactment. The Proteus style Suite might be an exclusive code device suite utilized mainly for electronic style mechanization. The code is utilized essentially by electronic style specialists and experts to frame electronic and schematic prints for delivering PC circuit sheets.

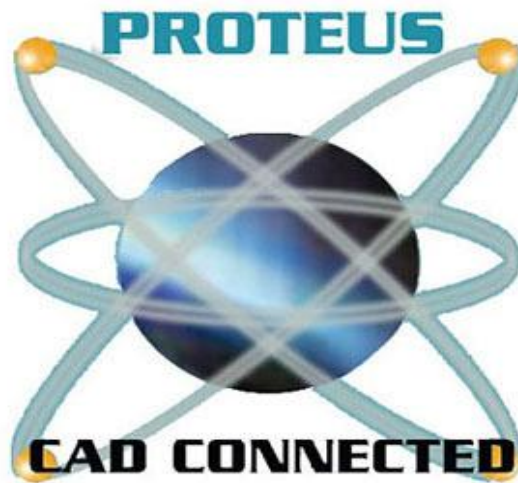


Figure 4.12.1 Proteus

## Part-E: Hardware Description

### 4.13 Overview

- **Arduino Uno**

The semiconductors collect ASCII reports of micro-controller board delivered by The Arduino Uno, that name is ATmega328P microcontroller and that tooled by Arduino.cc. The board is given arrangements of computerized and simple information/yield (I/O) sticks that can be interfaced to changed development sheets (safeguards) and different circuits. The board has fourteen advanced I/O pins (six equipped for PWM yield), vi simple I/O sticks, and is programmable with the Arduino IDE (Integrated Development Environment), through a structure B USB link. It squares live regularly controlled by the USB link or by AN outer 9-volt battery, however it acknowledges voltages somewhere in the range of seven and twenty volts. It's almost like the Arduino Nano and sculpture producer. The equipment reference vogue is circulated under an ingenious Commons Attribution-Share-Alike 2.5 permit and also out there on the Arduino site. Format and creation documents for some of adaptations of the equipment likewise are available.

In Italian, "uno" implies that "one" and that was picked to check the underlying required of the Arduino programming. The Uno board was the essential all through arrangement of USB-based Arduino sheets. The variant 1.0 of the Arduino IDE were the reference forms of Arduino that have as of now developed to more up to date delivers step by step. A bootloader prearranged with the ATmega328 board. That permits transferring new code to it while not the utilization of Associate in Nursing outer equipment of PC client.

While the Uno deliver abuse essential STK500 coalescence, it contradicts from all former sheets in this it doesn't improve FTDI of USB-to-chronic driver chip. When all the things being equal, it utilizes the Atmega16U2 (Atmega8U2 up to version R2) switched as a USB-to-chronic convertor.

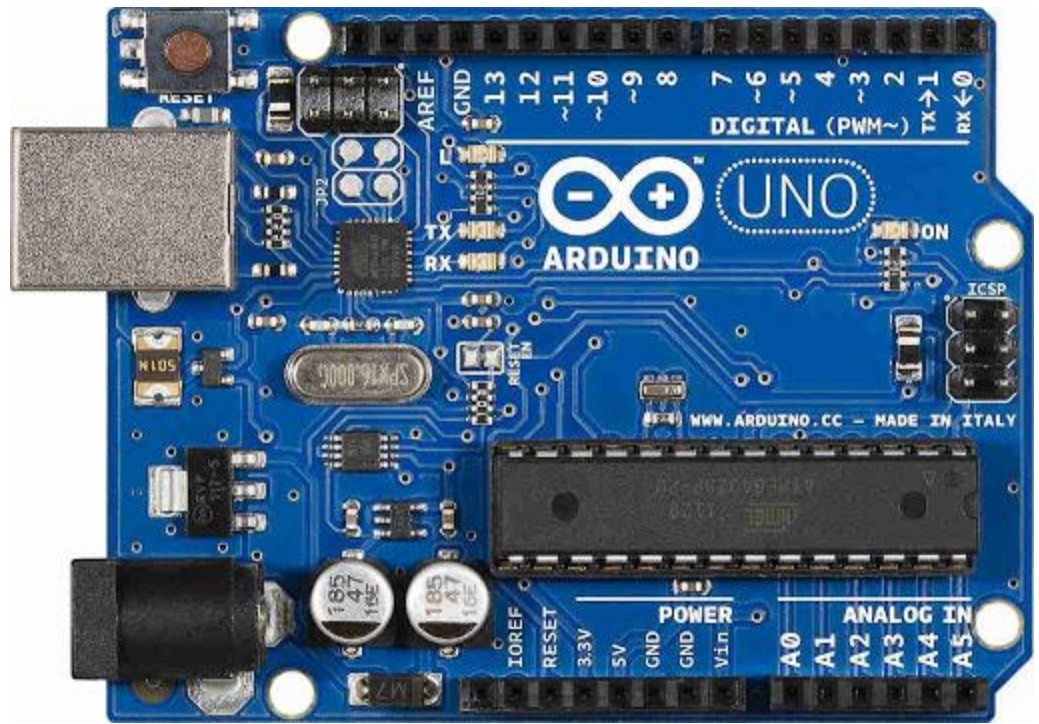


Figure 4.13.1 Arduino Uno

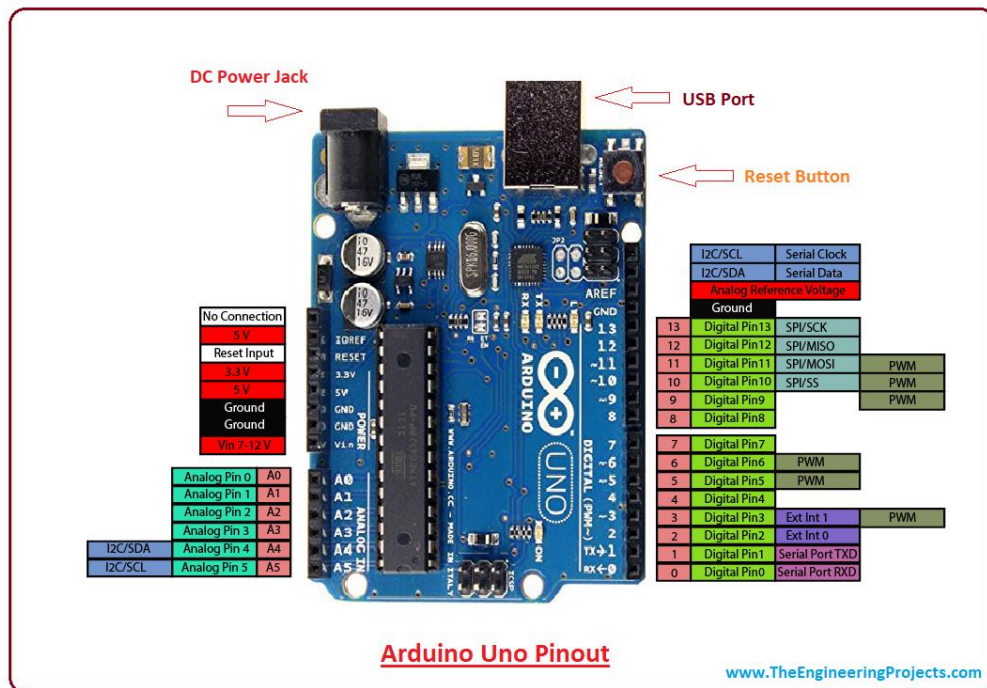


Figure 4.13.2 Arduino Uno Pin Diagram

- **ACS712 Current Sensor**

ACS712. For mensuration current all through a circuit, an apparatus is required. ACS712 Current gadget is that the device which can be acclimated live and compute the measure of current applied to the conductor. Though not contacting the exhibition of the opening framework. ACS712 Current gadget may even be a completely coordinated, Hall-impact based generally direct gadget IC. The ACS712 may even be a completely coordinated, lobby impact based straight current gadget with a blend of 0.1 kVRMS voltage seclusion and an incorporated low-opposition current conductor. Specialized terms to the side, it's only spot forward as a current gadget that utilizes its conductor to ascertain and live the measure of current applied to begin with the heap. We even have utilized a 12 Voltage DC Motor adjacent to a 12 Voltage force offer. The screw point terminals of the Current device ASC712 module board unit of mensuration associated sequential with the engine and force offer as demonstrated among the circuit outline. At that point associate the OUT, VCC and GND of the ASC712 board to +5V, A0 and GND of Arduino.

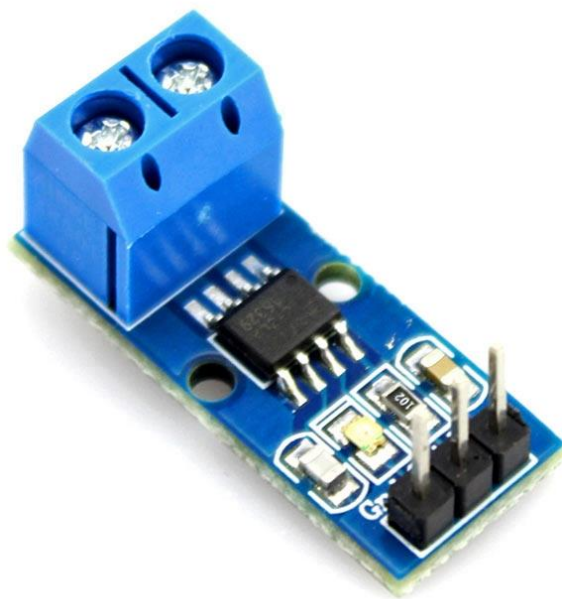


Figure 4.13.3 ACS712 Current Sensor

- **LDR**

A few sections will correction opposition cost by changes inside the amount of daylight contacting them. One sort is that the greenockite photoconductive cell (Cd) extra lightweight that inflicts it, the more modest its opposition cost becomes. There square measure numerous assortments of those gadgets. They shift per lightweight affectability, size, obstruction cost and so on Envisioned at the left might be an ordinary CDS photoconductive cell. Its width is eight metric direct unit, high 4 mm, including a chamber kind. When brilliant light-weight is contacting it, the value is in regards to 200 ohms, and once inside dim, the opposition cost is in regards to 2M ohms.



Figure 4.13.4 LDR (Light Detecting Resistors)

### 4.14 Circuit Diagram of the Project

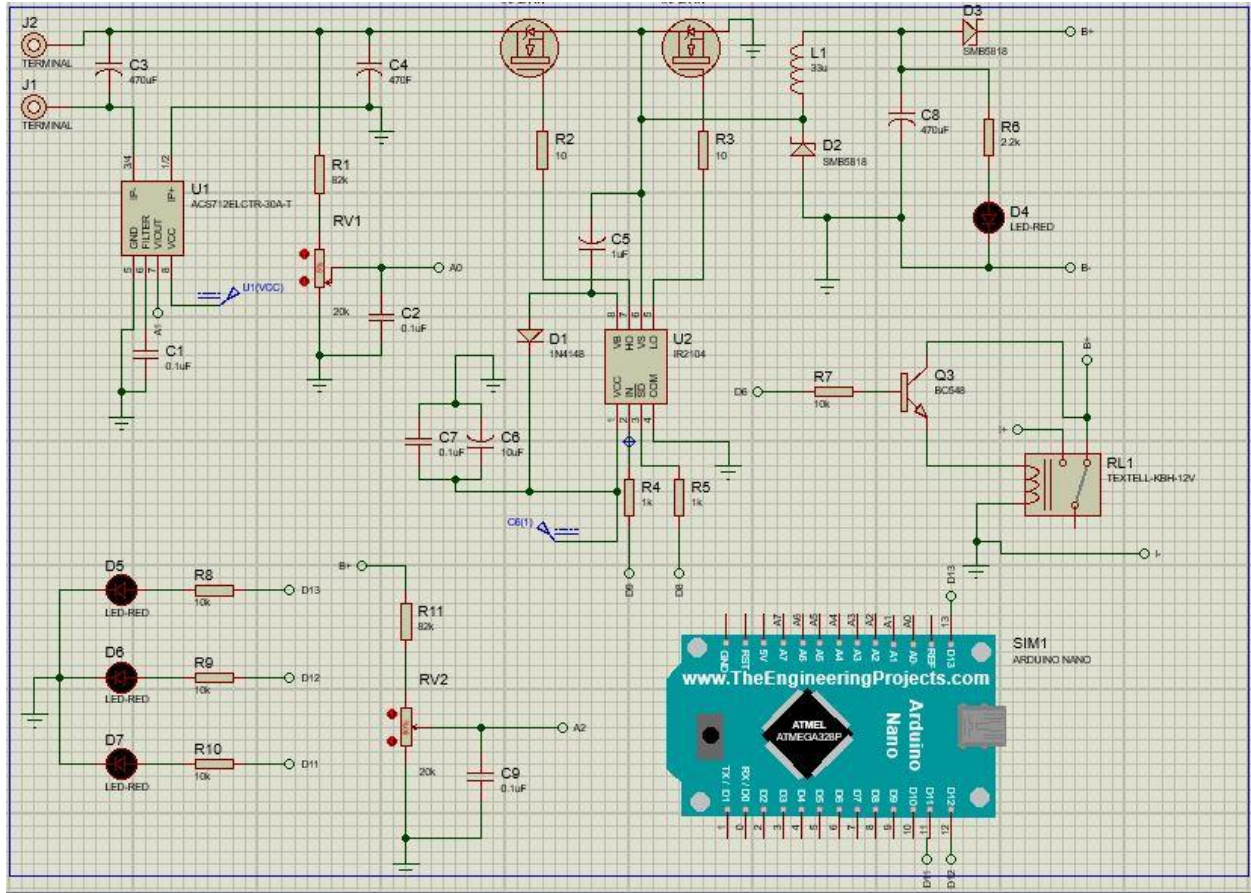


Figure 4.14.1 Circuit Diagram of MPPT

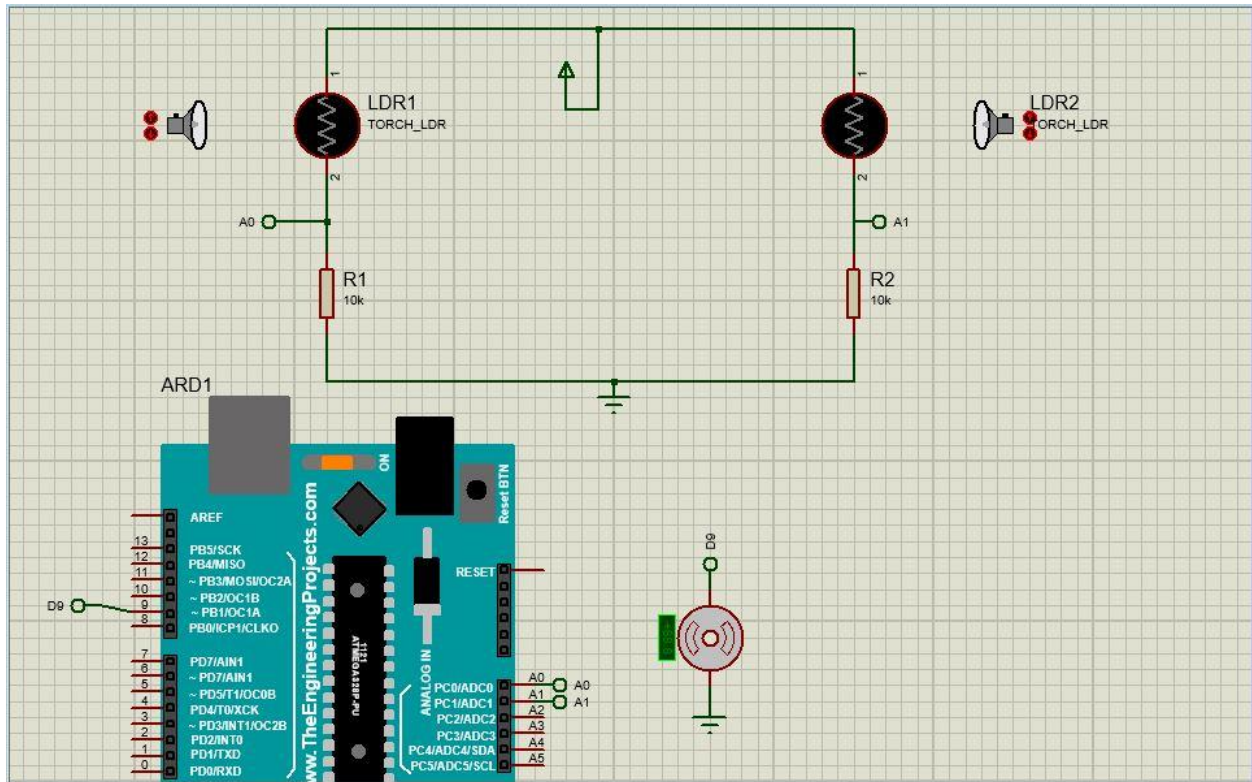


Figure 4.14.2 Circuit Diagram of Solar Tracker



## **Part-F: Hardware Implementation**

Our project is divided into two part. One is Solar tracking Part and another one is MPPT/ Charge controller part.

### **4.15 Solar Tracking**

In solar tracking part we are using Arduino uno as the brain of the project. Ldr is used as the sun tracking sensor. Two 10 kilo ohm resistor are connected parallel with the two ldr sensor. One ldr sensor is associated with the simple pin 0 and another ldr sensor is associated with the analog simple pin 1. At the point when daylight hit the left ldr then the obstruction of the ldr gets high. What's more, it's send an information to the microcontroller, at that point the microcontroller move the sunlight based board in the left side. Thus, way it worked. Similar thing happens with the right side too. One servo motor is connected with the digital pin 9. It's the microcontroller PWM signal pin.

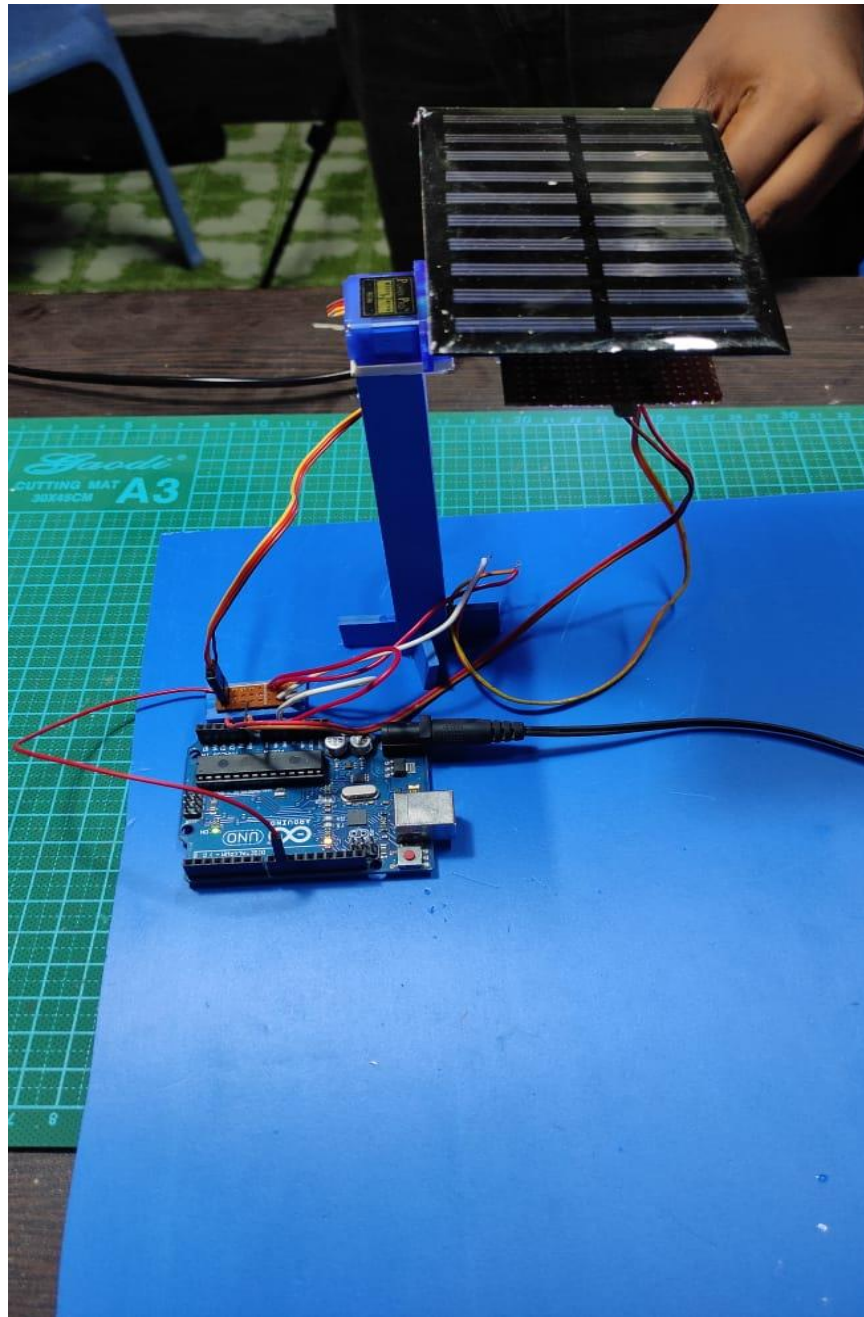


Fig 4.15.1 Figure of solar tracker

## 4.16 Charge Controller

In the Charge controller part, we have applied the MPPT work for increment the effectiveness of the close planetary system. Since in MPPT function, its charge the battery in more productive way.

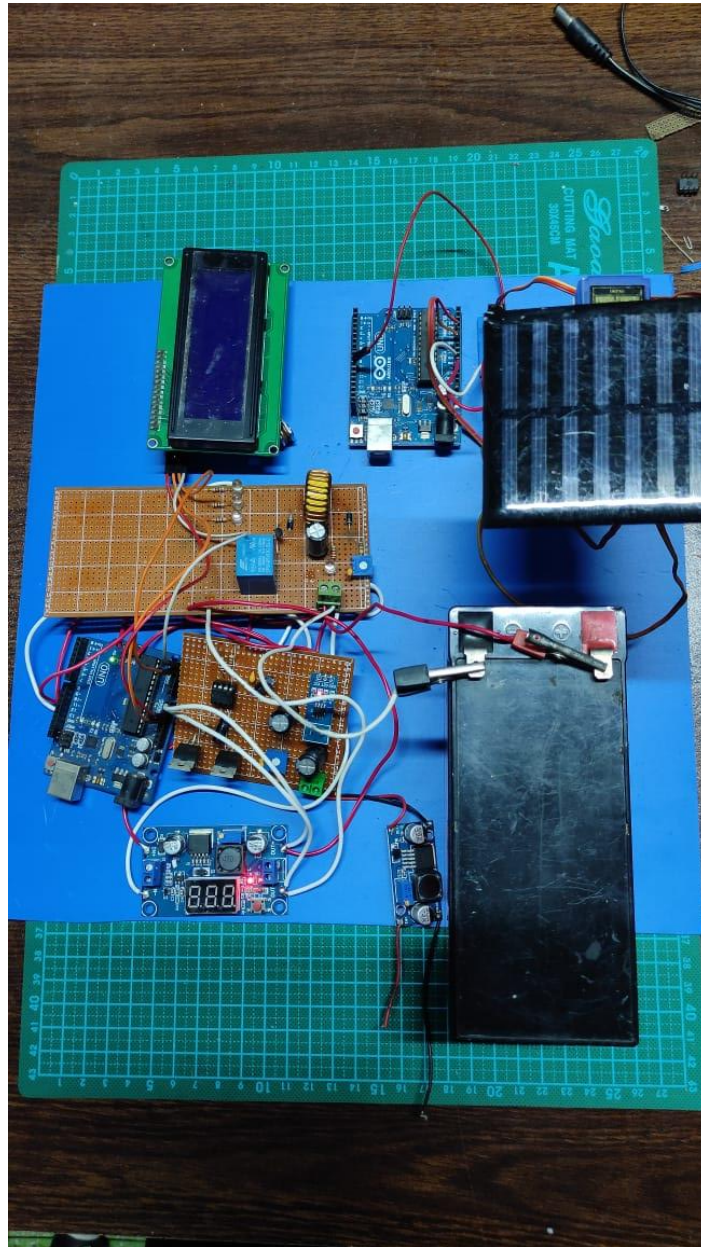


Fig 4.16.1 Charger controller

## 4.17 Working Procedure

Our Project is split into 2 half. One half is star pursuit and another half is MPPT charge controller half. The operating procedure of 2 half is given below:

Solar Tracker:

- Operating Voltage is 5V DC
- Operating Current is a one.5 Amp DC
- Single Axis star hunter
- It can add the day light-weight
- Controlling by Arduino
- LDR works because the sun pursuit detector
- Solar panel movement is management by servo motor

MPPT Charge Controller:

- Input the voltage of the controller from solar battery is 12v to 24v
- Input the current of the controller from the solar battery is 5amp grievous bodily harm
- Charging voltage of the controller is 12V
- Charging voltage of the controller is 10amp grievous bodily harm
- Maximum operating power of the controller is 300watt
- Maximum load terminal voltage is 12V
- Maximum load terminal current is 10amp
- Controlled by Arduino
- Led for indicating the charging, load affiliation, full charged condition.
- LCD show is for showing the input, and output knowledge
- It charges the battery mistreatment most electric outlet pursuit perform
- The PWM signal is very due the condition of batteries

## CHAPTER 5

### Result and Discussions

#### (Advantages, Applications, Cost Analysis)

##### 5.1 Advantages

Sunlight-based following frameworks square measure won't to consistently arrange electrical marvel boards towards the sun and may work with boost the interest in PV framework.

They are useful in light of the fact that the sun's situation inside the sky would amendment be able to bit by bit throughout the span of day by day and over the seasons consistently.

Energy creation is at partner ideal and energy yield is raised year circular. This is frequently especially significant all through the late spring a long time through its extended periods of sunlight obtainable to catch then no power of energy will be lost.

For these with a confined house, it proposes that a more modest cluster exclusively should be placed in, a gigantic benefit for those more modest locales with exclusively a little space to situate star huntsman.

The ordinary PV module generates force with most voltage capacity of almost seventeen V once estimated when the cell temperature of 25°C, it will drop to almost fifteen V on an outrageously hot day and also it might similarly arise to eighteen V on terrible winter. Climate, overcast or murky days: usually, PV module operates higher at cold winter temperatures and MPPT is usage to remove most force open from them.

The MPPT star charge regulator is basic for any elective energy frameworks must be constrained to separate most force from PV module; such powers PV module to controls at voltage near the very edge of the most electric repository most available force to draw.

## 5.2 Applications

MPPT star charge regulator might be applied to various environmentally friendly power sources like little water turbines, wind-power turbines, and so on In this manner, by carrying out MPPT charge regulator framework we will in general have an inclination to tend to can improve the intensity of an elective energy plant that serves to be a significant force age asset in future. Increment the affectability and precision of pursue by utilizing a very surprising lightweight gadget. A phototransistor with an Associate in Nursing enhancement circuit would supply improved goal and higher pursue exactness/accuracy. Use a double pivot style versus a solitary hub to expand pursue exactness.

### 5.3 Cost Analysis

Components-Name	Quantity	Price (BDT)
Arduino Uno	2	900
ACS712	1	260
Motor	1	230
LDR	2	20
Buck Converter	1	420
IRFZ44N	3	150
1N5818	2	10
1N4841	2	10
0.1 uf	6	12
470 uF	4	36
10 uF	2	10
1 uf	1	5
2.2 k	2	5
82k	4	8
1 k	6	10
20k pot	2	30
33 mH	1	120
LED	10	30
20*4 LCD Display	1	450
I2C Display Module	1	150
Meal Header	2	20
Female Header	2	20
Vero Board	3	90
Solar Panel	1	620

From the above table we can see the cost of this project. Although the total cost of the project is more, because of installation cost, fare cost aren't include in the above list.

## CHAPTER 6

### Conclusion and Future Scope

#### 6.1 Conclusion

PV highlights an amazing fascination because of it generates electrical energy to a free endless inventory, sun, exploitation no moveable parts, overpowering no petroleum products, and making no contamination or ozone-depleting substances during the office age. Along these lines, it's our desire to frame the P-V framework more effectively all together that it able to support for the advancement of daily life. This undertaking has introduced a technique for monitoring a sun following exhibit with the installed micro-controller chip framework, a functioning programming answer for expanding photovoltaic cell yield by situating a sun-powered battery at the motivation behind the most extreme force. This task impending a method of discovering and following the sun and resetting it for a substitution day. Improvement of an undertaking upheld most extreme sun-powered energy flowing with changed boundaries being constrained by a microcontroller partner degree kept up extra to an ideal worth requisite for charging the battery; abuse hang on elective force exclusively an ascent in yield of sunlight-based battery on account of the execution of greatest sun-based energy flowing.

The proposed project is very valuable for uneven zones where there's scant daylight in winters. What's more, will have in a matter of moment's reaction and can consume the least space it is frequently fabricated even on the roof of homes, in exceptionally populated sloping regions. Energy can even be put away at an outsized scale and may be used for warming the house water in winters available in tanks of house.



## 6.2 Future Scope

Presently MPPT framework is viable with just 1 electrical gadget. In the event that we will in general interface it to the matrix or corresponding with no of electrical gadget it will in general figure the basic MPP of entire lattice and can't works on individual MPP of each board bringing about fall of force.

Additionally, there is a new pattern of unpracticed energy bringing about creations like star IMPULSE a couple off and heaps of option unpracticed energy ideas. Henceforth, this venture includes a horrendously wide degree in future to search out its application in use energy power revolution.

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