"Modeling and Implementation of Off-grid Solar (PV) System"

A project report submitted in partial fulfillment of the requirements for
The Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering.

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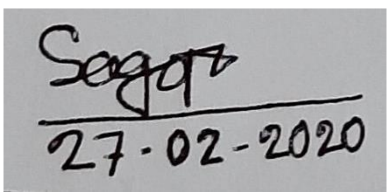
February 2020

Certification

This is to certify that this project and thesis entitled **"Modeling and Implementation of Off-grid Solar (PV) System"** is done by the following students beneath my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

Signature of the candidate



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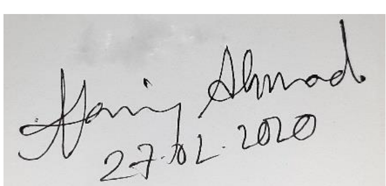

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Dedicated to

My Parents & Elder Brother

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PV	Photovoltaics
IC	Integrated Circuit
BJT	Bipolar Junction Transistor
MOSFET	Metal-oxide Semiconductor Field-effect Transistor
LED	Light Emitting Diode
DC	Direct Current
AC	Alternating Current
PWM	Pulse width modulation

ACKNOWLEDGEMENT

At first, we give thanks to God. Then we would like to accept this opportunity to express our appreciation and gratefulness to our project supervisor **Mrs. Kanij Ahmad, Lecturer** of **Faculty of Engineering** for being dedicated in supporting, inspiring and guiding us through this project. This project can't be done without her useful helps and advice. Also thank you very much for giving us opportunity to pick this project.Apart from that, for sharing knowledge; information and helping us in making this project a success we would like to thank our whole friends. Also thanks for borrow us various tools and equipment. For being very supportive and also for their inspiration and encouragement during our studies in this University, we want to give our deepest love and gratefulness to My dear family.

Abstract

This Project present Modeling and Implementation of solar Off-grid Solar System. The main purpose of this project introduce and approach to the model an Off-grid solar system for home use with a charge controller, battery, Inverter and a low-pass Filter. Photovoltaic (PV) panels can collect solar energy to produce electric power. In applications requiring electricity, using a solar PV system can be a valid consideration that provides energy to an energy demand installation. The charge controller Circuit Designed by using MOSFET, Transistor, Relay, zener diode, Diode, Capacitor, Resistor, LED etc. For reserved the energy, we are using a Lead Acid Battery. For Design an Inverter we are also use IC, MOSFET, Capacitor, Resistor etc. We are also use a Low-pass Filter for filtering wave shape. This Project present Modeling and Implementation of solar Off-grid Solar System. The main purpose of this project introduce and approach to the model.The purpose of our project is to provide electricity throughout the whole year by designing a solar off-grid PV system on the rooftop of every house in the rural area where no electricity has been reached yet.

CHAPTER-1
INTRODUCTION

1.1 Introduction

The population on earth is constantly increasing. As the population grows, the daily needs of the people are increasing. So people are becoming increasingly dependent on sophisticated equipment. That is to say, the use of electric power is increasing steadily. Most of the world's power plants use fossil fuels, mostly oil-gas-coal, etc. as fuel for generating electric power. But research has shown that the amount of fossil fuel available in the world, There is a huge potential for it to disappear within the next 40 to 50 years. Another concern for the use of fossil fuels is the burning of greenhouse gas emissions from burning these fuels And it has a huge detrimental effect on the adverse environment. For these reasons we need to find alternative ways to generate electricity.

1.2 Project Objectives

There are several objectives involved in this thesis. These objectives are explained below:

- To analysis the technique of Solar (PV) panel.
- To design and implementation of a Charge controller using MOSFET and Relay switching circuit.
- To design and implementation of an Inverter using Transformer.
- To design and implementation of a Low-pass filter.

1.3 Methodology

We have used solar mono panel, charge controller, battery, DC/AC inverter and low pass filter for this project. We have also worked to store the charge on the battery and make it useful for later use. Our background study was conducted through many types of books and internet. The project was well planned on the basis of background research & valuable ideas of our honorable supervisor. We received a lot of help from our supervisor, about the project.

1.4 Block Diagram

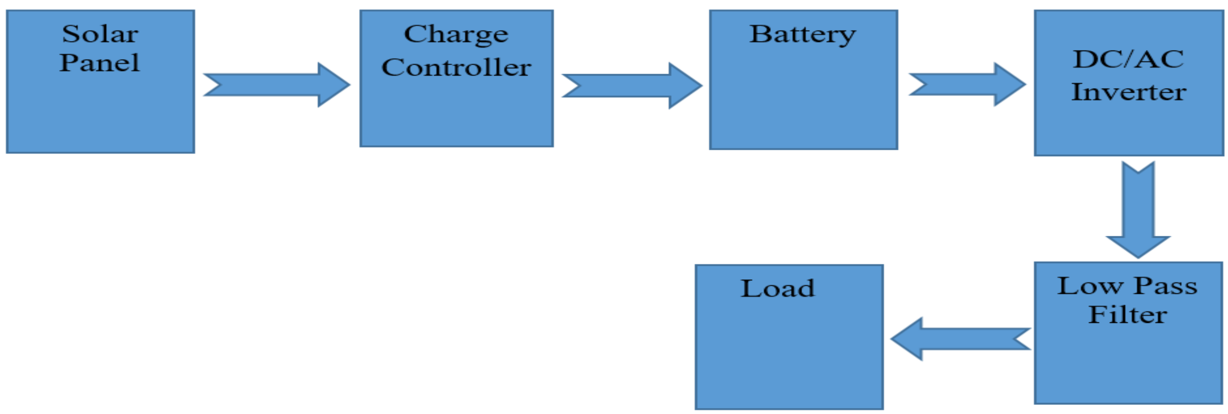

Fig: 1.4.1 Block Diagram of Solar PV System

CHAPTER-2

LITERATURE REVIEWS

2.1 Introduction

This chapter will discuss how this system was created earlier. We are not the first ones who have been working on this system. There has been a lot of work done on this system before. There have been many speculations about this system long ago. Now we have come to the point where we can easily create such a system like this. This chapter will discuss in detail, when and how this system was implemented before.

2.2 Historical Overview

Since ancient times, people have been using solar power in many ways. In the beginning, people used solar power to dry clothes and cook wood. When people began to use glass in the 16th century, sunlight was used to burn a bunch through a lens. After the invention of electricity in the 18th century, scientists thought of the invention of electricity from solar power. In the year 1888, Russian physicist Alexander discovered the first photoelectric effect. Then in 1905 Albert Einstein invented quantum theory with which he explained photoelectric effect. The first solar cell was discovered in the year 1954.

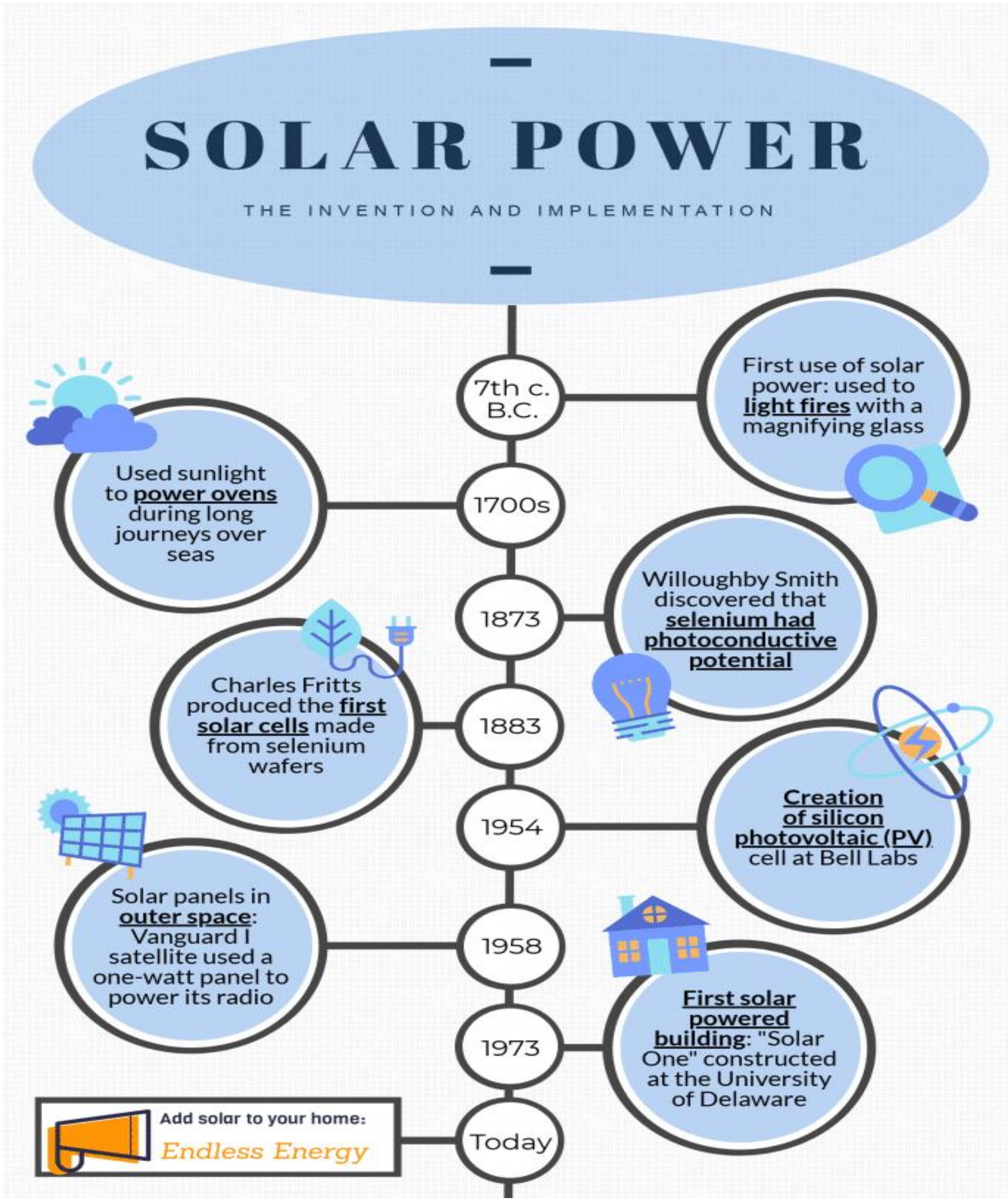

Fig: 2.2.1 The invention and implementation of solar power

The most important milestone in the history of solar photovoltaics is usually recorded as 1954, where Bell Laboratories publicly announced that its three scientists-Daryl Chapin, Calvin Fuller and Gerald Pearson. Had invented a silicon photovoltaic cell capable of converting the sun's energy into enough energy to operate everyday electronic equipment. On April 7, the company convened a press conference to discover a solar battery, a panel of cells that can power a small toy, and the next day they present it at the National Academy of Sciences in Washington. The New York Times headlined the invention on its front page, writing that solar cells' could be the beginning of a new era, which eventually led to the realization of one of mankind's.

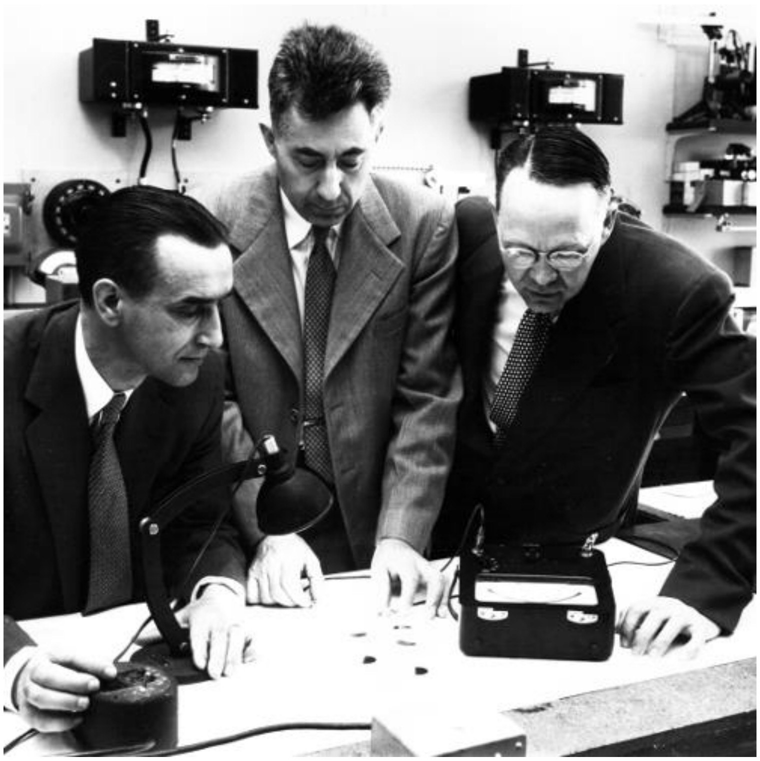

Fig: 2.2.2 In 1954 The First Solar cell Invention on Bell Laboratories

Since then, solar panels have been further modernized in the evolution of time. Modern solar cells are much more refined than before. As a result, the availability of its use has increased and the price has decreased.

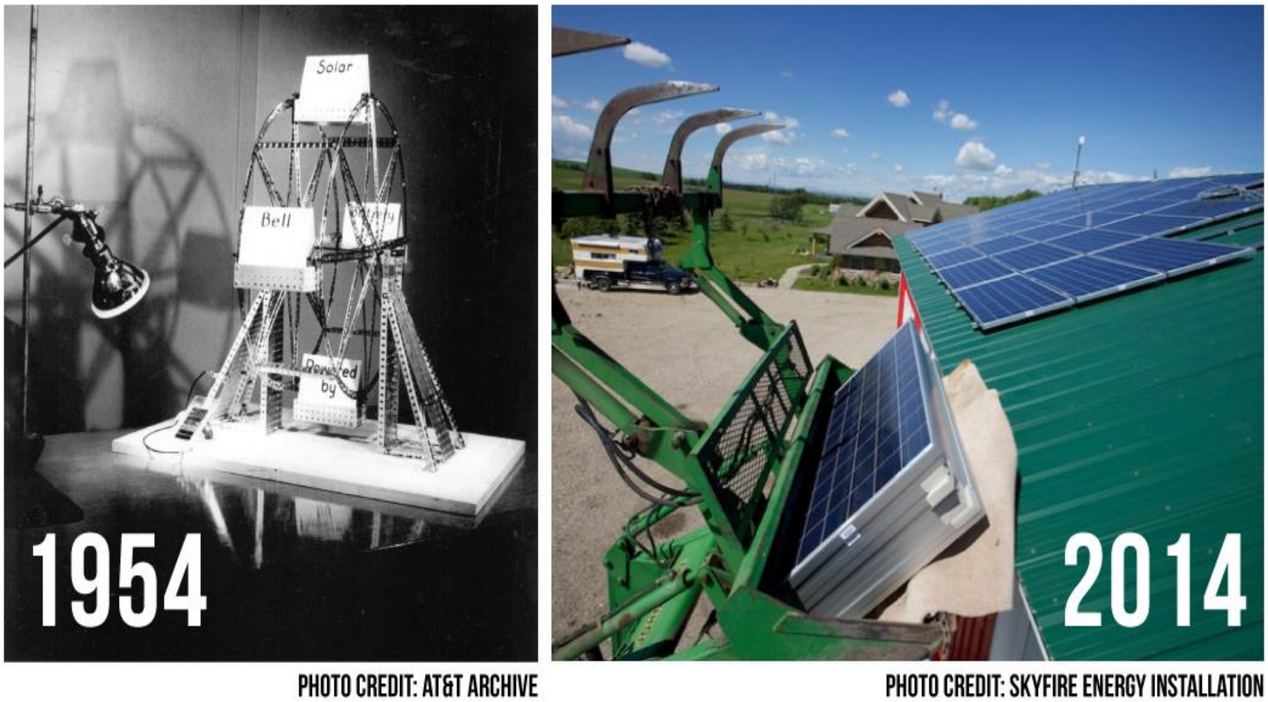

Fig: 2.2.3 Old solar cell vs Modern solar panel

It is then used to charge the battery with solar power but in this case, DC load was always used. Later, scientists thought of the invention of power inverters to use AC Load and they were able to make it. In 2007, F. Dickerson and Rick West presented an apparatus and method of control for converting DC power from a solar photovoltaic source to AC power. A novel DC-to-AC power converter .

2.3 Summary

This chapter reviews the history of solar cell discovery. we have discussed about the basic information about our project and research the related work that done by others before.

CHAPTER-3

EQUIPMENT & ANALYSIS

3.1 Introduction

This is a hardware based section. This chapter is providing all the information about some Active component such as Solar Cell, IRFz44N MOSFET CD4047 chip, LM7805 Regulator IC, Transformer etc. & some passive components such as Vero Board, Connecting Wire, soldering wire etc.

3.2 Solar (PV) cell Module

The main component of a PV system is a photovoltaic (PV) cell, also known as a solar cell. Figure 4.2.1 has given a PV cell. A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light into electricity by direct photovoltaic effects, which is a physical and chemical phenomenon. Interaction times are different. Individual solar cell devices can be integrated into forming modules, otherwise known as solar panels.

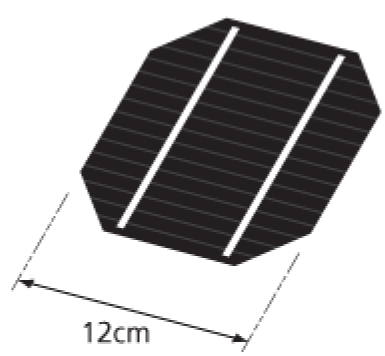

Fig: 3.2.1 solar (PV) Cell

3.2.1 Module Materials

Most PV bulk silicon PV modules consist of transparent top surfaces. An EVA, a rear layer and a frame near the outer edge. The top surface of the solar module is made by glass. The EVA(Ethyl vinyl acetate) and the Rear layer is Tedlar. The following figure is given the all materials of solar cell.

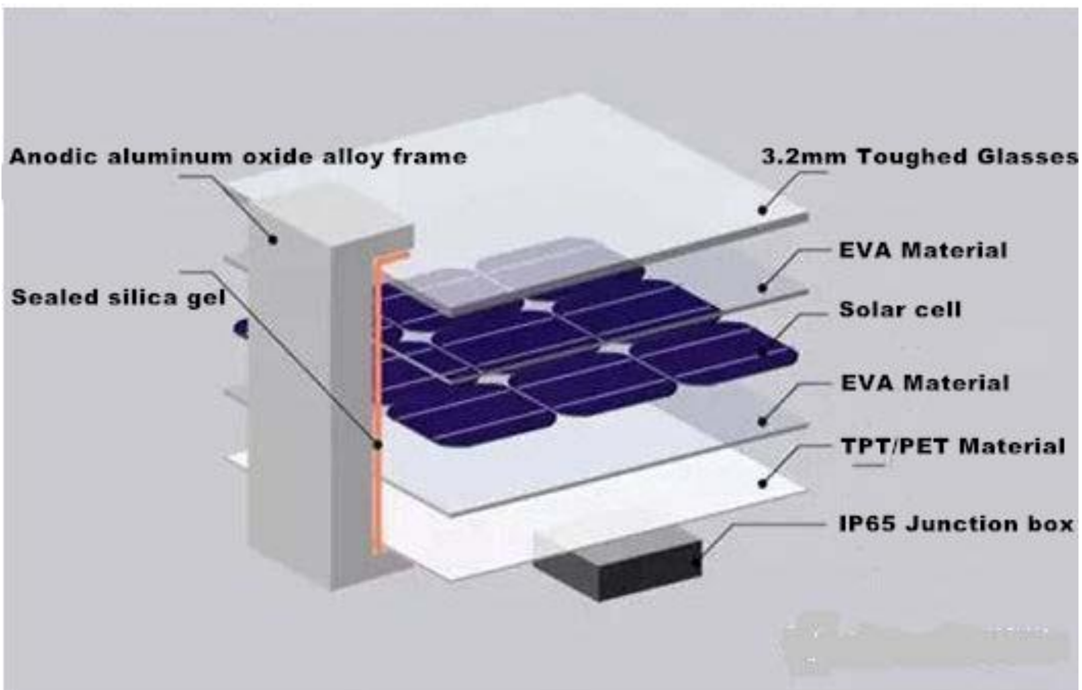

Fig: 3.2.2 structure and working of solar cell.

3.2.2 Packing Density

The packing density of solar cells in a PV module refers to the area of the module enclosed with solar cells relative to zero. The density of the packing depends on the size of the solar cells used. The packing density is given by the following diagram.

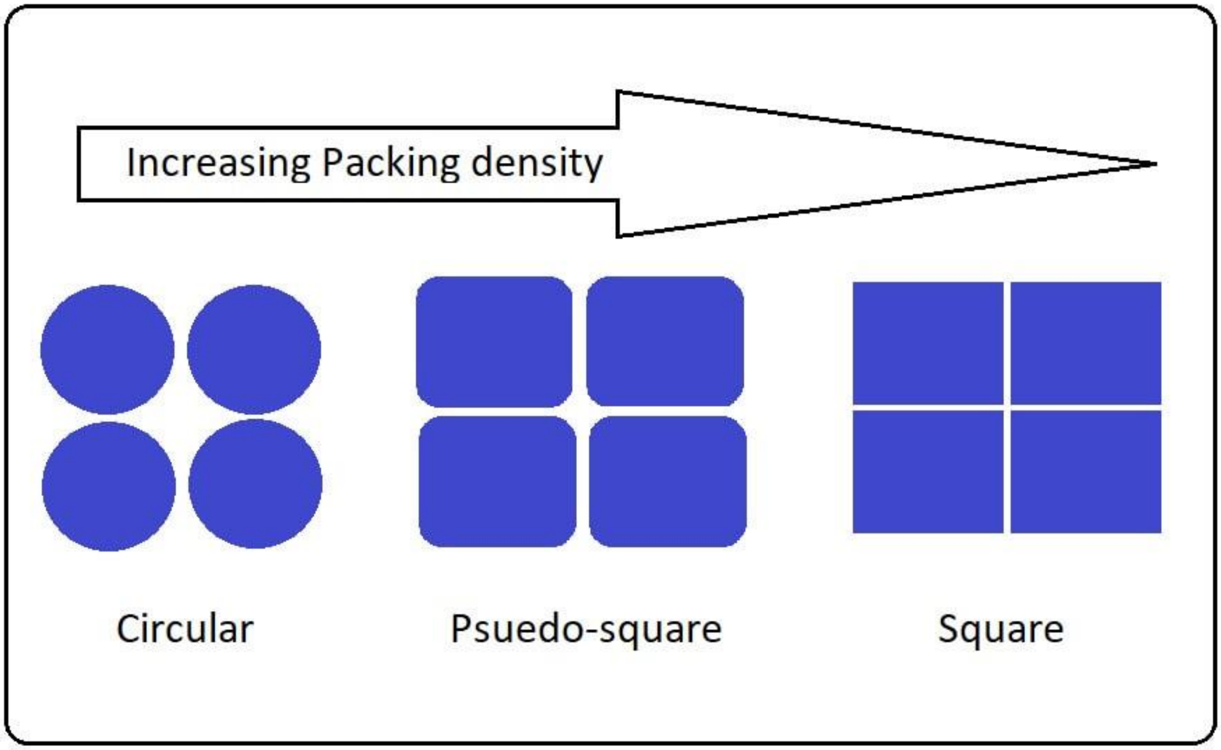

Fig: 3.2.3 Packing Density

3.2.3 Panel and PV array

To maximize their utility, many individual PV cells are linked together in a sealed, weatherproof package called a panel (module). For example, a 12V panel (module) series will have 36 cells attached and a 24V panel (module) will have 72 PV cells attached to the series.

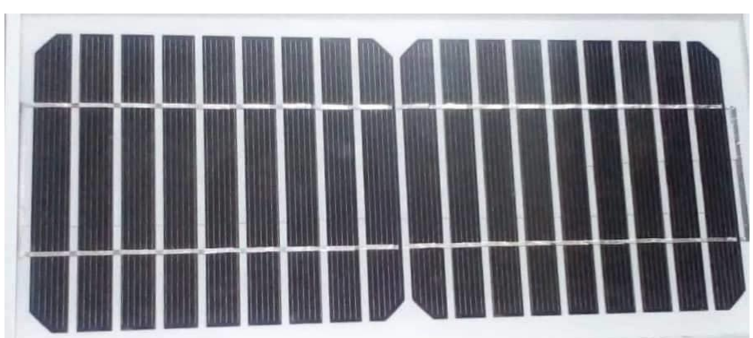

Fig: 3.2.4 A single solar panel

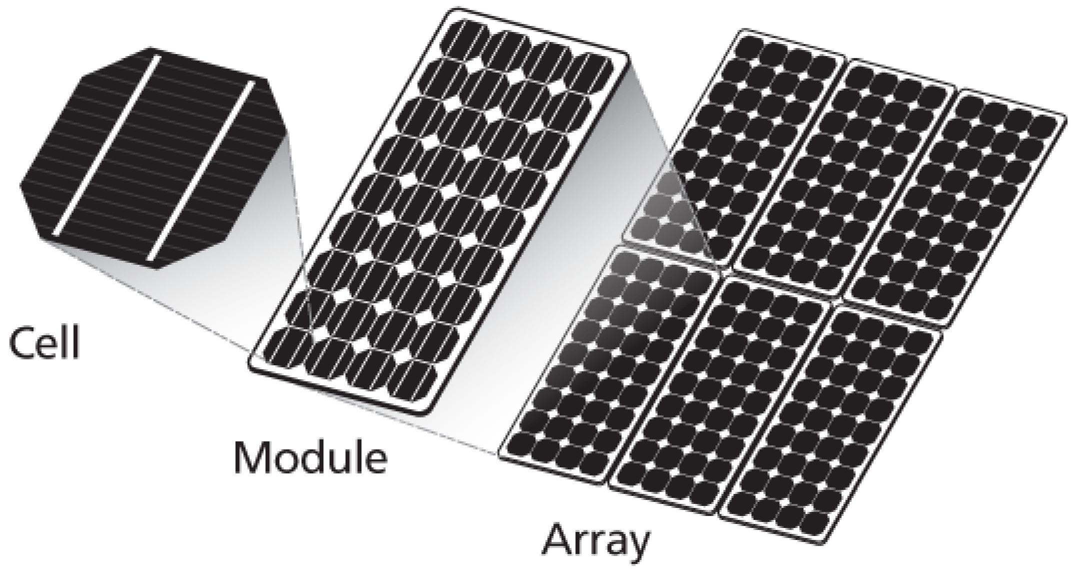

Fig: 3.2.5 Solar cell, Module, Array.

Photovoltaic sun based board retains daylight as a wellspring of vitality to produce power. A photovoltaic module is a bundled, associated1with gathering of normally 6*10 photovoltaic sun based cells.

3.2.4 Bypass Diode & Blocking Diode

Blocking Diode: Solar cells are mainly capable of producing electricity during the day. The electricity from the solar cell is stored in the battery. Solar cells usually do not generate any electricity during the night But since the solar cell is connected to the battery, the solar cell flows from the battery to the solar cell and damages the solar cell. So a type of diode is used in the solar cell to prevent the battery from flowing into the solar cell. This diode is called blocking diode. The diode basically prevents the flow of electricity from the battery.

Bypass Diode: Many times the shadow can fall on the solar panel cell. In that case, the electrical energy generated from other cells is interrupted by shadow cell. In this case the cells become very hot and the electrical flow is disrupted. This is also called hotspot heating. To solve this problem, the diode is used separately in each cell. In order to prevent shadows from flowing into a cell, the current flows through the diode. This is called Bypass diode.

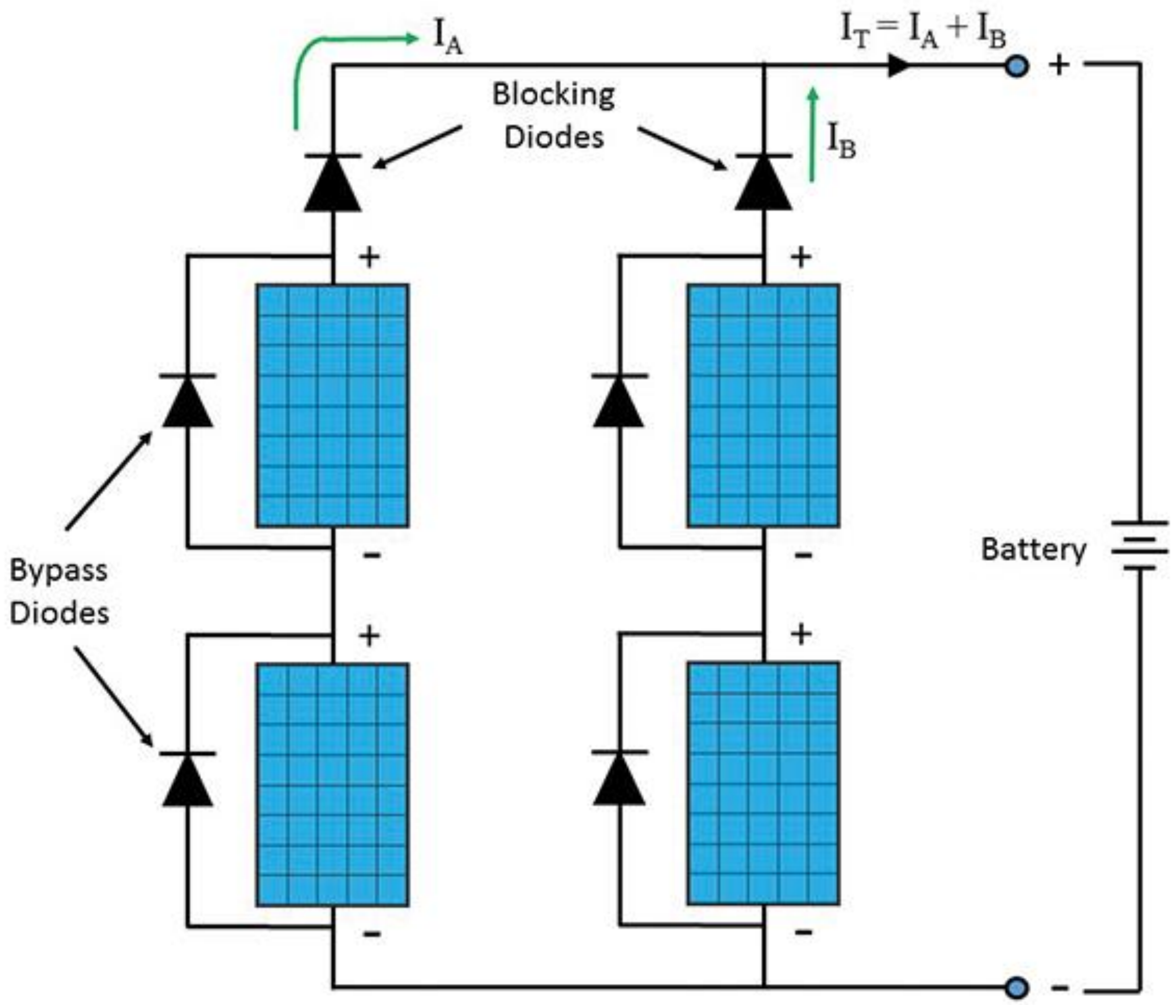

Fig: 3.2.6 Bypass Diodes & Blocking Diode

3.3 MOSFET:

MOSFET means a Metal Oxide Silicon field effect transistor or a metal Oxide Semiconductor Field Effect transistor. The value IGFETI is expressed in the money insulated gate field effect transistor. The FET operation appears in both the Hester and the End methodology. The diagram shows a real MOSFT that appears.

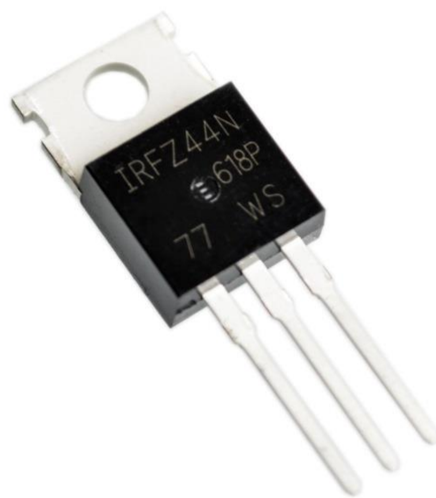

Fig: 3.3.1 MOSFET

3.3.1 Construction of a MOSFET:

FET has some similarities in building MOSFETs. The oxide layer is deposit on the substrate where the gate terminal is attach. This oxide layer acts as an insulator (insulates CO2 from the substrate).And therefore has another name for IGBT as MOSFECT In the construction of MOSFET, the light Doped substrate is splitting into a heavy doped region.

The following Fig. shown the construction of a MOSFET:

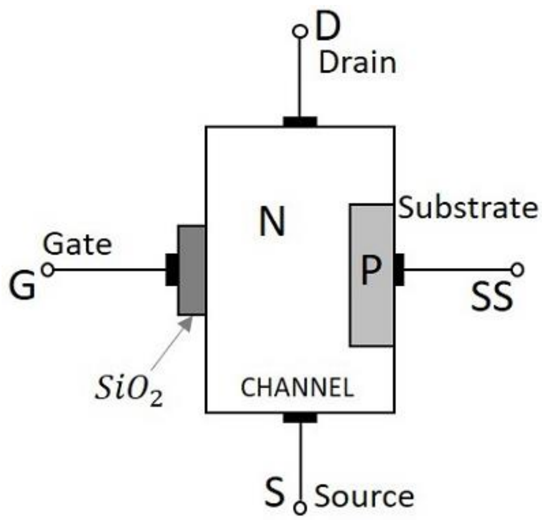

Fig: 3.3.2 Constraction of a MOSFET

3.3.2 Classification of MOSFETs:

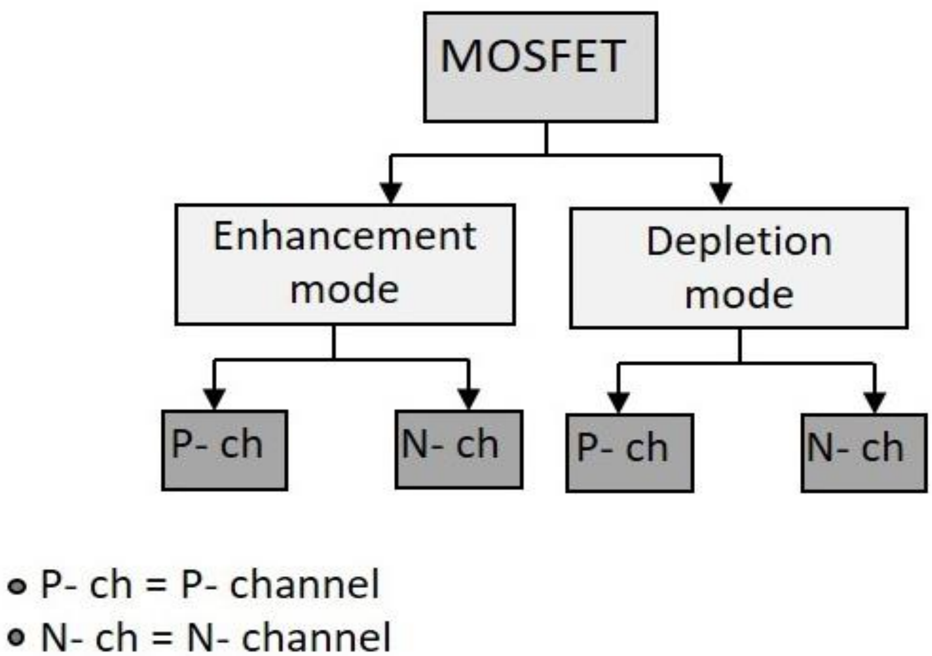

Fig: 3.3.3 Classification of MOSFET

3.3.3 N-Channel MOSFET:

The drain and source are heavily doped n + zones and the layer is p-typed. The current flows due to the influx of negatively charged electrons, also known as N-channel MOSFET.

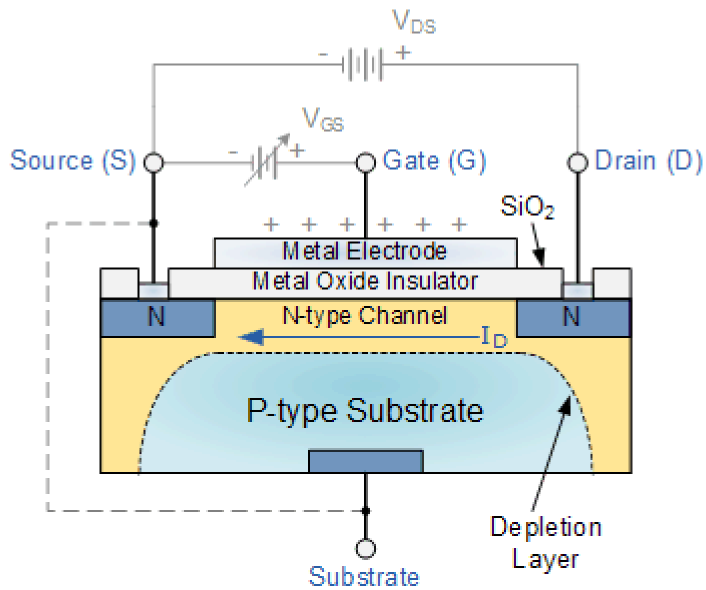

Fig: 3.3.4 stracture of N-Channel MOSFET

3.3.4 Encherment Mode of N-channel MOSFET

A general MOSFET has three reasons

I. Cut-off Region
II. Linear or Ohmic Region
III. Saturation Region

In the following figure the regions are mentioned. Fig- a was given transfer characteristics & fig-b output characteristics of the MOSFET.

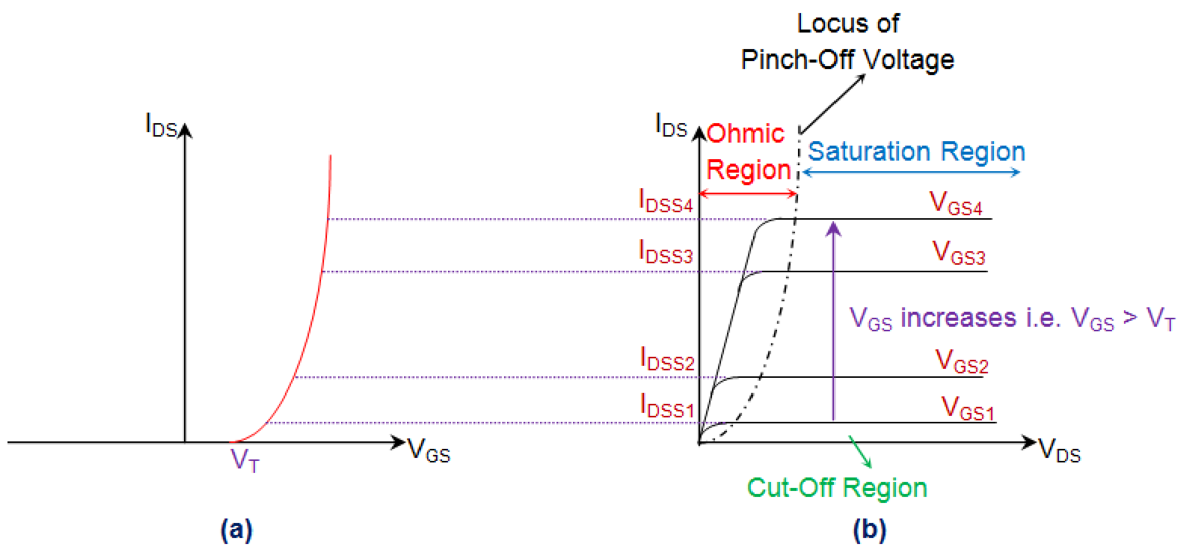

Fig: 3.3.5 N-Channel Enhancement MOSFET characteristics

3.4 IC CD-4047

Cd 4047 is a multi-vibrator IC. It is used for making inverters. This IC has a total of 14 pins. This IC typically operate within 9v to 12v power supply. pin 1 & 2 are directly connected by a 0.1µF capacitor and PIN 2&3 are connected by a 100kΩ (variable)Resistor & a 10kΩ Resistor. This RC section has controlled the output Frequency of this IC. The pin numbers 10 and 11 act as output sections. When voltage is provided on the IC. At a certain time interval, the output pin11 & pin12 has produced an output pulse. This output pulse has operated the power section & This pulse used for the trigger of MOSFET. Figure-4.1 has given a CD-4047 IC.

Fig: 3.4.1 CD-4047 IC

3.4.1 CD-4047 Pin-out Diagram

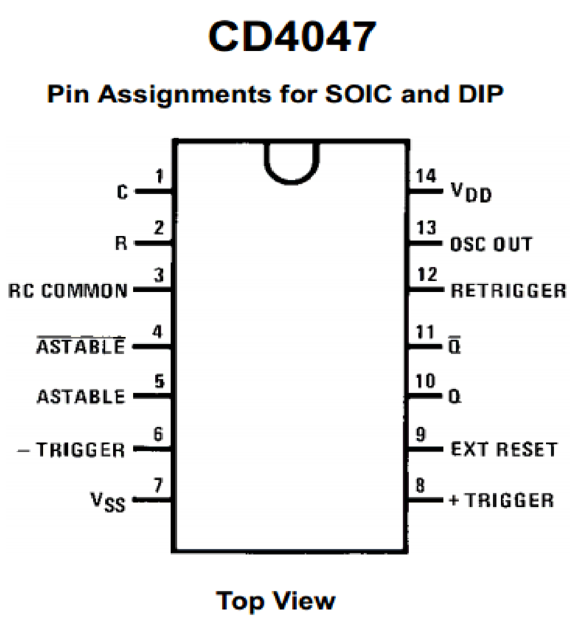

Fig: 3.4.2 pin-out diagram of cd4047

3.4.2 Block Diagram of cd-4047

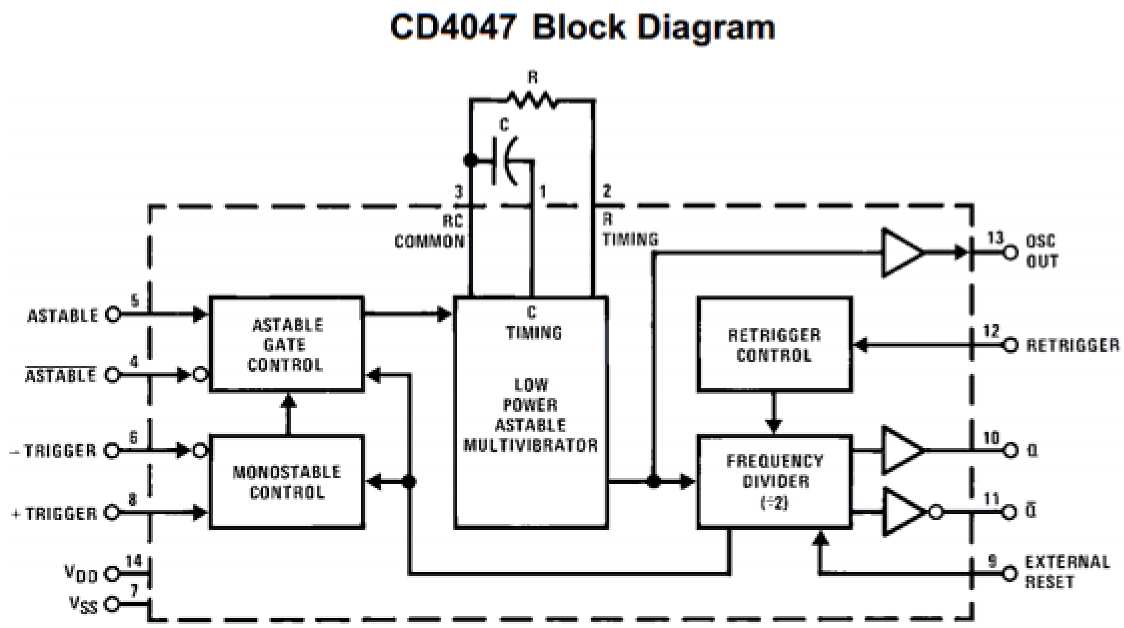

Fig: 3.4.3 Block diagram of cd4047

3.4.3 Feature of CD-4047

I. Power consumption is low
II. Provide One-short and Free running operation
III. High noise immunity
IV. Circuit Design is very easy
V. Symmetric output properties

3.5 LM7809 Regulator IC

LM7809 is an accessible IC. It supplies 9V DC. It has only three pins. The first pin act as the input, center is ground & the last pin is Output. Tis IC Produced a Constant voltage(9V) & output Current is 1.5A. so It Less likely to damage the appliance.Fig-4.7.1 was given a LM 7809 IC.

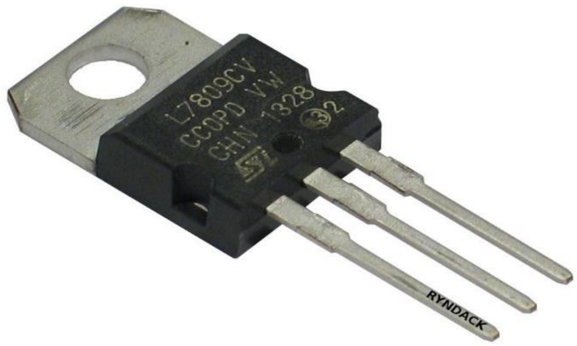

Fig: 3.5.1 LM7809 Voltage Regulator IC.

3.5.1 Circuit Diagram of LM7809

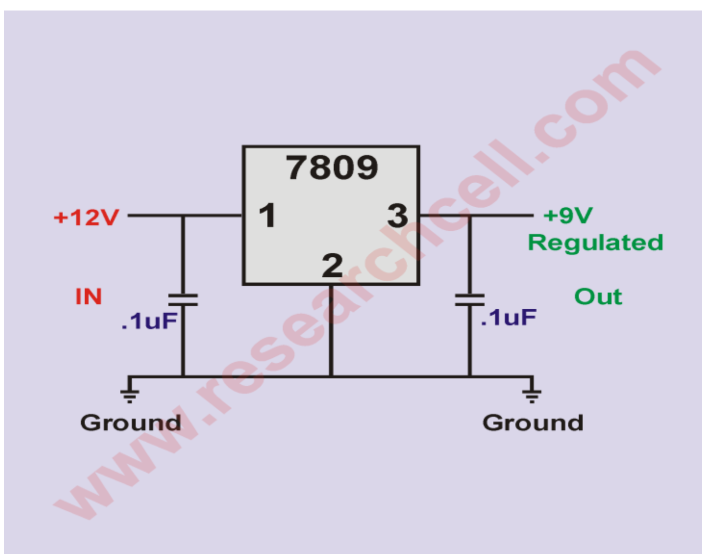

Fig: 3.5.2 Circuit diagram of LM7809

3.6 Center tap Transformer

Since we will Build a single phase current inverter, so we are also used a single phase Center tap Transformer.Fig-4.8.1 was given a center tapped transformer. This transformer Primary section is 220V and the secondary section is 12-0-12 volts. Since we will create 220 volts current inverter, we will use this transformer as a step-up.

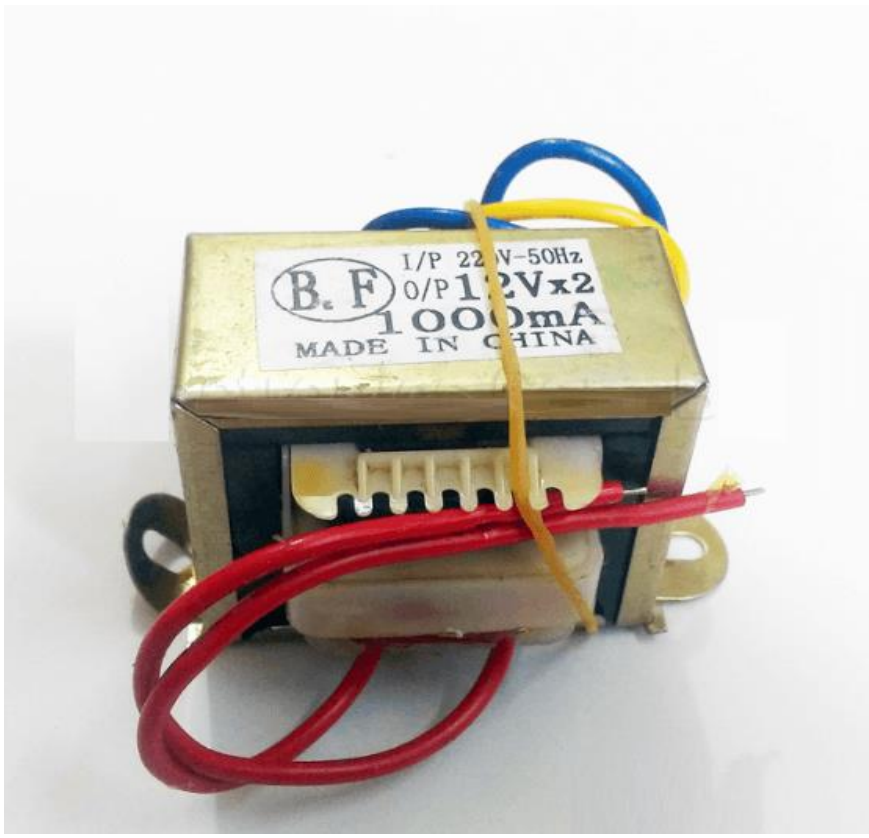

Fig: 3.6.1 Transformer

3.7 Vero Board

Vero board is a brand of stripboard, a pre-formed circuit board material of copper strips on an insulating board.

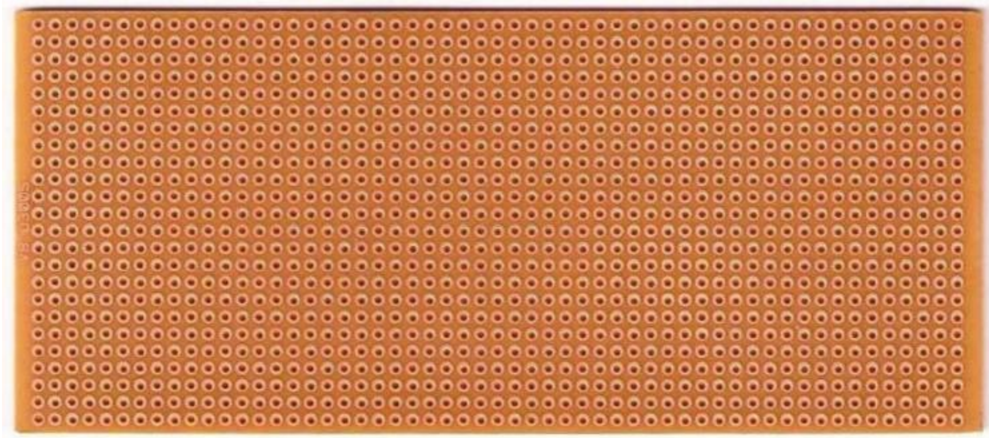

Fig: 3.7.1 Vero Board

3.8 Electrical Connector

An **electrical connector** is an electromechanical device used to join electrical terminations and create an electrical circuit.

Fig: 3.8.1 Electrical Connector

3.9 Soldering wire

Soldering is a process in which two or more items are joined together by melting and putting a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal.

Fig: 3.9.1Soldering Wire

3.10 Summary

In this chapter we've describe about all components that we used in our project with figure. And final structure of the project.

CHAPTER-4

HARDWARE DEVELOPMENT

4.1 Introduction

In this chapter we will review the charge controller, inverter ,battery, low pass filter etc. we will describe the charge controller design and its function. As well as the battery charge and its voltage. In this chapter we will design a Inverter circuit with a Low-pass Filter.

4.2 Charge Controller

A Charge controller is basically used to protect the solar system's batteries. It protects the performing various tasks and tasks at the required time. As a result, the solar system's equipment and batteries are long lasting.

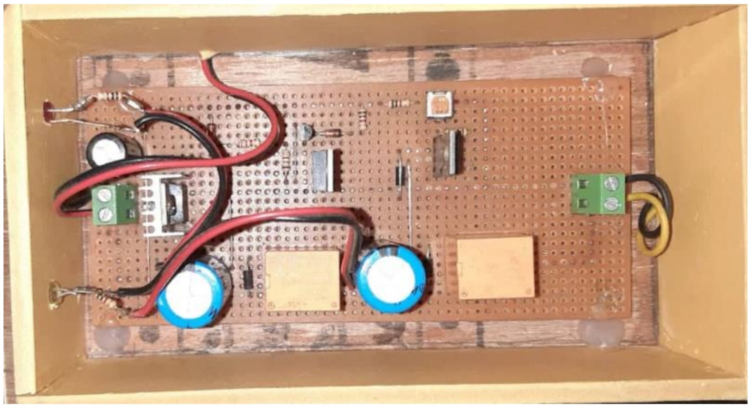

Fig: 4.2.1 Charge controller

4.2.1 Advantages of charge controller

I. Low voltage protection.
II. Over voltage protection.
III. Battery cut off circuit.
IV. Back current protection.
V. Over discharge protection.

4.2.2 Concept of My Charge-controller Design

The above MOSFET relay switch circuit is attached to a common-source configuration. With zero voltage input, low position, VGS value, there is not enough gate drive to open the channel and the transistor is "off".But when the VGST MOSFET is raised above the bottom voltage VT, the channel opens, the current flow and the relay coil is driven. Then the raise mode MOSFET acts as a simple open switch, making it ideal for switching to smaller loads such as relays.

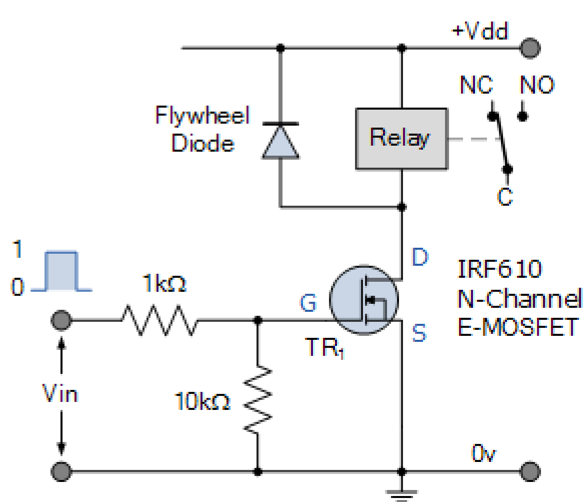

Fig: 4.2.2 N-channel MOSFET Relay Switching Circuit.

4.2.3 Components List Of Charge Controller

The essentials of the charge controller design are listed in the form of a table below:

Sl No.	Components Name	Model No.& Value	Designation	Quantity
01	MOSFECT	IRFz 44	Q1,Q2,Q3	1
02	Transistor (p-n-p)	2N3904	Q4	1
03	Zener Diode	1N4740A	10V	1
04	Zener Diode	1N4744A	15V	1
05	Resistor	2k	R1	1
06	Resistor	1k	R2,R4,R5,R8	4
07	Resistor	1.5k	R3	1
08	Resistor(variable)	10k	R6	1
09	Resistor	10k	R7	1
10	Relay	Relay-SPDT	U1,U2	2
11	Capacitor	2200µF/25V	C1,C2	2
12	Diode	1N4007	U5,U6,U7	3
13	LED	Red, Yellow	U3,U4	2

Table no: 4.1 Essential components of the charge controller

4.2.4 Circuit Diagram of Charge-controller

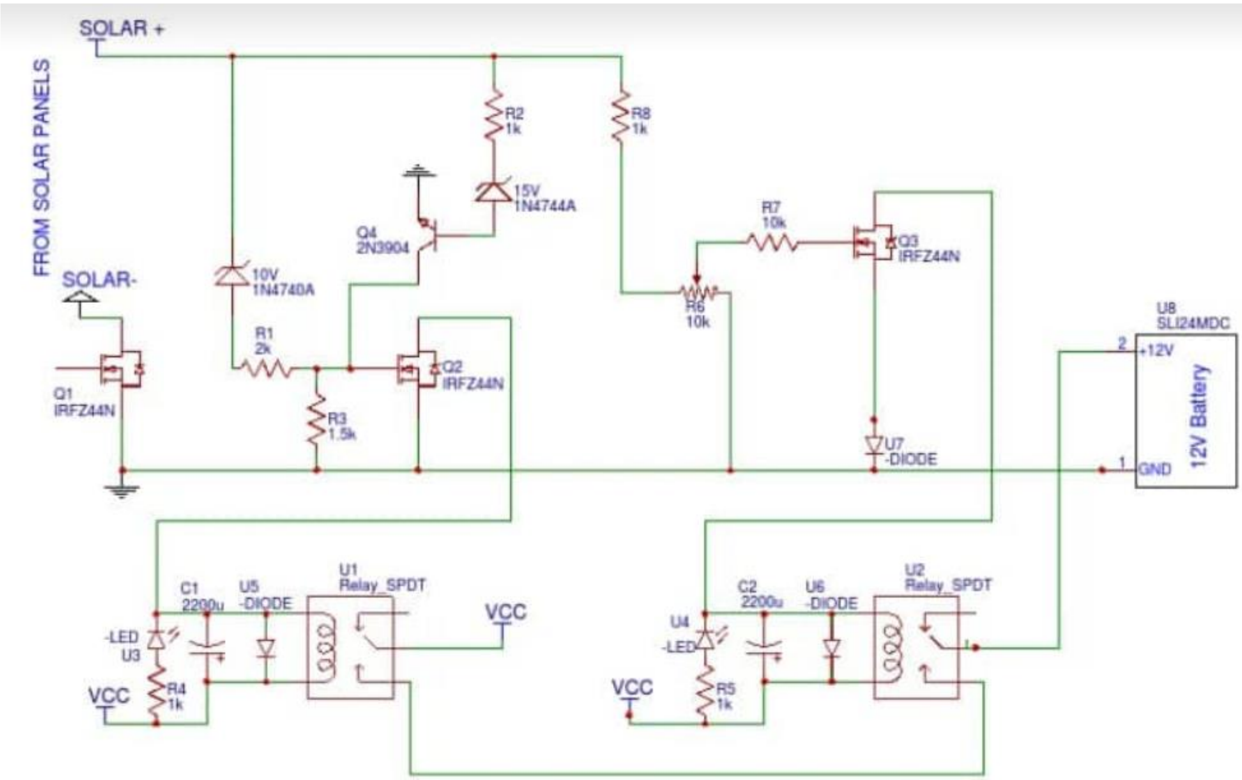

Fig: 4.2.3 circuit diagram of charge-controller

4.2.5 Working Procedure of Charge Controller

The first part of the circuit is just a simple N-channel MOSFECT in a forward bias condition, To stop the flow off current from the batteries to the solar panel. Now during the sun rise when ever the panel voltages is reaches 10V The zener diode 10V is start conducting, then the MOSFECT Q2 is ON and it also start conducting through the relay coil. which ultimately turn on the relay. This is called low voltage protection. Now for the over voltage protection. When ever the panel voltage reached 15V. the 15v zener diode start conducting has the transistor Q4 also reached the saturation shade . So negative voltage flows through it & Q3MOSFET is turned off. So the battery charging process stops. Now to understand overcharge protection let assume that the battery is not fully charged, so most of the current flows through the battery. But when the battery charging is full lets current flows through by the variable resistor R6 & R7. Which turn off the second MOSFECT Q3, Which ultimately turn off the second relay and this cycle will repeat when ever the battery voltage decreases to a certain limit. This is how the solar charge controller works.

4.2.6 Working Condition of MOSFET vs Relay Switch

Solar panel voltages	MOSFET Q2	MOSFET Q3	Relay U1	Relay U2	LED	Charging Status
0V-9V	OFF	OFF	OFF	OFF	OFF	Not charging
10V-15V	ON	ON	ON	ON	ON	Charging
15V- ∞	OFF	ON	OFF	ON	OFF	Not Charging

Table no: 4.2 working Condition of MOSFET vs Relay Switch

4.3 Battery

Battery stores current electricity that produces from solar arrays for using when sunlight is not visible, nighttime or other purposes. The batteries used in solar cells are somewhat different from those of ordinary batteries. Normally C20 battery is used in solar system. These battery plates are a bit thicker than normal batteries. Because of this, the charge on the battery is somewhat slower and the battery's stability will increase manifold.

Batteries are often used in PV systems for the purpose of storing energy produced by the PV array during the day and to supply it to electrical loads as needed (during the night and periods of cloudy weather). In this project we have used 12 V and 4.5 Ah Seal Lead Acid Battery.

Fig: 4.3.1 Sealed Lead Acid Battery

4.3.1 Lead Acid Battery Structure

Led acid batteries have a complex structure. The lead acid battery mainly consists of two parts. One is the outer part and the other is the inner part. The outer part is basically covered with a sturdy plastic case. Two items in the upper part of the battery are usually noticeable, One is the battery terminal and the other is valve. There are two terminals one is positive and the others is negative terminals. Valve are used to insert acid or other chemical elements into the battery. The inner side of the battery has two Lead plate. One is the positive plate & the other is Negative plate. In the middle of these two plates there is an abrasive microporous separator. A type of connector is used to attach the positive and negative plate. The sealed lead acid battery usually contains acid when dry.

Here is the figure of Lead Acid Battery Structure

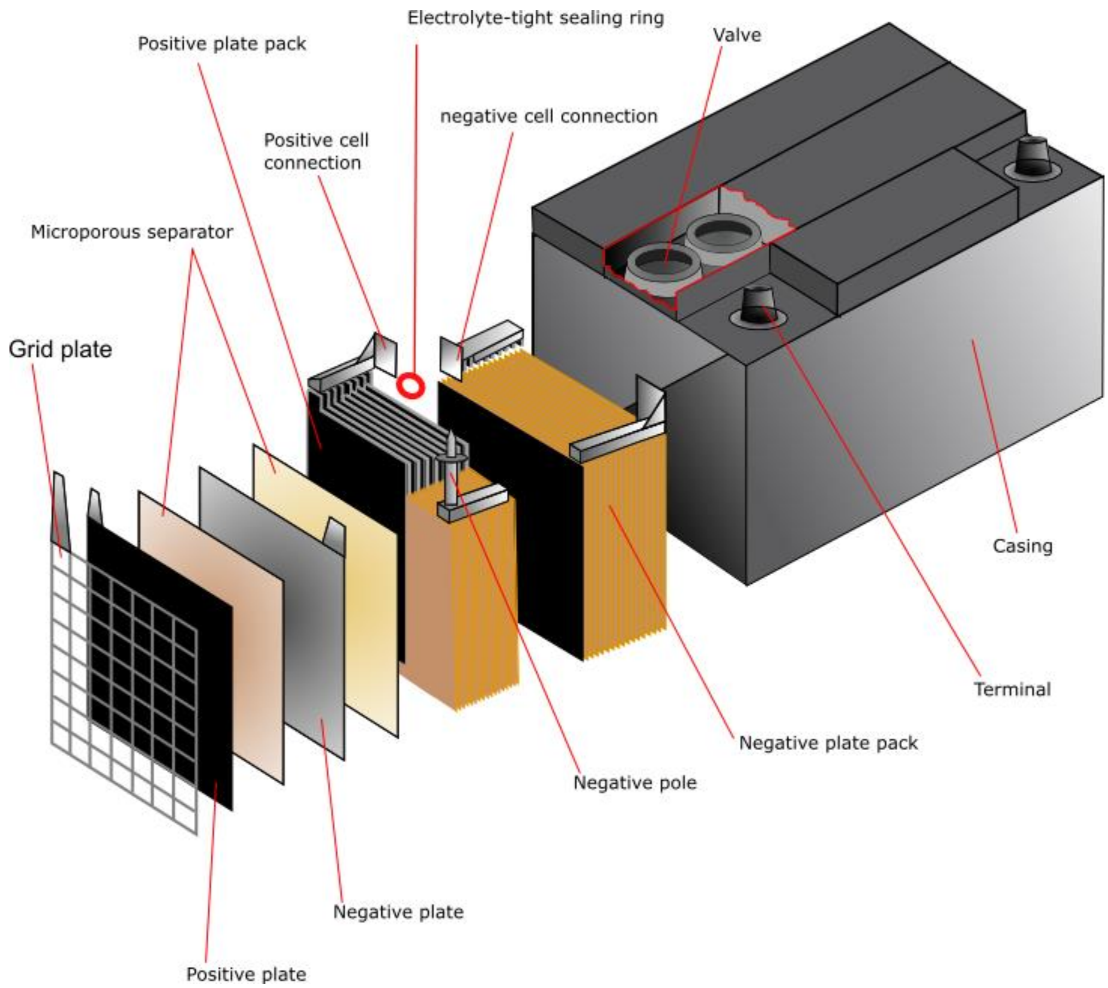

Fig: 4.3.2 Lead Acid Battery structure

4.3.2 NO Load Typical voltage vs state of Charge

Basically, solar charging is done slowly with the battery. So the amount of charging at a particular time is fixed. However, in the case of solar electricity, the sun's light has to depend a bit. Charges vary over a period of time in a total of 6 cells of a 12 volt battery. Over time, the concentration of charging in the cells increases. The following table lists the percentage of charging in details.

State of Charge	Voltage of battery	Volt per cell
100%	12.7	2.12
90%	12.5	2.08
80%	12.42	2.07
70%	12.32	2.05
60%	12.20	2.03
50%	12.06	2.01
40%	11.9	1.98
30%	11.75	1.96
20%	11.58	1.93
10%	11.31	1.89
0	10.5	1.75

Fig: 4.3 Typical voltage vs state of charge

4.4 Inverter

Inverter is a critical component of any solar PV system that converts DC power output of solar arrays into AC for AC appliances. An inverter is an electrical device that converts direct current (DC) to alternating current (AC); the resulting AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits. Inverters are commonly used to supply AC power from DC sources such as solar panels or batteries. The electrical inverter is a high-power electronic oscillator.

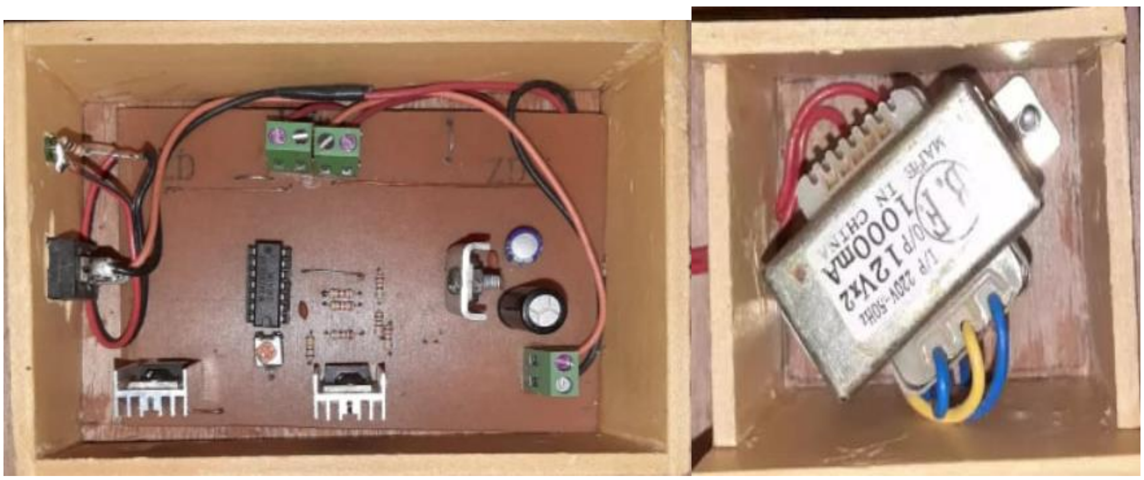

Fig: 4.4.1 Inverter Circuit with Transformer

4.4.1 Fundamental of Inverter design

There are two ways to create a power inverter. One uses a transformer and the other is a transformer less design. Here we have designed the inverter using transformer. The first condition to create an inverter using a transformer is to conduct electricity inside the transformer through the switching method. In this case, we used two power MOSFET. Which acts as a high magnification switch. We used an oscillator IC to turn on the on-off MOSFET. Which turns on- off the MOSFET's at a certain time.

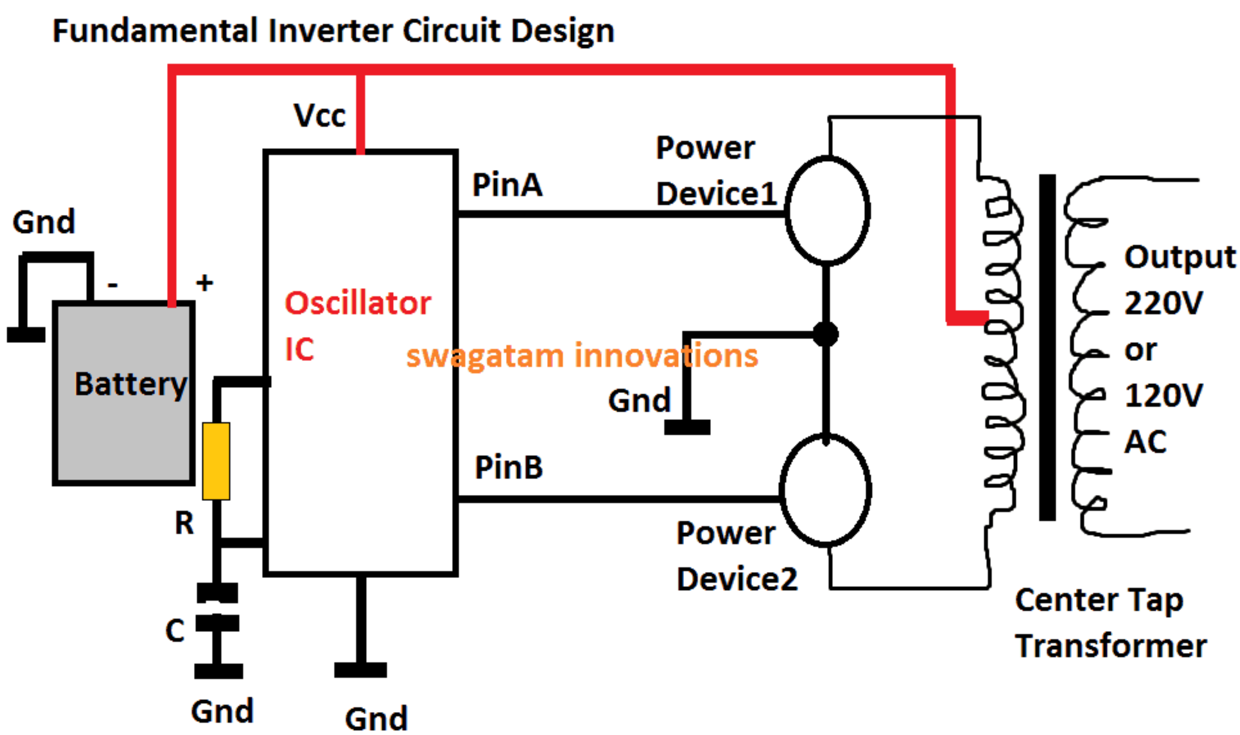

Fig: 4.4.2 Fundamental Inverter Circuit Design

4.4.2 Components List for Inverter

Here we will refer to the components of inverter generation. The following table describes it:

SL	Name	Model No./Value	Designator	Quantity
01	IC	CD4047	U1	1
02	IC	LM7809		1
03	MOSFET	IRFz-44	Q1,Q2	2
04	Transformer	12-0-12/1000mA	T1	1
05	Capacitor (Electrolyte)	1000µF/25V	C1	1
06	Capacitor (Electrolyte)	100µF/16V	C4	1
07	Capacitor(Ceramic)	0.1µF	C2,C3&C5	3
08	Resistor(Variable)	10KΩ	R1	1
09	Resistor	10KΩ	R2	1
10	Resistor	2.2kΩ	R3,R4	2
11	Resistor	220Ω	R5,R6	2

Fig: 4.4 Components list for Inverter

4.4.3 Working Procedure

In Making inverter we have worked in total Four steps. In the first step we ensure the required power supply of various part of the circuit. A total of two types of DC voltages is used in two parts of the circuit. One was driver section voltage and another was power section voltage.

For power section voltage we connect 12V Battery directly. For the driver section Voltage, We need a 9volts dc supply. So, we used the regulator circuit for creating 9V. The Regulator circuit gives in Figure 5.4.2. Fig: 5.4.3 Inverter Circuit

Driver IC is turned on when 9volts power is confirmed in the driver section. The main component of the driver section is a CD4047.

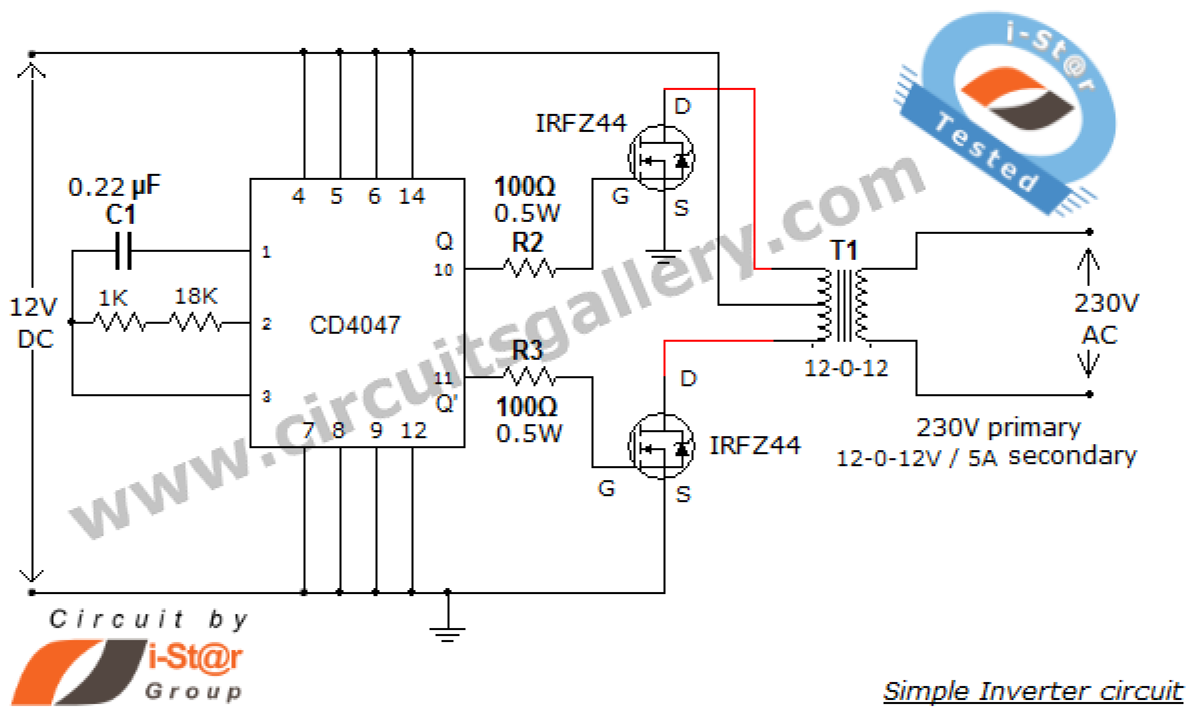

Fig: 4.4.3 Inverter Circuit

We have discussed this IC in the previous chapter. We get the output signal of ic from pin 10&11. Output pin10 & pin11 has produced an output pulse. This output pulse has operated the power section & This pulse used for the trigger of MOSFET Q1 and Q2. This MOSET is Flow of Current through the Transformer. The primary of the transformer is used here as a step-down.

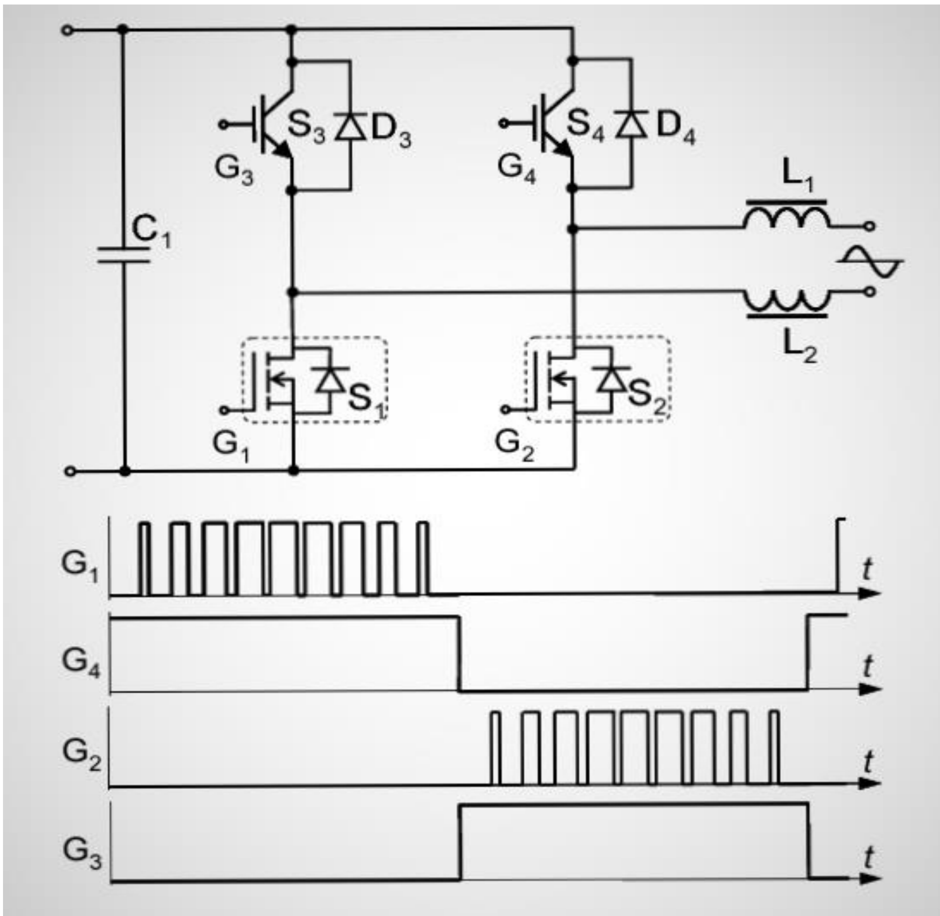

Fig: 4.4.4 Switching mode of MOSFET

Battery has been used as a source of energy for MOSFET. Here, a large amount of AC current flows in the primary section of the transformer, through the switching method of MOSFET. In the primary section, the volume of the current is high but the voltage is less near about 12v AC.

During the transformer induction rules, voltage will be generated in the transformer secondary Section. Since the primary section of the transformer is 12-0-12 volts and the secondary section is 220V. so the secondary section of the transformer will produced 220V AC. Next we will be filtering the this 220 volt AC.

4.5 Low Pass Filter

Low-pass filters allow the fundamental component of the waveform to pass to the output while limiting the passage of the harmonic components. If the inverter is designed to provide power at a fixed frequency, a resonant filter can be used. For an adjustable frequency inverter, the filter must be tuned to a frequency that is above the maximum fundamental frequency.

Fig: 4.5.1 Low Pass Filter

4.5.1 Circuit Construction for Low-pass Filter

For construction a Low-pass filter. We consider a RLC circuit. Figure has given some inductor. Inductor is so many important for Low-pass Filter. It was balancing the frequency of the circuit.

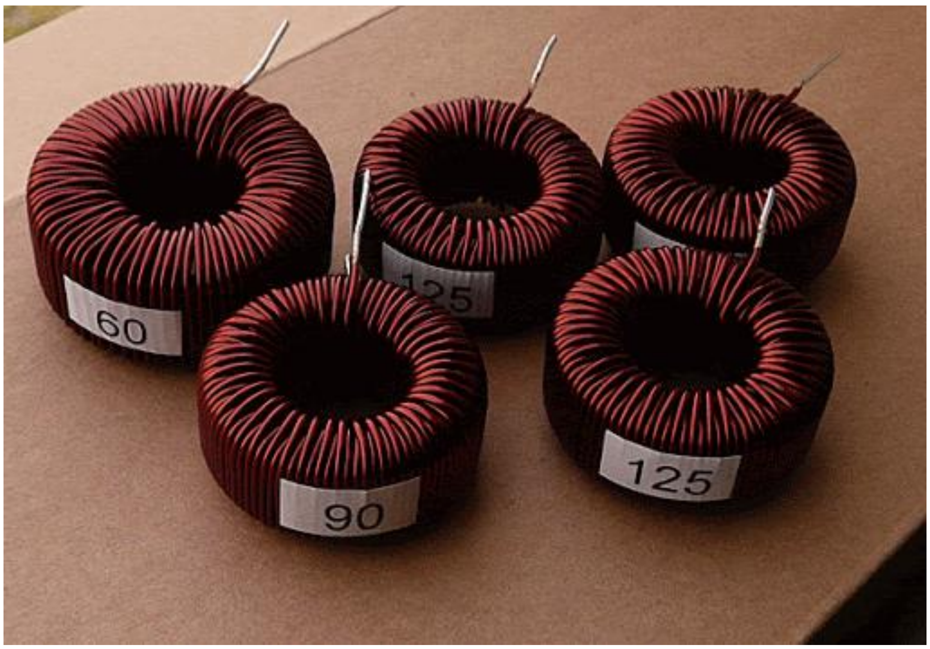

Fig: 4.5.2 Inductor

Here is some mathematics Equation for selection inductor and capacitor in Low-pass Filter circuit.

$$L= \frac{Z_0}{\pi f C} \text{ Henry}$$

$$C= \frac{1}{Z_0 \pi f C} \text{ F}$$

Cut-off frequency, $f_c = \frac{1}{\pi\sqrt{LC}}$ Hz

Where, Z_0 = Characteristic impedance in, ohm

C = Capacitance in, Farad

In this circuit given in, fig- we are using a 100Ω Resistor, 100mH inductor and a 0.33uF/400V capacitor. The RLC circuit, Resistance and Inductor in series Circuit connected by output Phase of the Transformer. The Capacitor is connected in parallel with Neutral Line. Which is connected the output side of RL circuit.

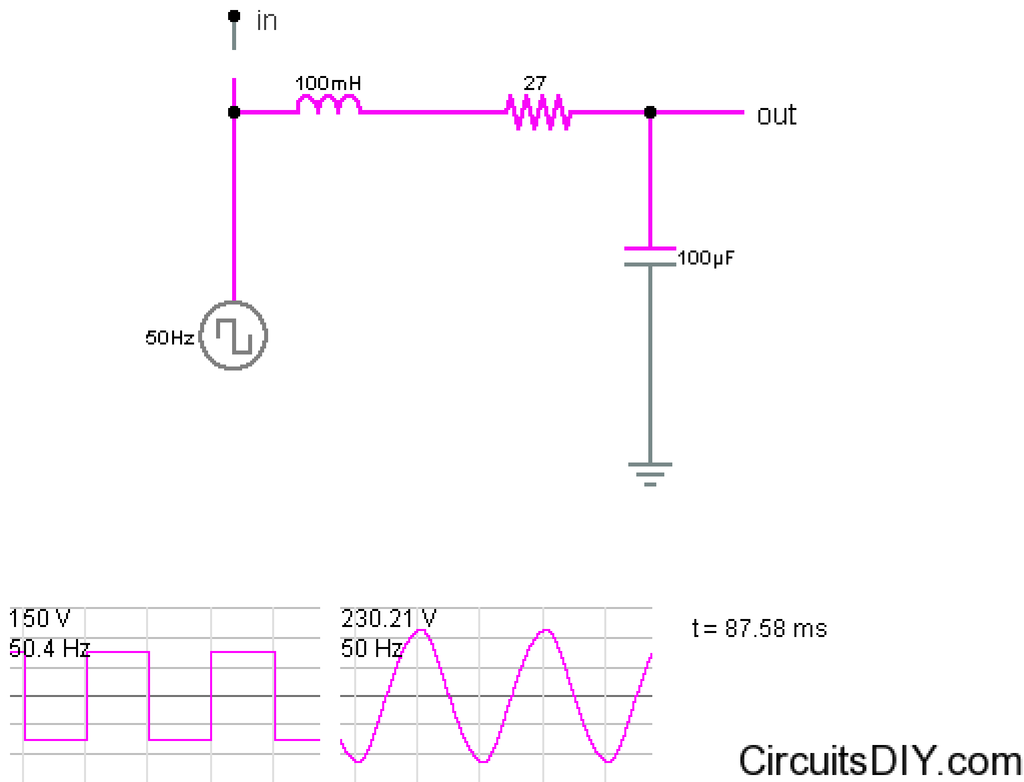

Fig: 4.5.3 Low-pass Filter circuit

4.5.2 Output wave shape

Here is the output Shape of the Low-pass Filter. Fig- has given the three types of wave-shape. Our inverter circuit was produced the square wave. so we are using a low-pass filter circuit for Change this wave shape. After we are using this filter circuit, then we are Produce the sine wave AC signal. The output shape of this AC Line is so many effective. Because pure sine wave is suitable in the load.

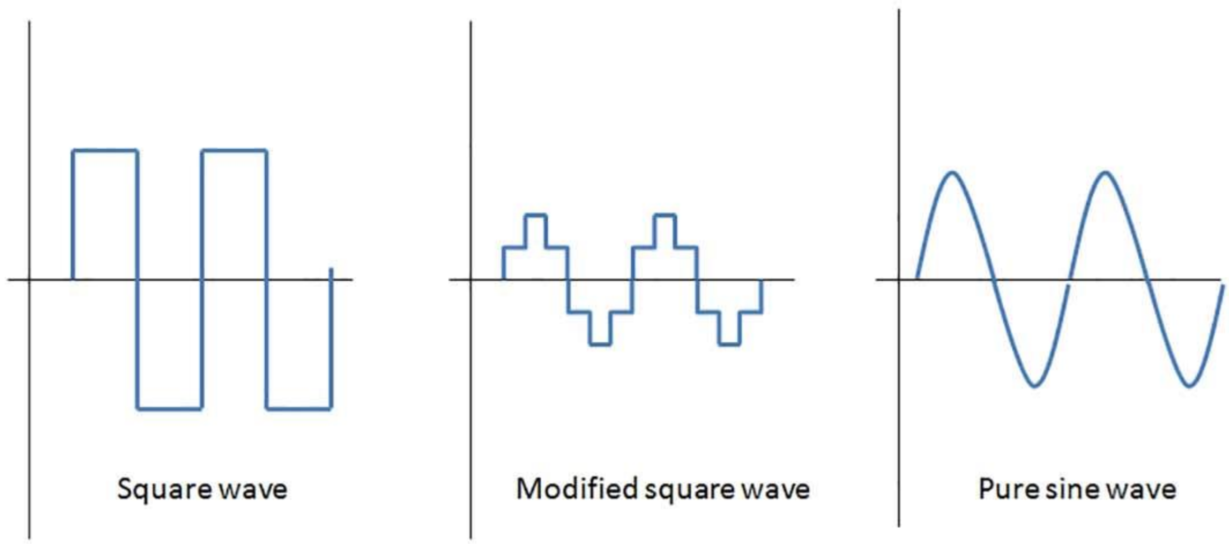

Fig: 4.5.4 wave Shape of the inverter

4.6 Summary

In this chapter we have done various tasks including circuit design and setup. We have tried to give a clear idea of how the charge controller, Battery and Inverter works.

CHAPTER-5

RESULTS AND COST ANALYSIS

5.1 Introduction

The entire working process of the way our system works on this chapter is revealed in a final picture and cost analysis. This will give us a complete visual idea of our system.

5.2 Result of Our Project

Finally we were able to create a beautiful project. In the project The solar panel, charge controller, battery, inverter, Low-pass Filter etc is working properly. As a load we used a 15 watt LED bulb. Which is worked properly. The charge Controller is working properly.

The function of the charge controller is to protect low voltage, high voltage and over voltage. When the battery is full, the charge controller cuts off power consumption. The battery has a charge reserve. Power supply from the battery at night. The inverter circuit generates an AC voltage of 12 volts, and the AC voltage is transmitted to the transformer by 225 volts. It does not give a pure sine wave, the low pass filter is used to get a pure sine wave. A voltmeter is added in the low pass filter, the output voltage can be seen from it.

5.3 Cost Analysis

No	Equipment name	Quantity	Price (Taka)
1	Solar Panel	1	450
2	Battery	3	550
3	Resistance	9	10
4	Capacitor	5	50
5	Ceramic Capacitor	1	5
6	Vero Board	3	60
7	Transformer	1	120
8	IC (Cd-4047)	1	20
9	IC(LM7809)	1	10
10	MOSFET	5	100
11	Zener Diode	2	20
12	Diode	3	15
13	Relay	2	50
14	LED	3	10
15	Inductor	1	10
16	Connecting Wire	-	50
17	Soldering Wire	-	45
18	Switch	1	10
19	Led Bulb	1	150
20	Others	-	250
Total			1985 TK

Table: 5.1 Cost Analysis of the Project

5.4 Summary

Finally in this chapter we discern the step by step operation of our project. In this project we have tried to mention everything.

CHAPTER-6

CONCLUSIONS

6.1 Conclusions

The solar PV system is intended to cover 100 % of the energy demand needed by the shelter electric appliances. As the system captures the sun’s energy using the solar PV array, it stores the excess of its need in the batter bank and uses it at the night times when the solar PV system is incapable of providing it with its need. It is quite unambiguous that this project perfectly serves the energy demand of such shelters/cabins as it seems so encouraging and feasible and ideally suited for migration away from nonrenewable fossil fuel towards sustainable solar.

6.2 Future Scope

As the demand for electricity is increasing day by day and after some time the short source of electricity may end because they are limited and in the future there will be a crisis of resources in the world. This technique is used to improve the electricity supply for residential PV system. Further research on the design of off-grid PV Solar system for a rural shelter is recommended; to test the system behavior over the months when the solar radiation is at their bottom values in order to encompass a complete extensive results over the course of a full year or seasonal changes which will result in more conclusive and pronounced outcomes for the future optimization off-grid PV system and get conclusive evidence if any backup generating energy source might be added to cover the slight shortages of the energy demand on those months with minimum solar radiation values. A thorough cost and feasibility study customized to suit the climate, energy demand, and market in Jordan is also recommended.

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