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Solar pannel energy generation using MPPT and inverter To the load side using battery

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Abstract -- Inverters are often needed at places where it is not possible to get AC supply from the Mains. An inverter circuit is used to convert the DC power to AC power. Inverters can be of two types True/pure sine wave inverters and quasi or modified inverters. These true /pure sine wave inverters are costly, while modified or quasi-inverters are inexpensive. These modified inverters produce a sine wave and these are used to power delicate electronic equipment's. Here, a simple voltage driven inverter circuit using power MOSFET as switching devices is build, which converts 12V DC signal to single phase 220V AC with the help of Step -Up transformer. The basic idea behind every inverter circuit is to produce oscillations using the given DC and apply these oscillations across the primary of the transformer by amplifying the current. This primary voltage is then stepped up to a higher voltage depending upon the number of turns in primary and secondary coils.

Ke ywords- ***Inverters, MOSFET, oscillations, transformer, amplifying.***

I. INTRODUCTION

This report focuses on DC to AC power inverters, which aim to efficiently transform source to a high voltage AC source, simila r to power that would be available at an electrical walloutlet.Inv erters are used for many applications, as in situations where low voltage DC sources such as batteries,solar panels or fuel cells must be converted so at devices can run off of AC powerOne ex ample ofsuch a situation would be converting electrical power f rom a car battery to run a laptop, TV or cell.The method in whic h the low voltage DC power is inverted, is completed in two ste psThe firstbeing the conversion of the low voltage DC power to a high voltage DC source,and the second step being the conversion of the high DC source to an AC waveform using pulse width modulation. Another method to complete the desired outcome would be to first convert the low voltage DC power to AC, and then use a transformer to boost the voltage to 220V.This project focused on the first method described and specifically the transformation of the high voltage Dc source into an AC output. Of the different DC-AC inverters on the market today there are essentially two different forms of AC output generated: modified sine wave, and pure sine wave. A modified sine wave can be seen as more of a square wave than a sine wave; it passes the high DC voltage for specified amounts of time so that the average power and rms voltage are the same as if it were sine wave. These types of Inverters are much cheaper than pure sine wave inverters and therefore are attractive alternatives. Besides being used for heating and cooling, solar energy can be directly converted to electricity. Most of our tools are designed to be driven by electricity, so if you can create electricity through solar power, you can run almost anything with solar power. The solar collectors that convert radiation into electricity can be either flat-plane collectors or focusing collectors, and the silicon components of these collectors are photovoltaic cells.

II. BLOCK DIAGRAM

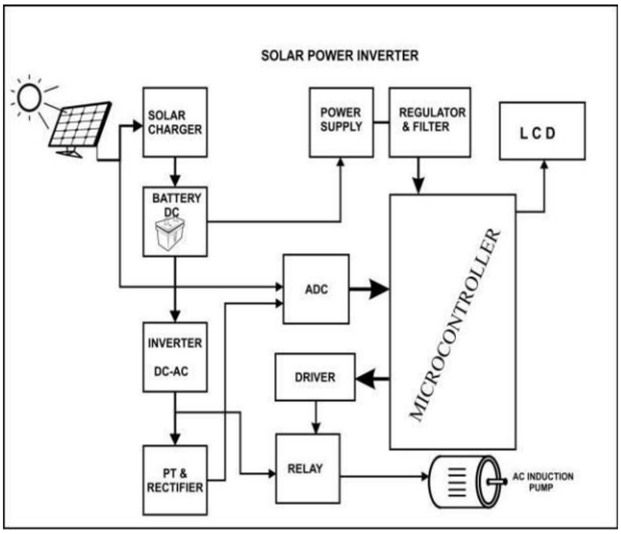

Fig 1:- Block Diagram

Above is the setup in which we are going to implement the circuit. The first part of the block diagram is charging and inverter circuit and the second part is an microcontroller and LCD Panel. The major hardware modules which are needed: microcontroller, solar panel, inverter circuit and an LCD Panel. The solar energy conversion into electricity takes place in a semiconductor device that is called a solar cell. A solar cell is a unit that delivers only a certain amount of electrical power. In order to use solar electricity for practical devices, which require a particular voltage or current for their operation, a number of solar cells have to be connected together to form a solar panel, also called a PV module. For large-scale generation of solar electricity the solar panels are connected together into a solar array. The solar panels are only a part of a complete PV solar system. Solar modules are the heart of the system and are usually called the power generators. One must have also mounting structures to which PV modules are fixed and directed towards the sun. For PV systems that have to operate at night or during the period of bad weather the storage of energy is required, the batteries for electricity storage are needed. The output of a PV module depends on sunlight intensity and cell temperature; therefore components that condition the DC (direct current) output and deliver it to batteries, grid, and/or load are required for a smooth operation of the PV system. These components are referred to as charge regulators. For applications requiring AC (alternating current) the DC/AC inverters are implemented in PV systems. These additional components form that part of a PV system that is called balance of system (BOS). Finally, the household appliances, such as radio or TV set, lights and equipment being powered by the PV solar system are called electrical load. The elements of a PV system are schematically presented in figure.

III. COMPONENTS

A. PV System

The solar cell is the basic unit of a PV system. An individual solar cell produces direct current and power typically between 1 and 2 W, hardly enough to power most applications. For example, in case of crystalline silicon solar cells with a typical area of 10 × 10 cm an are sealed for protection against corrosion, moisture, pollution and weathering. The output power is typically around 1.5 Wp, with Voc ? 0.6 V and Isc ? 3.5 A. For actual usage, the solar cells are interconnected in series/parallel combinations to form a PV module.

B. Lead acid Battery

The most commonly available lead-acid battery is the car battery, but these are designed mainly to provide a high current for short periods to start engines, and they are not well suited for deep discharge cycles experienced by batteries in PV systems

C. Inverter

The inverter's main functions are: transformation of DC electricity into AC, wave shaping of the output AC electricity, and regulation of the effective value of the output voltage.

D. MPPT

To maximize a PV module output power, we need to continuously track maximum power point of the system. But the maximum power point depends on the irradiance levels, the panel's temperature, and the load connected. Using a charge controller without MPPT is like connecting the battery directly to the solar module. A traditional charge controller may charge a battery with the voltage that is dictated by battery.

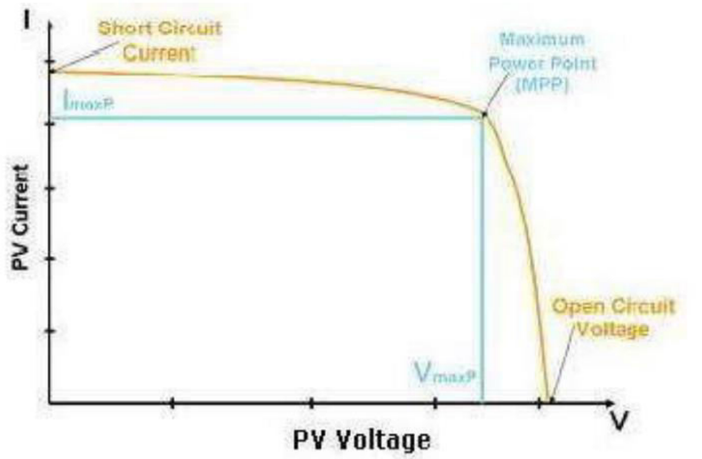

Fig 2:- MPPM Unit VI Dig

E. REGULATOR IC 7805

Voltage regulators are very common in electronic circuits. They provide a constant output voltage for a varied input voltage. In our case the 7805 IC is an iconic regulator IC that finds its application in most of the projects. The name 7805 signifies two meaning, "78" means that it is a positive voltage regulator and "05" means that it provides 5V as output. So, our 7805 will provide a +5V output voltage.The output current of this IC can go up to 1.5A. But the IC suffers from heavy heat loss hence a Heat sink is recommended for projects that consume more current. For example, if the input voltage is 12V and you are consuming 1A, then (12-5) * 1 = 7W. This 7 Watts will be dissipated as heat.

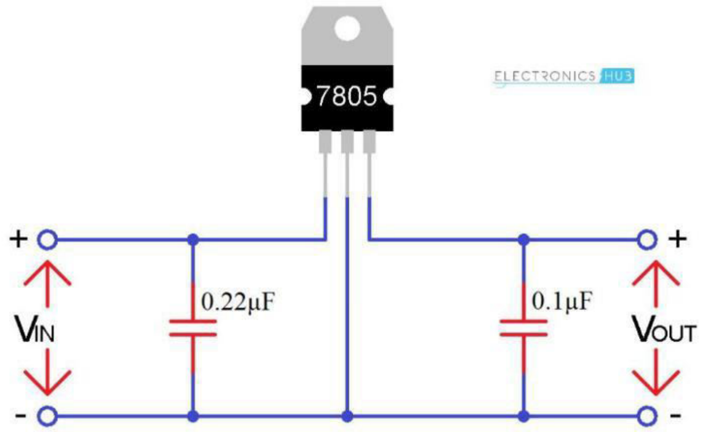

Fig 3:- Regulator IC 7805 Dig

F. Driver IC ULN2003

ULN2003 IC is one of the most commonly used Motor driver IC. This IC comes in handy when we need to drive high current loads using digital logic circuits like Op-maps, Timers, Gates, DRIVERS, PIC, ARM etc. For example a RELAY that requires

12V and 300mA to run cannot be powered by a PIC I/O hence we use this IC to source enough current and voltage for the load. This IC is commonly used to drive Relay modules, Motors, high current LEDs and even Stepper Motors. So if you have anything that anything more than 5V 80mA to work, then this IC would be the right choice for you. The ULN2003 is a 16-pin IC. It has seven Darlington Pairs inside, where each can drive loads up to 50V and 500mA. For these seven Darlington Pairs we have seven Input and Output Pins. Adding to that we can a ground and Common pin. The ground pin, as usual is grounded and the usage of Common pin is optional. It might be surprising to note that this IC does not have any Vcc (power) pin; this is because the power required for the transistors to work will be drawn from the input pin itself.

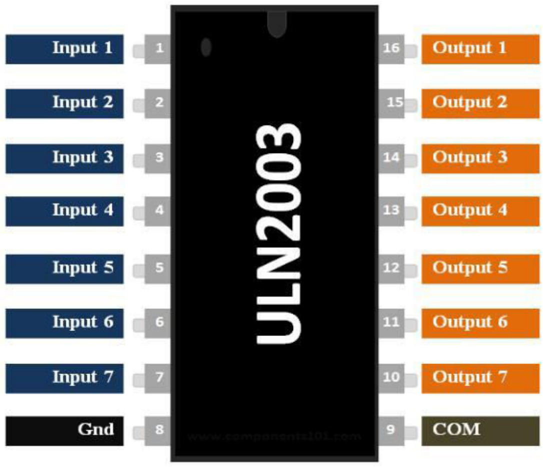

Fig 4:- Driver IC ULN2003

G. LIQUID CRYSTAL DISPLAY(LCD)

A **liquid-crystal display** (**LCD**) is a flat panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly,[1] instead using a backlight or reflector to produce images in colour or monochrome. LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day-to-day life, either at PCO's or calculators.

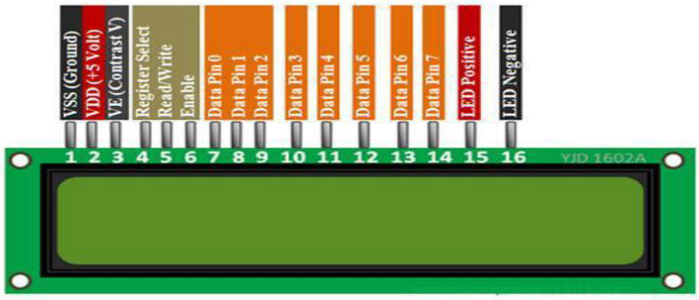

Fig 5:- LIQUID CRYSTAL DISPLAY (LCD)

H. RELAY

Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

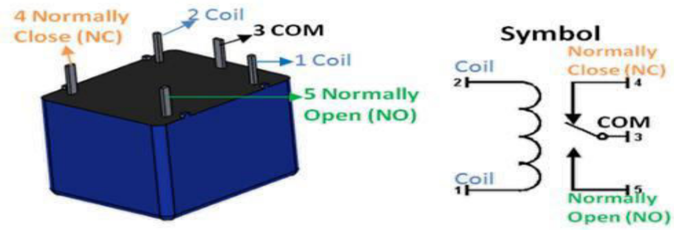

Fig 6:-Relay Dig

I. TRANSFORMER (CENTER TAPPED)

A centre-tapped transformer also known as two phase three wire transformer is normally used for rectifier circuits. When a digital project has to work with AC mains a Transformer is used to step-down the voltage (in our case, to 24V or 12V) and then convert it to DC by using a rectifier circuit. In a centre-tapped transformer the peak inverse voltage is twice as in bridge rectifier hence this transformer is commonly used in full wave rectifier circuits.

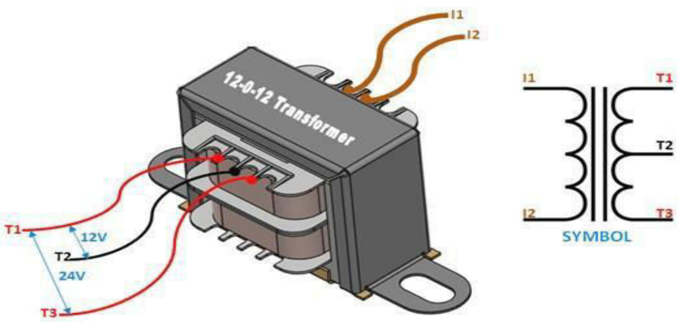

Fig 6:-Transformer Dig

J. SG3524 Regulating Pulse Width Modulator IC

The **SG3524 IC** incorporates all the functions required in the construction of a **regulating power supply**, **inverter**, or **switching regulator** on a single chip. SG3524 also can be used as the control element for high-power-output applications.

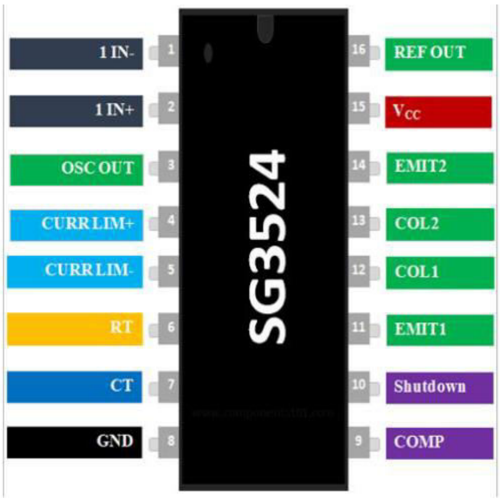

Fig 6:- SG3524 Regulating Pulse Width Modulator IC

IV CONCLUSION

Photovoltaic power production is gaining more significance as a renewable energy source due to its many advantages. These advantages include everlasting pollution free energy production scheme, ease of maintenance, and direct sunbeam to electricity conversion. However the high cost of PV installations still forms an obstacle for this technology. Moreover the PV panel output power fluctuates as the weather conditions, such as the insolation level, and cell temperature. The described design of the system will produce the desired output of the project. The inverter will supply an AC source from a DC source. The objective of the circuit was to invert power from high voltage DC sources or an output voltage of DC to DC boost into AC power similar to one available in our wall sockets for any load and of which was partially met. Some of the important conclusion that can be drawn from this work are;

1. Output waveform frequency was found to be satisfactory at 50Hz equivalent of standard Indian power system.

2. Sine pulse with modulation circuit is much simplified by the use PIC16F886 microcontroller.

3. From giving 12V input from solar panel as well as battery within 300 Ms, inverter gives AC output.

4. While disconnecting solar panel from the circuit inverter keeps running on battery without any interruption.

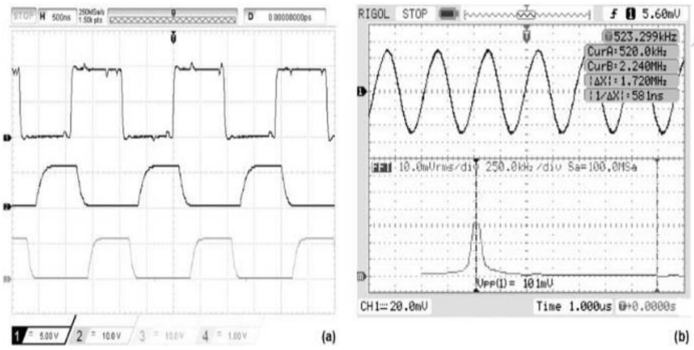

Fig 7:- OUTPUT WAVEFORMS

V AKNOLEGEMENT

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VI. REFERENCES

The reference of the books and websites, we have referred in order to complete my training report are as follows:-

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