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# Digital Solar Inverter Using Microcontroller

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**ABSTRACT**: The aim of this project is to design and implement a single phase inverter which can convert DC voltage to AC voltage at high efficiency and low cost. Solar and wind powered electricity generation are being favored nowadays as the world increasingly focuses on environmental concerns. Power inverters, which convert solar-cell DC into domestic-use AC, are one of the key technologies for delivering efficient AC power. A low voltage DC source is inverted into a high voltage AC source in a two-step process. To deliver such performance, the power inverters is driven by high-performance PIC 16F887A microcontroller units (MCUs) that can achieve high-level inverter control, and therefor this microcontroller is the heart of the system and controls entire system. The microcontroller is programmed using embedded c compiler and in specific mikro C pro to generate square pulses which are used to drive H-bridge.

**KEYWORDS:** Inverter, Microcontroller, MOSFETs ,H-bridge.

## I.INTRODUCTION

With the increasing concern about the non-renewable energy sources, constant increase in the prices of fossil fuels, global warming and damage to environment and ecosystem, the renewable energy is becoming more popular and is gaining more attention as an alternative to non-renewable energy sources. Among the renewable energy sources, the energy through photovoltaic effect is being considered as the most essential and sustainable energy resource such as compared to other type of energy sources such as wind, biomass, hydro power, tidal. Nowadays photovoltaic system are likely recognized & widely utilized for different types of power system applications. These systems can generate direct current electricity without any environmental impact. Being a semiconductor device, the PV system is static and free of moving parts which make it easy for operation and also requires less maintenance.

## II. SCOPE OF RESEARCH WORK

In the present days power is most important need of human life due to day by day increases in population, conventional energy sources are decreasing. The extensive usage of energy has resulted in an energy crisis, a lug worry at present to overcome this problem so many research are carry on by so many people to improve non -conventional power. Power generation by using solar energy will be a small part of their research. Our paper is based on noble concept of power generation from solar energy. Now a days energy and power are the one of the basic necessities regarding this modern world. As the demand of energy is increasing day by day, so the ultimate solution to deal with these sorts of problems is just to implement the renewable source of energy. The objective of this work is power generation from solar energy which is renewable energy obtained from the sun .The adoption of AC power has created a trend where most devices adapt AC power from an outlet into DC power for use by the device. However, AC power is not always available and the need for mobility and simplicity has given batteries an advantage in portable power. Thus, for portable AC power, inverters are needed. Inverters take a DC voltage from a battery or a solar panel as input, and convert it into an AC voltage output. Thus a result we have concluded that these types of designs and techniques of power generating systems are very useful and handily in order to match the supply and demand of energy globally as well.

## III.BLOCK DIAGRAM

In the above fig shows that the, battery supply the power to voltage regulator and DC-DC step up. Voltage regulator supplies the 5V supply to the microcontroller to operate. Then microcontroller[2] sends the signal to MOSFET driver to

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run the MOSFETs connected in the H- bridge configuration. The output of the MOSFETs is filtered by the filter and the then given to the desired load.

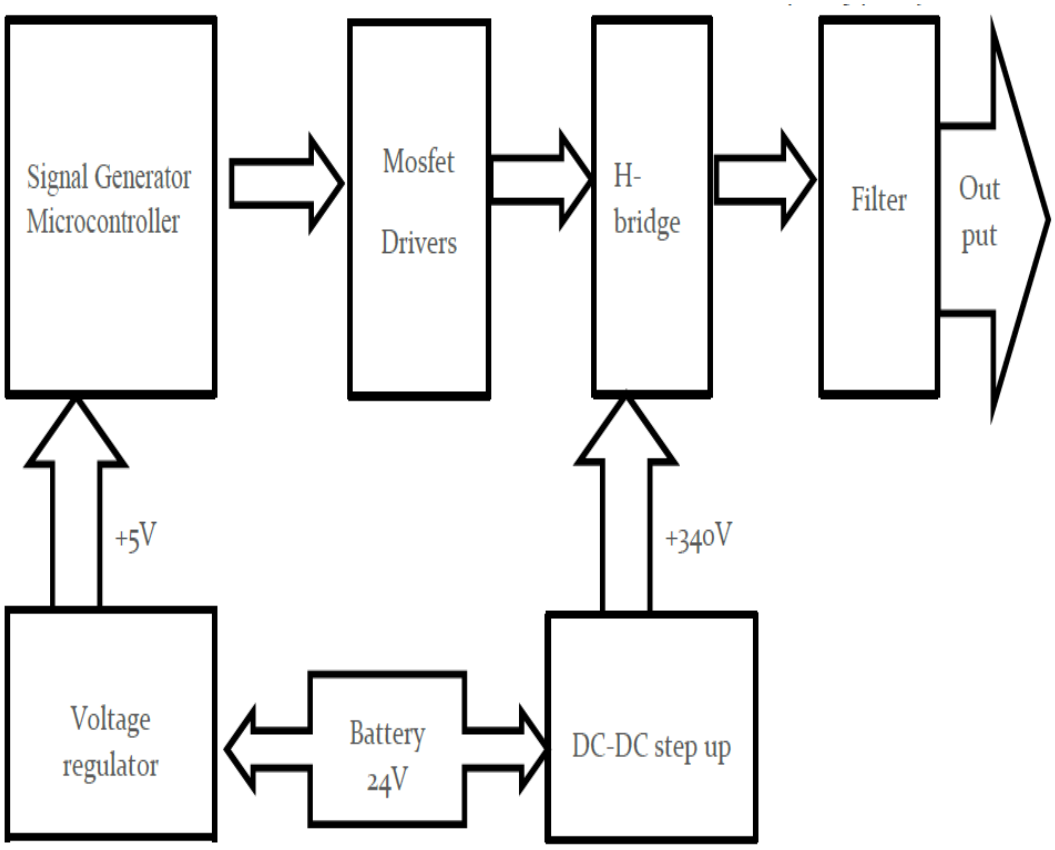


Fig 1 Block Diagram

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## IV.PROPOSED METHODOLOGY AND DISCUSSION

**Circuit Diagram:** Fig shows the circuit diagram of the Solar inverter. This circuit is divided in to 4 group: Solar panel and battery circuit, control circuit, inverter circuit, AC supply circuit.

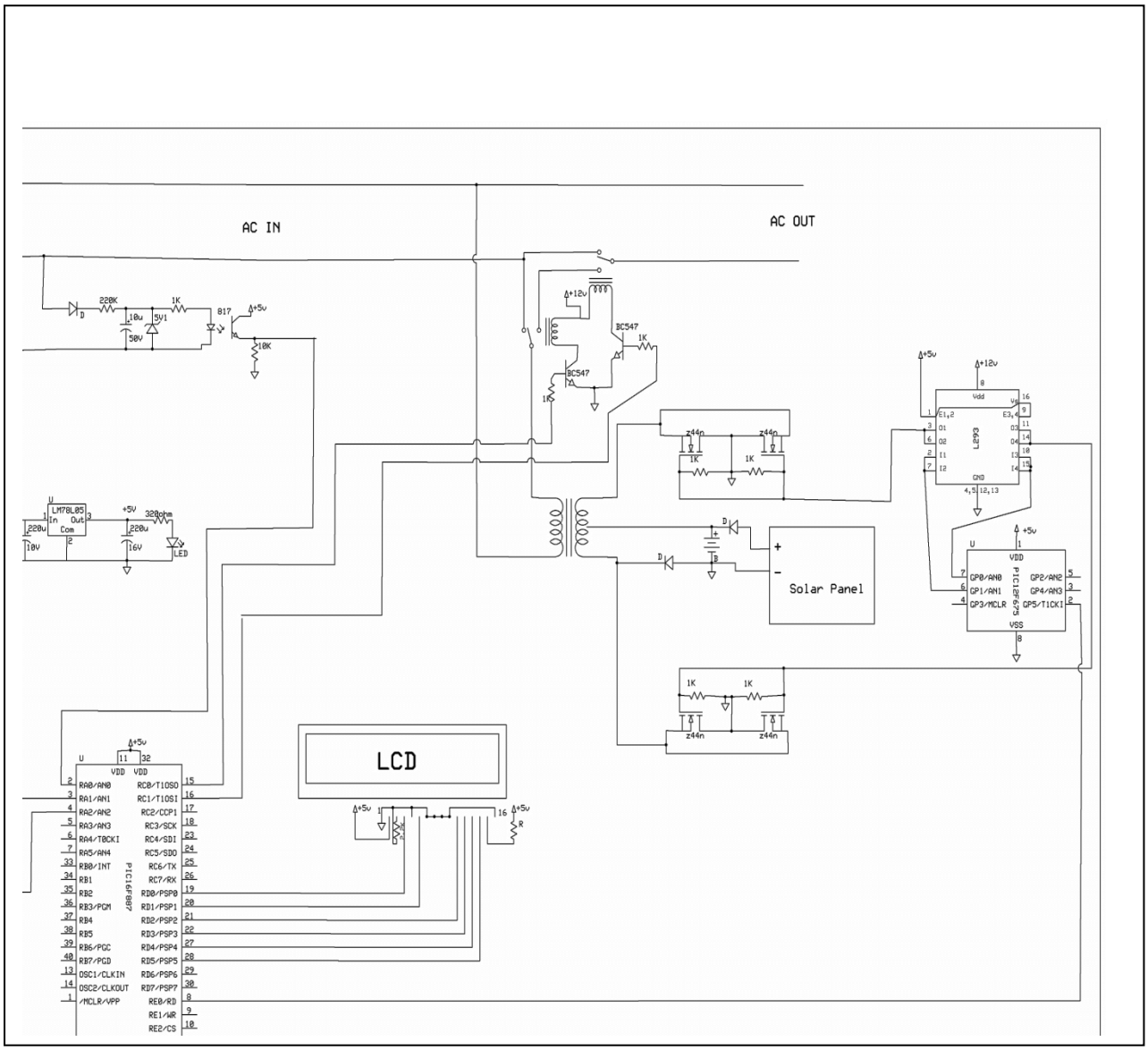


Fig 2 Circuit Diagram

## V .WORKING

Working of the circuit can be explained with the help of 4 main sub circuits:

1. **Solar Panel and battery Circuit :** In this circuit 40 watts solar panel is connected to battery using a 1N4007 diode. When sunlight falls on the solar panel then emf is generated and a current starts to flow thatwill

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eventually charges the the battery. Diode is connected in forward biased to the battery because in case of AC charging current will not goes back to the panel.

2. **Control Circuit:** This circuit comprises of a PIC16F887 Microcontroller that controls the operation of the whole circuit i.e. this microcontroller will make sure that in the absence of sunlight it will shifts the circuit to AC supply, and during daylight i.e. in the presence of sunlight it will shits the operation to DC supply through solar panel. And when battery got full charged it will cuts the supply from the solar panel using relay. Microcontroller also connected with the LCD that will show the battery percentage.

3. **Inverter Circuit:** This circuit comprises of Transformer, Relay, 4 MOSFETs, MOSFET driver and PIC12F675.Duringdaylight i.e. in the presence of sunlight microcontroller PIC16F887 sends the signal to PIC12F675, therefore it will send pulse to the MOSFET driver that will drive the MOSFETs. MOSFETs are connected to the driver circuit in such a way that when driver sends a pulse to the upper two MOSFETs it will give positive cycle of AC and when it sends the signal to lower two MOSFETs it will give negative half cycle in the output. This AC output from the MOSFETs is therefore step-up to 230V AC.

4. **AC Supply Circuit:** In the absence of sunlight whole operation of the circuit will shift to AC supply. Microcontroller PIC16F887 will stop sending signal to the PIC12F675 therefore the inverter circuit will stop working and battery will start charging from AC supply. And during charging the battery, load can also be connected.

## VI. ACTUAL HARDWARE

Figure 1 is showing the prototype of the solar inverter in which all the components are connected like solar panel battery etc. and in figure 2 shows the battery charging from the solar energy.

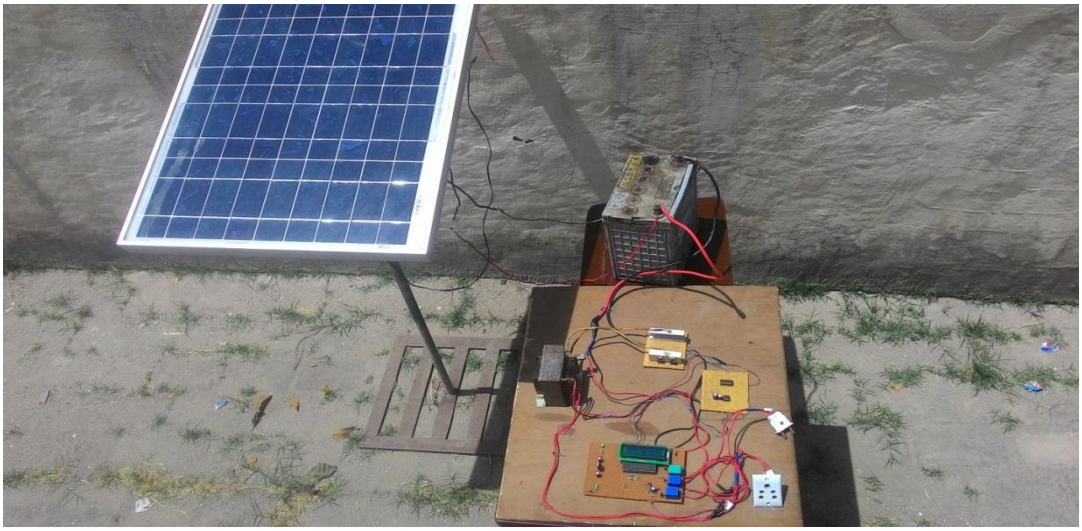

Fig 3Assembled prototype of solar inverter

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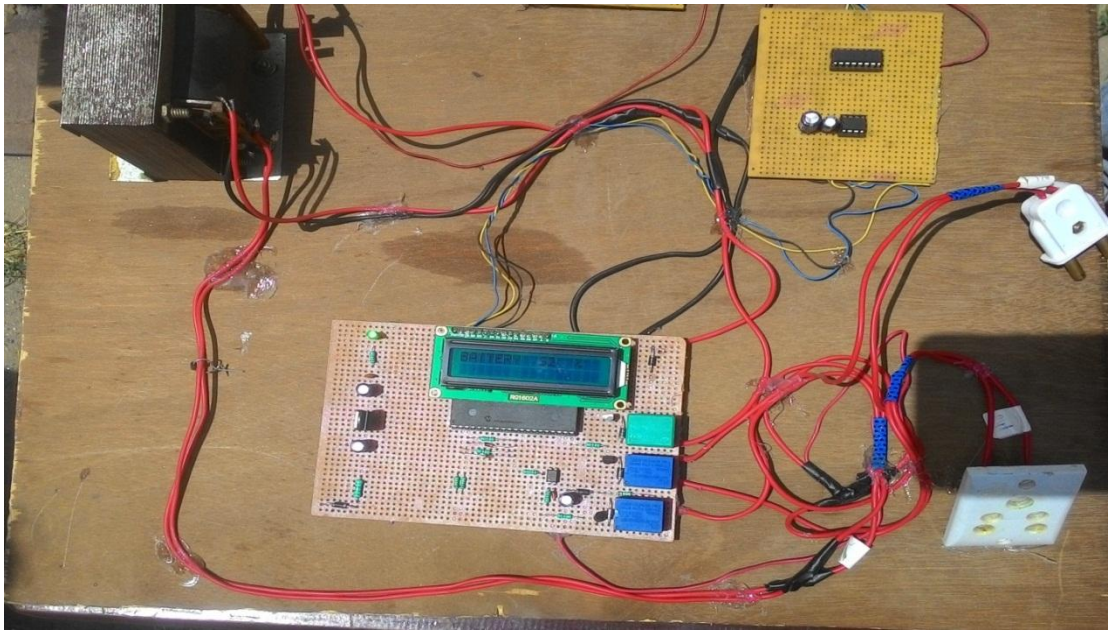

Fig 4Battery charging shows in digital form

## VII. OUTPUT

Fig 5.1 showing the output from the inverter in the form of bulb glowing firstly the battery Is charged using solar panel and then battery is giving its power to the inverter therefore bulb is glowing, and in fig 5.2 showing the output of the simulation model in Proteus.

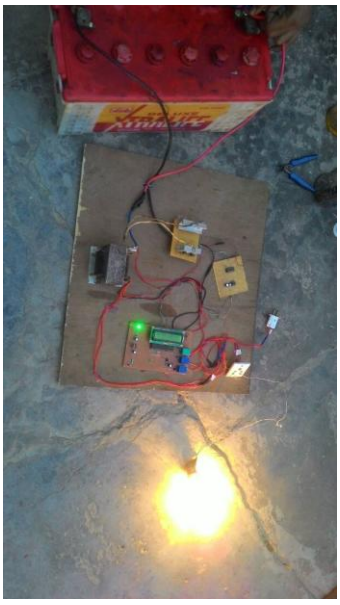

Fig 5 Bulb glowing through output from inverter

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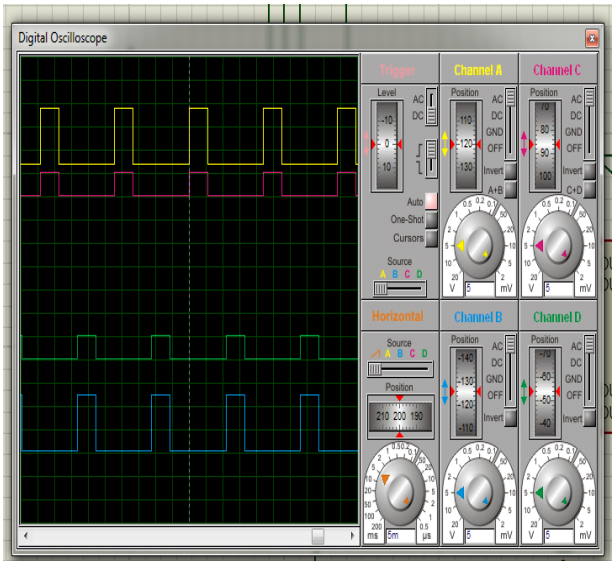


Fig 6 Output waveform from the simulation model of the solar inverter

## VIII.CONCLUSION

The objective of the circuit was to invert power from high voltage DC sources or an output voltage of DC into AC power similar to one available in our wall sockets for any load and of which was partially met. This inverter power output is usable for any load although not practically tested. Almost 90% of the project was completed within time line given and by the time this report was being submitted. The fact that I was able to integrate the whole system and achieve a desired output of both the frequency and voltage with reverence to rail voltage supplied shows that much of key parts of this project is practically achievable and with required DC voltage a complete working inverter can be achieved.

## REFERENCES

[1] A.AliQazalbash, Awais Amin, Abdul Manan and Mahveen Khalid, "Design and Implementation of Microcontroller based PWM technique for Sine wave Inverter*", International Conference on Power engineering, Energy and Electrical Drives,* POWERENG '09. 2009 pp.163-167, IEEE.
[2] S. M. Mohaiminul Islam, Gazi Mohammad Sharif, "Microcontroller Based Sinusoidal PWM Inverter for Photovoltaic Application*", First International Conference Developments in Renewable Energy Technology (ICDRET)*, December, 2009 pp. 1-4, IEEE.
[3]] Julio Sanchez and Maria P. Canton, Microcontroller Programming the microchip pic, 1st edition, CRS press 2009.
[4] PIC16F87XA Datasheet – 40 Pin Enhanced Flash Microcontroller by Microchip
[5] M. H. Rashid, "Power Electronics Circuits, Devices and Applications," 3rd Edition, Prentice-Hall of India, Private limited, New-Delhi, 2004.
[6] John J. Grainger and William D. Stevenson, POWER SYSTEMS ANALYSIS McGraw-Hill, Inc.1994
[7] A. A. Mamun, M. F. Elahi, M. Quamruzzaman, M. U. Tomal, "Design and Implementation of Single Phase Inverter" *International Journal of Science and Research (IJSR), India Online ISSN: 2319-7064* Volume 2 Issue 2, February 2013.
[8] NagarajaNaik R, Jayapal.R, "Design of Online Ups System with Over Voltage, Under Voltage and Phase Out Protection*" International Journal of Modern Engineering Research (IJMER)* Vol.2, Issue.5, Sep-Oct. 2012 pp-3684-3688.
[9] Gopinath.G, PG and A.Arikesh "Development of Three Step Charging H-Bridge based Sine wave Inverter" *International Journal of Advanced Trends in Computer Science and Engineering*, Vol.2 , No.2, Pages : 149-153 (2013)
[10] Ian F. Crowley and Ho Fong Leung, "PWM Techniques: A Pure Sine Wave Inverter" Worcester Polytechnic Institute 2011.