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Implementation of Solar Inverter using Microcontroller

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Abstract: *This paper focuses on design of modified sine wave inverters which converts DC to which aims to efficiently transform a DC power source to a high voltage AC source, related to the power available at a regular wall outlet. Inverters are used for many applications, as in devices can run off of AC power situations where low voltage DC source such as batteries, solar panels or fuel cells must be converted as per the requirement.*

Keywords: *Driver IC ULN2003, Regulator IC7805, PIC16F886 -8bit Microcontroller, LCD, PWM.*

1. INTRODUCTION

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. A customized sine wave can be seen as more of a square wave than a sine wave; it passes the high DC voltage for specified amount of time so that the average power and rms voltage are same as if it were a sine wave. These types of inverter are much cheaper than pure sine wave inverter and therefore are attractive alternatives.

2. SCOPE OF RESEARCH WORK

Power is now days considered as most important conventional energy source of energy. 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 day's energy and power are the one of the basic requirements 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 devices uses AC power from a source into DC power for the application. However, ac power sources are limited and result is more efficient using portable power. Thus, for portable AC power, inverters are needed. In this project, we have designed an inverter which coverts dc voltage from batteries to ac supply which is inexpensive. 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.

3. PROBLEM STATEMENT

In case of power inverters, there are many choices which ranges from very expensive to cheap with varying degrees of quality, efficiency, and power output capability. High quality combined with high efficiency exists, though it is often at a high monetary cost.To solve these problems, modified sine wave inverter unit must be introduced. In this paper a Solar Inverter Using Microcontroller was aimed to utilize SPWM and analog components for clear sinusoidal output with very little switching noise, combined with the inexpensive manufacturing.

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4. OBJECTIVES

The main objective includes design and construction of a PV based system that operates in dual mode, supplying stand-alone AC loads, while minimizing its cost and size. Another important aspect is Production of quality electricity from renewable sources.

5. METHODOLOGY

In this paper we have built a simulation program using proteus application. DIPTRACE is used to design PCB layout. Also we are going to build a hardware design.

6. BLOCK DAIGRAM

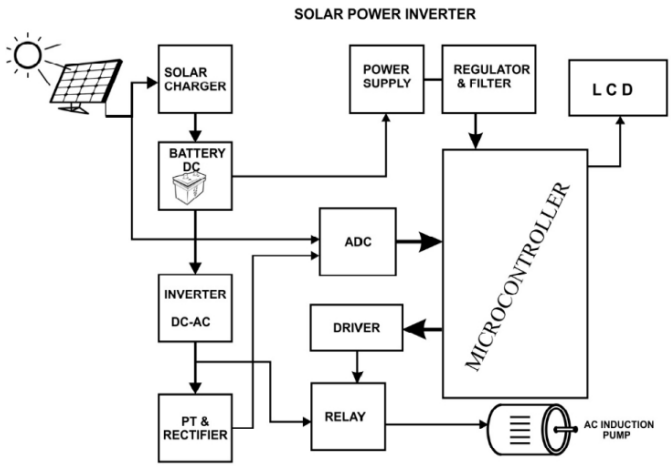

Figure 1:Block daigram of solar inverter using microcontroller

Firstly, the method includes initialization all ports and peripherals [ADC, Timers, Compare Modules]. Initialization of interrupts for Timer0 and compare module, further check SOLAR PANEL voltage level. If SOLAR PANEL voltage level< 11.5v inverter connected load trips. Note and adjust output voltage as required.
This is a quasi-sine wave inverter that we made since it was more demanding than the sine at the time. We have a project with quasi-sine wave as well with a PIC microcontroller. In this design we use IRFP150 x 2 on each leg for 100W. We can use other MOSFETs as well. There are 2 transistors for driving the MOSFETs, on the control board - 2xc547. We need to change the 7805 with an auxiliary supply 12V, that's the only change. If battery is full or high while charging, then there we use a battery full charged indicator. Output volt is adjusted to achieve 230V or 220V as per requirement. Battery max is for battery high cut voltage, to cut off charging when battery reaches a specific voltage. I set mine at around 13.5v.Charging current is for setting the current at which battery is to be charged. In our 1Amp is set to charge the battery. Low battery is for setting battery low cut voltage in our project will be for 10.5v.The one for current is a pot that is adjustable in small units. The 2 transistors are for MOSFET driving the transformer we have is 12-0-12 primary, doesn't need to be accurate, since you can adjust the output voltage using the pot. What I meant is, say you wanted a 12-0-12 transformer, but you got some error, then you can just adjust the pot to set output at 230v. No separate winding is used, feedback is taken on the breadboard using different components. Charging is done using the same MOSFET board, only a special feature is just a snubber on the board. Transformer primary is not strict. MOSFET can be added for a nice design, but we neglected it as it was more demanding to have the MOSFET board separate, in case the MOSFETs burnt. The transformer is rated at 100W power and is a standard transformer used for100Winverters over here. The primary voltage is 12-0-12, secondary voltage is 0-240.This inverter has short circuit protection. In case of short circuit, DC bus voltage significantly decreases. The microcontroller senses that and indicates short circuit. Reverse voltage protection isn't provided as it's connected to the battery 24/7.

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7. HARDWARE TOOLS

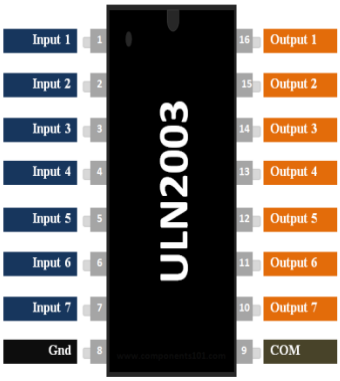

Figure 2:Driver IC ULN2003

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 an 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.

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.

PIC16F886 – 8 Bit Microcontroller-Watt Technology. This microcontroller is popular among hobbyists and engineers due its features and cost.PIC16F886 is microcontroller from „PIC16F" family and is made by MICROCHIP TECHNOLOGY. It is an 8-Bit CMOS Microcontroller with Nano.

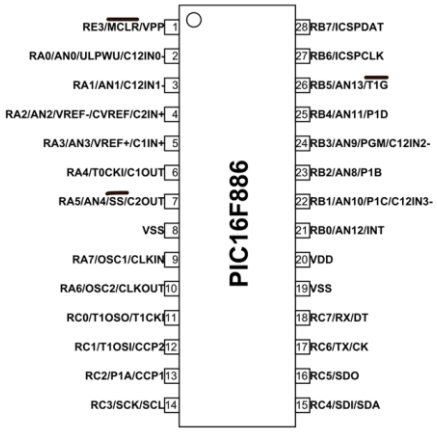

Figure 3:Microcontroller PIC16F886

Liquid Crystal Display(LCD)-Brief Description on LCD modules: 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.

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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 10

Transformer(Centre 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,to24V or 12V) and then convert it to DC by using a rectifier circuit. This type of transformer is mainly finds applications where full wave rectifier circuits are used.

IRFZ44N N-Channel Power Mosfet-The IRFZ44N is a N-channel MOSFET with a high drain current of 49A and low Rds value of 17.5 mΩ. It also has a low threshold voltage of 4V at which the MOSFET will start conducting. Hence it is commonly used with microcontrollers to drive with 5V. However a driver circuit is needed if the MOSFET has to be switched in completely.

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 application

Figure4:SG3524 Regulating Pulse Width Modulator IC

HARDWARE

After simulation and determination of specifications of the overall design, a prototype is built of the final circuit as shown below. A preliminary prototype was constructed on a PCB for testing of the components before being mounting**.** Some of the important conclusion that can be drawn from this work are-Output waveform frequency was found to be satisfactory at 50Hz equivalent of standard Indian power system. Sine pulse with modulation circuit is much simplified by the use PIC16F886 microcontroller. From giving 12V input from solar panel as well as battery within 300 ms, inverter gives AC output. While disconnecting solar panel from the circuit inverter keeps running on battery without any interruption.

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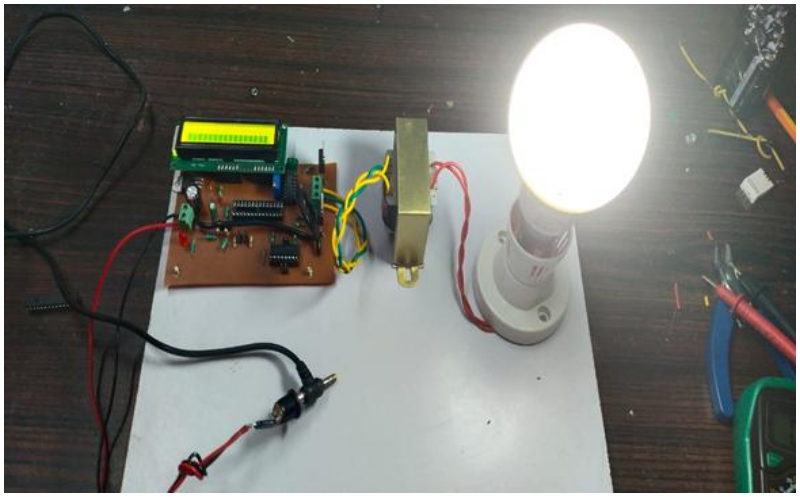

Figure 5: Experimental prototype of inverter

8. CONCLUSION

Power production using PV modules is gaining more importance as it has many advantages. This compensation includes everlasting pollution free energy fabrication scheme, ease of maintenance, and direct sunbeam to electricity change. However the high cost of PV installation still forms an obstacle for this technology. Moreover the PV panel output power fluctuates as the weather conditions, such as cell temperature. The inverter will supply an AC source from a DC source.

REFERENCES

[1] Khan, B.H.: Non-Conventional Sources of Energy, 5/e, Mc Graw Hill Education(India).

[2] Van Valkenburg, M.E. : Network Analysis, 3/e, Mc Graw Hill Education (India).

[3] Milliman, Jacob & Christos Halkias: Integrated Electronics, 2/e, Mc Graw Hill Education(India).

[4] Gupta, J.B. : Electronics Devices & Circuit, 3/e, S.K. Kataria & Sons, 2009.

[5] Salivahanan, S. & S. Arivazhagan: Digital Electronics, 3/e, Vikas Publication, 2007.

[6] Fitzgerald, A.E., Charles Kingsley & Stephen D. Umans : Electric Machinery, 3/e, Mc Graw Hill Publication (India).

[7] Hussain, Ashfaq : Electrical Machines, Second Edition, Dhanpat Rao Publications.