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A Module Integrated Isolated Solar Micro Inverter

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Abstract: **The Objective of this paper to design of a low powered portable and cost effective solar micro-inverter. Where solar panel is able to run the AC and DC loads, the system consists of a solar panel, DC-AC inverter, LC filter and the test loads. The solar cell power converter which boosts the input DC voltage into the desired rated input voltage of the inverter, High frequency Pulse Width Modulated (PWM) pulses are generated by a CD4047IC and provided to the mosfet. Here solar panel voltage is monitored. The microcontroller used here is PIC16F73. All these data are displayed on a 16X2 LCD interfaced to PIC microcontroller. This project uses regulated 5V; 500mA power supply. A three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary step down transformer.**

Keywords: **Solar plate, lead acid battery, micro inverter, transformer, Rps, microcontroller, LCD displays.**

I. INTRODUCTION

The paper aims at developing a solar Micro inverter, which is capable to generate all AC like AC Fan, Bulb, Motors, Industrial Appliances, etc. Solar energy is used to store in one rechargeable battery and then this power can be used to our 230V AC appliances using Inverter Circuit. The system has manually ON/OFF the Inverter using switches, and this system continuously monitoring the battery /solar voltage and displays on LCD using Microcontroller, so that we can observe the status of battery and we can increase the Inverter Efficiency. Solar cells can turn light energy into electricity. Some toys and calculators use solar cells instead of batteries. Solar panels are made of many solar cells. Some people put solar panels on their home. These solar panels can make enough electricity for a house. Solar panels are good for houses and buildings without access to power lines. The paper makes use of a solar plate and Microcontroller. The solar energy obtained is stored to a battery. The battery supply is fed to pulse generator and in turn to a MOSFET which is capable of generating ON/OFF pulses of different frequencies. This is fed to a step up transformer to generate a 230V AC voltage so that this power can be used to our ac appliances. This system continuously monitoring the battery/solar voltage and displays on LCD with the help of microcontroller

Solar Energy:

Solar energy is the most abundant source of energy in the world. Solar power is not only an answer to today's energy crisis but also an environmental friendly form of energy. Photovoltaic generation is an efficient approach for using the solar energy. Solar panels (an array of photovoltaic cells) are nowadays extensively used for running street lights, for powering water heaters and to meet domestic loads. The cost of solar panels has been constantly decreasing which encourages its usage in various sectors. This green way for energy production which provides free energy once an initial investment is made.

II. PAPER DESCRIPTION

Block Diagram:

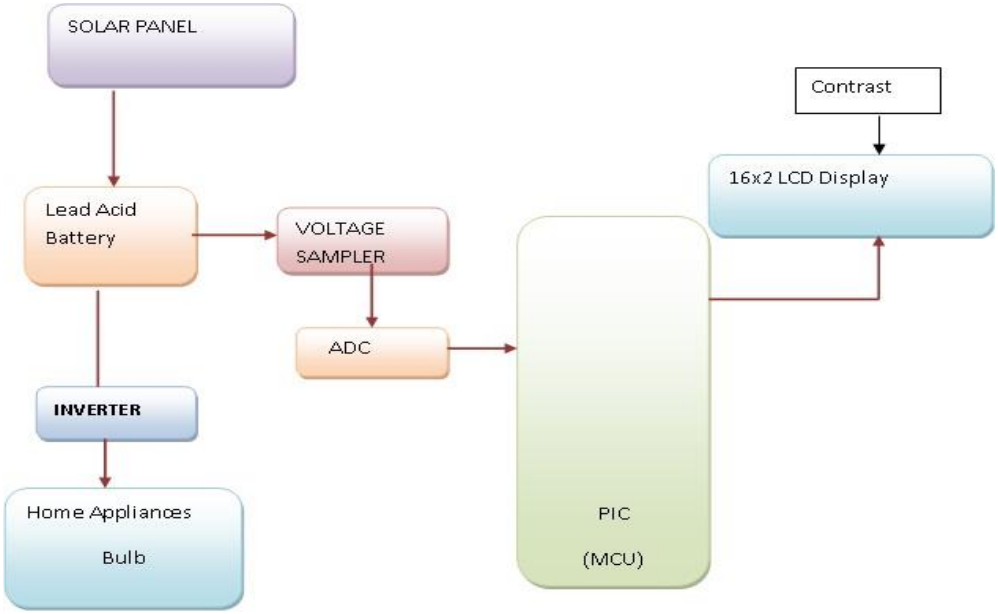

Fig. 1 Block diagram

Solar cell/Plate:

A solar cell or photovoltaic cell is a device that converts solar energy into electricity by the photovoltaic effect. Sometimes the term solar cell is reserved for devices intended specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is unspecified. Assemblies of cells are used to make solar panel, solar modules, or photovoltaic arrays. Photovoltaic is the field of technology and research related to the application of solar cells for solar energy. Solar cell efficiencies vary from 6% for amorphous silicon-based solar cells to 40.7% with multiple-junction research lab cells and 42.8% with multiple dies assembled into a hybrid package. Solar cell energy conversion efficiencies for commercially available multi crystalline Si solar cells are around 14-19%.Solar cells can also be applied to other electronics devices to make it self-power sustainable in the sun. There are solar cell phone chargers, solar bike light and solar camping lanterns that people can adopt for daily use

Fig.2 solar panel

Photons in sunlight hit the solar panel and are absorbed by semi conducting materials, such as silicon. Electrons (negatively charged) are knocked loose from their atoms, allowing them to flow through the material to produce electricity. Due to the special composition of solar cells, only allow the electrons to move in a single direction. The

complementary positive charges that are also created (like bubbles) are called holes and flow in the direction opposite of the electrons in a silicon solar panel. An array of solar panels converts solar energy into a usable amount of direct current (DC) electricity.

Inverter Designing:

This is a 100 Watt inverter circuit using minimum number of components. Here circuit used IC CD 4047 IC from Texas Instruments for generating the 100 Hz pulses and four 2N3055 transistors for driving the load.IC1 Cd4047 wired as an astable multivibrator produces two 180 degree out of phase 100 Hz pulse trains. The 220V AC will be available at the secondary of the transformer. Nothing complex just the elementary inverter principle and the circuit works great for small loads like a few bulbs or fans. If you need just a low cost inverter in the region of 100 W, then this is the best. The maximum allowed output power of an inverter depends on two factors. The maximum current rating of the transformer primary and the current rating of the driving transistors,

IC CD4047:

IC CD4047B is capable of operating in either the monostable or astable mode. It requires an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse width in the monostable mode, and the output frequency in the astable mode. Astable operation is enabled by a high level on the astable input or low level on the astable input. The output frequency (at 50% duty cycle) at Q and Q outputs is determined by the timing components. A frequency twice that of Q is available at the Oscillator Output; a 50% duty cycle is not guaranteed. Monostable operation is obtained when the device is triggered by low-to-high transition at a trigger input or high-to low transition at b trigger input. The device can be retriggered by applying a simultaneous low-to-high transition to both the trigger and retrigger inputs. A high level on Reset input resets the output.

Description:

Here is the circuit diagram of a simple 100 watt inverter using IC CD4047 and MOSFET IRF540. The circuit is simple low cost and can be even assembled on a veroboard. CD 4047 is a low power CMOS astable/monostable multivibrator IC. Here it is wired as an astable multivibrator producing two pulse trains of 0.01s which are 180 degree out of phase at the pins 10 and 11 of the IC. Pin 10 is connected to the gate of Q1 and pin 11 is connected to the gate of Q2. Resistors R3 and R4 prevents the loading of the IC by the respective MOSFETs.When pin 10 is high Q1 conducts and current flows through the upper half of the transformer primary which accounts for the positive half of the output AC voltage. When pin 11 is high Q2 conducts and current flows through the lower half of the transformer primary in opposite direction and it accounts for the negative half of the output AC voltage.

Circuit diagram:

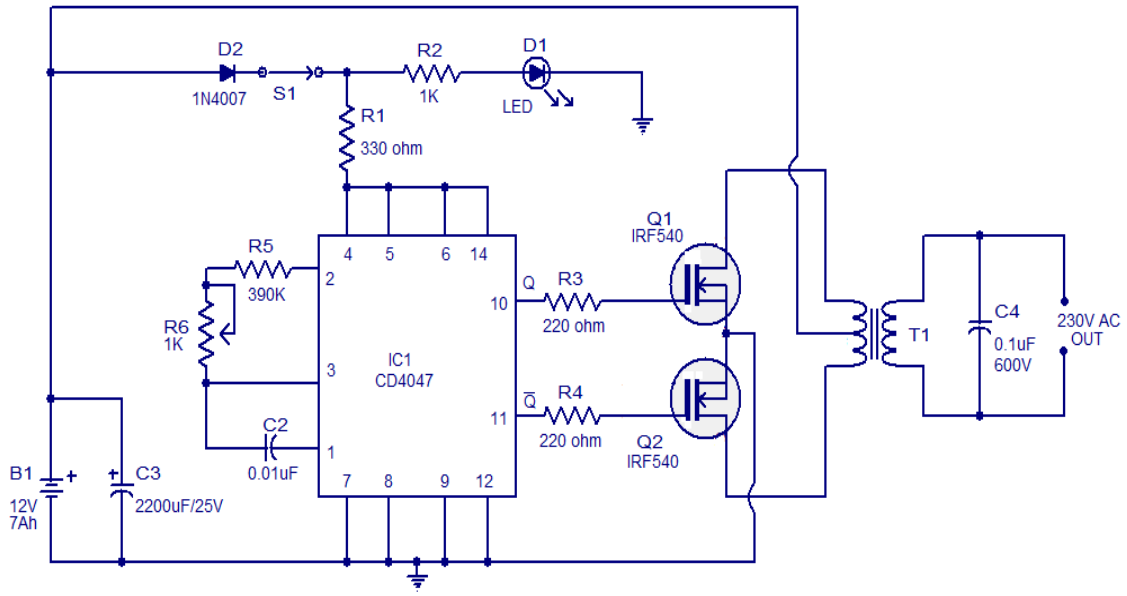

Fig.3 inverter circuit diagram

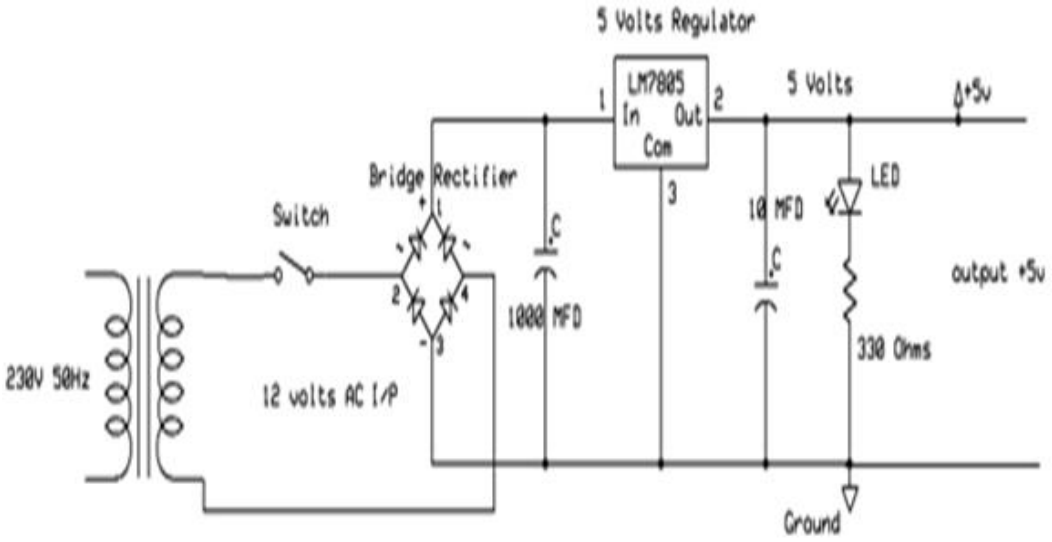

Fig. 4 Regulated power supply

Microcontroller Pic 16f73:

The PIC16F73 CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C73B/74B/76/77, PIC16F873/874/876/877devices. It features 200 ns instruction execution, self programming, an ICD, 2 Comparators, 8 channels of 8-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

Pin description:

PIC16F73 has a total of 28 pins. It is most frequently found in a DIP28 type of case but can also be found in SMD case which is smaller from a DIP. DIP is an abbreviation for Dual In Package. SMD is an abbreviation for Surface Mount Devices suggesting that holes for pins to go through when mounting aren't necessary in soldering this type of a component.

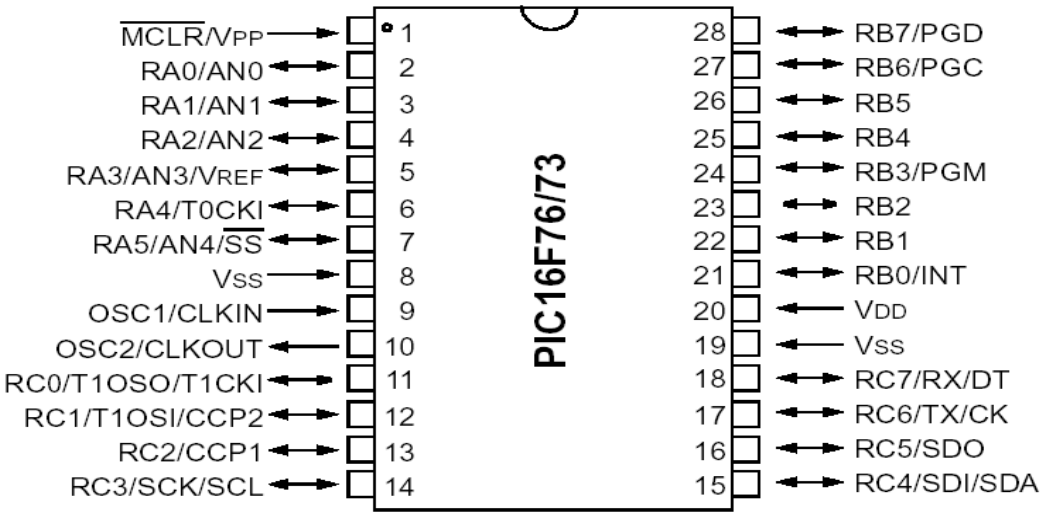

Fig. 5 pin diagram of microcontroller

Lcd display:

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 18x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

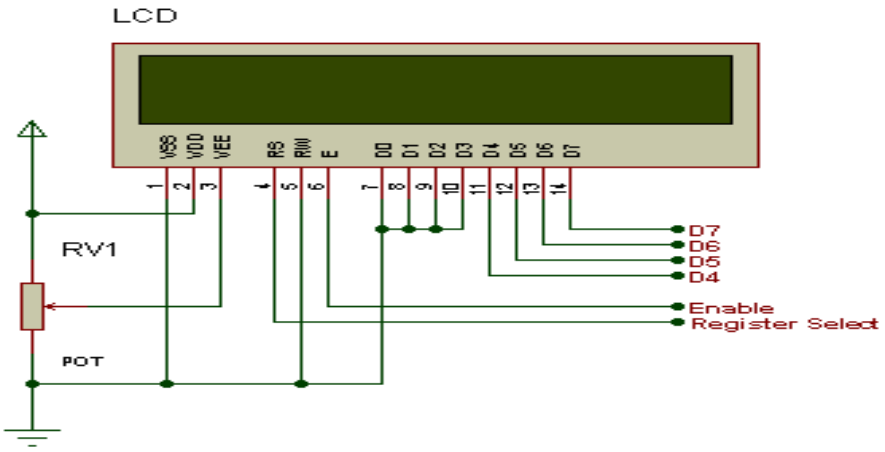

Fig. 6 Basic 16x 2 Characters LCD

Result:

The paper "A Modulo Integrated Solar Micro Inverter" was designed such that to design a solar inverter circuit. The paper aims at developing a solar Micro inverter, which is capable to run All AC appliances to, like Light, Fan, and water pumped. Solar energy is used to power up the battery. The system has a provision for ON/OFF the solar battery charging according to user's wish. it is also continuously Monitoring the Battery/solar voltage and display on LCD.

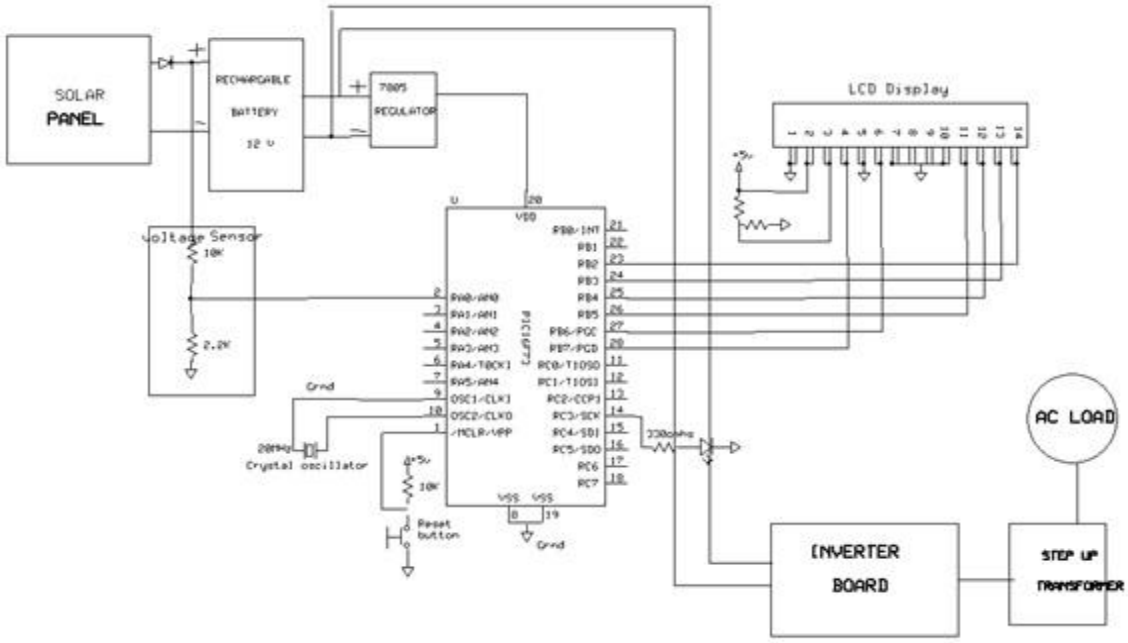

Fig. 7 circuit diagram

Wave forms:

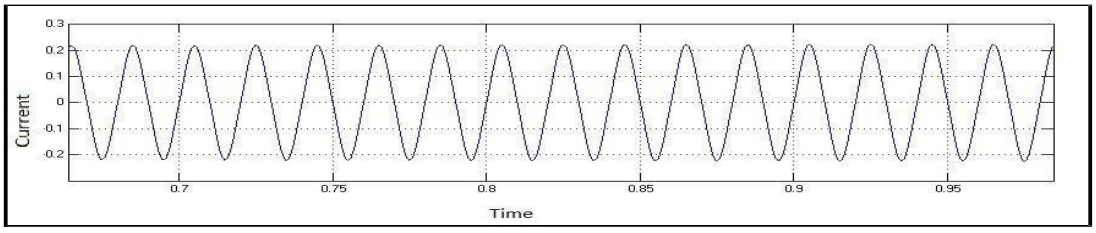

Fig. 8 Output waveforms of the micro inverter

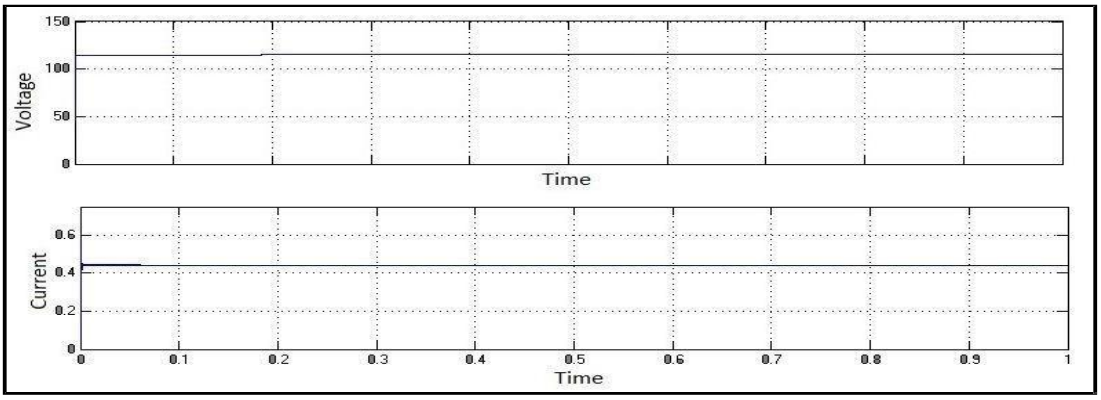

Fig. 9 Waveforms of Battery charging

III. CONCLUSION

A module integrated isolated solar micro inverter is low powered portable and cost effective By using solar micro-inverter where we can able to run the home appliances i.e. bulb, fan etc. This system continuously monitoring battery voltage and displays on LCD using Microcontroller.

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