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Single Phase Solar Inverter with Smart Charge Control

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ABSTRACT

In recent years, the interest in solar energy has risen due to surging oil prices and environmental concern. In many remote or underdeveloped areas, direct access to an electric grid is impossible and a photovoltaic inverter system would make life much simpler and more convenient.
With this mind-set, this paper aims to design, build, and test a solar panel inverter with thermo electric generator to convert waste heat in to electricity. This inverter system could be used as backup power during outages, battery charging, or for typical household applications. The key features of the system are a true 50Hz, 230V RMSoutput voltage, a wide input range, an intelligent charger and a power output for led lamps. The overall goal is to design this system while minimizing component costs. Although systems with similar features already exist, many are prohibitively expensive. In addition, inverters in the lower price range typically lack the features mentioned above. Hence the main aim of the proposed work lies in designing a solar panel inverter that is flexible and utilizes a wide range of input voltage range for various photovoltaic panels. Also, the proposed scheme is said to provide a charge control option that makes optimal use of any solar panel.

Keywords. Solar panel, charge switcher control

I. INTRODUCTION

This section explains the motivation of the project and purpose of design. This section also provides information about the technology used and the device performance in household applications.

The initial selection of this project was motivated by the increased interest in renewable energy systems, which has been fuelled by rising oil prices and environmental concern. It is our belief that the marketplace needs a wider variety of products that will utilize such systems for household applications.
We also believe that the process of designing a solar panel interface will be greatly beneficial to a power engineer in the rapidly expanding field of renewable energy applications. With additional power source as thermoelectric generator for waste heat to power, as compared to other commercially available inverter system, flexible – utilizing a wide input voltage range for various photovoltaic panels as well as providing a charge control option, and make optimal use out of any solar panels Centrifugal pump is still in operation then, definitely pump will be heated up, which leads to failure of winding, wear and tear losses. The water also acts as a coolant to cool down various components of pump. If pump is running dry then due to heat factor, parts can be damaged and this will cease the pump.

II. OBJECTIVE

The main objective of this project is to design, a solar panel inverter. As compared to other commercially available inverter system, flexible – utilizing a wide input voltage range for various photovoltaic panels as well as providing a charge control option, and make optimal use out of any solar panels.

Optimal cost for manufacturing will be rupees 3,000 to 4,000. Long backup hours due to LED usage technology as a source of light. Advance monitoring system gives good battery life and fast charging cycle and two way charging can also be done.

Figure 1 shows the block diagram used in the present work.

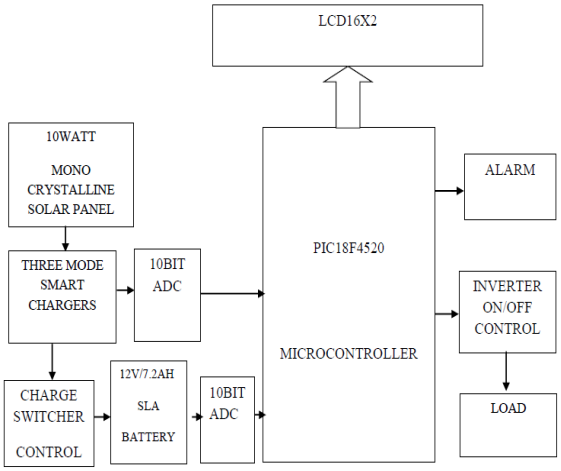

Figure 1.Block Diagram on charging control

III. METHODOLOGY

In the circuit diagram we can observe that 12V battery is connecter to the diode LED and also connected to the pin8 of the IC 4047 which is VCC or power supply pin and also to pin 4 and 5 which are astable and complement astable of the IC. Diode in the circuit will help not give any reverse current, LED will work as a indicator to the battery is working or not. IC CD4047 will work in the astablemultivibrator mode. To work it in astablemultivibrator mode we need an external capacitor which should be connected between the pin1 and pin3. Pin2 is connected by the resistor and a variable resistor to change the change the output frequency of the IC. Remaining pins are grounded .The pins 10 and 11 are connected to the gate of the mosfets IRF540. The pin 10 and 11 are Q and ˜Q from these pins the output frequencies is generated with 50% duty cycle.

The output frequency is connected to the mosfets through resistor which will help to prevent to the loading of the mosfets. The main AC current is generated by the two mosfets which will act as a two electronic switches. The battery current is made to flow upper half or positive half of the primary coil of transformer through Q1 this is done when the pin 10 becomes high and lower half or negative half is done by opposite current flow through the primary coil of transformer, this is done when pin 11 is high. By switching the two mosfets current is generated.

This AC is given to the step up transformer of the secondary coil from this coil only we will get the increased AC voltage , this AC voltage is so high; from step up transformer we will get the max voltage. Zener diode will help avoid the reverse current.

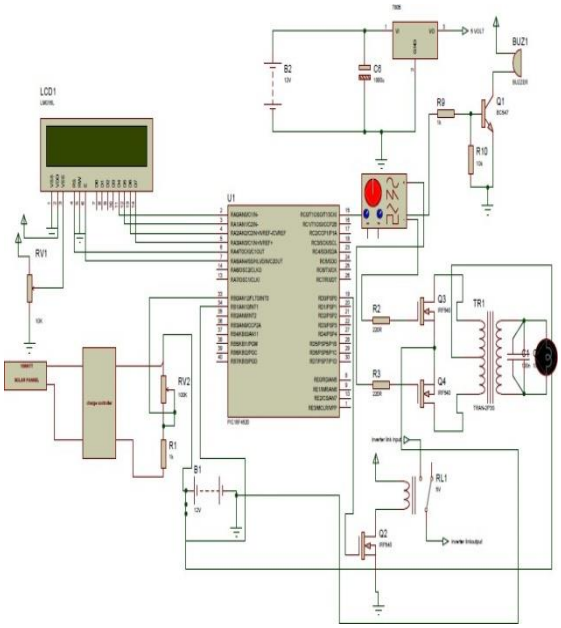

Figure 2. Circuit diagram of charging control

IV. HARDWARE USED

Table 1. shows the list of hardware components

SlNo.	Component	Quantity
1	Pic 18f4520	1
2	Btal 12 triac	1
3	Buzzer	2
4	Opto coupler	1
5	Lcd 16x2	1
6	relay	5
7	Transformer 12v,1a	1
8	10watt solar panel	1
9	IC 7805 Voltage Regulator	1
10	Irf 540 fet	2
11	Cd 4017 ic	1
12	12 volt 7.2 ah sealed lead acid battery	1
13	IC LM324	4

V. SOFTWARE USED

MikroC pro

The MikroC PRO for PIC is a powerful, feature-rich development tool for PIC microcontrollers. It is designed to provide the programmer with the easiest possible solution to developing applications for embedded systems, without compromising performance or control.

PIC and C fit together well.PIC is the most popular 8-bit chip in the world, used in a wide variety of applications, and C, prized for its efficiency, is the natural choice for developing embedded systems. MikroC PRO for PIC provides a successful match featuring highly advanced IDE, ANSI compliant compiler, broad set of hardware libraries, comprehensive documentation, and plenty of ready-to-run examples.

VI. ADVANTAGES

Direct room temperature conversion of light to electricity through a simple solid state device. Absence of moving parts. Ability to function unattended for long periods as evidence in space program me.Modular nature in which desired currents,voltages and power levels can be achieved by mere integration.Maintenancecost is low as they are easy to operate.They do not create pollution.They have long effective life.They are highly reliable; They consume more fuel to operate as the sun's energy is free. They have rapid response in output to input radiation changes; no long-time constant is involved, as on thermal systems, before steady state is reached. They are easy to fabricate, being one of the simplest of semiconductor device. They can be used with or without sun tracking, making possible a wide range of application possibility.

VII. DISADVANTAGES

Their principal disadvantages are their high cost, and the fact that, in many applications, energy storage is required because of no isolation at night. Efforts are being made world- wide to reduce cost through various technological innovations. The conversion efficiency of solar cells is limited to 10 %. Large areas of solar cell modular are required to generate sufficient useful power.The present costs of solar cells are comparatively high, making them economically uncompetitive with other conventional power generation methods for terrestrial applications, particularly where the demand of power is verylarge.

Solar energy is intermittent and solar cells produce electricity when sun shines and in

proportion to solar intensity. Hence, some kind of electric storage is required making the whole system more costly. However, in large installations, the electricity generated by solar cells can be fed directly into the electric grid system. Battery charge level maintenance and discharge limit and lifeshortened

VIII. APPLICATIONS

Various solar photovoltaic systems have been developed and installed at different sites for demonstration and field trial purposes. The terrestrial applications of these include provision of power supply to:Water pumping sets for micro irrigation and drinking watersupply, Radio beacons for ship navigation atports, Community radio and televisionsets,Cathodic protection of oil pipelines, Weathermonitoring, Railway signallingequipment, Batterycharging, Streetlighting.

The major application of photovoltaic systems lies in water pumping for drinking water supply and irrigation in rural areas. The photovoltaic water pumping system essentially consists of.
A photovoltaic (PV)array, Storagebattery, Power controlequipment, Motor pump sets,and Water storagetank.

IX. RESULT

Single Phase Solar Inverter and Charging SystemDevelopment

ssAs the project proceeded, the module went through various changes and improvements. This section discusses many of the obstacles and advancements the group faced as the project developed. The key points that will be outlined in this section are the evolution of the portable design, the obstacles faced, and the completeunit.

Table 2. Shows the output values of Light Condition

Conversion efficiency	Light condition	Solar voltage	Time	Season
10%	10%	6-7 volts	5am-7am	Summer
40-60%	90-100%	19 volts	7am-4pm	
10-20%	5-10%	3-4 volts	5am-7am	Rainy
40%	40-50%	16-19 volts	7am-4pm	

Resulting output condition of battery and inverter:

Battery:

Output:12V, 7.2 Amperehour

PWMfrequency:4-5 kHz and its maximum will be up to 400kHz.

Inverter:

Batteryfullcharge.Load 18 watts it will back up to 9 hours Battery70%

Charge.Load 18 watts it will back up to 6-7 hours Battery50% charge.Load 18 watts it will back up to3hours

Outputload:120-200volts and current consumption will be depending onload.

FINAL SETUP OFPROJECT

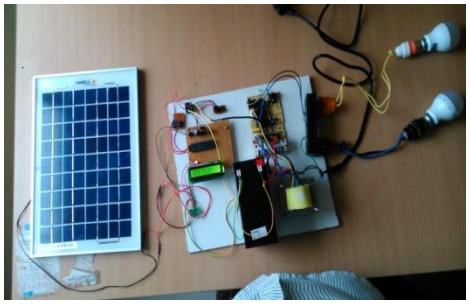

Figure 3. Inverter is turned off

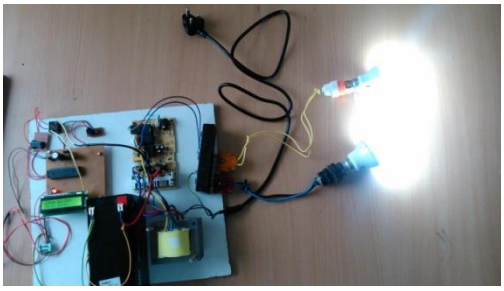

Figure 3.1. Inverter is turned on

X. 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 electricityconversion.

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 insulation 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 controller will implement the MPPT algorithm and synchronization with the grid.

In this work, a single phase PWM inverter has been implemented with PIC18F4520 microcontroller and gate drivers. Several outstanding features of the developed Sinusoidal PWM inverter are.fewer harmonic, low cost, simple and compact. The implemented inverter is for low power and low voltage application.

XI. FUTURE IMPROVEMENTS

Besides we've done no work for voltage regulation. So in this sector there has also opportunity for future scope. Besides these, our project work is not tested on high voltage. We just work on 220 volts which is in household range. Now a day there is a high demand on DC power transmission. For industrial and high voltage DC voltage conversion will be a good future work. It needs the further enhancement of the system. It needs a huge transformer. Of course the requirements will cause huge amount of expenses. Finance is a critical issue for further enhancement. This system will be enhanced to additional devices like Televisions, Washing machine, Mixer, Grinder, Fan with additional battery increase in wattage of the solar panel.

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