Solar powered ups

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Abstract : sudden change in voltage may cause damage for the functioning of mission critical electrical loads. To avoid these damages and to provide a steady flow of power to these electrical loads we are using uninterruptible power supply(UPS). It provides instanraious solution to these power quality problems. It includes the design, analysis research methodology used and the findings the market study during the research. In the design of solar UPS there are mainly two parts they are solar panel and specially designed inverter circuit. The inverter circuit has been designed on the basis of solar panel. The paper provides study of possibilities of design and functionality of a solar powered UPS. Main purpose of using solar UPS is having high efficiency and also a successful alternate to electrical UPSs in the market. There are two main components in the design: an outdoor solar panel comprising of solar cells. Which will convert solar energy into electrical energy and inverter that will convert that energy into alternating current to be used for home appliances, solar power and uninterruptible power supply (UPS) are two technologies that are growing rapidly.

***Keywords* - Renewable energy, solar panels, battery, inverter, alternating source**

I. INTRODUCTION

Solar power charge controller is applicable in many sectors such as solar home system, hybrid systems, solar water pump system etc. solar panel converts sun light energy into electrical energy through an electrochemical process also known as photovoltaic process. Energy stored in the battery with the help of charging circuit through a diode and a fuse. This energy will be used in case of main power failure. In the battery chemical energy is converted into electrical energy which in turn illuminates electrical appliances or helps in pumping water from the ground. Therefore, we need to protect battery from over charge, deep discharging mode while DC loads are used or in under voltage as it is the main component in a solar power charge controller. Solar panel produce direct currents (DC) to convert into AC output at a certain required voltage level and frequency connect these panels to the electricity grid. The conversion from DC to AC is essentially accomplished by means of DC-AC inverter, which is major component in the system. Yet the output of the solar panels is not continuously constant and is related to the instantaneous sun light intensity and ambient temperature. In an attempt to provide 10watts electricity for a DC powered home in an incessant manner, this work deals with the design and implementation of a solar PV based home with uninterrupted power supply. The backup power is supplied by the power grid and battery to maintain constant output voltage, the solar PV is cascaded with a buck converter with a PWM modulator circuit in its feedback. to adjust the Kp value, a proportional controller, which maintain the output voltage at constant level by appropriately varying the duty ratio of the buck converter. The output of this buck converter is connected to a common DC bus. When solar DC power is unavailable, a reduced voltage single phase AC power grid (of 90V) supplies the home through a rectifier and a buck converter which maintains a constant 13.6V DC output. Battery is charged either from rectifier AC or from solar PV which supplies power in cases when the other two sources are unavailable. A microcontroller design insures that this 100W Dc home is supplied power for maximum amount of time at the minimum possible cost. For mission critical electrical loads Providing a steady flow of power is important. such as data centers, life support systems, naval ships, scientific research facilities, and telecommunication systems. Slight variations in the voltage may cause these loads to fail even if the power loss is only for a fraction of a second. Specifically, our UPS system set out to rectify the grid voltage to DC voltage and invert that back to AC voltage.

2. DESCRIPTION OF THE CIRCUIT DIAGRAM

2.1 Solar Battery Charger

The solar cell exposed to light and the energy from each light particle heating the silicon and forms an electron and a corresponding hole. If this happens within range of the electric field's influence, the electrons will be sent to the N side and the holes to the P one, resulting in yet further disruption of electrical neutrality. This movement of electrons is a current; the electrical field in the cell due to a voltage and the product of voltage and current is power. The solar energy is stored in the battery in the form of DC from solar cells with the help of battery charging circuit. The charging circuit is made up of IC 7812 voltage regulator and two transistors BC547. That DC voltage is then fed to the voltage regulator IC 7812; the output will be regulated to constant 12V. at the output of voltage regulator 12volt rechargeable battery is connected, when the main power is available the battery will be charged. This circuit also indicates the charging status that is the LED1 is glows when the battery is charged (Above 10.5V). When battery voltage goes below a particular value, LED1 stops glowing and the buzzer produces sound indicating that the battery has been discharged and it needs recharge. When the battery is fully charged the zener diode conducts in reverse biase mode. And it collects the current from charging circuit through zener diode and it is discharged through transistor emitter to the ground, so the battery will be safe in case of fully charged condition. The battery will be charged through diode so the battery will not be discharged in case of solar energy cut-off.

Charging time of battery = Battery Ah / Charging Current

T = Ah / A

Where,

T = Time hrs.

Ah = Ampere hour rating of battery

A = Current in Amperes

Example:

Suppose for 4.5 Ah battery,

First of all, we will calculate charging current for 4.5 Ah battery. As we know that charging current should be 10% of the Ah rating of battery**.**

Therefore, Charging current for 4.5Ah Battery = 4.5Ah x (10/100) = 0.45 Amperes. But due to some losses, we may take 0.45-0.5 Amperes for batteries charging purpose instead of 0.45 Amp.

Suppose, we are going to install a solar power system in our home for a total load of 10W where the required backup time of battery is 3 hours (You may use it your own as it is just for sample calculation)

Load = 10 Watts

Required Backup time for batteries = 3 Hours

Solution:

Inverter / UPS Rating:

Inverter / UPS rating should be greater than 25% of the total load (for the future load as well as taking losses in consideration)

10 x (25/100) = 2.5W

Our Load + 25% Extra Power = 10+2.5 = 12.5 Watts

This is the rating of the UPS (Inverter) i.e. We need 12.5W UPS / Inverter for solar panel installation according to our need (based on calculations)

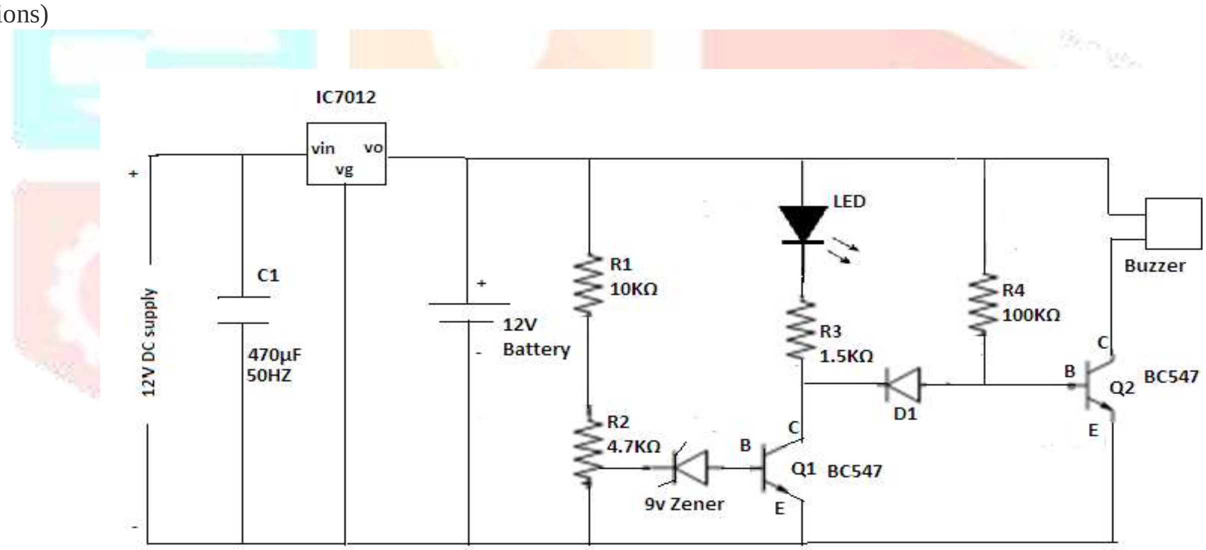

Fig -1: **The Solar Battery Charger Circuit**

2.2 Inverter Circuit:

This circuit converts DC to AC, where the circuit work based on the multi vibrator (Astable and Monostable). On this circuit using CD4047 IC as the heart of multi-vibrator that functions to generate a wave 50Hz is not stable, because this type of IC to provide a complementary output stage, contrary to the pins 10 and 11, as shown, and 50% of the duty cycle to meet the obligation to produce pulse inverter. Circuit is called a simple DC to AC inverter, if the output signal is not sinusoidal, and there is lot of harmonic signals on the output. To suppress this signal we have to use a filter such as capacitor C. Because of this simplicity are only suitable circuits for lighting needs. To build a sinusoidal inverter DC to AC. At the circuit this multivibrator is used to provide high power, and then we have to use the MOSFET IRFZ44. IRFZ44 provide high current to step-up transformer, so power is available in addition to the high voltage transformer. The power MOSFETs are connected in Push Pull configuration (Power amplifier). The MOSFETs will switch according to the pulse from CD4047 multivibrator. Thus an AC voltage is transferred to the primary of transformer; it is step up to 230V.The transformer used here is an ordinary step down transformer which is connected in inverted mode. That is, the primary of a

230V to 12V-0-12V step down transformer can be treated as secondary for this inverter project. This circuit uses 12V input (12V battery) to output 220V 50HZ.

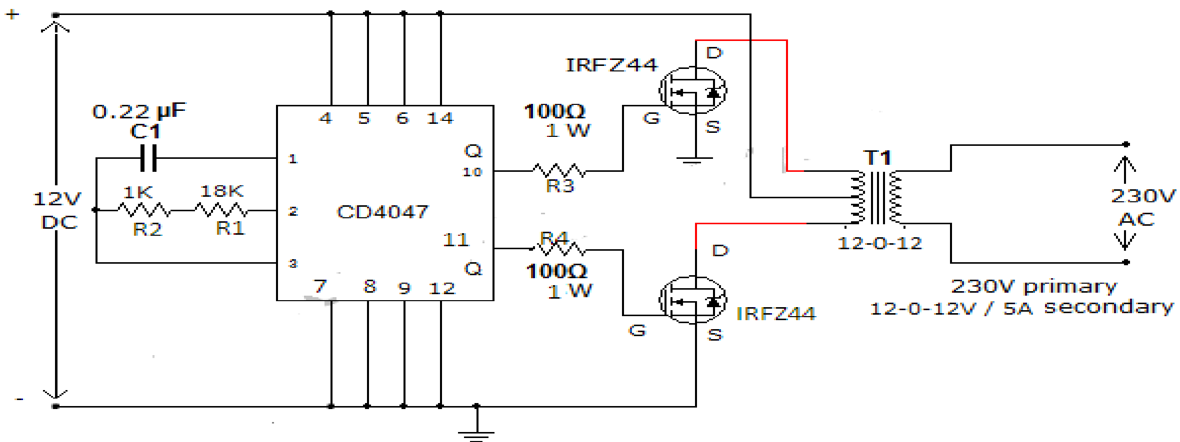

Fig -2 The Inverter Circuit

Voltage equations for inverter circuit

For commutation:

$$R_aI_a+L_a\frac{dIa}{dt}+\frac{d\,\phi a}{dt}-R_oI_o-L_o\frac{dIo}{dt}-\frac{d\,\phi o}{dt}=VS$$

$$R_aI_a+L_a\frac{dIa}{dt}+\frac{d\,\phi a}{dt}-R_bI_b-L_b\frac{dIb}{dt}-\frac{d\,\phi b}{dt}+VD=0$$

$$I_a+I_b+I_c=0$$

For Duty On

$$R_iL_i+L_i\frac{dIi}{dt}+\frac{d\,\phi i}{dt}-R_jI_j-L_j\frac{dIj}{dt}-\frac{d\,\phi j}{dt}=VS$$

For duty off

$$R_iI_i+L_i\frac{dIi}{dt}+\frac{d\,\phi i}{dt}-R_jI_j-L_j\frac{dIj}{dt}-\frac{d\,\phi j}{dt}-VD=0$$

3. Block Diagram:

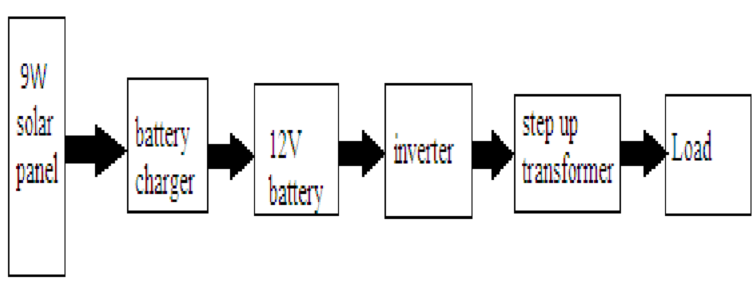

Fig -3: Block Diagram of solar UPS

Here we propose solar based ups extended that by using solar energy to charge the battery and afterward the dc battery output is utilized to control an AC inverter.

The solar panels is used to always charge the 12V DC battery with help of charge controller circuit and then once we turn on the switch the 12V battery output is applied to the inverter input. The inverter converts the 12V DC to 12V AC, and then it is step up to 230V AC supply with help of step up transformer. In this manner the solar powered ups can be utilized as a part of main power failures or blackout and has the ability to function as a primary source without the need of any outer power supply. Now a days the solar power can be used as secondary source, grid power can be used as primary source. The unit per cost will be increased so the lot of peoples suffered to this problem. To avoid this problem we can use solar power as primary source and grid power used as secondary source.

4. HARDWARE:

Fig -4 Hardware setup of proposed solar ups

Fig –5 Inverter set up with CRO

From Fig-4 it is noticed that, when the solar panel is exposed to Sunlight the voltage developed across the Solar charger circuit varies due to the solar irradiation and the values are tabulated in Table-2 and in Fig-5 the Energy stored in the battery is reused with the help of converter circuit and the converted AC waveform can be observed in the CRO.

4.1 Hard Ware Specifications:

Table -1: specification parameters

S. No	Component	Ratings
THE SOLAR BATTERY CHARGER		
i	Solar panel	9W

ii	Diodes	IN4001, IN 4007
iii	Capacitors	470µF, 50V
iv	Voltage regulator IC 7812	IC 7812
v	Transistor	BC547
vi	Resistors (Each 0.25 watt)	10kΩ,1.5kΩ,100kΩ
vii	Buzzer	12V
INVERTER		
i	IC CD4047	CD4047
ii	Resistors	1K, 18K, 100Ω- 0.5W
iii	Capacitor	0.22µF
iv	MOSFET	IRFZ44
v	Step Down Transformer	230V/12V-0-12V,5A
vi	Battery	12V,4.5Ah

4.2 Hardware Output

Table -2 Experimental Results

	Solar output in DC	**Inverter output in AC**
Theoretical values	20V	230V
Practical values	14V (at 35^0 C)	195V
	19V (at 40^0C)	224V

5. CONCLUSIONS

The solar panels should be connected in accordance to the size of the connected load. The type of battery to use is mainly influenced by the temperature of the room and the need for maintenance. If an expansion of load is to be conducted the current UPS system should be utilized to as a high degree as Possible. This can be done by either connecting new UPS units to feed the loads or to expand current UPS units by running them in parallel with new UPS units. 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, easy of maintenance, and direct solar radiations 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 insulation level, and cell temperature. shifted on using renewable sources of energy. There is more advancements pending in this field which will revolutionize the energy stream and solar energy will be playing the most important role of all. The present implementation has 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 project described is valuable for the promising potentials it holds within, ranging from the long run economic benefits to the important environmental advantages. This work will mark one of the few attempts and contributions in the Arab world, in the field of renewable energy; where such projects could be implemented extensively. With the increasing improvements in solar cell technologies and power electronics, such projects would have more value added and should receive more attention and support.

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