

EXPERIMENTAL SETUP OF SOLAR POWERED UPS SYSTEM

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ABSTRACT

In this article, we use solar power, which is very important source in the move to clean energy production. Solar panel, which consist solar cell, used to transform solar energy into electrical energy. Since this time, one power UPS can be as useful in daily life. This design of solar UPS consist of solar panel, inverter circuit, & solar charge controller and the design architecture of solar UPS is compact and successful with few ripple in the output sine wave as verified by fluorescent light bulb. The switching between dc battery and ac supply takes negligible time i.e., less than the discharging time of the storage capacitor. The design also ensures no reverse current flow from battery to mains enhancing the safety features; this light bulb runs for four hours without electricity. In the project, we have charging circuit, which will charge the battery, and inverter circuit, which will convert in AC after that we used the AC supply for light bulb.

Keywords: Solar UPS system

INTRODUCTION

Full form of UPS is Uninterrupted Power Supply. Introducing a new and helpful way in which with the help of battery backup system ups gives uninterrupted power while running the electrical appliances and electronic equipment. Solar UPS is electrical and electronic device that can generate both ac and dc power without any mechanical interfaces. The design is very compact in size. Solar UPS is very environment friendly and as well as very easy in installation. The solar ups are the perfect backup power solution for essential home appliances, emergency power electronics and full size office equipment during a power outage. The working of ups depends on different type of ups system such as online ups, offline ups and hybrid ups. In online UPS, the load is always fed through the ups. The incoming

AC power is rectified into DC power, which charges a bank of batteries. This DC power is then inverted back into AC power, to feed the load. If the incoming AC power fails, the inverter is fed from the batteries and continues to supply the load. In addition to providing ride-through for power outages, an online UPS provides very high isolation of the critical load from all power line disturbances. However, the online operation increases the loss and may be unnecessary for protection of many loads. However, in offline UPS a standby power supply is sometimes referred as offline, since the normal line power is used to power the equipment until a disturbance is detected and a switch transfers the load to the battery-backed inverter. The transfer time from the normal source to the battery-backed inverter is important. A standby power supply does not typically provide any transient protection or voltage regulation, as does an online UPS. In hybrid UPS similar in design to the standby UPS, the hybrid UPS utilizes a voltage regulator on the UPS output to provide regulation to the load and momentary ride-through when the transfer from normal to UPS supply is made. UPS system integrated with both solar power and grid power charging technology is called as solar ups or solar generator. In this by using inverter that convert DC supply to AC supply and power converter that converts AC supply to DC supply is stored and reproduced from batteries in the system. Solar panel used to convert the sunlight into electricity.

SYSTEM DESCRIPTION

Solar ups system block diagram is shown in figure below.

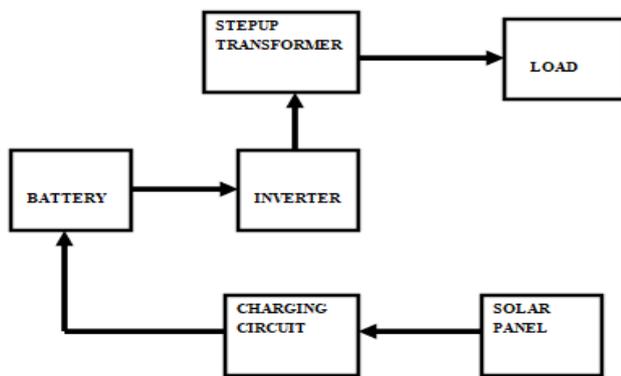


FIG 1: Block Diagram

CIRCUIT DIAGRAM

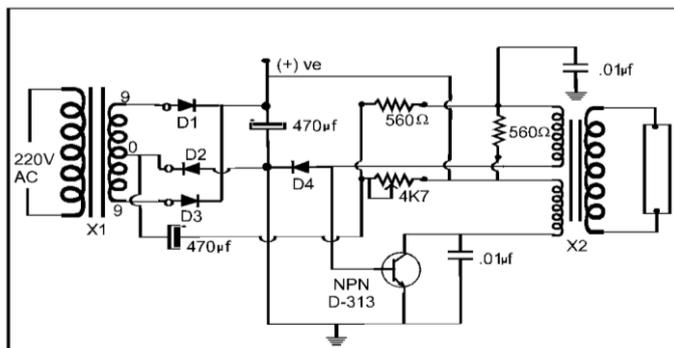


FIG 2: Circuit Diagram

Here we are used DC battery. Battery is connected to UPS section (MOSFET). MOSFET section converts DC supply to AC supply. After that, we used this AC supply for tube light. There are used switch to switching for tube light.

The dc voltage is converted into ac voltage with the help of dc to ac ups. To make the alternating current which flow into the transformer ups circuit switch to the dc voltage source.

In the given circuit, Transformer X₁ is used to charge the 12V 7.5Ah battery. Diode D₁ & D₃ provides full wave rectifier & Capacitor 470uf gives ripple filtration across the battery. While charging the 0V of the transformer blocks transistor is biasing (reverse biasing) & not to allow the emergency light to glow while charging. Diode D₁ provides reverse biasing for the same purpose to transistor T₁. When the main supply is switched off the transistor gets positive voltage via 4.7k variable - 560 resistance half of primary coil of transformer. The Output of transistor is coming through collector & other half of the transformer X₂. Secondary of transformer is connected to the tube light for high voltage to glow the tube. The first half of transformer also provides

feedback to the transistor. Capacitor 0.01uf across collector & emitter provides ripple free glow for light.

WORKING

In this project, we use solar power. UPS is a device to converter 12 volts dc power to high volts ac power. This can be used to any power equipment. Since this time, I have been amazed at the uses a power UPS can have. One power UPS can be as useful in daily life. Here are just a few of the uses I have found for a power UPS.

This 60-Watt incandescent light bulb runs for four hours without electricity. One can use this as emergency light. The circuit comprises the inverter unit. The power converted into ac from 12V dc with the help of power transistor T1 that is of (NPN) type. Then the inverter received the output power of the transformer. Thus, inverter transformer (here used 6-0-6 transformer) steps up 12v DC to 180V AC, which is sufficient for operating some electrical equipments. In the circuit, all the components should be mounted on PCB except step down transformer X₁. It is used to charge the battery and switch off transistor T-1 by applying reverse bias to its base when 230V AC mains supply is available. Diode D-2 & D-4 provides negative supply to the base of transistor T-1 to make it reverse biased. Capacitor C-2 smooth's this negative supply. When the supply fails, transistor T-1 conducts through LC network. The biasing voltage can be varying by resistor R-3. The output from its collector is fed to the primary of inverter transformer. The step-up output is available at secondary of is transformer to glow the light.

COMPONENT DECIPTION

1. TRANSFORMER

A Transformer is a static device, which convert electrical energy from one circuit to another circuit via magnetic flux without change in frequency. The core of transformer is made up to CRGO (Cold Rolled Grain Oriented Silicon Steel) and minimizes hysteresis loss. Laminate the magnetic core to reduce the eddy current loss. It has two winding primary and secondary. Primary has N1 turns and secondary has N2 turns. Transformer works on Faraday's law of electromagnetic induction (mutual induction). When two coils are inductively coupled and when current in one coil is changed, emf is induced in the other coil. Transformer specification, which used

Number of transformer : 2
Current rating of Transformers: 1A, 5A
Voltage rating of Transformer: 230V/12V

2. SOLAR PANEL

Solar panels are used to absorb sun's rays and convert them into electricity or heat. A solar panel is actually a collection of photovoltaic cells or solar cell, which can be used to generate electricity through photovoltaic effect. At the junction of specially modified semi conducting compounds, photons of light are captured and turned into a flow of electrons an electric current. Like other semiconductor devices, manufacturing a PV cell is extremely energy intensive. Under average conditions, a PV cell will have to produce energy for two to four years before it recoups the energy invested in its manufacture. Firstly, photovoltaic (PV) cells produce very little electricity by comparison with other power generation options.

Solar panel specification, which used

Number of panel : 1
Maximum power : 250W

3. BATTERY

A battery is a device that converts chemical energy directly to electrical energy. The battery has a negative anode and positive cathode. Power of this battery is used for glowing light bulb when the power supply is off. Otherwise, the power supply keeps charge the battery.

Battery Specification, which used are as followed:

Type : Lead acid battery
Cathode : Lead oxide
Anode : Lead
Electrolyte : H_2SO_4
Charging current : 4A

4. INVERTER

Inverter is a device that transforms direct current (DC) power to alternating current (AC) power at desired output voltage and frequency. In solar ups system with solar charge controller, inverter uses solar power to charge the circuit of battery and then convert DC power supply to AC power supply.



Fig: Inverter circuit

ADVANTAGES OF SOLAR UPS

Simple Installation: A Solar UPS is less demanding to introduce than some other power generator. Likewise, it includes a low upkeep cost.

Sparing: These frameworks are a one-time venture, which devours a lesser measure of intensity, and are greatly reasonable.

Solid: Unlike some other power framework, a sun-oriented UPS has a long life and gives stretched out practical life to alternate machines going through the UPS.

High Productivity: These UPS frameworks create the most extreme power yield with ease. Their capacity age is considerably higher than their capacity utilization.

APPLICATIONS

UPS with solar panel has many applications. Some of them are as follows:-

1. It can be used at home.
2. It is used in the industry.
3. It is used in shops.

FUTURE ENHANCEMENTS

The deigned architecture can be further enhanced for higher power / voltage ratings and more commercials uses with some more value added features like pure sine wave output using digital signal processing techniques. Surge power & Starting surge delivery can be enhanced by using more powerful batteries and features like shut down on reverse polarity at input battery, overload can also be added.

- Medical Power UPS
- Home Power UPS
- Car Power UPS
- Grid Tie Power UPS

- Marine Power Inverter / Inverters

RESULTS & CONCLUSIONS

In this project, solar panel charge 12V DC battery continuously with the help of charge controller. When we turn on the switch, battery charge will inverted into AC with the help of inverter circuit and stepped the voltage from 12V DC to 230V AC.

The design architecture of 60W UPS is compact & successful with few ripples in the output sine wave as verified by light.

The switching between dc battery and ac light takes negligible time i.e. less than the discharging time of the storage capacitor. The design also ensures no reverse current flow from battery to mains enhancing the safety features.

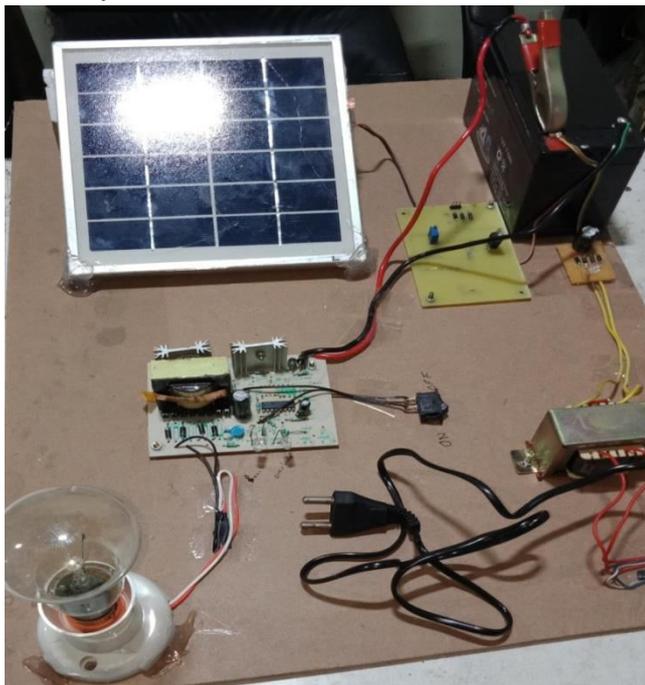


Fig : Final system

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