

Solar UPS Powered by Lithium Ion Battery

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Abstract

This project presents a plan for cost-efficient small-grid electricity production in a residential location high-powered by alternative energy sources A electrical phenomenon (PV) star grid is employed to convert solar energy, that may be a concept of DC power generation from solar lightweight falling onto a solar grid and changing it to AC power with the assistance of an electrical converter in low budget. Associate in Nursing integrated chip controls the voltage and frequency. It changes the frequency point depending on the energy of the battery, which slows down the charging or discharging of the battery. This project is an attempt to overcome the energy challenge, particularly in developing countries. The simulation model of the system is developed in the "EVERY CIRCUIT APPKICATION" environment of mobile software

Key-words: Solar UPS, Solar Photovoltaic System (SPVS),

1. Introduction

India remains facing a new energy crisis in rural and community areas. The issues worsen in summer. Winter isn't any different, however, as there's still a mean equipment failure of 3-4 hours per day. Those without generators and UPS face enormous problems. In these cuts. The costs of each corporations continuing to rise thanks to a sharp increase within their demand. We don't use a solar UPS as a replacement; however it can be used as an emergency power in the event of a grid failure. It doesn't hurt the setting either. A solar photovoltaic system (SPVS) is a concept in which direct current is generated from sunlight falling on a solar panel and converted into alternating current with the help of an inverter. Electricity can be used in a variety of applications, such as: for lighting, pumping and charging batteries. We can use this inexhaustible resource and help to meet the shortage

of electricity. We use lithium batteries to replace lead-acid batteries. The advantages of the lithium battery are that it is smaller, has a long service life and is also inexpensive to buy in large quantities. Since it is an acid-free battery, it can withstand 500 cycles, which can last longer than 5-6 years. In addition, there are no top-up and maintenance costs for distilled water.

2. Literature Survey

Britt et. al.,[1] have conferred an experimental investigation to review a semiconductor material utilized in a PV cell and its importance in determinant the potency of the photovoltaic cell at various parameters akin to regards to behavior with reference to temperature, weight and yet as alternative parameters with that it's used and everyone those contribute to the deciding issue of efficiency of the PV cell The discoverer has conducted several experimental researchers to devise improvised strategies and equipment for forming thin film layers of semiconductor materials.

Sadati et. al., worked on analysis of supply ruler and residential area using photovoltaic systems in I.R. Iran. They need commented on use of sun's energy has the most important energy provides and is clean and annexable supply which may be utilize by using applicable technologies. The overall radiation received by totally different regions throughout the year the common energy consumption needed result of temperature voltage –current curve characteristics are conceder for evolving a photograph voltaic system to satisfy the domestics required, economic analysis has been created for justification of the employment age of photovoltaic system. A high-frequency photovoltaic pulse charger (PV-PC) for lead-acid accumulator (LAB) radio-controlled by a power-increment-aided incremental-conductance maximum power point tracking (PIINCMPPPT) was projected by Hung-I Hsieh et al [2].

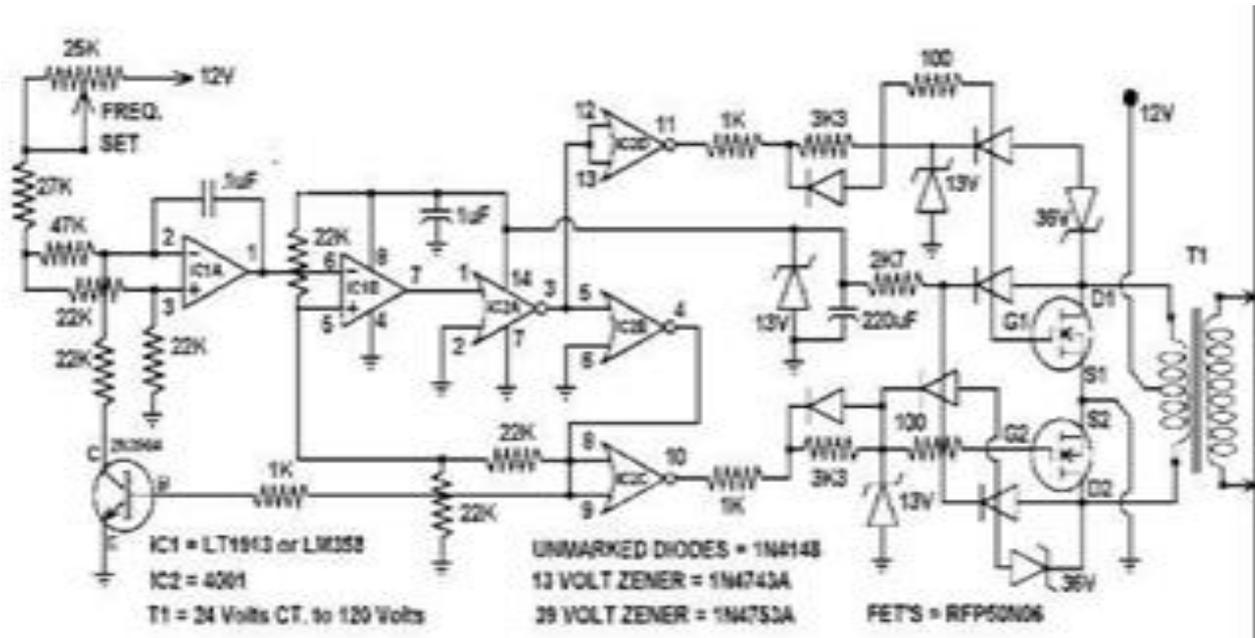
S. Yuvarajan et al [3] proposed a fast and accurate maximum power point tracking (MPPT) algorithm for a photovoltaic (PV) panel that uses the open circuit voltage and the short circuit current of the PV panel [8]. The mathematical equations describing the nonlinear V-I characteristics of the PV panel were used to develop the algorithm.

3. Comparison Between Existing System and Proposed System

In existing system, lead acid battery is used which has low lifecycles and also it requires high maintenance. We are replacing lead acid battery with lithium ion battery because it has high charge density and high life cycles and low maintenance

4. Existing Circuit for Solar Power Generation in Market

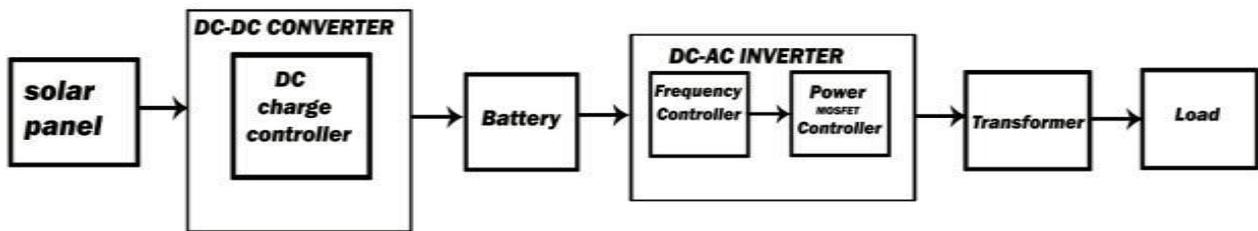
Figure 1 - Existing Circuit for 20 Watts Power Production



Frequency is generated using RC component oscillator circuit that is why six IC's used in it.

Figure 2 - Proposed Block Diagram

Block Diagram of proposed system

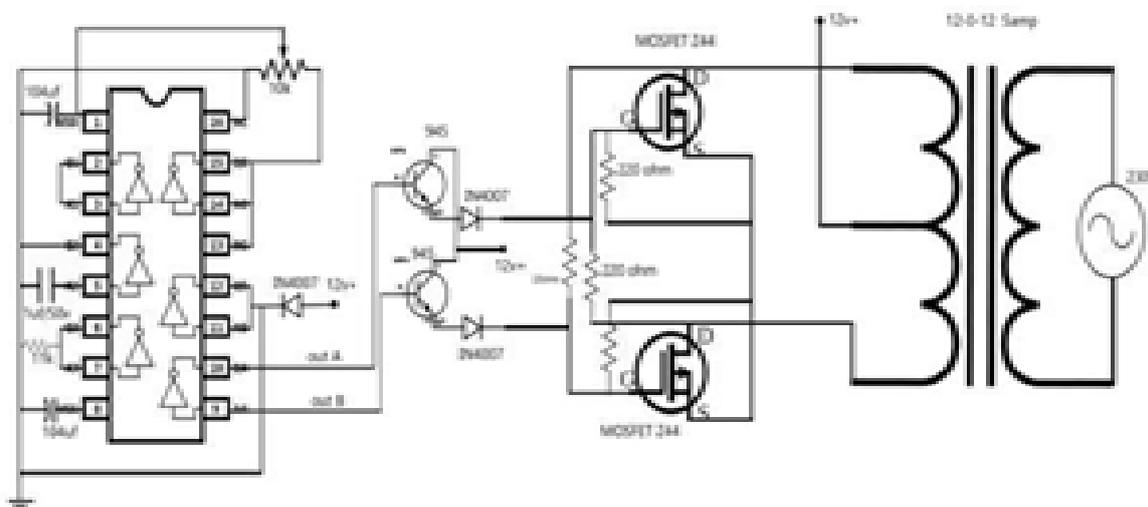


In this solar based UPS project, we are using solar energy for charging 12V DC battery. Our solar panel will constantly charge battery with the help of solar charge controller. And once we switch on the circuit the battery charge will inverted into AC with help of inverting circuit and stepped the voltage from 12V DC to 230V AC using Step up transformer and we are connecting to the load. We are setting up two stages where the output of the transformer is connected parallel, so the current increases up and the voltage remains constant. By parallel operation it is possible to drive heavy loads. We are setting a LED indicator, once the battery is fully charged LED light glows. We are going to test our project by giving supply to 10W load and checking whether it is glowing or not.

This system can successfully use as UPS as an emergency power cut and have a capacity to standalone without any external electricity.

5. Proposed Circuit

Figure 3 - Proposed Circuit



This is the propose circuit for inverter section. Here multivibrator CD4047 is used. This is the astable multivibrator. The output of the astable multivibrator is square wave since AC circuits works on pure sine wave so the square wave signal is sent to two MOSFETs IRZ44 which trims into pure sine wave and connecting to transformer. From transformer, connection is connected to the load.

6. Solar Charge Controller

A solar charge controller manages the current coming into the battery bank from the solar array and ensures that the deep cycle batteries don't seem to be overcharged throughout the day which the current doesn't flow back to the solar panels and discharge the batteries at night. Some charge controllers are offered with further options love lighting and charge control, however managing the ability provide is their primary role. Overcharging any kind of battery will cause irreparable damage. Overcharging lead-acid batteries can result in excess gas which, within the worst case scenario, can truly "boil" the battery. warming and high pressure can turn out explosive results if released. Smaller charge regulators usually contain charge management circuitry. Load control switches and relays may also be accustomed load control DC masses up to forty five or sixty amps. aboard a charge controller, a relay driver is additionally normally used to switch relays on and off for load control. The relay

driver includes four separate channels to grade additional crucial loads. additionally to the charge controller, the relay driver is also usually used to flip the relays on and off and control the load. The relay driver contains four separate channels to prioritize more crucial loads so they keep longer than less critical loads. management and alarm notifications the foremost advanced star charge controllers may also monitor the temperature and regulate the battery charge to optimize the charge accordingly.

Figure 4 - Charge Controller



7. Lithium Ion Battery

Lithium-ion (Li-ion) is an advanced battery technology within which Li-ions are a necessary part of electrochemistry. throughout the discharge cycle, the lithium atoms within the anode are ionised and separated from their electrons. Anode and submit to the solution till they reach the cathode, wherever they reconnect with their electrons and electrically neutralize every other. The lithium ions are sufficiently little to pass through the micro-permeable centrifuge between anode and cathode. because of the tiny size of lithium (third solely once atomic number 1 and helium), lithium-ion batteries will have a really high voltage and charge per unit of mass and volume. Lithium-ion batteries will use many various materials as electrodes. the foremost common combination is that of Li atomic number 27 compound (cathode) and black lead (anode), that is most {typically} found in transportable electronic devices like cellphones and laptops. different cathode materials embody lithium Mn oxide (used in hybrid electrical and electric automobiles) and lithium iron phosphate. Lithium-ion batteries typically use ether (a category of organic compounds) as an electrolyte. Compared to other high-quality battery technologies (nickel-cadmium or nickel-metal hydride), lithium-ion batteries have several advantages. have one in every of the very best energy densities of all battery technologies accessible these days (100-265 Wh / kilogram or 250-670 Wh / L). In addition, the lithium-ion battery cells can deliver up to 3.6 V, 3 times over technologies like Ni-Cd or

Ni-MH, which implies that they'll be employed in superior applications wherever Li-ion batteries are comparatively low-maintenance and not planned Cycles need massive amounts of electricity to be equipped so as to take care of their service life. Particle batteries don't have any memory effect. This can be a prejudicious method where perennial cycles of partial discharge / charge can cause the battery to "remember" a lower capacity. This can be a bonus over Ni-Cd and Ni-MH that show this effect. Particle batteries even have a coffee self-discharge rate of around 1.5 to 2% per m. They contain no harmful cadmium that makes them easier to get rid of than Ni-Cd batteries. Because of those advantages, lithium-ion batteries have replaced Ni-Cd batteries because the market leader for transportable electronic devices (such as smartphones and laptops). The new, additional environmentally friendly Boeing 787, the burden of which is a vital price factor. From a clean energy perspective, a lot of the promise of lithium-ion technology comes from its potential use in battery-powered cars. The Nisan Leaf and Tesla Model S use lithium-ion batteries as their main fuel supply.

Figure 5 - Lithium Ion Battery



8. Inverting Circuit

Basically there will be a flow of electron from source to drain when minimum gate pulse is given to mosfet. The output voltage of about 12volt from transistor C945 is given as gate pulse via 100 ohms resistor to the gate of transistor. When gate pulse attains the mosfet it gets turn ON and sends negative voltage from source to drain so that DC IS CONVERTED INTO AC because waveform from negative to positive will be in one direction and from positive to negative will be in opposite direction. IC TL494 is used as a frequency regulator and controller. RC Oscillator is used for controlling the frequency of transformer. The output frequency waveform can be seen at the output pins of IC 9 and 10. By giving 12 volt dc to circuit it generates 50 hertz frequency with minimum bias voltage of about 5 volts at the pins 9 and 10.

REQUIRED FREQUENCY=50Hz

Figure 6 - Inverter



9. Step Up Transformer

A transformer that is used to increase the output voltage whereas keeping this flow stable without change is named a step-up transformer, which is mainly utilized in power transmission and power station applications. The transformer has two windings as primary and secondary. the primary coil has less winding than the secondary coil.

Figure 7 - Transformer



10. Parallel Operation of Transformers

In order to perform parallel operation, the primary winding of transformer is connected to a common voltage source and its secondary winding is connected to a common load. Operating the

transformer in parallel has some advantages, for example it increases the efficiency of the system and makes it more flexible and reliable.

11. Necessary Condition for Parallel Operation

To ensure correct parallel operation of a transformer, two main conditions are required: First, the polarity of the transformers must be the same. Another condition is that the Turn Ratio of the transformer should be equal. The other two desirable conditions are as follows: The voltage at full load across the transformer's internal impedance must be the same. The ratio between the resistance of your winding and the reactance must be the same for both transformers.

12. Proposed System Components

COMPONENTS	QUANTITY
BATTERY,1.2Ah	6
IC TL494	2
MOSFET IRFZ44	4
RESISTORS	4
CAPACITORS	2
TRANSFORMER (2) (500 EACH)	2
CHARGE CONTROLLER	2
SOLAR PANEL	4

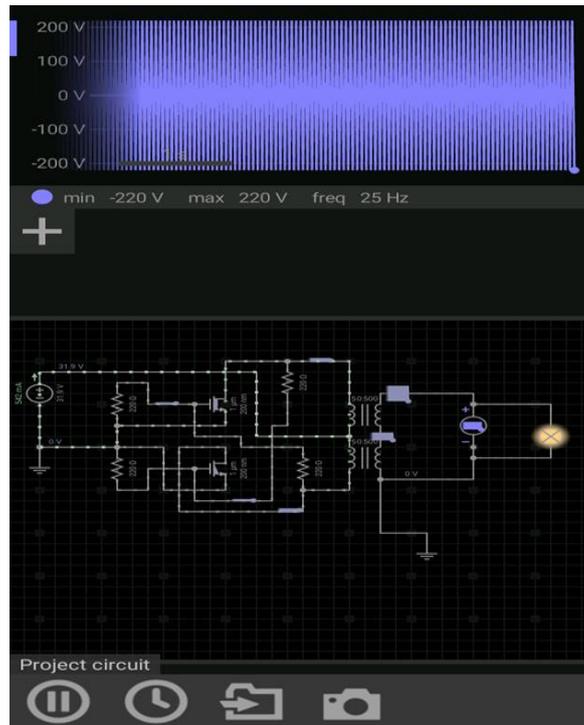
OUTPUT

Figure 8 - Output



Every Circuit Simulation

Figure 9 - Simulation Output



13. Result

It is very worthwhile contribution towards the society for bringing out a cost effective inverter with a new concept of making parallel operation of power transformers for home appliances and simulated our outputs in a new mobile application called every circuit. It is significant to note that we have produced a good quality of power.

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