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Solar Power Battery Charging with Reverse Current Protection

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ABSTRACT

The solar mobile charger with reverse current protection is the subject of this research. It was created to fulfil the increased need for the power supply required to keep our cell phone batteries charged and safe. A solar cell phone battery charger is an electrical gadget that uses the photovoltaic effect to transform light energy directly into electricity. It accomplishes this by the use of a solar panel, which is a type of photoelectric cell that can generate and sustain an electric current without being connected to any external voltage source when exposed to ultraviolet light. This paper aims to build a solar cell phone battery charger system that can receive 12V dc from a solar panel and convert it to a level that is safe for the cell phone battery (5V) while also protecting the phone from reverse current.

1. INTRODUCTION

When the power goes out, solar energy is used to generate electricity, which is then used for home reasons. Solar energy is used to power a device or charge batteries with a solar charger. They are usually transportable. Installed in a stationary location, a set of solar cells can be interconnected to a battery bank to store energy for off-peak use. The sun is the only source of energy for most portable chargers.

The generation of electrical power by the cold-based steam power plant and nuclear power plants causes pollution, which is likely to be more harmful in future due the to the large generating capacity on one side and it Became tough Because of greater awareness of the people in this respect. The recent worse energy catastrophe has forced the world to grow better and substitute methods of power generation, which could be adopted easily due to their effectiveness and many various reasons. The different non-conventional methods of power generation may be such as solar cells, fuel cells, thermoelectric generators, solar power generation, wind power generation, geothermal energy, tidal power generation, etc. This paper gives an idea about non-conventional Energy sources and why we are going for that non-conventional energy sources. The proper uses of solar energy and its different application are used at home, in the defence sector, in marines, in remote areas, etc.

2. DESIGN CONSTRAINTS

This paper will be necessary to convert solar-generated energy into AC voltage, which will be able to power most modern devices. The design must include a method for monitoring voltage levels and protecting the system from being overused or overcharged. It must also be able to monitor its solar efficiency and sustain the highest quantity of solar energy feasible under the given environmental and weather circumstances. The most significant limitation of this work will be to enhance solar efficiency in order to supply the maximum electricity to the system that the solar panels can produce. When calculating the effectiveness and performance of solar panels, weather and solar patterns must be taken into consideration. Clouds, dampness, haze, dust, and pollution will all reduce the output power of the station's panel array.

Figure 1: Block diagram of a circuit

A. System Design

It came to the conclusion that this paper would be required. A source, a function, and an output are all required. It will use solar panels that have been optimized for solar tracking as our source. The system will include a microcontroller that will act as a charge controller and an inverter that will convert the 12-volt DC stored in the batteries to 110-volt AC. A schematic diagram of the system is shown in Figure 2. The solar tracker would be attached to the solar panel and communicate with the microcontroller.

B. *Solar Panel Technology*

This is the most important part of any solar photovoltaic system, as it turns the sun's energy into an electrical current. The solar photovoltaic (PV) effect is the conversion of light (photons) to electricity (voltage). Solar cells that use photovoltaic technology convert sunlight directly into electricity (electricity). It makes use of thin layers of semiconducting material with varying charges on the top and bottom layers. A sheet of glass or a polymer resin can be used to enclose the semiconducting substance. Electrons in semiconducting materials absorb photons when exposed to daylight, leading them to become highly charged. These move back and forth between the top and bottom surfaces of these mi-conducting materials. A current known as a direct current is created by the movement of electrons (DC).

Types of Solar Panel

- Monocrystalline Panels
- Polycrystalline Panels
- Hybrid Panels
- Black-Backed Panel

Figure 2: solar panel

C. Solar Tracker

Solar trackers provide precise tracking of the sun by tilting the solar panels towards the sunlight as it moves throughout the day and as well, the year. When sunlight strikes a solar panel, it comes in at an angle, called the angle of incidence. The normal angle to the cell is perpendicular to a PV cell's face and this normal is necessary to achieve the panel's proper alignment towards the sun. A tracking system can keep the angle of incidence within a certain margin and would be able to maximize the power generated. Trackers are categorized as either a single axis or dual axis system. Single-axis accounts for horizontal east to west daily movement while dual-axis integrates a vertical north and south seasonal tilt into the system. Single-axis can provide a 15% to 30% increase in efficiency and solar power generated over a stationary panel while the dual-axis provides an additional 6% [2]. The cost comparison for implementing a dual-axis tilt tracker vs. a single-axis shows that a dual-axis will not cost-effective for this project because of the complex it and maintenance of the mechanics. Fewer components, in this case, will mean greater reliability and less downtime.

D. Charge Controller

The Charge Controller is a switching device that can connect and disconnect the charger to the battery and it will take control of overcharging and stop charging at the correct voltage. This will protect the batteries from damage from over-charging and regulate the power going from the solar panels to the batteries. A microcontroller in the circuit will read the level of the batteries and then cut off the source of the solar panels to the batteries, once it sees the battery is at a fully charged state. If this was not in place, the solar panels would keep feeding the batteries energy and the batteries would become overheated and damage the internal components. The advantage to have a microcontroller in the system is that it will open a variety of features to add to the system. For example, the microcontroller will be programmed to control and display the battery level of the system.

E. Battery

The team has selected two deep-cycle batteries to power the system. Each battery is 12V and has a 35 Amp-hour Capacity. Batteries for PV system batteries generally have to discharge a smaller current for a longer period, such as at night or during a power outage, while being charged during the day. Deep cycle batteries are designed to discharge to a lower capacity, between 50% and 80%, than a conventional battery. The most commonly used deep-cycle batteries are lead-acid batterie and nickel-cadmium batteries, both of which have pros and cons. The deep-cycle batteries can be easily charged and discharged many times and can last for several years due to the thicker plate material utilized. Batteries in PV systems can also be very dangerous because of the energy they store and the acidic electrolytes they contain, so you'll need a well-ventilated, non-metallic enclosure for them.

F. Inverter

An inverter is an integral component in the solar station design. It will convert the DC voltage generated from the solar panels to an AC voltage. The team will be testing two designs by using special ICs or several pairs of transistors and diodes. An inverter can produce a square wave, modified sine wave, pulsed sine wave, or sine wave depending on circuit design, as demonstrated in Figure2. The two dominant commercialized waveform types of inverters as of 2007 are modified sine wave and sine wave. There are two basic designs for producing household plug-in voltage from a lower voltage DC source, the first of which uses a switching boost converter to produce a higher-voltage DC and then converts to AC. The second method converts DC to AC at battery level and uses a line-frequency transformer to create the output voltage can have a power loss of 10 % or even up to 20%. The team anticipates a larger power inverted based on our maximum expected output and that the largest output will be required when two laptops are plugged into the system. Generally, laptops can draw anywhere between 65-90 Watts. For two laptops rated at 90 Watts, the inverter will be required to generate 180 Watts. From our calculation, we determined a 200Watt inverter will suffice. At a 90% efficiency (10% power loss), the inverter will generate the 180 Watts we need.

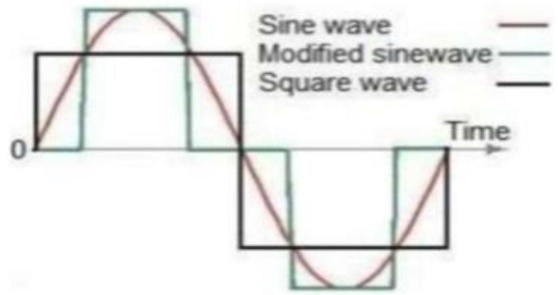

Figure 3: Sample Inverter Output

G. Methodology

To achieve the aim and objectives of this work, the following are the steps involved:
1. Study the previous work on the project to improve its efficiency.
2. Draw a block diagram.
3. Test for continuity of components and devices,
4. Design of the system was carried out.
5. Studying various components used in the circuit.
6. Construct the system circuit.
7. Finally, the whole device was cased and a final test was carried out.

This System provides portable, reliable power anywhere it is needed...from off-grid construction sites to remote locations where power is not accessible or affordable, and without the associated with traditional fuel-driven generators. Flexible Panel Systems are designed for highly mobile applications where a small footprint & high power is required. Systems provide power platforms that are versatile, effective, and multi-faceted. Portability is a key feature of the System that can be assembled or removed in minutes, allowing for rapid deployment in the field. The system can be deployed and operational for just an hour, or indefinitely. It is as temporary or permanent as necessary.

CONCLUSION

In this paper solar battery connects to the supply line parallel to the solar battery charger. It is breaking the power supply which using 8051 microcontrollers through operating the solar battery charger is a flow of the best in the future life. This System provides portable, reliable power anywhere it is needed...from off-grid construction sites to remote locations where power is not accessible or affordable, and without the associated with traditional fuel-driven generators. The idea of a solar cell phone charger is an excellent one in that it's meant to allow you an option for charging your phone when you're in a remote area or just don't have access to an electrical outlet or car charger. There are a few on the market today that will do what they say they will do, whereas others are not living up to high expectations Cell phones can be a real lifesaver in emergencies. People have come to depend on this technology greatly over the last few years. Technologies such as iPods, MP3 players, and hand-held games have also become quite popular. All of these require fully charged batteries to function at their optimal level. Solar chargers are great for those times you are not close to a power source. Another benefit of these chargers is that they're free to use since they use the sun's energy. The backup battery stores energy even when it's not actively charging, so you can enjoy more time in between having to charge your cell phone battery via electricity.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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