RENEWABLE ENERGY BASED COMMUNITY MOBILE CHARGING STATION

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ABSTRACT- In almost all the countries mobile phones is the most popular form of communication. The number of mobile users will surpass 7.6 billion this year (2021) and the number is growing as technology is getting better and the cost of production also lowers. However it becomes very inconvenient for persons occupied with work or travelling long distances as the average lifetime of a mobile phone battery is less than 10 hours. Solar phone chargers use solar panel to absorb light. And also the proposed system, solar powered charger (SPC) plays an important role in mobile charging during long power cuts. The sun is the ultimate power source and solar energy is renewable energy source. The SPC system is eco-friendly and user friendly. The solar panel used is of 75W rating. This panel is sufficient enough to charge 12v battery and then the battery powered solar charging station charge 8 mobile phones at same time. We designed a final prototype that should be able to charge any of the commonly used local phones in 1-2 hours of direct sunlight according to mobile battery capacity.

***Key Words*: Solar panel, Battery, Charging controller.**

1. INTRODUCTION

Solar energy is the energy produced directly by the sun and collected elsewhere, normally the Earth. The sun creates its energy through a thermonuclear process. The process creates heat and electromagnetic radiation.

Only a very small fraction of the total radiation produced reaches the Earth. The radiation that does reaches the Earth is the indirect source of nearly every type of energy used today. The radiation that does reach the Earth is the indirect source of nearly every type of energy used today. The exceptions are geothermal energy, and nuclear fission and fusion. Even fossil fuels owe their origins to the sun; they were once living plants and animals whose life was dependent upon the sun.

Much of the world's required energy can be supplied directly by solar power. More still can be provided indirectly. The practicality of doing so will be examined, as well as the benefits and drawbacks. In addition, the uses solar energy is currently applied to will be noted.

Due to the nature of solar energy, two components are required to have a functional solar energy generator. These two components are a collector and a storage unit. The collector simply collects the radiation that falls on it and converts a fraction of it to other forms of energy (either electricity and heat or heat alone). The storage unit is required because of the non-constant nature of solar energy; at certain times only a very small amount of radiation will be received. At night or during heavy cloud cover, for example, the amount of energy produced by the collector will be quite small. The storage unit can hold the excess energy produced during the periods of maximum productivity, and release it when the productivity drops. In practice, a backup power supply is usually added, too, for the situations when the amount of energy required is greater than both what is being produced and what is stored in the container.

1.1 PHOTOVOLTAIC CELL

A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light

1.2 SOLAR PROCESS

Photovoltaic cells are made of special materials called semiconductors such as silicon. An atom of silicon has 14 electrons, arranged in three different shells.

The outer shell has 4 electrons. Therefore a silicon atom will always look for ways to fill up its last shell, and to do this, it will share electrons with four nearby atoms. Now we use phosphorus (with 5 electrons in its outer shell). Therefore when it combines with silicon, one electron remains free.

When energy is added to pure silicon it can cause a few electrons to break free of their bonds and leave their atoms. These are called free carriers, which move randomly around the crystalline lattice looking for holes to fall into and carrying an electrical current.

However, there are so few, that they aren't very useful. But our impure silicon with phosphorous atoms takes a lot less energy to knock loose one of our "extra“ electrons because they aren't tied up in a bond with any neighbouring atoms. As a result, we have a lot more free carriers than we would have in pure silicon to become N-type silicon.

The other part of a solar cell is doped with the element boron(with 3 electrons in its outer shell)to become P-type silicon.

Now, when this two type of silicon interact, an electric field forms at the junction which prevents more electrons to move to P-side.

When photon hits solar cell, its energy breaks apart electron-hole pairs. Each photon with enough energy will normally free exactly one electron, resulting in a free hole as well. If this happens close enough to the electric field, this causes disruption of electrical neutrality, and if we provide an external current path, electrons will flow through the P side to unite with holes that the electric field sent there, doing work for us along the way. The electron flow provides the current, and the cell's electric field causes a voltage.

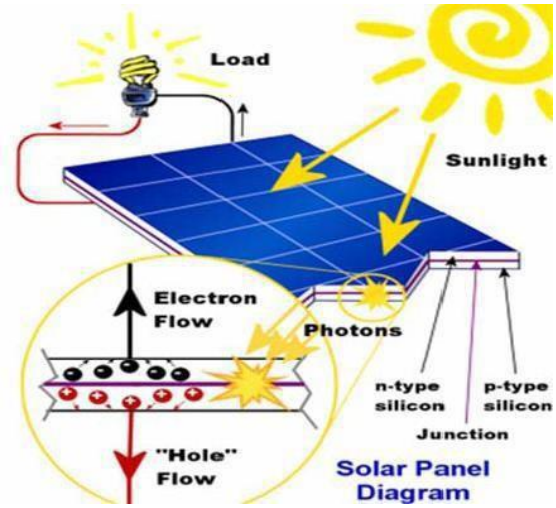

Fig -1: Solar Process

1.3 LITHIUM BATTERY

The storage battery or secondary battery is such a battery where electrical energy can be stored as chemical energy and this chemical energy is then converted to electrical energy as and when required. The conversion of electrical energy into chemical energy by applying external electrical source is known as charging of battery. Whereas conversion of chemical energy into electrical energy for supplying the external load is known as discharging of secondary battery.

Fig -2: Lithium Battery

2 METHODOLOGY

2.1 BLOCK DIAGRAM OF THE SYSTEM

The block diagram of the system contains a solar panel, buck converter and battery. The solar panel is used to convert the solar energy to electrical energy .The normal voltage rating of the solar panel used is 75W.The principle used is PHOTOELECTRIC EFFECT for the conversion of solar energy to electrical energy .When light is incident upon a material surface; the electrons present in the valence band absorb energy and get excited. They jump to the conduction band and become free. Some reach a junction where they are accelerated into a different material by a Galvani potential. This generates an electromotive force, and thus electric energy. Then charging circuit reduces the input voltage to desirable voltage of charging. Battery is charged from this output of charging circuit.

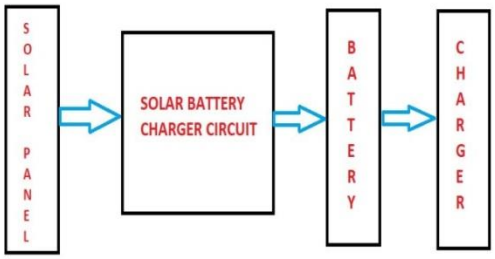

Fig -3: Block Diagram

2.2 WORKING OF THE SYSTEM WITH WORKING DIAGRAM

Solar powered mobile phone charging unit. The system consists of a PV module, charge controller, battery and charging ports. The energy generated by the PV module is stored in a battery. Battery is connected to the PV module through a charge controller. The charge controller acts as a maximum power extractor and a voltage regulator for the battery. A vertical pole is used to mount the PV (solar) panel and a box is designed with proper ventilation to protect the battery and controller. Fig2 shows the structural design of the system. This vertical structure can be installed for public use in public places. A universal charging port is connected to the system which has 8 ports to charge 8 mobile phone at same time.

Fig -4: renewable energy based community mobile charging station

3. CONCLUSION

Solar act as good power supplies in bright sunlight. The only problem is the unregulated voltage due to the variation in intensity of light. Voltage regulator is used to solve this problem by regulating the output voltage. The charge so obtained is stored in the battery and is given to the respective loads. The charge present in this battery is analysed and displayed on an LCD. Solar powered cell phone chargers can be a better alternative to electrical cell phone chargers.

4 FUTURE SCOPES

Basically the solar mobile charger is designed for charging mobile battery. But in future, by some modifications this project can use to charge batteries used in different portable devices like laptop, walky-talky, i-POD, digital camera etc.

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