Global Journal of Researches in Engineering: a Mechanical and Mechanics Engineering
Volume 17 Issue 5 Version 1.0 Year 2017
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN:2249-4596 Print ISSN:0975-5861

Design and Construction of a Portable Charger by using Solar Cap

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Abstract- Sun is a source of renewable energy called solar energy. Solar energy is a basic need of living plants and human being on the earth. By the use of solar energy there is no pollution and no waste. There are many fields of using solar energy. It can be used directly in a variety of thermal applications like heating of water or air, charging batteries, drying, distillation, cooking etc.

Bangladesh is an under developing country. It is a country of lot of problems. Energy crisis is one of the important problems. To overcome this problem solar energy may be used as an alternative. It is not possible to solve the giant problem over a night but it can be decreased. Solar energy is one kind of renewable energy. Everyday a lot of power is used for charging purpose like mobile, camera, light etc.

Keywords: *solar energy, energy, renewable energy, solar cap, reservoir.*

GJRE-A Classification: *FOR Code: 290501*

Strictly as per the compliance and regulations of:

Design and Construction of a Portable Charger by using Solar Cap

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Abstract- Sun is a source of renewable energy called solar energy. Solar energy is a basic need of living plants and human being on the earth. By the use of solar energy there is no pollution and no waste. There are many fields of using solar energy. It can be used directly in a variety of thermal applications like heating of water or air, charging batteries, drying, distillation, cooking etc.

Bangladesh is an under developing country. It is a country of lot of problems. Energy crisis is one of the important problems. To overcome this problem solar energy may be used as an alternative. It is not possible to solve the giant problem over a night but it can be decreased. Solar energy is one kind of renewable energy. Everyday a lot of power is used for charging purpose like mobile, camera, light etc. Those devices can be easily charged by using solar charger. In this project a solar cap is designed and constructed for charging mobile phone, camera etc. which is nothing but a solar panel based charging system. Here a solar panel is placed on a cap. An USB port is attached with the panel. A cable is connected with the solar panel and the device that will be charged. At day time the device can be easily charged by using this solar cap. If the device is fully charged then the extra charge can be stored in a reservoir. So, by using the charger the devices can be charged day and night.

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I. Introduction

Energy crisis is one of the basic problem in developing country like Bangladesh. One step to overcome this problem may be the use of solar energy as an alternative. A huge amount solar energy is available in the environment that can be utilized and also could be stored to use any suitable time.

Solar energy, radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic, solar thermal electricity, solar architecture and artificial photosynthesis. Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulated with air.

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Sun is responsible for most of accessible energy resources. Solar energy can be used both directly and indirectly. It can be used directly in a variety of thermal applications like charging of batteries, heating water or air, drying, distillation, cooking etc. The heated fluids can in turn be used for applications like power generation. A second way in which solar energy can be directly through the photovoltaic effect in which it is converted to electrical energy. Indirectly, the sun causes winds to blow, plants to grow, rain to fall and temperature differences to occur from the surface to the bottom of oceans. Useful energy can be obtained for commercial and non-commercial purposes through all these renewable sources. Solar portable charger is one type of chargers which can be carried any place at any time. In addition, a good portable solar charger should be straightforward and easy to use. In this type of portable charger, solar panel is placed on the cap which is put on the head. When sun strikes on the solar panel photons release from it. Then electron starts flow though the cable which is connected with solar panel. A PCB board is also connected with solar panel. Solder the positive output wire of the voltage regulator to the USB's positive. Similarly, connect the negative output of regulator to the negative of USB. The USB port must be fixed properly to the PCB board. A reservoir is used which store charge and supply charge to the battery when require.

Solar portable charger is very effective for everyday use. It is suitable for use in rural area where electricity is not available or load shading frequently occur. Travelers and advantageous people can also use this type portable charger.

II. Design

a) *Assumptions for Design*

- Solar panel should be capable of supplying 5-6 volts.
- The cap should be easily carried.
- Reservoir should store charge properly and supply it when require.

b) *Design of Components*

Different components needed for this system are designed. When designing above assumptions are taken under consideration.

- Solar panel

There were various types of solar panel. In this construction TYN355-366 type solar panel was used. The capacity of this type of solar panel was 5V (volt) and 5W (watt).It could able to supply 800-1000 mA current which was required for charging a battery (mobile, camera etc.). It was required to place the solar panel perfectly on the head. So that the dimension is selected Length= 16 cm, Width= 12 cm

- Reservoir

The length of the reservoir was 10.3 cm and width is 2.8 cm. Reservoir had charged storing capacity. It was able to supply charge to battery when required.

- Charging system

A PCB board was connected with solar panel. The length of the PCB board was 3 cm and width=2cm.USB port and LED lamp attached with PCB board. Finally a cable was connected between battery cell and USB port. The length of the cable was used according to required.

c) Description of the designed system

There are two types of charging method a) Direct charging b) Charging by use reservoir. In 'direct charging' method, one end of cable is connected with USB port of solar panel and other end of the cable is connected with battery cell. In 'charging by reservoir' method, only different from the previous method is that it uses a reservoir which primarily store charge. The storage charge from the reservoir then supply to the battery cell by cable.

d) Circuit diagram

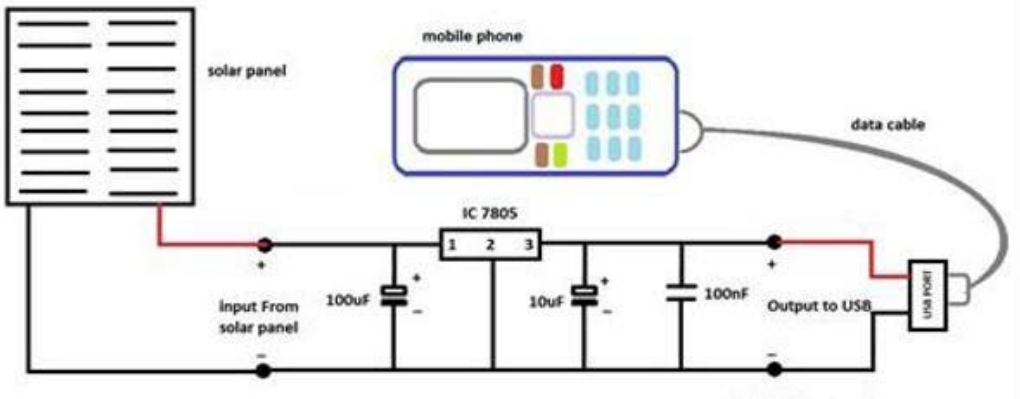

Figure 2.1: Circuit diagram (mobile phone connects with solar panel)

Fig. shows that, a solar panel is connected with IC 7805. This integrated circuit(IC) is divided with 3 section and amount of current flow is 100μF. Now, IC is connected with the output of USB. A data cable is connected with USB port. Finally current flows though the data cable and charges the battery of mobile, camera etc.

III. Construction

Components Required:

a) The required components are

i. Solar Panel
ii. Cap
iii. PCB board
iv. USB port
v. Reservoir
vi. Wire
vii. LED lamp
viii. Battery (mobile, camera, torch etc.)

b) Description of Construction

☐ A PCB board is connected with solar panel. Solar panel consists of

☐ Semiconductor material silicon (Si).There are two types of silicon i) p-type silicon ii) n-type silicon. This two types of silicon produce pnp junction or npn junction.

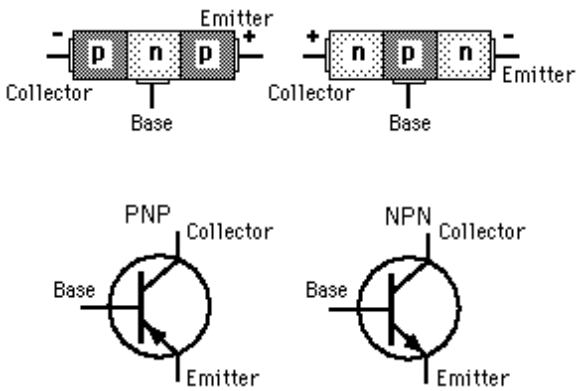

Figure 3.1: PNP junction and NPN junction

- ☐ Solder the positive output wire of the voltage regulator to the USB's positive. Similarly, connect the negative output of regulator to the negative of USB. The USB port must be fixed properly to the PCB. Next, connect the solar panel to the input of the voltage regulator (positive of solar panel to positive input of voltage regulator and negative of solar panel to negative input).
- The regulator circuit consists of the following components.

1) IC7805
2) 100uF
3) 10uF
4) 4) 100nF

- USB port and LED lamp is attached with PCB board. When sun light strikes on the panel photon release and electron start to flow.
- A cable is connected with USB port. Once everything is connected, measure the output voltage in open sun light. It should be around 5V. Now, connect batteries of mobile phone or camera and it starts charging.

Figure 3.2: Direct charging of battery of a mobile phone

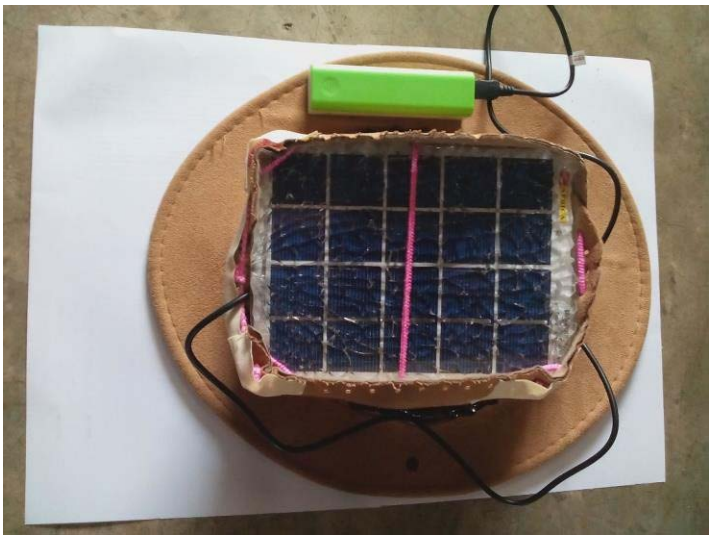

Figure 3.3: Charging the battery of mobile from reservoir Test Procedure

IV. Test Procedure

Batteries were charged both at stationary and moving conditions. In both the cases it was observed to charge the battery successfully. The performance of portable charger depends on solar intensity that was also observed while charging in sunny and cloudy sky. Storing of charge in the reservoir was checked by charging battery at night successfully.

V. Result and Discussion

Test results of battery charger was found satisfactory. It took almost same amount of time to be fully charged from main. Storing of charge and also charging from the reservoir were checked and found satisfactory.

Performance of storing of charge and charging of battery were found satisfactory and both were found satisfactory and both were delayed in cloudy sky was also observed.

VI. Conclusion

A portable solar charger by using a solar cap has been designed and constructed successfully. Battery has been charged directly by the dc voltage produced by a solar panel through a USB port. Performance of the devices has been tested and following results are obtained.

1. Batteries can be charged both stationary and moving condition.
2. Charging time takes almost same amount of time to be fully charged from main.
3. Performance of portable charger depends on solar intensity
4. Charge can be stored in the reservoir.

References Références Referencias

1. Ozisik M. Necati, "Heat Transfer, A Basic Approach", International edition, McGraw - Hill Book Company, 1985.
2. Suhas P Sukhantme, "Solar Energy Principle of Thermal Collector and Storage", 2nd Edition, Tata McGraw-Hill Publishing Company, New Delhi, 1997.
3. Bullock, Charles E. and Peter H. Grambs. "Solar Electricity: Making the Sun Work for You", Monegon, Ltd., 1981.
4. Komp, Richard J., "Practical Photovoltaic", Aatec Publications, 1984.
5. Edelson, Edward. "Solar Cell Update", Popular Science. June, 1992.
6. Murray, Charles J., "Solar Power's Bright Hope", Design News. March 11, 1991.
7. Duffie, John A. and Beckman, William A., "Solar Engineering of Thermal Processes", A Wiley-Interscience Publication, John Wiley Sons, Newyork, USA, 1980.
8. R. S. Khandpur, "Printed circuit boards: design, fabrication, assembly and testing", Tata-McGraw Hill, 2005.
9. Elisabeth Rosenthal and Felicity Barringer, "Green Promise Seen in Switch to LED Lighting", The NewYork Times, 2009.