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A Study on Solar Mobile Phone Charger

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Abstract: The use of flying machines powered by the sun is even mentioned in Indian Vedic literature. In the twenty-first century, we have come a long way in developing solar cells, which are the devices that will power our future by converting the sun's energy into electricity. This project is about using non-conventional energy, such as solar energy, to charge mobile batteries. Solar chargers are simple, portable, and ready-to-use devices that anyone, especially in remote areas, can use. Solar panels do not provide regulated voltage, which batteries require for charging. To achieve the desired constant voltage, an external adjustable voltage regulator is used. Because it is impossible to charge mobile batteries everywhere at all times, we designed this mobile charger to charge mobile batteries anytime, anywhere. In this paper, we use the concept of energy harvesting to charge batteries using solar energy. We can use it to charge our mobile batteries in remote areas where there is no electricity. The cost of this circuitry can be reduced to a point where the average person can afford it and benefit from it. As nonrenewable energy sources deplete on the planet, renewable energy sources must be incorporated for daily needs. Mobile phones have become such an important part of daily life that they must be charged at all times. This paper proposes a system for charging mobile phones that is powered by solar energy.

Keywords: Renewable energy, solar energy, mobile phones, battery, low voltage devices, Power Electronics, Energy Crisis, Power Failure, Solar Charger, Comparator.

I. INTRODUCTION

Solar power has long piqued the interest of scientists and researchers as the ideal alternative to fossil fuel energy. Given the abundance of sunlight available to us as a blessing from our sun, it is natural to want to tap this energy that has been present since the beginning of time and use it to power our engines and homes. Despite the fact that solar energy is abundant, efforts to harness it, convert it to a useful form, and use it to power our daily lives have been futile. This is why solar energy has yet to become a significant source of our energy needs. However, technological advancements have enabled cellular phones to reduce the size of not only ICs, but also batteries. However, even though technology has advanced and made our phones smaller and easier to use, one fundamental issue remains: we must plug the phone into the wall to recharge the battery. Most people accept reality because there are no other options, so they carry extra batteries with them. Because it is impossible to charge mobile batteries everywhere at all times, we designed this mobile charger to charge mobile batteries anytime, anywhere. We use the concept of energy harvesting using solar energy in this paper. The reason for charging the battery. We can use it to charge our mobile batteries in remote areas where there is no electricity. The cost of this circuitry can be reduced to a point where the average person can afford it and benefit from it. [1]

Technology has allowed the cellular phone to shrink not only the size of the ICs, but also the size of the batteries over the years. However, even though technology has advanced and made our phones smaller and easier to use, one of the original problems remains: we must plug the phones into the walls to recharge the batteries. Most people accept reality because there are no other options, so they carry extra batteries with them. It is not always possible to charge mobile batteries everywhere and at any time, so we designed this mobile charger to charge mobile batteries anywhere and at any time. In this project, we are utilising the concept of energy harvesting by using solar energy to charge batteries. We can use this to charge our mobile batteries in remote areas where there is no electricity. The cost of this circuitry can be reduced to a certain extent so that the average person can easily purchase it and benefit from it. We will broaden the scope of this project by making some changes, and we will be able to use this charger with various handsets. This project's modifications will also apply to any battery-powered device, such as a laptop. This project is divided into two parts: hardware development and software development. The solar panel connection, charging and control circuit, and microcontroller are all part of the hardware development. Microcontroller programming is one of the software developments. [2]

A mobile phone, also known as a communication device, is a device that most people carry with them on a daily basis. This device keeps you connected and allows for quick and easy communication. A mobile phone has numerous sophisticated features. It enables the user to take pictures, store personal information, access emergency services, business and education services, travel and tourism, health and financial information, and so on. It ensures safety and continuous and uninterrupted communication regardless of movement or distance. As a result, it has become an essential part of modern human life. This helps to understand the significance of charging and keeping mobile phones ready. It's difficult to charge these phones, especially when you're not at home. To charge the batteries of mobile phones, an AC or DC power source is required. It is difficult to locate these charging stations for mobile phones while travelling or away from home. Because renewable energy sources are abundant in nature and it is past time to consider an alternative source of energy that does not rely on fossil fuels, this paper

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proposes a solar-powered mobile phone charging system. [3-4]

Solar power systems will be connected to the utility grid in an on-grid system. These systems will generate the electricity needed to power the household appliances. Because the house is linked to the grid, grid power can be used if the generated solar power is insufficient. When solar systems produce more energy than is required for home appliances, the excess energy can be sent back to the grid and used to earn credits for the power sold to the grid company [5].

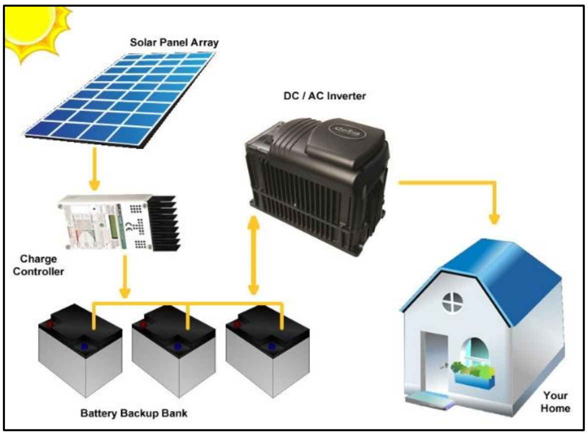

Figure 1: Solar Off Grid System

Figure 1 depicts the design of an off-grid solar system. Off-grid electricity requires a battery storage device for a continuous supply of energy. A cloudy day makes it difficult for an off-grid solar system to generate the necessary energy. There will also be no way to get some extra energy unless an extra storage device is available.

II. REVIEW OF LITERATURE

Many countries currently rely on nonrenewable energy sources such as coal, oil, and natural gas, according to Alrikabi (2014). Fossil fuels and nonrenewable energy sources are finite and will eventually become too expensive or environmentally damaging to recover. The massive use of fossil fuels harms the environment in a variety of ways, including disrupting the ecological cycle and contributing to global warming and climate change. Vehicles now have very high fuel efficiency due to technological advancements, addressing the discussed problem. Renewable energy sources are given importance in accordance with the high efficiency of vehicles. [6]

Different dc-dc converters, such as step-up converters for increasing voltage and step-down converters for decreasing voltage, can be used, according to Biswal and Sabyasachi (2012). When the output voltage is much lower than the input voltage, a step-down converter is far more efficient than a linear voltage converter (Zhang, 2013). As a result, using a step-down converter as a voltage regulator for a solar charger is ideal. Many pieces of information about the solar charger's design are taken from various sources. Akin (2012) claims that a solar panel can be directly connected to a USB type voltage regulator and used as a DC charger. [7-9]

The efficiency of a charger, according to Aarniovuori et al. (2013), can be measured by its input and output values; however, when comparing the efficiency of two systems in one aspect, that aspect of the systems to be compared can be contrasted in the simplest units. As a result, when comparing the efficiency of a solar charger and a wall charger, the charging speeds can be compared. As previously stated, the solar charger can be used to charge cellphones directly, or the energy can be stored in power banks for off-peak use. In terms of power bank efficiency, the time it takes to charge from a solar charger and a regular wall charger could be compared. According to Roger et al. (2007), multiple trials are required to obtain a precise and accurate result of an experiment; thus, three trials for efficiency testing of the charger would be conducted. [10-11]

III. OBJECTIVES

1) construct a solar-powered cellphone charger from the necessary components;
2) test its voltage at various points along the circuit and at different times to ensure proper operation and safety;
3) compare its efficiency to that of a standard wall charger.

IV. RESEARCH METHODOLOGY

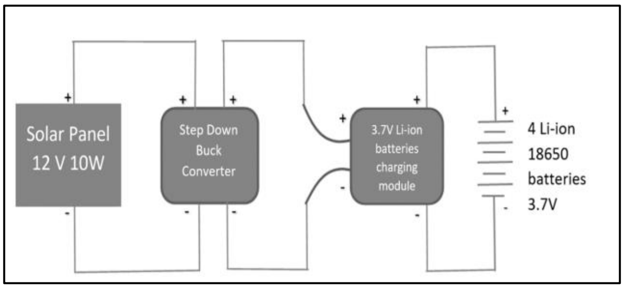

Figure 2: The technical circuit

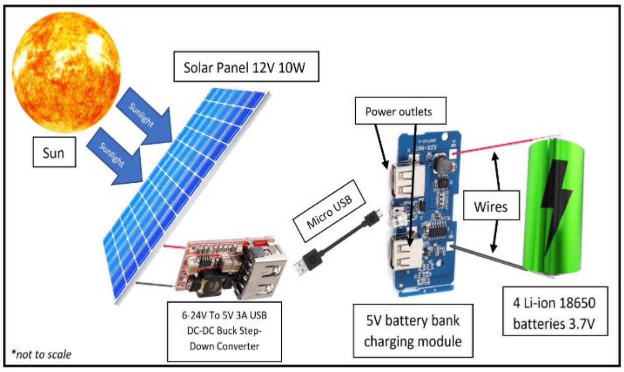

Figure 3: The intuitive circuit

The model depicted above (Figures 2 and 3) is the desired or targeted model that researchers will create for this comparative study. It consists of the following elements: [12-13]

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- 12 volts 10 watts solar panel: This solar panel captures sunlight and converts it into electrical energy. The solar panel for this project will be purchased from Shoppe, an online shopping website. The 12V and 10W solar panel will be purchased because it provides enough energy to the circuit and is the cheapest when compared across all online stores.
- A step down voltage converter reduces the voltage of a higher voltage source. This will also be purchased at Shoppe.
- 5V battery bank charging module: This is the circuit that is specialised in taking 5V of current and charging the 3.7V 18650 Li-ion batteries that are connected to it; this component will also be purchased from Shoppe.
- Wires: Wires are used to connect various parts of the circuit together. This circuit's wires will also include a micro USB cable that will be an original Samsung charger cable. Wires can be purchased from the nearest electrical hardware store, but in this study, they will be purchased from NVM Marketing in Valencia City, Bukidnon, Philippines.
- 4 Lithium-ion 18650 3.7V batteries: The batteries store energy that can be used at any time, especially the 18650 3.7V batteries, which are used in many chargeable devices such as power banks, vapes, laptop batteries, solar chargers, and so on. These are taken from old laptop batteries for this study, but they can also be purchased online or from a nearby electrical store.

V. RESULT AND DISCUSSION

Mobile phone charging station powered by the sun. A PV module, charge controller, battery, and two voltage regulation circuits comprise the system. The PV module's energy is stored in a battery, which is linked to the PV module via a charge controller. The charge controller serves as the battery's maximum power extractor and voltage regulator. The PV panel is mounted on a vertical pole, and a box with proper ventilation is designed to protect the battery and regulator circuits. Figure 4 depicts the proposed system's structural design. This vertical structure can be installed in public places for public use. To charge any mobile phone, a universal charging port is connected to the regulation circuit. Both the 7809 and 7805 capacitors are used to remove ripples and serve as filter capacitors in this application (to remove AC components).

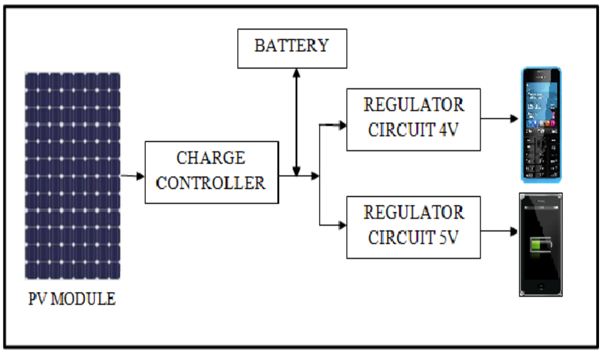

Figure 4: Solar Powered Mobile Phone Charging System

The ICS regulator is primarily used to keep the voltage precise in the circuit that follows the power supply. A regulator is primarily used with a capacitor connected in parallel to the IC regulator's input and output terminals. Capacitors are used to detect large changes in input and output filters. Bypass capacitors, on the other hand, are used to detect short-term spikes at the input and output levels. Bypass capacitors are typically used in small quantities to bypass short-duration pulses directly into the earth. Because of the nature of solar energy, both components require a working solar power generator. A collector and a storage unit are the two components. Only the radiation that falls on it is collected by the collector, and a portion of it is converted to other forms of energy (either electricity and heat or heat alone). Due to the non-stationary nature of solar energy, the storage unit is required; only very small amounts of radiation will be received at certain times. [14]

Building the solar-powered gadgets charger

The solar charger was constructed in the manner depicted in the above-mentioned intuitive circuit as well as in figure 5. Many small tests were conducted prior to using it as a cellphone charger. After ensuring the charger's functionality, it was used in this study. It weighs about 1.25 kilogrammes and measures 35.5cm24.0cm3.5cm. The expenses incurred during this research study are listed below (table 1). This research study cost a total of PHP 2,785.04, but the laptop batteries were obtained from an old laptop battery, so the actual expenditure by researchers was only PHP 1,785.04. If any reader of this research wants to replicate this model, the total cost of making the solar charger is PHP 2,306.04. [15]

Table 1. Budget of this research study

Item	Expense
Solar Panel	PHP 550 (including delivery)
USB Cable	PHP 110
DC-DC Buck Converter	PHP 245 (including delivery)
Digital Multimeter Tester	PHP 135
USB Voltage Tester	PHP 138.39 (including delivery)
Charging Module	PHP 106.65 (including delivery)
Wires	PHP 21
Batteries × 4	N/A (from old laptop battery) Cost PHP 1,000 (4 × batts approx.)
Travel Costs	PHP 200
Internet Fee	PHP 300
TOTAL	**PHP 2,806.04**

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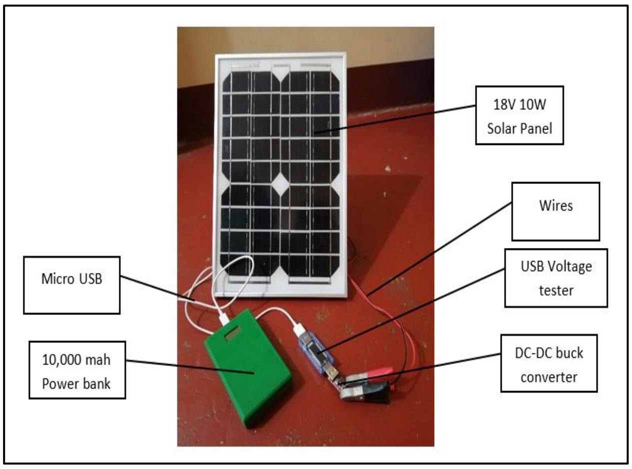

Figure 5: Solar charger

Explanation Of Charger And List Of Components Used

Electronic devices such as cell phones and iPods have made our lives much easier. However, they all have one thing in common: they are charged at regular intervals. This becomes a problem when we are travelling or in an area where there is no electricity. Renewable energy sources are also mentioned as the next generation fuel for all of our electricity needs.So, in this paper, we'll learn how to make our own solar phone charger and how it works.

Materials Required

1. Solar panel 5.5V 245mA (3 in Number)
2. 5V Boost converter module
3. Switch
4. Masking Tapes
5. Wires
6. Soldering kit

Hardware Implementation

In Proteus, the designed regulator circuit is simulated and the output is verified. Figures depict simulation circuits for 5V circuits. The circuits are simulated with 12 V inputs to obtain the desired outputs.

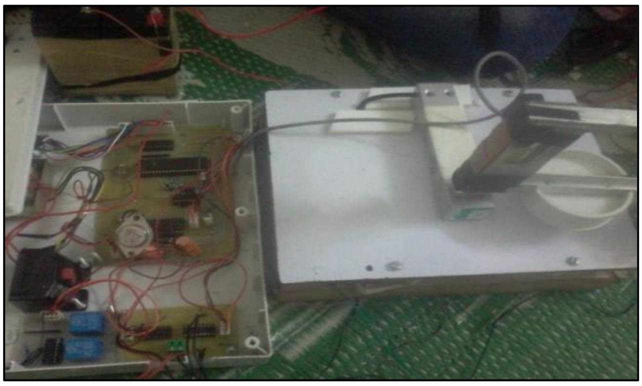

Figure 6: Hardware Implementation

VI. CONCLUSION

We can conclude that this system is useful for charging mobile phones at a low cost. This system is usable in any public place. This system may be more useful in rural areas where there is a lack of electricity. Renewable energy is not a new concept, but with an exponentially growing population, its development and improvement are critical to sustaining world power hunger. The world's population is expected to reach 9 billion people in 2050, with approximately 5 billion using mobile phones. The use of renewable energy in portable devices is beginning to play a significant role in global energy savings. Solar chargers are simple, portable, and ready-to-use devices that anyone, especially in remote areas, can use.

REFERENCES

[1] N. Mohan, T. M. Underland and W. P. Robbins, Power Electronics: Converters, Applications and Design, Canada: John Wiley and Sons, Inc., 1995.

[2] H. Andrew and M. Antonio, "Cell phone Charger for the DC House Project," San Luis Obispo, 2012

[3] C. T., S. G. and R. Ch. Babu, "Mobile Charger Based on Coin by Using Solar Tracking System," International Journal of Innovative Research in Science, Engineering and Technology, vol. III, no. 2, pp. 9603-9608, 2014

[4] A.Hussain, N. G. Beza, G. Hasan and K. A. Ahmed, "Portable Solar Charger with Controlled Charging Current for Mobile phone Devices," International Journal of Thermal and Environmental Engineering, vol. 7, no. 1, pp. 17-24, 2014.

[5] J. Liu, J. Wang, Z. Tan, Y. Meng and X. Xu, "The analysis and application of solar energy PV power," 2011 International Conference on Advanced Power System Automation and Protection, Beijing, 2011, pp. 1696- 1700, doi: 10.1109/APAP.2011.6180758

[6] Alrikabi, N. M. A. (2014). Renewable energy types. Journal of Clean Energy Technologies, 2(1), 61-64.doi: 10.7763/JOCET.2014. V2.92

[7] Biswal, M., & Sabyasachi, S. (2012). A study on recent dc-dc converters. International Journal of Engineering Research and Applications (IJERA), 2 (6), 657-663. Retrievedfromhttps://pdfs.semanticscholar.org/915c/4042f1c938f67ea8597287d22ee23bdbe5c2.pdf

[8] Zhang, H. J. (2013). Basic concepts of linear regulator and switching mode powersupplies.Retrieved fromhttps://www.analog.com/media/en/technical-documentation/application-notes/an140fb.pdf

[9] Akin, B. (2012). Solar power charger with universal USB output. 2012 IEEE 5th India International Conference on Power Electronics (IICPE). doi:10.1109/iicpe.2012.6450447

[10] Aarniovuori, L., Kosonen, A., Sillanpää, P., & Niemelä, M. (2013). High-power solar inverter efficiency measurements by calorimetric and electric methods. IEEE Transactions on Power Electronics, 28(6),2798-2805.doi: 10.1109/TPEL.2012.2221166

[11] Roger, C., Herman, J.A., Dufek, J.S., & Bates, B.T. (2007). Number of trials necessary to achieve performance stability of selected ground reaction force variables during landing. Journal of Sports Science and Medicine, 6(1), 126–134. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3778688/.

[12] Cougnet, C., Sein, E., Celeste, A., & Summerer, L. (2004). Solar power satellites for space applications. Journal of the British Interplanetary Society, 55, 1-8. Retrieved from https://www.researchgate.net/publication/237291237_Solar_power_satellites_for_spa ce_ applications.

[13] T. Voigt, H. Ritter,and J. Schiller, "Utilizing solar power in wireless sensor networks", Proc. IEEE Conference on Local Computer Networks, 2003.

[14] An Energy -aware survey on Mobile-phone chargers,P.8.Bonner,J.(2012),portable solar panel charging station,p.31.

[15] Chengliu Li, Wenyan Jia, Quan Tao and Mingui Sun, "Solar cell phone charger performance in indoor environment," 2011 IEEE 37th Annual Northeast Bioengineering Conference (NEBEC), Troy, NY, 2011, pp 1-2, doi: 10.1109/NEBC.2011.5778623.