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Development of a Mobile Multiple Phones Charger for Isolated Use

[*1]Adebayo, A. A., [2]Mustapha, T. A.

[*1]Department of Electrical/Electronic Engineering, Federal Polytechnic, Ado-Ekiti. NIGERIA.

[2]Department of Electrical/Electronic Engineering, Kwara State Polytechnic, Ilorin. NIGERIA.

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Abstract: Mobile phones have become the basic necessity of life for people living both in the urban and rural communities in developed, developing and underdeveloped countries of the world. Presence of electricity is very important in making the best use of this basic device because it helps to keep it constantly available for use. As a result of lack of electricity in many developing areas despite electricity being basic, many of the populace residing in these places usage of mobile phones has been challenging because they find it difficult to maintain constant use of their mobile phones which requires the presence of electricity for charging them. The use of alternative source of energy to maintain charge for the mobile phone is a means to surmount this challenge. Various alternative source of energy for charging the mobile phones exist among which are wind energy, thermal energy, hydro power, nuclear energy and solar energy. Of all the sources of energy, solar energy plays a vital role at powering isolated applications and has the ability to be made available for small use. The objective of this work is to provide alternative source of energy for the charging of mobile phones which is an essential communication device for people living in the urban or rural communities. This work has provided an isolated multiple mobile phones charger that makes use of solar energy as its energy source. It makes use of 12V which it accessed from the solar panel which is reduced to 5V at its output for charging the mobile phones. It was discovered that it took the developed mobile multiple cell phones charger 60 minutes (1 hour) to charge an Infinix Android phone to its full capacity with the use of a battery bank and 120 minutes (2 hours) when use with only a Polyvinyl cell (Solar panel). It was also observed that the time taken to full charge is the same when used with the conventional Alternating Current (AC) source. This shows that the developed mobile phones charger is able to perform at the same rate the conventional source of energy performs because it took it the same time to charge the mobile phones, thus making it a good means and alternative to mobile phones charging. Therefore, rural dwellers and people living in areas in which there are no constant supply of electricity through the public utility companies or no supply at all can still make use and enjoy constant supply of power to there mobile phones through the use of this isolated mobile phone charger.

Keywords: renewable energy, phone, battery, solar, charger.

I. Introduction

Energy is one of the most important factors affecting and shaping our daily life. Basic life necessities such as water and food are also obtained and transported by energy. Therefore, having high quality and uninterruptible energy is a basic need, for reasons, such as rising fuel prices, energy requirements, pollution and greenhouse gases, the use of environmentally friendly renewable energy sources is increasing rapidly.

Renewable energy sources are environmentally friendly [1]. With increasing public awareness of environmental protection and strengthening continued government support, more and more home users have installed small scale distributed renewable energy power generation systems such as solar power and wind energy [2, 3]. Therefore, it is highly expected that future markets will see high growth of this technology with different types of distributed generation [3]. Moreover, the generation of electricity from renewable energy sources integrated into a smart grid system can be one of the best choices for future energy security. Smart network system overcomes resource breakdown and modern information technology for communication and improves power distribution efficiency. However, renewable energy is likely to be produced not only at the industrial level (for example, on a large-scale state or private company) but also at the household or individual level [4].

Human activities contribute to climate change and consequently, environmentally friendly energy generation is needed. Therefore, exploring the possibility of utilizing solar energy became a necessity [5], because it can be used to overcome dependence on non-renewable resources [6]. Renewable and alternative energy has great potential benefits of replacing dependence on fossil fuels and bringing it into the mainstream slowly in most developing countries [7] has become the focus. A study conducted by [3] shows that the proposed algorithm is applied for household electrical load sorting with solar panels, with high accuracy and reliability. In general, previous research related to Renewable energy and solar panels has only examined one research topic, such as one country [8], one affiliation [9], and one field [10]. The creation and management of records by individuals or organizations is growing rapidly, especially the change from print to electronic, and the smallest fraction of records or metadata [11].

Solar energy is considered a reliable, promising and profitable energy source. It has various advantages such as pollution free, long life and low maintenance . Solar energy is used in at least 4 different ways in our daily lives, and these ranges from heating water to generating electricity [12].

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Mobile phones have become part of the daily necessity of living for all human since it coming because of the ease experienced with the use of it but for it to be available constantly for use there is the need for charging and recharging of it because it makes use of power for it to be active. This power is stored in batteries which needs to be recharged from time to time after it drains it energy from use or unuse for a period of time.

The batteries used in mobile phones are either Nickel-Cadmium (NiCd), Nickel-Metal Hydride(NiMH), Lithium-ion (Li-ion) and Lithium-Polymer (Li-Po). Although, NiCd and NiMH are rarely used nowadays [13]. These batteries are rechargeable thus providing a guarantee that the mobile phone will be available for use after they have been charged for some time. This phone batteries are charger by means of charger from a source that provides energy for their charge.

Challenges are being faced by mobile phone users because of irregularity of power or absolute unavailability of power in some communities to provide charge for the mobile phones. The need for an alternative of charging mobile phones arose from the need created by the unavailability of the conventional power source.

To charge a mobile phone there is need for the presence of a source to charge the phones. A phone charger that makes use of the photovoltaic effect of the sun by converting it to electricity for the purpose of charging the phones is called the Solar cell phone charger. They are an alternative to conventional electrical cell phone chargers and in some cases can be plugged into an electrical outlet. Solar cell phone chargers come in different shapes and configurations including folding and rotating types. They also come in the form of straps, with solar cells on the outer surface and a nickel metal hydride battery within. They are capable of charging a mobile device fully within six hours of exposure to the sun resulting in 40 minutes of talk time.

Solar chargers are also available for other cell phone accessories, such as Bluetooth headsets and speaker phones. Various types of chargers that utilize the solar energy as source of power are emerging. They might have variations in their design, construction, time and cost of work and the type of components used in the prototypes but their overall purpose is charging cell phones or other wireless devices. The electronic circuits often use solar panels consisting of few or several solar cells, standard voltage regulator integrated circuits (IC) chips, transistors, Zener diodes, diodes and resistors all of them used to regulate the output voltage and charging currents [14].

Nigeria, one of the developing countries of the world's population access to electricity stands at 61.2% as at 2023 according to World Bank [15]

The objective of this work is to design and construct a working solar powered multiple cell phones charging booth to charge a number of cell phones simultaneously.

II. Materials and Methods

The following listed components are used to achieve the aim of the study:

A Solar panel of 180W

Five Twins female USB Port

Battery 12v, 100AH

Charge controller 30A

Inverter 1KVA

A Standalone booth

The block diagram of the work is shown in Fig. 1

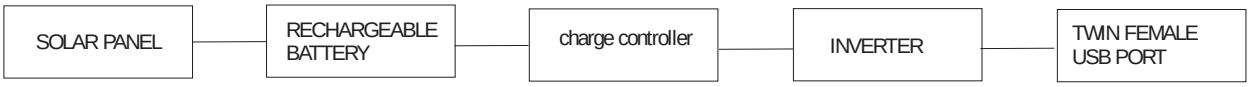

Fig. 1 Block diagram of a multiple cell phones charger

Layout of the isolated mobile phones charger

Wires were connected to the back side of the solar panel (Red color to the positive terminal and the white to the negative terminals)

The solar panel was connected to the input of the regulator circuit (the positive of the solar panel to the positive input and the negative of the solar panel to the negative input).

The solar power inverter was connected to the input of the charge controller the positive of the solar power inverter to the positive input and the negative of the solar power inverter to the negative input).

The twin female USB port was connected observing the negative and the positive connectors and its output was eventually measured for efficiency and proper functioning.

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The positive and negative output wires of the USB were connected.

The battery was also connected to the input and output of the charge controller.

Output voltage was measured in the open sun light to re check the required voltage in direct sunshine.

The seven steps are as shown in Fig. 2

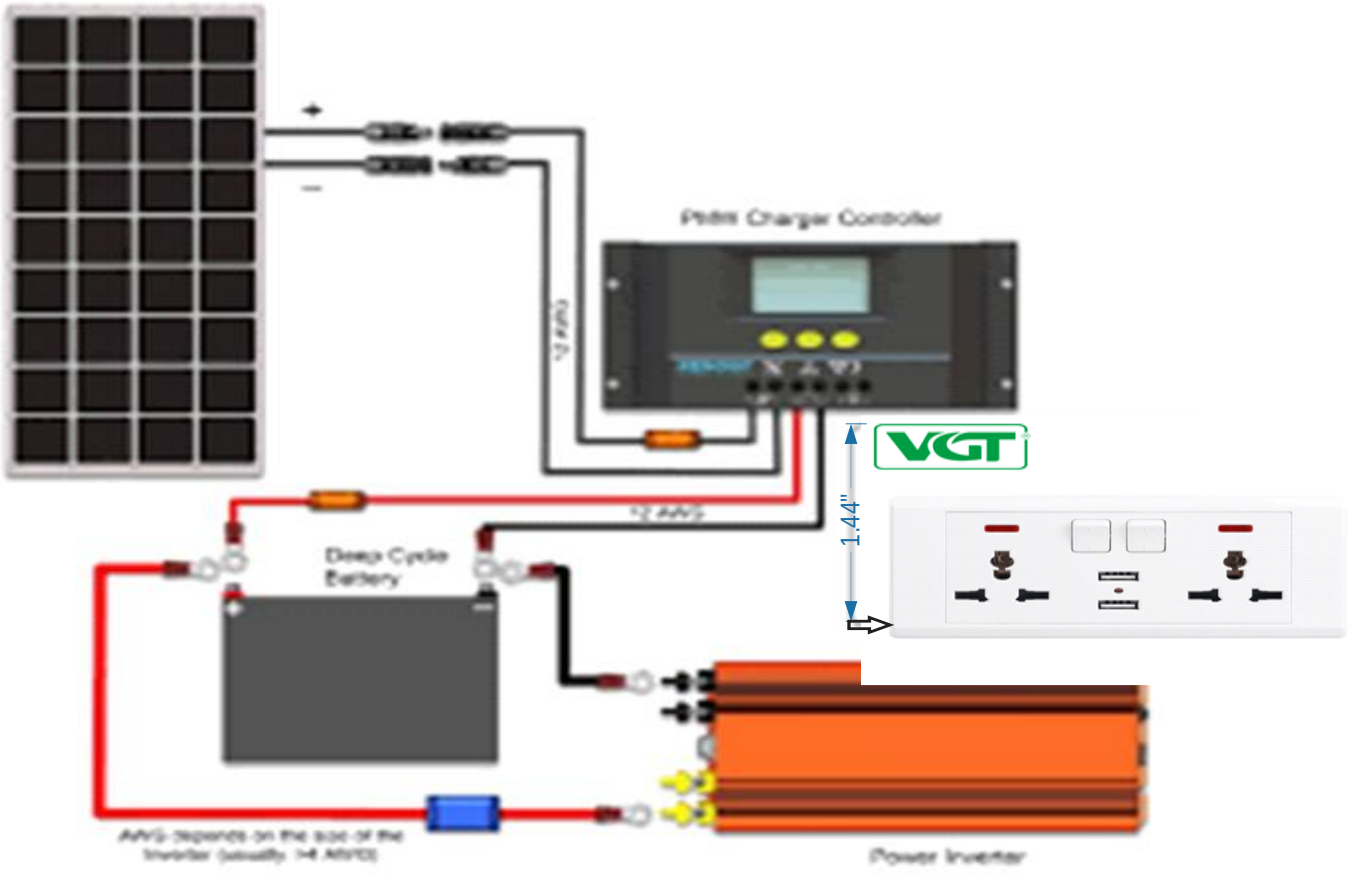

Fig. 2 Connection Circuit of the Multiple Cell Phones Charger

III. Results and Discussions

The charging current and voltage of the Solar Mobile Charger constructed were determined by experiment using an ammeter and voltmeter. It was found that the charging current for initial charge was 0.05A and 0A for the final charge. It was further observed that, the charging voltage was 4volt D.C.

Tables 1 to 3 are the results of the experiments carried out on the constructed Multiple Mobile Phones Charger

Experiment 1

This experiment is aimed at determining the time it takes to attain the full charge of Infinix Android phone. It was observed that, the device constructed took 60 minutes (1hrs) to fully charge the Infinix Android mobile phone with 100Ah battery capacity as shown in Table 1

Table 1: Charging Time for Infinix Android Mobile Phone Using Solar Mobile

Charger

Charging Time (Min.)	**Percentage of Charge**
0 – 10mins	17%

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10-20min	34%
20-30mins	50%
30-40mins	67%
40-50mins	84%
50-60mins	100%

Experiment 2

This experiment is aimed at determining the time taken taken to attain the full charge of the Infinix Android phone using the charge of the battery.

Table 2: Charging Time of Infinix Android Mobile Phone Using the Battery

Bank Alone in the Solar Mobile Charger

Charging Time (Min.)	**Percentage of Charge**
0 – 10mins	10%
10-20min	17%
20-30mins	34%
30-40mins	45%
40-50mins	50%
50-60mins	55%
60-70mins	60%
70-80mins	68%
80-90mins	70%
90-100mins	75%
100-110mins	80%

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110-120mins	100%

Experiment 3

This experiment is aimed at determining the charging time of the Infinix Android phone using conventional (AC) charger

Table 3: Charging Time of Infinix Android Mobile Phone Using Conventional Charger

Charging Time (Min.)	**Percentage of Charge**
0 – 10mins	17%
10-20min	34%
20-30mins	50%
30-40mins	67%
40-50mins	84%
50-60mins	100%

IV. Discussions

The following findings were made;

The charging current for the solar mobile charger was 0.05A as against 0.5A for the conventional (AC) charger.

The maximum charging voltage for both solar and conventional mobile chargers is constant and fixed at 5volts. This is due to the voltage regulation components (IC7805) in the device.

The charging time for the solar mobile charger was 60 minutes; and the same with the conventional (AC) charger which is also 60 minutes (1hr).

The charging current and the charging voltage of the solar charger depend on daily radiation capacity. The higher the daily sun radiation capacity, the more the charging current and charging voltage.

The solar mobile phone charger cannot generate electricity at night when there is no sun. Therefore, the battery bank was needed to help it work consistently at all times.

The charging current of the conventional (AC) charger is 10 times greater than the solar mobile charger. Hence, the conventional (AC) charger is faster than the solar mobile charger.

V. Conclusion

The findings of the study have shown that the solar charger takes a longer time to fully charge a phone's battery, which is a disadvantage. Generally, the product after construction is portable, efficient, durable, robust, and above all environmentally friendly. The solar powered mobile charger would not be able to generate electricity on a cloudy day or at night, hence, the introduction of a battery bank in the device for storage of power during the absence of sunlight. As a result, the more convenient approach was to use batteries to store the solar energy which may not be immediately used. However, the mobile solar charger is a good option for people living in the rural areas or less developed areas in Nigeria where conventional power supply is absent or available for scanty number of hours for the provision of opportunity for charging their mobile phones.

In addition, most of these people depends on generators that makes use of fossil fuels which is costlier to maintain and not too good for the environment because of the generation of green house gases, this mobile solar charger provides an alternative to this because

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it does not pollute the environment and is not harmful to the human health. The fact that it is portable and mobile is also an advantage to this solar charger because it makes possible to move it to the area where it is needed and not limited to just a position alone.

It is recommended that for future work on this solar multiple mobile charger, the economic feasibility be taken into consideration and scalability of the charger to see its potential for widespread adoption.

References

1. A. Herez, M. Ramadan & M. Khaled (2018). A New Performance Assessment Methodology of Bifacial Photovoltaic Solar Panels For Offshore Applications. Energy Conversion and Management, 220(May), 112972. https://doi.org/10.1016/j.enconman.2020.112972.
2. Y. Zatsarinnaya, D. Amirov & M. Elaev (2020). Real-Time Monitoring Dan Power Point Tracking Solar Cell (Bagian II). UNIVERSITAS AIRLANGGA.
3. J. X. Sun, J. N. Wang, W. X. Yu, Z. H. Wang & Y. H. Wang (2020). Dynamic Capabilities Information Technology Enabler for Performance Organization. Library Philosophy and Practice, 1–31.
4. W. Strielkowski, D. Streimikiene, A. Fomina & E. Semenova (2019). Internet of Energy (Ioe) and High-Renewables Electricity System Market Design. Energies, 12(24), 1–17.
5. D. Strušnik, D. Brandl, H. Schober, J. Ferčec, & J. Avsec (2020). A Simulation Model of The Application of The Solar STAF Panel Heat Transfer and Noise Reduction With and Without A Transparent Plate: A Renewable Energy Review. Renewable and Sustainable Energy Reviews, 134(July). https://doi.org/10.3390/en12244790.
6. G. Sahu & H. Raheman (2020). Development of a Renewable Energy Operated Paddy Thresher. https://doi.org/10.1109/TIA.2017.2741925
7. M. Vaka, R. Walvekar, A. K. Rasheed & M. Khalid (2020). A Review on Malaysia's Solar Energy Pathway towards Carbon-Neutral Malaysia beyond Covid'19 Pandemic. Journal of Cleaner Production, 273, 122834.
8. C. A. J. Pantua, J. K. Calautit & Y. Wu (2020). Development of an Off-Grid Solar Energy Powered Reverse Osmosis Desalination System for Continuous Production of Freshwater with Integrated Photovoltaic Thermal (PVT) Cooling. Desalination, 495(May), 114679. https://doi.org/10.1016/j.desal.2020.114679.
9. N. Preston, A. Maroufmashat, H. Riaz, S. Barbouti, U. Mukherjee, P. Tang, J. Wang, E. Haghi, A. Elkamel & M. Fowler (2020). A Fluid-Structure Interaction (FSI) and Energy Generation Modelling for Roof Mounted Renewable Energy Installations in Buildings for Extreme Weather and Typhoon Resilience. Renewable Energy, 160, 770–787. https://doi.org/10.1016/j.renene.2020.06.023.
10. R. Ioannidis & D. Koutsoyiannis (2020). A Review of Transparent Solar Photovoltaic Technologies. Renewable and Sustainable Energy Reviews, 94(January 2017), 779–791. https://doi.org/10.1016/j.rser.2018.06.031.
11. M. F. Wicaksono & M. R. Nurpratama (2017). Stochastic Management of Hybrid AC/DC Microgrids Considering Electric Vehicles Charging Demands. Energy Reports, 6, 1338 – 1352.
12. A. A. F. Husain, W. Z. W. Hasan, S. Shafie, M. N. Hamidon & S. S. Pandey (2018). Review on Solar Cooker Systems: Economic and Environmental Study For Different Lebanese Scenarios. Renewable and Sustainable Energy Reviews, 81(May 2017), 421–432. https://doi.org/10.1016/j.rser.2017.08.021.
13. A. Singh, S. Baranwal, S. Utkarsh, S. Chaudhary and K. Singh (2021). A Review on Different Types of Mobile Phone Batteries. International Journal on Advances in Engineering and Management, 3(7): 364-367. https://doi.org/10.35629/5252-0307364367.
14. R. Kamble, S. Yerolkar, D. Shirsath and B. Kulkarni (2014). Solar Mobile Charger. International Journal of Innovative Research in Computer Science & Technology, 2(4): 35-39.
15. Trading Economics (2025). Nigeria - Access to Electricity (% of Population). www.tradingeconomics.com/Nigeria/access-to-electricity-percent-of-population access 7th May