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Low-Cost Solar Mobile Power System

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Abstract: From the beginning of human history, technology has been rising and continuing to evolve. A variety of technologies have been invented to make daily human life easier while preserving comfort, and virtually all technology has been developed requiring electric power. The main objective this paper is carried out on developing a portable system that can produce substantial power in rural areas. Nevertheless, by conducting this paper manage to analyze the voltage of battery and also the solar power during both weather which is sunny and also rainy. Furthermore, the method that can be used to analyze the reading is by obtaining the reading during both conditions in both ways which reading in battery voltage and also solar power reading. The result generated to read the graph pattern of the reading to analyze. In this paper, an experimental and creative method for giving users a sufficient real-time power supply has been put into the main objective have been archived.

Keywords: Solar, Mobile, System, Temperature, Humidity, Voltage

1. Introduction

The number and diversity of battery-powered portable electronic gadgets have increased steadily since the development of communications technology. The widespread usage of portable electronic devices has expanded with the emergence of mobile phones and personal organisers with sophisticated processing capabilities, a large range of software applications, and internet connection. Mobile phones, tablets, and other portable devices are typical of a developing market category known as "lifestyle electronics," and they all require electricity, which is supplied by rechargeable internal or external batteries[3].

"Portable battery backup systems have been developed by manufacturers for use in charging electronic gadgets, either by adding extra batteries to the battery of the device or by charging the battery of the item itself "[5]. These systems use a variety of solar panels connected in small packages, however human assembly is necessary to connect the batteries to the solar panels.

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It’s common in Malaysia, for the citizens to organize and attend various kinds of outdoor activities. Most of this activity are being held during the day time. Regardless on the time, it is necessary to obtain electricity to power the required electrical devices such as mobile phones, laptops, lights and any communication device in the surrounding. " This is quite difficult if the venue is in open space with no electrical source nearby, in case of power loss or any emergency there is no way to overcome it "[4]. When the batteries in these electronic devices run out, we frequently find ourselves scrambling to find a suitable power source to recharge the batteries. Consequently, in this case, a transportable solar power system would be a more workable option to charging these batteries.

The main objectives for this study are to develop a product which is a portable solar power system that can produce substantial power in rural areas so that can be used during emergency purpose. Adding on, to indicate the reading between the solar voltage and the battery voltage produced together with obtaining the reading of temperature and humidity. From this could analyse the graph reading of both condition of weather. The third objective is to indicate the reading between the solar voltage and the battery voltage produced together with obtaining the reading of temperature and humidity.

For this project, the scope will be focusing on the hardware will include the materials such as the solar panel, Lithium-ion batteries, PIC micro controller (Peripheral interface controller) ASB32 WIFI Module, printed circuit board (PCB), solar panel and other electrical circuit component such as sensors temperature sensor and voltage sensor. Adding on, the solar panels is placed on top of the luggage according to their preference, to ensure it is facing directly towards the sun to receive the maximum amount of solar energy followed by the solar panel converts energy directly, and the battery charger then processes that energy. Besides, energy from the battery charger is used to fuel several batteries which the supplies to the load which is electronic devices such as handphone charges and laptops. This solar mobile power system also has Liquid Crystal Display (LCD) which allows to display the important information to the users, which are to monitor the amount of solar voltage displacement. Followed by, also displays the current battery voltage of the power system, the amount of load current and the temperature and humidity will be displayed on the LCD panel.

2. Methodology

To comprehend and construct the system that was necessary, taking into account the tools and resources that would be applied. Solar photovoltaic, humidity, and this prototype's efficiency all require additional investigation and analysis. The innovation of the project can be identified and set apart from other current items in the selected relevant topic by doing project analysis. This technique is essential if you want your product to stand out or differ from similar ones already on the market. It is possible to grow from those concepts and produce or design a Solar Mobile Power System by conducting analysis and research depending on the price, technology employed, and components being installed.

Figure 1 shows the general workflow proposed in this work, which mainly based on the solar system where once the solar panel receives the sunlight the solar photovoltaic cells produce direct current electricity from sunlight which can be used to power equipment or to recharge. Followed by, the solar charge controller which regulates the voltage and current coming from the solar panels flowing to the output without overcharging. Once its sunny day the output supply current and the electronic gadget gets charged. While wifi module sends message to the blynk application to so monitor the reading of the voltage,temperature and humidity. And the LCD displays the reading of the result obtained by the blynk application. If the day turns of to be rainy there’s where the battery takes place where the inverter can be used as substitute of solar power the inverter can be on and the AC port can be used to charge the electronic gadgets.

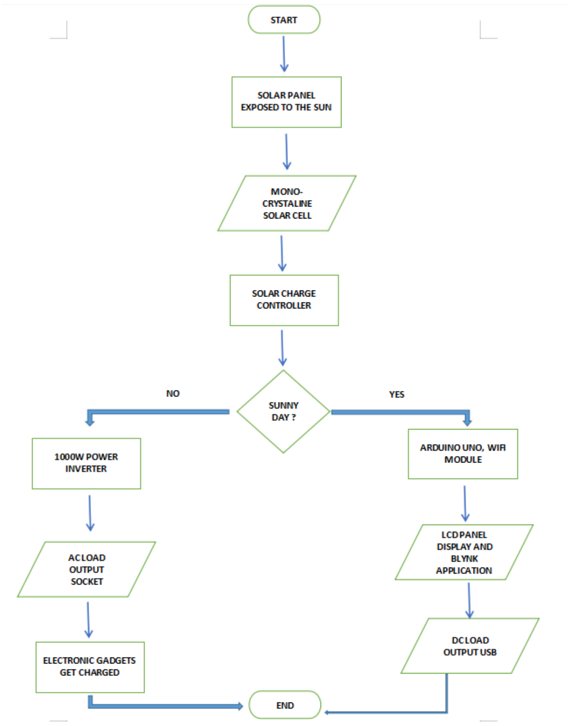


Figure 1: Flow Chart

The block diagram in Figure 2 describes the flow of signal process throughout this system. Which can be break into four parts, as stated below:

Data Input : Photovoltaic cell

Process : Solar charge controller, Lithium-ion battery, inverter

Controller : Arduino Uno micro controller

Output : Dc load output, Ac load output, LCD display panel and Mobile Blynk1` application

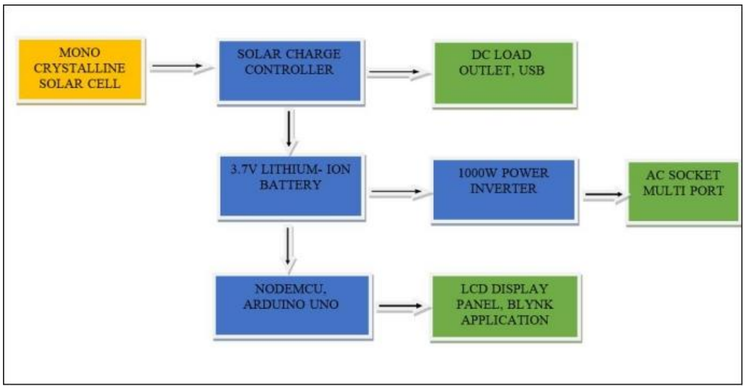


Figure 2: Block Diagram

"Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet" [7]. It is a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. Currently, "Blynk supports most Arduino boards, Raspberry Pi models, the ASB32, Particle Core, and a handful of other common micro controllers and single-board computers, and more are being added over time"[7].

Figure 3: Setup of Blynk Application

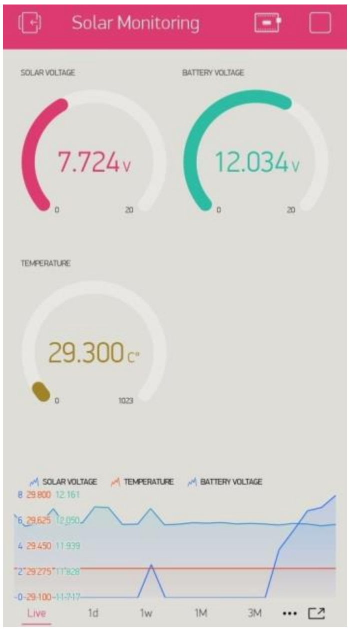


Figure 4 depicts the prototype being evaluated for an average of 1-2 hours on different days to make sure the prototype performs as intended. A few electronic equipment, including a few cell phones, are powered up to test the prototype. Hand phones were the electronic device that was selected for testing as the load.

Figure 4: Testing

The electronic device circuit is developed using breadboard. The components used in hardware development in Figure 5. The components used in the hardware development included ASB32 micro controller Arduino, voltage sensor, temperature sensor and solar panel. There are total 3 sensor that being used. This sensor is being used for monitoring each system of the solar panel charging system. Basically, this system we just implement the sensor to the system which we can monitor the system.

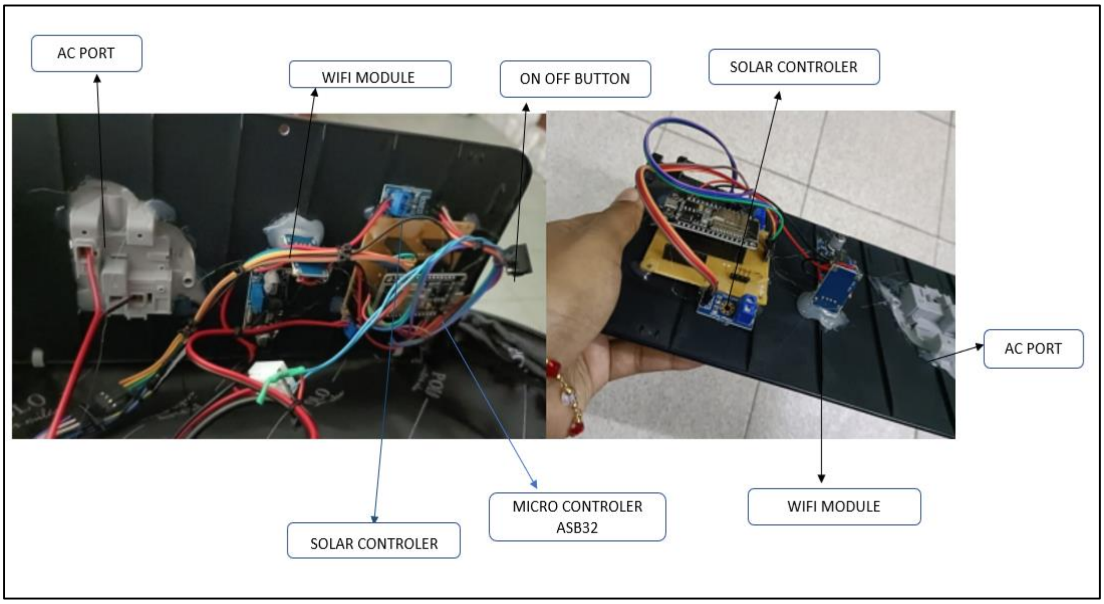


Figure 5: Electronic Device Circuit

Therefore, the hardware development is complete by combined the electronic device circuit of the project in the luggage. Figure 6 shows the complete hardware of solar mobile power monitoring system. The electronic device for this project were inserted in the luggage and the solar panel is placed on top of the luggage surface.

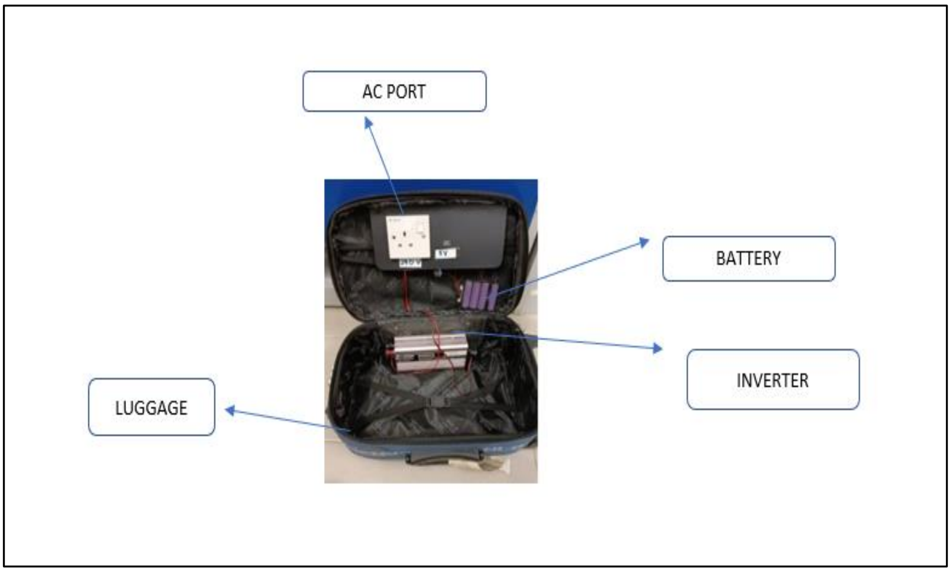


Figure 6: Complete Hardware

3. Results

The prototype developed consist of various components assembled and attached along the prototype. Each component has their particular functions to be done. Figure 7 displays the temperature, battery voltage reading, and battery solar voltage reading, respectively. It provides a temperature and humidity parameter indication. The graphs for the temperature, battery, and solar voltage parameters are shown in red, blue, and yellow, respectively.

Figure 7: Prototype Reading Testing

Figure 8 shows the reading of the solar voltage and also the humidity level of the current temperature on the LCD display which has been placed on the luggage for reference.

Figure 8: Temperature and Humidity Reading

Figure 9 shows the graph reading on a hot day where the temperature was high and the humidity level was lower than the rainy day. Also the reading of the temperature had maintained as the day was sunny. The red line shows the battery voltage reading and the yellow line shows the solar reading depending the temperature of the nature.

Figure 9: Prototype Reading During Sunny Day

Table 1: Reading On Sunny Day

SOLAR (V)	TEMPERATURE (ºC)	BATTERY (V)	HUMIDITY	DAY
6.0 V	30.8	11.8V	69	SUNNY
5.5V	30.775	11.3V	68	SUNNY
5.1V	30.75	10.7V	73	SUNNY
4.6V	30.725	10.2V	69	SUNNY
4.2V	30.7	9.2V	67	SUNNY

In Table 1, reading was obtained during sunny day where the solar voltage reading which was recorded were 6V, 5.5V,5.1V,4.6V and 4.2V. And the temperature was recorded was in range of 30.8ºC till 30. 7ºC.This shows it was a hot day so the solar panel had received enough amount of light source to generate current. Apart from that the humidity also lower shows that amount of water vapour were lower in air to indicate the temperature. So, battery voltage is lower in usage as solar panel takes places to supply current input. Figure 3.4 shows the graph of temperature and the humidity reading during hot days where the temperature were in range of 30ºC while the humidity was in range of 67-73. Sensors were used to detect the reading of temperature and humidity were temperature sensor which detects the changes of the temperature and also humidity. The reason why humidity and temperature monitoring is important is because during charging condition the temperature of device might rise high to humidity of the internal bag might drop as the temperature rises the bag tend to get burn as it is made up of fabrics. So humidity and temperature monitor is needed for safety purpose.

Figure 10: Reading During Sunny Day

Figure 11 is the reading during rainy day where the temperature was lower than the sunny day and also the reading of temperature falls. The blue line shows the reading of the temperature while the top yellow line shows the battery voltage while the below bottom line shows the solar reading its shows lesser because of rainy day the solar absorbs lesser light.

Figure 11: Sunny Day Reading

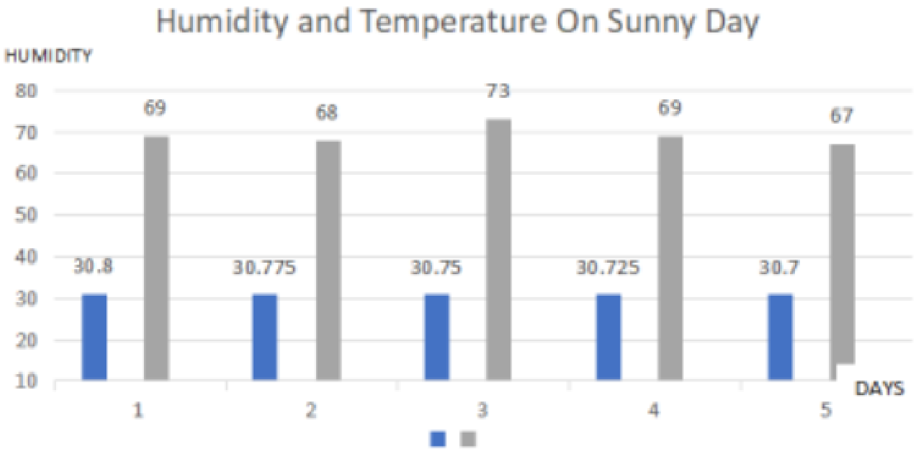


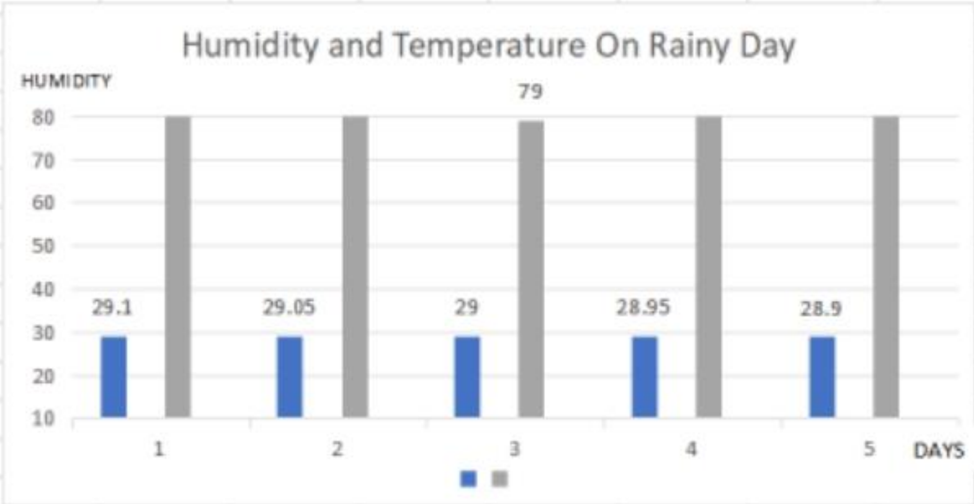
Table 2: Reading During Rainy Day

SOLAR (V)	TEMPERATURE (ºC)	BATTERY (V)	HUMIDITY	DAY
3.282V	29.1	12.135V	81	RAINY
3.229V	29.05	12.109V	85	RAINY
3.175V	29	12.084V	79	RAINY
3.122V	28.95	12.059V	83	RAINY
3.068V	28.9	12.033V	85	RAINY

Table 2 is the reading of the solar voltage during the rainy days as it drops compared to the reading of sunny day. And the reading of the temperature also falls but the reading of the battery voltage was increased directly proportional to the solar voltage as it was raining so usage of battery using inverter was quit often. Adding to it the reading of the humidity also had increased compared to the sunny day as the day was cool and were raining all the time. Figure 12 is the graph of humidity and temperature reading on rainy day.

Figure 12: Rainy Day Reading

Figure 13 is the users interface for Blynk mobile monitoring application. Blynk is a Platform with



IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where can build a graphic interface for project by simply dragging and dropping widgets. It shows the reading captured during testing purpose where it displays the reading of temperature, solar voltage and also the battery voltage. It also has the features on generating a graph depending on the reading obtained.

Figure 13: Blynk Mobile Monitoring Interface

4. Conclusion

Model created makes it simple for users to transport this power source to remote or non-electricity grid places. Due to the size and specs capabilities of each component, which works as the procedure for temporarily creating power supply, this prototype is claimed to power a suitable amount of real-time power supply. By substituting the components with Solar Mobile Power System parts with greater specifications, this prototype can be used for longer periods of time and higher power production. This prototype is the initial iteration of a gadget that is in the early stages of offering users an off-grid power supply. It is clear to predict much better and cleaner cities and environments in the future thanks to technological advancements and growing public awareness of the use of renewable energy sources, such as solar energy and the importance of practising usage of this energy resource. This model, are moving closer to achieve Sustainable Development Goal #7, which calls for more accessible and environmentally friendly energy.

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