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# Portable Solar Power Bank

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**ABSTRACT:** The Abstract of this project is to design a Solar Powered Portable Power Bank for mobile phone using sunlight as its ultimate power, which can be used effectively during disaster events. It has in-built solar panel which converts the solar energy to electrical energy. The charge is then transferred to a battery for storage of charge for further use, with the battery having a microcontroller indicating the percent of charge present in the battery. The battery is connected to a charging circuit having an USB port as output to the respective Mobile phones.

**KEYWORDS:** Solar panel, Sunlight, Portable, Battery, Portable Bank

## I. INTRODUCTION

Electrical line distortion or a lack of energy generation, which occurs in rural regions or during disasters or natural calamities, is the most major liability or disadvantage of communication lines. To address these issues, we require a renewable energy source that can operate 24 hours a day, seven days a week. This solar power bank is quite unique. It converts solar energy to electricity and aids in the charge of cell phones for communication, making it crucial during natural catastrophes and power outages. The development of solar charger goes from the fundamental level like soldering lamination and making the panel etc. The developed charger is planned for 6 Volts with ma capacity at bright sunlight and step down to 5 Volts using regulator. In the report, the detailed experimental characteristics of mobile charger are noted. 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.

## II. RELATED WORK

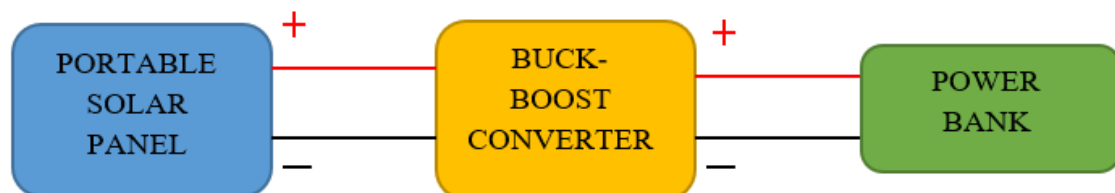
The separate extraction of those carriers to an external circuit. In contrast, a solar thermal collector collects heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation. "Photo electrolytic cell" (photo electrochemical cell), on the other hand, refers either a type of photovoltaic cell (like that developed by A.E. Becquerel and modern dye-sensitized solar cells or a device that splits water directly into hydrogen and oxygen using only solar illumination. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Materials presently used for photovoltaics include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium gallium selenide/sulphide. In today's time with rapidly changing technologies power banks and portable charging has become a part of everyone's life. Power banks are used for providing portable power to charge battery powered items like mobile phones and other similar items that have a USB interface: they can charge via USB, etc or wirelessly. Power banks are commonplace and with our increasing use of battery powered equipment: everything from mobile phones to battery powered headphones, portable speakers, MP3 players can be charged via a power bank. They are effectively a portable charger. All they need is a USB charging interface. Power banks come in a variety of shapes and sizes and to suit many different people and

their needs. In recent years, the use of power banks has risen significantly as they provide a very convenient and easy method of charging smartphones and other devices when away from mains power.

### III. METHODOLOGY

In this research, we explored the applications of solar cells and how they can be implemented. Battery management and capacity of solar cell and the price range is being covered in this paper. Current solar cell relevance and pertinence is analysed. The project laid emphasis upon types of cells that can be implemented for the project. The paper talks about the vast uses of solar cells and the categories in which they are available in market. Decision making on the basis of these categories and choosing the best solar cell /panel was covered. We inferred the scope of the project as well as the future implementation of it. The Paper describes new ways in which integration of nano structures can make regular Solar cells impactful. The potential changes and novelty was understood. This paper talks about the problems that can be rectified by providing alternative power to the battery continuously and small size battery will be sufficient to operate mobile with more features. The paper talks about the power is calculation according to the principle that the integration of the PV output current over the time interval proportional to the PV output voltage becomes the power. This paper talks about the harvesting of energy using solar cells. To increase the energy capacity and making the best out of the available energy source is done. Using the battery for storage of solar energy and making it available in Remote conditions is understood. The research gives more information about the types of solar cells, efficiency of the different types of solar cells. The trajectory of conduction and functioning can be maximize through this analysis.

### IV. BLOCK DIAGRAM



Solar Photovoltaic: A solar cell, also called photovoltaic cell, is a device that directly converts solar radiation into usable electricity based on the photoelectric (or photovoltaic) effect. The total capacity and no. of solar panels need to be installed depends on the power required from the system. Charge Controller: A charge controller performs regulation of voltage and current in between solar array and battery and keep batteries safe from overcharging and prevent deep discharging. Thus it helps to extend the battery lifetime, also. Battery: Lead-acid batteries are widely available, comparatively cheap but because of its heavy weight, liquid electrolyte and frequent maintenance requirement, those are suitable for large, stable charging stations. Lithium-ion batteries are expensive but yet it is best for both portable and stationary solar systems for its dry, portable and maintenance-free electrolyte and longer lifespan. Inverter: Solar system outputs DC voltage only which can be converted to AC by using additional inverter and AC loads can directly be charged through the system. Large systems involve charge controllers of bigger capacity with built in inverter facility. Converters: Use of converters depends on output voltage requirement. Solar power bank, like the name indicates, these solar power banks can use sunlight to charge up. To do this they have photovoltaic panels. These are really only able to trickle-charge the internal battery when placed in sunlight because the solar cells are relatively small, but nevertheless this can be a very useful function, but really only in very sunny or bright conditions. It can also be charged in the normal way, using the solar power for a slow trickle charge. Like the standard wired power bank, these solar powered ones have standard Type A USB.

### V. OBJECTIVE

The purpose of this research is to develop a portable solar power bank that can be used in disasters. It contains a built-in solar panel that transforms sunlight into electricity. The charge is then transferred to a battery, and the battery is



connected to a charging circuit with a USB connector as an output to the corresponding power bank. There are still certain parts of India that are without electricity. People in these rural places may charge their phones and other USB devices without needing energy using this solar power mobile charger. Solar energy is completely free. The sun's energy is completely free. Because humans get sunshine directly from the sun, the energy source is basically free. Solar energy is both environmentally benign and renewable. As a result, there is no natural contamination. It is less expensive, and once installed, it provides numerous advantages. Maintenance is fairly inexpensive. We will be able to run various USB gadgets by storing this energy in batteries (like USB fan, USB light). This solar power bank is unique. It operates on the power of the sun, converting solar to electrical and assisting in the charge of cell phones for communication, making it indispensable during calamities and power outages.

## VI. PROCESS

When picking a solar panel or constructing a solar system, there are two crucial factors to consider. The capacity of a battery is measured in Amp Hours. To convert AH to Watt Hours, multiply the AH value by the battery voltage, as shown in the basic technique below. (1), where Y represents available power in Watt-hours and  $X \times Y = Z$  represents the battery's AH capacity. We'll never be able to fully utilise a battery because we know we won't be able to power it if the voltage falls below the specifications of our equipment. Lead-acid batteries will provide around half of their rated power, whereas lithium-ion batteries will provide roughly 80%. The solar panels are the most significant and final component of a solar panel's design. Watts are the units of measurement for the quantity of power produced by a solar panel. The potential energy delivery to a battery is computed by multiplying the solar panel's power production rating (in Watts) by the number of hours the panel is exposed to sunlight.

## VII. PHYSICAL PROTOTYPE

The system is powered by solar panels, which are vital to the experiment. By connecting a two or four 5V-watt solar panel to the system's battery, we can preserve solar energy for later use. The battery has a 5V voltage and is composed of two parallel 5V batteries. The battery is then connected to a mobile charging circuit, which is connected to a USB connector, from which a mobile device can be charged. The solar panel is connected to the battery via one relay circuit, and the battery is connected to the cell phone via another. The microcontroller acts as the brain of the circuit, ensuring that the correct quantity of charge is delivered from one end to the other. When the microcontroller detects low or high voltages, the relays are notified, and the connection is terminated by shutting down to protect vital components such as the transistor and resistor. LEDs are also utilised on the solar panel charging station to monitor energy flow. When the solar panels are opened, direct sunlight strikes the photovoltaic cell of the panel, converting solar energy to electrical energy. If the voltage is appropriate and equal to the value assigned to the battery by the microcontroller, the panel generates a 12 volt charge, which is sent to the battery. The charge transfer from the panel to the battery is shown via an LED. When the battery is fully charged, as shown by the four LEDs attached to it through the microprocessor, the microcontroller shows the percentage of charge left in the battery, at which time a mobile phone can be connected to the circuit's end. A relay circuit is also attached here to evaluate the voltage flow. If the voltage is too low or too high, the relay will turn off, leaving the circuit open. The phone can be charged at the end of the circuit, which has a USB port; the phone can be charged at the end of the circuit, which has a USB port.

## VII. EFFICIENCY

Solar Cells Output capacity, battery charge rate In using solar power as an energy source for charging our battery and our wireless charging circuits, we are already using a method of renewable energy. The table will never negative energy usage. So already we are talking about a high efficiency rating when comparing power used or lost in the charging process and power consumed to charge the battery and power the circuit. In the solar cells and battery system, it is important to ensure that the charge controller is properly setup. The power produced by the solar cells should reach the battery to charge it without major losses in between. Our team monitored both voltage and current levels produced by the solar cells and the charge rate of the lead acid battery. From this data we were able to conclude that losses in this system were minimized.

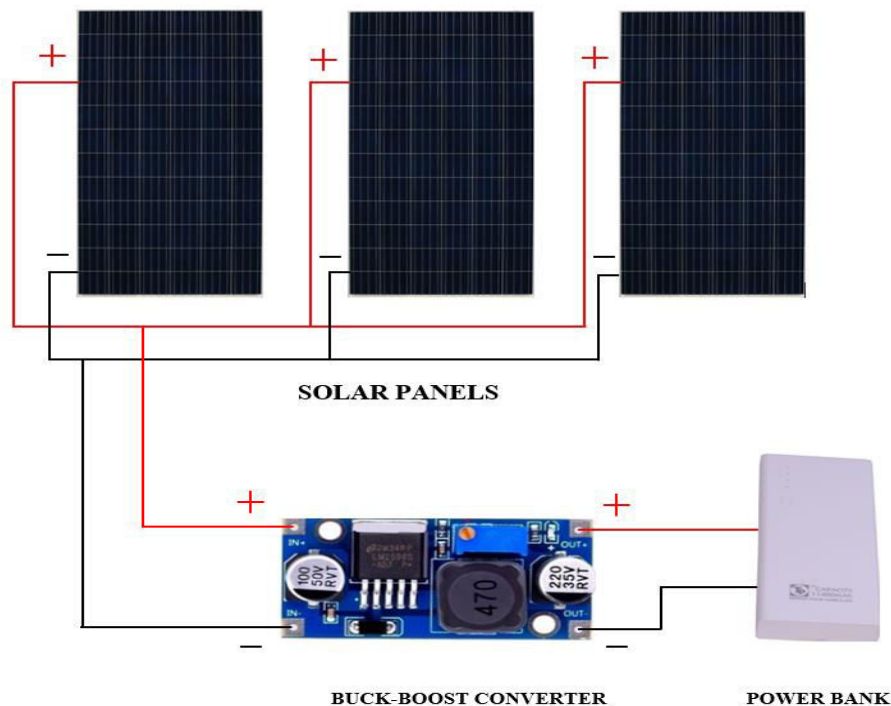
## VIII. APPLICATIONS

They are usually portable enough to be carried about for use when the need arises, but some are big and so need to be stationed at a spot. Solar power banks come in various capacities (usually between 1000 – 50,000 mAh). The solar power bank is an innovative device that you will find highly beneficial as long as you buy one of high quality. Solar power banks are affordable, environment friendly, cost- saving and a reliable source of power supply for your gadgets. Most importantly, it helps you stay connected anytime, anywhere and on the go! A solar-powered bank might be added to the mix of various charges now in use. This will allow you to experiment with the new device without having to make a difficult move. Charging your phone when travelling, especially for an extended period of time, might be challenging. Taking a power bank on a trip is a wonderful idea because it allows you to recharge your phone. The store numerous gadgets, and makes travelling much easier and more pleasant. Another significant benefit is that using a dependable power bank eliminates the need for an adapter.

## IX. FUTURE IMPROVEMENT

Although we met most of our goals, there are several aspects of our design that could be improved. The biggest improvement to our design is increasing the current output from our wireless charging circuit. Our goal was to have a power output of 5W, which is 5V at 1A. This would allow us to cut down on the charging time it takes to charge a phone with our system drastically. In addition to being able to charge a phone faster, it would also allow us the ability to support multiple devices charging at once, which is something Apple had troubles with when designing their multi-device charger known as the AirPower working on the Qi standard.

## X. HARDWARE DISCRIPTION



Project is to design a Solar Powered Portable Power Bank for mobile phone using sunlight as its ultimate power, which can be used effectively during disaster events. It has in-built solar panel which converts the solar energy to electrical energy. The charge is then transferred to a battery for storage of charge for further use, with the battery having a

microcontroller indicating the percent of charge present in the battery. The battery is connected to a charging circuit having an USB port as output to the respective Mobile phones. A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that generate electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules. Solar panels are usually arranged in groups called arrays or systems. A photovoltaic system consists of one or more solar panels, a inverter that converts DC electricity to alternate current (AC) electricity, and sometimes other components such as controllers, meters, and trackers. A photovoltaic system can be used to provide electricity for off-grid applications, such as remote homes or cabins, or to feed electricity back into the grid and earn credits or payments from the utility company. This is called a grid-connected photovoltaic system. Some advantages of solar panels are that they use a renewable and clean source of energy, reduce greenhouse gas emissions, and lower electricity bills. Some disadvantages are that they depend on the availability and intensity of sunlight, require maintenance and cleaning, and have high initial costs. Solar panels are widely used for residential, commercial, and industrial purposes, as well as for space and transportation applications.



The buck boost converter is a DC-to-DC converter. The output voltage of the DC-to-DC converter is less than or greater than the input voltage. The output voltage of the magnitude depends on the duty cycle. These converters are also known as the step up and step-down transformers and these names are coming from the analogous step up and step-down transformer. The input voltages are step-up/down to some level of more than or less than the input voltage. By using the low conversion energy, the input power is equal to the output power. The following expression shows the low of a conversion. The buck boost converter is a DC-to-DC converter. The output voltage of the DC-to-DC converter is less than or greater than the input voltage. The output voltage of the magnitude depends on the duty cycle. These converters are also known as the step up and step-down transformers and these names are coming from the analogous step up and step-down transformer. The input voltages are step-up/down to some level of more than or less than the input voltage. By using the low conversion energy, the input power is equal to the output power. The following expression shows the low of a conversion.



Power banks are portable charging devices that can be used to charge smartphones or any other devices that have a USB port within them. Power banks can also be used to charge Bluetooth speakers, Bluetooth headphones, other types of charged headsets, etc. Power banks are becoming a necessity these days and almost every other commonplace has it. The main reason for increased demand in power bank sales is due to the fast and rapid charging it provides along with no mess of wires involved. But as we know every electronic device has a certain time up till 19 which it works profoundly and then wear and tear may occur. This is also the case with power banks. Because of constant charge-discharge cycles after a span of 5-6 months the power bank may lose its efficiency. However, the performance of a power bank depends on the type of model one may select. If you opt for a cheaper product and expect a great working period of 6-7 months then this might be a misconception. Still, a power bank is a must for all the people who need to constantly travel and also to a normal household where every time you may not get a free plug point. Now that we know the importance of a power bank let's discuss the specifications one must consider while buying a power bank.

## XI. CONCLUSION

Recapping the work we accomplished during this project, we set out with several design goals which we strived to meet. Our product collects and stores light energy via solar cells and can generate more than 5W in both an indoor and outdoor setting. The design moves power from the battery, through both a transmission and receiving inductive coupling circuit using matching networks to optimize power transfer, tune coils, and minimum losses. The system supports any charging standard through the use of a female USB Type-B port located on the receiving circuit. Additionally, through the modular design of the table itself, we were able to create an aesthetically pleasing, polished looking final product which was easy to service, repair, and assemble. Finally, in the development of our wireless charging system and our product design, we ensure that our device would pose no safety or health concerns to the users. Also, we worked to minimize the effort and environmental impact of disposal once the device reaches the end of its projected lifetime.

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