GREEN COMPUTING PROJECT

Renew Ability

…renewing our sustain ability

A

PRESENTATION ON SOLAR BASED POWER BANK.

INDEX:

INTRODUCTION:

A **solar charger** is a charger that employs solar energy to supply electricity to devices or batteries. They are generally portable.

Solar chargers can charge lead acid or Ni-Cid battery banks up to 48 V and hundreds of ampere hours (up to 4000 Ah) capacity. Such type of solar charger setups generally use an intelligent charge controller. A series of solar cells are installed in a stationary location (ie: rooftops of homes, base-station locations on the ground etc.) and can be connected to a battery bank to store energy for off-peak usage. They can also be used in addition to mains-supply chargers for energy saving during the daytime.

Most portable chargers can obtain energy from the sun only. Some, including the Kinesis K3, and GeNNex Solar Cell 2 can work either way (recharged by the sun or plugged into a wall plug to charge up). Examples of solar chargers in popular use include:

- Small portable models designed to charge a range of different mobile phones, cell phones, iPods or other portable audio equipment.
- Fold out models designed to sit on the dashboard of an automobile and plug into the cigar/12v lighter socket to keep the battery topped up while the vehicle is not in use.
- Flashlights/torches, often combined with a secondary means of charging, such as a kinetic (hand crank generator) charging system.
- Public solar chargers permanently installed in public places, such as parks, squares and streets, which anyone can use for free.

As coming to the introduction of our project model the major liability of drawbacks of communication. Lines comes because the distortion of electrical lines or lack of generation of electricity. The major liability or drawbacks of communication lines comes because of the distortion of electrical lines or lack of generation of electricity as like in remote areas or during disaster or natural calamities. To set back such drawbacks, we need a renewable source of energy which can function round the clock without any disruption. Solar power bank is one of its kind. It works on the power of the sun, converting solar to electrical and helps in charging the cell phones which can be used in communication, and thus, turns to be vital during disasters and power outage.

There are 2 main things to consider choosing a Solar panel or creating a Solar system. Battery capacity is measured in Amp Hours. The AH figure must be multiplied by the battery voltage to convert this to Watt Hours which is given by the simple calculation below.

where,

Y = Battery Voltage

Z = Power available in watt hours X =Battery size in AH.

However, as we know that we will not be able to power the battery once the voltage drops below our equipment's requirements, that is why, we are never really able to take all the power from a battery. Lead acid batteries will give around 50% of their rated power and Li-ion batteries will give around 80% of their rated power.

Solar panels are the most critical and final part in designing solar panels. The generation of power in a solar panel is measured in Watts (e.g. The power generation of part number STP010 in a solar cell is 10W).Theoretically, the energy that can be supplied to a battery can be calculated by multiplying the power generation rating of the solar panel (measured in Watts) to the number of hours the panel is exposed to sunshine.

A photovoltaic module can be defined as an assembly of 6x10 solar cells connected and packaged together. The solar array of a photovoltaic system which is generally comprised of these photovoltaic cells generate solar electricity and is used in domestic applications. Under standard test conditions, the DC output power of each module ranges between 100 to 365 watts. If the rated output of a solar panel remains the same, the efficiency is determined by the area of the module.i.e. A 16% efficient 230 W solar module will consume half the area as that of a 8% efficient 230W module. Only a few solar panels exceed an efficiency of over 19%. Most installations contain multiple modules as a single solar module generates only a limited amount of power. Some of the typical examples of photovoltaic systems are an array of solar modules, a solar inverter, a battery, a solar tracker and interconnection wiring.

The photovoltaic panels present in solar-charged power banks can trickle-charge the internal battery of the system when placed in direct sunlight. Depending on the capacity of the Power Bank and its current level of charge, it can take quite a while to fill up. For example, the time taken by a smartphone to charge completely is same as the time taken to charge a 1500mAh power bank completely. For larger banks, this charging time can be doubled, tripled or quadrupled. Most Power Banks use LED indicators to show whether these power banks are at capacity and a safety cut-off valve to avoid overheating and overcharging. Solar Power Bank is a new generation of Electronic gadget. This prototype is a innovation of a formal power bank.

Basically the formal power are using ac current to recharge the prototype. By using the new invention of technology the are using solar system to recharge the prototype. By using Solar Panel this prototype can be charge without using any current. Solar panel are really useful in broad daylight so the prototype can be easily charge up. Besides that, we have decide to rebuild a simple solar charger which can be used on the go.

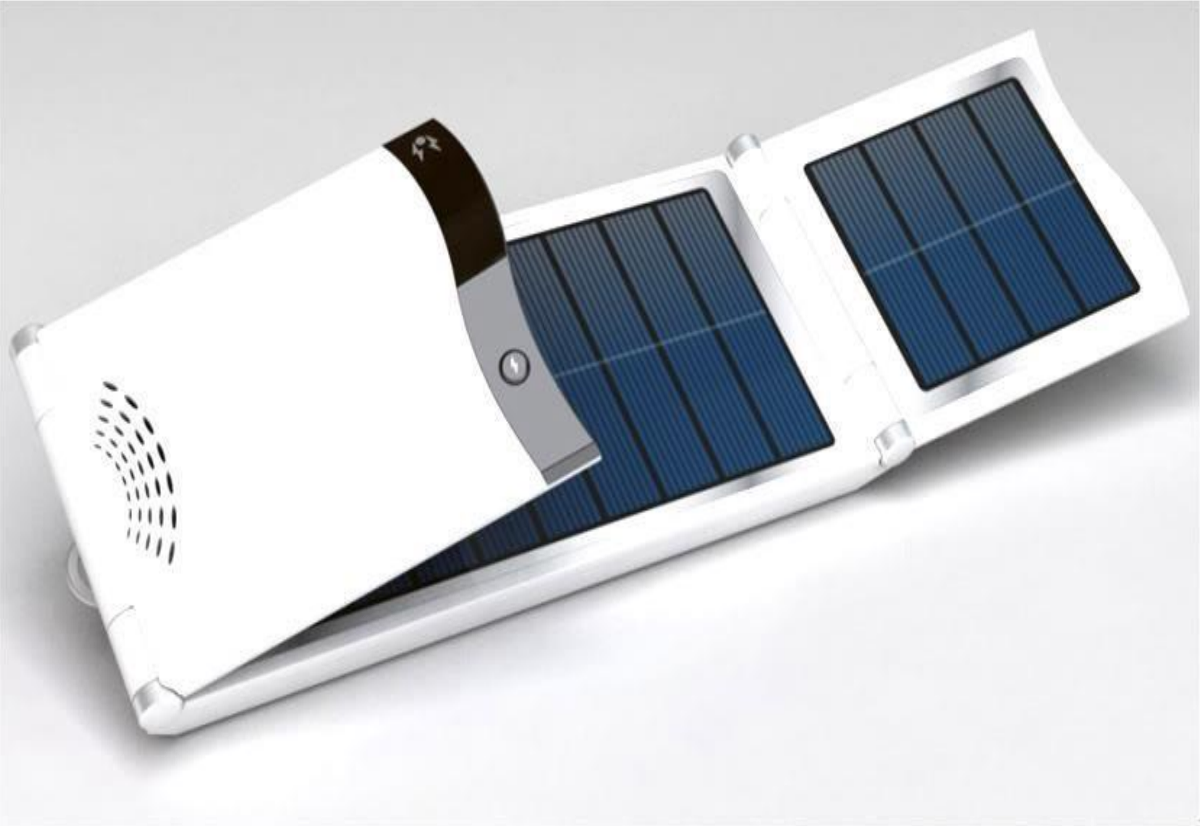


Figure: A simple power bank

REVIEW OF LITERATURE:

A power bank gives you all these, plus being able to charge them outdoors. In case you're interested, there are other solar-powered gadgets you might want to consider having as well.

Solar power banks are available in various sizes and different battery quantities. Depending on your usage plans, you can choose a power bank with a smaller or larger charging capacity.

Some power banks allow you to charge several devices at the same time – and naturally come with a higher charging capacity.

A solar power bank is able to hold a high level of power and can, therefore, be used to charge your phone throughout several days. It will also let you get rid of lots of hassle and simply relax, as you will not have to keep eyeing the space around you for charging opportunities. All you have to remember is to take your power bank out in the daylight and let it regain its power.

And another big plus – with a reliable power bank, you'll be able to forget about bothering with the appropriate adapter.

The usage of "battery" to describe a group electrical devices dates to Benjamin Franklin, who in 1748 described multiple Leyden jars by analogy to a battery of cannon . Alessandro Volta described the first electrochemical battery, the voltaic pile in 1800 . So according to Volta, this was a stack of copper and zinc plates that was separate by brine soaked paper disks, which is can produce a steady current for a considerable length of time. However, Volta did not appreciate that the voltage was due to chemical reactions and he thought that his cells were an inexhaustible source of energy, and that the associated corrosion effects at the electrodes were a mere nuisance, rather than an unavoidable consequence of their operation, as Michael Faraday showed in 1834 . Although, early batteries were of great value for experimental purposes, in practice their voltages fluctuated and they could not provide a large current for a sustained period. The Daniel cell, invented in 1836 by British chemist John Frederic Daniel, was the first practical source of electricity, becoming an industry standard and seeing widespread adoption as a power source for electrical telegraph network. It consisted of a copper pot filled with a copper sulphate solution, in which was immersed an unglazed earthenware container filled with sulphuric acid and a zinc electrode . These wet cells used liquid electrolytes, which were prone to leakage and spillage if not handled correctly. Many used glass jars to hold their components, which made them fragile. These characteristics made wet cells unsuitable for portable appliances. Near the end of the nineteenth century, the invention of dry cell batteries, which replaced the liquid electrolyte with a paste, made portable electrical devices practical.

Methodology:

In this study, the concept of a solar power generation system consists of batteries, low emissivity glass and the aluminium sheet plates. When light from the sun is collected by the flat solar collector, it is directed on the focus point where the thermoelectric generators are mounted. The working principle simply is that as one side of the thermoelectricity generator is heated; the other side's temperature is lower (cool side) then a temperature difference is generated within thermoelectric module. This event leads to the generation of electricity. In the SPB design, a mini-model or pattern was created with a cardboard material. Then its dimension of mm was measured to understand the physics of the solar compartment. After initial evaluation, the cardboard pattern for the rechargeable battery compartment was then measured to be 590 × 480mm.

The cardboard pattern was used to construct the Solar Power Bank (SPB)-case using 4 x 3 mm thick aluminium plate. The bending of the thick aluminium plate for the solar collector and battery compartments was carried out via a bench vice and later the plate was hammered into shape. The aluminium plate was acquired and marked out to the necessary size according to the specifications. The desired shape was cut out before it was folded to the required shape with length of 1120 mm and breadth of 910 mm. The aluminium plate is a very vital component in this model due to the qualities such as; high tensile strength and good The cutting process was performed with the use of hacksaw tool. Subsequently, holes were drilled on the aluminium plate through the use of a pillar drilling machine and 4 mm drill bit. The holes are necessary for 5 mm bolts and nuts to be used for the fitting of the structure. The finishing touches to the device were the joining of the solar collector and battery compartment. The fixing of plastic air trapper and a digital temperature sensor was the last step of the construction . A 3 mm and 4 mm glass was used for the surface of the SPB device ,thermoelectric converters were used.

The battery powered is a device that consists of one or more electrochemical cells that convert stored chemical energy into electrical energy. In a battery, the overall chemical reaction is divided by two physically and electrically separated processes, such as one is an oxidation process at the battery negative electrode wherein the valence of at least one species becomes more positive, and the other is a reduction process at the battery positive electrode wherein the valence of at least one species becomes more negative. The battery functions by providing separate pathways for electrons and ions to move between the site of oxidation and the site of reduction. The electrons will pass through the external circuit, where it can provide useful work, for example power a portable device such as a cellular phone or an electric vehicle.. While, the ions pass though the ionically conducting and electronically insulating electrolyte that lies between the two electrodes inside the battery. Therefore, the ionic current is separated from the electronic current, which can be easily controlled by a switch or a load in the external circuit. When a battery is discharged, an electrochemical oxidation reaction proceeds at the negative electrode and passes electrons into the external circuit, and a simultaneous electrochemical reduction reaction proceeds at the positive electrode and accepts electrons from the external circuit, thereby completing the electrical circuit. The change from electronic current to ionic current occurs at the electrolyte or electrode interface. When one attempts to recharge a battery by reversing the direction of electronic current flow, an electrochemical reduction reaction will proceed at the negative electrode, and an electrochemical oxidation reaction will proceed at the positive electrode

The photovoltaic effect was first experimentally demonstrated by French physicist A. E. Becquerel. In 1839, at age 19, experimenting in his father's laboratory, he built the world's first photovoltaic cell. However, it was not until 1883 that the first solid state photovoltaic cell was built, by Charles Fritts, who coated the semiconductor selenium with an extremely thin layer of gold to form the junctions. The device was only around 1% efficient. In 1888 Russian physicist Aleksandr Stoletov built the first cell based on the outer photoelectric effect discovered by Heinrich Hertz earlier in 1887 . Panels in the 1990s and early 2000s generally used 5 inch (125 mm) wafers, and since 2008 almost all new panels use 6 inch (150 mm) cells. The widespread introduction of flat screen televisions in the late 1990s and early 2000s led to the wide availability of large sheets of high-quality glass, used on the front of the panels.

Compared to battery power, solar powered operates by converting sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power (CSP) . Concentrated solar powered systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic convert light into electric current using the photoelectric effect . Solar powered can provide higher power densities. Nevertheless, both these power sources will operate differently. Besides that, Solar energy can be converted to electricity in other ways, that is through the solar thermal or electric power plants generate electricity by concentrating solar energy to heat a fluid and produce steam that is used to power a generator.

Fig: The sensor mode of solar panels.

Primary battery	**Zinc-air**	**Lithium**	**Alkaline**
Energy density	3780	2880	1200

Table: Energy density for primary batteries.

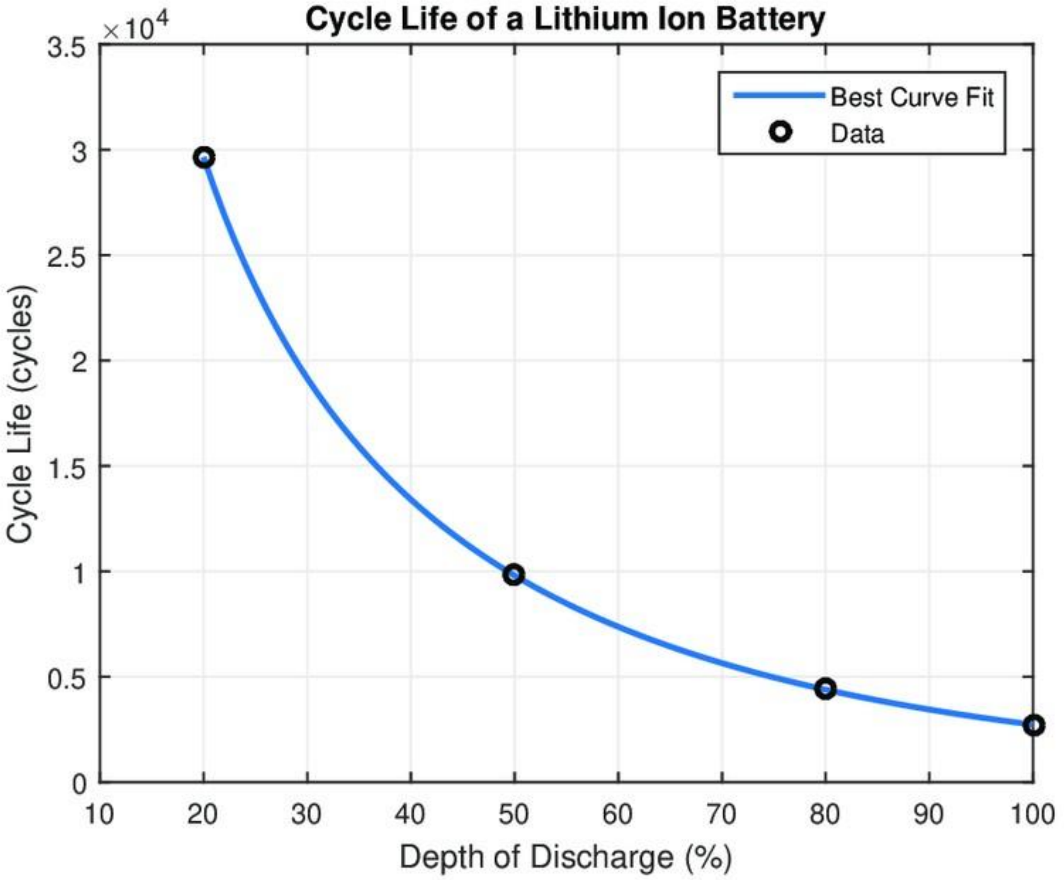


Figure: Depth of discharge versus cycle life of the lithium-ion battery.

Storage system	**Energy Density (mWh/cm)**	**Continuous operation**	**Periodical operation**
Lithium	(195-532)	31	0.032
NiMH	(151-410)	50	0.051
Supercapacitor	(3.8-6.4)	2700	2.7

Table: Energy density and required sizes of storages.

Battery	Advantages	Disadvantages
Primary (not rechargeable) Battery	High energy density. Wide availability of standard products. Best alternative for low cost.	Fixed and limited energy rating(limited lifetime) High cost of continuous replacement. Dangerous and lead to fire, Explosion and chemical
Rechargeable Battery	Cost is paid quickly for high utilization applications. Increase economic and environmental benefits. Flat discharge curve.	Cost of charger-for low cost applications the charger can cost much more than the actual product. Lower energy density over charging can damage the battery.

Table : Advantages and disadvantages of battery powered.

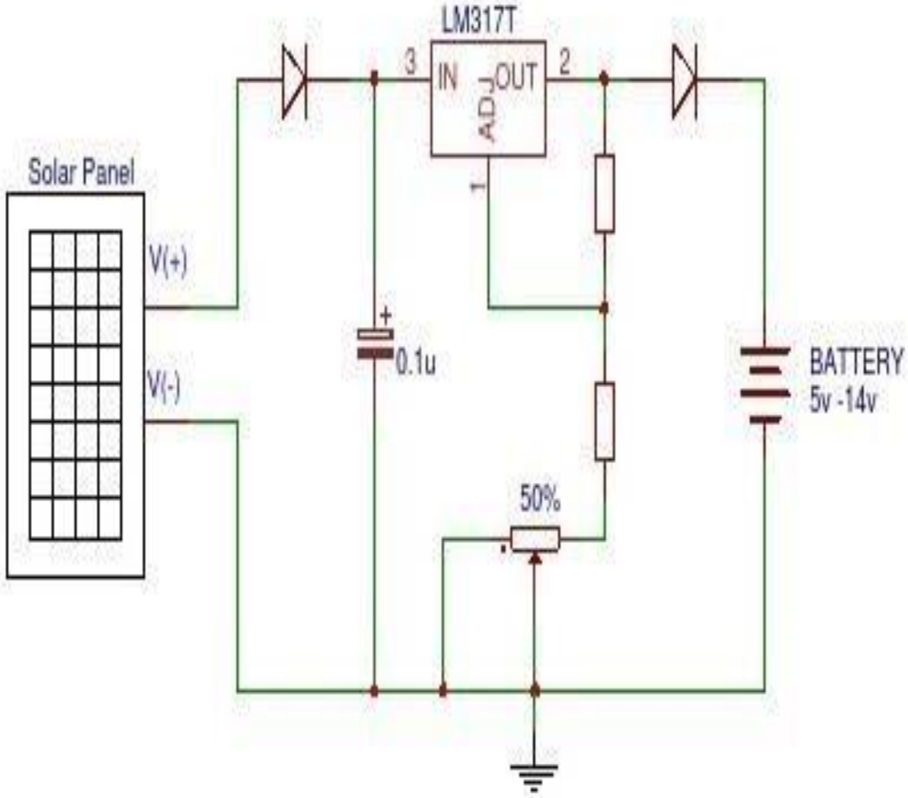
PHYSICAL PROTOTYPE:

The Proposed system is solar based and solar panel plays a vital role in the experiment. Here, we have two solar panels each of 6v, for receiving the sunlight, which is connected to the battery of the system where the charge from the sun is stored for future use. The battery is also of 12v with three 4v battery connected in series. Then, the battery is connected to the mobile charging circuit which is further connected to a USB Port from where a mobile can be connected for charging. There are two relay circuits, one attached between the solar panel and the battery and other one attached between the battery and the mobile phone which is controlled by the microcontroller. The microcontroller is the brain of the whole circuit as it checks and allows the required amount of flow of charge from one end to another. If at any point, we might get low or high voltages, then the microcontroller signals the relays and the relays cut the connection by switching off to protect the appropriate elements like the transistor, resistor etc. There are also LEDs attached at the solar panel side, at the charging point for detection of flow of charge. There are also 4 LEDs to show the percentage of charge present in the battery.

When the solar panels are open, then sunlight direct falls on the photovoltaic cell of the panel and it converts the solar energy to electrical energy. The panel gives a voltage of 12v and the charge flows through the relay to the battery if the voltage is appropriate and is equal to the value set by the microcontroller to the battery. There is also a LED which displays the transfer of charge from the panel to the battery. When the battery is charged perfectly up to its full capacity, which is shown by the 4 LEDs connected to the battery through the microcontroller, the microcontroller shows the percentage of charge present in the battery and then we can connect a mobile phone at the end of the circuit. Here, we also attach a relay circuit which checks the flow of voltage. If we get low or high voltage, the relay switches off and the circuit becomes open. With the appropriate charge, we can charge the mobile phone at the end of the circuit Initial Construction:

Some mathematical formulas were used to calculate parameters such as; the power generated from the STEG, heat transfer within the STEG and the maximum heat power expected in the SPB. The mathematical representation includes power, heat transfer and expected maximum power generated from the heating device: P=V^2/R Q=t*A*T*/\T/D W=Energy/time Here, V is the voltage generated by the TEG, R is the resistance within TEG module, t is the time, K is the thermal conductivity, A is the cross sectional area of TEG module, T is the change in temperature within TEG module and d is the thickness of TEG module

When heat in form of solar energy is applied to the hot side of the TEG modules a reaction occurs in the inbuilt components of the TEG modules thereby causing electricity to be produced, two panes of glass with thickness 3 mm and 4 mm will cover the top of the solar compartment. The glass retains the heat from the sun which enables the TEG modules to generate electricity. An insulation tape is used to secure trapped heat. The specifications for the TEG modules are listed below: MODEL: TEC 1-12706i. SIZE: 40mm × 40mm × 4mm ii. OPERATIONAL TEMPERATURES: iii. MAX POWER CONSUMPTION: 60 Watts iv. OPERATIONAL AMPERES: 0-15.2 V DC and 0-6 Av.


LM317T
3
IN
ADJ
OUT
2
1
Solar Panel
V(+)
V(-)
+
0.1u
BATTERY
5v -14v
50%

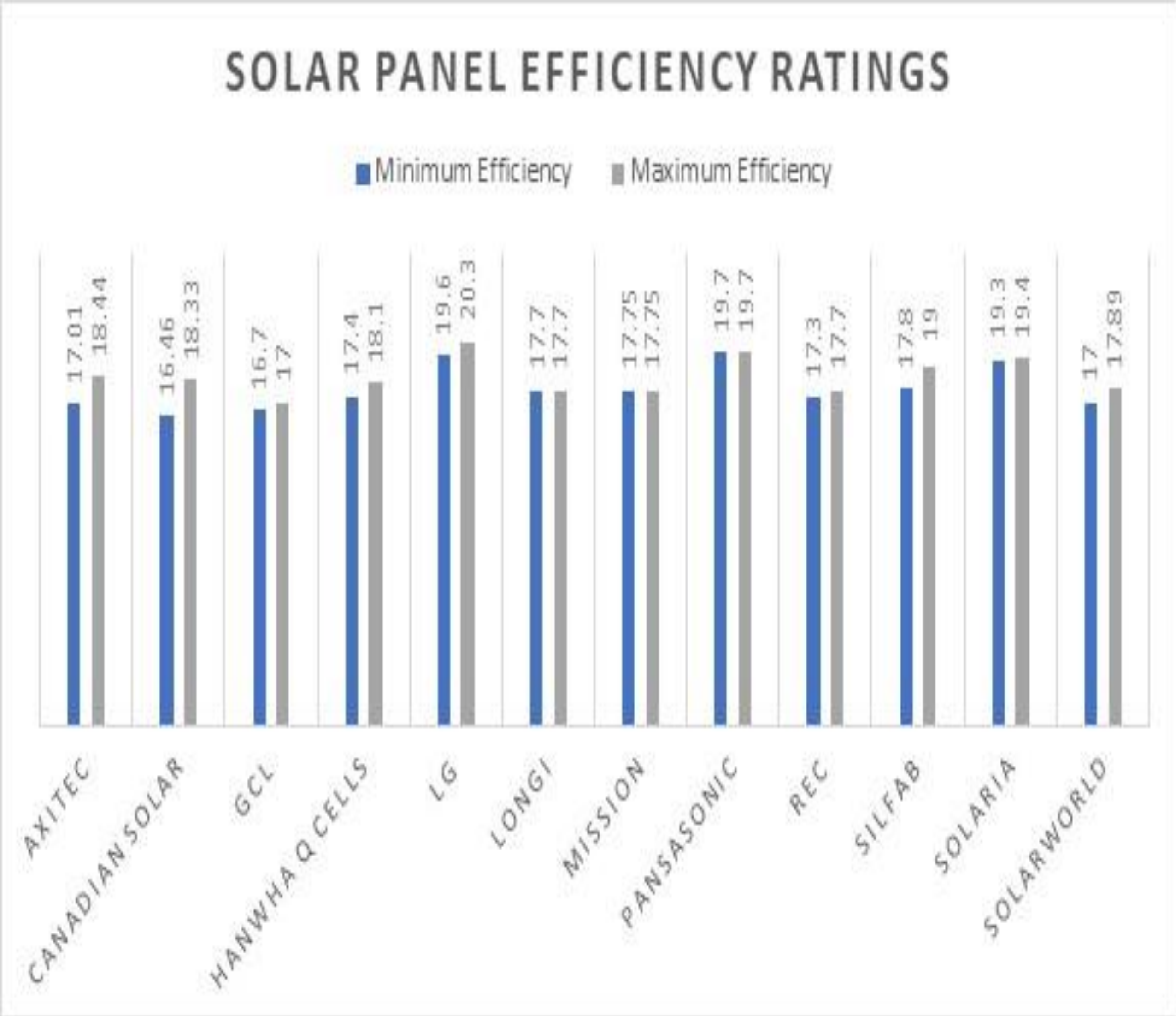
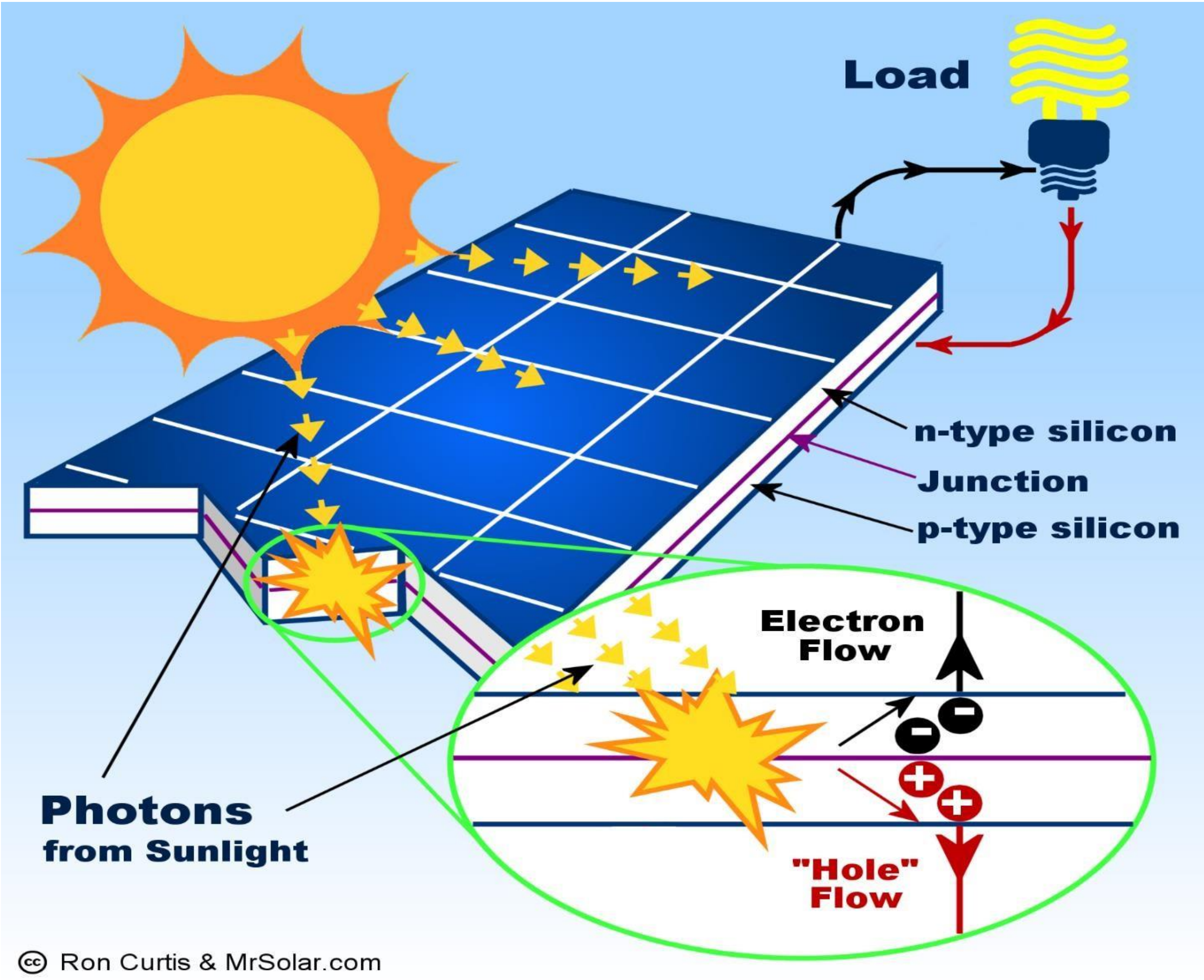


Figure: Solar panels efficiency ratings


Load
n-type silicon
Junction
p-type silicon
Electron
Flow
Photons
from Sunlight
"Hole"
Flow
Ron Curtis & MrSolar.com

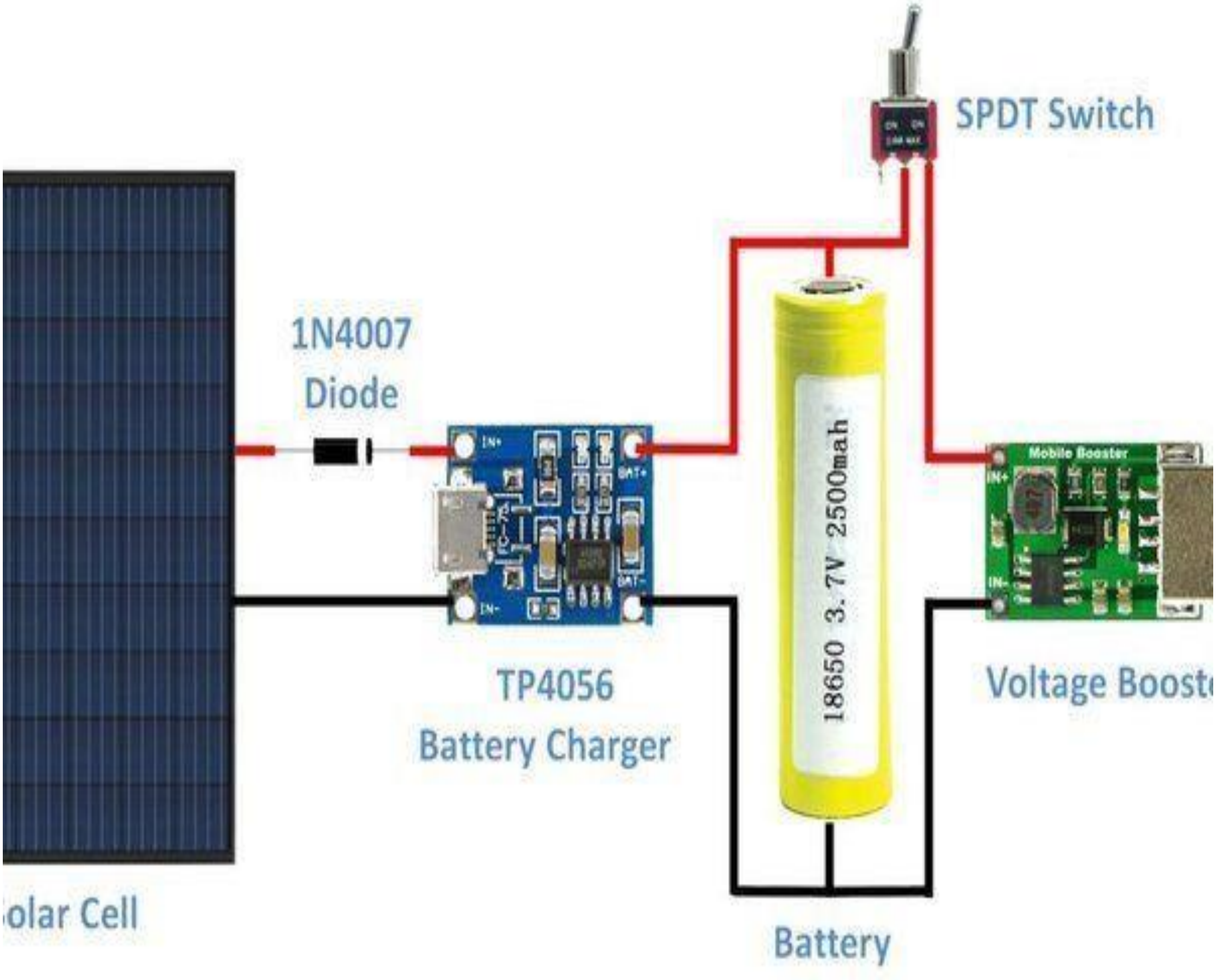


Figure: Working of a solar power bank

Power banks are common place 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 can be defined as portable batteries that use circuitry to control any power in and power out. They can charged up using a USB charger when power is available, and then used to charge battery powered items like mobile phones and a host of other devices that would normally use a USB charger.

The name power bank can be likened to a financial bank where funds can be deposited, stored, and withdrawn when needed. These items are also often referred to as portable chargers, as they can charge items like mobile phones without the need to be connected to the mains during charging, although they will need to be charged, and this normally requires a mains charger.

TYPES OF POWERBANKS:

There are a few different types of power bank portable charger that can be bought. Obviously the size is one of the main criteria, but there are some other categories that can be considered.

Universal or standard power bank***:*** These are the normal power bank portable chargers which are available in the stores and online. They are charged from the normal USB sources like USB chargers.

Solar power bank: As 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.

As the solar charging is slow, they can also be charged from a USB charger as well. The solar charging is a useful back-up, especially if you are travelling away from mains power.

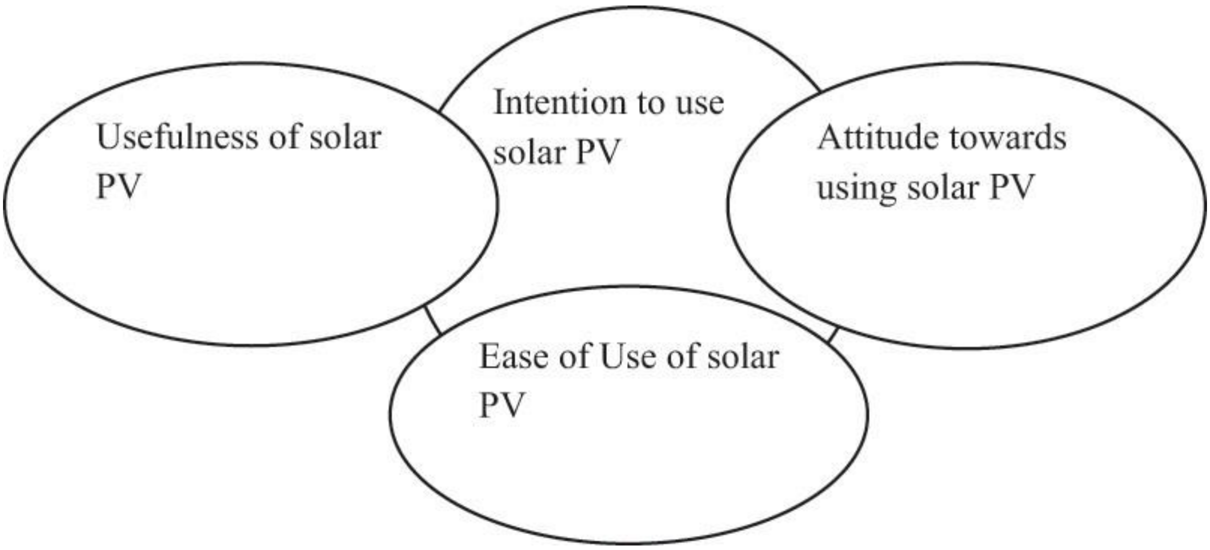


Figure: Zinc-air batteries used in solar powered banks.

ANALYSIS:

This paper analyzes about the potential power sources for sensor nodes. Analysis between power sources, such as batteries power and Solar cell power from energy harvesting for sensor node. In order to provide a general understanding of the various sources of power, the following metrics will be used for comparison in terms of energy and power density efficiency to generate power for the sensor nodes, the lower cost and also in terms of characteristics such as size and weight. Based on analysis and researches from other journal, the batteries have been the dominant form of power storage and delivery for electronic devices over the past 100 years, thus their consideration for use in sensor node is natural . So, the batteries are the main solution at present, but unless they can provide very long lifetime while not dominating the size or cost of the nodes, the battery will be a significant deterrent to widespread adoption of these technologies.

The primary batteries are perhaps the most versatile of all small power sources. The energy density for a few common primary battery chemistries. Meanwhile, the average power available from these battery chemistries versus lifetime. So, in many type of primary battery, zinc-air batteries have the highest energy density from others, although the battery lifetime is very limit and short.

The secondary or rechargeable batteries are commonly used in consumer electronic products such as cell phones, PDA's, and laptop computers. The rechargeable batteries also used as power sources in sensor node. Sometimes, the energy harvesting source on the node itself, such as a solar cell powered, would be used to storage power and recharge the battery. It gives the energy density a few common rechargeable batteries powered. One item to consider when using rechargeable batteries is that electronics to control the charging profile must often be used. These electronics add to the overall power dissipation of the device. Nevertheless, like primary batteries, the voltages are stable and power electronics between the battery and the load electronics can often be avoided .

The purpose of this paper is to classify the possible methods to provide power to the wireless nodes into three groups, such as energy stores in the nodes (like a battery), distributing power to the node (like wires), and collecting ambient power available at the nodes (such as solar cells). The basic stages of a sensor node. The sensor node that only can relay or receive data can skip functions such as sensing and analogue processing. The sensing block includes one or more sensors. Analogue processing matches the sensor output to the digital processor usually used a lower cost microcontroller and commercial transceivers also are used for wireless communication. Meanwhile, the power supply has to be provided to the different stages.

However, power can also be dominated by the sensor stage . So, new low-power sensors and electronic interfaces can help in the reduction of the power consumption of a sensor node. Furthermore, the power supply stage must be able to provide both the total energy demanded during the expected lifetime and the instant power at the activation time. A block diagram of the power supply of a sensor node. The load accounts for the sensing, processing and communication stages. The left three blocks will sense by solar cell powered from the harvesting energy or either the battery powered is used likes in dashed blue box. After that, the ensuing power conditioning stage will provides the appropriate power supply to the load. In addition, the batteries with the appropriate amount of energy must be used to avoid their replacement.

Commonly, energy harvesting and the solar cell power required the storage systems to help and provide power when the solar power cannot operate. The storage can provide and also store the power for sensor node. The rechargeable batteries are the common choice of energy storage for sensor node design . The rechargeable battery is a storage cell that can be charged by reversing the internal chemical reaction. A few popular rechargeable technologies like Sealed Lead Acid (SLA), Nickel Cadmium (NiCad), Nickel Metal Hydride (NiMH) or Lithium Ion (Li-ion). So, regarding to Table-1, Lithium-ion batteries have highest output voltage, energy density, power density and charge-discharge efficiency along with low
discharge rate. While, the NiMH and Li-based, emerge as good choices for using by solar powered of sensor nodes.

BASICS:

- The sun is a star made up of hydrogen and helium gas and it radiates an enormous amount of energy every second.
- Solar cell works on the principle of photovoltaic effect. Sunlight is composed of photons, or “packets” of energy
- These photons contain various amounts of energy corresponding to the different wavelengths of light.
- When a photon is absorbed, the energy of the photons is transferred to an electron in an atom of the cell.
- It runs on the power of the sun, converting solar to electrical and helps in charging the cell phones which can be used in communication.
- The solar energy is the energy obtained by capturing heat and light from the sun
- The method of obtaining electricity from sunlight is referred as the photovoltaic method.
- This is achieved using a semiconductor
- The other form of obtaining solar energy is through thermal technologies
- Solar energy refers to capturing the energy from the sun and converting it into energy

Although mankind has been aware that the sun has been providing heat and light to Earth for billions of years, it’s only recently that we have figured out how to make use of the sun’s power.

It was in 1954, where researchers at Bell Laboratories created the photovoltaic cell, which later evolved into solar cells that transform the heat of the sun into a usable source of energy. Many people, especially those who are concerned with the environment or simply want to cut back the costs incurred from using traditional sources of energy, have slowly adopted and welcomed the use of solar energy to give light to their homes (at night) and power their appliances. There are even solar powered water heaters for showers and swimming pools.

TOP 11 BEST SOLAR POWERED CHARGERS OF 2019:

The era of electronic gadgets is upon us and we find our phones and tablets requiring constant charging during our daily activities. Nevertheless, there are times when we are not in close proximity to a power outlet. Therefore, solar chargers come in handy. They are easy and efficient bearing in mind that they use the power of the sun to gain the energy used to charge our gadgets.

However, in order to have a solar charger that is efficient in its functions, there are various factors to look at. For starters, you must have the right kind of solar panels with the right wattage, optimal storage of the batteries, proper portability, a high level of durability, and efficient USB connections. Generally, we judge the efficiency of the solar chargers by their value and their performance.
Consequently, this article seeks to highlight the best of solar chargers to use.

1. CXLiy Portable Solar Charger 2500Mah

The has ultra huge capacity of 25,000mah & Water-Proof function that can be used more conveniently & solar charging panel that can absorb any light and then be transferred into electricity. The three Outputs that can be shared with your friends as well as two Inputs that can be charged by either Iphone Port or Android Port. A specific hook is used for hanging on the backpack so it will be convenient for those who are going for outdoor activities with backpack.

This is a perfect product for Traveling, Camping, BBQ and Outdoor activities. You need not to worry about your cellphone going out of power. Multiple Useful Flashlights Of Battery Pack: LED light can be used for illumination and SOS light. Color lights with fast frequency can be used for emergency lights also.

2.

Ayyie Solar Charger, 10000Mah Solar Power Bank

Ayyie portable solar charger is water-resistant, shock-resistant and dust proof solar phone charger, featured with compass and 2LED flashlight. It is awesome for outside activities such as camping, hiking and other emergency use. Built with Dual USB : 5V/1A, 5V/2.1A outputs are available for most digital equipment. It has dual USB ports so you can charge two devices simultaneously. An extra Compass whislter is included for emergency purpose.

It has five pilot lamps indicate the status of solar power bank timely. When charging the power bank by the solar panel, the green indicator will on, otherwise the blue indicator when USB charging. Perfect for outside activity as camping travel hiking constructions and many other emergency use. Let you charger anywhere in the world.

3.

Anker 21W Dual USB Power Port Solar Lite Charger.

This charger is home to dual USB ports thus can simultaneously charge two gadgets. Anker Company has a specialized technology known as power IQ and sun power panels that ensures the fastest conversion and charge of about 2.1 amps/15 watts. This translates to about 2 hours to charge a tablet and a smartphone simultaneously. The power IQ also adjusts the amperage of power supplied thus ensuring safety of the devices.

The solar panels are highly sensitive even under low light conditions such as shade where they still sense sunlight and provide about 8 watts. It has an overcharge system that ensures safety of the device. It offers outdoor durability owing to its panels which are sewn into polyester canvas that keeps it dust proof and shock proof. However, one should keep it away from rain or water since itis not entirely waterproof. It is also super light, of compact size and easily portable.

4.

SunJack 8000mAh Solar Charger.

It is regarded as one of the most powerful chargers. This is because it has 4 very efficient monocrystalline panels coupled up with two USB ports which translate to 2 amps per port. Moreover, it has two batteries of 8000mAh which translates to a power of 16000mAh rivalling the Jetsun in that category. It also has a small in-built IC chip that ensures the charger is able to identify the gadget and optimize on the current.

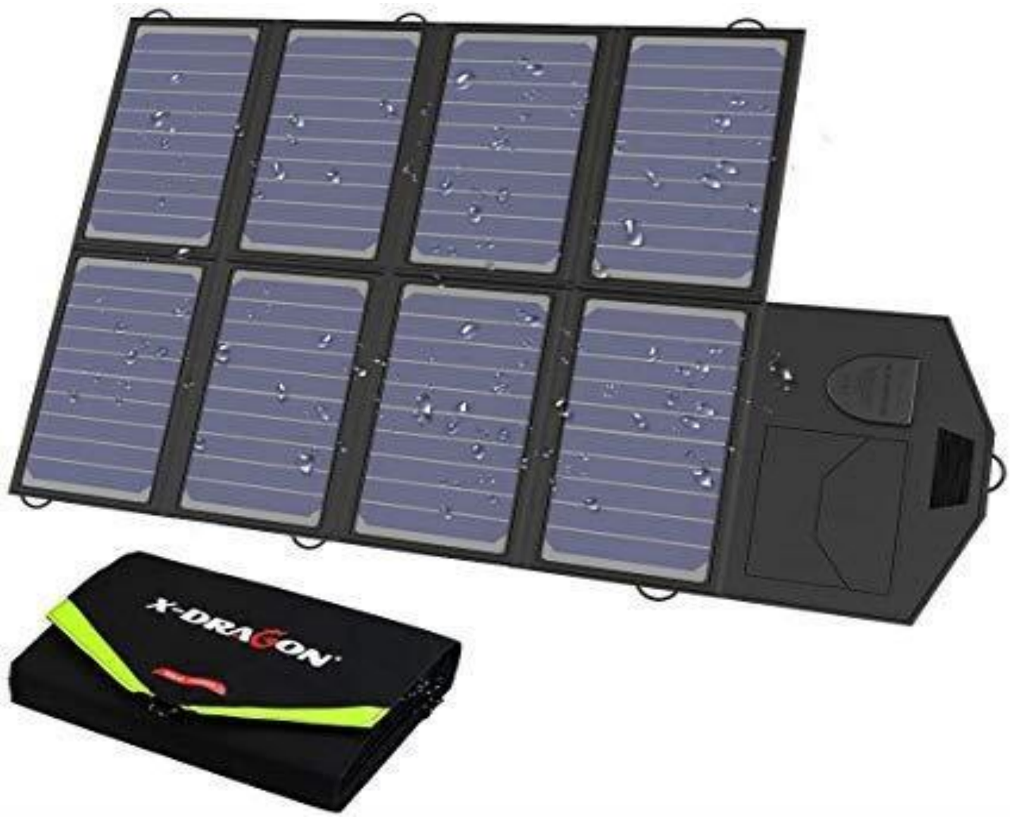
In addition, this power means that it can charge up to 8 gadgets before recharge. In-built is an over-charge system that protects the device. Unlike most of the powerful power chargers that take about 2 hours to charge a gadget, the SunJack takes less than 90 minutes to do so to 100%. It has an advantage over the Jetsun and other chargers since it takes roughly 5 hours to charge fully. It exhibits similar outdoor characteristics since it is dustproof and shock proof and has been used in military expeditions

5.Yolk YKSP 5W Solar Paper.

Its unique design and weight of 4 ounces makes it the world's lightest and thinnest solar charger in the world. It is so thin and compact that it can fit between the pages of a notebook. Each of its panels' boast of 2.5W and aids in charging any device. Its size means that it is very portable. It has one port unlike most powerful chargers.

The Yolk has an in-built LCD screen to display the flow of current being delivered. It rivals the Wildtek in being waterproof with a waterproof rating of IP64. Again, there is an automatic reset for when weather conditions change from cloudy to sunny or vice versa. Also, the charger has strong magnets that are attached to the panels and ensure that there is extra power.

6.X-Dragon Sun Power Solar Charger.



It has high amperage with a 10,000mAh polymer battery and is charged by 3 polycrystalline solar panels of 1.2W each. Like most powerful chargers, it has two USB ports. However, these ports differ in surge of power with one being 5V/2A, for small gadgets and the other with a higher surge of power at 18V/2A for charging slightly more powerful gadgets like laptops.

Also, it possesses an in-built LED light, which means it can be used as a flashlight. Its exterior is made of leather sheath and ABS to prevent shocks and drops when exposed to rough conditions. It is also water resistant with inclusion of rubber seals on its ports. The X-Dragon is slim and thus, very portable.

7.Voltaic 20W Solar Charger.

It boasts of the one of the highest amperage with 19,800mAh worth of a battery. The power surge in this charger is better than that of the SunJack since it can fully charge a smartphone for about an hour. In addition, the Voltaic Charger can charge a laptop fully. The power of this charger is so great that once full, it can charge a laptop, two iPads and seven smart phones all to 100%. As such, it is quite bulky as a unit but still portable. It has 73W solar cells responsible for conversion, it is foldable, and waterproof.

8. Dizual 5000mAh Portable Solar Bank.

It has two USB ports, which make it possible to charge two devices simultaneously. It also waterproof and shock proof thus durable and suitable for rough conditions. Moreover, it is easily portable. It has an in-built LED light that ensures it can function as a flashlight and shows the level of charge available during charging and when the charge is getting depleted. It is ideal for phone charging and can charge a phone for two hours to 100%.

9. BESWILL 10000MAH Solar Phone Charger.

BESWILL solar charger has built in 10000MAH battery, the solar changer with solar energy technology & environmentally friendly, so that it can recharge under the sun. Has Dual USB Ports:5V/1A&5V/2.1A outputs allow you to charge two devices at the same time, work well for your iPhone, tablets and other electronics devices.

The solar phone charger not only equipped with a hanger, but also a compass. The hanger is good for hanging on your bag when you in your trip. With a compass of the power bank, there is no need to worry about missing our direction when you’re outside. It has five pilot lamps indicate the status of power bank timely. When charging the power bank by the solar panel, the green indicator will on, otherwise the blue indicator when USB charging.

10. Goal Zero Venture 30 Solar Panel Kit.

The kit is home to two products working simultaneously. These are the Nomad 7 solar panel and the Venture 30 battery. The battery has amperage of 7800mAh with the addition of 7W from the 7 panels. Furthermore, the batteries are rechargeable, which enables travellers to have back up batteries fully charged. The charger is one of the most durable chargers owing to the fact that it is waterproof and rugged.

Unlike the other waterproof chargers, the Goal Zero does not need rubber plugs at its charging points. It has dual USB ports high speeds of 4.8A for fast charging. As a result, it can charge smartphones for just under an hour. It also boasts of an in-built LED light to ensure that there is provision of light in the form of a flashlight.

11. Solar Charger RAV Power 24W Solar Panel with Triple USB Ports.

The RAV Power 24W solar panel is a solar powered portable charger that utilizes the sun’s rays to charge your smartphones and tablets. The 24W solar charging technology increases the efficiency of charging by up to 21.5% – 23.5%. You can power your portable devices from sunrise to sundown whenever you are outside.

All three USB ports are equipped with iSmart technology, which automatically detects and delivers the optimal charging current for connected devices; up to 2.4A per port or 4.8A overall when used under direct sunlight. Smart IC frequency technology detects and evenly distributes output current to all three USB ports ensuring every device is evenly charged.

Power bank lifetime:

There are two main forms of lifetime that are associated with power banks.

- Charge discharge cycles***:*** Any rechargeable battery will gradually wear out. Normally the lifetime of a battery is quoted in terms of the number of charge discharge cycles it can undergo before its performance falls by a given degree. Some cheaper power banks may only have a life of 500 or so charge discharge cycles, but better ones will have lifetimes of many more charge discharge cycles.
- Self discharge time***:*** All battery cells, whether rechargeable or primary have a certain level of self discharge. For rechargeable batteries these days with their own control circuitry, a small amount of power is required to keep these circuits alive. As a result there is only a finite time that a battery will remain charged.

  A good power bank can hold charge for up to 6 months with only a small loss of charge, but lower quality ones may only retain a useful charge for about a month. These figures are for room temperature, but storing them outside these temperatures considerably reduces their performance.

POWER BANK BATTERY TECHNOLOGY:

All power banks use rechargeable batteries based around lithium technology. Lithium-Ion and Lithium-Polymer batteries are most commonly used for power banks but don’t be surprised if other types start to hit the market before long. Battery technology is key to many new developments: everything from mobile phones to electric vehicles, and as a result it is quite likely there will be some spin-offs into power banks.

The two technologies that are currently used have slightly different properties:

- Lithium-ion: Lithium-Ion batteries have a higher energy density, i.e. they can store more electrical charge in a given size or volume, and are cheaper to manufacture, but they can have issues with ageing.
- Lithium-polymer ***:*** Lithium-polymer power banks do not suffer from ageing to the same extent so are a better choice. However they are more costly to manufacture and as a result they may not suit all budgets. Sometimes it may be that it is best to spend less, especially if they are likely to be accidentally lost or left in places.

FUTURE USE OF SOLAR ENERGY:

The immense global energy flux from the Sun makes it the prime candidate for future sustainable energy production. Both solar thermal energy and solar PV conversion involve technologies that can be deployed on personal through community to regional scales, using both simple and advanced technologies. You have probably seen solar PV panels that power automatic roadside weather stations and other low-drain communications systems. The panels require low maintenance and usually charge batteries to allow them to remain operational during the night. In poor countries where the energy infrastructure is rudimentary or absent, PV systems hold out great potential. An important use is for daytime pumping of water from wells.

In its 1997 renewable energy plan, the EU set a target of half a million villagescale direct solar systems to be deployed in developing countries and a similar number in European houses by 2010. The United Nations has asked world governments to deploy 4.5 GW of solar PV electricity generating capacity in developing countries by 2012. Both Japanese and German governmental subsidies have boosted both photovoltaic production and deployment, and a similar 'hard-sell' stems from commercial sources in the US. As a result, power capacity of solar PV rose from a global 50 MW in 1995 to over 2 GW in 2002, and is estimated to be growing at a rate of 40% per year. The main hindrance to greater deployment is simply that of cost; at between US$ 0.2 to 0.5 per kWh, solar PV electricity was almost ten times as expensive in 2005 as that from the cheapest fossil-fuel source, natural gas. To progress, the technology requires continued reduction in the cost of the solar cells themselves - but the enormous reduction in cost of silicon-based computer hardware since the 1970s is cause for optimism.

Solar PV could theoretically supplement grid-power during daylight hours to reduce generating costs and environmental emissions. However, at this scale serious disadvantages emerge. The daily intensity of sunlight varies dramatically because of cloud cover. Moreover, solar power is greater in the summer while the demand for electricity is lower, except in areas with high use of air conditioners. Provided photovoltaic conversion contributes no more than 10-20% of the total amount of electricity in the grid, its integration seems feasible. This is because electricity grid systems are designed to cope with large variations in demand, and they can cope equally well with fluctuations from different forms of supply.

Should future solar PV power rise above 20% of the total electricity supply, then existing grid systems built to be dominated by coal, oil and nuclear generation would have to be modified. This is because conventional power plants are slow to start up and shut down; they are **slow-response systems**.

Solar conversion, along with other alternative sources whose power source fluctuates uncontrollably (e.g. wind and waves), is a **fast-response system**. A distribution grid with solar PV power as a major component would need to be supplemented by *controllable* fast response systems, principally hydroelectric and gas-turbine generators. Another solution would be short-term electrical storage installations, but they are both costly and inefficient. A means of 'having one's green cake and eating it', however, would be to use electricity from solar PV to generate hydrogen by electrolysis of water. Hydrogen gas is combustible, storable and moveable, and so avoids most of the problems associated with electrical storage. The hydrogen could even be converted back into electricity using fuel cells.

Despite these caveats, the potential of solar PV is enormous. If photovoltaic conversion with 10% efficiency was installed over an area of 500 000 km^2 (about 1.3% of the area of tropical deserts) humanity's present energy requirements would be met. That outlook is probably far off. Of the electricity generated from all alternative energy sources in the early 21st century, solar PV contributes only about 0.02%, with solar thermal generation a little more significant at 0.06%.

ADVANTAGES:

A solar battery charger is a device used to avoid using power source for charging. They are easy to use and you do not have to pay a lot of attention. This charger has solar panels to collect power from the sun and convert into electricity. The main advantage of using a solar battery charger is that it can be used to store energy, which can be used later when sun is not available on a wet or cloudy day. You can charge the battery of your cell phone without taking them out in the sun. You can store the solar energy in the solar charger during the day and can use it at night to charge your phone.

You can easily store and hold a solar phone charger. There is an AC outlet in this charger and it can used to charge the battery of your phone. You can also use this charger for charging other devices that need power such as laptops, iPad, tablets, etc. You can place this charger at a safe place where it can be exposed to the maximum sunlight. You can select a suitable charger as per your needs. The number of solar panels available on the charger determines the amount of power it can store. The specifications of the charger also depend upon the device that you want to charge.

A solar charger is portable and you can easily carry it anywhere to charge the battery of your device. The main benefit of using this charger is that you do not require an external power source to charge your device. It is extremely handy for outdoor activities. You can carry it along with when you are going out with friends on a picnic or a party. Thus, you can remain connected with your friends and family members when you are out of home and do not have a power source to charge your devices by using this unique charger.

A solar power charger will also help in converting the energy from the sunlight into solar energy. A portable solar power charger will make use of solar power for the purpose of recharging. Mobiles and laptops are some of the most common appliances which can be recharged by making use of solar power battery chargers.

A lot of advantages can be gained by deciding to make use of solar power. The most important benefit of a solar power panel is that people can learn to use it

CONCLUSION:

In this project we designed and implemented an MPPT charge controller circuit from scratch. The main goal was to deliver power from an array of solar panels to a Li-ion battery in order to charge it. To obtain charging efficiency, we set up a maximum power-point tracking circuit that would ensure that the greatest amount of power is delivered to the battery. The Buck-converter was used to regulate the voltage delivered to the battery. Since the solar panels generate a much higher voltage than what the battery requires to reach full charge, the Buck-converter performs voltage step-down.

We optimize our Buck-converter by choosing inductance and capacitance values so that the power is maximized at near 4 V, which is the perfect voltage for charging the 3.7 V Li-ion battery. Combined with our charge controller, which decreases the amount of voltage flowing into the battery as the battery voltage approaches 3.7 V, our battery will never be overcharged. The USB Port and adapter prevent the battery from over discharging, as it shuts down when the battery voltage gets too low to power it.

The Arduino Uno microcontroller is the heart of this circuit, providing the PWM and the sensing capabilities that allow for MPPT and charge control. It is powered by the solar panels, thus taking away the need for more power sources. Our project successfully demonstrates how harnessing solar energy can be used to charge devices with a USB connect capability at a low cost. This project provides a potential solution to the very real problem of needing to charge personal devices, such as mobile phones, iPods, iPads, etc. – on the go.

In order to make the battery charger design presented here more realistic, it is necessary to add various protection methods. In the future, we hope to equip out current design with thermal sensors that will allow the detection and prevention of overheating. Once those are in place, the most logical progression of this project would be to transfer the components to a solder-able circuit board, for compactness and easier packaging and transport. Last but no least, we would want to a solar panel package that can be easily attached and detached from backpacks, purses, and other carry-on items to allow users to charge their devices on-the-go.

Solar power is an immense source of directly useable energy and ultimately creates other energy resources: biomass, wind, hydropower and wave energy.

Most of the Earth's surface receives sufficient solar energy to permit low-grade heating of water and buildings, although there are large variations with latitude and season. At low latitudes, simple mirror devices can concentrate solar energy sufficiently for cooking and even for driving steam turbines.

The energy of light shifts electrons in some semiconducting materials. This photovoltaic effect is capable of large-scale electricity generation. However, the present low efficiency of solar PV cells demands very large areas to supply electricity demands.

Direct use of solar energy is the only renewable means capable of ultimately supplanting current global energy supply from non-renewable sources, but at the expense of a land area of at least half a million km

Both forms of power bank work well, but it is a balance between cost and performance.

The cardboard pattern was used to construct the Solar Power Bank (SPB)-case using 4 x 3 mm thick aluminium plate. The bending of the thick aluminium plate for the solar collector and battery compartments was carried out via a bench vice and later the plate was hammered into shape. The aluminium plate was acquired and marked out to the necessary size according to the specifications. The desired shape was cut out before it was folded to the required shape with length of 1120 mm and breadth of 910 mm. The aluminium plate is a very vital component in this model due to the qualities such as; high tensile strength and good The cutting process was performed with the use of hacksaw tool. Subsequently, holes were drilled on the aluminium plate through the use of a pillar drilling machine and 4 mm drill bit. The holes are necessary for 5 mm bolts and nuts to be used for the fitting of the structure. The finishing touches to the device were the joining of the solar collector and battery compartment. The fixing of plastic air trapper and a digital temperature sensor was the last step of the construction . A 3 mm and 4 mm glass was used for the surface of the SPB device ,thermoelectric converters were used.

The cool side of the thermoelectric module was placed on a white insulator with considerable thickness to keep the cold side of the thermoelectric module minimally cool to ensure that there is a differential in the operational temperature of both sides of the thermoelectric module Fig. (1). This idea partially explains the mathematical representation in equations 1 and 2. This cooling approach may not be the best but we are more interested in the construction of a low-cost solar power saving device. Obviously the work is still ongoing. After the construction of the solar thermoelectric generator, some readings were taken for some days using a multimeter and digital thermometer. The parameters include the temperature in the solar chamber and total voltage generated by the TEG modules.

RESULTS:

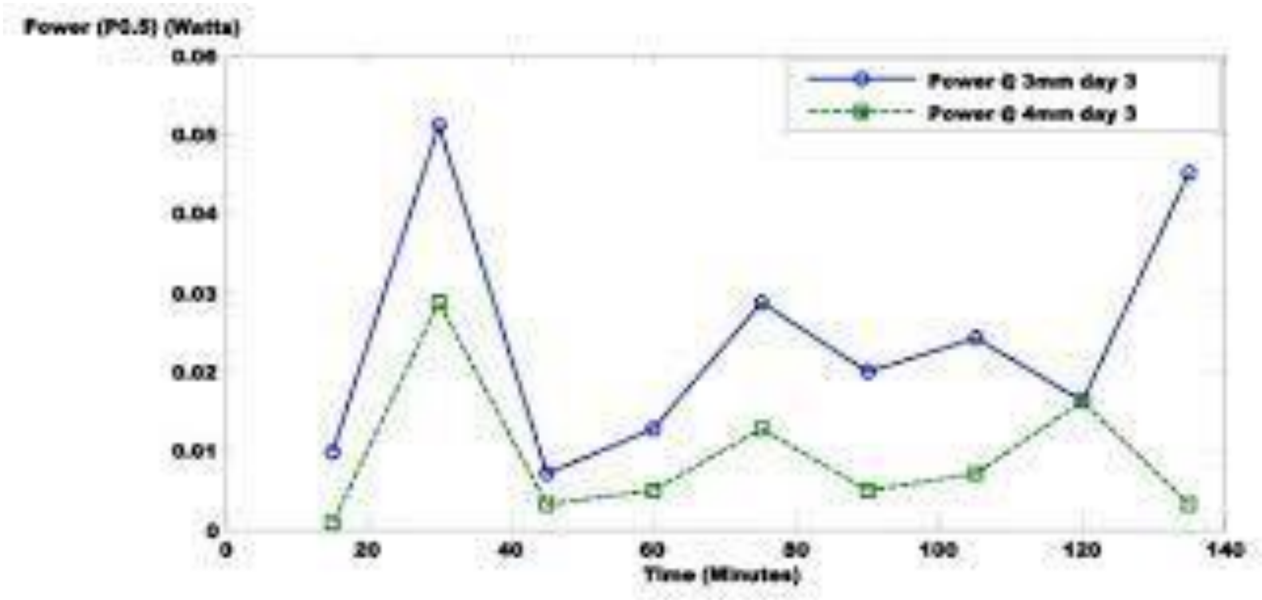


Figure: Time versus Power Graph of Solar Power Bank

Graphs provide information about the real world; in this case they show the amount of power (measures in watts W and kilowatts kW) that a solar panel array generates. Graphs can be generated by data that is given in a table. 2. When a graph represents a physical quantity, the area under the graph can have an important contextual meaning; in the case of the graph of power vs time, the area under the graph gives the energy generated by the solar panels. 3. Units are important in real world problems and keeping track of units can help one better understand math concepts. 4. The area under a curve can be approximated by adding up the areas of geometrical shapes.

REFRENCES:

1] Chih-HaoHou Chun-Ti Yen Tsung- Hsi Wu Chin-Sien Moo, “A Battery Power Bank of Serial Battery Power Modules with Buck-Boost Converters”, The 2014 International Power Electronics Conference, pp. 211-216, 2014.

↵ In article

[2] Ke Liu, John Makaran, “Design of a solar powered battery charger”, Electrical Power & Energy Conference (EPEC), 2009 IEEE, 2009, pp. 1-5.

↵ In article

[3] Sangyoung Park, Bumkyu Koh, Yanzhi Wang; Jaemin Kim, Younghyun Kim, Massoud Pedram, Naehyuck Chang,“Maximum power transfer tracking in a solar USB charger for smartphones”, Low Power Electronics and Design (ISLPED), 2013 IEEE International Symposium, pp. 88-93.

↵ In article ~~View Article~~

[4] Kevin Otto & Kristin Wood, Product Design –Techniques in Reverse Engineering and New Product Development, 4th ed. Noida (U.P): Pearson Education, 2014, pp. 51-409.

↵ In article

[5] K.Jaiganesh, K.Duraiswamy, “Dump Power Control Techniques for standalone Hybrid Wind / Solar Power Generation Control”, 2012 - International Conference on Emerging Trends in Science, Engineering and Technology, pp. 422-428.

↵ In article ~~View Article~~

[6] AtmelAVR. Wikipedia. Retrieved 12 February, 2016, from https://en.wikipedia.org/wiki/Atmel_AVR.

↵ In article

[7] Solar panel. Wikipedia. Retrieved 14 February, 2016, from https://en.wikipedia.org/wiki/Solar_panel.

↵ In article