UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SOLAR MULTIPURPOSE POWER SUPPLY

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Industrial Electronics) (Hons.)

by

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This report is submitted to Faculty of engineering technology of UTEM as a partial fulfilment of the requirement for the degree of bachelor of engineering technology (Industrial Electronic) with honour. The member of the supervisory committee is as follow:

……

(Project Supervisor)

ABSTRAK

Solar bekalan kuasa adalah satu alat elektronik yang boleh dicas dengan menggunakan palam dinding (240 voltan) dan cahaya matahari (sistem solar) . Panel solar akan mengumpul tenaga daripada cahaya matahari dan menukarkannya kepada tenaga elektrik. Negara-negara di bawah khatulistiwa yang paling sesuai untuk projek ini, ia kerana keamatan cahaya matahari yang konsisten. Fungsi bekalan kuasa ini adalah untuk mengecaskan semula alat-alat elektronik. Terdapat banyak produk elektronik mudah alih, semua alat elektronik itu perlu menggunakan bateri untuk berfungsi. Tetapi bateri yang terbina dalam alatan elektronik itu adalah pada kapasiti yang rendah, dengan projek ini masalah kekurangan bateri boleh diselesaikan. Terdapat dua keluaran yang dijana daripada bekalan kuasa ini, 0.5A untuk telefon bimbit dan 2.1a untuk tablet. Solar bekalan kuasa boleh disambungkan dengan beberapa jenis kabel seperti Universal Serial Bus (USB) kabel , kabel untuk telefon bimbit dan peranti mudah alih seperti peranti MP3 atau permainan mudahalih. Sementara itu produk ini juga boleh digunakan luar kerana ia mudah dibawa dan mudah digunakan. Hasil daripada projek ini, produk ini akan mengecas telefon kita tanpa merosakkan peranti. Solar bekalan kuasa boleh menguntungkan kepada pengguna pada masa akan datang kerana ia boleh cas semula dengan menggunakan sumber bebas iaitu kuasa solar.

ABSTRACT

Solar multipurpose power supply is an electronic device that can be recharge by using wall plug (240 volt) and sunlight (solar system). The solar panel will collect the energy from the sun and convert it into usable electrical energy. Countries below the equator are most suitable for this project, it is because of a consistent among of sunlight. The function of this power supply is to charge electronic devices. There are many portable electronic product in world, all have to use batteries for functioning it. But the batteries for built-in battery are low capacity, with this project the lack of batteries problem can be solved. There are 2 output that generate from this power supply, 0.5A for the cell phone and 2.1A for the tablets. This solar multipurpose power supply can be detach with several type of cable such as Universal Serial Bus (USB) cable, cable for general mobile phone and portable device such as MP3 or Sony PSP. Meanwhile this product also can been used outdoor because it easy to carry and easily. From the result of the project, this product will charge our cell phone without damaging the device. Solar multipurpose power supply can be profitable to consumers in the future because it can be recharge by using free source namely as solar power.

ACKNOWLEDGEMENT

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternate current
DC	-	Direct current
V	-	Voltage
A	-	Ampere
mA	-	Milliampere
P	-	Power
IC	-	Integrated circuit
LiOn	-	Lithium-ion
NiMH	-	Nickel-metal hydride
NiCd	-	Nickel-cadmium
>	-	More than
<	-	Less than

CHAPTER 1
INTRODUCTION

In the past, cell phone is an accessory that some of the wealthiest but today cell phone is a basic needs of life not just for people who are working but even to among of students. Communication is an important factors to facilitate questions and spreading news or information. The effect of increased cell phone user many companies such as Nokia, Samsung, Motorola and Sony develop new product that affordable by consumers of all ages.

All kind of device require supply such as batteries to generate it's, however the charge or electron in the batteries will decrease when it been used. When the electron in the batteries are lacking or approaching to zero the batteries need to recharge so that the electron in the batteries will restore and the cell phone will able to function again. Normally, method that been used to recharge utilize by wall plug which is 240V alternating current (AC). This high voltage will step-down to 5V to 8 V depend on the cell phone.

The focus of this project is to build a portable power supply that charge the cell phone and it can be recharge by using wall plug and solar energy. This method can generate electric current by converting the solar energy. Malaysia is located below the equator, so this project is highly recommended. It is because of the very consistent sunlight intensity.

Application that using solar energy are growing rapidly, many research state that solar energy is a clean energy and it produce great outcome. Besides that, this solar energy is an alternative energy sources that economical and can be used for long period of time.

1.1 Problem Statement

Cell phone is one of the most best-selling device on the market today, it would be difficult to imagine what life would be like without the cell phone. Well known all cell phone had to recharge the batteries when the electron inside it decreasing or approaching to zero.

Normally the method that been used to recharge the cell phone is wall plug charger, this charger step-down the output voltage from 240V to 5V till 8V and change the current to DC from AC. These method works effectively but it's occur some problem when there have no electricity supply or the cell phone are needed when emergency.

To overcome this problem, the idea is to make a portable power supply that can be recharge by using wall plug or solar energy. This project are very suitable for country that receive 12 hours consistence among of sunlight. This product should be built in portable so that it can be placed anywhere such as in car, in camping area or in other word it must be easy to carry and used.

1.2 Objective

The main objective of this project is to understand the concept of solar panel and what the value that can it's generate and make a portable power supply that can be recharge by using wall plug and solar energy with better life expectancy.

Other objective of this project is to learn the all type of Direct current (DC) to DC converter and try to apply on this project. So that the output from the solar panel can be simulate to become a desire output.

Last objective is to learn about varies type of battery that suitable for this project. The battery must be small and easy to carry.

1.3 Scope

This project focus on innovative of the idea from a device that called "Power Bank". The main innovative of this project is solar panel. It is use to recharge the power supply besides using wall plug. Some research state that there shall occur some problem when this two circuit are combined. Apart from that a voltage regulator should be built so that the output voltage is suitable to the power supply. The selection of the right components also emphasized so that it can produce better circuits

CHAPTER 2
LITERATURE REVIEW

This chapter discuss on the overall project theory and concept. The purpose of this literature review is to explain the components and method that is used in this project. Moreover, this chapter will show the theory and concept used to build this product. This reviews based on journals, books and the internet as reference.

2.1 Solar Power

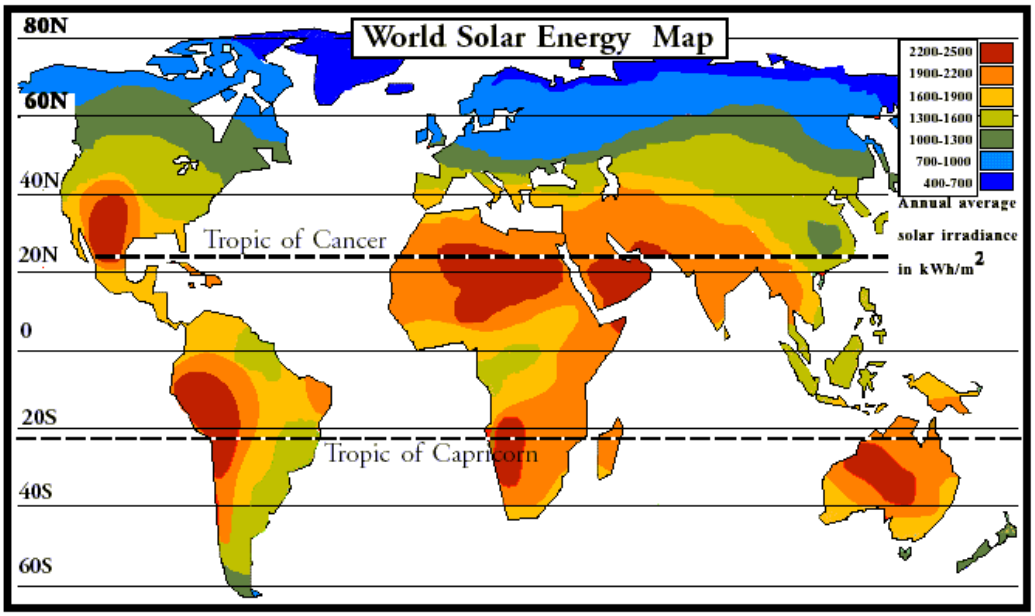

Figure 2.1: Rates of Solar Power

Solar power is the technology of obtaining usable energy from the light of the sun. Solar energy has been used in many technologies for centuries and has come into widespread use where other power supplies are absent, such as in outdoor locations and in space. Solar energy is currently used in a numbers of application. Figure 2.1 shows the rates of solar energy around the world. In equatorial line are the best area to utilize the solar power.

2.1.1 Advantages of Solar Power

Environmentally friendly

- Renewable energy source.
- It is a clean energy source, no potential damage to the environment.

Cost

- Solar energy is free and is available to all.
- Because of the improvement in the technology, the solar equipment's are getting cheaper

Independency

- Solar energy is available to all at fairly equal manner, unlike fossil or fuel sources, which are concentrated at some locations only
- This fact provides a chance that an individual can generate his/her own energy depending on the requirement, at his/her place of choice. Solar system therefore can be used in remote areas.

2.2 Solar Panel

Solar panel is an assembly of the solar cells. Solar panel use light energy from the sun to generate electricity through the Photovoltaic effect. Photovoltaic effect is the creation of voltage or electric current in a material upon exposure to light.

Figure 2.2: Solar Panel

2.2.1 Solar Cell

Solar cell is the basic building block of solar panel. The solar cell are made up of semiconducting material silicon

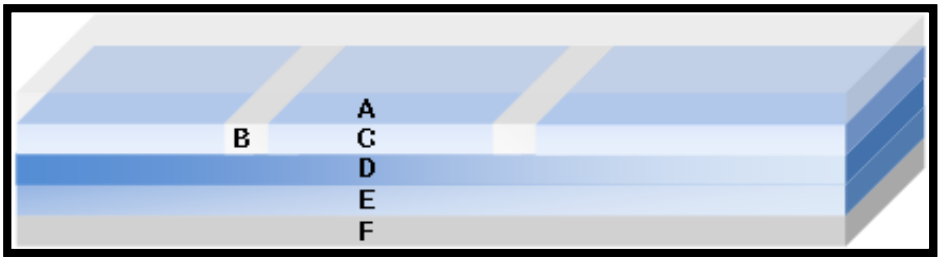

Figure 2.3: Solar Cell Structure

(A) Encapsulate - The Encapsulate, made of glass or other clear material such clear plastic, seals the cell from the external environment.

(B) Contact Grid- The contact grid is made of a good conductor, such as a metal, and it serves as a collector of electrons.

(C) The Antireflective Coating (AR Coating) - Through a combination of a favourable refractive index, and thickness, this layer serves to guide light into the solar cell. Without this layer, much of the light would simply bounce off the surface.

(D) N-Type Silicon - N-type silicon is created by doping (contaminating) the Si with compounds that contain one more valence electrons than Si does, such as with either Phosphorus or Arsenic. Since only four electrons are required to bond with the four adjacent silicon atoms, the fifth valence electron is available for conduction.

(E) P-Type Silicon- P-type silicon is created by doping with compounds containing one less valence electrons than Si does, such as with Boron. When silicon (four valence electrons) is doped with atoms that have one less valence electrons (three valence electrons), only three electrons are available for bonding with four adjacent silicon atoms, therefore an

incomplete bond (hole) exists which can attract an electron from a nearby atom. Filling one hole creates another hole in a different Si atom. This movement of holes is available for conduction.

(F) Back Contact - The back contact, made out of a metal, covers the entire back surface of the solar cell and acts as a conductor.

2.2.2 Photoelectric Effect

Photoelectric Effect is emitting of electrons by a matter when hit by photons. The photon's energy transfers to the valence electron of an atom in the n-type Si layer. That energy allows the valence electron to escape its orbit leaving behind a hole. In the n-type silicon layer, the free electrons are called majority carriers whereas the holes are called minority carriers. As the term "carrier" implies, both are able to move throughout the silicon layer of the solar cell, and so are said to be mobile. Inversely, in the p-type silicon layer, electrons are termed minority carriers and holes are termed majority carriers, and of course are also mobile.

The p-n junction:

The region in the solar cell where the n-type and p-type Si layers meet is called the p-n junction. As you may have already guessed, the p-type silicon layer contains more positive charges, called holes, and the n-type silicon layer contains more negative charges, or electrons. When p-type and n-type materials are placed in contact with each other, current will flow readily in one direction (forward biased) but not in the other (reverse biased). An interesting interaction occurs at the p-n junction of a darkened solar cell. Extra valence electrons in the n-type layer move into the p-type layer filling the holes in the p-type layer forming what is called a depletion zone. The depletion zone does not contain any mobile positive or negative charges. Moreover, this zone keeps other charges from the p and n-type layers from moving across it.

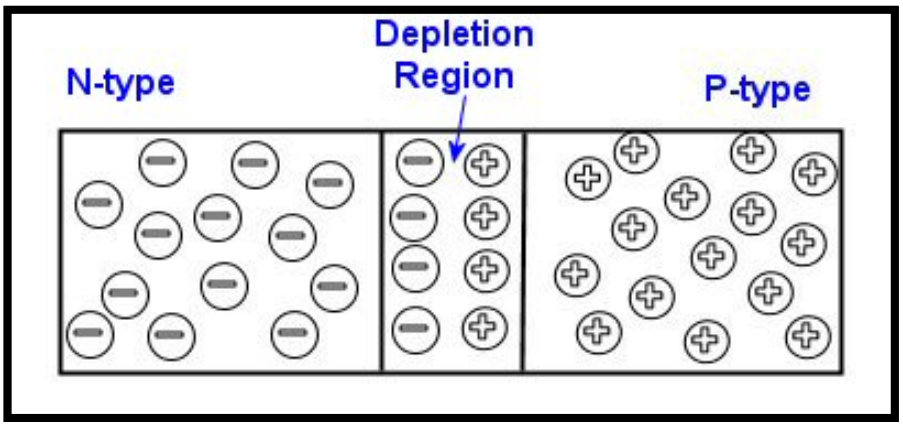

Figure 2.4: Repletion Region

When photons hit the solar cell, freed electrons (-) attempt to unite with holes on the p-type layer. The p-n junction, a one-way road, only allows the electrons to move in one direction. If we provide an external conductive path, electrons will flow through this path to their original (p-type) side to unite with holes.

The electron flow provides the current (I), and the cell's electric field causes a voltage (V). With both current and voltage, we have power (P), which is just the product of the two. Therefore, when an external load (such as an electric bulb) is connected between the front and back contacts, electricity flows in the cell.

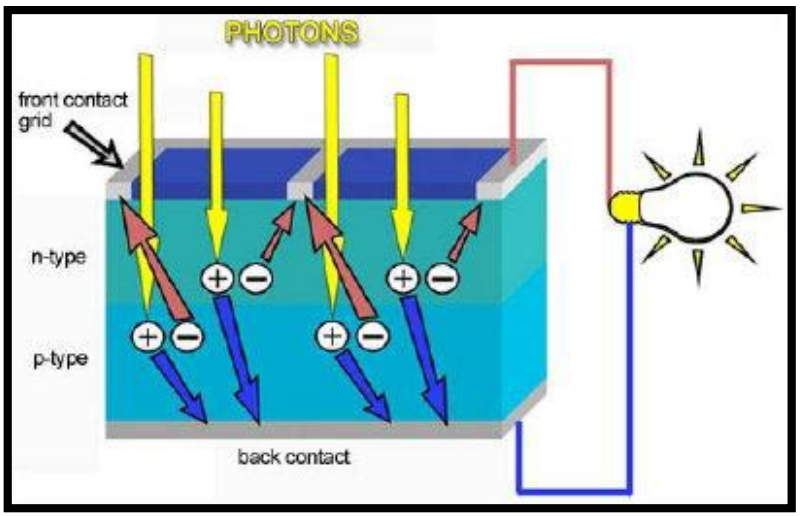

Figure 2.5: Example of solar cell produces electric energy

2.3 Rechargeable Batteries

Figure 2.6: Rechargeable Batteries

A rechargeable battery is a battery that can be recharged and used many times over. It is otherwise known as a storage battery because it is able to accumulate and store energy which then becomes available to the user when he puts the battery to use. A rechargeable battery is sometimes referred to as a secondary cell as well, which is opposed to the non-rechargeable variety which is a primary cell.

When a battery is discharged, it goes through electrochemical changes. In a non-rechargeable battery, these changes are irreversible. A rechargeable battery, however, has the ability to efficiently reverse the chemical changes that occur during discharge when electric energy is applied to it. In this manner, it is restored to full charge and fit for use once again.

The ability for reverse reaction, however, is not the sole characteristic of a rechargeable battery. It must also be able to undergo the reverse reaction both efficiently and safely many times. For example, some batteries can be recharged but because the chemical reactions are not completely reversed, they are only able to undergo the recharging process a few times, and their performance each successive time is less efficient. In addition, dangerous gases are sometimes built up, causing explosions or ignition either during or after recharging.

One of the first applications for rechargeable batteries was the car battery. Today, many electronics use rechargeable batteries, among them cellular phones, laptops, MP3 player, video cameras, and cordless power tools. In fact, many modern products are designed to only use rechargeable batteries.

2.3.1 Type of Batteries

Non-rechargeable batteries, or primary cells, and rechargeable batteries, or secondary cells, produce current exactly the same way: through an electrochemical reaction involving an anode, cathode and electrolyte. In a rechargeable battery, however, the reaction is reversible. When electrical energy from an outside source is applied to a secondary cell, the negative-to-positive electron flow that occurs during discharge is reversed, and the cell's charge is restored. The most common rechargeable batteries on the market today are lithium-ion (LiOn), though nickel-metal hydride (NiMH) and nickel-cadmium (NiCd) batteries were also once very prevalent.

2.3.1.1 Lithium-ion (LiOn)

Li-ion batteries are becoming more and more popular. They have a very high energy density allowing them to power the huge range of electronic devices that fill our modern lives. Li-ion batteries also have very good charge retention and can be recharged over a thousand times.

The downside is they are more expensive than NiMH batteries and because Lithium is such a volatile element the devices they power have to include protective circuitry. More advanced Lithium batteries using slightly different chemicals are being developed all the time. One example are Lithium polymer (Li-pol) batteries that use the electrolyte in a solid state. Li-pol batteries are much more robust than Li-ion batteries making them popular in RC model vehicles.