IMPLEMENT SOLAR POWERED NOTEBOOK

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This thesis is submitted as partial fulfillment of the requirements for the award of the Bachelor of Electrical Engineering (Power Systems)

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June 2012

ABSTRACT

A notebook integrates most of the typical components of a desktop computer, including a display, a keyboard, a pointing device (a touchpad, also known as a track pad, and/or a pointing stick) and speakers into a single unit. A notebook can be used away from an outlet using a chargeable battery. Usually, notebook is powered by AC supply from single phase 240V. When the notebook is depending on the AC supply, it cannot recharge whenever in rural area where there is no AC supply. In this project, the solar powered notebook that implement solar energy is represented in order to give supply to a notebook. The solar notebook concept is a laptop with complete power independent. This is due to powerful batteries that are recharged by any solar panel attached to the computer. The solar panel that attached to the notebook is able to convert solar energy to DC power that can give power to the notebook. It is expected that the notebook can switch on without AC power as it energized by solar energy.

ABSTRAK

Komputer riba mengintegrasikan komponen tipikal komputer, termasuk skrin paparan, papan kekunci, peranti penuding (touchpad, yang juga dikenali sebagai pad trek, dan / atau kayu menunjuk) dan pembesar suara ke dalam satu unit. Komputer riba boleh digunakan dari alur keluar menggunakan bateri yang boleh dicas semula. Biasanya, komputer riba dijanakan oleh bekalan arus ulang alik (AU) dari satu fasa 240V. Apabila computer riba bergantung kepada bekalan AU, ia tidak boleh dicas semula bila-bila masa di kawasan luar bandar yang tiada bekalan AU. Dalam projek ini, komputer riba yang dikuasakan oleh solar akan memberi bekalan kuasa kepada computer riba ini. Konsep computer riba ini menggunakan kuasa yang tidak bergantung kepada mana- mana sumber. Ini adalah disebabkan oleh bateri berkuasa yang boleh dicas semula dari panel solar yang dipasang pada komputer riba. Panel solar yang dipasang ke computer riba ini mampu untuk menukar tenaga solar kepada kuasa arus terus (AT) yang boleh memberi kuasa untuk komputer riba ini. Dijangka bahawa komputer riba ini boleh digunakan tanpa kuasa AU kerana ia dijana oleh tenaga solar.

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CHAPTER 1

INTRODUCTION

1.1 Background

A notebook integrates most of the typical components of a desktop computer, including a display, a keyboard, a pointing device (a touchpad, also known as a track pad, and/or a pointing stick) and speakers into a single unit. A notebook can be used away from an outlet using are chargeable battery. Usually, notebook is powered by AC supply from single phase 240V. When the notebook is depending on the AC supply, it cannot recharge whenever in field works where AC supply is not available.

In this project, the solar powered notebook that implemented solar energy is represented in order to give supply to a notebook. Solar energy is produced from solar panel attached to the notebook. The solar notebook concept is a laptop with complete power independent. This is due to powerful batteries that are recharged by any solar panel attached to the computer. The solar panel that attached to the notebook is able to convert solar energy to DC supply and thus provide power to the notebook. As we know, solar energy is a renewable energy. It is a green technology that can help save electricity plus, can reduce pollution. Because the solar source is free, it is so affordable in cost.

1.2 Solar Panel

Solar panel is a packaged, connected assembly of solar cells, also known as photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Because a single solar panel can produce only a limited amount of power, many installations contain several panels. A photovoltaic system typically includes an array of solar panels, an inverter, and sometimes a battery and interconnection wiring.

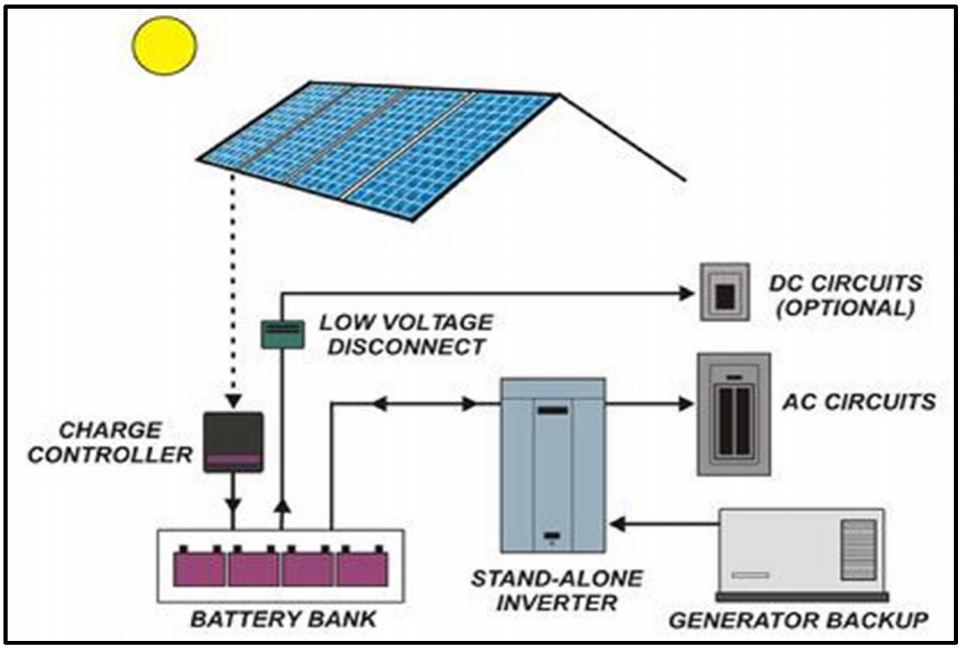


Figure 1.1: Photovoltaic system

Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer or the back layer. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The conducting wires that take the current off the panels may contain silver, copper or other conductive (but generally not magnetic) transition metals. The cells must be connected electrically to one another and to the rest of the system. Cells must also be

protected from mechanical damage and moisture. Most solar panels are rigid, but semi-flexible ones are available, based on thin-film cells.

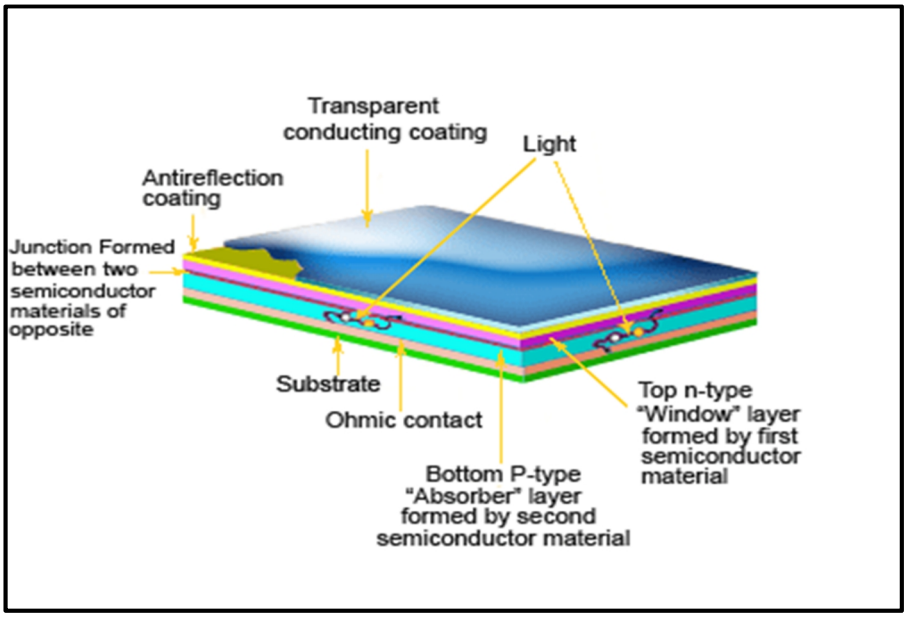


Figure 1.2: Structure of thin film solar cell

The solar notebook concept is a laptop with complete power independent. This is due to powerful batteries that are recharged by any solar panel attached to the computer. The solar panel that attached to the notebook is able to convert solar energy to DC supply that can give power to the notebook. As well-known, solar energy is a renewable energy. It is a green technology that can help save electricity plus, can reduce pollution. It is also affordable in cost because the solar source is free.

1.3 Voltage Regulator

In designing buck-converter circuit, LM 338 used as it is voltage regulator. Voltage regulator is an electrical regulator that has been designed to automatically maintain a constant voltage regulator. Usually, electronics voltage regulator was found in device such as computer power supplies where the function is to stabilize the DC voltages used by the processor and other elements. [6] Basically, the

topology used is based on buck converter as buck converter did step down voltage. LM 338-adjustable used to provide the 18.5V output voltage that capable to charge the notebook battery.[4]

1.4 Objectives

The objectives of this project are:

i. To design and develop solar based adapter or controller that capable to charge the notebook battery.
ii. To study the possibility of the design adapter whether able to charge the notebook without battery or not.

1.5 Scope of Project

The scopes of project include:

i. Notebook battery rating : 10.8V and 47Wh
ii. The controller/adapter provides 18.5V output that capable to charge notebook battery with 10.8V.
iii. Using solar panel provided by FKEE.

1.6 Contribution

The project is focused for those who like to travel and like to bring their notebook together. As well known, when in rural area, it is kind of difficult to find power source. So, with this controller or adapter, it can solve the problem. The solar panel will gain the solar energy and the controller will convert the voltage and current from the solar energy to desired voltage and current to support the notebook's battery.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the study that have been done before developed the Solar Powered Notebook. Some of them were about the meaning and usage about solar energy. Other, about the concepts and components of this system.

2.2 Solar Energy

"A photovoltaic system is based on the ability of certain materials to convert the radiant energy of the sun into electrical energy. The total amount of solar energy that lights a given area is known as irradiance (G) and its measured in watts per square meter (W/m^2)".[1]

This article is about what solar energy itself or as known as photovoltaic. This shows that solar energy has been converted into electrical energy for human usage.

“Solar energy, radiant light and heat from the sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies. Solar energy technologies include solar heating, solar photovoltaics, solar thermal electricity and solar architecture, which can make considerable contributions to solving some of the most urgent problems the world now faces.”[2]

This article shows that solar energy can contribute to solve problem that world must face when the energy is out of service.

2.3 Photovoltaic system components

A basic photovoltaic system consists of four components. There are solar panel, battery, regulator, and load. Panels are responsible to collect the energy from sun and generate electricity. After that, the regulator start play its role by converting the energy from direct current (DC) to either DC [1] itself but with constant output of to alternate current (AC) for house usage. The energy then will charge the battery and keep the energy for later use. Last but not least, the load will be the consumer.[1]

2.4 Solar Panel

Solar energy is one of the most famous renewable energy that people pay attention the most. Advances in technologies are allowing more efficient photovoltaic panels to be produced. There are four main types of solar panels.

2.4.1 Monocrystalline

Pure semiconducting material is needed in order to produce monocrystalline silicon cell. Monocrystalline rods are extracted from melted silicon and then sawed into thin plates. This process guarantees a high level of efficiency makes the monocrystalline panels one of the most efficient panels.

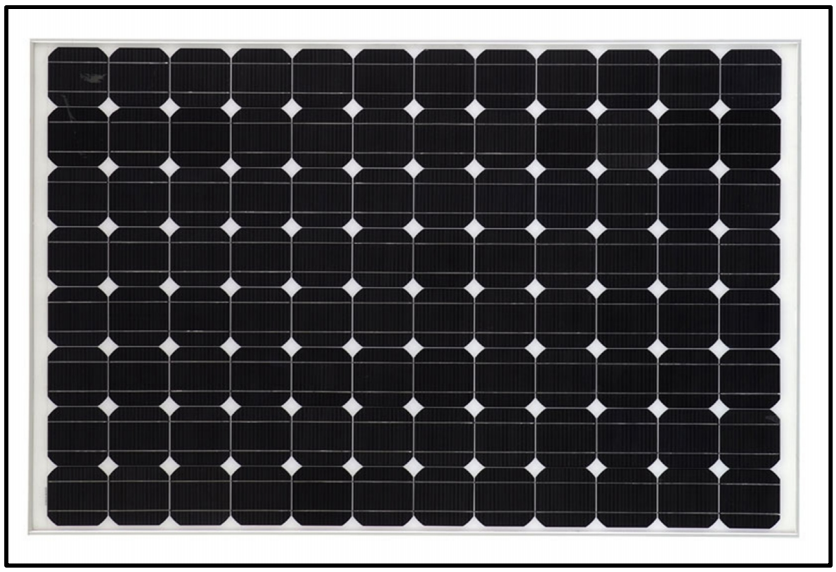


Figure 2.1: Monocrystalline solar cell

2.4.2 Polycrystalline

A polycrystalline module was made from a block of silicon that has multiple crystals. These panels have square in shape. The mix of different crystals gives the polycrystalline module a good performance.

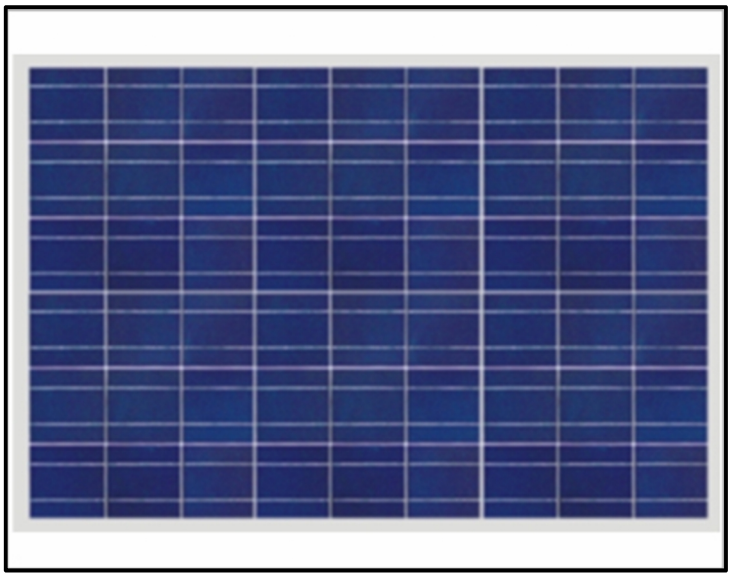


Figure 2.2: Polycrystalline solar cell

2.4.3 Amorphous

Amorphous or thin film silicon uses the least amount of silicon and also produces the least efficient solar cells. Mostly use in low power equipment (watches, pocket calculators) or as fascade elements and roll out roofing materials.

Figure 2.3: Thin film solar cell

2.4.4 Hybrid solar cell

Hybrid solar cells are the latest photovoltaic development. It is composed of an organic material mixed with a high electron transport material to form the photoactive layer. The two materials are assembled together in a photoactive layer. By placing one material into contact with each other, the power conversion efficiency can be greater than a single material generating better output at lower light levels.

2.5 Regulator

Regulator plays role to avoid overcharging and over discharging the battery [1]. In regulator, the energy will convert from DC to DC our source is solar which is DC [1]. So, in this project we will use converter as the buck converter function to convert unstable and low DC input to stable and desired DC output [3]. Buck

converter is used to step down the voltage as the input voltage is 22V and the desired voltage is 18.5V. Circuit was design according to original adapter. Lim Siong Boon investigate the DC-DC converter using LM 2576 [5] provide stable voltage output. It used switching control to reduce the input DC to desired output. The output voltage results is in better regulated output, less energy wasted, and can use for high current application.

2.6 Battery

Currently, there are three types of batteries commonly used for laptops/notebooks. There are Nickel Cadmium, Nickel Metal Hydried, and Lithium Ion.

2.6.1 Nickel Cadmium (Ni-Cd)

Nickel Cadmium (Ni-Cd) batteries were the standard battery since years, but today they are out of date because new laptop did not use them anymore. They are heavy and prone to “memory effect” which means they remember if a NiCd did not fully discharged, they will continue the old charge when you use it for next time. The memory effect will affect your battery’s lifetime. To avoid it, you should completely discharge the battery and fully recharge it again at least once a week.

2.6.2 Nickel Metal Hydried (Ni-MH)

This battery are less affected by the memory effect that NiCd. Thus, require less maintenance. However, the have problems at very high of low temperatures. NiMH better than NiCd is that NiMH battery offers higher energy density than NiCds. In othe words, the capacity of NiMH is twice the capacity of NiCd counterpart.

2.6.3 Lithium Ion (Li-ion)

Lithium Ion (Li-ion) are the new standard for portable power. Li-ion batteries produce same energy as NiMH but have lighter weight than NiMH about 20%-30% less. They do not suffer memory effect unlike NiMH and Nicd. Their substances are non-hazardous.

2.6.4 Smart Batteries

Smart batteries have internal circuit boards with chips which allow them to communicate with laptop and monitor battery performance, output voltage and temperature. This battery will generally run 15% longer due to their increased efficiency and also give the computer much more accurate “fuel gauge” capabilities to determine how much battery run time is left before the next charge is required.

2.7 Laptop/notebook

Laptops or notebooks have become an essential thing to own nowadays. There are many brands of notebook around the world.

2.7.1 Hitachi Laptop

Hitachi is pursuing high- performance as well as high- quality image for customer who edit and convert images to enjoy various types of content. Furthermore, Hitachi laptops and their parts are reasonable prices. An affordable Hitachi laptop is a perfect solution for those looking for a combination of high quality and reasonable price.

2.7.2 Asus Laptop

Asus is well-known for top-quality and innovative technology. As a leading supplier of 3C (computers, communications and consumer electronics)

solutions, Asus continues to refine their quality management process to ensure customers receive quality solutions cost effectively. Asus offers several series of laptops: Asus Business notebook series, Digital Home, Surerior Mobility, New Concept, Portability, Tailor Made notebooks. All of the Asus notebooks provide secure and convenient computing experience and make perfect value for users.

2.7.3 Acer Notebook

Acer laptops have a well-deserved reputation for being some of the best laptops in the world. Acer laptops are definitely worth serious consideration when you are choosing a suitable laptop. When shopping for a laptop, we are mostly concerned with two main things – the quality and the price. By knowing that Acer is global and well established, Acer at least worth a look.

2.7.4 Compaq Laptop

Compaq notebooks have always been known for being affordable. The majority of notebooks and desktop computers offered by Compaq were mid-priced and aimed at the "typical" computer user. This proved to be very significant for Compaq as it had a distinguishable popular computer lineup, which was incorporated into the main laptop buying market. Compaq notebooks took on a new look that were very similar to HP's notebook lines. The Compaq logo also received a major overhaul as it changed from Compaq's old Ticker Logo to the newer more refined HP version Compaq Logo.

2.8 DC-DC Converter

DC-DC converter are electronic devices whenever to change DC electrical power efficiently form one voltage level to another. There are a few types of DC-DC Converter. For convenience they can be classified into various groups. For example some converters are only suitable for stepping down the voltage, while others are

only suitable for stepping it up; a third group can be used for either. Another important distinction is between converters which offer full dielectric isolation between their input and output circuits, and those which don't. Needless to say this can be very important for some applications, although it may not be important in many others.

2.9 Conclusion

This can be conclude as the solar energy was collected by solar panel and the energy will convert by regulator and store in battery and consume to the load. In this project, the circuit will be using DC-DC converter since the solar itself is DC source and the notebook use DC supply. Basically the topology used is buck converter as it has to step down the voltage. [4] The solar panel used was made by monocrystalline which can produce effective output.

CHAPTER 3

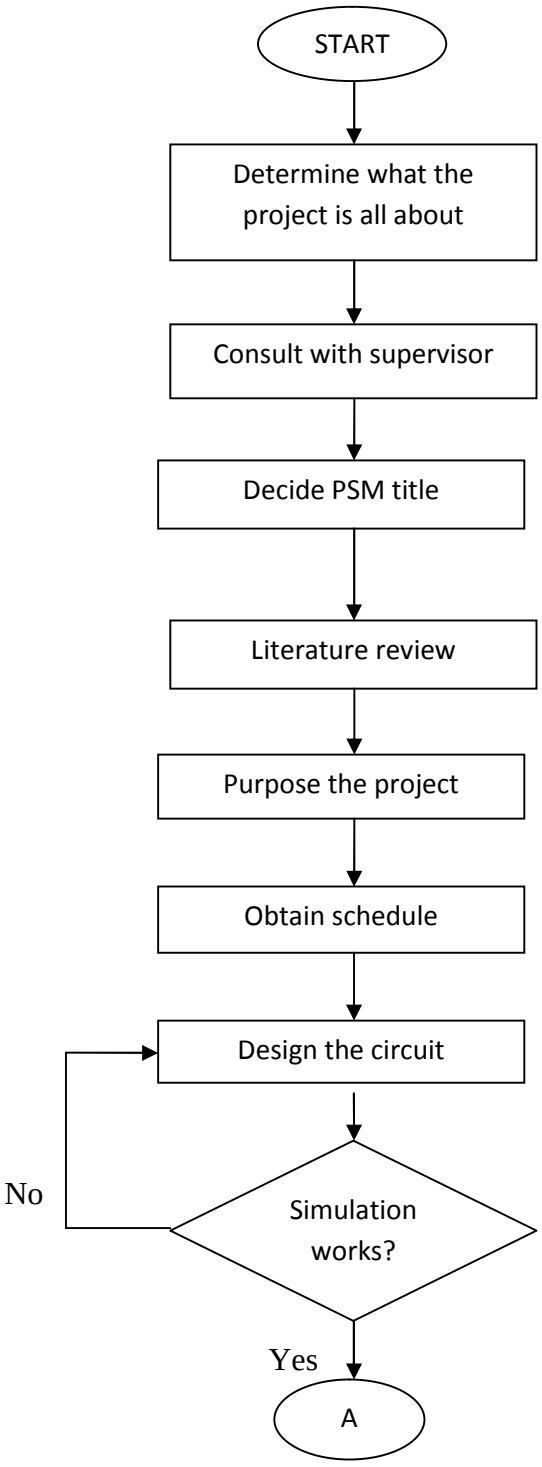
RESEARCH METHODOLOGY

3.1 Introduction

This segment explain my progress work in PSM I and becoming plan in PSM II. Research methodology explains the flow and sequence of a research. By planning and setting the methodology, research could be carried out in an ordered manner as well as abide by the time that has been set.

3.2 Project work flow diagram

This is the project flow during one whole year during PSM project:



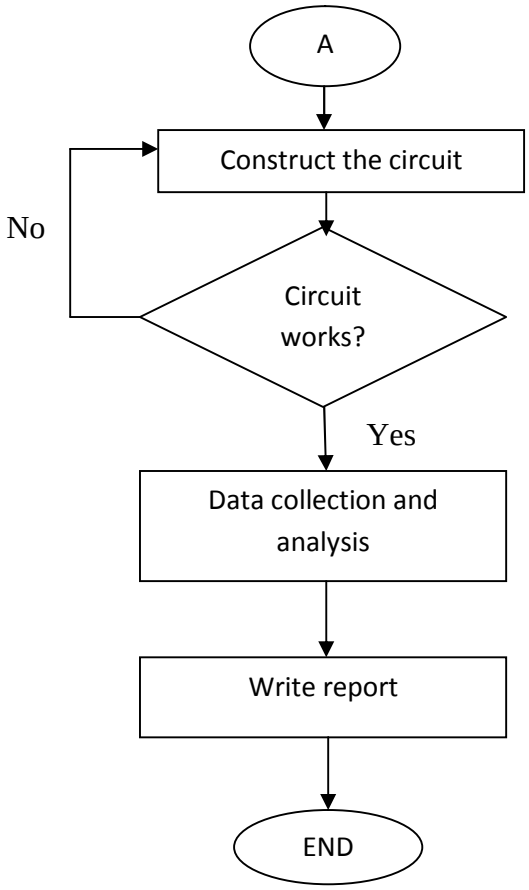


Figure 3.1: Flow chart of my project

In this whole final year, firstly, determine the title project. To get more information about the title, meet the supervisor. After that, choose the project title and start literature review. After doing some research about literature review, the project is proposed. After the project accepted, the schedule for the whole final year was obtained. Then, start to design the circuit and simulate the circuit. If nothing goes wrong, get the components and start doing the prototype. After the prototype was done successfully, data was collected and was analysed. Finally, the report is written for the whole hard work.

3.3 Block diagram

This is the overall block diagram:

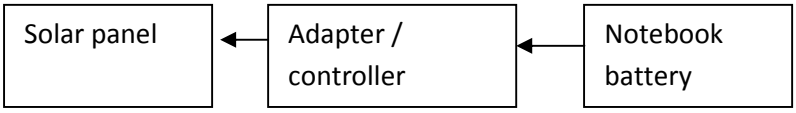


Figure 3.2: Block diagram of my system

Basically, the source of the project is solar panel. Solar panel provides DC supply with 22V input and 5A current. The voltage give input to charging circuit that used buck converter with main component LM 338 as voltage regulator to regulate and stabilize the voltage output. The charging circuit will be shown in Figure 3 in 3.3 under sub-topic 3.3.1. The voltage will charge the notebook battery. The notebook used is COMPAQ PRESARIO V3000 with spec 18.5V input voltage to charge a battery with 10.8V. The solar panel used branded Solar World with specification 21.9V rating voltage and 5A rating current.