SOLAR DATA LOGGER

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ABSTRACT

There are so many reasons for logging solar insolation for solar system. When planning to install a solar system, one must be able to predict the power output in order to determine the financial costs and benefits of the installation. Apart from that when planning an off grid solar electric power system, the output must be closely matched with the load so as to provide sufficient power without considerable waste. The proposed this report intends to enhance the use of solar Photovoltaic (PV)systems in University Malaysia Pahang by looking into the insolation value of the solar. I intend to build solar data logger. The objective of this project is to measure the voltage and current that will be produce from the photovoltaic panel. Later the data will be log to the memory and downloaded to the computer. The system is powered by small solar panel. When put out in sunlight the photovoltaic measure the insolation level of the solar. By using PIC18f45501 ,it converts the analog input from the solar panel converted to digital that is stored in flash memory. Later the data will be display to LCD and downloaded to the computer. By using the visual basic program every time the system logs a data point , it also logs the time and date so that it will be analyzed in the future.

ABSTRAK

K Terdapat banyak sebab untuk menyimpan data tahap keamatan cahaya. Ketika merancang untuk memasang sistem suria, seseorang harus dapat meramal keluaran kuasa untuk menentukan kos kewangan dan manfaat daripada pemasangan. Selain itu ketika merancang grid sistem tenaga solar, keluaran mesti disesuaikan dengan beban sehingga boleh memberikan kuasa yang mencukupi tanpa berlaku pembaziran. Laporan ini bertujuan untuk menggalakkan penggunaan solar panel sistem di Universiti Pahang Malaysia dengan menilai tahap keamatan matahari. Jadi projek ini ada untuk membina peyimpan data solar. Objektif dari projek ini adalah untuk mengukur voltan dan arus yang akan menghasilkan daripada solar panel. Kemudian data akan masuk ke memori dan dimuat turun ke komputer. Sistem ini disokong oleh panel suria kecil. Ketika diletakan di bawah sinar matahari fotosensor yang terdapat dalam soalr panel menguukur tahap keamatan matahari. Dengan menggunakan PIC18F4550, analog input akan ditukar daripada suria panel kepada nilai digital dan disimpan dalam memori . Kemudian data yang akan dipaparkan ke LCD dan dimuat turun ke komputer. Dengan menggunakan program "visual basic" setiap kali data di simpania juga mencatat waktu dan tarikh untuk dianalisis

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LIST OF SYMBOLS

1.	ADC	Analog to Digital
2.	DEC	Decimal
3.	V	Voltage
4.	A	Ampere
5.	DC	Direct Current
6.	AC	Alternating Current
7.	EJ	Exa-joule
8.	kw/h	kilowatt per hour
9.	*F*	fahrenheit
10.	C	Celcius
11.	Ω	Ohm
12.	RXD	Receive Data
13.	TXD	Transmit Data
14.	VCC	Voltage supply/input
15.	GND	Ground
16.	VOUT	Voltage ouput

LIST OF ABBREVIATIONS

LCD	-	Liquid Crystal Display
I/O	-	Input or Output
ADC	-	Analog-to-digital converter

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CHAPTER 1

INTRODUCTION

1.1 Background

We use energy every day. It surrounds us in different forms, such as light, heat, and electricity. Our bodies use the energy stored in molecules of substances like carbohydrates and protein to move, breathe, grow, and think. We also use energy to do work and to play. Humans have invented thousands of machines and appliances that use energy to make our work easier, to heat our homes, and to get ourselves from place to place. Some of these machines use electricity, while others, like automobiles, use the energy stored in substances such as gasoline.

Renewable energy is energy obtained from the continuing or repetitive currents of energy occurring in the natural environment. An obvious example is solar (sunshine) energy, where "repetitive" refer to the 24hours major period. Note that energy is passing through the environment as a current flow, irrespective of there being a manmade device to intercept and harness this power [1]

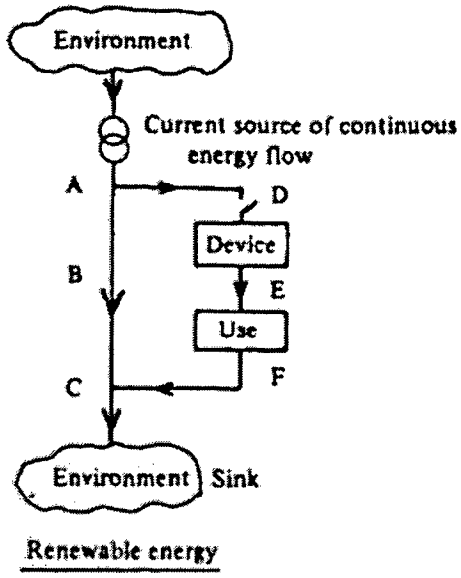

Figure 1.1 : Environmental energy flow ABC, harnessed energy flow

The currents of energy passing continuously as renewable energy through the earth in Figure 2. For instance, total solar flux incident at sea level is 1.2 x 10^{17} W. Thus the solar flux per person in earth (with more than 4 x 10^{9} people) is nearly 30MW- the power of ten very large diesel electrical generators. The maximum solar flux density perpendicular to the solar beam is about 1kW m^{-2}.

However the global data of Figure 2 are of little value for practical engineering application, since particular sites can have remarkably different environments.

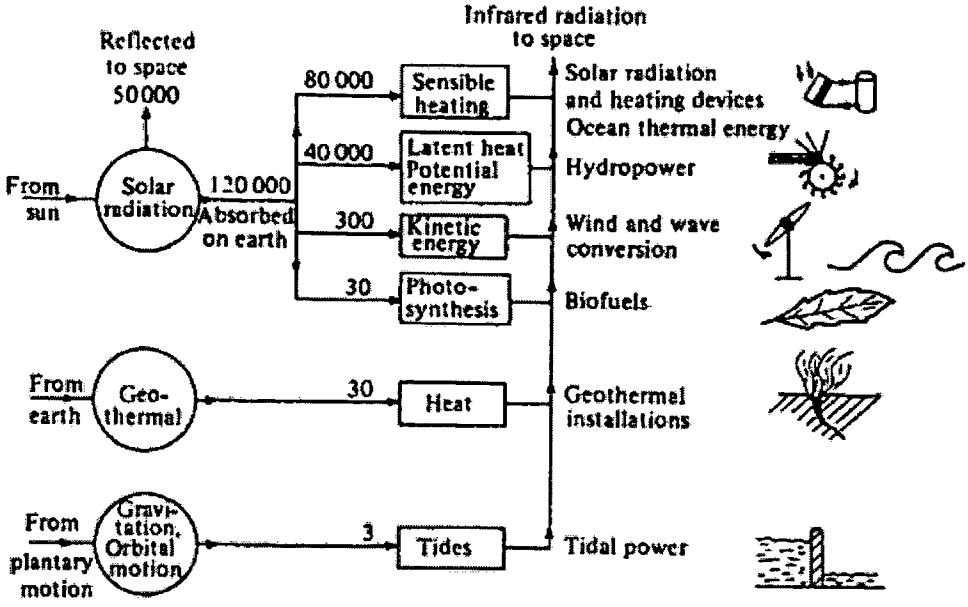

Figure 1.2 : Natural energy currents on earth, showing renewable energy systems.

Renewable energy also can be defined as is type of material we can replenish which is renewable energy is technology that exclusively relies on an energy source that is naturally regenerated over a short time and derived directly from the sun, indirectly from the sun, or from moving water or other natural movements and mechanisms of the environment. One can distinguish:

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- Biomass energy (plant growth driven by solar radiation).
- Wind energy (moving air masses driven by solar energy).
- Direct use of solar energy (as for heating and electricity production).
- Hydropower.
- Marine energy (such as wave energy, marine current energy, and Energy from tidal barrages).
- Geothermal energy (from heat stored in rock by the natural heat flow of the Earth).

Most sources of renewable energy have an endless supply. In simpler words, renewable energy is derived from resources that can never be used up. They are also very safe for the environment which means we can avoid some of the destruction that the use of other resources is creating

1.1.1 Biomass

Biomass can be classified as plant biomass (woody, non-woody, processed waste, or animal biomass. Most woody biomass is supplied by forestry plantations, natural forests, and natural woodlands. Non-woody biomass and processed waste are products or by-products of agro industrial activities. Animal manure can be used as cooking fuel or as feedstock for biogas generation. Municipal solid waste is also considered a biomass resource. [4]

Biomass is solar energy stored in organic matter. As trees and plants grow, the process of photosynthesis uses energy from the sun to convert carbon dioxide into carbohydrates (sugars, starches and cellulose). Carbohydrates are the organic compounds that make up biomass. When plants die, the process of decay releases the energy stored in carbohydrates and discharges carbon dioxide back into the atmosphere. Biomass is a renewable energy source because the growth of new plants and trees replenishes the supply. Over millions of years, natural processes in the earth transformed organic matter into today's fossil fuels: oil, natural gas and coal. Fossil fuels are not renewable. The oil, natural gas and coal we use today are gone forever. The use of biomass for energy causes no net increase in carbon dioxide emissions to the atmosphere. As trees and plants grow, they remove carbon from the atmosphere through photosynthesis. If the amount of new biomass growth balances the biomass used for energy, bioenergy is carbon dioxide "neutral." That is, the use of biomass for energy does not increase carbon dioxide emissions and does not contribute to the risk of global climate change. In addition, using biomass to produce energy is often a way to dispose of waste materials that otherwise would create environmental risks. Biomass CHP uses

the heat created during the biomass process to drive a turbine which then generates electricity which can be used to provide heat and power. Many buildings that need a constant supply of power and heat, such as hospitals and hotels, and factories are taking advantage of biomass CHP.

1.1.2 Wind energy

The wind energy stands out to be one of the most promising new sources of electrical power in the near term. The energy available in the wind varies as the cube of the wind speed, so an understanding of the characteristic of the wind resources to all aspect of wind energy characteristic from identification of suitable sites and the design of the wind turbines themselves plus understanding their effect on electricity distribution networks and consumers.

From the point view of wind energy, the most striking characteristic of the wind resource is its variability. The wind is highly variable both geographically and temporally. On a large scale, spatial variability describe that there are many different climatic regions in the world in the world. These regions effect on latitude which contribute effect amount of insolation. The type of vegetation may also have significant influence through its effects on the absorption or reflection of solar radiation, affecting surface temperature, and on humidity.

Wind turbines have blades designed like airplane wings. They rotate due to a pressure differential caused by air moving over the surface of the blade. The blades turn a rotor which drives an electrical generator. Turbines are designed to automatically face the wind either mechanically or by computer-controlled drive systems. Wind turbines can operate at variable speeds or at fixed speeds. Variable speed designs are more complex but convert wind power into electricity more efficiently. Most new projects use variable speed design.

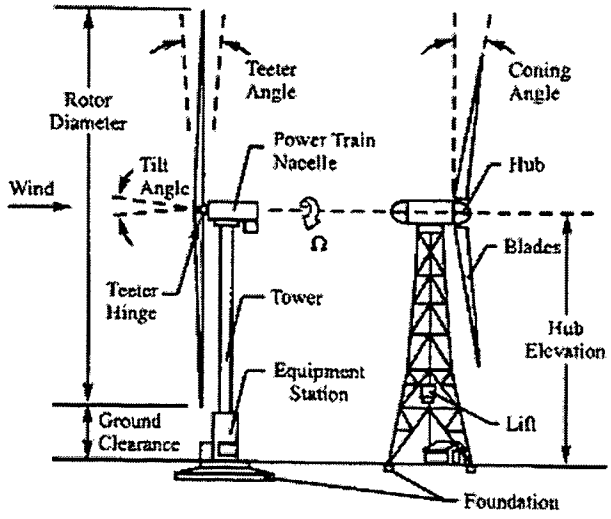

Figure 1.3: Schematic view of turbine concept.

1.1.3 Hydroelectric energy

Hydroelectric power is an attractive source of comparatively low-cost electricity, which presently provides about 20 percent the world's electricity. Hydroelectric systems with large reservoirs are particularly valuable to electricity grids that have large amounts of intermittent renewable because their reservoirs can buffer the variable output of the intermittent renewable because their reservoir can buffer the variable output of the intermittent. However as noted only a modest fraction of the hydroelectric potential will be exploited because of environmental and social concerns about hydroelectric projects. [3]

In nature, energy cannot be created or destroyed, but its form can change. In generating electricity, no new energy is created. Actually one form of energy is converted to another form.

To generate electricity, water must be in motion. This is kinetic (moving) energy. When flowing water turns blades in a turbine, the form is changed to mechanical (machine) energy. The turbine turns the generator rotor which then converts this mechanical energy into another energy form -- electricity. Since

water is the initial source of energy, we call this hydroelectric power or hydropower for short.

At facilities called hydroelectric power plants, hydropower is generated. Some power plants are located on rivers, streams, and canals, but for a reliable water supply, dams are needed. Dams store water for later release for such purposes as irrigation, domestic and industrial use, and power generation. The reservoir acts much like a battery, storing water to be released as needed to generate power.

The dam creates a head or height from which water flows. A pipe (penstock) carries the water from the reservoir to the turbine. The fast-moving water pushes the turbine blades, something like a pinwheel in the wind. The waters force on the turbine blades turns the rotor, the moving part of the electric generator. When coils of wire on the rotor sweep past the generator=s stationary coil (stator), electricity is produced.

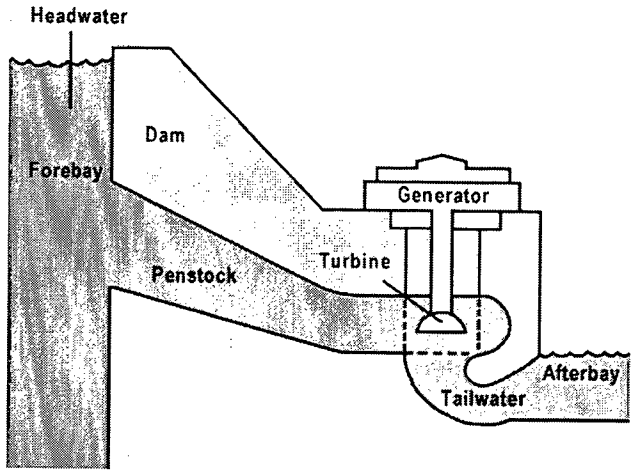

Figure 1.4 : Hydroelectric Power plant

1.1.4 Solar energy

The sun is by far the most significant source of renewable energy. This abundant source of energy can be utilized directly by solar thermal or photovoltaic system. The most important components of a PV cell are the two layers of semiconductor material. When sunlight strikes the PV cell, the solar energy excites electrons that generate an electric voltage and current. Extremely thin wires running along the top layer of the PV cell carry these electrons to an electrical circuit.
A photovoltaic module is made of an assembly of photovoltaic cells wired in series to produce a desired voltage and current. The PV Cells are encapsulated within glass and/or plastic to provide protection from the weather. Photovoltaic modules are connected together to form an array. The array is connected to an inverter which converts the Direct Current (DC) of the PV modules to Alternating Current (AC).

Solar energy is one of the renewable sources. The total solar energy absorb by the earth approximately about 3,850 000 EJ which equal to 1.06944 X^{18} kw/h. Solar cells are long lasting sources of energy which can be used almost anywhere. They are particularly useful where there is no national grid and also where there are no people such as remote site water pumping or in space. Solar cells provide cost effective solutions to energy problems in places where there is no mains electricity. Solar cells are also totally silent and non-polluting. PV power systems are the only devices currently available for generating electricity without any moving parts. This makes them brilliantly simple and easy to take care for, which is a real benefit to the homeowner. As they have no moving parts they require little maintenance and have a long lifetime. Compared to other renewable sources they also possess many advantages; wind and water power rely on turbines which are noisy, expensive and liable to breaking down. Rooftop power is a good way of supplying energy to a growing community. More cells can be added to homes and businesses as the community grows so that energy generation is in line with demand. Many large scale systems currently end up over generating to ensure that everyone has enough. Solar cells can also be installed in a distributed fashion. Solar cells

can easily be installed on roofs which mean no new space is needed and each user can quietly generate their own energy.

As our society grows and moves forward we are more dependent on the resources we have. As a result there are concerns they will one day run out. Apart from that renewable resources provide flexibility and can be used in large-scale wind, solar electric power plants, or on the rooftops of residential and commercial facilities for electricity and water heating purpose. With the increasing evidence of global warming, and idea of being carbon neutral becoming more prominent, the increase in interest in renewable energy is growing rapidly. Legislation is ensuring that governments and companies as well as individuals are considering their effects on the environment, and how they can use renewable energy. [2]

1.2 Project overview

I am choosing solar as my renewable energy source because solar energy is one of the biggest source of energy. Apart from that base on climate in Malaysia. This due to Malaysia climate has a tropical climate which is hot and humid throughout the year. Sometimes Malaysia is also called as the tropical paradise situated north of the equator. Climate in Malaysia sees temperatures averaging around 86°F (30°C), though it is cooler in the highland areas. More than that our day equal 12 hours so we have a long time in a day to use sun as our source of energy.

On seemingly sunny day in Gambang, Kuantan. The sun can delivers some amount of electricity power. Although seasonal and annual average insolation levels for major Kuantan are available on the internet, cloud cover and other weather effects can be extremely localized depending on the topography. Thus, the data from large cities isn't always same as the data for the smaller town like Gambang. More than that with the wide land, less of tree, clouds and fog levels varies significantly from one part of town to another. How can we know the potential of the voltage of the PV panel will produce unless they can measure the incoming light? To build this system we must be

able to predict the power output based on the voltage and the current in order to determine the financial cost and benefits of the installation. More than that the output most closely matched with the load so to provide sufficient power without considerable waste. Due to that I intend to build a prototype of the solar data logger. From this project we can analyse the power that will be produce at Gambang furthermore we can also avoid the wasting of money and time. This due to the installation of the solar system required a lot of money so with this project we can analyse and make a conclusion whether the solar panel are suitable to use in here, Gambang. This project include photovoltaic panel which can convert the solar energy into electricity in analogue signal. To analyse the data, first we must convert the signal into digital signal. To convert the analogue signal I'm using PIC 16F877. The function of PIC 16F877 to convert from analogue to digital signal. More than that this PIC 16F877also have memory that we can store the data and keep it to analyze. For interfacing the data I'm using visual basic program. The data then will appear and more than that it will also show the graph of the data. The data also will be in real time so the data and graph will change from time to time. .

1.3 Project Objective

The main objective of this project is to To develop an inexpensive prototype of self-powered data logger to collect data. There are two secondary objective that will be achieve the main objective above.

The first to measure output voltage and current then log this to memory to be later downloaded to the computer. The voltage and the current are taken from the photovoltaic panel and then display the data.

The second is to analyze the data and giving the accurate result for the prediction of the power output..

1.4 Project Scopes

The scopes of this project include to the place the data taken. The research of the project are been taken around University Malaysia Pahang. This project perform on sunny day, so from that the important thing is the sunlight

The range of the project basically been consider are: The lights that enter the photovoltaic ,The measurement of the volatge and current and log to the memory in database. The analysis from the result of the light level that been produced

The concept of this project is use solar system concept. These system implements collaborative between logging the data and analyze techniques.

CHAPTER 2

THEORY LITERATURE REVIEW

In this chapter, explanations about all the word history and literature review. The total figure to this report will be added in this chapter along with the detail.

2.1 Overview

Using solar as one of the system in electricity had been widely use these day. But sometime the applying the solar system at the certain place is not very suite. This due to the electricity that can be produce from the solar panel is not same as the consumer need.

As we can see now the payment charge for an electricity had been rise rapidly because the increasing of gas charge. Many researchers have tried to find the alternative energy to replace the gas. One of the alternative energy that we can use is solar energy. Photovoltaic energy is the most promising and popular form of solar energy. In solar photovoltaic' sunlight is actually converted into electricity. This is very different from a conventional understanding of solar energy around the world, is briefly explained below.

Sunlight is made of photon, small particle energy. These photons are absorbed by and pass through the material of solar photovoltaic panel.

The photon agitates the electrons found in the material of the photovoltaic cell. As they begin to move (or are dislodged), these are "routed" into a current. This, technically, is electricity- the movement of electron along a path. Solar panels made of silicon to convert sunlight into electricity. Solar photovoltaic are used in a number of ways, primarily to power homes that are inter-tied or interconnected with grid.

These day many people use solar or photovoltaic energy as an alternative power because it's free and renewable. Solar power sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Solar radiation is secondary resources like as wind and wave power, hydro electricity and biomass account for most of the available flow of renewable energy on earth. Solar energy technology can provide electrical generation by heat or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water and thermal energy for cooking. Advantages of solar energy

There are countless advantages associated with Solar Power Energy. Uses for solar energy are not just for humans to take advantages from but it is amazingly useful for environment as well. The most unique and best feature of solar energy is its abundance in quantity available to our mother earth, if we use it to maximum levels it is not going to go anywhere until next five billion years. Solar power plants can also be connected to existing source of power generation to form hybrid system to boost energy requirements during sunny, hot and dry day. Solar energy plants are available for both small scale energy requirements and for larger scale energy requirements; it cops the market for both residential and industrial requirements. Solar energy can is easily be provided in rural areas where conventional electricity is not present already or it may cost more to setup electric grid station. It is cost effective to use solar energy generation methodologies in such rural areas. Solar power plants are