STAND ALONE POWER LIGHT SYSTEM

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This project and research work is dedicated to my beloved parents for their devoted caring throughout my life, my loving brother and sisters also my friends for their encouragement and love.

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ABSTRAK

Pada masa sekarang, penggunaan tenaga elektrik semakin tidak terkawal kesan daripada penggunaan alat-alat elektrik yang digunakan samaada perkakasan rumah atau di luar. Selain daripada air, arang batu atau tenaga nuklear, tenaga solar juga boleh digunakan untuk menjana tenaga elektrik. Dengan menggunakan tenaga solar, ia dapat menjana tenaga tanpa mencemarkan udara ataupun persekitaran alam. Dalam projek ini, tenaga solar digunakan sebagai sumber utama bekalan tenaga elektrik. Daripada solar panel, ia akan mengecas bateri pada siang hari untuk digunakan pada waktu malam. Hasil daripada penyelidikan, solar panel dapat menjana tenaga sebanyak 4V pada ketika ia tidak didedahkan kepada cahaya dan mencapai 8V apabila didedahkan kepada cahaya lampu. Apabila cahaya matahari yang penuh, ia mampu mencapai sehingga 12V. Untuk projek ini, penapis shunt digunakan untuk mengelak solar panel daripada mengecas bateri melebihi daripada hadnya. Oleh kerana solar panel amat sensitif terhadap bayang-bayang dimana ia akan menyusutkan hampir separuh tenaga yang dihasilkan, solar panel ini kemudiannya disetkan untuk bergerak dari timur ke barat mengikut pergerakan cahaya matahari. Oleh itu, ia dapat menjana semaksum tenaga yang mampu. Sebagai tambahan sistem, litar sensor direka untuk mengesan cahaya pada waktu hujan atau mendung. Untuk menghasilkan sistem ini, ia memerlukan kos yang agak tinggi tetapi untuk jangka masa yang panjang, ia adalah menjimatkan.

ABSTRACT

Nowadays, the usage of electrical energy are uncontrolable due to the electrical appliance used whether at home or others. Instead of water, charchoel and nuclear, solar energy can be used to generate electricity. With solar energy, it could generate energy without pollution. In this projek, solar energy is used as a main supply. From solar panel, it would charged the battery during sun hour to be used at night. From the research, solar panel can generate up to 4V when it is not exposed to the light and could achieve up to 8V when it is exposed to light of lamp. By exposed it to full of sunlight, it can achieve more than 12V. For this project, shunt regulator was used to prevent the solar panel from overcharging the battery. Since the solar panel are very sensitive to the shading, it set to move from east to west to generate maximum energy as it can. As a backup system, sensor circuit is created to sense the light during rainy or cloudy day. To implement this project, it needs high cost but for long term usage, it is saving.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Nowadays, many devices use sensors instead of switches. Switches have been replace by sensor because the significant of sensor. With sensor human don't need to push any buttons, everything will be done automatically. Solar cells are converters. They take energy from sunlight and convert the energy into electricity. Solar power is useful and could replace the electricity power that is used today and it also save a bills and operating cost. But this technology is not famous in Malaysia even in our University. People will think a better way to replace cable because cable is hard to manage and untidy. In this project, the advantages of sensor and solar power are taken. It will insert in this project as the input and output of the microcontroller. Sensor will make the output work remotely. The project name is 'Stand Alone Power Light System' because the light is turn ON automatically when the sensor doesn't sense any light. Sensor will turn on a multiple output for motor to rotate the PV panel clockwise or counterclockwise. Solar cells alone cannot produce usable power.

They need to be interconnected with other system components that ultimately conduct a specific electrical demand, or load.

Photovoltaic (PV) systems can either be stand alone or grid connected. The main difference between these two basic types of systems is that for grid connected systems, the PV systems produce power in parallel with the electrical utility. It can feed power back into the utility grid if the onsite load does not use all of the PV systems output.

Others output is a florescent light that will light on when is dark. When the sun is shining, the direct current (DC) electricity from the PV modules is converted to alternating current (AC) by the power of an electronic inverter, and then fed directly into the side power distribution system where supplies electric power. Any excess solar power is exported to the utility power grid and any shortfall is made up which electricity supplied by the grid. During non sun hours, the site is supplied by utility power alone.

All of this device are been controlled by a single microcontroller chip that is PIC 16F877A microcontroller.

1.2 HOW SOLAR WORKS

Most electricity today is produced by electrical generators. A generator is a device that spins wire through a magnetic field inducing electricity flow in the wire. Some power plants use hydro or water power, but in most large power plants, fossil or nuclear fuels are used to create steam, which in turn is used to spin a turbine. The turbine then spins the generator. This is called “thermodynamic” cycle.

A solar cell converts light directly into electricity using “Photovoltaic Effect”. There is no fuel, steam or thermodynamics involved. When light hits a solar cell, it instantly produces electricity. Solar cells today do not store electricity. In other words, when the light is taken away from the cell, it stops producing electricity. It is very common to store the electricity from a solar cell in a battery.

Because most applications require electricity when the sun is not shining, battery storage of electricity is usually necessary. The batteries used in PV systems are similar to automobile batteries, but are specially constructed to withstand many deep discharge cycles. (Current is provided for extended periods) Automobile batteries are designed for shallow discharge cycles (to provide large current for short periods) and are not suitable for PV systems.

The two most common types of batteries used in PV systems are not flooded lead acid batteries that require periodic maintenance (addition of distilled water and equalization), and valve regulated lead acid batteries, which are “maintenance free”. To reduce the maintenance frequency required by flooded batteries, catalytic recombine caps can be used. These caps recombine the hydrogen and oxygen gases emitted by the battery cell into water that is returned to the battery.

The Stand Alone Power Light System was control using PIC16F877A. This system consists of:

i. PV panel
ii. Motor
iii. Sensor
iv. Microcontroller
v. Shunt regulator
vi. Lead Acid battery
vii. Light

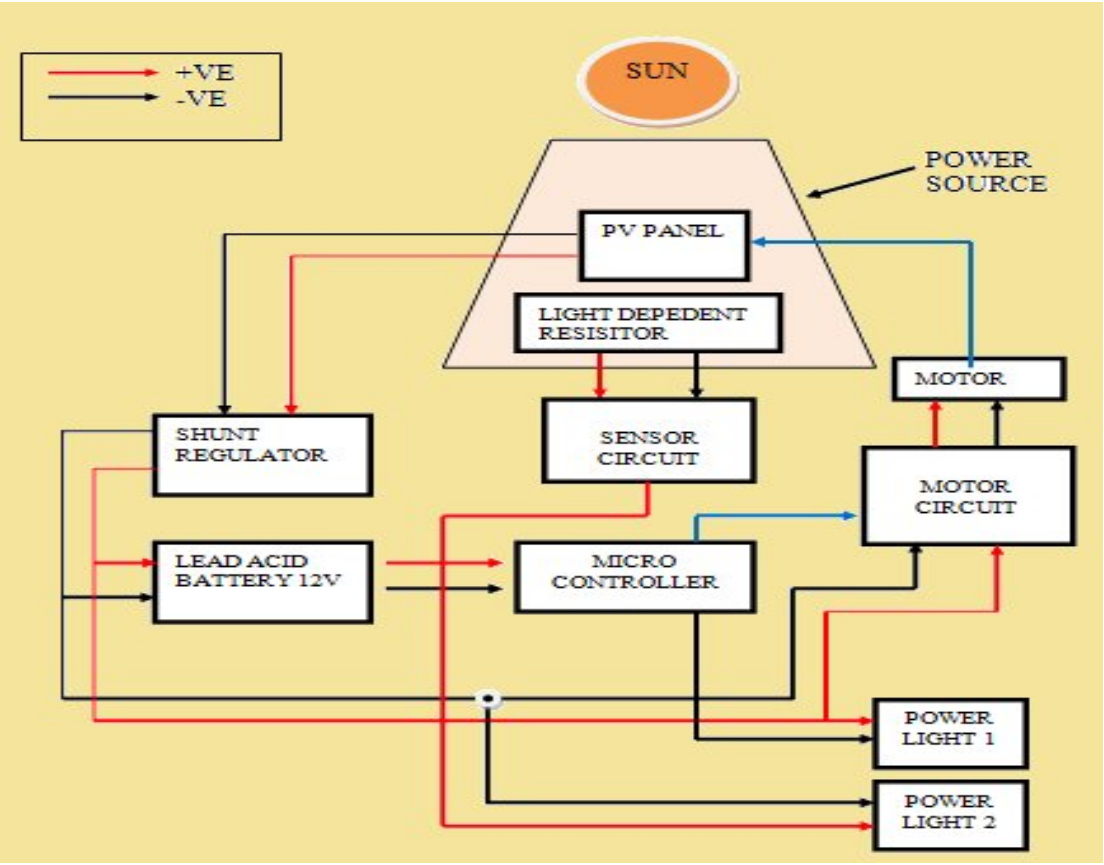


FIGURE 1.1: THE BLOCK DIAGRAM OF S.A.P.L.S

1. Figure 1 shows how the SALPS system works. This system was a stand-alone and it has own source power from the solar panel.

2. The Sun was the major power source to operate this system and also recharging the battery for load device such as motor and power light.
3. From the power of PV panel it will flow into lead acid battery 12V and converter to operate the component. This lead acid battery was kind of maintenance free.

4. Micro controller will be used to control the motor and power light. This system depending on light sensor. At night the power from solar panel will be cut through lead acid battery and then the battery will supply the power light.

1.3 OBJECTIVES

Today, we could see at our rest shelter doesn't have lamp to lighten on the shelter at night. By investing in solar power today, it can gain energy independence and generate the own clean, renewable electricity from the sun while:

1. Lowering the utility bills & operating costs.
2. Hedging against rising electricity prices.
3. Reducing distinct energy demand from utility grids.
4. Help sustain environment.

1.4 PROBLEM STATEMENT

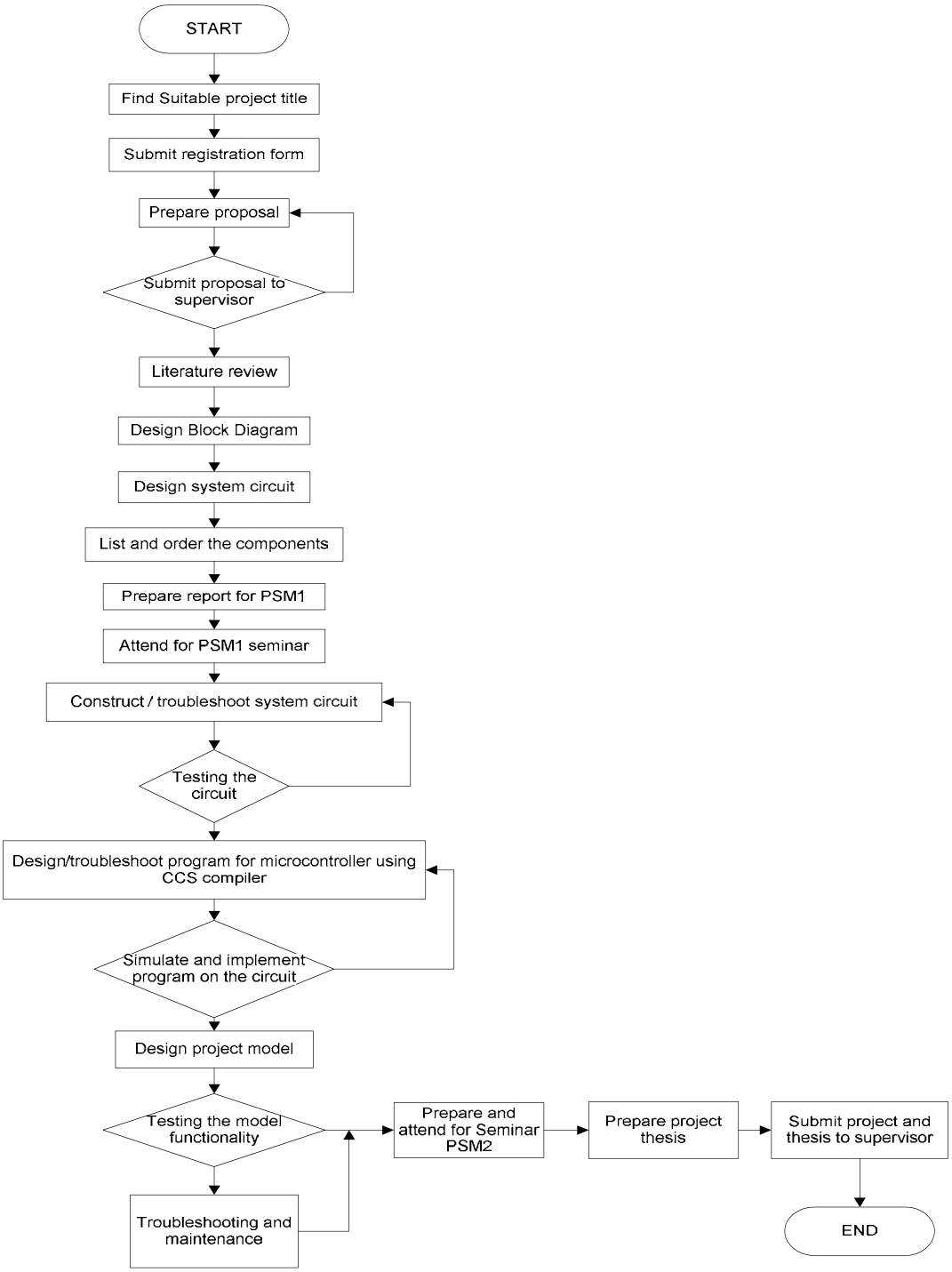
Nowadays, the increasing of the electrical usage is unctrollable due to many types of electrical equipments or appliances we used. Our country also doesn't have enough electrical source to support our needs daily. Instead of charcoal, nuclear, water and wind, solar energy also can generated electical power. Solar is used because it can gain energy indepence and generate the own clean, renewable electricity form the sun while help sustain environment. In this project, a random survey is done around girl hostel at taman tasik utama and it seen that at the rest shelter doesnt have lamp to light on the shelter. An association between female students and male students especially during night can produce a suspicios among the outsider even they are discussing about their study. By investing this project, it can reduce the suspicious and also the students can discuss their work comfortly without any worry. Using a solar power also have some benifit such as:

i. Portability: it can move easily.
ii. Reliability: it can operate for long period with little maintenance.
iii. Low operating cost: the fuel is free.
iv. Low environmental impact: it is quiet and nonpolluting.
v. Stand alone capability: they operate in remote area far from power line.
vi. Modularity: power output can be increased by adding more modules.
vii. Safety: they are not flammable.
viii. Ease of installation: no heavy construction equipment is required.

1.5 SCOPE OF WORK

This project will cover hardware and software parts. The hardware part are the microcontroller circuit as the controller for this project, sensor circuit to detect the light from the sun and the motor circuit to rotate the pv panel by following the sun movement. Charger controller circuit also will be implemented in this project to limit the maximum voltage to the battery charger when on charge from PV panel. The software part will control the overall process in this project. The software is develop using PIC.

1.6 PROJECT METHODOLOGY



CHAPTER 2

LITERATURE REVIEW

"The Earth receives more energy from the Sun in just one hour than the world uses in a whole year," according to Solarbuzz, a San Francisco-based solar energy research and consultancy firm. With that knowledge, it's no wonder that renewable energy enthusiasts have high hopes for the future of solar technology. But forget the future, today, financing strategies are making it possible to benefit from solar technology.

The Stand Alone Power Light System was using the advantages of light source. The important device used in this system called as Photovoltaic's are best known as a method for generating electric power by using solar cells to convert energy from the sun into electricity. Photovoltaic (PV) Solar Panels generate electricity by the *Photovoltaic Effect*. Discovered in 1839 by 19 year old Edmund Becquerel, the photovoltaic effect is the phenomenon that certain materials produce electric current when they are exposed to light.The photovoltaic effect refers to photons of light knocking electrons into a higher state of energy to create electricity energy. The term photovoltaic denotes the unbiased operating mode of a photodiode in which current through the device is entirely due to the transduced light energy. Virtually all photovoltaic devices are some type of photodiode.

Solar cells produce direct current electricity from light, which can be used to power equipment or to recharging a battery. The first practical application of photovoltaic's was to power orbiting satellites and other spacecraft, but today the majority of photovoltaic modules are used for grid connected power generation. The light from the sun is made up of packets of energy called *Photons*. Each photon carries an amount of energy corresponding to its wavelength of light. When a visible light photon strikes a solar cell it can do one of three things which is pass straight through, be reflected, or be absorbed. If the photon is absorbed, its energy is absorbed by an electron in an atom of the solar cell enabling it to escape from its normal position (*photon excitation*), cross the junction and fill a hole. Since electrons are physically moving across the PN junction, the positive charge carrying holes are effectively moving in the opposite direction around the load circuit (a rechargeable battery or light bulb etc). This completes the circuit providing more holes for the electrons to combine with and providing usable electricity. Because this system is reliability, the process can be repeatedly over many years due to its usable lifetime. A basic photovoltaic (PV) solar electric panel system for 12V battery charging comprises a solar panel, charge controller, battery and appliances.

Whenever exposed to daylight PV panels will produce a more or less constant output voltage. This means that even in temperate zones in winter, a useful charging current can be produced. This output current however does vary with light intensity. The rated output of all panels are measured by a standard illumination of 1kw/m (1 sun) at a temperature of 25°c.

Maintenance on PV systems include checking and topping up of battery electrolyte, cleaning the PV panels to ensure exposure to direct sunlight, checking the charge controller operation, and ensuring that the wiring connections are secure.