LOW COST MOBILE POWER GENERATOR SYSTEM

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This report is submitted partial fulfillment of the requirement for the award of Bachelor of Electronic Engineering (Industrial Electronics/ Telecommunication Electronics/ Computer Engineering*) With Honours

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A special dedication to my dear parents, families, brothers and friends.

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ABSTRACT

The aim of this project was to build a low cost mobile power generator system that can be portable for outdoor used where electricity is hard to access. Alternative energy is always around us such as wind, sun and hydro. These energies are clean and renewable. Power is a main issue that concerns many countries especially for the undeveloped rural areas. In order to harness free and clean energy, solar power is the ideal choice since the sun's intensity is constant through out the year. The conventional solar panels are placed at a static position and then collect the energy from the sun. This causes power to be loss when the panel is not perpendicular to the sun's incident ray. And as the angle of incident deviates greater, so will be the energy loss. Hence a smart way to solve the problem is by tracking the sun's movement all day long. The best way to track the sun is using a dual axis solar tracker which is more efficient compared to single axis solar tracker. The dual axis that is build is a prototype that is only to support a light solar panel. The motor that is rotating and tilting is the servo motor that can be controlled easily by a PIC microcontroller. Four LDRs are then used to detect the sun's position that will trigger the movement of the servo motor to move the panel to track the sun's position. The design is then tested to see how smart it tracks the difference of light detected by the LDR and how the servos move to the correct position. The result and analysis will then be presented in the report.

ABSTRAK

Tujuan projek ini adalah membina sebuah penjana kuasa yang berkos rendah dan boleh dibawa untuk aktiviti-aktiviti luar yang sukar untuk mendapat sumber elektrik. Tenaga alternatif sentiasa wujud di sekeliling kita seperti angin, matahari dan hydro. Tenaga-tenaga ini adalah bersih serta boleh diperbaharui. Issue tenaga pada zaman ini adalah isu telah menjadi perhatian pada negara-negara di seluruh dunia terutamanya kawasan yang belum dibangunkan. Tenaga solar adalah menjadi pilihan utama untuk dimanfaatkan kerana negara kita mempunyai pancaran matahari yang berpanjangan pada seluruh tahun. Cara tradisi untuk meletak panel suria adalah pada suatu kedudukan yang statik. Kebanyakan tenaga akan hilang sebab semasa posisi panel suria adalah tidak 90 darjah tegak pada pancaran matahari. Semakin besar darjah yang tidak tegak 90 darjah dari pancaran matahari, semakin besar kehilangan tenaga dari panel suria. Cara untuk mengatasi masalah ini adalah dengan mengunakan penjejak matahari yang mempunyai dua paksi untuk menjejak posisi matahari sepanjang hari. Cara ini adalah lebih berkesan berbanding penjejak yang hanya satu paksi. Penjejak matahari dua paksi adalah merupakan prototaip yang hanya dapat menyokong panel suria yang ringan. Moto yang akan memusing dan mencondong panel suria tersebut adalah servo moto yang boleh dikawal oleh PIC yang boleh disambung terus dari servo moto. Empat LDR akan digunakan untuk mengesan kedudukan matahari dan mengaktifkan servo moto untuk bergerak. Prototaip tersebut akan diuji apabila sudah siap dan cara mengesan kedudukan matahari oleh prototaip akan diperhati. Segala keputusan dan analisis hasil projek kemudian akan dipaparkan dalam laporan ini.

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LIST OF ABBREVIATIONS

AC	-	Alternative Current
ADC	-	Analogue to Digital Converter
AGM	-	Absorbed Glass Matt
CFL	-	Compact Fluorescent Lamp
CCTV	-	Closed Circuit Television
DC	-	Direct Current
DOD	-	Depth of Discharge
LCD	-	Liquid Crystal Display
LDR	-	Light Dependent Resistors
PCB	-	Printed Circuit Board
PIC	-	Programmable Integrated Circuit
PID	-	Proportional, Integral, Derivative
PSM	-	Projek Sarjana Muda
PV	-	Photovoltaic
PWM	-	Pulse Width Modulation
RC	-	Radio Control
SLA	-	Sealed Lead Acid
TV	-	Television
USB	-	Universal Serial Bus
ZIF	-	Zero Insert Force

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CHAPTER 1

INTRODUCTION

1.1 Introduction to Project

Energy resources have become an importance when we are out for outdoor activities. If it rains, camp fires will die out and torch light batteries usually do not last long. Besides that, hawkers from the night market also rely on generators to provide light.

The world is full of alternative energies such as the heat from the sun, wind and hydro power. These energies can be harness to reduce relying totally on the supplied electricity. Moreover, some of the electrical devices and home lightings use only little power. Harnessing the natural energies can save money paid for the electricity and help to save our world. Hence the purpose of this project is to design a fully automated low cost power generation system that will harness solar energy and then convert it into electrical energy to power some of the electrical devices at home and for outdoor lighting. An additional feature is the solar tracking method of the panel which can maximize the energy harnessed.

The system will also include a backup battery which will store the extra charge giving the system to provide longer energy supply. The cost for the project will be emphasizing on low cost to produce so that it will be affordable to be installed for every home. Moreover, the design of the low cost mobile power generator will be convenient to be carried around to places where availability for electricity is an issue.

1.2 Objectives

The objective for the project is to produce a mobile generator system which is portable for many various uses such as outdoor activities and areas where there is a shortage of power supply. Besides that, it can also be used for residents in the rural area. The design of the project will also focus on low cost on producing the generator so that it is affordable. The low cost power generation system will be fully automated so that it will be easy to use.

Solar power will be the power source option for the generator. To enhance the design for maximizing energy harness, a dual axis solar tracker will be added on the panel so that tracking the sunlight will improve the charging time.

This project is also meant to fulfil the course requirements of BENU 4973 (Final Year Project I) and BENU 4984 (Final Year Project II). This project will help graduates be more competent in future as the experience gained in completing the project will be highly evaluated by the industry.

The overall objectives can then be summed as the main points below:

i. To build a low cost mobile generator system
ii. To have a portable design of the system

iii. Solar tracking feature to maximize energy harnessed
iv. To complete the course requirement of BENU 4973 (Final Year Project) and BENU 4984 (Final Year Project II).

1.3 Problem Statement

The problems that might surface during the execution with this project can come from various aspects. The project not only involves electronic knowledge but also knowledge for mechanical design for the dual axis solar panel. The pulling forces and torque of the motor must be studied before being purchased so that it will have enough to move the panel.

Another problem will be programming issues for the PIC 16F877A. The complexity of the programming will need to have synchronization with the hardware so that the response is ideal. The programme itself is also very challenging and need to be debugged for errors before downloading it into the PIC. A study on the programming language is essential to complete the task.

1.4 Scope

This project will include working with both hardware and software. The hardware will include the materials such as the solar panel, acid lead battery, PIC microcontroller, stepper motor, printed circuit board (PCB), solar panel and so on. The hardware materials will be purchased either locally or pre order from companies from different states.

Not all of the hardware are designed but rather purchased to contribute as a part of the system such as lead acid battery and charge controller. The hardware will then be set up by connecting the system in a correct sequence. The mechanical design for the

project will be studied such as the gear ratio that will be needed to move the solar panel to the desired angle.

The available features of the PIC 16F877A will be responsible for controlling the solar panel's movement. A sensor will be needed to sense the sun's position so that the panel will then move accordingly into position. The PIC will be functioning as a hub to connect the hardware and software elements in the dual axis solar tracker design.

Studies and research will then be carried on the topics such as the design of the dual axis solar panel. This will include the hardware and software implementation for the system. Software programming and hardware design will be deterministic for the overall outcome of the project.

After the materials are finally ready, the overall components and materials will be combined to work and function as a mobile energy generator. If there are problems that occur, troubleshooting will be done until the project works properly.

1.5 Methodology

To implement the execution of the project, a flow chart will be used to have an overview of the top down approach to construct the project step by step. For any problems that might surface, an iterative method is used to troubleshoot the project until the project can finally function properly. Below is the flow chart that will be used to conduct the project in the methodology.

1.5.1 Methodology Flow Chart

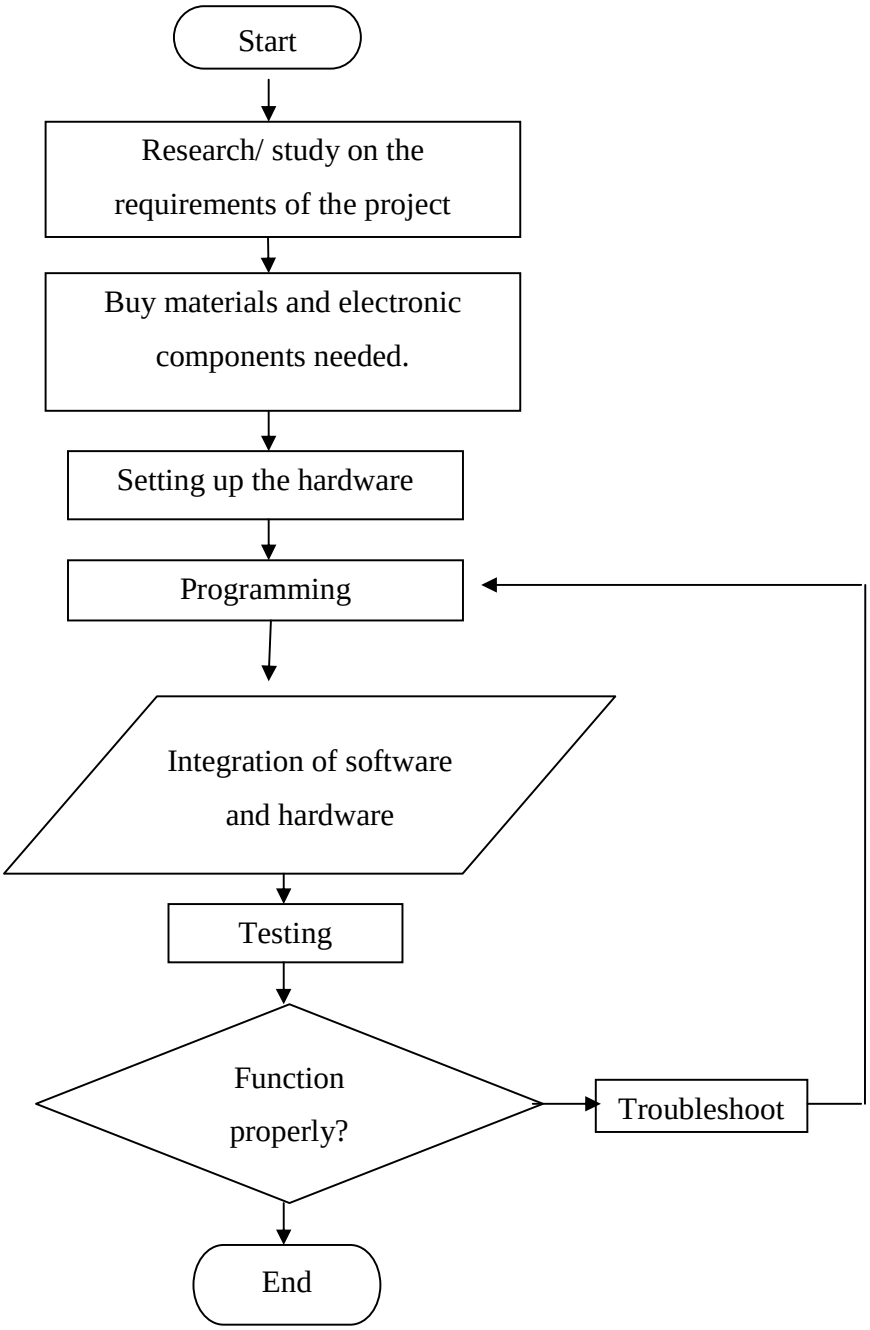

Figure 1.1: The flow chart of methodology

1.6 PSM Report Overview

In brief, the report will contain 5 main chapters that will present the overall progress from the main idea to design and representing the results of the project. At the end, a conclusion will be made based on the findings after the completion of the project. Suggestions will be added along this chapter to provide ideas on how to make the design even better. Hence, the main contents of the report will be as the following:

i. Chapter 1: Introduction
ii. Chapter 2: Literature Review
iii. Chapter 3: Methodology
iv. Chapter 4: Result And Discussion
v. Chapter 5: Conclusion And Discussion