DESIGN & DEVELOPMENT OF ELECTRICAL HARVESTING ENERGY DEVICE FROM NATURAL SOURCE (WIND ENRGY)

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Dedicated to my dearest dad and mum who supported me all the time and my friends who always by my side.

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ABSTRACT

The motivation behind this project is to design and develop a wind turbine system that able to charge the small electronic devices. The wind turbine system is a good solution to generate energy in order to reduce the non-renewable energy such as fossil fuel. Besides, the emission of carbon dioxide will increase global warning. By using wind energy, it will lower the emission of carbon dioxide. This is because wind energy is clean, renewable and free pollution. In this project, the wind is used as medium to transfer energy to wind turbine system in order to generate electric. Hence, the objective of this project is study how the wind energy can be harvest to produce energy. Besides that, another objective of this project is design and develop wind energy system device that may replace current electrical energy. With the help of table fan, it is able to control the velocity of wind and carry on the 2 experiment of wind turbine system. First experiment is design the wind turbine whether it can success generate power source to device. Second experiment is testing that the battery can charging through the electric produce by wind turbine. Prototype is needed to analyse the waveform of power source from wind turbine and apply it into the software. Next, the simulation of software is done to analyse the magnetic field and velocity magnitude for wind turbine by using COMSOL MULTIPHYSIS software.

ABSTRACT

Motivasi di belakang projek ini adalah mereka bentuk sistem turbin angin yang mampu mengecas peranti elektronik kecil. Sistem turbin angin adalah penyelesaian yang baik untuk menjana tenaga bagi mengurangkan tenaga yang tidak boleh diperbaharui seperti bahan api fosil. Selain itu, pelepasan karbon dioksida akan meningkat amaran global .Dengan menggunakan tenaga angin, ia akan mengurangkan pelepasan karbon dioksida. Ini kerana tenaga angin adalah pencemaran yang bersih, boleh diperbaharui dan percuma. Dalam projek ini, angin digunakan sebagai medium untuk memindahkan tenaga kepada sistem turbin angin untuk menjana elektrik. Oleh itu, objektif projek ini ialah mengaji bagaimana tenaga angin boleh menjadi tuaian untuk menghasilkan tenaga. Selain itu, objektif projek yang lain ialah mereka bentuk dan membangunkan tenaga angin peranti sistem yang boleh menggantikan tenaga elektrik semasa. Dengan bantuan kipas meja, ia mampu untuk mengawal halaju angin dan menjalankan eksperimen 2 sistem turbin angin. Percubaan pertama adalah mereka bentuk turbin angin samaada projek inin boleh berjaya menjana sumber kuasa kepada peranti. Percubaan kedua menguji mengecas bateri melalui hasil elektrik oleh turbin angin. Prototaip yang diperlukan untuk menganalisis bentuk gelombang sumber kuasa daripada turbin angin dan menerapkannya ke dalam perisian. Seterusnya, simulasi perisian dilakukan untuk menganalisis medan magnet dan magnitud halaju untuk turbin angin dengan menggunakan perisian COMSOL MULTIPHYSIS.

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LIST OF ABBREVIATIONS

AC	-	Alternating Current
ARES	-	Advance Routing & Editing Software
DC	-	Direct Current
HAWT	-	Horizontal Axis Wind Turbine
ISIS	-	Intelligent Schematic Input System
LED	-	Light Emitting Diode
MPPT	-	Maximum Power Point Tracking
NiCd	-	Nickel Cadmium Battery
NiMH	-	Nickel Metal Hydride Battery
PCB	-	Printed Circuit Board
TSR	-	Tips Speed Ratio
UV	-	Ultraviolet
WEH	-	Wind Energy Harvesting
VAWT	-	Vertical Axis Wind Turbine

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CHAPTER 1

INTRODUCTION

1.1 Overview

The wind is outgassing of light chemical elements from Earth's atmosphere into space. The Earth absorbs and releases heat at different rates from different materials and different geologies. Hence, it produces different pressure in different places. Wind is formed by difference of the pressure. The flow of wind is accelerated from higher to lower pressure. The wind is also deflected by the Coriolis Effect, which is deflection of moving objects, when they are viewed in a rotating reference frame. Wind energy is unpolluted, eco-friendly and consistent energy. Electrical energy generated by wind energy can help to reduce electric rates and protects the dependency of consumers against fossil fuel volatility. Since wind energy is useful, there are a lot of researches had been conducted to make it more accessible. As an intermittent energy source, wind energy is inconsistent due to some factors that are beyond nature atmosphere. In this project, the concept of wind turbine generator was used for charging device with small energy. By converting kinetic energy to electric energy, the product produced 1V until 6V to charge battery.

1.2 Motivation for Research

Nowadays, source of energy is an important part of our daily life and it is essential for our survival. In human daily life, energy is indispensable such as use energy to generate electricity and to activate electric motor. Source of energy comes from coal, oil and other sources, but fuel and gas are non-renewable energy. The non-renewable energy has limited in quantity. They may be exhausted in future. In such a rapid grow economy, an electrical energy has great impact on human routine and activities, however the price of fuel becomes more costly. Wind energy offer cost effective solutions to reduce reliability on costly foreign oil and gas to generate electricity and it can handle the problem of limited energy.

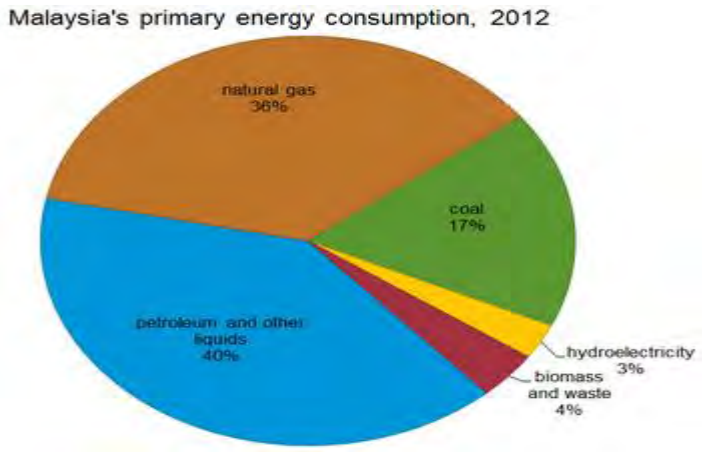

Figure 1.1: Malaysia energy consumption of primary energy, 2012[1]

In Malaysia, petroleum and other liquids are main energy sources and they constitute 40% in pie chart while natural gas has 30% in the primary energy consumption analysis. The renewable energy occupies only a few percentages. From this analysis in 2012, Malaysia is heavily dependent on oil and natural gas for enduring its economic growth. If petroleum and natural gas finish depleted in the future, the economic growth of Malaysia will drop. Hence nowadays the government always looks forward and encourages investments in renewable energy to replace the non-renewable energy.

1.3 Objectives

The main objectives of this project are:

- To study and investigate how wind energy can be harvest to produce electric energy.
- To design and develop wind energy system device that may replace current electrical energy.
- To provide low power source for small application usage.

1.4 Problem Statement

Human depends heavily on primary energy supply such as fossil fuels, coals, and oil & nature gas. The problem with fossil fuel is it is non- renewable. It is limited and will deplete one day. The world needs some sources to produce and maintain energy. Besides that, price of fossil fuels had increased until RM2.20 per litres and it is still increasing. It forces people to pay extra money. Moreover, by using fossil fuels, coals and oil & gas to generate electricity, it also caused an emission of carbon dioxide that leads to global warming. Next, lack of exposition on the green technology will limit environmental awareness to protect environment. The gases produced by fossil fuels will increase global warming in Earth. Besides, the output voltage of another product by using renewable energy is non-consistent and stable. Due to this problem statement, the solution provided by this project is replacing non-renewable energy with wind energy and maintain the output energy in the same level. In addition, the basic knowledge of wind turbine and energy storage is required to design the wind system.

1.5 Scope of Work

Several scopes had been outlined in order to achieve the objectives. The scope of this project is referring to three objectives stated in previous section. This project is used to study and investigate the performance of small wind turbine to supply the small energy for electronic devices. Besides that, it also encourages and increases the awareness of benefits of alternative power source. The simulation was done by using COMSOL MULTIPHYSICS software based on the friction on wind blade and wind speed. The project devices included only three stages for this project. In first stage, the circuit simulation was designed by using Multisim software. After that, the device circuit was tested on breadboard and troubleshoot was done. The device circuit was soldered in PCB board for final stage. The functionality on whole prototype was measured and tested. Then, the result and data were collected.

1.6 Thesis Outline

This thesis consists five chapters. It explains and discusses each description and detail for each chapter.

I. Chapter 1- Introduction

   Introduction briefs important parts of whole project, objectives of project, problem statement of project and scope of project.

II. Chapter 2- Literature review

   In this part, reviews on related journal, conference paper, book, and internet resources are presented. This is due to study the related project in order to improve the project for wind turbine application. The comparison is completed for wind turbine type, different method for wind application, and the differentiation of renewable energy. Besides that, the specific component was done by reviewing the data sheet in order to utilize the function of the component.

III. Chapter 3 – Methodology

In this part, it explains about the method used to design wind system application. The software will help to simulate the graph and data of the project. Besides, Multisim software was used to show the output voltage. The hardware and software were combined to produce a wind system application.

IV. Chapter 4- Result and Analysis

Several experiments were done to ensure the wind system application successful to achieve output target. The data were collected and compiled as the guidance to public. Besides that, software was used to analysis the data to prove the wind system application is valid.

V. Chapter 5- Conclusion and Recommendation

Suggestion will be given to improve the wind system application. The result and analysis for whole project were concluded in conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

In this chapter, it includes the background about renewable energy, wind energy, wind alternator, generator, the microcontroller, additional information and relevant hardware is related to this project.

2.2 Renewable energy

The supplies of fossil energies such as coal, oil and other sources are limited .They will deplete within a few decades and then cease to exist. [3] Hence, non-renewable energy is used to replace by renewable energy to generate electricity. Renewable energy is the continuous energy source that can fill up in a short time period from natural. Examples of renewable energy are solar energy, wind energy, biomass energy and hydro energy. Below in Table 2.1 shows the comparison between renewable energy and non-renewable energy.

Table2.1: Comparison between renewable energy and non-renewable energy [4, 6, 7]

	Important Aspect	Renewable energy	Non–renewable energy
1	Source	Nature environment	Static stock
2	Supply time	Infinite	Limited
3	Normal state	Successive energy flow	Limited source of energy
4	Location	Site and society specific	General and profitable use
5	Cost effectiveness	Free	More and more expensive
6	Scale potential	Small scale	Large scale
7	Skill requirement	Interdisciplinary studies and varied wide range of skill	Strong link with electric and mechanical engineering with specific range of skills.
8	Dependence	Self–supporting system encouraged	System dependent on outside input
9	Area specific	Rustic and decentralised industry	Urban centralised industry
10	Effects on environment	Little harmful on environment	Environment pollution for air and water
11	Safety	Less hazards	Dangerous
12	Example	Solar, wind , biomass, hydro	Coal , oil , natural gas