UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF A PROTOTYPE OF PORTABLE 5V BATTERY CHARGING SYSTEM USING WIND ENERGY

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours

by

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TAJUK: **DEVELOPMENT OF A PROTOTYPE OF PORTABLE 5V BATTERY CHARGING SYSTEM USING WIND ENERGY**

SESI PENGAJIAN**: Semester 2017/2018**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive Technology) with honours. The member of the supervisory is as follow:

……

EN. MUHAMMED NOOR BIN HASHIM

(Project Supervisor)

ABSTRAK

Tenaga Angin adalah salah satu jenis tenaga boleh diperbaharui yang boleh digunakan secara meluas kerana sumber angin tersedia di kebanyakan negara. Dengan menuai tenaga angin untuk menghasilkan tenaga elektrik, kenaikan kos elektrik dapat dikurangkan. Projek ini melihat tenaga angin yang boleh dituai ketika menunggang motosikal untuk menghasilkan elektrik dengan itu menggunakannya untuk mengecas telefon bimbit. Prototaip turbin angin mudah alih direka bentuk dan fabrikasi, menjadikan ia sesuai untuk dipasang pada bakul motosikal. Peningkatan kelajuan apabila menunggang motosikal menyebabkan turbin angin berputar lebih cepat dan meningkatkan voltan yang dihasilkan. Penggunaan booster voltan 5V meningkatkan voltan keluaran yang dihasilkan tetapi menghasilkan arus keluaran yang mempunyai nilai yang sangat rendah. Projek ini menunjukkan bahawa prototaip turbin angin mudah alih yang difabrikasi mampu untuk menghasilkan jumlah voltan keluaran yang diperlukan untuk mengecas telefon bimbit tetapi menghasilkan arus keluaran yang rendah menyebabkan telefon bimbit dicaj dengan kadar yang lebih perlahan daripada pengecs telefon yang digunakan secara komersial. Prototaip ini disyorkan untuk digunakan terutamanya dalam perjalanan panjang apabila menunggang motosikal untuk konsisten kelajuan dan voltan keluaran motosikal.

ABSTRACT

Wind energy is one of the renewable type of energy that can applicable widely because wind resources is available in most countries. By harvesting wind energy to produce electricity, the increment of electricity cost can be reduced. This project looks at which wind energy can be harvested when riding a motorcycle to produce electricity hence use it to charge mobile phones. A prototype of portable wind turbine is design and fabricated, so it is suitable to be attached on a motorcycle's basket. Increasing in speed when riding a motorcycle cause the wind turbine to rotate faster and increasing the output voltage. The usage of 5V voltage booster increasing the output voltage produced but the output current produces is significantly low in value. This project shows that the portable wind turbine able to produce the amount of output voltage needed to charge mobile phones but the low output current produce causing mobile phones to be charge in a slower pace than the commercially used phone chargers. The prototype recommended to be used especially in a long journey when riding a motorcycle for the consistency of motorcycle's speed and output voltage produce.

DEDICATION

To my beloved parents,

Omar Bin Ambu Laungan and Siti Rubiah Binti Abd Rashid

Who raised me to become a useful person, helping person and a successful person in a world and here after.

To my honored supervisor,

Mr Muhammed Noor Bin Hashim

and all UTeM lecturers

thank you for always giving me guidance and persistent help to complete this project thesis.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

2D	-	Two-Dimensional
3D	-	Three-Dimensional
A		Ampere
AC	-	Alternating Current
DC	-	Direct Current
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
CAM	-	Computer Aided Manufacture
CATIA	-	Computer Aided Three-Dimensional Interactive Application
EMF	-	Electromotive Force
HAWT	-	Horizontal Axis Wind Turbine
P		Power
PC	-	Personal Computer
USB	-	Universal Serial Bus
UTeM	-	Universiti Teknikal Malaysia Melaka
V		Voltage
VAWT	-	Vertical Axis Wind Turbine

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, the project's introduction, background, problem statement, objectives and scope of project will be discussed. This project focus on designing and fabricating a prototype of portable wind turbine for that can be attached to motorcycle It works by converting wind energy to kinetic energy and then producing electrical energy. will be design and attach to a motorcycle and will provide electricity by harvesting wind energy when riding the motorcycle. The purpose of the portable wind turbine is to overcome the problem of increasing cost of electricity usage.

1.1 Background

The main function of a generator is generating electricity. The discovery of electromagnetic induction by Michel Faraday demonstrated a method to build a simple generator. The need for such a device at that time was little as commercial energy such as light still not invented.

Through the 1860s and 1870s, many inventors search for ways of using Faraday's induction principle to generate electrical mechanically. There are two types of generators which are direct current (DC) and alternating current (AC) generator.

In Malaysia, the electricity output is generated mainly from burning of limited fossil fuel resources. For example, from the burning of oil, coal or natural gas that may cause consequences for the environment.

As Malaysia is one of the rapidly developing country, the demand for electricity over the past decades has rapidly increased whether from the industrial sector or the residential and commercial use of the Malaysian.

The increasing cost and electricity demand per capita has been a huge problem that had to be faced by the Malaysian. Based on the statistics from the energy commission of Malaysia, the electricity demand per capita shows increment each year, from 626 kWh/person in 1980 to 4194 kwh/person in 2014

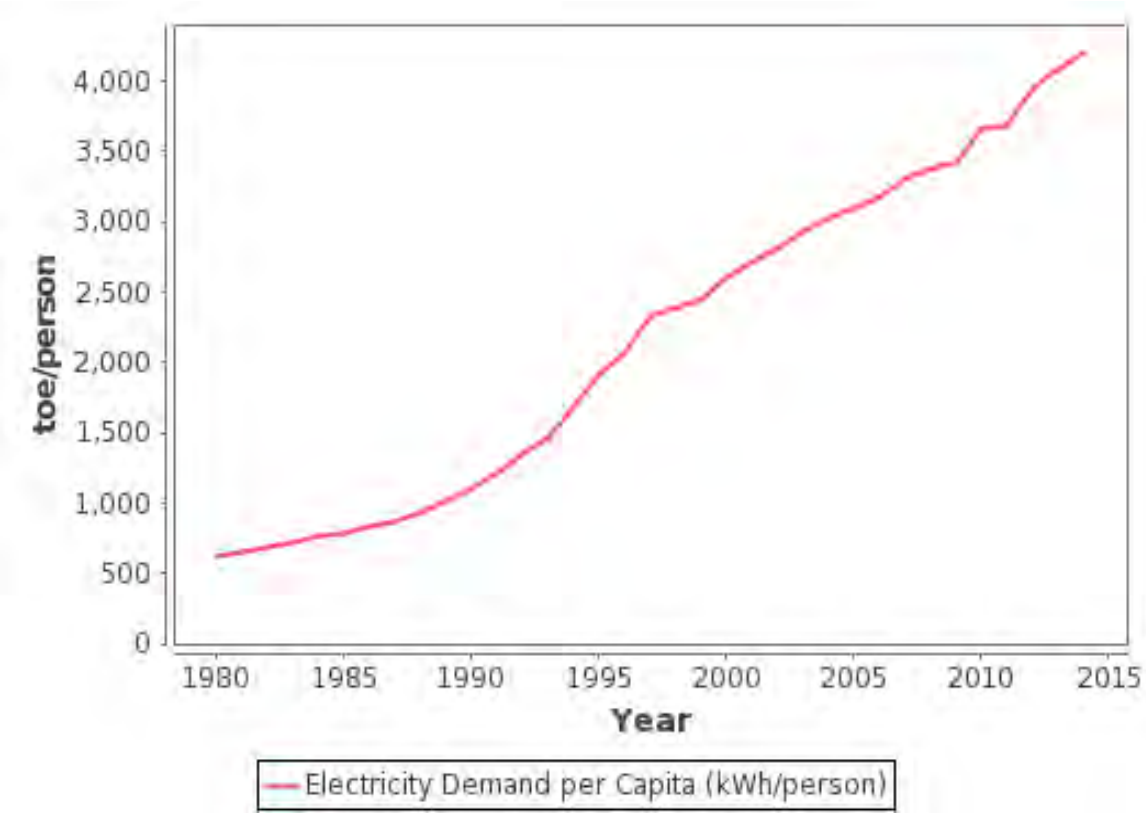

Figure 1-1: Graph increment of electricity demand per capita from 1980 to 2014

(Source: <http://meih.st.gov.my/statistics> 29/03/17)

Some ways that can be used to decrease the amount of electricity usage is by harvesting energy from surrounding. One of the energy that can be harvest is wind energy. Some of the time that can be used to harvest wind energy is when riding a motorcycle. Huge amount of wind energy is produced when riding motorcycle especially in higher speed. Hence, harvesting the wind energy by using small wind turbine will result in electricity production. Although, the electricity produce is maybe low, it can be used to charge mobile phones hence decreasing the electricity cost usage.

1.2 Problem Statement

The main problem faced is the increasing cost and electricity demand per capita of Malaysian. Some of the reason that contribute to the increment of cost and electricity is due to usage of mobile devices such as mobile phones. Based on the statistics from the energy commission of Malaysia, the electricity demand per capita shows increment each year, from 626 kWh/person in 1980 to 4194 kwh/person in 2014. The rapidly increasing electricity cost and demand per capita cause people to look for other alternate source of energy.

1.3 Objectives

The purpose of this project is to build a prototype of 5V battery charging system by using wind energy. The portable wind turbine is expected to be able to charge 5V battery. In short, the objectives are:

i. To design a prototype of portable wind turbine that can be attached to a motorcycle.
ii. To fabricate a prototype of portable wind turbine that can be attached to a motorcycle.

iii. To measure the output voltage of the portable wind generator by using multimeter.

1.4 Scope of Project

The scope of this project is divided into two main parts. The first main part will focus on designing the prototype of the portable wind generator, while the second main part is focusing on fabricating the prototype of the portable wind generator.

For the designing of the prototype itself, some concepts of the portable wind turbine system will be developed and sketch. The most effective or suitable concept will be selected by concept selection method The finalized design concept will be continued to be design in Computer Aided Design (CAD) Software. CATIA V5 Software will is the CAD Software that will be used to design and draw every part of the prototype of 5V battery charging system.

A prototype of the 5V battery charging system will be fabricated based on the finalized drawing. The prototype is also expected to be able to be attached to a motorcycle and expected to produce electricity. The prototype will be tested whether it can produce enough current to charge a 5V battery.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter discussed about some published information regarding this project and it will cover with some basic theories with a principle for a better understanding about this project.

2.1 Wind Energy

Wind power is a relatively established technology. Wind energy contends with other energy sources in terms of worth, ecological effects and usage. Even though improving project economy is a vital test for wind power, it is closer to commercial productivity compared to other renewable sources apart from hydro power. Wind resources is available in most countries, so it can be applicable widely. Wind energy is relatively established and a lot of countries have resolved cost and technology challenges (Jaber 2014).

2.2 Wind Turbines.

2.2.1 History of Wind Turbines.

Technology of winds start to be acknowledge centuries ago. Simpler wind devices which are vertical axis windmill found thousands of years ago at the Persian-Afghan borders around 200 BC. Meanwhile, horizontal- axis windmills found much later which is the property of the Netherlands and the Mediterranean around 1300 – 1875 AD. Evolution of the system was further perfected by the USA during 19th century. In 1888 Cleveland, Ohio, a low speed and high-solidity wind turbine was installed which is the first large wind machine to generate electricity. Design of airplane propellers and monoplane wings had inspired further development of wind generators in the United States of America (USA). During 1935 to 1970 periods, subsequent effort in several European countries prove that large-scale wind turbine could work (Kaldellis & Zafirakis 2011)

According to Kaldellis & Zafirakis, 2011 one of the most important moment of the wind energy history is the involvements of. USA government in wind energy research and development after 1973 oil crisis. Wind turbines market evolved to utility interconnected wind farm applications from domestic and agricultural. Over 16000 machines ranging from 20 to 3050 kW were installed between 1981 and 1990 cause the first large-scale wind energy penetration in California. Through 80s and 90s, wind farm installation increase steadily in northern Europe due to increment of electricity cost and the creation of small but stable market due to excellent wind resources. Majority of market activity moves to Europe after 1990, as the last 20 years brought wind energy by major players from all world regions as the front line of the global scene.

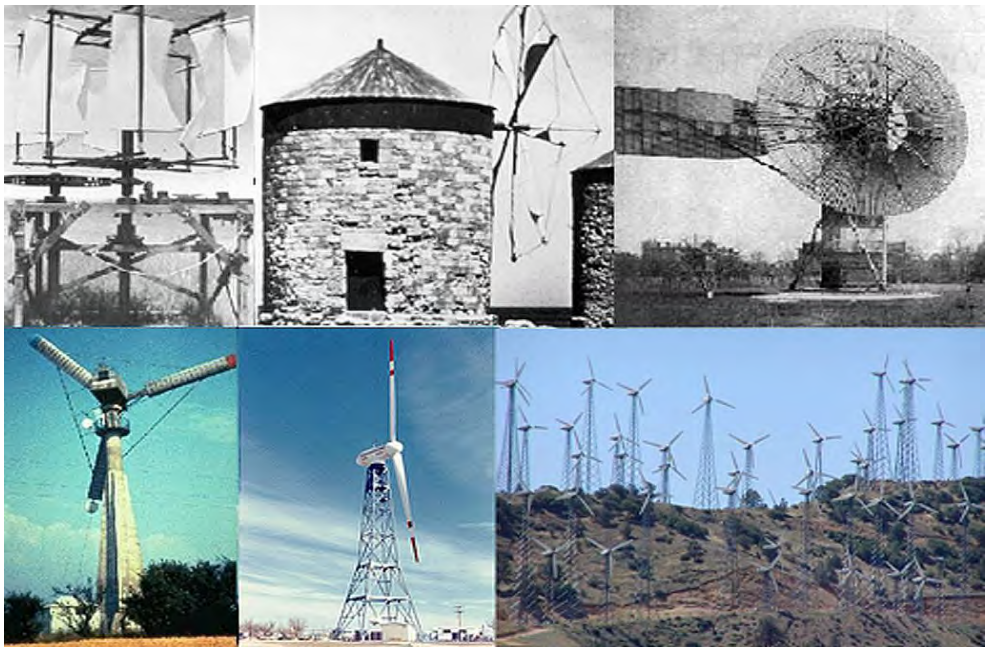

Figure 2-1: Primary stages development of wind turbine

(Kaldellis & Zafirakis 2011)

2.3 Types of Wind Turbines

There are two major types of wind turbines which are Horizontal Axis Wind Turbine and Vertical Axis Wind Turbine.

2.3.1 Horizontal Axis Wind Turbine

Horizontal Axis Wind Turbines (HAWT) are the most common style of wind turbine. A HAWT design is similar to windmill, it consists of blades that look similar to a propeller that rotates on the horizontal axis.

HAWT have main rotor shaft and electrical generator at the top of its tower that pointed into the wind. Small turbines pointed by a simple wind vane place

square with the rotor, while large turbines used a wind sensor coupled with servo motor to turn the turbine into the wind. Large wind turbines usually have a gearbox that function to turn the rotation of the rotor from slow into a faster rotation that have more efficiency in driving an electrical generator.

The tower will produce turbulence behind it, hence the turbine usually pointed upwind to the tower. As wind turbine blades are stiff, it prevents the blades from being pushed into tower cause by high winds. The blades usually placed in some amount in front of the towers and usually tilted up a bit. (C Bracken Meyers, 2013)

Figure 2-2: A Horizontal Axis Wind Turbine

(Sources :< https://www.turbinesinfo.com/horizontal-axis-wind-turbines-hawt/> 27/11/2017)

2.3.2 Vertical Axis Wind Turbine

Vertical Axis Wind Turbines (VAWT) have the main rotor shaft arranged vertically. Difference with the HAWT that have main rotor shaft that arrange horizontally

The wind turbine does not need to be pointed into the wind for this type of wind turbine. It is an advantage on place which has turbulent winds, or the wind direction is highly variable.

As the VAWT has vertical axis, its generator and other primary components can be placed near the ground hence the tower does not need to support those components. It also makes the maintenance for the wind turbine easier. The main disadvantages for this kind of wind turbines are it generally create drag when rotating into the wind.

VAWT have two subtypes which are Darrieus wind turbine and Savonius wind turbine. C Bracken Meyers, 2013)

Figure 2-3: A Darrieus Wind Turbine of VAWT subtypes

(Source:< https://en.wind-turbine-models.com/turbines/93-dornier-darrieus-55>27/11/2017)

Figure 2-4: A Savonion Wind Turbine of VAWT subtypes

(Source:<http://www.archiexpo.com/prod/windside/product-88530-959470.html> 27/11/2017)

2.4 Generators

Generator is a device that converts mechanical energy to electrical energy for use in an external circuit. The generator can be used to produce electric power, and as an electromotor to produce mechanical rotational energy. The generator can draw out electric power by utilizing any source of energy, especially suitable being driven by wind An energy reverse conversion from electrical energy into mechanical energy was done by electric motor. Many motors can be mechanically driven to generate electricity and frequently make acceptable generators.