# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## DESIGN OF SUPPLY GENERATOR FROM WIND SYSTEM BY USING MICROCONTROLLER

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Automation Industries and Robotics) with Honours.

by

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## APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Automation Industries and Robotics) with Honours. The member of the supervisory is as follow:

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## ABSTRAK

*Bahan api fosil digunakan secara meluas untuk menjana elektrik tetapi mereka akan merosakkan alam sekitar dan akan menyebabkan lebih banyak kos menjana elektrik. Sebagai contoh, pencemaran angin yang disebabkan oleh bahan api fosil. Oleh itu, tenaga baru untuk menjana elektrik tanpa merosakkan alam sekitar diperlukan. Angin adalah sumber yang sangat diperlukan kerana tenaga bersih dan turbin angin digunakan secara meluas pada hari ini. Oleh itu, tenaga angin adalah sumber tenaga yang boleh diperbaharui dan boleh menjadi sumber tenaga yang tidak habis-habis. Pelaksanaan projek ini adalah reka bentuk penjana bekalan dari sistem angin dengan menggunakan mikrokontroler. Untuk kuasa angin, turbin angin akan dibekalkan dengan jumlah bilah dan kelajuan angin bilah kipas bersama-sama dengan penjana. Penukar penukar digunakan untuk meningkatkan voltan elektrik yang dihasilkan oleh penjana angin dan menghantar kepada pengawal beban elektronik. Kemudian, pengawal beban elektronik akan memadankan kuasa yang sesuai untuk beban. Komponen utama projek ini adalah tenaga yang dihasilkan oleh turbin angin dengan menggunakan reka bentuk Archimedes. Mikrokontroler akan memantau keseluruhan sistem. Hasil yang diharapkan untuk projek ini adalah untuk menghasilkan tenaga elektrik dengan menggunakan penjana turbin angin dan sistem ini akan berfungsi sebagaimana mestinya.*



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## ABSTRACT

*Fossil fuels are widely used to generate electricity but they will spoil the environment and will cause more costs to generate electricity. For example, wind pollution caused by fossil fuels. Because of that, new energy to generate electricity without damaging the environment is required. Wind is an indispensable source because clean energy and wind turbine are widely used today. Therefore, wind energy is a renewable source of energy and can be an inexhaustible source of energy. Implementation of this project is design of supply generator from wind system by using microcontroller. For wind power, wind turbine will be supplied with the total blade and wind speed of the fan blade together with the generator. The boost converter is used to increase electrical voltage generated by the wind generator and send to electronic load controller. Then, the electronic load controller will match the suitable power for the load. The main component of this project is energy that generated by wind turbine by using Archimedes design. The microcontroller will monitor the whole system. The expected outcome for this project is to generate electricity by using a wind turbine generator and this system will function as it should.*



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## DEDICATION

This project and thesis are wholeheartedly dedicated to our beloved parents, who have been our source of inspiration and gave us strength that continually provide their moral, spiritual, emotional, and financial support.

To our brothers, sisters, relatives, supervisor, lecturer and who shared their words of advice and encouragement to finish this study. To my close friends, Mohd Khairul Asyraf Bin Mohd Johar, thank you for helping out throughout completion this project.

And lastly, we dedicated this study to ALLAH SWT, thank you for the guidance, strength, power of mind, protection and skills and for giving us a healthy life.

(Muhamad Hafiz Bin Roslan 2018)



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# LIST OF SYMBOLS

| | | |
|---|---|---|
| **D, d** | - | Diameter |
| **F** | - | Force |
| **g** | - | Gravity = 9.81 m/s |
| **I** | - | Moment of inertia |
| **1** | - | Length |
| **m** | - | Mass |
| **N** | - | Rotational velocity |
| **P** | - | Pressure |
| **Q** | - | Volumetric flow-rate |
| **r** | - | Radius |
| **T** | - | Torque |
| **Re** | - | Reynolds number |
| **V** | - | Velocity |
| **w** | - | Angular velocity |
| **x** | - | Displacement |
| **z** | - | Height |
| **q** | - | Angle |



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# LIST OF ABBREVIATIONS

| | |
|---|---|
| **B.C.** | Before Christ |
| **HAWT** | Horizontal-axis Wind Turbine |
| **VAWT** | Vertical-axis Wind Turbine |
| **THD** | Total Harmonic Distortion |
| **PIC** | Programmable Integrated Circuit |
| **PMSG** | Permanent Magnet Synchronous Generator |
| **MPPT** | Maximum Power Point Tracking |
| **WTE** | Wind Turbine Emulator |
| **TSR** | Tips-speed Ratio |
| **SCR** | Silicon-controlled Rectifier |
| **SEIG** | Single Phase Personal Excited Induction Generator |
| **ELC** | Electronic Load Controller |
| **CRT** | Cathode Ray Tube |
| **LCD** | Liquid Crystal Display |



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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

Electricity is a kind of energy which will provide capacity to load. Power source can be produced by using solar panel, wind turbine, generator, sea wave, nuclear, natural gas, hydroelectric, petroleum, geothermal resource and so forth. Different country used various selection of technique in generating power depending on the source. Malaysia uses a technique like hydroelectric, coal, natural petroleum and gas. However, this source offers their own limitation regarding to cost and quantity. Therefore, this project propose electric power generator by using wind turbine.

## 1.2 Problem Statement

Nowadays, most homes use variety of electrical equipment. However, the usage of high power of these equipments will increase the cost of electricity. The operating cost of generating electricity is rising of the price of a non-renewable source. The non-renewable source such as generator, fossil, coal and petroleum will caused the pollution, for example, acid rain, global warming and greenhouse gases. Furthermore, the non-renewable energy will be contaminated and may run out someday. In addition, manual generator such as fossil and hydroelectric pressure requires manpower to move the generator. The wind turbine proposed to this project because it is natural source which never run out and always be with us. Wind generator can move without the need for



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manpower and automatically works. Also, wind system is renewable energy source in producing a green energy.

## 1.3 Objective

The objectives of the project are:

I. To develop a prototype of generator based on wind turbine system.

II. To analyze the performance of the designed system based on different characteristics of the system.

III. To validate the application of the designed system on daily usage equipment.

## 1.4 Scope of the Project

The scopes of this project are:

I. To design a prototype of generator based on wind turbine system by using Arduino.

II. The performance of the designed system will be analyzed by observing different material and location of the wind system.

III. The effectiveness of the designed system will be tested by apply it to daily usage equipment.



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# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This subtopic reviews about the past research that relevance with this project. The purpose of this project is to use a renewable energy as a source, reducing damage of nature and produce green technology. In this chapter, it consist all of the theory and implementation of the component regarding the project to achieve the project objective.

## 2.2 Wind turbines

According to (ERIN R. PIERCE and DANIEL WOOD n.d.), indicates that the thought of harnessing wind flow energy to create mechanical power goes back for millennia. The moment 5000 B.C., Egyptians used wind flow energy to propel boats along the Nile River. American colonists relied on wind turbines to grind grain, pump normal water and cut wood at sawmills. Today's wind turbines would be the wind turbines contemporary comparative with switching the kinetic energy in wind flow into clean, alternative electric power.

Nearly all wind generators contain three blades set up to a tower produced from tubular steel. Some types are less familiar with two blades, or with concrete or metal lattice towers. At 100 ft or higher above the bottom, the tower allows the turbine to take advantage of faster wind speeds found at higher altitudes. Turbines catch the wind's energy utilizing their propeller-like blades, which actions very much as an aircraft wing.



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When the flow of wind blows, the air pressure powders form low pressure on the main part of the blade. The low-pressure atmosphere pocket pulls the blade toward after that it, resulting in the rotor to cautiously turn. That is known as lift. The pressure of the lift is much more powerful compared to the wind's drive against leading facet of the blade, to generate drag. The combination of lift and drag causes the rotor to spin just like a propeller.

A number of gears improve the rotation of the rotor from about 18 revolutions a complete minute to roughly 1,800 revolutions every single minute is a swiftness that allows the turbine's generator to make AC electricity. A streamlined enclosure known as a nacelle homes essential turbine parts are usually just like the gears, generator and rotor can be found within a casing known as the nacelle. Seated atop the turbine tower, some nacelles are large plenty of for a helicopter to property on. Another key component may be the turbine's controller that keeps the rotor rates from exceeding 55 mph in order to avoid damage by high winds. An anemometer measures wind speed and transmits continually the data to the controller. A brake, housed in the nacelle also, helps prevent the rotor mechanically or hydraulically in emergencies electrically.

## 2.3 Type of Wind Turbine

Presently there are two basic types of wind generators which are horizontal axis and vertical axis. Nearly all wind turbines possess a horizontal axis that's a propeller-style with blades that rotate around a horizontal axis. Horizontal axis turbines are either upwind (the wind hits the blades prior to the tower) or downwind (the wind hits the tower prior to the blades). Upwind turbines likewise incorporate a yaw travel and motor.



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These parts turns the nacelle to keep carefully the rotor facing the wind when its path changes.

### 2.3.1 Horizontal-axis Wind Turbines

According to (Camille Bajaro Year and Gandhi n.d.), the horizontal-axis wind turbines (HAWT) have the primary rotor shaft and power generator near the top of a tower, and could be pointed into or from the wind. Small turbines are pointed by a straightforward wind vane, while large turbines use a wind sensor in conjunction with a servo motor generally. Most have got a gearbox, which turns the gradual rotation of the blades right into a quicker rotation that's more suitable to operate a vehicle an electrical generator.

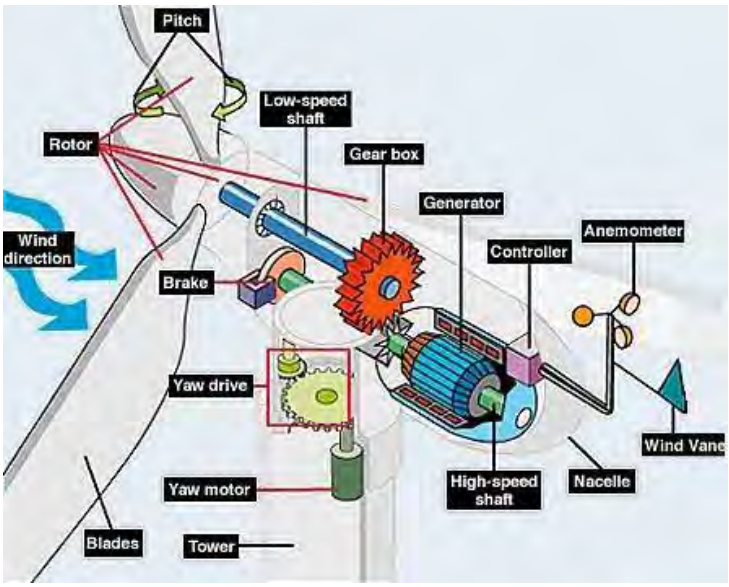


**Figure 2.1: Design of HAWT**



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**Blade**

- The lifting style wind generator blade. These are the most effectively designed, specifically for capturing energy of solid, fast winds. Some European companies actually manufacture an individual blade turbine.
- The drag design wind turbine blade, most utilized for water mills popularly. The blades are flattened plates which capture the wind. These are made for capturing the energy of heightened winds poorly.

**The rotor** was created aerodynamically to capture the utmost surface of wind to be able to spin the most ergonomically. The blades are light-weight, corrosion-resistant and durable material. The best components are composites of fiberglass and reinforced plastic material.

**A gear box** magnifies or amplifies the energy result of the rotor. The gear box is located directly between the rotor and the generator. A rotor rotates the generator (which is shielded by a nacelle), as directed by the tail vane.

**The generator** produces electricity from the rotation of the rotor. Generators can be found in various sizes, in accordance with the output you intend to generate. The nacelle may be the casing or enclosure that seals and protects the apparatus and generator box from the elements. It is easily taken out for maintenance of the wind.

**The tail vane** directs the turbine to assemble maximum wind energy.



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### 2.3.2 Vertical-axis Wind Turbines

(VERTICAL AXIS WIND TURBINES n.d.), declare that the "vertical axis wind turbine" has turbine blade styles possibly vertical or in the form of an egg beater, and similar in lots of ways to the wind powered centrifugal ventilators seen on chimney's and flue's. The vertical axis wind mill blades are mounted on a central vertical shaft and which includes particular advantages over the horizontal wind turbine styles. When the blades spin, the shaft spins which is mounted on an alternator generally located in the bottom of the shaft, at ground level often. Except for the form of its rotor blades, all the components found in the VAWT wind turbine will be the same in both styles, with some minor variations within their placement.

Vertical axis wind turbine blades could probably of either a drag-driven or lift-driven rotor design. The most frequent drag-driven vertical axis wind turbine design is definitely that of the Savonius rotor, which includes been used for more than 100 years for water other and pumping such mechanical applications. The Savonius VAWT wind mill has an S-designed rotor when seen from above and functions as a drag gadget, and therefore, the angular velocity of the turbine cannot go beyond the ambient wind swiftness. The energy from the Savonius turbine style is founded on the difference in air flow pressure over the blades as one group of blades retreat from the wind and the additional groups of blades advance in to the wind. This can be in turn linked to the difference in the drag coefficients linked to the convex part of the blade and the concave aspect of the blades. Generally, in comparison to various other forms of wind mill designs, the Savonius rotors possess low efficiencies fairly.



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