



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF DOMESTIC RENEWABLE ENERGY
USING WINDBELT GENERATOR**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Electronic Engineering
Technology (Industrial Electronics) with honours

by

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I hereby, declared this report entitled “DEVELOPMENT OF DOMESTIC RENEWABLE ENERGY USING WINDBELT GENERATOR” is the results of my own research except as cited in references.

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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 Engineering Technology (Bachelor Degree of Electronic Engineering Technology (Industrial Electronics))(Hons.). The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRACT

Nowadays, the energy we use today comes mainly from non-renewable sources such as coal, oil, natural gas and uranium, all of which are finite resources and will be depleted. Problem also happen because unsustainable price of fossil fuels and high growing demand energy in global. Additionally, the use of these types of fuel are damaging to our health and to the environment. Malaysian also lack of exposure about renewable energy. This is to create awareness about renewable energy. This windbelt generator uses wind or moving air energy to produce electricity. The device uses the effect called “the aero elastic flutter movement” to produce electricity. This project also is to develop a prototype of windbelt generator that can combine with a home appliance that is table fan which usually uses at home or building. By using windbelt generator, this energy can generate electricity. The system for these projects also have been developed that consist boost circuit and inverter circuit. The windbelt on this project manage to produce electricity that can be used for DC or AC load.

ABSTRAK

Pada masa kini, tenaga yang kita gunakan hari ini datang terutamanya daripada sumber-sumber yang tidak boleh diperbaharui seperti arang batu, minyak, gas asli dan uranium, di mana kesemuanya adalah sumber yang terhad dan akan habis. Masalah juga berlaku kerana harga tidak menentu bahan api fosil dan permintaan tinggi tenaga yang semakin meningkat di peringkat global. Selain itu, penggunaan jenis bahan api yang merosakkan kesihatan kita dan alam sekitar. Malaysia juga kekurangan pendedahan tentang tenaga boleh diperbaharui. Ini adalah untuk memberi kesedaran tentang tenaga boleh diperbaharui. Ini penjana windbelt menggunakan angin atau bergerak tenaga udara untuk menghasilkan elektrik. Peranti ini menggunakan kesan yang dipanggil "pergerakan debar anjal aero" untuk menghasilkan elektrik. Projek ini juga adalah untuk membangunkan satu prototaip penjana windbelt yang boleh bergabung dengan perkakas rumah yang kipas meja yang biasanya menggunakan di rumah atau bangunan. Dengan menggunakan penjana windbelt, tenaga ini boleh menjana tenaga elektrik. Sistem untuk projek-projek ini juga telah dibangunkan yang terdiri rangsangan litar dan litar penyongsang. The windbelt dalam projek ini berjaya mengeluarkan tenaga elektrik yang boleh digunakan untuk DC atau AC beban.

DEDICATIONS

To my beloved family, fellow friends and lecturer's that gives full commitment and support for this Final Year Project.

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LIST OF SYMBOLS AND ABBREVIATIONS

| | | |
|-----|---|-----------------------|
| V | - | Volt |
| DC | - | Direct Current |
| AC | - | Alternate Current |
| VDC | - | Direct Voltage |
| VAC | - | Alternate Voltage |
| LED | - | Light Emitted Diode |
| kWh | - | kilowatt hour |
| W | - | Watt |
| h | - | hour |
| RM | - | Ringgit Malaysia |
| PSM | - | Projek Sarjana Muda |
| mW | - | miliwatt |
| PCB | - | Printed Circuit Board |

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter presents the overview for overall description for this project. It's including the background of project, objective and scope. The organization of the report also state in this chapter for the preview of the report ahead.

1.1 Project Background

In this project, the main focus component that use is windbelt generator. Windbelt generator is a device that converts wind or moving air energy to electricity. The suitable call for that energy in this project is moving air because this energy comes not comes naturally from nature but produce from table fan that based on the title given on this project "Development of Domestic Renewable Energy Using Windbelt Generator", domestic means the relating to the directing of a home or local building. A windbelt generator is a motion of aero elastic flutter effect of tape to move a magnet that put closer and farther from one or more coils to induce electricity. These generator designs to be suitable furniture to place at home or local building for the uses of home appliance such as charging hand phone or other electronic devices that use 12V capacity range. Electricity that induces from windbelt generator comes on the smaller scales which range between 1V to 2V. So, another system and component must be built to produce requirement electricity such as rectifier, boost or step up converter circuit, inverter circuit, rechargeable 12V battery, and DC or AC load appliance. This generator develop to help reduce electrical bill and backup electricity sources for household and to expose the people in Malaysia about windbelt generator also the importance of renewable energy uses.

1.2 Problem Statement

Nowadays, Malaysia currently adopts a five-fuel mix (gas, coal, hydro, oil, and other sources) for electricity generation. The energy we use today comes mainly from non-renewable sources such as coal, oil, natural gas and uranium, all of which are finite resources and will be depleted. Problem also happen because unsustainable price of fossil fuels and high growing demand energy in global. Additionally, the use of these types of fuel are damaging to our health and to the environment. As individuals, your home has a direct impact on the environment. Power stations that provide our electricity, generally burn fossil fuels to supply our energy needs. Among people Malaysia also lack of exposure about renewable energy. This is to create awareness about renewable energy.

1.3 Project Objective

- i. To design a sustainable and affordable of renewable electricity resources.
- ii. Smart way to produce electricity in home by using furniture.
- iii. To reduce electrical bill.
- iv. Backup electricity sources when blackout.

1.4 Scope of Project

The project work scope is to design a suitable wind generator prototype to place at home or local building and to develop system to store the requirement electricity.

These systems contain:

- Rectifier circuit
- Boost or step-up converter circuit
- Inverter circuit
- Rechargeable Battery
- Battery 12V
- AC load

For the windbelt generator, it must be vibrate efficiently to produce electricity range between 1V to 2V. The rectifier uses for this system is to convert the AC voltage from windbelt generator to DC voltage. Then, the boost or step-up converter circuit uses to boost the DC voltage to 12VDC then it flow to rechargeable battery hence charge the battery. The inverter will convert the voltage that get from charger circuit from DC voltage to AC voltage. The system is expected to produce electricity 12VDC for DC load and 240VAC for AC load.

1.5 Summary

This chapter discuss about the overview of the Winbelt generator and purpose of this project. Introducing Development of Domestic Renewable Energy Using Windbelt Generator has the potential to create an alternatively electric supply to be used for later purpose. This project has the capability to reduce the usage of existing fossil energies which sooner or later these energies will run out due to continuous usage by the users. The concept of the project which covers the project functionality will be shown in this chapter. Because of that, Development of Domestic Renewable Energy Using Windbelt Generator was built in order to save our exhausted fossil energies and hence creates an alternative electric supply.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter is to summarize the literature review of the project. In order to complete this project also, some researches about the previous system also been studied and explore. It is a body of text that aims to review critical pint of current knowledge for any related information and reviews on Windbelts and awareness about electricity consumptions. These chapters also consist of aim to show all related studies, formula, result, history, type and function of Windbelts in order to show the relationship with this project.

2.1 Comparison between Wind Generators

Table 2.1: Comparison between Wind Generators

| Type of generator | Windbelts Generator | Wind Turbine |
|----------------------|---|---|
| Operation | Use aero elastic flutter motion from wind to converts into electricity. | Use rotational energy from wind to converts into electricity. |
| Cost of Construction | Cheap | Expensive |
| Market Production | Small | Big |
| Development | Still in process for development | Widely develop |

2.1.1 Windbelt Innovation

This recently, turbine the only device that harvesting wind but Shawn Frayne the founder of the Humdinger Wind Energy given the infamous phenomenon by redeem Windbelt as a new form of cheap and clean device for harvesting wind. Shawn Frayne has received a Breakthrough Award from Popular Mechanics for the Windbelt him invented. Windbelt is in one of such devices that holds a promising future in the renewable energy market. The device converts wind energy to electrical energy by means of a stretched membrane and few a magnets located within metal coils. [1] He noted that providing wind power on a global scale would require hardware that simpler and much cheaper than what we've got to develop a radically different power generator that uses a fluttering membrane, magnets and a metal coil to turn wind into power that compare to turbine, the Windbelt can produce energy at a cost-per-watt that significantly lower than conventional devices. Windbelt relies on an aerodynamic phenomenon known as aero elastic flutter. This phenomenon is a well-known as destructive force. Researchers at Humdinger have discovered that it can also be useful and powerful mechanism for catching the wind at scales and costs beyond the reach of turbines. The Windbelt uses a tensioned membrane that oscillates to pull energy from wind or moving air. It can be pictured how it works by think how the strapping on a truck can be seen moving in the wind or how you held a blade of grass between your fingers as a kid and made it whistle. That is roughly how the Windbelt can pull energy from the wind then turn that energy of moving membrane into electricity, which is done by actuating new types of linear generators. The famous example of the destructive power of aero elastic flutter is a collapse of Tacoma Narrows Bridge. The bridge across Puget Sound opened on July 1, 1940. Four months later a strong continuous wind induces oscillation into the structure, which showed torsional and longitudinal flutter, eventually causing it collapse. The Windbelts turn it flutter into electricity by a pair of magnets is fastened to the belt, so as the belt moves up and down the magnet follow the same motion. This motion of the magnets takes place directly to the stator (coil). Then, a magnetic field moving next to a coil of wire induces a current to flow.

2.2 Humdinger Wind Energy and Windbelt Innovation

Until recently, the only commercially viable wind harvesting device was the turbine. Humdingers Windbelt is the first non-incremental innovation beyond this century-old approach. [2]Humdinger Wind Energy was the company that built by Shawn Frayne to market the Windbelt into worldwide. History of this Windbelt technology conceived in 2004, during a trip to Petite Anse, Haiti. Shawn Frayne working that area and found the fishing village near the coast was not connected to an electrical grid and the only lighting available was diesel powered or kerosene-based. He recognized that white LEDs powered by a very inexpensive wind generator might be able to better light homes and school in that area. Shawn has tried to design an affordable turbine-based wind generator but the turbine technology is too inefficient at these scales to be a viable option. Then, he led to a new invention because of these difficult constraints of cost and local manufacture. The new inventions call the Windbelt generator. Today, the suite of technologies and intellectual property behind the Windbelt is wholly owned by Humdinger Wind Energy, LLC (“Humdinger”). Humdinger, a Hawaii limited liability company with a wholly-owned subsidiary (Humdinger Wind Energy (HK) Limited) in Hong Kong, is primarily a research and development house focused on pushing forward the development of the Windbelt technology. Through its growing intellectual property base in the US and abroad, Humdinger manages rights to the Windbelt technology. Humdinger is seeking strategic partners interested in licensing intellectual property rights to manufacture and sell products incorporating our Windbelt technology. This company has created a several Windbelt product that use in worldwide that is Micro Windbelt, Medium Windbelt and Large Windbelt.

2.2.1 Micro Windbelt

This Micro Windbelt used to replace an AA battery to generate power millions of wireless sensors. This sensors use to collecting data about everything from the temperature of a building to the air quality of a city to the stresses in bridge that shown in Figure 2.1.

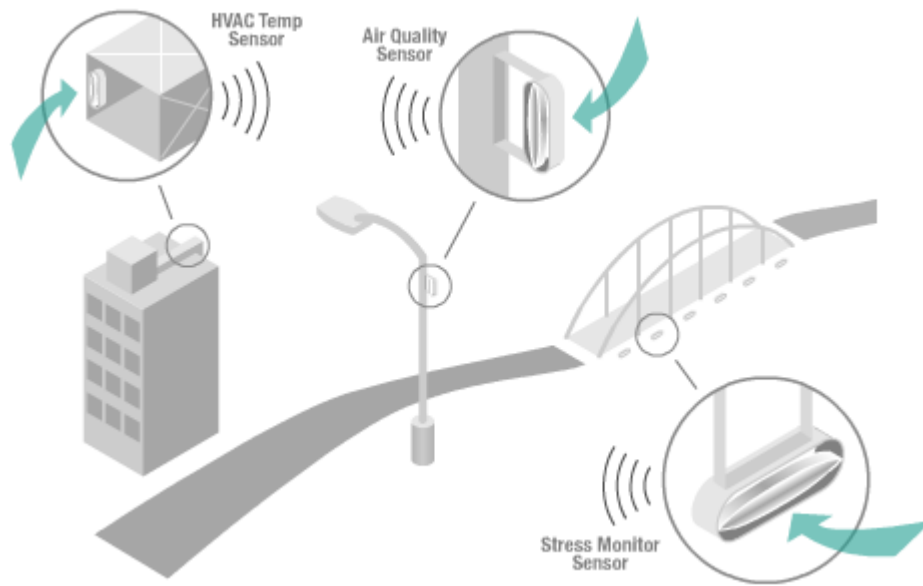


Figure 0.1: Some applications of the Micro Windbelt.

Soon, these wireless sensors can be are billions of use because the conduits that connect the real world with the internet world. This Micro Windbelts solve the problem if the battery is used, can imagine replacing that batteries that use in billions and every year to generate the wireless sensor. This Micro Windbelt is a clean and unlimited power source for the data sensors that fill our world. Whether sipping from the air flowing in the duct of an energy-efficient LEED smart building or creating electricity on the underside of a bridge for stress monitoring, the Micro Windbelt far outperforms batteries and nano-turbines.

2.2.2 Medium Windbelt

Medium Windbelt is being developed to change turbine-based wind harvester which only cost effective on a unit size of nearly a megawatt and maintenance is expensive and difficult. This Humdinger's product has 1-meter long and demanding 0.1kWh to 1kWh of energy per month. A single Medium Windbelt, for instance from is sized to power meshed WiFi repeaters, whereas a few units linked together can provide power to ocean navigation buoys or isolated lighting apps. The systems, like all of Humdinger's main products, are modular, in that individual units can be combined together as building blocks for larger installations.

2.2.3 Large Windbelt

A Large Windbelt shown in Figure 2.2 is engineered to bring the wind power to new places at the prices of coal. It is designed for modularity, safety and very low cost. The Large Windbelt is being developed to make installing wind energy as easy as putting up a fence. Capable of being assembled into vast arrays, with no spinning blades and very little moving mass the Large Windbelt can be installed in all those locations that wind and solar have never been able to go.



Figure 0.2: Large Windbelt aim to bring wind power to new micro grids in the city.