



## **DESIGN OF POWER GENERATOR BY USING PRINCIPLE OF PRESSURE**



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**BACHELOR OF ELECTRICAL ENGINEERING  
TECHNOLOGY (INDUSTRIAL POWER)**

**2020**

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GENERATOR BY USING PRINCIPLE  
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BEEI

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**Faculty of Electrical and Electronic Engineering Technology**



**Muhammad Nur Nazmi Bin Zamri**

**Bachelor of Electrical Engineering Technology (Industrial Power) with Honours**

**2020**

**DESIGN OF POWER GENERATOR BY USING PRINCIPLE OF PRESSURE**

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B071710249**

**This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
Faculty of Electrical and Electronic Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2020**

## DECLARATION

I declare that this report entitled “Design of Power Generator by Using Principle of Pressure is the result of my own research except as cited in the references.

Signature :

Name : MUHAMMAD NUR NAZMI BIN ZAMRI

Date : 15.2.2021



## APPROVAL

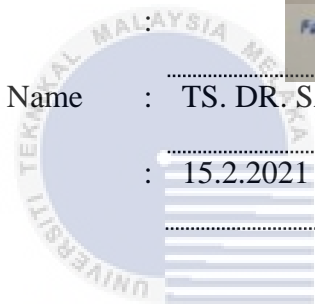
I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The members of supervisory are as follow:



Signature

Supervisor Name : TS. DR. SAHAZATI BINTI MD. ROZALI

Date : 15.2.2021



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## **DEDICATION**

To my beloved parents

To my supervisor, Dr. Sahazati Binti MD. Rozali

To my co-supervisor, Puan Rosnaini Binti Ramli

To my lecturers

And not forgetting to all my friends.





## ABSTRACT

In the last few years, low power electronic devices have been increased rapidly. The devices are used in a large number to comfort our daily lives. With the rise in the energy usage of these portable electronic devices, there is a need for us to find a way to develop a new harvesting system. Besides that, many issues arise from the use of energy like greenhouse gas emissions, acid rain, climate change, dependency on depleting supplies of fossil fuels especially from politically unstable regions of the world. Today, 80 percent of the world's electricity supply comes from fossil and nuclear fuels, and almost all transport is powered by liquid petroleum (gasoline). The prediction says, energy demand will triple by 2050 and the fossil fuels by definition are non-renewable are destined to run out, as the population grows to 8-9 billion and developing nations elevate living standards. Furthermore, the emissions from the burning of fossil and nuclear fuels create atmospheric, water, and land pollution and toxic waste. To fulfill its needs, one of the effective methods to generate electricity is by using footstep energy generation. The purpose of this research is to generate power from footsteps as a source of renewable energy that can be obtained while walking or standing on certain arrangements such as footpaths, stairs, plate shapes, and these systems can be installed particularly in the more populated areas. In this project the energy of force is generated by human footstep and energy of force is converted into mechanical energy, DC generator will produce the generator. The basic principle behind this system is piezoelectric effect. The piezoelectric material converts the pressure applied to it into electrical energy. Proposal for the work and use of extravagant resources in the footsteps of humans is very much planned for highly populated nations such as China and India. Where the streets, railway stations, and bus stations are overpopulated and packed like sardines that move around the clock. In addition, piezoelectric transduction is more attractive because of its advantages such as simplicity and versatility, thus generating less current than electromagnetic transduction. The idea is to convert the energy of weight into electrical energy. The power that generates to transform kinetic energy into electrical energy.

## **ABSTRAK**

*Dalam beberapa tahun kebelakangan ini, peranti elektronik berkuasa rendah telah meningkat dengan pesat. Peranti ini digunakan dalam jumlah besar untuk menenangkan kehidupan seharian kita. Dengan meningkatnya penggunaan tenaga alat elektronik mudah alih ini, kita perlu mencari jalan untuk mengembangkan sistem penuaian baru. Di samping itu, banyak masalah timbul dari penggunaan tenaga seperti pelepasan gas rumah kaca, hujan asid, perubahan iklim, ketergantungan pada pengeluaran bekalan bahan bakar fosil terutama dari wilayah dunia yang tidak stabil secara politik. Hari ini, 80 peratus bekalan elektrik dunia berasal dari bahan bakar fosil dan nuklear, dan hampir semua pengangkutan digerakkan oleh petroleum cair (petrol). Ramalan itu mengatakan, permintaan tenaga akan meningkat tiga kali lipat pada tahun 2050 dan bahan bakar fosil secara definisi tidak dapat diperbaharui ditakdirkan habis, kerana populasi meningkat menjadi 8-9 bilion dan negara-negara membangun meningkatkan taraf hidup. Tambahan pula, pelepasan dari pembakaran bahan bakar fosil dan nuklear menimbulkan pencemaran atmosfera, air, dan tanah dan sisa toksik. Untuk memenuhi keperluannya, salah satu kaedah berkesan untuk menjana elektrik adalah dengan menggunakan penjanaan tenaga langkah kaki. Tujuan penyelidikan ini adalah untuk menghasilkan tenaga dari langkah kaki sebagai sumber tenaga boleh diperbaharui yang dapat diperoleh ketika berjalan atau berdiri di atas susunan tertentu seperti jalan kaki, tangga, bentuk piring, dan sistem ini dapat dipasang terutama di daerah yang lebih berpenduduk. Dalam projek ini tenaga daya dihasilkan oleh langkah kaki manusia dan tenaga daya diubah menjadi tenaga mekanikal, penjana DC akan menghasilkan penjana. Prinsip asas di sebalik sistem ini adalah kesan piezoelektrik. Bahan piezoelektrik mengubah tekanan yang dikenakan kepadanya menjadi tenaga elektrik. Cadangan untuk kerja dan penggunaan sumber daya yang berlebihan di jejak manusia sangat dirancang untuk negara-negara berpenduduk tinggi seperti China dan India. Di mana jalan-jalan, stesen kereta api, dan stesen bas terlalu banyak penduduk dan dikemas seperti ikan sardin yang bergerak sepanjang masa. Di samping itu, transduksi piezoelektrik lebih menarik kerana kelebihanannya seperti kesederhanaan dan fleksibiliti, sehingga menghasilkan arus yang lebih sedikit daripada transduksi elektromagnetik. Ideanya adalah untuk menukar tenaga berat menjadi tenaga elektrik. Kuasa yang dihasilkan untuk mengubah tenaga kinetik menjadi tenaga elektrik.*

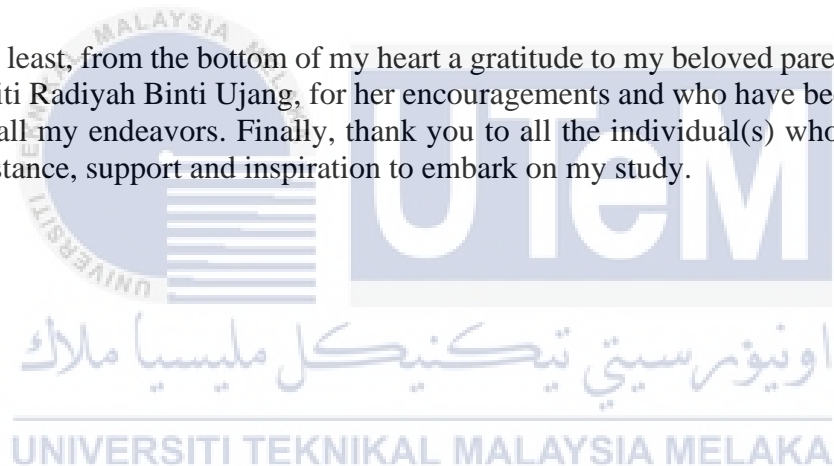
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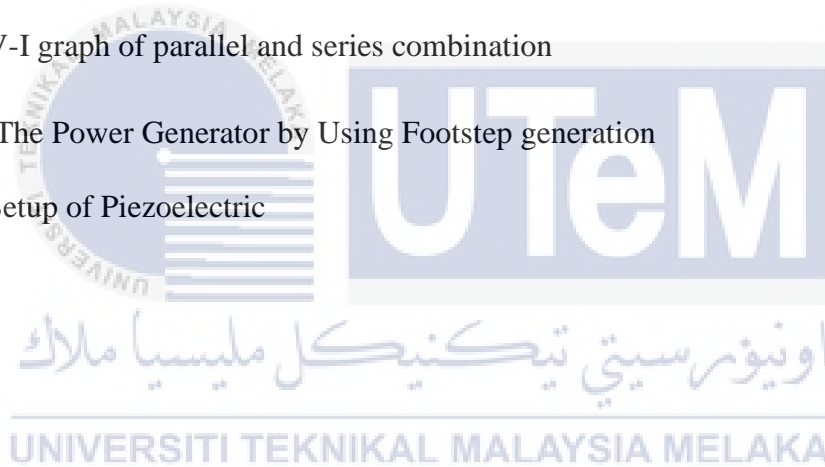
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## LIST OF SYMBOLS AND ABBREVIATIONS

E	-	Energy Consumed
V	-	Voltage
C	-	Capacitor
$\mu$	-	Ampere
W	-	Watt
kg	-	Kilogram
DC	-	Direct Current
AC	-	Altenating Current





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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

There are many ways or methods to generate electricity in a rapidly developing world, especially in terms of technology. One of the effective methods to generate by using footstep energy generation. Footstep power generation system is where system to generate electric is very economical, affordable energy solution to common people. This system can be used for many applications in rural areas where use less power availability and total absence.

Suggestions for the use of foot power for human movement are very relevant and important for highly populated countries where roads, railway stations, bus stands, temples are all crowded and millions of people move all the time. At such a place this system is placed at the main entrances which are at any entry point or exits, so, the people must step to those devices to get through. This whole human/bioenergy is wasted if possible to use it, it will be a great invention and the public energy field will be a very useful source of energy in crowded countries. This energy is converted from mechanical energy into electrical energy.

The most common activity in human life is walking. Walking is one of the easiest exercises to burn calories. The basic principle behind this system is the piezoelectric effect. The piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it. The output dc voltage is then stored in a rechargeable battery. The voltmeter will be attached in order to measure its output and then supply the small led for demonstrations.

## 1.2 Problem Statement

Energy is the most important thing for human life and development in the country especially for technology nowadays. Therefore, there is a need for alternatives to power generation methods. Besides, renewable energy can also be produced from non-natural sources using other techniques of energy harvesting. Because the same energy is wasted in many forms and one example is due to human movement. Energy wasted can be converted into usable forms such as electricity that can provide a lot of benefits to everyday users.

Today people are too dependent on sustainable energy, which is a major source of power generation. Most of these non-renewable energy cause energy pollution problems. Also, the choice of other sources is nuclear, hydroelectric, and solar energy, so this non-renewable energy source is not the main source. However, this option requires very high costs to operate and maintain. Therefore, the cheapest and fastest methods for energy harvesting should be considered as the first place to support, reduce, and thus reduce energy consumption costs provided by energy providers.

## 1.3 Project Objective

The objective of this project:

- i. To design energy harvesting by using the piezoelectric sensor.
- ii. To create power supply or electrical generator based on the principle of pressure.
- iii. To analyse the effectiveness and ability of piezoelectric in order to produce AC voltage.

## 1.4 Scope of Research

This project will be focused on the new potential energy harvesting method from the public places such as any entrance or exit so that are many people walking through all day by using piezoelectric device system. This piezoelectric harvesting system consists of piezoelectric sensors that convert mechanical energy into electrical energy, where we use human walking steps for the mechanical energy. Power output generated from piezoelectric sensors will be stored in a rechargeable battery as a storage system. The entire system will be controlled by a switch. The system will be set up between rectangular planes before being used at the entrance or exit to produce AC voltage to light up the streetlamps. Piezoelectric systems are designed to be used to capture ambient devices at the entrances or exit because there is vibration generated by human steps to generate electricity.

## 1.5 Conclusion

Based on the objectives previously presented on the approach proposed before, this thesis is made up of five (5) chapters, which contents are summarized as follows:

- Chapter 1. Introduction. This chapter presents the background of the study, research problems, objectives, scopes, contributions and significance of the research.
- Chapter 2. Literature review. This usually involves from the internet journal, paper proceedings and research, books and lectures in this literature review section. The literature review involves the project case study that could emerge to solve the issues and contains a valuable knowledge of the project's fundamentals.

- Chapter 3. Methodology. This chapter explains the flow chart of the development process of the system. It consists of the methods used to achieve the goals of the project, the equipment and software, and the type of raw materials used. This research approach also concerns the overall functionality of a piezoelectric device.
- Chapter 4. Case studies. In this chapter, the result of the whole will be shown and discussed. The result consist about the electricity generates by footstep power generation. The discussion will be show how we solving the problem in making this project.
- Chapter 5. Conclusion and future works. This chapter summarizes the main conclusions as well as achievements of the work undertaken in this research and suggests areas for future work.

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## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

This usually involves the internet journal, paper proceedings and research, books, and lectures in this literature review section. The literature review involves the project case study that could emerge to solve the issues and contains a valuable knowledge of the project's fundamentals.

#### 2.2 Piezoelectric

Nobel laureates Pierre and Jacques Curie discovered piezoelectricity (pressure electricity) in 1880 during their study of the effects of pressure on crystals such as quartz, tourmaline, and Rochelle salt. Piezoelectric materials may be designed in several different ways to prove useful in applications for power harvesting. The configuration of the power harvesting system can be modified by adjusting piezoelectric materials, changing the electrode design, changing the polishing and stress direction, layering the material to increase the active capacity, inserting prestress to optimize the material's binding and strain, and tuning the device's resonant frequency. A significant percentage of recent research into piezoelectric harvesting has concentrated on improving the performance of piezoelectric power harvesting systems. The type of piezoelectric material chosen for an application for power harvesting may have a major impact on the functionality and efficiency of the harvester. To date, we have developed a variety of different piezoelectric materials. Piezoelectric has proved to be a powerful method in this research and is used for strain, pressure, acceleration, or force determination. Piezoelectric is an element that transforms the mechanical into the electrical form of energy through subjection to mechanical stress. When pressure is applied to a piezoelectric material it produces a mechanical deformation and charging displacement which is highly proportional to the pressure applied. Besides, piezoelectric is also referred to as a method for micro-energy harvesting, where it generates mW or  $\mu$ W level power.

Type of Energy Harvesting	Source of energy	Solution	Ultimate Goal
Macro	Renewable source like solar, tidal, wind etc	Energy Management solutions	Reduce oil dependency
Micro	Small scale source like heat, vibration, motion etc	Ultra-low power solutions	Driving low energy consuming devices

Table 2.1 Types of Energy Harvesting Classifications

However, the high piezoelectric elasticity modulus that shows virtually zero deflections when compressed makes it a requested system in industrial sensing applications. The reverse-piezoelectric effect can also occur within the piezoelectric crystal where it happens oppositely. A voltage that is applied across a piezoelectric crystal is like placing electric pressure on the atom within it. The atoms in the crystal must move to rebalance themselves and cause the piezoelectric crystal to change shape slightly when there is voltage over them.

The piezoelectric is a property of certain crystalline materials such as quartz Lead-Zirconate-Titanate ceramics (PZT), Barium Titanate ceramics, and Rochelle salt which produces electricity when the pressure is applied to the direct effect (Heung et al, 2011).