



**Faculty of Electrical and Electronic Engineering Technology**



**DEVELOPMENT OF PIEZOELECTRIC FOOTSTEP POWER  
GENERATOR SYSTEM WITH IoT MONITORING**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ASHRAF FARHAN BIN SAFIEE**

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

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**DEVELOPMENT OF PIEZOELECTRIC FOOTSTEP POWER GENERATOR  
SYSTEM WITH IoT MONITORING**

**ASHRAF FARHAN BIN SAFIEE**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours**



**Faculty of Electrical and Electronic Engineering Technology**

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I declare that this project report entitled “Development of Piezoelectric Footstep Power Generator System With IoT Monitoring” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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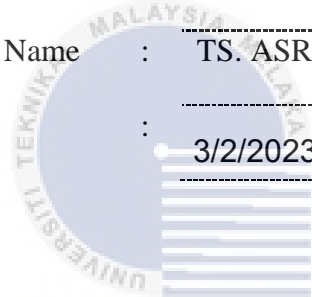


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## DEDICATION

*I would want to dedicate the success of this final year project degree, in particular to my parents, Safiee Bin Samsudin and Khalijah Binti Ismail. This report will be dedicated to them because I want to express my gratitude for the sacrifices, they made for me during my time at this university. The second recipients of this commitment are my siblings, who provided guidance, financial assistance, and moral support in the creation of this report. Next, I would like to express my appreciation to my supervisor, TS. Asri Bin Din, and to my friends who provided a great deal of assistance throughout the completion of this Final Year Project.*



## ABSTRACT

Electricity has been more significant and in demand in recent years. Many energy resources have been squandered and depleted. A new approach to produce power has been discovered by relying on humans' movements. The footsteps vibrations produced by humans are usually gone to waste because there were no uses for that. By reusing this wasted energy, electrical energy may be produced. A piezoelectric transducer is the kind of transducer used to detect vibrations. The electrical energy can be produced by converting the mechanical energy by using the transducer. The electrical energy is converted from the pressure produced by human footsteps that are delivered to the transducer. A series-parallel connection is used to connect the piezoelectric transducer. The transducer is then placed on a wooden tile that will function as a footstep platform to produce pressure to the transducer. This tile may be used in a congested location, on a walking path, or crowded area. The goal of this research project is to focus on producing energy using piezoelectric footstep and act as backup power source. Various methods have been taken in conducting the research by referring to previous articles and research to further deepen the knowledge about this project. The results for this project are achieved when the footstep piezoelectric prototype can successfully charge electronic devices and can be monitored by using Blynk applications and controlled through electronic devices such as mobile phones. Different output power have been successfully produced and measured depending on the different human weight and different time to pressure used during the testing. In conclusion, the results of this prototype piezoelectric power outputs shown the potential of this type of renewable energy source to be implemented in congested public area.



## ***ABSTRAK***

Sejak beberapa tahun kebelakangan ini, sumber elektrik adalah sangat penting dan mempunyai permintaan yang tinggi dalam penggunaannya. Jadi banyak sumber tenaga telah dibazirkan dan habis. Oleh itu, pendekatan baru untuk menghasilkan kuasa telah ditemui iaitu dengan bergantung pada pergerakan manusia. Seperti yang diketahui, manusia dapat menghasilkan tenaga yang terhasil daripada berjalan kaki. Dengan menggunakan semula tenaga terbuang ini, tenaga elektrik mungkin dihasilkan. Oleh itu, transduser piezoelektrik akan digunakan untuk menghasilkan projek ini, transduser piezoelektrik adalah jenis transduser yang digunakan untuk mengesan getaran dan tekanan. Dengan itu, tenaga elektrik boleh dihasilkan dengan menukar tenaga mekanikal dengan menggunakan transduser tersebut. Tenaga elektrik ditukar daripada tekanan yang dihasilkan oleh tapak kaki manusia yang dihantar ke transduser. Projek ini akan menggunakan sambungan secara siri-selari untuk menyambungkan transduser piezoelektrik. Transduser kemudiannya diletakkan di atas jubin kayu yang akan berfungsi sebagai platform pijak untuk menghasilkan tekanan kepada transduser. Jubin ini boleh digunakan di lokasi yang sesak, di laluan berjalan kaki atau kawasan yang ramai orang melaluinya. Matlamat projek penyelidikan ini adalah untuk memberi tumpuan kepada penghasilan tenaga menggunakan piezoelektrik dan bertindak sebagai sumber kuasa simpanan. Pelbagai kaedah telah diambil dalam menjalankan kajian dengan merujuk artikel dan kajian lepas bagi mendalami lagi pengetahuan tentang projek ini. Keputusan untuk projek ini dicapai apabila prototaip piezoelektrik footstep berjaya mengecas peranti elektronik dan boleh dipantau dengan menggunakan aplikasi Blynk melalui peranti elektronik seperti telefon bimbit. Output kuasa yang berbeza telah berjaya dihasilkan dan diukur, tetapi bergantung pada berat badan manusia yang berbeza dan masa yang berbeza untuk tekanan yang digunakan semasa ujian dijalankan. Kesimpulannya, hasil keluaran kuasa piezoelektrik prototaip ini menunjukkan potensi sumber tenaga boleh diperbaharui dan serta boleh dilaksanakan di kawasan awam yang sesak.

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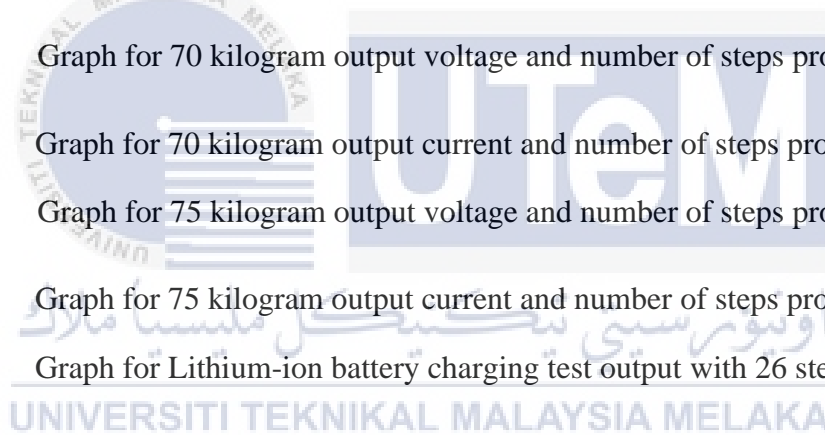
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## LIST OF SYMBOLS

$\delta$	-	Voltage angle
$^{\circ}C$	-	Degree celcius
$\mu$	-	Micro



## LIST OF ABBREVIATIONS

<i>V</i>	-	Voltage
<i>mA</i>	-	Milliampere
<i>mW</i>	-	Milliwatt
<i>Ah</i>	-	Ampere hours
<i>MHz</i>	-	Megahertz
<i>E</i>	-	Electromotive force
<i>KB</i>	-	Kilobyte
<i>MB</i>	-	Megabyte
<i>KHz</i>	-	Kilohertz
<i>mm</i>	-	Millimeter
<i>A</i>	-	Ampere
<i>Cm</i>	-	Centimeter



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Electric is a very important source of energy in our daily lives. Every day people use electrical appliances. Not only that, it is also useful especially in electronic equipment, building lighting and so on. Next, Malaysia is a rising country with increasing number of human population and technological advances which also affect the use of electricity. This is because humans are active in several major industries.

Besides that, electrical energy can be produced through many ways and sources. Malaysia is one of the countries that use electrical energy from hydroelectric energy. However, hydroelectric energy can be categorized as a renewable source of energy, but not too many people are aware about the importance of electrical energy saving. So, to overcome this problem, the development of piezoelectric footstep power generator system with IoT monitoring is created to reduce the amount of energy wasted. As a lot of people know, many countries in Europe have already use piezoelectric footstep as an alternative way to save energy. By this, we can use these European countries as an example for us Malaysians to produce energy through other method.

This project is created so that it can be used in public and crowded places such as shopping malls. This device can be placed along the path where people can walk and step on it every day. Then, this device will produce voltage for every time people step on it and if the device is constructed in series-parallel connection, it will generate a considerable amount of electrical energy and it can be monitored by using IoT. So, with this footstep

power generation by using piezoelectric sensors, it can produce non-conventional energy to electrical energy as well as reducing the amount of energy wasted by using human footsteps that can produce electrical energy.

## **1.2 Problem Statement**

As the population of the country grows, so does the need for electricity. While this was going on, energy wastage also rose dramatically. As a result, the most important answer is to reform this energy and make it useable again.

Devices like computers and smartphones have become more commonplace as technology has progressed. Conservative energy sources are becoming insufficient. It becomes necessary to find a new way to generate electricity. At the same time, human mobility wastes energy in several ways.

As an alternative solution, a piezoelectric sensor may be used to transform waste energy into useable energy. A voltage is generated when pressure is applied to the sensor. This is the footstep power generation mechanism, and it's how we generate electricity by conserving energy.

## **1.3 Project Objective**

In creating and completing this project there are several objectives that have been set. The main aim of this project is about:

- a) To generate electrical energy by using piezoelectric cell.
- b) To monitor battery storage using IoT system.
- c) To analyze battery storage capacity.

## 1.4 Scope of Project

To eliminate any confusion about this project as a result of specific limits and constraints, the project's scope is stated as follows:

- a) This project focuses on producing energy using piezoelectric footstep and act as backup power source.
- b) The project is designed to measure the output voltage produce by piezoelectric.
- c) The piezoelectric footstep can be monitored through Internet of Things by using the Blynk applications

