UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF ELECTRICITY ENERGY USING WAVE ENERGY SOURCE WITH ARDUINO UNO

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Bachelor of Electrical Engineering Technology with Honours

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DEVELOPMENT OF ELECTRICITY ENERGY USING WAVE ENERGY SOURCE WITH ARDUINO UNO

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology with Honours

Faculty of Electrical and Electronic Engineering Technology

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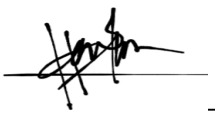

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APPROVAL

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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 with Honours.

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DEDICATION

Thank God because, with his abundant grace, we were able to complete our project within the set period and according to what we wanted. I would like to take this opportunity to say a million thanks to our supervisor, Puan Rohaina Binti Jaafar, for her willingness to spend time and give me guidance throughout the effort to complete this project. Special thanks also to my academic advisor Ts Mazree Bin Ibrahim who had taught and guided me throughout my studies and during this Bachelor Final Project 2. All views and constructive criticism give me more motivation to complete this project regardless of the tiredness. I acknowledge my sincere dedication, honours and gratitude to both of my parents for their love, encouragement, supports, and sacrifices throughout the whole of my life. Without their sacrifices and encouragement, I cannot possibly reach this stage. I would like to thank all my friends who always have helped a lot and voiced their opinions throughout this project. Thank you also to all parties involved directly or indirectly. Without the support, encouragement and opinions from all of them, surely this project could not be completed smoothly. Thank you.

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ABSTRACT

Renewable energy comes from natural sources such as wind, rain, sunlight and the sea. Wave energy is an abundant and reliable source of energy. The ocean, which covers more than 70% of the earth's surface, has long been recognized as an important source of renewable energy. It is a growing industry with the ability to meet global energy demands. Wave power is the way of the future for electricity generation. Wave energy conversion techniques are one of the many methods of obtaining energy from the sea that is now available. This study was conducted to generate electricity by using the concept of wave energy. The scope of this project is to use a solenoid as a medium to generate electric flux. The changes that took place in this project tried to change the concept of the wave energy from using turbines as an electricity generation mechanism to permanent magnets with solenoids as an electricity generation mechanism. One of the objectives is to build a circuit capable of increasing the signal of electric current. In general, this project uses the concept of renewable energy applied in inland areas close to the coast. Overall, this wave energy project can demonstrate electricity generation without the presence of grid transmission. This can create innovation in the scope of renewable energy sources as this project can generate electricity from water waves. The output of this system is focused on lights adjacent to the beach. It helps these lights to turn on, thus making it easier for residents for example it seems that distance should be taken when close to the beach so that undesirable things happen and warnings will sound when the water level rises above the normal level.

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ABSTRAK

Tenaga boleh diperbaharui datang daripada sumber semula jadi seperti angin, hujan, cahaya matahari dan laut. Tenaga gelombang adalah sumber tenaga yang banyak dan boleh dipercayai. Lautan, yang meliputi lebih daripada 70% permukaan bumi, telah lama diiktiraf sebagai sumber penting tenaga boleh diperbaharui. Ia adalah industri yang semakin berkembang dengan keupayaan untuk memenuhi permintaan tenaga global. Kuasa gelombang adalah cara masa depan untuk penjanaan elektrik. Teknik penukaran tenaga gelombang adalah salah satu daripada banyak kaedah untuk mendapatkan tenaga dari laut yang kini tersedia. Kajian ini dijalankan untuk menjana tenaga elektrik dengan menggunakan konsep tenaga gelombang. Skop projek ini adalah menggunakan solenoid sebagai medium untuk menjana fluks elektrik. Perubahan yang berlaku dalam projek ini cuba mengubah konsep tenaga gelombang daripada menggunakan turbin sebagai mekanisme penjanaan elektrik kepada magnet kekal dengan solenoid sebagai mekanisme penjanaan elektrik. Salah satu objektifnya adalah untuk membina litar yang mampu meningkatkan isyarat arus elektrik. Secara umumnya, projek ini menggunakan konsep tenaga boleh diperbaharui yang diaplikasikan di kawasan pedalaman yang berhampiran dengan pantai. Secara keseluruhannya, projek tenaga gelombang ini boleh menunjukkan penjanaan elektrik tanpa kehadiran penghantaran grid. Ini boleh mencipta inovasi dalam skop sumber tenaga boleh diperbaharui kerana projek ini boleh menjana tenaga elektrik daripada gelombang air. Output sistem ini tertumpu pada lampu bersebelahan dengan pantai. Ia membantu lampu ini menyala, sekali gus memudahkan penduduk contohnya nampaknya jarak harus diambil apabila dekat dengan pantai supaya perkara tidak diingini berlaku dan amaran akan berbunyi apabila paras air naik melebihi paras biasa.

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LIST OF SYMBOLS

Ω	-	Voltage angle
μ	-	Micro
%	-	Percentage
$°c$	-	Degree Celcius

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LIST OF ABBREVIATIONS

V	-	Voltage
IC	-	Integrated circuit
Hz	-	Hertz
mA	-	Miliampere
LCD	-	Liquid-crystal display
mV	-	Milivolts
cm	-	Centimeter

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CHAPTER 1

INTRODUCTION

1.1 Background

Renewable energy is the best option because it has the least amount of environmental impact. By 2030, there will likely be disruptions and problems in the global energy supply and demand for each type of fuel, according to the International Energy Agency's (IEA-OES2005) estimate[1]. Global carbon dioxide emissions will increase by 1.6% year from 2003 through 2030. Half of all carbon emissions worldwide will be caused by the production of electricity. These statistics show that the world's dependency on fossil fuels, as well as the issues of pollution and global warming, would deteriorate if global energy consumption practices remained the same. It is not assured that such energy sources will be used indefinitely.

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The use of renewable energy technology is growing in popularity as a means of combating climate change today. Given that they are both locally available and non-polluting, renewable energy sources can address both supply security and environmental problems. Many renewable energy sources, including the wind, sun, waves, and tidal, have variable outputs, which means that the output is reliant on uncontrollable weather conditions. A plentiful and dependable source of energy is wave energy. Over 70% of the earth's surface is covered by oceans, which have long been acknowledged as important sources of renewable energy[2]. It's a sector that's expanding and capable of supplying the world's energy needs. Wave power is the way of the future for electricity generation. Wave energy

conversion techniques are one of the various methods for obtaining energy from the sea that is now available.

There are many different technologies used for wave energy. Among them are Absorbers extracting energy from the ups and downs of waves with buoys as shown in Figure 1.1. Once the energy is extracted it is then converted into electrical energy with a linear or rotary generator. Wave generators gather kinetic energy resulting from ocean dynamics. The earliest recorded patent to harness the power of ocean waves was submitted in 1799 in Paris by Girard and his son. An early example of wave power utilization was a device built by Bochaux-Praceique in the year 1910 to light and power his home in Royan, France, close to Bordeaux[3]. Coastal, near-shore, and offshore devices are widely used to categorize wave energy systems. Depending on the water depth and distance from the coast, several physical conditions such as water depth, power level, directionality, and hydrodynamics are crucial for converting wave energy. In conclusion, wave energy should be applied gradually in order to increase our nation's output and help it catch up to other nations.

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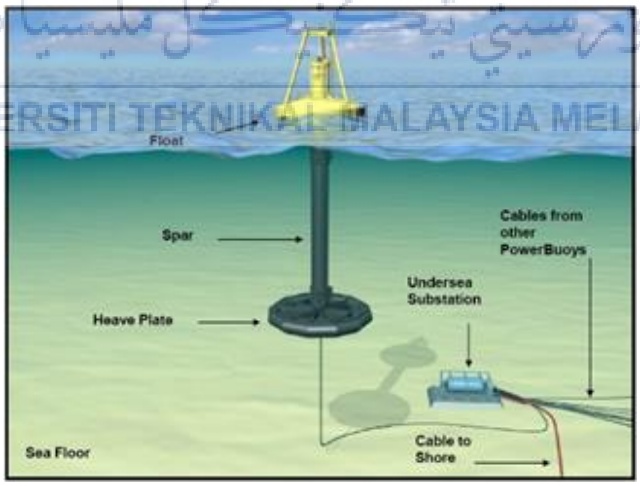

Figure 1.1 Wave Energy Diagram

1.2 Problem Statement

According to the observations that have been studied, this wave energy has not yet been practiced 100 percent in Malaysia. It is because Malaysia does not have technology comparable to foreign countries such as technology in China, Japan, and Denmark that are capable of generating high-value electricity. In addition, the problem of rising coal prices in Indonesia and Austria caused Malaysia to bear high costs for electricity generation[4]. Next, the level of air pollution becomes the cause of fuel burning which is increasingly critical for electricity generation. Now, what is worrying is the electricity problem experienced especially in rural areas near the coast that do not have a Grid connection. The lack of electricity supply is the main obstacle for the people in this area to live their daily lives. Therefore, wave energy was developed as a prototype to solve the above problems such as reducing coal consumption, reducing air pollution, and solving electricity problems in inland areas close to the coast. Malaysia can take the potential to generate tidal power as a challenge.

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1.3 Project Objective

The study was conducted to generate electricity by using the concept of tidal wave energy. To meet the objectives of this study, the following objectives have been made:

a) To generate electricity using wave energy as a prime mover.

b) To construct a circuit that can increase the voltage value.

c) To analyze the wave energy performance in generating electricity.

1.4 Scope of Project

The scope of this project are as follows:

a) Using a permanent magnet with copper wire as an electric flux generation medium.

b) This project uses wave energy theory that can be implemented on the coast of Malaysia.

c) This project uses a DC-to-DC boost converter circuit, which can convert a DC voltage to a larger DC voltage. It was able to convert a 0.1mV DC voltage into 5V.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review provides a summary of previous discussions, journal articles, and research papers on Wave energy sources with Arduino Uno. Wave energy is the energy created by waves moving through seawater and converting it into other forms of energy, mainly electricity. Since waves are essentially always moving and never interrupted, they are a reliable source compared to others. Among the current technologies for energy production from renewable sources, ocean wave energy and tidal power can make a significant contribution to the creation of a more sustainable energy system[5]. This chapter will be utilized as a reference in the future to aid with the experience of difficulties during project execution in order to guarantee that this project is successful.

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2.2 Research, Ideology and Concept Previous Project

2.2.1 Generation of Electricity Using Point Absorber Wave Energy Converter and its Prospect in Bangladesh

Based on the journal by Md. Sazzad Hossain, Mostafa Kamal, Jannatul Adan, Arjan Chakrabartty, Sheikh ShataddruTahsin, Yeasir Arafat and Ehsanur Rahman on 2019. The main objective of this research was to find promising, sustainable, and still ecologically friendly energy sources in a world where the need for electric power generation is always rising. Pay more attention to utilising ocean wave energy's enormous potential. Numerous studies conducted to date have demonstrated that the effectiveness of wave energy extraction is significantly influenced by the device's shape, design, and interaction with the energy