



## **Faculty of Electrical and Electronic Engineering Technology**



### **DEVELOPMENT OF MICROCONTROLLER BASED LOW MAINTENANCE TANK FOR MASS SEAWEED CULTURE**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
ZARITIL WADI BINTI AMARUDDIN

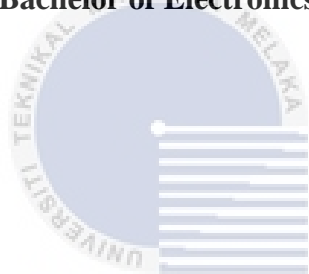
**Bachelor of Electronics Engineering Technology (Industrial Electronics) with  
Honours**

**2021**

**DEVELOPMENT OF MICROCONTROLLER BASED LOW MAINTENANCE  
TANK FOR MASS SEAWEED CULTURE**

**ZARITIL WADI BINTI AMARUDDIN**

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



**Faculty of Electrical and Electronic Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2021**

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Tajuk Projek: Development of Microcontroller Based Low Maintenance Tank for Mass Seaweed Culture.

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Tarikh: 8 Januari 2022

Tarikh:

## DECLARATION

I declare that this project report entitled “Development of Microcontroller Based Low Maintenance Tank for Mass Seaweed Culture” 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.

Signature

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Student Name

:

ZAHRITIL WADI BINTI AMARUDDIN

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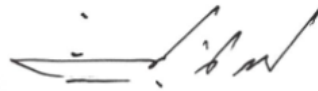
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## APPROVAL

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 with Honours.

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Name (if any)

Date :

.....  
.....

## DEDICATION

*First and foremost, Alhamdulillah and thanks to Almighty Allah who gave me the strength and patient to finish this work.*

*Next, I realised that every challenging work, needs self-efforts as well as guidance of elders especially those who were very close to my heart. My humble effort I dedicate to:*

*My supervisor*

*Who helped me academically and professionally in completing this project and also for his encouragement, patience and guidance.*

*My mother*

*A strong and gentle soul who always taught me to trust Allah, believe in hard work and that so much could be done with little.*

*My father*

*For earning an honest living for us and for and encouraging me to believe in myself.*

*My late grandfather*

*Who taught me the meaning of patience and perseverance.*

*My fellow classmates*

*For sharing their knowledges and ideas in helping the researches of my project.*

*Lastly, special thanks to all those who had gave me their affection, love, encouragement, and prayers of day and night that make me able to get such success and honour.*

## ABSTRACT

The title of the project is Development of Microcontroller-Based Low Maintenance Tank for Mass Seaweed Culture. This project will discuss the parameters that influence seaweed growth. All these parameters refer to the basic requirements required by seaweed to achieve a good level of growth. The highlighted objective is the importance of a good monitoring system for seaweed tanks to ensure the continuity of seaweed growth while looking at the impact on seaweeds based on the parameters required by seaweeds for their growth through microcontroller systems and low maintenance systems. In addition, this study was conducted through the cultivation of selected seaweed species in a glass aquarium tank that has the parameters needed by seaweeds so that they can survive and grow like their real life in the seabed. Furthermore, the method used to complete this project is through the observation method. Seaweeds will grow on their own. Therefore, the weight of the seaweed will be taken and recorded on a weekly basis until the sixth week. This is because seaweed takes six weeks for it to reach a mature growth rate. In this study, the importance of monitoring the comprehensive parameters to the cultivation of seaweed in the tank will be identified. The main goal of this project is to build and provide a seaweed cultivation tank that offers a low level of maintenance. These tanks will be used to monitor the growth and enlargement of seaweeds, as well as coordinate the basic requirements needed by seaweeds to survive in the tank. Therefore, this can be realized through the use of microcontroller development methods. The findings show that these parameters are very important as factors that influence seaweed growth. In addition, the effect of these parameters on seaweed can also be identified. In conclusion, from the work of this course, the factors that influence the growth of seaweeds and the parameters they need to survive in the tank will be able to be identified.

## ***ABSTRAK***

Tajuk kajian ialah Pembangunan Tangki Penyelenggaraan Rendah Berasaskan Mikropengawal untuk Pembudayaan Rumpai Laut Besar-Besaran. Projek ini akan membincangkan mengenai parameter-parameter yang mempengaruhi pembesaran rumpai laut. Kesemua parameter ini adalah merujuk kepada keperluan asas yang diperlukan oleh rumpai laut untuk mencapai tahap pertumbuhan yang baik. Objektif yang diketengahkan ialah kepentingan sistem pemantauan yang baik kepada tangki rumpai laut untuk menjamin kelangsungan pertumbuhan rumpai laut di samping melihat kepada kesan yang timbul terhadap rumpai laut berdasarkan kepada parameter-parameter yang diperlukan oleh rumpai laut untuk pertumbuhan mereka melalui sistem mikropengawal dan sistem penyelenggaraan yang rendah. Selain itu, kajian ini dijalankan melalui penanaman spesies rumpai laut yang dipilih di dalam sebuah tangki akuarium kaca yang terdapat parameter-parameter yang diperlukan oleh rumpai laut agar ianya dapat terus hidup dan membesar seperti kehidupan sebenar mereka iaitu di dalam dasar laut. Tambahan lagi, kaedah yang digunakan untuk menyiapkan projek ini ialah melalui kaedah pemerhatian. Rumpai laut akan membesar dengan sendiri. Oleh itu, berat rumpai laut akan diambil dan dicatat pada setiap minggu sehinggalah pada minggu keenam. Hal ini kerana rumpai laut mengambil masa enam minggu untuk ia mencapai kadar pertumbuhan yang matang. Dalam kajian ini, kepentingan pemantauan terhadap parameter-parameter yang menyeluruh kepada penanaman rumpai laut di dalam tangki akan dikenalpasti. Matlamat utama projek ini adalah untuk membina dan menyediakan tangki penanaman rumpai laut yang menawarkan tahap penyelenggaraan yang rendah. Tangki ini akan digunakan untuk memantau pertumbuhan dan pembesaran rumpai laut, serta menyelaraskan keperluan asas yang diperlukan oleh rumpai laut untuk terus hidup di dalam tangki. Oleh itu, hal ini dapat direalisasikan melalui penggunaan kaedah pembangunan mikropengawal. Dapatan menunjukkan parameter-parameter ini sangat penting sebagai faktor yang mempengaruhi pembesaran rumpai laut. Selain itu, dapat dikenal pasti juga kesan parameter-parameter tersebut kepada rumpai laut. Secara konklusinya, daripada kerja kursus ini, faktor-faktor yang mempengaruhi pembesaran rumpai laut dan parameter-parameter yang diperlukannya untuk terus hidup di dalam tangki akan dapat dikenalpasti.



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## LIST OF SYMBOLS

% - Percentage



## LIST OF ABBREVIATIONS

TDS	-	Total Dissolved Salts
PPT	-	Part Per Thousand
IDE	-	Integrated Development Environment
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
EMS	-	Electromechanical System
RAS	-	Recirculating Aquaculture System



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

For PSM 2, I was entrusted to undertake the task of handling a project entitled Development of Microcontroller Based-Low Maintenance Tank for Mass Seaweed Culture. My project is aimed at designing and making a seaweed planting tank that provides a low-maintenance system. This tank will be used to accommodate seaweed and monitor the seaweed growth as well as provide the basic requirements or parameters required by seaweeds for their survival in the tank.

This project will use the development of a microcontroller system as a medium to monitor all the involved parameters that will be studied more widely. Specifically, among the parameters that will be studied in this project are the temperature of the water in the tank, the level of salinity of the water in the tank, the pH of the water in the tank, the light source and also aeration. All these parameters are actually the factors that influence the level of growth of seaweed when in the tank. These parameters are also indirectly the basic requirements that need to be emphasized in this project and are also needed by the seaweed to survive in the tank.

## 1.2 Problem Statement

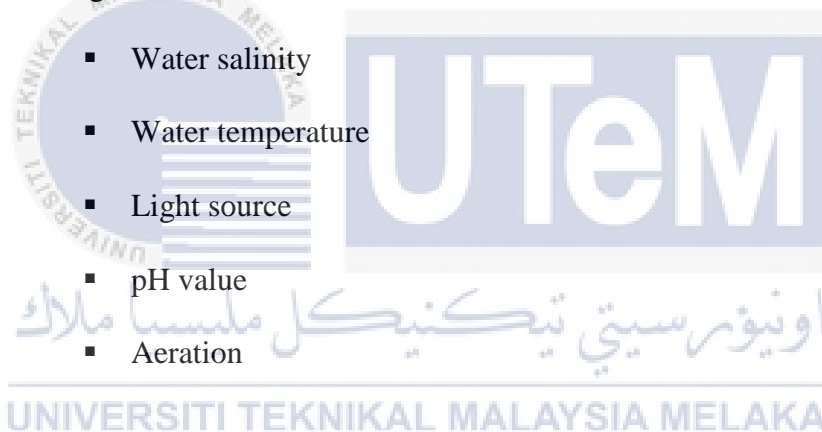
Firstly, seaweed farming has a lot of limitations which causes the decrease in the net weight product of seaweed that is being harvested. The first problem is the environmental factors faced by seaweed farming. Changes in global climate and its unpredictability have an impact on ecological, biological, and socioeconomic systems, necessitating additional effort in doing research on seaweed development and production. Due to global climate issues, the increase of seaweed output has been steadily declining. Seaweed growth is affected by the high-temperature stress caused by global warming.

Secondly, seaweed is an organism that needed constant monitoring throughout the seaweed culturing process. Its been a tough thing for farmers to go out of their homes going ahead to the sea to monitor the farming process. Unfortunately, farmers might have to have their homes near the sea to facilitate their work. Seaweed farming is very hard to monitor as it is a species that is very sensitive to being planted due to many obstacles. Therefore, seaweed cultivation must be smoothly regulated since it grows quicker in the sea. Seaweeds are very delicate organisms, necessitating regular monitoring during the planting process.

### 1.3 Project Objective

This project's primary goal is to design and construct a low-maintenance seaweed cultivation tank. This tank will be used to monitor the growth and production of the seaweed culture, as well as provide fundamental needs for the culture of seaweed, using microcontroller development. Specifically, the objectives are as follows:

- a) To design a low maintenance tank for seaweed culture that can accommodate the seaweed directly and safely from other harmful effects.
- b) To monitor the growth rate of the seaweed culture. The parameters that are being monitored are as follows:



### 1.4 Scope of Project`

The goal of this project is to create a low-maintenance tank for mass seaweed cultivation. Basic requirements for seaweed cultivation, such as water salinity, water temperature, light source, and aeration, should be met in the tank design. The seaweed will be cultivated from small until it is large enough to harvest, which takes around 6 weeks. The goal of this project is to design and build a low-maintenance seaweed growing tank. The project is evaluated based on the seaweed's growth rate, which is measured weekly, as well as the capacity to autonomously manage the temperature and salinity of the water. However,

the pH value of water cannot be controlled. It can just be directly monitored. Seaweed farming must be closely managed in order to produce higher-quality seaweed.

The aquarium design employed is a glass tank with the size of 32cm x 21cm x 21cm. This tank can plant seaweed until it reaches its mature life. Besides providing the parameter needed by the seaweed, this tank will fulfill the fundamental requirements for seaweed development. The proposed tank should generate a system that allows for water salinity, temperature, aeration, light source, and pH value monitoring. Therefore, much electrical equipment, both software and hardware will be employed to develop this project.

In addition, this tank will provide a low-maintenance seaweed growth system where it required a cleaning process only once a month. Water can just be replaced if only the water in the tank has turbid and produced waste. However, the seaweed will not produce any waste as it always because it does not live in the sea. This is the advantage of planting seaweed at home and straight away in front of the eyes. Therefore, this can guarantee that the seaweed will live a long time in the tank.

Because the weight of the seaweed is being measured week by week, its physical must have changed. As a result, the initial weight (before it's put in the tank) will be compared to the most recent weight in that week. The rate of increase in the weight is then calculated. Plus, the use of control devices will aids in the monitoring of the seaweed. Sensors, motors pumps, electronics equipment, computers, and software must be used to optimize aquaculture system output by providing steady and ideal circumstances for the seaweed with less stress but good development. Lastly, a microcontroller will be used in this

project. This microcontroller is intended to track the state and parameters of the seaweed as it grows. The scope of this project are as follows:

- Designing a tank with low maintenance requirement.
- Implementing a programming method to monitor the key parameters in the tank system by using C languages.
- Setting up the variable required to monitor the growth of seaweed consisting of hardware and software.
- Develop electronic circuits for a maintenance system that based on microcontroller by using Arduino UNO and ESP8266.
- Implementing IoT concept using ThingSpeak



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Seaweed has been gathered throughout the world's beaches since at least the Neolithic period, and it has long been a staple of human dishes. Human interest in seaweeds appears to have begun around 1700 years ago, according to historical records. Several seaweed species have been employed in ethnic cuisines for millennia, and the seaweed also can be used for many purpose. These early discoveries allowed Japan, China, and Korea to start farming. However, demand for seaweed in the West did not begin until after World War II, when agar, alginate, and carrageenan were produced. [1]

Concerns about the impact of climate change on seaweed availability, distribution, and quality have been growing across the world. While kelps appear to be resilient to global temperature change, biomass availability varies substantially from one location to the next. As a result, developing alternate manufacturing techniques is both necessary and opportune. [2] Many experts and entrepreneurs expect a bright future for innovation in the seaweed sector as the industry evolves in the twenty-first century. Food items and polysaccharides will be affected, but so will more valued products like functional foods, cosmeceuticals, nutraceuticals, medicines, and maybe lower value products like biofuels with a high biomass need. [3] The 'biorefinery idea,' in which seaweed biomass is exploited in a holistic fashion with minimal waste and minimal environmental damage, appears to be the only realistic path forward in industrial growth. [1]

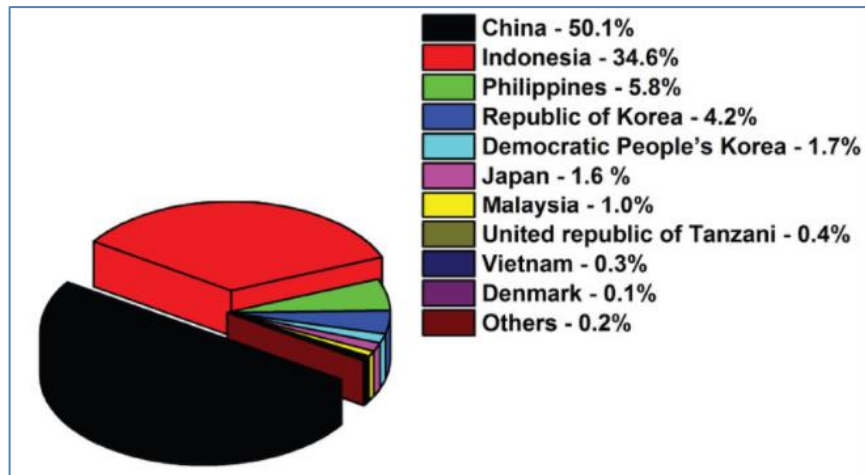


Figure 2.1: Seaweed production countries, 2017 [4]

However, the seaweed farming nowadays, are facing many problems and obstacles as the world is getting sick. Changes in global climate and its variability have an influence on the seaweed's growth. [5] Year by year the earth has experiencing various types of disasters. This is due to irresponsible human actions. Due to the damage caused by human hands, there will be sudden changes in weather and this will affect the production and growth system of seaweed in the world. Therefore, this project show how global climate change affects the growth and production of seaweed and also their associated ecosystems.

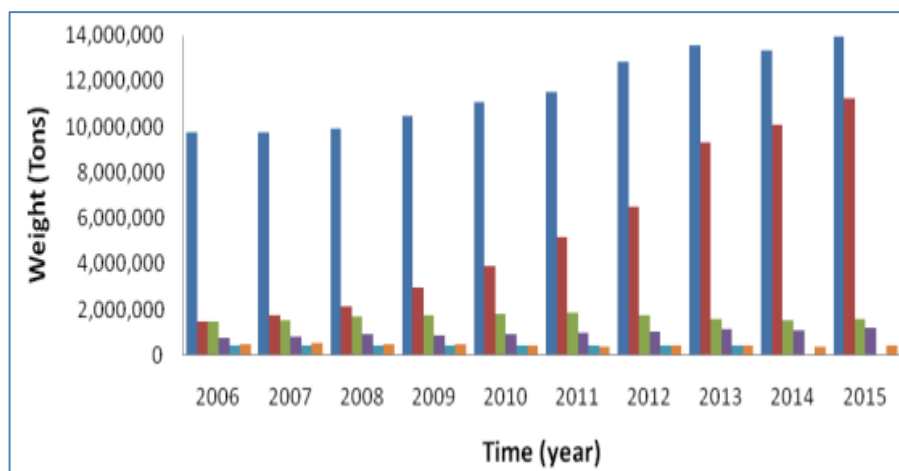


Figure 2.2: Global seaweed culture production drop [6]

## 2.2 Research Background

In general, this research background context will explain the theoretical review about what needs to be understood, particularly the general information, about the title of this thesis. This section depicts a thesis analysis that involves a description of the research field, current knowledge on the topic, previous studies on the issue, and relevant background on the issue. In order to design a tank that provides low maintenance for the cultivation of seaweed, the key parameter must first be considered. Therefore, to monitor the key parameters in the seaweed tank, a few things should be researched and taken into consideration. This includes the selection of suitable seaweed to be used as project material as an experiment to find out the important aspects that will affect the growth factors of seaweed in the tank. Plus, all the parameters required to monitor the seaweed growth must also be considered. The core theory of all the aspects stated above is researched and comprehended in order to construct this system.

### 2.2.1 Seaweed in General

Seaweeds are a type of coastal plant that may be found in a variety of sizes and forms. Seaweeds, both natural and farmed, contain vast quantities of bioactive compounds in a variety of forms, which are increasingly being studied in the health industry for their distinct bioactivities. [7] Biological products made from seaweed and based on bioactive seaweed compounds have become commonplace in our daily lives. Functional meals containing a range of bioactive seaweed compounds are projected to rise in popularity and relevance as a way to help people avoid and treat ailments in modern society. [8]