



**REAL-TIME WATER QUALITY MONITORING USING IOT NEAR  
BRACKISH WATER AREA IN SUNGAI MELAKA**



**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY  
WITH HONOURS**

**2023**



**Faculty of Mechanical and Manufacturing Engineering  
Technology**



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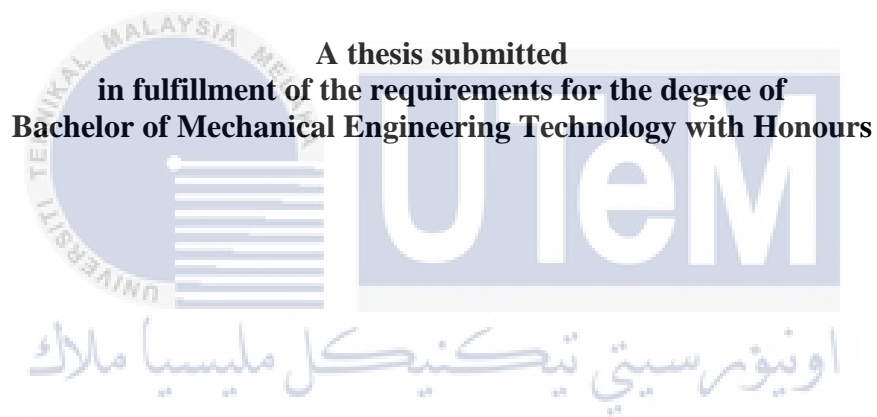
**Nurul Syuhadah Binti Abdul Jafar**

**Bachelor of Mechanical Engineering Technology with Honours**

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**REAL-TIME WATER QUALITY MONITORING USING IOT NEAR BRACKISH  
WATER AREA IN SUNGAI MELAKA**

**NURUL SYUHADAH BINTI ABDUL JAFAR**



**Faculty of Mechanical and Manufacturing Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2023**

## DECLARATION

I declare that this thesis entitled “REAL-TIME WATER QUALITY MONITORING USING IOT NEAR BRACKISH WATER AREA IN SUNGAI MELAKA” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

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Name

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Nurul Syuhadah Binti Abdul Jafar

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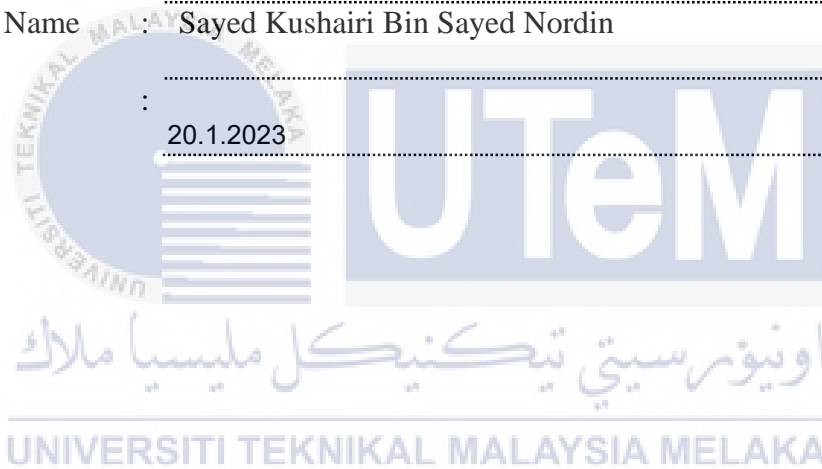
## APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology with Honours.

Signature : 

Supervisor Name : Sayed Kushairi Bin Sayed Nordin

Date : 20.1.2023



## DEDICATION

I dedicate this final year project to my parents because they are the reason why I strive to make this project successfully. I also dedicate this project to my supervisor, Sayed Kushairi Bin Sayed Nordin and my co-supervisor TS. Mohd Idain Fahmy bin Rosley for his countless hours of reflecting, reading, encouraging and most of all patience throughout the entire process.



## ABSTRACT

Water is a vital resource in human life and is necessary for the global life system to function. Humans use water in their daily lives for a variety of reasons, including agriculture, cattle, industry, and so on. However, due to the irresponsible behaviour of some parties, the water is getting increasingly polluted. Water pollution, according to the Environmental Quality Act of 1974, is defined as any direct or indirect change to the physical, thermal, biological, or radioactive properties of any part of the environment that releases, emits, or places these wastes in such a way that they affect the use and cause a situation that is dangerous and detrimental to the public's health, safety, and welfare, or other life such as birds, fish, aquatic life, and the like. Among the causes of water pollution in Malaysia is due to the dumping of garbage from residential areas along the river. For example, the uncontrolled dumping of waste materials such as oil, garbage and others and cause changes in the nature of water, will lead to pollution. In addition, the irresponsible attitude of some factory managers by dumping toxic waste into rivers or seas is also one of the causes of water pollution. This will affect life in the water. With the occurrence of water pollution, it will disrupt human health. Contaminated water contains chemicals such as mercury, sodium and so on that can be harmful to human health. In this study, HydroQS is a device that will be produced to monitor water conditions in the Melaka River. With this device, to some extent can help the state of Melaka reduce water pollution. This study will conduct a field test to prove that this project can help the country to some extent because this study is also a joint venture between UteM and Perbadanan Pembangunan Sungai dan Pantai (PPSPM). Due to water pollution that occurs in the Melaka River, can cause tourists do not want to go to Melaka and will bring down the economy of the state of Melaka.

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## ***ABSTRAK***

Air merupakan sumber penting dalam kehidupan manusia dan menyokong kepada sistem kehidupan global. Manusia memerlukan air dalam kehidupan seharian sebagai contoh pertanian, penternakan, perindustrian dan sebagainya. Namun, air semakin hari semakin tercemar angkara sikap tidak bertanggungjawab oleh sesetengah pihak. Menurut Akta Kualiti Alam Sekeliling 1974, pencemaran air didefinisikan sebagai apa-apa perubahan langsung atau tidak langsung kepada sifat-sifat fizikal, haba, biologi atau radioaktif iaitu mana-mana bahagian alam sekitar yang melepaskan, mengeluarkan, atau meletakkan buangan ini sehingga menjejaskan kegunaan dan menyebabkan sesuatu keadaan merbahaya dan memudaratkan kesihatan, keselamatan, dan kebajikan pihak awam, atau kehidupan lain seperti burung, ikan, hidupan akuatik dan sebagainya. Antara punca berlakunya pencemaran air di Malaysia adalah kerana pembuangan sampah dari kawasan perumahan di sepanjang sungai. Sebagai contoh, pembuangan bahan buangan seperti minyak, sampah dan lain-lain secara tidak terkawal dan menyebabkan perubahan sifat air, akan membawa kepada pencemaran. Selain itu, sikap sesetengah penguasaha kilang yang tidak bertanggungjawab dengan membuang sisa toksik ke dalam sungai ataupun laut juga merupakan salah satu punca berlakunya pencemaran air. Ini akan menyebabkan kehidupan di dalam air terjejas. Dengan berlakunya pencemaran air, ia akan mengganggu gugat kesihatan manusia. Air yang tercemar mengandungi bahan kimia seperti merkuri, sodium dan sebagainya yang boleh memudaratkan kesihatan manusia. Dalam kajian ini, HydroQS adalah peranti yang akan dihasilkan untuk memantau keadaan air di Sungai Melaka. Dengan adanya peranti ini, sedikit sebanyak dapat membantu negeri Melaka mengurangi pencemaran air. Kajian ini akan menjalankan ujian lapangan untuk membuktikan bahawa projek ini sedikit sebanyak dapat membantu negara kerana kajian ini juga merupakan usaha sama UteM dan Perbadanan Pembangunan Sungai dan Pantai (PPSPM). Di sebabkan pencemaran air yang berlaku di Sungai Melaka, boleh menyebabkan pelancong tidak mahu untuk ke Melaka dan akan menjatuhkan ekonomi negeri Melaka.



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In the Name of Allah, the Most Gracious, the Most Merciful

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As high as appreciation is given to my supervisor, Sayed Kushairi Bin Sayed Nordin and also my co supervisor TS. Mohd Idain Fahmy bin Rosley because of his constant help, support and guidance this has steered me to finish my report of project. His enthusiasm and professional works have motivated and inspired me whenever I feel down or lack of ideas while doing this project. Whenever I really need help, he always provides me with his help and giving words of encouragement to me to overcome the difficulties in doing this report.

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## TABLE OF CONTENTS

	<b>PAGE</b>
<b>DECLARATION</b>	
<b>APPROVAL</b>	
<b>DEDICATION</b>	
<b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>vi</b>
<b>LIST OF FIGURES</b>	<b>vii</b>
<b>LIST OF SYMBOLS AND ABBREVIATIONS</b>	<b>x</b>
<b>LIST OF APPENDICES</b>	<b>xii</b>
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>
	<b>13</b>
1.1 Background	13
1.2 Problem Statement	15
1.3 Research Objective	16
1.4 Scope of Research	16
<b>CHAPTER 2</b>	<b>LITERATURE REVIEW</b>
	<b>17</b>
2.1 Introduction	17
2.2 Water	18
2.2.1 Function water	18
2.2.2 Water pollution	19
2.3 Internet of things (IoT)	20
2.4 Water monitoring technology based on IoT	21
2.5 Water quality index	21
2.6 Types of water quality sensor	23
2.6.1 Temperature	23
2.6.2 pH level	24
2.6.3 Turbidity	25
2.6.4 Total Dissolved Solid (TDS)	26

<b>CHAPTER 3</b>	<b>METHODOLOGY</b>	<b>27</b>
3.1	Introduction	27
3.2	Project planning	27
3.3	HydroQS	29
	3.3.1 HydroQS casing component	30
	3.3.2 HydroQS sensor equipment	32
	3.3.3 Electronic component	38
3.4	Software	41
3.5	SLS Machine Farsoon SS402P	42
	3.5.1 Sintering Process	43
	3.5.2 Assemble of casing, sensors, and electronic component procedure	45
3.6	Hydroqs structure design and placement.	45
3.7	Costing For Sensor	47
<b>CHAPTER 4</b>		<b>49</b>
4.1	Introduction	49
4.2	Sensing system	49
4.3	Pretesting device	49
	4.3.1 Floating test	50
4.4	3D printing part	61
4.5	Field test data	62
	4.5.1 Result and Discussion	63
4.6	Product Improvement	67
	4.6.1 Main body	67
	4.6.2 Buoy	68
	4.6.3 Electronic casing.	69
<b>CHAPTER 5</b>	<b>CONCLUSION AND RECOMMENDATIONS</b>	<b>71</b>
5.1	Conclusion	71
5.2	Recommendations	72
<b>REFERENCES</b>		<b>73</b>
<b>APPENDICES</b>		<b>75</b>

## LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	National Water Quality Standards for Malaysia (NWQS)	22
Table 2.2	ANNEX water classes and uses	22
Table 3.1	pH level sensor specification	34
Table 3.2	Turbidity specification	35
Table 3.3	Temperature sensor specification	36
Table 3.4	Analog Total Dissolved Solid (TDS) sensor specification	37
Table 3.5	Arduino Uno specification	39
Table 3.6:	Cost for sensor	47
Table 4.1	Data for 24 hours	63
Table 4.2	Summary of statistics	64
Table 4.3	Summary of statistics in morning	64
Table 4.4	Summary of statistics in evening	64
Table 4.5	Summary of statistics in night	64
Table 4.6	Difference data taken and NWQS	65

## LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	Temperature sensor	23
Figure 2.2	pH level sensor	24
Figure 2.3	Turbidity	25
Figure 2.4	Total Dissolved Solid sensor	26
Figure 3.1	Flowchart	28
Figure 3.2	How HydroQS System Functioning	29
Figure 3.3	The main body of HydroQS	30
Figure 3.4	The main body of HydroQS	31
Figure 3.5	The buoy for HydroQS	31
Figure 3.6	Aluminum carbon	32
Figure 3.7	H-101 pH level sensor that used.	33
Figure 3.8	H-101 pH level sensor	33
Figure 3.9	Analog turbidity sensor	35
Figure 3.10	Temperature sensor	36
Figure 3.11	Analog Total Dissolved Solid (TDS) sensor	37
Figure 3.12	Arduino Uno	38
Figure 3.13	Powerbank	39
Figure 3.14	Solar Panel	40
Figure 3.15	Lamp	41
Figure 3.16	Home assistant	42
Figure 3.17	Farsoon SS402P Seective Laser Sintering (SLS) machine	43

Figure 3.18 Sintering Process	44
Figure 3.19 Tools used	45
Figure 3.20 HydroQS in Solidworks	46
Figure 3.21 HydroQS	46
Figure 3.22 pH level sensor	47
Figure 3.23 Turbidity sensor	47
Figure 3.24 Total Dissolved Solid (TDS) sensor	47
Figure 3.25 Temperature sensor	48
Figure 4.1 Data will appear at home assistant.	49
Figure 4.2 Fully buoy in water	50
Figure 4.3 Polyurethane Liquid A and B	51
Figure 4.4 Water level in block	51
Figure 4.5 Main body and buoy	52
Figure 4.6 This is the inner part of the main body.	53
Figure 4.7 Protective coating	53
Figure 4.8 KK233 Enhanced Interface Emulsion	54
Figure 4.9 Acrylic latex sealant gap filler	55
Figure 4.10 Spray (Clear)	56
Figure 4.11 Rubber O rings	57
Figure 4.12 Sensor casing before apply rubber O ring	58
Figure 4.13 Sensor casing after apply rubber O ring	58
Figure 4.14 Turbidity in home assistant.	59
Figure 4.15 Total Dissolved Solid (TDS) in home assistant	59
Figure 4.16 pH level for acid in home assistant	60

Figure 4.17 pH level for natural in home assistant	60
Figure 4.18 pH level for alkaline in home assistant	60
Figure 4.19 Temperature surrounding in home assistant	60
Figure 4.20 Bouy part.	61
Figure 4.21 Connector	61
Figure 4.22 Bouy amd main body in right side.	61
Figure 4.23 Main body	62
Figure 4.24 Field test for take data	62
Figure 4.25 Data TDS from Home Assistant.	65
Figure 4.26 Data turbidity from Home Assistant.	66
Figure 4.27 Data river temperature from Home Assistant	66
Figure 4.28 Data pH from Home Assistant.	67
Figure 4.29 Before improvement main body	67
Figure 4.30 After improvement main body	68
Figure 4.31 Before improvement buoy	68
Figure 4.32 After improvement buoy	69
Figure 4.33 Before improvement	69
Figure 4.34 After improvement	70
Figure 4.35 Electronic Casing with cover	70
Figure 5.1 Electronic Casing	72
Figure 5.2 Main Body	72

## LIST OF SYMBOLS AND ABBREVIATIONS

TDS	-	Total Dissolved Solid
HydroQS	-	Hydro Quality System
PPSPM	-	Perbadanan Pembangunan Sungai dan Pantai Melaka
PS	-	Point Sources
NPS	-	Non-point Sources
°C	-	Celcius
WHO	-	World Health Organization
IoT	-	Internet of Things
DOE	-	Department Of Environment
WQI	-	Water Quality Index
NWQS	-	National Water Quality Standards
BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
NH <sub>4</sub> -N	-	Ammoniacal Nitrogen
SS	-	Suspended Solids
USPHS	-	United States Public Health Service
ICMR	-	Indian Council Of Medical Research
H <sub>2</sub> O	-	Water
ppm	-	Parts per million
mg/L	-	Milligrammes per litre
SLS	-	Selective Laser Sintering
TSS	-	Total Suspended Solid
m	-	Meter
V	-	Volts
mm	-	Millimetre
MPa	-	Megapascal
g	-	Gram
mA	-	Milliampere
mAh	-	Milliampere hour



PC	-	Personal Computer
SMS	-	Short Message Service
FTKMP	-	Fakulti Teknologi Kejuruteraan Mekanikal dan Pembuatan
CO <sub>2</sub>	-	Carbon Dioxide
UTeM	-	Universiti Teknikal Malaysia Melaka
CCTV	-	Closed Circuit Television
NTU	-	Nephelometric
a	-	Maximum not to be exceeded
*	-	Related parameters, only one recommended for use.
**	-	Geometric mean.
N	-	No visible floatable materials or debris, no objectional odour or no objectional taste.



## LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Gantt chart	53



## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Water is one of the basic needs and requires for all life on earth. Water covering 71% of the total surface area in the earth. Water exists in all three of its states which is liquid, gas and solid. Many rivers have become polluted as a result of the numerous wastes poured into rivers from industrial areas. Malaysia is a tropical country with a similar seasonal climate, but the water level in the catchment varies during the monsoon. Both point sources (PS) and non-point sources (NPS) contribute to water pollution in Malaysia. Point sources have been identified as sewage treatment plants, manufacturing and agricultural industries, and animal farms. Diffuse non-point sources include things like agricultural activities and surface runoff.

In the last year, water resources have been depleted. According to global water pollution statistics, developing countries create 70% of untreated industrial wastes thrown into water, and an average of 99 million pounds (45 million kilogrammes) of fertiliser and chemicals are utilised each year (National Geographic Portal, 2016). This is a common occurrence in the Malacca River. The river is currently poisoned, causing the demise of a variety of fish species. Law enforcement, water resource regulations, religious and moral education, and public awareness about the value of the environment, particularly riverine water resources, have all been implemented by the state government. However, the state

government's adoption of such programmes to protect river water quality has not resulted in lower levels of water contamination.

The situation has grown more dangerous as it has progressed to a higher level. As a result, the key pollutants emitted by the major sources of pollution should be researched and quantified, particularly in terms of geographical variation in the Malacca River. Several systems for monitoring and analysing river water have been designed and marketed. The Sungai Melaka, on the other hand, has yet to be implemented due to a lack of information or technological know-how.

This study will be carried out in collaboration with Perbadanan Pembangunan Sungai dan Pantai Melaka (PPSPM), and will cover a 9-kilometer stretch of the Sungai Melaka from Batu Hampar in Peringgit to the river mouth in Bandar Hilir. The Hydro Quality System, or HydroQS, is a water quality monitoring equipment that can monitor and analyse water and send out alerts if the values are abnormal. Because HydroQS is integrated with IoT, all data can be viewed from anywhere using apps.

The selection of Nylon 12 or PA-12 are because it has good material properties. It is has low water absorption and density 1.01g/mL. PA-12 also have ability to sintered in powder from using selective laser sentering machine. In this study, it will used the recycled aging polyamide PA-12 of Hydro Quality System (HydroQS).

## 1.2 Problem Statement

To ensure the earth's sustainability, it is critical to protect it from various sources of pollution. Water pollution has also become a significant issue as a result of an increase in water-related activities such as transportation, fishing, and entertainment. It endangers people's lives and human and natural prosperity, as well as water quality in the surrounding area as the countries' economies develop. As the population grows, many activities, both accidentally and intentionally, contribute to water pollution. Dumping is dangerous. The new hydro quality survey sensor (HydroQS) system was born out of this problem. Designed and developed a new development to monitor and analyses river water quality system for river monitoring This system keeps track of the river's water quality in terms of water level, pH level, and other factors. Total Dissolved Solids (TDS), dissolved oxygen (DO), turbidity, current flow speed in Sungai Melaka water temperature, wind speed on the surface, ambient temperature, and humidity These The sensors are Arduino-based and can be linked and monitored in the control room via apps or online. Previously, numerous studies on pollution in Sungai Melaka were conducted. However, all of these studies were conducted on a short-term basis and did not reach PPSPM or other local organisations. authorities involved in the preservation, maintenance, and management of Sungai Melaka.

If the pollution persists, it will affect the economy of the state of Melaka due to the lack of tourists who come there. If the river water is polluted, it will affect the shops that facing the river because the river water will smelly. To some extent it will affect the shops that do business there.

### 1.3 Research Objective

There are many objectives that must be accomplished in this project, so they are as follows:

- a) To monitor the river water (brackish water) quality in Sungai Melaka by using HydroQS.
- b) To analyze the data collection result according to the measured parameter and compare with NWQS standard.
- c) To pre-test the HydroQS body and sensor calibration.

### 1.4 Scope of Research

The scope of this research are as follows:

- This study is to focus on monitoring water quality in brackish water area in Sungai Melaka on pH level, Total Dissolved Solids (TDS), turbidity, flow meter, humidity and water temperature.
- This study cover brackish water area in the Malacca River.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Environmental pollution is a serious issue in this era of globalization, yet it remains the world's greatest concern and one of the top causes of disease and mortality. There are many other sorts of environmental contamination, but we'll concentrate on water pollution. The pervasive problem of water contamination is endangering our health.. Each year, unsafe water kills more people than all other forms of violence combined. It is not only humans who are killed, but also aquatic life.

Our country (Malaysia) faces a significant problem with water pollution, which has a detrimental influence on the sustainability of water resources. It reduces the total water supply since the expense of treating filthy water is too great and, in some situations, it cannot be treated for human use. (BAO 2010).

Nowadays, river and sea are used as disposal routes for liquid and solid waste. Wastewater from residential. Commercial and industrial area caused foul smell especially in the presence of plastic waste, garbage and deteriorates the quality of water and pollutes the existing rivers system. According to Harian Metro (2 April 2021) news, the problem of river pollution in Kampung Permatang Tepi Laut, here, which has been lingering for the past few years, has threatened the livelihood of about 200 coastal fishermen. This situation proved that water pollution will affect the source of income.

According to the WHO, 80 percent of diseases are waterborne. Major sources of water contamination include industrialization, home waste discharge, radioactive waste, population increase, excessive use of pesticides and fertilizers, and leaking water tanks.

These wastes are detrimental to human health. Depending on their location and composition, the effects of various chemicals vary. Through dirty water, bacterial, viral, and parasite diseases such as typhoid, cholera, encephalitis, poliomyelitis, hepatitis, skin infection, and gastrointestinal are spreading.

## **2.2 Water**

At normal pressure and temperature, water is a chemical substance that exists as a liquid. 70% of the earth's surface is covered by water. Water is required for the survival of all species on this planet. Water can exist in three different states: solid, liquid, and gas. Water is the most common substance on the earth, particularly in liquid form. However, the atmosphere contains massive volumes of water in the form of gases (vapors) and solids (ice and snow).

Water is one of the most important natural resources that God has provided to humans. (Das & Jain, 2017)

After air, water is by far the most important life-sustaining substance. Water is essential for the survival of all living things and for the proper functioning of the body's metabolism. Water conservation and quality preservation are consequently critical for humans as well as existing ecosystems. (Kothari et al., 2021)

### **2.2.1 Function water**

Water is an important natural resource that we utilize for drinking and other purposes. (Haseena et al., 2017)

Safe and easily available water is essential for public health, whether it is used for drinking, home use, food production, or recreational activities. (Chowdury et al., 2019)