

THE INVESTIGATION OF MONITORING OF THE  
PERFORMANCE OF THE WATER QUALITY

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**THE INVESTIGATION OF MONITORING OF THE  
PERFORMANCE OF THE WATER QUALITY**

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**This report is submitted in partial fulfilment of the requirements  
for the degree of Bachelor of Electronic Engineering with Honours**

**Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka**

**2018**

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : THE INVESTIGATION OF MONITORING OF  
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## **DEDICATION**

For my beloved parents and family who supported me in all things great and small.

## ABSTRACT

The quality of water is vital to the living for consumption and recreational activities. The Department of Environment of Malaysia has standardised the National Water Quality Standard and distinguish the classes based on the Water Quality Index of 72 parameters of water. This study is to investigate the water quality of the lakes and classifying them according to the performance of the pH and turbidity level. The Internet of Things is applied for a real-time monitoring and easier analysis of water quality. The system consists of the pH and turbidity sensors, an Arduino Uno microcontroller, an ESP8266-01 Wi-Fi module and a cloud server to analyse the data. Samples of different lakes had been tested and analysed for its class and quality. The findings contribute to sustainability and environment by indicating the pH and turbidity level are proven to be in the range of safe usage. Hence, updating the water quality level for recreational purposes.

## ABSTRAK

*Kualiti air adalah penting untuk kehidupan bagi penggunaan harian dan rekreasi. Jabatan Alam Sekitar Malaysia telah menyeragamkan Standard Kualiti Air Negara dan membezakan kelas berdasarkan Indeks Kualiti Air dengan 72 parameter-parameter air. Kajian ini bertujuan mengkaji kualiti air di beberapa buah tasik dan mengklasifikasikannya mengikut tahap pH dan kekeruhan air. 'Internet of Things' telah digunakan bagi pemantauan masa nyata dan memudahkan analisa bagi quality air. Sistem ini terdiri daripada sensor pH dan kekeruhan, pengawal mikro Arduino Uno, modul Wi-Fi ESP8266 dan 'cloud server' untuk menganalisis data. Sampe air dari tasik yang berbeza telah diuji dan dianalisis bagi tujuan pengelasan dan pemantauan. Dapatan kajian ini menyumbang kepada kelestarian dan alam sekitar dengan menunjukkan tahap pH dan kekeruhan air. Seterusnya, mengemaskini tahap kualiti air bagi tujuan rekreasi.*



## ACKNOWLEDGEMENTS

This dissertation is dedicated to my father, siblings and family that has been supporting me during my endeavour in studies and for being my pillar of strength to achieve the accomplishments that I never knew I could to. To my beloved mother, that had told me to pursue my studies before anything else, this is a prove that I have strived for your last words. No amount of gratitude could reward everything that they had done for me to finish my bachelor degree. Other than that, I would love to use this opportunity to express my indebtedness to the lecturers that had been sharing their knowledge, support and advices during my studies. Also, to my friends that has been a great help in a way I could not ever repay for their kindness and friendship throughout the years.

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## LIST OF SYMBOLS AND ABBREVIATIONS

ADC	:	Analogue to digital converter
DC	:	Direct current
DO	:	Dissolved oxygen
DOE	:	Department of Environment
FPGA	:	Field Programmable Gate Array
FTP	:	File Transfer Protocol
GPRS	:	General Radio Packet Services
GSM	:	Global System for Mobile communication
IoT	:	Internet of Things
LED	:	Light-emitting diode
NWQS	:	National Water Quality Standards
ORP	:	Oxidation and Reduction Potential
PIC	:	Peripheral Interface Controller
RF	:	Radio frequency
RS	:	Remote sensing
SoC	:	System On-Chip
SRAM	:	Static Random-Access Memory

TTS	:	Total suspension solid
UART	:	Universal Asynchronous Receiver/Transmitter
UI	:	User interface
VHDL	:	Very High Speed Integrated Circuit Network
WQI	:	Water Quality Index
WSN	:	Wireless Sensor Network

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# **CHAPTER 1**

## **INTRODUCTION**

Water which is a molecule consists of two atoms of hydrogens and an atom of oxygen, is the most crucial fluid for humans and all lifeforms. Water is essential for consumption or recreation for every species on Earth to survive. An investigation to monitor the performance of quality of water is done to study the pH and turbidity of the lakes.

### **1.1 PROJECT INTRODUCTION**

This report explains the details of The Investigation of Monitoring the Performance of Water Quality for Final Year Project. The project investigates the pH level and turbidity of water with the implementation of Internet of Things (IoT) in analysing a real-time data.

The Internet of Things has been used in interconnecting communicating objects that are installed at different locations for the past years. IoT represents a concept where network devices have the ability to gather data from the sensor, and then share that data across the internet or cloud where that data can be processed for various purposes and being shared or notify the user.

An Arduino will be used as the microcontroller or platform which will read the received inputs by the sensors and transmits whilst converts the data to the output. The programmed Arduino will send data to the server, thus notifying the users.

The developed project would inform the real-time data of the quality of water for its pH and turbidity to the users. Thus, we can conclude for its class and uses for recreational or fishery based on the Water Quality Index (WQI) classes from Department of Environment (DOE) of Malaysia.

### **1.1.1 Water Quality Monitoring**

Water quality has been the main issue for consumers to analyse and measure its condition whether for its physical or chemical characteristics. Water quality monitoring has been implemented to observe the main parameters in determining the quality and usage.

Back in the 1970s, the environmental acts and regulations has been established in Malaysia. An act which is related to the improvement of the environment, prevention and control of pollution are based on the "Environmental Quality Act 1974".

Based on the National Water Quality Standards (NWQS), the quality of water can be improved into a higher class based on the standardised values of 72 parameters in 6 water use classes since 2008. The water usage and classes can be identified in Table 2.1 [1].

From the 72 parameters that are classified, the main parameters that are critically considered and standardised by the DOE into determining the quality of water are the Ammoniacal Nitrogen (AN), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), pH and total suspended solid (SS).

These 6 parameters are the benchmark in account for the WQI are to measure and obtain the exceptional quality of water. It has been introduced by DOE for the past 25 years and used as a standard for the assessment of evaluating water quality.

*Table 1.1: Water classes and uses*

Class	Uses
Class I	Conservation of natural environment. Water Supply I – Practically no treatment necessary. Fishery I – Very sensitive aquatic species.
Class II A	Water Supply II – Conventional treatment. Fishery II – Sensitive aquatic species.
Class II B	Recreational use with body contact.
Class III	Water Supply III – Extensive treatment required. Fishery III – Common of economic value and tolerant species; livestock drinking.

Class IV	Irrigation.
Class V	None of the above.

## 1.2 OBJECTIVES

The objectives for the proposed work are:

1. To investigate the quality of water by its pH and turbidity level.
2. To analyse the quality of water for lakes.
3. To develop a mobile prototype in obtaining the data of the water quality level.
4. To implement the Internet of Thing (IoT) in analysing data of the performance of water quality level.

## 1.3 PROBLEM STATEMENT

Water may be impure or may contain several types of impurities. The fickle quality of water may affect the health and the environment. Therefore, a depth of investigation is needed to determine whether the water is suitable for consumption or recreational uses.

Despite that, a laborious method of determining the values of water parameters consumes a lot of time and must go through complicated processes to achieve an accurate result. Other than that, special apparatus is needed to ensure and preserve the condition of samples throughout the preservation in the lab.

## 1.4 SCOPE OF WORK

The scope for this project includes the need to develop a device that can measure and investigate the quality of the water. The location that is decided to investigate its quality are UTeM's lake, Taman Rimba Park's lake and Ayer Keroh Lake.

Next, the development of the device will consist of a microcontroller, a pH sensor and a turbidity sensor. The water parameters will be checked for its the pH and turbidity of the lake by using the sensors attached to the microcontroller which is the Arduino. After that, we will monitor and check all the aspects based on the received data. Then, the information of all the aspects from Arduino will be send to authorized personnel via computer. Finally, all data will be recorded and analysed to determine its class based on the WQI.

The scope for this project will not include the usage of another water samples from different lake. Next, other parameters will not be considered for this investigation due to limitation of cost and equipment. Finally, the last thing that will not be included in this scope is the application used to receive information from Arduino.

## **1.5 METHODOLOGY**

The methodology applied into the development of the project involves the software and hardware build-up. This project analyses the pH and turbidity of water which are one of the main parameters into measuring and classifying the water quality. Based on the result obtained, conclusion can be made into classifying the quality into classes and uses whether for recreation of fishery.

Into classifying and investigate the quality, the DOE has standardised the quality of water that is known as the National Water Quality Standards (NWQS). By referring the NWQS, the classes and uses can be determined based on Table 2.1 in Chapter II.

For data collection and analysis, many journals and articles were found and taken into consideration to be analysed and compared for its project development. Each material was studied thoroughly, and then detailed analysis was made for each. Each