Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT-BASED WATER QUALITY MONITORING SYSTEM

MUHAMMAD DANIEL BIN MOHD NOOR

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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Faculty of Electrical and Electronic Engineering Technology

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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 Computer Engineering Technology (Computer Systems) with Honours.

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DEDICATION

I would like to take this opportunity to express my deepest grateful appreciation to all wonderful people have continuously giving me support, advices, knowledge, understanding and contribution towards the successful completion of this Final Year Project. I wish to express my sincere appreciation to my supervisor, Dr Aminah Binti Ahmad for encouragement, guidance, critics, advices, suggestion and motivation on developing this project. Without her assistance and involvement in every step throughout the process, this paper would have never been accomplished. I would like to thank you very much for your support and understanding over these past years. I also would like to express my sincerest gratitude and deepest thankfulness to my parent and siblings for their love, support, and encouragement that they had given to me to make sure I could focus fully on this project. Besides that, I also would like to thank my friend and all my housemate who has help me a lot and support me throughout completing this project.

ABSTRACT

Water quality monitoring system is the most essential for continuity to get the pure water source. As water utilities face greater challenges, drinking water may become increasingly valuable to all people. These issues develop as a result of the high population, limited water resources, and other factors. As a result, many approaches are utilized to monitor water quality in real time. To ensure that water is distributed safely, a new approach based on the "Internet of Things (IoT)" has been proposed to monitor water quality in real time. With an expansion in the wireless device network technique in the IoT, real-time water quality observation is investigated through data collecting, method, and transmission. Microcontroller with the processed value remotely to the core controller, NodeMCU with a built-in Wi-Fi module protocol, is used to interface the measured value from the sensor. The water quality observation interface sensors with quality observation with IoT setting was projected in this way. Water Quality Monitoring (WQM) determines water parameters such as temperature, water level and water turbidity. The information is sent to the web server using this manner. The data on the server, which is updated at regular intervals, can be downloaded or accessed from anywhere in the world.

Keyword: IoT, Water Quality Monitoring, WQM, Turbidity

ABSTRAK

Sistem pemantauan kualiti air adalah yang paling penting untuk kesinambungan untuk mendapatkan sumber air tulen. Oleh kerana utiliti air menghadapi cabaran yang lebih besar, air minum mungkin menjadi semakin berharga bagi semua orang. Isu-isu ini berkembang akibat jumlah penduduk yang tinggi, sumber air yang terhad, dan faktor-faktor lain. Akibatnya, banyak pendekatan digunakan untuk memantau kualiti air dalam waktu nyata. Untuk memastikan air diedarkan dengan selamat, pendekatan baru berdasarkan "Internet of Things (IoT)" telah diusulkan untuk memantau kualiti air dalam waktu nyata. Dengan pengembangan teknik rangkaian peranti tanpa wayar di IoT, pemerhatian kualiti air masa nyata disiasat melalui pengumpulan, kaedah, dan penghantaran data. Mikrokontroler dengan nilai yang diproses dari jarak jauh ke pengawal teras yang merupakan NodeMCU dengan protokol modul Wi-Fi bawaan digunakan untuk menghubungkan nilai yang diukur dari sensor. Sensor adalah antara muka untuk pemerhatian kualiti air dengan pemerhatian berkualiti dengan tetapan IoT diunjurkan dengan cara ini. Pemantauan Kualiti Air (WQM) menentukan parameter air seperti suhu, paras air dan kekeruhan air. Maklumat dihantar ke server web menggunakan cara ini. Data di server, yang dikemas kini secara berkala, boleh dimuat turun atau diakses dari mana saja di dunia.

Katakunci : Iot, Sistem Pemantauan Kualiti Air, Kekerohan

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FIGURE **TITLE** **PAGE**

LIST OF SYMBOLS

V	-	Volt
mV	-	miliVolt
˚C	-	Degree Celcius
A	-	Ampere
mA	-	miliampere
Cm	-	Centimeter
M	-	meter.
NTU	-	Nepholometric Turbidity unit

LIST OF ABBREVIATIONS

Iot	-	Internet of Things
V	-	Voltage
Cm	-	Centimeter
M	-	meter
RTC	-	Real-Time Clock
WQM	-	Water Quality Monitoring
NTU	-	Nephelometric Turbidity Unit
TTS	-	Total Suspended Solids

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

This chapter describes the content of this chapter generally regarding the water quality monitoring system, including the problem statement, objective, and scope. The few things that need to be achieved to solve the problem that arises are the project's objective and the problem statement related to how the problem that wanted to solve will occur. However, in this case, there will be a limitation in completing this project discussed in this chapter.

1.2 Project Background

The water supply system is an infrastructure of collecting, transmission treatment, storage and distribution of the water for the home, commercial, industry and irrigation. The provision of potable water is perhaps the most vital. Every person in this world will seek water for drinking, cooking, washing, waste carry, and other domestic needs. For this to happen, the water supply system must also need to meet the public, commercial, and industrial activities requirements. In this case, the water that comes from the water supply must fulfil the quality and quantity requirements.

In Malaysia, most of the state in was received good quality water supply. Some states were having difficulties receiving good quality and shortage of water supply due to

pollution and low level at the water supply compound. The rivers provided the main water source for the Malaysians. About 97% water supply used for the domestic, industrial and agriculture came from rivers in Malaysia. The water source will go to the treatment before supply to domestically and industries. Monitoring the water supply is traditionally done by the department of the environment come to the river and using the test kit for the water quality testing. This process takes time to inspect every river that available in Malaysia. Sometimes, the inspector needs to go through the unpaved road due to river in Malaysia, sometimes in the countryside. The advanced way to monitor that is to set up the base equipped with a computer. This method will reduce the test that needs to conduct, but the availability for anyone to access is denied. The inspector still needs to go to the station to read the value from the computer.

The main purpose of this project is to develop the IOT based water level and quality monitoring system using NodeMCU to reduce time to test the water level and the quality of water. The data received from the sensor will be sent to the website that will display the value that the user can read. For this prototype, the system will sensor the water level and the turbidity of the water.

Water is a big role in supporting the communities. Without an existing water supply, there should not be able to run local business and industries from the array of pipes, canals and pumping stations managed by our public water systems that can bring the source of water to our taps each day. Source of water come to start as rain or snow, and it flows into our local lake, rivers, and stream or underground. We are lucky to have access to some of the safest treated water.

The usage of water come from the individual, community and business related. As for the individual, the water is used for daily life to surviving and for work done in daily life. Daily life water usage comes from drinking, cooking, shower, toilet and washing.

Then, water usage in the community comes from the water supply for the residential area for their daily use.

1.3 Problem Statement

The water quality monitoring system idea comes from a real situation. Most river in Malaysia still monitors the water quality by manual method. The inspector of the quality goes to the river and uses their kit to check the river. The problem will cause the inspection company's irregular and time-consuming inspection to inspect all the river that is available in Malaysia. The main purpose of this project is to develop an IoT-based water quality monitoring system that can reduce time and labour wastage has been conducting right now. In short, this study focuses on developing a prototype system that can help water quality inspector reduce their time and energy. This project will design and develop an IoT-based prototype and monitor the water quality monitoring system using NodeMCU.

1.4 Project Objective

The objectives of this project are as follows:

a) To develop a prototype of water quality monitoring system that able to measure the water level, water temperature and and water turbidity.

b) To analyze the performance of the water quality monitoring system using the IoT system by testing the prototype on river water.

c) To analyze the data for the water quality monitoring.

1.5 Scope of Project

The project will develop a prototype for a water quality monitoring system displayed on the website that allows the inspector to monitor it. This system will use NodeMCU as the central controller and a built-in ESP8266 module that will enable us to make the project IOT and send it to the website. The sensor used in this project was the turbidity sensor and the ultrasonic sensor that allowed us to check the turbidity and water level. The prototype will be placed on the water's surface, and the ultrasonic sensor for water level will be placed at the top and constant to measure the level of water. River water will test the prototype at Sungai Melaka to test the performance functionality of the prototype.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This literature review will explain and focus on the ideas and the information needed to complete the project. Besides, the advantage and disadvantage of previous research are reviewed and compared. There is also the research on the hardware component that is used in other projects also will be reviewed. Furthermore, by analyzing the previous projects, the possibilities that affect the quality of their project can be analyzed and reviewed. Lastly, some recommendation has been made to overcome the problem exist in the previous study.

2.2 Introduction to Water Quality

The chemical, physical, and biological content values of water are used to characterize its quality. Even when there is no pollution, the water quality of rivers and lakes varies with the seasons and geographical areas. There is no significant value that can help us obtain high-quality water. For example, drinking water can be used for farming or irrigation, but irrigation or farming water cannot be guaranteed to be suitable for drinking. A guideline exists that provides fundamental scientific information on water quality parameters and ecologically relevant toxicological threshold values to protect certain water uses. Sedimentation, runoff, erosion, pH value, temperature, pesticides, toxic and

hazardous compounds, detergents, litter, and garbage are all factors that affect water quality. There were also substances in the air that influenced the rain that fell to the ground. Dust, volcanic gases, and natural gases like carbon dioxide, oxygen, and nitrogen will dissolve or become imprisoned in the rain. Meanwhile, other substances such as sulfur dioxide, hazardous chemicals, or lead are caught in the rain and rain to the ground, picking up any other substance as it flows from the hill to the river or lake. As a result, the quality of water that comes from natural sources such as rain and rivers will face challenges in meeting human water needs.

2.3 Overview of Water Quality Monitoring

When it comes to finding the best water quality, water can be used to process fish, wash fish, or ice making water meets drinking water standard, and it is considered safe or good quality[1]. The main reason is that contaminated water is the cause of the pathogen-loading of fish and can be hazardous to the consumer. In contrast, the detail of the sampling, testing and analysis was used to follow the general description of the significance of water quality test that was usually made. Testing procedure and parameter may be grouped into physical, chemical and bacteriological. First is the physical testing reveal qualities that can be detected by the sense. Then, chemical tests are used to evaluate the levels of mineral and organic substances that have an impact on the quality of water. And Bacteriological assays reveal the presence of germs that are typically associated with fecal contamination.

The colour, turbidity, total solids, dissolve solid, suspended solids, odor and tasted will be recorded in the physical test. For colour, the presence of the mineral such as manganese and iron or by other substance in vegetable bases such as algae or weeds. This substance will affect the colour of the water. Then, the turbidity of the water can be caused

by suspended solids and colloidal matter. Then turbid also affected by the erosion of the soil in the water or due to the growth of the micro-organism. Then, a physical test also includes the odor and taste of the water to detect the presence of microscopic organisms or organic substances, including weed, algae, or any industrial waste containing ammonia, halogen, phenols, and hydrocarbons.

Furthermore, in testing the water quality, a chemical test needs to be conducted in terms of pH value and Biological Oxygen Demand (B.O.D). The concentration of hydrogen ions is measured by ph. It is a measure of water's relative acidity or alkalinity. High alkalinity is indicated by readings of 9.5 and above, while the acidity is indicated by values of 3 and below. Low pH levels aid successful chlorination but cause corrosion issues. In the marine environment, values below 4 often do not support live creatures. The pH of drinking water should be between 6.5 and 8.5. The water level in the harbor basin can range from 6 to 9.

And lastly, the bacteriological test, Indicator organisms should be numerous in faeces but absent or present in modest numbers in other sources. They should be easy to isolate, identify, and count, and they should not develop in water[2]. They should also survive in the water longer than pathogens and be more resistant to disinfectants like chlorine. No one creature can meet all of these criteria in actuality, but coliform species, particularly Escherichia coli, may. Escherichia coli is the most important indicator of pollution by faecal material of human or animal origin.