IOT - BASED WATER QUALITY MONITORING SYSTEM FOR FISHERY

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IoT - BASED WATER QUALITY MONITORING SYSTEM FOR FISHERY

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Computer Networking) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2021

DECLARATION

I hereby declare that this project report entitled

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is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT : _____ Date : 9/9/2021

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I hereby declare that I have read this project report and found this project report is sufficient in term of the scope and quality for the award of Bachelor of Computer Science (Computer Networking) with Honours.

SUPERVISOR : _____ Date : 9/9/2021

(DR. WAHIDAH BINTI MD SHAH**)**

DEDICATION

Thanks to Allah S.W.T,

for giving me a strength to accomplish this project.

To my supervisor,

Dr. Wahidah Binti Md Shah,

Thank you for being supportive and give non-stop guidance throughout this journey to complete this project.

To my wonderful parents,

Salim Bin Zakaria and Jamaliah Binti Abdul Razak,

Thank you for your prayers and moral support.

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I would like to thank you for your constantly advice and support.

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I would like to thank my supervisor, Dr. Wahidah Binti Md Shah, who has always led and provided guidance throughout this project. The project would not have been completed without her, and the progress of the project would not have been known.

Special thanks to my family, Salim Bin Zakaria, Jamaliah Binti Abdul Razak, and all my siblings for their moral support while studying at UTeM to complete this project. I had many problems and mistakes in making this project a great project, which made me inactive. With their presence, they have boosted my enthusiasm by giving me endless inspiration to make me emotionally stronger to complete my project.

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ABSTRACT

Water plays a significant role include hydration, agriculture, electricity, and aquaculture use. Water quality is an important aspect of fish farming production. Poor water quality led to slow fish growth and result in fish death. Fishpond water quality monitoring could be hassle and time consuming which requires breeders to obtain their own water samples and test it using special meters. The IoT-based system is proposed to assist fish breeders in monitoring the fishponds water and alert them about poor water quality conditions. The system consists of Raspberry Pi, pH sensor, and temperature sensor. A pH sensor is used to detect the pH of the water while a temperature sensor is used to detect the water temperature of fishponds, Raspberry Pi is a microprocessor that processes these water parameter readings. This system uses Wi-Fi for the data transmission process as it uses the built-in Wi-Fi module on the Raspberry Pi, fish breeders can perform monitoring via mobile apps on their android smartphones. If the pH and temperature values exceed the set action levels, fish breeders will get alert notifications from mobile apps. This will help breeders to carry out the process of maintaining the fishpond. The results are collected through testing, and the system's efficacy judgments are drawn from the findings for which sensor readings could be performed with a moderate degree and notification alerts functioned with excellent response.

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ABSTRAK

Air memainkan peranan penting termasuk hidrasi, pertanian, elektrik, dan penggunaan akuakultur. Kualiti air adalah aspek penting dalam pengeluaran ternakan ikan. Kualiti air yang buruk menyebabkan pertumbuhan ikan lambat dan mengakibatkan kematian ikan. Pemantauan kualiti air kolam ikan dapat menjadi kesulitan dan memakan masa yang memerlukan penternak untuk mendapatkan sampel air mereka sendiri dan mengujinya dengan menggunakan meter khas. Sistem berasaskan IoT dicadangkan untuk membantu penternak ikan dalam memantau air kolam ikan dan memberi tahu mereka tentang keadaan kualiti air yang buruk. Sistem ini terdiri dari Raspberry Pi, sensor pH, dan sensor Suhu. Sensor pH digunakan untuk mengesan pH air sementara sensor suhu digunakan untuk mengesan suhu air kolam ikan, Raspberry Pi adalah mikropemproses yang memproses pembacaan parameter air ini. Sistem ini menggunakan Wi-Fi untuk proses penghantaran data kerana menggunakan modul Wi-Fi bawaan pada Raspberry Pi, penternak ikan dapat melakukan pemantauan melalui aplikasi mudah alih di telefon pintar android mereka. Sekiranya nilai pH dan suhu melebihi tahap tindakan yang ditetapkan, penternak ikan akan mendapat pemberitahuan amaran dari aplikasi mudah alih. Ini akan membantu penternak menjalankan proses pemeliharaan kolam ikan. Hasilnya dikumpulkan melalui ujian, dan penilaian keberkesanan sistem diambil dari penemuan yang mana bacaan sensor dapat dilakukan dengan tahap sederhana dan amaran pemberitahuan berfungsi dengan respons yang sangat baik.

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LIST OF ABBREVIATIONS

FYP	**-**	**Final Year Project**
IoT	**-**	**Internet of Things**
RPI	**-**	**Raspberry Pi**
GPIO	**-**	**General-Purpose Input/Output**
RAM	**-**	**Random Access Memory**
Wi-Fi	**-**	**Wireless Fidelity**
MATLAB	**-**	**Matrix Laboratory**
API	**-**	**Application Program Interface**
APK	**-**	**Android Package**
DIN	**-**	**Data In**
DOUT	**-**	**Data Out**
VREF	**-**	**Voltage Reference**
VDD	**-**	**Voltage Drain-to-Drain**
VCC	**-**	**Voltage Common Collector**

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CHAPTER 1: INTRODUCTION

1.1 Introduction

One of the most crucial aspects of a healthy environment is water quality. Clean water is essential for the survival of a wide range of plants and animals. The quality of the water used in fish farming is crucial. Poor water quality is a low water quality or standard that it is in bad condition. The status of various water parameters like pH and temperature cannot be overlooked for maintaining a healthy aquatic environment (Bhatnagar and Devi, 2013). The neglection of water quality can lead to fish death, this happens to fish breeders where water pollution is mostly caused by waste generated from agricultural activities. This is because, the main water source is from a nearby river that has been polluted (Astro Awani, 2019).

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To determine the water quality, the water manually tested using complete equipped to test the water before it can be used for fish farming purposes. Nowadays, most fish breeders, especially rural breeders, use manual methods in monitoring the water of their fishponds. This water quality monitoring is done by using special equipment that requires the breeders themselves to go down to the location of the pond to obtain water samples for testing. Once the results were obtained, all records were kept in a book by hands for future reference. This monitoring process is done periodically either once a week or once every two weeks. This poses difficulties to breeders, additionally, this water analysis process requires some time to obtain water quality results.

In the agricultural sector perspective, the use of sensors is used for water monitoring processes. A system developed for measuring parameters water such as turbidity, solute, pH and temperature. The developed system is equipped with suitable sensors for measuring water parameters. Therefore, Water Quality Monitoring System is designed to monitor the condition of the water quality in the fishponds based on the water parameters (R. Verma and D. Kiran, 2019). Just like other livestock sectors, fish also needs good monitoring of water parameters especially tilapia which is the focus in this project for better fish growth and production. By leveraging the use of sensors, the system will detect the pH level and temperature of the water in the fishponds as a benchmark for the water parameters. This system will alert the fish breeder if the water parameters exceed the action level. Values that exceed this level of action are expected to have negative effects on fish survival and quality. Therefore, with the use of this system, breeders can anticipate and perform water maintenance on the fishpond more efficiently.

1.2 Problem Statement (PS)

In fish farming, it is difficult for breeders to monitor water for the purpose of water maintenance process. The need for fully equipped tools and a lengthy process to test water causes breeders to have time constraints with other matters in managing their premises. Easiest way could be by manually look at the color or turbidity of the water. However, this method is not accurate since other parameters such as pH and temperature cannot directly observable. This can endanger the fishpond environment and interfere with fish growth. Despite the color of the water is clear, does not guarantee good water quality in the fishpond. Thus, manual tools are used for measuring, for example water samples obtained from the ponds by the breeders themselves which are then evaluated manually using special meters for pH and temperature readings. This also pose problem and hard time to fish breeders in monitoring their fishpond. To summarize this, the problem statements for this project are shown in Table 1.1.

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Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS_1	Hard to monitor the quality of water using the manual method
PS_2	No indicator for water maintenance and only based on the physical change of water color
PS_3	Lack of notification to identify the poor water quality

1.3 Project Question (PQ)

Project questions were used to identify questions on monitoring water quality conditions. Based on several studies, it can be concluded that there are some difficulties in determining whether water quality reaches the required level for fish farming purposes. Table 1.2 shows the summary of the project question.

Table 1.2: Summary of Project Question

PS	PQ	Project Question
PS_1	PQ_1	How to monitor water quality for tilapia farming more effectively?
PS_2	PQ_2	How to determine water quality conditions based on water parameters?
PS_3	PQ_3	How to warn fish breeder if water quality exceeds the level of action?

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1.4 Project Objective (PO)

Project objectives are tailored to the problem statement and project questions. The objectives of this Water Quality Monitoring System project are shown in the Table 1.3 below.

Table 1.3: Summary of Project Objective

PS	PQ	PO	Project Objective
PS_1, PS_2, PS_3	PQ_1, PQ_2, PQ_3	PO_1	To identify water quality parameters for tilapia fish farming.
		PO_2	To design and develop IoT based monitoring system that able to monitor and alert water quality.
		PO_3	To test the effectiveness of the system functionality, response time, and accuracy.

1.5 Project Scope

1. Focus on the use of fish breeders in maintaining the water quality of their fishponds. Fish breeders can view water quality indicators through their mobile phone.
2. A smart IoT project that focuses on the development of features that can be offered through the system by detecting water parameters in terms of pH level and water temperature using sensors. Initially, the dissolved oxygen water parameter also includes as part of the project plan but cannot be done due to finance constraint. Alerting system that can notify the mobile phone user when the parameters values exceed the action level.

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1.6 Project Contribution (PC)

Project contribution defines the expected outcome from this project. This project may help many fish breeder especially modest breeder by providing the monitoring system for their fishpond water quality maintenance. The main goal of this project is to monitor the water quality for fish farming purposes.

The utilization of IoT with mobile application technology eases the project development in monitoring and alerting to the mobile phone. Detecting the parameters of

the water helps to increase the water quality that meets the requirement for the use of fish farming. Table 1.4 below shows the summary of project contribution.

Table 1.4: Summary of Project Contribution

PS	PQ	PO	PC	Project Contribution
PS_1, PS_2, PS_3	PQ_1, PQ_2, PQ_3	PO_1	PC_1	Provide a solution in detecting the parameter of the water quality.
		PO_2	PC_2	Provide mobile application that can monitor and alert.
		PO_3	PC_3	Provide an effective system for consumerism.

1.7 Report Organization

Chapter 1: Introduction

This chapter discuss about the purpose in developing the Water Quality Monitoring System which includes project background, problem statement, project question, and project objective to clarify the intention of the system.

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Chapter 2: Literature Review

This chapter discuss about other topics that have similar fields and can correlated to this project. Previous work or related work that using different tools and methods been compared. In this chapter will make changes to the existing work and identify the improvements needed in this project.

Chapter 3: Project Methodology

This chapter consists of a preview to the project methodology and methods that can be done on this project. This project uses Agile model and every stage of this methodology will be described in this chapter. The project milestones will be planned