UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT AQUARIUM WATER QUALITY MONITORING AND PALLET DISPENSER BY USING MICROCONTROLLER

MUHAMMAD FADHIL BIN BAHARUDDIN

Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

2023

DEVELOPMENT OF IOT AQUARIUM WATER QUALITY MONITORING AND PALLET DISPENSER BY USING MICROCONTROLLER

MUHAMMAD FADHIL BIN BAHARUDDIN

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

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Development of IOT Aquarium Water Quality Monitoring and Pallet Dispenser by Using Microcontroller

Sesi Pengajian : 2022/2023

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DEDICATION

To my beloved mother, Zabitah binti Zakaria, and father, Baharuddin Abd Rashid

And

My dearest family.

ABSTRACT

As fish lives in water, fish owners need to acknowledge their aquarium water environment. When the owners are going outstation, the water's behaviors cannot be monitored and recorded. Apart from that, fish needs to be fed consistently to ensure good growth and health. It is not healthy for aquarium tanks to have water with either acidic or alkaline water, rather, aquarium tanks should aim to achieve as close to a pH measure of 7, which is neither acidic or alkaline and therefore balanced. So, this project has developed a prototype to solve the issue by designing a system that monitors the pH value, temperature value and also turbidity level of the water inside an aquarium. A pH stabilizer system has been developed to keep the water pH level in the desired range. Moreover, an automatic fish feeder system will help to feed the fish consistently. This system has integrated with the IoT system by using the Blynk App so the fish owner can review the aquarium's behavior and set the feeding frequency from anywhere in the world. The project successfully achieved the objective within the scope of the project.

ABSTRAK

Memandangkan ikan hidup di dalam air, pemilik ikan perlu mengetahui persekitaran air akuarium mereka. Apabila pemilik meninggalkan akuarium, tingkah laku air tidak boleh dipantau dan direkodkan. Selain itu, ikan perlu diberi makan secara konsisten untuk memastikan tumbesaran dan kesihatan yang baik. Adalah tidak sihat untuk tangki akuarium untuk mempunyai air sama ada dengan air berasid atau beralkali, sebaliknya, tangki akuarium harus menuju untuk mencapai hampir dengan ukuran pH 7, yang tidak berasid atau beralkali dan oleh itu seimbang. Jadi, projek ini telah membangunkan prototaip untuk menyelesaikan isu tersebut dengan mereka bentuk sistem yang memantau nilai pH, nilai suhu dan juga tahap kekeruhan air di dalam akuarium. Sistem penstabil pH telah dibangunkan untuk mengekalkan tahap pH air dalam julat yang dikehendaki. Selain itu, sistem penyuap ikan automatik akan membantu memberi makan ikan secara konsisten. Sistem ini telah disepadukan dengan sistem IoT dengan menggunakan Aplikasi Blynk supaya pemilik ikan boleh menyemak tingkah laku akuarium dan menetapkan kekerapan memberi makan ikan dari mana-mana sahaja di dunia. Projek ini berjaya mencapai objektif dalam skop projek.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my special thanks of gratitude to my BDP1 supervisor, IR Ts Mohd Syahrin Amri bin Mohd Noh and BDP2 supervisor, Ts. Ahmad Nizam Mohd Jahari for their for their valuable time and guidance which assisted me in completing this project. The accomplishment of this project is attributed to their kind patience and expertise.

My highest appreciation goes to my parents and family members who supported me with love and always being there throughout the journey of my research. Their endless supports have been a source of motivation for me to complete this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM), my friends, and my fellow classmates for their willingness of sharing their thoughts and ideas regarding the project.

The production for this project has been a tiring but nevertheless, satisfying and wonderful journey, To those who are directly and indirectly involved in this accomplishment, thank you very much.

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℃	-	Celcius
V	-	Volts
A	-	Ampere
L	-	Litre

LIST OF ABBREVIATIONS

V	-	Voltage
IoT	-	Internet of Things
NTU	-	Nephelometric Turbidity Unit

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, there are so many people that have pets as their companion. There are some animals that are common to be choose as a pet such as cat, dog, hamster and aquarium fish. However, it is a bit different to pet a fish as they live inside the water. So, it is crucial to maintain healthy water for a healthy fish. The Development of IoT Aquarium Water Quality Monitoring and Pallet Dispenser by Using Microcontroller will help the pet owner to maintain their water quality. This project will increase the aquarium owner's awareness to their aquarium water quality in pH level, water temperature, and also water turbidity level. Also, the fish feeding time can be customized by the user in order to give the best experience in maintaining the fish ecosystem health.

1.2 Problem Statement

Various factors can lead to the behaviour of the water quality within the aquarium. The factors would be as excess of fish food, water temperature, dead fish body, fish population and also water turbidity level. These factors will lead to change in water pH level which is quite displeasing for aquarium ecosystem. For the purpose to get the pH value from the water in the conventional way is by using the litmus paper which is a bit troublesome. Furthermore, it needs the operator to always use litmus papers and they need to record the value manually inside their notebook. Moreover, as a human being, turbidity level in water cannot be judged by using naked eyes. Other than that, water temperature needed to be

checked to know the water temperature. Lastly, it is hard for the user to feed their fish pet in exact time every day with the exact same amount food.

1.3 Project Objective

A systematic and effective methodology are the main aim if this project proposal in developing an IoT aquarium water quality monitoring and pallet dispenser by using microcontroller to that can overcome aquarium owners problems. Specifically, the objectives are as follows:

a) To develop a monitoring system for water pH level, water temperature and water turbidity level with a customizable fish feeding dispenser by using an ESP32 microcontroller.

b) To display the parameters on developed apps & record the parameters on the LCD and the Blynk Application.

1.4 Scope of Project

Below are the defined project's scopes in order to avoid any uncertainty due to some limitations and constraints in making this project:

a) The values of pH level, temperature, and turbidity will be display on the LCD display and the developed apps.

b) This project is using ESP 32 as the microcontroller.

c) The values of the parameters will be recorded to within the Blynk cloud.

d) The amount of fish food and the feeding time is set and only the feeding frequency can be customized by the user.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Throughout the development of IoT aquarium water quality monitoring and pallet dispenser by using microcontroller, there are some research found that can help in optimizing the project. From the readings, water quality monitoring system are done with different methods by the other researchers. There are using quite same methods but with different approach. Most of the researchers are focusing on pH level reading because that is the most important aspect in the aqua life. This literature review is a part of this research in identifying new approach in developing and improving the water quality monitoring system.

2.2 Past Related Project Research

There are some researches made on the topic of water quality monitoring system and automatic fish feeding system. As the project is combining those two systems, there are about ten past related project researches that are suitable to be as the reference.

2.2.1 Smart Monitoring System for Fish Farming based on IoT[1]

[1] The present method's objective is to provide a secure and safe environment that assists aquatic planters and fish pond owners in the process of breeding fish of a high grade by keeping a regular fish tank's water level.

In the system that we have presented, the fish pond is maintained using sensors and is controlled by a microprocessor. In order to monitor the pond's water level and the water quality, ultrasonic and PH sensors have been permanently installed in the system. The

ultrasonic sensors are what had been used to detect the object of the living in the pond, and the pulse is what is used to transmit the echo of the sound that is produced by the system of the pond and received by the receiver. The amount of water in a pond system may be determined with the use of a PH sensor. Figure 2.1 is the block diagram for the project.

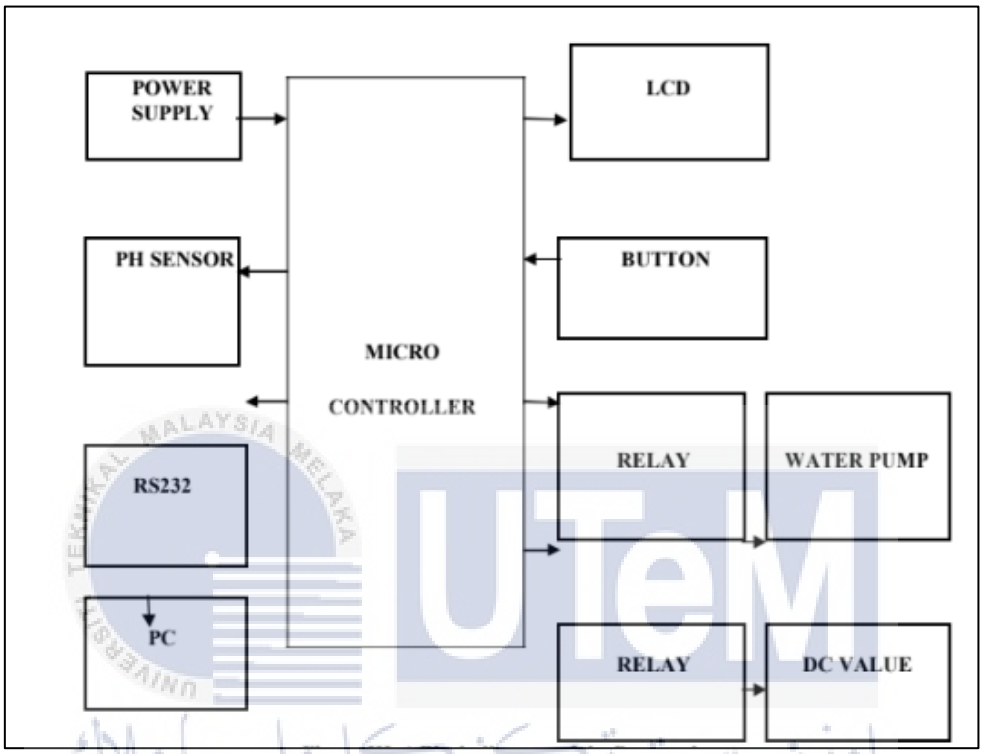

Figure 2.1System's Block Diagram[1]

LCD displays are linked to the microcontroller, and if there is a problem in the system, it will show an indication that there is a defect in the system. Microcontrollers are used to control the system as a whole. The approach is discussed, but the water that flows into fish lakes is given the chance to be inspected on a daily basis, and its quality is ensured via the regulation of criteria such as pH level, turbidity, temperature, and other things. Figure 2.1 the system's block diagram.

The microcontroller based and self-maintained aquarium using the sensors framework makes use of a number of different innovations in its construction, development, and operation. The system used a microprocessor to monitor the operation of the fish tank

in an overhead tank storage system. It is able to determine the level of water within the tank, turn on or off the tank employing sensors following the requirements, and display the results on an LCD screen.

2.2.2 IoT based Automated Fish Feeder

[2] Fishes need more attention when it comes to monitoring the temperature, the time intervals at which they are provided food, the amount of food that is supplied to them, and the quantity of food that is fed to them. Additionally, the quality of the water must be monitored. This project's goal is to automate the system as much as possible while also reducing the amount of work that has to be done by humans.

In order to get data into the NodeMCU for this project, an ultrasonic sensor and a LM35 temperature sensor were utilised as inputs, and a servo motor was used as an output. Connecting to Wi-Fi allows for the automation of the system. Both the serial monitor of Arduino IDE and the display of the user's smartphone display the output of the programme. On the Blynk app, the temperature as well as the amount of feed that was remaining were shown. Figure 2.2 is the block diagram for the project.

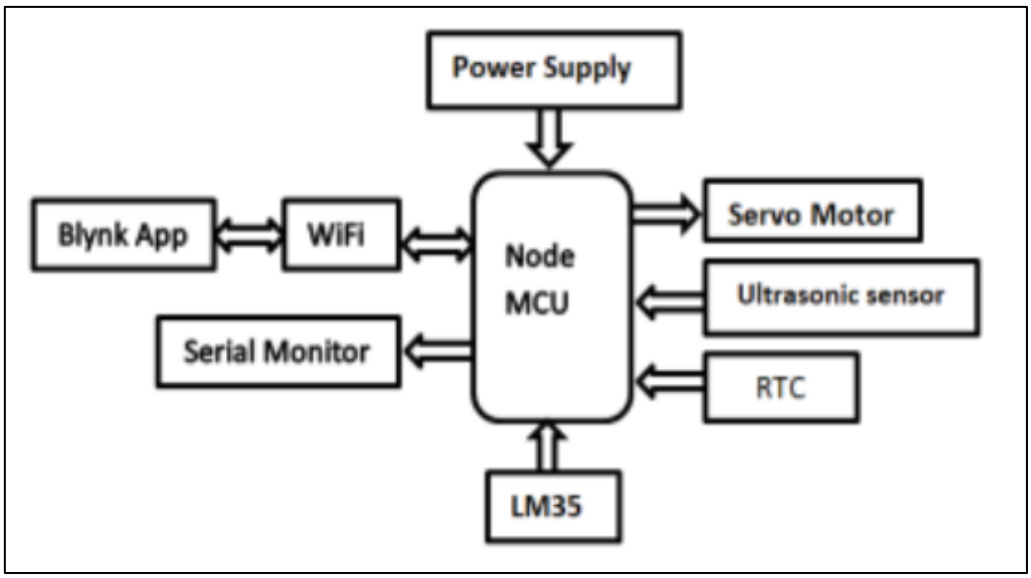

Figure 2.2Block diagram of Feeder System[2]

2.2.3 IoT Based Domestic Fish Feeder

[3] When the user is not with the aquarium meaning they are not at home to care for their fish, those who keep fish as pets at home experience anxiety because their fish suffer. This might result in the fish being overfed or starving to death if they go without food. The goal of the research is to develop a model that can perform long distanced monitoring of the fish in the tank. The components of our suggested system include mechanical, electrical, and communication in nature, and they are all IoT integrated.

The mechanical parts of the project consist a Raspberry Pi B+ that controls a stepper motor from a web interface. This motor is able to dispense food pellets by performing the 360 degree rotations of the container that is holding the food pellets in accordance with the preferences of the person who is providing care for the pet. The electrical component is made up of a Raspberry Pi B+ module and a pi-camera, both of which are responsible for providing a web interface and the collecting of fish data in real time through video.

The user-fixed schedule, feeding statistics, live streaming of fish, and other features are all accessible via the web interface. Feeding may be done in one of two ways: either remotely (manually) using a web interface or according to a pre-scheduled feeding time that the caretaker sets.

When feeding on a schedule, the caretaker is responsible for updating the schedule on the relevant web page. When using the hand feeding method, the user must utilise the web interface in order to feed the fish remotely. In a nutshell, the module may either be used for feeding the fish on a predetermined schedule or for remote feeding through a web interface.

The Raspberry-Pi Model B+ computer was used to put the aforementioned ideas into practise and verify their viability in the real world. The needs that there be a constant

source of electricity and internet access are the only two disadvantages that have been noted. If one of these components fails, the module as a whole will not work properly.

2.2.4 A Smart Aquarium Monitoring System Based on IoT

[4] In this study, a prototype of smart aquarium monitoring that is Internet of Things (IoT)-based system was constructed. The goal of the system is to maintain clean water in an aquarium so that aquatic life may thrive there. The purpose of the system is to perform monitoring of the fresh water to provide a healthy environment for fish life. In its functionality, this device functions as a fish feeding system and is controlled by a smartphone.

From figure 2.3, the hardware implementation of the project made use of a NodeMCU and an Arduino MEGA as the respective microcontrollers. A servo motor model SG90 will serve as the actuator for the fish feeding system. For the purpose of determining the pH level of the water, this project simply makes use of a single sensor known as the pH sensor (SKU: SEN0161). The 16x2 LCD display serves as an indication for the level of pH water in the aquarium. It displays the level of pH water. In addition to its function as a microcontroller, NodeMCU may also serve in the role of a Wi-Fi module. This allows for a direct connection to be made between the user's smartphone and the various project components. In the field of software design, a BLYNK app is an essential tool for developing software programmes that are compatible with the Android operating system.