UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART CONTROL WATER QUALITY USING IOT IN AQUARIUM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Telecommunication) with Honours

by

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FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **SMART CONTROL WATER QUALITY USING IOT IN AQUARIUM**

SESI PENGAJIAN: **2018/19 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Hari ini kebanyakan industri akuakultur menggunakan sistem air manual dan pelepasan air yang bersih. Dalam kes ini, kerugian air adalah tinggi dan membelanjakan lebih banyak wang untuk tujuan penyelenggaraan. Sistem ini dibina di dalam akuarium untuk memeriksa kualiti air yang memberi tumpuan kepada nilai pH secara automatik dan akan membuang air yang tidak sesuai untuk digunakan mengikut kualiti air yang diperiksa. Projek ini memfokuskan kepada kualiti hidup ikan atau ikan hiasan kerana orang ramai kini mempunyai permintaan tinggi untuk produk ikan kerana ikan mempunyai banyak nutrien dan baik untuk kesihatan. Untuk mencegah pembaziran air yang digunakan oleh akuakultur, projek ini menggunakan sensor ultrasonik untuk mengesan paras air yang ditetapkan. Pam air digunakan dalam sistem ini untuk membolehkan air masuk dan keluar dari akuarium. Pam air akan beroperasi mengikut nilai pH ditetapkan dan akan berhenti berfungsi apabila air dalam akuarium mencapai satu peringkat.

ABSTRACT

Today most aquaculture industries use manual water systems and clean water discharges. In this case, water losses are high and spend more money for maintenance purposes. The project is built into the aquarium to check the water quality that focuses on the pH value automatically and will remove the water that is not suitable for use according to the quality of the water being checked. This project focuses on the quality of life of fish or ornamental fish as people now have high demand for fish products because fish have many nutrients and are good for health. To prevent wastage of water used by aquaculture, this project uses ultrasonic sensors to detect water levels in sets. Water pumps are used in this system to allow water in and out of the aquarium. The water pump will operate according to the pH value set and will stop functioning when the water in the aquarium reaches one level.

DEDICATION

Special dedication to my family, my supervisor, my lecturer, my friends, my fellow colleagues and all faculty members for all care, supported and believe in me.

ACKNOWLEDGEMENTS

Firstly, I would like to express my deepest and special gratitude to all those help and provided me the possibility to complete these report entitled “Smart Control Water Quality Using Iot in Aquarium” to fulfil the compulsory requirements of Universiti Teknikal Malaysia Melaka (UTeM) and the Faculty of Electrical and Electronic Engineering Technology(FTKEE). The sincerest gratitude given to my supervisor Ms Siti Asma Binti Che Aziz and co-supervisor Ms Zahariah Binti Manap from Faculty of Electrical and Electronic Engineering Technology, Universiti Teknikal Malaysia Melaka (UTeM) for their guides and help to supervise with patience, quality, motivational support and encouragement to finish this report. Special thanks to both of my parents. Mr Hamdan Bin Hj.Mohd and Ms Masnah Binti Sulaiman for their motivation and back support for completing this project. Besides, I also would like to express my gratitude towards my fellow friend who always supported and never give up to give advice and suggestion to complete this research. Lastly, thanks to the lecturer, assistance engineers and lab assistant in UTeM that always assisted me from start the research until this level. Their willingness to give the feedback make this research complete in required time.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain the background of this project in designing a Smart Control Water Quality Using IoT in Aquarium. This chapter includes background, problem statement, objective and scope of the project.

1.2 Background

Aquacultures are any activities that use water and water's life product. Current aquaculture right now can't maintain regularly fish feeding at fixed time because the system being handled manually. Sometimes, the worker may forget to feed the life's product, this system also cannot check the quality of the water which are focusing on the pH value automatically and cannot detect the water level automatically. All works are being done manually in this current system of aquaculture.

These projects focus on the quality of life of fish or ornamental fish. People are now in demand for fish products because fish have many nutrients and are good for health. Among the species of aquaculture that can be carried out are fish Tilapia, Catfish and Silver Catfish. Fish products are one of the products that claim from various countries. Fish needs more protein (food and nutrients to increase production and maintain its quality). With the quality and quantity of enough protein (food) can be maintained in fish health. In order to develop and improving this current

aquaculture, this project have been added with main components which are Arduino Uno, ultrasonic sensor, pH sensor, 9G servo motor, mini DC3V-5V water pump and ESP8266 Wi-Fi development board. The ultrasonic sensor is use to detect the water level in the aquarium. The distance between water and ultrasonic will determine the water pump to flow the water into the tank. The pH value sensor will send the information of the pH value of the water in the tank to application. This is because; pH value sensors have coordinated tool through the Blynk App. Servo motor is a motor that can spin around of 180 degrees; it is use as the fish feeder to the catfish. Blynk is use as the controller to the servo motor in order to spin it around and feed the catfishes.

1.3 Problem statement

This project is built up based on issues one of the problems is the difficulty to maintain regular fish feeding at fixed time manually. As the solution, the server motor is link to our software by making some programming in the Blynk App and the ESP8266. The rotation of the servo motor can be control using Blynk App at any time automatically.

The aquaculture right now has no special system for checking the water quality in the aquarium so that the system uses pH water sensors where it can read water pH values in the aquarium. The pH value that has been read and transmitted to aquaculture, aquaculture can see the water quality through the Blynk App.

Then, current aquaculture doesn't have specific system to change the water in the tank aquarium. As the solution, this project is including with the water pump and ultrasonic sensor. Water pump will function according the level water in aquarium that read by the ultrasonic sensor.

1.4 Aims and objective

This project aim is to develop a Smart Control Water Quality Using IoT in Aquarium and has a few objectives to be achieved. These objectives are:

1. To design smart water quality control systems to maintain pH water.
2. To design an automatic control system of the aquaculture using IoT.
3. To analyse water quality through pH sensor for smart aquarium.

1.5 Work scope

The scope of this project is to develop projects that emphasize on designing water quality control systems, developing and improving current. Smart Control Water Quality in Aquarium provides new features for aquaculture practitioners such as water level detection, pH value sensors and feeding automatically. The scope of this project is hardware and hardware.

On the hardware part, Arduino Uno, ultrasonic sensor, pH value sensor, little aquarium, servo motor, water pump, 2- channel relay and ESP8266 are uses. Small aquarium 20x14x12cm is being used only for the prototype. The ultrasonic sensor is in contact with the buzzer and relay. This system is in contact with internet of things it through ESP8266 and the servo motor also link to Blynk Application. The pH value sensor is also in contact with the Blynk. So, as the water pump turn on and flow the water into the aquarium the ultrasonic sensor will read the distance until it reach a certain level and it will trigger the pump to turned off. Then, pH value sensor will measured the pH value of the water and lastly the rotation of the servo motor will be control through Blynk app.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of previous studies, research and works related on knowledge sharing to the project proposed including thesis, journals, research paper and etc. It is introducing a case study framework that covers the main focus of research explained in this project. This is to provide the primary data collection requirements for the main research will be undertaken before the project begins, so the data and information collected from the relevant project will be used to assist the implementation of the next process. From that it will be able to discuss the components used in this project operation.

2.2 Research on previous project

The quality of smart water controls that use IoT in aquariums is a device that helps to see the water quality automatically and can be used as a tool to study and analyse the rate of water change when aquatic life is in the aquarium. To develop a systematic irrigation version using IoT, the previous project will be reviewed for better information about this project and summarized to find related to this project.

2.2.1 Control water Level based the system

The purpose of this project is to control the flow of water in the aquarium proposed by (Shin & Angani, 2017). This process, an electric valve should be used to

control the automatic flow of water controlled by the sensor level and this process is controlled by the micro controller. The detector level reads the height of the water tank and sends the data to the controller to operate the electric valve to a certain extent. When it reaches the set level, the valve will be automatically closed.

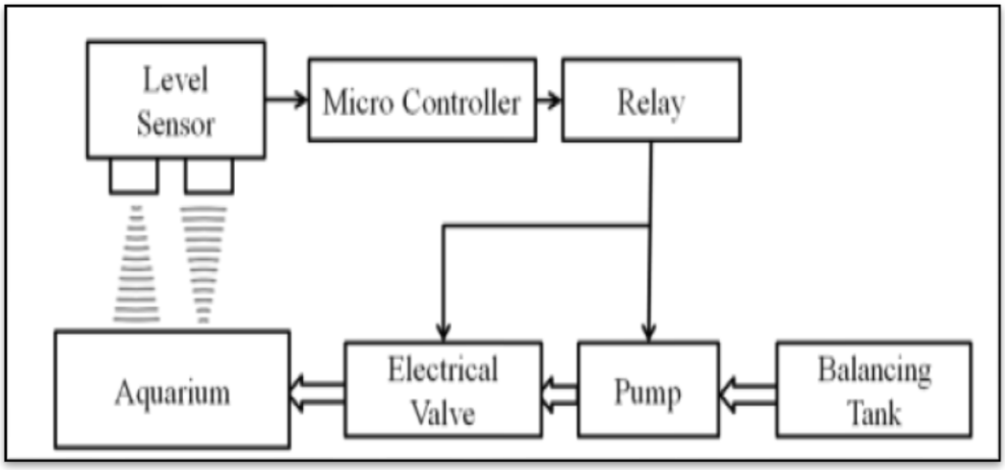

Figure 2. 1: Design of Electrical Valve for Water Control

Automatic mode is the valve in the open condition when the motor rotate clockwise. On the other hand, the electric valve has to be controlled manually by rotating the potentiometer. This system consists of micro Controllers, Arduino as a DC motor and potentiometer used to select 2 types of modes used, valve control the water through it, level sensor reading the water level height aquarium and relay is to on/off the electric valve and pump as shown in Figure 2.1.(Shin & Angani, 2017)

During this time, most aquaculture industries use water management systems that operate open loop water circulation. Therefore, after the use of most aquaculture will throw the high quality water that has been used. This will cause increased spending for water maintenance and waste purposes. The main purpose by (Shin, Angani, & Akbar,2017) is to recycle aquaculture systems that reduce water consumption and prevent wastage of water or reuse water. This system is water

recirculating and uniform to maintain temperature, pH and oxygen levels without the waste of water.

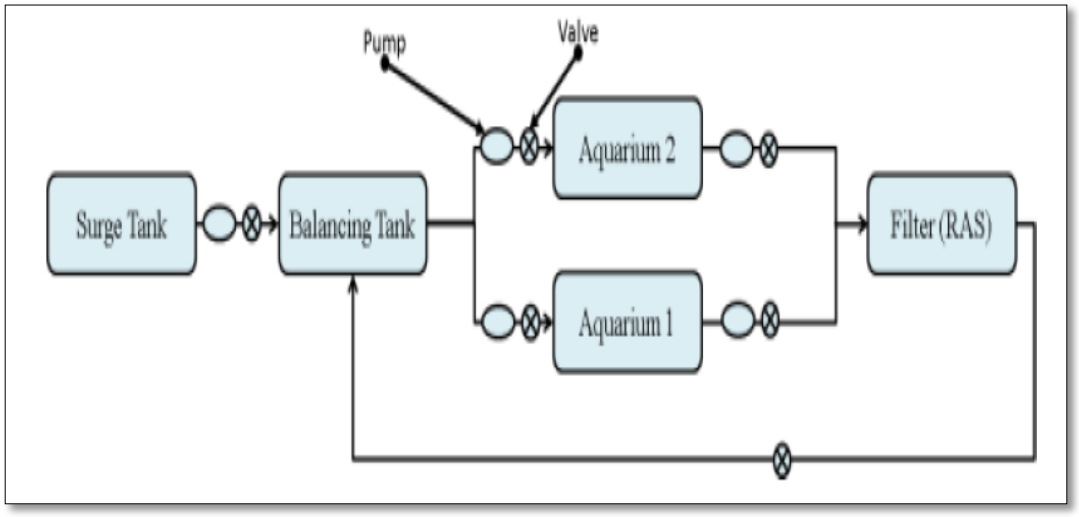

Figure 2. 2: Water Circulating in this System

In this system, the electric ball valves are designed for fluid flow control in the aquarium. The construction of the tank consists of two tanks namely surge and balancing tank. The hot water in the surge tank will allow the water to flow into the tank balancing. Tank balancing is a tank where it will neutralize the water temperature to a certain level and drain the water into the tank through the water pump and valves. The valve is a mechanical system used to conduct, start, stop, mix and control fluid process flow and temperature. The contaminated water will be brought into the water tank RAS for cleaning. Two filter types in the RAS used. The first is the filter sludge waste particulates such as fish food, fish dirt and dust. The second is a biological filter to be neutralize chemical and clean waste produced during water distribution and fish life as shown Figure 2.2.(Shin et al., 2017)

For next journal is about Saving Water with Water Level Detection in a Smart Home Bathtub proposed by (Mantoro & Istiono,2018). For everyone on earth,

water is essential. Unfortunately, people have sometimes forgotten to turn the water tab off the house, which wastes water. When water floods in house, the neighbours may be disturbed. At the same time, there is limited water available somewhere in the country. The aim of this report is to save wastage through the development of a water conservation tool. To save water, it used sensor water level detection as shown in Figure 2.3. This research suggests the development of a water saving tool through the use of automatic devices that opens and closes the water table to prevent water wastage. When the bath is full of water, smart home immediately closes the water tap automatically.

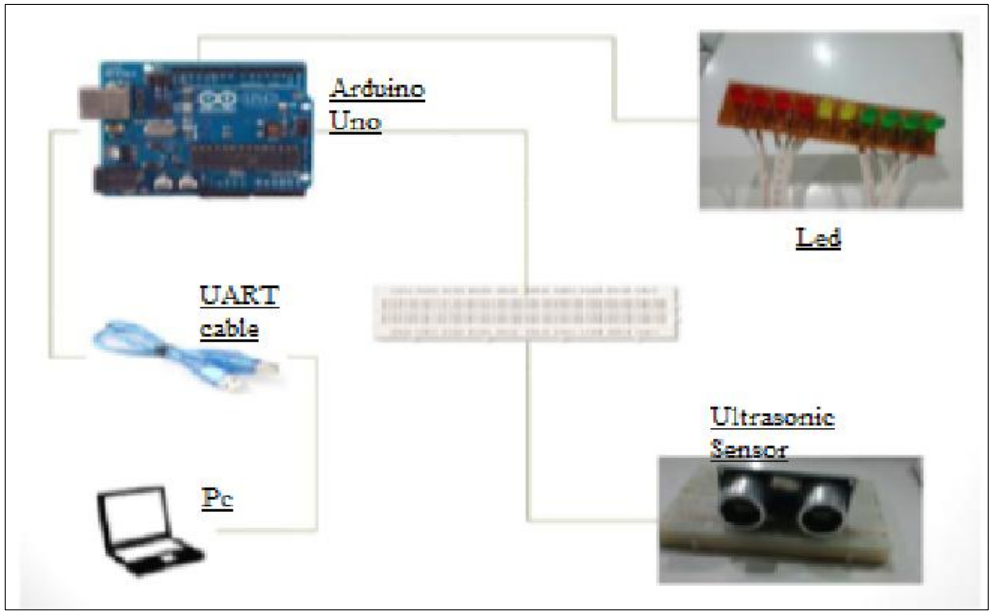

Figure 2.3: Hardware circuit configuration

To detect water level, this study uses an ultrasonic sensor. If the sensor reads the surface of the water and closes to the ultrasound sensor, the water tap is shown to be high and is locked before the flood takes place. Arduino Uno and Fuzzy logic algorithm are used in this study. To get the water to stop in time, the Fuzzy logic

approach has been used to evaluate the indication of water levels. (Mantoro & Istiono, 2018).

Global warming has risen heavy rain sporadically fall in a rural town spot state by this journal (Saitou, Kuwahara, Niibori, & Kamada,2013). For a short time, it rains pretty heavily to cause local flash floods that could endanger lives. This research has developed a system where the system can display real water levels using web-based. for early warning purposes. This system uses compact sensors water level with short-range radio for water level newly designed, an access point for gathering sensor data, and a website for real-time visualization of level water. By means of device pressure sensitive, the sensor measures water level and transmits the information to the access point through the IEEE 802.15.4-. Data sets obtained wirelessly from sensors will be uploaded to the web server.

Figure 2. 4: Pressure-sensitive device measure the water level

The water level sensor is built in this system in a vertical pipe that is higher than for the highest possible water level predicted as seen in Figure 2.4. A pressure-sensitive device is placed at the bottom of the pipe to measure water level as the pressure of the water. The pressure is transferred electrically to the top of the pole

where a digitizer IC acquires the measuring for its digital transmission. (Saitou et al., 2013)

2.2.2 System Using Internet of Things

Based on the (Sachio, Noertjahyana & Lim, 2019) the Internet has become a necessity for communities around the world. People can easily and quickly communicate with one another. People from various continents can easily interact with people from other continents with internet. The Internet not only connects people, it can also connect to other objects. Transferring information from something that generates data to server via internet connection without the help of humans or computer interactions is called the IoT concept.

The system consists of pumps, sensors, relays and microcontrollers as shown in Figure 2.5. Esp8266 is a type of microcontroller that can generate a relay switch open and close. Sensors used are ultrasonic sensors to read the water level. If the water does not reach the target that the sensor wants to achieve it will generate data and give signal to the microcontroller. Microcontroller will give two data to relay and Blynk. The relays that have received the signal will open the relay to allow the flow to turn on the water pump. The pump that has been switched allows water to pass through it until the level has been fixed and until the level that has been set this system will be automatically off. Blynk is an application for control modules such as Arduino used in this project's system over the Internet. In the configured Blynk application can see the height of water, maximum or minimum water level limit and there are two mod options in this system ie auto / semi-auto. (Sachio et al., 2019)