



## **UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

### **DEVELOPMENT OF AUTOMATIC WATER REPLACEMENT AQUARIUM WITH FISH FEEDER USING ARDUINO**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the Degree of Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

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## **ABSTRAK**

Sistem penukaran air secara automatik pada sistem akuarium merupakan satu sistem yang dibangunkan untuk membantu pengusaha akuarium dalam mengekalkan kondisi air yang sesuai di dalam akuarium berdasarkan bacaan pH air di dalam akuarium tersebut. Sistem utama projek ini mampu untuk mengawal bacaan pH air di dalam akuarium dengan menukar air secara automatik berdasarkan pengesanan bacaan pH air di dalam akuarium. Satu akuarium bersaiz sederhana telah dibangunkan sebagai alat bantuan untuk menguji proses penukaran air secara automatik tersebut. Kriteria lain yang penting dalam projek ini adalah untuk mengekalkan paras air di dalam akuarium pada tahap ketinggian yang optimum sambil mengawal dan mengekalkan tahap bacaan pH air di dalam akuarium. Sistem pemberi makanan ikan secara automatik telah dibangunkan untuk mengatasi masalah yang timbul dalam memberi makanan kepada ikan pada masa yang sama dengan amaun makanan(palet) yang sama ketika setiap kali memberi makanan. Sistem masa yang telah ditetapkan untuk memberi makanan telah diubah supaya pengusaha ikan dapat memprogramkan masa pemakanan ikan secara sendiri. Untuk simulasi projek ini, masa pemakanan ikan telah ditetapkan untuk diaktifkan secara automatik setiap satu minit untuk melepaskan makanan kepada ikan di dalam akuarium. Dengan mengaplikasikan kedua-dua sistem inovatif ini, segala masalah yang timbul kepada pengusaha akuarium sebelum ini akan dapat diatasi

## **ABSTRACT**

Automatic water replacement aquarium is a system that is developed to help the aquarist in maintaining the suitable condition of water based on the pH reading in the aquarium. The main system of this project is capable to regulate the pH value of the water by automatically replacing the water based on the detected pH value of the water in the aquarium. A medium prototype of aquarium system has been developed to aid the process on developing the automatic water replacement system. Another criterion that is important in this project is to maintain the height of the water at its optimum water level while regulating the pH value of the water. The automatic fish feeder is developed to overcome the problem arising on how to feed the fish at the same time with the same amount of food (pallets). The timer of the automatic fish feeder is modified so that the feeding system can be programmed accordingly by the aquarist. For project simulation purpose, the timer has been set to be activated automatically for every one minute to release pallets to the aquarium. So, with the implementation of these innovative methods to the normal aquarium system, all the problems arising have been overcome.

## **DEDICATION**

To my beloved father and mother

Special dedicated to my dearest and precious parents and family.

As for their love, eternal support, encouragement and all scarification. Besides, I would like to take this opportunity to express my grateful heartfelt especially to my classmates and friends who helped me in the mission to make my final year project a success. First and foremost, I would like to thank Allah who provides me the strength and good health condition to do persistently without give up to my work and contribute my best to it so that it has turned into one of the successful project. As my final words, thank you to each and all individual who have been my source of support and encouragement to help me in accomplishing my goal and achieve my individual final year project successfully.

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## **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE**

LED	-	Light Emitting Diode
BNC	-	Bayonet Neill-Concelman
IR sensor	-	Infrared sensor
PLC	-	Programmable logic controller
GSM	-	Global System for Mobile Communications
SMS	-	Short Message Service
IDE	-	Integrated Development Environment
ICSP	-	In-Circuit Serial Programming
USB	-	Universal Serial Bus
PWM	-	Pulse-width modulation
MHz	-	Megahertz
kHz	-	Kilohertz
=	-	Equal to
≤	-	Less than equal to
≥	-	More than equal to



# CHAPTER 1

## INTRODUCTION

### 1.0 Project Background

Development of automatic water replacement aquarium with fish feeder is a project where automatically replace water in the aquarium and dispense an amount of food into aquarium at a particular time each day. The main purpose of this development is to reduce manpower monitoring in maintaining aquarium optimum condition especially in water replacement system. A part of the water should be gradually replaced as replacing all of the water at any point in time will change the water chemistry which will be stressful to the fish. So, with this automatic water replacement development, the aquamarine lives of the fish are able to be maintained at the same time. The main controller of this project is Arduino UNO. Two types of sensor will be used in this project. The first sensor uses to detect the pH value of the water (Rashid & Nordin 2014) and second sensor is to detect the water level in the aquarium. The replacement of water is based on the pH value of the water. When pH of the water is out from the optimum range of 5.8-6.5, the water replacement process will take place. Water level sensor is use to maintain the optimum water level during water replacement process.

An innovative automatic fish feeder is a device that automatically feed the fish at a predetermined time(Ogunlela & Adebayo 2016). In a way, the fish feeding activity is control by using a fish feeder that combined the mechanical system and electrical system to form a device instead of manually feeding the fish by hand(Owerri 2015). Automatic

fish feeder will develop regular feeding schedules which important for the fish growth and reproduction. Next, for the fish survival, the fish require regular care in order to remain healthy. Thus such an innovative device is very convenient.

## **1.1 Problem Statement**

People nowadays usually love to have pet like fish in their home. Nevertheless, they are too busy with their commitment every day until the maintenance's work for the fish in the aquarium become one of their burden. Besides that, changing and cleaning the aquarium manually really takes time and may cause messy, dirty and wet condition around the place. There are also some people who lacks of knowledge on how to properly do the maintenance work without abruptly disturb the aqua marine lives. The manual feeding system is not so practical for the fish. Owner usually forgot to feed the fish and that is really rare case where the owner feed the fish at the same time with the same amount of fish food every day. Thus, with such an innovative project, all the problems stated above can be overcome.

## 1.2 Objectives

There are several objectives that are should be focused to be achieved at the end of the project which includes:

- a) To modified an automatic fish feeder timer for indoor aquarium.
- b) To develop an aquarium that automatically replacing water with fish feeder using Arduino.

## 1.3 Scope

As to ensure the completion of project achieved the stated objectives. The development of the project is estimated to involve software and hardware. So, the project shall be completed within these scopes:

- a) This project focuses on developing a medium size aquarium with the automatic water replacement and fish feeder system.
- b) Modifying timer of the automatic fish feeder for the aquarium.
- c) Main circuit capable to replace the water automatically by detection value of pH sensor.
- d) Maintaining the optimum water level in the aquarium. Water level sensor will be place at the top and bottom of the aquarium.
- e) The product is capable to feed the fish periodically as set by the user.

## 1.4 Thesis Outlines

This thesis consists of five chapters. The following chapters are the outline of the implementation of automatic water replacement with fish feeder system.

Chapter 1 is the introduction of this project. Basically, it discusses briefly the overview of the project such as project background, objectives, problem statement, scope of project and thesis outlines.

Chapter 2 is a literature study on automatic water replacement system with fish feeder. It contains the research and information about the project on several important concepts of automatic water replacement and fish feeder system, technology and tools used in the study. This chapter also includes details in software and hardware design for automatic water replacement and fish feeder system. The further information about pH sensor, type of water level sensors available, aquarium system and previous study about automatic water replacement system also fish feeder system existed also are discussed in this chapter.

Chapter 3 is the methodology chapter where the objective of the project is determined. The require concept design is chosen based on objective. Main development flowchart and flowcharts for every mechanism involved is depicted in this section. All those methodology should be followed to get the expected project result and better performance.

Chapter 4 will elaborate comprehensively on the design prototype and the experimental setup. All the hardware that use in assisting the main component will be introduced in this chapter.

Chapter 5 will discuss result and analysis detailed on designing the prototype of automatic water replacement with fish feeder system model. Hardware and software result will be discussed in this chapter. The results presented in this thesis are based on the design procedure that has been stated before.

Chapter 6 is the conclusion and recommendation chapter. In this chapter, it included the conclusion of this project and the improvement that can be doing for the future invention. Any comment or suggestion can be attached in order to improve the project in future.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter fundamentally directs the innovator in setting up the whole report substance including the graphic outlines which can be found in supplements. As the first chapter clarified the background of the project, this chapter proceeds with a fully-referenced review from the relevant literature. It covers introduction to freshwater fish aquarium, manual versus automatic aquarium system, water replacement system, fish feeder and literature review on current existing projects.

#### **2.1 Freshwater Fish Aquarium**

The subtopic of freshwater fish aquarium includes the introduction to aquarium and the freshwater fish as well as few types of freshwater fish.

##### **2.1.1 Aquarium**

Aquarium, name for any supervised exhibit aquatic home for animals and plants. Aquariums are known to have been constructed in ancient Rome, Egypt, and Asia. It is an enclosed ecosystem area of any size having at least one transparent side in which water-dwelling plants or animals are kept and displayed. An aquarium can be a small tank, or a large building with one or more large tanks

(Hakim & Nusantara 2016). An aquarist owns fish or maintains an aquarium, typically constructed from glass or high-strength acrylic. There are few types design of aquarium existed. There are cuboid aquariums which also known as fish tanks or simply tanks while bowl-shaped aquaria are also known as fish bowls. Size can range from a small glass bowl to immense public aquaria (tourist attraction). Specialized equipment maintains an appropriate water quality and other characteristics suitable for the aquarium's residents (Hutchins & Smith 2003). Aquarists usually deciding first on how many and the size of fish that they want to raise before selecting suitable aquarium size.

### **2.1.2 Freshwater Fish**

Freshwater fish is one of type of fish that aquarist usually choose to keep at home (Matthews 1998). It is because freshwater fish aquarium offer pure beauty in the form of a miniature nature scene enclosed in a glass box. Next, from recent research stated that aquarium can provide a relaxation and reduce stress to the aquarist (Cole & Gawlinski 2000). Fish aquarium can be easily found at the hospital, restaurant, hospitals, commercial buildings, and hotels are just a few that typically house a freshwater fish tank in their lobby. Freshwater fish is one of type of fish that easy to care. They do not need constant care and attention. Thus, freshwater fish really suitable for aquarist that have a busy life. Next, freshwater fish are very peaceful fish and easily get on with other fish. They can live together as a community, and not spend their time attacking and eating each other (Matthews 1998). They are many types of freshwater fish that available for the aquarist to choose. Figure 2.1 and 2.2 show several examples of freshwater fish:



Figure 2.1: Neon Tetra



Figure 2.2: Platies