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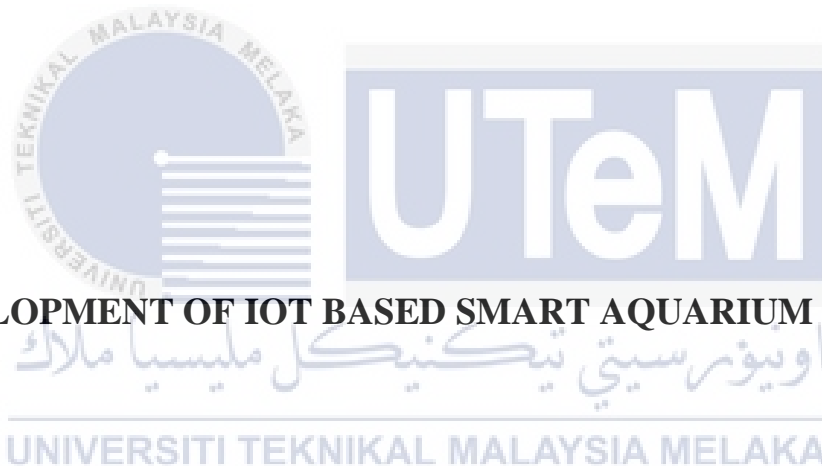
DEVELOPMENT OF IOT BASED SMART AQUARIUM SYSTEM

NURUL NAJWA BINTI AHMAD SABRI

Bachelor of Electronics Engineering Technology with Honours

2021

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**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Industrial Electronics) with
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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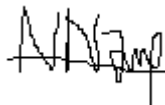4. Sila tandakan (✓):

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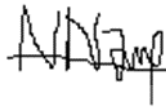
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I declare that this project report entitled "Development of IoT Based Smart Aquarium System" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

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 Electronics Engineering Technology (Industrial Electronics) with Honours.

Signature   :

Supervisor Name   :   DR. MOHD SA'ARI BIN MOHAMAD ISA

Date   :   10/1/2022

Signature   :

Co-Supervisor   :

Name (if any)

Date   :

DEDICATION

To my beloved mother, Zabariah Binti Tawang, and my father, Ahmad Sabri Bin

Zainuddin, and

To my all fellow friends.

ABSTRACT

Regardless of age, a hobby is one of the activities that can make someone happy and occupy their free time. Keeping a pet is one of the hobbies that people likes to do such as keeping a hamster, a cat, a fish and so on. However, keeping a fish needs more effort to be done and faced several problems in taking care it. For example, fish keepers need to monitor the water or temperature that suits the environment for the fish, sometimes forget to feed the fish on time and so on. This problem can cause fish to die if we do not monitor their environment or miss feeding them. The aim of this project is designing an aquarium system with low cost based on IoT that can control and monitor a feature likes food feeder, light will turn on when detecting movement around the tank, monitor the water quality and temperature in aquarium system easily using mobile application. This smart aquarium system can help fish keepers save their physical energy and take very good care of their fish, especially those who are restless after work and forget to take care of their fish when out of the house. With this combination IoT, users can use their smartphones to control and monitor the aquarium system over Wi-Fi internet.

ABSTRAK

Tanpa mengira usia tua atau muda, hobi merupakan salah satu aktiviti yang boleh menggembirakan seseorang dan mengisi masa lapang. Memelihara haiwan peliharaan merupakan salah satu hobi yang digemari orang ramai seperti memelihara hamster, kucing, ikan dan sebagainya. Walau bagaimanapun, memelihara ikan memerlukan lebih banyak usaha untuk dilakukan dan menghadapi beberapa masalah dalam penjagaannya. Sebagai contoh, pemelihara ikan perlu memantau air atau suhu yang sesuai dengan persekitaran untuk ikan, kadang-kadang terlupa memberi makan ikan tepat pada masanya dan sebagainya. Masalah ini boleh menyebabkan ikan mati jika kita tidak memantau persekitarannya atau terlepas memberinya makan. Matlamat projek ini adalah mereka bentuk sistem akuarium dengan kos rendah berasaskan IoT yang boleh mengawal dan memantau ciri seperti penyuap makanan, cahaya akan menyala apabila mengesan pergerakan di sekeliling tangki, memantau kualiti air dan suhu dalam sistem akuarium dengan mudah menggunakan aplikasi mudah alih. Sistem akuarium pintar ini dapat membantu pemelihara ikan menjimatkan tenaga fizikal mereka dan menjaga ikan mereka dengan sangat baik terutama mereka yang penat selepas bekerja dan terlupa menjaga ikan mereka ketika keluar rumah. Dengan gabungan IoT ini, pengguna boleh menggunakan telefon pintar mereka untuk mengawal dan memantau sistem akuarium melalui internet Wi-Fi.

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I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parents for the financial support through advice which enables me to accomplish the project. Not forgetting my fellow colleague, Nurul Hidayah A.Halim and other friends for the willingness of sharing his thoughts and ideas regarding the project.

Finally, my highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to Ahmad Fauzi for all the motivation and understanding.

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LIST OF SYMBOLS

°   -   Degree
°F   -   Degrees Fahrenheit
°C   -   Degrees Celcius
         -
         -
         -
         -
         -

LIST OF ABBREVIATIONS

V -   Voltage
-
-
-
-
-
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-

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CHAPTER 1

INTRODUCTION

1.1   Background

People nowadays prefer to maintain fish in their homes as a decorative feature or as a hobby to keep them occupied during their free time. Apart from poultry, the majority of them prefer looking for fish. However, taking care of fish can be a challenging job, since you would need to monitor the environment of fish in term of water quality and temperature that suitable with them, giving them a food and so on. So sometime the fish keepers forget to do all this task. As a result, I decided to design and build a low cost Smart Aquarium System based on IoT that can automatically control and monitor the aquarium system via mobile application that have several function likes food feeder, lighting, refill water, monitor quality water and temperature and filter the water if the water become cloudy. Furthermore, this project would ease them of the responsibility of caring for fish.

The idea of the "Internet of Things (IoT)" has been around for a few years and is getting traction as wireless time progresses (Huang & Li, 2010; Uckelmann, Harrison,& Michahelles, 2011). The phrase "Internet of Things" refers to the interaction of the modern world with the virtual world of the Internet. The Internet of Things (IoT) is a network of physical items that can connect, detect, and interact with their internal and external environments. For example, devices that use IoT, such as smartphones, smart watches, tablets, household electronic devices, and other electronic monitoring system devices.

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1.2   Problem Statement

Nowadays, most aquarium keepers are faced with so many issues related to system maintenance and fish care. The problem is, the fish keeper needs to frequently monitor the water and temperature of the water in tank, miss in feeding food to fish on time and turning on the lights manually. Basically, the manual aquarium system uses a lot of manpower and time. Therefore, using this IoT technology is to reduce the problem of fish keepers that can easily control by using smartphone via Wi-Fi internet. From the problem above, this project will provide a simple solution to handle and care the aquarium system using low cost equipment.

1.3   Project Objective

The main goal of this project is to present a simple and smart aquarium system based on the Internet of Things to solve the basic daily routine that fish keepers experience when keep the fish. The following are the specific objectives:

a)   To create an IoT-enabled smart aquarium that will make fish keeper easier.

b)   To build an aquarium system with features such as automatic refill water, automatic food feeder,automatic lighting, automatic filter water and monitor water quality and temperature with low cost equipment.

c)   To develop a Smart Aquarium sytem that can be operated easily via mobile application using ESP32 microcontroller and Wifi-internet.

1.4   Scope of Project

The purpose of this project is to give specifics on the features and components that will be developed. To complete the task and objectives of this project, the scope of work is listed in detail below:

a) To interact between ESP32 board using Blynk Application.

b) Designing the suitable circuit for project system that have been proposed.

c) Designing the simple and low cost smart aquarium that easily control via smartphone.

d) Create several features likes food feeder, on off light, refill water, monitor water quality and temperature and filtering water using suitable component likes servo motor, DC 12v water pump, float water sensor, turbidity sensor, ds18b20 temperature sensor and other components.

e)   Prepare a code program in Arduino IDE that can control and monitor the aquarium system according to its requirement.

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CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Based on a review of related literature journals or articles, this chapter more focus on the theory and some information about the scope of this project for food feeder, quality of water and system in aquarium. This material was gathered from a relevant journal and used in the aquarium system project's application and references. The project will be expressed in this chapter, which will provide an explanation of how to apply appropriate methods. By studying this chapter, an improvement from the previous project by implementing a few features in aquarium system in order to overcome the problem.

2.2   Research Previous Aquarium Project

2.2.1   Smart Aquarium Kit using PIC Microcontroller.2017

While doing some research for a literature review, I found throughout many previous projects that were relevant to my current project. Amel Yousif Ali Mohammed & Vrajesh Dinesh Maheta created a project called "Smart Aquarium Kit using PIC microcontroller"[1]. This project's main controller is a PIC16F887 and the LCD to display variable system data like as the aquarium's water level, PH level, oxygen level, humidity level, and temperature level. After entering the right password, the user can use the keypad to adjust any desired parameter. This project has several advantages, including a filtering system for a better aquarium environment, automatic control and maintenance of parameters

such as temperature, humidity, water level, the amount of dissolved oxygen, water filtration, and PH, and the installation of a food supply system.

However, this project has a disadvantage in that it does not connect the system to the user's mobile phone and does not create an IoT-based system to make aquarium control easier. When the PIC microcontroller is activated, for example, the feeding process will turn on manually.

2.2.2   Smart Pet Care System using the Internet of Thing (IoT).2016

Another research project related to this project is Seungcheon Kim's "Smart Pet Care System Using Internet of Things." This project was similarly connected to my project, so I decided to learn more about it and obtain some ideas in how to improve it. The objectives of this work is to solve the problem of pet feeding, as compared to the previous project that used only one huge food storage unit and delivered food directly to the pet, and in the event of a system failure, delivered complete food to the pet. They make some improvements as a result of the problem by adding one small storage unit to prevent overfeeding. Thankfully, all of these tasks may be completed via the internet. As a result, the owners' productivity, as well as their time and effort, will be preserved.[2]

2.2.3   Smart Aquarium Based on the Internet of Things (IoT).2019

Smart Aquarium Based on the Internet of Things (IoT) was created by R.Hafid Hardyanto, Prahenusa Wahyu Ciptadi, and Andika Asmara to solve the problem that occurs when an aquarium is kept in a residence that receives insufficient sunshine[3]. Besides that, the fish feeding schedule is still done by hand, and the owner still does it at least once a day. This aquarium system is visually beautiful while also being fully automated in terms of lighting and fish feeding.

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Arduino is used in the Smart Aquarium's architecture. The Atmega 328 is used as the main hardware control system, and sensors such as light sensors, humidity sensors, and water level sensors are used to monitor the water level. A web-based interface is implemented for software, which allows users to monitor and includes information on lighting, humidity, and water level on a smart aquarium system.
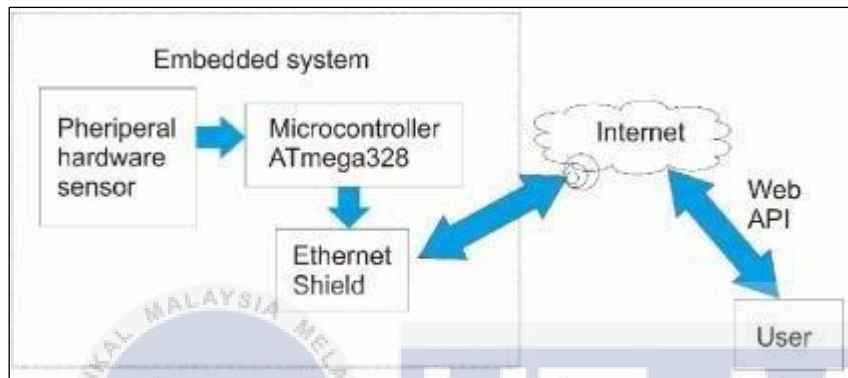

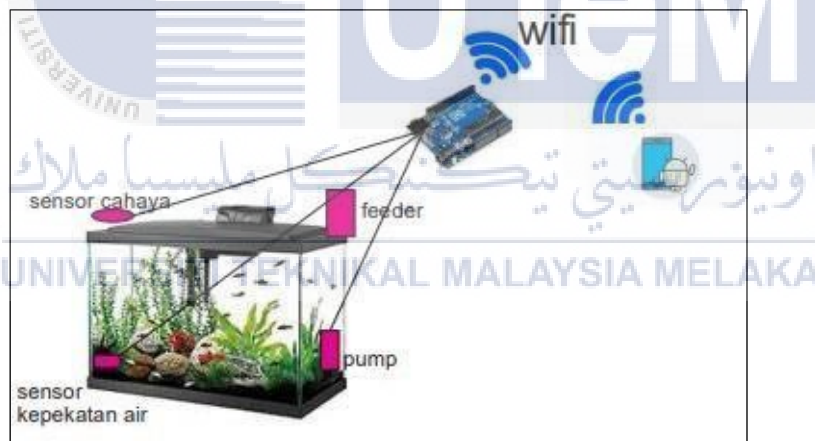Figure 2:1 Architecture diagram of Smart Aquaponics

Figure 2:2 The overall model of The Smart Aquarium system

2.2.4 Automatic Pet Feeder Using Arduino.2018

This project build to overcome the problem of animal lovers who are so busy with work until they are unaware of their pets and forget to fed them on time. So, they developed 'Automatic Pet Feeder using Arduino'(Mritunjay Subhashchandra Tiwari, Sahil Manoj Hawal & Nikhil Navanath Mhatre) to ensure that pets are fed regularly. Food storage, servo

motor, dispenser, feeding bowl, and other components constitute the Automatic Pet Feeding System. Arduino has also been used to control the processes automatically.[4]

Aside from that, this automatic system is a technology that can feed pets at regular intervals while the owner is out. The dish for feeding pets can be filled in a variety of ways, one of which is by setting the time and date on an Arduino Uno and then displaying it on an LCD screen. This DIY system uses an Arduino and auger that can be programmed with two feeding periods as user-defined food quantity and a battery-backed internal clock. The servo motor MG995 turns the AUGER which feeds food from storage to dish and receives a signal from Arduino, Ky-40 Rotary Decoder Encoder Module, Real Time Clock (RTC), Acrylic sheets for making the outer body of pet feeder and it's safe for making food storage containers, PVC pipe T-Section, Wi-Fi module (ESP8266) used to receive the signal from mobile and transmits to Arduino which further gives signal to the servo motor and LCD Display to display the output.

2.2.5 The Smart Monitoring and Automation Control System for Fish Aquarium Based on the Internet of Things Technology.2019

The project 'The Smart Monitoring and Automation Control System for Fish Aquarium Based on the Internet of Things Technology 'was designed by Yasmine Afifah,Chico Hermanu B A, Rizal Abdulrozaq Rosadi & Mohammad Raihan Hafiz. Every fish keeper's dream is being able to care for a healthy fish. So, in order to keep the fish healthy and its habitat in fine condition, the fish keeper needs pay close attention to feeding schedules, water quality, and other factors. A Raspberry Pi is used in this smart system to take action and transmit the report to the owner's device. Besides that, they emphasize aspects of temperature water that appropriate range for fish survival andturbidity of water quality. The proposed using an Internet of Things device to analyze the requirement of a fish

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