Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT-BASED AQUARIUM MONITORING SYSTEM

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

2021

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

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF IOT-BASED AQUARIUM MONITORING SYSTEM

Sesi Pengajian : 2020/2021

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DEDICATION

I would like to express my special dedication to people who support me with this thesis. I am grateful and acknowledge that both of my parent and sibling give me encouragement and endless support to me for completing this Bachelor Degree Project (BDP). Without them, I probably not reach this stage. Besides, special thanks for my fellow lecturer for advice, taught, and guidance through my studies. Not forgetting, all of my beloved friends throughout this wonderful journey. Finally, thank you to all people who help me directly or indirectly for the support in completing this project.

ABSTRACT

Many people and martial fish sellers feed pet fish in aquarium tanks that must be set up and kept properly or the fish will have an unpleasant and short life. The aquarium tanks, on the other hand, must be correctly set up and maintained, otherwise the fish will have a miserable and short life. As a result, it's vital to keep a constant eye on water conditions and work to enhance the water quality in aquarium tanks. The Internet of Things can help solve this challenge (IoT). This (IoT) technology is simple to operate using a smartphone. It may be used to easily install intelligent control for varied water conditions using (IoT). This system can also monitor the pH and temperature values that are appropriate for the type of fish life, as well as apply smart feeding, which allows the user to enjoy manual feeding while the fish are not underfed or overfed. It can also detect the water pump's operation and send a notification to our smartphone. Finally, this approach will make it easy for the user to maintain the state of their aquarium.

ABSTRAK

Ramai orang dan penjual ikan bela diri memberi makan ikan peliharaan di dalam tangki akuarium yang mesti disediakan dan disimpan dengan betul atau ikan itu akan mempunyai kehidupan yang tidak menyenangkan dan pendek. Tangki akuarium, sebaliknya, mesti dipasang dan dijaga dengan betul, jika tidak, ikan akan mengalami kehidupan yang sengsara dan pendek. Akibatnya, sangat penting untuk terus memerhatikan keadaan air dan berusaha meningkatkan kualiti air di tangki akuarium. Internet of Things dapat membantu menyelesaikan cabaran ini (IoT). Teknologi (IoT) ini mudah dikendalikan menggunakan telefon pintar. Ini dapat digunakan untuk memasang alat kawalan pintar dengan mudah untuk berbagai kondisi air menggunakan (IoT). Sistem ini juga dapat memantau nilai pH dan suhu yang sesuai untuk jenis kehidupan ikan, serta menerapkan pemberian makanan pintar, yang memungkinkan pengguna menikmati pemberian makanan secara manual ketika ikan tidak kekurangan makanan atau terlalu banyak makan. Ia juga dapat mengesan operasi pam air dan menghantar pemberitahuan ke telefon pintar kami. Akhirnya, pendekatan ini akan memudahkan pengguna mengekalkan keadaan akuarium mereka.

ACKNOWLEDGEMENTS

Alhamdulillah, all praises to Allah for the strength and His blessing in completing this project. A big thank you to my supervisor, Ts.Sulaiman Bin Sabikan for all of the supports, comments, feedback and ideas also time consideration for complete my Bachelor Degree Project(BDP)..

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v	-	Voltage
$°c$	-	Celsius

LIST OF ABBREVIATIONS

V	-	Voltage
IoT	-	Internet Of Things
AC	-	Aalternatif Current
DC	-	Direct Currennt

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, the number of people holding fish continues to increase. Caring for an aquarium seems to be very difficult for an aquarium. The aquarium should well cared for make the fish healthy life. Current methods require the aquarium to manually detect and manage aquarium parameters such as fish feeding, lighting, water PH, temperature, oxygen motor, and so on. Fish should be fed twice a day, and because the fish keeper cannot control the aquarium when they are not present, the fish cannot be fed by the aquarium.. I created our project which is Development Of IoT-Based Aquarium Monitoring System. It is a system that is more efficient. It may be installed in any aquarium to replace human maintenance with an automated system. It can also save time and cost to care for fish in the long term.

1.2 Problem Statement

Aquarists play a critical role in maintaining the health of their fish in aquariums. Water feeding is a challenging activity for fish keepers while they are away from their station or when they travel out of station. Furthermore, for fish to live in good health, the temperature and pH of the water must be monitored on a regular basis. To allow fish to breathe easily, the oxygen supply within the water must be monitored. A system for continuous observation, control, and treatment of the fish must be established.

1.3 Project Objective

The major objective of this study is to develop an efficient system estimation approach.. Specifically, the objectives are as follows:

a) To design an aquarium controller supported with iot system

b) To design system for motor pump, pH and temperature value

c) To analys the perfomance of controller

1.4 Scope of Project

The scope of the project is:

a) This smart aquarium is to create a design controller that connect to iot
b) It cannot rely on a feeding system that was installed instead need to provide the feeding system manually.
c) Suitable use for a small scale like an aquarium that can be found at house and not be used for large scale.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This Chapter discusses an overview of the whole aquarium and IoT projects. Past research related to aquarium technology. This study was made to plan the implementation to solve the problem of fish defenders in aquariums. The advantages and disadvantages of previous research will also be compared. This literature review is to review the source and validate the statement issued with research evidence relevant to the project.

2.2 Smart Aquarium

An aquarium is a tank, bowl, or form of glass that houses fish, aquatic animals, or living plants. It is also a structure where visitors can view exhibitions of maritime plants and animals. For the history of aquariums, in the last 4500 years, aquariums were known by the Sumerians who had made their ponds to store fish. While as early as 1000 BC, the Chinese may have been the first to breed goldfish for food successfully. Goldfish breeding as an ornament was introduced to Japan, where its breeding was perfect. The ancient Romans kept fish as their food and entertainment, and with a fresh supply of seawater, they built ponds.

Before the middle of the 19th century, the term aquarium was applied to describe the containers used to grow aquatic plants. Although the first known glass aquarium was developed in 1832 by the French-born naturalist Jeanne Villepreux-Power, in the writings of British naturalist Philip Gosse, the phrase first used a contemporary definition as a vessel on which aquatic animals, as well as plants, could be held. His research increased public interest in aquatic life. Fish, amphibians, and reptile farming became valuable in environmental studies in the 1850s.

The first public display aquarium debuted in 1853 in London's Regent's Park. It was followed by aquariums in Berlin, Naples, and Paris. The circus owner P.T. Barnum recognised the commercial potential of living aquatic animals and established the first private display aquarium at the American Museum in New York City in 1856. By 1928, the world had 45 public or commercial aquariums, but growth stalled, and few major aquariums were built until after World War II.. (EncylopaediaBritannica, 2018).

Pet ownership has steadily increased over the last 20 years. Freshwater fish are now the most popular pet after cats and dogs. Fish aquarium maintenance is a difficult task in and of itself.. Aquaponics is a modern farming system that combining planted farming, which produces plants and fish. The way aquaponics works is to use nutrient-rich water as a provider of food and organic nutrients to help plant growth, whereas plants cleanse, filter, and recycle the water environment, thus creating a symbiotic relationship between plants and fish

Fish is an animal that is widely defended on this earth because of the beauty of the colour of the fish. With that, Smart Aquariums are created. Smart Aquarium is a project done to make it easier for users to take care of fish. With having this Smart Aquarium, the lifespan of this fish can be extended because most of the consumers who defend this fish forget to pay attention to their fish. They forget to feed the fish or even fail to look at the water quality for their fish. So with a Smart Aquarium, it is easier for the user.

2.3 Internet of Things (IoT) Technology

IoT is an essential element for the success of this project. The ESP32 to Wi-Fi. It is activated with system commands and will be connected to the internet. This makes it easier for the user to monitor when the user is not at home. The system is easy to use by users as they can monitor the condition of the aquarium even when they are not at home.

The Internet of Things (IoT) is a network of physical objects or people referred to as "things" that are embedded with software, electronics, a network, and sensors to collect and exchange data. The Internet of Things aims to extend internet connectivity from standard devices such as a computer, mobile phone, or tablet to relatively simple devices such as a toaster.

The Internet of Things (IoT) transforms virtually everything into a "smart" system by leveraging the power of data collection, artificial intelligence algorithms, and networks to improve various aspects of our lives. IoT can also refer to a person implanted with a glucose monitor or an animal equipped with tracking devices.

2.4 Feeding System

A feeding system is an organisation that manages the provision of feed supplies to groups of animals during at least one production cycle. The feeding system, being part of the farming system, is influenced by whatever impacts the main system(Roggero, Bellon and Rosales, 1996). This system is the interdependence of two or more functional units that form a homogenous totality capable of receiving all available physical and sequential resources—choosing, directing, and arranging the parts for later handling and assembly.(TAD, 2020)This feeding system is a system used by most pet advocates to feed their pets automatically. This is because sometimes consumers are so busy with their affairs that they forget to feed their pets. This system simplifies their work.

To save time and increase the feed rate component, the feeding system is integrated with a standard installation channel since there will be a delay in the feeding rate during the presentation by hand. This system removes a lot of output and saves time when feeding. It may initially cost a bit, but it is very effective and saves labour, and they can do other jobs. With this system, the animal will eat enough of this because the feeding time of the animal will follow the time. This makes the animal will be healthier and less diseased.

2.5 Related Previous Research

Related previous research is a project related to the project that will be carried out, such as the previous project using IoT, and this project also uses IoT. means that they are related.

2.2.1 Related Previous Research on Smart Aquarium

Today's aquarium system is a typical aquarium. While the aquarium system on the market today is already interesting, with a collection of plants and fish, the issues that arise when the aquarium is stored indoors are less due to the aquarium's need for sunlight. Occasionally, the lights in an aquarium are not adapted to the needs of the aquarium's plants or fish. Another issue is the manual distribution of fish feed. This is particularly problematic if the aquarium's owner is highly active, as the risk of forgetting to feed the fish is extremely high. To overcome the difficulties mentioned earlier, it is necessary to have an aquarium system that is visually appealing and completely automated, both in terms of lighting and fish feeding.(Hardyanto, Ciptadi and Asmara, 2019)

A Smart Aquarium is developed for a fish aquarium. The prototype incorporates Internet of Things technology, allowing fish keepers to remotely adjust fish requirements (water and feed) from anywhere and anytime. Temperature and turbidity sensors, an automatic water drain, and a live stream are all included in the system. The data collected will be processed on the Raspberry Pi to take action and send a report to the device's owner.(Afifah *et al.*, 2019)

A control center is used to obtain information about the state of animals and plants in an aquarium's main tank body, as well as to monitor water level, salinity, temperature, oxygen content, PH (potential of hydrogen) value, and illuminance in a water area environment via a vision capturing system and an environment monitoring system; the control center is also used to compile data about the state of animals and plants in the aquarium's main tank body.(Kaimal *et al.*, 2017)

2.2.2 Related Previous Research on Internet of Things (IoT)

The Internet of Things (IoT) is the era of communication that is about to begin. The Internet of Things enables physical objects to create, receive, and exchange data seamlessly. Multiple IoT applications are aimed at automating various tasks and at empowering inanimate physical objects to act autonomously. Existing and future IoT applications hold great promise for increasing users' comfort, efficiency, and automation. To implement such a world in an ever-growing manner requires a high level of security, privacy, authentication, and attack recovery. It is critical to make the necessary changes to the architecture of IoT applications to achieve end-to-end secure IoT environments.(Hassija *et al.*, 2019)

According to (Mekki *et al.*, 2019), by 2020, radio communications will connect more than 50 billion devices. Low power wide area networks (LPWANs) have become a popular low-distance radio communication technology due to the Internet of Things (IoT) market's rapid growth. Sigfox, LoRa, and NB-IoT are three leading low-power wide-area network (LPWAN) technologies vying for large-scale IoT deployment.

The Internet is rapidly evolving and introducing new methods of connectivity. The Internet of Things (IoT) is one of those methodologies that repurposes existing Internet communication for Machine-to-Machine (M2M) communication. Thus, IoT enables seamless connectivity between the physical world and cyberspace via physical objects embedded with various intelligent sensors. Many interconnected machines will generate and exchange enormous data, facilitate daily life, assist in complex decision-making, and provide beneficial services. The evolution and importance of IoT in everyday life, the general architecture, the most widely used protocols, the numerous possible applications, and concerns about security and privacy in IoT, real-world implementation of IoT systems using Arduino, and its future trends. The Internet of Things is likely to become one of the most popular networking concepts, as it can yield numerous benefits.(Tuwanut and Kraijak, 2016)

Based on research (Pasha Mohd Daud *et al.*, 2020), the Internet of Things (IoT) has an advantages on Wireless Sensor and Actuator Networks (WSAN) and the Pervasive Computing domain. The security was challenging based on the technology and how information was acquired and manipulated by this technology.The IoT is very important to addressing physical and environmental accessibility issues in everyday. IoT also suggest a methods that potentially to remove these barriers. IoT has benefits for developing the countries such as sustainable agriculture, water quality and use, healthcare, industry, and environmental management.The ITU (International Telecommunication Union), has proves that anyone can temporarily use the data that they can be clarified by the machine to complete