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Date : 12 February 2022

SMART AUTOMATION FEEDING CONTROL FOR FISH FARM

NIK NUR EZZAHAZYYATIE BINTI NIK MAT

Thesis submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Electrical Engineering Technology (Power & Machine) With Honours

Faculty of Electrical & Electronics Engineering
UNIVERSITI MALAYSIA PAHANG

FEBRUARY 2022

ACKNOWLEDGEMENTS

In the name of Allah, the most merciful and the most compassionate. All praises to Allah for giving me the strength, guidance and wisdom to complete this Senior Design Project (SDP). Without His will and blessing, it would have been possible to complete this project in range of the time.

This thesis would not have been possible without the guidance and the assistance of several individuals who contributed and extended their valuable support in the preparation and the completion of this project. I am extremely thankful and indebted to my supervisor for this project, Dr Maziyah binti Mat Noh who is a Senior Lecturer of Faculty of Electrical & Electronics Engineering Technology for his patient, guidance, comment, suggestions, and encouragement which had help me throughout this whole project. Not to be forgotten to my coordinator, Ts. Dr. Waheb Abdul Jabbar Shaif Abdullah that have been work hard to make sure all the information, problem and process of SDP journey are smooth and also to all the instructors of Faculty of Electrical & Electronics Engineering Technology (FTKEE) of University Malaysia Pahang.

I owe my deepest gratitude to my partner along this journey, Ahmad Eiman Hidayat bin Ihsan for his patience, relentless effort and commitment that he gave for this project from the beginning until the completion of this project. I thank my family for their support and understanding to keep me motivated and move forward to complete my study. My accomplishments and success are because they believed in me and who keep me grounded, remind me of what is important in life, and are always supportive in my work doing.

Last but not least, thank you dear self for keeping strong go through all the obstacles and also, I thank all my colleagues and lectures that always support, and taking care of me along this journey.

ABSTRAK

Tesis ini membincangkan satu sistem automatik berdasarkan Internet of Things (IoT) yang dijanakan. Matlamat utama projek ini adalah untuk proses memberi ikan makan secara automatik menggunakan mikro-kawalan Arduino disamping mempunyai ciri-ciri mengambil data kekeruhan air dalam kolam ikan. Segala data berkaitan kekeruhan air boleh dilihat secara maya di aplikasi Blynk. Banyak penternak ikan secara umumnya terlupa untuk memberi ikan makan disebabkan faktor kekurangan tenaga buruh ataupun terlalu banyak kolam ikan yang perlu dijaga. Di samping itu, kos pembayaran upah buruh dan pekerja sangat tinggi. Kualiti air juga perlu dilihat secara alami bagi mengelakkan kekeruhan air melebihi piawaian kehidupan air. Air juga penting untuk hidupan dalam air mendapatkan nutrient yang baik untuk kesihatan mereka.

ABSTRACT

This thesis is about an automated system that was created using the Internet of Things (IoT). The main purpose of this project is to automate the feeding of fish using an Arduino microcontroller, as well as to collect data on water turbidity in fishponds. The Blynk app allows you to virtually observe all data related to water turbidity. Due to a shortage of personnel or the maintenance of too many fishponds, many fish farmers neglect to feed the fish. Furthermore, the cost of paying labor and wages is quite expensive. To avoid water turbidity exceeding water life limits, water quality must also be assessed in its natural state. Water is also important for the fish's health since it provides them with essential nutrients for their well-being.

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LIST OF SYMBOLS

USB	ET Cetera
PWM	Pulse Width Modulation
IDE	Integrated Development Environment
IoT	Internet of Things
WI-FI	Wireless Fidelity
JTU	Jackson Turbidity Unit
NTU	Nephelometric Turbidity Unit
AC	Alternating current
DC	Direct current
FNU	Formazin Nephelometric Unit
LCD	liquid crystal display
PVC	Polyvinyl chloride
LED	light emitting diode
pH	potential hydrogen

LIST OF ABBREVIATIONS

ETC	ET Cetera

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Project Background

The aims and objectives of this chapter are to provide reviews on previous studies and products for the automatic fish feeder system from various backgrounds and references. Other than that, this chapter represent a discussion on few components that will be implemented in this project. Application on fish feeding system for fish farm is the main focus content in this chapter.

For growth and production, food or feeding is the crucial part to ensure continued survival[1]. In aquaculture development and maintenance, one of the main challenges that need be face by them is their management. For fish owners very important for them to control of food delivery in order to make sure the survival of fish. Other than that, economic aspect are emphasized as well to ensure the survival of the company. Development of automated device to deliver food are one of the way to solve this problem.

In 2017, the country's total fishery production was 1.7 million tonnes, with nearly 1.5 million tonnes coming from capture and 0.2 million tonnes coming from aquaculture. The majority of fish from the marine capture sector is sold fresh and chilled, whereas those from aquaculture are sold live, directly to restaurants, at a higher price than in other markets. Demand for fish is increasing as people become wealthier and more aware of the health benefits of fish. In 2016, per capita fish consumption was around 59 kg, making it one of the highest in the world [2]. Based from the article, it clearly proof that aquaculture sector also plays as important role in order to grow our economy. Therefore it is important for the young generation to be competent in this field for the sake of our future. Parallel greatly growing demand of white meat requirements, development of automation feeding control for the fish farm could be very prove to be useful and

supportive of our country's aquaculture development. Aquaculture practise is improved by increased innovation by making it less labour intensive for farmers.

Fish food management for aquaculture is one of the crucial part that need attention besides the water quality. Complete and appropriate nutrients are critical for efficiently and economically raising fish. To get an effective feeding planning should has frequency of feeding, feeding technique and feeding rate. With follow the planning, it helps to avoid food waste, best digestive and metabolic activity (high oxygen content), able to monitor the health level of fish and etc. Other than that, to attract the young generation to involve in this field, we strive to produce a product that parallel with the growth of technology nowadays. This product literally have be done by others, we decided to upgrade this automation feeding control system with water quality control that focusing on cloudiness of water using turbidity sensor. Pursuit of an Arduino Uno as the controller for the fish feeding system to function as desired and developing control fish feeder using Blynk apps.

1.2 Project Problem Statement

According Sinar Harian newspaper, Tuesday 27 January 2019 state that 'the country's fishing industry lacks young people' [7]. According to former minister of agriculture and agro, Datuk Salahuddin Ayub said, his ministry is planning various approaches in an effort to modernize the fishing industry to attract more young people to get involved in the industry Through research study on commercial fish feeder that has available in market and also through research journal, there are number of problem that have been detected. As for intention of recreating, modernize or, if achievable, to improve the efficiency of the previous design of automatic fish feeder.

I. Hand Feeding Ineffectiveness

Regarding the statement has mention on modernize the fishing industry, its need to change from manually feed the fish with using system that can feed the fish as same manual system or much better more. The old method on fish feeding which is use manpower to feed manually is impractical for the owner that need to go outstation that might be for a long period or if the owner have a huge fish farm that need to feed up but did not enough manpower to handle it. In spite of that, the invention of fish feeder

nowadays have focused on upgrading an accuracy feeding device that come along with timely setting which can help the aquarist to feed the fish. This is the main of purpose in designing an effectiveness of feeding system for this project. The owner can set the smart feeder the time setting to deliver the pellets. Referring the word of automatic system, its mean the feeder can be function without supervision from the aquarist at certain range time.

II. Fish Get Disease Because Of The Cloudiness Of Water

Matter of course when jumped in aquaculture sector, the most important thing to concern in fish care is about the water quality. In addition, a good quality and healthy fish is depend on the quality of water, as water itself as their source of life. It can be conclude that the biggest problem or point that aquarist need to be face is to ensure the water quality was in good condition according what type of fish that they have, as every type of fish have different of measure quality. Might some of them need very clear water but some of them can survive although the cloudiness of water was medium level. In invention of smart automatic fish feeder, it is important also to concern on how to create a system that also can operated to ensure that quality of water are always in good condition and suitable with the fish to ensure the sustainability.

1.3 Project Objectives

Based on the problem statement, the objectives of the study are:

To design and develop a smart automation feeding control for fish farm that capable of determining the cloudiness of the water.

1.4 Project Scopes

Here are some other boundaries that have been identified for this study project in order to ensure that it would not spin out of control course and only achieves its goals.

I. Investigate the use of an appropriate controller and transducer for the fish feeding system to perform properly.

II. This automatic fish feeder only appropriate for freshwater fish with range of size between big and small

III. The cost of constructing a prototype is limited, and its appealing value is not prioritized.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The goal of this chapter is to provide reviews of prior research and products for the automatic fish feeder system based on a variety of backgrounds and references. Aside from that, this chapter discusses a number of the components that will be used in this project, as well as some associated research, such as the fish feeding mechanism, system controller, motor, user interface, and feedback system. This chapter focuses mostly on the use of a fish feeding system for freshwater fish farm.

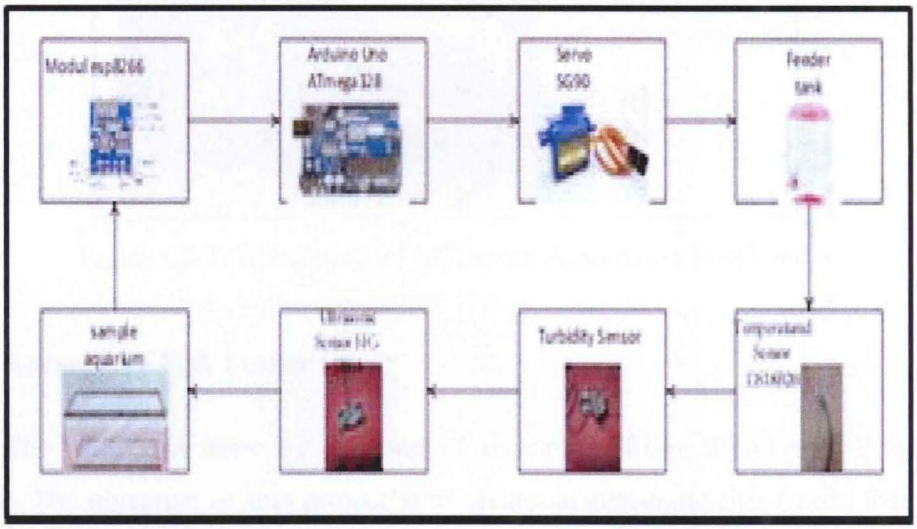
2.2 Automatic Fish Feeder

Before beginning the design and construction process, it is critical to first understand the fish feeding system in order for this project to meet its goals. Most autonomous systems are invented as a result of research into earlier publications and products on automatic fish feeders, with the goal of assisting aquarists in saving energy .The introduction of this self-contained technology also ensures the health and happiness of the fish. As a result, both parties will benefit. The controller, the feeder mechanism, and the motor are identified as the basic components for most automatic fish-feeding systems while looking through the general components. Certain automatic fish feeders, on the other hand, include a sensor as a feedback system, as well as a user interface, such as a display unit, keypad, or graphical user interfacing software, as extra functions and features to the basic automatic fish-feeding system. The sections below provide a summary of some previously studied works.

2.2.1 Smart Fish Feeder Using Arduino Uno with Fuzzy Logic Controller

As the project from Polytechnic Pos Bandung, Indonesia which is Smart Fish Feeder Using Arduino Uno with Fuzzy Logic controller [10]. The premise behind smart fish feeders is that all operations are completed in a short amount of time, with the feeding

time measured in milliseconds. Sensors put in aquariums provide measurements, which are sent into a real-time Firebase database to keep the monitoring and control process from clogging up the server. Arduino Uno is the micro controller utilized. The technology employed is fuzzy logic controller, which is utilized to create a controller that will identify the best feeding strategy based on temperature and turbidity. A fuzzy logic controller transforms expert-derived language control techniques into an automated control method.

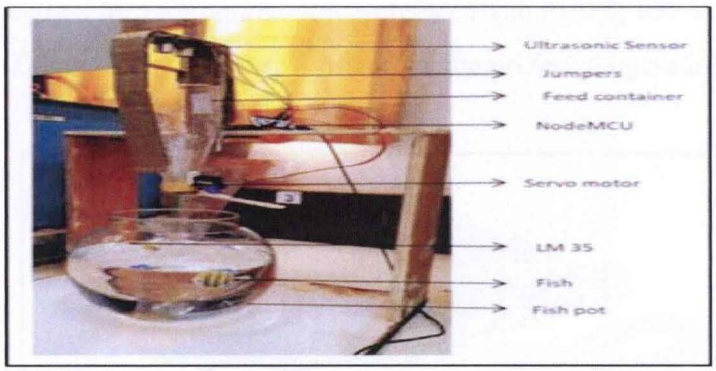


Figures 2-1: Block diagram of Smart Fish Feeder Using Arduino Uno with Fuzzy Logic Controller

2.2.2 Iot Based Automated Fish Feeder

This is able to be controlled using a mobile phone so the users can feed the fish if the user is out of town. Its enables to monitor the last feed status of feed. Next, it can control the feed amount depending upon the number of fishes. It also can measure the temperature of water. The level of feed and the temperature of water were displayed on the smartphone.

The ultrasonic sensor and LM35 temperature sensor serve as inputs to the NodeMCU, while the servo motor serves as an output. Connecting to Wi-Fi automates the system. The output is shown on both the Arduino Ide serial monitor and the smartphone. The feed level was checked, the feed button was pressed, and the servo motor moved appropriately



Figures 2-2: Illustration of IoT based Automated Fish Feeder

2.2.3 Automated Fish Feeder

The project is done by a group of researcher from Worchester Polytechnic Institute. The objective of this project is to create an automatic fish feeder that can be used in the home. The gadget was created to feed a single goldfish for at least 14 days without the user's assistance. The multi-stage system feeds the fish while preventing faults that may result in too much food being supplied. It uses an Arduino micro controller to operate two stepper motors. The compact design will attach to the tank for easy setup [11].

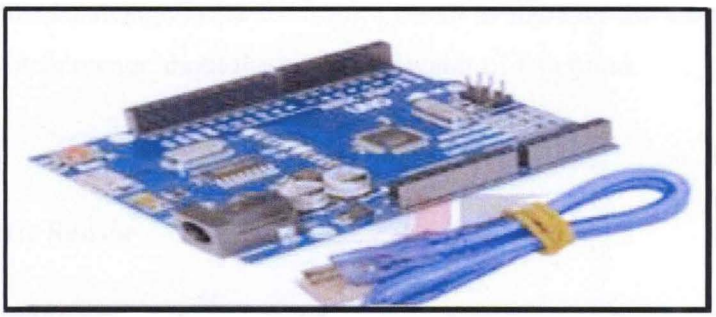
2.3 Controller

Controller in the main of the project that will ensure all the part in the project will work smooth. If there were some problem with the controller, all the system will be affected as the controller control all the function for every component.

2.3.1 Arduino Uno

Arduino UNO is a microcontroller board created by Arduino.cc, an open-source electronics platform based on the Atmega328 AVR microprocessor. The Arduino Uno nowadays consists of a USB interface, six analogue input pins, and 14 I/O digital ports

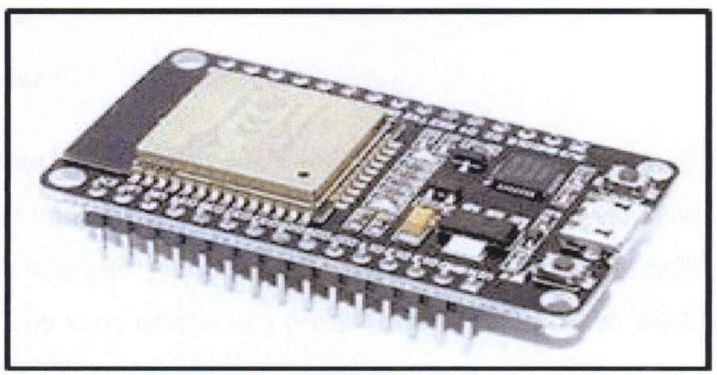
allowing connection to external electronic circuits. 6 pins out of the 14 I/O ports can be configured for PWM output. It enables users to connect with and detect external electronic devices in the real application. This board has all of the functionality required to run the controller and may be attached to a computer through USB to transmit code to the controller using IDE (Integrated Development Environment) software which was specifically designed for programming in Arduino. Even though IDE is compatible with Windows, MAC and Linux systems, Windows is the preferred operating system.



Figures 2-3: Arduino UNO

2.3.2 ESP32 Microcontroller

The ESP32 is a low-cost, low-power microcontroller with Wi-Fi and Bluetooth built in. It succeeds the ESP8266, which is a low-cost Wi-Fi microprocessor with limited features. It has a built-in antenna and RF balun, as well as a power amplifier, low-noise amplifiers, filters, and a power management module. The complete solution occupies the smallest amount of space on the printed circuit board. This board is utilised with TSMC 40nm low power technology 2.4 GHz dual-mode Wi-Fi and Bluetooth chips, which have the best power and RF attributes, are safe, dependable, and scalable to a range of applications.



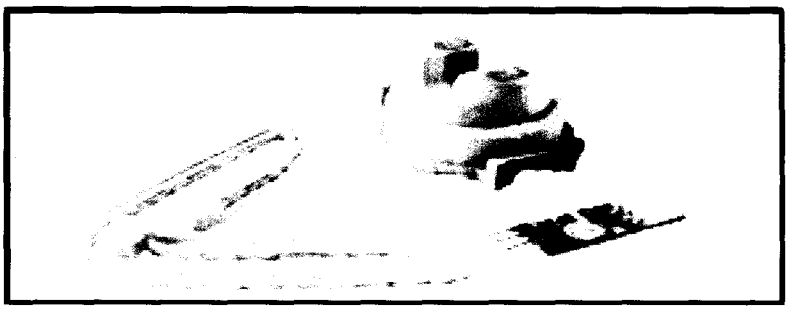
Figures 2-4: ESP32

2.4 Feedback System

A feedback system is a feedback system compares its output to a desired input and adjusts its output to match the input. For this project, the feedback system that implement to the automatic fish feeder design are a feedback system to indicate the cloudiness of water fish farm and notify owner about the quality of water of fish pond.

2.4.1 Turbidity Sensor

The turbidity sensor measures turbidity or coarseness to determine water quality. It monitors light transmittance and scattering rate which varies with the amount of total suspended solids in water to detect suspended particles in water. As the total suspended solids increasing, so the turbidity level will also rising. Turbidity sensors are used to measure water quality fishing ponds.



Figures 2-5: Turbidity Sensor

2.5 Servo Motor

Servo motors have been used in a variety of applications for a long time. They are modest in size, but unlike other motors, whether AC or DC, these motors have a lot of power and are also very energy efficient. They can be used to control radio-controlled or remote-controlled toy cars, robots, and aeroplanes because of their qualities. Industrial

applications, robotics, in-line manufacturing, pharmaceutics, and food services all use servo motors. Servo motors, unlike conventional motors, can only rotate in one direction, whereas normal motors can rotate 360 degrees. In a paper written by Ahmed, Chellali and Zahir (2013), in these recent times, servo will be an important device in industrial application. Plus, this field will require high dynamics on position control. Numerically controlled machinery, robotics, automation, and other mechanisms with quick and precise starting and stopping functions are examples of such applications. This motor is utilised in robotic applications to drive the robotic arm to a specified location using controllers in automated manufacturing lines of industries. The servo motor's unique feature is that the rotor is built of a light-weight material that reduces the armature's inertia while still delivering the required magnetic flux. Because of the low rotor inertia, the ability to start and stop quickly during on-off situations improves.

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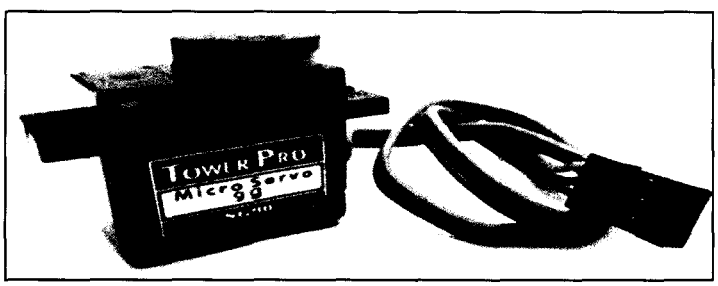
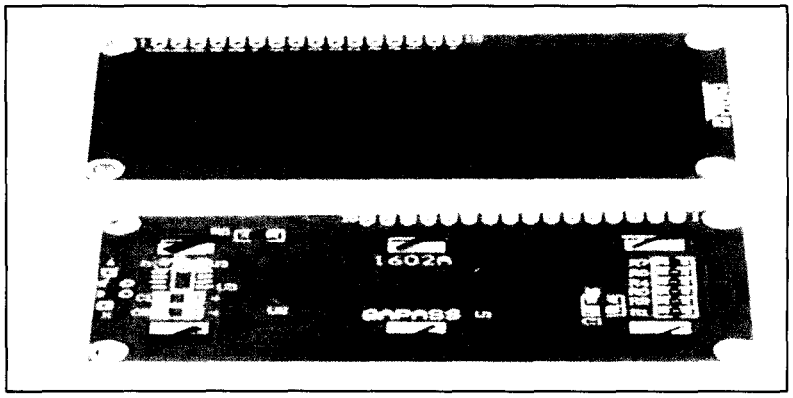
A servo motor is a miniature motor with an output shaft. By transmitting a coded signal to the servo, this shaft may be moved to various angular locations. The servo can retain the shaft's angular orientation as long as the coded signal is present on the input side. The angular orientation of the shaft varies as the coded signal changes. Servo motor are used in radio-controlled airplanes, radio-control cars, robotics and many more industries. The servos is very vital in robotics industries. The motors are lightweight, have built-in control switching devices and very efficient and affordable.



Figures 2-6: Servo Motor

2.6 LCD 16 X 2

The LCD display is used in order to extract data from Arduino and apply the message into LCD so the users its current status. The purpose is to acknowledge users about the situation about the feeding status, Ultrasonic sensor, the pH level reading and the turbidity check inside the fish ponds. So, the LCD will be connected into Arduino and receive all the information of the three sensors and notified the users. Never the less, it will also be link with Blynk App about its status

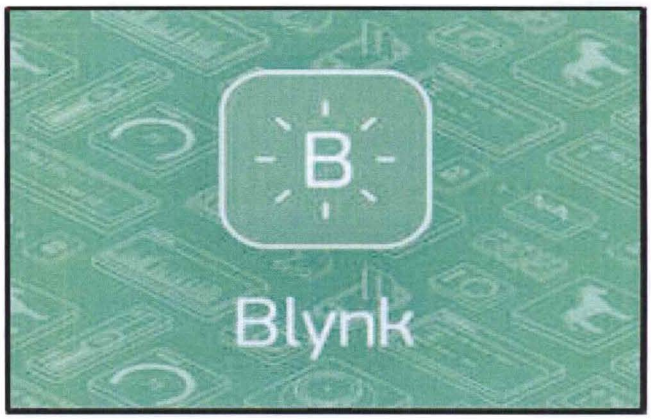


Figures 2-7: LCD 16 X 2 Display

2.7 User Control Interface

2.7.1 Blynk Application

The Blynk App software is nowadays IoT interfaces that being used worldwide. The Blynk Apps is famously known for its capability of connecting devices into the cloud, monitoring system for all applications, analyzing telemetry data and many more.



Figures 2-8: Blynk App

CHAPTER 3

METHODOLOGY

3.1 Introduction

This part will clarify the proposed design. The components utilised in the fabrication of this mechanical fish feeder were found locally and were fairly common but adaptable. The following methodology is utilised to complete the research objectives. The first stage is the literature review, which is study about the previous research and design of smart fish feeder and also type of fish that suitable for this fish feeder. In addition, from the previous paper also can analyse advantages and disadvantages for every design and system. Second stage is considering the component used and optimization of cost due to the broad variety of things available on the market. Third stage, study and analyse on how the motor operates and how to control it. To make the motor function, coding code is needed to control the motor properly according to the user input. Fourth stage, learn to assemble every function system in fish feeder in controller and sensor that suitable to use for this fish feeder. Lastly, identify a software that can be used to notify the owner

The design and fabrication was divided into two section:

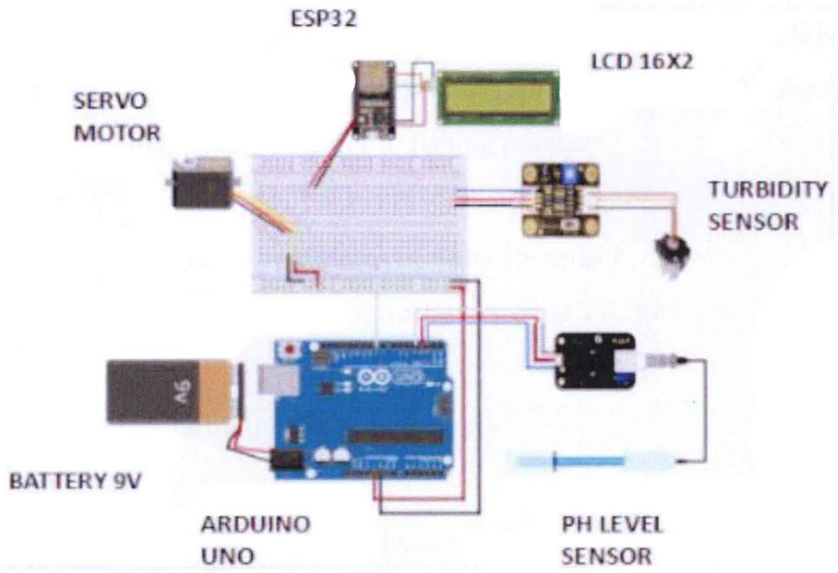
1. The mechanical section
2. The electronic sections

During the design and development of the automated system, the following significant considerations were made:

1. the system's ability to work with the size and type of feed that is being used
2. the ability of motor functioning the feeder mechanism

3.2 Proposed Design

In figure 3-1, shows the circuit that we have proposed. But for in the real design, we not include the PH level sensor.



Figures 3-1: Circuit for Propose Design

3.3 Overview of proposed Design

There are plenty type of design automatic fish feeder, which for each type having different calculation, objectives and also the advantages and disadvantages. The differentiation for every design of fish feeder can be define by the size as might be some of the design are suitable for fish that have range size between small to medium or medium to big and also size for the fish habitat either for aquarium or fish farm. To find the right frame design, need to consider all the purposes and the cost.

The purposes for this project, besides to feed the fish in automatic way, along with it; implement one function that can control the quality of the water as fish are totally dependent upon water to breathe, feed, grow, excrete waste, maintain a salt balance and reproduce. Therefore, we focused to how to control the quality of water by checking the water cloudiness.

3.3.1 Turbidity Sensor

The turbidity sensor measures turbidity or coarseness to determine water quality. It monitors the rate of light transmittance and scattering varies with the number of additional suspended total dissolved solids to detect suspended particles in water. As a result of the combined amount suspended solids increasing, so the turbidity response is activated as well. Turbidity sensors are used to assess the quality of water in fishing ponds.

Table 1: features of turbidity sensor

Compatible with Arduino, Raspberry Pi, AVR, PIC, etc.
Measures turbidity of water in rivers.
Detects and verifies water quality.
Digital and analog output;
Able to detect particles that are suspended in water.
Trim pot for sensitivity adjustment.

3.3.2 Servo Motor

A DC motor, a gear system, a position sensor, and a control circuit make up a servo motor. The DC motors are battery-powered and run at high speeds with low torque. The DC motors' gear and shaft arrangement reduces this speed to a sufficient speed and higher torque. The position sensor detects the shaft's position relative to its fixed position and sends the data to the control circuit. The control circuit decodes the signals from the position sensor, compares the current position of the motors to the intended position, and

controls the direction of rotation of the DC motor accordingly to achieve the desired position. A DC supply of 4.8V to 6V is often required for servo motors.

Tables 2: specifications of servo motor

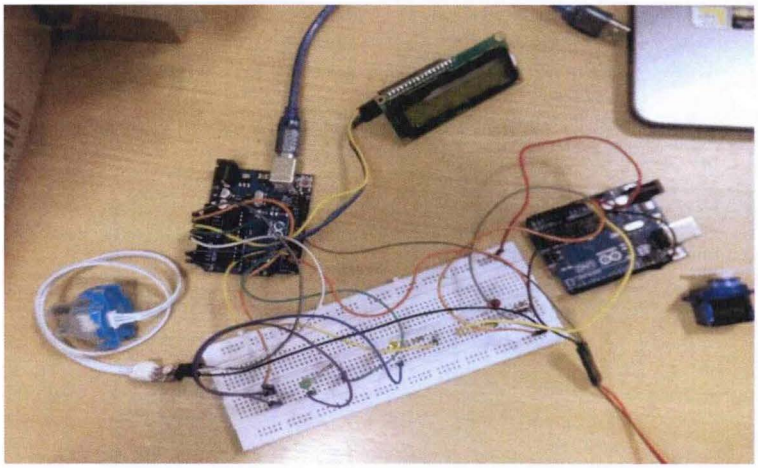
Operating speed (4.8V no load) :	0.12sec / 60degrees
Stall torque : 1.2kg / 42.3oz(4.8 V) ;	1.2kg / 42.3oz(4.8 V) ; 1.6kg / 56.4oz (6.0V)
Operating voltage :	3.0 - 7.2V
Temperature range :	-30 C ~ 60 C
Dead band width :	7us

3.4 Electrical Implementation

An electric circuit is a path for transmitting electric current. An electric circuit consists of a device that provides energy to the charged particles that make up the current, such as a battery or a generator; devices that use current, such as lamps, electric motors, or computers; and the connecting wire

3.4.1 Electrical Circuit

Electrical circuit for this project we use, 2 boards of arduino Uno to run the whole system. The reason we use 2 arduino Uno because of voltage factor that not enough if using 1 aeduino Uno only.



Figures 3-2: The Electric Circuit

3.4.2 Arduino UNO

First of all, we need to acknowledge that there are many types of Arduino in this microcontroller industries. Arduino UNO is the most common used between them all. Next, we are encourage to use the Arduino in order to analyze the coding and programming that will be inserted to the software and will the intermediary between input and output.

The Arduino Uno nowadays consists of a USB interface, six analogue input pins, and 14 I/O digital ports allowing connection to external electronic circuits. 6 pins out of the 14 I/O ports can be configured for PWM output. It enables users to connect with and detect external electronic devices in the real application. This board has all of the functionality required to run the controller and may be attached to a computer through USB to transmit code to the controller using IDE (Integrated Development Environment) software which was specifically designed for programming in Arduino. Basically, based on the figure above, the right side of block diagram indicating the inputs of this system which is the servo motor and turbidity sensor. On the left side indicating the output of this system which is Blynk application and the automatic hopper for feeding process. The servo motor is basically the main function in this system meanwhile all the sensors as the side function for monitoring system for owners. The servos used in order to feed the fishes automatically. The inputs and outputs of this system are connected into ports inside Arduino UNO. Other than that, the system will fully run by Arduino software based on

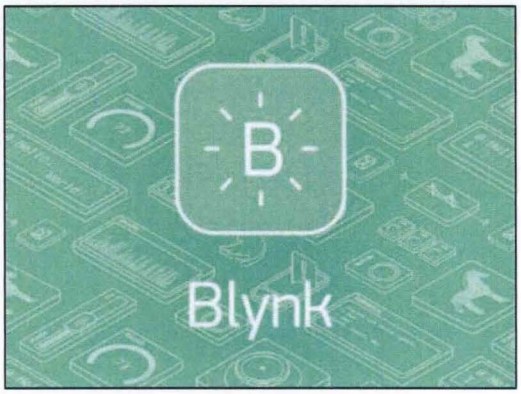
the specified coding. The turbidity sensor is used to monitor the changes in check the water cloudiness in the fish farms.

Tables 3: Specification of Arduino UNO

Microcontroller	ATmega328P
Operating Voltage	5V
Digital I/O	Pins 14 (of which 6 provide PWM output)
PWM Digital I/O	Pins 6
Analog Input	Pins 6
DC Current per I/O	Pin 20 mA
DC Current for 3.3V	Pin 50 mA
Flash Memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

3.5 Blynk Application

The Blynk App software is nowadays IoT interfaces that being used worldwide. The Blynk Apps is famously known for its capability of connecting devices into the cloud, monitoring system for all applications, analyzing telemetry data and many more



Figures 3-3: Blynk App

3.6 Hardware installation

The hardware installation starts with assemble of PVC pipe and fishpond canvas. The idea to make the fishponds within the small scale is because to make it look realistic. The ideal prototype is 100CM X 50CM X 25CM based on our desired fishpond canvas. The process is to make all the measuring of the pond and can be implemented into real time process.

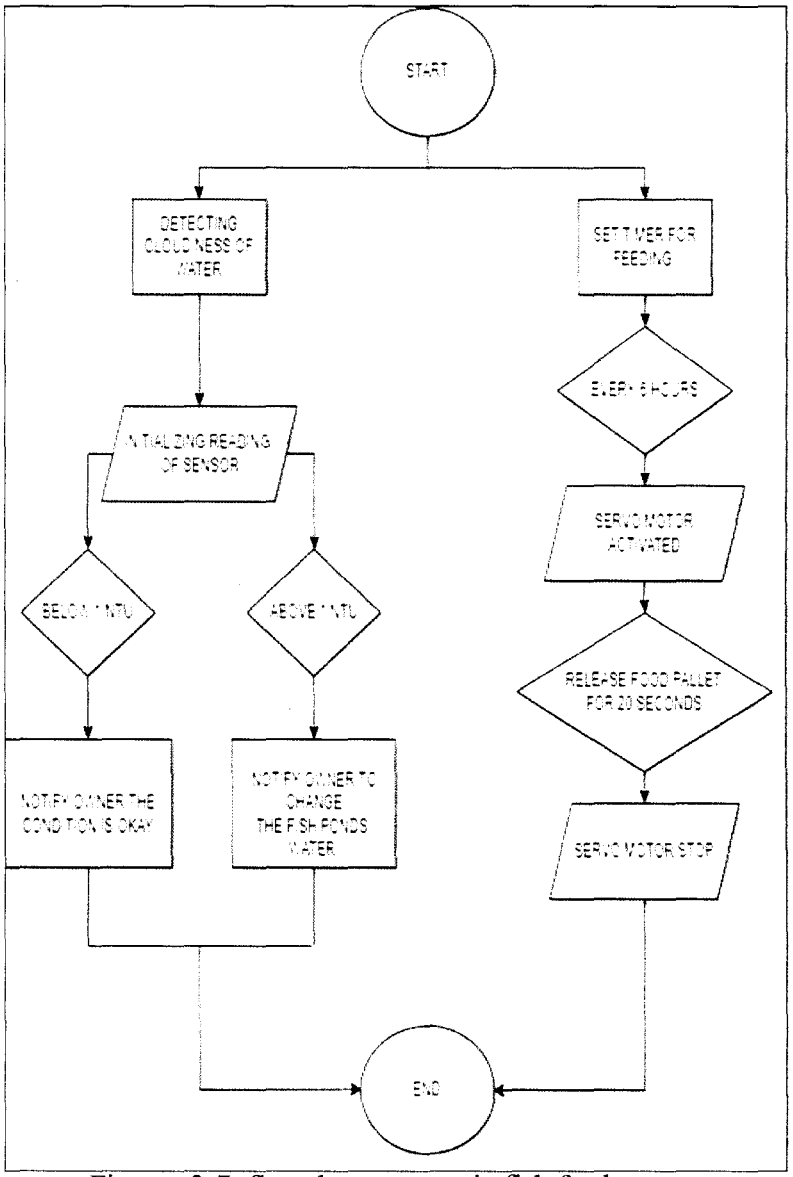
Figures 3-4: Preparation for Prototype

Figures 3-5: Prototype for Fish Farm

Figures 3-6: Testing Placing With Microcontroller Box

3.7 Flowchart of the control system

When the control system started, servo motor the feeder mechanism started move according the timer. The fish pallet been released. The turbidity sensor in the water to detect the cloudiness of the water.



Figures 3-7: flowchart automatic fish feeder

CHAPTER 4

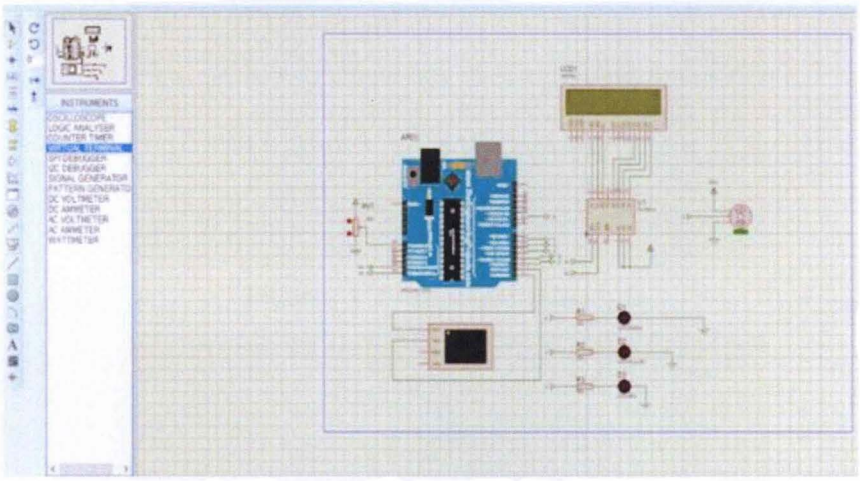
RESULTS AND DISCUSSION

4.1 Introduction

In this chapter we will discuss the results of our methodology on administering our project. We will analyse the effectiveness our design and fabrication technique, does our project achieved every objective. The test on the function of turbidity sensor to check the cloudiness of the water and send notify to the owner will be tested.

4.2 Fish feeder fabrication

The proteus is a simulation programme that aids with the attachment of objects. A large number of components with a PIC microcontroller out with the simulation. It allows you to mimic the output of the controller components, as well as observe and alter it if necessary.



Figures 4-1: Proteous Simulation

Servo motor: a rotatory actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration

Fish feed: support by servo motor for the rotation and the pallets in the tank

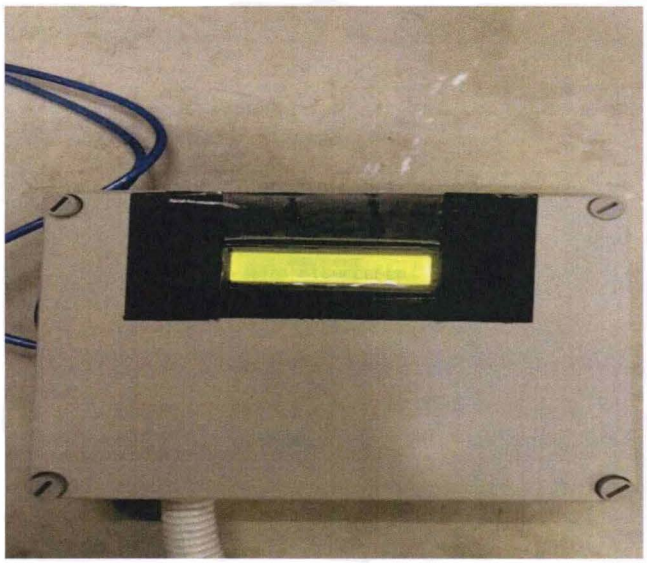
LCD display: this is used for display turbidity reading

Turbidity sensor: to determine the cloudiness of the fish pond

LED: as indicator notify cleanliness of fish pond

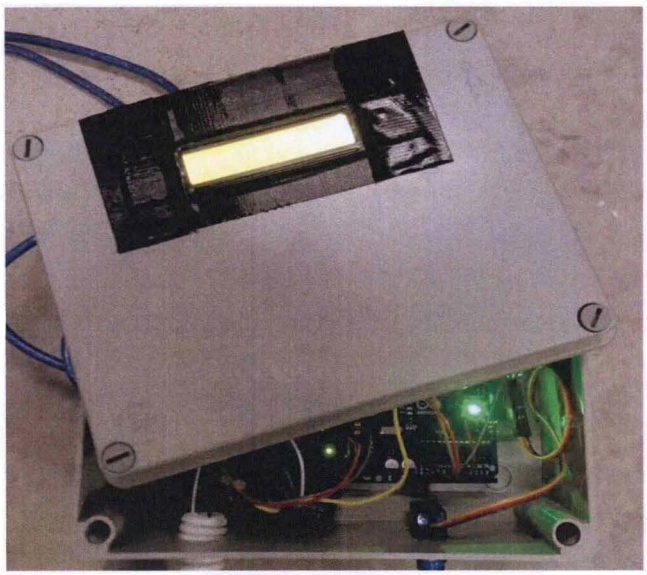
4.2.1 Final design of fish feeder

As an outcomes from this project, we have design a fish feeder that achieve with our objectives. A microcontroller box that consists with Arduino Uno circuit that have programming with turbidity sensor and servo motor. In Figures 4-2, shows the microcontroller box display 'WELCOME AUTO FISHFEEDER'. For Figures 4-3, shows that feeder mechanism that connected to servo motor that function to release the pellets. For figure 4-4, shows the compartment in controller box and for the last figure 4-5 shows at the microcontroller box display the reading of cloudiness water.

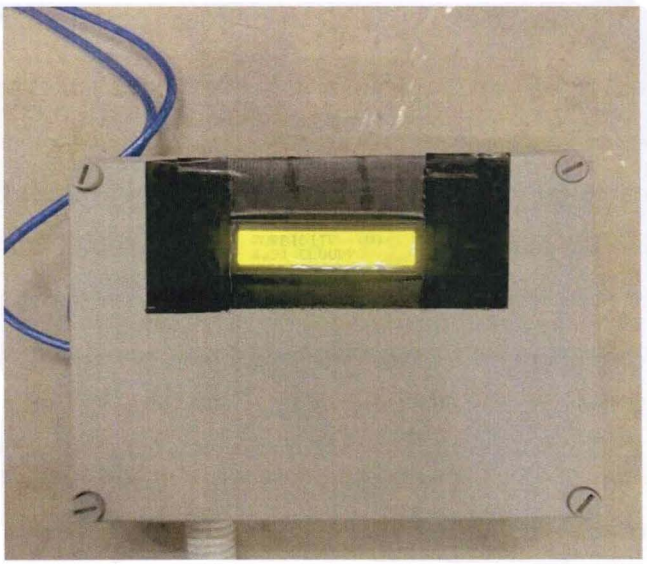


Figures 4-2: microcontroller box

Figures 4-3: feeder mechanism that connected to servo motor



Figures 4-4: compartment in controller box



Figures 4-5: reading of turbidity sensor

4.3 Results and Discussion

The unit used to quantify the turbidity of a fluid or the amount of suspended particles in water is known as the NTU (Nephelometric Turbidity Unit). The higher the suspended particles content in the water, the dirtier it seems and the higher the turbidity.

Turbidity units, have no intrinsic value. They are a qualitative, not a quantitative, measurement. There is no standard conversion between turbidity units (e.g. NTU or FNU) and mass measurements (mg/L) 52. Furthermore, pure water isn't always healthy, and murky water doesn't always mean there's a problem.

The several turbidity units in use might be perplexing as a qualitative, context-based measurement. A separate unit is used in each measurement method. Because the type of light source, detector, or measurement angle affects the turbidity result, a plethora of turbidity units have been developed. Furthermore, mineral-based materials reflect more light, whereas organic particles absorb more. These effects are dependent on the relationship between particle size, colour, and concentration, as well as the wavelengths and beam widths of light. As a result, even within the same sample, different turbidity devices can produce varied turbidity readings.

While turbidity units can be roughly equivalent, consistency in methods and devices is required to provide accurate data. Because they were assumed to be equivalent, units like NTU and JTU were frequently interchanged incorrectly in the past. Unfortunately, this practise continues to be used today, especially at FNU and NTU. Because they are more well-known, many instrument manuals recommend using unsuitable units. The Quality Standards section explains which units should be used with which measurement method or equipment type.

If adequate data is obtained, linear regression analysis can be used to find correlations between total suspended solids or suspended sediment concentrations in mg/L and turbidity in turbidity units. This relationship is expressed using the equation below in exclusively mineral-based samples., as in (1) :

$$NTU = a\ (TSS)\ ^{\wedge}b \qquad (1)$$

NTU = a * TSSb

NTU = Turbidity Measurement

TSS = Suspended solids measurement in mg/L

a = regression-estimated coefficient

b = regression-estimated coefficient, approximately equal to 1

This equation can become inconsistant when organic material, air bubbles, or dissolved coloured pigment are present. Furthermore, the correlation's accuracy is based on the linear relationship between turbidity and suspended solids. The equation is no longer valid when the relationship becomes non-linear (over 40 NTU for nephelometric methods).

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter summarised the research's key findings. The findings of this study provided an overall description of this case study. The limitations or problems encountered while conducting this research were also reported, along with recommendations for future research purposes.

5.2 Conclusion

At the end of the day, we met all the objectives to develop the smart automatic fish feeder. The fish feeder controlled by Arduino Uno with combination of servo motor that functioning work for feeder mechanism and turbidity sensor that detect the cloudiness of the water. The time setting in Arduino Uno programming have successful make the feeder mechanism operate for every 6 hours when it connected to the power supply. In this project also, the owner successful get notify about the reading of the water through Blynk apps.

5.3 Recommendation

With the outcomes that we have discovered, there a lot of improvement that should be taken and to improve for this smart automation fish feeder. There are many more sensor or component that should implement in this project.

Firstly, the design of the fish feeder need be more specific from perspective of technical calculation. The calculation should suitable for big area as this product are implement for fish farm and also the suitable design that fix with fish farm condition.

Secondly, the usage selection of turbidity sensor must be suitable with our project and the purpose of using turbidity sensor. Example in this project, we supposedly use turbidity sensor model SEN-0189 as it more accurate and higher resolution of data intake.

Thirdly, in this project we used servo motor type SG90 which is not suitable to implement for big scale of fish farm as it have slightly low speed with small size. For recommend it is more suitable to use DC motor that able to carry much more power and suitable to implement for fish farm

Fourth, adding more sensor function and complexity component that able implement in fish feeder. As for our project there are no complexity part that with implement in our fish feeder.

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APPENDICES

Appendix A: Gantt chart

NO	TASK NAME	WEEK													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project Briefing														
2	Sdp2 Briefing														
3	Specify Detail Requirement														
4	Develop Prototype														
5	Apply Final Construction														
6	Implementation (Roll-Out Final Design)														