AUTOMATIC FISH FEEDER

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by

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TABLE OF CONTENTS

CHAPTER 3: METHODOLOGY

CHAPTER 4: RESULTS AND DISCUSSION

LIST OF TABLES

LIST OF FIGURES

PENUANG MAKANAN IKAN AUTOMATIK

ABSTRAK

Sistem penuang makanan ikan yang tidak betul akan membawa kepada sisa makanan serta akan menyumbang kepada alam sekitar seperti kesan pencemaran air. Pembinaan sistem penuang makanan ikan automatik adalah bertujuan mengatasi isu ini. Tujuan utama projek ini adalah untuk membantu perternak ikan yang mempunyai keadaan kehidupan yang sibuk sehingga tidak dapat mengekalkan penjagaan tetap permakanan. Sistem penuang makanan ikan automatik dikawal oleh jam masa nyata (RTC) dan ia mampu memberi ikan makan mengikut jadual masa yang telah ditentukan tanpa kehadiran operator. Pengguna boleh memilih mana-mana jumlah yang dikehendaki untuk memberi ikan makan dengan kelengkapan sistem yang mudah untuk menentukan jadual untuk memberi makan. Setelah jadual yang telah ditetapkan, motor servo akan berputar dan membuka penutup bekas untuk menjatuhkan makanan ikan dengan sewajarnya. Selain itu, bahagian lain yang dilengkapi dalam projek ini adalah sistem amaran. Ia adalah untuk memberi amaran kepada pengguna untuk mengisi semula pelet ke dalam bekas. Oleh kerana keadaan ini, ia menjadi sangat berguna kepada perternak ikan.

AUTOMATIC FISH FEEDER

ABSTRACT

Improper fish feeding system leads to feed waste as well as contributing to environmental impact such as water pollution. The development of an automatic fish feeder is to overcome this issue. The main purpose of this project is to help the aquarist fish who have the hectic which unable to maintain the regular care of feeding. The automatic fish feeder is controlled by a real time clock (RTC) and it is capable of feeding the fish in accordance with a pre-determined time schedule without the presence of an operator. The feeder can select any of the desired amount of feeding and conveniently choose the schedule for feeding. Once the schedule has been set, the servo motor will rotate and open the container to feed the fish accordingly. The other part in this project is the warning system. It is to alert the user to fill the pellet into the container. Due of this circumstance, it become very helpful to the aquarist fish.

CHAPTER 1

INTRODUCTION

1.1 Research Background

Nowadays, there are increasing number of aquarist fish who keeping fish inside their home, whether for hobby or business. The production of aquaculture in Asia for business matter has dominated the market by contributing around 91% of the world total by volume and 82% by value [1]. From the article, there are 89,453 fisherman and 21,504 fish culturists are being provided with direct employments in the fisheries sector in Malaysia [2].

Time management controller is the main important parameter of the feeding system. It is still considered a significant issue that needs to be tackled nowadays. Traditionally, the aquarist fish needs to feed the fish manually and so, problems will arise when this routine cannot be done on regular terms. On another extreme, lot of food will be wasted. Otherwise, too much feeding will consequently cause water pollution as when this happens, a significant amount of time is needed to clean the aquarium from the wasted food.

1.2 Problem Statement

In this modern times, there are many aquarists of fish owner own a hectic life, in where they need to go far away from home for business or vacation. They often have to face the same problem where it is hard for them to maintain a regular schedule to feed their fish. Regular care is crucial to keep the fish healthy. If not, the life expectancy of the fish will create water pollution inside the aquarium. Consequently, the owner will need to spend a lot of time to clean the aquarium. Another issue is the water temperature. Different types of fish needs to be in a different water temperature, therefore, in order to ensure that the fish are in appropriate conditions.

Automatic fish feeding system is seen as the most reliable solution to this problem. By utilizing this system the feeder will be able to operate automatically without human help at least over a certain period of time. There is a lot of automatic fish feeder on the market with different designs and brands, however the commercialized products allow room for improvement, with varying limits on each. This project offers an additional feature, which is the warning system that need to be countered order to complete this research [3]. The question are:

1. How to control the amount of fish feed into aquarium?
2. What kind of sensor is suitable for the warning system?

1.3 Objectives

The objective of this project is to develop an automatic fish feeder which is able to:

I. To provide feeding at the right schedule and amount of pellet.

II. To built the alerting system.

1.4 Scope of Project

The focus of this project is on the system and the controller that involved in the feeding system. In order to improve this system, there are still have further attention due to its limitation of the project. Basically, this project divided into two parts of works which are hardware development and software development by using Arduino microcontroller. Both parts are needed to complete the project and to gain the result so it can be observed.

This project specifically focuses on feeding fish in an aquarium-sealed environment. The amount of pellet and the schedule of feeding is the main part that needs to be optimized. The right amount of pellet is important to avoid waste. The overfeeding or potentially toxic chemical will give harm to the fish inside the aquarium, as this can cause clog filters and water lines.

The overall project is developed by using Arduino software to model the functioning system as followed by design of the hardware part using AutoCAD software.

1.5 Thesis Outline

This thesis has been discussed in detail about the project. Approximately there are five main chapters in this thesis to describe and explain

Chapter 1, Introduction, it's given the details about the research background, problem statement, objectives, scope of research and thesis outline.

Chapter 2, Literature review, illustrates the related progress of the study, fundamental theories and professionals' invention.

Chapter 3, Methodology, reveals the objective of the project is determined. Each criteria of the project are discussed. The required materials and component used in this project is revealed.

Chapter 4, Result and Discussion, shows the performance final result based on the feeding system. The projection problem encountered is discussed in this thesis.

Chapter 5, Conclusion, concludes the project and give the suggestion of improving that can done in the future.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss about the different types of fish feeder machine that are available on the market these days. The specifications of each product are observed and the differences between each product are discussed in this thesis. In addition to that, this chapter also includes the discussion on the pellet for the fish and the optimum feeding time.

2.2 Automatic Feeding Machine

The first design of automatic fish feeder was introduces by David C. Smeltzer on 4th April 1985, the system capable of dispensing feed with high speed and accuracy [3]. The device was equipped with the vibration movement to differentiate the amount of food given out. This system utilized an adjustable counterbalance weight of water for dispensing action. The movement inside the aquarium will be read by the vibration movement component, it is to calculate the right amount of pellet to be released. However, the system is not appropriate due to difficult to control the amount of food released. The overfeeding will cause water to be polluted, and meanwhile the less of food will make the fish starving. In general, the method of fish feeding have already been classified into three methods which manual feeding, semi-automatic feeding and automatic feeding. The three methods feeding was based on the type of the applied energy to dispense the feed such as pneumatic

energy, hydraulic energy and electric energy. The different method to feed fish also play the factor reason to be classified the method of feeding; as the automatic feeder could be in static condition or works as a mobile unit.

The fixed feeder [4], does not require labor to deliver the feed due to the system acquires the feed from the main storage and delivers the feed independently to the pond for dispensing process. As for the mobile feeder, the reduce control system complexity and increasing the robustness of the system was utilized.

The automatic feeding system helps to control feeding over 24 daily feeding cycles and it can adjust on the timer system. The concept of the system is shown in the Figure 2.1.

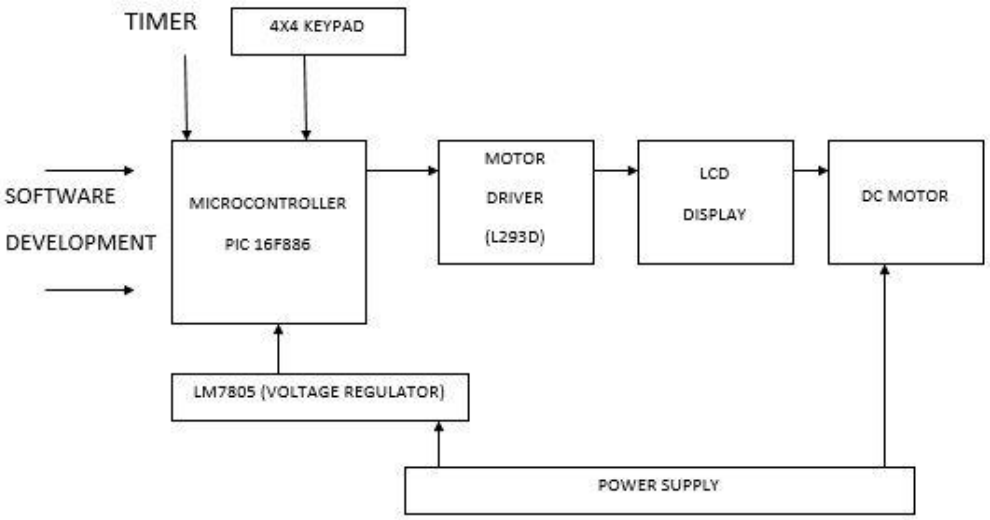

Figure 2.1: Conceptual diagram of the system [4]

2.3 Fish Feeder Machine

There are several types of automatic fish feeder product that are available on the market that can be used as the basic idea to design this project. For example, EHEIM Everyday Fish Feeder [5], IntelliFeed Fish Feeder [6], Hydoor Automatic Fish Feeder [7], Meco Aquarium

Automatic Fish Food Tank Feeder [6], and Rusee Daily Automatic Fish Feeder [6] are among the commercialized fish feeder product around. By using an automatic fish feeder, its helps by doing things that user does not have to. Also, by having an automatic fish feeder, it saves time and it frees user to go out anywhere.

2.3.1 EHEIM Everyday Fish Feeder [5]

The EHEIM everyday fish feeder product is shown in Figure 2.2 [5]. This product can feed fish up to eight times a day by using a controlled program that has been set up by the user. This product comes with the ability to feed pets other than fish such as frogs, newts, and turtles. The transparent drum feature in the design helps to tell the number of pellets left. This system uses the power of two AA batteries to power up the product and it can last long up until 6 weeks of feedings.

Not only that, this product comes with a feature enables feeding even though the pellet slot is positioned downward. Moreover, the integrated fan ventilation system helps to maintain a dry environment around the pellet. The only drawback observed is that this product does not come with any ‘off’ button to turn it off. Rather, it needs to be reprogrammed when the batteries are removed.

Figure 2.2: EHEIM Everyday Fish Feeder [5]

2.3.2 IntelliFeed Fish Feeder [6]

The IntelliFeed fish feeder is a suitable product to feed a large number of fish. This product helps to feed twice per day, and can dispense twelve feedings for each day. The user does not have to worry since the product can provide feedings for three weeks or more, and it is also equipped with a dispenser that can help to keep the pellet to remain dry and easy to dispense.

The product is reliable on the sense that it can use batteries or direct power as a source. However it becomes disadvantageous as the batteries are not easily accessible when they are already plugged in. The design of this product is relatively simple, as shown in Figure 2.3 [6], but the product does have a lot of moving parts, so there's a greater chance that some part will break down. It is also very expensive.

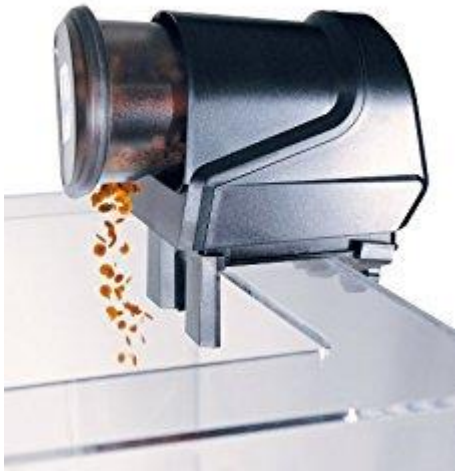

Figure 2.3: IntelliFeed Fish Feeder [6]

2.3.3 Hydoor Automatic Fish Feeder [7]

Figure 2.4 [7] illustrates the Hydoor automatic fish feeder. Similar to the previously mentioned products, this feeder able to maintain the pellet in a dry environment. The feeding system of this product is adjustable from one to three times a day and it is user-dependent.

This product use power efficiently, where it can last effectively long, up until nine to ten months with three feeding times per day. It is also equipped with the low battery indicator feature to alert the user. The only drawback observed is the product it is not easy to set up, as the user only have limited options when you mount it. The programming for this product is not flexible, as the feeding scheduling has already been embedded in the system. The small pellet container provided is also another issue.

Figure 2.4: Hydoor Automatic Fish Feeder [7]

2.3.4 Meco Aquarium Automatic Fish Food Tank Feeder [6]

Figures 2.5 [6] illustrates the Meco aquarium automatic fish food tank feeder. The product feature is easy to operate and cheap, which makes it the most popular product for all levels of users. It provides food compartment that is sufficient for two to three weeks of feeding, and can feed fish up to 4 times per day. The food amount is also can be modified by the user.

This product is sourced by 2 AA batteries, bearing in mind that it won't operate normally with rechargeable ones.

Figure 2.5: Meco Aquarium Fish Food Tank Feeder [6]

2.3.5 Rusee Daily Automatic Fish Feeder [6]

The Rusee daily automatic fish feeder, as shown in Figure 2.6 [6], is a battery-operated fish feeder. The battery mounts on the rim of the aquarium. The system that been used in this product is quite simple where, as the motor start to rotate, the food will fall from the bin. The timing system for feeding also easily setup, like setting a clock. The others advantage that this product come are the ruse automatic feeder can dispense a variety of feeds including flakes, granules, crumbles and pellet up to about 5/16'.

This product is sourced of battery, and its make the timer runs slowly down as the battery runs down.

Figure 2.6: Rusee Daily Automatic Fish Feeder [6]

Table 2.1: Summary of all the products

Product	**Advantages**	**Disadvantages**
EHEIM Everyday Fish Feeder	• Reliable • Easy to set up and use • Reasonable price despite the quality • Lots of convenient features	• No off button
IntelliFeed Fish Feeder	• Reliable • Can feed lots of fish • Effective against moisture	• Very expensive • Not easy to access the batteries
Hydoor Automatic Fish Feeder	• Extremely reliable • Can work for a very long time with the batteries	• Not easy to set up • Louse programming options
Meco Aquarium Automatic Fish Food Tank Feeder	• Quite affordable	• Not intuitive • Small food container

Rusee Daily Automatic Fish Feeder	• Inexpensive • Battery-powered in case of power outage • Dispenses a variety of foods • Feeds multiple times a day	• Exact food dosing is not possible • Cannot feed different foods on different days like more advanced feeders. • Timer slows down as battery runs down.

Overall, all the product was friendly user. The listed product easier to setup and use. Most of product in the Table 2.1 are at average affordable price. Others than that, the container that have been equipped feature that can prevent from moisture. Even though all the product have come with a lot of good feature, the power supply always become the disadvantage for the product.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will distribute into several parts. The first part, project layout will discuss about project flow with attached the flow chart of the project. Second part, the use of components for both hardware and software will be explained in detail. The third part, will involve with the fabrication process. The last part briefing the assembly process for this project.

3.2 Project Layout

Every product need to have plan first before it can be made, and it's the same for this project. Several stages have been prepared in order to implement this project. Starting with research development, the concept for the project can be generated. The electronic flow system, mechanical flow system, software flow system, assembly part and testing part will be conducted to gain the data. The collected data will be examined as to achieve the objectives of the project.

At the earlier stages, the concept design on how to feed the fish, followed by the appropriate amount of pallets and at a predetermined time is studied. The warning system to alert the user about inadequacy pellets is studied as well for this stage.

The best concept design for the feeding system is chosen based on the research that have been done. The next stage is to design the flow of electronics, mechanical and software system. Starting with electronic part, the circuit for the system need to be designed and real time clock (RTC), servo motor, push-button, and LCD display is required by this system. The circuit will be tested on the breadboard, and meanwhile the circuit also will be run simulation to check the voltage and current flow. Troubleshooting will be carried out after any problems identified.

In mechanical part, the sketched idea for design of automatic fish feeder need to be displayed in real form, and an AutoCAD software has been chosen to implement the design. The design of the system was included with the scale and shape. Next, the process continues with finding the suitable material with the design. The fabrication process will be conducted after the suitable material has been selected.

The software part is a part to program the system that will serve to meet the objectives specified by using C-programming. Then, various type of command will be used to complete the tasks related to feeding system as *forloop()* to create delay, *if()* and *else()* to control time feeding and so on. The last part for this process is to run the test by compiling all the coding using Arduino Uno microcontroller.

Lastly, all the part will be assembled together for both electronic part and mechanical part. After that, the observation will be started once the system operate. The feeding time, rotation of servo motor, and the amount of pellet will be monitored. If the collected data is unsatisfactory, the process will be repeated again until satisfaction is achieved.

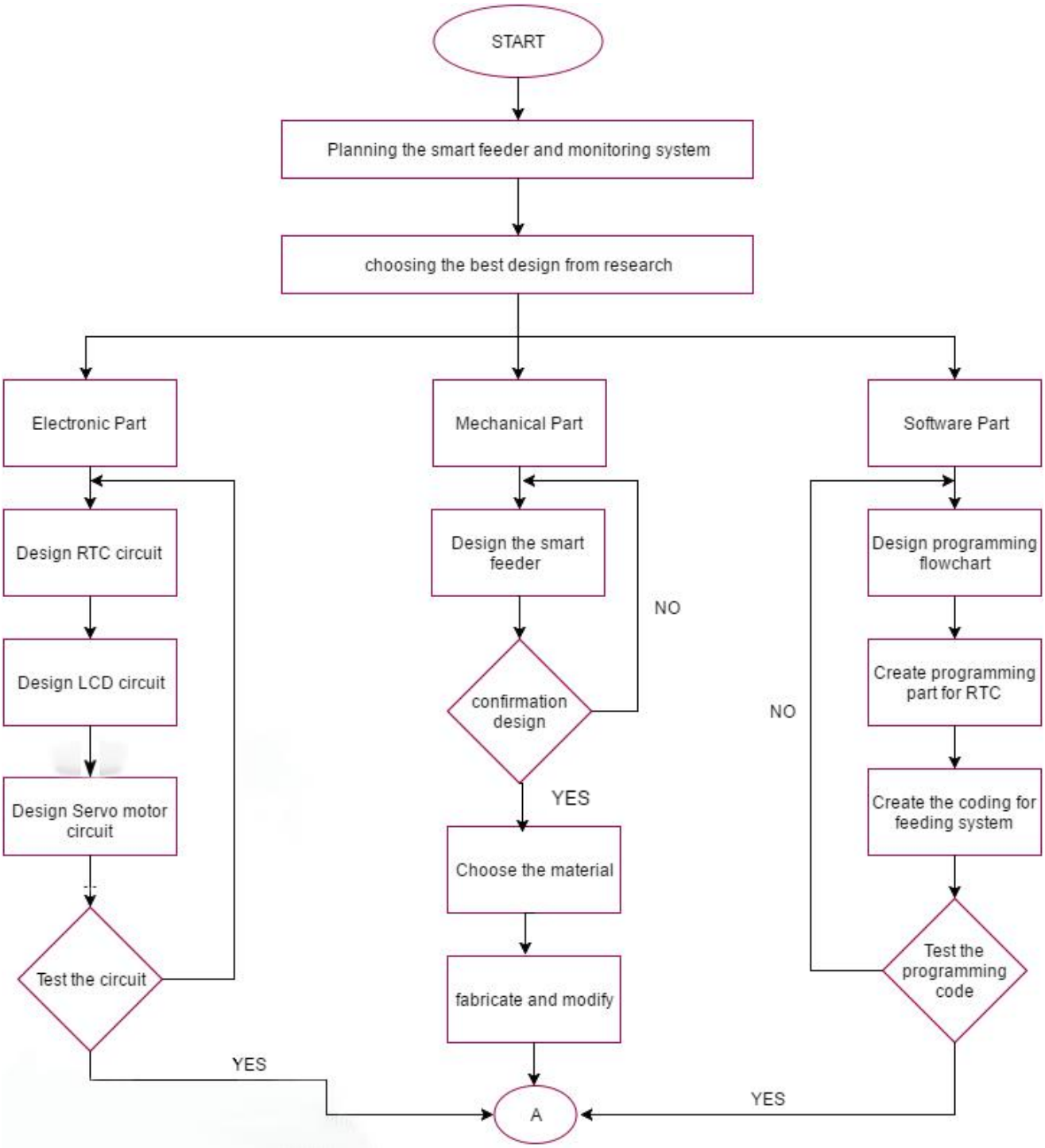

Figure 3.1: Implementation flow chart

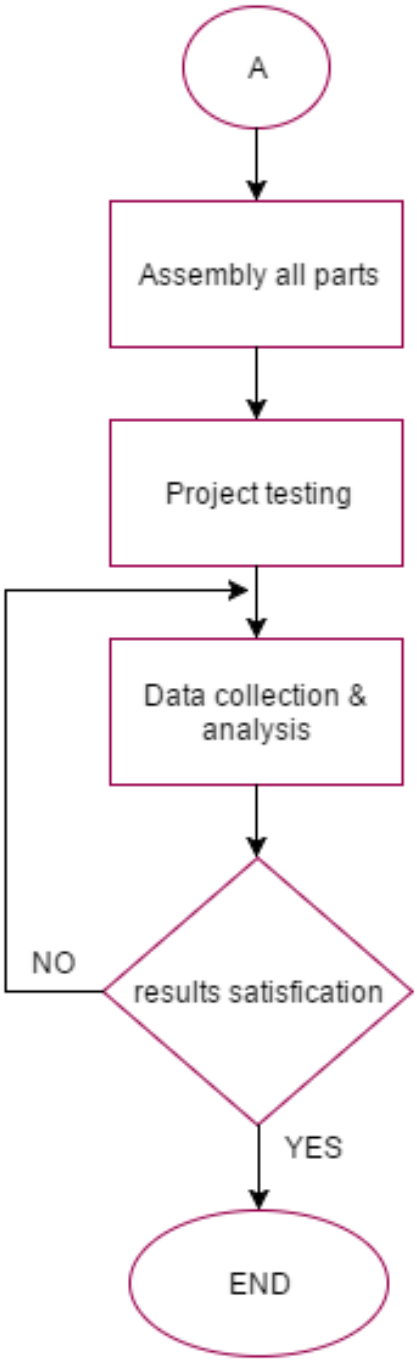

Figure 3.1: Implementation flow chart(continue)

3.3 Concept and Mechanism

The concept plays an important role in the development of new products. The mechanism come after the own concept have been set. The basic concept to create new design after number of studies that have been conducted. The mechanism concept that have been highlighted in this project are the food tank and the feeding system.

3.3.1 Mechanism of Food Tank

The first part of mechanism is to decide the mechanism for the automatic fish feeder. For this project, the concept was made by grommet hole (Figure 3.2). The grommet hole have two layer and for both layer equipped with hole. When the upper layer rotate, the hole will be closed and it block any material to pass through the hole. Thus based on this concept, the grommet hole will act as a servo motor. The servo motor will rotate one of the layer to play a role as opening and closing the hole. The food will be dropped when the hole in open, and will keep the food in the container during the closed state. The figure below shown at the open hole (Figure 3.3) and closed hole (Figure 3.4) conditions.

Figure 3.2: Grommet hole

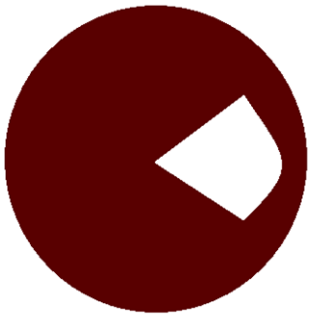

Figure 3.3: Open hole condition

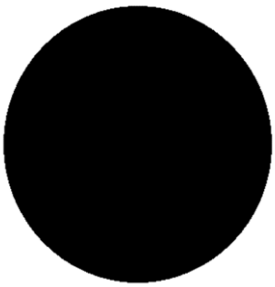

Figure 3.4: Closed hole condition

3.3.2 Arduino Uno Microcontroller

Arduino Uno is a microcontroller board (Figure 3.5). It is equipped with 14 digital input/output pins, among them are 6 pins can be used for PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button is equipped as well. Table 3.1 shown the input and output pin usage on the Arduino board.

This microcontroller also equipped with USB connector for easier to connect with computer. It also can be used USB cable or power it with an AC-to-DC adapter or battery to get started.

The Arduino UNO also equipped with Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter, makes it differs from all previous boards that features with FTDI USB-to-serial driver chip. The USB connection can be powered up the Arduino UNO as external power supply. Each of the 14 pins on Arduino can receive up to a maximum of 40 mA, which can operate in a low power supply.

The languages that been used for Arduino are C++ language, which the language is less complex than others PIC microcontroller. The features with 14 input/output pins makes the Arduino are the most suitable microcontroller to be used in this project. The Arduino Uno also equipped with EEPROM/memory to save and can operate at any place that is desired.

Table 3.1: List of number of input used

Component	**Input**
I2C Arduino LCD Display 20x4 Module	2
Push Button	4
Servo Motor	2
Real Time Clock	3
Micro Switch	1
LED	2

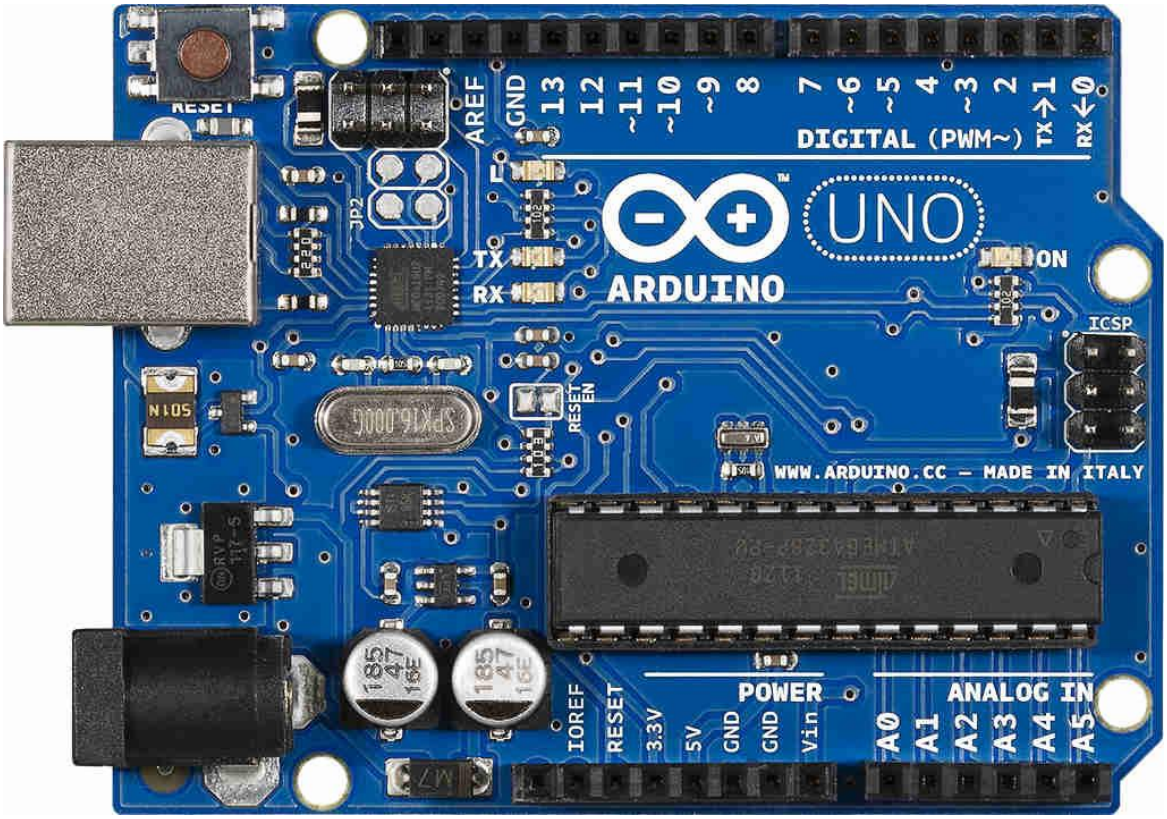

Figure 3.5: Arduino UNO microcontroller board

3.4 Mechanical Components

3.4.1 Feeder System

Hardware component that used in this project, automatic fish feeder, are Perspex and Corrugated Plastic Sheets.

Perspex

Perspex also known as acrylic glass. For this project, Perspex used to make the food tank. This is because the characteristics of the Perspex; transparent view, easy to handle and low in cost compare to wood and steel. It features also make it easy to cut and assembly into

different shape. This Perspex has UV-resistant and able to hold up against heat up to 150 C temperature. Perspex can reusable and become eco-friendly material. It can be recycled and does not give impact to the planet.

Corrugated Plastic Sheets

Corrugated plastic sheets are high impact twin-wall plastic sheets that are made from polypropylene copolymer. The corrugated plastic sheets are stronger than corrugated cardboard, and if want to compare with cardboard, corrugated plastic sheets can be left out in rain better than cardboard. Also, corrugated plastic sheets are being used many different industries for varied applications, such as, Agriculture, Automotive application, Packaging, and Signage and Graphic arts. Due to its design versatility, durability, waterproof feature, and recyclability, corrugated plastic sheets make into wonderful component for this project. The corrugated plastic sheets that used for this project is shown in Figure 3. below.

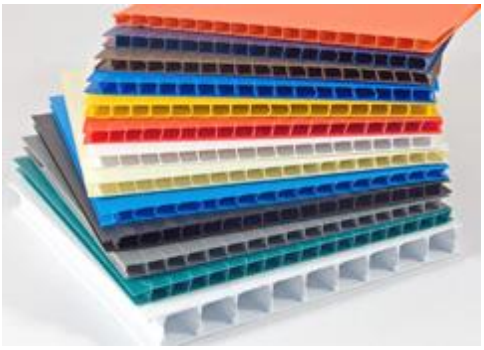

Figure 3.6: Corrugated plastic sheets used on the project.

3.5 Electrical and Electronic Components

There are several types of components which used in this project such as real time clock (RTC), push-button, servo motor, and I2C Arduino LCD display module

Real Time Clock (RTC)

Real Time Clock module is component that allows microcontroller to keep track of time even if it is reprogrammed or if the power is lost. The RTC equipped with backup coin cell which it enough to support IC since it has low power consumption, and the battery life support about 9 years of usage. There are four pins that important on RTC, which are 5V pin, GND pin, SDA pin and SCL pin. 5V pin need to be connected to power supply, at the same time, GND pin need to be connected to the ground from Arduino. However, SDA pin and SCL pin which need to connect to the analog pin on Arduino. RTC required DS1307 library to set and program it in the microcontroller. RTC that used in this project is shown in Figure 3.7.

Figure 3.7: Real Time Clock (RTC) that used as timer

Servo Motor

For this project, servo motor (Figure 3.8) is used to control the movement of the opening and closing of the disk. Servo motor used were type C is the best choice for this project because it capability to holding the weight of pellet.

Figure 3.8: Servo motor is used to control opening and closing the lid.

Push Button

Next is push-button component. Push-button is a simple or easy switch mechanism for controlling some process. The flat or shaped surface design on push-button make it easily depressed or pushed. There are different terms for the “pushing” of the button, where it depend on the user, such as press, depress, mash, hit and punch. On this project, push-button is used as press button to move up and down, and also to enter and exit menu. Push-button that used in the project is shown in Figure 3.9.