MECHANICAL SYSTEM OF IOT-BASED AUTOMATIC AQUARIUM

MUHAMMAD NASRI BIN AHMAD NAZUKI@MARZUKI

BACHELOR OF ENGINEERING TECHNOLOGY (ELECTRICAL) HONS

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ID Number : TB17100

Date : 10 FEBRUARY 2020

MECHANICAL SYSTEM OF IOT-BASED AUTOMATIC AQUARIUM

MUHAMMAD NASRI BIN AHMAD NAZUKI@MARZUKI

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ABSTRAK

Pada masa kini penyimpanan ikan menjadi ikutan. Orang dari semua peringkat umur suka menyimpan ikan untuk tujuan hiburan, hiasan atau sebagai hobi di rumah mereka, tempat kerja, pusat membeli-belah dan hotel. Terdapat banyak jenis ikan yang digunakan untuk menjaga ikan seperti marin, tropika air tawar, air sejuk dan kurungan. Bergantung kepada jenis ikan yang perlu diputuskan dengan jenis air yang perlu digunakan. Tetapi penyimpanan ikan perlu mengambil tindakan serius untuk dikekalkan paras air, air perlu diubah, ikan perlu diberi makan, suhu mesti berada dalam keadaan optimum dan paras air akuarium harus sentiasa mencukupi. Dalam projek ini, akuarium pintar dengan internet perkara (IOT)aplikasi telah direka untuk menjadikan kehidupan lebih mudah dan fancier untuk memantau akuarium. Akuarium ini terdiri daripada pam air automatik yang telah digabungkan dengan penapis untuk mengurangkan dan kekeruhan di dalam air. Untuk mengawal kekeruhan, kuasa air sensor tahap hidrogen digunakan untuk projek ini Apabila akal paras air kurang atau lebih daripada 7 akan memberitahu pengguna daripada aplikasi. Sebagai tambahan , projek ini juga telah direka tangki dengan penunjuk yang memberitahu pengguna apabila tangki kosong. Seterusnya, lampu automatik dan sensor suhu ditambah kepada projek ini untuk menyokong pertumbuhan ikan dan tingkah laku ikan. Semua ciri ini akan dikawal oleh aplikasi melalui telefon bimbit.

ABSTRACT

Nowadays fish-keeping is become trending. People from all ages like to keep fish for entertainment purposes, decorative or as a hobby in their homes, workplaces, mall, and hotels. There are many types of fish used for fish keeping such as marine, fresh water tropical, cold water and brackis. Depends with what kind of fish to decide with type of water need to use. But fish keeping need to take it serious action to maintained the water level, water needs to be changed, the fish needs to be fed, the temperature must be in optimum condition and water level of the aquarium should always be enough. In this project, smart aquarium with internet of things (IOT)application has been design to make life easier and fancier to monitor the aquarium. This aquarium consist the automatic water pump that already combined with filter to reduce and turbidity in the water. To control turbidity, water power of hydrogen level sensor is applied to this project. When water level sense less or more than 7 will notify user in from an applications. In addition, this project also has been designed feeder tank with indicator that notify user when the tank is empty. Next, automatic lamp and temperature sensor is added to this project to support fish growth and fish behavior. All of this features will control by application through a cell phone.

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LIST OF SYMBOLS

A	Ampere
°C	Degree Celsius
Ω	Ohm
V	Voltage

LIST OF ABBREVIATIONS

IoT	Internet of Things
pH	Potential hydrogen
DC	Direct Current
AC	Alternate Current
VB	Visual Basic
GPRS	General Packet Radio Service
PV	Photovalve
LED	Light-Emitting-Diode
RC	Radio Page
dB	Decibel
DSP	Digital Signal Processing
ARM	Acan RISC Machine

CHAPTER 1

INTRODUCTION

1.1 Project Background

In fact, the iot-based automatic aquarium is an aquarium tank that has been applied with a few technologies that could help humans reduce human power to monitor fish and their needs, such as water level, adequate temperature, lower turbidity level, sufficient food and oxygen using a smartphone application. In the mechanical system that focus on water motor pump ,LED and food feeder. For regulating water pumps maintain the optimal amount of water in fish tanks with efficient energy usage by sufficient water consumption. Pumping flow rate selection and filling level of tanks. This automatic monitoring by the use of electrical switches .The aquarium is used for fish keeping purposes for hobby and for indoor and outdoor decoration. The aquarium monitoring system was then introduced to ensure proper maintenance of the aquarium. In addition, users can monitor and control their aquariums and fishes, at any time and from anywhere through the internet, with the aid of IoT devices such as the aquarium monitoring system.

The Internet of Things (IoT) is a distributed information and communication technology (ICT) system that incorporates sensors, computer devices, algorithms, and physical objects. Without any human interaction, the products still have the ability to collect and transmit data over linked networks, thereby providing automated data processing capabilities. A communication network is one of the main components of an IOT system that enables a large number of sensors, actuators, computers, controllers and data storage to flow information through (Jamil Y.Khan).The mechanical system will react to the data transmitted from the sensor and operate as per task for the maintenance.

1.2 Problem Statement

In preserving the vitality and health of fishes along with the appearance of the aquarium, aquarium care takers face many issues. Any of the challenges are the challenge of changing water and where the nitrites and waste products from the fish deposited in the water need to be filtered to prevent a high degree of turbidity.

They also face trouble maintaining the water strength of the aquarium's hydrogen level and temperature. This ability for the level of hydrogen water and the level of temperature in the aquarium can have an impact on fish growth and health.

Apart from that, feeding the fishes with timetable is a common problem facing fish keepers. User neglect can lead to an inappropriate feeding schedule which can also affect the growth of fish which can lead to death from starvation.

1.3 Objectives

This project served to accomplish the following objectives:

I. To develop monitoring system to monitor water quality of the aquarium such as potential hydrogen (pH) level, water turbidity level, water temperature and food tank level.
II. To develop an automation system to maintain the food supply, filtration process and water level of the aquarium.
III. To develop user-friendly web and displaying to an application to monitor water quality sysem.

1.4 Project Scope

The main objective of this project is to design a mechanism or network capable of monitoring water quality, such as its pH, turbidity and aquarium automation system based on an internet application, by means of a notification to alert the user. In addition, the device must be simple to set up effectively based on the specifications required by the consumer, compact and user-friendly. Several initiatives have been introduced for this project in order to counter the problems listed above.:

1. The system's range is restricted to medium-sized aquariums, along with 180-gallon aquariums with fish.

2. The boundary of the area used only within a certain range of the home or that has good and reliable internet coverage, as the device allows the user to be updated via the internet on the status of the aquarium.

1.5 Thesis Outline

In addition to this chapter, it also includes the following chapters. Chapter 2 provides a literature review on the introduction the design and development the motor water pump with filters.

Chapter 3 introduces the recommended methods that are used to create details of the flowchart study on how to performance motor water pump with filter , LED and food feeder. This chapter will also briefly explain mechanical system of water pump and design of aquarium.

The important content of the thesis is results will covered in chapter 4 in the order to get a general idea of working prototype and testing result. That will show the strength and the limitation of the product developed. So that, future work can propose to improve the quality of the product in the ecosystem of the innovation technology world to maximize human potential for societal good.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter purpose to discuss the research previously done by others in the fields of sorting systems and the control of such systems. The valuable information and idea are essential to decide the best application for the design and development the motor water pump with filters.

2.2 Existing Project

Based on the research that has been done, there are several similar products related to this current project. One of the projects known as “Automatic Arowana Raiser Controller Using Mobile Application Based on Android” by (Norliani Hidayah Ritonga, Agung Nugroho Jati and Rifki Wijaya). After observing, analyzing and reviewing their project, there are some improvement and weakness need to improvise on her project.

In this project, Raspberry pi was used as primary microcontroller which is always online and it is connected to sensors such as ultrasonic sensor, temperature sensor and some mechanical part such as actuator like servo motor to feed, light for aquarium and water pump the system. This system commonly called as AURORA SYSTEM. The mechanism of this system work as the measure data of different sensors will be sending to raspberry pi and uploaded to the cloud. Then, the android based end devices can access the data and take the appropriate actions based on the requirement or the criteria develop by the user. The strength of this project is the implementation of Internet of things (IoT) concept. Android application is used to monitor and control the sensors and actuator that are connected to the microcontroller through the cloud services. This helps the user to access the information about their aquarium and control them from anywhere in the world through internet platform easily.

However, The weakness of this project is although they have sensors to examine their aquarium condition and android application to monitor and control their aquarium's actuator, the system still need human's interference to control the servo motor for feeding, to switch on or off the light for aquarium and to change water pump for the aquarium. The system does not have the ability to make own appropriate decision based on the sensors value of the aquarium. For example, the system should feed the fish on time or change the water of aquarium when the water turns cloudy without human interferences. This feature is very important because if the user went for long holiday away from their house, it's not practical that the user have to monitor and feed the fish all the time because human tend to forget.

Besides, another project that related to this system is "A Multi-functional Aquarium Equipped with Automated Thermal Control/Fodder-Feeding/water Treatment using a Network Remote Control System" develop by (Min-Chie Chiu, 2010). After analyzing on their product, found that they have a few strength and weakness on their product.

In the product, all the sensors are managed by PC (Personal Computer) which is used as main controller. The sensors were connected to the PC controlling system via different module. The module is the ADC (Analogue to Digital) which convert the analogue signal from the sensors to digital signal so that the PC can read and classify the values. Then, via the VB interface, the client PC can communicate with server-PC to monitor and control the aquarium based on the data from sensors. The strength of the product is the used of PC as the controlling system. PC has high processing power and it can manipulate or exploit the data obtained from the sensors via modules faster compared to microcontroller which has limited processing power.

However, there are some weaknesses exist in this product. First of all, is the portability of the product. The used of PC as center part of system make it difficult to move the product from one place to another. Other than that, the product consists of a PC as center of the system which control and managed the whole system which is expensive to allocate a whole PC just to manage the aquarium system.

2.2.1 Comparison of Existing Project

Table 1: Comparison of Existing Project

No	Title	Strength	Weakness
1	"The Design and Development of Automatic Fish Feeder System using PIC microcontroller" By (M. Z. H. Noor,A. K. Hussian, M. F. Saaid, M.S. A. M. Ali, M. Zolkapli,2012).	- Dispense the pellets by rotational motor into the target region. - Control engine speed using resistance strung. - -Shift pace by duty-cycle shift	- The user cannot change the DC motor because the microcontroller has no internet connection
2	"Automatic Arowana Raiser Controller Using Mobile Application Based on Android" by (Nurliani Hidayah Ritonga; Agung Nugroho Jati; Rifki Wijaya 2016).	-Concept Implementing the Internet of Things (IoT). -The Android application allows monitoring and control -Using cloud services to	- The machine also needs human control to regulate and feed water pumps - It is not practical to monitor the aquarium.

		connect microcontroller.	
3	"Smart Water Quality Monitoring System" by (A.N.Prasad, K. A. Mamun, F. R. Islam, H. Haqva, 2015).	-Product complexity. -Use of the internet as principal devices.	-High cost -High maintenance
4	"An Embedded Fuzzy Decision System for Aquaculture" develops by (Taotao Xu; Feng Chen, 2014).	- System that can make appropriate decision. - System able to monitor them and take an appropriate action for the changes.	-Only the result of the decision-making is sent to the aquaculture farmers via GPRS or messages -Not able to see the sensor value on real time
5	"A Multi-functional Aquarium Equipped with Automated Thermal Control/Fodder-Feeding/water Treatment using a Network Remote Control System" develop by (Min-Chie Chiu, 2010).	- PC as the controlling system. - it can manipulate or exploit the data obtained from the sensors	- Portability of the product. - Expensive

2.3 Actuators

The actuators can adjust and correct the following parameters (additional actuators may be connected, up to 10) .Aerator is a device that provide proper aeration in the aquarium to allow fishes to breath properly. It brings water and air in close contact to eliminate dissolved gases such as carbon dioxide.Heater keeps the water temperature at stable and desired level.Peristaltic Pump used for automatic pumping for different fluids. Water Filter extract excess food pellets, free-floating solids, hazardous chemicals, and the fish's excrements from the water.((1Ahmad Kamal Pasha Mohd Daud, 2020)

A need has been identified for a simply constructed, photovoltaic-powered, water pump to improve the water supply in rural areas of developing countries. The use of a linear actuator to provide the lifting force was investigated as part of a way to meet this need. Substantial challenge was presented in optimizing the system to suit the power characteristic of a photovoltaic panel and the hydraulic requirements of the application. An iterative process combining finite element analysis and analytic expressions was devised to allow comparisons to be made between many geometrical and electrical configurations of the linear actuator. Model predictions achieved close comparison with measured results from an existing water pump. The modelling technique was used to generate an actuator design that will utilize the available power more efficiently in a next generation pumping device. (N.S.WadeaT.D.Shortb, 2012)

A typical diagram-configuration photovoltaic (PV) water pumping system consists of a d.c. permanent magnet motor driving a diaphragm pump via a cam. The typical efficiency is low and the lifespan short. The use of a linear d.c. motor or actuator as the drive is suggested. A higher efficiency and life expectancy could be achieved. The aims of this project were to measure the pump, evaluate possible electromagnetic configurations with a finite-element analysis (FEA) package and to evaluate different electromechanical options. The results obtained for these criteria will be discussed concluding with a choice of the best topology. (Merwe, 1995)

2.4 Control Pump

Aquaponics System using Solar Powered Control Pump, which consists of solar panel which generates solar energy that is used to control the water pump and air pump based on peripheral interface control technology. It also involves a combination of the electrical, electronics and agricultural aspects into one system which consists of the water pump, air pump, inverter and solar panel. Solar panel will produce electricity. In this microcontroller is also used to control the operation of the aquaponic system for switching on/off water pump, battery charge and the discharge.((Analene Montesines Nagayo, 2017) (Ihsan1)*, 2020).

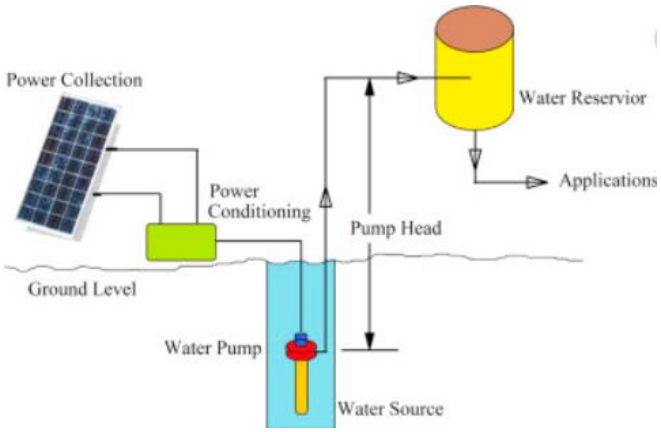

Figure 1: Aquaponics System (M.Elamind, 2018)

Furthermore, the research with the title "the design of an automatic water pump on an Arduino Uno-based fishing boat for a case study on the island of Terong, sub-district behind Padang, Batam City" (Sahidul Lukman, Rozeff Pramana, ST., 2017)This tool performs the process of removing water on the boat using an ultrasonic sensor, and can last for 2.4 hours and can pump water in a boat of 37 liters / minute.

Furthermore, there are also several studies that use technology using control using Arduino such as monitoring and stimulating heart rate (Ilham, Hardisal, Balkhaya, Candra, & Sipahutar, 2019). Control lights with social media notifications (Candra, Ilham, Hardisal, & Sriwahyuni, 2019). Automatic paddy gate controller (Dharma, Tansa,

& Nasibu, 2019). Automatic water machine control by utilizing Arduino with a smartphone (Lubis et al., 2019).

Table 2 : Hardware Specification

No	Name	Function
1	Arduino Uno R3	Controller in the design of the infusion warning device
2	Boat	As a place to test the tools made
3	Water Pump	Serves as a water drain to be thrown out
4	Water Sensor	Detect water entering the boat
5	Buzzer	Buzzer circuit or what is often called a series of alarm message reminders and alerts
6	Jumper	Connect the whole tool.
7	Battery	As energy from the tools used

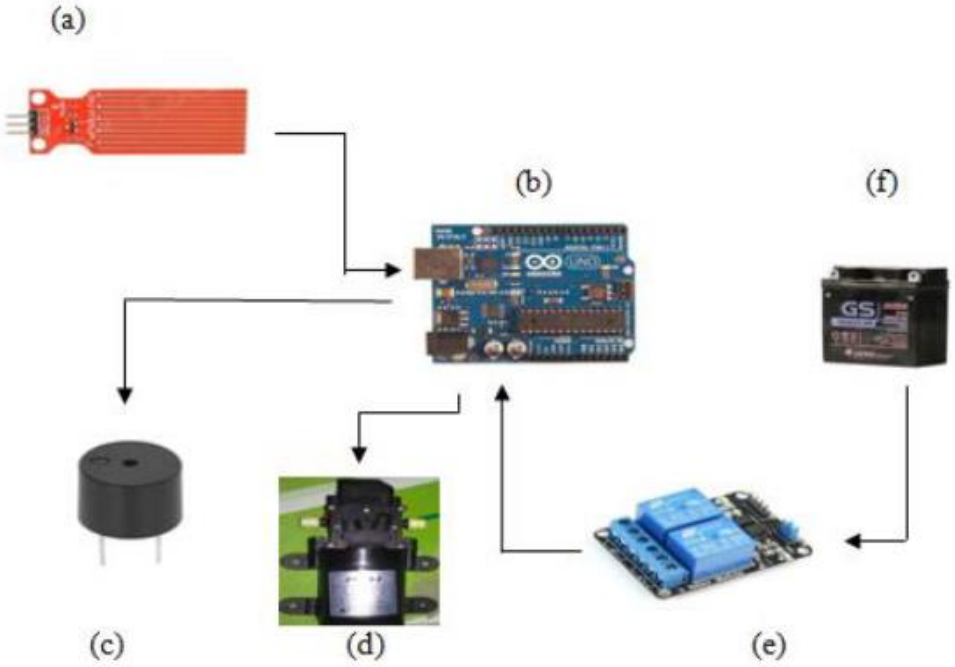

Figure 2.: System Hardware Installation (Ihsan1)*, 2020)

Figure 3: Whole tool suite (Ihsan1)*, 2020)

2.5 DC MOTOR

DC motors are very similar to DC generators. In fact, DC generators can be operated as DC motors by simply connecting a supply of rated DC voltage to the output terminal. In a similar fashion, a DC motor can be operated as a DC generator by simply connecting a prime mover to the shaft and a load to the DC terminals. DC motors offer some of the highest torque to horsepower ratios of all motors.

Instead of connecting the armature to a load, however, the armature is connected to a DC voltage supply. Armature and field flux are created with such a relationship that the armature rotates. The DC motor also uses a commutator. As the armature rotates, the brushes are connected, alternately, to each side of the armature loop

Table 3: Dual-redundancy brushless DC motor

Parameters	Value
Rated voltage	270 V
Rated speed	10 000 r/min
External diameter	60 mm
Internal diameter	30 mm
Slot number	12/24

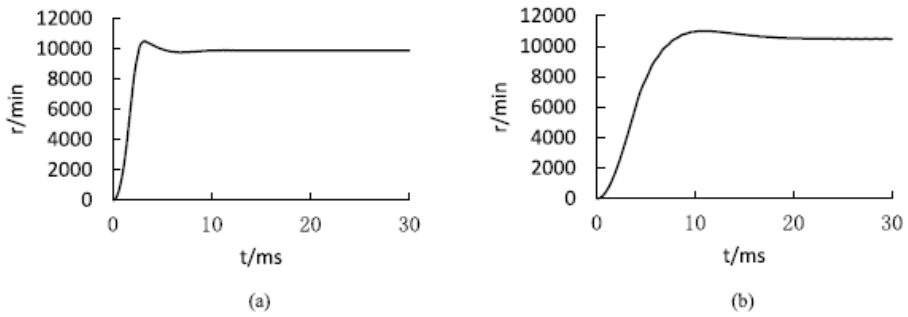

Figure 4: Simulation of motor speed r/min. (Zhaoyang Fu∗, 2020)

2.6 Filter

Filtration systems are primarily internal or external to the aquarium. Internal filters sit inside the tank whereas external filters sit underneath the tank in a cabinet, hang on the back of the tank, or can be built into the hood above the waterline. External filters are designed with a hermetically closed container connected to the aquarium by intake and exit pipes. They can be placed near the tank or under it, and usually are employed for

bigger aquariums since they have stronger pumps. If filtration is the heart of an aquarium, then biological is the heart of your filtration system.

Especially in a marine aquarium must have a biological filter in addition to one of the other two types. An average filter does not have enough biological support to process saltwater .The capacity of a biological filter is determined by the available surface area for bacterial growth and the oxygen content of the water passing over them. Toxic ammonia, which is produced by natural plant decay, fish waste, and uneaten food, is removed by nitrifying bacteria in the biological process. (Jim C. Chu, 2016)

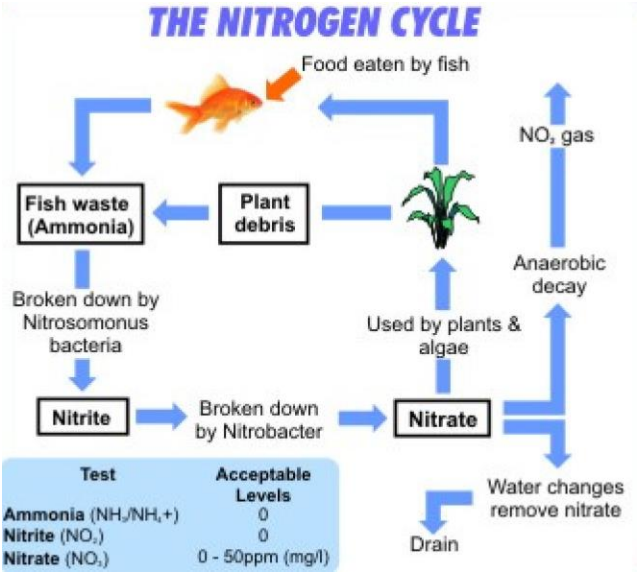

Figure 5: The Nitrogen Cycle (Jim C. Chu, 2016)

2.6.1 Undergravel Filters

Underground filters are the classic filters of the past. It is designed to sit in the base of the aquarium, between the glass/acrylic and substrate, such as gravel. Collecting bacteria that live on the gravel, the water is filtered as it passes over the gravel and up the lift tubes.

Figure 6 : Undergravel Filter

2.6.2 Hang-on Power Filters

There are a few modern hang-on power filters that have enough biological support to process saltwater, along with mechanical and chemical support. This design incorporates biological wheels or grids for the added biological filtration. These units also include the pump necessary to draw the water into the filter and are completely selfcontained. The aquarium water is pulled into the filter using a u-tube and flows through a cartridge or other type of filter material. Most models require filter cartridges, usually containing activated carbon, which are designed for the specific model of filter.

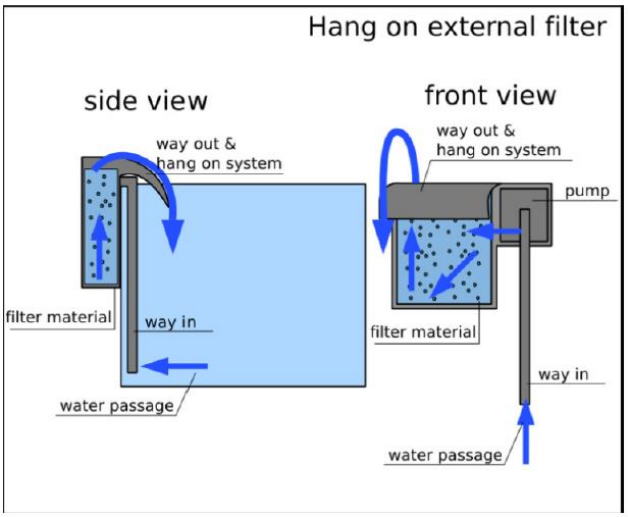

Figure 7 : Hand on Power Filters

2.6.3 Canister Filters

Canister filters are pressurized units that perform all three types filtration. Available in two types either a complete unit that includes its own pump, or in a modular form that requires an additional pump. The modular units are useful when combined with other types of filtration, such as a wet/dry filter (discussed below). The complete units use a utube as the water intake and typically a spray bar for the water return. The water entering the filter will first pass through a mechanical media such as floss and will then be forced through the chemical media such as carbon. After the chemical filtration is complete, the water then enters the last chamber containing the biological media where

Figure 8: Canister Filters

2.7 Conclusion

In the conclusion, this section reason to talk about the examination recently done by others in the fields of arranging frameworks and the control of such frameworks. The important data and thought are fundamental to choose the best application for the plan and improvement the engine water pump with channels.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter is focusing chosen methods have been considered in every aspect to ensure a satisfying result of the performance motor water pump with filter , LED and food feeder. This project begins by developing the project workflow and conducting a literature review of the project can be completed on time, the scheduling must be carried out and must also serve as a guideline for the work schedule of the project.

3.2 Automation System

The proposed mechanical system is include with Led , motor pump with filter and 4 Channel relay. A humming pump creates pneumatic force along a cylinder and is either connected to the admission base or back segment of the channel. In the event that the pump is appended to the return hose, the water is conveyed into the channel utilizing a wipe. When the pump is connected to the admission hose, the water is gotten back with gravity. In this project, two water pump in used in order to pump in and pump out water from the aquarium.

One pump will be placed inside the aquarium to pump out the water, and another pump will be placed at the new water source and its pipe will be placed into the aquarium to pump in water to aquarium.A programmed fish feeder is a strong speculation for any aquarium. It is an electrical or electronic device that is intended to apportion the precise measure of food into the aquarium at a specific time every day.For the Led, it will connect to relay and trigged if the temperature of water in aquarium is low. The medium temperature for gold fish is 20°C to 24°C. The Led can heat the water to become in standard temperature. The flowchart of the mechanical system is as displayed in

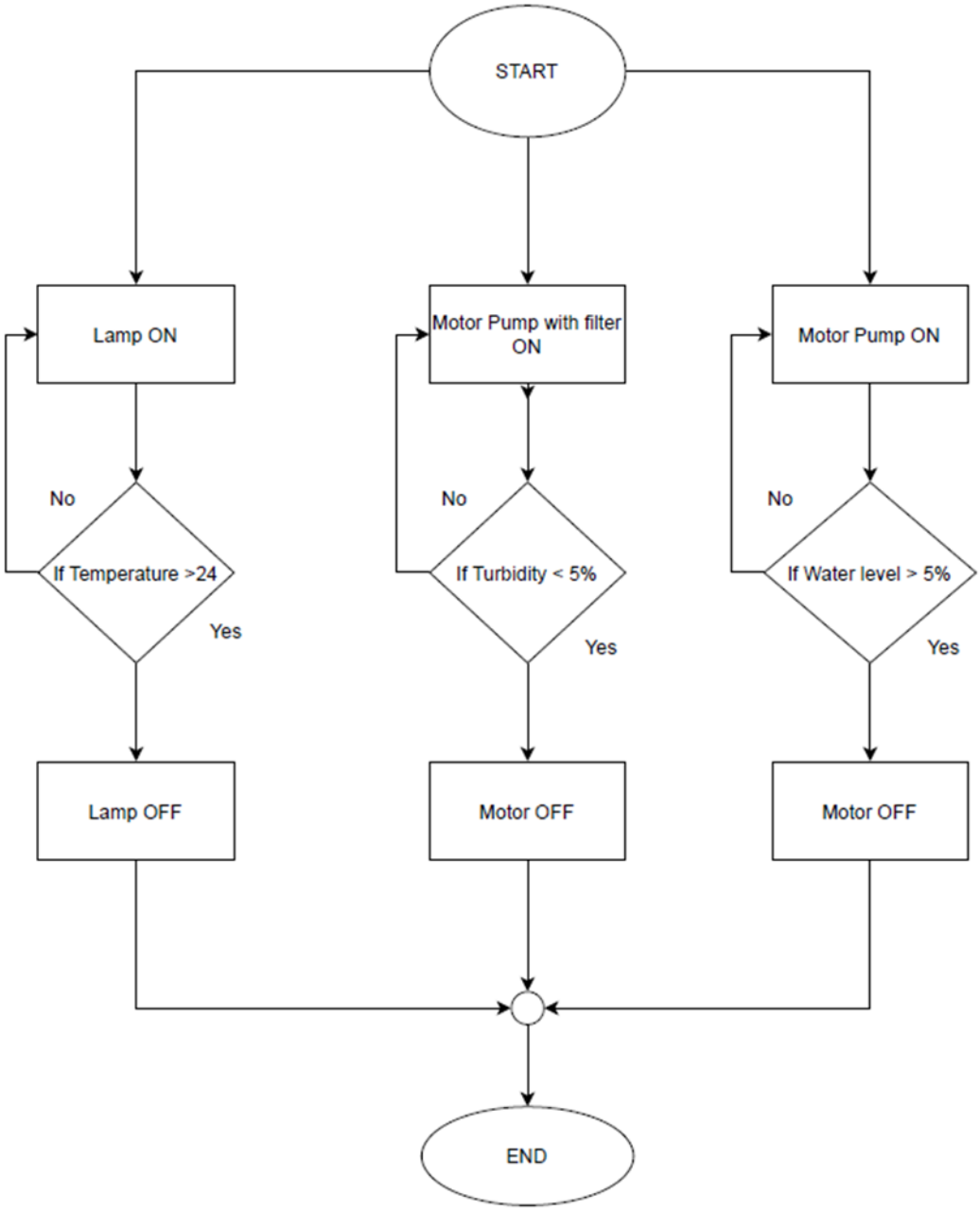

Figure 9 : Flowchart of Mechanical System

3.3 Material

3.3.1 Brushless Dc (Bldc) Motor Pump

For automation system part of this project, the BLDC will be used to control the water level. BLDC motor pump reduces audible noise and RFI problem which due to the total elimination of the brush/commutator assembly. Furthermore, BLDC motor many advantages such as produce high power factor, low cost maintenance, allow precise positioning and high efficiency. Figure 4.0 illustrate an example of BLDC motor that available in the market and store.

Figure 10: Brushless DC (BLDC) Motor pump

3.3.2 Waterproof Aquarium Lamp

Waterproof aquarium lamp will be used in this project as automation system part. Waterproof aquarium lamp is device or tools that produce artificial light that is used to illuminate an aquarium. Excessive and fewer amount light exposition and duration will affect the fish behaviour, health, stress level. Figure 9 shows an example of waterproof aquarium lamp that are available in market.

Figure 11: Waterproof Aquarium Lamp

3.3.3 4 Channel 5V Relay

4 Channel 5V relays can be use like switch which to control various appliances and equipment with large current output. It is equipped with high current relay that work under AC250 10A or DC30V 10A.It has standard interface that can be controlled directly by microcontroller. Figure 4.3 bellow shows an example of 4 Channel 5V relays that is available in the market.

Figure 12: 4 Channel 5V Relay

3.3.4 Step Down LM2596

This is LM2596 DC-DC step-down buck converter with high-precision potentiometer for adjusting output voltage, capable of driving a load up to 3A with high efficiency. When the output current required is greater than 2.5A(10W), an external heatsink (not included) is suggested.

Figure 13 : LM2596 DC-DC step-down

3.3.5 Ceramic Bio Ring Aquarium Fish Tank Filter

Essential for aquaponic/aquarium Bio rings provide more surface area for benificial bacteria to grow Porous surface area allowing far more beneficial bacteria to grow in a contained area Nitrification bacteria is part of the nitrogen cycle to break down toxic ammonia to nitrate and then toxic nitrate into relatively harmless nitrate.

Figure 14: Ceramic Bio Ring Aquarium Fish Tank Filter

3.3.6 Servo Motor SG90

This is a low-cost plastic gear RC servo with 1.80kg.cm holding torque at 4.8V. It is a perfect solution for student robotic projects who build arms or linkages.The advantage of RC servo over the DC brush motor is the ability to control its rotation angle.

Figure 15: Servo Motor SG90

3.4 Specification

3.4.1 3.5.1 Brushless Dc (Bldc) Motor Pump

The name of the Brushless DC (BLDC) Motor pump is DC12V3M240L/H Mini Magnetic Brushless Motor Water Pump Lift 300CM Water Proof and the specification are as follows:

- Pump material: ABS.
- Condition of use: continuously.
- Fluids: Water, oil, gasoline, acid and alkali solution.
- Working temperature: 0 ~ 60℃.
- Power consumption: 4.2W.
- Rated voltage: 12V DC.
- Max rated current: 350mA.
- Max flow rate: 4L/MIN (1.06G/MIN).
- Max Head (lift height): 3M.
- Noise: <40dB (most 35dB).
- Water proof class: IP68(can be submersible installed).
- Life span: More than 30000hrs.
- Power supply: Solar panel, DC electric source, batter

3.4.2 Waterproof Aquarium Lamp

The name of the Waterproof aquarium lamp is 21 LED Bar Light 12V DC SMD 5630 Interior Light Strip Bar Lamp Van Fish Tank and the specification are as follows:

- Voltage: 12V DC
- LED Style: SMD 5630
- LEDs quantity: 21 for each one
- Shell material: Full aluminium body with pc cover Light
- Colour: Cold White/ Warm White Shell
- Colour: Clear
- Total Length: 33.2cm
- LED Strip Light Length: 30cm
- The Distance Between Two Mounting Holes: 32.3cm
- Viewing Angle: 120 Degree

3.4.3 4 Channel 5V Relays

The name of the 4 Channel 5V relays is 4 CH Active H/L 5V Ray Module and the specification are as follows:

- 5V 4 channels relay module
- Configurable Activation Logic, High or Low, via mini jumper
- Maximum Current Rating: 10A
- Maximum Voltage Rating: AC 250V
- Can control various appliances with large current and high voltage
- Can be controlled directly by microcontroller such as Arduino, 8051,AVR, PIC, DSP and ARM
- Build in 4 units of Opto-Isolator for extra isolation and protection to controller.
- A power indicator LED, Green
- Each relay comes with an indicator LED

3.4.4 Step Down LM2596

Input: DC 4.5V to 35V, (input voltage must be higher than the output voltage to 1.5v).Output: DC 1.3V to 30V, voltage continuously adjustable (with potentiometer), high-efficiency maximum output current of 3A.Dimensions: 45 (L) * 20 (W) * 14 (H) mm.Compact size, and with positioning holes

- LED indicator
- Pins (no headers)
- IN+ input positive
- IN- input negative
- OUT+ output positive
- OUT- output negative

3.4.5 Ceramic Bio Ring Aquarium Fish Tank Filter

- infrared bacteria ball,
- no infrared bacteria house, g
- lass ceramic ring,
- nano white technology ring,
- infrared breathing ring,
- ceramic biosphere,
- hexagonal glass ceramic ring,
- medical stone, ammonia,
- volcanic rock activated carbon,
- biochemical ball

3.4.6 Servo Motor SG90

- Compatible with the Arduino Servo library.
- Plastics gears
- Operating Voltage: 4.8 - 5VDC
- Speed at 4.80V(no load): 0.12 s/60°Torque at 4.80V : 1.8 kg.cm (~0.1765 N.m)
- Rotation angle: 180 degree
- Size: 23.0 x12.2 x 29.0mm
- Weight: 9.0g

3.5 Design

From this part will show part design, components and product. It uses existing concept and component by add or combine the elements and components. The characteristics include dimensions, shape of component and material.

3.5.1 Proposed Design

This part show the design by hand sketch and dimension. The sketch for each element along with the material in Design the aquarium by using SolidWorks Software.

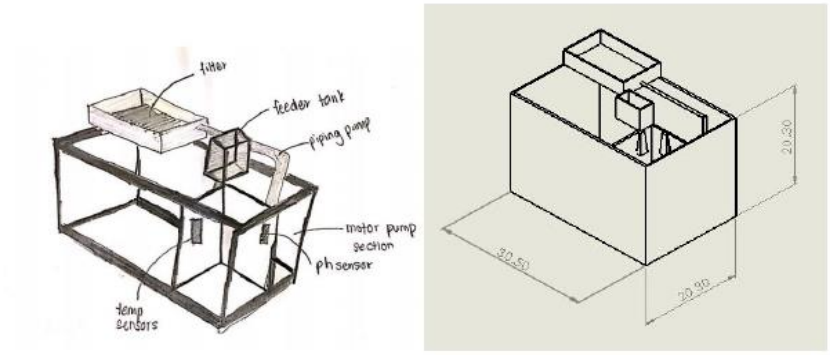

Figure 15: Hand Sketch and Dimesion Design

For this figure show , the overview design by using SolidWorks Software. This show the top view and side view the aquarium.

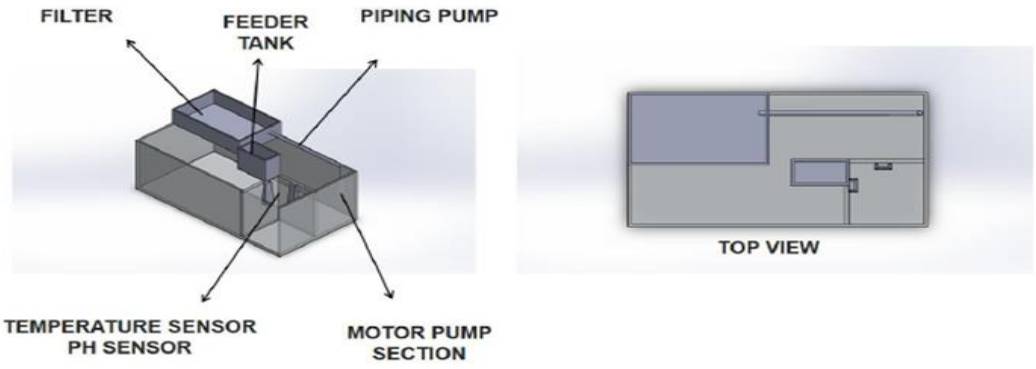

Figure 16: Overview Design

3.5.2 Actual Design

From this figure, it show the whole design of the product. The figure show the top view , front view and side view for the design.

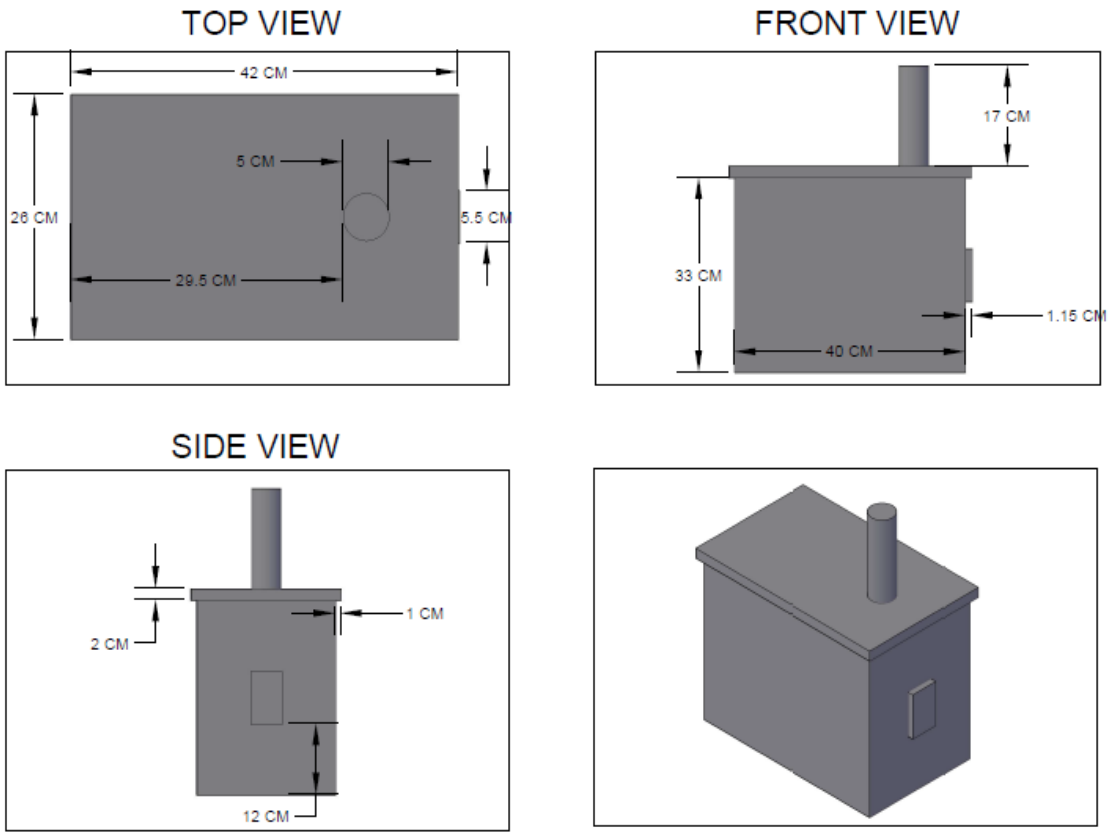

Figure 17: Actual Design

3.5.3 Developed Prototype

This figure about the early modeling a product constructed to test. This design of aquarium is necessary to validate the design by developing multiple prototypes.

Figure 16: Developed Prototype

3.6 Circuit Diagram

The real electrical connections are shown by a circuit diagram. A drawing is considered a design. The figure shows the whole components and interconnections of the circuit utilizing normalized symbolic representations.

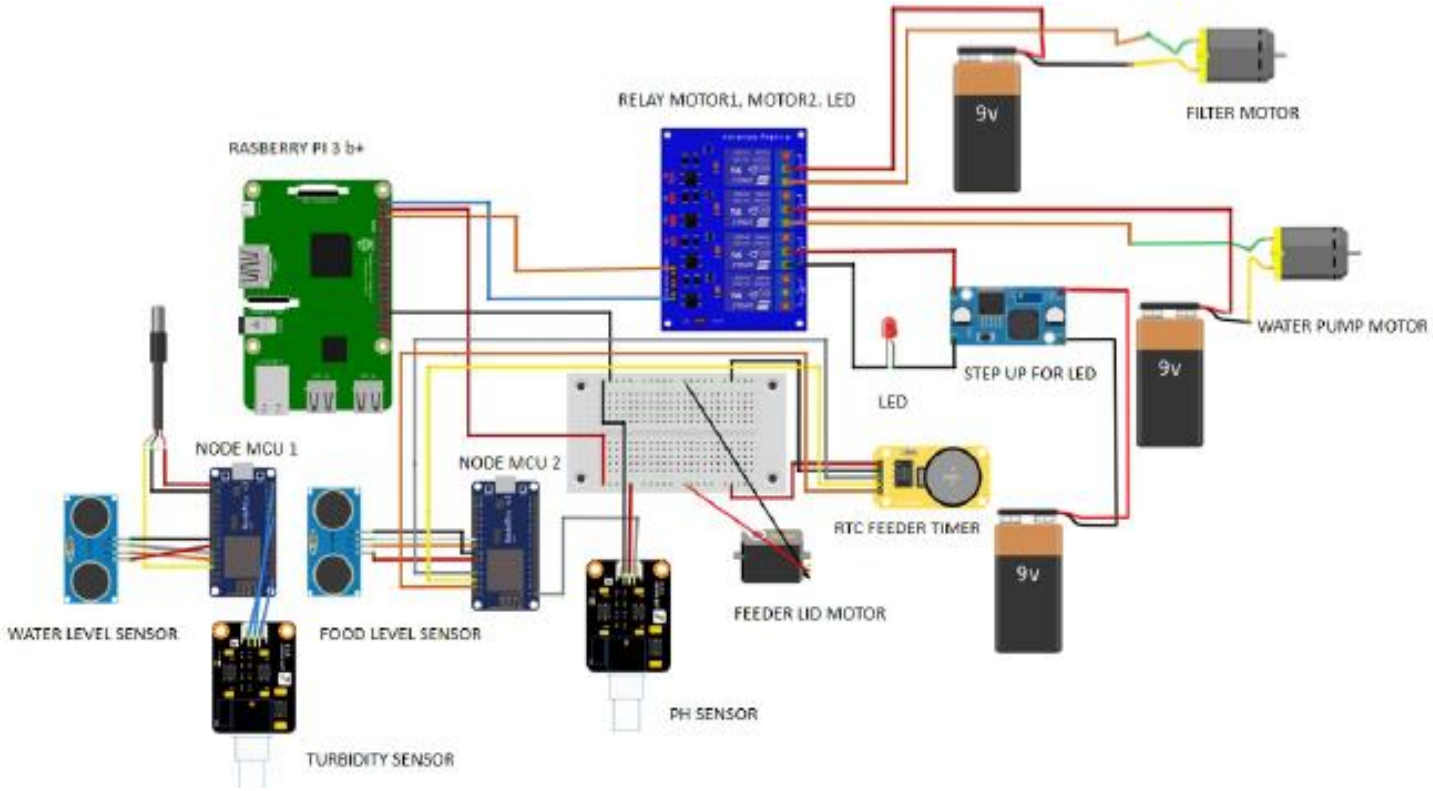

Figure 17: Circuit Diagram

3.7 Cost analysis

List budget for prototype design

Table 4: List budget for prototype design

Components	Quantity	Price
DC Brushless water pump	2	RM28.00
LED waterproof lamp	1	RM10.00
AC DC Adapter converter	1	RM66.70
Total		RM104.70

List budget for the whole system

Table 5: List budget for whole system

Components	**Quantity**	**Price**
Turbidity sensor	1	RM 35.70
Ultrasonic sensor	1	RM 3.00
Temperature sensor	1	RM 8.00
pH sensor	1	RM 48.00
DC Brushless water pump	2	RM 28.00
LED waterproof lamp	1	RM 10.00
Raspberry pi	1	RM 166.00
Control feeding device	1	RM 25.00
Jumper wire MM/FF/MF	3	RM 14.50
12-liter empty aquarium tank	1	RM 85.00
AC DC adapter converter	1	RM 66.70
Total		**RM 489.90**

3.8 Conclusion

In this chapter, the author has explained about the flow, method and material that used to design and mechanical system part of the aquarium. This product starts by building up the task work process leading a writing audit of the undertaking can be finished on schedule, the planning should be completed and should likewise fill in as a rule for the plan for getting work done of the product.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this section, it a process of water pump with filter and Led. It consisted of a tested part. In order to get a general idea of working prototype.

4.2 Testing Result

After the simple experiment is done, the result is noted and analyze in this section. Besides that there are few unexpected problem has been identify which also will be analysed.

4.2.1 Water motor pump test result working

As a result the water motor pump is actually moved without any problem and give amount of water from the spinning motor. So from here, it can be conclude that the motor does not have any problem working for long term. The water motor pump is nothing to worry about since the pump is made for submersible purpose.

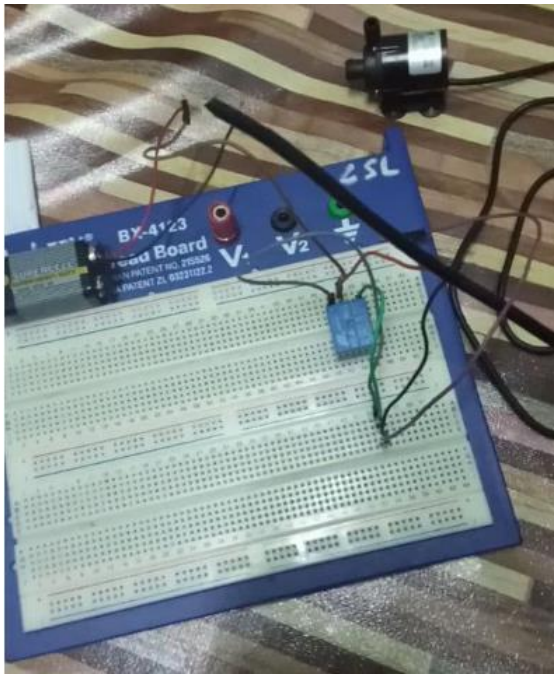

Figure 18: Water Pump Motor Tested

4.2.2 LED test result working

The connection between white led strip, 5V relay and the Raspberry pi. The white LED is power up using external power source DC 12V 1A. The power source and the LED's power line is connected at 4 relay. The LED's ground is connect with the ground of external power supply. Connect the 4channel 5V relay board to the power 5V and the ground of the Pi. Then connect the wire from Pi's GPIO14 (Pin 8) to the 4 channel relay board's pin of IN4. When the Pi's send LOW to IN4 the relay will connect the power supply to the LED which will make the light to on and send HIGH to turn of the relay and the light.

Figure 19: LED Tested

4.2.3 Food Feeder Testing

In task servo engine is utilized to create programmed fish taking care of system. The feeder is fuelled by servo engine and controlled utilizing PWM signals .On getting signal the servo engine twists and drops the fish feed on the time set by the client. The RTC module in our project is used to obtain time and date for light and feeding device power.

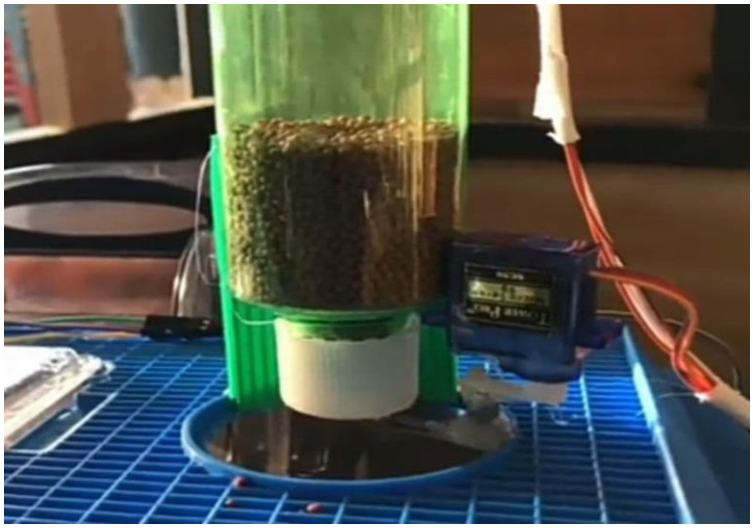

Figure 20: Food Feeder Testing

4.3 Final Product Aquarium

This show the whole design final product aquarium and plastic frames added for decoration to the upper and lower edges. The design show all the material include all the sensor, wiring box and food feeder.

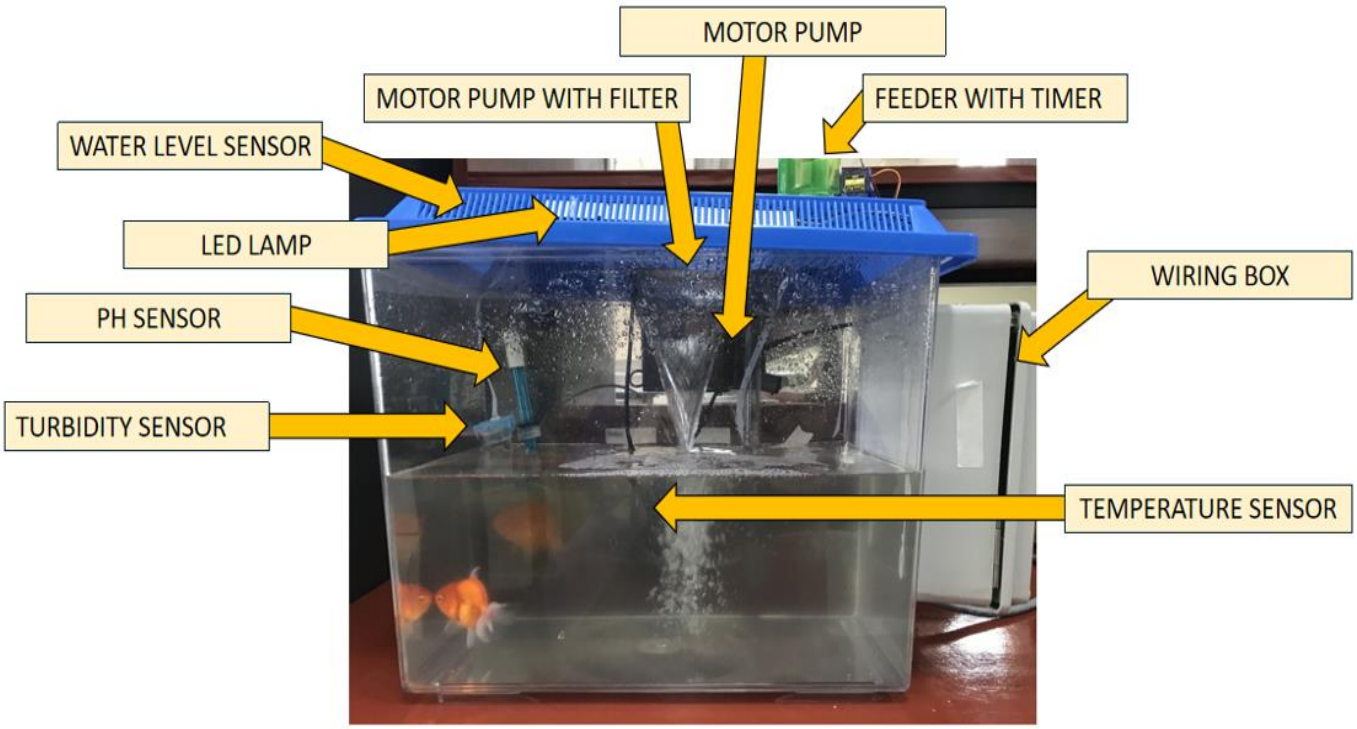

Figure 21: Final Product Aquarium

4.4 Conclusion

In this chapter, the author have explained about the final design of the system prototype as well as result achieved from testing the prototype. The design is an arrangement or detail for the development of an item or framework or for the usage of a movement or measure, or the consequence of that arrangement or particular as a model, item or interaction.

CHAPTER 5

Conclusion and Recommendation

5.1 Conclusion

The pump storage capacity is the most important aspect. The higher the capacity, the more pressure can be provided by the pump. But for small water pumps, due to technological gaps such as heat transfer, it is difficult to generate a huge power output. There is minimal pressure that small electric water pumps can provide. LED lighting has increased in popularity from small to large areas that require a source of light, and particularly in situations such as aquariums that may require lighting up to 12 hours a day. There is no pressure over the battery kicking the bucket, while the battery operated feeders are without electrical stun or blackout stress, the advantage of electrical force feeders. Fish feeders are usually braced just over the water to the mass of the tank. Overall performance aquarium in the great condition.

5.2 Recommendation

The following recommendation are proposed and needed for prompt and future execution:

i. The motor pump need to increase the motor efficiency is to operate with higher voltage.

ii. The design of aquarium can be improve by add monitor.

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