POLYTECHNIC SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART HYDROPONIC AQUARIUM

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DEPARTMENT OF ELECTRICAL ENGINEERING

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This report is submitted to the Department of Electrical Engineering to fulfill some of the requirements of the Diploma Electrical Engineering

DEPARTMENT OF ELECTRICAL EGINEERING

JUNE 2019

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TITLE : SMART HYDROPONIC AQUARIUM

SESSION : JUNE 2019

1. **We, 1. MUHAMMAD AMIR FIKRI BIN MOHD YUSRI (08DJK17F1125)**
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We are final year student of the **Diploma in Electrical Engineering, Department of Electrical Engineering, Polytechnic Sultan Salahuddin Abdul Aziz Shah,** with an address at the **Persiaran Usahawan, 40150 Shah Alam, Selangor** (hereinafter referred to as 'the Polytechnic').

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at..... on .....)

Witness by, WAN MOHD ZAMRI BIN WAN AB RAHMAN (730820-09-5313)) .....

as project supervisor on: .....) WAN MOHD ZAMRI BIN WAN AB RAHMAN

APPRECIATION

We would like to give an appreciation and sincere thanks to our project supervisor, Encik Wan Mohd Zamri and also our lecture project that is Pn Rohana binti Sahak, Pn Rokiah binti Hassan and Pn Saliza Hanim Binti Leman for the guidance and ideas presented during the project was implemented.

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ABSTRACT

Aquaponic is combination of two symbiotic and interdependent food production technologies namely the aquaculture where dirty water from the fish tank is treated and cleaned by the root of the plants and clean water is returned to the fish tank. Next, Aquaponic users face several problems in maintaining the vitality and health of fish and check the aquarium situation. This project is built aiming to facilitate fish and crops at the same time. This project has been designed and constructed with water cycle system which prevent the water from submerge the plants. This system is also known as tidal system. This project is using arduino, turbidity sensor, mosfet, temperature sensor and water pump. All of the information gained by the sensors can be monitored by smartphone connected to Wi-Fi. In conclusion, this project can be implemented by the community to encourage agriculture activity at home.

ABSTRAK

Akuaponik adalah gabungan dua teknologi pengeluaran makanan yang simbiosis dan saling bergantungan iaitu sistem kitaran air akuakultur di mana air dari tangki ternakan ikan dirawat dan dibersihkan sebelum dikembalikan ke dalam tangki ikan dan sistem tanaman hidroponik tanpa tanah menggunakan nutrien sisa yang terhasil dari tangki ternakan ikan sebagai sumber baja.Seterusnya, Kajian ini dibina dengan tujuan untuk memudahkan pengguna untuk membela ikan dan menanam tanaman dalam masa yang sama. Satu sistem mini akuaponik telah direkabentuk dan dibina dengan satu sistem kitaran air yang dipasang pada takung tananam bagi membolehkan air yang dipam dari tangki ternakan ikan memenuhi ruang takungan tanaman dan kemudian setelah paras air mencapai tahap tertentu, air akan dikeluarkan dengan kadar yang cepat bagi mengelakkan akar pokok terendam. Sistem ini juga dikenali sebagai sistem pasang surut. Projek ini menggunakan Arduino, Pengesan kekeruhan, Pump air, Pengesan suhu dan mosfet dan infomasi yang dikesan oleh pengesan boleh dipantau melalui Telefon pintar dengan menggunakan Wi-Fi.Kesimpulannya, sistem akuaponik adalah satu sistem ringkas penghasilan bahan seperti sayur-sayuran dan ikan yang berpotensi untuk dilaksanakan oleh masyarakat sebagai aktiviti pertanian dalam kediaman.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCITON

Aquaponic is combination of two symbiotic and interdependent food production technologies namely the aquaculture where dirty water from the fish tank is treated and cleaned by the root of the plants and clean water is returned to the fish tank. Next, Aquaponic users face several problems in maintaining the vitality and health of fish and check the aquarium situation. This project is built aiming to facilitate fish and crops at the same time. This project has been designed and constructed with water cycle system which prevent the water from submerge the plants. This system is also known as tidal system. This project is using arduino, turbidity sensor, mosfet, temperature sensor and water pump. All of the information gained by the sensors can be monitored by smartphone connected to Wi-Fi. In conclusion, this project can be implemented by the community to encourage agriculture activity at home.

1.2 BACKGROUND RESEACRH

Technology advancement force humans to be creative, as the human nature to keep improve better than before. Technology that created by humans also minimalize task in daily life. One of the sectors that have huge impact in technology advancement is the agriculture. Hydroponic is one of the technology advancement in agriculture. Farming use water, nutrition and oxygen. Hydroponic is a technology that farm that benefits water without using soil that concentrate on the nutrition for the plants. The need for water in hydroponic is more than a normal farming type using soil. Based on the hydroponic definition the implementation of technology on agriculture ease humans to farming, especially lack of place to plant crops. If Hydroponic is the innovation in the agriculture, Arduino is the innovation in the technology advancement. Arduino are mainly used as a microcontroller that works as a controller to the hydroponic system. The water flow can be controlled by Arduino so it give the crops enough water. This system reduce the usage of soil, energy and time. For this purpose we design a project called Smart Hydroponic Aquarium.

1.3 PROBLEM STATEMENT

Based on the background research, we can identify the problems as following:

1. Difficulty in reading the temperature and turbidity in the aquarium even when near the aquarium.

2. Difficulty in maintaining the vitality and the health of fish while user are away from the home, office etc.

3. Lack of time to care for the crops and fish because daily task is full chores to do.

1.4 PROJECT RESEACRH OBJECTIVE

Objective and benefits from this project:

1. Design and construct hydroponic or aquaponic system to be integrated with the aquarium using microcontroller.

2. Reduce the manual works for daily task such as watering the plant, feed the fish and fertilizing the crops.

3. Ease the user to facilitate and maximize the user control on the aquarium whenever they around or not.

1.5 PROJECT QUESTION

Here some of the question related to the project:

1. How the aquaponic system that integrated to the aquarium can bring impact to the crops and fish health?

2. How the hydroponic system can reduce the time to water the crops and feed the fish?

3. Which non-government organization (NGO) or government organization can help us in commercializing our project?

1.6 PROJECT SCOPE

This project will give all the information about what happening in the aquarium such as temperature and turbidity and will be display on the device that have internet connectivity and if there is any error in the aquarium the devices will be notified. This project will also be able to water the crops using the water in aquarium as a filter for the water. Smart hydroponic is for Small breeders that want to breed fish and plant crops in their home.

1.7 IMPORTANCE OF THE PROJECT

Hydroponic Aquarium are designed to help user to dive in agriculture on a small scale, ease the user and maximize the control over the system. By using this project we are able to increase crops growth and maintain the quality. Next, this project able to reduce the crops problems such as pest and plant disease caused by bacteria, roundworms in the soil. This project are more efficient because user didn't have to water their plants and didn't need fertilizer and the garden can be installed level by level according to the user needs.

1.8 CHAPTER CONCLUSION

From this chapter, we have indicated and explained our projects in terms of introduction and statement of problems. The purpose of our project is based on the objective of the Ministry of Agriculture and Agro-Based Industry Malaysia to expose agriculture to the youth especially students. We believe that this project is able to attract youth in agriculture sector.

CHAPTER 2

LITERATURE RESEARCH

2.1 CHAPTER INTRODUCTION

This chapter is about literature review about this study. This chapter will explain about aquaphonics and water turbidity in this study.

2.2 THEORY CONCEPT

2.2.1 AQUAPONICS

Aquaponics is a modern farming system and it very suitable at small spaced area. The nutrient will be recycling the aquaphonics process. A wastewater from fish will recycle by production of vegetable. It is reported that aquaponics system that rely solely on fish waste to supply nutrients for plants (Graber and Junge, 2009). Rakocy and Hargreaves (1993) stated that aquaponics system have the only bio filter that generates income, which is obtained from the sale of hydroponic produce such as vegetables, herbs and flowers.

2.2.2 TEMPERATURE

The temperature has a great influence in determining what type of organisms can survive in a water body. The temperature directly affects the amount of oxygen that can be dissolved in water (Peavy et al., 1985) Besides that, the activity of the fish increased as the temperature increased during the day and dropped as the temperature reduced during the sun set (Ntengwe and Edema, 2008). The activity of the fish is related to the stress level of the fish.

2.3 PREVIOUS RESEARCH

The earliest integrated system for fish and vegetables appears to have been documented in the 1980s. The first article, published by Watten and Busch (1984) described aquaponics as a recirculating water system for plants and fish. This work was performed at the University of Virgin islands (UVI). James Rakocy, a prolific author of aquaponics research (Rakoocy,et al. 2006; Rakocy, 2002), continued the work at UVI and developed the deep water aquaponics system (also called floating raft system). Also during 1980s, aquaponics was being developed by the New Alchemy Institute and reported by Zweig (1986).

2.4 CHAPTER SUMMARY

The uncertainty about the economic feasibility of an aquaponics system presents opportunities for undergraduate engineering students to explore how to the design of components of an aquaponics system affects the overall efficiency and feasibility. This projects have a scope that are within the capabilities of undergraduate engineering students.

CHAPTER 3

PROJECT METHODOLOGY

3.1 CHAPTER INTRODUCTION

Aquaculture is a technology that combines fish culture activities with crop types in the circulation system. This water cycle contains nutrients or fertilizer water that is produced by fish or produced by microbial organisms of organic matter. This material can be absorbed by hydroponically grown plants, which are soil-free. Aquaculture is an increasingly popular agricultural technology among fans and farmers especially in food production activities. Furthermore, this aquatic technology is performed where water is consistently circulated and will not cause water loss due to soil absorption. Instead, the root of the plant will be submerged in a constantly flowing fertilizer. The continuous absorption of fertilizer water can give rise to crops. In addition, projects such as vegetables that can be sold along with fish products from the aquaponic system can produce the second product of the system.

3.2 PROJECT DESIGN

In aquaculture, anaerobic (filtered) anaerobic water filtration systems like in the Recirculation Aquaculture System (RAS) are replaced by hydroponic cultivation systems. The applied tidal system, serves as a bio-filter for the conversion of ammonia to nitrate.

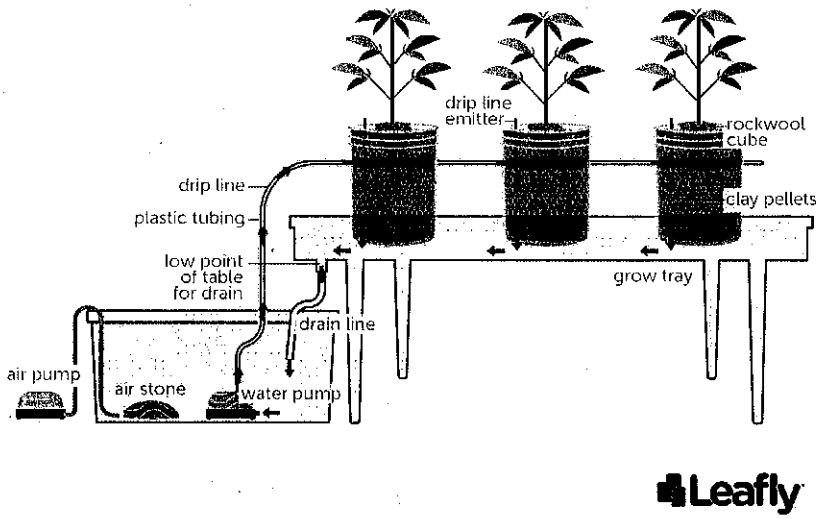
The source of nutrients for crops especially nitrogen and phosphorus is derived from fish waste that is flowing into the crop. This method also prevents nutrients being released into the environment. The results show that only 30% of the nitrogen source of food is consumed by fish. If the acupuncture system is used, another 40% of the nitrogen can be absorbed by the plant. (Hambrey Consulting, 2013). In addition, the interaction between bacteria, fungi and micro plantons in the water cycle contributes to plant growth. However, the quantity and size of crops and fish need to be balanced to maximize growth. This condition also depends on the type of crop and fish used. Further research needs to be done on this aspect.

The components of a basic aquatic system are:

- Fish tanks
- Heel crop
- Tidal bell / bell system
- Pump

3.2.1 PLANTING SYSTEM

Usually hemp plants are made of plastic material. Plastic material was chosen because the workmen cut and installed the water cycle system easier. The size of the heel depends on the number and type of crop. Non-soil media is used for aquaculture. Various media can be used depending on the size of the heel and the type of crop. The media used should be uniform and have enough space to store and release water and not float in the water. The most commonly used media are clay balls and fine pebbles. There are three types of media used in the experiment of this aquatic system, broken bricks, clay balls and fine pebbles.

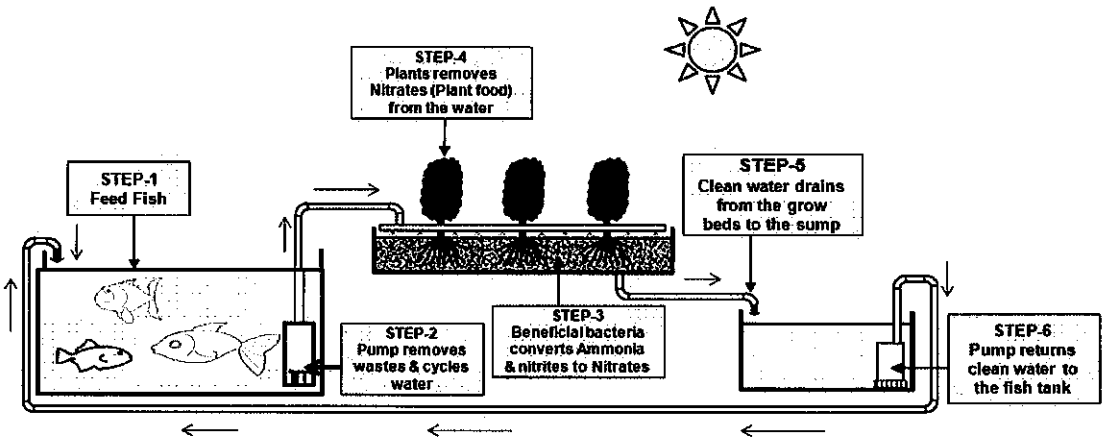


3.2.1 Planting System

3.2.2 FISH LIVESTOCK TANKS

Fish tanks are commonly used in a circular shape to facilitate water flow and to avoid accumulated dirt on the corners of the tank. Additional ventilation systems should be included in the tank for sensitive fish breeding such as tilapia and if large numbers of livestock are included in the tank. The ventilation system can also reduce the risk of fish death if a cycling system such as a clog or pump does not work. The number of fish in the livestock tank depends on the fish species, water temperature and ventilation efficiency. Tilapia and carp fish survive and grow well in quantity 60-70kg / m3. Fishs can fit in larger quantities even when underwater. However,

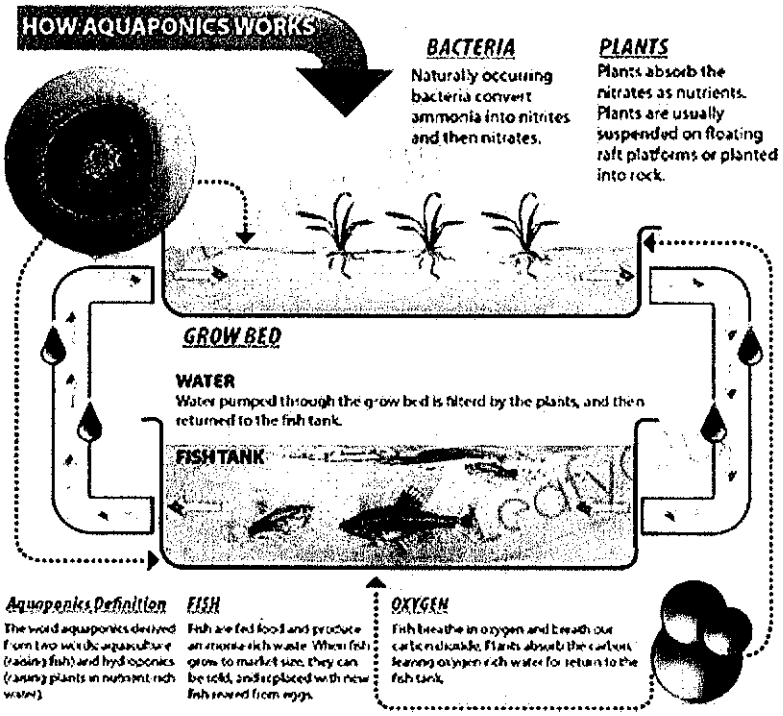
livestock tanks need to be covered with nets to prevent catfish from jumping in or out of the tank.



3.2.2 Fish Livestock Tanks

3.2.3 WATER CYCLE SYSTEM

The pump used is capable of raising water up to 4 feet high and capable inhaling dirt in a fish tank. A 5W pump, 3500 liters / hour is used in the system trial. The pump is connected to a 0.5-inch PVC pipe that is fed directly to the plant at the top. An optimized water rate of between 8-10 liters / minute goes into the heel the plant is controlled with a manual valve. Water from the fish tank is controlled to the maximum extent in the crop by using a chiffon bell system consisting of several components. Standpipe is a pipe vertically mounted on the base of the plant. The stand pipes are the conduit for removing water from the crop heights and it determines the maximum level of water in the crop. The drain pipe is connected to a drain pipe under the heel where the water is flowing to or other crops to fish tanks. A pipe is placed outside the stand pipe 2-foot diameter pipe called "bell pipe" is fitted with a cover on one the end. At the foot of the bell a sufficient opening for the waterway was made. On the cover of "pipe bell "holes are punched and fitted with air tubes and lowered to the bell pipe wall. The end of the tube the air is cut slightly above the bottom opening. This air tube is needed to stop flow of chiffon.



3.2.3 Water cycle system

3.2.4 NFT (NUTRIENT FILM TECHNIQUE)

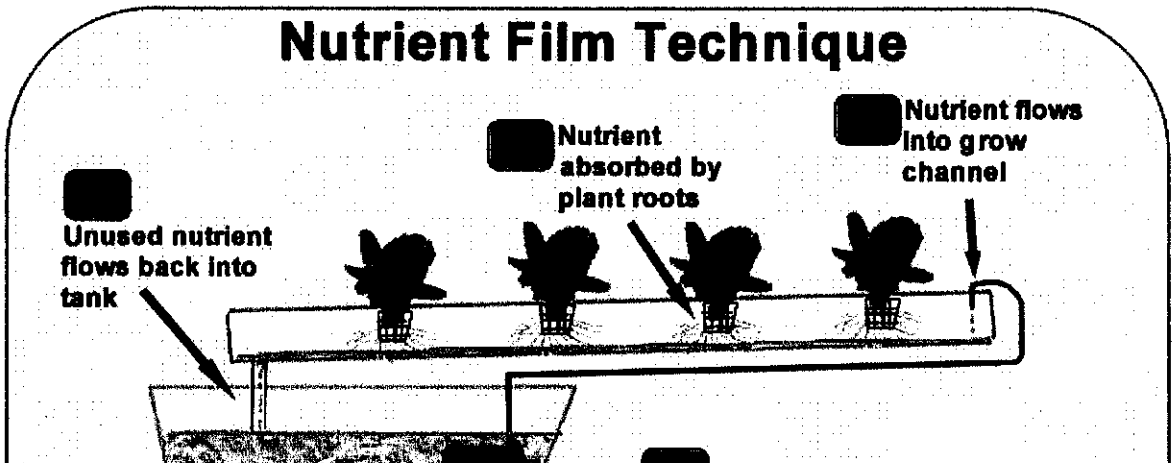
NFT (Nutrient Film Technique) is an aquaponic model that floods its crop media using a thin layer of water. Just like the raft model, this technique does not use crop media. Roots of cultivated or cultivated roots are left on the basis of where the plants are grown and then treated with nutrient-rich water. The running water should not stop. So it must continue to flow quickly until a thin layer is created.

Before knowing what NFT aquaponic requirements must be met for optimal results it is important to know the advantages and disadvantages of any of these aquaponic techniques. The advantage of this technique is that the water used to irrigate the crop is very small. Therefore, the pump used is quite small. The productivity is not quite as high as the raft model, but it is relatively stable. However, this NFT model has some disadvantages.

First, this technique is very susceptible to climate change. If earlier in the morning the air is cold and then in the day it will be hot so this will negatively affect the roots of the plant. The root of the plant with the slightest change in temperature will die. Second, just as with the raft model, this technique requires an additional biofiltration process because the biofiltration performed on the cropping media is inadequate. Third, in this technique only vegetable plants that enjoy a lot of water can be grown. Fourth, irrigation cannot be performed on this NFT aquaponic model. The results of the sowing must be done elsewhere. Fifth, the pump must operate for 24 hours

because the root of the plant must be kept moist with flowing water. Just a moment the pump goes out (does not turn on) and causes the roots to dry out. Therefore, although not as large as the raft model, the power consumption for these NFT models is relatively high.

The main supply of equipment is the bed (gutter), the tank (water bunker), and the pump and the genset if the power supply is turned off. Use a household bed or gutter about 4 meters long and 13 - 17 cm wide. Try to get rid of the gut (1-5%) to drain the nutrient solution. The speed of the flowing water should not be too fast. The faucet opening is in the range of 0.3-0.75 L / min). Water flow, oxygen and nutrition are constant with a current thickness of approximately 2-3 mm. Use porous or water-resistant planting media, such as limestone, zeolite, and charcoal. Short-term cultivated crops of about 30 - 45 days can be harvested, such as lettuce, spinach, mustard, basil and so on.



3.2.4 Nutirent Film Technique

3.2.5 PLANNING OF PROJECT SMART HYDROPONIC AQUARIUM

This Gantt charts are used in this Smart Hydroponic Aquarium to illustrate the start and finish dates of the terminal elements and summary elements of a project. A Gantt chart is used for project management, it is the most popular and useful ways of showing activities, task or events displayed against time. This Gantt chart has shown the task that need to be completed within the dateline. Every task need to mark on which number of week the task done will.

Table 1.0 and 1.1 shows a Gantt chart for two semesters which is semester 4 and semester 5. It shows the activities need to do every week. In the table, the blue color for planning and the orange color is when the activities has been do. In semester 4 there are seven activities need to do in 15 weeks while in semester 5 it has seven activities in 15 weeks. In semester 5 more focus in build the Smart Hydroponic Aquarium project while in semester 4 it more to planning and design the Smart Hydroponic Aquarium. There are few activities that had been done in the planning date and few activities are not. From this Gantt chart, it make every student to be more punctual in time when doing the work.

TABLE 1. 0 **SEMESTER 4 PROJECT GANTT CHART**

WEEK / RESEARCH / PROJECT ACTIVITY	LW 1	LW 2	LW 3	LW 4	LW 5	LW 6	LW 7	LW 8	LW 9	LW 10	LW 11	LW 12	LW 13	LW 14	LW 15
Project briefing															
Build a project															
Background study group presentation															
Presentation the characteristics of project															
Methodology															
Report earnings															

Project selection	
Identify project circuit	
Comparison and search for project items	
Production circuit and project code	
Project remake	
Project presentation	
Proposal submission	

TABLE 1. 1 **SEMESTER 5 PROJECT GANTT CHART**

WEEK / RESEARCH / PROJECT ACTIVITY	LW 1	LW 2	LW 3	LW 4	LW 5	LW 6	LW 7	LW 8	LW 9	LW 10	LW 11	LW 12	LW 13	LW 14
Presentation of final project development														
Final report inventory														
Create project														
Troubleshoot														
Troubleshoot														
Presentation of final project with supervisor														
Report writing														
Project inventory														
Final project competition														

3.2.6 FLOWCHART SMART HYDROPONIC AQUARIUM

Planning flow chart is an important elements in developed Smart Hydroponic Aquarium. It may be included of sequence of actions, materials or services entering or leaving the process (inputs and outputs), decisions that must be made, people who become involved, time involved at each step and/or process measurements.

The process described can be a manufacturing process, an administrative or service process and a project plan. This is a generic tool that can be adapted for a wide variety of purposes. This flowchart consist of the flow for overall of Smart Hydroponic Aquarium.

3.2.6.1 Overall flowchart

The overall flowchart state the flow of making the Smart Hydroponic Aquarium. The flowchart consist of from the starting ideas to choose the main project until the finishing of Smart Hydroponic Aquarium Several test had been done from assembling the components until finishing the project. The main purpose is to test the components or to avoid short circuit when running the Smart Hydroponic Aquarium. The Smart Hydroponic Aquarium had been tested.

While tested there is some unwanted problem occur. The problem need to overcome by troubleshooting and fix the problem.

The flowchart can be adapted when configure the device as Smart Hydroponic Aquarium using the arduino and mobile device that need to be configure. The process described can be a manufacturing process, an administrative or service process and a project plan. This is a generic tool that can be adapted for a wide variety of purposes. This flowchart consist of the flow for overall of Smart Hydroponic Aquarium.

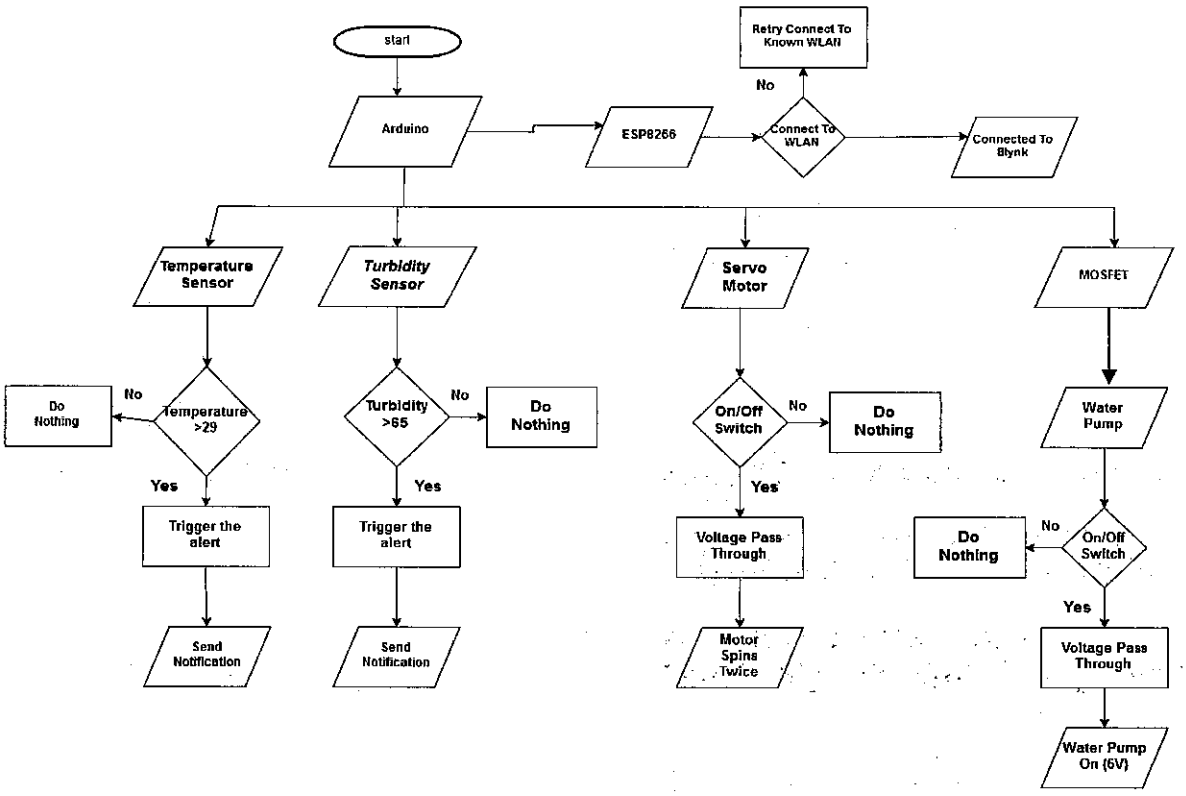


Figure 3.2.6 : Overall flowchart

Figure 3.2.6 show the overall flowchart of Smart Hydroponic Aquarium project. First step is choosing a project tittle. Then collect information and start buying a component. After arrange the component. Test the functionality of the component. If the component is failed when test it, buy or test another component. If all the component are functionality, go to next step which is configuring device and finishing design the Smart Hydroponic Aquarium. After finishing, do again test for Smart Hydroponic Aquarium. If there are no failed no need to do troubleshooting. If there are failed, the Smart Hydroponic Aquarium need to do some troubleshooting.

3.2.7 BLOCK DIAGRAM OF SMART HYDROPONIC AQUARIUM

A block diagram is a diagram of a system for Smart Hydroponic Aquarium in which the principal parts or functions are represented by blocks connected by lines. It shows the relationships of each block. They are heavily used in engineering in hardware design, electronic design, software design, and process.

Block diagrams are used for higher level, less detailed descriptions that are intended to clarify overall concepts without concern for the details of implementation. Contrast this with the schematic diagrams and layout diagrams used in electrical engineering, which show the implementation details of Smart Hydroponic Aquarium components and physical construction.

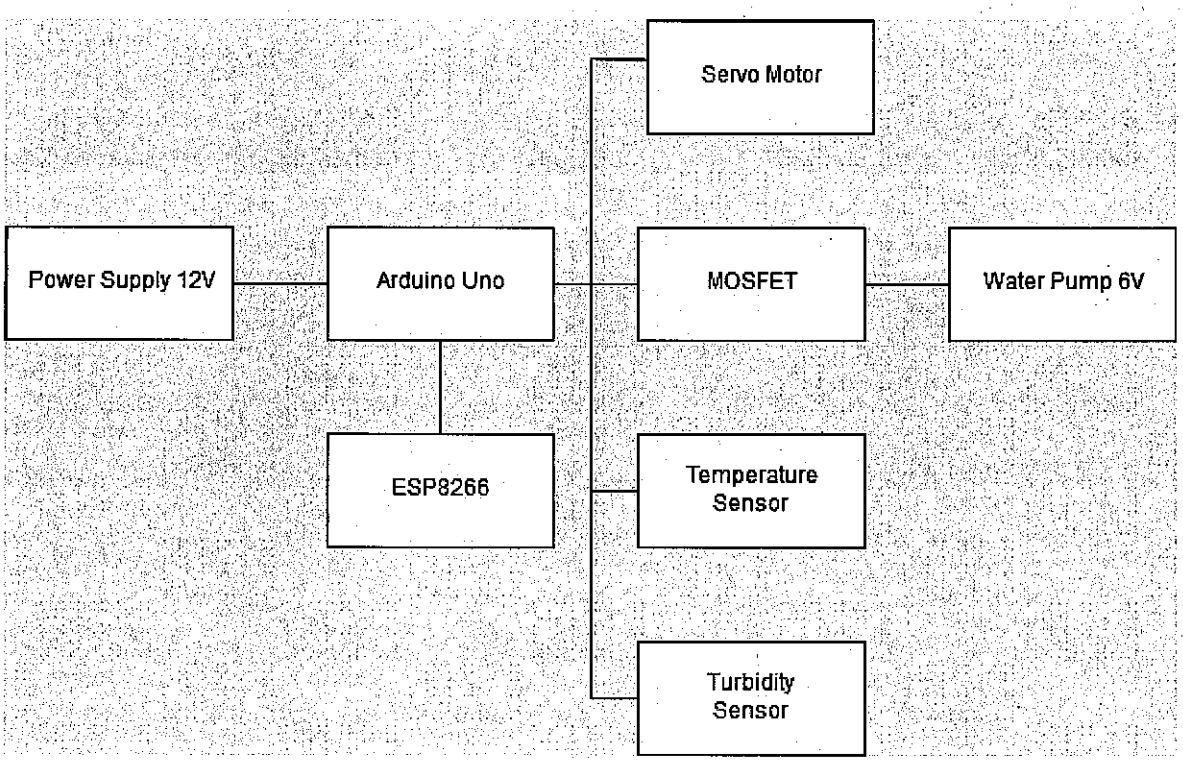


Figure 3.2.7 Block Diagram

3.2.8 SCHEMATIC DIAGRAM

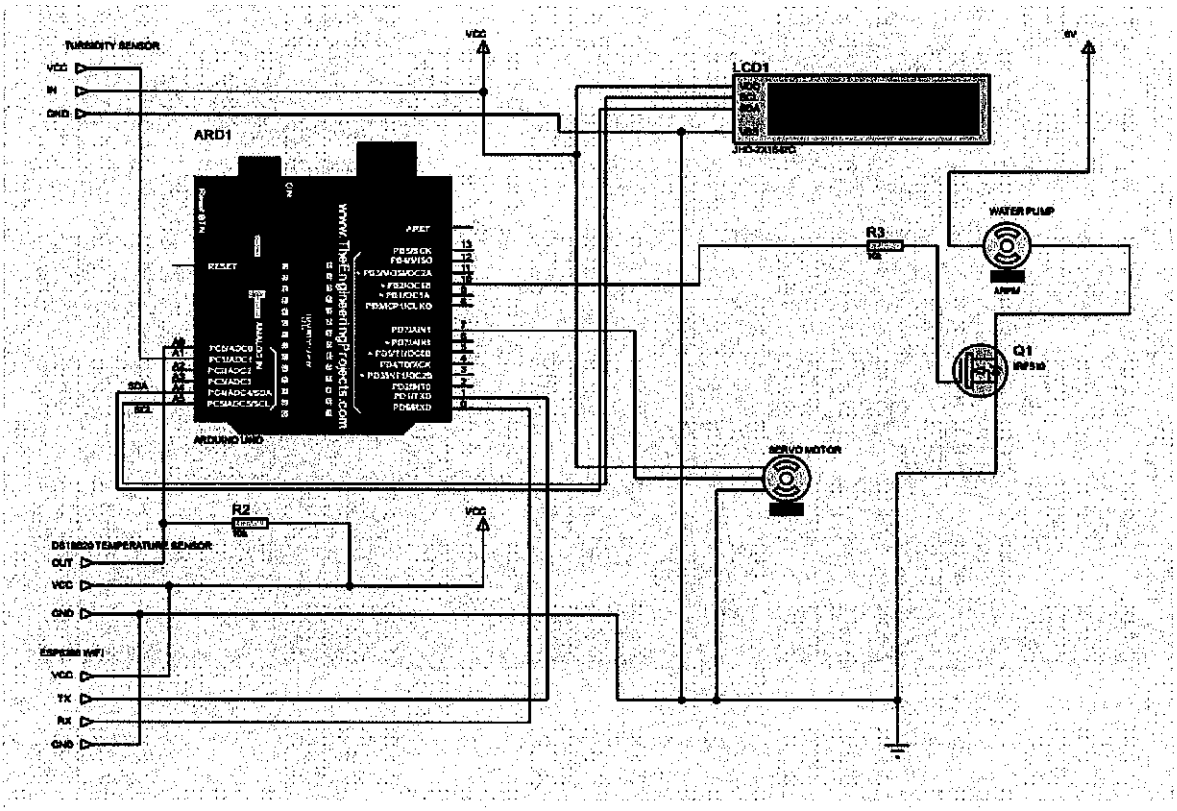


Figure 3.2.8 Schematic Diagram

Figure 3.2.8 shows Smart Hydroponic Aquarium circuit diagram by using proteus software in PCB layout. The components in this circuits are temperature sensor to display on app, wifi module to connect between consumer and Smart Hydroponic Aquarium, turbidity sensor to display on app , servo motor use to control fish feeder and water pump use to cycle water on hydroponic system . The arduino uno act as a microcontroller of the project. The software programming of arduino uno has been embedded into the hardware of Smart Hydroponic Aquarium.

3.3 METHOD OF DATA COLLECTION

We apply a method of data collection techniques. This was done in order to collect adequate and relevant data to address the research objectives of this study. Nonetheless, we used qualitative research method.

3.3.1 Library Research

Library research is a process dealing with the analysis of evidences such as articles, newspaper and documentary. Similarly, it means gathering data from library materials which includes textbook, documents such as journals, dissertations and thesis .Library research also includes information gathered from internet search.

Data gathered via library research is categorized as the secondary data. Secondary data means the data is readily available and used by anyone beside researches. This means that secondary data is not originally collected but rather obtained from published or unpublished sources.

In this research, the secondary data is used in literature review and in chapter two. The literature view consists of data gathered from numerous journals regarding aquaponics/ hydroponics activity, research and development all around the world.

3.3.2 SURVEY

Field Research composes a number of research methods to solve the existing research problems such as case study, interview and questionnaire. This project adopted the method of survey. We share the link of the survey on google form to the public to provide opinion and guidance in handling the aquarium. Survey method is one of the ways to obtain data.

3.4 PROJECT INSTRUMENT

For the Smart hydroponic aquarium, the instruments need to be used in this project must be selected appropriately compatible with the function for the project. Each of detector components on the circuits play an important role and has its own function. The size of the components also be in accordance with the design and the space area that supposed to install it.

a) **ARDUINO UNO**

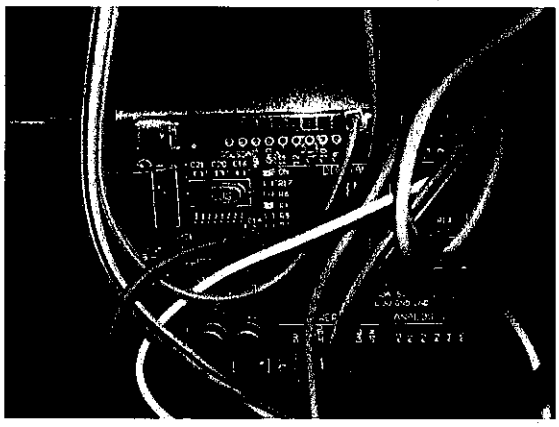


Figure 3.4.1 Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (6 can be used as PWM output), 6 analogue inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

b) **SERVO MOTOR**

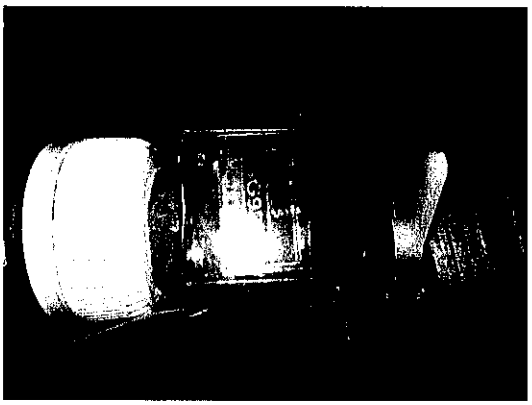


Figure 3.4.2 Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

c) **MOSFET (IRF250)**

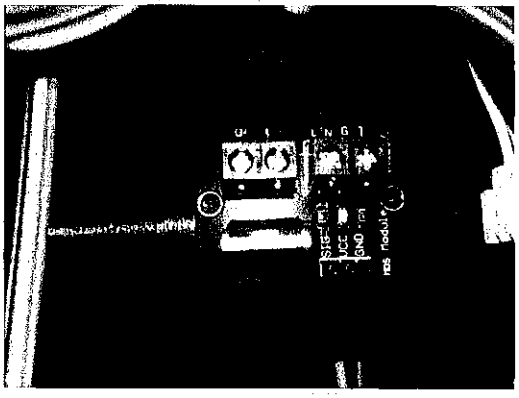


Figure 3.4.3 MOSFET

The MOSFET (Metal Oxide Semiconductor Field Effect Transistor) transistor is a semiconductor device which is widely used for switching and amplifying electronic signals in the electronic devices. The MOSFET is a core of integrated circuit and it can be designed and fabricated in a single chip because of these very small sizes.

d) **ESP8266**

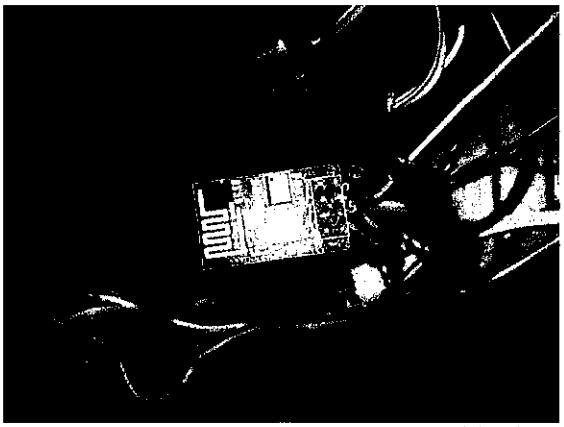


Figure 3.4.4 ESP8266

This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

e) **WATER PUMP (6V)**

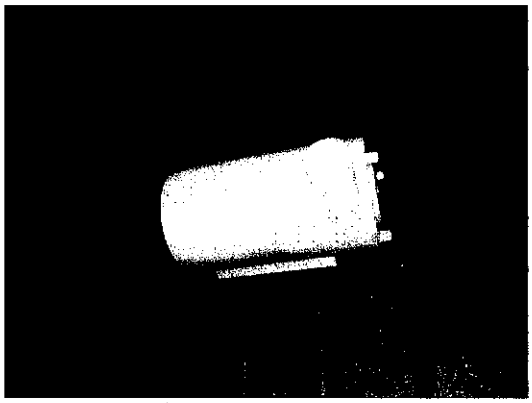


Figure 3.4.5 Waterpump

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from

a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location

f) **TURBIDITY SENSOR**

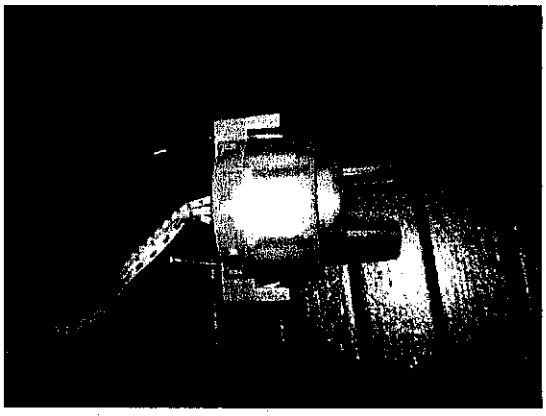


Figure 3.4.6 Turbidity

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.

g) **TEMPERATURE SENSOR**

Figure 3.4.7 Temperature

A thermistor is a type of resistor whose resistance is dependent on temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors (negative temperature coefficient or NTC

type typically), self-resetting overcurrent protectors, and self-regulating heating elements (positive temperature coefficient or PTC type typically).

3.5 SAMPLING TECHNIQUE

In this study, we employed the purposive sampling method for the selection of the participants. Purposive sampling refers to intentionally chosen sample according to the needs of the study. Our participants is open to anyone who is willingness to participate in the study. Likewise, this strategy enables the researcher to collect relevant and useful information for answering the research question.

3.6 ANALYSIS DATA METHOD

Data analysis is the process that most differentiates quantitative from qualitative research. Data analysis is a process whereby researchers make search and arrange it in order to enhance their knowledge of the data to present that they learned to others. Similarly, highlighted data analysis is to arrange data, separating it into effective units according to topics and themes.

This project adopted the fundamental approaches in analyzing the output from the questionnaires. The data gathered from interview will be arranged and summarized according to categories as such as Age, Gender and factors of that determine opinion about aquarium.

3.7 CHAPTER SUMMARY

Aquaponics can be simply described as a combination of aquaculture and hydroponics. This is where the name aquaponics comes from. The focus in Aquaculture is to maximize the growth of fish in a tank or pond. Fish are usually stocked in tanks or ponds with high density. This high stocking rate means that water for cultivation becomes easily polluted by fish droppings. This fish droppings are in the form of Ammonia which is poisonous to fish. Meanwhile, Hydroponics depends on the application of man-made nutrients. This nutrient is made from a mixture of chemicals, salts and micro elements. Nutrition ingredients are mixed thoroughly to form the optimal balance for plant growth. Aquaponics combines the two systems. Aquaponics uses fish droppings that contain almost all the nutrients needed for plant growth. Aquaponics also uses plants and their media to clean and purify water. So in aquaponics there is a symbiosis between plants and fish.

CHAPTER 4

RESULTS

4.1 CHAPTER INTRODUCTION

After all the data and information available, the analysis is conducted to see the effectiveness of smart aquaponic tank has been installed The decision obtained in this chapter represent the results obtained from the questionnaires and tests done. The data generated from the questionnaire and experiment are more detailed to draw conclusions based on the stated objectives of the study. This study was carried out using respondents from polytechnic citizens and netizens. There are several aspects that are the main focus:

1) Respondent Demographics (gender and age)

2) Public View of Studies

4.2.1 RESPONDENT DEMOGRAPHICS (FEEDBACK)

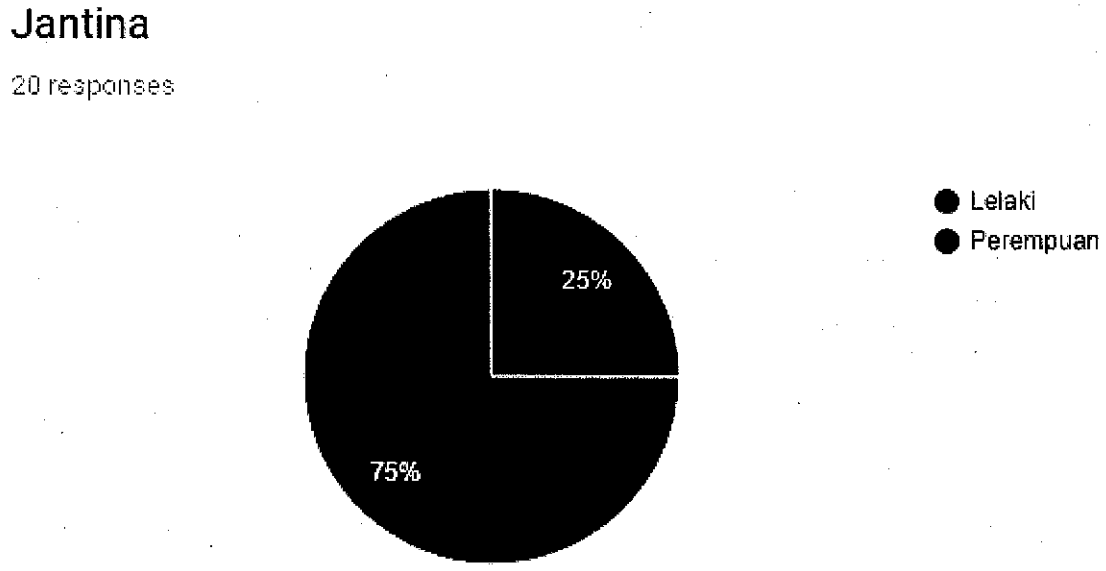


Figure 4.2 i : Gender Respondent

Figure 4.2 i shows the number of polytechnics and nitizens who responded to the study. A total of 75% of the respondents were 15 men while 25% of the respondents were 5 were female. The high proportion of male respondents as most of these respondents spend more time on vegetable cultivation than females. Most women are more interested in flowering activities.

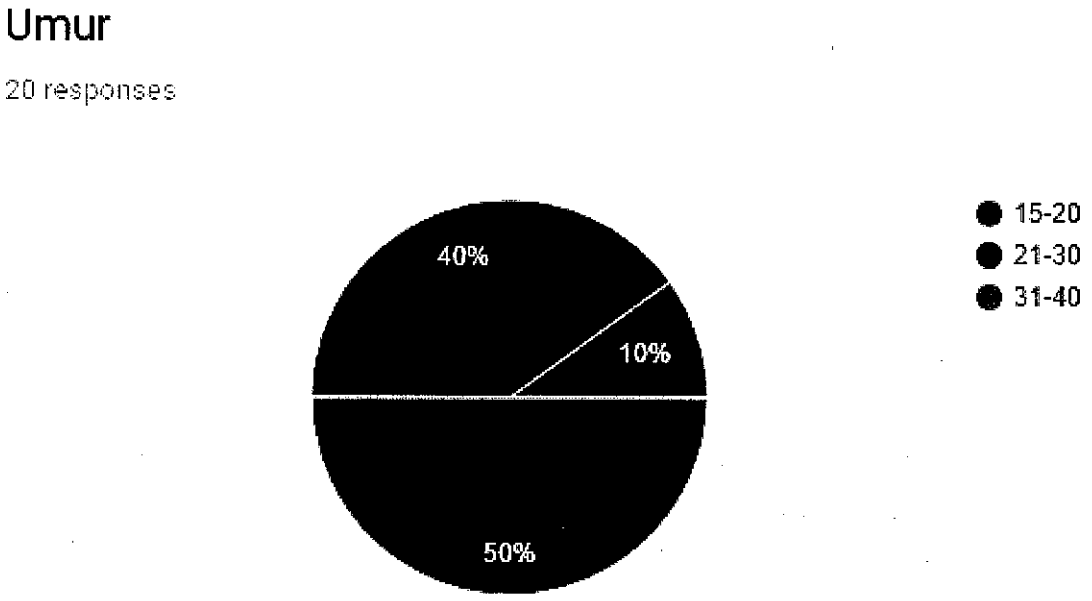


Figure 4.2 ii : Age Respondent

Figure 4.2 ii In addition, the results of the study found that 10 respondents of 50% aged 15-20 years and older answered this questionnaire. Because of this, they consist of polytechnic students. Most of them are students who enjoy doing tree planting in their free time. In addition, a total of 8 respondents, of which 40% were 21-30 years old. Subsequently, 2 respondents ranged from 31-40 years of 10%. From among these, consisting of an adult among netizens.

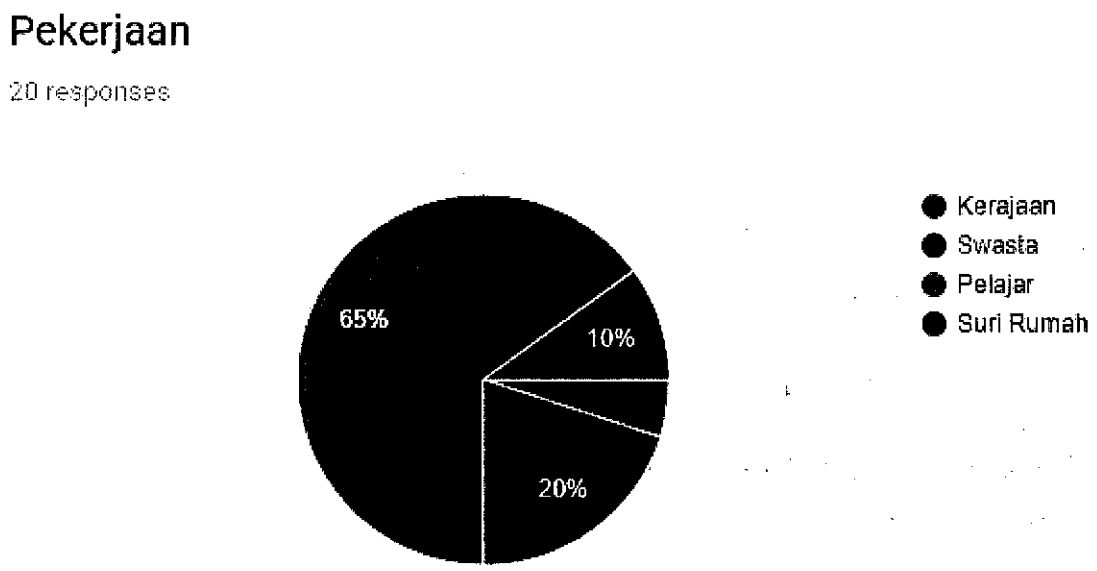


Figure 4.2 iii : work

Figure 4.2 iii Next, the study found that of the 13 respondents, 65% of students who are more answered the questionnaire. This is because they are PSA students. Most of them are students who enjoy doing tree planting in their free time. In addition, 5 respondents of which 25% are working status. They should have a hobby of planting trees in their spare time. Next, a total of 2 respondents, of which 10% were housewives. From among these, comprising among netizens that adults who have a garden / small plants at home.

4.3 DATA COLLECTION

4.3.1 ANALYSIS OF STUDY DATA

The process of analyzing the survey data will be shown in graphs, tables and charts. The analysis is based on the study of the peripheral views of the crop system and the preservation of fish in aquariums. The results of the data analysis results will be presented in the form of a histogram. In the aquaponic system method it is installed in a small aquarium or a pet aquarium and takes a month to obtain research results such as fish feeding time, aquarium water temperature control and water turbidity control.

4.3.2 SURVEY QUESTIONNAIRE

To further strengthen this research, the questionnaire was conducted by involving PSA students and nitizens. The data obtained are interpreted in the form of pie graphs to facilitate the analysis of data. The following is information related to the survey conducted.

A) PUBLIC VIEW OF STUDIES

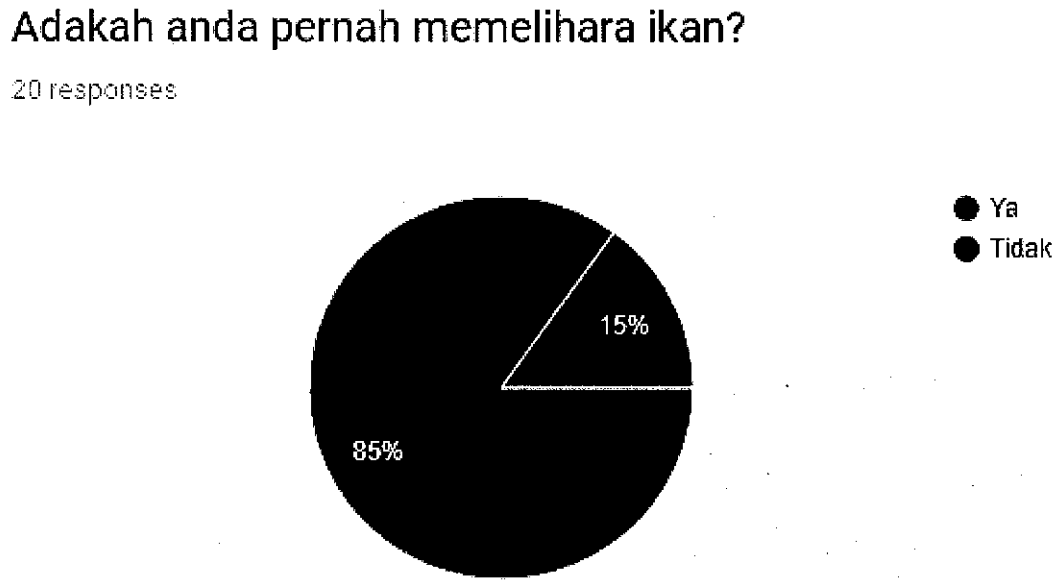


Figure 4.3 i Activities to keep the fish

Figure 4.3 i ishows an analysis of the activities that respondents have taken care of. From the analysis, 85% (17 persons) of the respondents had taken care of fish.

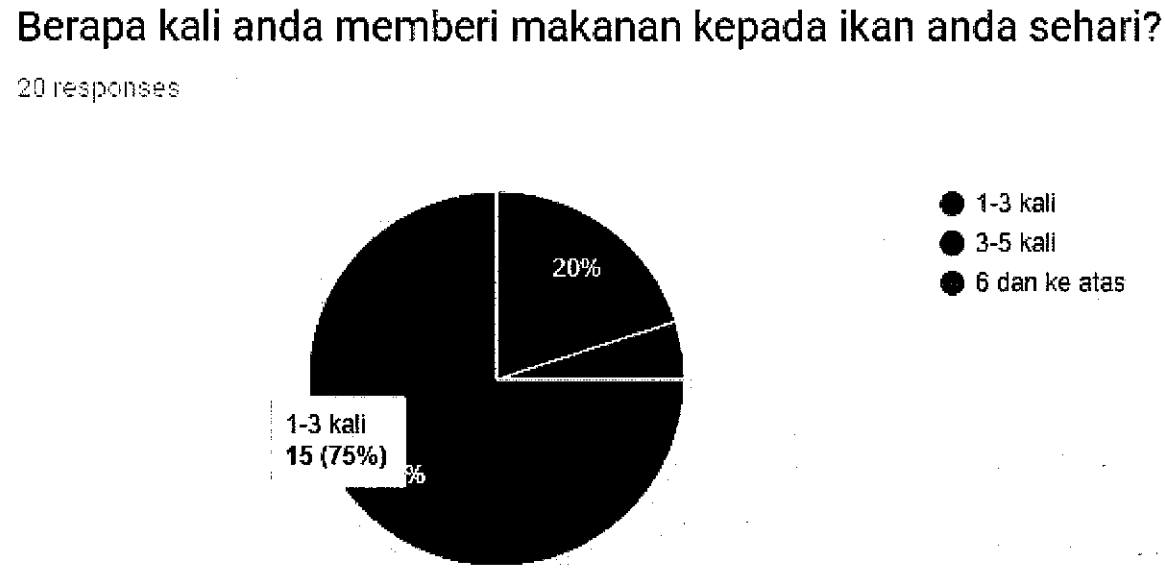


Figure 4.3 ii number of times feeding fish per day

For analysis of the rate of feeding of fish per day, **figure 4.3 ii** shows the results of the distributed questionnaire. About 75% of respondents said they fed fish 1-3 times a day. However, 20% responded that they feed the fish 3-5 times a day. In addition, 5% of respondents said they had fed the fish 6 times and above daily.

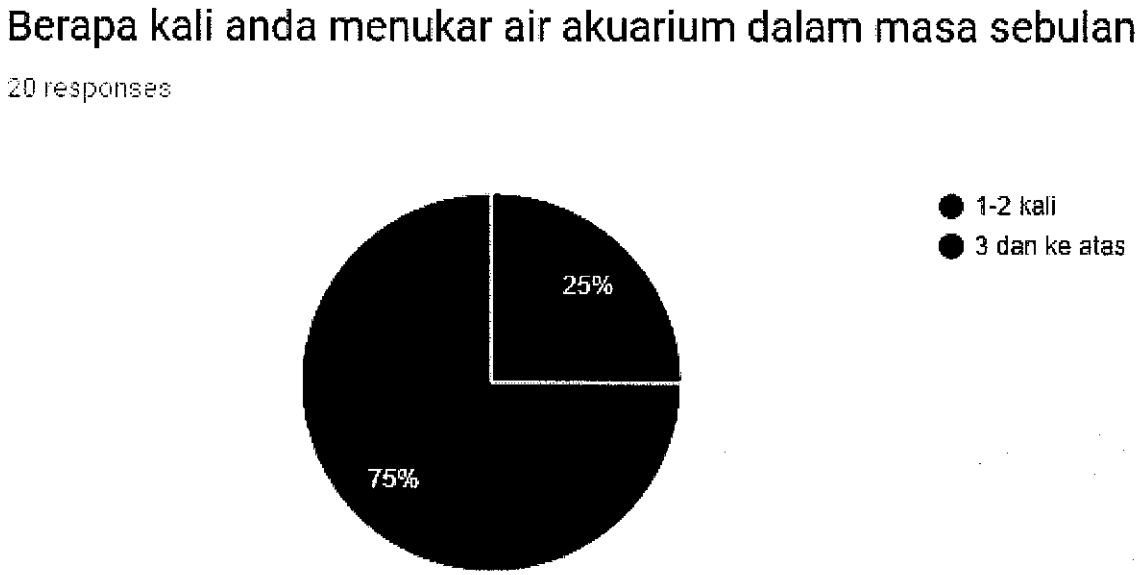


Figure 4.3 iii Diagram of the number of water exchanges in a month

In Figure 4.3 iv, 75% of the respondents (15 people) changed the water in the aquarium 1-2 times a month. About 25% (5 people) changed the water in the aquarium 3 times and above a month.

figure 4.3 iv Current feelings when changing aquarium water

The results of the analysis above, 55% (11 people) of respondents said they felt burdened when changing aquarium water while 45% (9 people) of them said they did not feel burdened when changing aquarium water.

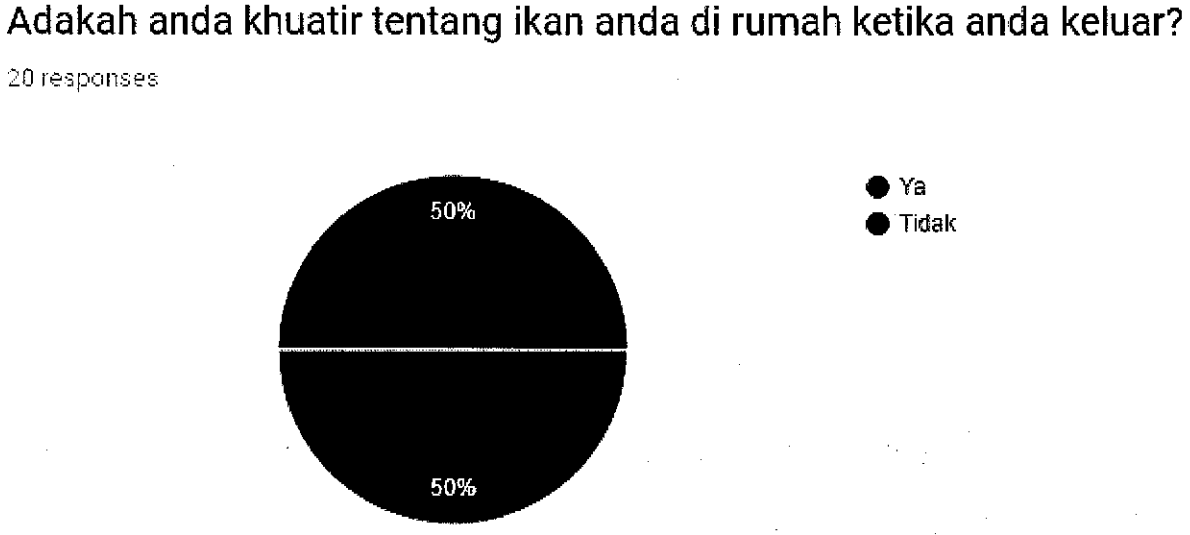


figure 4.3 v graph showing concern for fish when not home

Based on the analysis in figure **4.3 v** , as many 50% (20 people) of respondents worry about their fish when they are not home. Also, as much 50% (50) of respondents did not worry about their fish when they were not home.

4.4 CHAPTER SUMMARY

The questionnaire conducted on PSA and netizens was to find out the general opinion of the study. From the results obtained, it is known that;

i. 85% said they had kept fish in this aquarium because of their interests or hobbies.

ii. 15% say they have never kept a fish in an aquarium possibly because they are lazy to take risks such as difficulty in changing the water, forgetting to feed the fish and may feel overwhelmed when changing the water in the aquarium.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 CHAPTER INTRODUCTION

This chapter will tell you about discussion, conclusion and proposal of our project, Smart Hydroponic Aquarium.

5.2 DISCUSSION

Our objectives is to design and construct Smart Hydroponic Aquarium that have a lot of benefits for users that want to start dive in aquaponics on a small scale. This project also able to attract the Malaysian especially youth to take interest into agriculture and fishery and improve this sector in our country.

5.3 CONCLUSION

From the project, we are able to design and construct aquaponic system that can be integrated with the aquarium. The project are able to monitor temperature, turbidity and control feeding motor and water pump by using smartphones so that user wouldn't have to watch their aquarium. Other than that, reduces the manual work such as feeding the fish and fertilizing the crops. Finally, we can become one of the country that is known for its agricultural activity.

5.4 RESEARCH COMPLICATION

The complication of this project is aquaponics can experience a problem of bugs which destroys the plants. Next, not frequently testing ammonia because fish produces ammonia in their solid waste and excrete it through their gills. Over time, the ammonia builds up to toxic level and this destroys the crops. Lastly having too much fish in the tank also a problem for aquaponics and it's related to ammonia problems.

5.5 RECOMMENDATION

Future improvement for this project are able to display more information and change from the aquarium and crops such as changes that happen to the fish or crops. With this, users will be able to stay up to date with their aquaponics. Next, we also planned to upgrade our project for a big scale for farm and not limited for aquarium only. Lastly. we hope that his project able to handle big farm and this project able to reduce workers cost.

REFERENCE

1. Aquaponics Systems 2013, Diagram, Freeborn blog, accessed 3 July 2015, "https://freebornblog.wordpress.com/2013/11/05/aquaponics-and-vertical-farming/".

2. Advantages and Disadvantages of Aquaponics 2013, Aquaponics Innovations, accessed 2 July 2015, "http://aquaponics-commercial-backyard.blogspot.com.au/2013/08/advantages-and-disadvantages-of.html"/.

ATTACHMENTS

Gantt Chart

SEMESTER 4 PROJECT GANTT CHART

WEEK / RESEARCH / PROJECT ACTIVITY	LW 1	LW 2	LW 3	LW 4	LW 5	LW 6	LW 7	LW 8	LW 9	LW 10	LW 11	LW 12	LW 13	LW 14	LW 15
Project briefing															
Build a project															
Background study group presentation															
Presentation the characteristics of project															
Methodology															
Report earnings															
Project selection															
Identify project circuit															
Comparison and search for project items															
Production circuit and project code															
Project remake															
Project presentation															
Proposal submission															

SEMESTER 5 PROJECT GANTT CHART

WEEK / RESEARCH / PROJECT ACTIVITY	LW 1	LW 2	LW 3	LW 4	LW 5	LW 6	LW 7	LW 8	LW 9	LW 10	LW 11	LW 12	LW 13	LW 14
Presentation of final project development														
Final report inventory														
Create project														
Troubleshoot														
Troubleshoot														
Presentation of final project with supervisor														
Report writing														
Project inventory														
Final project competition														

Project design