UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART AQUAPONIC SYSTEM FOR ECO SCHOOL PROJECT

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

by

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2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Tajuk: DEVELOPMENT OF SMART AQUAPONIC SYSTEM FOR ECO SCHOOL PROJECT

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronics Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Kebelakangan ini, pembangunan di Malaysia semakin pesat dengan peningkatkan penduduk dan tanah kekurangan, dan kos tenaga kerja yang semakin mahal. Pertumbuhan bandar-bandar sudah mencabar sistem bekalan makanan tempatan. Perkebunan bandar adalah salah satu strategi untuk memerangi ketiadaan makanan. Walau bagaimanapun, di Malaysia, kesedaran mengenai bandar pertanian masih rendah dan konsep sistem aquaponic bukanlah satu konsep yang meluas. Tujuan kajian ini adalah untuk mengkaji minat dan kesanggupan pengguna berpotensi dengan latar belakang pertanian untuk mengamalkan penyelenggaraan lestari untuk pertanian bandar. Objektif penyelidikan ini adalah (i) untuk menstabilkan penyelarasan sistem Eco antara tumbuhan dan ikan untuk mendapatkan nutrien yang cukup dan tumbuh bersama dan (ii) untuk mengenal pasti sama ada sistem aquaponic dapat membantu mengurus penyelenggaraan dan mengetahui pengguna yang berpotensi, sistem ini dapat mengurangkan beban penyelenggaraan. Keperluan akal yang tinggi dalam aquaponik, jumlah penyelenggaraan yang tinggi, dan keperluan kemahiran kritikal adalah tiga halangan utama untuk pelaksanaan sistem aquaponik. Penyelidikan ini juga membantu (iii) membina sudut sains yang sesuai untuk SK Padang Temu . Sebaliknya, potensi sistem akuakultur dapat menjadi sistem asas untuk penambahbaikan dan dapat digunakan untuk tujuan perniagaan. Dalam kajian masa depan, integrasi reka bentuk bangunan dengan sistem aquaponic boleh dipelajari untuk meningkatkan motivasi orang untuk mengamalkan sistem aquaponik.

ABSTRACT

In recent years, Malaysia with rapid urban development, raising of population, land scarcity and expensive of labor. The growth of cities is already challenging the local food supply system. Urban farming is one of the strategies to combat food insecurity. However, in Malaysia, the awareness of urban farming is still low and the concept of aquaponic system is not a widespread concept. The aims of this research are to study the interest and willingness of potential user with agriculture background for practicing a sustainable maintenance for urban farming. The objectives of this research are (i) to stabilize Eco-system irregularities between plant and fish to get enough nutrients and grow together and (ii) to identify whether aquaponic systems can help manage maintenance and know potential users, this system is able to reduce the burden of maintenance. Requirement of high intellect in aquaponic, high amount of maintenance, and requirement of critical skill are the three main barriers for the implementation of aquaponic system. This research also helps (iii) to build proper science corner for SK Padang Temu. Conversely, the potential of an aquaponic system are it can be a basic system for further improvement and can used for business purpose. In future study, the integration of building design with aquaponic system can be studied to increase the motivation of people to practice an aquaponic system.

DEDICATION

To my beloved parents for their faith, time and effort in me, Ayob bin Abas and Jamaliah Binti Hasan. To my sisters in particular, for their support and motivations, to all my friends.

ACKNOWLEDGEMENTS

The final year project has been a long and arduous journey. However, the supports from friends, classmates and lectures gave me unlimited energy to move forward and finally complete this project. First of all, I want to express my thanks to Sir Wan Norhisyam bin Abd Rashid, my supportive supervisor, for unlimited guidance and advice on the project. Secondly, I would also like to express my appreciation to the staff of Sekolah Padang Temu which is Ustaz Azmi, the headmistress Puan Rusnah for their help in completing this community project. Next, I would like to express my appreciation for the support and assistance provided by my friend and my classmates. Last but not least, thanks to my family who have helped me all the way, both spiritually and financially, that are the greatest inspiration for this venture.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Aquaculture is universally the quickest developing area of farming that should be practical and should likewise satisfy bioeconomic needs. Aquaponic is a cutting-edge agribusiness cultivating with the blend of aquaculture and hydroponics where the losses from aquaculture action will be used in the hydroponic framework to create plants, at the interim, changing over the dangerous mixes in the water into nontoxic before recycling the water once again into fish culture tank. Aquaponic is otherwise called a supportable sustenance generation framework that joins conventional aquaculture (fish in the tank) with aquaculture (developing plants in water) inward environment. The aquaponic framework can be different in structure and size. The structure can be a small indoor or outside while the size can be business use or private use.

1.1 PROBLEM STATEMENT

Nowadays, the world population continues to increase, people should figure out how to create bigger amounts of sustenance in an economical manner. Present day cultivating is required by networks particularly those in the farming division. The cutting-edge planting framework is picking up intrigue overall individuals as a greater number of individuals are turning towards current cultivating than conventional cultivating. In Malaysia, the aquaculture isn't broadly utilized by the network as there is no all-encompassing introduction to aquaponics. The project is intended to address 3 major issues that are poor maintenance management that can harm the plant and fish growth systems that current at SK Padang Temu. Second, low quality of water that can be a rearing ground for Aedes because there is no water flow. Third, there is no legitimate science corner for the understudy at SK Padang Temu. The expected result will be this aquaponic system will make circulation between fish and plant more systematic and water cleaner than before.

1.2 OBJECTIVES

The objective of this project is:

1. To stabilize Eco-system irregularities between plant and fish to get enough nutrients and grow together.
2. To identify whether aquaponic systems can help manage maintenance and know potential users.
3. To build proper science corner for SK Padang Temu.

1.2 SCOPE

Below will be the list of scope for the project:

1. Build aquaponic system that make eco-system stable.
2. Create new features in the aquaponics system by creating an efficient power system and eco-friendly materials.
3. Create small-scale aquaponic system at school science (5m x 2m) pond

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

In this chapter, the purpose is to make a review of the past studies that have been done by other researchers that related and relevant to the aquaponics control system. This chapter also will discuss the maintenance control system needed for an aquaponic system. Prior to that, the validity of previous research according will be discussed and determined. Similarity, literature that was studies included features and analysed on completeness regarding their strengths and weakness to avoid maintenance problem are included in this section.

2.1 Aquaponic System

An aquaponic system, normal vegetables are created in an obliged space by reusing water from a fish tank, well off in enhancements that are basic for plant advancement. Out of all the available water resources on planet Earth, 2.5% is a freshwater resource. In this 2.5%, simply 0.3% is the speedily open freshwater resource accessible to individuals. 70% of this confined proportion of crisp water available is used for farming.(Menon, 2013)

Furthermore, Aquaponics might be a property sustenance creation framework that blends development like fish and blends with horticulture inward environment. In the development, effluents aggregate inside the water, expanding danger for the fish. Aquaponic frameworks fluctuate in size from little indoor or out-of-doors units to giant specialty units, abuse a comparable innovation. The frameworks in some cases contain H2O; be that as it may, saltwater frameworks are conceivable looking on the kind of fish and that plants. The biofilter also hydroponic parts can be united by using plant reinforce medium, for instance,

shake or sand that moreover limits as biofilter media. Uniting biofiltration with hydroponics is an alluring objective since it is disposing of the cost of a different biofilter (Mohamad, 2014).

Other than that, the process of nitrification is involved to remove the solid waste in water through mechanical filter, and then to convert bacteria ammonium into nitrate using biofilter. Now the nitrate and other nutrients are mixing in water will flow to the plant grow bed and the plants will absorb all the nutrients needed before the water flow back into fish tank purified. To create a healthy environment and balanced environment, the plant, fish and the bacteria must work together(Publikoa, 2018).

2.2 Water Quality Maintenance

The water quality care is to assurance living thing can endure and sound. The water quality limitations, for example, oxygen, pH, temperature and nitrogen mixes. Lopsided dimensions of temperature and pH can expand the poisonous quality of smelling salts and hydrogen sulphide. Hence, the key for both the wellbeing and development of cultural life forms is keeping up adjusted dimensions of water quality limitation.

2.2.1 Temperature Control

The essential basic water quality limitation of water temperature for the aquaponic framework since it impacts the broke up oxygen. The less breakup oxygen, more smelling salts, and limit the retention of calcium in plants happen when the temperature of the water is high. The ideal aquaponic framework water temperature is around 18-30 ºC. For the most part, the fish for the most part without remorse and subject to the encompassing water temperature that responds to their inward body temperature (Somerville, 2014).

The determination of fish species and plant types, the temperature is one of point to be considered on the grounds that comparable temperature

prerequisites of harvests ought to be refined together. For instance, tilapia is warm water fish and a warm temperature crop like basil ought to be developed together (Mullins, Nerrie, and Sink, n.d.).

2.2.2 PH Level Control

The pH level in the aquaponic system must be manipulated to prevent the pH level condition too high or low. The standard range of pH level aquaponic system which is suitable for fish and plants is between 6-7pH.

The unionized ammonia and carbon dioxide must control by pH level for chemical equilibrium of several toxic fish metabolites. The respiration and photosynthesis relative rates of the pond when the pH falls or rises for control the net adding or elimination of carbon dioxide.

The water temperature and biomass of plants, animals and microorganisms in water and bottom sediment are affected the respiration rate (Tucker & D'Abramo, 2008).

Ammonium is changing into nitrites and nitrites changing into nitrates. Both reagents can be accumulated in the water since the input rate process take shorter than the nitrification process (Publikoa, 2018).

2.3 Power Management

The primary wellsprings of producing power, for example, oil, gas, atomic power is more costly than any time in recent memory. Other than that, the assets are diminishing the measure of non-sustainable as a result of the world interest rising.

An unnatural weather changes additionally rising quicker if consuming fossil can deliver nursery. One of the cleanest techniques for vitality creation known is solar power however it isn't for all intents and purposes utilized

generally on the grounds that sun-based boards exceptionally cost contrast with power for coal-terminated power plants (Mohamad, 2014).

2.4 Aquaponic System other maintenance

This topic is other maintenance that required as additional to aquaponic system.

2.4.1 Plant disease management and fish disease management

A disease is ordinarily plotting as strange development and additionally pathology of a plant. Diseases are the consequence of some confusion in the ordinary life procedure of the plant. There are Biotic sicknesses are brought about by living life forms which are parasites, microbes, and infections. Abiotic ailments are brought about by non-living natural conditions which are soil compaction, wind, ice, soil salt harm, and supporting roots. Fish is simpler anguished pressure and delicate with the water state.

The water is gone about as a living domain to the fish, along these lines, any difference in water condition straight affects the fish, for example, the unusual change in water temperature and pH. Hence, the safe arrangement of the fish against the infections will reduce when any terrible condition of the water happen.

2.5 Previous research of aquaponic system

From the past research of the aquaponic system by (Mohamad, 2014) the examination is about the aquaponic framework utilizing a solar panel to control the water siphon and pneumatic machine dependent on Peripheral Interface Controller (PIC) innovation. They secured a sustainable power source that includes a blend of electrical, hardware and agribusiness into one supportable framework which comprises of a solar panel, inverter, water siphon, and vacuum apparatus. The principal reason for the framework is to supplant the non-

sustainable power source that diminishing and beginning to run out while the requests of the world continue rising.

Next, the other task from (Toal, Claggett, and Justin, 2017) is about an aquaponics framework that was self-continuing however much as could reasonably be expected just as material to whatever number situations as could be allowed. In this task, they secured the temperature control, water stream, and fish sustaining. To make this framework feasible in a wide assortment of situations, they needed to fuse a powerful framework that would work in an off-matrix or inconsistent lattice setting. This undertaking likewise fit to control the remainder of the parts for quite a long time at any given moment in case of outer power source misfortune.

Moreover, from (Kloas et al., 2015) past undertaking they secured new ideas for aquaponics is to improve manageability and efficiency attendant with bringing down natural outflows. They are utilizing water siphon, ventilation units, crisis control framework, however, no microcontroller including in this venture.

Journal

Table 2.1: previous project

Title	Objective	Scope	Hardware and software	Writer
1. A new concept for aquaponic systems to improve sustainability, increase productivity, and reduce environmental	To improve sustainability and productivity concomitant with lowering environmental emissions.	Combine 2 independent recirculating units an aquaculture system (RAS) for fish and a hydroponic unit for plants.	Water pump, ventilation units, emergency power system, no microcontroller.	Werner Kloas, Roman Groß, Daniela Baganz
2. Aquaponics System for Treat A Catfish Wastewater	To determine the characteristics of water quality from the cultured fish tank. To determine effect of vegetable distribution on the wastewater quality. Effect of the vegetable growth	Determine the water quality characteristics from culture fish tank. Besides, next, Determine effect of vegetable distribution on the wastewater quality and effect of the vegetable growth	Water Pump, no microcontroller.	Hasan, nurain abu