DEVELOPMENT OF WATER FLOW MANAGEMENT AND VECTOR CONTROL FOR RAINWATER HARVESTING TANK

KISHEN A/L KUNALAN

B071710622

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"DEVELOPMENT OF WATER FLOW MANAGEMENT AND VECTOR CONTROL FOR RAINWATER HARVESTING TANK"

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

by

KISHEN A/L KUNALAN

B071710622

961216-08-6097

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

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No54, Lorong 16,
Taman Mawar,
34700 Simpang,
Perak.

Tarikh: 14/02/2021

Disahkan oleh penyelia:

.....
TS. FAKHRULLAH BIN IDRIS

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APPROVAL

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

Signature: .....

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ABSTRAK

Krisis air menjadi isu dominan di seluruh dunia. Masalah ini juga berlaku kerana pengedaran air yang buruk, penggunaan yang boros, dan ketiadaan sistem pengurusan air yang mencukupi dan betul. Untuk mengelakkan masalah kekurangan air, sistem penuaian air hujan diperkenalkan oleh kerajaan Malaysia. Tetapi, kawalan vektor yang buruk di tangki penuaian air hujan akan menyebabkan pembiakan vektor yang serius dan akan menyebabkan penyakit vektor seperti denggi, malaria, demam kuning, dan lain-lain. Kes denggi di Malaysia meningkat dari 72 kes untuk 100000 populasi pada tahun 2001 menjadi 361 kes pada 100000 populasi pada tahun 2014. Untuk mengatasi masalah pembiakan vektor ini dan menguruskan kawalan air hujan dengan bijak prototaip untuk pengurusan aliran air dan kawalan vektor untuk tangki penuaian air hujan telah dibina.

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ABSTRACT

The water crisis is becoming a dominant issue all over the world. This issue also occurs because of poor water distribution, wasteful use, and absence of sufficient and proper water management system. In order to prevent the water scarcity problem, the rainwater harvesting system (RWHS) is introduced by the Malaysian government. But, poor vector control in the rainwater harvesting tank will cause serious vector reproduction and will lead to vector diseases like dengue, malaria, yellow fever, and others. The dengue cases in Malaysia has risen from 72 cases for 100000 population in 2001 to 361 cases in 100000 population in 2014. In order to overcome this vector reproduction problem and smartly manage the rainwater vector control and water flow management for rainwater harvesting tank prototype had been developed.

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DEDICATION

I dedicate this project report to my beloved parents and friends. A special thanks to my mother Mrs. Thanaletchimi a/p Thamotharem and father Mr. Kunalan a/l Rajamani who both always being support my ideas and give encourage to do this project. I also being grateful to thanks my supervisor Ts. Fakhrullah bin Idris who give lot of ideas and share his knowledge on doing report. I will always appreciate the help and knowledge shared especially by Mr Dhevan, Mr Suraien and Mr Loga.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

RWHS	-	Rainwater Harvesting System
LCD	-	Liquid Crystal Display
lcd	-	Liters per Capita
s	-	Distance
v	-	Speed of sound
t	-	Time taken
>	-	More than
<	-	Less than

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CHAPTER 1
INTRODUCTION

1.0 Background

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Water is the most significant fluid to sustain life. 70% of the earth is covered with water. Even though the earth has an abundant supply of water the clean water supply is only 3%. Out of this only, 1 % of water can be used because the rest of the water is in the form of ice. The human population has increased 3.1billion over the last decade (Lee *et al.*, 2016). According to (Lee *et al.*, 2016), demand for clean water supply is increasing double fast than the population. According to (Darus, 2009) by 2025, the human population will be facing drastic water shortage. The water crisis is becoming a dominant issue all over the world. This issue also occurs because of poor water distribution, wasteful use, and absence of sufficient and proper water management system. It is more important to reserve water for human daily activities. Rainwater harvesting system introduced by the government to overcome this problem. The government introduced this system because it is the easiest way to store rainwater. The stored water is used for domestic, agricultural, and industrial purposes. The rainwater harvesting method used since ancient times. Till now it is the best way to store water. Plenty of rainwater harvesting systems available in the market since the introduction of the rainwater harvesting system by the government. Nevertheless, a rainwater harvesting tank will make the tank not perfect to store rainwater if it has a poor vector control and water management system.

In order to overcome this issue, a water management and vector control for rainwater harvesting tanks had developed. This system consists of raspberry pi, ultrasonic sensor, water pump, and LCD. Raspberry pi acts as a microcontroller. The amount of water left in the tank will be measured by the ultrasonic sensor. Water flow

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is managed precisely by pumping water from the sump tank to the header tank using a water pump. Meshing is applied to the inlet and overflow of the tank to avoid vector reproduction.

1.1 Problem Statement

In Malaysia, the supply of water for everyday consumption originates from treated water. Being a developed country, Malaysia still cannot escape from water shortage because of the increase in population and development of industries and agriculture. The issues emerge when the water isn't adequate to fulfill the need or being contaminated (Ayob and Rahmat, 2017). Besides, environmental change is one of the reasons for the water shortage. It changes the accessibility, amount, and quality of the water supply (Ayob and Rahmat, 2017). El Nino is the main natural phenomenon that affects the supply of water in Malaysia (Che-Ani *et al.*, 2009). This phenomenon will occur in the Pacific Ocean, which will cause an impact on the climate like the surrounding temperature will be increased and the amount of rainfall will be reduced (Ayob and Rahmat, 2017).

In order to get better of the water scarcity problem, the rainwater harvesting system (RWHS) is introduced by the Malaysian government (Che-Ani *et al.*, 2009). RWHS is known as storage and collection of rainwater by avoiding wastage from flowing into drains. But, poor vector control in the rainwater harvesting tank will cause serious vector reproduction and will lead to vector diseases like dengue, malaria, yellow fever, and others. The dengue cases in Malaysia has risen from 72 cases for 100000 population in 2001 to 361 cases in 100000 population in 2014 (Mudin, 2015). In order to overcome this vector reproduction problem and smartly manage the rainwater, vector control and water flow management for rainwater harvesting tank prototype had been developed.

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1.2 Objective

Objectives that need to achieve in this project:

- To design and develop a water flow management and vector control system for rainwater harvesting tank.
- To study the possibility of vector infestation in rainwater tank.
- To analyse the performance of the developed prototype in terms of water inflow and vector infestation.

1.3 Scope

For experimentation purposes, the design of experiment method will be used in small residential testing. Only one prototype will be developed and one type of water tank tested. The project focuses on using raspberry pi to communicate with the ultrasonic sensor, linear solenoid actuator, and water pump. This prototype can be attached to any rainwater tank to smartly manage water and control vector reproduction. Besides, this project focuses to study the effectiveness of the prototype and the possibility of vector infestation in the rainwater harvesting tank. This prototype will be tested in a housing area. The effectiveness of the water pump to pump water and resistance of the vector control against vector reproduction will be analysed for a time period of 14 days.

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1.4 Thesis Organisation

Chapter 1 provides the background of water management and vector control. The problem statement is stated and objectives are listed to set as a benchmark to be achieved to solve the problems. Lastly, this chapter covers the scope of research.

Chapter 2 discusses the previous research on water issues in Malaysia, rainwater harvesting tank, vector-borne disease in water tank, and vector control in water tank. Comparison between the projects is done to identify the main idea, theory, and provide a wider view on the type of implementation which will be suitable for this project. Chapter 3 gives an overview of the methodology done to complete this project. The methodology is done by taking specific steps to develop the project while obeying the objectives stated. A flow chart will be designed to show the procedures taken.

Details of results are provided in Chapter 4. The data or output of the project will be analysed and discussed in detail. Figures of output will be attached. Chapter 5 concludes and summarises the main ideas and states whether the project output has achieved the objectives.

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CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter is all about previous research on water issues in Malaysia, rainwater harvesting tank, vector-borne disease in water tank, and vector control in water tank. This chapter emphasize mostly on the history, facts, previous research, and difference between technique used by the researcher. The source for the research and fact-finding is taken from article, journal, manuscript, books, and internet. At the end of this chapter, the research that had done can be used to improve the project and making it different from other projects. Therefore, this chapter is the most important part in improving the project.

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2.1 Water Issues in Malaysia

Malaysia even though being a developed country it still faces water crisis. Malaysia is generally wealthy in water sources having around 2400 mm yearly rainfall, (Che-Ain et al.,2009). Malaysia is among the Indian Ocean and the Pacific Ocean. Southwest monsoon and northeast monsoon mostly affect Malaysia's climate (Lee *et al.*, 2016). Southwest monsoon is often called as the dry season it usually occurs from May till August while northeast monsoon is often called as wet season and it usually occurs from November till February.

Malaysia has experienced a lot of development since its independence in 1957. Due to this rapid development, it put a higher demand for water resources (Rahman *et al.*, 2013). Other than rapid development, the number of populations also drastically increased. According to (Lani, Yusop and Syafiuddin, 2018) cities like Malacca,

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