



**Faculty of Electrical and Electronic Engineering Technology**



**DEVELOPMENT OF IOT BASED RAINWATER HARVESTING  
SYSTEM USING ESP8266 FOR MELAKA GREEN HOMES**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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**Bachelor of Electronics Engineering Technology (Telecommunications) with Honours**

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**DEVELOPMENT OF IOT BASED RAINWATER HARVESTING SYSTEM USING  
ESP8266 FOR MELAKA GREEN HOMES**

**NADHIRAH BINTI MAZALAN**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electronics Engineering Technology with Honours**



**Faculty of Electrical and Electronic Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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## DECLARATION

I declare that this project report entitled “Development of IOT based Rainwater Harvesting System using ESP8266 for Melaka Green Homes” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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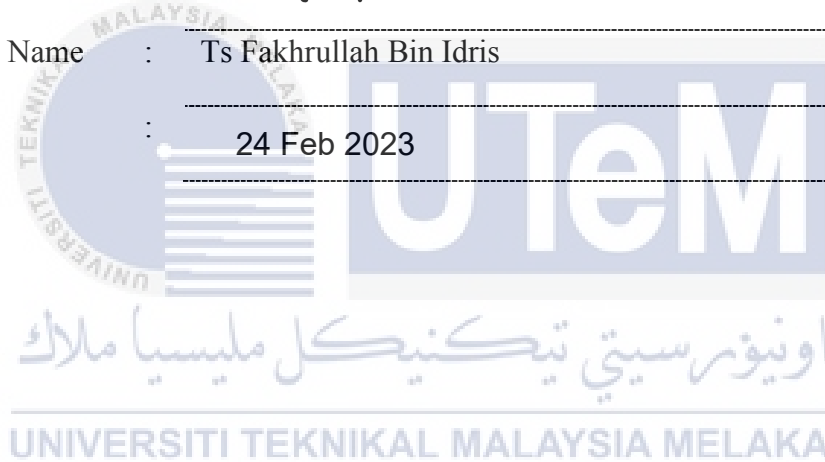
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## APPROVAL

I approve that this Bachelor Degree Project 1 (PSM1) report entitled “Development of IoT Based Rainwater Harvesting System using ESP8266 for Melaka Green Homes” is sufficient for submission.

Signature :   
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## DEDICATION

*This report is dedicated to my late mother, Norzamni Binti Yahya who has been a constant source of support and encouragement during the challenges of finished this final year project. This work also dedicated to my father, brothers and sister who encouraged me attentively with their fullest and truest attention to accomplish my work with truthful self-confidence.*



## ABSTRACT

A rainwater harvesting system collects rainfall and stores rainwater in storage with various functions and purposes. This rainwater harvesting focuses on the residential area in Melaka to achieve Melaka Green Homes. Then, it ensures that the system complies with sustainability, water quality and design standards. This study is to solve water crisis problems and flash flood that occurs in Melaka. Melaka faced several drought cases in the past decade and was forced to ration clean water to its population as its dams ran out of water. Sometimes, Melaka experienced a flash floods in heavy rain, especially in developing areas. Moreover, in many cases, rainwater harvesting will cause vector breeding, such as mosquitos. Therefore, the objective of this project is to implement a rainwater harvesting system in the residential area in Melaka. The expected result of this project improvement will stop larva breeding for around 3 months maximum. So, this IOT Based Rainwater Harvesting will help hold rainwater catchment and distribute it to the consumer in the house and eliminate vector breeding in stored water.

## ***ABSTRAK***

Sistem penuaian air hujan ialah suatu sistem yang mengumpul dan menyimpan air hujan di dalam bekas simpanan dengan pelbagai fungsi dan tujuan. Penuaian air hujan ini memberi tumpuan kepada kawasan perumahan di Melaka untuk mencapai Rumah Hijau Melaka. Kemudian, ia dapat memastikan bahawa sistem ini mematuhi kelestarian, kualiti air dan standard reka bentuk. Kajian ini adalah untuk menyelesaikan masalah krisis air dan banjir kilat yang berlaku di Melaka. Melaka menghadapi beberapa kes kemarau dalam dekad yang lalu dan terpaksa membuat catuan air bersih kepada penduduknya oleh kerana air di empangan telah hampir kering. Melaka turut mengalami banjir kilat ketika hujan lebat terutamanya di kawasan membangun. Dalam banyak kes yang berlaku, penuaian air hujan akan menyebabkan pembiakan vektor seperti nyamuk. Oleh itu, objektif projek ini adalah untuk melaksanakan sistem penuaian air hujan di kediaman yang mampu mengurangkan masalah yang dihadapi. Hasil jangkaan penambahbaikan projek ini akan menghentikan pembiakan larva selama kira-kira 3 bulan maksimum. Oleh itu, Penuaian Air Hujan Berasaskan IOT ini akan membantu menahan air hujan dan dapat diedarkan kepada pengguna di rumah dan menghapuskan pembiakan vektor dalam tangki simpanan air.

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## LIST OF SYMBOLS

$l$	-	liter
$m^3$	-	Metre cube
	-	
	-	
	-	
	-	
	-	
	-	



## LIST OF ABBREVIATIONS

- RWHS* - Rainwater Harvesting System  
*PBT* - *Pihak Berkuasa Tempatan*



## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Rainwater harvesting is a method of collecting rainwater as a supplemental source of water for residences, business and industrial buildings, landscape watering, livestock watering, and agricultural irrigation [1]. Rainwater harvesting systems became a feasible and viable options for reducing potable water consumption during the dry season and possibly reducing the adverse effect of floods during heavy rainfall.

#### 1.2 Problem Statement

Water is the most important substance in our daily life such as for drinking, washes, landscape watering and more. Water management in Melaka faces many challenges such as flash floods and dams running out of water. Efficient and effective water management is thus a main focus to maintain stability. Alternative water source and storage system must be identified to solve the water issues. One possible solution is RWHS. If the RWHS implemented widely in Melaka to increase water storage at homes level, the possibility an outbreak of vector diseases and infestation in the water storage. It may lead to increasing of dengue fever cases in Melaka.



### 1.3 Project Objective

The main aim of this project is to propose a systematic and effective water reuse while saving water consumption in Melaka. Specifically, the objectives are as below :-

- a) To develop a rainwater harvesting system in every house for effective system to hold rainwater catchment for water supply and control flash flood.
- b) To prevent vector diseases from spreading in water storage that hold rainwater
- c) To measure the amount of rainwater stored in water catchment for water consumption to be distributed to consumers.

### 1.4 Scope of Project

The project scope of this project is due to some limitations and constraints, the scope of the project is defined as follows:

- a) The rainwater harvesting system helps to hold rainwater to store the rainwater in water storage for uses of consumer in the house.
- b) Develop a rainwater catchment to control larva from spreading disease in stored water in house using mesh on top of the tank.
- c) The data will capture and shared into cloud for the PBT monitoring to detect the amount of water uses of consumer in the house that install the rainwater harvesting.

## CHAPTER 2

### LITERATURE REVIEW

This chapter is to discuss about the rainwater harvesting system for Melaka green homes. In the context of planning, sustainable water management is guaranteeing enough supplies of fresh water for current and future generations, as well as the environment. [2] Rainwater harvesting is a solution to manage water consumption in Melaka and process that collect rainwater in a water storage to consumer in a house that install the Rainwater Harvesting System. There will be some risk after the installation of this system. So, this chapter will study about how to implemented rainwater harvesting system and finding the solution.

#### 2.1 Melaka Water Crisis

Water is essential to the life of every human. It is true that awareness and concern about water has grown considerably, globally and locally. Back in 1998, Malaysia have been in water crisis included Melaka[3]. According to the Transport and Public Amenities exco Datuk Mohd Sofi Abdul Wahab on malay mail said there are 12 areas facing water disruption, with nine in Melaka Tengah and three in Jasin. From finding news, water consumption in the state of Melaka was about 600 litres a day [4]. In the previous century, water usage increased at a rate more than double that of population growth. Increased demand for potential water from the agricultural, industrial, and home sectors of the economy will come from this level of population expansion.

In 2020, Melaka is experiencing a water crisis that gotten worse than before. As result, many areas experience scheduled water rationing which had to be done by Syarikat Air Melaka Berhad. This is due to the lack of rain in the beloved land of Melaka, resulting in capacity in

the Melaka state dam [5]. Figure 1 below shows the statistics on the Average Annual Rainfall Distribution(mm) in the Melaka state dam from 2015 until 2019. It shows that the average rainfall began decrease sharply in 2019. This is associated with the Northeast Monsoon wind circulation which usually began on October until March [6].



Figure 2.1 : Statistic rainfall in Melaka from 2015 until 2019 Source: Facebook Kerajaan Negeri Melaka [6]

Rainwater is a part of hydrologic cycle which means the never ending exchange of water from the atmosphere to the ocean and back again as rainwater. The precipitation like hail, rain, sleet, snow and all the consequent movement of water in nature forms are from part of this cycle.

Generally, Rainwater Harvesting is one of the solutions of water crisis management. Rainwater Harvesting system, not only aiming of collecting excess water from rain. In fact, it brings benefits to the urban hydrological cycle and also as a tool pollution quality controllers in urban areas. Thus, the method of harvesting rainwater is seen supports the idea of pro-environmental flow, while highlighting theoretical capabilities ecological modernization that utilizes natural water resources in a more modern way and high-tech [7].

RWHS is an effective water management or known as Best Management Practice (BMP). Following the study of the water crisis occurs in Melaka in 1998, the implementation of RWHS became the first initiative in Malaysia [8].

### **2.1.1 Seasonal water drought in Melaka**

The state government, according to the chief minister, has developed a medium- and long-term plan to alleviate Melaka's water supply issue. A RM35 million project in Tasik Biru in Chinchin, Jasin, has been finalised by the state government and is anticipated to be finished in the first quarter of 2019. Up to 200 million litres of water per day are anticipated to be pumped from the lake to the Durian Tunggal Dam near Alor Gajah. [9].

During the dry season, rainwater collection has become a practicable and viable method for lowering potable water usage. Rainwater harvesting is a technique for collecting rainwater as a supplemental source of water for residences, business and industrial buildings, landscape irrigation, livestock watering, and agricultural irrigation. In this study, we focused on Rainwater Harvesting especially for housing area. Utilizing rain water harvesting system in commercial buildings can potentially reduce water consumption and flood effect [10]. Rainwater harvesting is one of the green building practices because it involved with processes that are environment friendly. So, Rainwater harvesting system is one of the best solutions for drought happens in Malaysia especially in Melaka. By using this method, this project able to helps stored water and distributed to consumers.

### **2.1.2 Floods**

Lately, some cities in Malaysia had been face the flash flood. In point of view, the flash flood happened because of the drain that not systematic and do not have rain catchment. As

we are in era of technology that be spread widely, there are many developments in our country. The flash flood happened because of the drain that not systematics [11]and extremely heavy rainfall that begins within 6 hours and often within 3 hours [12] . RWHS will helps to decreases the flash floods by making a rainwater catchment and helps decreasing of the flash flood in certain area. This project will collect until maximum volume of rainwater for future uses.

## **2.2 Water Supply**

Water is an invaluable resource which has to managed well to ensure its availability. While water is important to support the development of a country, we also need to maintain the natural ecosystem to ensure sustainability of the resource for future generations. Climate change has been identified as one of the significant factors for alteration of weather conditions around the world [13]. The changes in rainfall amount and temperature might have severe impact on reliability of conventional water supply system, government authorities are promoting sustainable alternative technologies like rainwater harvesting system in various country including Melaka, Malaysia.

In this year 2022, Melaka experienced a rather unusual rainfall phenomenon. It increasing in rainfall distribution between 140mm to 150mm compared to 30mm to 40mm on a normal day. This means that the distribution of rainfall in Melaka when hit by flash flood is 4 times compared to normal times.

## **2.3 Melaka Green Homes**

Melaka is a frontrunner in Malaysia that is actively involved in embracing the concept of 'Green City'. The state government has announced an ambitious plan to become the first state in Malaysia to adopt green technology and be a green 'city-state' by 2020. Melaka have started houses project that built with eco-friendly features to encourage a sustainable lifestyle. Taman

Nuri Phase 3 that located in Durian Tunggal designed with a rainwater harvesting system for efficient water usage [14]. Rainwater harvesting system also have been implemented in selected school in Melaka. Their projects only focused on utilized for cleaning and gardening activities in their school.

### **2.3.1 Implemented Green Homes technology**

The scenario that occurred in 1998 where Melaka faces a crisis because the supply of raw water was insufficient to meet the needs of the population. So, the design of RWHS is one the best solution for flash flood and water shortage problem. In addition, these simple solutions also decrease stormwater runoff. Rainwater can easily be used in homes for non-potable purposes. It is also very practical for garden irrigation, livestock, fountains and ponds. Mostly, project of RWHS have problem of insects or larvae in the water storage. So, these projects will invent a water storage that may eliminated vector breeding in stored water.

### **2.4 Rainwater Harvesting**

As we are in era of technology that be spread widely, there are many developments in our country, Malaysia. Lately, some cities in Malaysia had been face the flash flood. In point of view, the flash flood happened because of the drain that not systematic and do not have rain catchment.

In Melaka, some places have installed rainwater harvesting system. Figure 2 below shows the example of rainwater tank that Majlis Perbandaran Alor Gajah (MPAG) have used as green technology pioneer. This system is called rooftop rainwater harvesting. There were several types of rainwater harvesting tank such as ground rainwater harvesting ad rooftop. These rainwater tank able to hold rainwater about 2.273 litres per tank. While for ground rainwater

able to hold about 4,546 litres per tank. With these systems, we able to save on clean water consumption and reduce water bills [15].

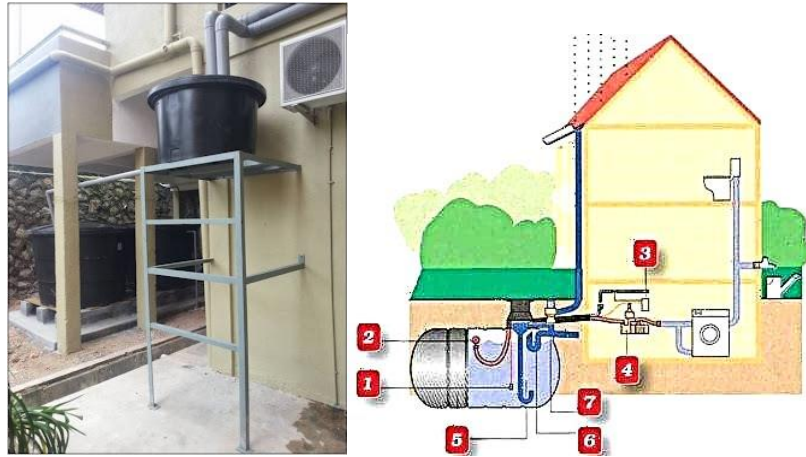


Figure 2.2: Rainwater tank storage Source: Blog Teknologi Hijau Alor Gajah [15]

The use of this system has been known as a source of sustainable water supply as this system is able to preserve the environment through with the reduction of energy input to treat and pump water to a wide service area. This situation can reduce carbon emissions and rainwater consumption to save the use of treated water. Furthermore, it can reduce deforestation to build dams to overcome the problem of floods and water supply shortage.

### 2.4.1 The implemented of Rainwater Harvesting System

There are many country included Malaysia have been implemented RWHS and used for various purposes such as laundry, irrigation, used in toilets, cleaning or purified for human use.

Table 2.1 : Comparison RWHS in few countries

Country	Storage tank (m <sup>3</sup> )	Types	Water demand	Average annual rainfall (mm)	Reference
China	3 & 6	Roof catchment	rooftop area of 100 m <sup>2</sup> ; 4 floors with one family each, 4 dwellers in each family; and water demand for flushing toilet of 60 lpcd (liter per capita per day)	1758 - 6124	[16]
Bangladesh	5	Roof catchment	3686 megaliters per day according to the populations.	2200	[17]
Malaysia	10, 15 and 25	Roof catchment	21.14% for toilet flushing in hospital.	1225	[10]
Japan	3	Roof catchment	83.5 km <sup>3</sup> , or 20% of water availability in an average year.	1016 - 2540	[18]
Mexico	10	Roof catchment and ground storage	Mexico's per person consumption of water is about half that of Canada but with proportionately more allocated to agriculture	760	[19]