



Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF IoT INDOOR PLANTER BOX WITH
RAINWATER HARVESTING SYSTEM**

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Bachelor of Electrical Engineering Technology with Honours

2021

**DEVELOPMENT OF IoT INDOOR PLANTER BOX WITH RAINWATER
HARVESTING SYSTEM**

IRA ARESHA BINTI ARIAN

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



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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I declare that this project report entitled “Development Of IoT Indoor Planter Box With Rainwater Harvesting System” 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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DEDICATION

To the ones who never stop in providing me the supports mentally and physically, and the motivation through life, my beloved mother, Noraini Binti Juhari, father, Arian Bin Ahmad and also Muhammad Aliff Bin Ahmad Zahir.



ABSTRACT

The main purpose or aim for this project is to be able to monitor and water indoor garden automatically with aid of the Internet of Things which connects from hardware to a smartphone with applying Blynk application. This project also has an automatic rainwater harvesting system which will collect rainwater for the purpose of irrigation. This is so that the tank that connected to the planter box will never run out of water unless there is a natural occurrence such as draught where there will be no rain to refill the tank. The project presents the use of correct soil moisture sensors which helps to ease out the pain to monitor and keep records about the changes in soil moisture. Using the Arduino Mega microcontroller with moisture sensor and temperature sensor, temperature is measured and analysed. The soil for a certain duration, provides information related to the moisture status of the soil. The Arduino Mega will collect and process the data received from the sensor. When a threshold moisture level of the soil is reached, the water will supply accordingly. This is essential because water must be provided to the plant at a particular time for a good yield. In addition to that, rainwater harvesting system also connected with rain sensor, ultrasonic sensor and servo motor. Rain sensor will be working together with ultrasonic sensor as the input to the water tank. Once rain is detected and the water level in the tank is low, servo motor will do its work by opening the lid of the tank thus collect rainwater. In conclusion, this project will be very suitable for any residential area and also can be improve for the use of future indoor plantation system.

ABSTRAK

Tujuan atau matlamat utama projek ini adalah untuk dapat memantau dan menyiram tanaman atau kebun secara automatik dengan bantuan *Internet of Things* yang menghubungkan dari perkakasan (*hardware*) ke telefon pintar dengan menggunakan aplikasi *Blynk*. Projek ini juga mempunyai sistem penuaian air hujan automatik yang akan mengumpul air hujan untuk tujuan pengairan. Ini adalah supaya tangki yang disambungkan ke kotak penanam tidak akan kehabisan air melainkan berlaku kejadian semula jadi seperti kemarau yang tidak akan berlaku hujan untuk mengisi semula tangki. Projek ini membentangkan penggunaan penderia kelembapan tanah yang betul yang membantu mengurangkan keperluan untuk memantau dan menyimpan rekod tentang perubahan dalam kelembapan tanah. Menggunakan mikropengawal Arduino Mega dengan sensor kelembapan dan sensor suhu, suhu diukur dan dianalisis. Tanah untuk tempoh tertentu, memberikan maklumat yang berkaitan dengan status kelembapan tanah. Arduino Mega akan mengumpul dan memproses data yang diterima daripada sensor. Apabila tahap kelembapan tanah adalah pada kadar minimum, air akan disalurkan ke tanaman dengan sewajarnya. Perkara ini amat penting kerana air mesti disalurkan kepada tumbuhan pada masa tertentu untuk hasil tumbuhan yang baik. Selain itu, sistem penuaian air hujan juga disambungkan dengan sensor hujan, sensor ultrasonik dan motor servo. Penderia hujan akan bekerjasama dengan penderia ultrasonik sebagai input kepada tangki air. Setelah hujan dikesan dan paras air dalam tangki menjadi rendah, motor servo akan melakukan kerjanya dengan membuka penutup tangki sekali gus mengumpul air hujan. Kesimpulannya, projek ini amat sesuai untuk mana-mana kawasan perumahan dan juga boleh ditambah baik untuk kegunaan sistem ladang dalaman pada masa hadapan.

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LIST OF SYMBOLS

V	-	Volts
A	-	Ampere
°C	-	Degree Celcius
KB	-	Kilobytes
MHz	-	Mega Hertz



LIST OF ABBREVIATIONS

- PWM - Pulse Width Modulation
- DC - Direct Current
- EEPROM - Electrically Erasable Programmable Read-Only Memory
- LED - Light Emitting Diode
- LCD - Liquid Crystal Display



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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain the brief ideas about the project. It will be consisting of project background, problem statement, objectives and also scope of work. In addition, a simple flow of work will also be explained which is from the starting of operation until the end. This project mainly consists of the Internet-of-Things (IoT) devices which is a requirement in achieving the Industry Revolution 4.0 (IR 4.0)

1.2 Background

Irrigation is an important system for a plantation and agricultural crops. Irrigation system is a popular system among farmers because of its efficiency and that it allows crops to grow at a uniform schedule. Besides, irrigation system is very easy to install, maintain and it is suitable for any types of crops or soils which is why many farmers choose to use an irrigation system.

Malaysia tropical climate is at advantage because of its suitability to produce variation of fruits and vegetables since Peninsular Malaysia rarely encounter hurricanes or droughts. Agriculture is one of the important sectors in Malaysia's economy by contributing 12 percent to the national Gross Domestic Product (GDP) and provide 16 percent employment of the population. Thus, Malaysian farmers produce quite a number of fruits and vegetables for domestic market including durian, coconut, rambutan and others.

However, farmers or gardeners must always keep on checking their crops or garden to make sure the soils are moisture to assist the growth of plantations. Despite, most farmers or gardeners are only able to plant their tree outdoor. This is due to the need of sunlight for photosynthesis and plant growth. In a fact, plant does not only need sunlight to do photosynthesis instead, they need an ultraviolet lighting because that is utmost importance in plant growth. Besides, plants and crops has their own temperature and humidity that effect for growing in each phases that are vegetative and flowering phase.

In addition, through the years, more and more smart farming technique has been encountered. As it is widely known, every technique either aquaponics, hydroponics, aeroponics and even the normal soil plantation needs a lot of water. Water on the other hand, has its own issues. As like what is widely spread through the newspaper, social medias, television, radios and other information related channels, enough information regarding the less and less consumable and usable water is available.

Since that Malaysia has a high rate of rainfall distribution throughout the years which varies between 2300 up to 4500 depending on the states, it is a beneficial first step as to which if to waste all the rainwater, it could be collected will then be used to water indoor farm. Rainwater will be harvest into a tank which will then gradually be pump into an internal pump that is smaller to give supply to the indoor farm. Moreover, the system that includes the indoor farm will be monitored through the Blynk apps while giving push notification on every details regarding the farm.

1.3 Problem Statement

Through more development of self-sustain vegetable garden, the problem regarding water supply were always to be discussed as an issue. Does not matter whether the system

is either aquaponics, hydroponics, aeroponics or just anything that related to crop and farming, there will be some shortness of water problem. Even if there are no water issues in this case, the water used can be supplied to other that needed it the most.

Problems that has been risen through the past indoor garden is obviously the need to top up the amount of water supplied from the water tank into the planter box. In order to solve this problem, a system of rainwater harvesting that will only require only a little bit of space.

1.4 Project Objective

The objectives for the Development of IoT Indoor Planter Box with Rainwater Harvesting System are:

- To develop an automatic indoor plant watering system with the aids of rainwater harvesting system
- To implement IoT based wireless monitoring and notification system using Blynk open source application
- To enhance the use of rainwater harvesting system for plantation.

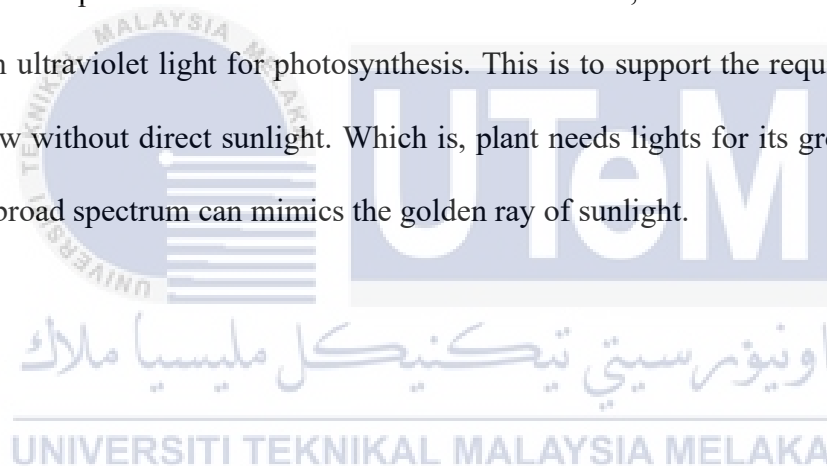
1.5 Scope of Project

The Development of IoT Indoor Planter Box with Rainwater Harvesting System is designed for indoor space. A system of rainwater harvesting will be used to collect water as the supply for the planter box. Firstly, a tank will be placed on the roof of a building and attached to it is rain sensor module to detect the presence of rain. In the tank, an ultrasonic sensor will be placed to measure water level low. Data from the both rain sensor and ultrasonic sensor will then be sent to Arduino Mega which will trigger the servo motor if the water level is extremely low.

Inside the tank, a DC water pump will be connected directly to plant that will then distribute water to the smart indoor planter box as required. The planter box will be equipped with temperature and humidity sensor and moisture sensor which eventually will give the small tank the signal to water the crops.

With the aid of ESP8266 Wi-Fi Module that were to be paired with Arduino Mega, the data from temperature and humidity sensor attached near the planting box will directly be send to the owner's Blynk apps. As the advantage, the owner can monitor the condition of their planter box in live mode.

In order to get the artificial sunlight, the planter box will be attached to it, an ultraviolet led strip which consist of balance amount of blue, red and white led which will give enough ultraviolet light for photosynthesis. This is to support the requirement for the plant to grow without direct sunlight. Which is, plant needs lights for its growth. But only lights with broad spectrum can mimics the golden ray of sunlight.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is one of the most important part of a project where it acts as a reference and guidelines for a new project to be improve and developed. Without them, no new inventions and improvement will be made in regards of the existing products. The aim of reinvention is to upgrade the technology while making human more advance.

In this chapter, reviews on definitions, past studies and projects regarding the Development of IoT Indoor Planter Box with Rainwater Harvesting System and all its component that will be used will be explain.

2.2 Indoor Garden

As the years went by, less and less outdoor space were left on this earth due to major development. By the year 2050, population of the world were estimated to reach 9.7 billion. In order to provide enough food for everyone, it has been estimated that worldwide food production needed to be increased by up to 70% in the next 30 years or so [12].

Due to that estimated information, an initiative to solve this problem, indoor gardening was introduced to the world. Indoor garden or so called indoor farming was done from a long time ago. Compared to the old era, the only difference is that we have a lot of new technologies and inventions that were developed in making sure that the vegetative crops grow healthy with great quality.