UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART IRRIGATION SYSTEM USING LORA

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

by

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I hereby, declared this report entitled DEVELOPMENT OF SMART IRRIGATION SYSTEM USING LORA is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to Faculty of Electrical and Electronic Engineering Technology (FTKEE) 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:

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ABSTRAK

Tanaman memerlukan sumber air yang mencukupi untuk menjadi sihat dan subur. Jumlah lebihan air dan jumlah kurang air yang dibekalkan kepada tumbuhan boleh menyebabkan tumbuhan layu dan mati. Penyelidikan yang lepas telah memberi tumpuan kepada kaedah Bagaimana untuk menyiram air pada tanaman pada waktu yang sesuai dengan jumlah air yang betul. Kajian ini tertumpu kepada bagaimana untuk membangunkan sistem penyiraman automatik menggunakan Arduino supaya tumbuhan disiram pada masa yang sesuai dengan jumlah yang betul. Tujuan lain sistem ini adalah untuk memudahkan manusia dalam menyiram tumbuhan tanpa melibatkan mana-mana tenaga manusia dan sistem ini memudahkan manusia untuk memantau tumbuhan meraka secara jarak jauh. Untuk membangunkan sistem automatik sepenuhnya yang akan mengukur secara pintar kelembapan tanah, pendekatan yang berbeza daripada kaedah yang digunakan dalam bidang berbeza telah dikaji semula. Sistem yang paling sesuai telah dipilih untuk menjadi sumber idea dan bimbingan. Idea sendiri dicadangkan untuk meningkatkan pendekatan sistem yang sedia ada. Komponen akhir dan bahan-bahan yang diperlukan untuk menyokong sistem penyiraman automatik yang cekap telah didapati dengan menganalisis dan menguji prototaip. Sistem penyiraman pintar dengan LoRa adalah satu sistem yang memudahkan manusia dalam menyiram tumbuhan. Arduino diguna Bersama Sama dengan sensor kelembapan tanah bagi mengesan tahap kelembapan tumbuhan dan menghantar isyarat untuk mengawal dan mematikan pam air sensor. Selain itu sensor suhu dan kelembapan udara juga digunakan untuk mengawal sengkuap secara automatik. Setiap data yang didapati akan dihantarkan mrngguna LoRa iaitu teknologi baharu yang membolehkan penghataran jarak jauh sehingga 30 Km.

ABSTRACT

Plants need sufficient water resources to be healthy and fertile. Excess amount of water and less amount of water supplied to plant may cause the plant to wither and die. Past research has focused on the method on how to water the plant water on the right time with the right amount of water. This research focused on how to develop an auto watering system using Arduino that watering plant at the right time with the right amount. This system is to facilitate human in watering plant without involving any manpower and help user to monitor remotely. To develop a fully automated system that intelligently measures the soil moisture, different approaches of methods used in varying fields were reviewed. The most suitable system had been selected to be a source of ideas and guidance. An own idea proposed to improve the approaches of existing systems. The final components and materials needed to support an efficient auto watering system was obtained by analyzing and testing the prototypes. Smart Irrigation System with LoRa is a system that facilitates human in watering the plant. Meanwhile, Arduino works together with the soil moisture sensor upon detecting the moisture level of plants and send signal to control the on and off the water pump. The system also comes with Temperature and humidity sensor to control the retractable awning. All the data obtain will be send using LoRa, it is new technology that use a low-power wide-area network technology. It is based on spread spectrum modulation techniques derived from chirp spread spectrum technology and can send data up to 30 Km

DEDICATION

This thesis is dedicated to:

My beloved parents,

My supervisors,

My lecturers

My family,

And all my friends,

Thank you for the guidance, encouragements and support.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

DC - Direct current

LCD - Liquid-crystal display

IoT - Internet of Things

USB - Universal Serial Bus

PWM - Pulse Width Modulation

LED - Light emitting diode

MCU - Micro Controller Unit

PCB - Printed Circuit Board

GND - Ground

VCC - Power Supply

RX - Receive Data

TX - Transmit Data

LoRa - Long Range

COM - COMMON

DC - Direct Current

IDE - Integrated Development Environment

NC - Normally Closed contact

NO - Normally Open contact

GSM - Global System for Mobile

ADC - Analog-To-Digital Converter

LDR - Light Dependent Resistor

PIC - Programmable Interface Controller

RFID - Radio-Frequency Identification

℃ - Celsius

% - Percentage

Km - Kilometre

SDA - Serial Data

SCL - Serial Clock

RFM - Radio Frequency Module

MHz - Megahertz

CHAPTER 1

INTRODUCTION

1.1 Introduction

Water is the most important needs for plant to growth and sustain its life. Plant needed water to transport nutrient from the soil throughout the stem and branches and this help to produce a good quality of crop. In Malaysia, irrigation is needed because uncertain weather conditions and uneven distribution of rainfall in this country. Plant requires water so they can use it to create their own food by doing the photosynthesis. In order to ensure the needs of the plants is satisfied the Smart Irrigation with Lora is used. This system will monitor and supply water to the plant and control the volume of water to control the water optimally. The system will irrigate the plant automatically by sensing the soil moisture.

The system is controlled by using a microcontroller and it will act as the main brain, it will decide to irrigate the plant or not by sensing the soil moisture. The system can also help in reduce the usage of water and this help in decrease the usage of water and the system also connected with temperature and humidity sensor in order to observe the temperature of the surrounding. Every plant need sunlight to do photosynthesis, higher temperatures can also contribute to plant damage as well. In order to aid that there will be an automated retractable awning that will open when temperature is higher than the set threshold value.

Nowadays many devices can be used to remotely and in this case the system can be monitor remotely by using a computer such to access the data of the plant in the field and monitor the condition of the plant anytime.

1.2 Problem Statement

Malaysia is an agriculture country and it contribute up to twelve percent of the nation's GDP and around sixteen percent of Malaysian citizen involve in the agriculture sectors in some sort. This large scale of agriculture can be dated back during the British colonization and this contribute to many big sectors of agriculture in Malaysia such as, palm oil (1917), cocoa (1950) and rubber (1876). Water is the most treasure minerals in the world, and it is needed by all organism because it carries a mineral that is important. The source of water is depleted annually due to the global warming, the number of people increase, deforestation and many more. To preserve water, the Smart irrigation system with Lora is implemented to reduce usage of water

Each of the plant has different amount of water they needed. To reduce wastage of water each plant is set to their optimum volume of water for its to do photosynthesis and to maintain the quality and sustainability of the plant. The system will operate by process the data receive from the soil moisture sensor and compare the threshold value and the initial value. For plant to do a photosynthesis it needs sunlight as its catalyst and sunlight generate heat, increasing in heat can lead to stunt the growth of the plant. The increasing of temperature is due to greenhouse effect from the CO2 emission from the earth that are trap in the atmosphere and keeping the earth warmer. In order to produce the higher quality of plant temperature needs to be consider. For photosynthesis to occur

the optimum temperature needed is 25°C to 28°C if the temperature is increase higher than these points rates of photosynthesis will drop drastically.

As we all know Malaysia is a tropical country, and its mainly sunny in here. There is an article from Berita Harian (24 January 2017), it is stated that the temperature has risen 0.87°C in global and will rise every year. In order to overcome the condition and maintain the quality of the plant the system use temperature and humidity sensor DHT22 to monitor the surrounding temperature. This system has protective mechanism to protect plant from excessive heat by covering the plant when temperature exceed the optimum temperature that is 25°C to 28°C. The system will read the surrounding temperature and it will open an automated retractable awning to protect the plant from excessive heat.

Nowadays, people have awareness of the important of plant and there are lots farm and they even growth plants as hobby. There are type of people that loves to growth plant, but they didn't have the time to take care of it. This system can help this urban people lifestyle by allowing them to irrigate the plan automatically and even monitor the plant remotely. The user can access the data of the plant by simply using a computer and here they can view the surrounding temperature, the time of the irrigation and the level of soil moisture.

1.3 Objective Project

The project goals are important in ensuring that the research meets the solution to the problem. Therefore, there are 3 main objectives of the project follows:

1. To study on the design and create the Smart irrigation system with Lora using a microcontroller.

2. To develop the prototype of the Smart irrigation system with Lora.

3. Study the reliability of the newest communication shield, Lora for its functionality in this project and its advantages and disadvantages.

1.4 Scope of work

From the problem statement and the objectives, this device can be implemented in variety of ways whether as agriculture or as a hobby kit. This system is a device that helps the user to monitor and irrigate the plant automatically. The aim of this device is to helps to reduce wastage of water by controlling the volume of water use, this device also helps to protect the plant from excessive heat to maintain the quality of the plant and finally this device can helps the User to monitor the user's status field and plant remotely to ensure the wellbeing of the plant.

This project uses a microcontroller to controller the activity of the device and system. Basically, the microcontroller will read the value from the sensor and make a comparison between the data and will devise an appropriate action. All the data can be monitor remotely by using a computer and the data are sent wirelessly by using a communication shield.

1.5 Expected Results

The Smart irrigation system with Lora is a device that help the user by monitor the plant and irrigate it automatically so that it can make people's lives easier. This device can be used for all type of purpose whether to use in the plantation or even at home by according to user's suitability. This device is used to determine the level of soil moisture and even to read the temperature and even humidity of surrounding area. There will be multiple outcome for the device to process and the result are depending by the data accumulate from the sensor connected. The expected results are listed in the table below included with reasons.

Input	Conditions	Expected Output	Reasons
Moisture of the soil	Moist	Nothing happens.	The initial data value is below the set threshold value
	Dry	The water pump is on and it continue to water the plant until reaches the threshold value.	The initial data exceed the threshold value. Microcontroller will trigger the motor in ON state to irrigate the plant.
Temperature of surrounding	Below or equal to 28°C (<=28°C)	Nothing happens.	The initial data value is below the set threshold value

	Higher than 28°C (>28°C)	The automated retractable awning will cover the crop from the sunlight.	The initial data exceed the threshold value. Microcontroller will trigger the motor and open the retractable owning.

Table 1.1: Expected results for the system

1.6 Thesis Organization

This report is consisting of 5 individual's chapters. All of this chapter will be discussing on the implementation of this project that is, Development of Smart Irrigation System using Lora.

I. Chapter 1 discusses the project's overview that include introduction, problem statement, objectives, scope of work, rational studies, expected results, thesis organization, summary of methodology and summary of introduction of the project.

II. Chapter 2 will describe about the literature and the past project of irrigation system.

III. Chapter 3 will explain in detail on how the methodology used in order to solve this project Smart Irrigation System using Lora. This is accomplished in order to obtain a better result for this project.

IV. Chapter 4 is a discussion on the results of the hardware and software obtained from the system and a discussion will be held on the analysis based on the results obtained and the overall discussion of the project and the summary of how the system works.

V. The last chapter, chapter 5 will conclude on all the overall project and the recommendation will be made for the purpose to enhance the project in the future.

1.7 Summary

The idea of developing the smart irrigation system by using Lora is being discussed in this chapter deeply. The importance of water to the plant so that it continuing to live and its importance towards Malaysian citizen in the introduction. The main reason can be referred at the problem statement where the wastage issues of water is being discussed, the effect of excessive heat towards the plant and how the plant affect the lifestyle of urban citizen. The main purpose of this project is to develop a device that can ease the user and act as the monitoring system for the plant to growth and sustain its life. In the scope of work basically, talks about the device mechanism and its general flow throughout the system. For the expected results, shown the possible outcome generate from this device and the system. Finally, the thesis organization is to summarize of contents in each chapter.