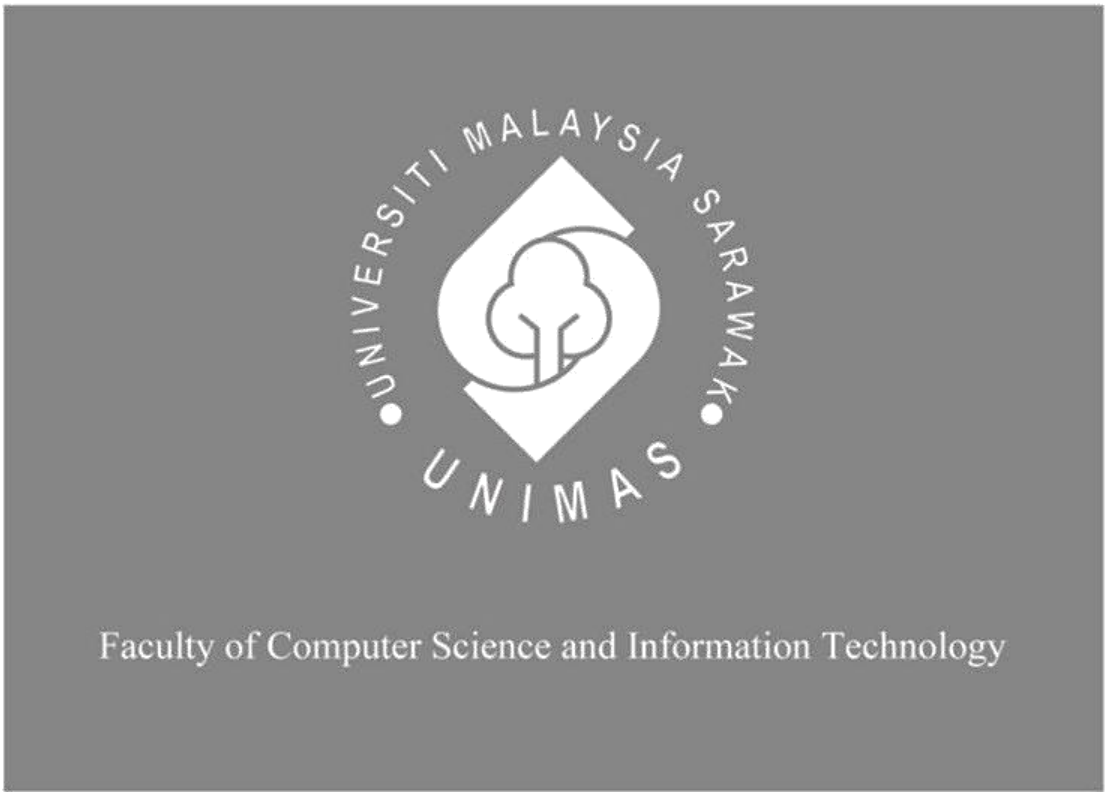

Plant Monitoring System with Email Alert using Arduino and Raspberry Pi

Lau Ming Xian

Bachelor of Computer Science with Honors (Software Engineering)

2019

UNIVERSITI MALAYSIA SARAWAK

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Plant Monitoring System with Email Alert using Arduino and Raspberry Pi

LAU MING XIAN

This project is submitted in partial fulfillment of the requirements for the degree of Bachelor of Computer Science with Honors

Faculty of Computer Science and Information Technology
UNIVERSITI MALAYSIA SARAWAK 2019

DECLARATION

I hereby declare that the project entitled “Plant Monitoring System with Email Alert using Arduino and Raspberry Pi” submitted by me to Faculty of Computer Science and Information Technology, University Malaysia Sarawak (UNIMAS) is a record of an original work done by me under guidance of Madam Nurfauza binti Jali.

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(LAU MING XIAN)

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Most of the people stop gardening is because of the insufficient knowledge about taking care of the plant. The proposed system for this project aims to ease the process of grows plant using sensor to capture environment data. The environment data including temperature, air humidity, light, and soil moisture. In this project, a DHT11 basic temperature humidity sensor will be used to receive temperature and air humidity data. Next, an analog capacitive soil moisture sensor will be used to measure the soil moisture level. These data will be sent to Raspberry Pi and these data will be visualized and the result will be displayed to the user through the web-based system interface. Based on the data captured, an email alert will be sent to the user as a reminder to water the plant.

ABSTRAK

Kebanyakan orang berhenti penanaman kerana pengetahuan yang tidak mencukupi tentang penanaman. Projek ini bertujuan untuk memudahkan proses penanaman tumbuhan dengan menggunakan sensor untuk mendapat maklumat persekitaran tumbuhan. Maklumat persekitaran termasuk suhu, kelembapan udara, cahaya, dan kelembapan tanah. Dalam projek ini, sensor "DHT11" akan digunakan untuk menerima data kelembapan udara dan suhu. Seterusnya, sensor "Gravity" akan digunakan untuk menerima tahap kelembapan tanah. Maklumat ini akan dihantar kepada Raspberry Pi dan maklumat ini akan divisualisasikan dan pengguna boleh memantau statistic persekitaran tumbuhan. Berdasarkan maklumat yang diterima, e-mel akan dihantar kepada pengguna sebagai peringatan untuk menyiram tumbuhan.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

A new trend in the Internet technologies and Wireless Sensor Networks (WSN) is being realized with the increase in users of the Internet and changes on the internetworking technologies enable networking on everything around people. (Kelly, Suryadevara, & Subhas, 2013). “Internet of things (IoT)” is about machine talking to each other and these communications will be extended to “things” (Sundmaeker, Guillemin, Friess, & Woelffle , 2010). A machine attached with sensors can collect the data and perform certain tasks automatically to solve the daily life problems. These data collected by the sensor can be saved for the future decision making.

Gardening works as a means of nurturing relationships between people, communities and the landscape. The relationships are social, economic and ecological (Irvine, Johnson , & Peters, 1999). The practice of a community gardening is widespread as both collective gardens and individual allocated spaces (Holland, 2011).

However, most of the people do not have the time or resources to do gardening. It is important to develop devices that facilitate the process of growing the plants which can promote the interest of people on gardening.

This project is designed to help inexperienced gardener or those who always forget to take care of their plants by using IoT devices. Few factors need to be considered when gardening such as soil, weather, and climate. The system will display the condition of the environment of the plant by collect the data using analogue sensor and send mail to the user when the plants need water by

using Raspberry Pi which acts as a server. The user can water the plant till the optimum soil moisture according to the result to avoid over usage of water.

1.2 Problem Statement

There are research states that people use more water in gardening due to lack of knowledge about water usage (Liangxin, Fei, Guobin, & Wei, 2014). If there is too little water will prevent plant growth and the quality of the plant will be affected while if there is too much of water, it will leach fertilisers and reduce aeration (Caetano, Pitarma, & Reis, 2015). People often scared of growing plants especially for the people who have less experience in gardening as they scared the plants will die due to lack of water or watering the plant over the optimal level. Besides, the location of the plants is important as the plant overexposes to the sunlight will cause the water evaporates fast and cannot absorb by the plant. Furthermore, it is time-consuming to take care of a plant, and it will be a troublesome for those busy at work.

1.3 Objectives

1. To analyse the existing plant monitoring system and proposed solution on improving the design of graphical user interface and alert features.
2. To design and implement plant monitoring system that visualises environment data and display in numerical or graph form.
3. To test different environment data to identify the suitable value of environment data that reach optimum condition.

1.4 Scope

The plant monitoring system is intended to give the user a graphical interface showing the condition of the environment. Besides, the system also sends an email alert to the user to remind them to water the plant or inform them about the condition of the environment of the plant. The end user is focused on those people who are busy at work to remember water the plant and people who are lack of experience in gardening.

The main scope for this system is to ease the process of growing the plant. It shows the result in graphical or numerical from which gives the user a better understanding of the environment of the plant and what they should do to facilitate the growth and maintenance of plants.

1.5 Brief Methodology

This project is using Agile Software Development Lifecycle model to design the system. The agile methodology breaks project into different cycles. In each cycle, there are phases such as planning, requirement analysis, design, implementation and testing, and review. Agility capability enables software development process can deal with unpredictable situation and rapid changes (Highsmith & Highsmith, 2002). The agile methodology releases prototypes which have further improvement from the previous prototype. Diagram of Agile Software Development Lifecycle is defined in the Figure 1.1 below.

For planning phase, the problem statement of the project needed to be defined clearly. Based on the problem statement, the scope and objectives of the project are defined in this phase. For requirement analysis phase, similar project will also be reviewed in this phase to help gathering

useful information for this project. Besides, the datasheet of the component needed to be collected to define the specification of these component. For the design phase, the hardware architecture needed to be defined in this phase. The sketch of the hardware architecture is defined in the Figure 1.2 below. Each of the sensor is divided into different module to ease the process of design the interface and input output functions. Moreover, the backend system is designed in this phase for data storing and client-server communication purpose. For implementation and testing phase, the system is implemented and testing under different condition. The various function of the system will be tested with different data input. Lastly, for the review phase, any limitations or errors will be collected and make changes in the next prototype.

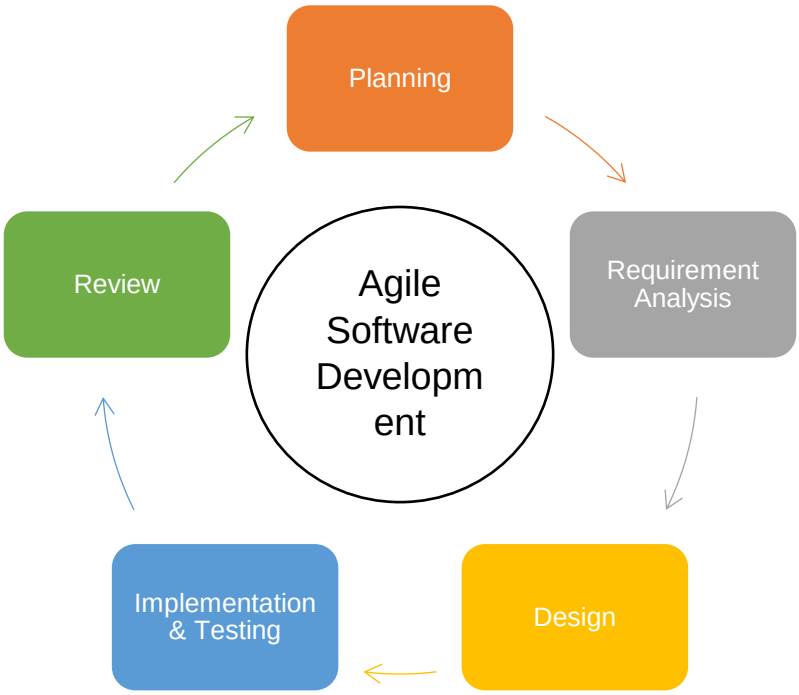


Figure 1.1: Agile Software Development Lifecycle Diagram

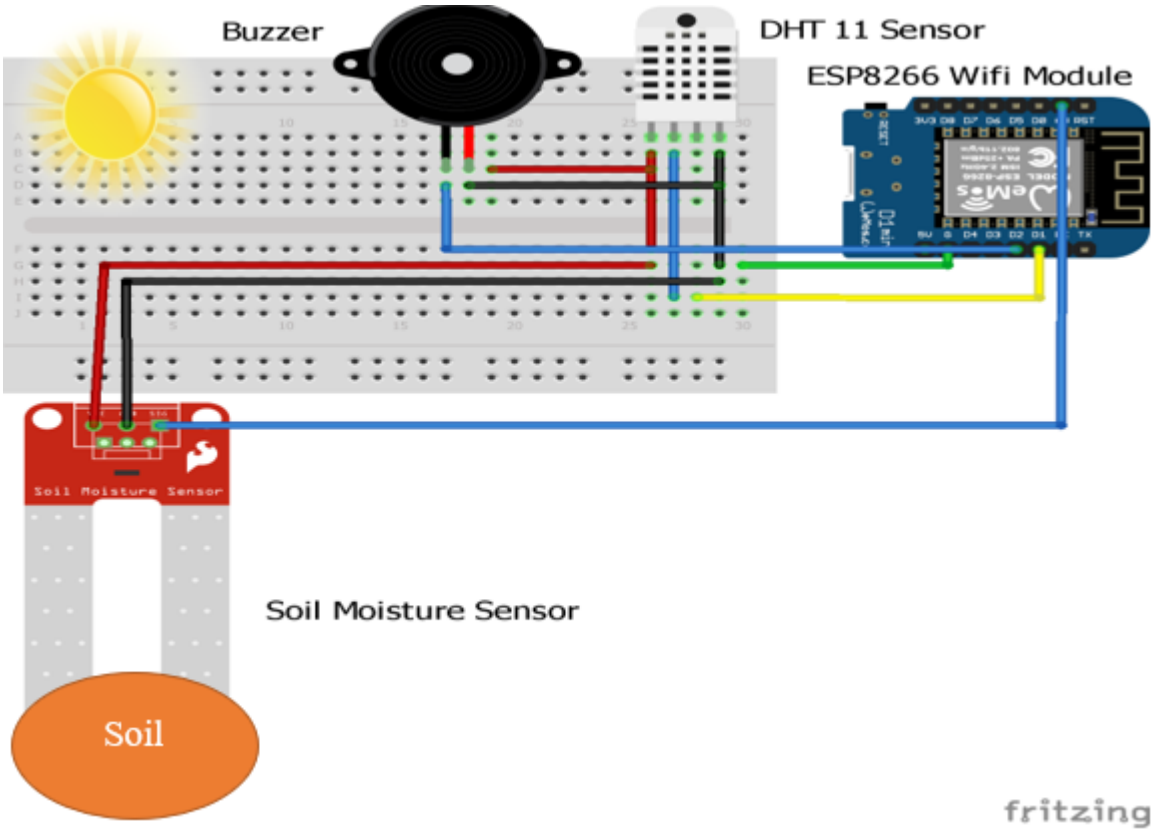


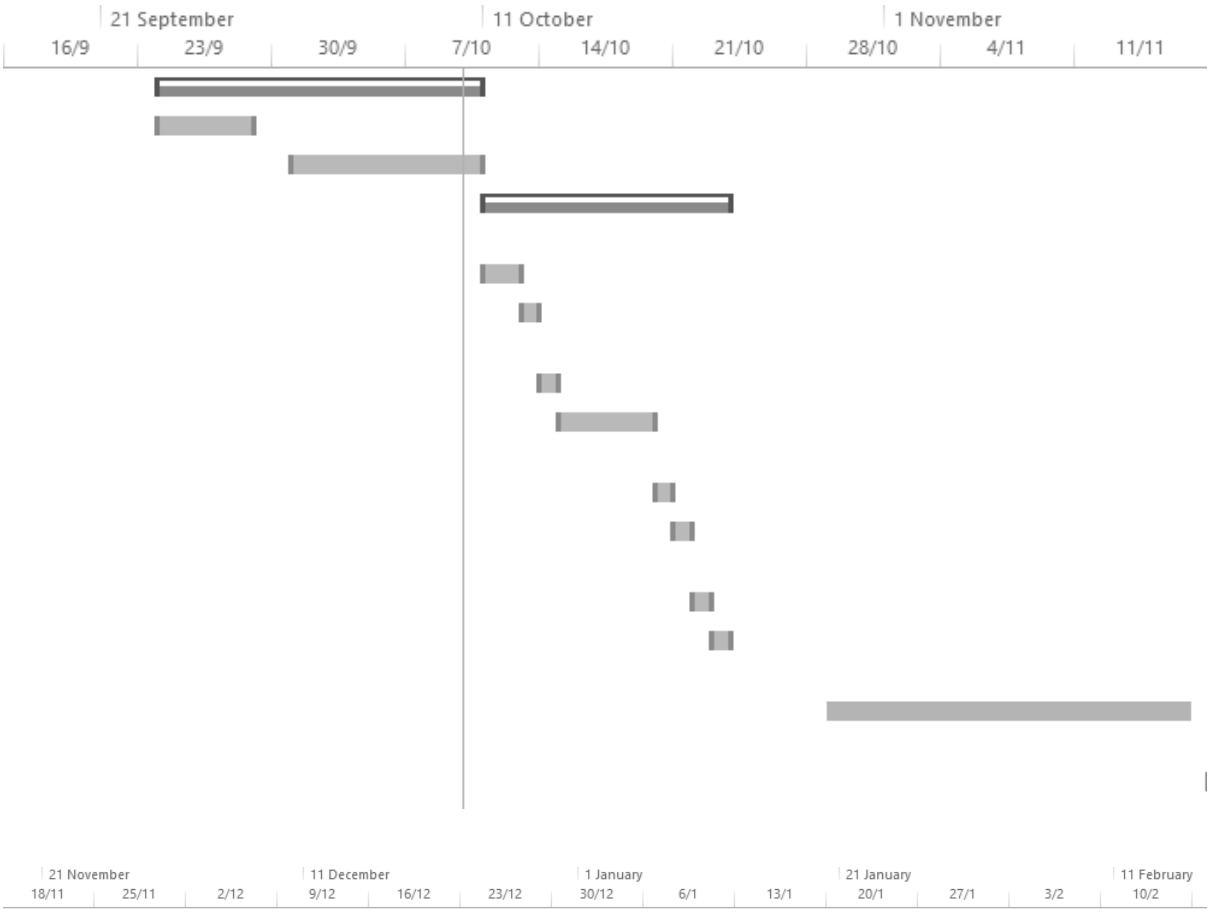
Figure 1.2: Sketch of hardware design

1.6 Significance of Project

The main aim for this system is to ease the process of growing the plant by creating a system that monitoring the environment of the plant. These data show in graphical or numerical from which gives the user a better understanding of environment of the plant and what they should do to facilitate the growth and maintenance of plants.

1.7 Project Schedule

	Task Name	Duration	Start	Finish
1	**Project Proposal**	**13 days**	**Mon 24/9/18**	**Wed 10/10/18**
2	Brief Proposal	5 days	Mon 24/9/18	Fri 28/9/18
3	Full Proposal	8 days	Mon 1/10/18	Wed 10/10/18
4	**Chapter 1: Introduction**	**9 days**	**Thu 11/10/18**	**Tue 23/10/18**
5	Introduction	2 days	Thu 11/10/18	Fri 12/10/18
6	Problem Statement	1 day	Sat 13/10/18	Sat 13/10/18
7	Objective	1 day	Sun 14/10/18	Sun 14/10/18
8	Brief Methodology	5 days	Mon 15/10/18	Fri 19/10/18
9	Scope	1 day	Sat 20/10/18	Sat 20/10/18
10	Significant of the Project	1 day	Sun 21/10/18	Sun 21/10/18
11	Project Schedule	1 day	Mon 22/10/18	Mon 22/10/18
12	Expected Outcome	1 day	Tue 23/10/18	Tue 23/10/18
13	**Chapter 2: Literature Review**	**15 days**	**Mon 29/10/18**	**Fri 16/11/18**
14	**Chapter 3: Methodology**	**17 days**	**Sun 18/11/18**	**Mon 10/12/18**
15	**Submission of FYP 1 Final Report and Paper for Assessment**	**25 days**	**Mon 10/12/18**	**Fri 11/1/19**
16	**Chapter 4: Implementation and Testing**	**60 days**	**Mon 14/1/19**	**Fri 5/4/19**
17	**Chapter 5: Conclusion and Future Works**	**14 days**	**Mon 8/4/19**	**Thu 25/4/19**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27/1
3/2
10/2

Figure 1.3 Project Schedule Gantt Chart

1.8 Expected Outcome

The system can visualise the data collected by sensors and display in a graph or numerical form.

The system can send an email alert to the user containing the data and the action need to be taken.

1.9 Project Outline

For chapter one, the introduction is lists out the problem statement, objectives and scope of the project, the methodology used, significance of project, project schedule and the expected outcome of the project.

For chapter two, it is regarding research on the existing plant monitoring system. Their limitations and functionalities will be identified and compared. It also discusses how the proposed system can overcome or improve these limitations. Besides, the software and hardware used for the project will be listed and explained in this chapter.

For chapter three, it is regarding how the current system works. The analysis of the systems to take the environment data and method to visualise the environment data are discussed in this chapter.

For chapter four, it is discussed abut the tools and methods for design, implementation of the systems, and system testing.

For chapter five, it is discussed about the summary and conclusion of the project. Moreover, it also discussed about the future work or improvement that can be done for this system.

1.10 Conclusion

This chapter is regarding the introduction of the proposed system. The proposed system is about developing a system that can help the user to monitor the environment of the plant and helps the user to do decision whether the need to water the plant or not. This system able to increase the efficiency of the user in gardening.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews the sensor used in this project and the existing smart garden system. The features and the design of the graphical user interface will be compared. The pros and cons of the system will be compared to determine the functionality and design of the proposed system. Besides, the tools and techniques to design the backend will be examined to choose the suitable backend framework.

2.2 Background

Gardening works as a means of nurturing relationships between people, communities and the landscape. The relationships are social, economic and ecological (Irvine, Johnson , & Peters, 1999). The practice of a community gardening is widespread as both collective gardens and individual allocated spaces (Holland, 2011).

However, most of the people do not have the time or resources to do gardening. It is essential to develop devices that facilitate the process of growing the plants which can promote the interest of people on gardening. Most of the products on the market use hydroponic growing which requires technical knowledge.

2.3 Review of the existing system

There are four existing systems will be reviewed in this system. The system consists of two hydroponic growing smart garden system which are Plantui6, and Aerogarden. Another two