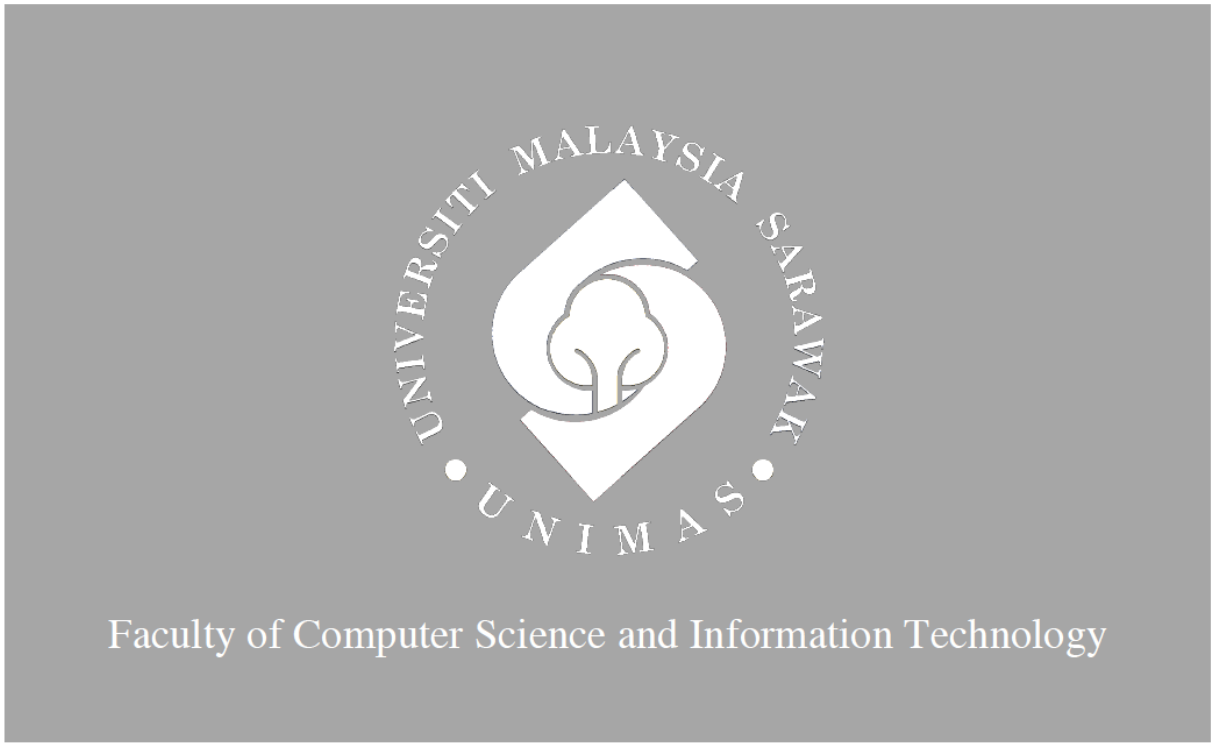

CHILI PLANT HEALTH MONITORING SYSTEM (CHIPMS) USING IOT

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Bachelor of Computer Science with Honours

(Network Computing)

2019

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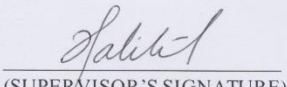

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Mohd Insyirah Bin Kamaruzaman

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University Malaysia Sarawak

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I give my thanks to everyone who motivated me and giving me idea during. Special appreciation to Dr Halikul Bin Lenando who ensures that my project does not go astray. He has given me enough guidance and knowledge for me to continue the project. Special thanks also to other lecturers who I have consult regarding the project either directly or indirectly. Next, a special thanks also to student from FSTS especially in Plant and Biotechnology course who give many tips regarding the project. I also did not forget to thanks to Masjid Desa Ilmu Committee that gave me the chance to test my system on their chili field. Lastly to all my friend in the same faculty and in the same course, directly or indirectly helping me, I personally offered my thanks and gratitude.

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Abstract

This paper is about fertigation system used in the agriculture sector to increase product yield and systematic farming. The problem of the fertigation system is that it is still labor intensive, does not collect any data from the farm and does not help the farmer monitoring the farm consistently. The objective of this paper is to aid and improve the fertigation system by adding Chili plant health monitoring system. The system will consist of sensors to collect data from the farm. Next, the data will be stored and process. The user will be able to monitor it through mobile application. The significance of this project is it can help the development of technology in agricultural sector in Malaysia, reduce the wastage of water and fertilizer and increase the farm production in terms of product and efficiency. The system is hoped to be useful in future technology and development in agricultural sector.

Abstrak

Kertas ini mengandungi perihal sistem fertigasi yang digunakan di dalam bidang pertanian untuk meningkatkan penghasilan produk tanaman dan penanaman secara bersistematik. Masalah system fertigasi adalah pengunaan tenaga buruh yang tinggi, tidak mendapatkan apa-apa maklumat daripada ladang dan tiada bantuan untuk para peladang memantau keadaan semasa tapak penanaman. Tujuan kertas ini adalah untuk menambahbaik system fertigasi yang sedia ada dengan menambahkan pengunaan pengesan untuk mendapatkan maklumat dari ladang. Kemudian data tersebut akan disimpan dan diproses. Pengguna akan dapat melihat data tersebut melalui aplikasi telefon pintar. Kepentingan sistem ini adalah untuk menambahbaik penggunaan teknologi dalam sector pertanian. Mengurangkan pembaziran air dan baja dan meningkatkan kecekapan sistem dan hasil. Justeru, diharapkan pada masa hadapan sistem ini akan dapat diguna pakai dan ditambah baik dalam sektor pertanian.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Chili plant is one of the most valued vegetable in the world now days. It is said this plant originated from Mexico before it is being recognized by the Asian country (Mehta, 2017). It is used in many traditional cuisines in many countries all around the world like China, India, Malaysia and even in European country. Take India as example it is said in a research that the importance of spice is well known in India until there is saying among the women in India that "Chili rules the kitchen" (Mehta, 2017). Even in Malaysia, the ethnic like Malays have used it in traditional cuisine like Nasi Lemak, Rendang and many else to increase the taste impact of the food. In fact, almost all the food in Malaysia contain at least some type of chili in their food. In addition, chili also serves as an important item in humans' health as a natural medicine. Chili is a vegetable that add a bit of spice in the dishes while also containing vitamin c to maintain immunity (Handri, Judika Heiranto, Khameswara & Maaruf , 2017). Some of the disease that is proven to be cured or treatable by the consume of chili is asthma, Arthritis, blood clots, headaches and many else (Mehta, 2017). It also brings antibacterial and anticancer effect (Sanati, Razavi & Hosseinzadeh, 2018). Besides that, in today's trend for spicy food that goes around the world, chili is quite famous. In a certain chili like Jalapeno, Ghost Pepper and many kinds of chili is in high demand.

The term of health is given three definition that can be used said by Sartorius (2007). The first one is health is the unavailability of any disease or impairment. Second, health is a condition that permits the person to cope with all requirement for daily life. Third, is health is a condition where person in a state of balance where it literally means "an equilibrium that an

individual has established within himself and between himself and his social and physical environment" (Sartorius, 2007). The first definition is more suitable for the plant since the project is focus in the early detect of disease of chili plant. Any impairment and disease should be considered as health issue for the plant.

The monitoring system is a system that monitors the object and area of the chili plant. In a work to create suitable area for the plant to grow and monitoring constantly for any change that will appear at chili plant. Unlike health monitoring for human or other type monitoring system. This system is specified in chili collecting data focused on plant. For many times we depend on the farmer experience and knowledge to check on plant. Farming is a labor-intensive work especially with a large plantation. Farming also relies on the experience farmer which are not many now days to supervise each plant in every lane. This result in late observing of plant disease, resulting in plant degrade in health and harvesting time (Kitpo, Kugai, Inoue, Yokemura &Satomura,2019). Hence, this a sign of need on a system that can monitor the health of plant especially chili plant.

This paper is about a system that uses the capability of Arduino UNO named Chili Plant's Health Monitoring System (ChiPMS). It will then handle a set of sensors in determining the condition of the plan and the environment. The sensors are the soil moisture, Arduino camera, humidity, and temperature sensor. The data is stored in a cloud database where it is been sort and save for future reference. User can access the data through a mobile apps that retrieve the data and process it to produce useful information. The application also provides awareness to farmer about current condition of plant through image and threat for a certain environment condition.

1.2 PROBLEM STATEMENT

Fertigation system is one of the solutions offered by the agriculture research. A system that inject or supply the nutrient to the plan direct to the root area. The previous technique where the nutrient or the fertilizer is spread manually using hand is labor intensive work which spending more time and energy. There are devices that eased the spreading by using pump-based tools and engine but all of them still wasted a lot of water and fertilizer. The fertigation system required only small amount of water just enough for the plan to stay healthy. The plan is separated using polybag, resulting any soil inborn plant disease will be unable to spread.

The disease comes in any form through many medium. The most microorganism infection through soil, carried by insect or caused by its larvae or any genetic based problem. The microorganism like virus, fungi, bacteria and animal like bugs have a tight relationship with the environmental change or climate change. For example, Anthracnose a disease caused by fungal infection named Colletotrichum gloeosporioides and C. capsica is severe during the wet season that infect the fruit, this disease only can be managed by removing the infected fruit, removing the plant debris and increase the plant distance (Lee, Nur Najwa Hamsein & Eng, 2016). There is also condition called bacteria wilt often happen during the dryer season which is no cure and only can be diagnosed using certain method. It is caused by Ralstonia solanacearum that caused plant to wilt, the only method is to remove the plan before it spread to others (Lee et al, 2016).

There is no doubt that fertigation system offered solution to the farmer and researchers but still there are few disadvantages need to be counted. For example, the system does not collect the environment data to adjust the allocation of water and fertilizer during the different seasonal weather. The system also doesn't take note on any change to the medium of the plant to adjust the output of the nutrient. Next, the system does not aware for any change available

only to human eyes like plant and fruit disease. There are a few systems that offered the spreading of water and nutrition depends on the soil condition now days. For example, we took the water sprinkler system or plant watering system. Usually most of the time, this current solution takes the parameters and notice any change on the soil and the environment and spread the water and the fertilizer according to the need of the plant. This method will ensure that the plant is not over watered or malnutrition resulting in a stress state. Unfortunately, this system does not educate the user about the disease threat on plant. Hence, Chili Plant's Health Monitoring System (ChiPMS) is hoped to educate the user on when and what disease could occur in certain environmental change. With the respect for the value of the current system we modified to certain level to process the data gained from the sensor, store it for any purpose and present it in useful information so that user are aware the condition of the farm and learn on a disease that only can be identify by observation.

1.3 SCOPE

The scope of the project is to develop a system that can alert the farmer on the condition of the farm, medium(soil), environmental change and presenting useful information using available data. The system also should be able to trigger the user about possible disease based on certain condition.

14 AIM AND OBJECTIVE

1. To collect data automatically from the farm through sensors.
2. To analyzed and present collected data.
3. To monitor the condition of chili farm, medium and environment using the mobile application.
4. To develop a monitoring system to assist farmer in monitoring the health of chili plant.

1.5 BRIEF METHODOLOGY

This project will use the rapid application development as method to develop the system illustrated in Figure 1. The first phase is to make an analysis for the system. The method for analysis is through interview, observation on the farm itself and study case of the past project through research paper and journal article. Using the information gained, the second phase is to create early design the system according to the need of the user, observation, and research available system through research material.

Next, the prototyping phase. After a detailed early design is achieved the system will be constructed in the prototyping stage also known as prototype cycle. The construction will be an iterative proves from building, demonstrate, and refine until exist a final prototype according to analysis. The developer will be working with the user to achieve satisfaction on creating first prototype. This is to make sure user requirement is always updated and fulfill.

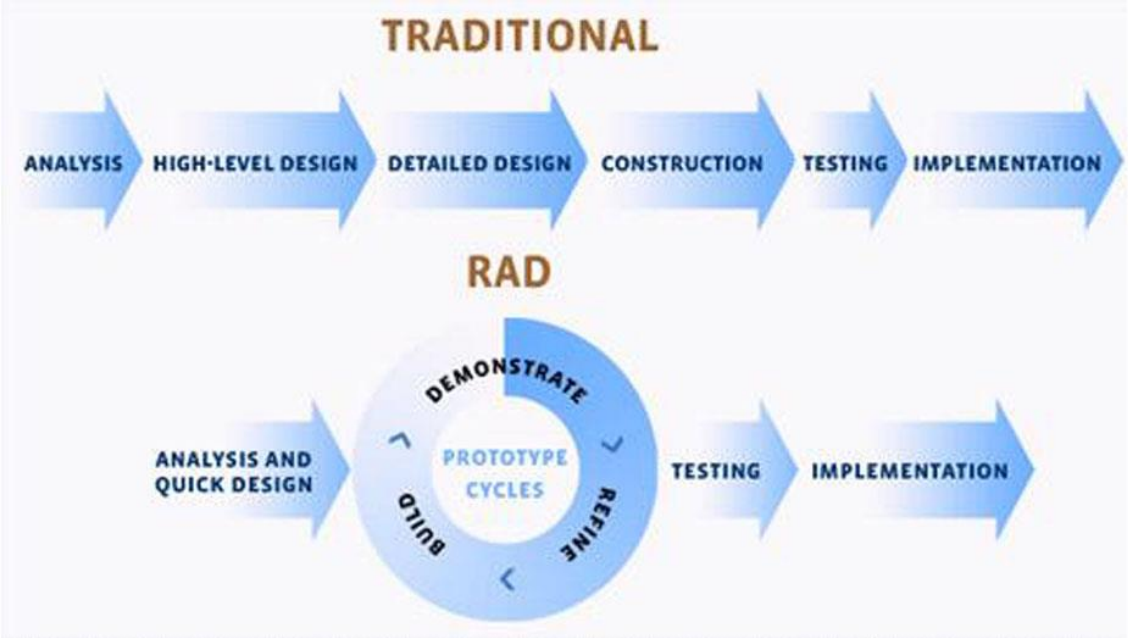

Figure 1:Comparison RAD and traditional SLDC method (Mazepa,2018).

The next part is the testing phase where the system is tested in the field with a real plant. This stage we will look for any bugs that still need to be fixed and test the capability of the system to catch data and present useful information to the user. The last phase is to implement the system for the user while maintaining and updating from time to time. RAD is suitable because the iterative process during the construction phase allowing to check on error and resolving any issues regarding user requirement and design. Hence, RAD is suitable for IOT project that heavily rely in the prototype design.

1.6 THE SIGNIFICANCE OF PROJECT

The significance of this project is as follow: -

1. The need of development in Malaysia agriculture technology especially in common food item like chili and other vegetable.

2.Reducing the wastage of water and fertilizer according to the real needs of plant.

3. Increasing the production of chili in plantation and the detection of plant disease before it is too late.

1.7 PROJECT SCHEDULE

	Task Mode	Task Name	Duration	Start	Finish
1		Pre Proposal	7 days	Fri 20-09-19	Sun 29-09-19
2		Full Proposal	16 days	Mon 30-09-19	Sat 19-10-19
3		Completion of Chapter 1	7 days	Sun 20-10-19	Sat 26-10-19
4		Completion of Chapter 2	17 days	Sun 27-10-19	Sat 16-11-19
5		Completion Of Chapter 3	15 days	Sun 17-11-19	Thu 05-12-19
6		Fyp 1 Final Report	5 days	Fri 06-12-19	Thu 12-12-19
7		Chapter 4 : Implementation and Testing	45 days	Fri 13-12-19	Thu 13-02-20
8		Chapeter5 : Conclusion and Future Work	12 days	Fri 14-02-20	Sat 29-02-20

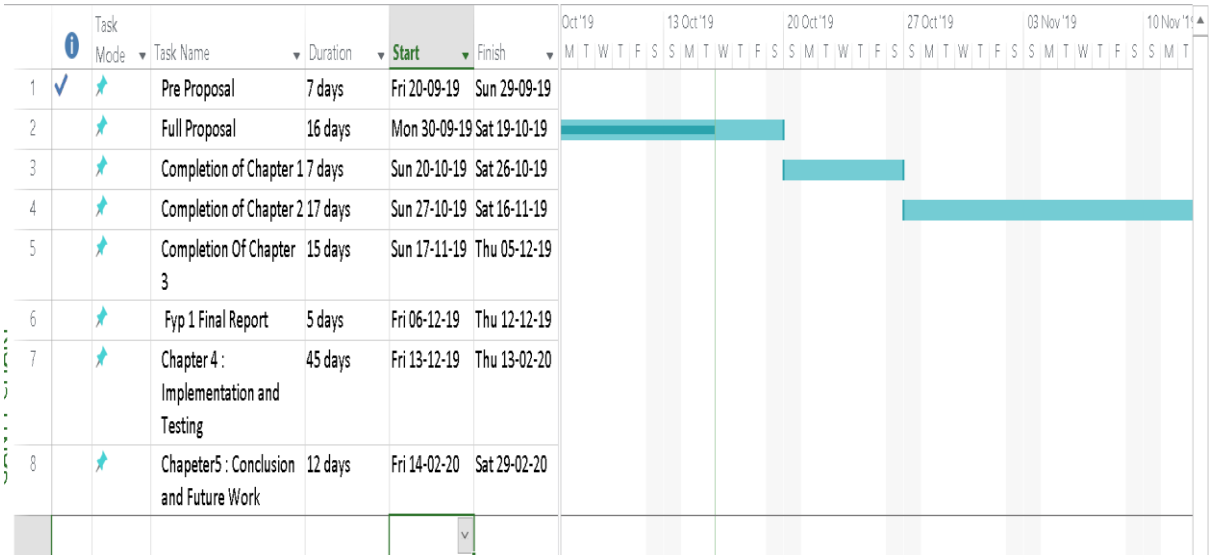

Figure 2:Project Schedule

1.8 EXPECTED OUTCOME

1. Producing system that can collect data from the chili farm and store it in the database.
2. Producing a useful information using the data collected.
3. Producing mobile application that warn the user about some disease occurrence in different season.

1.9 PROJECT REPORT OUTLINE

1.9.1 Chapter 1: introduction

Introductions contain all the essential definition of the project according to the title, background, objective, problem statement, scope, significance, methodology, project outcome, project schedule and project description. The chapter introduce the system and contain all basic information, necessary for this project.

1.9.2 Chapter 2: literature review

Chapter 2 discuss on the existing project that are related to the project and contribute on the idea of this project. The project from other researcher are compared with Chili Plant's Health Monitoring System (ChiPMS). The chapter also compared the system proposed by other the researcher. There are at least three different system compared each other. The system is compared in terms of cost, technology used and the significance behind their design.

1.9.3 Chapter 3: requirement analysis and design

Chapter 3 will discuss on the requirement of the user for this project. Focusing in how to get user requirement on design base on interview, observation and research through previous

project. This chapter will introduce the sensor, device and software used to build Chili Plant's Health Monitoring System (ChiPMS). Using RAD as a methodology. The project will quickly produce prototype and iteratively refine it.

1.9.4 Chapter 4: implementation and analysis

Chapter 4 focusing on the implementation of the project. Applying it for the user in the real situation. This chapter show on the how to conduct test with the device created. The product will be test and analysis. Chili Plant's Health Monitoring System (ChiPMS) will endure many tests to ensure it will work on the field. This chapter will also discuss the full function of the design.

1.9.5 Chapter 5: conclusion and future work

This is the final chapter. It concludes all the project. It includes the proper documentation and delivery. This chapter also discuss current any weakness available in Chili Plant's Health Monitoring System (ChiPMS). This chapter also includes the future work for the project. It is to maintain the project after delivery.

1.10 SUMMARY

Chili is one of the important spices needed by the world and known for its importance in food, medicine and even economy. The monitoring system is used to help farmers to detect any disease and irregularity to medium and farm environment that will affect the chili plant. Chili Plant's Health Monitoring System (ChiPMS) is aiming to ease the farmer job and increase the production of the chili. Next, it aims to decrease the rate of soil degrading and mortality of the plan itself. Aiming to use three type of parameter to control and monitor the condition of the plan. That parameter is environment, medium and the plant itself. This chili plant monitoring system may help the Malaysia industries like pepper industries in Sarawak, food industries and even health industries.