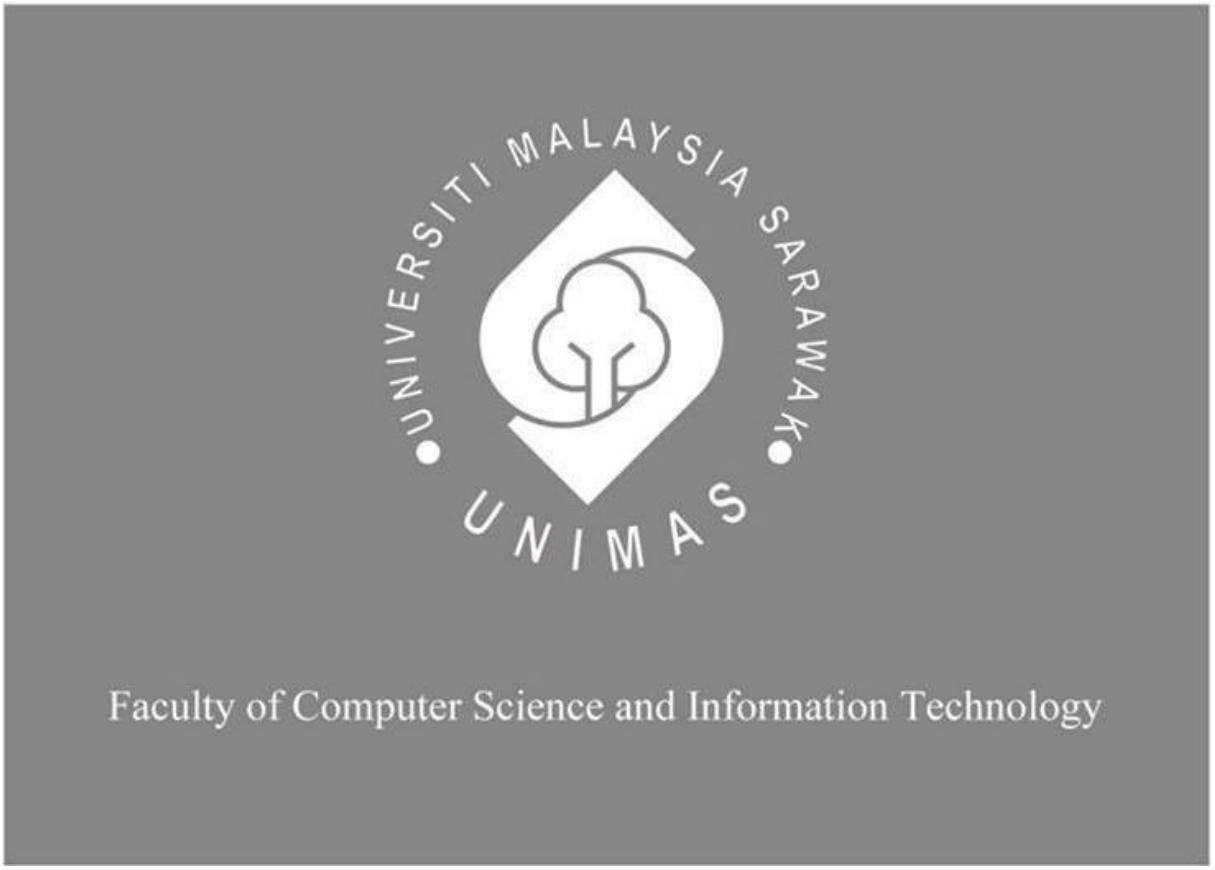

Internet of Things for Hydroponics System

Hillary Anak Sidie

Bachelor of Computer Science with Honours (Software Engineering)

2020

Internet of Things for Hydroponics System

HILLARY ANAK SIDIE

This project is submitted in partial fulfillment of the

requirements for the degree of

Bachelor of Computer Science with Honours

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2020

UNIVERSITI MALAYSIA SARAWAK

THESIS STATUS ENDORSEMENT FORM

TITLE Internet of Things for Hydroponics System

ACADEMIC SESSION: Semester 2 2019/2020

(CAPITAL LETTERS)

hereby agree that this Thesis* shall be kept at the Centre for Academic Information Services, Universiti Malaysia Sarawak, subject to the following terms and conditions:

1. The Thesis is solely owned by Universiti Malaysia Sarawak
2. The Centre for Academic Information Services is given full rights to produce copies for educational purposes only
3. The Centre for Academic Information Services is given full rights to do digitization in order to develop local content database
4. The Centre for Academic Information Services is given full rights to produce copies of this Thesis as part of its exchange item program between Higher Learning Institutions [or for the purpose of interlibrary loan between HLI]
5. ** Please tick (√)

	CONFIDENTIAL	(Contains classified information bounded by the OFFICIAL SECRETS ACT 1972)
	RESTRICTED	(Contains restricted information as dictated by the body or organization where the research was conducted)
✓	UNRESTRICTED	

(AUTHOR'S SIGNATURE)

Permanent Address

34, Taman Gloria

Jalan Tun Hussein Onn, 97000 Bintulu

Date: 07/08/2020

Validated by

(SUPERVISOR'S SIGNATURE)

Nour Alamshah bin Bolhassan
Associate Professor
Faculty of Computer Science and Information Technology
Universiti Malaysia Sarawak

Date: 07/08/2020

Note * Thesis refers to PhD, Master, and Bachelor Degree
** For Confidential or Restricted materials, please attach relevant documents from relevant organizations / authorities

Acknowledgement

First of all, I would like to acknowledge my final year project supervisor, Associate Professor Dr Hj Noor Alamshah bin Bolhassan, for his supervision, motivation and support throughout doing this project. I would like to express my gratitude and appreciation to him for his guidance and knowledge.

Also, I would like to acknowledge my friends who encourage and give moral support to complete this project. For sure we really care and give support for each other when needed.

Lastly, for my beloved family, special thanks to you for your love, care, support and everything. I am totally indebt to all of you.

Table of Contents

List of Figures vii
List of Tables x
Abstract xi
Abstrak xii
CHAPTER 1: INTRODUCTION 1
1.1 Project Title 1
1.2 Introduction 1
1.3 Problem Statement 1
1.4 Objectives 2
1.5 Methodology 2
1.5.1 Requirements Planning 3
1.5.2 User Design 3
1.5.3 Construction 3
1.5.4 Cutover 3
1.6 Scope 4
1.7 Significance of Project 4
1.8 Project Schedule 5
1.9 Expected Outcome 7
1.10 Project Report Outline 7
1.10.1 Chapter 1: Introduction 7
1.10.2 Chapter 2: Literature Review 7
1.10.3 Chapter 3: Requirement Analysis and Design 7
1.10.4 Chapter 4: Implementation 8
1.10.5 Chapter 5: Testing 8
1.10.6 Future Work 8
1.11 Summary 8
CHAPTER 2: LITERATURE REVIEW 9
2.1 Introduction 9
2.2 Reviews on Similar Existing System 10
2.2.1 Smartcultiva 10
2.2.2 Nido 12
2.2.3 Titan Smartponics 15
2.3 Comparison between the Existing System and Proposed System 18

2.4 Review of Tools and Technology 19
2.5 Summary 21
CHAPTER 3: REQUIREMENT ANALYSIS AND DESIGN 22
3.1 Introduction 22
3.2 Rapid Application Development 22
3.2.1 Requirements Planning 23
3.2.2 User Design 41
3.2.3 Construction 41
3.2.4 Cutover 41
3.3 Summary 41
CHAPTER 4: IMPLEMENTATION 42
4.1 Introduction 42
4.2 Installation and Configuration of Development Tools 42
4.2.1 Arduino IDE 42
4.2.2 Blynk 44
4.2.3 NodeMCU ESP8266 45
4.2.4 Keyestudio sensor kits 46
4.3 IOT for Hydroponics System 49
4.3.1 Solution Level Reading 50
4.3.2 Motion Detector 53
4.3.3 Temperature Reading 55
4.3.4 Light Percentage Reading 59
4.4 Summary 64
CHAPTER 5: TESTING 65
5.1 Introduction 65
5.2 Functional Testing 65
5.2.1 Test Case 65
5.2.2 Summary of Functional Testing 76
5.3 Non - Functional Testing 77
5.3.1 User Acceptance Testing 77
5.4 Summary 78
CHAPTER 6: CONCLUSION AND FUTURE WORKS 79
6.1 Introduction 79
6.2 Objective Achievement 79

6.3 Limitations and Constraints 80
6.4 Future Works 80
6.5 Conclusion 80
References 81
APPENDIX A 83
APPENDIX B 87
APPENDIX C 88

List of Figures

Figure 1.1: RAD Model in System Development Life Cycle (SDLC) approach 2

Figure 1.2(i): Project Schedule for Final Year Project 5

Figure 1.3(ii): Project Schedule for Final Year Project 5

Figure 1.4(iii): Project Schedule for Final Year Project 6

Figure 1.5(iv): Project Schedule for Final Year Project 6

Figure 2.1: Smartcultiva IOT system 10

Figure 2.2: Smartcultiva Dashboard 11

Figure 2.3: Smartcultiva Reading Screens 11

Figure 2.4: Nido IOT system 12

Figure 2.5: Nido Dashboard 13

Figure 2.6: Nido Assisted Cultivation Interface 13

Figure 2.7: Nido Manual Cultivation Interface 14

Figure 2.8: Nido Maximum Control Interface 14

Figure 2.9: Titan Smartponics IOT System 15

Figure 2.10: Titan Smartponics Web Interface 16

Figure 2.11: Titan Smartponics Mobile Interface 16

Figure 2.12: Titan Smartponics Air Temperature Log 17

Figure 2.13: Titan Smartponics Light Log 17

Figure 2.14: Titan Smartponics pH Sensor Log 17

Figure 2.15: Titan Smartponics Water Temperature Log 17

Figure 3.1: Graphical representation of Rapid Application Development (RAD) model 22

Figure 3.2: Drawing of the proposed IOT system for Hydroponics 25

Figure 3.3: Solution level workflow in the IOT system for Hydroponics represents in flowchart 26

Figure 3.4: Light percentage workflow in the IOT system for Hydroponics represents in flowchart 27

Figure 3.5: Temperature reading workflow in the IOT system for Hydroponics represents in flowchart 28

Figure 3.6: Monitor plants workflow in the IOT system for Hydroponics represents in flowchart 29

Figure 3.7: Pesticides spray workflow in the IOT system for Hydroponics represents in flowchart 30
Figure 3.8: Use Case Diagram of the IOT system for Hydroponics 31
Figure 3.9: Sequence Diagram (Solution Level) of the IOT system for Hydroponics 34
Figure 3.10: Sequence Diagram (Light Percentage) of the IOT system for Hydroponics 35
Figure 3.11: Sequence Diagram (Temperature Reading) of the IOT system for Hydroponics 35
Figure 3.12: Sequence Diagram (Monitor Plants) of the IOT system for Hydroponics 36
Figure 3.13: Sequence Diagram (Spray Timer) of the IOT system for Hydroponics 36
Figure 3.14: Activity Diagram (Solution Level) of the IOT system for Hydroponics 37
Figure 3.15: Activity Diagram (Light Percentage) of the IOT system for Hydroponics 38
Figure 3.16: Activity Diagram (Temperature Reading) of the IOT system for Hydroponics 38
Figure 3.17: Activity Diagram (Monitor Plants) of the IOT system for Hydroponics 39
Figure 3.18: Activity Diagram (Spray Timer) of the IOT system for Hydroponics 39
Figure 3.19: User Interface of IOT system for Hydroponics 40
Figure 4.1: Arduino IDE website 42
Figure 4.2: Arduino IDE Library Manager 43
Figure 4.3: Layout of Arduino IDE 43
Figure 4.4: Install Blynk from Google Play Store 44
Figure 4.5: Create new project Interface 44
Figure 4.6: IOT for Hydroponics Interface 45
Figure 4.7: NodeMCU ESP8266 45
Figure 4.8: HC-SR04 Ultrasonic Sensor 46
Figure 4.9: DHT11 Temperature and Humidity Sensor 47
Figure 4.10: Ks0052 PIR Motion Sensor 47
Figure 4.11: Ks0028 Photocell Sensor 48
Figure 4.12: Prototype for IOT for Hydroponics System 49
Figure 4.13: Distance further (solution in tank decrease), relay turned on the pump 50

Figure 4.14: Distance closer (new solution is filled in the tank), relay turned off the pump 51

Figure 4.15: Interface for Solution Level Reading in Blynk 51

Figure 4.16: Source code for Solution Level Reading (i) 52

Figure 4.17: Source code for Solution Level Reading (ii) 52

Figure 4.18: Motion detected, notification send to the owner. 53

Figure 4.19: Interface for Motion Detector in Blynk 54

Figure 4.20: Source code for Motion Detector 54

Figure 4.21: Prototype for feature Temperature Reading 55

Figure 4.22: Temperature increase, fan is turned on 56

Figure 4.23: Interface for Temperature Reading in Blynk 57

Figure 4.24: Source code for Temperature Reading 58

Figure 4.25: Prototype for feature Light Percentage Reading 59

Figure 4.26: Average light percentage below 50%, lights is turned on 60

Figure 4.27: Interface for Light Percentage Reading in Blynk 61

Figure 4.28: Source code for Light Percentage Reading (i) 61

Figure 4.29: Source code for Light Percentage Reading (ii) 62

Figure 4.30: Source code for Light Percentage Reading (iii) 63

Figure 4.31: Source code for Light Percentage Reading (iv) 64

List of Tables

Table 2.1 Comparison between the Existing System and the Proposed System 18

Table 2.2 Review of Hardware 19

Table 2.3 Review of Software 20

Table 3.1: Use Case 1 in the IOT system for Hydroponics 32

Table 3.2: Use Case 2 in the IOT system for Hydroponics 32

Table 3.3: Use Case 3 in the IOT system for Hydroponics 33

Table 3.4: Use Case 4 in the IOT system for Hydroponics 33

Table 3.5: Use Case 5 in the IOT system for Hydroponics 33

Table 5.1: Feature (Solution Level Reading) 66

Table 5.2: Feature (Solution Level Reading) Specification 66

Table 5.3: Test Case for Feature (Solution Level Reading) 67

Table 5.4: Feature (Light Percentage Reading) 68

Table 5.5: Feature (Light Percentage Reading) Specification 68

Table 5.6: Test Case for Feature (Light Percentage Reading) 69

Table 5.7: Feature (Motion Detector) 72

Table 5.8: Feature (Motion Detector) Specification 72

Table 5.9: Test Case for Feature (Motion Detector) 73

Table 5.10: Feature (Temperature Reading) 74

Table 5.11: Feature (Temperature Reading) Specification 74

Table 5.12: Test Case for Feature (Temperature Reading) 75

Table 5.13: Outcomes of User Acceptance Testing 78

Table 6.1: Summary of Objectives and Achievements 79

Abstract

Internet of Things for Hydroponics System is a system that is used to enhance the effectiveness of the hydroponics system. Nowadays, hydroponics system has been increased in use for agriculture. The hydroponics system grows plant with only using the formulation of nutrient solution in solvent without using soils. Also, this hydroponics system needs high supervision so that the plants can grow to its optimum level. Therefore, this system is essential to ensure the latest hydroponics technologies are applied in this system for the innovation of agriculture. This system aims to deliver a system that functions effectively and user-friendly. The basis of the research and the established method for the proposed system will be displayed in this report.

Abstrak

Internet Pelbagai Benda untuk Sistem Hidroponik adalah sistem yang digunakan untuk meningkatkan keberkesanan sistem hidroponik. Pada masa kini, sistem hidroponik telah meningkat penggunaan untuk pertanian. Sistem hidroponik menyuburkan tumbuhan dengan hanya menggunakan formulasi nutrien dalam pelarut tanpa menggunakan tanah. Juga, sistem hidroponik ini memerlukan pengawasan yang tinggi supaya tumbuhan dapat tumbuh ke tahap optimumnya. Oleh itu, sistem ini adalah penting untuk memastikan teknologi hidroponik terkini digunakan dalam sistem ini untuk inovasi pertanian. Sistem ini bertujuan untuk menyampaikan sistem yang berfungsi dengan berkesan dan mesra pengguna. Asas penyelidikan dan kaedah yang telah ditetapkan untuk sistem yang dicadangkan akan dibentangkan di dalam laporan ini.

CHAPTER 1: INTRODUCTION

1.1 Project Title

Internet of Things for Hydroponics System

1.2 Introduction

Hydroponics is a part of hydro culture which help plants' owner to grow their plants to optimal growth and higher yields using a correct formulation of nutrient solution in solvents. However, improper composition of nutrition may affect the outcomes of this method. This often led to an issue for the hydroponics system. In addition, this growing method also needs a high supervision which require a time cost.

In order to encounter these issues are by establishing an Internet of Things (IOT) system for this hydroponics method. This IOT system can help the effectiveness of this method by helping to guide a proper formulation for the amount of nutrition that need to be added in the solvents. Other than that, IOT system also ease the job of supervising the plants by letting the plants' owner to supervise the plants by an app which receive the data that is being sent to the cloud through some devices or sensors that are being added to the hydroponics system. Hence, the aim of this project is to create a more systematic system that are time saving, easy and can increase the optimal growth of the plants using hydroponics method.

1.3 Problem Statement

Hydroponics is a method of growing plant with only using nutrient solution in solvent and this method is growing in use especially in Sarawak for agriculture. Unfortunately, incorrect composition of the nutrient solution cause a nutrition deficiency which may lead to non-optimal growth. Hydroponics method also requires a high supervision that is very time cost. Without a proper method and supervision, it is hard to get the optimal growth of the plants using hydroponics method. One of the problems that the agriculturist face is the water level needed as a solvent for the hydroponics system. Also, the surrounding temperature which may affect the growth of the plants if it is not in optimal temperature. Other than that, no pest control will damage the plants and the lack of brightness for the plants to have photosynthesis are the problems that the agriculturist face.

1.4 Objectives

Knowing the purpose or the objectives of project are advantageous in order to achieve a successful project. The objectives of this project are:

i. To review the latest hydroponics technologies that can be applied in the innovation of agriculture.
ii. To design and develop an IOT based system that can ensure the hydroponics method functions effectively.
iii. To ensure the proposed system is easy to use and efficient.

1.5 Methodology

Methodology is used to reach the objective of the project that will fulfil a perfect result. The methodology that is selected for this project is the Rapid Application Development Model (RAD). This model also known as an iterative life cycle model which compresses the step by step development of traditional methods into an iterative process. Figure 1.1 below shows the sequential phases in RAD Model:

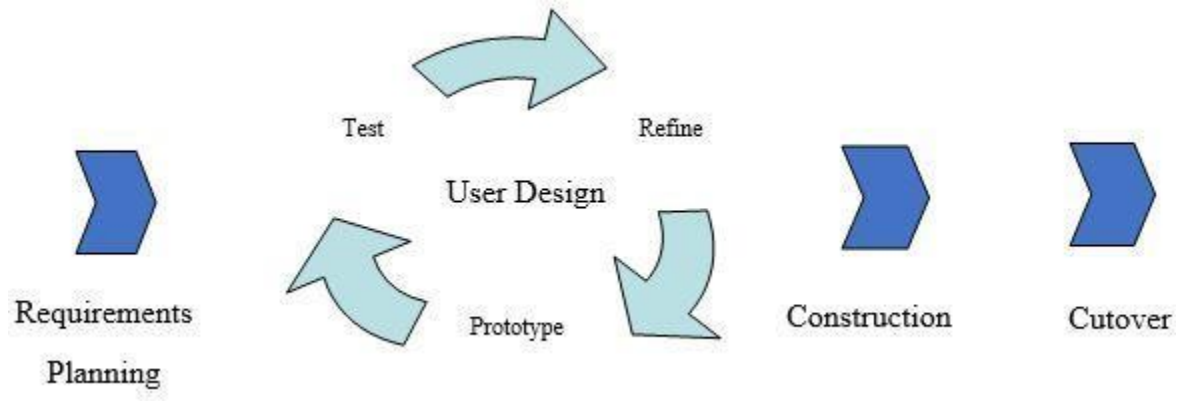

Figure 1.1: RAD Model in System Development Life Cycle (SDLC) approach

1.5.1 Requirements Planning

During this phase, the project's objectives will be detailed distinctly and the problem statement will be identified. A discussion with Associate Professor Dr Hj Noor Alamshah bin Bolhassan was done briefly to gather the requirement for this project, input about hydroponics and problems that come across such as nutrition deficiency and high supervision. Other than that, a project schedule will be designed to work out what need to be done systematically to avoid any delay for the project. Data will be gathered to get more results which will be analysed and compared in a table created. A new feature will be proposed based on the analysis such as sensor for detecting composition of the nutrient solution.

1.5.2 User Design

During user design phase, hand in hand work with the client is a must to ensure all needs are being met at the design process. A customizable software development will be created so that client can test each prototype of the system through each phase. This is to make sure the hydroponics prototype model is up to his expectations. Debugging process also taken place using an iterative process. The prototype will be refined and tested together with client on what is needed to be added and what is not worked in the design. Cooperation with client during this phase will help to adjust the model to reach an acceptable model.

1.5.3 Construction

During this phase, the prototype will be finalised and converted into working model as large part of the errors and changes were addressed during iterative design phase. Program and application of the hydroponics system will be developed which include coding and system testing. The system will be reconstructed if there are changes or new add up suggested by the client to achieve the objectives of this project.

1.5.4 Cutover

In this phase, the completed system of hydroponics will be launched. System training will also be carried out for new user.

1.6 Scope

Deciding the scope of the project is obligatory to pinpoint the work boundaries and achievement of the project to ensure the goals being racked up. This system is designed to achieve the effectiveness of method of growing plant with only using nutrient solution in solvent, hydroponics. The main target user for this system is the agriculturalist. This system will help the agriculturalist to supervise the hydroponics plant and understand the nutrition efficiency which may lead to optimal growth of the plant. Thus, the agriculturalist will be able to supervise the plant systematically and precisely even when he or she is outstation. Other than that, the system will detect the condition of the plant through particular sensors that are being set in the hydroponics system. Also, the system will sent the notifications through an interface to the user so that he or she will be kept up to date.

1.7 Significance of Project

The main idea of this project is to create an IOT system that ensure the hydroponics method functions effectively. It is important to push forward the hydroponics method as it brings virtue for agriculture. As mentioned in the introduction, this IOT system can help to guide a proper formulation for the amount of nutrition that need to be added in the solvents. Also, the system also ease the job of supervising the plants. In addition, this IOT in hydroponics system can be more systematic, time saving and improve the optimal growth of the plants.

1.8 Project Schedule

	A	B	C	D
1	Task Name	Duration	Start	Finish
2	**Final Year Project 1**	**90**	**13/9/2019**	**12/12/2019**
3	Brief Proposal	16	13/9/2019	29/9/2019
4	Approval of Brief Proposal	6	29/9/2019	5/10/2019
5	**Full Proposal**	**14**	**5/10/2019**	**19/10/2019**
6	Research on project	12	5/10/2019	17/10/2019
7	Analyse project requirement	4	9/10/2019	13/10/2019
8	Determine project scope	3	14/10/2019	17/10/2019
9	Determine methodology	2	17/10/2019	19/10/2019
10	Submission of Full Proposal	1	19/10/2019	19/10/2019
11	**Chapter 1: Introduction**	**6**	**20/10/2019**	**26/10/2019**
12	Finalise project proposal	5	21/10/2019	26/10/2019
13	Submission of Chapter 1	1	26/10/2019	26/10/2019
14	**Chapter 2: Literature Review**	**20**	**27/10/2019**	**16/11/2019**
15	Review, journals of existing systems	11	27/10/2019	7/11/2019
16	Documentation	8	8/11/2019	16/11/2019
17	Submission of Chapter 2	1	16/11/2019	16/11/2019
18	**Chapter 3: Requirement Analysis and Design**	**18**	**17/11/2019**	**5/12/2019**
19	Requirement collection	4	17/11/2019	21/11/2019
20	Create DFD, ERD	4	22/11/2019	26/11/2019
21	Design prototype	3	27/11/2019	30/11/2019
22	Testing	4	1/12/2019	5/12/2019
23	Submission of Chapter 3	1	5/12/2019	5/12/2019
24	**Submission of FYP 1 Final Report**	**1**	**12/12/2019**	**12/12/2019**
25				

Figure 1.2(i): Project Schedule for Final Year Project

26	**Final Year Project 2**	**122**	**28/1/2020**	**29/5/2020**
27	**Chapter 4: Implementation**	**55**	**28/1/2020**	**23/3/2020**
28	System design	6	28/1/2020	3/2/2020
29	Develop the system	48	4/2/2020	23/3/2020
30	Submission of Chapter 4	1	23/3/2020	23/3/2020
31	**Chapter 5: Testing**	**13**	**24/3/2020**	**6/4/2020**
32	Test plan	6	24/3/2020	30/3/2020
33	Evaluate system	6	31/3/2020	6/4/2020
34	Submission of Chapter 5	1	6/4/2020	6/4/2020
35	**Chapter 6: Future Work**	**8**	**7/4/2020**	**15/4/2020**
36	Clarify limitations	3	7/4/2020	10/4/2020
37	Conclude future work	4	11/4/2020	15/4/2020
38	Submission of Chapter 6	1	15/4/2020	15/4/2020
39	**Submission of FYP Full Report**	**1**	**29/5/2020**	**29/5/2020**

Figure 1.3(ii): Project Schedule for Final Year Project

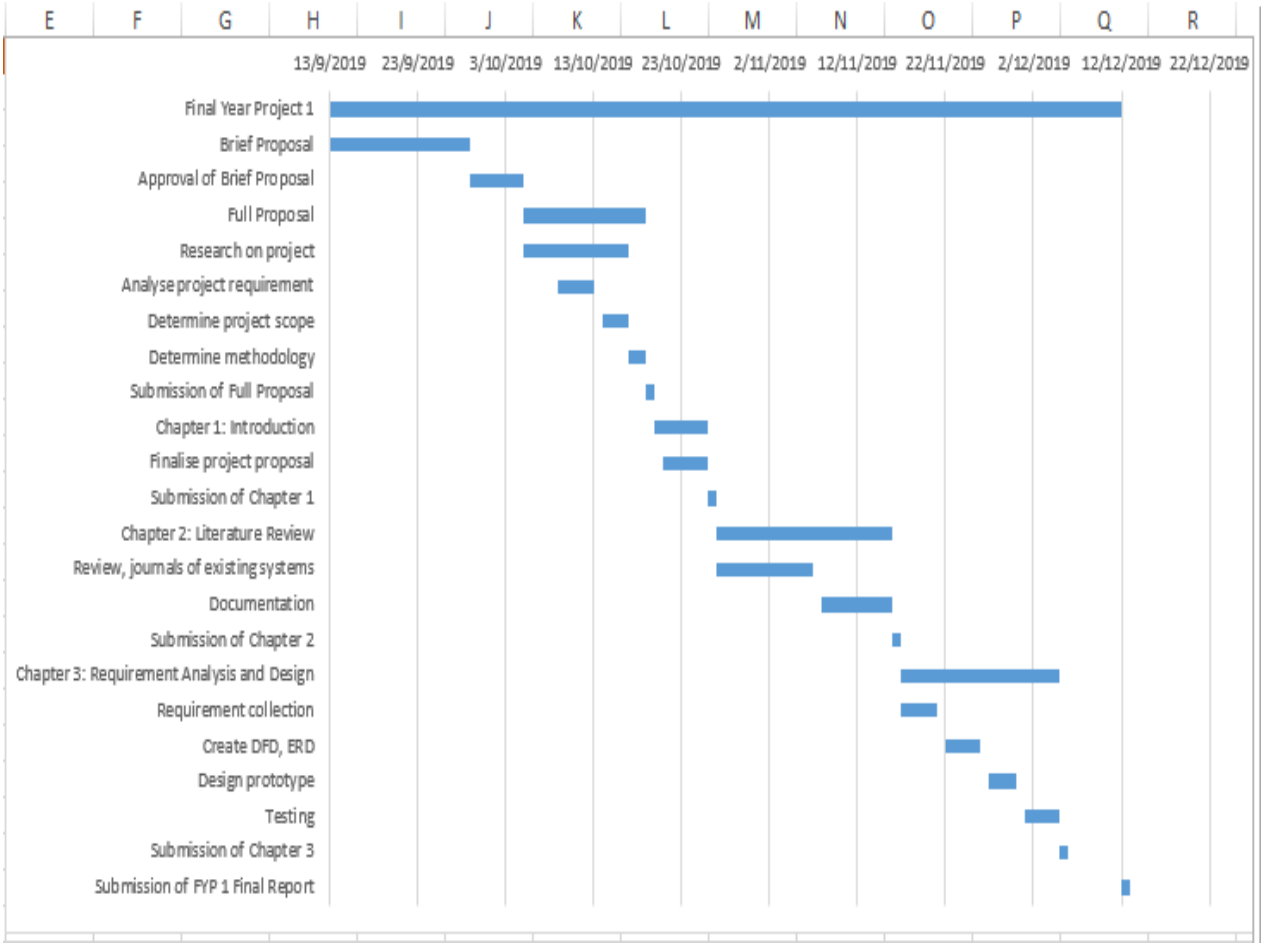

Figure 1.4(iii): Project Schedule for Final Year Project

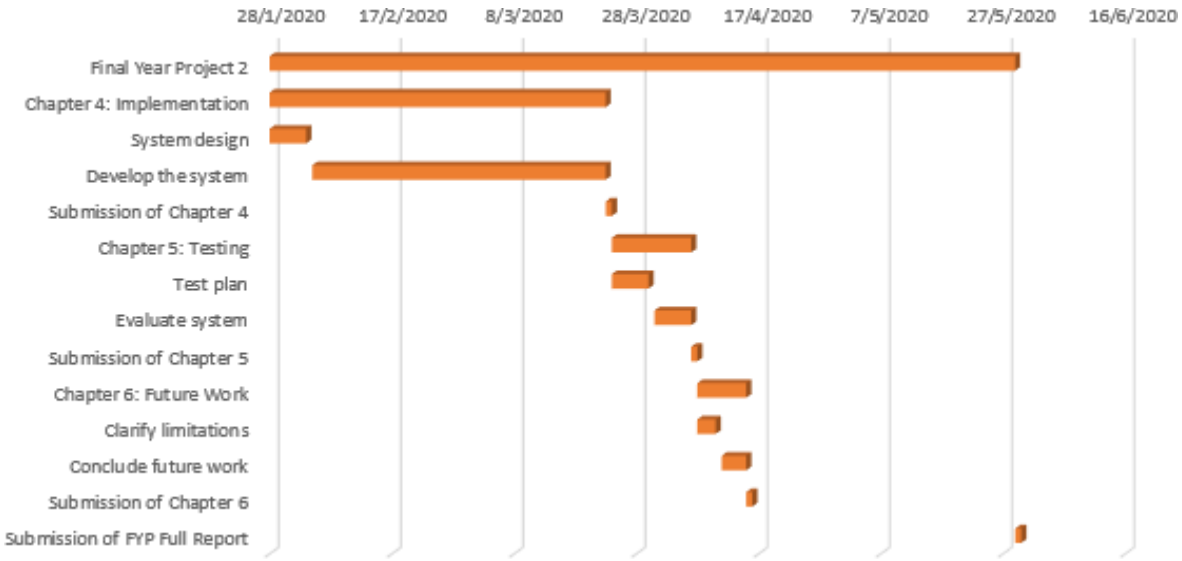

Figure 1.5(iv): Project Schedule for Final Year Project

1.9 Expected Outcome

Towards the fulfilment of the project, the most expected after-effect is a fully function system of IOT in hydroponics method of agriculture. The system should achieve the objectives and requirements. Other than that, this system is expected to be used for long period of time. Lastly, the system should be trouble-free for everybody.

1.10 Project Report Outline

1.10.1 Chapter 1: Introduction

Chapter 1 speaks to the presentation of the proposed framework. This includes the introduction which briefly explains the hydroponics system and the use of IOT in this system. Other than that, the problem statement gives details of the issues that present in the system. The objectives explain the target that need to be accomplished for this project and the methodology clarifies the procedure towards building up the system. Next, the scope shows the borderline of this proposed project. The significance of project represents the noteworthy of the proposed project to the system and the project schedule displays the timeline of this project. Lastly, expected outcome portrays the ultimate results once the task is finished.

1.10.2 Chapter 2: Literature Review

Chapter 2 talks about the audit done on existing systems based on system features that are the same as the proposed project. A finer features of the system will be proposed and at the end of the chapter, there will be portrayals and surveys on the new features and the proposed system.

1.10.3 Chapter 3: Requirement Analysis and Design

Chapter 3 ponders about the methodology used for the improvement of the whole undertaking. The Rapid Application Development Model (RAD) will be used to progress the proposed system. This chapter shows that hand in hand work with the client is needed to get requirements for the system which may include Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD) to show the system plans and streams.

1.10.4 Chapter 4: Implementation

Chapter 4 shows a full description of the proposed system. The structure of the system illustrated using screenshots and the configuration of the interface. Also, development of the proposed system using Arduino ESP8266 will be explained.

1.10.5 Chapter 5: Testing

Chapter 5 is where the system testing is conducted. Also, the features are evaluated to enhance the performance. Testing is done to measure the system effectiveness, performance and debugging any errors in the system.

1.10.6 Future Work

Chapter 6 concludes the plan as a whole and discusses future work. Recommendations or suggestions for possible improvements in the future will be given based on the test results in the previous chapter.

1.11 Summary

This chapter describes the introduction of the proposed system. The objective of this proposed project is to develop an Internet of Things for Hydroponics System. This chapter includes the problem statement which shows the problem that current system faced, objectives which determines the goal of the project, the methodology that is selected which is Rapid Application Development (RAD), the project scope, significance of project, project schedule and the expected outcome of the project.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter is about reviewing of existing systems that have the similar features to the proposed system. Three existing systems that are being reviewed, Smartcultiva, Titan Smartponics and Nido. These three systems will be compared to create new ideas for the features of the proposed system. “A literature review is a systematic, explicit and reproducible method for identifying, evaluating, and interpreting the existing body of recorded work produced by researchers, scholars, and practitioners” (Fink, 2005, p.17).

Hydroponics is a part of hydro culture which help agriculturists to grow their plants to optimal growth and higher yields using a correct formulation of nutrient solution in solvents. The Oxford English Dictionary, 2nd Edition, 1989, defines hydroponics as “the process of growing plants without soil, in beds of sand, gravel, or similar supporting material flooded with nutrient solutions.” This method of agriculture has been practiced for centuries and get popular in this modern day. The advancement in technologies and innovations are known to boost the use of hydroponics system nowadays.

Internet of Things (IOT) is one of the advancement of technologies that are being used in hydroponics system. IOT is a system that interconnected technology devices with objects, animals or people via internet which allow them to transfer and receive data. This “Internet of Things” term is known coined by Kevin Ashton, a British technology pioneer who cofounded the Auto-ID Center at the Massachusetts Institute of Technology (MIT), which created a global standard system for RFID and other sensors. IOT helps hydroponics system to supervise the plants from afar and ensures the system works systematically. Hence, this justifies the first objective which is to study and analyse the latest hydroponics technologies that can be applied in the innovation of agriculture.

A hydroponics system usually need high supervision. Agriculturists must ensure the water level flow through the root zone of the plants are maintained. Other than that, agriculturists need to detect the surrounding temperature of the plants so that the plants is in optimal temperature. Next, pesticides also need to be applied on the plants to control pest. Lastly, the agriculturists need to monitor the growth of the plants and intruders that have intention to disturb the plants. Hence, this justifies the second and third objectives of the proposed system, which are to design and develop an IOT based system that can ensure the hydroponics method functions effectively and to evaluate the proposed system utilizing ease of use and developer’s execution methods.

2.2 Reviews on Similar Existing System

2.2.1 Smartcultiva

Smartcultiva is an IOT system that is being used for hydroponics. Developed by the co-founder of Smartcultiva, Martin Gonzalo and Eileen Ebene, also the advanced IOT engineering, Matias Penida, and the advisory board & friend, Gabriel Griffa. This system is suitable for hydroponics advancement technologies. Smartcultiva is a friendly use system.

To enable the system to flow, local Wi-Fi device is needed to provide signal coverage over sensing devices. Smartcultiva provides two set of sensors which are Sensor A and Sensor B. Sensor A is used to measure water tank levels and temperature of water. Also, Sensor A collects the value of pH level, EC level and O2 level in the water. Sensor A also used to open and close the pump. Mostly, Sensor A measures the pH in the solution and level of nutrients in the solution. While for Sensor B, it is used to measure light intensity, temperature of water and the circulation of the water. Sensor B also uses to measure temperature and humidity of surrounding. Sensor B is mainly used to measure the surrounding condition which is the presence of light and temperature of surrounding. The sensor data from both sensors can be controlled and viewed in the form of charts through mobile and web.

There are some pros and cons for this system. The advantage of this system is that the system is usually for industrial used. Also, it can collect pH and EC level of the water. However, the disadvantages of this system are the lack of securities measure and high cost.

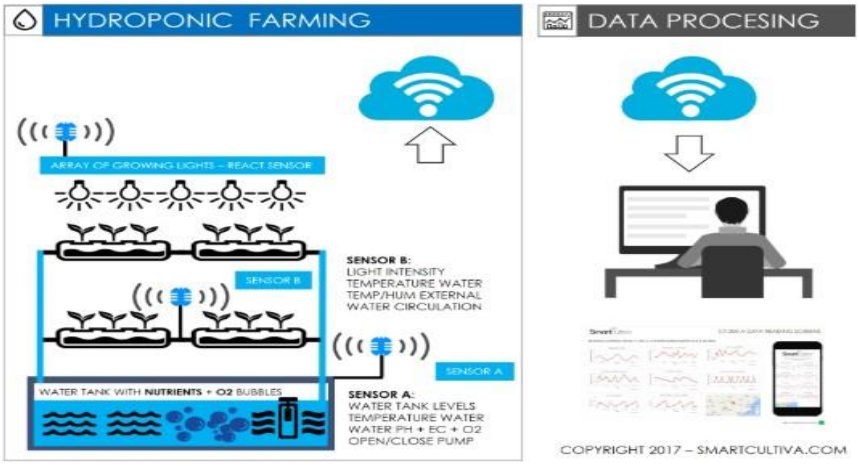

Figure 2.1: Smartcultiva IOT system

Figure 2.2: Smartcultiva Dashboard

Figure 2.3: Smartcultiva Reading Screens