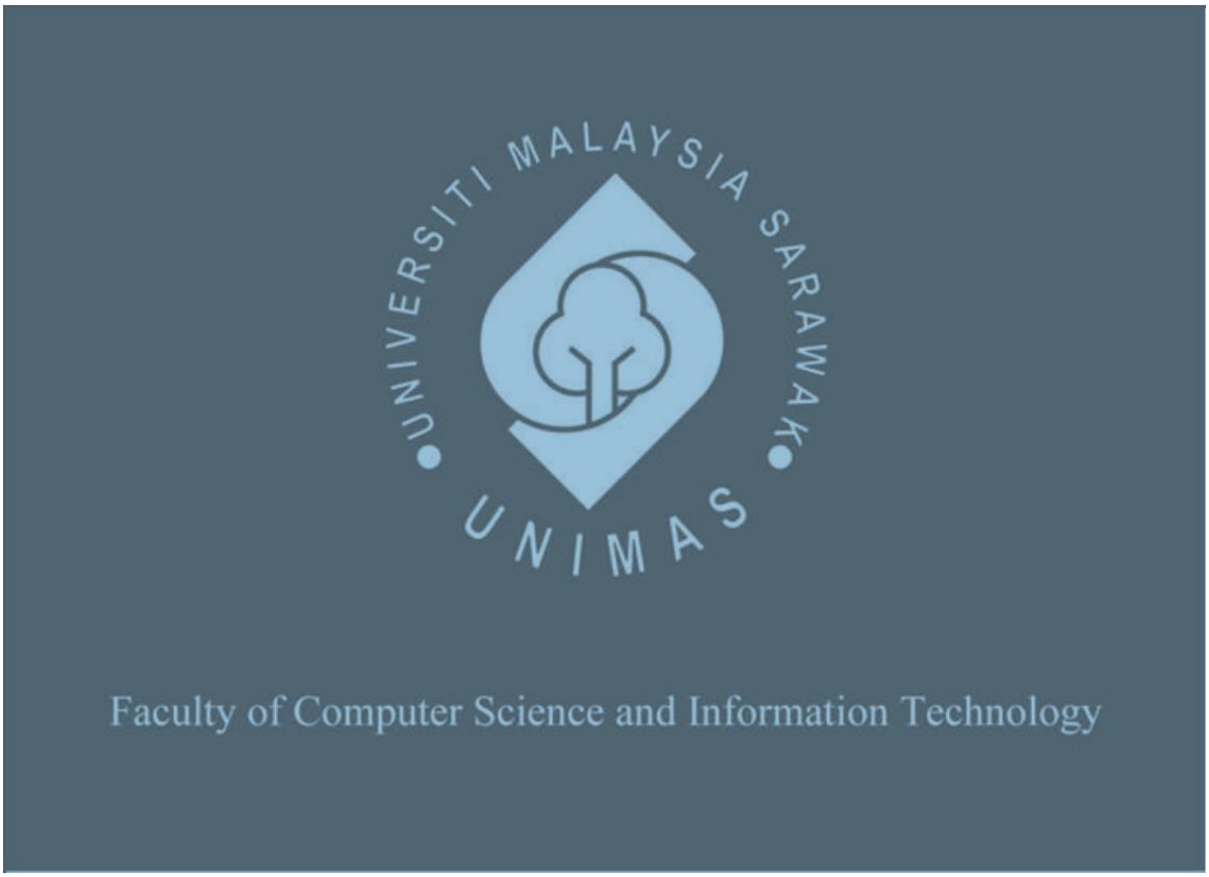

Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices

Danial Azree bin Anuar

Bachelor of Computer Science with Honours

(Multimedia Computing)

2020

Faculty of Computer Science and Information Technology

University Malaysia Sarawak

Project Title

Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices

Name: Danial Azree bin Anuar

Matric Number: 58535

Program: Multimedia Computing

This project is submitted in partial fulfilment of the requirement for the degree of Bachelor of computer Science with Honours (Multimedia Computing)

Fakulti Sains Komputer dan Teknologi Maklumat

University Malaysia Sarawak

Tajuk Projek

Sistem Pemantauan Tuaian Madu Kelulut Menggunakan Peranti IoT

Nama: Danial Azree bin Anuar

No.Matrik : 58535

Program: Pengkomputeran multimedia

Projek ini merupakan salah satu keperluan untuk ijazah Sarjana Muda Sains Komputer dengan Kepujian (Pengkomputeran multimedia)

Form B

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Danial Azree bin Anuar (58535)

December 2019

Faculty of Computer Science and

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Abstract

Harvest of honey produced by stingless honeybees follows a schedule which proves to be non-beneficial as every box or nest differ in terms of activeness that affects honey production. This project focuses on producing a solution to harvest the honey efficiently and effectively from stingless bee box with the suitable condition for it to become relevant for harvest. The method of observation and research is used to further investigate the problem concerning the harvest of stingless bee honey by visiting a stingless bee farm and research past solutions to enhance the proposed solution for this project. The results obtained are the need of sensors to monitor the parameters of weight and temperature that proves to be essential to monitor the status of a stingless bee box which has more product other than honey which is bee bread that raises the difficulty of harvesting the honey when accumulated over time. The proposed solution is then decided by utilizing IoT devices consisting mainly of weight sensor, temperature sensor, and NodeMCU ESP8266 that will be connected to Firebase Realtime Database and the data will be displayed on a web application. This will enable users to monitor the status of a stingless bee box focusing on the change in weight and temperature as well as previous harvest records that can be interpreted as the production of stingless bee products so users can act accordingly to the situation.

Abstrak

Tuaian madu yang dihasilkan oleh lebah kelulut mengikut jadual yang dibuktikan untuk tidak membawa manfaat kerana setiap kotak atau sarang berbeza dari segi keaktifan yang memberi kesan terhadap penghasilan madu. Projek ini memberi tumpuan terhadap penyelesaian yang dapat menuai madu secara cekap dan berkesan dari kotak kelulut dengan keadaan yang bersesuain untuk dituai. Kaedah pemerhatian dan penyelidikan digunakan untuk melanjutkan penyiasatan masalah tentang tuaian madu kelulut dengan melawat ladang kelulut dan menyelidik jalan penyelesaian silam untuk menambah baik jalan penyelesaian yang dicadangkan untuk projek ini. Hasil yang didapati ialah keperluan untuk menggunakan sensor berat dan suhu yang penting untuk memantau status kotak kelulut yang ada produk lain selain madu iaitu roti lebah yang meningkatkan kesusahan untuk menuai madu jika dibiar berkumpul. Penyelesaian yang dicadangkan diputuskan untuk menggunakan alat-alat IoT yang merangkumi terutamanya sensor berat, sensor suhu dan NodeMCU ESP8266 yang akan disambungkan ke Firebase Realtime Database dan data diperoleh akan dipaparkan ke aplikasi sesawang. Perkara tersebut membolehkan pengguna untuk memantau status kotak kelulut terutamanya dalam perubahan berat dan suhu serta rekod tuaian silam yang boleh dilihat sebagai penghasilan produk kelulut supaya pengguna boleh bertindak megikut keadaan.

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Chapter 1: Introduction

1.1 Project Title

Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices

1.2 Background

Harvest of honey produced by stingless honeybees follows a schedule which is not necessarily beneficial as each box or nest differ in terms of activeness that affects honey production. There is currently no method to harvest the honey efficiently and effectively without knowing the correct threshold for it to become relevant to harvest. There are records of researchers utilizing IoT sensors and the data is stored but it is utilized solely for investigation purposes on the behaviour of stingless bees and their hive activities.

The focus on harvest detection carries an important aspect because it can manage the productivity of honey in a control manner as to reduce wastage of resource on inactive hives and stingless bee box production as well as reduce difficult harvest should a stingless bee box be left too long. The planned solution is utilizing IoT sensors that can measure the weight and temperature parameter and connect it to a database via Wifi where the results will be displayed on a web application.

1.3 Problem Statement

The act of harvest is very tedious and unpredictable considering the external factors that affect the production of Stingless bee honey. Since there are no indicators, harvesters could not determine the amount of honey produced in the stingless bee box which results in inefficient harvesting. The production of honey of an inefficient harvest will either cause oversupply or undersupply with no control of the output in accordance to demands.

In the case of a massive farm, management of harvesting will be more difficult and may result in repetitive and unnecessary harvest even with a schedule. Problems like which nest produce slower or less is not collected and analysed so the proper action for the production to stabilize could not be taken. The proposed system will act as an indicator, monitor, data collector for honey produced as well as their productivity rate for each stingless bee box.

1.4 Project scope

The scope of this project is a module that is equipped with load cells, temperature sensor, and a nodemcu ESP8266 with Wifi capabilities. Firebase Realtime Database will be used to receive and store data from the modules. The data will then be displayed on a web application that will be built using the combination of HTML5 for the page, CSS3 for the design, and Javascript for the backend programming to connect the web application to the database and the module. Any web browser can access the web application to watch the data collected by the module in real time. The sensors involved to measure the parameters are expected to be a load cell for weight and DHT11 for temperature. Additional parameter Humidity can be also collected by utilizing the DHT11 however it is not prioritised.

1.5 Project Objectives

The system produced will be able to send data obtained from the sensors to a database via Wifi. The data will be displayed on a web application access by any web browsers to see the status of the model Stingless Bee box equipped with the system's module. The status will display the amount of honey currently produced in the box based on weight, the environment temperature, and the date of the last harvest. The project will prioritise these main functions:

-The system can determine the amount of honey produced in the stingless bee box based on the weight.

-The system can determine the last time and date of harvest based on the change of weight in accordance to time (Reduction of weight over time to determine if the box was harvested).

-The system can indicate which stingless bee honey box is full and alert the user.

-The system can detect the environment's temperature.

1.6 Methodology

Agile methodology is used in this project and the model is as shown:

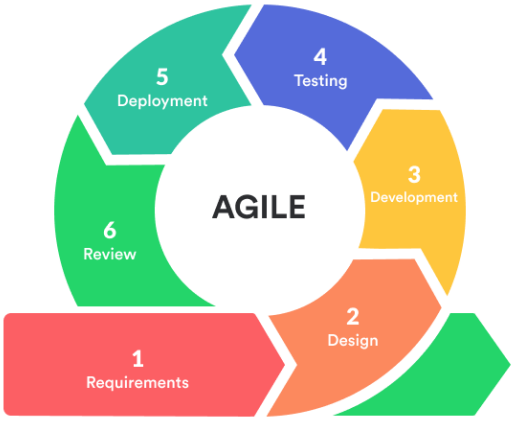


Figure 1.1 Agile SDLC Adapted from " **Agile SDLC: Skyrocketing Your Project with Agile Principles**" by **Olha Anurina**, 2019, May 10, from https://mlsdev.com/blog/agile-sdlc?source=post_page---------- .

Agile SDLC model is known for its flexibility which allows developer to update their project more frequently in a fast-paced environment. This allows versatility which is useful because of the ever-changing needs of customer/clients (Anurina,2019). The methodology will follow an iterative approach which will allow the project to be in a repetitive cycle until the final product fulfil all the needs of clients/customer.

Phases:

1. Requirements – Gather the requirements and information. It will be analysed to define the problem and solution of the project. Observation and interview are primarily used in this phase which involves site visit to a stingless bee farm. It is further supported with research on the internet.

2. Design- The architecture of the project is formed in this phase. Based on the research, the foundation of the solution is formed with the selection of materials, design of the project and the method of constructing the project.

3. Development-Application of the code and implementation of functions and components into the project.

4. Testing- Test the product and check for faulty parts. Fix the faulty parts and test it again until all problems are resolved.

5. Deployment-The project is released to end users.

6. Review- Receive feedback from users. If issues are found, depending on the level of severity, hotfix or fix can be applied on the next planned release of the project.

1.7 Significant of Project

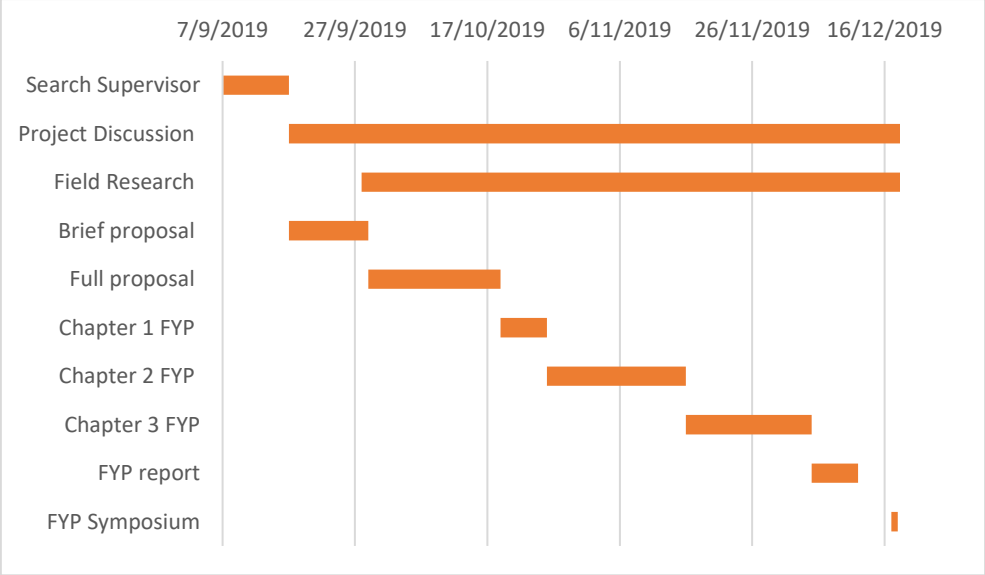
This project will allow the management of honey to be easier and data can be also analysed for future reference regarding the stingless bee honey production. The system detects the change in weight of the stingless bee box and if it reaches a certain threshold, the system will alert the user. The user can harvest it and the reduction in weight over time will be regarded as the box being harvested by the system and the time and date will be recorded. Other than the monitoring the weight of honey produced, temperature is also monitored to use as a factor data that may affect the honey production or quality. This way, the amount of honey harvested can be controlled based on the production rate of the honey, so management is easier. This will benefit the agriculture industry thus helping the local economy to further enhance their knowledge and income regarding the business. The success of this system can potentially help other areas of agriculture if the harvest is measurable and applicable to the method of this project which is weight change and provide the same benefits it does as the harvest of stingless bee honey.

1.8 Project Schedule

The project schedule is represented in a Gantt chart to observe the timeline of every task to ensure it is completed in the allocated timeframe. The schedule starts on 7/9/2019 and is planned to end on 18/12/2019 for FYP 1 in the first semester while for FYP 2 in the second semester starts on 2/3/2020 and is planned to end on .

Task	**Start Date**	**End Date**	**Duration**
Search Supervisor	7/9/2019	17/9/2019	10
Project Discussion	17/9/2019	3/1/2020	108
Field Research	28/9/2019	3/1/2020	97
Brief proposal	17/9/2019	29/9/2019	12
Full proposal	29/9/2019	19/10/2019	20
Chapter 1 FYP	19/10/2019	26/10/2019	7
Chapter 2 FYP	26/10/2019	16/11/2019	21
Chapter 3 FYP	16/11/2019	5/12/2019	19
FYP report	5/12/2019	12/12/2019	7
FYP Symposium	17/12/2019	18/12/2019	1

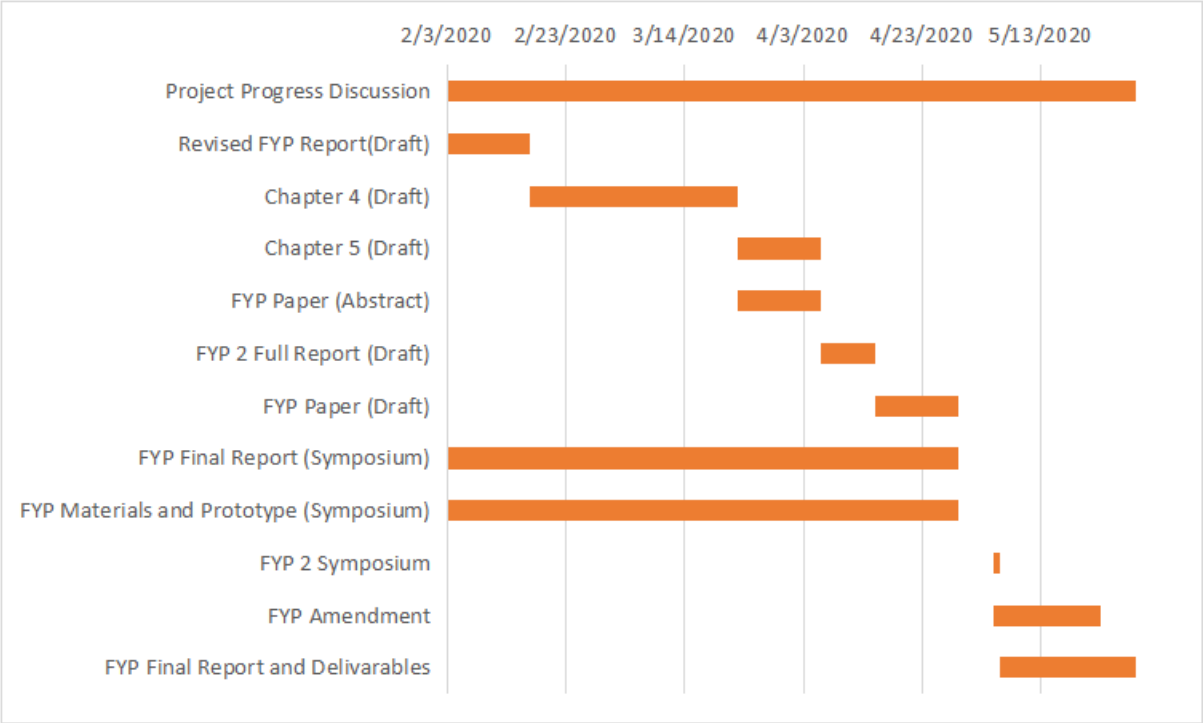
Table 1.1 Project schedule



Gantt Chart of Project Schedule(Semester 1)

Task	Start Date	End Date	Duration
Project Progress Discussion	2/3/2020	5/29/2020	116
Revised FYP Report(Draft)	2/3/2020	2/17/2020	14
Chapter 4 (Draft)	2/17/2020	3/23/2020	35
Chapter 5 (Draft)	3/23/2020	4/6/2020	14
FYP Paper (Abstract)	3/23/2020	4/6/2020	14
FYP 2 Full Report (Draft)	4/6/2020	4/15/2020	9
FYP Paper (Draft)	4/15/2020	4/29/2020	14
FYP Final Report (Symposium)	2/3/2020	4/29/2020	86
FYP Materials and Prototype (Symposium)	2/3/2020	4/29/2020	86
FYP 2 Symposium	5/5/2020	5/6/2020	1
FYP Amendment	5/5/2020	5/23/2020	18
FYP Final Report and Delivarables	5/6/2020	5/29/2020	23

Table 1.1.1 Project schedule(Second Semester)



Gantt Chart of Project Schedule(Semester 2)

1.9 Expected Outcome

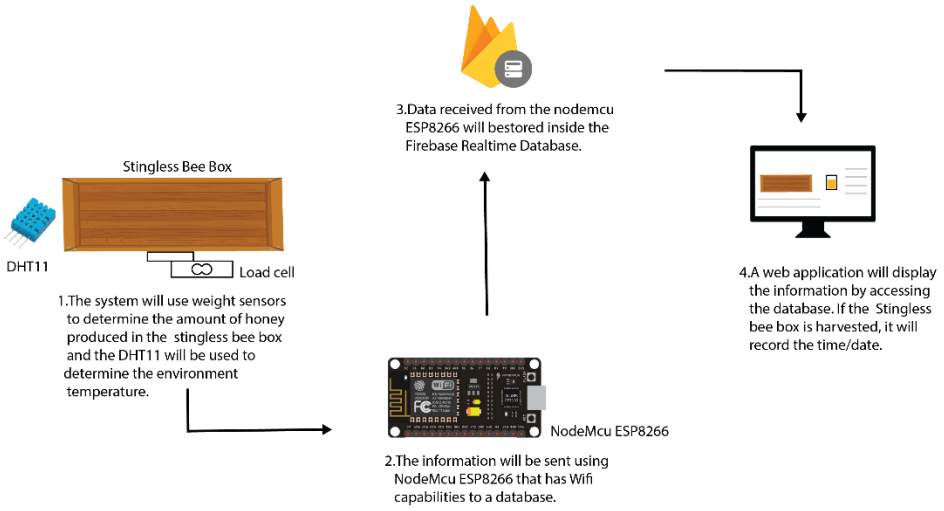


Figure 1.2 Overview Diagram

An IoT system that can monitor the production of Stingless bee honey in the Stingless bee box and integrate the data via Wifi to a database which will be displayed in a web-based system. The diagram above showcases the flow of the outcome. The data displayed will be the status of the box which will consist of the amount of honey produced in weight parameter and the temperature, the last harvest detail containing the date, time, temperature and honey produced in weight parameter based on the last harvest which is detected when the box weight of the box is reduced in a certain rate over time. The parameters weight will be measured using a load cell while the temperature of surrounding will be measured using DHT11.

1.10 Project outline

2. Chapter 1: Introduction

This chapter contains the introduction to the project, Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices, in which the description regarding the project's detail is stated and elaborated. The main components of this chapter consist of problem statement, project objective, methodology, project scope, significant of project schedule and the expected outcome.

2. Chapter 2: Literature Review

This chapter contains the research of the project by comparing it to previous existing systems. The comparison must comprise of three or more existing systems to be compared with the project, Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices. The expected outcome of this chapters is to refine the project based on the comparison discovering the pros and cons of the proposed project.

3. Chapter 3: Requirement Analysis and Design

This chapter contains the methodology implemented to the form the project, Stingless Bee Honey Harvest Monitor System Utilizing IoT Devices, structure. This includes the requirements such as software and hardware to be used. Agile methodology is used in this project with an iterative approach to allow the project to be versatile and upgrade based on feedback from clients.