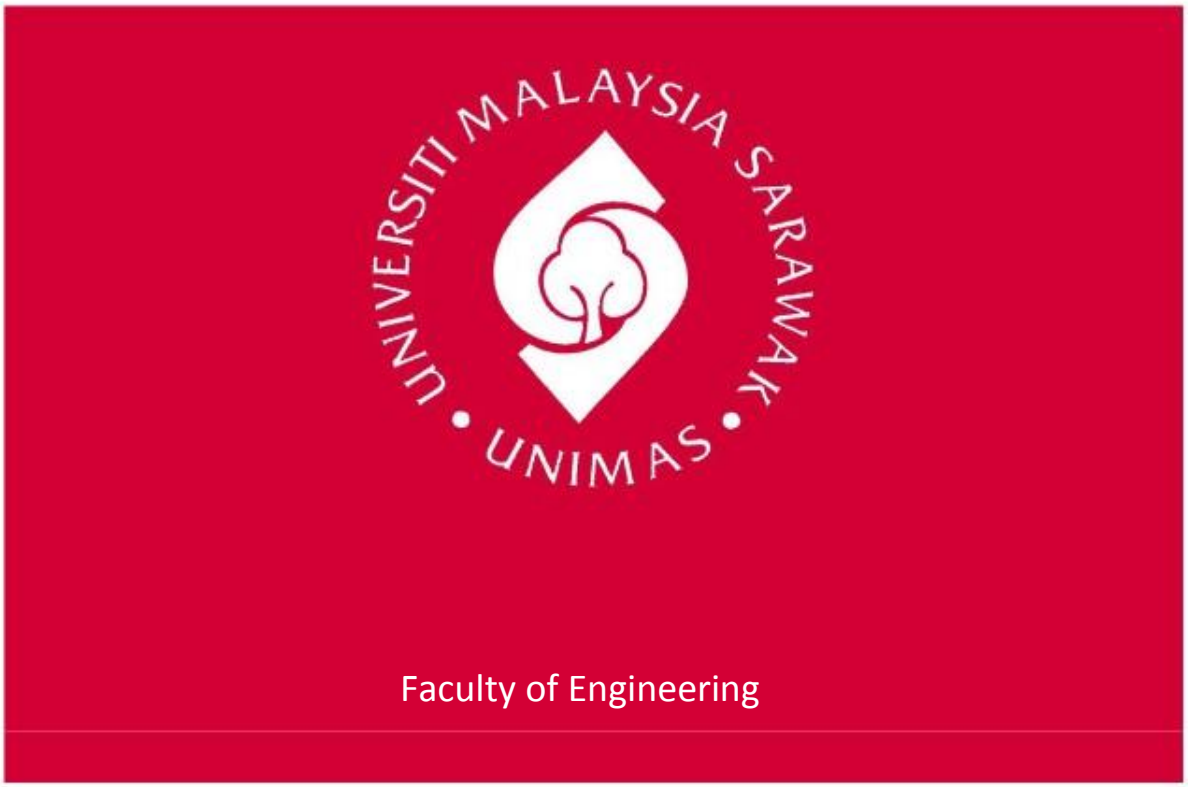


# MOBILE APPS MONITORING SYSTEM FOR MADU KELULUT AGRICULTURAL

Macquine Baling Anak David Dari

Bachelor of Engineering (Hons)

Electrical and Electronics Engineering

2019

UNIVERSITI MALAYSIA SARAWAK

Grade: A-

**Please tick (√)**

Final Year Project Report ☑

Masters ☐

PhD ☐

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# MOBILE APPS MONITORING SYSTEM FOR MADU KELULUT AGRICULTURAL

MACQUINE BALING ANAK DAVID DARI

A final year project report submitted in partial fulfilment of
The requirement for the degree of
Bachelor of Engineering (Hons) Electrical and Electronics Engineering

Faculty of Engineering
Universiti Malaysia Sarawak

2019

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# ABSTRACT

Nowadays, honey which is produced by stingless bees is high in demand. This is because of their unique characteristic and their benefits against infection. Stingless bee honey has a lot of vitamins and minerals. It is known as natural wound healing and mother of medicine. However, it is hard to know whether the honey is ready to harvest or not. Most of the time, farmers or beekeepers have tendency to frequently open the box containing stingless bee which contribute discomfort to stingless bees itself. Thus, this paper will introduce a mobile apps monitoring system for stingless honey bees agricultural. The objectives of these projects are to develop a monitoring system to monitor the production of Madu Kelulut (MK) or Stingless Bee Honey (SBH) and to create mobile application which is able to monitor bee hive condition remotely. Project then validate using wooden box containing stingless bee honey. These projects are the combination of the camera module as surveillance with wireless sensor network to measure the temperature and humidity of the surrounding area. The data will be sent through Cayenne apps via our mobile phones. Thus, farmers or beekeepers are able to monitor the progress of stingless bee production. They are also able to monitor the required data such as temperature and relative humidity through their mobile phones directly.

# ABSTRAK

Madu yang dihasilkan oleh lebah kelulut sangat tinggi permintaan pada masa kini. Hal ini kerana ciri-ciri unik dan faedah-faedah madu tersebut terhadap jangkitan. Madu lebah kelulut mempunyai banyak vitamin dan mineral. Ia dikenali sebagai penyembuhan luka semulajadi dan ibu perubatan. Walau bagaimanapun, sangat sukar untuk mengetahui sama ada madu tersebut siap untuk dituai atau tidak. Kebanyakan masa, petani atau peternak lebah cenderung untuk sering membuka kotak yang mengandungi lebah kelulut yang mungkin menghasilkan ketidakselesaan kepada lebah kelulut itu sendiri. Oleh itu, projek ini adalah mengenai sistem pemantauan aplikasi mudah alih untuk lebah madu kelulut. Projek ini adalah gabungan daripada modul kamera sebagai pengawasan dengan rangkaian sensor tanpa wayar untuk mengukur suhu dan kelembapan kawasan di sekitarnya. Data akan dihantar melalui aplikasi Cayenne melalui telefon bimbit. Oleh itu, petani atau peternak lebah kelulut dapat memantau perkembangan pengeluaran madu kelulut dari semasa ke semasa atau hasilnya melalui telefon bimbit mereka secara langsung.

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MK – madu kelulut

IoT – Internet of Things

DHCP - Dynamic Host Configuration Protocol

SBH – Stingless Bee Honey

ROS – Reactive Oxygen Species

NCD – Non Communicable Disease

CVD – Cardiovascular Disease

RMS – Remote Monitoring System

GSM – Global System Mobile communication

# CHAPTER 1

# INTRODUCTION

## 1.1 INTRODUCTION

This chapter is to discuss the overview of the project which is about mobile application monitoring system in agriculture to visualize whether the "Madu Kelulut" (MK) or Stingless Bee Honey (SBH) is ready to harvest or not. This mobile application will help to keeping an eye on and visualizing the production of MK. The overview of this chapter which are project background, motivation for research, problem statement, problem definition, objective, significant of the research, contribution to knowledge, research approach and scopes and also thesis outline will be further discussed in details in section 1.2 to 1.10 respectively.

## 1.2 PROJECT BACKGROUND

Kelulut also known as stingless bees are social bees in particular lack a functional sting. As per an exploration officer in the Malaysian Agricultural Research and Development Institute (MARDI), stingless honey bees represent considerable authority in the capacity to fertilize little estimated blooms because of their modest or little figure which cannot be accomplished by different kinds of honey bees. Plus, stingless honey bees are not choosey in building a settlement hive and it is less demanding to manufacture a counterfeit hive to control the province and increment the nectar generation. Stingless bees lack the functional of sting, and it is less demanding for us to separate the nectar, dust, and propolis much of the time.

Moreover, stingless honey bees are less demanding to deal with when contrasted with bumble bees that are dependably surrender their hive and are powerless against some sort of infection. In general, they are easily distinguished from other types of bees, as their reduction and weakness of wing venation, presence of the *penicillum* and the reduction of the stings[1]. They usually can be found in tropical and subtropical region across the globes. Furthermore, they are major visitors and native pollinators of flowering plant to collect exudates and resins from plant[2]. Their honey has a lot of minerals and vitamins which beneficial to our health.

Stingless bees have their own nesting biology which is highly visible aspect of stingless bee behaviour[3] where they prefer for a less interruption, or else the colonies will leave the nest. Stingless bee species usually build their nest inside hollow trees[4]. They lived in colonies with a queen, drones and many workers live in a nest of various types of cavities[5] and beekeepers usually place them at wooden box that placed above the log hives that contain stingless bees nest obtained from the forest to allow the colony to expand their honey and pollen pots within it[6]. This is to ensure that honey can be harvested easily without damaging the nest and sustain production from the colony.

Thus, it is crucial to add a monitoring system in order to observe whether the honey is ready to harvest or not.

## 1.3 MOTIVATION

Nowadays, there are many remote monitoring systems have been widely used in agricultural sector. Monitoring and visualizing directly to our mobile phone is indeed can exaggerate the production and the quality of the MK or stingless honey which is produced by stingless bees from *Trigona* species. This is because; we can observe the amount of the honey inside a box or harvesting region without disturbing the process that is carried out by the stingless bees. As a result, we can expand the production of honey and quality of honey in time which is sweet sour taste rather than sour only. Stingless honey or MK agricultures are currently higher in demand as it may provide several advantages especially towards our health based on traditional methods.

It is proven that MK have some of the chemical properties such as polyphenols, flavonoid and phenolic[7] which can act as anti-ageing property, relieving sore throat, cough and cold and also as an immune system towards our body against pathogen[8]. Cancer has been a major problem worldwide.

One of the alternative management to treat or cure cancer is via chemoprevention which is by using natural or synthetic substances in order to decrease or reduce the risk of developing cancer[9]. Traditionally, MK is used for anti-ageing, to enhance libido and immune system, killing pathogens, treatment of bronchial phlegm, relieving sore throat, cough and also cold[10]. Aftermath, MK has grabbed the attention of researchers due to its higher nutritional values as compare to ordinary honey. It is called "Mother Medicine" and popular among practitioners and researchers[11].

## 1.4 PROBLEM STATEMENT

It is hard to monitor whether the honey is ready to harvest where we have tendency to open the box frequently which is not a preferable condition for them during the production of honey activity by the stingless bees. Thus, it is one of the difficulty tasks in order to observe either honey is ready to harvest or not. Less interference during the observation is significantly required as this kind of environment is significantly preferred by the stingless bee during the production of the MK.

Hence, a mobile apps monitoring system for this controlling purposes are substantial to be developed in order to facilitate the operation for honey harvesting works. Furthermore, until now, there are no monitoring systems for production of MK agriculture. Besides, with this app, it may increase the production of stingless honey or MK, where fewer parentheses will contribute to high fabrication.

It is necessary to make verification where we need to run the system using real stingless bee. This method is to check the condition of stingless bee honey whether they are comfortable to do their daily activity while producing honey.

## 1.5 PROJECT OBJECTIVE

The objectives of this project are mainly to:

1. Develop a monitoring system to monitor the production of Madu Kelulut (MK) or Stingless Bee Honey (SBH)
2. Create mobile application which is able to monitor bee hive condition remotely
3. Verify the system with real Stingless Bee condition

## 1.6 PROJECT SIGNIFICANT

The significant of this project is to:

1. Facilitate the monitoring of the MK's production effectively, thus, the production of stingless honey or MK is increased.

## 1.7 PROJECT SCOPES

The scopes of this research are mainly focus to monitor and control the remote sensing network for one wooden box of stingless bees hive colony. The wooden box will equip with one Arducam Mini Camera Shield and Arducam Wi-Fi board which connected with DHT11 and LED. For this research, humidity and temperature sensor is added in order to measure the temperature for the surrounding area. LED also have been added to this project where users can control the led by turning on or off if necessary.

## 1.8 PROJECT APPROACH

Agriculture of harvesting MK or stingless honey usually carries out during morning time. This is because; the colonies mostly out by the time seeking for the nectar from flowers to flowers. Thus, it is easy for the beekeepers to harvest the honey without even disturb the colonies. Beekeepers usually use a small suction device to extract honey

from pots in log hives without damaging the pollen pots and brood[12]. Further research on agriculture of MK will be described briefly on chapter 2, literature review which include the comparison of the study from previous years.

As for the hardware, Arducam Mini Module Camera will connect to Arducam ESP8266, where the ESP8266 Wi-Fi and Arducam modules will take high resolution photos and publish the photos to webpage. The picture can be accessed or monitored the result using the IP Address which is provided from mobile phone. The ESP8266 connects the user Wi-Fi router through Dynamic Host Configuration Protocol (DHCP), then connects server through web browser. Humidity and temperature sensor are also connected to Arducam ESP8266 UNO board in order to measure the temperature for the surrounding area. This sensor helps to determine the weather by sending the data to mobile user. In addition, LED is also connected to the Arducam board where, it can be controled the LED by turning on or off through mobile apps. Main components used and its costs are listed in A, B, C and D.

A) ESP8266 ESP-12E UNO board + Arducam Mini 2MP Camera compatible Arduino UNO R3 = RM170
B) Jumper Wire = RM10
C) DHT11 Humidity and Temperature sensor = RM 12
D) LED = RM5

As observed from above, the total price for components used is RM197 for one prototype that will be attached inside a wooden box containing colonies of stingless bee. All the softwares and coding used inside the Arducam are further discussed in Chapter 3 and Chapter 4 of this thesis. Details methods on pin connection are further discussed as well. Then, the procedures of experimentation are also explained.

The apps is then experimented according to different situation for an instant, testing inside bright and dark surrounding, according to the weather which is rainy, sunny, storm before validation on real application. The mobile applications also involved in Wi-Fi range coverage experimentation. During the validation process, the hardware is will be then placed at the box of stingless bee. This is in order to observe on how stingless bee might react. The validation process for this system is carried out using wooden box that contains colony of stingless bees that is provided by one of the farmers or beekeepers itself.

## 1.9 THESIS OUTLINE

Throughout this thesis, there are six chapters, where;

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Methodology

Chapter 4; Design of Experiment with Results

Chapter 5: Discussion

Chapter 6: Conclusion and Recommendation

For Chapter 1, it discusses on the project background, motivation of the project, problem statement, project objectives, project significant, project scopes and project approach.

Then Chapter 2, it discusses on the general information of stingless bees, advantages of the stingless bee honey, analysis of monitoring system and the process of harvesting stingless bee honey.

Chapter 3 explains on the research types, research tools which are about Cayenne Apps for mobile phones, Arducam ESP8266 UNO V2 board, Arducam mini camera module, lithium battery, LED, PCB board and also DHT11 humidity and temperature sensor and research process.

In Chapter 4, it presents on the design of the experiment by phases which are experimental method with results on hardware and software, mobile apps testing for Cayenne apps and the validation process.

Finally, Chapter 5 and Chapter 6 provide discussion and conclusion respectively.

## 1.10 CONCLUSION

As a summary of this chapter, project background is the study about the agriculture of stingless bee or MK. As for the motivation, mobile application device for monitoring can increase the production of stingless honey. Next, from the problem statement, definition and objective are focusing on how to avoid and prevent the colony from leaving their nest and some of the factor that may distract their activity during honey production. Significant of the research and contribution to knowledge of this chapter is simply mention on mobile application and stingless bee. This research was limited to monitor two wooden box containing colonies. Apart from that, research approach has discussed some of the components use and their cost. Agriculture of stingless honey has a lot of benefits to us as the honey contains some of the element and vitamin which is essential to our body and by providing the monitoring system to harvest its honey will increase the productivity of MK.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter is to describe briefly in details about the literature review which is more to limitation, advantages, production, research in MK and technology used in harvesting the honey of stingless bee.

## 2.2 LITERATURE REVIEW

There are approximately 500 species of stingless bee genus and there are two types of genera for stingless bee which are *Trigona sp* and *Melipona sp* and also known as kelulut bee in Malaysia is the type of honey that has high medicinal beneficial as compare to other bee species. The nectar was deliberately drawn with the syringe, moved into a void sterile holder, and secured instantly. This compartment was then kept in a cool, dry place. As indicated by the Malaysian Agricultural Research and Development Institute (MARDI), stingless honey bees practice with their capacity to fertilize little size blossom because of their diminutives figure which cannot accomplished by huge size bumble bee[13].

According to farmers and some researches, some animals have been found predating on stingless bee. These include lizards, birds and even toad as well. One of the serious enemies is ants. This is because; ants feed on their honey and their nest as well. Stingless bees prefer to live in environments that are suitable for their survival. Physical environment also affects their nesting biology. For example, they prefer warm temperature or during sunny day and passive during rainy days and night time. As the