

# DOOR LOCK USING HAND GESTURE RECOGNITION



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

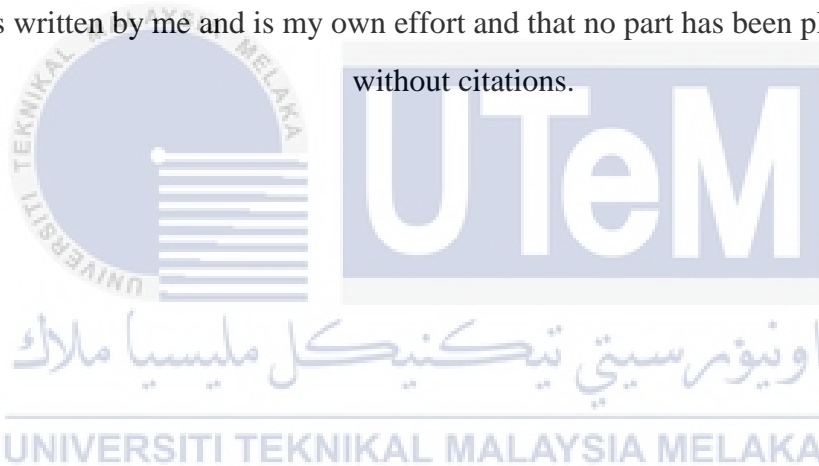


## DECLARATION

I hereby declare that this project report entitled  
**DOOR LOCK USING HAND GESTURE RECOGNITION**

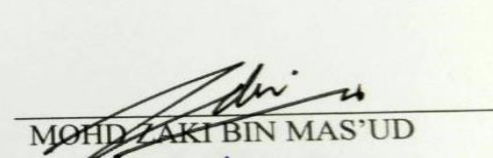
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DATE: 18/08/2017

## DEDICATION

To my parents, thank you for your encouragement, financial support and your true love towards me.

Promise I will never let you down.

Aina & Faghaa, thanks forcing me to further my study.

Azila Harun, thank you so much.

Last but not least my classmate for past 3 years,

#BITZMafia

For sharing your knowledge, help me and encourage each other



And TKJ Blue House,  
Those I shall never forget.



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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## ACKNOWLEDGEMENTS

Praise to Allah, with His willing I manage to complete my Final Year Project, Home Lock using Hand Gesture Recognition. I would like to express my infinite thanks to my supervisor, Sir Mohd Zaki bin Mas'ud who guide and help me finishing my final year project. Without him, I may not complete my project. To my parents and family who always encourage me and support me from many sides. Thank you to the member of Faculty of Information Communication and Technology UTeM, for your commitment and cooperation during the completion of my project. Last but not least to 3Bitz, my classmate, for sharing knowledge, teach me, and help me to finish this Final Year Project



## ABSTRACT

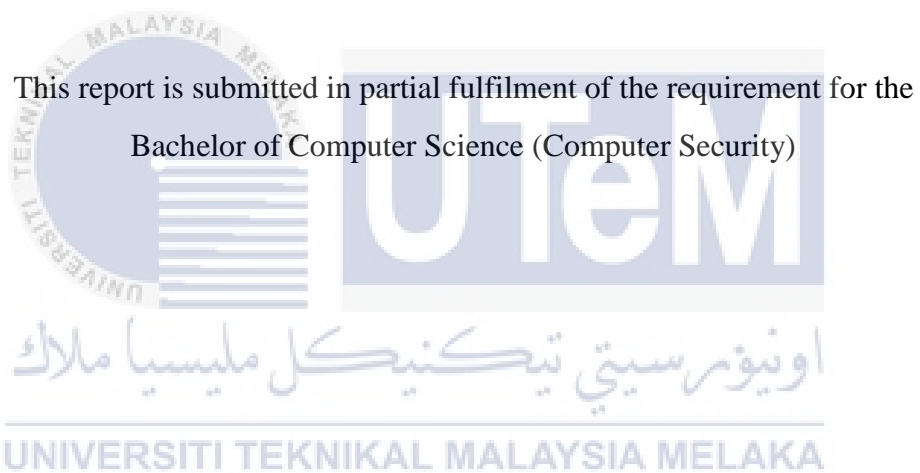
A great product can be produce by combining hardware and software integrated with other devices. Door locking method today also can be enhance from its traditional way to more interesting method. In fact, there are many company have built new type of locking system such as implementing password to open door. Exchanging traditional way of home lock such as using key to using human physical body is one of the idea to enhancing the usage of traditional lock. The idea to enhance home locking system by developing hand gesture recognition that can act to lock door or unlock it. As for the security features the development of hand gesture can also be used for authentication. Developing this project need a Raspberry Pi board integrated with other addition devices such as Pi camera, other product by the Raspberry Pi production company or a webcam. Project objectives come out by referring problem statements. Thus, objective of developing home lock system using hand gesture are to explore about motion detection and tracking to be used in hand gesture recognition, to design a locking system using hand gesture and to develop a hand gesture detection for authentication as security features. Developing this project used waterfall methodology that consist several phases that are requirement analysis, design, development phase, testing and lastly maintenance phase. Project significant or project contribution is about developing a low-cost home locking system with the development of hand gesture using Raspberry Pi. The development of hand gesture can act as security features besides locking methods. The motion detection and tracking can help in identifying entity. Improving new interesting method of locking door by using hand gesture recognition as key to unlock and look a door.

## ABSTRAK

Produk yang hebat boleh dihasilkan dengan menggabungkan perkakasan dan perisian bersepadu dengan peranti lain. Cara mengunci pintu hari ini juga boleh diubah dari cara tradisional kepada kaedah lebih menarik. Malah, terdapat banyak syarikat telah membina sistem mengunci seperti melaksanakan kata laluan untuk membuka pintu. Bertukar cara tradisional mengunci rumah seperti menggunakan fizikal badan manusia sebagai kunci adalah salah satu idea untuk meningkatkan penggunaan kunci tradisional. Idea untuk meningkatkan sistem rumah mengunci dengan membangunkan tangan pengesanan gerak isyarat yang boleh bertindak untuk mengunci pintu atau membuka kuncinya. Bagi keselamatan pembangunan isyarat tangan juga boleh digunakan untuk pengesanan. Membangunkan projek ini memerlukan papan Raspberry Pi bersepadu dengan peranti tambahan lain seperti kamera Pi, produk lain oleh syarikat produksi Raspberry Pi atau kamera web. Objektif projek keluar dengan merujuk pernyataan masalah. Oleh itu, objektif membangunkan sistem kunci rumah dengan menggunakan isyarat tangan adalah untuk meneroka mengenai pengesanan gerakan dan pengesanan yang akan digunakan dalam tangan pengesanan gerak isyarat, untuk mereka bentuk sistem kunci yang menggunakan isyarat tangan dan untuk membangunkan pengesanan isyarat tangan untuk pengesanan sebagai ciri-ciri keselamatan. Membangunkan projek menggunakan ini metodologi air terjun yang terdiri beberapa fasa yang analisis keperluan, reka bentuk, fasa pembangunan, pengujian dan fasa penyelenggaraan akhir sekali. Sumbangan projek ini adalah membangunkan sistem rumah mengunci kos rendah dengan pembangunan isyarat tangan menggunakan Raspberry Pi. Pembangunan isyarat tangan boleh bertindak sebagai ciri-ciri keselamatan di samping mengunci kaedah. Pengesanan gerakan dan pengesanan boleh membantu dalam mengenal pasti entiti. Meningkatkan kaedah baru yang menarik mengunci pintu dengan menggunakan tangan dan pengiktirafan isyarat sebagai kunci untuk membuka kunci dan mengunci pintu.

DOOR LOCK USING HAND GESTURE RECOGNITION

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## LIST OF ABBREVIATIONS

GPIO	General-purpose input/output
HDMI	High-Definition Multimedia Interface
VGA	Video graphic array
SD Card	Secure Digital Card
RAM	Random access memory
LED	Light-emitting diode



## CHAPTER I

### INTRODUCTION

#### 1.1 Introduction

As per today, the technology has growth fast, rapidly build and become sophisticated. A combination of hardware and software integrated with other devices can produce a great product. Door locking system today can also be enhance from the traditional way to more sophisticated system. We can convert the traditional way locking door such as padlocks and key using other methods. In fact, there are many company have built new type of locking system such as implementing password to open door. Exchanging the traditional methods to more interesting method using a human physical body is one of the idea to enhance the usage of traditional lock. Many part of our body can be used, such as hand gesture.

Nowadays any projects can be build using today sophisticated minicomputer Raspberry Pi. The idea to enhance home locking system by developing hand gesture recognition that can act to lock door or unlock it. As for the security features the development of hand gesture can also be used for authentication. Developing this project need a Raspberry Pi board integrated with other addition devices such as Pi camera, other product by the Raspberry Pi production company or a webcam.

## 1.2 Problem Statement

Every development must be based on problems arising. Table 1.1 below show the problems that occur triggering the idea of developing this project.

**Table 1.1: Summary of problems statement**

No	Problem Statement
1	The usage of traditional lock door such as key and padlock
2	No security features for authentications
3	Low quality of image to identify entities

## 1.3 Project Question

Project questions are arise based on problem statements. Each question is creating to identify problem statement. Table 1.2 show the summary of project questions.

**Table 1.2: Summary of project questions**

No	Problem Statement
1	What are the weakness of the usage of traditional locks?
2	Does others product have or provide any security features for authentication?
3	Does the visual captured have a good quality?

## 1.4 Project Objective

Once problems statement and project questions are detect, next is to identify project objectives. Project objectives come out by referring problem statements. Each project objective can be refer on Table 1.3 below.

**Table 1.3: Summary of project objectives**

No	Objective
PO1	To explore about motion detection and tracking to be used in hand gesture recognition.
PO2	To design a locking system using hand gesture.
PO3	To develop a hand gesture detection for authentication as security features.

Three main objectives that been identified in developing home locking system and the description of each objective which are listed as below:

**PO1: To explore about motion detection and tracking to be used in hand gesture recognition**

Study and exploring about of motion detection and tracking in helping to identifying an entity.

**PO2: To design a locking system using hand gesture**

Enhancing the traditional way of locking door with new interesting methods that can be implement in such a small premise like home.

**PO3: To develop a hand gesture detection for authentication as security features**

Implementing the development that can be used as security features besides the origin functions.

## 1.5 Project Scope

The scope of development will be focusing on some issues as stated below:

1. The development will be focused on Raspberry Pi as a new controller.
2. The development of home locking system using hand gesture is can be used in a small premise such as a home.



3. This project can also detect a motion under its range.
4. The detection of hand up to for hand gesture only.

## 1.6 Project significant

The project is about developing a low-cost home locking system with the development of hand gesture using Raspberry Pi. The Raspberry Pi will be configured with Raspbian as image tool. All of the configuration will be stored on SD card that will plug into the Raspberry Pi board. The project will need other integrated devices to operate such as Pi infrared camera and PIR sensor. PIR sensor will detect motion under its radius and Pi infrared camera will capture image. The development of hand gesture can act as security features besides locking methods. The motion detection and tracking can help in identifying entity.

## 1.7 Thesis Organization

In this section are the summary of each chapter from chapter 1 until chapter 7.

Table 1.4 below are the description summary of each chapter:

**Table 1.4: Chapter summary**

Chapter No	Chapter Summary
Chapter 1: Introduction	This chapter will discuss about overall project development background, including problem statement and project objectives

Chapter 2: Literature Review	Chapter two will discuss about literature review of the project. Contains about related work, past research, critical review proposed solution and conclusion.
Chapter 3: Methodology	This chapter explain approach methodology that have been implement in this project. Discussing about selection methodology, methods and techniques so that project are completely done according to schedule
Chapter 4: Design	In chapter 4, discuss about elements that need in order to develop project. All of the element including hardware specification, software, logical and physical design.
Chapter 5: Implementation	This chapter will explain more about the implementation process of the project. Discussing how the implementation take place and the environment setup to develop project.
Chapter 6: Testing	Once the project been developed, chapter 6 will show testing process to test the whether the project are successful or failed. In this chapter also discuss how we test and analyse project. All of the testing result will show at the end of the chapter.
Chapter 7: Project conclusion	The phase will discuss the overall of the project, the contribution of the project, constraints project and future works to enhance this project.

## 1.8 Conclusion

At the end, this chapter will help to understand project's background, problem statement, project objectives, scope of the project and project significant. The expected result is developing home locking system using Raspberry Pi platform and with the development of hand gesture as authentication. The development of hand gesture can also act as controller that can lock and unlock the door.

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter will discuss more on literature review of locking system using hand gesture project. Literature review is a good approach to understand more about subject being research. The main objectives of doing literature review are combine information and make it into a summary, critical analysis can identify limitation of the theories, and it will present what have been found in organized way. Once finished all the information gathering, next step is proposing the solution and make overall conclusion which conclude all about the project.

#### 2.2 Related work / previous work

##### 2.2.1 Terms

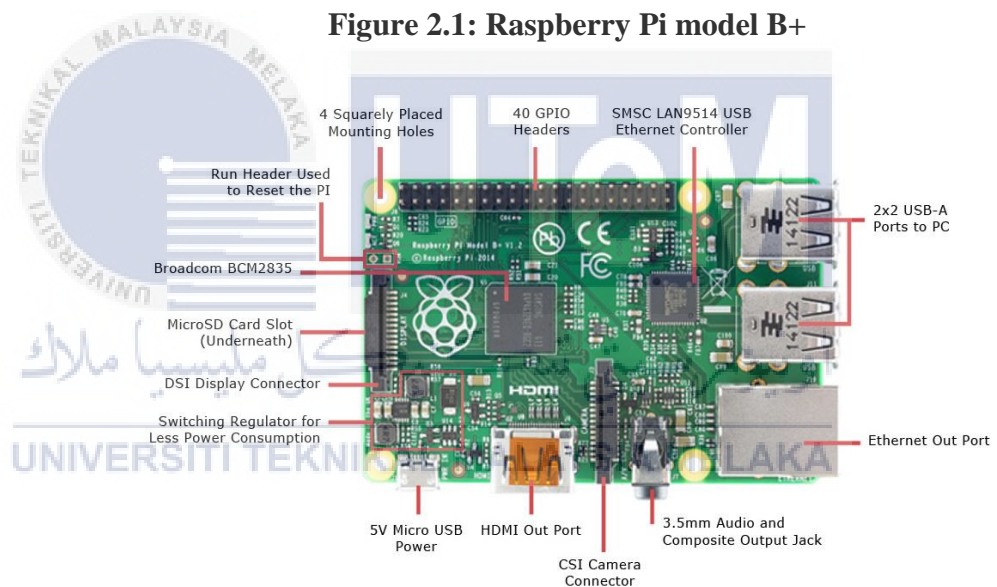
##### **Raspberry Pi**

Living in the high technology era today, there are many kind of computer have been build. From the biggest computer to the smallest all of it gives almost same functionality. One of the great invention today, develop by Eben Upton is Raspberry Pi. Raspberry Pi is a credit-card sized computer

designed for education. Eben Upton goal was creating low costing devices that can improve programming skills and hardware understanding.



**Figure 2.1: Raspberry Pi model B+**



**Figure 2.2: Raspberry Pi model B+ component**

Figure 2.1 and figure 2.2 show the design of Raspberry Pi model B+ and its component. In developing this project, Raspberry Pi model B+ been choose as the main component. It is an inexpensive and low power consumption microcomputer. Very flexible computer run python programming language and it is also easy to use.

## Pi infrared camera

The Raspberry Pi NoIR camera is another device build same company as Raspberry Pi board. It is a custom designed add-on device. To use this camera, a user must have attached it to the Raspberry Pi board using short ribbon cable. The board itself is 25mm x 24 mm x 9mm and it weight is only 3g. This camera supports the latest version of Raspbian, the Raspberry Pi operating system. The camera resolution is 5 megapixels which is good in capturing image.

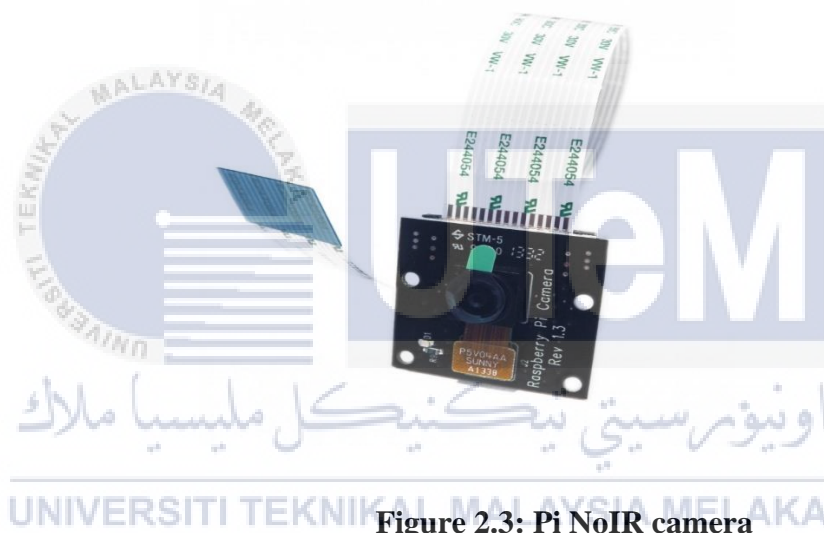


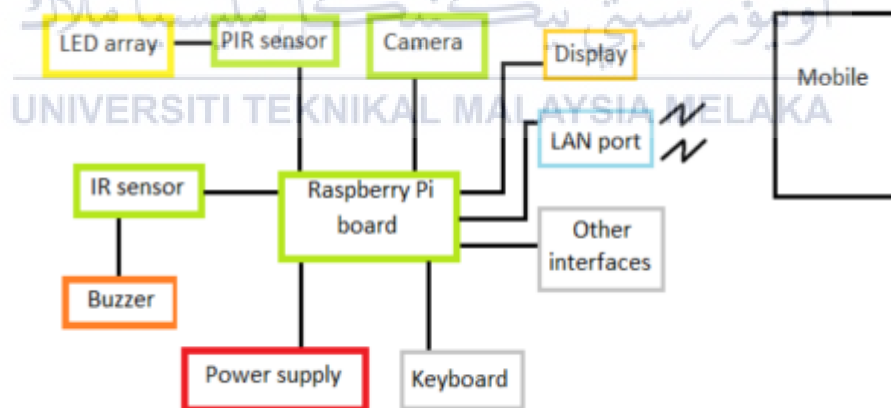
Figure 2.3: Pi NoIR camera

### 2.2.2 Previous project research

Based on a book title as “*Programming the Raspberry Pi: getting started with python*” wrote by **Simon Monk (2013)**, Raspberry Pi began to impetrate market end of February 2012 and often been said since then. Raspberry Pi is computer that come in with a few port such as USB port, HDMI, Ethernet port and running a Linux operating system. It is a small board computer, specifically a size of a credit card and super cheap. The reason why

Raspberry Pi is affordable, because not all components were included example its case. Raspberry Pi coming in a bare board without its case. The casing of the Raspberry Pi can be purchased individually same goes the power adapter. Simon Monk stated on his writing that we do can pretty much everything using raspberry pi just like using a Linux computer. Editing document, browsing internet and playing games are some of activity that can be done using Raspberry Pi. It can also act as media centre to play video.

**Aldrich et al, 2016** used Raspberry Pi in their project. The idea is to build a home automation system using Raspberry Pi. The project allowing user monitor and controlling their house using mobile devices such as energy management, access control and media. It is including monitoring home appliances and security. Using Raspberry Pi as the platform and the project can be customized because of its multiple GPIO ports.



**Figure 2.4: Diagram purposed by (Aldrich et al., 2016) in their project home automation system using Raspberry Pi**

Raspberry Pi might as well act as controller that can do something and using others medium to trigger besides mobile devices. Since most of previous

project used devices approach like (Khedkar, 2016) used a GSM module with Raspberry Pi on his automation project, a behavioural pattern approach can substitute uses of the devices F.Mod Ma'asum et al, 2015 on their journal entitle as "An Overview of Hand Gesture Recognition System Technique" have stated that the functions and usage of touch screen displays can be replaced with new evolvement of human computer interaction. As be specific the uses of hand gesture.

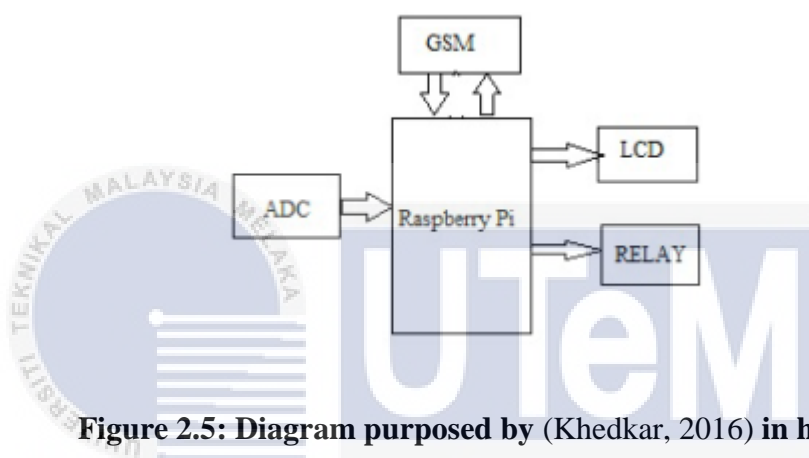


Figure 2.5: Diagram purposed by (Khedkar, 2016) in his project

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 The pattern of the hand gesture that been capture can triggered specific event. "Event Triggering using Hand Gesture" wrote by (Parashar & Pareek, 2016) stated that hand gesture can trigger an event by a few step starting from hand detection, hand tracking and event triggering. This process can be complete using MathLab for image processing.

## 2.3 Critical review

Table 2.1 Summary of critical review

Research Title	Purpose	Description	Problems
<p>Programming the Raspberry Pi: Getting Started with Python</p> <p>Author: Simon Monk</p>	<p>Raspberry Pi is a mini computer that come in with a few port such as USB port, HDMI, Ethernet port and running a Linux operating system. It is a small board computer.</p>	<p>Editing document, browsing internet and playing games are some tasks that can be done using Raspberry Pi.</p>	<p>Do Raspberry Pi act as controller besides providing a basic task like others computer.</p>
<p>Home Automation using Raspberry Pi</p> <p>Authors: Aldrich, Deshmukh, Murudkar, &amp; Tripathi</p>	<p>The idea is to build a home automation system using Raspberry Pi. The user is given an option to open or closed door using their smart phone.</p>	<p>The project allowing user monitor and controlling their house using mobile devices such as energy management, access control and media</p>	<p>Project could be complex with the presence of additional devices such as smart phone.</p>
<p>Using Raspberry Pi and GSM Survey on Home Automation</p> <p>Author: Shrikrushna Khedkar</p>	<p>The main objective of the project is to control the home automation appliances using SMS services with the help of Raspberry Pi.</p>	<p>Focusing more on controlling appliances and send alert via SMS.</p>	<p>Can the uses of additional devices as medium to trigger be replace with something else like behavioural pattern approach.</p>
<p>Event Triggering using Hand Gesture</p> <p>Authors: Parashar &amp; Pareek</p>	<p>Hand gesture can be classified as identical expression that contain meaningful messages. Purpose of</p>	<p>Step to identify or detect hand gesture recognition can be start by hand detection, hand</p>	<p>Is it possible to detect hand pattern with high successful rate using step been</p>