



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF PERSONAL SAFETY BOX USING  
QR CODE AND IMAGE PROCESSING**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer system) with Honours.

by

**NURUL SHAHIRAH BINTI AZMI**

**B071610245**

**940701-07-5428**

**FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING**

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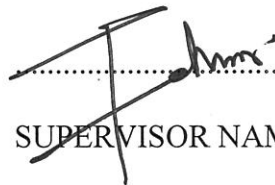
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Yang benar,

Disahkan oleh penyelia:



NURUL SHAHIRAH BINTI AZMI



SUPERVISOR NAME

Alamat Tetap:

Cop Rasmi Penyelia

185, Jalan Bunga Raya 16,

Taman Tasik Jaya,

70400 Seremban,

Negeri Sembilan

FAKHRULLAH BIN IDRIS  
Jurutera Pengajar  
Jabatan Teknologi Kejuruteraan Elektronik dan Komputer  
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik  
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Date: 8/1/2020

## APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer system) with Honours. The member of the supervisory is as follow:

Signature:   
.....  
Supervisor: FAKHRULLAH BIN IDRIS

Signature:   
.....  
Co-supervisor: AHMAD FAIRUZ BIN MUHAMMAD  
AMIN

## ABSTRAK

Tujuan projek ini adalah untuk orang yang memerlukan tempat untuk menyimpan barang peribadi mereka atau untuk memelihara barangan yang penting seperti dokumen penting, barang kemas, wang, dan lain-lain. Oleh itu, membangunkan kotak keselamatan peribadi menggunakan Kod Pantas Semula (kod QR) dapat membantu memastikan item pemilik tetap aman dan terjamin. Kod Pantas Semula (kod QR) adalah kod bar dua dimensi yang disulitkan yang boleh menyimpan maklumat yang dikodkan, dan mata manusia tidak dapat mentafsirkan corak kod bar 2D. Kod QR digunakan sebagai kunci untuk membuka kunci kotak keselamatan dalam projek ini apabila pemilik kotak mengimbas imej kod QR yang dicipta oleh aplikasi android penjana kod QR. Tambahan pula, projek itu menggunakan Raspberry Pi untuk memproses input pengesanan kod QR dan menghantar output ke motor servo untuk membuka kunci kotak keselamatan.

## ABSTRACT

The aim of this project is for people who need a place to keep their privacy or to preserve an important thing like important documents, jewelry, money, and other things. Therefore, developing a personal security box using the Quick Response code (QR code) may help to ensure that owner item remain safe and secure. The Quick Response (QR) code is an encrypted two-dimensional bar-code that can store encoded information, and the human eye cannot interpret the 2D bar-code pattern. The QR code is used as a key to unlock the security box in this project when the box's owner scans the QR code image that is created by the QR code generator android app. Furthermore, the project used Raspberry Pi to process the QR code detection input and send the output to the servo motor to open the safety box lock.

## **DEDICATION**

Special dedication to Azmi Bin Ahmad and Habsah Binti Razali, my dear parents, who always help, support, and encourages me to complete this project. I also dedicate my report to Sir Fakhrullah Bin Idris, my supervisor who always supports and guides me to complete this project. Finally, thank you to my beloved friend who helped me carry out this project and motivated me to keep the project going and never give up.



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Nowadays, every person who wants to protect his home and office against all types of threats had to have a personal security box. Besides, each house owner has a certain document, money and a family treasure that they want in their own home or office to be safe and secure. There are a lot of crimes before the Safety Box System is set up, so people are involved in the crime of robbery, steel, and others. So, personal safety box is one of the ideas or option to keep the owner belongings to be safe.

The safety of the property and properties are determined by many different factors. Therefore, many effective and affordable security systems are available for anyone that can keep their belongings completely safe. Besides, the high-quality security box is the best bet to keep the stranger away from precious things.

Furthermore, all the safety box may also be specified as a safe, electronic, biometric or security box. There are many types of safety box that people can find it in the market besides using keys for example like using password, fingerprint, and others. All possession of the owner is safe and secure due to the safety box function. Besides, safety boxes can also store confidential or financial information in safes and guarantee that without permission, they do not go into incorrect hands.

In this project, it upgrades the personal safety box by using the QR code as the security method to make the safety box safer. The camera on the safety box will scan or capture the QR code picture and transfer the data to the controller and match it with the store



QR code. In this case, besides using the keys, only the person with the QR code can open the box. The personal safety box cannot be opened without the QR code even if there is a key to open.

## **1.2 Problem Statement**

As mentioned earlier, there are many safety boxes that have the high-end product that applied high technology that people can buy on the market as their safety box. Nowadays, the safety box sold on the market is not to secure and friendly user. For the safety box that used a password as the security, if the owner always changes the passwords, they can forget the passwords or may be confused with the old passwords.

Furthermore, the other safety box such as a fingerprint could also be too sensitive and could not be found due to the fingerprint that was injured, sweated or dirty. So, when an emergency occurs, opening the box will make it difficult to get things into the box quickly.

Therefore, one of the solutions that can solve the problem is with using the QR code. The QR code is one way of ensuring the security of the personal item. Besides, the QR code will not cause any physical issue like a fingerprint or forget the passwords. So, it will make the safety box become more secure and friendly user. Furthermore, people can only see the camera on the safety box and will not know how to use the QR code. Besides, a thief or another person, besides the safety box owner, is almost impossible to open the safety box and get valuable belongings into the safety box. Other than that, QR code also is a simple way to open the box with just only scan or capture the QR code from the device.

### **1.3 Objective**

The aims of this project are to:

1. To design an intelligent safety box using the raspberry pi controller with a QR code as a security algorithm.
2. To detect the received QR code and match it with the store code to open the safety box using the raspberry pi controller.
3. To analyse the performance of the raspberry pi camera board to scan or capture the QR code image and send the data to the microcontroller.

### **1.4 Scope of project**

The scope of this investigation is to develop the safety box based on the objective mentioned. This security, Anti-theft system is built using the quick response (QR) code as the main detection purpose. Another essential point, as a detector, the Raspberry Pi camera is used to convert the QR code into the controller and enables the lock to be opened. Next, the raspberry pi microcontroller will set as the core controller for governing the input and output of this project. Lastly, the liquid crystal display (LCD) will display the open and close operation for the personal safety box lock.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

In this chapter, this literature review is intended to analyze previous projects and research done by other people that significant to the QR code image processing, safety box or security. Meanwhile, the legitimacy of past research will be discussed and determined. The method and results in the past paper will be contrasted and assess all together to create a good product for this project.

#### 2.1 Safety box

Nowadays, as the living standard of people is improving with many new things, safety box becoming the increasing essential. It the good thing that can save people valuables from vandalism, robberies, fire, and other factors that can cause loss or damage to things. Other than that, it also can consider having a trustworthy person who can access it when the owner is not around. Besides, the benefits of a safety box as needed in a home are unlimited. The safety box can keep saving the vital document, estate handling, saving money, securing weapon and many other benefits that people can use for personal life or personal thing.

Furthermore, as mention in (Yahya, Wisjhnuadji and Arunkumar, 2017), the Safe-deposit box is a device that can be used to store one or more valuable objects. Besides, the safes have a function to protect valuables from theft or robbery. So, at the beginning of the discovery of safes, used only in the form of a safety lock. Other than that, there are many types of safety box available in the market nowadays like using password, fingerprint, and

others. One of the examples of safety box using the password is shown in figure 2.1. This is one of the safety boxes that usually can see in the hotel. It used to keep the important or private thing for the customer that stay in the hotel for their safety.



**Figure 2.1: Safety Box using password**

As mention by (Sajić *et al.*, 2018) the ways to create, design and implement a system for safe and protected storage and digital customer maintenance of valuable items in banks, called the digital safety deposit box. It is one of the technologies which use modern mobile technologies, communications, and modern electronic information technologies to keep secure the bank's money. So, it cannot easily be a hack or stolen by the unwanted people from the bank. Furthermore, the bank is one of the already existing safe and protected places when customers already retain their financial and other valuables things and have very high confidence. So, it needed to improve the system to make it a more secure and safe place for all people that use the bank as their trusted place.

So, based on the article, as all of us know that the safety box is very important to people that needed to keep their personal thing safe and secure from a stranger or unwanted

person. Nowadays, there are many items and belonging that are valuable to people that need for users to store valuable item in a safe, secure, and protected place without any people know it. Furthermore, Other than money, there are many other things that important to someone to keep it safe and secure. For example, like jewellery, document, family treasure and others. All the thing needed a secure place to avoid missing thing or any bad happen to the belonging that valuable to the owner. Moreover, using the safety box at home will take home one of the safe places where people can keep their personal belongings besides the bank.

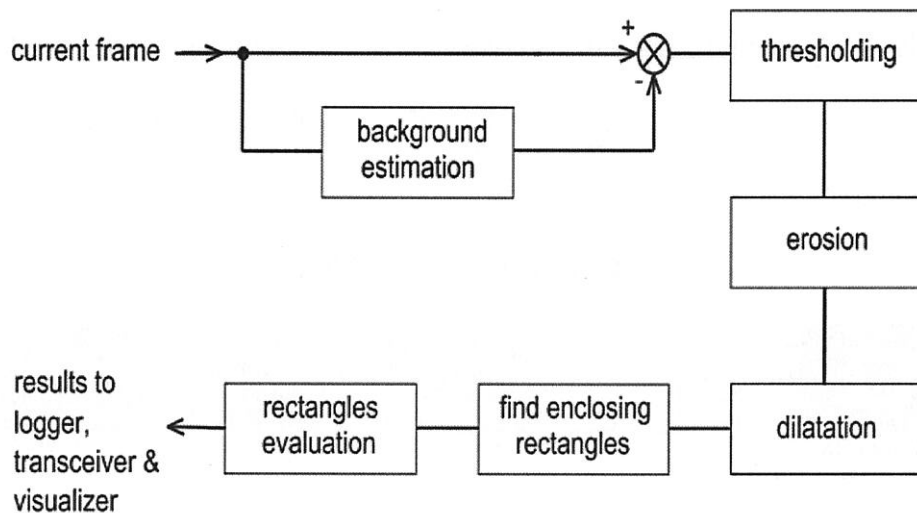
## **2.2 Image processing**

In this century, technology becoming the most popular and important thing that can change people life. Then, image processing is one of the technologies that people used nowadays to improve their lifestyle. The meaning of image processing is a process to convert an image and perform certain operations in digital form so that an enhanced picture can be taken, or useful information can be extracted. In general, the image processing system uses two-dimensional signals to treat images while using already defined methods of signal processing. Furthermore, there are various methods for the improvement of the image, conversions, geometric and morphologic transformations, extraction and recognition of objects techniques in computer vision and image processing that have been used (Horak and Zalud, 2016).

In the next subtopics, a variation of projects that have been done by scholars that used the image processing using the raspberry pi as their main controller for their project is discussed. All projects show the image processing process using Raspberry Pi as the centre controller on their venture whether effectively worked or not.

### 2.2.1 Traffic Monitoring using Raspberry Pi Board

One of the technologies that use image processing is traffic light. The traffic light is the common thing in our daily life. All place in the country has a traffic light to control the traffic. So, monitoring and analysis of traffic flow are the active subject of research and engineering for more than two decades. Based on (Kochláň *et al.*, 2014) the traffic flow monitoring system based sensor nodes used for the collection and analysis of environmental image information consists of Raspberry Pi. So, the traffic flow needed the camera to monitor the traffic. Since it needs to process of video streams with high definition for real-time applications. Moreover, the traffic image processing is based on image processing block figure 2.2 in order to perform the moving objects detection and classification.



**Figure 2.2: image processing block review (Kochláň *et al.*, 2014)**

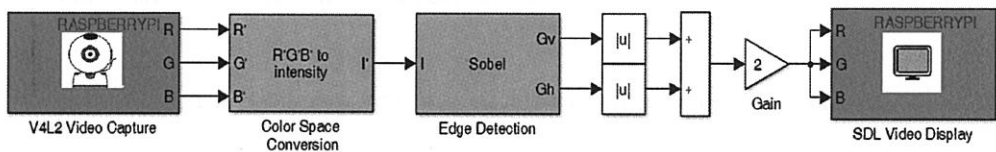
In this paper, modern GPUs are extremely effective for the treatment of computer graphics and more effective in their highly parallel structure than the general-purpose CPUs for the processing of large databases in parallel algorithms. Besides, the

Multimedia Abstraction Layer (MMAL) C library used in video data acquisition and processing can access Raspberry Pi GPU resources. So, image processing using Raspberry Pi can be used to process traffic images.

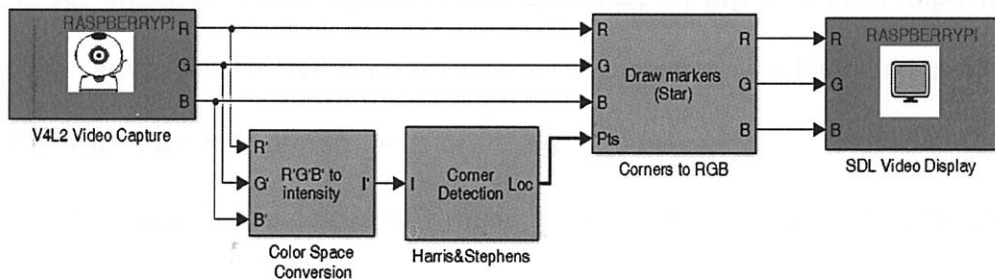
### 2.2.2 Image Processing on Raspberry Pi for Mobile Robotics

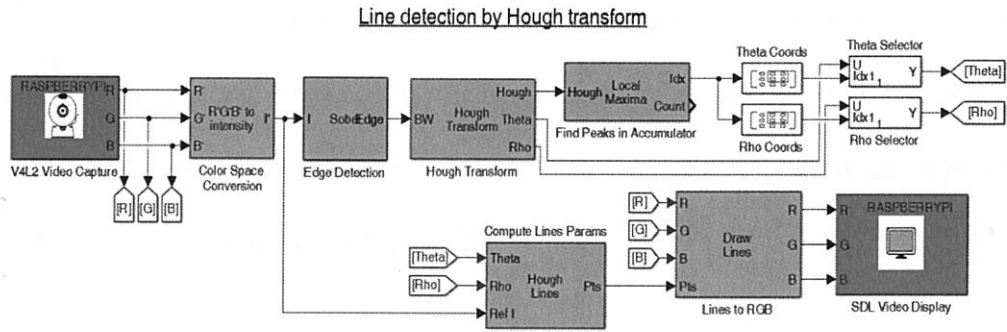
Based on (Horak and Zalud, 2016) mobile robots on the Raspberry Pi platform via Simulink in Matlab using image processing techniques. In this project, a small robot called Cube has been designed for simple robotics tasks and student work. Besides, the Cube is only equipped with a camera with small and lightweight computing platform Raspberry Pi. Therefore, this research project has decided to implement and test several geometric detection methods frequently employed in robotics to understand the environment and recognize objects. Furthermore, for Simulink implementation and performance measurement on a Raspberry Pi 2, the three representative algorithms have been selected and included in this paper. Therefore, the three representative algorithms are for edge, corner and line detection like show in figure 2.3.

#### Edge detection by Sobel operator



#### Corner detection by Harris&Stephens operator





**Figure 2.3: Edge, corner and line detection Simulink models (Horak and Zalud, 2016).**

The three representatives include Sobel operators for edge detection, Harris operator for corner detection and Hough transformation for line detection. Those three representatives have its own function for the image processing with using the raspberry pi camera. From that, especially if optimizations were carried out with respect to Simulink schemes and target code (C / C++), the FPS values measured were relatively good, and the Raspberry Pi 2 platform certainly for most common robotics tasks can be applied.

### 2.2.3 Development of Face Recognition on Raspberry Pi for Security Enhancement of Smart Home System

Smart Home Systems are one of today's most popular technologies. In this project, they have presented a face recognition system as the Raspberry Pi security system for the Smart Home System. Other than that, for this project, it implements a prototype design for the real world that has been elaborated, in which the output of the algorithm for face recognition locks or unlocks the magnetic lock placed at the door using relay circuit. It had discussed Raspberry Pi's limited processing ability affecting