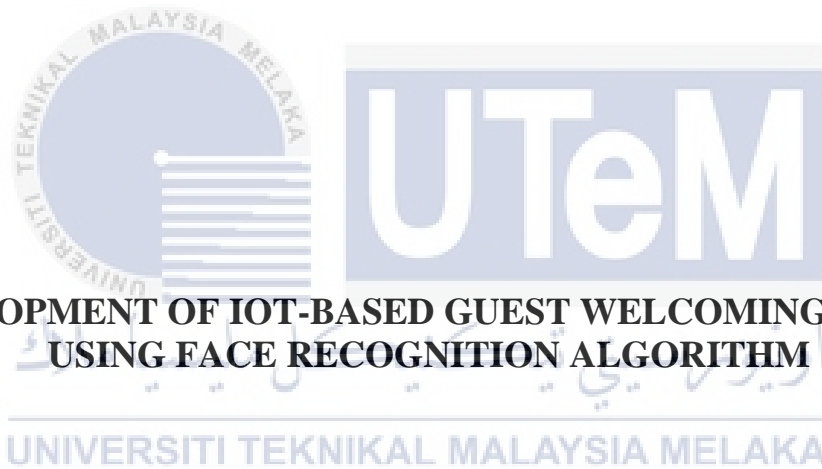




Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF IOT-BASED GUEST WELCOMING SYSTEM
USING FACE RECOGNITION ALGORITHM**

NUR FARAH WAHIDA BINTI YAHAYA

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2021

**DEVELOPMENT OF IOT-BASED GUEST WELCOMING SYSTEM USING FACE
RECOGNITION ALGORITHM**

NUR FARAH WAHIDA BINTI YAHAYA

**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours**



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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USING FACE RECOGNITION ALGORITHM

Sesi Pengajian: 2021/2022

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DEDICATION

Dedicated to my mom Naimah bt Muhammad and my dad Yahaya bin Che Cob, the most who gave me strength to complete this final year project.



ABSTRACT

Automatic doors have become a typical feature on many different types of buildings, and they are growing more popular by the day in terms of producing effective electrical gadgets that provide enough security. Because of the enormous increase in crime rates and everyone wants to take adequate precautions to prevent it. This project aims to develop a guest welcoming system for home security purpose. Face recognition algorithm whose role to recognize whether a guest is a real guest or intruder, becomes the main feature of the developed system. From the literature, most of the technologies used in developing a guest welcoming system are complex in terms of number of components used. Therefore, this project simplifies the system's design by using more simple circuit, portable and user friendly. The developed system is formed of three main components which are a camera, Raspberry Pi microcontroller, and mobile application. The camera captures the image of guest and feed to the microcontroller, where the recognition and matching take place. Microcontroller will send the output to mobile application. Additionally, an external circuit is designed to control the door locking function. In short, the objective of this project is to develop a visitor welcoming circuit system based on face recognition technique, to develop a mobile application and integrate with the visitor greeting circuit for output display and to test the performance of the developed system that can access the hardware output. The performance and the output were being tested and being evaluated. With this project, the surrounding of the house will feel more safe.

ABSTRAK

Pintu automatik telah menjadi ciri tipikal pada pelbagai jenis bangunan, dan ia semakin popular dari hari ke hari dari segi menghasilkan alat elektrik yang berkesan yang menyediakan keselamatan yang mencukupi. Kerana peningkatan kadar jenayah yang sangat besar dan semua orang mahu mengambil langkah berjaga-jaga yang mencukupi untuk mencegahnya. Projek ini bertujuan untuk membangunkan sistem penyambut tetamu untuk tujuan keselamatan rumah. Algoritma pengecaman muka yang berperanan untuk mengenali sama ada tetamu adalah tetamu sebenar atau penceroboh, menjadi ciri utama sistem yang dibangunkan. Daripada literatur, kebanyakan teknologi yang digunakan dalam membangunkan sistem menyambut tetamu adalah kompleks dari segi bilangan komponen yang digunakan. Oleh itu, projek ini memudahkan reka bentuk sistem dengan menggunakan litar yang lebih ringkas, mudah alih dan mesra pengguna. Sistem yang dibangunkan ini terdiri daripada tiga komponen utama iaitu kamera, mikropengawal Raspberry Pi, dan aplikasi mudah alih. Kamera menangkap imej tetamu dan suapan ke mikropengawal, tempat pengecaman dan pepadanan berlaku. Pengawal mikro akan menghantar output ke aplikasi mudah alih. Selain itu, litar luaran direka untuk mengawal fungsi mengunci pintu. Secara ringkasnya, objektif projek ini adalah untuk membangunkan sistem litar pelawat pelawat berdasarkan teknik pengecaman muka, untuk membangunkan aplikasi mudah alih dan menyepadukan dengan litar ucapan pelawat untuk paparan output dan untuk menguji prestasi sistem yang dibangunkan yang boleh mengakses keluaran perkakasan. Prestasi dan output sedang diuji dan dinilai. Dengan adanya projek ini, persekitaran rumah akan berasa lebih selamat.

اونيورسيتي تيكنيكل مليسيا ملاك

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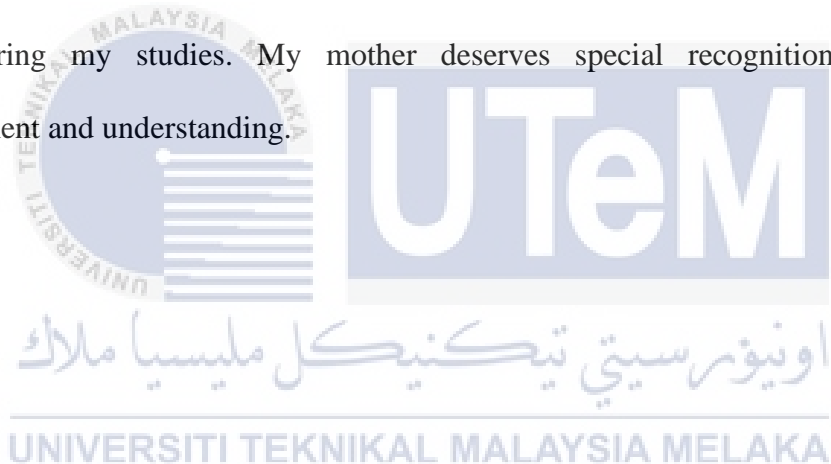


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LIST OF SYMBOLS



LIST OF ABBREVIATIONS

<i>GSM</i>	-	<i>Global System for Mobile</i>
<i>HOG</i>	-	<i>Histogram of Gradient</i>
<i>MLP</i>	-	<i>Multiplayer Perception</i>
<i>OpenCV</i>	-	<i>Open-Source Computer Library</i>
<i>PIR</i>	-	<i>Passive Infrared sensor</i>
<i>RF</i>	-	<i>Random Forest</i>
<i>RFID</i>	-	<i>Radio Frequency Identification</i>
<i>Rpi</i>	-	<i>Raspberry Pi</i>
<i>SVM</i>	-	<i>Support Vector Machine</i>
<i>VNC</i>	-	<i>Virtual Network Computing</i>
<i>Wi-Fi</i>	-	<i>Wireless Fidelity</i>



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CHAPTER 1

INTRODUCTION

1.1 Background

Home security with only door locker is not enough to protect your house and family. However, the innovative home security system on the market still not popular for household uses because of the high price tag. Besides that, the smart home security system is still can be improved to higher security level and build with low-cost material to fulfil the market's need. Regarding this issue, welcoming guest system using face algorithm project can help solve this issues. This welcoming system security system are accurately detects visitors or guests who enter and leave through the door. As a result, this chapter will briefly present the project's overview. This chapter also emphasises the problem statement, project objectives, scope, and overall report organisation.

This project aims to develop an IoT based Guest Welcoming A system that can see anyone or guest that come to our house by capturing the face by using Raspberry Pi Camera and can access to lock and unlocked only just using app which is Telegram application by using via mobile phone or any devices by searching the system name. In a nutshell, the buzzer will automatically sound, if the PIR sensor detects any motion in front of your house to alert the people in the house without guest must push any bell. The project consists of two main processes, hardware development (involves sensor and devices selection and integration) and software development (involves face algorithm development which is face recognition that captures the face and can see it through mobile app development).

The expected result from this project was used to analyze the performance about recognize person's face just alert the house owner through a mobile app. The developed system will undergo a series of real-time testing to evaluate its performance based on the accuracy and efficiency of recognition.

1.2 Problem Statement

Refer to the abstract which is this project aims to develop a guest welcoming system for home security purpose. Face recognition algorithm whose role to recognize whether a guest is a real guest or intruder, becomes the main feature of the developed system. The system that accurately recognise the guest's face in order to check the guest's identity before accepting them. However, the system still requires further improvement to achieve higher accuracy and efficiency. Furthermore, the issues that involve recognizing while synchronously with system still a challenging.

1.3 Project Objective

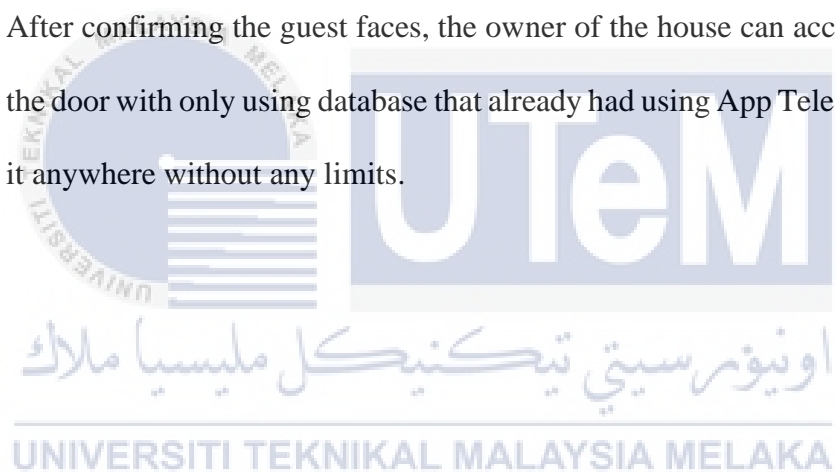
The goal of this project is to develop an IoT- based Guest Welcoming system that can detect people's faces by capturing the photo and sends a notification to the home owner via a mobile app. Following are the three objectives:

- a) To develop a guest welcoming circuit system based on face recognition technique.
- b) To develop a mobile application and integrate with the visitor greeting circuit for output display.
- c) To test the performance of the developed system that can access the hardware output.

1.4 Scope of Project

This project primarily focuses recognising faces by applying image processing techniques collected by a module camera in a single plank personal computer, namely a Raspberry Pi 3 model B+ for the microcontroller and Python for the software. In this project, we focus on the following scopes:

- a) The output which is the motion will triggered with sound to alert the home owner and save time to access the hardware ouput anywhere.
- b) Other than alerting with sound(buzzer), the owner of the house can access to capturing the faces of the guest before confirming to enter their house.
- c) After confirming the guest faces, the owner of the house can access to open up the door with only using database that already had using App Telegram to access it anywhere without any limits.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the Era, across the world are regularly implementing smart home and office security control system. The main part of any home and office security system are accurately detecting visitor or guest who enter and leave through the door. Face recognition has received important attention from security guard due to people activities found in several applications of security like forensic, airport, face tracking and criminal recognition. Compared to other biometric qualities like finger print, using iris and face scanning. Due to people activities seen in numerous security applications such as forensic, airport, face tracking, and criminal detection, face recognition has gotten a lot of attention from security guards. When compared to other biometric traits such as finger prints, iris and facial scanning are more accurate. They can be taken without the knowledge of the visitor and utilised for security-related purposes such as criminal detection, face tracking, airport security, and forensics. Face recognition entails taking a photo of a person's face with a webcam. This chapter summarises findings from prior studies on the related project.

2.2 Overview face recognition system or objective/activity recognition system

Based on the previously literature review that being review most of them doing significance of such system in applications like surveillance, private security has been proven to be very effective[1].

A detail survey on face recognition can be found all the authors [2] , [3], [4], [5], [1], [6], [7], [8], [9], [10], [11], [12] & [13].

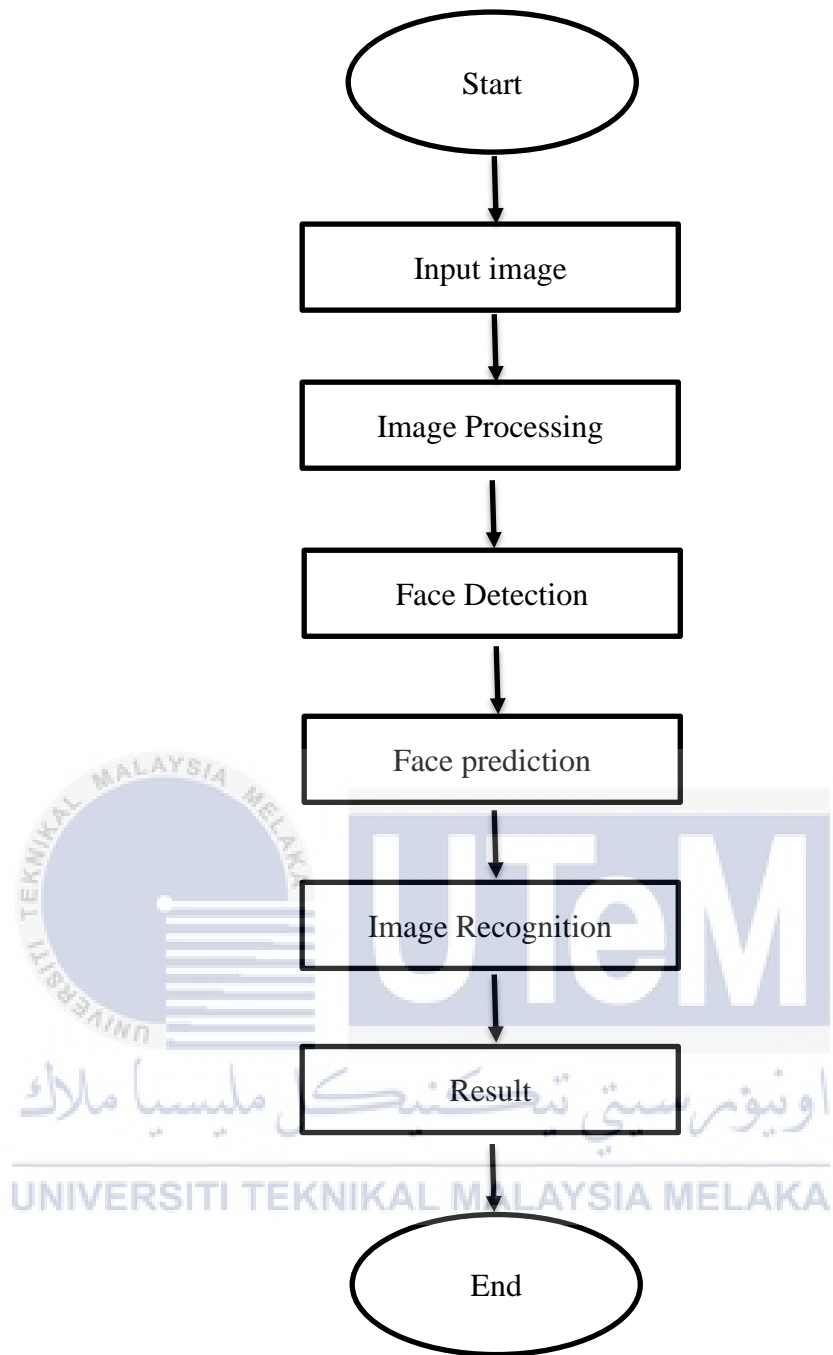


Figure 2.1 Block Diagram of Flow Recognition development

Technology	Approximate accuracy	Coverage	Strength	Weakness
Wi-Fi	1.5m	Building	Low cost and High accuracy	Locate at entry point
RFID	1m – 5m	Room	Low cost and Side of inactivity	Precision is Very low
GSM Module	1m – 5m	Large multi-floor buildings	GSM standard has traditionally employed the strongest cells	Not suitable for efficient communication

Table 2.1 Comparison for Technologies that used

The authors in [1] suggested from their survey that the widely used techniques for smart doors, openCV based on the Internet of Things (IoT) is being used for face recognition. The implementation area is divided into three categories which is home, office, and campus. When the bell is ring, the technology detects and recognises faces in real time. The taken image is compared to the database, and if there is a match, access is given and the door opens. On the other hand, the authors in [10] utilising the Histogram Object Gradient (HOG). Face encoding is used in this approach to recognise a person's face and eye and it works well with fluctuations in light/illumination variations. The extraction of facial features will be done later.

Compare face could be a function that uses a Support Vector Machine classifier to categorise and output the face encoding. [12] machine learning methods (RF, SVM, and MLP) were compared. The features were extracted supported fixed-size windows round the observations. It shows that it's possible to realize a high accuracy for binary activity recognition with simple features, and that we discuss the optimization of various parameters like the sensors collection frequency, and therefore the storage buffer size. Table 2.2 Machine learning algorithms (RF, SVM, and MLP) are compared.

		RF	SVM	MLP
Activity	Accuracy (%)	86.01	94.17	81.12
	Kappa	0.72	0.88	0.62
Group Size	Accuracy (%)	59.25	54.01	55.66
	Kappa	0.17	0.08	0.11
Talking vs All	Accuracy (%)	54.67	57.66	66.42
	Kappa	0.09	0.15	0.33

Table 2.2 Machine learning algorithms (RF, SVM, MLP) are compared.

Furthermore, as an example, the outcome of all of these publications is that they have successfully achieved their goal [1] The goal of the paper is to offer the user with information utilising open-source technology. For [9] This paper highlights the problems of activity recognition using anonymous sensors in the environment, its possible applications and advantages compared to classical smartphone and wearable based approaches, as well as the improvements such as authors [10].

The purpose of distribution feeder (cable or line) is to provide path for energy flow from GSS all the way to the distribution customer. Traditional distribution feeders (without DER) are usually operated in radial configurations - the energy flows uni-directionally from the GSS to the load. The feeders are typically categorized by its: (i) voltage level, (ii) conductor material, (iii) conductor size (cross sectional area), (iv) insulation type and (v) no of phases. These feeders scattered all over different supply zones. Hence, they are extensive and large in numbers.

2.3 Technologies for face recognition system

Face recognition technology is a major research topic that cuts across many industries and disciplines. Face recognition is a fundamental human behaviour that is crucial for good communications and interactions among individuals, according to the authors[14].However, a variety of technologies are being presented as a means of developing and improving the face recognition and activity system. Indoor positioning technology can be divided into a few