Faculty of Electrical and Electronic Engineering Technology

COST-EFFECTIVE IOT BASED COMPANY BUILDING FACE RECOGNITION SECURITY SYSTEM USING MOBILE APPLICATION

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Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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RAHMAN KAZI ASHIKUR

A project report submitted in partial fulfilment of the requirements for the degree of

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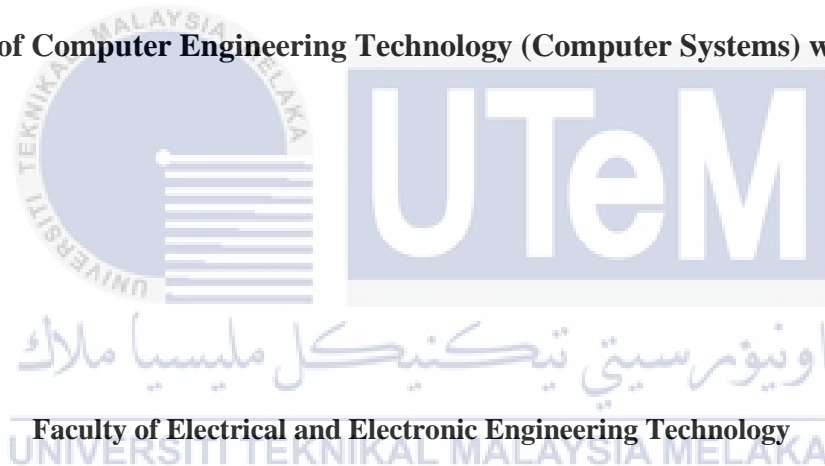
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I declare that this project report entitled Development of Face Recognition Door Lock System using TensorFlow algorithm in phone apps the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ....
Name : Rahman Kazi Ashikur
Date : 13/1/2023

APPROVAL

I hereby declare that I have checked this project report, and, in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

Signature :

Supervisor Name : LIM WEE TECK

Date : 15.1.2023

ABSTRACT

In this project work a mobile application-based face recognition door lock system using mobile phone camera. Implementation of the system is to reduce the system cost and increase the reliability of the system with high security. The system established communication between the hardware device with mobile application through IoT based system. For face recognitions TensorFlow algorithm with real time face recognition technique was used. Users need to login and add the picture to train the application, after that app will recognize the user automatically from the trained dataset and open the door lock for the user.

ABSTRACT

Dalam projek ini, sistem kunci pintu pengecaman muka berasaskan aplikasi mudah alih menggunakan kamera telefon bimbit. Pelaksanaan sistem adalah untuk mengurangkan kos sistem dan meningkatkan kebolehpercayaan sistem dengan keselamatan yang tinggi. Sistem ini mewujudkan komunikasi antara peranti perkakasan dengan aplikasi mudah alih melalui sistem berasaskan IoT. Untuk pengecaman muka algoritma TensorFlow dengan teknik pengecaman muka masa nyata telah digunakan. Pengguna perlu log masuk dan menambah gambar untuk melatih aplikasi, selepas apl itu akan mengenali pengguna secara automatik daripada set data terlatih dan membuka kunci pintu untuk pengguna.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter start with overview of the project. It describes the specific objective, background, the problem statements, and scope of the project. Finally, it will analyse the aim of project.

1.2 Background

The progression of information technology has developed in a rapid shift in human being behaviour. Computer, networking, and mobile device applications have become more common as electronic and communication technology has advanced.in our everyday lives These improvements have accelerated the growth of the Internet of Things. (Internet of Things), which incorporates smart home-based machineries.

Face recognition has recently been a prominent topic in study, gradually replacing other biometric system security. A face recognition system is more practical to unlocking the door. Building access control system is widely used in this technological. Usually, the handling access control of large organization requires new visitor to register at reception area and receive a pass for the entrance. Most of the existing commercialized smart building security systems have many drawbacks in the way that NFC, RFID-based and even smartphone-based schemes can either lost, cloned, or misused by irresponsible individuals

[1]. The limitations of existing systems also require some form of human intervention which may cause some inconvenience especially to the elderly and disabled who try to perform authentication. While the conventional method is still to be applicable, it does not utilize the technology that is available effectively. In pace with advancement of technology, smartphones have become an essential part of human's life.

With the new advances in computing and communication techniques, many applications that previously required embedded systems running in a rather isolated manner can now be interconnected in an Internet of Things (IoT) world providing the end user a more integrated view of the whole system and new ways to interact with the environment. IoT has enabled a transition from smart devices to smart homes, towards smart organizations and smart cities, while new challenges and threats are to be answered and faced [2]. The access control is such a typical interaction between a security system and people. Its purpose is to detect and recognize the presence of an individual, uniquely identify it using one or more authentication techniques, log the event in a database and authorize the access [3].

A modern system in opening a door locks with a face recognition system using a smartphone was introduced. The smartphone is the most useful item that has become part of life, people always bring it everywhere, and impossible to leave it. Using the face recognition system to open the door with a mobile application has higher security and make life more convenient. In this study, a mobile phone uses a facial recognition system to control the door lock, so that the user can enter without any card or key. It allows more people to avoid many time-wasting things and at the same time reduces the theft rate and reduces many costs. This system uses a wi-fi module to receive data from the firebase and a mobile application was used to recognized face, for face recognitions TensorFlow algorithm with real time face recognition technique was used.

1.3 Problem Statement

There has been excellent work in the field of door locking systems due to their widespread application in everyday life. Yet, there are a lot of issues and challenges that need to be improved. Researchers are working hard to improve security with better techniques, which will reduce the size and cost of the locking system and improve the reliability and security.

Though, physical keys for door look are one of the oldest ways, but an easy to make a copy. It never knows how many unauthorized copies are made or who is holding the keys. Whoever holds the key can easily access the premises, so the physical key lock system does not secure in terms of high security. Also currently, RFID sensor uses for door lock systems, this system also has defects such as can be easily lost or forgetting to bring an RFID card. As well as can be stolen RFID card and then by that card thief can aces easily to the system premises.

Nowadays, face recognition is used to unlock the door of high-security systems. But the cost and system reliability are not satisfactory. This project work aims at reducing the components used in face recognition-based locking systems and at the same time able to minimize the system cost with improved output quality. The key issue for face recognition-based security system used external camera internal data management system which increases the cost of the system. But we need a more convenient and low-cost system with better security. In this situation, face recognition based on a mobile application is more efficient and cost-effective compared with existing technology.

The main purpose of this project is to implement a mobile application for a face recognition-based door lock security system with low cost and higher security systems.

1.4 Find problem solve

This project work mainly focused on developing a mobile application for face recognition which will be used for the door lock systems. The significant output of this work is to develop a mobile application which will use a mobile camera and reduce the cost and improve the reliability of the door lock system compared to a conventional lock system.

A facial recognition door lock can decrease the strangers' unauthorized access to the premises by using intelligent face recognition utilizing mobile applications. With this system can be possible to solve security problems.

If using a mobile application-based face recognition system, no need to worry about carrying a door key or RFID card also no need to think about bringing a door key and losing the key. To open the door, the owner only needs to open the phone application and then need to verify his face using the application. If the face match with database face, the door will open automatedly.

Also, there is no work conduct using mobile application for face-recognition based door lock system. So in this project work conduct using mobile application work conduct using mobile application

1.5 Project Objective

This project work is primarily concerned with implementing the face recognition technique using mobile phone camera by utilizing mobile application. Mobile application for door lock system with higher security is focused on this project. The key objective of this project work are:

- To Develop a mobile app that is able to recognize face with mobile camera

- Using mobile app as a door key alternative

- To analyse the performance of the system and validate the combination between app and hardware

1.6 Scope of Project

- Make a apps which recognise face.
- On apps will store user face with his name, when user open app and try to recognise his face phone apps will show his name on apps.

1.7 Summary of Chapter-1

This project about Face recognition door lock system. When owner of house wants to enter in house owner just need to open phone apps then need to verify face by apps, when owner face match with database picture door will open automatically. For that First time need to store house owner specific picture on database and train those pictures using face recognition algorithm. Then system recognize owner face using apps then if can recognize door will open automatically.

CHAPTER 2

Literature review

2.1 Introduction

This chapter is process of gathering information for this project. Try to learn about the face recognition algorithm. Look into door lock security systems as well.

2.2 Related works

Some application was made for face recognition-based door lock system. But all of them use the mobile application for lock open and close as a door key. They turn on webcam by using mobile phone.

In [4] an internet enabled access control system was developed using mobile application. They used password, pictures, RFID, fingerprints, security question in the authentication stage. They used a camera near to the door to detect the subject, and Raspberry Pi3 for system process. Although, they have developed a proper system using the mobile application, but it need lots of extra equipment's for unlocking the door.

The system proposed in [5] used mobile phone applications for lock the door lock, but the author used extra door camera for recognize the user face. The main purpose of the application is to lock if someone forget to lock the door.

Seamless personnel authentication using facial recognition based on mobile devices shows in [6]. The system use a video camera to detect the user using video feed. If the system recognize the face, then automatically send a notification to the user mobile device using an application and after that user can perform the unlocking process. They didn't use mobile app for face recognition process.

In [1] The Haar cascade classifier based on characteristics was used to recognise and localise the face in the system. Face features were retrieved using a measured Local Binary Pattern technique. In 110 milliseconds, improved system evaluated a full face. In 2 milliseconds, a few biometric patterns were matched. On FERET data collection, the suggested instilled face-recognizing system obtained accuracy of 99.33 percent for CMC and 1% for EER.

In [2] This researcher has written a paper about how the Raspberry Pi could be used in a face-recognition system. Usual face detection and recognition algorithms for example PCA and Haar detection are used by the face-recognizing system. That article proved to improve face recognition to the point where it might be used in high-security systems and premises instead of RF I Cards and passwords.

In [3] Des They reviewed the number of thefts and how ID forgery has become a problem in this study. To avoid these problems, a facial recognition system would be built.Face detection features equivalent to Haar and the HOG +SVM algorithm for face identification were utilised. To gain greater precision and impact, they combined the OpenCV and Python libraries.On an embedded device known as the Raspberry Pi, identification and training were carried out.

In [4] They defined how image-based biometrics could be employed in Internet of Things setting utilising the Raspberry Pi in this study. They showed a proof-of-concept information system that can be accessed over the internet, includes face recognition security, and permits licensed users to access important records.

In [5] This thesis proposes that the thesis focus on face recognition in the first place, as well as the Internet of Things in an academic setting. The project resulted in a workable solution that included OpenCV for facial recognition, IoT over MQTT protocol, Raspberry Pi clients, and an Android OS app on a phone. The foundation for a system based on the three components was laid out in that thesis. They can be utilised in a variety of other applications, including as IoT, OpenCV, and the MQTT protocol, to recognise faces linked with the Internet of Things on low-cost equipment.

In [6] Sha Using a biometric mechanism and cloud services, this smart home application efficiently enhances the control management for safeguarding households, boosting comfort, and lowering energy usage. Alina Munir and colleagues

In [7] This study used a built-in TensorFlow sequential model module to create a surface layer of a convolutional neural network. Object detection, particularly face recognition, typically employs a transfer learning method. Because the truthfulness of an existing model, such as the InceptionV1 model, delivers acceptable accuracy in cross-validation preparation but a large mistake in testing the trained face, this research does not use transfer learning. Because it was designed in a Python language situation, the attendance management system was constructed in Flask Web Structure. The custom model has an

average accuracy of 88.23%, and it has been tested with 16 distinct students, each of whom has 48 photos.

A software and hardware for vehicle door system was developed in [8]. They design a web browser for face recognitions, user need to brows the weblink and camera will detect the face and recognized it for vehicle unlocking system. Although, they used mobile camera, but it need a web browser for using the camera features, they didn't developed application for frequent use.

Taking consideration of all the mobile applications and camera-based door lock security system, there is no research conducted on mobile applications using mobile camera for face recognition and unlock the door lock without the use of extra camera, sensors and expensive hardware device like Raspberry Pi. In this research we developed a mobile application which can recognize user face and unlock the door automatically without any interruptions using IoT based technology, also the system required less complexity and low cost.
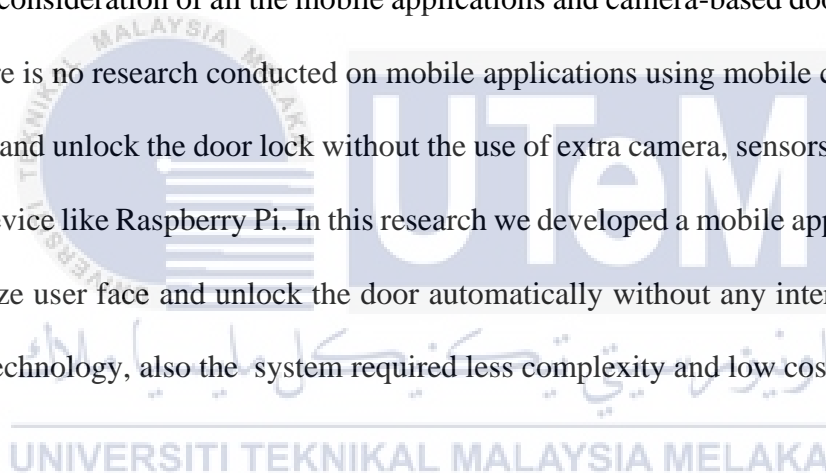
2.3 Related work for face recognition algorithm.

Ref	Paper title	Year	Result	Algorithm use
[1]	Face recognition system on Raspberry Pi	2015	The proposed embedded system for recognising faces has been tested on FERET data and achieves accuracy levels of CMC: 99.33 percent and EER:	Local Binary Pattern algorithm (LBPA)

			1%.	
[2]	Real-Time Emotion Recognition n from Facial Images using Raspberry Pi II	2016	94 percent with a medium operating time of 120ms on the Linux platform using the Raspberry Pi	geometric features using Raspberry Pi I
[8]	A Smart System for Face Detection with Spatial Correlation Improvement in IoT Environment	2017	achieve face detection with a medium precision of 85.7 percent using scientific procedures	Haar Featurebased Cascade Classifiers
[3]	Smart home automation with a unique door monitoring system for old age people using Python, OpenCV, Android and Raspberry pi	2019	gained can be 99.25%, as examined over ORL images of faces data	Image features and dimension reduction were extracted using DWT and PCA methods
[9]	Face and Speech Recognition Based Smart Home	2019	A development of 90% in the outcomes has been obtained.	OpenCV algorithms for offline face recognition

[7]	Custom Deep Learning Face Recognition based on TensorFlow Model for Attendance Management System	2021	TensorFlow Algorithm	The custom model has an average accuracy of 88.23%, and it has been tested with 16 distinct students, each of whom has 48 photos.

2.4 About HOG Face recognition algorithms

First, try to do my system using HOG algorithms and Haar cascades algorithms but I find problem to recognize face , system take long time to recognize face therefor I decide to do my project using TransforFlow algorithm.

2.5 HOG algorithm

The hog technique yielded the following image HOG (Historical Histogram of Oriented Gradients) is a feature descriptor like the Canny Edge Detector and SIFT (Scale Invariant and Feature Transform). For the goal of object detection, it is employed in computer vision and image processing.