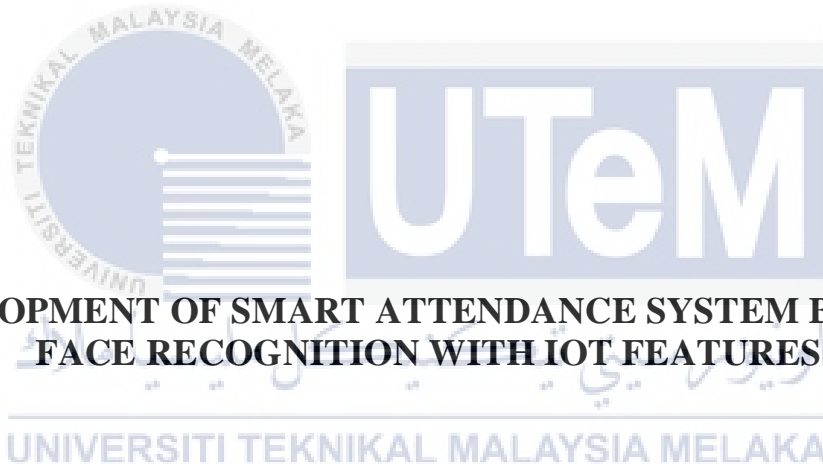




Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF SMART ATTENDANCE SYSTEM BY USING
FACE RECOGNITION WITH IOT FEATURES**

MUHAMMAD AMIRUL RASYID BIN MOHAMAD RAFFI

**Bachelor of Electronics Engineering Technology (Industrial Electronics) with
Honours**

2021

**DEVELOPMENT OF SMART ATTENDANCE SYSTEM BY USING FACE
RECOGNITION WITH IOT FEATURES**

MUHAMMAD AMIRUL RASYID BIN MOHAMAD RAFFI

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



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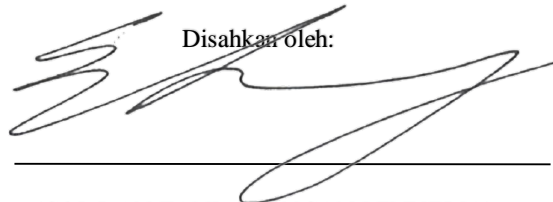
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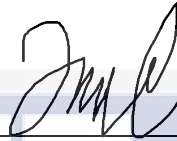
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DEDICATION

Special dedicated to my beloved parents for their caring, understanding and encouragement



ABSTRACT

In this era of Covid-19 pandemic, The Ministry of Education (MoE) has announced that schools and universities can be reopen and all parties must comply with the standard operating procedures (SOP) to ensure safety environment for students. Even though in this pandemic situation, teachers still need to record student's attendance that allow them to identify students who need support and keep in touch to help them continue their studies. However, in every school or university the typical way of taking attendance is a challenging work. The standard approach of a teacher or lecturer marking attendance was to manually call out the names of students, which could take a long time during a class session. The aim of the project is therefore to design a smart attendance system with IOT features. The goal of this project is to create a smart attendance system that uses face recognition method and use a sensor to record students' temperatures before they enter the classroom. Then, by using this system the data will be collected and update in Google Sheet as reference for future use. This attendance system uses a Raspberry Pi as a low-cost computer to collect image samples for training purposes, and these images were subsequently saved in a dataset as the names of the corresponding students. A contactless infrared temperature sensor is used to read the student's temperature before entering the class. When students scan their face, the system will compare their image and if the image are same as in dataset, system will send student's details and temperature to the google sheet as an attendance record. Based on the results, this attendance system is more efficient, safe to use and cost effective compared to other biometrics system. This project is easy to use and user-friendly as it introduced an efficient way to record the student's attendance.

ABSTRAK

Dalam era pandemik Covid-19 ini, Kementerian Pendidikan Malaysia (KPM) telah mengumumkan bahawa sekolah dan universiti dapat dibuka semula dan semua pihak mesti mematuhi Standard Operating Procedure (SOP) untuk memastikan keselamatan pelajar terjamin. Walaupun dalam keadaan pandemik ini, guru masih perlu mencatat kehadiran pelajar yang membolehkan mereka mengenal pasti pelajar yang memerlukan sokongan dan terus berhubung untuk menolong mereka melanjutkan pelajaran. Namun, kaedah tradisional untuk mengambil kehadiran adalah sangat memenatkan di setiap sekolah atau universiti. Cara yang lama untuk guru atau pensyarah menandakan kehadiran dengan memanggil nama setiap pelajar secara manual memerlukan banyak masa semasa sesi kelas. Oleh itu, tujuan projek ini adalah untuk membina sistem kehadiran pintar dengan menggunakan pengecaman wajah dengan ciri IOT. Objektif projek ini adalah untuk mewujudkan sistem kehadiran pintar dengan menggunakan pengecaman wajah, untuk merakam suhu pelajar dan menghantar data ke Google Sheet untuk rujukan di masa hadapan. Sistem kehadiran ini menggunakan Raspberry Pi sebagai komputer kos rendah untuk mengumpulkan sampel gambar bagi tujuan latihan dan kemudian gambar-gambar ini akan disimpan sebagai data pelajar masing-masing dalam set data. Suhu inframerah tanpa sentuhan digunakan untuk membaca suhu pelajar sebelum memasuki kelas. Semasa pelajar mengimbas wajah mereka, sistem akan membandingkan gambar mereka dan jika gambarnya sama seperti dalam set data, sistem akan menghantar butiran dan suhu pelajar ke Google Sheet sebagai catatan kehadiran. Berdasarkan hasil kajian, sistem kehadiran ini lebih efisien, selamat digunakan dan menjimatkan kos berbanding sistem biometrik lain. Projek ini mudah digunakan dan mesra pengguna kerana memperkenalkan kaedah yang cekap untuk mencatat kehadiran pelajar.

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LIST OF SYMBOLS

Σ	-	Summation of value
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LIST OF ABBREVIATIONS

RFID	-	Radio Frequency Identification
QR	-	Quick Response
SVM	-	Support Vector Machine
PCA	-	Principle Component Analysis
LBPH	-	Local Binary Patterns Histogram
LDA	-	Linear Discriminant Analysis
CNN	-	Convolutional Neural Network
IDLE	-	Integrated Development Environment
OpenCV	-	Open Source Computer Vision



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CHAPTER 1

INTRODUCTION

1.1 Background of Study

One of the most critical aspects of any institution is the student attendance record and it is to ensure that students will always maintain their performance. A good attendance system is beneficial not only to students but also to the institute. Poor attendance system has a significant impact on the quality of education and parents always expect a proper attendance management system to keep them informed about their child's academic progress. Every institution has its own system for recording student attendance and mostly will do manually by calling student's names on a piece of paper during lecture hours. This traditional method is an exhausting task and not very efficient in this era of Covid-19 pandemic as it takes a lot of time. Therefore, a lot of institutes started to use different method of taking attendance such as use of biometrics systems, radio frequency identification (RFID) and iris scanners to record the attendance. However, these methods are queue-based, which means it takes longer and not very efficient. Furthermore, due to Covid-19 pandemic, peoples are advised to keep their distance at least one meter between each other to helps limit the spreads of the virus. So, any system that requires to touch or contact is unsafe and can spread the virus even more.

RFID stands for Radio Frequency Identification, and it is a type of automatic identification device. Similar to a barcode, an RFID tag has a unique identifying code that can be read by a scanning device. In the case of educational institutions, a RFID-based system is implemented, in which students are given an RFID card that they must use to

record their attendance by placing it on the card reader. This attendance management system is useful, but it has a few flaws and drawbacks. Since an unauthorised individual uses an RFID card to gain entry to the institution, the system allows fraudulent access. Purchasing tags for all students is very expensive and it requires a significant variety of technologies. Furthermore, electromagnetic radiation is emitted by RFID devices. This raises the question of whether the reading devices can have an effect on human health in areas where they are used.

A fingerprint attendance system has been created to allow students to place their finger on a sensor before they enter the classroom without the need for additional assistance from the instructor. This system ensures that attendance is accurately recorded. However, experts agree that the virus that triggers Covid-19 spreads primarily from person to person due to the pandemic situation. Besides, the fingerprint is not changeable. For example, when fingerprint is registered using index finger, the scanner would not be able to detect if that person using another finger when scanning. Same issues when a person has a wounded finger and covered with bandage, the scanner will also have a difficulty in scanning the fingerprint.

During the winter months, the fingerprint attendance device, which identifies the attendance based on fingerprints, is more likely to fail. The skin becomes rough, dry, and flaky during the winter. As a result, the scanning attempts are difficult to register the attendance to the system. Next, to authenticate a user's identity, the majority of common biometric authentication methods rely on partial details. Using this method, the data is saved online and there is a high risk of biometric data leakage because it is stored online on the master data. As a result, any data breach may have a significant effect on the personal lives.

Face recognition is one of the most effective technologies for identifying persons in this modern era. It is suitable for usage in schools, colleges, and other organisations. In order to prevent the problem of collecting attendance of a large number of people, an

automated attendance system that is quick and decreases the possibility of fraudulent attendance is required. When students enter the classroom, their faces are continuously detected by a camera and their attendance is recorded. The software detects the faces first and then compares them to a predetermined dataset.

1.2 Problem Statement

Teachers still need to record student's attendance that allow them to identify students who need support and keep in touch to help them continue their studies. However, the old ways of taking attendance seems not very efficient and waste a lot of time. In addition, due to Covid-19 pandemic, teacher also need to record the student temperature before entering the class so that it can maintain low risk of spreading the viruses.

In order to rectify these problems, the Quick Response code (QR) were used so that students can scan the code by using their smartphone to submit the attendance. However, to access the information using QR codes the devices must be connected with internet and for those who are still in school, the uses of smartphone is prohibited inside school area. So, being friendly to this technology might cost much to the people in general. Besides, is it true that nowadays most people have at least one smartphone in their pocket and some may have more than one. But if their smartphone has no battery, it cannot be used to scan the code. Therefore, in this work, the usage of face recognition based smart attendance may bring great benefits to reduce cost, save a lot time and faster way to keep track of attendance.

1.3 Project Objective

There are three (3) objectives in this project:

- a) To design a system that records and monitors student attendance by using facial recognition technology.
- b) To develop a system that can identify a person identity and record the temperature using a non-contact temperature sensor.
- c) To store attendance and temperature data in cloud for future reference.

1.4 Scope of Project

The scope of this project is the development of a system that able to record the attendance by using the face recognition method and send the data to the google sheet for future references. This system can be used by any organizations, schools or institutes that requires an advanced attendance system that can reduce human workload. This project used a raspberry pi which is a low-cost computer that capable of processing image for face recognition. Additionally, a web cam is used as an input for detecting a face. The dataset that will be used as the sample in this project is personal collection by selecting classmate from BEEE class. The MLX90614 non-contact temperature sensor is used to detect the temperature of the students when they are scanning their face. The data of student details and temperature will be sent to the google sheet in order to access it from anywhere and anytime. Lastly, a software of Visual Code Studio will be used in order to write a code and program.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Face recognition is becoming more common as a biometrics method for an organization's attendance system. As a result of pandemic Covid-19, the common attendance system needs to be modified and implemented by using a face recognition as one way to prevent the virus from spreading. This chapter will provide a quick introduction of face detection and recognition research, as well as several popular face detection and recognition algorithms. This will contain a general overview of the approaches and processes that have previously been used.

2.2 Student Attendance System

The first and crucial step towards academic achievement is consistent attendance monitoring. Learning is a continuous process based on knowledge and abilities related to the knowledge that already acquired in daily learning. As a result, a high number of absences and a lack of enthusiasm might lead a student to fail in exam and fall behind compared to other students. Thus, increasing the likelihood of dropping out of school owing to inability to keep up with the tasks. An organized student attendance system can give a significant on the quality of education and parents always expect a proper attendance management system to keep them informed about their child's academic progress. As a result, every institution has started to develop its own system for attendance system and mostly will do by using fingerprint technology, RFID and QR code system which all of these have their own limitations.

2.2.1 Fingerprint System

According to R. Nandhini, N. Duraimurugan, and S. P. Chokkalingam (2019) pointed out some of the disadvantages of using fingerprint system, iris based identification system and RFID system [1]. For fingerprint system, an earlier configuration of a portable fingerprint system with the student's fingerprint is needed and it requires the user to touch the sensor. It is a common knowledge that every surface is a magnet for bacteria, viruses and germs and the contamination level of the sensor surface is comparable to the door handles. This means the fingerprint recognition sensors, like any other widely touched surface, can be used to spread the virus through contact.

2.2.2 Radio Frequency Identification System

As for the RFID system, there is a chance that fraudulent access could occur. Some students may use another student's ID to ensure their attendance when that particular student is missing. However, when it comes to facial recognition, the human face is always exposed and contains less detail compared to the iris system. A more detailed iris recognition system could intrude on the user's privacy [1]. In addition, C. Gomes, S. Chanchal, T. Desai, and DiptiJadhav (2020) also highlights a few existing system of student attendance and their limitations which are false signatures and proxies for pen and paper method as fraudulent signatures is a frequent practise among students nowadays [2]. Besides, for RFID tag, it can be used by someone else and for fingerprint approach, it is very expensive to develop.

2.2.3 Quick Response Code

The introduction of Quick Response code (QR) increasingly draws the attention of any organizations. The QR Code's appearance, on the other hand, was not created with human eyes in mind. The standard QR Code, which is made up of black and white modules,

is unappealing to the eye and difficult to recognise. The use of graphic QR Codes in product packaging, marketing campaigns as well as used in attendance system has exploded in recent years. However, noise occurs when a printed graphic QR Code is scanned, interfering with recognition and resulting in failure [3].

2.3 Face Detection

In this era of technology, face detection has a wide range of applications but the distinctions between face detection and face recognition are frequently muddled. Face detection only detects a face segmentation in an image which means a system can determine that an image or video contains a human face. However the face recognition identifies the individual who owns that facial image. A. Kumar, A. Kaur, and M. Kumar (2019) mentioned some challenges that will reduce the accuracy and detection rate of face detection which are the complex background, too many faces in images, odd expressions, illuminations, less resolution, face occlusion, skin colour, distance and orientation [4].

According to S. A. V Palanisamy and R. A. Jothi (2017), a complex background indicates the presence of various objects in the image, which reduces face detection accuracy and speed, whereas too many faces and unusual expressions indicate the presence of too many human faces in the input image [5]. Hence, faces appear to have some expression, unlike regular faces, and this can create changes in fractal geometry and the contour of facial features. Next, the difference in illumination caused by different lighting which some areas of the picture may have a lot of light, while others may have a lot of darkness is also some of the challenges in face detection. The resolution also is very important because poor resolution of the image may slow down the detection rate. Besides, occlusion means the human face hidden by any object like glasses, hat, and makeup also may affect the detection rate as the algorithm facing difficulties when trying to extract the features. Lastly, the