AUTOMATED ATTENDANCE SYSTEM BASED ON FACIAL RECOGNITION

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DEVELOPMENT OF AUTOMATED ATTENDANCE SYSTEM BASED ON FACIAL RECOGNITION

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A report submitted in partial fulfilment of the requirements for the degree of Mechatronics Engineering

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2018

I declare that this report entitle Development of Automated Attendance System Based on Facial Recognition is the results of my own research except as cited in the reference. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree

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To My Beloved Family and Friends

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ABSTRACT

This Project is stress on the development of automated attendance system based on facial recognition using the principle component analysis (PCA) method with the Eigenface approach. In the past, student's attendance management system is an important task done by every institution in order to maintain the student's academic results and this project able to reduce the chances of forgery attendance marking. The main objective to be achieved is the development of face recognition system based on Eigenface approach using the PCA algorithm which includes the face detection part using the Viola Jones method of detection. To achieve this objective, the MATLAB software build in algorithm such as image processing toolbox and image acquition toolbox is utilized. Using this algorithm, the expected result from this system is the collection of student database through capturing the image of the students for face recognition process which will detect the face of the student from the whole image eliminating background and other elements from the image and save it in the database and ready for face recognition process which will give a message to indicate that the person is recognized or not. The system performance will be analysing based on the accuracy under different lighting condition, varying in number of person and varying the distance between the student and the webcam. The analysis shows that the performance decreases as the number of person in an image is increased. Although the performance decreases, the accuracy obtain for 5 person in an image records a percentage of greater than 80%. Besides that, the analysis results for varying the distance from webcam shows that the increase in the distance between webcam and the students effect the performance of the system where for distance 3 feet the system records a 94% of accuracy but for distance 9 feet records 0% of accuracy. Lastly, the lighting effect under which the image is capture does not affect the systems performance which records 100% of accuracy for both the lighting condition. Therefore, this system perform very well in face recognition which can be used for attendance recording system.

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ABSTRAK

Projek ini menekankan pembangunan system kehadiran secara automatic berdasarkan pengecaman wajah yang mengunakan kaedah ‘Principle Component Analysis (PCA)’ dengan menggunakan ‘EigenFace’. Pada zaman dahulu, system pengirisan kehadiran pelajar adalah satu tugas penting yang harus dilakukan oleh setiap institusi untuk mengekalkan keputusan akademik pelajar. Sehubungan dengan itu , projek ini dapat mengurangkan pemalsuan dalam menandakan kehadiran. Objektif utama yang perlu dicapai oleh projek ini ialah membangunkan system pengecaman wajah berdasarkan pendekatan ‘EigenFace’ dengan mengunakan algoritma PCA yang termasuk pengesanan bahagian muka menggunakan keadah ‘Viola Jones’. Untuk mencapai objectif ini, perisian MATLAB digunakan yang menpunyai algoritma ‘image processing toolbox’ dan ‘image acquition toolbox’. Dengan mengunakan algoritma ini, hasil yang dijangkakan dari system ini ialah sistem dapat mengumpulkan pangkalan data pelajar dengan mengambil imej para pelajar untuk proses pengenalan wajah. Seterusnya, sistem akan memproses pengenalan wajah dengan membandingkan wajah dengan wajah asal dalam pangkalan data. Jika wajah tersebut sepadan dengan wajah dalam pangkalan data, sistem akan mengeluarkan mesej bahawa wajah pelajar tersebut terkandung dalam pangkalan data Prestasi sistem akan menganalisis berdasarkan ketepatan perbezaan keadaan pencahayaan, perbezaan jumlah bilangan orang dalam satu imej dan perbezaan jarak di antara pelajar dan ’webcam’. Seiring itu, analisis ini menunjukkan bahawa prestasi sistem berkurang apabila bilangan orang dalam seimej bertambah. Walaubagaimanapun, sistem ini masih berkebolehan untuk merekodkan peratusan prestasi yang besar iaitu 84% jika bilangan orang dalam seimej ialah 5. Selain itu, keputusan analisis bagi perbezaan jarak dari webcam menunjukkan bahawa peningkatan dalam jarak antara webcam dan pelajar boleh memberi kesan kepada prestasi system. Didapati, untuk jarak 3 kaki sistem boleh merekodkan 94% ketepatan sementera untuk jarak 9 kaki rekod ketepatan prestasi didapati 0%. Akhir sekali, kesan pencahayaan pada masa sesuatu imej ditangkap tidak menjejaskan prestasi keseluruhan sistem yang didapati boleh merekodkan 100% ketepatan untuk kedua-dua keadaan pencahayaan.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Face recognition is the current challenging problem face in the field of image analysis and computer vision which received a great attention over the past years because of the applications and uses in various fields. Face recognition techniques mainly divided into three (3) categories based on the face data acquisition methodology, method which operates on intensity images, method that deals with video sequences.

Since the use of image processing is wide, broad research and studies being carried out to utilize its potential and to make new imaginative applications. Facial recognition is the untimely application utilized from this innovation, which is the standout amongst the most demonstrated strategy in human face detection. A face is a multidimensional structure and needs good computational investigation for face recognition. Figure 1.1 shows the various kind of biometric application used in the open world.

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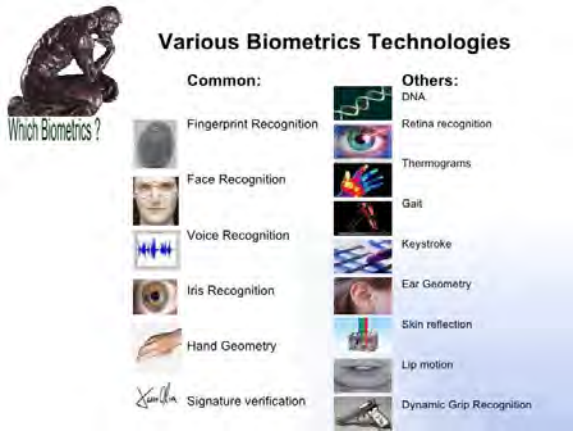

Figure 1.1: Various kind of biometric application

In numerous institution and organization, the attendance is an essential factor to keep up date as this record are referred for salary calculation, over time calculations, performance check etc. Most of the institution and organization take after the manual technique utilizing the old paper and document strategy and some of this institution have moved to biometric method. The present strategy that institutions utilize is that the lecturer passes a sheet or make roll call and mark the attendance of the students and the sheet additionally goes to the administrator office for final entry in excel sheet. This procedure is very wild and tedious.

1.2 Problem Statement

Attendance of every student is an important task to be maintained by every school, college and university throughout the world especially in Asia countries as Asia countries educational systems believes that attendance is the key factor of the students' academic performances. There are also proven results shows that student with poor attendance record will reflect in the examinations results as missing classes by the students will results in limited knowledge of the subject where most of the important lessons and examination preparation are done in a class room[12]

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Currently, most of the school, collage, university maintain manual attendance record which said to be inefficient and requires plenty of lecture timing to sort out and compute the average attendance records. Henceforth, there is a necessary to build a framework that able to solve the problem of student's attendance management and average attendance calculation. One of the efficient ways to make student attendance record management automatic is by facial recognition system where the system must be able to recognise the student by analysing their faces.

1.3 Project Objective

The Objective of this project is as follows:

1. To develop a face recognition system based on the Eigenface approach using the Principal Component Analysis (PCA) algorithm.
2. To build an automated attendance system by using the MATLAB function which link with Microsoft Excel Spreadsheet.
3. To perform an analysis on the system performance in term of accuracy and reliability.

1.4 Project Scope

The scope of this project is limited to develop a face recognition algorithm using the Principle Component Analysis (PCA). The image processing function for this project will be done using the MATLAB build in toolbox and using the toolbox available in MATLAB such as image acquition toolbox and computer vision toolbox. The Spreadsheet link EX toolbox is utilized to save the attendance record of the students. An external webcam is used to capture the image of the students before it is process as this is not a real time system. In this project, a total five (5) student's data will be analysis in terms of recognition accuracy, accuracy due to distance of the webcam & student and accuracy due to lighting effect.

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1.5 Summary

In this chapter, the introduction of the project, problem statement, project objective, and the scope of the project has been discuss widely. From the objective of this project, we can conclude the main aspect that we gone do in this project and what we want to achieve from this project at the end of this project. On the project scope, we discuss widely on what we do and the limitation on the project when doing this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Background

In this cutting edge period of mechanization numerous logical progressions and developments have occurred to spare work, increase the precision and to improve our lives. Automated attendance system is the headway that has occurred in the field of automation supplanting attendance marking system. Automated attendance system is basically a bio-metric based, smart-card based and web based. These frameworks are generally utilized as a part of various associations. Customary technique for attendance checking is extremely tedious and complicated when the quality is more. Automated Attendance System has edge over customary technique as it spares time and furthermore can be utilized for security purposes [1]

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Face recognition is an intriguing and fruitful use of pattern recognition and image examination. Facial pictures are fundamental for keen vision-based human computer connection. Face processing depends on the way that the data can be extracted from the images accordingly. Face detection has numerous applications, running from entertainment, information security, and biometrics [2].Various strategies have been proposed to identity faces in a single image. To assemble a completely automated system, strong and effective face detection algorithm required. The face is identified once a man's face comes into view [3]. Once a face is detected, the face district is trimmed from the picture to be utilized as "Test" into the learning to check for conceivable matches.

2.2 Face Recognition using PCA approach

The original way of calculating the Eigenface using the PCA method are as follows:

1. Preparation of database of the face which can be named as training set T_i
2. The average matrix Ψ has to be determine which is then subtracted from the original trainning set data T_i and the results are stored in the variable Φ_i

$$\Psi = \frac{1}{M} \sum_{n-1}^{M} Tn \tag{2.1}$$

$$\phi_i = T_i - \Psi \tag{2.2}$$

3. Next is the calculation of covariance matrix C based on the equation below:

$$C = \frac{1}{M} \sum_{n-1}^{M} \phi_n \phi_n^T \tag{2.2}$$

4. The step continues by calculating the eigenvectors and eigenvalues of the covariance matrix where the eigenvector u_i and the corresponding Eigen values λ_i should be determined. These values must be normalised so that they are called as unit vector.
5. Selection of principle components: The M value with highest value of eigenvalues will be selected. This is because, the higher the eigen value, the higher the characteristic feature of the face where the particular eigen vector is described. The Eigenface which has lower eigenvalues can be eliminated as they explain a minimum amount of the in characteristic feature of the face.

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2.2.1 Image Processing Toolbox

The image processing toolbox is a gathering capacity that expands the ability of the MATLAB numeric figuring condition. The tool kit underpins an extensive variety of picture preparing operation, including:

- Spatial image transformations
- Morphological operations
- Neighbourhood and block operations
- Linear filtering and filter design
- Transforms
- Image analysis and enhancement
- Image registration
- De blurring
- Region of interest operations

2.2.2 Computer Vision Toolbox

The field of significance for such different application as independent vehicles, exploring with the assistance of image captured by the attached camera, and high precision estimation utilizing images, taken by the aligned camera. In this paper, we will show various numerical schedules carry out in MATLAB software that are helpful in assortment computer vision toolbox. The accumulation of schedules will be known as the Computer Vision Toolbox. One of the primary issues in Computer Vision is to figure the 3D- structure of the scene and movement of the camera from estimation in the image taken from various views.

2.2.3 Image Acquisition Toolbox

The main functions of image acquition toolbox are as follows:

- Acquiring images through many sort of image acquition gadgets, from professional grade frame grabbers to USB based webcam
- Preview of the live streaming videos

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- Triggering acquition
- Configuring call back function that execute when certain functions occur

The image acquition toolbox components are shows in Figure 2.1

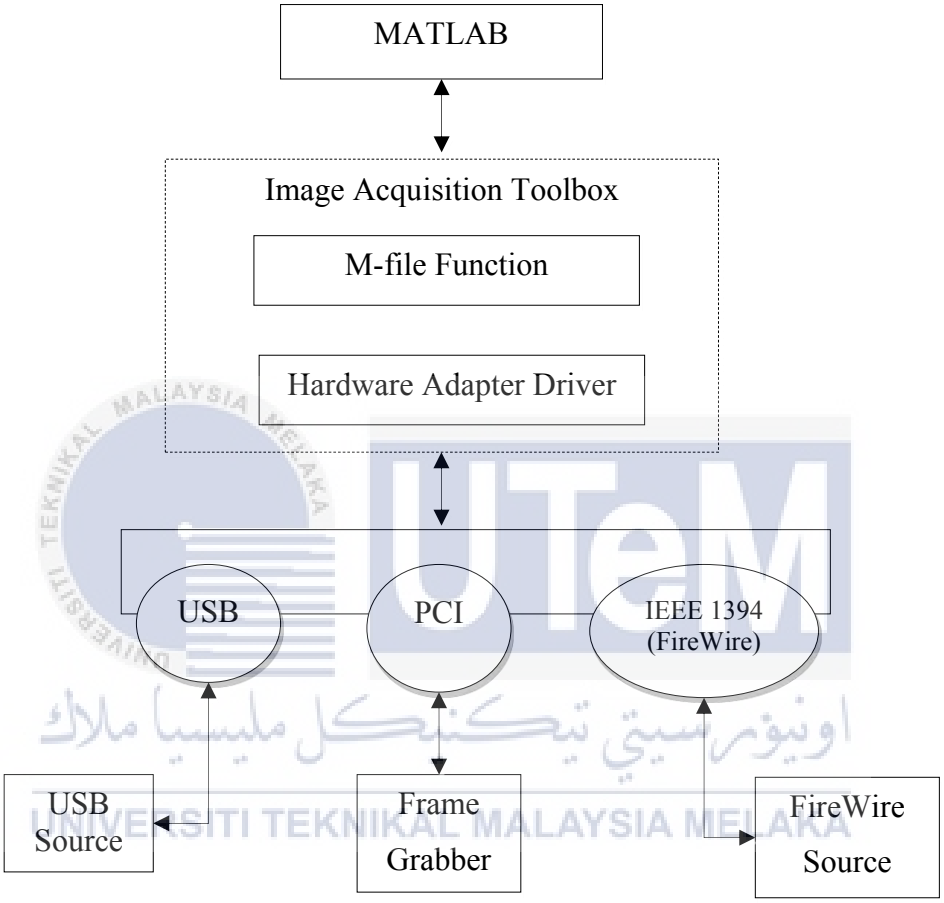

Figure 2.1: Image acquition toolbox components

2.3 Literature Review on Previous Study

Automated attendance system based on facial recognition an important tool to help the learning institution to keep track of the student record to class in a simple way. The important segment in this system is the face recognition done to the person before the attendance record is recorded in the excel spread sheet. From the previous researches, it is learned that they are many method used for face recognition such as

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Principle Component Analysis (PCA), Eigenface approach, back propagation neural network and other method.

2.3.1 Face Recognition using principle Component Analysis (PCA)

According to [4], PCA is a statistical method under the title factor analysis. PCA serves the purpose of reducing the large dimensionality of the date space to smaller intrinsic dimension of feature space in which need to describe the data economically. The scope of Principle Components analysis method is able to do prediction, redundancy removal, feature extraction, data compression. Facial recognition has various applicable areas. This can be categorized into face classification, sec determination and face identification. The most helpful application of face recognition is crowd observation, video content ordering. Individual distinguishing proof (ex. International passport), mug shot shots matching, entrance security. The fundamental idea of utilizing PCA for face recognition is to acknowledge is to express the large 1-D vector pixels which is constructed from the 2-D facial image into conservative principle components of the feature space which can be define as eigenspace projection. Eigenspace is ascertained by diagnosing the eigenvectors of the covariance matrix derived from a set of facial images (vectors).

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2.3.2 Face recognition using Eigenfaces

According to the researcher [5], the approach to detect and identify a human face and acknowledge framework which track a subject's head and perceive the individual by contrasting quality of the face with those known people. Their approach for face recognition based on the two-dimensional recognition problems. It is described that the fact, faces are normally in upright position thus it may be describes by a small set of 2-D characteristic views.

Building a computational model for face acknowledge is very troublesome, in light of the fact that faces are complex, multidimensional, and important visual stimuli. Consequently dissimilar to most early visual capacities, for which it may be developed point by point models of retinal or striate activity. This research focus towards the development of early preattentive pattern recognition which does not depend on the

full 3-D models or point to point geometry. The aim is to come up with a computational model of face recognition which is fast, simple, and accurate in obliged conditions. Figure 2.2 shows the simplified version of free space diagram

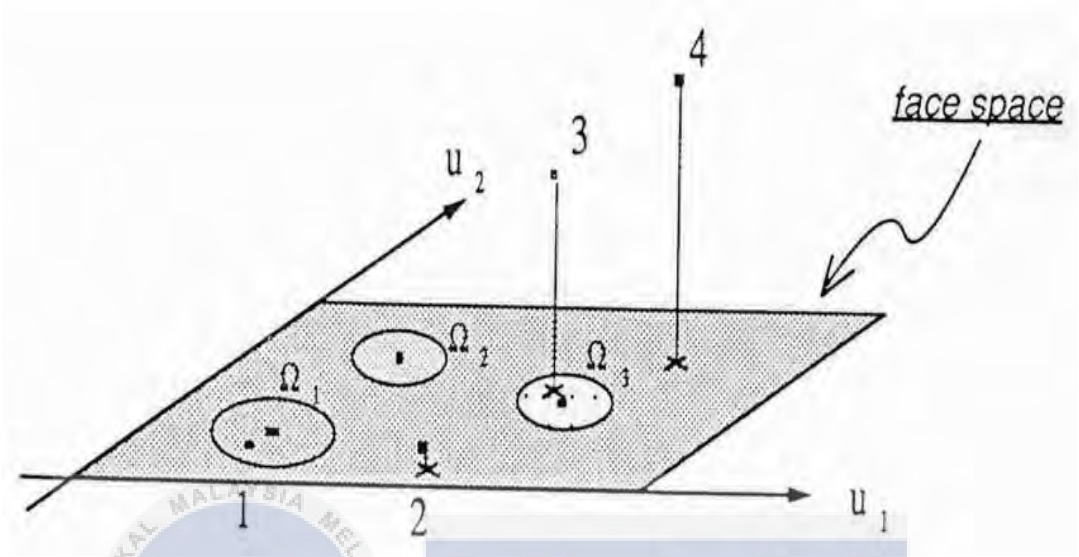

Figure 2.2: Simplified version of face space to illustrate the four results of projecting image into face space

2.3.3 Face Recognition using Eigenface Approach

In this paper [6], the Eigenface is used for the recognition process. They have developed a computational model to recognize the individual face, which are generally basic and simple to actualize. From this paper, it is said that the current system which represents some face space with higher dimensionality and not accurate. It is said that even with high dimension, in real, the span is very low dimensional space. Therefore it is said to concentrate with only the subspace with lower dimensionality to match with the face space.

In this paper, a face recognition system is develop which able to recognize static images which can altered to work with dynamic images. The image which is received from the web camera is converted into the static position and afterwards a similar method can be connected to them. Face recognition process is done by anticipating a new set of image into the subspace spread over by the Eigenfaces (face space).this process is continued by characterizing the face by looking at its position of

the face space with the position of the known person in which the Eigenface approach gives an efficient way to find this in lower dimensional space. Figure 2.3 shows the simplified version of face recognition using the eigenface approach.

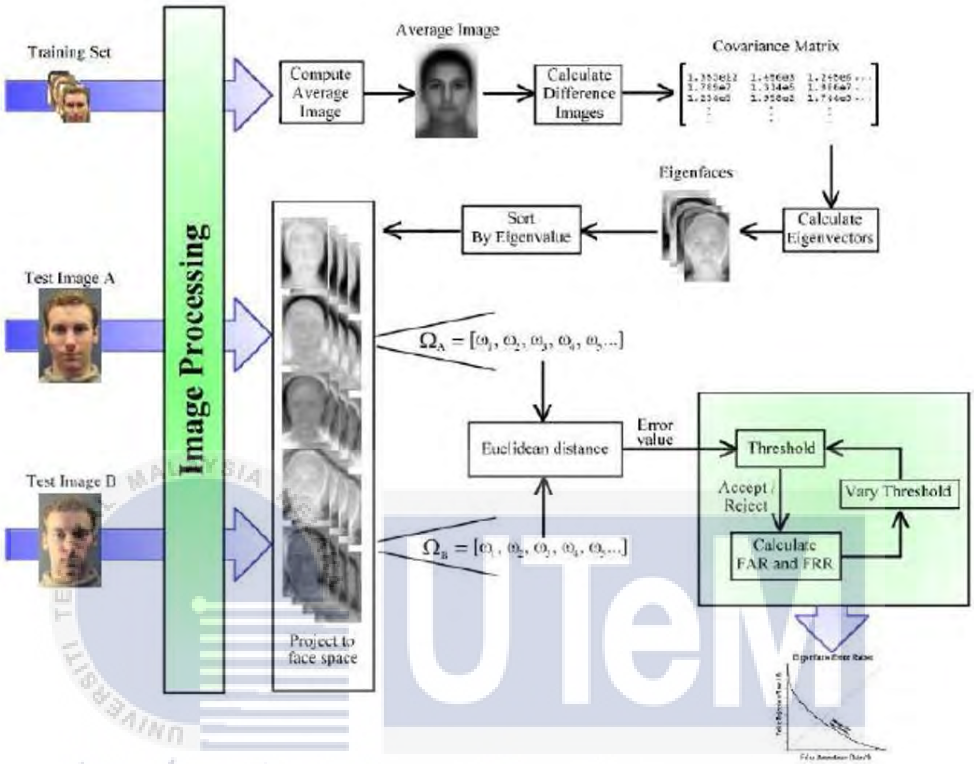

Figure 2.3: Procedure of face recognition using eigenface approach

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2.3.4 Automated Attendance System Using Face Recognition

In this paper [7], the author has proposed an automated attendance management system. It is learned that, this system based on face detection and recognition algorithm which automatically capture the students when they are in the class and record their attendance. This system used Viola-Jones Algorithm face detection which able to capture human face using the cascade classifier and principle components algorithm (PCA) for the feature selection and support vector Machines (SVM) for identification. Directly accessible face recognition technique fundamentally depend on the methodologies. Firstly, local face recognition which utilizes facial highlights of the face such as nose, mouth, eyes and so forth to connect the face with a person. The second approach or worldwide face recognition framework utilize the entire face to

distinguish a person. These two methodologies have been executed somehow by different algorithm.

In this paper [7], the automated attendance management system is explained in five main modules. Firstly, image capturing process. In this process, the image capturing device which is the camera is placed at position from the position to capture the image of the students which undergoes for face detection process. Secondly, face detection process. In this, the Viola-Jones detection algorithm is used as this is a method with high efficient for real time application. It is learned that this method gives a better results in different lighting condition.

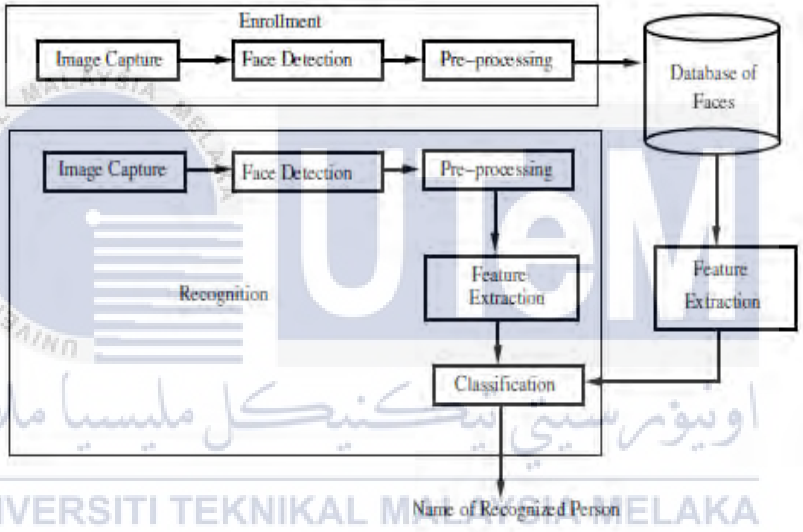

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Figure 2.4: Block diagram of face detection

Next, the pre-processing process where the detected faces are involves with the histogram equalization of the extracted face image and resized to 100x100 resolutions. Lastly, the data base development. In this paper, the biometric based enrolment system is used to create the database of every student where the student image is capture and extracting the bio-metric feature and it is stored in the database. Figure 2.4 shows the block diagram of the face detection process.

2.3.5 Automated Attendance using Face Recognition Based on PCA with Artificial Neural Network

According to the paper [8], the use of face recognition for attendance marking is a smart way to manage the attendance record of the students. In this paper, they have use the principle components analysis (PCA) along with Artificial Neural Network (ANN). The ability of training and identifying is converted into machine system using Artificial Neural Network (ANN) .The main function of the face recognition system is to analyse the substance of a person which is perceived with the faces effectively prepared in the Artificial Neural Network (ANN) and it perceived the best coordinating face as the output even at various lightening conditions, viewing conditions and facial expressions.

It is learned that the features of the face image are extricated by making the element vectors of most extreme fluctuated confront face point and figuring S covariance column matrix utilizing PCA. These appearances are anticipated onto the face space that traverses the huge varieties in the face image stored in the database. These element vectors are the eigenvectors of the covariance network and face like appearance so that it is called as Eigenfaces which are utilized as contribution to prepare the Artificial Neural Network.

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The feature extractions of the face image are done by using the Principle Component Analysis (PCA). PCA is a dimensionality reduction method which retain majority of the distinguishing present in the data set. Figure below shows the basic architecture of PCA.

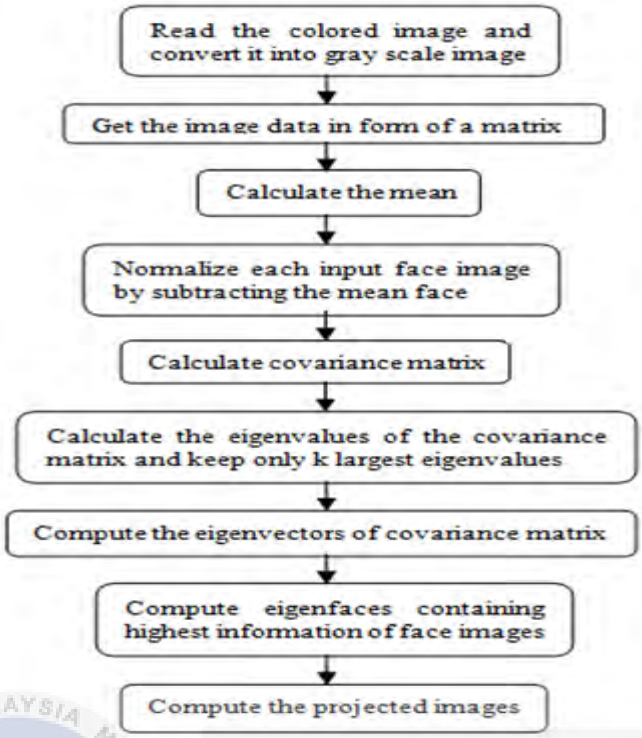

Figure 2.5: The basic architecture of PCA [8]

2.3.6 Automatic Attendance Management System Using Face Recognition

In this research [9], a system is proposed which consists of high definition digital camera that able to monitor the class room. In this system, a micro-controller based motor system which able to rotate its direction. This camera then capture the image of the class room then sent it to a computer programmed system for further process. This process is done in MATLAB computer based software which does the face recognition module. Initially, the image of each person is provided and generates a set of facial feature using the feature extraction method called the principle component analysis (PCA). In real time, the images of the person are extracted from the camera install in the class room. This is done by the MATLAB tool called as image acquisition toolbox. This method is uses the Eigenface approach for face recognition. This technique works by analysing the face image and calculating the Eigenface in which the face consists of eigenvectors. Thus, the comparison is used to identify the presence of a face an its identity

In this paper [9] also, it has reviewed a face recognition strategy based on feature extraction by utilizing broad geometry, it is conceivable to discover the shapes

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of the eye, eyebrow, nose, mouth and the face. Eigenface method is used due to its simplicity, speed, accuracy, learning capability.

2.3.7 Face Recognition using Neural Networks

From this paper [10], it is learned that neural base algorithm is presented to detect front view of the faces. Besides that, principle component analysis (PCA) also used before it is applied to the Back Propagation Neural Network (BPNN).PCA is the most popular technique used in face detection as PCA able to reduce the input data to lower dimension which able to facilitate the classification process. Principle component analysis (PCA) includes a mathematical procedure that changes the number of the potential associated factors into fewer uncorrelated factors called the principle components.

A Back propagation Neural Network (BPNN) is extensively used in learning algorithm with multilayer perceptrons in which consists of input layer, hidden layers and output layer of computation nodes. Figure below shows the multi-layer, feed-forward supervised learning of a BPNN

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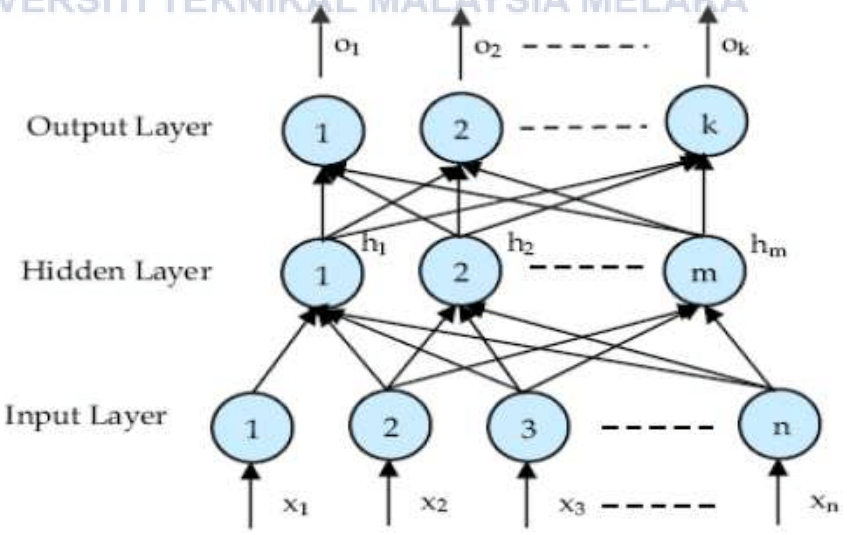

Figure 2.6: Block diagram of the Back Propagation neural network [10]

2.3.8 Neural Network Based Face Detection

In this paper [11], it is presented a neutral network based face recognition system which able to detect the frontal views of the person's face in gray-scale images. It is also mention that this algorithm and the training ways are general which can be used on other views of the face. In this paper, the system operation is divided into 2 (two) phases. The first phases consists of a neural network based filter in which the filter receive an input in 20 x 20 pixel region of images and produce a output ranging 1 to -1 which represents the present of absent of a face. The filter is applied at any location of the image. Figure below shows the filtration algorithm and shows the process of how a filter is applied to the image.

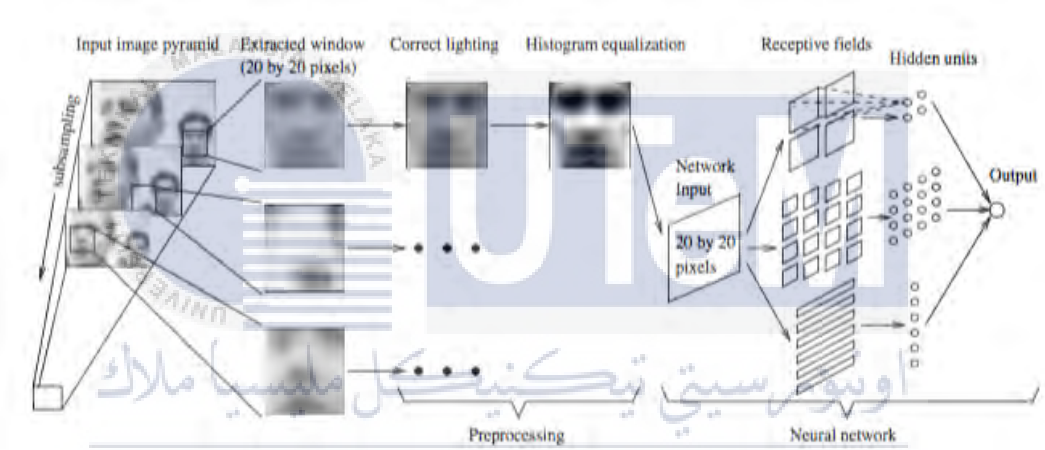

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Figure 2.7: The basic algorithm used in face detection

On the second phase of the system operation, merging overlapping detection and arbitration technique is used. A little amount of position and scale invariance in the filter channel, a genuine face are regularly identifies at various adjacent position and scales, while false identification just show up at a solitary position. By setting a base limit on the quantity of recognition, numerous false identification can be eliminated.

2.4 Overview on Previous Study related to Face Detection and Face Recognition

The table below shows the research done in the past regarding this project. This study show on what type of method used in there system.

Table 2.1: Comparison on Previous Studies

No	Paper Title	Author	Method Used	Summary
1	Face Recognition using principle Component Analysis (PCA) [4]	Kyungnam Kim	1. Face recognition based on Principle Component Analysis (PCA)	Shows the recognition percentage error when the number of image increases
2	Face recognition Using Eigenfaces [5]	Matthew A. Turk Alex P.Pentland	1. Eigenface Approach	Shows the different experiment done with varying lighting, head orientations, and size
3	Face Recognition using Eigenface Approach [6]	Vinay Hiremath Ashwini Mayakar	1. Principle Component Analysis (PCA) 2. Linear Discriminant Analysis (LDA)	Explain the main difference between PCA and LDA in term of no of image, sensitivity, and computational time
4	Automated Attendance System Using Face Recognition [7]	Akshara Jadhav Tushar Ladhe Krishna Yeolekar	1. Viola – Jones Detection Algorithm 2. Principle Component Analysis (PCA)	States that Viola Jones method gives a high detection rate and efficient in real time application
5	Automated Attendance using Face Recognition Based on PCA with Artificial Neural Network [8]	Jyotshana Kanti Shubha Sharma	1. Principle Component Analysis (PCA) 2. Artificial Neural Network	States that the PLCA able to extract the highest amount of information from face image which later taken as a input to the Artificial Neural Network

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6	Automatic Attendance Management System Using Face Recognition [9]	Jomon Joseph K. P. Zacharia	1. Principle Component Analysis (PCA)	States that the face recognition system is very sensitive to face background and head orientation. Besides that, when the threshold value increases, the number of misses begin to decrease.
7	Face Recognition using Neural Networks [10]	M.Nandini P.Bhargavi G.Raja Sekhar	Neural Network using Back Propagation Networks (BPN) and Radial Basis Function (RBF)	It is justified that the use of BPN and RBF result a high accuracy in face recognition compare to BPN only
8	Neural Network Based Face Detection [11]	Henry A. Rowley Shumeet Baluja Takeo Kanade	Face detection using Neural Network	States that the false positive rates as the threshold varied from 1 to -1 and at threshold 1. The false detection is zero.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter discussed about the method and the methodology that will be used for this project. On the previous chapter we have discussed the past research that have been done and the different method that have been used for face detection and face recognition. In this project, a system is develop in which the system able to mark attendance record automatically by using the image processing technique. An efficient method is used which can detect and recognize the students face efficiently. The method that has been chosen for face detection is the Viola-Jones face detection method. For the face recognition part, the Eigenface approach method is used.

The project methodology consists of the procedure and the method that will be used in completing this project as this methodology act as a guidance to complete the project successfully. In this chapter, the basic flow chart of the face detection and also the face recognition will be discussed and the all the relevant tools and software that have been used to generate the results.

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3.2 Methodology

3.2.1 Project Overview

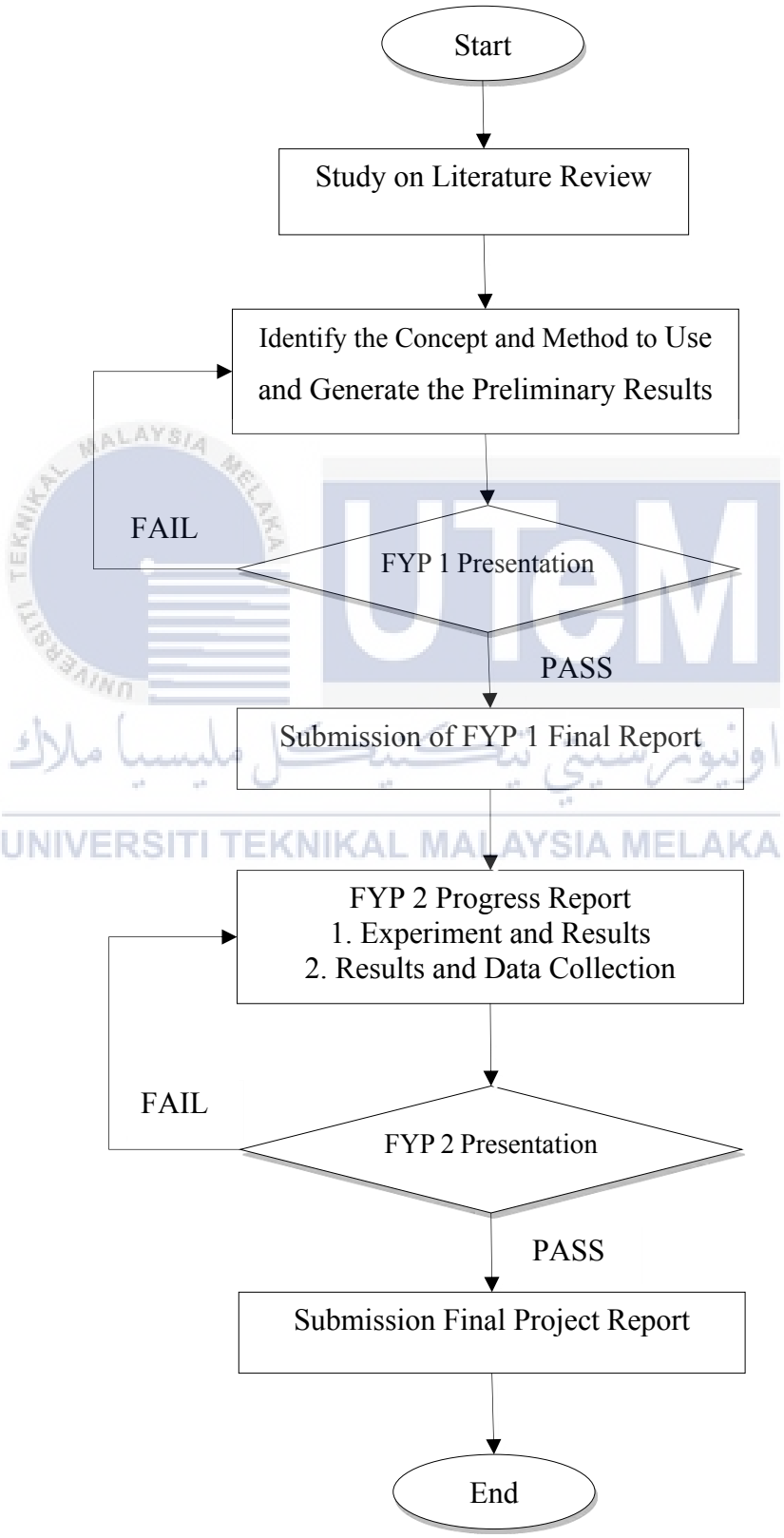

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Figure 3.1: Overall project implementation flowchart

Figure 3.1 shows the complete flowchart for this project. This project is divided into two parts. The first part which will be for FYP 1 is more to study regarding the face detection and face recognition and the research regarding the topics from other journals. FYP 1 also consists of identifying objective, scope, problem statement. Besides that, FYP 1 also on getting the preliminary results for this project which will be the face detection and face recognition of a person.

During the FYP 2, the project if focus on developing an automated attendance system based on facial recognition. In this session, we are to link the face recognition method from FYP 1 to the attendance system and produce attendance record on Microsoft excel spreadsheet. Besides that, during the implementation of FYP2, analysis on the results obtained is examine study the performance of the system using different parameters.

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3.2.2 System Execution

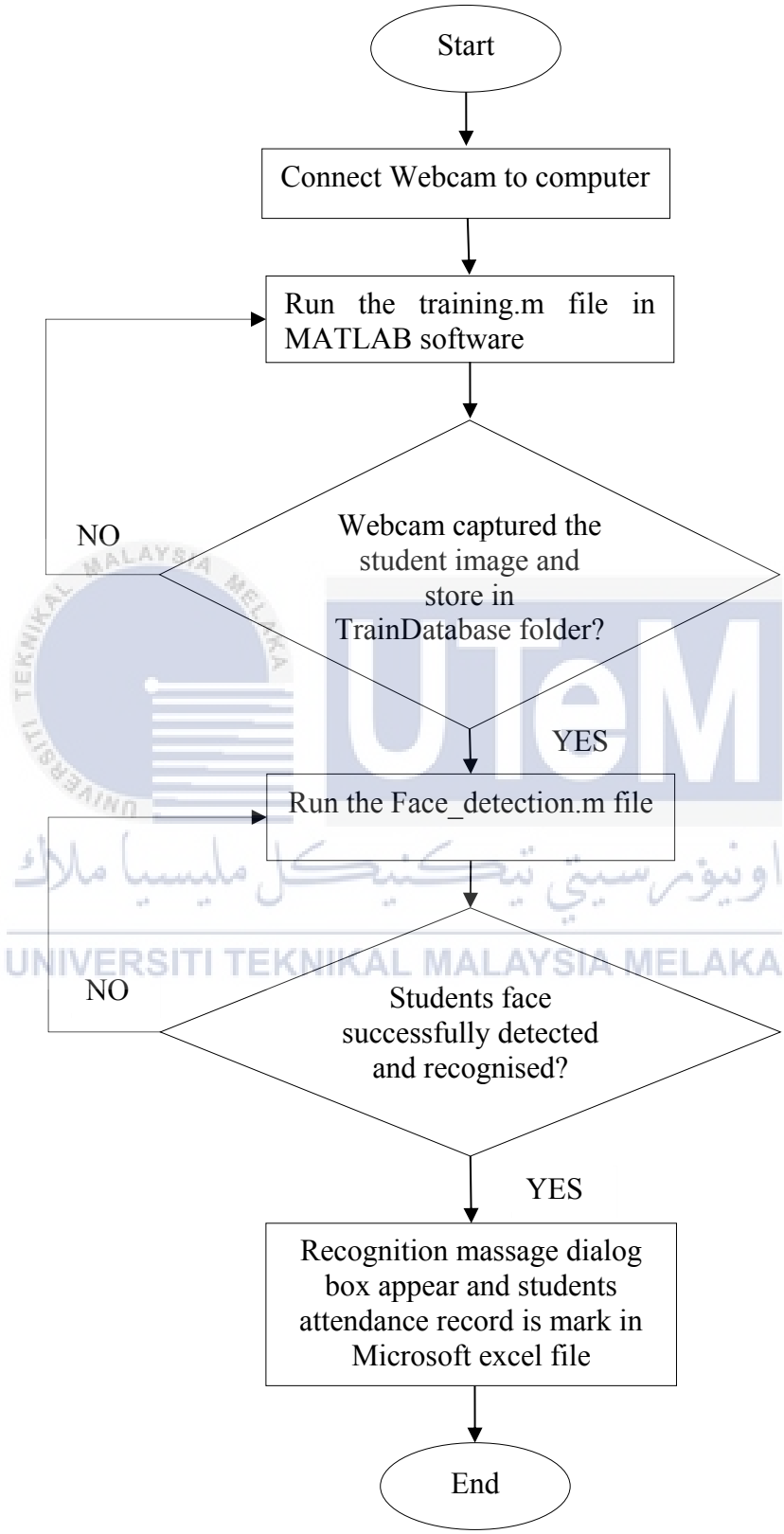

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Figure 3.2: Overall Project Execution Flowchart

Figure 3.2 shows the system flowchart for this project. In this project, MATLAB software is used to run the programs for this project. As discussed in the earlier section, MATLAB software comes with many useful function and toolbox that can make the work to run this program and this system easier and user friendly. The first step in running the system is by connecting the external webcam to the computer and opens the training.m MATLAB source code and run it. The function of this training.m source code is to capture the image of the students, crop the face and store in the TrainDatabase folder. In this project, each time the training.m file is executed, the system captures three images of the students automatically and saved in the TrainDatabase folder with the image detect the face and resize to 240x300 pixels. The three face for each student is then used to compare with image capture in the classroom for face recognition process.

The testing process starts when the Face_detection.m file is executed in MATLAB software. The webcam will capture the image of the classroom and detects the faces of the students, crops them. These cropped images are then used as an input argument for face recognition part. In recognition part, the cropped images are compared to the images saved in the TrainDatabase to find best match. If a best match is found, the system will display a massage on the system. The system also automatically marks the attendance of the students in the excel spreadsheet.

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3.3 Hardware and Software

3.3.1 Webcam

The camera plays an important role in this project as the main hardware used to capture the image of the students. There are many types of camera available in the market such as reflex camera, still camera, thermal imaging camera, webcam, IP camera, and more. On this project, the camera that will be using is the simple USB Digital PC HD webcam with 1920x1080 pixels. Table 3.1 shows the basic specification of the camera that have been used and Figure 3.3 shows the web camera that is being used in this project.

Table 3.1: Specification of the Webcam Used

1920 x 1080 Pixels	8 Megapixels
USB interface	Auto Focus
Automatic surrounding light adjustments	Build in image compression
Cmos image sensor	Low working Power Consumption

Figure 3.3: Example of Webcam Used in the Project

3.3.2 MATLAB Software

MATLAB defined as matrix laboratory. MATLAB is a multi-paradigm numerical processing condition and fourth-age performing dialect. An exclusive dialect created by Math Works. MATLAB permits matrix control, plotting of capacities and information, implementation of algorithms, creation of user interface, and interfacing with programs written in different dialects such as C, C++, Java, Fortran, and Python. Figure 3.4 below shows the MATLAB Software trademark.

Figure 3.4: MATLAB Software Trademark

Despite the fact that MATLAB is planned fundamentally for numerical registering, a discretionary tool stash utilizes the Mu PAD symbolic engine, enabling access to representative processing capacities. An extra bundle, Simulink, includes graphical multi-area recreation and model-based outline for dynamic and embedded systems.

The essential information formation in MATLAB software is the array, a requested arrangement of real or complex segments. This question is typically suited to portrayal of images, real-valued ordered set of colours or force data.

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MATLAB stores most of the images as two-dimensional arrays (ex. matrices), in which each components of the matrix compares to a solitary pixel in the displayed image. For example, an image composed of 200 rows and 300 columns of various shaded dads would be put away in MATLAB as a 200 by 300 matrix. A few images, for example, RGB, required a three-dimensional exhibit, where the principal plane in the third measurement speaks to red pixel intensities, the second plane denotes the green pixel, and third denotes the blue pixel.

This tradition makes working with the images in MATLAB like working with some other sort of matrix information, and makes the full energy of MATLAB accessible for picture handling applications. For instance, you can choose a solitary pixel from an image grid utilizing typical framework subscripting.

3.4 Proposed System of the Project

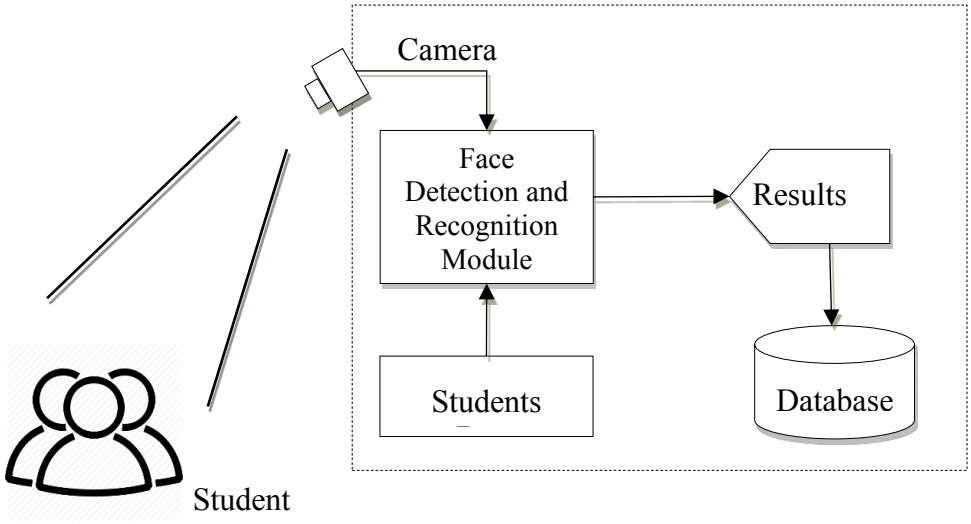

Figure 3.5: Proposed System

Figure 3.5 describes the proposed framework for automated attendance system based on facial recognition. The system required a camera to be fixed in the lecture room at a position where it could capture the image of all the students in the class and in this manner catch their image effectively. The image is processed to get the final result. The working of each block is explained in detail below:

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- **Camera:** A camera is mounted in the lecture room to capture the image of the students. This has to be mounted as such the position of the camera able to capture all the students face effectively. The camera will be integrated with the computer via wire or wireless setup for further process. In this project, we have use a wire external webcam model Logitech C310

- **Image Processing:** Face recognition algorithm is connected with the image captured by the camera. These images are then cropped and stored in the database for further processing. The module perceives the images of the student's face which need to be enlisted physically with their name and metric card number in the database. MATLAB software is used in all the image processing and image acquition process. The whole process is done using the below steps:

a) **Train Database:** At first, the image of the student is taken to enrol the students into the database. The system capture three (3) images for each student with different face expression. This data is then used later for face recognition algorithm. This process is done using the MATLAB software function called the image acquition toolbox where the entire image captured by the camera will crop the face in the image and resized the image to 240 x 300 image sizes.

b) **Face Detection:** The method used is viola Jones algorithm. This method is chosen for face detection as this method is good for detection. In this project, we used the MATLAB Computer Vision Toolbox using the function vision.CascadeObjectDetector(). This function work on the Viola – Jones algorithm as this algorithm gives more speed and reliability. This algorithm only used to detect the people's face from the whole image which consist other unwanted elements. The algorithm detects all the faces clearly in the captured image of the classroom. Each student need to be in upright position to avoid exclusion of their presence by the system

c) **Face recognition:** For the recognition part, the feature areas are refines and the face is standardized with the eyes and mouth in fixed location. The image from the face tracker is utilized to prepare a frontal Eigen space, and the main three eigenvectors are held. Since the face image have been twisted into frontal perspectives, a solitary Eigen space is sufficient. Face recognition process is then performed utilizing the Eigen face approach with extra fleeting included. The projection coefficient of all the images of every student are displayed as a Gaussian distribution and face is characterized in view of the probability match.

d) **Attendance Recording:** For the recording of attendance, the use of Microsoft Excel software is used under the MATLAB software toolbox. In MATLAB, the spreadsheet Link EX toolbox software function is used to update the attendance record of the student who

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are present to class from the output receive from face recognition algorithm. If the student is recognized, the attendance recorded is updated with '1' in the java.xlsx Microsoft excel file or else as '0'.

3.5 Algorithm of the System

This system mainly function based on algorithm that have been created in MATLAB software. This algorithm are C++ programming language. They are total 7 algorithm create and each of this algorithm has their own function in running the system perfectly.

3.5.1 Face_detection

```
clc
clear all;
close all;

FDetect = vision.CascadeObjectDetector;


I = Taking_Snapshot();


BB=step(FDetect,I);


figure,imshow(I);
counter=1;
for i = 1:size(BB,1)
            rectangle('Position',BB(i,:),'LineWidth',4,'LineStyle','-','EdgeColor','b');
            face=imcrop(I,BB(i,:));
            fac=imresize(face,[240,320]);
            title('Face Detection');
             savenam = strcat('C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\' ,num2str(counter), '.jpg');
        baseDir  = 'C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\';

        newName  = [baseDir num2str(counter) '.jpg'];

        while exist(newName,'file')
            counter = counter + 1;
            newName = [baseDir num2str(counter) '.jpg'];
        end

        imwrite(fac,newName);



figure,imshow(fac);

end

notmain()
```

Figure 3.6: Working principle of face detection algorithm

Figure 3.6 shows the algorithm used for face detection. The face detection is done using the function vision. CascadeObjectDetector where the image captured by

the webcam is used as the input to this algorithm. This algorithm detect the faces of the student by showing a rectangle box on the students image and resize the image to 240 x 320 eliminating all the other elements found in the captured image and keep in the memory for the face recognition process. This algorithm is the main function used in face recognition which calls all the necessary function and perform the face recognition and give the output of the student's attendance record in Microsoft Excel.

3.5.2 Create Database.m

```
1   function T = CreateDatabase(TrainDatabasePath)
2
3   TrainFiles = dir('C:\Users\rvind\Documents\MATLAB\Attendance\TrainDatabase\');
4   Train_Number = 0;
5
6   for i = 1:size(TrainFiles,1)
7       if not(strcmp(TrainFiles(i).name,'.')|strcmp(TrainFiles(i).name,'..')|strcmp(TrainFiles(i).name,'Thumbs.db'))
8           Train_Number = Train_Number + 1;
9       end
10  end
11
12
13  T = [];
14  for i = 1 : Train_Number
15
16
17      str = int2str(i);
18      str = strcat(str,'.jpg');
19      str = strcat(TrainDatabasePath,str);
20
21      img = imread(str);
22      img = rgb2gray(img);
23
24      [irow, icol] = size(img);
25
26      temp = reshape(img',irow*icol,1);   rs
27
28      T = [T temp];
29  end
```

Figure 3.7: Algorithm used to create database

Figure 3.7 shows the algorithm used to create the database for this project. This algorithm has the function to reshapes all the 2D images found in the TrainDatabase folder into a 1D column vectors. This 1D column vector are then arranged in a row to construct a 2D matrix function. The TrainDatabasePath found in line one describe the path where all the training image are saved. In this project, all the training image are define to be saved in the location path mention in line 3 of the algorithm. The line 18 in the algorithm above function to save the image into the folder by naming the image by corresponding number and saved in 'jpg' image format.

3.5.3 Delete_test.m

```
function  delete_test()

TestFiles = dir('C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\');
Test_Number = 0;

for i = 1:size(TestFiles,1)
    if not(strcmp(TestFiles(i).name,'.')|strcmp(TestFiles(i).name,'..')|strcmp(TestFiles(i).name,'Thumbs.db'))
        Test_Number = Test_Number + 1;
    end
end

for i = 1:Test_Number

    name= strcat('C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\', num2str(i), '.jpg');

    delete(name)
end
```

Figure 3.8: Algorithm used to delete the test images

Figure 3.8 shows the algorithm used to delete the test image after the recognition process is done. The test images are deleted in order to avoid unnecessary memory wastage and increase the response time of the system.

3.5.4 EigenfaceCore.m

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```
function [m, A, Eigenfaces] = EigenfaceCore(T)
m = mean(T,2);
Train_Number = size(T,2);


A = [];
for i = 1 : Train_Number
    temp = double(T(:,i)) - m;
    A = [A temp];
end



L = A'*A;

[V ,D] = eig(L);



L_eig_vec = [];
for i = 1 : size(V,2)
    if( D(i,i)>1 )
        L_eig_vec = [L_eig_vec V(:,i)];
    end
end

Eigenfaces = A * L_eig_vec;

```

Figure 3.9: Algorithm used for face recognition process

The algorithm in Figure 3.9 can be explained clearly using the flowchart in Figure 3.10 which is on the working principle of eigenface. The original image found in the training set are converted into a set of eigenface 'E'. The weight of the each image found in the training folder are calculated and stored in a set called 'W'. When an unknown image 'X' are scanned, the weight of the unknown image are calculated and stored in the vector. This vector 'Wx' are then compared with the weight of the image 'W' stored in the training folder. This is done by considering each weight vector as a point in the face space and calculate the average distance 'D' between the weight of the vector 'Wx' and the weight of the vector of the unknown image 'X'. If the average distance exceed the threshold value θ, then the weight vector of the unknown image 'X' lies too far from the weight vector of the image 'Wx' stored in training folder. As such the unknown face is not the face. If the average distance is less than the threshold value, then it is considered as the actual face as in the training folder.

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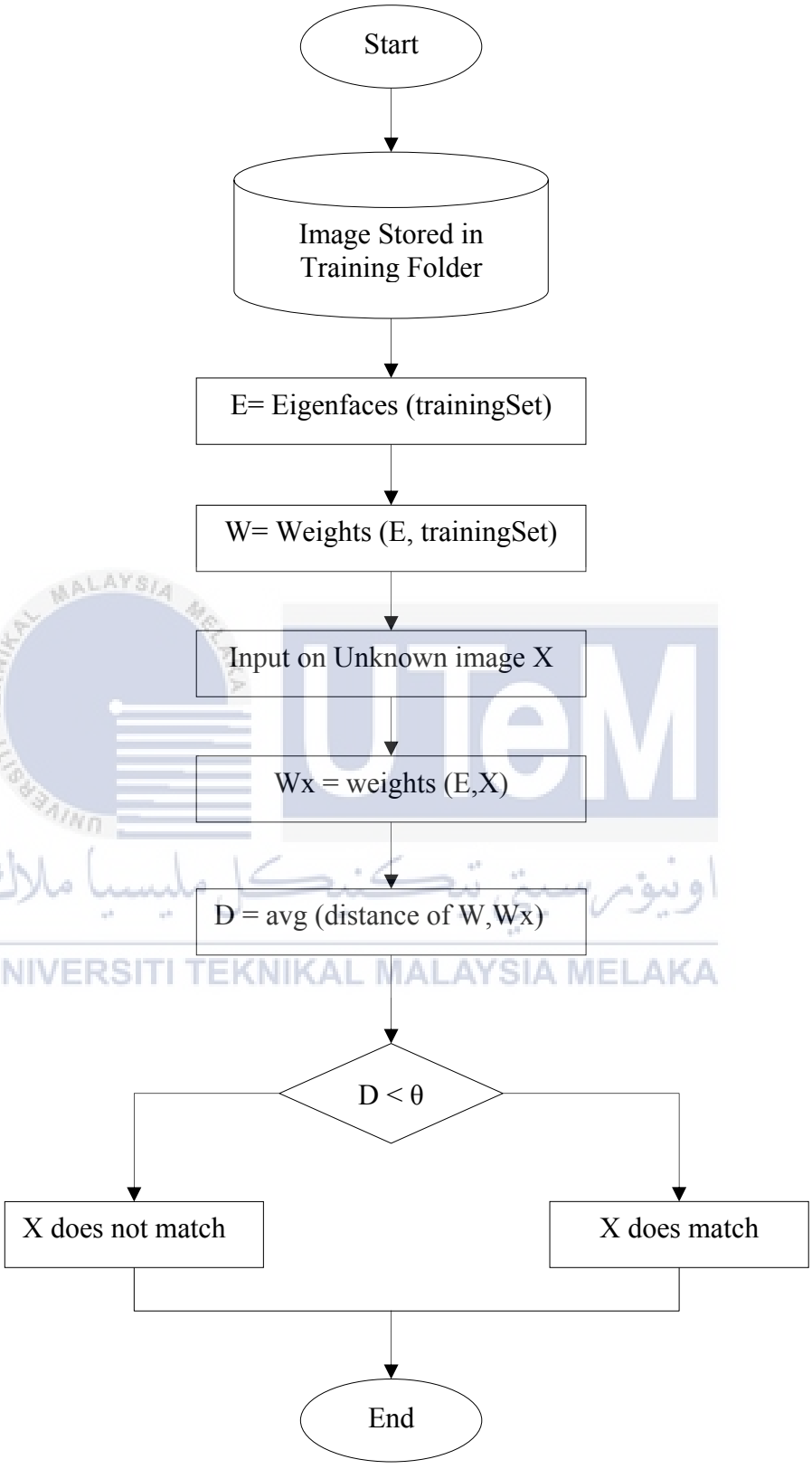

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Figure 3.10: Functioning principle of eigenface based face recognition

3.5.5 Notmain.m

```
1   function notout=notmain()
2
3   clc
4   clear all;
5   close all;
6   TrainDatabasePath = 'C:\Users\rvind\Documents\MATLAB\Attendance\TrainDatabase\';
7   TestDatabasePath = 'C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\';
8
9
10  TrainFiles = dir('C:\Users\rvind\Documents\MATLAB\Attendance\TestDatabase\');
11  Train_Number = 0;
12
13  for i = 1:size(TrainFiles,1)
14      if not(strcmp(TrainFiles(i).name,'.')|strcmp(TrainFiles(i).name,'..')|strcmp(TrainFiles(i).name,'Thumbs.db'))
15          Train_Number = Train_Number + 1;
16      end
17  end
18
19  v=Train_Number;
20  for j = 1:v
21      TestImage  = num2str(j);
22      s=strcat('a',TestImage);
23      TestImage = strcat(TestDatabasePath,'\',char( TestImage),'.jpg');
24      T = CreateDatabase(TrainDatabasePath);
25      [m, A, Eigenfaces] = EigenfaceCore(T);
26      [OutputName,Recognized_index] = Recognition(TestImage, m, A, Eigenfaces);
27      SelectedImage = strcat(TrainDatabasePath,'\',  OutputName);
28      SelectedImage = imread(SelectedImage);
29
30      imshow(SelectedImage);
31      switch Recognized_index
32          case 1
33              strmsg1 = 'The recognised person is ';
34              msg = [strmsg1 'ARVIND'];
35              msgbox(msg);
36              sd=strcat('D',num2str(1));
37               se=strcat('E',num2str(1));
38               dt = datestr(now,'mmmm dd, yyyy HH:MM AM');
39              dt=char(dt);
40               xlswrite('java.xlsx',dt,'Sheet1',se);
41              xlswrite('java.xlsx','1','Sheet1',sd);
42
43          case 2
44              strmsg1 = 'The recognised person is ';
45              msg = [strmsg1 'ARVIND'];
46              msgbox(msg);
47              sd=strcat('D',num2str(1));
48              se=strcat('E',num2str(1));
49               dt = datestr(now,'mmmm dd, yyyy HH:MM');
50               dt=char(dt);
```

Figure 3.11: Working principle of notmain.m algorithm

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Figure 3.11 shows the algorithm used to create the database of the student. This algorithm works together with createDatabase.m and face detection algorithm. The main function of this algorithm is to define the name of the students, give output results of the students in Microsoft excel and produce output dialog on the person recognition results. Referring to line no 38 and 40 where the algorithm record the time and date into the excel spread sheet document file ‘java.xlsx’.

3.5.6 Training.m

```
for ind=1:3
    vid = videoinput('winvideo',1);
    vidRes = get(vid, 'VideoResolution');
    nBands = get(vid, 'NumberOfBands');
    hImage = image( zeros(vidRes(2), vidRes(1), nBands) );
    preview(vid,hImage);
    img = getsnapshot(vid);
    imshow(img);
    FDetect=vision.CascadeObjectDetector('FrontalFaceCART');
    BB=step(FDetect,img);
    imshow(img);
    hold on
    for i=1:size(BB,1)
        rectangle('position',BB(i,:),'Linewidth',5,'Linestyle','-','Edgecolor','r');
    end
    hold off
    N=size(BB,1);
    counter=1;
    for i=1:N
        face=imcrop(img,BB(i,:));
        savenam = strcat('C:\Users\rvind\Documents\MATLAB\Attendance\TrainDatabase\' ,num2str(counter), '.jpg');
        baseDir  = 'C:\Users\rvind\Documents\MATLAB\Attendance\TrainDatabase\';
        newName  = [baseDir num2str(counter) '.jpg'];
        while exist(newName,'file')
            counter = counter + 1;
            newName = [baseDir num2str(counter) '.jpg'];
        end
        fac=imresize(face,[240,320]);
        imwrite(fac,newName);
        imshow(face);
        pause(2);
    end
    delete(vid);
end
```

Figure 3.12: Algorithm used to capture student image for database

Figure 3.12 above shows the algorithm used to capture the image of the students for database collection. When this algorithm is executed, the system activates the webcam and capture three image of the student continuously. The system then detect the faces of the student using the viola-jones technique and eliminate other elements in the image before storing the image in the TrainDatabase folder.

3.6 Experiment 1: Varying Number of person

In this experiment, the analysis is done by varying the number of person the system able to recognise correctly. This experiment is repeated for 50 times under the same distance of the webcam and light intensity rate. Each time the webcam capture the image of the camera, the output of the system to recognise the person or unrecognised is counted and recorded. Besides that, the number of student is manipulated from 1 to 5 students each time the system is run. This is performed to examine the accuracy of the system under different number of students at a time. The

percentage of accuracy is calculated based of the number of times the system correctly recognise the students for each case. If the accuracy level is high, the system can be classified as reliable otherwise unreliable.

3.7 Experiment 2: Varying Distance of Webcam

In this experiment, the permissible distance of the webcam from the students in the lecture room is varied. The distance from the camera is varied from 3 feet to 9 feet. This experiment is done to study the effect of distance which contributes to the output results of the system in terms of the recognition of the student.

3.8 Experiment 3: Lighting Effect

In this experiment, the performance of the system is studied by varying the lighting condition the image is captured which is in dim and bright lighting condition. This is done by running the experiment under full lecture room lighting (100%) for bright lighting condition and turning off few lights (40%) in the lecture room for the dim lighting condition. This experiment is repeated for 10 times with different face expression.

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3.9 Gantt Chart

A gantt chart is very important in very project as this chart will conclude the entire project schedule, resources, requirement and limitation in the project. Furthermore, gantt chart is important as this chart will discipline the person to complete the project on time without any delays. From this chart also, we will know what to do when as this chart is divided by weeks. The gantt chart for this project has been attach in the appendix section of this report.

3.10 Summary

In this chapter, all the working steps, method used, and application that was use in this project have been discussed in detail. Besides that, the explanation on the algorithm used also has been discussed.

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CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter discussed the output results from the experiment done using the proposed automated attendance system which was developed. The results on this system were obtained by running the source code manually in MATLAB software. Besides that, three types of analysis is done in this section to measure the performance and reliability of the developed system which is investigated by running repeatability test with different number of subject, lighting effect and permissible distance from camera.

4.1.1 Collection of Training Dataset

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Before the students are recognized, the student database is created using the training.m MATLAB file. Using the 5 students, three images of each student is obtained. These images are captured using the external web camera which is connecting to MATLAB via computer 2.0 USB port. When the training.m is debugged in MATLAB software, the external webcam is activated and start capturing the image of the students. This image is then process internally to detect the faces of the students and cropping the image of the students face. Once the student image us cropped, the faces are then saved in TrainDatabase folder. By running this training.m file, the student face is captured three times and save three images in the TrainDatabase folder. Figure below show the result obtained for collection of training database.

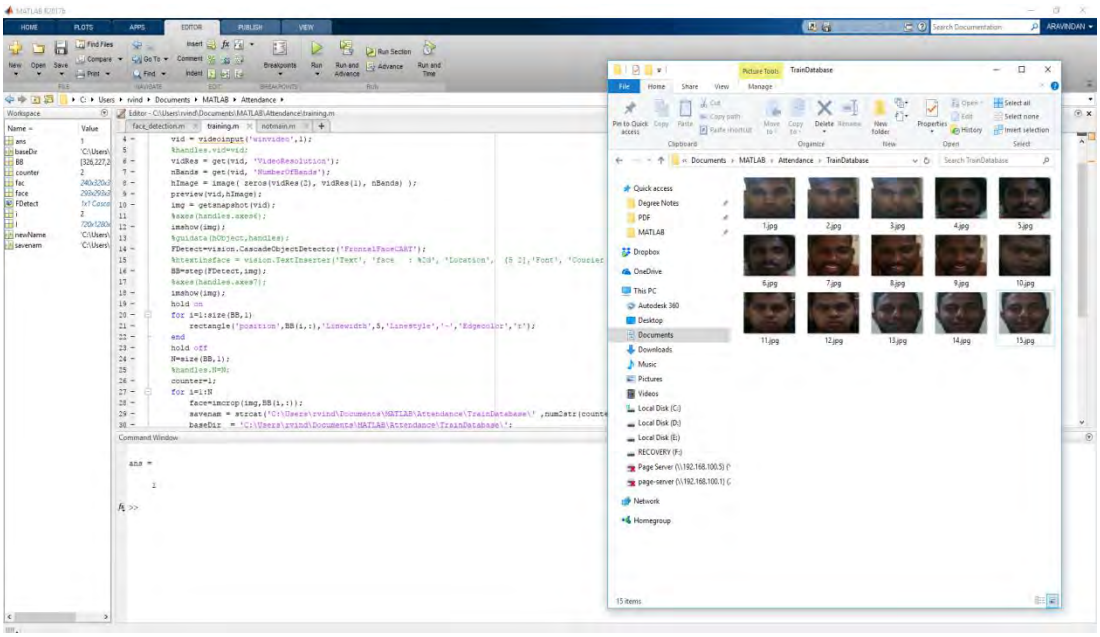

Figure 4.1: Collection Of Training Database

4.1.2 Face Recognition

Once the training database is obtained and saved in the TrainDatabase folder, the images are ready to be compared. When the testing process start by running the face_detection.m, the external web camera capture the image of the lecture room and detect the face of the students and eliminated all the other elements present in the image and compare the detected face with the faces found in the TrainDatabase folder. If the algorithm finds the best match of the faces, the system produce an output in a dialog based saying that 'The recognized person is Arvind'. If the system doesn't find the right match, the system simply ignores the faces. Figure 4.2 shows the results obtain using this system.

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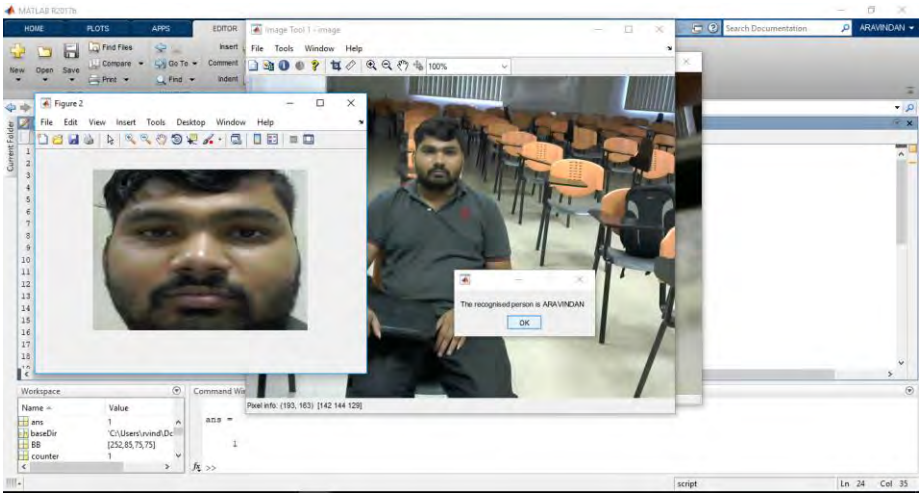

Figure 4.2: Result Obtain For Face Recognition

4.1.3 Output in Microsoft Excel

Once the student is recognized and the recognition dialog box appear, the output on the student attendance record will be updated in Microsoft Excel file 'java.xlsx' file. If the student is present, a '1' is passed under the particular student's name. Besides that, the date and time is also recorded on the excel sheet for reference. The time and date are recorded in the format of MONTH: DD: YEAR and time is recorded on 24hour clock. Figure 4.3 below shows the example of the output recorded in Microsoft excel.

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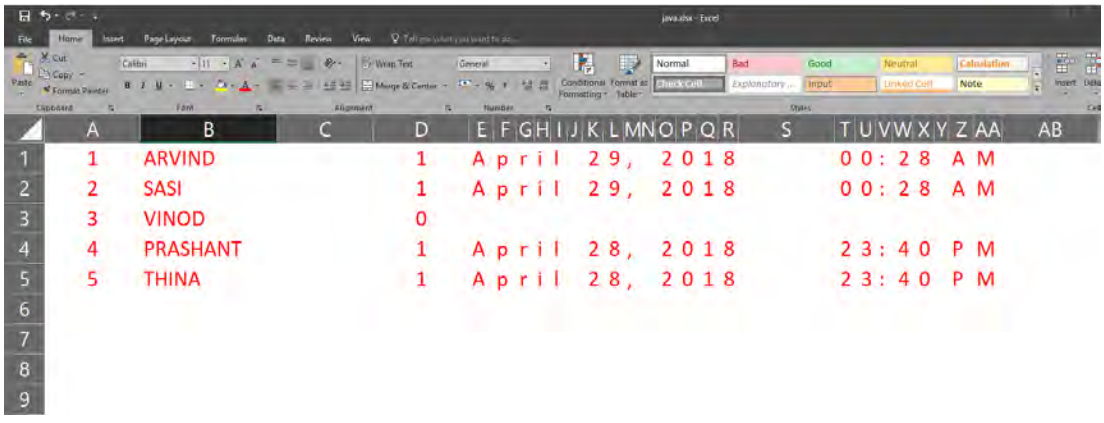

	A	B	C	D	E F G H I J K L M N O P Q R	S	T U V W X Y Z AA	AB
1	1	ARVIND		1	A p r i l 2 9, 2 0 1 8		0 0 : 2 8 A M	
2	2	SASI		1	A p r i l 2 9, 2 0 1 8		0 0 : 2 8 A M	
3	3	VINOD		0				
4	4	PRASHANT		1	A p r i l 2 8, 2 0 1 8		2 3 : 4 0 P M	
5	5	THINA		1	A p r i l 2 8, 2 0 1 8		2 3 : 4 0 P M	
6								
7								
8								
9								

Figure 4.3: The Output Result on Students Attendance Record

4.2 Analysis

For the analysis part, a total three experiment is carried to test and understand the system performance in terms of accuracy and reliability. The first test is done by examining the accuracy by varying the number of person in the frame each time the image is captured for face recognition test. Besides that, the reliability of the system is examined by capturing the student's image under different permissible distance between the student and webcam. Lastly, the system is run under different lighting percentage of the lecture room.

4.2.1 Varying Number of Person

Table 4.1: Results Obtained Through Simulation in MATLAB Software

No of Times	No of Person		
	1	2	5
1	YES	YES	YES
2	YES	YES	YES
3	YES	NO	YES
4	YES	NO	NO
5	NO	YES	YES
6	YES	YES	YES
7	YES	YES	NO
8	YES	YES	YES
9	YES	NO	YES
10	YES	YES	YES
11	YES	YES	YES
12	YES	YES	YES
13	NO	YES	YES
14	YES	YES	YES
15	YES	YES	YES
16	YES	NO	YES
17	YES	YES	YES
18	YES	YES	YES
19	YES	YES	YES
20	YES	YES	YES
21	YES	YES	NO
22	NO	YES	YES
23	YES	YES	YES
24	YES	YES	YES
25	YES	YES	YES

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26	YES	YES	YES
27	YES	YES	YES
28	YES	YES	YES
29	YES	YES	YES
30	YES	YES	YES
31	YES	YES	YES
32	YES	YES	YES
33	YES	YES	NO
34	YES	YES	NO
35	YES	YES	YES
36	YES	YES	YES
37	YES	NO	YES
38	YES	YES	YES
39	YES	YES	YES
40	YES	YES	YES
41	YES	YES	YES
42	YES	YES	YES
43	YES	YES	YES
44	NO	YES	YES
45	YES	NO	YES
46	YES	YES	YES
47	YES	YES	NO
48	YES	YES	YES
49	YES	YES	YES
50	YES	YES	NO
Total 'YES'	46	44	43
Total 'NO'	4	6	7
Accuracy, %	92	88	86

Accuracy percentage calculated:

$$A = 1 - \left|\frac{Yn - Xn}{Yn}\right| \quad (4.1)$$

$$Accuracy, \% = A \times 100 \quad (4.2)$$

Where,

Yn = Total number of times the experiment is repeated

Xn = Total number of successful recognition done by the system

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Accuracy for 1 no of person,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$
$$= 92\ \%$$

Accuracy for 2 no of person,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$
$$= 88\ \%$$

Accuracy for 5 no of person,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$
$$= 86\ \%$$

Table 4.1 shows the experiment done to examine the performance of the face recognition by using different number of person in an image which is 1, 2, and 5. Figure 4.4 and Figure 4.5 shows the example of result obtained in MATLAB simulation software for 2 person and 5 person in an image respectively. The permissible distance between the webcam and the students is keep constant with 3 feet distance and the experiment is done under a bright lighting condition. Firstly, the system is run for 50 times by capturing the image of the student with different expression and matching with the image that have been stored in the TrainDatabase folder. For experiment done with one person at a time, the system able to recognition the student correctly for 46 times out of 50 test done and the accuracy calculated is 92%. For the experiment done with two person at a time, the system able to recognition the student correctly for 44 time out of 50 test done and the accuracy calculated is 88%. Lastly, for the experiment done with 5 person at a time, the system able to recognition the student correctly for 43 times out of 50 test done and the accuracy calculated is 86%.

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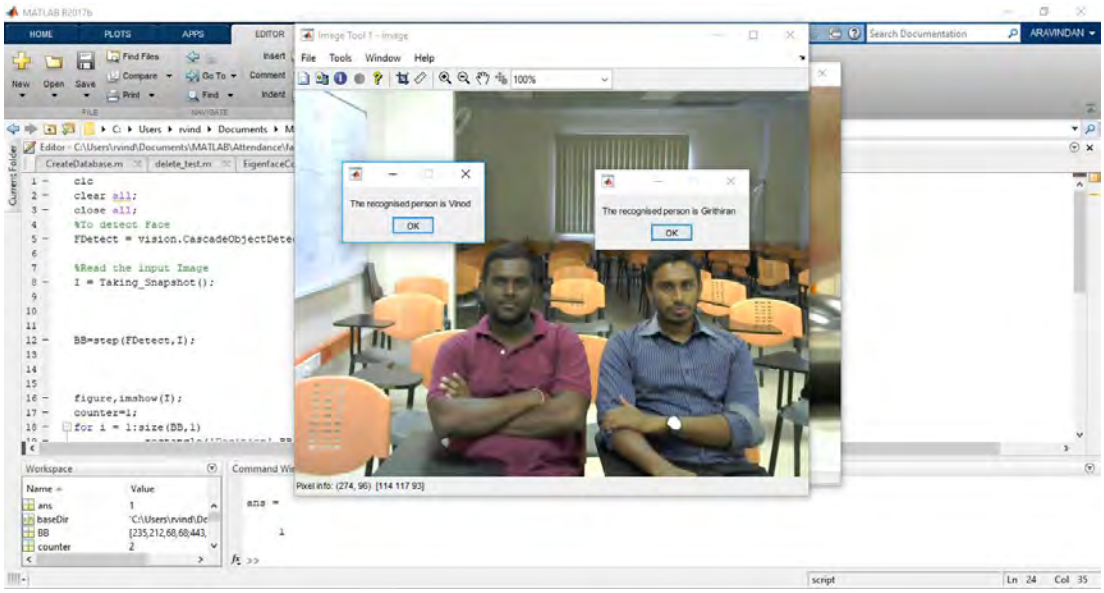

Figure 4.4: Example of 2 person in an Image with successful recognition result

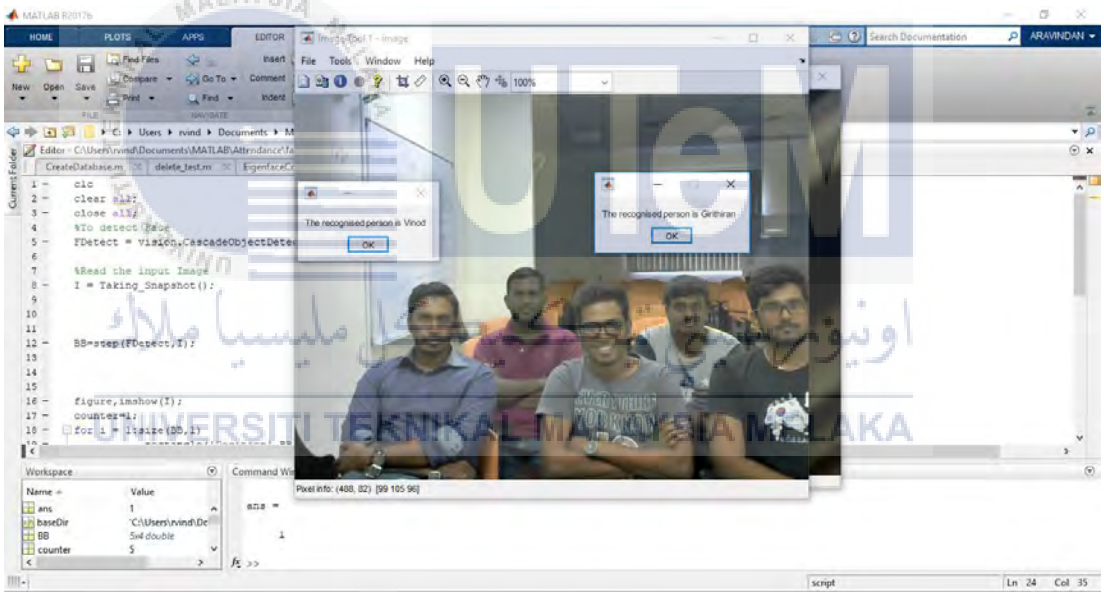

Figure 4.5: Example of 5 person in an Image with uncompleted recognition result

From the experiment perform and data collected, it is proven that the system accuracy changes as the number of person increases. However, the accuracy calculated for the other cases still above the acceptance % which is above 80%. Therefore, this system is reliable in recognising the student even when number person in the lecture room is increased as the system able to recognise the student as a genuine.

As shown in Figure 4.6, the results gain from 5 person gives a lower performance which is 46 successful recognition while test results gain from 1 person gives a better

performance. From this experiment, results obtained from 1 numbers person gives best number successful recognition times.

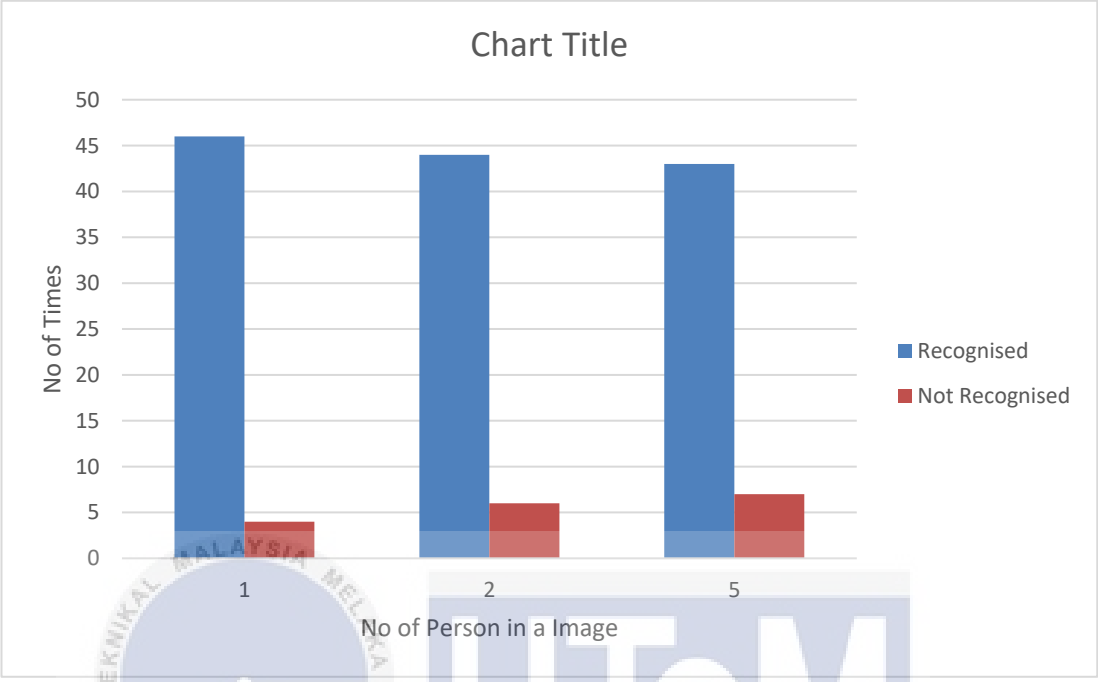

Figure 4.6: Bar Chart for Different Number of Person

4.2.2 Varying Distance from Webcam

Table 4.2: Results Obtained for Different Distance from Webcam

No of Times	Permissible Distance from Webcam (ft.)		
	3	6	9
1	NO	NO	NO
2	YES	NO	NO
3	YES	NO	NO
4	YES	NO	NO
5	YES	YES	NO
6	YES	NO	NO
7	YES	YES	NO
8	YES	NO	NO
9	YES	NO	NO
10	YES	YES	NO
11	YES	NO	NO
12	YES	YES	NO
13	YES	YES	NO
14	YES	NO	NO
15	YES	NO	NO

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16	YES	NO	NO
17	YES	NO	NO
18	YES	YES	NO
19	YES	NO	NO
20	YES	NO	NO
21	YES	NO	NO
22	NO	NO	NO
23	YES	NO	NO
24	YES	NO	NO
25	YES	YES	NO
26	YES	NO	NO
27	YES	NO	NO
28	YES	NO	NO
29	YES	NO	NO
30	YES	NO	NO
31	YES	NO	NO
32	YES	NO	NO
33	YES	NO	NO
34	YES	NO	NO
35	YES	NO	NO
36	YES	NO	NO
37	YES	NO	NO
38	YES	NO	NO
39	YES	YES	NO
40	YES	NO	NO
41	YES	YES	NO
42	YES	NO	NO
43	YES	YES	NO
44	NO	NO	NO
45	YES	NO	NO
46	YES	NO	NO
47	YES	NO	NO
48	YES	NO	NO
49	YES	NO	NO
50	YES	NO	NO
Total 'YES'	47	9	0
Total 'NO'	3	41	50
Accuracy, %	94	18	0

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Accuracy with 3 feet distance,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$

$$= 94\ \%$$

Accuracy with 6 feet distance,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$
$$= 18\ \%$$

Accuracy with 9 feet distance,

$$Accuracy, \% = 1 - \left|\frac{Yn - Xn}{Yn}\right| \times 100$$
$$= 0\ \%$$

Table 4.2 shows the results obtained under different permissible distance between the webcam and the student. In conducting this test, the number of person in a frame is maintain as one and the lighting effect in which the image is capture is under bright light. From the results obtain from running the system under this parameters, it is proven that the system performance is effected by the permissible distance between the webcam and the student. From the results the accuracy is calculated to determine the system reliability in terms of distance from the webcam and it can be concluded that the system performance decreases as the permissible distance between webcam and the student is increase.

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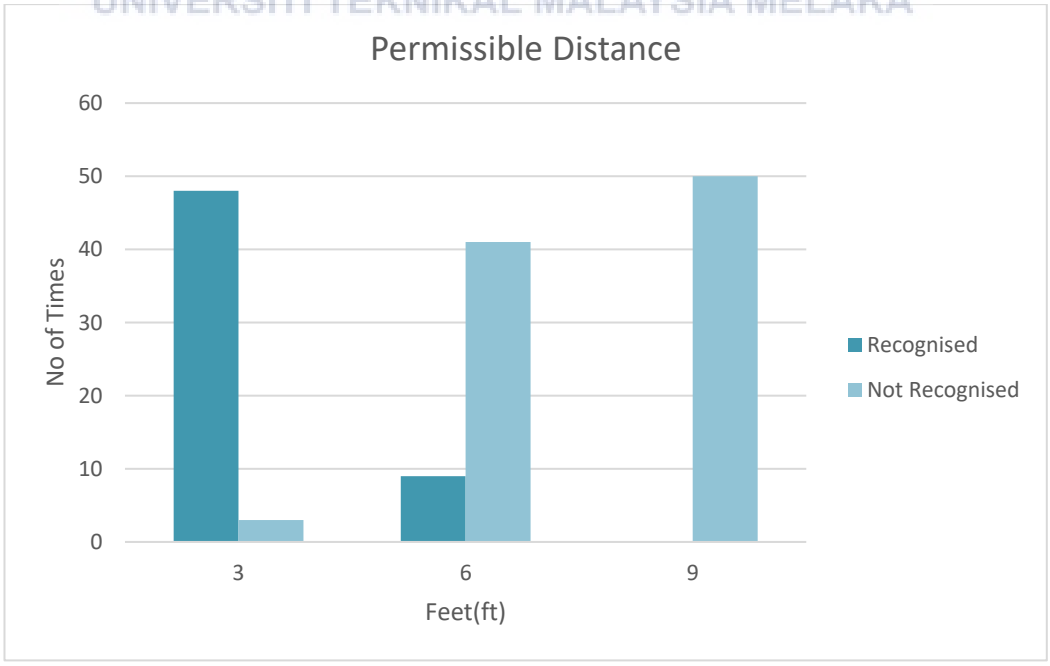
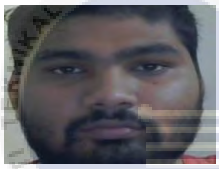


Figure 4.7: Graph for Different Permissible Distance from Webcam

Figure 4.7 above shows the bar graph analysed with three different permissible distance between the webcam and the student with 50 tests. It is proven that the face recognition done under the 3 feet distance record a high accuracy percentage compare to 6feet and 9feet. Therefore, the best ideal distance to run this system to get a perfect match for the face recognition is 3 feet distance.

4.2.3 Lighting Effect

Table 4.3: Results Obtained for Different Lighting Effect

Image	Bright Light	Image	Dim Light
	YES		YES
	YES		YES
	YES		YES
	YES		YES
	YES		YES
	YES		YES
	YES		YES

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	YES		YES
	YES		YES
	YES		YES
Total Recognise 'YES'	10	Total Recognise 'YES'	10
Total Not Recognise 'NO'	0	Total Not Recognise 'NO'	0
Accuracy	100%	Accuracy	100%

Table 4.3 shows the system performance in recognising the student correctly with different lighting effect which is under dim and bright lighting. Firstly in this experiment, 10 images are captured using the webcam with full lecture room lighting (100% of lecture room lighting) and capture the image with 40% of lecture room lighting. By running the system with the above lighting effect, the output of the system is recorded by getting the student image tested for face recognition. For both the condition which is under dim lighting condition (40%) and bright lighting condition (100%), the system able to give 100% accuracy this is because of the webcam used in this experiment. The webcam Logitech C310 has a build in technology where the webcam will automatically adjust the surrounding lighting to produce a best possible image.

4.3 Summary

In this chapter, all the results has been discuss in detail. All the output results are based on the simulation done using the MATLAB software. There are several experiment that was conducted such as face recognition accuracy by varying the number of student in each captured image, manipulating the distance the lecture room

image is captured from the webcam and lastly testing the lighting effect which contribute to the recognition results of the students. This experiments are conducted to examine the performance of the system in terms of accuracy and reliability.

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CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

For the conclusion, this project was undertaken to develop an automated attendance system based on facial recognition by using the viola jones technique for face detection and principle component analysis via Eigen face approach. The students attendance record is stored using the spread link EX software function which available in MATLAB software. This project is very useful for all the lecturers who are taking attendance of the students in daily classroom as this system able to reduce the time and effort taken and increase the lecture timing.

This chapter represents the conclusion for this final year project report. During the preparation of this report, many new knowledge, technology and information have been gathered and learned has been implemented in developing this system. For capture the image of the student, an external webcam is connect to the system to capture the image of the students. The face detection will be used as a pre-processing to detect the face from the full image of the students when the captured image is processed. In developing this system, the knowledge on MATLAB software has been enhance as this system mainly uses MATLAB software as the main software to run the face detection and face recognition algorithm. Besides that, in developing this project also, the knowledge on linking the attendance recording system using the Microsoft Soft Excel has been learned. Therefore, in doing this project, the knowledge on programming can be enhance.

Furthermore, in this project also they are few experiments are been done to study and analyse the system performance in terms of accuracy and reliability. As this project is a verification orientated system, the analysis focus more on the accuracy to ensure

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the system able to recognise the students correctly and record the attendance. For this project, a total 5 students has been used to analyse the performance of the system. The first experiment done to analyse the performance is done by varying the number of students each time the webcam capture the classroom image. Besides that, varying the distance between the webcam and the students. Lastly, the system is examined in terms of lighting effect. From the results obtained by running the simulation on the MATLAB software, it is clear that the increase in number of students each time the lecture image does not affect much to the performance of this system since the accuracy level still above 80%. Besides that, it is proven that the lighting effect does not affect the overall system performance until a high technology webcam is used.

Lastly, the system also very sensitive to the distance between the webcam and the students as this is proven through the results obtained. In overall, this system proven to be accurate and reliable to recognise the students and record their attendance. As completing this project, all the objective that been mention in chapter 1 have been successfully completed and achieved.

5.2 Recommendation

As time pass by, there are new technology being invented every day and for this technology there are still a long way more to go for this technology being used in the global industry. Therefore it is recommended that this system should be implement through the Internet of Things (IoT) based system so that it will be easier for the administration staff at the faculty to view the attendance report via internet which will save plenty of time. Besides that, this system shall be improvise to encounter the problem arise due to the distance between the webcam and the student. It is also recommended that a graphical user interface to be develop (GUI) so that the process of running and creating database can be made easier.

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APPENDIX A

Table 5.1: Gantt Chart

	FYP 1					FYP 2				
Week	**1-3**	**4-6**	**7-9**	**10-12**	**13-14**	**1-3**	**4-6**	**7-9**	**10-12**	**13-14**
Briefing										
Registration										
Gantt Chart										
Literature Review										
Objective										
Scope										
Project Background										
Methodology										
Preliminary Results										
Continue Progress										
Experiment and analysis										
Results and Data										
Report Preparation										
Report Submission										

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APPENDIX B

FYP Arvind

ORIGINALITY REPORT

19%	13%	7%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universiti Teknikal Malaysia Melaka Student Paper	2%
2	Submitted to Higher Education Commission Pakistan Student Paper	2%
3	www.ijsr.net Internet Source	2%
4	Shireesha Chintalapati, M.V. Raghunadh. "Automated attendance management system based on face recognition algorithms", 2013 IEEE International Conference on Computational Intelligence and Computing Research, 2013 Publication	1%
5	www.learningace.com Internet Source	1%
6	Submitted to Universiti Malaysia Perlis Student Paper	1%

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