"Automated Attendance System Using Face Recognition"

Project Report

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Engineering

by

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This is to certify that the project entitled ***Automated Attendance System Using Face Recognition*** is a bonafide work of **Khan Suhel**(11CO25), **Zakariya Mohd Hussain**(12CO63), **Khan Shoeb**(11CO24), **Pathan Nazim**(11CO21) submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Department of Computer Engineering**.

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Project Approval for Bachelor of Engineering

This project entitled ***Automated Attendance System Using Face Recognition*** by ***Khan Suhel*** is approved for the degree of ***Bachelor of Engineering in Department of Computer Engineering.***

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Declaration

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Abstract

The objective of this system is to present an automated system for human face recognition for an organization or institute to mark the attendance of their students or employees. This paper introduces face detection method using the Voila and Jones algorithm and recognition using correlation technique. The system will record the attendance of the students in class room environment. The above system is fully automated and easily deployable. User gets an authentication to upload the image containing file and also to view the attendance.

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Contents

List of Figures

List of Tables

Keywords And Glossary

Keywords :
Automated, Face Detection, Face Recognition, Voila and Jones Algorithm, Correlation, Attendance.

Glossary :

Face Detection: Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images.

Face Recognition: It is a type of biometric software application that can identify a specific individual in a digital image by analysing and comparing patterns.

Viola and Jones Algorithm: A widely used method for real-time object detection.

OpenCV(Open Source Computer Vision:) is a library of programming functions mainly aimed at real-time computer vision.

ROI: Region of Interest.

Correlation: Correlation refers to any of a broad class of statistical relationships involving dependence.

Chapter 1

Project Overview

1.1 Introduction

In many Institution and Organization the attendance is a very important factor to maintain the record of lectures, salary and work hours etc. Most of the institutes and organizations follow the manual method using old paper and file method and some of them have shifted to biometric technique. The current method that colleges use is that the professor passes a sheet or make roll calls and mark the attendance of the students and this sheet further goes to the admin department with updates the final excel sheet. This process is quite hectic and time consuming. Also, for professors or employees at institutes or organizations the biometric system serves one at a time. So, why not shift to an automated attendance system which works on face recognition technique? Be it a class room or entry gates it will mark the attendance of the students, professors, employees, etc. This system uses Viola and Jones algorithm for detecting and recognizing the faces. The main elements of this technology are as follows : a) Face Detection b) Face Recognition

a) Face Detection:

Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face detection also refers to the psychological process by which humans locate and attend to faces in a visual scene. Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars. Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process. A reliable face-detection approach based on the genetic algorithm and the eigen-face technique: Firstly, the possible human eye regions are detected by testing all the valley regions in the gray-level image. Then the genetic algorithm is used to generate all the possible face regions which include the eyebrows, the iris, the nostril and the mouth corners. Each possible face candidates is normalized to reduce lightning effect caused due to uneven illumination and the shirring effect due to head movement. The fitness value of each candidate is measured based on its projection on the eigen-faces. After a number of iterations, all the face candidates with a high fitness value are selected for further verification. At this stage, the face symmetry is measured and the existence of the different facial features is verified for each face

candidate.

b) Face Recognition:

A facial recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Some facial recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful systems is based on template matching techniques applied to a set of salient facial features, providing a sort of compressed face representation. Recognition algorithms can be divided into two main approaches, geometric, which looks at distinguishing features, or photometric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances. Popular recognition algorithms include Principal Component Analysis using eigenfaces, Linear Discriminate Analysis, Elastic Bunch Graph Matching using the Fisherface algorithm, the Hidden Markov model, the Multilinear Subspace Learning using tensor representation, and the neuronal motivated dynamic link matching.

1.1.1 Motivation

The main motivation for us to go for this project was the slow and inefficient traditional manual attendance system. This made us to think why not make it automated fast and mush efficient.
Also such face detection techniques are in use by department like crime investigation where they use cctv footages and detect the faces from the crime scene and compare those with criminal database to recognize them.
Also facebook, it uses an algorithm called deep face whose accuracy to recognize is 97.25% which is as close as what humans have that is 97.53%.

1.1.2 Advantages Over Current System

The previous approach in which manually taking and maintains the attendance records was very inconvenient task. Traditionally, student's attendances are taken manually by using attendance sheet given by the faculty members in class, which is a time consuming event. Moreover, it is very difficult to verify one by one student in a large classroom environment with distributed branches whether the authenticated students are actually responding or not. The ability to compute the attendance percentage becomes a major task as manual computation produces errors, and also wastes a lot of time. This method could easily allow for impersonation and the attendance sheet could be stolen or lost. An automatic attendance management system using biometrics would provide the needed solution. The results showed improved performance over manual attendance management system. Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years since, instead of authenticating

people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys and so forth, these methods examine an individual's physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. Biometric based technologies include identification based on physiological characteristics (such as face, fingerprints, finger geometry, hand geometry, hand veins, palm, iris, retina, ear and voice) and behavioral traits (such as gait, signature and keystroke dynamics). Face recognition appears to offer several advantages over other biometric methods, a few of which are outlined here: Almost all these technologies require some voluntary action by the user, i.e., the user needs to place his hand on a hand-rest for fingerprinting or hand geometry detection and has to stand in a fixed position in front of a camera for iris or retina identification. However, face recognition can be done passively without any explicit action or participation on the part of the user since face images can be acquired from a distance by a camera. This is particularly beneficial for security and surveillance purposes. Furthermore, data acquisition in general is fraught with problems for other biometrics: techniques that rely on hands and fingers can be rendered useless if the epidermis tissue is damaged in some way (i.e., bruised or cracked).

1.1.3 Proposed System Architecture

The System Architecture Consists of basically three layers that is, the Application Layer, the System Layer and the Databases layer.

1.1.3.1 Application Layer

There is the capturing phase in this the user captures the frames and using a web app that runs on almost all platforms upload the file to the server. Authentication is provided to the users. This web app is used to upload captured frames as well as to view the attendance.

1.1.3.2 System Layer

This is the layer where the processing is done that is the detection and recognition part at the server side. Viola and Jones algorithm is used to detect images from the frames. Initially an integral image is generated from the frame which simply assigns numbers to the pixels generated by summing up the values. Further to detect the objects from the frames the haar-like feature is generated and as millions of features being generated adaboost(boosting algorithm) is used to enhance the performance. The extracted features are passed through a trained classifier which detects the faces from the objects.
These detected faces are cropped and passed through the recognition module which by applying correlation to the cropped images and the images in the databases recognizes the faces.

1.1.3.3 Database Layer

The Database layer is a centralized database system which consists of student database and their attendance. The student database is formed by initial feeding of the frames from which system detects faces crops them and stores it to the database and these stored images are hence forth used for the recognition part. The results of the face recognition module are compared with the images from the student database and after the successful comparison the attendance is updated to the database. The sheet is generated and uploaded to the web app.

1.1.4 Formulation of Problem With using Technology

It really is tedious to use those paper sheets to mark the attendance as there are many classes in an institute and each class has many students. These many sheets and entries are to be entered manually to keep the record. This is quite hectic and time consuming. What if an automation is brought up in such systems and also the paper work is eliminated? The most common way to identify any human being is through his/her face. So why not mark the attendance of students or employees using face and recognition technologies! The current most efficient algorithm available is Viola and Jones algorithm which uses LBP functions and is available openly on OpenCV. Any employee or teacher has a mobile phone or a laptop with a camera and can use it to click the picture and upload to the system to mark the attendance. Web based applications are widely used in any company or institute due to their security and user friendly options. Hence, the idea is to build a web based application which provides user authentication, a dashboard with various charts, image upload and generates an attendance data sheet.

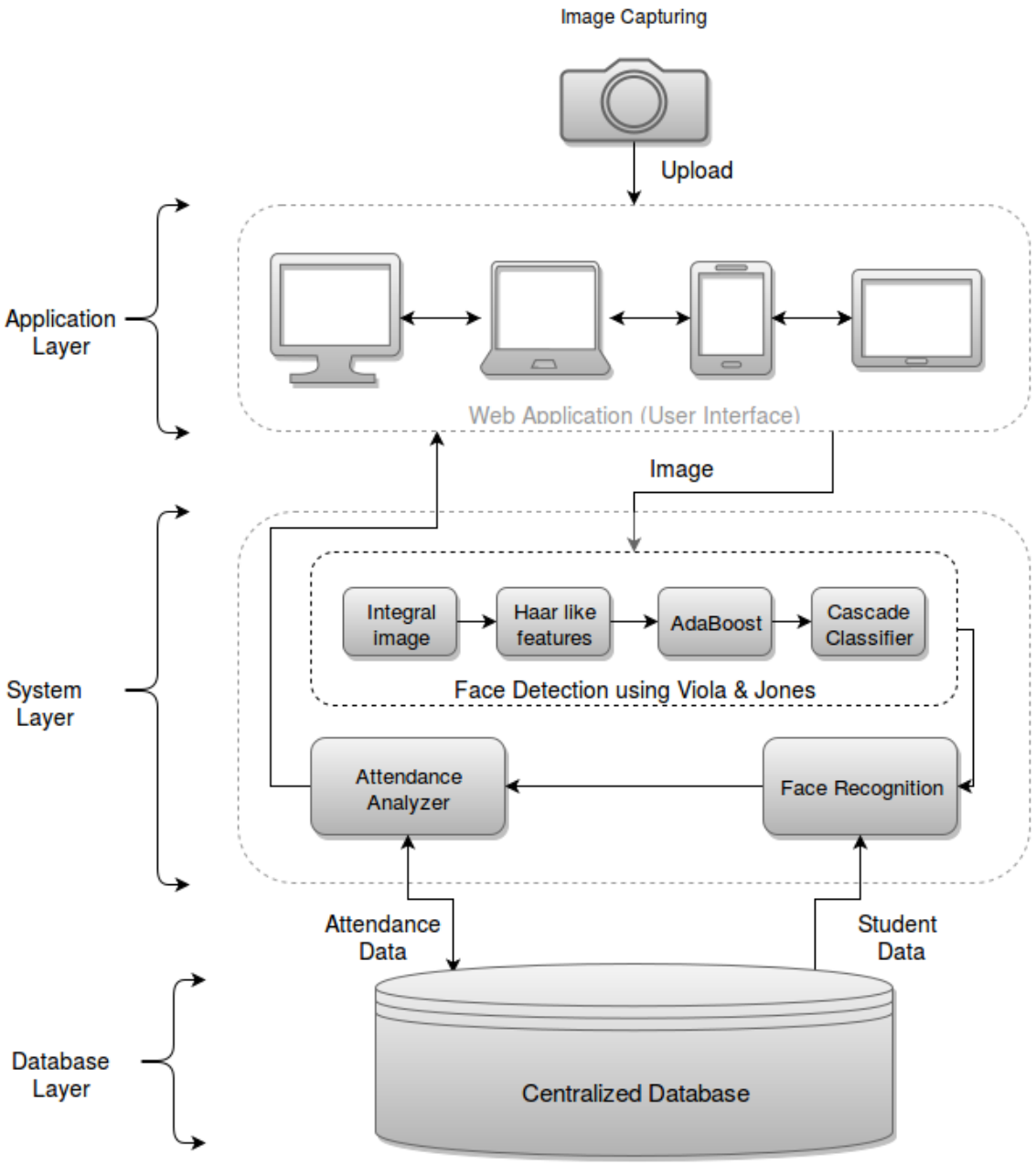

Figure 1.1: System Architecture

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1.1.5 Viola and Jones Algorithm

Viola and Jones Algorithm In project we are using Viola and Jones algorithm for object detection. The Viola–Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by the problem of face detection. Viola and jones is currently one of the best algorithms to detect the faces of human. This algorithm mainly has following functionality.

A. Face Detection
• Integral image or summed area table is a data structure and algorithm for quickly and efficiently generating the sum of values in a rectangular subset of a grid. In the image processing domain, it is also known as an integral image.
• Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with haar wavelets and were used in the first real-time face detector.
• Adaboost (adaptive boost) meta-algorithm formulated by yoav freund and robert schapire which is use to improve the performance of other algorithm. Viola and jones extracts the millions of features (pixels) for comparison so, we adaboost to enhance the overall performance and calculation speed of the algorithm.
• Cascade classifier is a particular case of ensemble learning based on the concatenation of several classifiers, using all information collected from the output from a given classifier as additional information for the next classifier in the cascade. Unlike voting or stacking ensembles, which are multi-expert systems, cascading is a multistage one.

B. Face Recognition
• Initially the ROI is extracted from the source face image, ROI is the sub image and is smaller than the original image.
• Normalized Cross-Correlation is performed on ROI and target image to find the peak coordinates.
• The total offset or translation is carried out based on the position of the peak in the cross correlation matrix.
• Check for the successful extraction of face from target image and figure out where the face exactly matches inside of target image.

1.2 Organization of the Project

The remaining part of the project is organized as follows.

Chapter 2 presents a review of related work.

Chapter 3 introduces the Software and Hardware Requirement of the project.

Chapter 4 proposes the Project Design of the Project . It represent the architectural design, front end design and database design of the project.

Chapter 5 introduces the system model and some basic assumptions and Dependencies of our work.

Chapter 6 presents the Results and Test cases related work.

Chapter 7 Described the time management and time utilization during the Project implementation.

Chapter 8 Described the Workload distribution.

Chapter 9 provides some concluding remarks and directions of our future work.

Chapter 2

Literature Review

2.1 Automated Attendance System Using Face Recognition Through Video Surveillance

2.1.0.1 Abstract

The objective of this system is to present an automated system for human face recognition in a real time background for an organization to mark the attendance of their employees or student. So automated attendance using real time face recognition is a real world solution which comes with day to day activities of handling employees or student. The task is very difficult as the real time background subtraction in an image is still a challenge. In the past two decades, face detection and recognition has proven to be very interesting research field of image processing. The work carried out describes an automated attendance system using video surveillance. The proposed algorithm is automatic and efficient in intelligent surveillance applications. Video surveillance is used to detect the object movement thereby the captured image undergoes face detection and recognition process and searches the student database and enters the attendance if it is valid in the list[1].

2.1.0.2 Proposed Algorithms

This paper uses Viola and Jones algorithm for face detection and correlations formulas for face recognition.
Viola and Jones algorithm is used for face detection. Where it is used in both creating database and face recognition process. Where in case creating database it takes input image through a web camera continuously. Captured image undergoes face detection. Detected face will be cropped and stored in database. Where in case of face recognition if there is any movement video surveillance will be used to detect the moving object. The captured image undergoes face detection and further processed later by face recognition.

Cross-Correlation and Normalized-Correlation are used to extract the Coordinates of peak with the RIO and target images.The peak of the cross-correlation matrix occurs where the sub images are best correlated.Find the total offset between the images. The total offset or translation between images depends on the location of the peak in the cross correlation matrix, and on the size and position of the sub images.Check if the face is extracted from the target Image. Figure out where face exactly matches inside of target image.

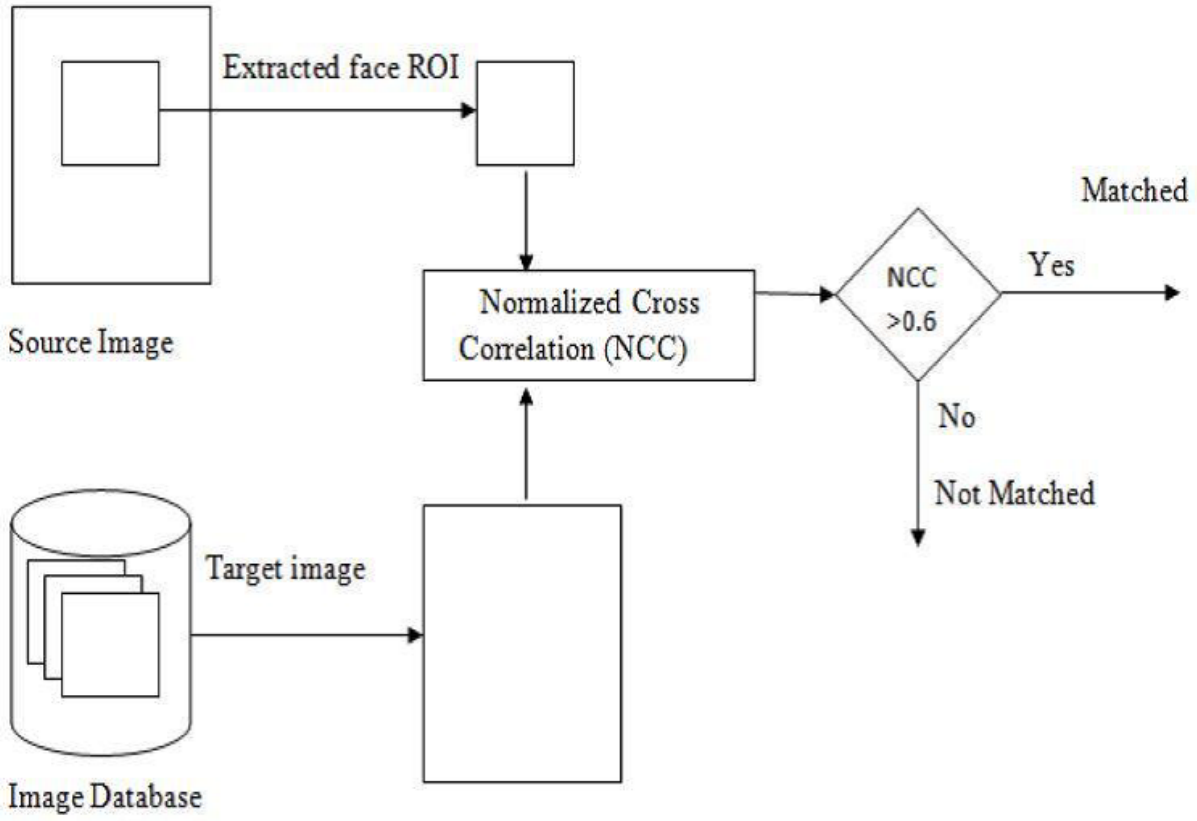

Figure 2.1: Stages of Face Recognition Algorithm

2.1.1 Weaknesses

- In Viola and Jones the result depends on the data and weak classifiers. The quality of the final detection depends highly on the consistence of the training set. Both the size of the sets and the interclass variability are important factors to take in account.

- The System overview does not provide the clear idea about components of the overall process.

- The analysis shows very bad results when in case of multiple person with different sequence.

2.1.2 How to Overcome

- The training of the data should be done in correct manner so that the quality final detection will increase.

- System overview should contain the overall architecture that will give the clear and comprehensive information of the project[4]

2.2 Study of Implementing Automated Attendance System Using Face Recognition

2.2.0.1 Abstract

Authentication is a significant issue in system control in computer based communication. Human face recognition is an important branch of biometric verification and has been widely used in many applications, such as video monitor system, human-computer interaction, and door control system and network security. This paper describes a method for Student's Attendance System which will integrate with the face recognition technology using Personal Component Analysis (PCA) algorithm. The system will record the attendance of the students in class room environment automatically and it will provide the facilities to the faculty to access the information of the students easily by maintaining a log for clock-in and clock-out time[2].

2.2.0.2 Proposed Algorithms

This paper is uses PCA(Principle Component Analysis) technique for face recognition and image compression. The implementation of this project is done using OpenCV libraries for face detection and further processes.
PCA method has been widely used in applications such as face recognition and image compression. PCA is a common technique for finding patterns in data, and expressing the data as eigenvector to highlight the similarities and differences between different data.
Then the system implementation is divided in three major part Face Detection and Extract, Learn and Train Face Images, Recognise and Identification. Implementation is done using OpenCV libraries which is open source and cross platform.

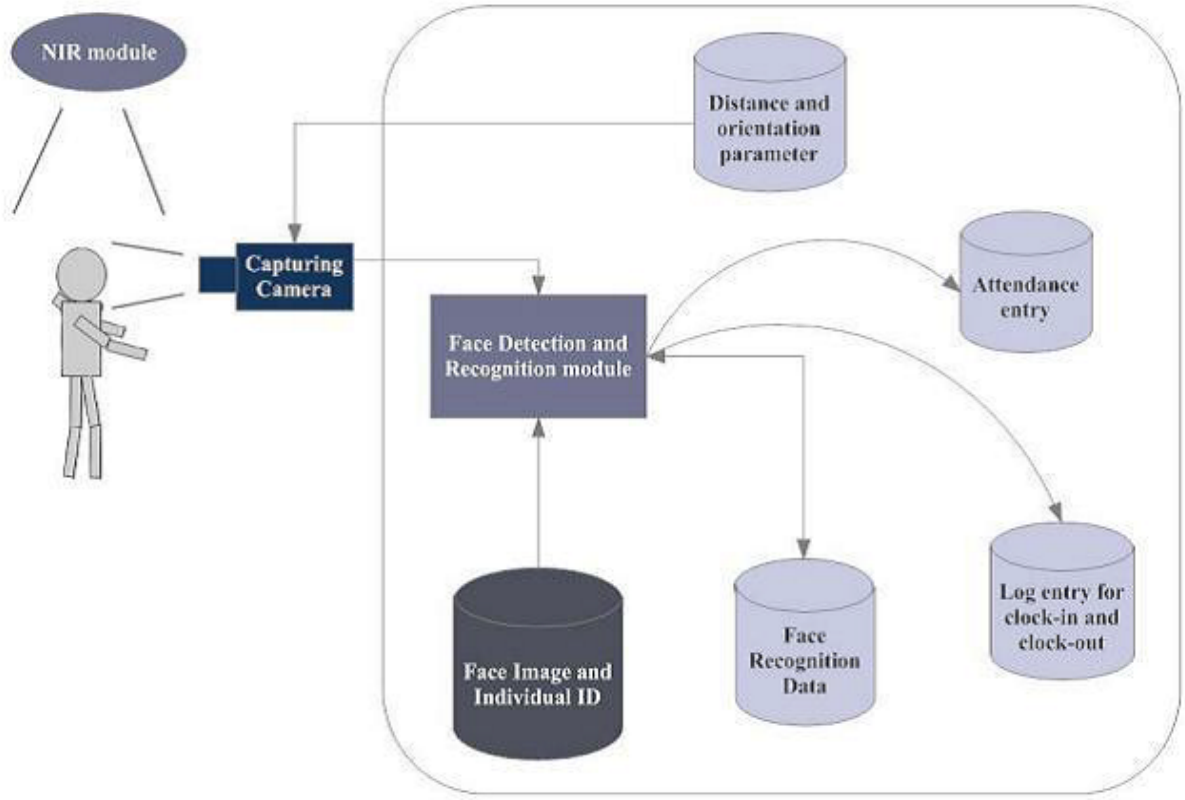

Figure 2.2: PCA technique

2.2.1 Weaknesses

This paper uses PCA which have two major disadvantages.

- The covariance matrix is difficult to be evaluated in an accurate manner
- Even the simplest invariance could not be captured by the PCA unless the training data explicitly provides this information

This paper is not giving the clear idea about face detection and recognition algorithm. Author explains the code of OpenCV instead of explaining the techniques and methods.

2.2.2 How to Overcome

- The training data should provide the information explicitly.
- Author should explain working of the algorithm which he/she going to use instead of explaining the functions of OpenCv libraries[5].

2.3 Algorithm for Efficient Attendance Management: Face Recognition

2.3.0.1 Abstract

Students attendance in the classroom is very important task and if taken manually wastes a lot of time. There are many automatic methods available for this purpose i.e. biometric attendance. All these methods also waste time because students have to make a queue to touch their thumb on the scanning device. This work describes the efficient algorithm that automatically marks the attendance without human intervention. This attendance is recorded by using a camera attached in front of classroom that is continuously capturing images of students, detect the faces in images and compare the detected faces with the database and mark the attendance. The paper review the related work in the field of attendance system then describes the system architecture, software algorithm and results[3].

2.3.0.2 Proposed Algorithm

This paper uses Viola and Jones algorithm for face detection and correlations formulas for face recognition.
Viola and Jones algorithm is used for face detection. Where it is used in both creating database and face recognition process. Where in case creating database it takes input image through a web camera continuously. Captured image undergoes face detection. Detected face will be cropped and stored in database. Where in case of face recognition if there is any movement video surveillance will be used to detect the moving object. The captured image undergoes face detection and further processed later by face recognition.

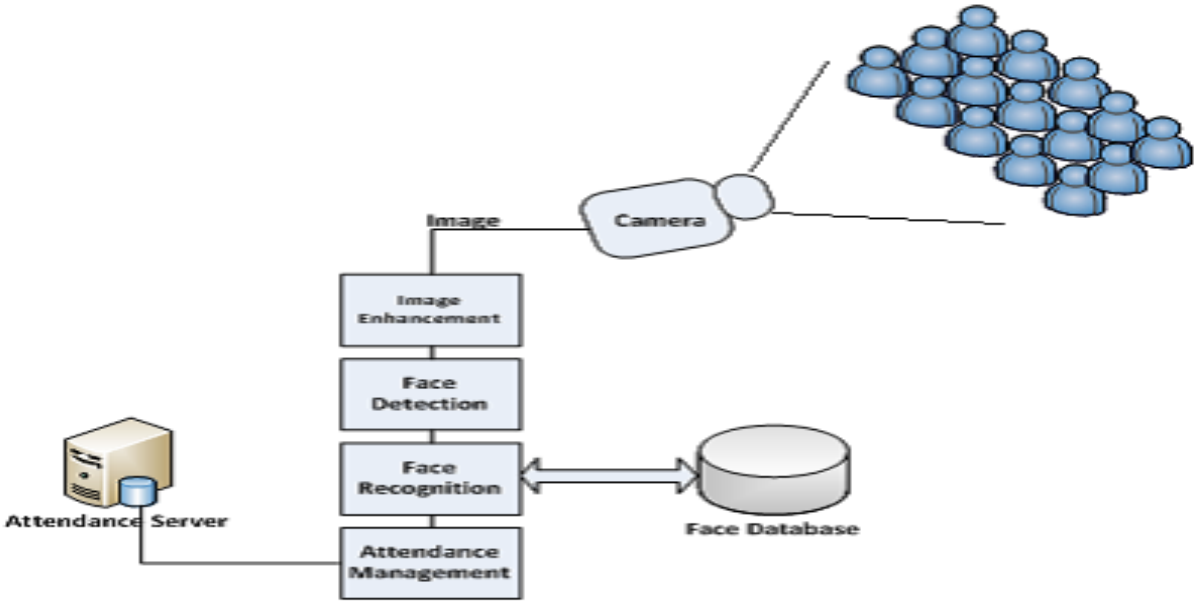

Figure 2.3: Experimental Setup

2.3.1 Weaknesses

- It uses hardware like camera and button which is makes it costly as these are to be installed in every classrooms.

- Histograms fails if there are grey values that are physically apart from each other.

2.3.2 How to Overcome

- Make connectivity through server using web application or android application to capture and upload from mobile/tab/web cam[6].

Chapter 3

Requirement Analysis

To be used efficiently, all computer software needs certain hardware components or other software resources to be present on a computer. These prerequisites are known as (computer) system requirements and are often used as a guideline as opposed to an absolute rule. Most software defines two sets of system requirements: minimum and recommended.

3.1 Platform Requirement

3.1.1 Supportive Operating Systems

The supported operating systems for client include :

- Windows XP/7/8/10
- Mac OS
- Linux Ubuntu/Mint ect
- Android/iOS/Windows Mobile

Software requirements deal with defining software resource requirements and prerequisites that need to be installed on a computer to provide optimal functioning of an application. These requirements or prerequisites are generally not included in the software installation package and need to be installed separately before the software is installed.

Web Browser

- Google Chrome
- Mozila FireFox
- Internet Explorer/Edge
- Opera

3.2 Software Requirement

- OpenCV 2.4.11 with gtk+
- noddeJS
- python 3.3.0
- Visual Studio 2013(Community Edition)
- mysql

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 7 million. The library is used extensively in companies, research groups and by governmental bodies.

As an asynchronous event driven framework, Node.js is designed to build scalable network applications. In the following "hello world" example, many connections can be handled concurrently. Upon each connection the callback is fired, but if there is no work to be done Node is sleeping.

MySQL is the world's most popular open source database. With its proven performance, reliability and ease-of-use, MySQL has become the leading database choice for web-based applica-

tions, used by high profile web properties.

Oracle drives MySQL innovation, delivering new capabilities to power next generation web, cloud, mobile and embedded applications.

3.3 Hardware Requirement

The most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware, A hardware requirements list is often accompanied by a hardware compatibility list (HCL), especially in case of operating systems. An HCL lists tested, compatible, and sometimes incompatible hardware devices for a particular operating system or application.

Component	Minimum	Recommended
Processor	1.8 Ghz Dual Core Intel Pentium/AMD Athlon 64 X2	Intel Core i3-2100 2nd Generation
RAM	2 GB	4 GB
Camera	8 Mega-Pixel	16 Mega-Pixel DSLR
Disk	128 GB	512 GB
Network	1 MB/s plan	3 MB/s

Table 3.1: Hardware Requirement

Chapter 4

Project Design

4.1 Design Approach

Design is the first step in the development phase for any techniques and principles for the purpose of defining a device, a process or system in sufficient detail to permit its physical realization. Once the software requirements have been analyzed and specified the software design involves three technical activities design, coding, implementation and testing that are required to build and verify the software. The design activities are of main importance in this phase, because in this activity, decisions ultimately affecting the success of the software implementation and its ease of maintenance are made. These decisions have the final bearing upon reliability and maintainability of the system. Design is the only way to accurately translate the customer requirements into finished software or a system. Design is the place where quality is fostered in development. Software design is a process through which requirements are translated into a representation of software. Software design is conducted in two steps. Preliminary design is concerned with the transformation of requirements into data.

4.2 Software Architectural Designs

Our system follows the three tier architecture . First tier consist of GUI, Recognition tier and the Database.

1. GUI: The GUI(Graphical User Interface) in our project deals with the interface for the user where the user enters the name of the product he/she wants to search. The GUI provides a platform for the user to communicate with the database.

Register/Login Initially when the user accesses the webapp he gets a login/register page.

Dashboard The user logs in to the app and is directed to the dashboard of the app. This is the main interface page with which the user interacts. It shows the user various statistics related to the attendance. It has the upload option with which user uploads the group image to get the attendance data sheet. With the details of the lecture mentioned with every upload an attendance data sheet is generated.

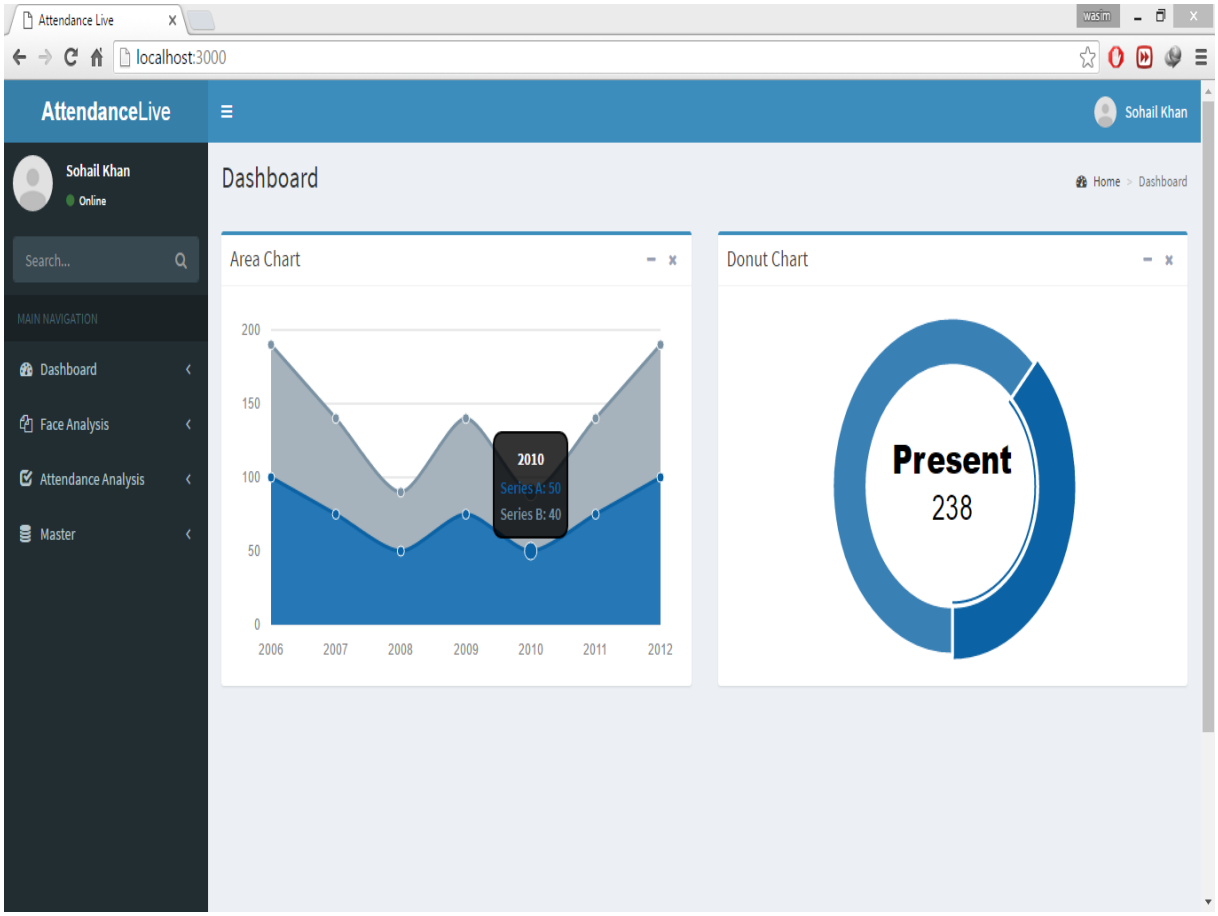

Figure 4.1: Dashboard

2. Trainer : At initial level the system is trained by providing 5-10 images of an individual. The images are given in grey scale form and further its histogram is made to enhance the recognition accuracy.

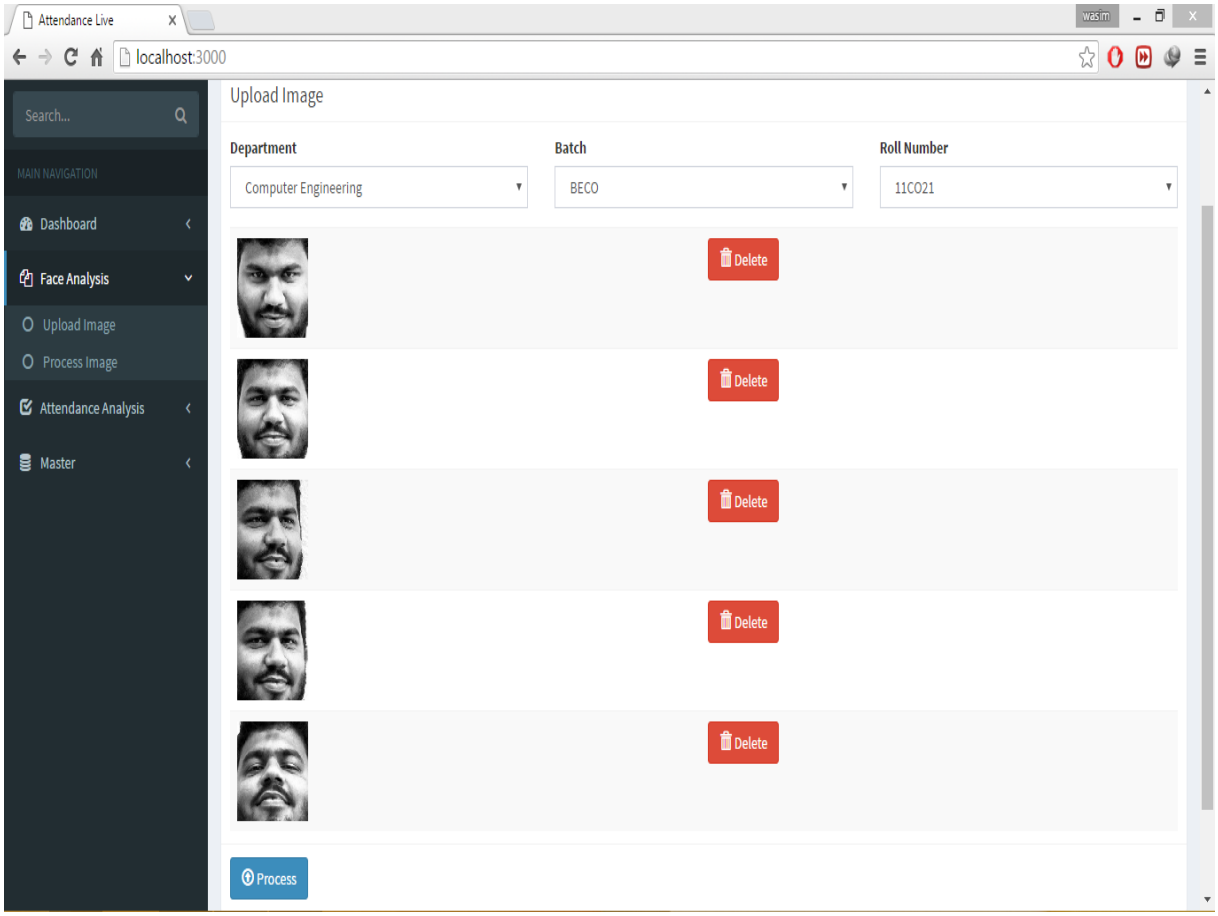

Figure 4.2: Trainer

Detection : Whenever any image is uploaded all the face in it are are cropped and stored for further comparison.

Face Recognition : Here the detected cropped faces are compared with the trained images from the database using correlation. if any of the croppedd image is recognized then that id would be marked present in the attendance data sheet.

3. Database: We have a centralized database with all the details of student and staff. the database is constructed using mysql. Every cropped or detected image compares itself with the trained images in this databases i.e retrieval is done and also the attendance sheet is generated using this database i.e updation is done.

4.2.1 Component Diagram

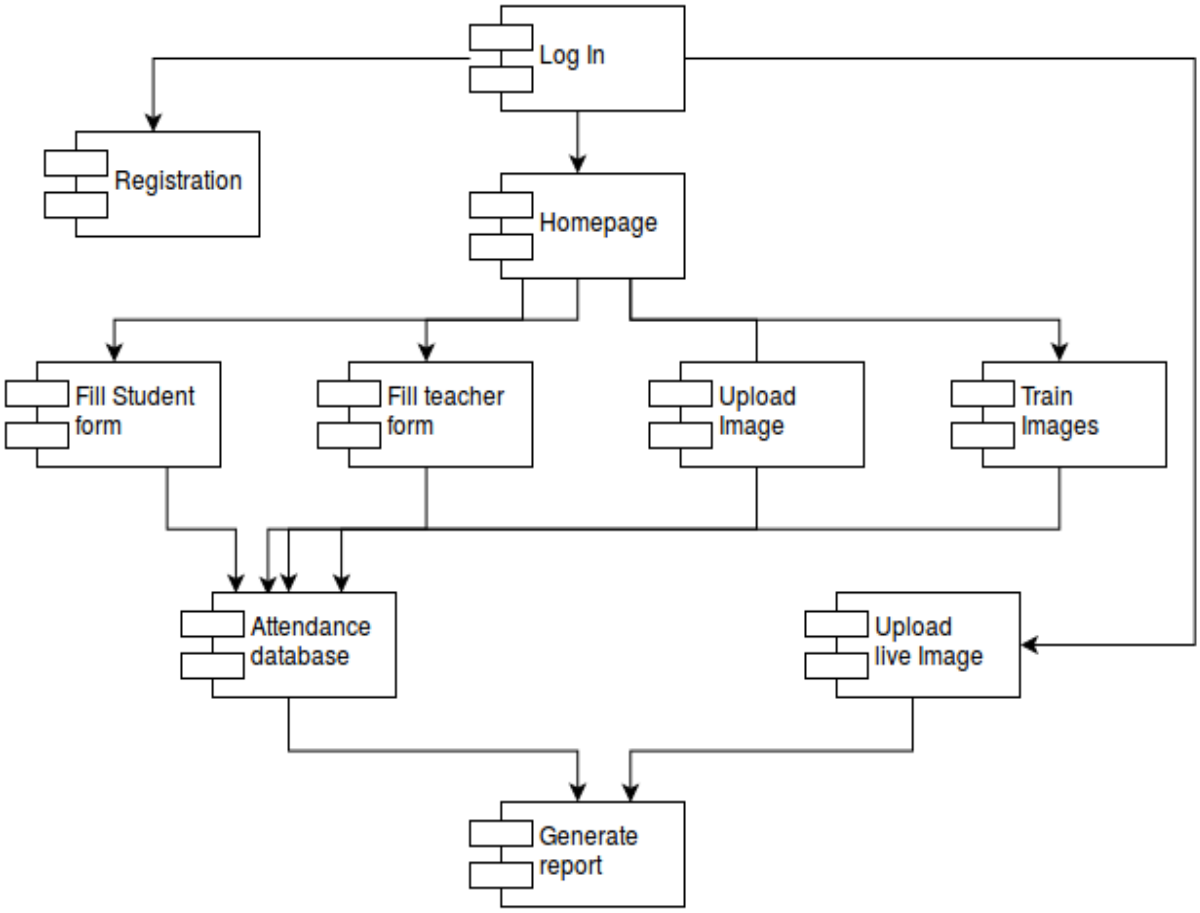

Figure 4.3: Component Diagram of Real Time Product Analysis

4.2.2 Deployment Diagram

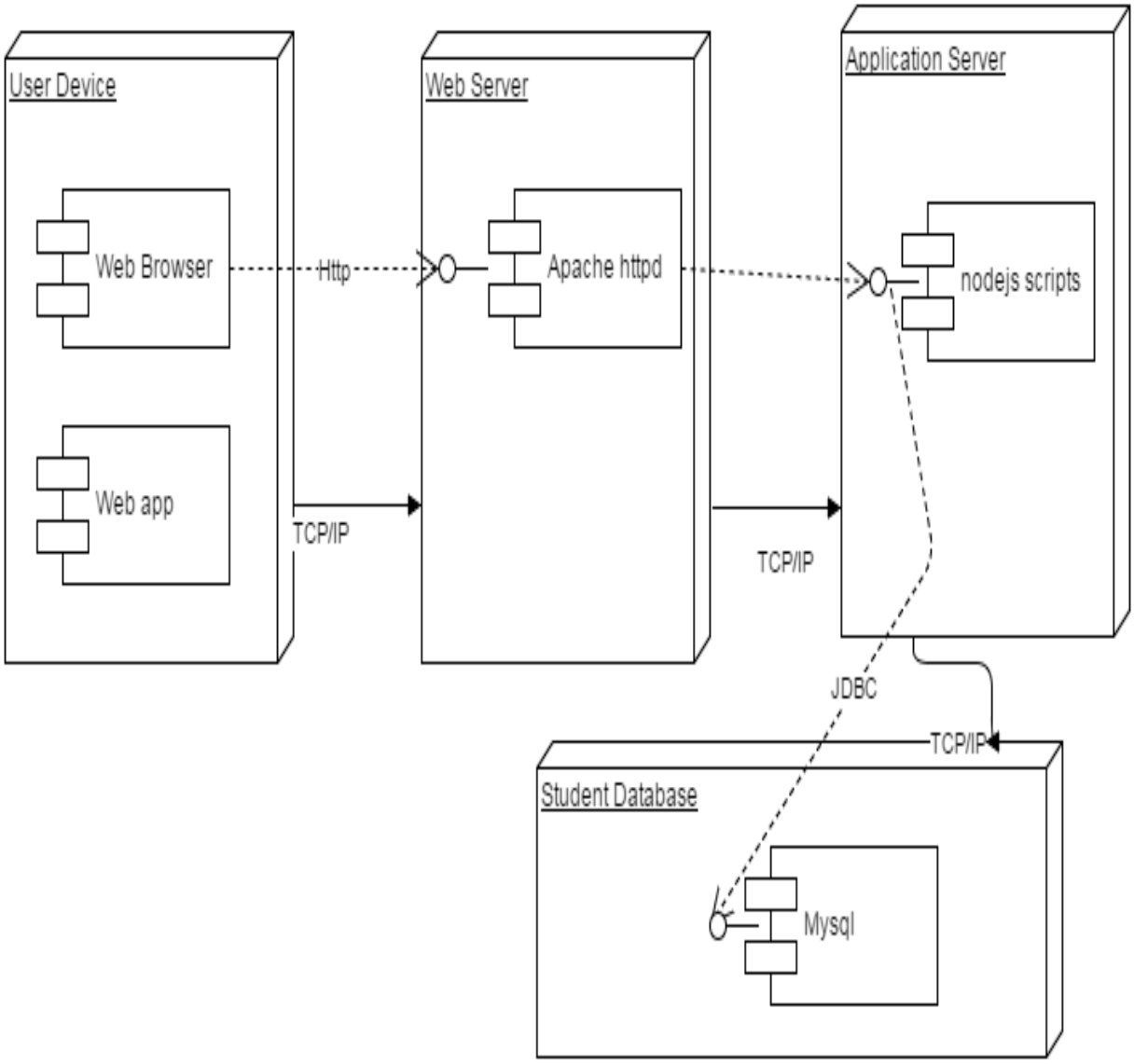

Figure 4.4: Deployment Diagram

4.3 Database Design

4.3.1 E-R Diagram

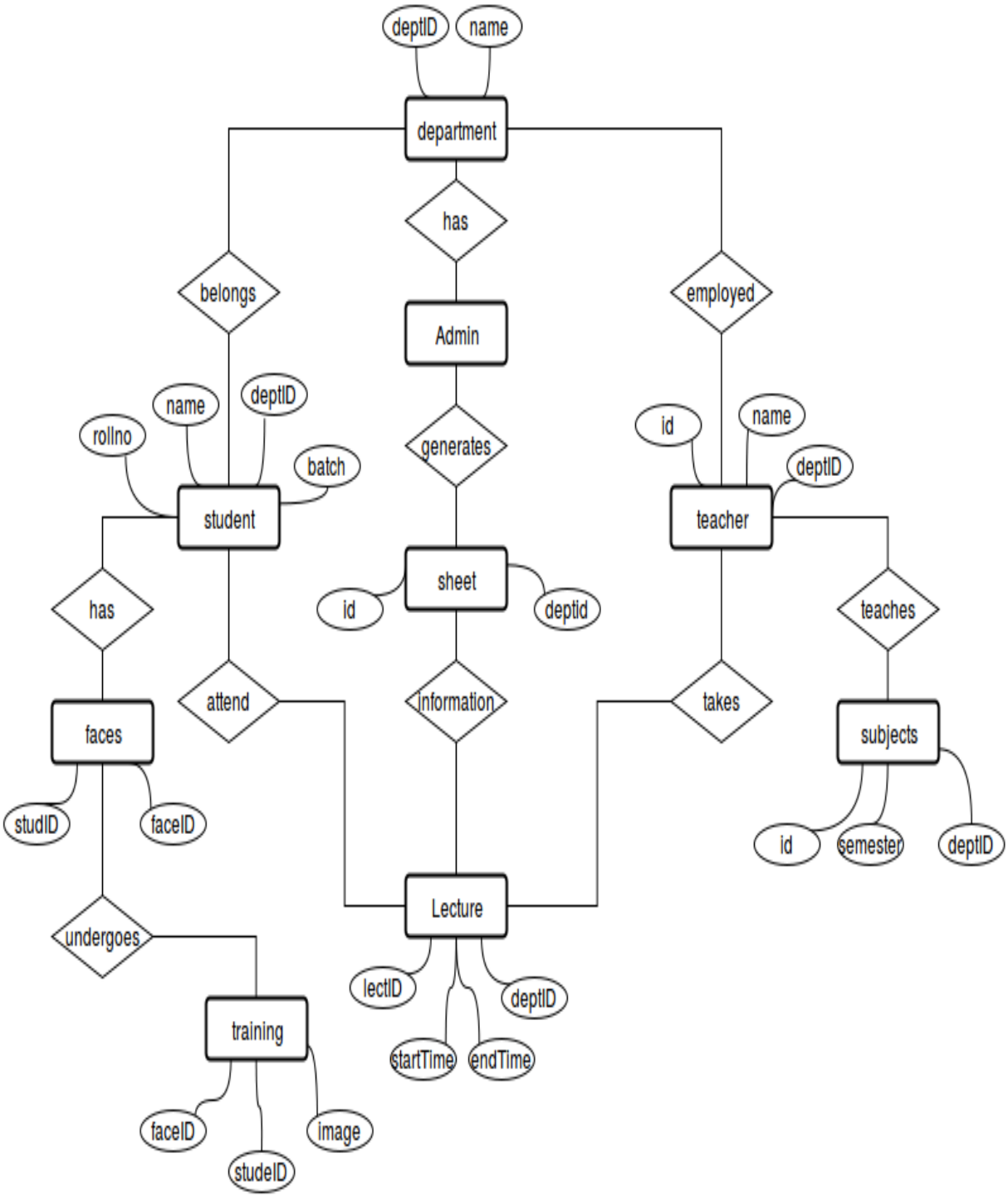

Figure 4.5: E-R Diagram of Real Time Product Analysis system

Chapter 5

Implementation Details

5.1 Assumptions and Dependencies

5.1.1 Assumptions

The following Assumption was taken into consideration:

- The detector module should crop every human face from the input image and not to crop other areas. So it was assumed that the detector will be very accurate in cropping just and all the human faces from the uploaded image and save it for further recognition.

- The recognition module has to be very accurate in recognizing that is comparing the detected image with the the images fetched from the database. So it was assumed that the recognition module will correctly recognize all the faces from the uploaded image so that a correct attendance sheet is produced.

5.1.2 Dependencies

The dependencies are as follows:

- Our scripts use opencv. Opencv provides libraries which has funtions like LBP which are the core part of detection and recognition module.

- Ee have used packages of nodejs like npm which is the strongest package manager available. The start or run time environment is provided by nodejs. It also shows the actual background working like confidence level, recognition accuracy, etc.

5.2 Implementation Methodology

The proposed system introduces an automated attendance system which integrates a web app and face recognition algorithms. Any device with a camera can capture an image or a video and upload to the server using web app. The received file undergoes face detection and face recognition so the detected faces are extracted from the image. The extracted faces are then compared with the saved faces of the database and on the successful recognition the database is updated with the attendance and a sheet is generated and displayed on the web app.

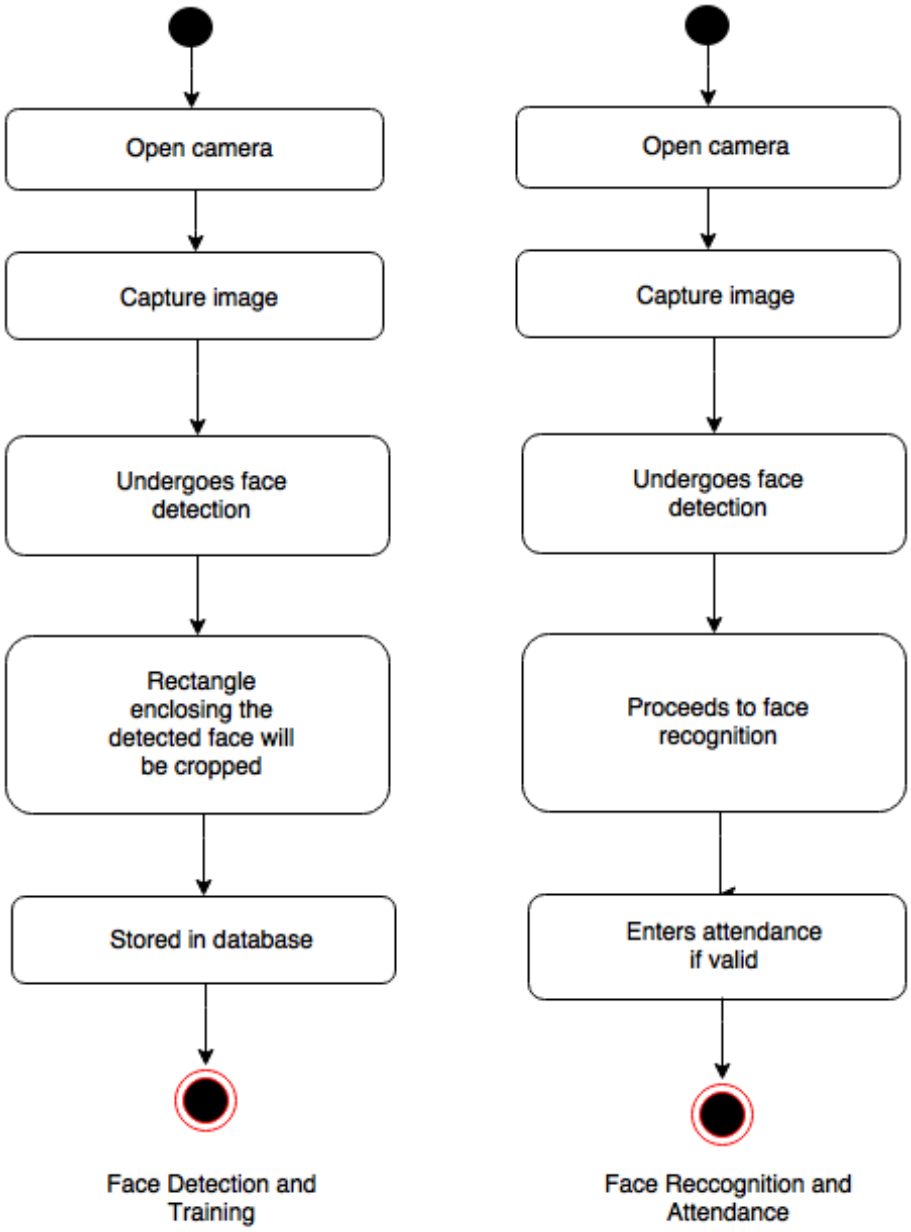

Figure 5.1: Flow Diagram

This work is being carried out in five stages:

Step 1: Generating Data for Training Initially the system is trained that is the cropped images are saved to the database and they undergo detection and recognition. Further this data will be used to compare the detected images in all the uploaded files and mark the attendance.

Step 2: Capturing In this the capturing of the video or image will be done using a device and the captured file is uploaded to the server using web app.

Step 3: Face Detection The file uploaded to the server undergoes face detection using Viola and Jones algorithm. The frames received are checked for the faces and those are cropped for further recognition.

Step 4: Face Recognition The detected images undergo correlation with the trained images of the databases. By this the detected images are now recognized.

Step 5: Attendance Marking After the recognition process the students recognized are searched in the database and their attendance is marked.

5.3 Competitive Advantages of Project

- Currently either manual or biometric attendance system are being used in which manual is hectic and time consuming. The biometric serves one at a time, so there is a need of such system which could automatically mark the attendance of many persons at the same time.

- This system is cost efficient, no extra hardware required just a daily mobile or tablet, etc. Hence it is easily deployable.

- The work of administration department to enter the attendance is reduced and also stationary cost so every institute or organization will opt for such time and money saving system.

- Not only in institutes or organizations, it can also be used at any public places or entry-exit gates for advance surveillance.

- One of the big benefits of using facial biometric systems in any organization is that you won't have to worry about time fraud. It will be impossible for buddy punching to occur, since everyone has to have go through face scanning biometrics devices to clock in.

- It provides better security with a face biometrics system. Not only can you track student through biometrics time attendance tracking, but any visitors can be added to the system

and tracked throughout the area too. Anyone that is not in the system will not be given access.

- Many companies like the fact that biometric imaging systems are automated. You won't have to worry about having someone there to monitor the system 24 hours a day.

- Integrated Biometric facial systems are also easy to program into any organization computer system. Usually they will work with existing software that they have in place.

- Facial biometrics technology today has a high success rate, especially with the emergence of 3D face recognition technologies. It is extremely difficult to fool the system.

5.4 Use Case Diagram

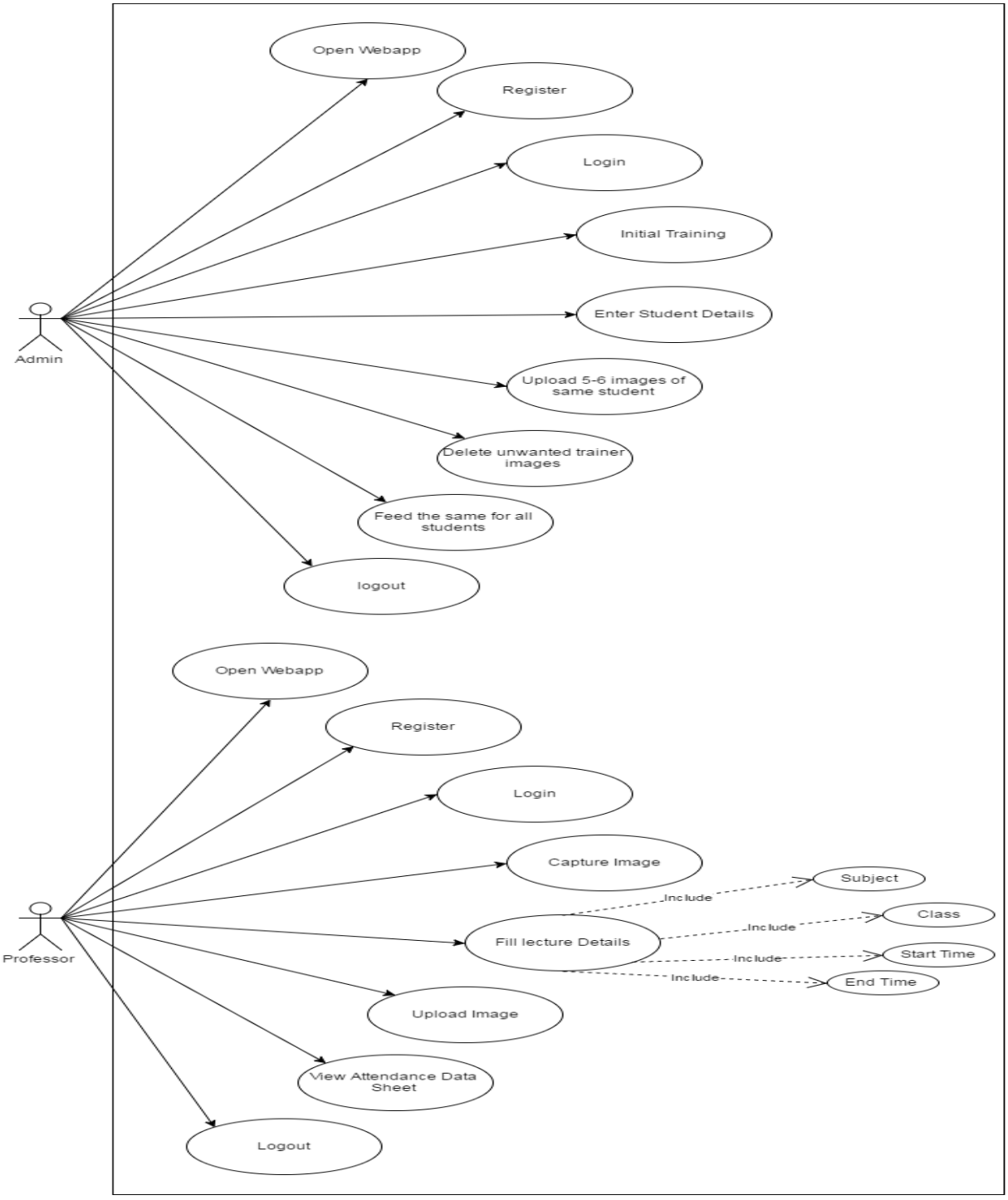

Figure 5.2: Use Case Diagram

5.5 Class Diagram

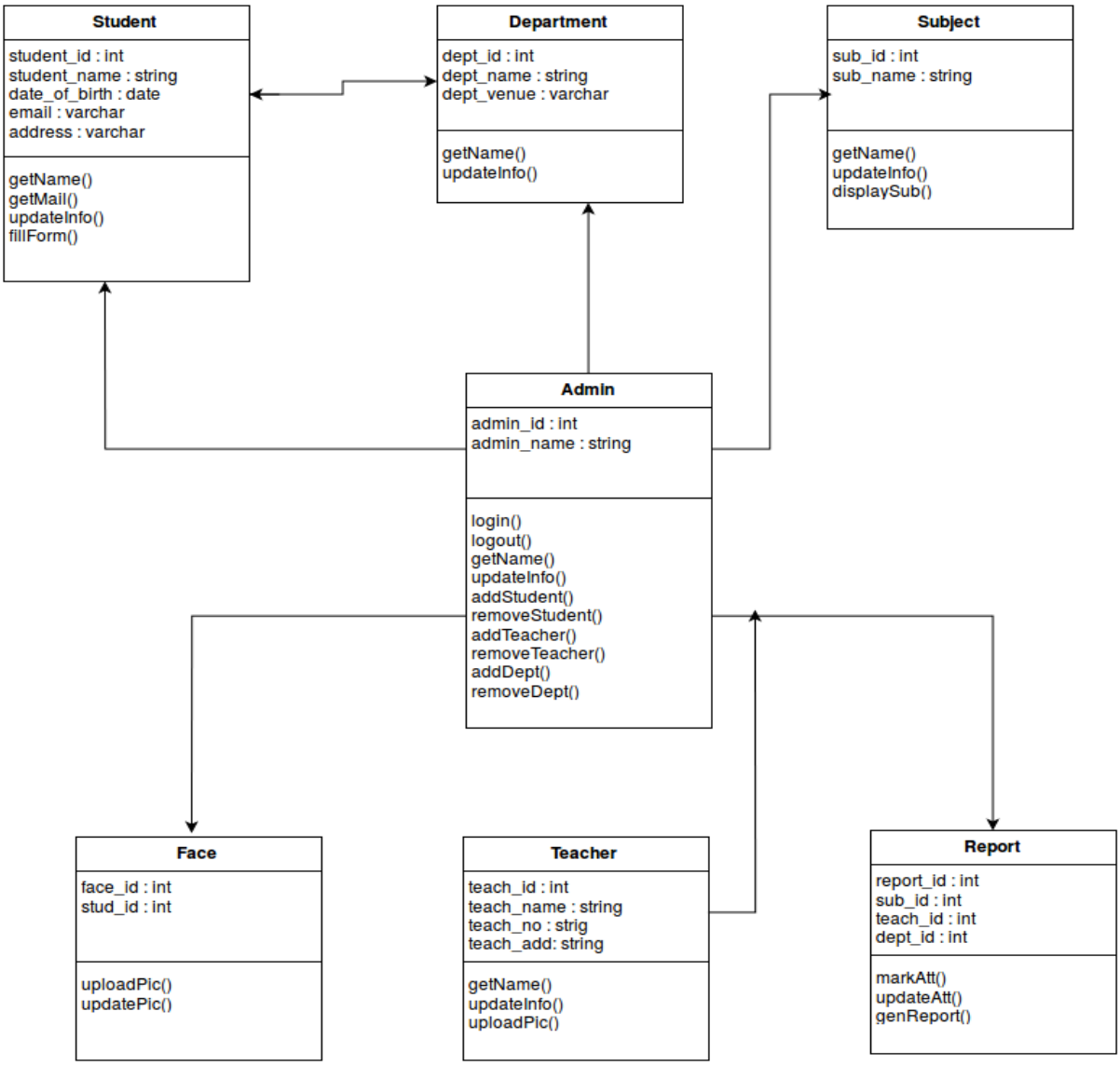

Figure 5.3: Class Diagram

Chapter 6

Results and Discussion

6.1 Test cases and Result

6.1.1 Unit testing

6.1.2 Functionality testing

After integrating all the modules we performed functionality testing to check all the scenarios which included failure paths and boundary cases.
User Registered, user was able to log in the app and the dashboard was visible with his profile in the up left corner.
We tested with a group image and selected the related information retrieved from the database.

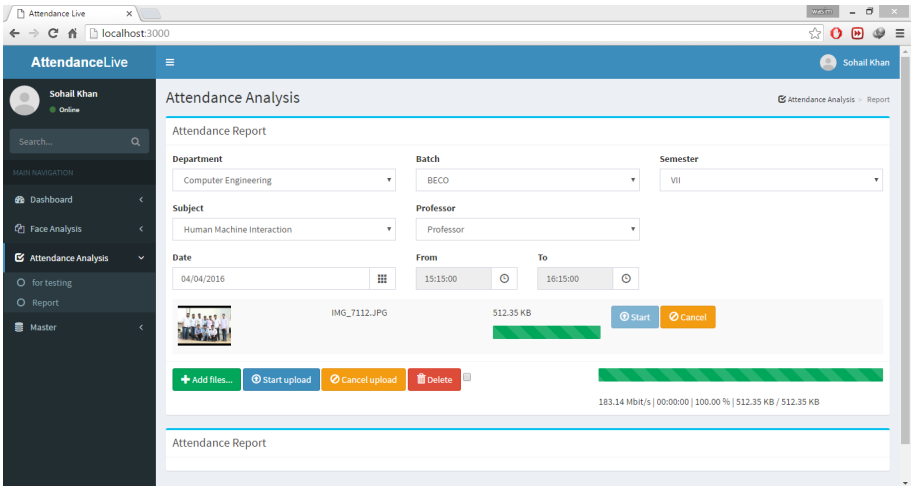

Figure 6.1: Successful Login

After the upload attendance sheet was generated and out of 10 students 9 were recognized and marked ass present. Other students not in the image were automatically marked absent.

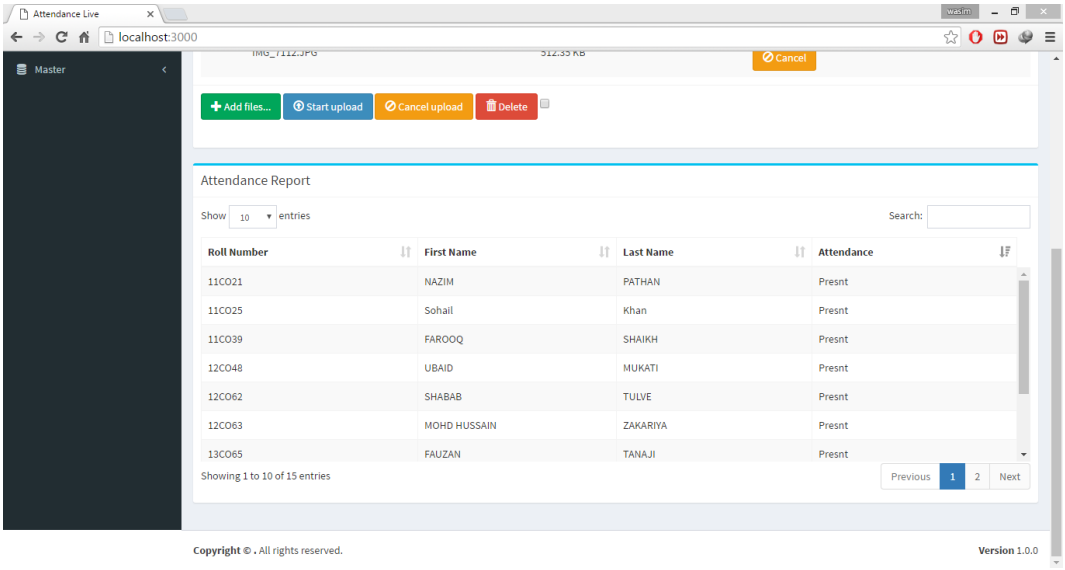

Figure 6.2: Generated Attendance Data Sheet

Also we checked the confidence levels of the recognized images like for id 1 confidence level was found as 63.60303

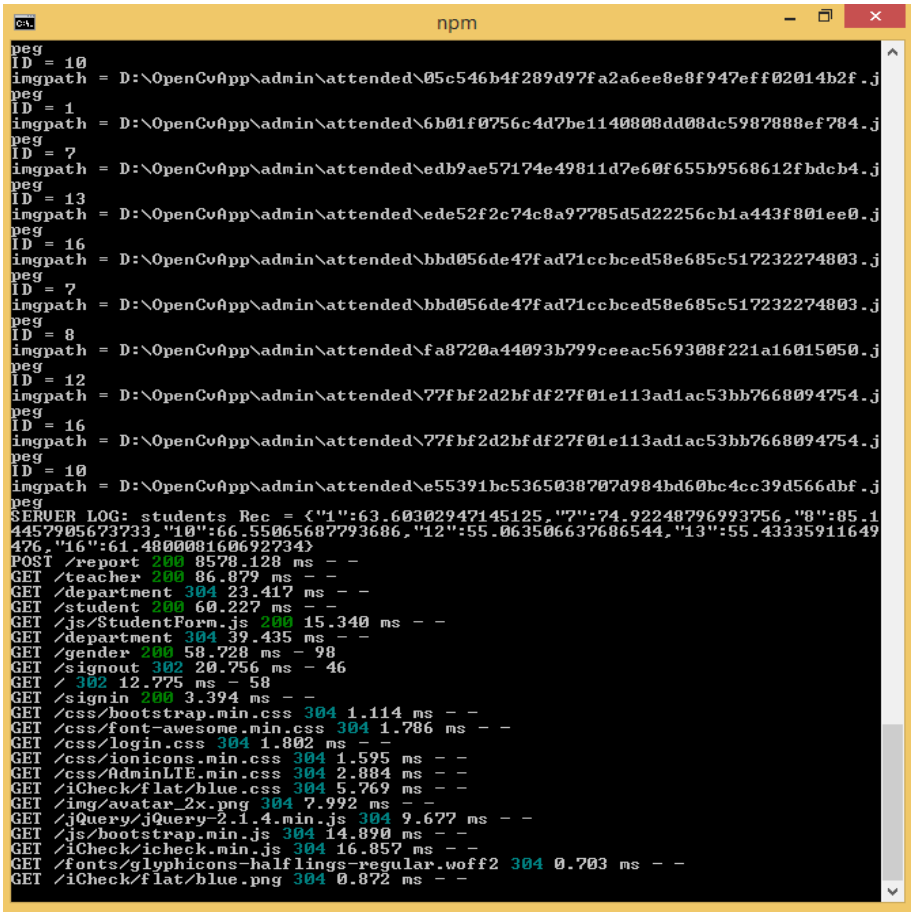

Figure 6.3: Confidence level of recognized face

6.1.2.1 White box testing

We performed tests to demonstrate the efficiency of the proposed method. Images of different persons are used in training set. In order to obtain the efficiency of proposed methodology 8 training images are taken. The detected faces from the image are compared with the database. This is called the selection of region of interest. In this way faces of students are verified one by one with the face database using the correlation method and attendance is marked along with the login time and date. Here face recognition rate achieved by proposed methodology is 81.875

Sr.no.	Number of Persons	Position	Accuracy of Recognition(%)
1	4	Linear	100
2	4	Random	80
3	9	Linear	80
4	9	Linear	90
5	10	Random	65
6	10	Random	70
7	10	Linear	80
8	10	Linear	90
Overall Acuracy			81.875

Table 6.1: Recognition Accuracy Test

Also we tried giving images of different resolutions to check the recognition accuracy of LBP with other methods. Level 1 contains images of 100x100 pixels, Level 2 contains images of 60x60 pixels, Level 3 contains images of 30x30 pixels, Level 4 contains images of 12x12 pixels and Level 5 contains images of 8x8 pixels. The LBP gave the most promising results.

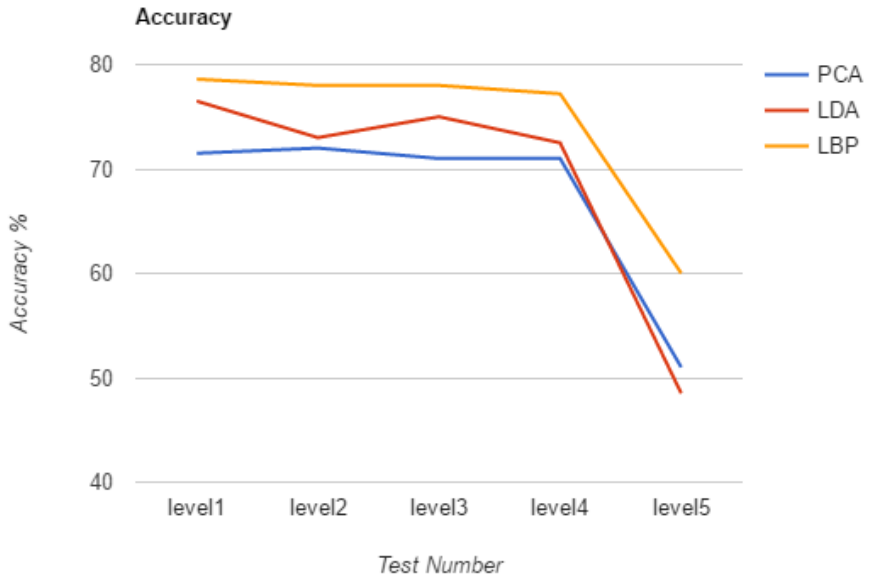

Figure 6.4: Testing based on Resolution

Chapter 7

Project Time Line

7.1 Project Time Line Matrix

	Name	Duration	Start	Finish	Predecessors	Resource Names
1	1(a)Requirement gathering	12 days	9/11/15 8:00 AM	9/28/15 5:00 PM		PM;TL;TM1;TM2
2	1(b)Confirm Requirements	8 days	9/18/15 8:00 AM	9/29/15 5:00 PM		TL;TM1;TM2
3	2(a)Front End User Interface	15 days	10/8/15 8:00 AM	10/28/15 5:00 PM		TM1;TM2
4	2(b)Backend Database Desig	7 days	10/11/15 8:00 AM	10/20/15 5:00 PM		TL;TM2
5	3(a)Frontend Coding	50 days	12/5/15 8:00 AM	2/12/16 5:00 PM		TM1;TM2
6	3(b)Backend Coding	15 days	1/7/16 8:00 AM	1/27/16 5:00 PM		TL;TM1;TM2
7	3(c)Trainer coding	7 days	1/22/16 8:00 AM	2/1/16 5:00 PM		TM2
8	3(d)Integrating Modules	4 days	2/12/16 8:00 AM	2/17/16 5:00 PM		TM1;TM2
9	4(a)Unit Testing	4 days	2/18/16 8:00 AM	2/23/16 5:00 PM		
10	4(b)Fuctional Testing	6 days	2/20/16 8:00 AM	2/29/16 5:00 PM		
11	5(a) Deployment	3 days	3/1/16 8:00 AM	3/3/16 5:00 PM		

Figure 7.1: Time Line Matrix

7.2 Project Time Line Chart

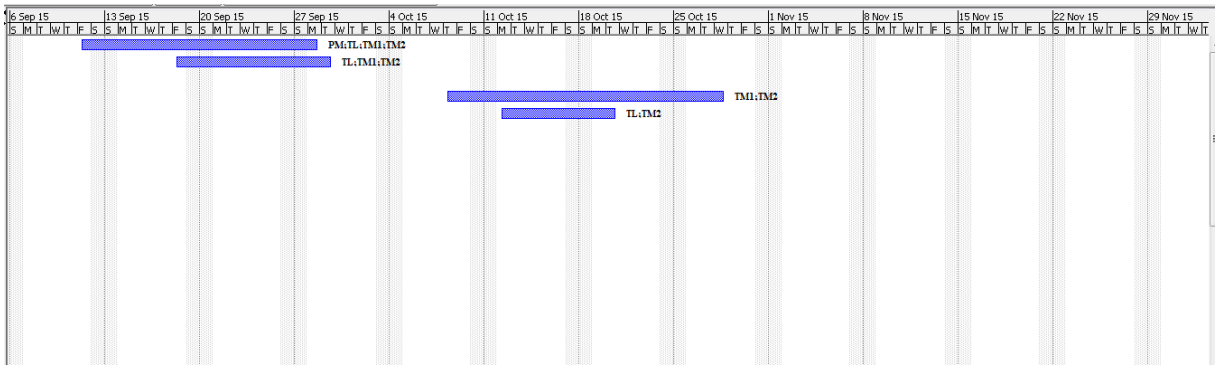

Figure 7.2: Time Line Chart

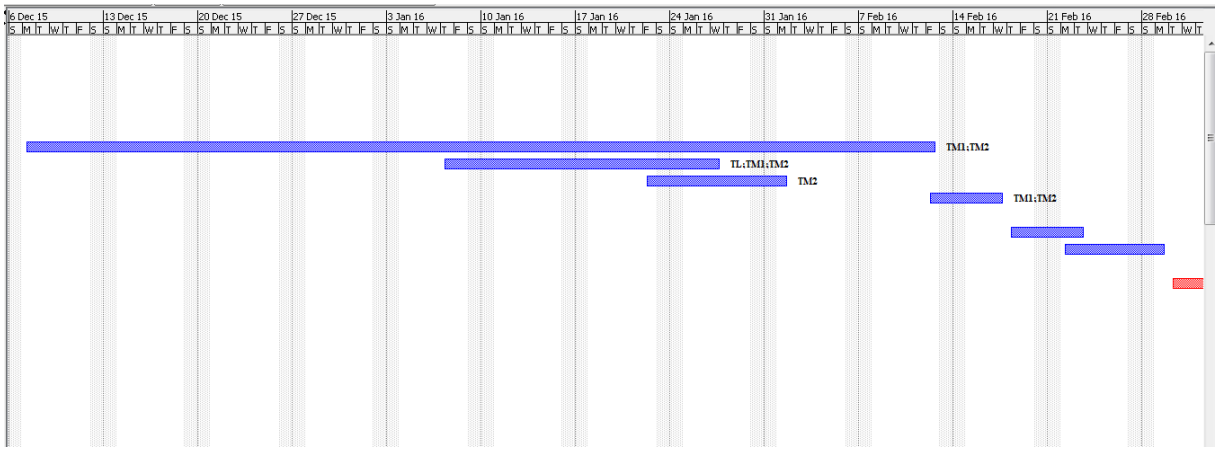

Figure 7.3: Time Line Chart

Chapter 8

Task Distribution

8.1 Distribution of Workload

8.1.1 Scheduled Working Activities

Activity	Time Period	Comment
Requirement Gathering	8 Days	Requirement gathering has took placed through searching on internet and taking the ideas, sharing the views among group members.
Planning	8 Days	Planing has done by Reviewing of literature of IEEE papers and by taking the walkthrough.
Design	6 Days	Designing has done by creating UML diagram, By creating Charts,
Implementation	90 Days	Implementation has done First creating the backend and then front end module by module.
Testing	10 Days	Testing has done by perfoming unit testing, alpha & Beta Testing, integrated testing and system testing.
Deployment	05 Days	Deployment has done by installing project on the server.

Table 8.1: Scheduled Working Activities

8.1.2 Members actvities or task

Member	Activity	Time Period	Start Date	End Date	Comment
M1, M2, M3, M4	Requirement Gathering	12 Days	09/11/15	9/28/15	M1 and M2 has perfomed the seaching for project requirement on the internet by reviewing the related literature and by anlysing the related prject which is already available in the market. Regularly inform to the other member of team.
M1, M2, M3, M4	Analysing of the requirement	2 Days	09/26/15	09/28/15	M1, M2, M3, M4 done the requirement analysing of project by sharing the ideas, and by discussing on related information which is gather by the M1, And M2. M3 and M4 has created the list of requirement after every meeting
M1, M2, M3, M4	Finalysing the requirement	4 Day	09/25/15	09/29/15	Whole team finalize the requirement. M1 and M4 has created a list of finalise requirement.
M1, M2, M3, M4	Planning	4 Days	10/1/15	10/4/15	Planning has done by walkthrough and by analysing the available product. M2 and M3 creats a list of funtion which will be implement in the project. Each and every module were discuss in every group meeting and M1 and M2 creates a blue print for project .

M1, M2	Front End design	15 Days	10/08/15	10/23/15	M1 and M2 creates the UML diagram for front end of the system and data flow diagrams and informed to the whole team regularly.
M3, M4	Back End design	7 Days	10/11/15	10/18/15	M3 and M4 creates the UML diagram for back end of the system and data flow diagrams and informed to the whole team regularly.
M3, M4	Installation of tools and technology for front end	2 Days	10/12/15	10/14/15	M3 and M4 installed the all the require tools which is use for front end design.
M1, M2	Installation of tools and technology for back end	2 Days	10/12/15	10/14/15	M3 and M4 installed all the require tools which is use for back end design.
M3, M4	Implementation of GUI	4 Days	10/24/15	10/28/15	M3 and M4 creates the GUI of the project and informed to other member.
M1	Implementation of Face Detection module	20 Days	12/05/15	12/25/15	M1 implemented the face detection and discuss on it with other team member
M2	Implementation of Face Recognition module	12 Days	12/26/15	01/07/16	M2 implemented the Face Recognition and discuss on it with other team member
M1,M2	Trainer Module	4 Days	01/22/16	02/01/16	M1 and M2 did the Trainer Module. M1 and M2 Explain the codes to the other member of team.

M3, M4	Integrating modules	4 Days	02/12/16	02/17/16	M3 and M4 integrated all the modules and discuss on it with other team member regularly.
M1,M2	Unit testing	4 Days	02/18/16	2/23/15	M1 and M2 performed the unit testing and noted down results and discuss with other member of team.
M3, M4	Functional testing	6 Days	02/20/16	02/29/15	M3 and M4 performed the functional testing and noted down results and discuss the result of testing with other member.
M1, M2, M3, M4	Deployment	•	03/03/2016	•	•

Table 8.2: Member Activities and Task

Chapter 9

Conclusion and Future Scope

9.1 Conclusion

In order to maintain the attendance this system has been proposed. It replaces the manual system with an automated system which is fast, efficient, cost and time saving as replaces the stationary material and the paper work. Hence this system is expected to give desired results and in future could be implemented for logout. Also the efficiency could be improved by integrating other techniques with it in near future.

9.2 Future Scope

It can be easily implemented at any institute or organization.
A method could be proposed to illustrate robustness against the variations that is, in near future we could build a system which would be robust and would work in undesirable conditions too.
Here it is proposed for an institute to take the attendance of the students but in future it can be used to do the same work at entry as well as exit points.
Authors are working to improve the face recognition effectiveness to build more efficient systems in near future.
In further work, authors intend to improve face recognition effectiveness by using the interaction among our system, the users and the administrators. On the other hand, our system can be used in a completely new dimension of face recognition application, mobile based face recognition, which can be an aid for common people to know about any person being photographed by cell phone camera including proper authorization for accessing a centralized database.

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Chapter 10

Journal Publication

Our Paper has been publish in the following International Journal :

1. Khan Suhel, Zakariya Hussain, Khan Shoeb, Pathan Nazim, Mubashir Khan and Apeksha Gopale, A Survey on Automated Attendance System Using Face Recognition, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 10, October 2015.

Our Paper is to be publish in the following International Journal :

2. Khan Suhel, Zakariya Hussain, Khan Shoeb, Pathan Nazim, Mubashir Khan and Apeksha Gopale, Automated Attendance System Using Face Recognition, International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 4, April 2016.

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Survey on Automated Attendance System Using Face Recognition

Khan Suhel[1], Zakariya Hussain[2], Khan Shoeb[3], Pathan Nazim[4], Mubashir Khan[5], Apeksha Gopale[6]
[1,2,3,4]Students of B.E, [5,6] Assistant Professor, Department of Computer Engineering, Kalsekar Technical Campus, New Panvel, India.

ABSTRACT: The objective of this system is to present an automated system for human face recognition in real time background for an organization or institute to mark the attendance of their students or employees. This paper introduces face detection method using the Voila and Jones algorithm and recognition using correlation technique. The system will record the attendance of the students in class room environment. The above system is fully automated and easily deployable. User gets an authentication to upload the image containing file and also to view the attendance.

KEYWORDS: Automated, Face Detection, Face Recognition, Voila and Jones Algorithm, Correlation, Attendance.

I. INTRODUCTION

In many Institution and Organization the attendance is a very important factor to maintain the record of lectures, salary and work hours etc. Most of the institutes and organizations follow the manual method using old paper and file method and some of them have shifted to biometric technique. The current method that colleges use is that the professor passes a sheet or make roll calls and mark the attendance of the students and this sheet further goes to the admin department with updates the final excel sheet. This process is quite hectic and time consuming. Also, for professors or employees at institutes or organizations the biometric system serves one at a time. So, why not shift to an automated attendance system which works on face recognition technique? Be it a class room or entry gates it will mark the attendance of the students, professors, employees, etc. This system uses Viola and Jones algorithm for detecting and recognizing the faces.

II. RELATED WORK

First there are different techniques implemented to detect the object of any type. Object detection is the technique or process of perceiving or detecting the specimen of real world objects such as faces, bottles, traffic signs, buildings and many more things in images or videos. These object detection algorithms are basically used to extract the features of the objects and learn from those features to recognize the object. These algorithms are widely used in various applications like video surveillance, automated attendance system and security.

The various object detection algorithms are:

- Viola and Jones object detection algorithm
  It detect object by using its library and classifiers

- The Pascal VOC Challenge
  It provides the standard image data sets for object detection

- Image segmentation
  It is the technique of dividing the digital image into multiple segments or set of pixels called super-pixels.

III. VIOLA AND JONES ALGORITHM

In project we are using Viola and Jones algorithm for object detection. The Viola–Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Although it can be trained to detect a variety of object classes, it was motivated primarily by

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the problem of face detection. Viola and jones is currently one of the best algorithms to detect the faces of human. This algorithm mainly has following functionality.

A. Face Detection

Integral image or summed area table is a data structure and algorithm for quickly and efficiently generating the sum of values in a rectangular subset of a grid. In the image processing domain, it is also known as an integral image.

Haar-like features are digital image features used in object recognition. They owe their name to their intuitive similarity with haar wavelets and were used in the first real-time face detector.

Adaboost (adaptive boost) meta-algorithm formulated by yoav freund and robert schapire which is use to improve the performance of other algorithm. Viola and jones extracts the millions of features (pixels) for comparison so, we adaboost to enhance the overall performance and calculation speed of the algorithm.

Cascade classifier is a particular case of ensemble learning based on the concatenation of several classifiers, using all information collected from the output from a given classifier as additional information for the next classifier in the cascade. Unlike voting or stacking ensembles, which are multi-expert systems, cascading is a multistage one.

B. Face Recognition

Initially the ROI is extracted from the source face image, ROI is the sub image and is smaller than the original image

Normalized Cross-Correlation is performed on ROI and target image to find the peak coordinates

The total offset or translation is carried out based on the position of the peak in the cross correlation matrix.

Check for the successful extraction of face from target image and figure out where the face exactly matches inside of target image.

IV. SYSTEM OVERVIEW

The System Architecture Consists of basically three layers that is, the Application Layer, the System Layer and the Databases layer.

A. Appli*cation l*ayer
There is the capturing phase in this the user captures the frames and using a web app that runs on almost all platforms upload the file to the server. Authentication is provided to the users. This web app is used to upload captured frames as well as to view the attendance.

B. System layer
This is the layer where the processing is done that is the detection and recognition part at the server side. Viola and Jones algorithm is used to detect images from the frames. Initially an integral image is generated from the frame which simply assigns numbers to the pixels generated by summing up the values. Further to detect the objects from the frames the haar-like feature is generated and as millions of features being generated adaboost(boosting algorithm) is used to enhance the performance. The extracted features are passed through a trained classifier which detects the faces from the objects.
These detected faces are cropped and passed through the recognition module which by applying correlation to the cropped images and the images in the databases recognizes the faces.

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Vol. 3, Issue 8, August 2015

C. Database layer

The Database layer is a centralized database system which consists of student database and their attendance. The student database is formed by initial feeding of the frames from which system detects faces crops them and stores it to the database and these stored images are hence forth used for the recognition part. The results of the face recognition module are compared with the images from the student database and after the successful comparison the attendance is updated to the database. The sheet is generated and uploaded to the web app.

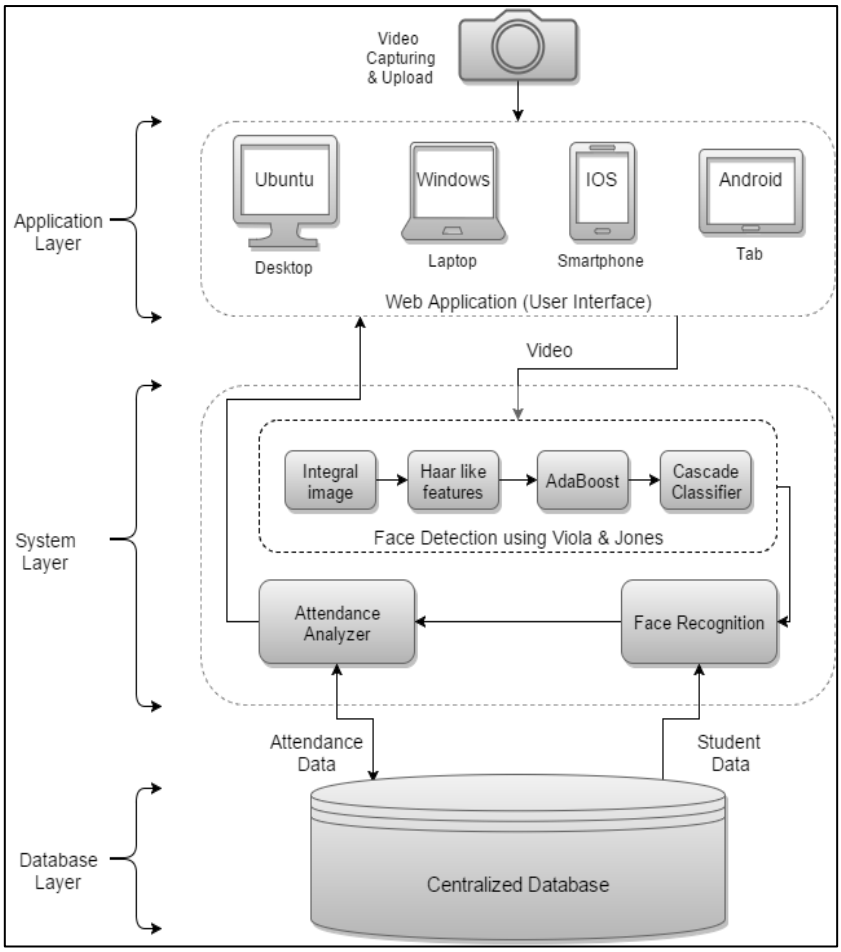

Figure 1: System Architecture

V. METHODOLOGY

The proposed system introduces an automated attendance system which integrates a web app and face recognition algorithms. Any device with a camera can capture an image or a video and upload to the server using web app. The received file undergoes face detection and face recognition so the detected faces are extracted from the image. The extracted faces are then compared with the saved faces of the database and on the successful recognition the database is updated with the attendance and a sheet is generated and displayed on the web app.

This work is being carried out in five stages:

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Vol. 3, Issue 8, August 2015

Step 1: Generating Data for Training
Initially the system is trained that is the cropped images are saved to the database and they undergo detection and recognition. Further this data will be used to compare the detected images in all the uploaded files and mark the attendance.

Step 2: Capturing
In this the capturing of the video or image will be done using a device and the captured file is uploaded to the server using web app.

Step 3: Face Detection
The file uploaded to the server undergoes face detection using Viola and Jones algorithm. The frames received are checked for the faces and those are cropped for further recognition.

Step 4: Face Recognition
The detected images undergo correlation with the trained images of the databases. By this the detected images are now recognized.

Step 5: Attendance Marking
After the recognition process the students recognized are searched in the database and their attendance is marked.

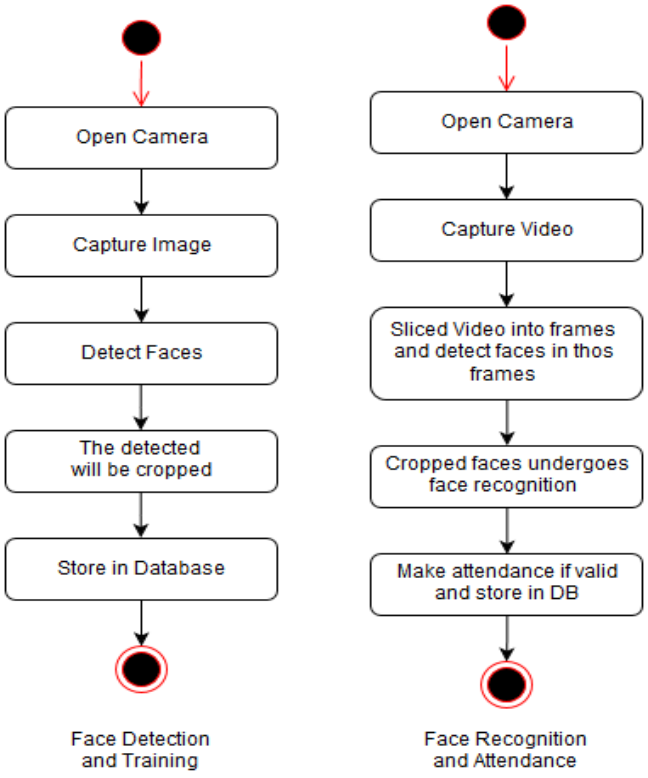

Figure 2: Training and Face Detection & Recognition

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VI. CONCLUSION AND FUTURE WORK

In order to maintain the attendance this system has been proposed. It replaces the manual system with an automated system which is fast, efficient, cost and time saving as replaces the stationary material and the paper work. Hence this system is expected to give desired results and in future could be implemented for logout. Also the efficiency could be improved by integrating other techniques with it in near future.

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Chapter 11

Appendix I

11.1 What is Local Binary Pattern?

Local binary patterns (LBP) is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990. LBP was first described in 1994. It has since been found to be a powerful feature for texture classification; it has further been determined that when LBP is combined with the Histogram of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.

11.1.1 The LBP feature vector:

Divide the examined window into cells (e.g. 16x16 pixels for each cell).
For each pixel in a cell, compare the pixel to each of its 8 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise or counter-clockwise.
Where the center pixel's value is greater than the neighbor's value, write "0". Otherwise, write "1". This gives an 8-digit binary number (which is usually converted to decimal for convenience).
Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center). This histogram can be seen as a 256-dimensional feature vector.
Optionally normalize the histogram.
Concatenate (normalized) histograms of all cells. This gives a feature vector for the entire window.

11.2 What is ROA?

A region of interest (often abbreviated ROI), is a selected subset of samples within a dataset identified for a particular purpose. The concept of a ROI is commonly used in many application areas. For example, in medical imaging, the boundaries of a tumor may be defined on an image or in a volume, for the purpose of measuring its size. The endocardial border may be defined on an image, perhaps during different phases of the cardiac cycle, for example end-systole and end-diastole, for the purpose of assessing cardiac function. In geographical information systems (GIS), a ROI can be taken literally as a polygonal selection from a 2D map. In computer vision and optical character recognition, the ROI defines the borders of an object under consideration. In many applications, symbolic (textual) labels are added to a ROI, to describe its content in a compact manner. Within a ROI may lie individual points of interest (POIs).

11.3 Correlation

Correlation technique is used for face recognition. Where after face detection image undergoes face recognition process, where test image will be compared with training images in order to perform face recognition.

11.4 Average Paper Sheet waste generated in a year by a single employee

Lowering paper usage at the office can result in higher efficiency measures and increased productivity levels throughout an organization. Changes in paper consumption can include increasing recycling efforts, printing less or even going paperless with document management software. Doing so could provide inspiration to employees as well as large monetary savings for your organization.

• The average office worker continues to use a staggering 10,000 sheets of copy paper every year.

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