Dr. A.P.J. Abdul Kalam Technical University

Uttar Pradesh

A MAJOR PROJECT SYNOPSIS REPORT

ON

Advance Face Recognition Attendence System

SUBMITTED TOWARDS

PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF TECHNOLOGY

(Computer Science And Engineering)

By

Rohit Gupta **Roll No: 1903630100087**

Shaurya Ranjan **Roll No: 1903630100097**

Shikhar Singh **Roll No: 1903630100098**

Sonu Verma **Roll No: 1903630100105**

CERTIFICATE

This is to certify that the Project Entitled

Advance Face Recognition Attendence System

Submitted by

Rohit Gupta

Roll No: **1903630100087**

Shaurya Ranjan

Roll No: **1903630100097**

Shikhar Singh

Roll No: **1903630100098**

Sonu Verma

Roll No: **1903630100105**

is a bonafide work carried out by Students under the supervision of

Prof. Dr. Yusuf Perwej

and it is submitted towards the partial fulfillment of the requirement of Bachelor of Technology (Computer Science And Engineering) Project.

Prof. Dr. Yusuf Perwej

(Internal Guide)

Prof. Dr. Neeta Rastogi

(Sr. Head Of Department)

Dept.of Computer Science And Engineering

Mr/Mrs .....

(External Examiner)

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Rohit Gupta

Shaurya Ranjan

Shikhar Singh

Sonu Verma

(B.Tech. Computer Science Engg.)

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Introduction

Attendance systems of old practices are not quite efficient now a days for keeping track on student's attendance. Student enrollment in schools and colleges increasing every year and taking each student attendance plays a very vital role. So, it is necessary to discuss the effective system which records the attendance of a student automatically.

Maintaining the attendance is very important in all the schools/colleges for checking the performance of students. Every school/college has its own method in this regard. Some are taking attendance of students manually using attendance registers or marking attendance sheets or file-based approach and some have adopted the methods of automatic attendance using some biometric techniques. But in these methods, students have to wait for a long time in making a queue at the time they enter inside the classroom.

Many biometric systems are available in the market but the key authentications are same in all of the techniques. Every biometric system consists of enrollment process in which the unique features of a person is stored in the database and after that, there are some processes of identification and verification of the person. These two processes compare the biometric feature of a person with previously stored template captured at the time of enrolment of a student. Biometric templates can be of many types like Fingerprints, Eye Iris, voice etc. Our system uses the face recognition approach for the automatic attendance of the students in the classroom environment without student intervention. The purpose of developing the new attendance management system is to computerize the traditional methods of taking the attendance. Therefore, in order to drag the attention of students and make them interactive in observing technologies, we try to move on to the latest upcoming trends on developing attendance systems. This is the reason for college/school attendance management system to come up with an approach that ensures a strong contribution of students in classrooms.

To track the attendance of the students, we have introduced the attendance management system. With the introduction of this attendance system, skipping classes for students without the staff's knowledge have become difficult. Attendance management system is to count the number of students and urge students to attend the classes on time, so as to improve the quality of teaching.

Usually, a roll-call is taken to determine whether the student is present in the class or not, which usually wastes a lot of time. In recent years, with the emerging technology and with the development of deep learning, face recognition has made great achievements, which leads us to a new way of thinking to solve the problem of student's enrollment. So, in order to save time, the idea to count the number of students in a class automatically based on face recognition is incorporated. This system is developed by using face recognition technique which is used to detect the face of an individual. There are many different face recognition algorithms introduced to increase the efficiency of the system. The system provides an increased accuracy due to the use of a large number of features like Shape, color, LBP,

wavelet, Auto-Correlation etc. of the face. However, the face recognition still remains a challenging problem for us because of its fundamental difficulties regarding various factor like illumination changes, face rotation, facial expression etc.

Problem Statement

When it here is so many students in a school/college, it becomes more and more difficult to mark attendance for each student and it is time consuming too. The Existing system of any institute is a manual entry for the students. This system faces the issue of wastage of time and also becomes complicated when the strength is more than the usual. Here, the attendance is being carried out in the hand written registers. It is very tedious job for us to maintain the record of the user.

Whenever we have to measure the performance of students, finding and calculating the average of the attendance of each enrolled student is also a very complicated task for us. The human effort is more here. The retrieval of the information is not a piece of cake as the records are maintained in the hand written registers. This existing system requires correct feed on input into the respective field. Therefore, we are in a need of an automated system for marking and maintaining attendance of the students. Let us suppose that the wrong inputs are entered, the application resist to work. So, the user finds it difficult to use the existing system.

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions. Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class. Thus, face recognition student attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get distracted in order to sign for their attendance. Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students.

The paper proposed by Zhao, W et al. (2003) has listed the difficulties of facial identification. One of the difficulties of facial identification is the identification between known and unknown images. In addition, paper proposed by Pooja G.R et al. (2010) found out that the training process for face recognition student attendance system is slow and time-consuming. In addition, the paper proposed by Priyanka Wagh et al. (2015) mentioned that different lighting and head poses are often the problems that could degrade the performance of face recognition-based student attendance system.

Hence, there is a need to develop a real time operating student attendance system which means the identification process must be done within defined time constraints to prevent omission.

The extracted features from facial images which represent the identity of the students have to be consistent towards a change in background, illumination, pose and expression. High accuracy and fast computation time will be the evaluation points of the performance.

Objective

Our objective is to detect unique faces with the help of mobile camera amidst the other natural components like walls, backgrounds etc. and to extract the unique features faces amongst other face characteristics such as beard, spectacles etc. of a face useful for face detection and recognition.

Our primary goal is to help the lecturers, improve and organize the process of track and manage student attendance and absenteeism. Additionally, we seek to:

- Provides a valuable attendance service for both teachers and students.
- Reduce manual process errors by provide automated and a reliable attendance system uses face recognition technology.
- Increase privacy and security which student cannot presenting himself or his friend while they are not.
- Produce monthly reports for lecturers.
- Flexibility, Lectures capability of editing attendance records.
- Calculate absenteeism percentage and send reminder messages to students.
- Easily manageable by School/College Staff and convert in the form of excel sheet.
- Avoiding the time losses during class started.

Feasibility study

A feasibility study is a high-level capsule version of the entire System analysis and Design Process. The study begins by classifying the problem definition. Feasibility is to determine if it's worth doing. Once an acceptance problem definition has been generated, the analyst develops a logical model of the system. A search for alternatives is analyzed carefully.

There are 3 parts in feasibility study.

Operational Feasibility

Question that going to be asked are:

- Will the system be used if it developed and implemented?
- If there was sufficient support for the project from the management and from the users.
- Have the users been involved in planning and development of the Project.
- Will the system produce poorer result in any respect or area?

This system can be implemented in the organization because there is adequate support from management and users. Being developed in Python so that the necessary operations are carried out automatically.

Technical feasibility:

- Does the necessary technology exist to do what is been suggested?
- Does the proposed equipment have the technical capacity for using the new system?
- Are there technical guarantees of accuracy, reliability and data security?
- The project is developed on Pentium version processor with 256 – 1024 MB RAM.
- The environment required in the development of system is any windows platform
- The observer pattern along with factory pattern will update the results eventually
- The language used in the development is core java Programming & Windows Environment

Financial and Economic Feasibility:

The system developed and installed will be good benefit to the organization. The system will be developed and operated in the existing hardware and software infrastructure. So, there is no need of additional hardware and software for the system.

Methodology

The approach performs face recognition-based student attendance system. The methodology flow begins with the capture of image by using simple and handy interface, followed by pre-processing of the captured facial images, then feature extraction from the facial images, subjective selection and lastly classification of the facial images to be recognized. Both LBP and PCA feature extraction methods are studied in detail and computed in this proposed approach in order to make comparisons. LBP is enhanced in this approach to reduce the illumination effect. An algorithm to combine enhanced LBP and PCA is also designed for subjective selection in order to increase the accuracy. The details of each stage will be discussed in the following sections.

The flow chart for the proposed system is categorized into two parts, first training of images followed by testing images (recognize the unknown input image) shown in Figure 1 and Figure 2 respectively.

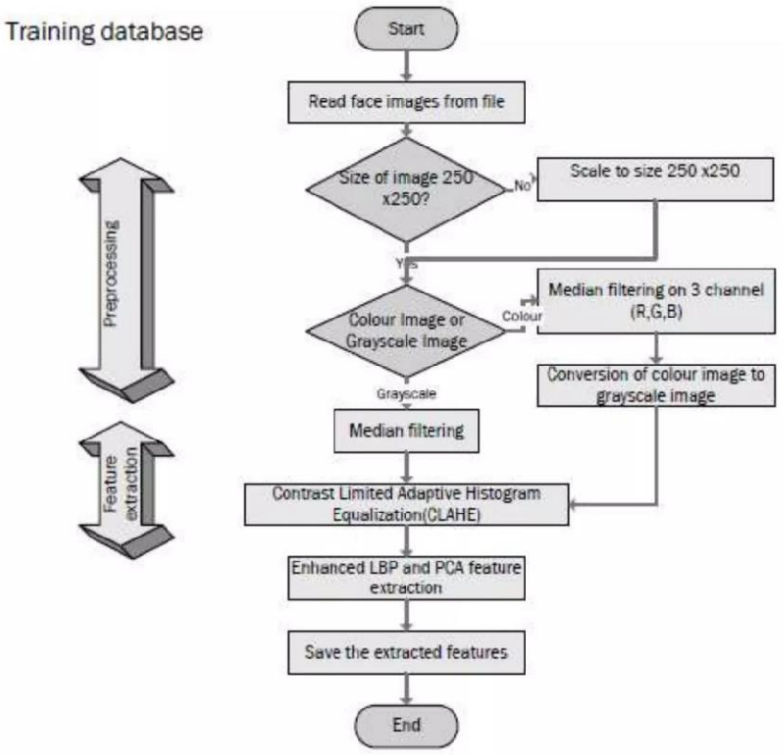


Fig 1: Flow of proposed Approach (training part)

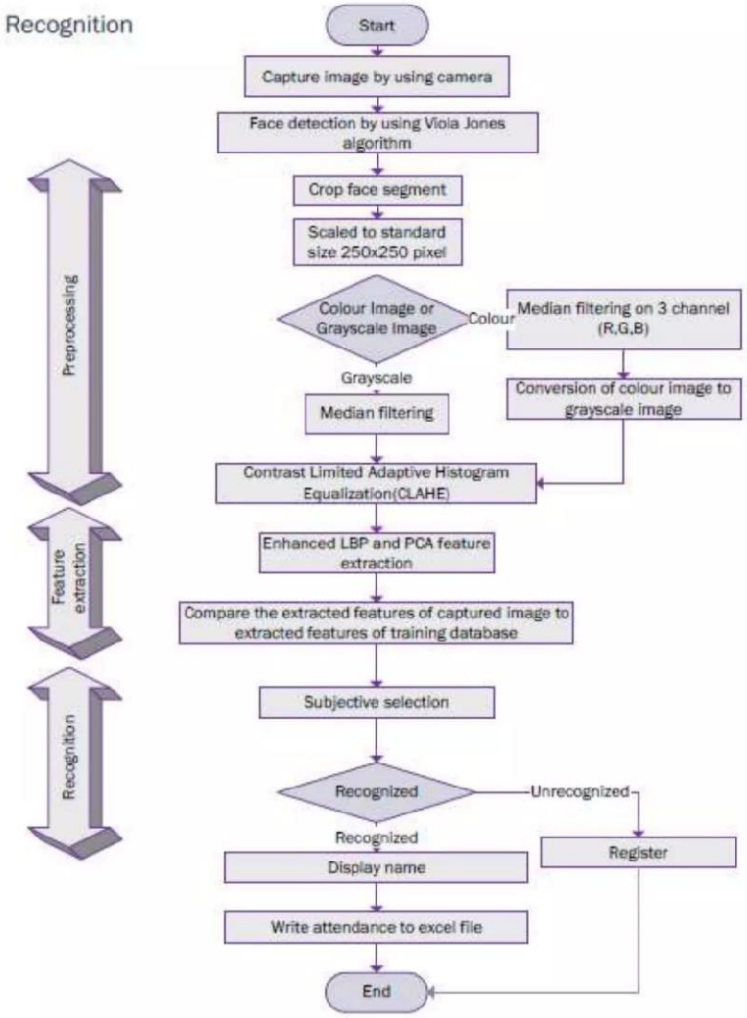


Fig 2: Flow of Proposed Approach (recognition parts)

Modules specification

The Proposed system are divided into Five modules such as:

- **Input image/ Image Capture**
- **Face detection**
- **Pre-Processing**

- **Database development**
- **Post processing**

Input Image

Although our own database should be used to design real time face recognition student attendance system, the databases that are provided by the previous researchers are also used to **design** the system more effectively, efficiently and for evaluation purposes.
Yale face database is used as both training set and testing set to evaluate the performance. Yale face database contains one hundred and sixty-five grayscale images of fifteen individuals. There are eleven images per individual; each image of the individual is in different condition. The conditions included center-light, with glasses, happy, left-light, without glasses, normal, right-light, sad, sleepy, surprised and wink. These different variations provided by the database is able to ensure the system to be operated consistently in variety of situations and conditions.

Limitations of the image

The input image for the proposed approach has to be frontal, upright and only a single face. Although the system is designed to be able to recognize the student with glasses and without glasses, student should provide both facial images with and without glasses to be trained to increase the accuracy to be recognized without glasses. The training image and testing image should be captured by using the same device to avoid quality difference. The students have to register in order to be recognized. The enrolment can be done on the spot through the user-friendly interface.
These conditions have to be satisfied to ensure that the proposed approach can perform well.

Face Detection: Face detection is a process of locating a face inside an image frame, regardless of the identity of that face. Before recognizing a face, it is first essential to detect and extract the faces form the original pictures. Face Detection target on finding the faces (area and size) in an image and probably extract them to be used by the face recognition algorithm. In recent years, many methods are proposed for detecting the face.
In face detection methods, those who are depending on training sets to capture the huge unevenness in facial features have enticed much attention and given the best results. Generally, these methods scan the input picture at all potential area and scales then as the sub windows either as non-face or face. Viola and Jones presented an effective detection technique using *Haar-like features* and AdaBoost as a quick training algorithm. For recognizing a face, the algorithms compare only faces. Any other element in the picture that is not part of a face deteriorates the recognition.
There are several existing algorithms for detecting faces. Prior to year 2000 there were many techniques for face detection, however they were mostly unreliable, slow and require manual inputs. In 2001 Viola and Jones invented the Haar-based-cascade a Classifier that

revolutionize the face detection method. It can detect objects in real time with an accuracy of 95%. It works not only for frontal face view but it can detect faces from side view as well.

Face Preprocessing:

Testing set and training set images are captured using a camera. There are unwanted noise and uneven lighting exists in the images. Therefore, several pre-processing steps are necessary before proceeding to feature extraction.
Pre-processing steps that would be carried out include scaling of image, median filtering, conversion of colour images to grayscale images and adaptive histogram equalization.

Any of the previous methods can be used for extracting faces from input pictures. The next step is to pre-process these faces in order to make the training phase easier and improve the probability to recognize a person correctly. The training data will be standardized. Not all the pictures have the same zoom on the face and have maybe not all the same size. Most of the algorithms for facial recognition require the same size for the entire training set. Pre-processing includes different modifications. First of all, the faces need to be centered in the picture in the same way. The location of the two eyes and the nose is often used as a landmark for centering faces. The aim is to have the eyes at the same level and the nose at the same position for all images. To apply these modifications, the coordinates of the landmarks are needed. For that, it is possible to use a Haar-cascade classifier for detecting nose and eyes.

After detecting a face in the frame, we can now process the face inside the green rectangle. Face recognition is susceptible to changes in lighting conditions, face orientation, face expression, so it is paramount to diminish these differences as much as possible. There are numerous techniques to eliminate those issues. Some of these techniques are:-

- Geometrical transformation and cropping: This procedure includes resizing of the image and rotating the image as well as removing background.
- Histogram equalization: This process standardizes the brightness and contrast of the image.
- Smoothing: In this process, the image noise is eliminated by applying some filters.
- Elliptical mask: The elliptical mask removes some remaining background.

Processing images can be computationally expensive in a PC or laptop, similarly in mobile devices. It requires higher processing power. Therefore, minimalizing the image processing in the mobile device is a must to achieve a real-time face recognition system

Database development:

In this Biometric based system collection of every individual is required. This database development phase consists of image capture of every individual student and extracting the Bio-metric feature for every individual, in our proposed system it is face, and after it is enhanced using pre-processing techniques and to be stored in the database.

Face Recognition/ Post Processing:

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

Proposed Algorithm

1. Capture the student's image through camera.
2. Detect each and every individual face by apply face detection algorithm.
3. Extract the ROI (Region of Interest) in rectangular bounding box.
4. Converting to gray scale, apply histogram equalization and resize to 100x 100 i.e., apply pre-processing.
5. If image captured then

Store in database

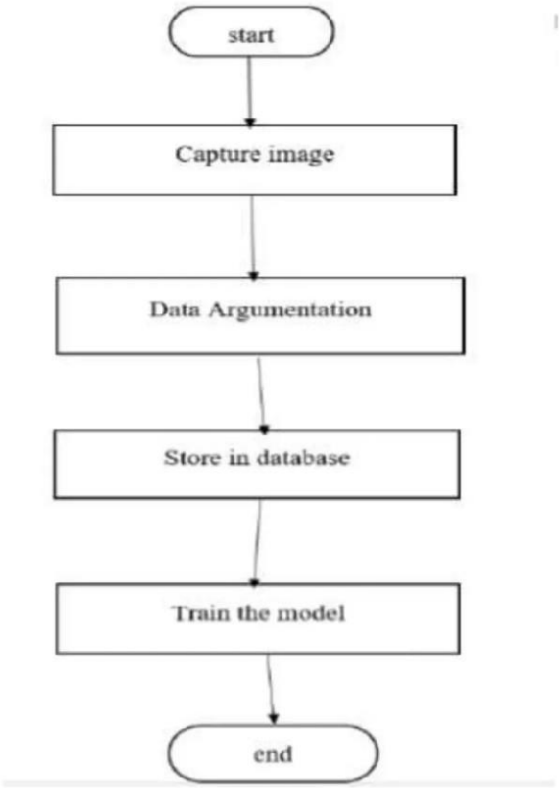
Else

Apply LBPH (for feature extraction)

Apply SVM (for classification)

End if

6.Post-processing



Component diagram

Component diagram:

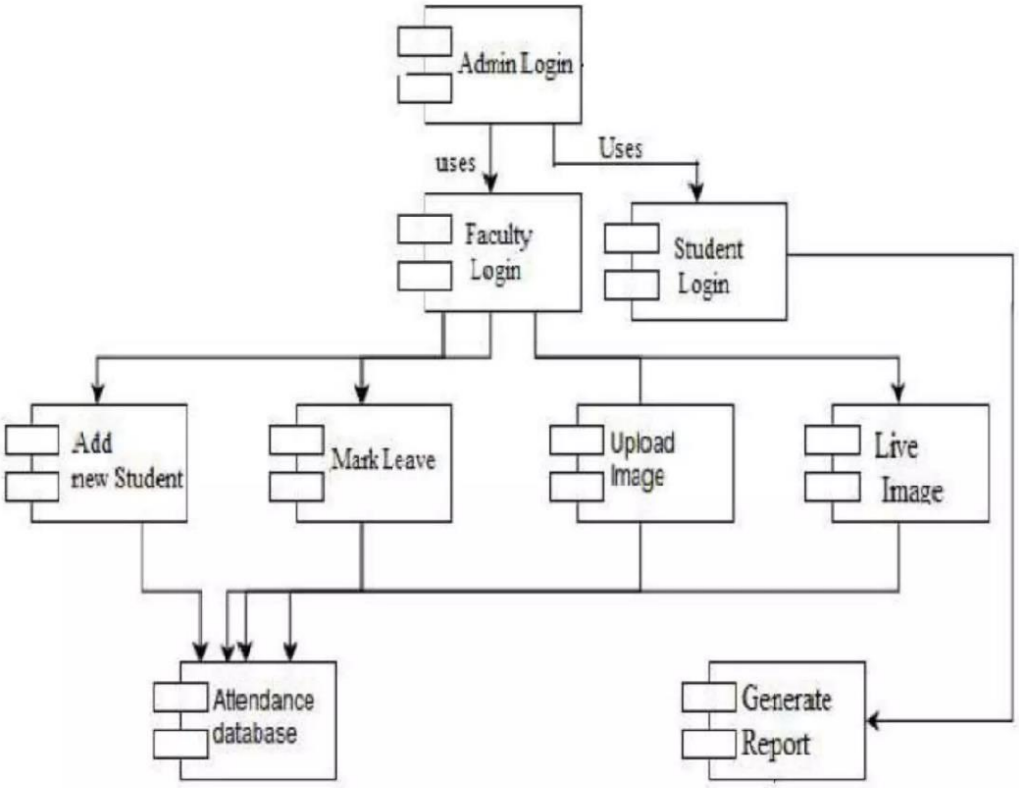


Fig 3: component diagram of face recognition for e-attendance

Entity Relationship diagram

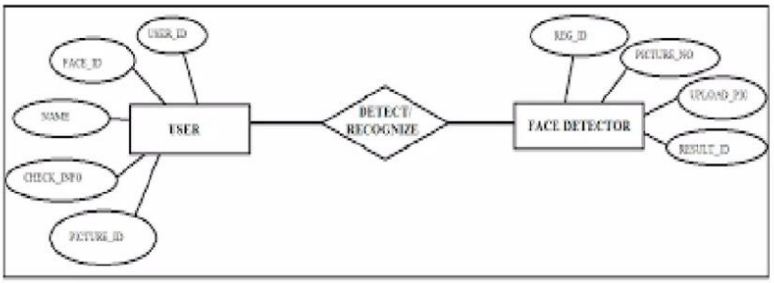


Fig: Relationship between user and face detection

Dataflow diagram

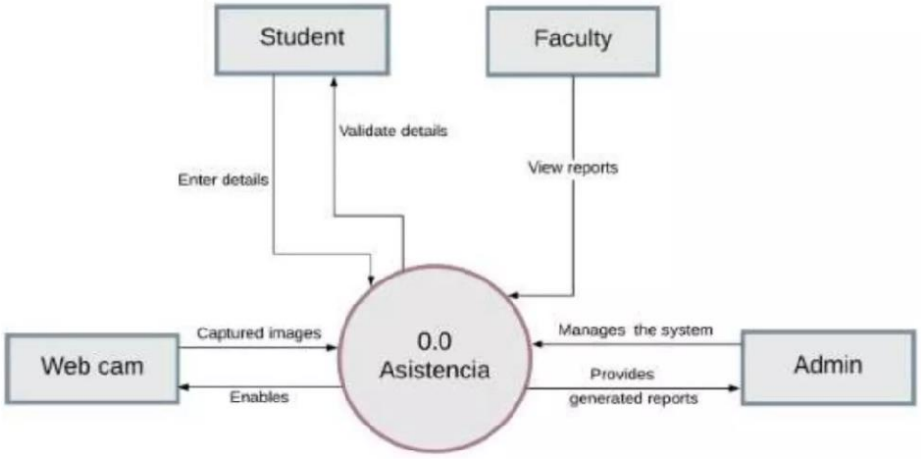


Fig: context diagram

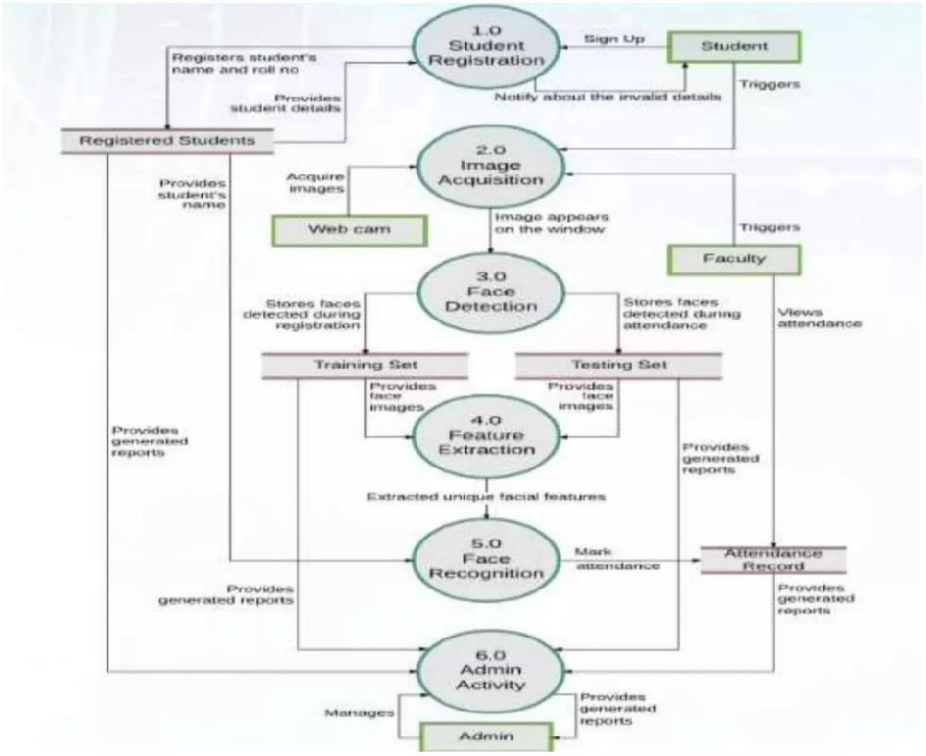


Fig: data flow diagram (level 1)

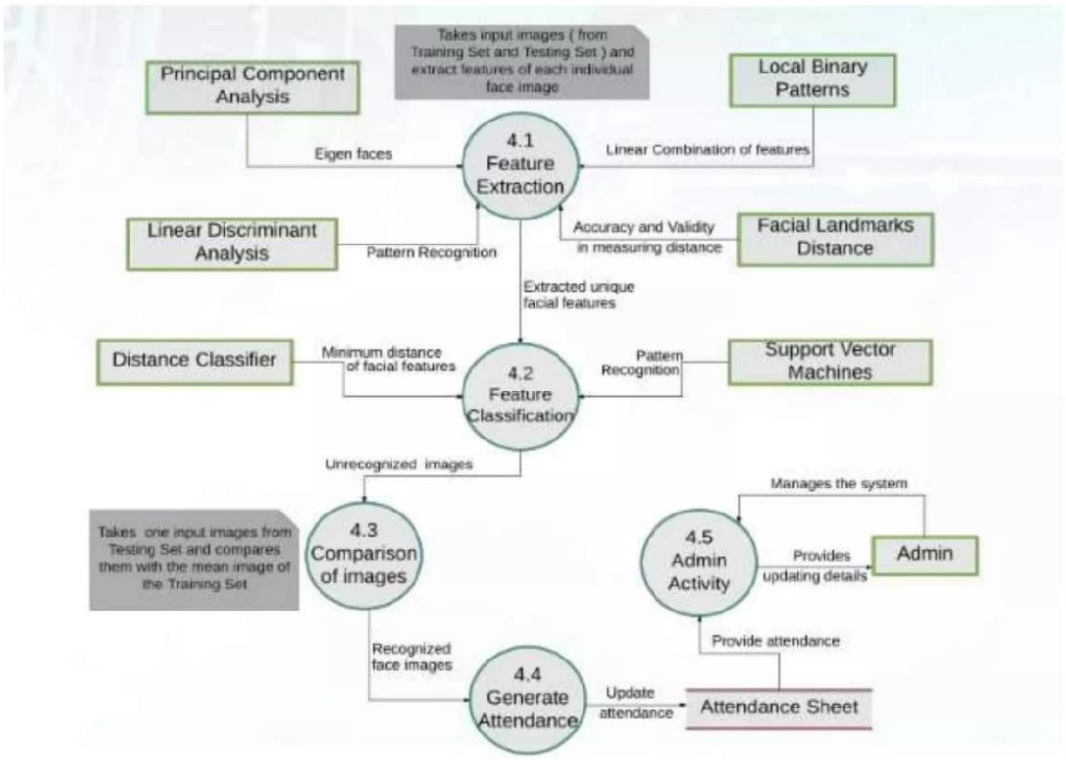


Fig: data flow diagram (Face Recognition)

Facility required for purposed work

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).

Tools and Environments Used

System Requirements Specification

- **Technical Requirement**

  Hardware Requirements

  - A standalone computer (intel Processor, 4gb ram or higher)
  - High-quality wireless camera to capture images
  - Secondary memory to store all the images and database

  Software requirements

  - Windows operating System (7, 8, 10)
  - Java development kit
  - Java applets
  - Latest version of all libraries

- **Functional Requirements**

  System functional requirement describes activities and services that must provide.

  - A user must be able to manage student records.

- An only authorized user must be able to use the system.
- A system must be attached to wireless camera and face recognition should be smooth.
- The administrator or the person who will be given the access to the system must
- login into the system before using it.
- The information must be entered and managed properly.

❖ **Non-Functional Requirements**

Non-functional Requirements are characteristics or attributes of the system that can judge its operation. The following points clarify them:

- Accuracy and Precision: the system should perform its process with accuracy and precision to avoid problems.
- Flexibility: the system should be easy to modify, any wrong should be correct.
- Security: the system should be secure and saving student's privacy.
- Usability: the system should be easy to deal with and simple to understand.
- Maintainability: the maintenance group should be able to cope up with any problem when occurs suddenly.
- Speed and Responsiveness: Execution of operations should be fast.

Non–Functional Requirements are as follow:

- ✓ The GUI of the system will be user-friendly.
- ✓ The data that will be shown to the users will be made sure that it is correct and is available for the time being. The system will be flexible to changes.
- ✓ The system will be extended for changes and to the latest technologies.
- ✓ Efficiency and effectiveness of the system will be made sure.
- ✓ The performance of the system will be made sure.

❖ **Student Requirements**

- ✓ A student needs to enter the proper details while registering him/her.
- ✓ He/ She needs to sit properly and capture 10-15 images of himself/herself in different directions and expressions.
- ✓ At the time of taking attendance, students need to sit properly facing the camera.

❖ **Teaching Staff Requirements**

- ✓ The faculty needs to log into the system at the time of attendance.
- ✓ The faculty needs to enter lecture details before starting the attendance process.
- ✓ If the entered lecture details don't match with the ones in the database (excel sheet) an error dialog will be displayed.

- ✓ As the students are recognized by the system, the attendance report will be generated and shown to the faculty.

❖ **Administrator Requirements**

- ✓ The administrator needs to log into the system at the time of registering the students in the face recognition process.
- ✓ He / She must make sure that the student enters the details properly.
- ✓ Only the administrator has the rights to manage any changes in the system.
- ✓ Only the administrator is allowed to view the Training set and the Testing set.
- ✓ Only the administrator has the rights to manage any changes in the stored data set.

Conclusion

In this approach, a face recognition based automated student attendance system is thoroughly described. The proposed approach provides a method to identify the individuals by comparing their input image obtained from recording video frame with respect to train image. This proposed approach able to detect and localize face from an input facial image, which is obtained from the recording video frame. Besides, it provides a method in pre-processing stage to enhance the image contrast and reduce the illumination effect. Extraction of features from the facial image is performed by applying both LBP and PCA. The algorithm designed to combine LBP and PCA able to stabilize the system by giving consistent results. The accuracy of this proposed approach is 100 % for high-quality images, 92.31 % for low-quality images and 95.76 % of Yale face database when two images per person are trained.

As a conclusion for analysis, the extraction of facial feature could be challenging especially in different lighting. In pre-processing stage, Contrast Limited Adaptive Histogram Equalization (CLAHE) able to reduce the illumination effect. CLAHE perform better compared to histogram equalization in terms of contrast improvement. Enhanced LBP with

larger radius size specifically, radius size two, perform better compared to original LBP operator, with less affected by illumination and more consistent compared to other radius sizes.

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. In this system we have implemented an attendance records to assist Faculty. It saves time and effort, especially if it is a lecture with huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional (manual) system.

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. I am 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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