STUDENT ATTENDANCE USING FACE DETECTION/ RECOGNITION SYSTEM

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Abstract

This paper seeks to explain the effectiveness of Biometric Face-Recognition Technology in a student attendance system. A face is a unique person identification feature similar to a finger print. Thus, network access control via face-recognition enables differentiation between persons and furthermore, makes it virtually impossible for hackers to steal one's "password". More importantly, the technology enhances the user-friendliness of human-computer interaction as the system does not need the object's corporation. Indexing or reviewing video data based on the appearance of persons is useful for students.

A Face Recognition Project was undertaken for Information and Communications University, Zambia with the objective of replacing the current student attendance marking system which is manual and requires students to write their names on a piece of paper that is passed on from one student to another during exams or lectures.

Some basic Dot Net Application Programming Interface (API's) are used to interact and get the output of local cameras which maybe a webcam or any other attached camera. The system works as follows: the university enrolment administrator will enrol the student's face into the attendance system using a camera. The system then manipulates live video data to identify faces in it. Faces are stored in matrix form and can be detected whenever they reappear. The system is capable of detecting multiple faces in real-time video at the same time.

Face Recognition requires no physical interaction on behalf of the student. It is accurate and allows for high enrolment and verification rate. It does not require an expert to interpret the result and it is the only biometric technique that allows performing passive identification in a one to many environments (e.g. identifying a person in a busy airport terminal). Among all biometric techniques, face recognition technique possesses one great advantage which is its user friendliness (or non-intrusiveness).

Introduction and Background

Face recognition rises from the moment machines became more "Intelligent" and had the advance to fill in, correct or help the lack of human abilities and senses. In 1960s, the first semi-automated systems for facial recognition was implemented to locate the features such as eyes, ears, nose and mouth. In 1970s Goldstein and Harmon used 21 specific subjective markers such as hair colour and lip thickness to automate the recognition and in 1988, Kirby and Sirovich used standard linear algebra technique for face recognition. The subject of face recognition is as old as computer vision. Face recognition is not the only method of recognising other people, even humans between each other have senses to recognise others. However, machines have a wider range for recognition purposes, which use thinks, such as fingerprints or iris scans. Despite the fact that these methods of identification can be more accurate, face recognition remains a major focus of research because of its non-intrusive nature and that it is people's primary method of person identification. This software project uses some basic .net API's to interact and get the output of the local camera. It may be a webcam or any other attached camera, the API's are used to get the video from the camera into the system. The video data is used to manipulate and recognise faces in real time. The system works as follows:

- The university enrolment administrator enrolls the student's face into the attendance system.
- Faces can be enrolled using the system camera.
- The system works to manipulate live video data to identify faces in it.
- The next step is to store faces of students based on a matrix form.
- Once faces have been recognized and stored, they can be detected.
- Whenever faces reappear, they can be recognized by name in a real-time video.
- The system is also capable of detecting multiple faces in a real-time video at the same time.

Humans have been using physical characteristics such as face, voice, etc. to recognise each other for thousands of years. With new advances in technology, biometrics has become an emerging technology for recognising individuals using their biological traits. In developing this system, the goal is to come up with an inexpensive security surveillance system which will be able to detect and identify students using their facial and body characteristics in adverse weather conditions. There are many factors that influence this type of method which include lighting conditions, background noise, fog and rains. Particular attention is given to face recognition as it refers to an automated or semi-automated process of matching facial images. Many techniques are available to apply face recognition one of which is Principle Component Analysis (PCA). PCA is a way of identifying patterns in data in such a way to highlight their similarities and differences.

Face Recognition

Face recognition is the task of identifying an already detected object as a known or unknown face, and in more advance cases, telling exactly whose face it is, as depicted in (Figure 1).

Face Detection is to identify an object as a "face" and locate it in the input image.

Fig. 1:

Face detection and face recognition flow chart

Image Input　　　　　　　　**Detected Face**

| Face Detection | → | Face Recognition | → | Matched or Unmatched |
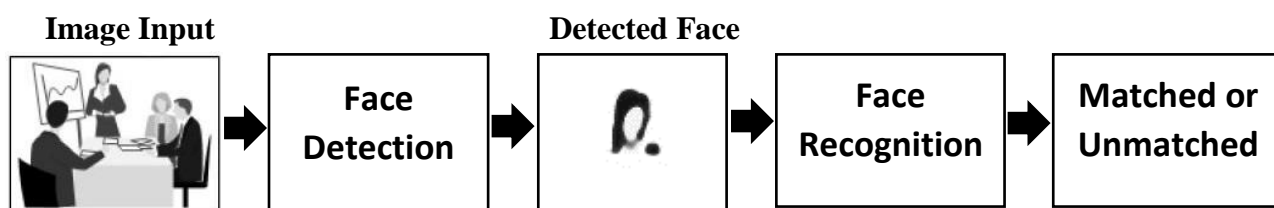
Materials / Methods / Deign / Methodology
Materials
The Project is loaded in Visual Studio 2010 which is used for Designing and coding. All databases are created and maintained in SQL Server 2008 such that tables are created and queries written for store data or project record.

❖ **Hardware Requirement: -**
  ➢ i3 Processor Based Computer
  ➢ 2 GB-RAM
  ➢ 5 GB Hard Disk
  ➢ Camera
❖ **Software Requirement:**

  ➢ Windows 7 or higher

  ➢ Visual studio 2010.
  ➢ SQL Server 2008.

Method
Verbal interviews with students as well as personal observations were the methods used to gather information for the coding of the proposed system. The system was inspired by Informal and formal deliberations with my fellow students. No questioner was made done to establish exact percentages of students supporting the system. However, the general view is that of having a system that would ease marking of attendance and avoid destruction brought about by writing of names on a piece of paper during exams or lectures.
Methodology

❖ **Proposed System**

1. Image input of students using cameras
   - Image input of class will be taken from the camera which will consist of all the students present in class for that particular lecture or exam.

2. Face Detection
   - Using algorithm, the face of the student is detected for identification.

3. Face Recognition
   - Here, the detected face is recognized for further comparison with the students for matching.

4. Feature Comparison
   - In this phase the calculated features are compared with stored features.

5. Attendance Database
   - Particular students are registered in the database. This database is stored in the backend of the system and the results drawn are all entered in the database.

6. Monthly Report
   - At the end of each month, monthly reports could be generated as per university norms.

The report can be generated accordingly, in this way, the proposed system does the work of attendance marking using face detection and face recognition respectively and generates the final report accordingly. The facial recognition system mainly consists of two phases: Enrolment phase and the Authentication / verification phase. Enrolment: This includes Capturing and processing of user biometric data for use by the system in subsequent authentication operations. During the first phase, user enrolment, features are extracted from the input face given by the student in a process called Feature extraction, and are modelled as a template. The modelling is a process of enrolling user to the verification system by constructing a model of his/her face, based on the features extracted from his/her facial sample. After the features are extracted and all the signal processing is done the system checks for the quality of the templates that are extracted from the face, if sufficient quality of features are extracted then the templates are stored in the database or else the system will acquire new facial image. The collection of all such enrolled models is called facial database. Facial recognition is a computer application that comprises complex algorithms that use mathematical and metrical techniques, these get the image in raster mode (digital format) and then process and compare pixel by pixel using different methods to obtain faster and reliable results, obviously these results depend on the machine used to process due to huge computational power that these algorithms have, functions and routines required, these are the most popular techniques used to solving this modern problem.

Design

The design of the system is as stipulated below:

- The university administrator enrolls the student's face into the attendance system.
- Faces can be enrolled using the system camera.
- The system works to manipulate live video data to identify student faces in it.
- The next step is to store these faces based on a matrix form.
- Once faces have been recognized and stored, they can be detected.
- Whenever student faces reappear, they can be recognized by name in a real-time video and attendance is marked.
- The system is also capable of detecting multiple faces in a real-time video at the same time.

Results

The outcome of the system is as stated below:

- Face recognition requires no physical interaction on behalf of the student.
- It is accurate and allows for high enrolment and verification rate.
- It does not require an expert to interpret the result and it's the only biometric that allows to perform passive identification in a one to many environment.
- Recognition is accurate regardless of vantage point or facial changes (glasses, beard and expression).
- User friendly design and fast identification
- High Usability and Security.
- Identification and authentication based on individual facial features.
- Combination of eye-zone extraction and facial recognition.
- Immediate user feedback.
- False acceptance rate is minimal approximately 1%.
- Biometric data readable and can be verified by humans.

Discussion

The proposed system satisfied user objectives and can be fitted easily into the current manual attendance marking operation. Moreover, the solution is operationally possible to implement and it will not cause any problem under any circumstances because it does not require any expert knowledge to interpret results. Economically, Face Recognition System is feasible in that the cost of development is very minimal compared to the financial benefits of the application. All the technologies required to develop the system are readily available.

This system can give guarantee of accuracy, ease of use, reliability and data security. Once implemented the university will no longer need the current attendance register which is more susceptible to errors. With minimal human interference, attendance is marked. Hence, a great financial saving resulting from reduction in manpower to specifically conduct roll call during exam and lectures.

The system would result in a great saving on time because as student report for either exam or lectures, an automatic attendance registration is done. Hence, the focus of lecturers and invigilators will be on mainly on academic exercises as they will have more time available to teach.

Once students are made aware of how accurate the attendance system is, all malpractices that may result from manual attendance marking system such as registering attendance on behalf of a colleague who is not even present may be avoided.

Conclusion

Face detection / recognition system has proved to be a simple and efficient techniques for processing and recognising face objects for students at communications and information university (ICU), Zambia. Considering its non-intrusive feature, it is the most accurate, reliable yet cost effective attendance system with the ability to produce excellent students' attendance reports. The problem of illumination and pose has also been dealt with in a uniform framework. In this system a reflectance model with varying albedo for 3D face has introduced a new concept with a self-ratio image. A 3D model has been used to synthesize the prototype image from a given image under any lighting and viewing conditions. This technique alone can be used to synthesize new images, i.e. enhancing appearance, adding this technique into existing subsequent subspace LDA system, basically the system is an enhanced system. Future plans include deforming 3D model to fit individuals better or using multiple 3D face models.

Acknowledgement

I am pleased to present "**Face Attendance System Project"** and take this opportunity to express my profound gratitude to all the people who helped me in my Project.

My deepest gratitude go to my Project Coordinator, Dr. Richard Silumbe for his valuable and timely advice during the various phases of the project, support, patience and trust in my ability to perform.

In conclusion I thank all my friends for their smiles and friendship that made my university life enjoyable and memorable, everyone who gave me assistance and family members for standing by me and provided the utmost moral support.
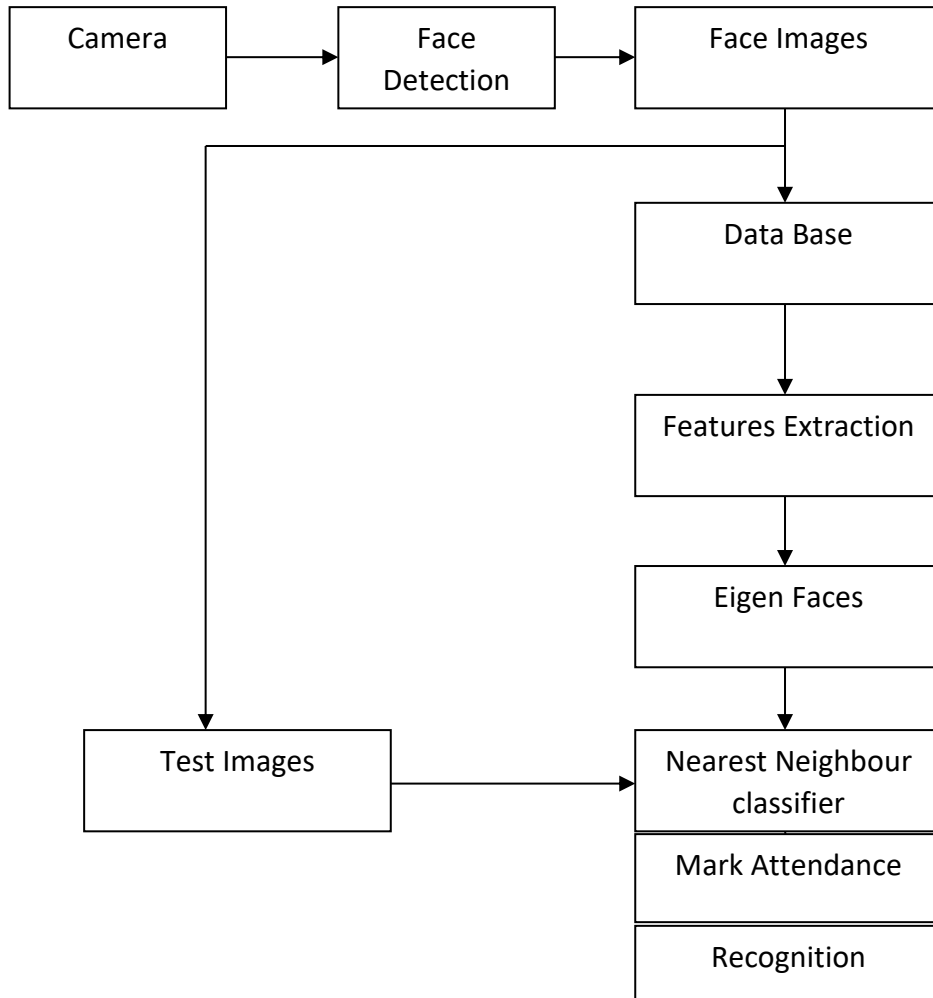
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[2] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=5274642&queryText%3Dface+detection

[3] http://en.wikipedia.org/wiki/Facial_recognition_system

[4] https://www.ijsr.net/archive/v2i11/MDIwMTM0ODI=.pdf

System Design

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┌──────────┐     ┌──────────┐     ┌──────────────┐
│  Camera  │────▶│   Face   │────▶│ Face Images  │
│          │     │ Detection│     │              │
└──────────┘     └──────────┘     └──────────────┘
      │                                   │
      │                                   ▼
      │                            ┌──────────────┐
      │                            │  Data Base   │
      │                            └──────────────┘
      │                                   │
      │                                   ▼
      │                            ┌──────────────────┐
      │                            │ Features         │
      │                            │ Extraction       │
      │                            └──────────────────┘
      │                                   │
      │                                   ▼
      │                            ┌──────────────┐
      │                            │ Eigen Faces  │
      │                            └──────────────┘
      │                                   │
      ▼                                   ▼
┌──────────────┐              ┌──────────────────────┐
│ Test Images  │─────────────▶│ Nearest Neighbour    │
│              │              │ classifier           │
└──────────────┘              ├──────────────────────┤
                              │ Mark Attendance      │
                              ├──────────────────────┤
                              │ Recognition          │
                              └──────────────────────┘
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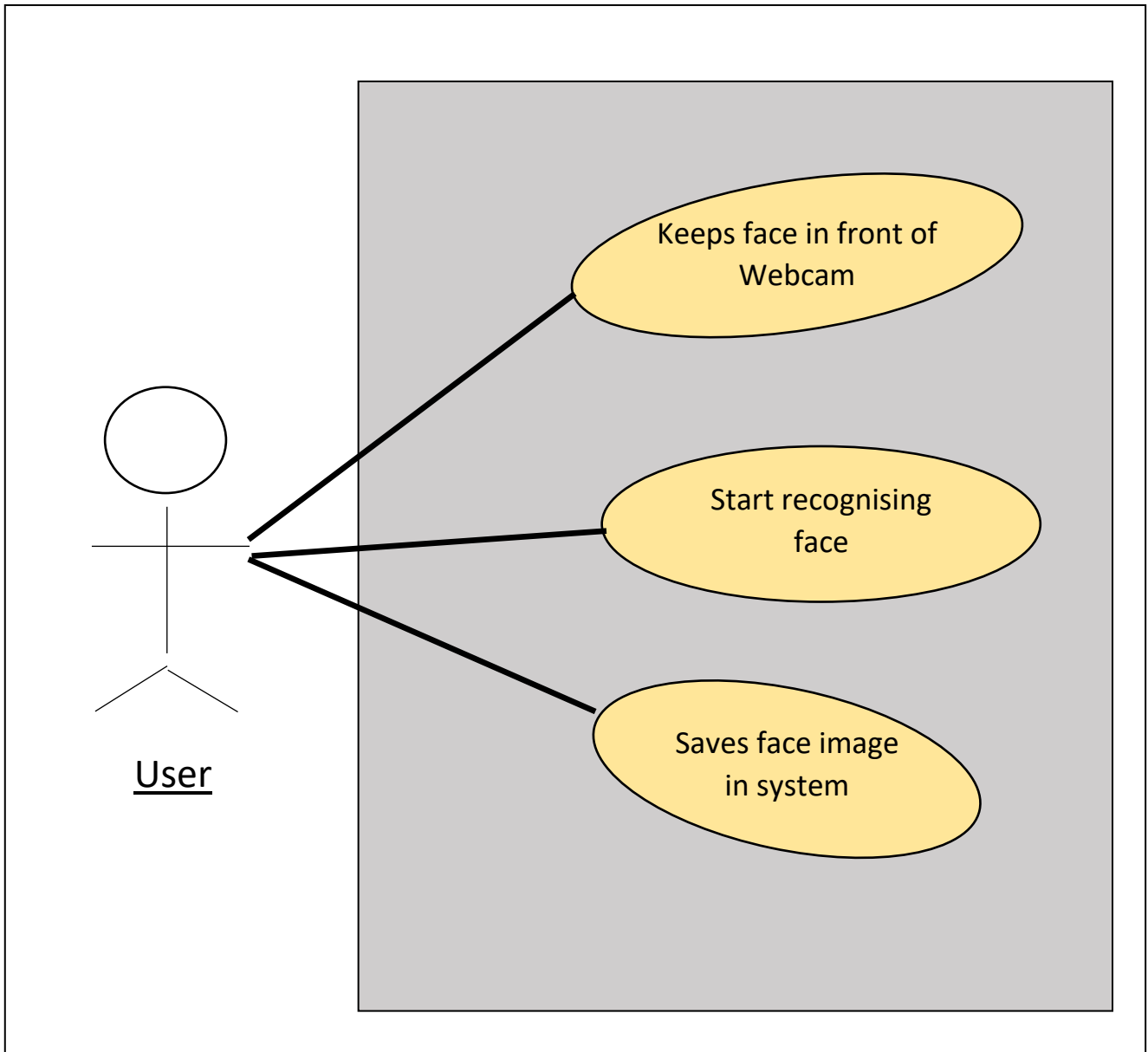**PROJECT DESIGN**

E-R Diagram
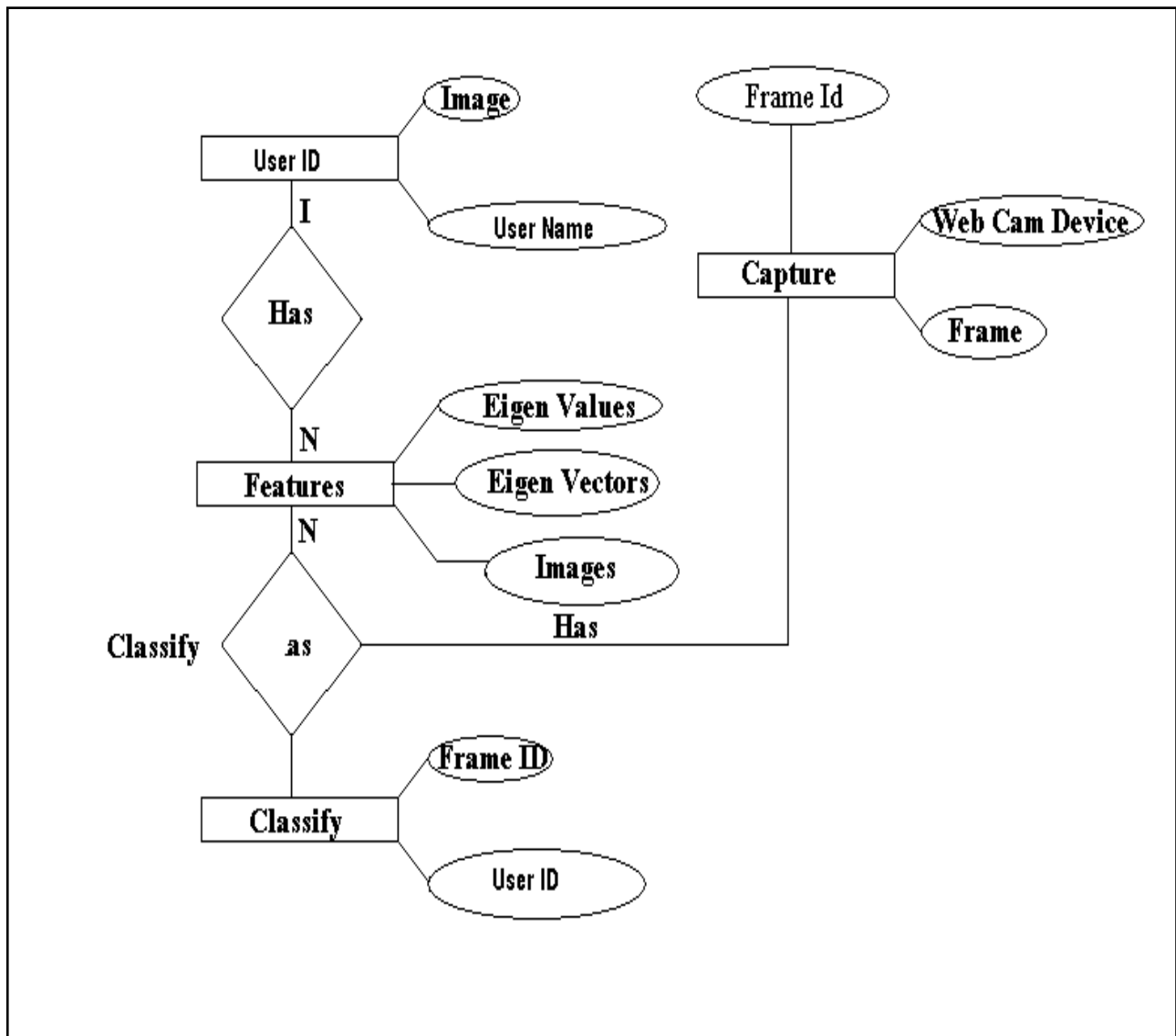
Use Case Diagram
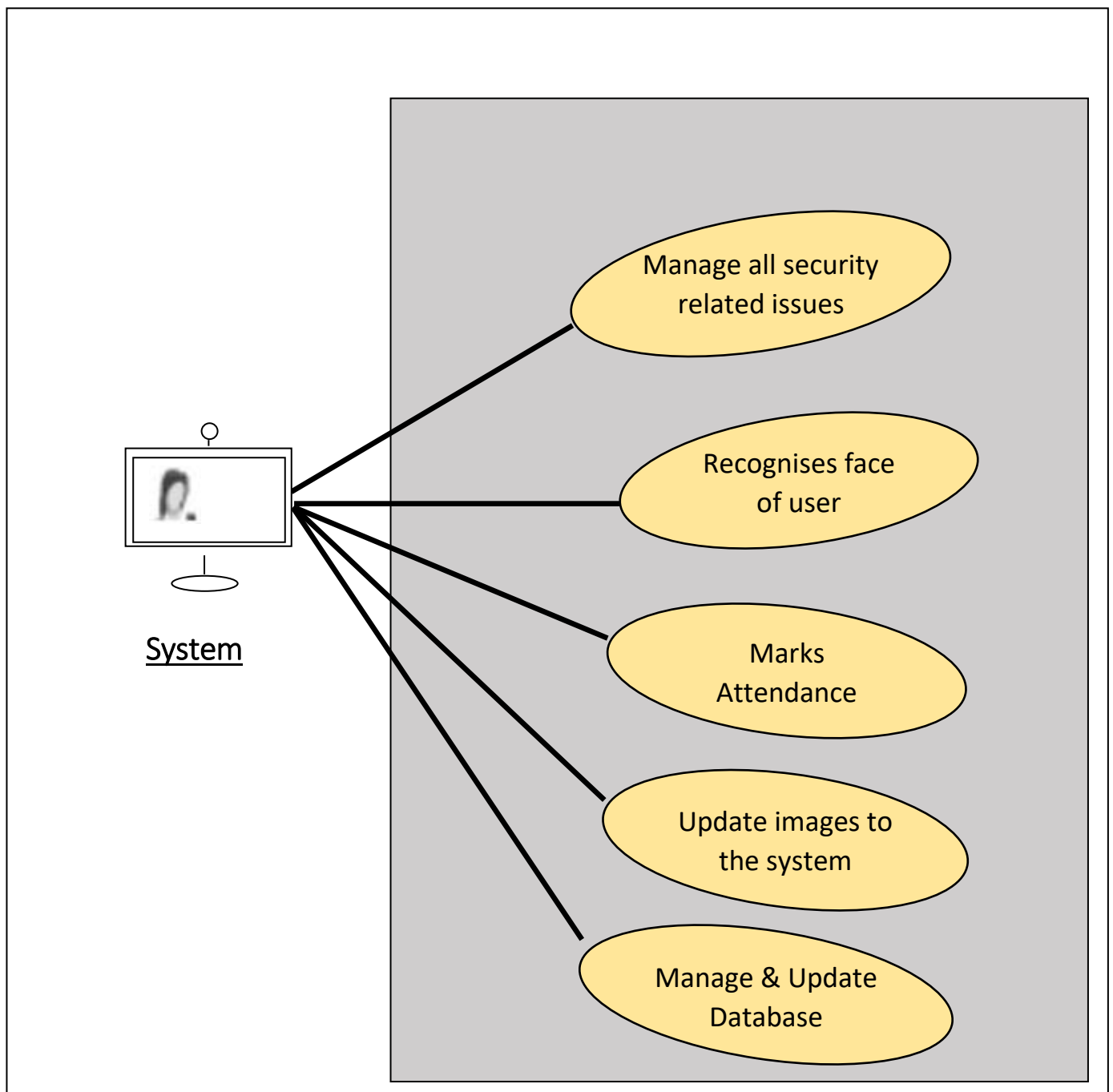
Sequence Diagram
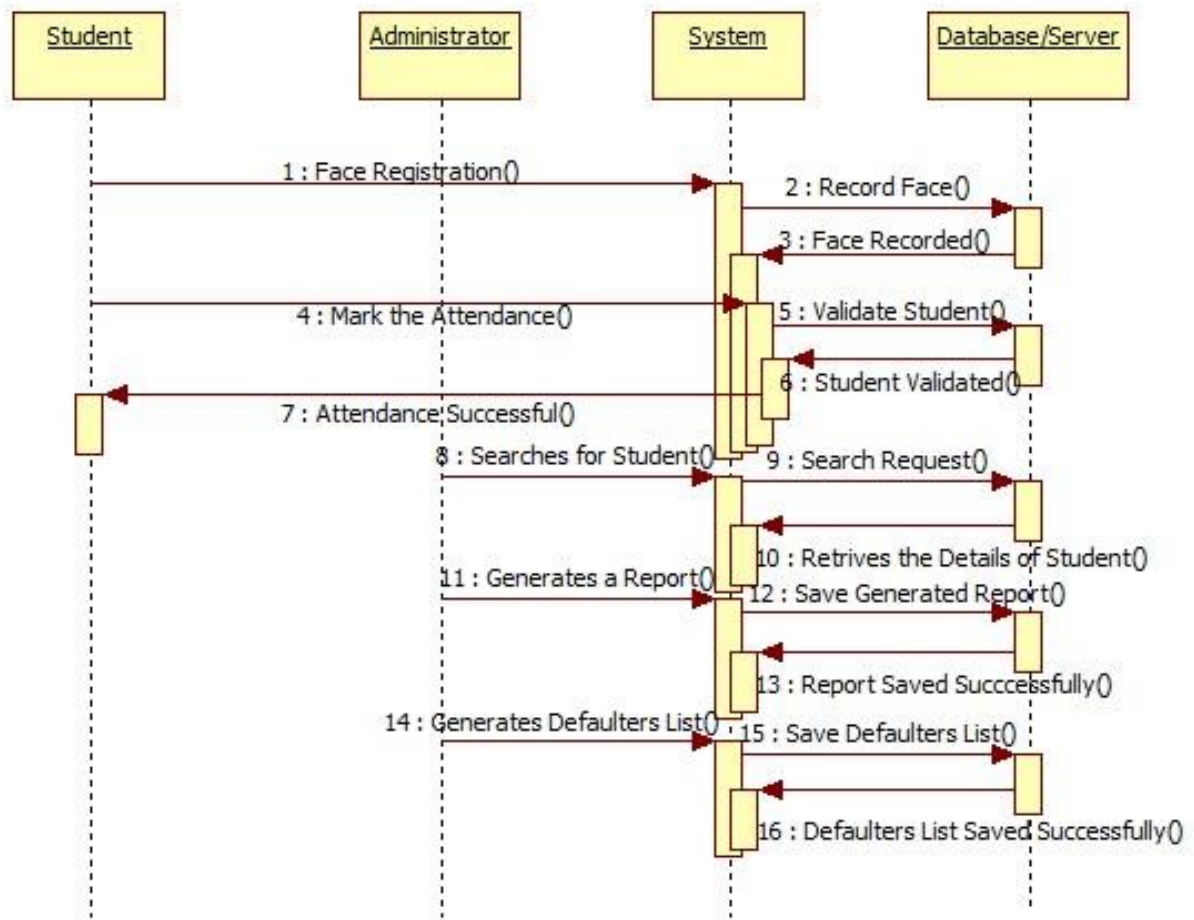
Activity Diagram
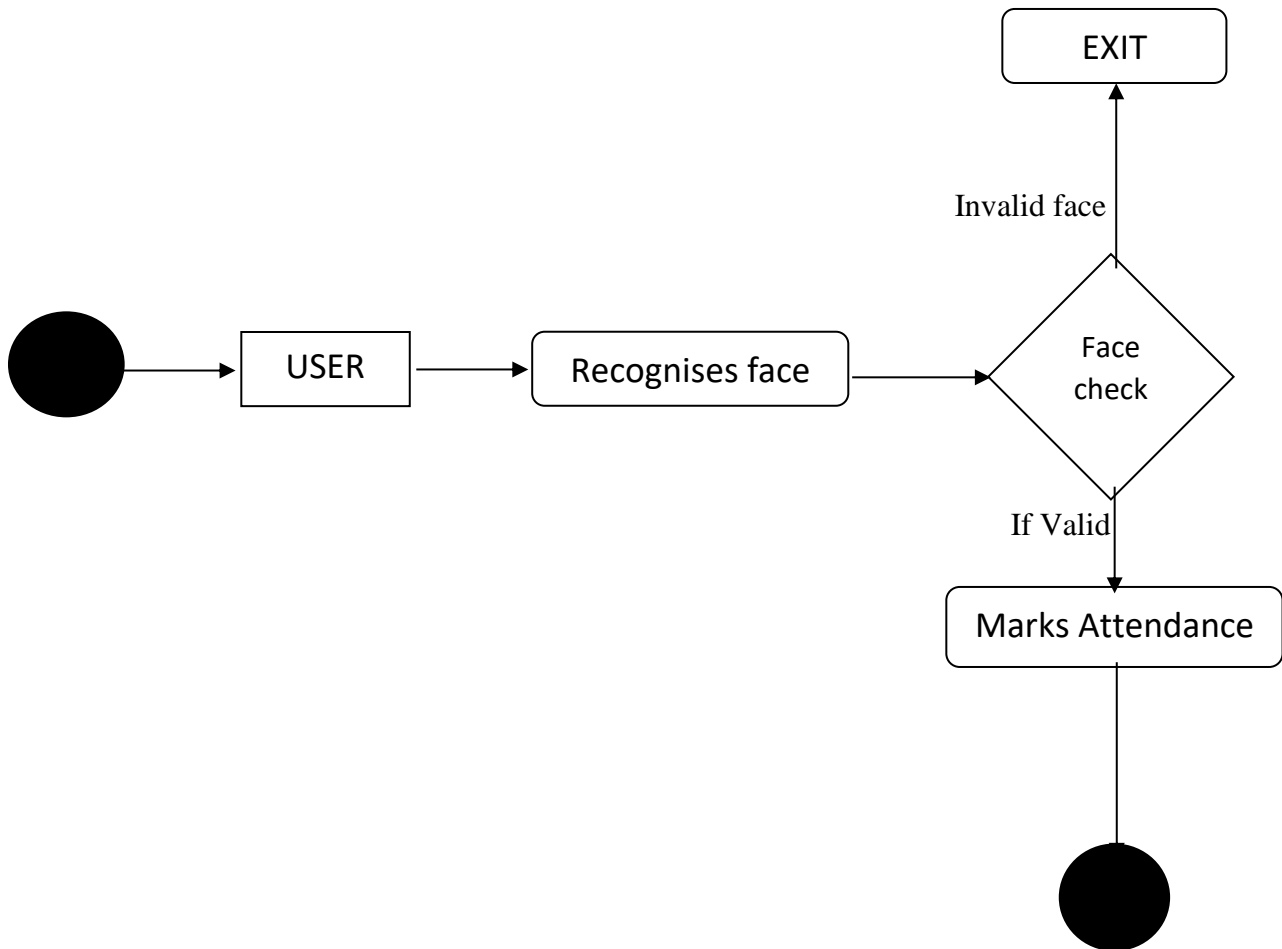
Class Diagram

Capture
Frame No.
Bitmaps
Capture ()
Save ()

User Details
Name: string
Add   :   string
Phone: string
Sex   :   string
DOB   :   int
Department: string
Btn_Click ()
Save ()

Classification
Images
Features []
Classify ()