Face Recognition Attendance System Using Python

A Project Report
Submitted in partial fulfillment of the
Requirements for the award of the Degree of

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

By

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CERTIFICATE

This is to certify that the project entitled "**Face Recognition Attendance System Using Python**" By Miss Payal Jadhav, Exam Seat No:_____. In the partial fulfillment of the requirement of the award of degree **Bachelor of Science (Information Technology)** from **University of Mumbai.**

Internal Guide **Coordinator**

External Examiner

Date: **College Seal**

ABSTRACT

The paper argues that maintaining regular attendance is crucial for student success, and traditional attendance management methods can be inefficient and time-consuming for teachers and administrators. For example, calling out student names or taking manual attendance on paper can take up valuable classroom time and can be prone to errors or manipulation .To address these issues, the paper suggests that a computer-based attendance management system using Computer Vision technology can be an effective solution.

Computer Vision involves the use of cameras, sensors, and algorithms to identify and analyze visual data, including images of individuals. In the context of attendance management, Computer Vision can be used to capture images of students during class and automatically recognize and mark their attendance using facial recognition technology. This approach can offer several advantages over traditional attendance methods.

Firstly, it can be faster and more accurate, reducing the time and effort needed to manage attendance manually. Secondly, it can provide real-time updates on attendance status, allowing teachers to track students who arrive late or leave early. Finally, it can generate reports on attendance patterns, allowing administrators to identify and address issues related to student attendance and engagement.

Overall, the paper highlights the potential benefits of using a computer-based attendance management system using Computer Vision, emphasizing its ability to streamline attendance management and improve student outcomes.

ACKNOWLEDGEMENT

It's my great pleasure to take this opportunity and sincerely thanks all those, who have showed me the way to successful project and helped me a lot during the completion of my project. I greatly thank my Project Guide **Ms. Neha R. Petkar Mam** without the completion of this project couldn't have been possible.

My Sincere thanks to respect IC. Principal **Dr. A. J. Awati Mam** and Head of Computer Science Department **Dr. Sachin Bhosale Sir** for providing all the facilities including availability of Computer Lab. I am greatly thanks teaching and Non-teaching staff of Computer Science Department of **ICS College of Arts, Commerce and Science.**

Finally, I am thanking to my all friends for their encouragement and support throughout period of completion.

Yours sincerely

PAYAL J. JADHAV (TYIT)

DECLARATION

I hereby declare that the project entitled, "**Face Recognition Attendance System Using Python**" done at **ICS College, Khed,** has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirement for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Miss. Payal J. Jadhav

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खेड, जि. रत्नागिरी

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Introduction

1.1 Face Recognition Attendance System:

To maintain the attendance record with day-to-day activities is a challenging task. The conventional method of calling name of each student is time consuming and there is always a chance of proxy attendance. The following system is based on face recognition to maintain the attendance record of students. The daily attendance of students is recorded subject wise which is stored already by the administrator. As the time for corresponding subject arrives the system automatically starts taking snaps and then apply face detection and recognition technique to the given image and the recognize students are marked as present and their attendance update with corresponding time and subject id. We have used Python techniques to develop this system, histogram of oriented gradient method is used to detect faces in images and Python method is used to compute and compare feature facial of students to recognize them. Our system is capable to identify multiple faces in real time. The main objective of this project is to develop face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only. The test images and training images have to be captured by using the same device to ensure no quality difference. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

1.2 Background:

Traditional attendance tracking methods involving paper registers, ID cards, or biometric systems have limitations that hinder productivity and data accuracy. FRAS emerges as a solution designed to leverage the cutting-edge technology of facial recognition to revolutionize attendance management.

In today's fast-paced world, managing attendance records manually can be a cumbersome and error-prone task, especially in institutions, organizations, and businesses where large numbers of people need to be monitored. Traditional methods of attendance tracking using paper registers or card swiping systems can be inefficient and prone to fraud. To address these challenges, the Face Recognition Attendance System (FRAS) project has been developed. FRAS leverages cutting-edge

facial recognition technology to automate the attendance tracking process, making it more efficient, accurate, and secure.

1.3 Objectives:

To identify the student faces accurately. To mark the attendance automatically. To reduce the time and the efforts required for manual attendance to provide a valuable attentive system for both teacher and students. It provides flexibility and reduces the time loss. There will be no chance for a proxy.

The objective of this project is to develop face recognition based automated student attendance system. Expected achievements in order to fulfill the objectives are:

- To detect the face segment from the video frame.
- To extract the useful features from the face detected.
- To classify the features in order to recognize the face detected.
- To record the attendance of the identified student.

Fig 1.3.1 (Block Diagram of the General Framework)

1.4 Features:

Face Recognition Attendance System offers a range of powerful features to achieve these objectives:

- **Facial Recognition:** Utilizes state-of-the-art facial recognition technology to identify individuals accurately and swiftly.
- **Real-time Tracking:** Records attendance in real-time, providing immediate access to attendance data.

- **Biometric Verification:** Relies on unique facial features for identity verification, reducing the risk of impersonation.
- **User-Friendly Interface:** Boasts an intuitive and user-friendly interface for administrators and end-users alike.
- **Data Storage:** Securely stores attendance records in a protected database for future reference and analysis.
- **Reporting:** Generates comprehensive attendance reports for various time frames and user groups.
- **Notifications:** Sends notifications to relevant parties (e.g., students) regarding their attendance status.
- **Integration:** Can be seamlessly integrated with access control systems for enhanced security and streamlined operations.

1.4 Purpose and Scope:

1. Purpose:

The Face Recognition Attendance System (FRAS) project is initiated with the primary objective of revolutionizing traditional attendance management methods by harnessing the power of facial recognition technology. The key purposes of this project are as follows:

- **Efficiency Enhancement:** To streamline and automate the attendance tracking process in various sectors, reducing the administrative burden associated with manual attendance recording.
- **Accuracy Improvement:** To ensure the accuracy and reliability of attendance records by utilizing advanced facial recognition algorithms, thereby eliminating errors and fraudulent practices like buddy punching.
- **Security Enhancement:** To enhance security by students biometric data in the form of facial features, making it difficult for unauthorized individuals to record attendance on behalf of others.
- **Resource Optimization:** To save valuable time and resources for both institutions and individuals by simplifying and expediting the attendance tracking process.
- **Accessibility:** To provide easy access to attendance data for authorized personnel through a user-friendly interface, facilitating efficient data management and analysis.

2. Scope:

The scope of the Face Recognition Attendance System project encompasses various sectors and applications, offering a versatile solution to modernize attendance management. The key areas of scope are as follows:

- **Education Sector:** FRAS can be implemented in schools, colleges, and universities to automate the attendance tracking of students and faculty, ensuring accurate and efficient record-keeping.
- **Corporate Environment:** Businesses can adopt FRAS to monitor employee attendance, enhance security, and optimize workforce management, particularly in large organizations.
- **Government Institutions:** Government agencies across different departments can benefit from FRAS by implementing efficient attendance recording methods, thereby improving overall resource utilization.
- **Event Management:** FRAS can simplify registration and attendance tracking at events, conferences, seminars, and workshops, ensuring precise participant records.
- **Access Control Integration:** Beyond attendance, FRAS can seamlessly integrate with access control systems, regulating entry and exit based on attendance status, further enhancing security.

The project's scope encompasses the entire lifecycle, including:

- **Design and Development:** Creating a robust and scalable Face Recognition Attendance System tailored to the needs of the specific sector or organization.
- **Deployment:** Implementing the system in the chosen environment, ensuring compatibility and usability.
- **Maintenance and Support:** Providing ongoing maintenance and technical support to ensure the system's continued reliability and effectiveness.

The Face Recognition Attendance System project aims to bring about a transformation in attendance management by harnessing the capabilities of facial recognition technology. It promises increased efficiency, accuracy, and security while reducing the administrative burden associated with traditional attendance tracking methods across a wide range of applications and sectors.

System Analysis

2.1 Existing System

Before delving into the proposed Face Recognition Attendance System (FRAS) project, it's crucial to understand the limitations and drawbacks of the existing manual attendance tracking systems commonly in use. The existing system typically involves traditional methods such as paper registers, ID card swiping, or manual entry into attendance software. Here, we'll discuss the shortcomings of these conventional systems:

1. **Manual and Time-Consuming:** In the existing manual systems, attendance is recorded through handwritten registers or card swiping machines. This process is labor-intensive and time-consuming, especially in organizations or institutions with a large number of attendees.
2. **Prone to Errors:** Human errors, intentional or unintentional, can lead to inaccuracies in attendance records. Illegible handwriting, data entry mistakes, and accidental omissions can all contribute to unreliable attendance data.
3. **Fraud Vulnerabilities:** Manual systems are susceptible to fraudulent activities, such as buddy punching, where one person records attendance on behalf of another. This can lead to inaccurate attendance records and financial losses for organizations.
4. **Limited Accessibility:** Access to attendance records is often restricted, making it challenging for relevant stakeholders (e.g., students) to access and verify their attendance data in real-time.
5. **Lack of Security:** Conventional methods do not offer robust security measures to prevent unauthorized access or tampering with attendance records. ID cards can be shared, and handwritten registers can be manipulated.
6. **Inefficiency and Paper Dependency:** Paper-based registers require storage space and are vulnerable to damage or loss. Card swiping systems may malfunction, leading to disruptions in attendance tracking.
7. **Inflexibility:** Traditional systems lack flexibility in terms of adapting to different attendance tracking requirements. They often cannot accommodate variations in attendance policies or capture additional data beyond basic check-in/check-out times.

2.2 Proposed System

All the students of the class must register themselves by entering the required details and then their images will be captured and stored in the dataset. During each session, faces will be detected from live streaming video of classroom. The faces detected will be compared with images present in the dataset. If match found, attendance will be marked for the respective student. The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs to be detected, even the seating and the posture of the student need to be recognized. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance database is updated.

- **Flow chart:**

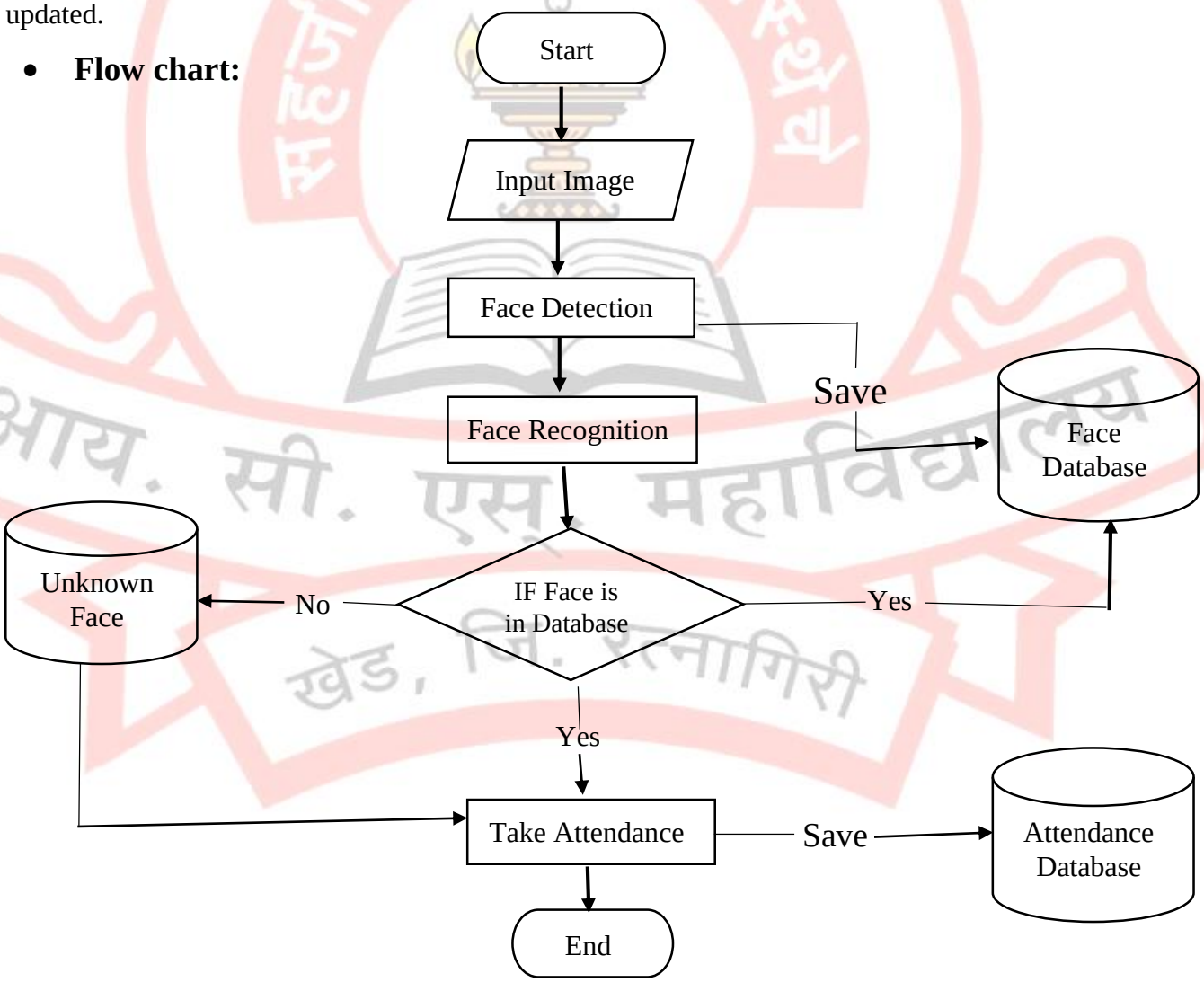

Fig 2.2.1(Project Outline)

2.3 Requirement Analysis:

- **Haar cascade Algorithm:**

It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images (where positive images are those where the object to be detected is present, negative are those where it is not). It is then used to detect objects in other images. Luckily, OpenCV offers pre-trained Haar cascade algorithms, organized into categories (faces, eyes and so forth), depending on the images they have been trained on.

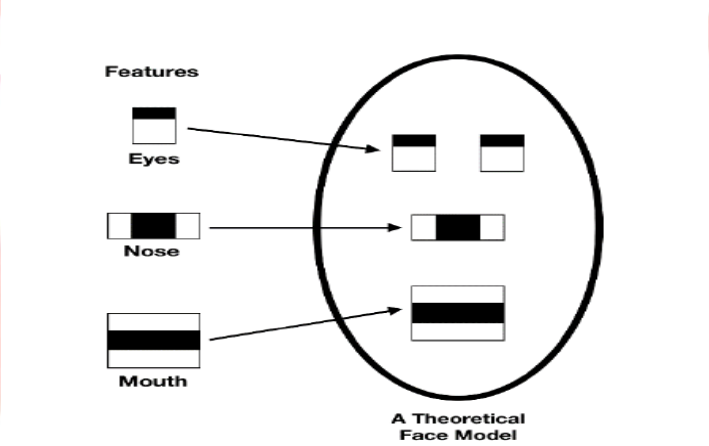

Fig 2.3.1(Haar Features)

- **LBPH Algorithm:**

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.

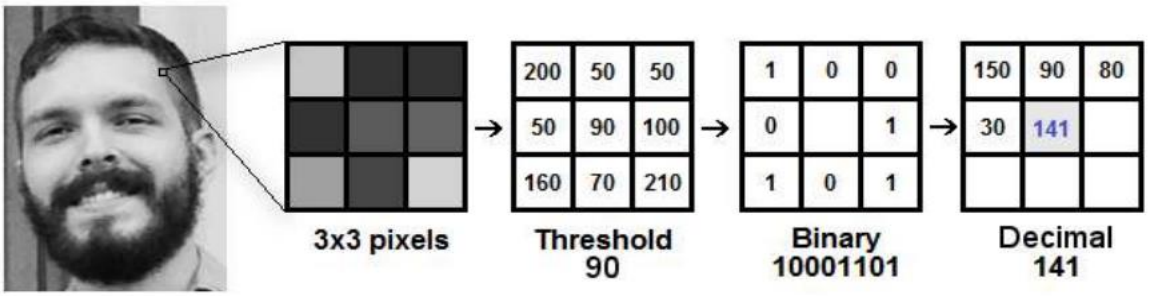

Fig 2.3.2 (LBPH Algorithm)

2.4 Hardware Requirements:

The hardware components required for the FRAS project may include:

- Laptop with 8 GB RAM or above
- Camera 720p or above

2.5 Software Requirements:

The software components required for the FRAS project may include:

- Visual Studio Code
- MySQL Workbench 8.0 CE
- Tkinter

2.6 Justification of Selection of Technology:

The selection of facial recognition technology for FRAS is justified for several reasons:

- **Accuracy:** Facial recognition technology has advanced significantly and can achieve high levels of accuracy in identifying individuals based on unique facial features.
- **Security:** Biometric data (facial features) is difficult to forge, providing robust security against unauthorized access and fraudulent attendance recording.
- **Efficiency:** Facial recognition allows for real-time attendance tracking, reducing administrative overhead and processing time.
- **User-Friendly:** Modern facial recognition systems can be designed with intuitive user interfaces, making them accessible to a wide range of users.
- **Compatibility:** Facial recognition technology can be integrated with existing hardware and software systems, allowing for seamless adoption in various environments.
- **Scalability:** It is adaptable to different scales, making it suitable for both small institutions and large enterprises.
- **Future-Proofing:** As facial recognition technology continues to evolve, the system can be updated to benefit from advancements in accuracy and security.

System Design

3.1 Module Division:

- **OpenCV Library:** 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.

- **NumPy package:** NumPy is a Python package which stands for 'Numerical Python'. It is the core library for scientific computing, which contains a powerful n-dimensional array object, provide tools for integrating C, C++ etc. It is also useful in linear algebra, random number capability etc.

- **Pandas Library:** Pandas is a high-level data manipulation tool developed by Wes McKinney. It is built on the NumPy package and its key data structure is called the Data Frame. Data Frames allow you to store and manipulate tabular data in rows of observations and columns of variables.

- **Tkinter Module:** Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit

- **Time Module:** Python has a module named time to handle time related task. To use functions defined in the module, we need to import the module first.

- **Date Time Module:** A date in python is not a date type of its own, but we can import a module named date time work with dates as a date objects.

3.2 Data Dictionary:

Creating a data dictionary for a Face Recognition Attendance System project helps define the data used in the system, its structure, and its relationships. Below is a simplified data dictionary for such a project:

- **Entities and Their Attributes:**

1. **User Data:**
    - **First Name:** User's first name.
    - **Last Name:** User's last name.
    - **Contact No:** User's latest contact number
    - **Email:** Using email as a login identifier on a login page
    - **Select Security Questions:** Selecting security questions for email use is an important step in enhancing the security of user email account.
    - **Security Answer:** Selecting security answers for security questions is a crucial step in enhancing the security of user email account.
    - **Password:** A unique identifier for students.

2. **Student Data:**
    - **Department:** Select Student Department (IT/CS/BMS)
    - **Course:** Select Student Course (AWP/Java/Python/….)
    - **Year:** Select Student Year (2020-21/2021-22/……)
    - **Semester:** Select Semester (Semester I/II/III/….)
    - **Student ID (Primary Key):** Unique identifier for each student Information.
    - **Student Name**: Student Name
    - **Roll No:** Unique identifier for each student Roll No
    - **DOB (Date of Birth):** Student Birth Date
    - **Gender:** Select Gender (Male /Female / Others)
    - **Phone No:** Student phone number
    - **Email ID:** Student Email ID
    - **Address:** Student Address
    - **Photo Sample:** Data representing facial features extracted during registration.

3. **Attendance Records:**
    - **AttendanceID (Primary Key):** Unique identifier for each attendance record.
    - **Roll No:** Unique identifier for each student Roll No
    - **Name:** Student Name
    - **Date:** Date when the attendance was marked.
    - **Times:** Time when the attendance was marked.
    - **Attendance Status:** Student Present or Absent

- **Relationships:**

Each user can have multiple face images (one-to-many relationship between User Data and Face Data). Each user can have multiple attendance records (one-to-many relationship between User Data and Attendance Records).

- **Data Types:**

  Contact No: Varchar (45)
  Email ID: Varchar (45)
  AttendanceID: Varchar (45)
  First Name: Varchar (45)
  Last Name: Varchar (45)
  Roll No: Varchar (45)
  Select Security Questions: Varchar (45)
  Security Answer: Varchar (45)
  Password: Varchar (45)
  Department: Varchar (45)
  Course: Varchar (45)
  Year: Varchar (45)
  Semester: Varchar (45)
  Student ID (Primary Key): Varchar (45)
  Student Name: Varchar (45)
  DOB (Date of Birth): Varchar (45)
  Gender: Varchar (45)

Phone No: Varchar (45)

Address: Varchar (45)

Photo Sample: Varchar (45) / Photo Sample Save in Folder

Date: Varchar (45)

Times: Varchar (45)

Attendance Status: Varchar (45)

This data dictionary outlines the core entities, attributes, relationships, and data types required for a Face Recognition Attendance System project. Depending on the project's complexity and specific requirements, you may need to expand or customize this data dictionary to accommodate additional features and data fields. Additionally, it's essential to ensure data security and privacy measures are in place when handling sensitive biometric information.

3.3 ER Diagrams:

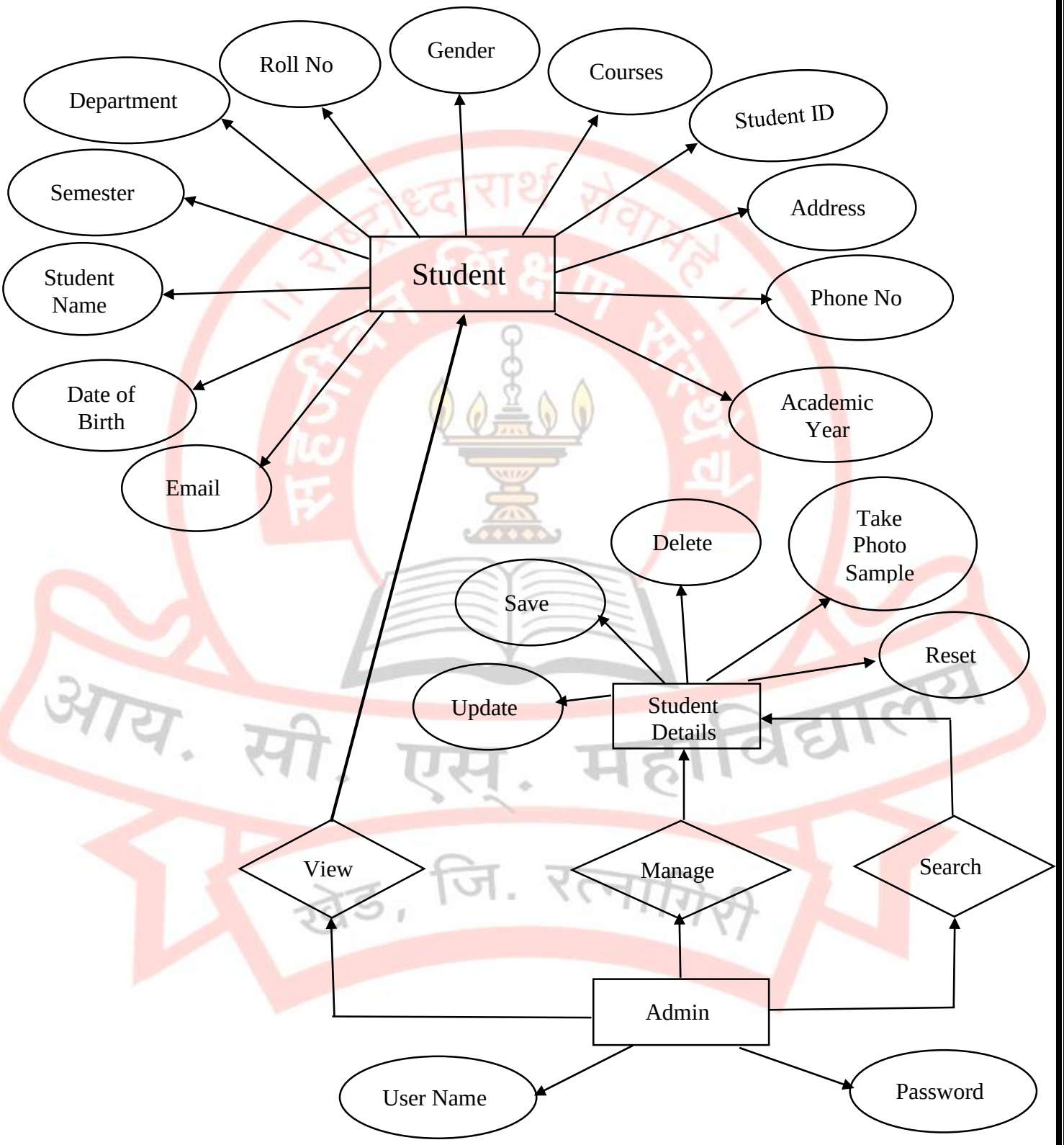

Fig 3.3.1 (ER Diagrams)

3.4 DFD/UML Diagrams:

- **Data Flow Diagram:**

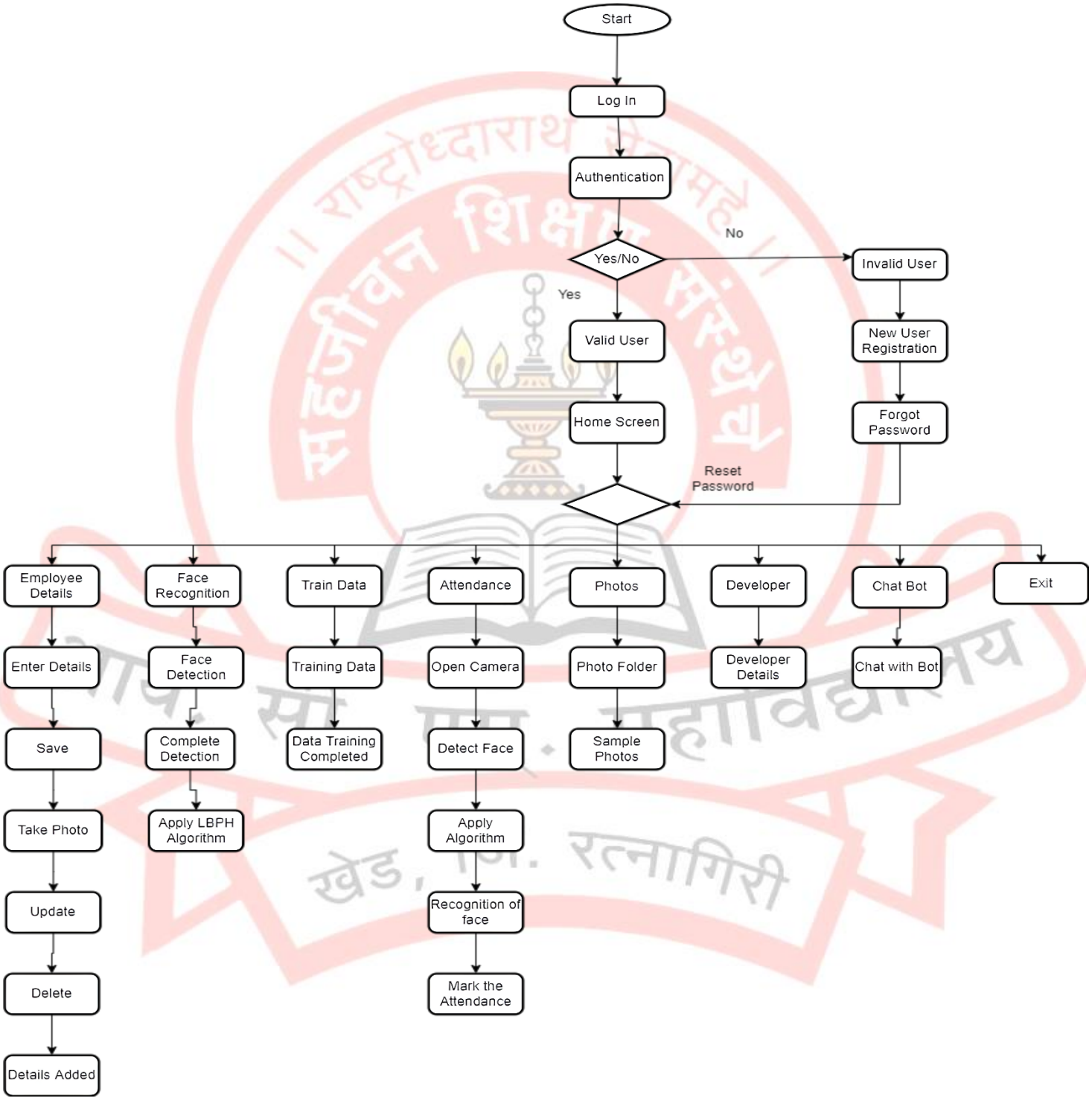

Fig 3.4.1 (Data Flow Diagram)

- **Use Case Diagram:**

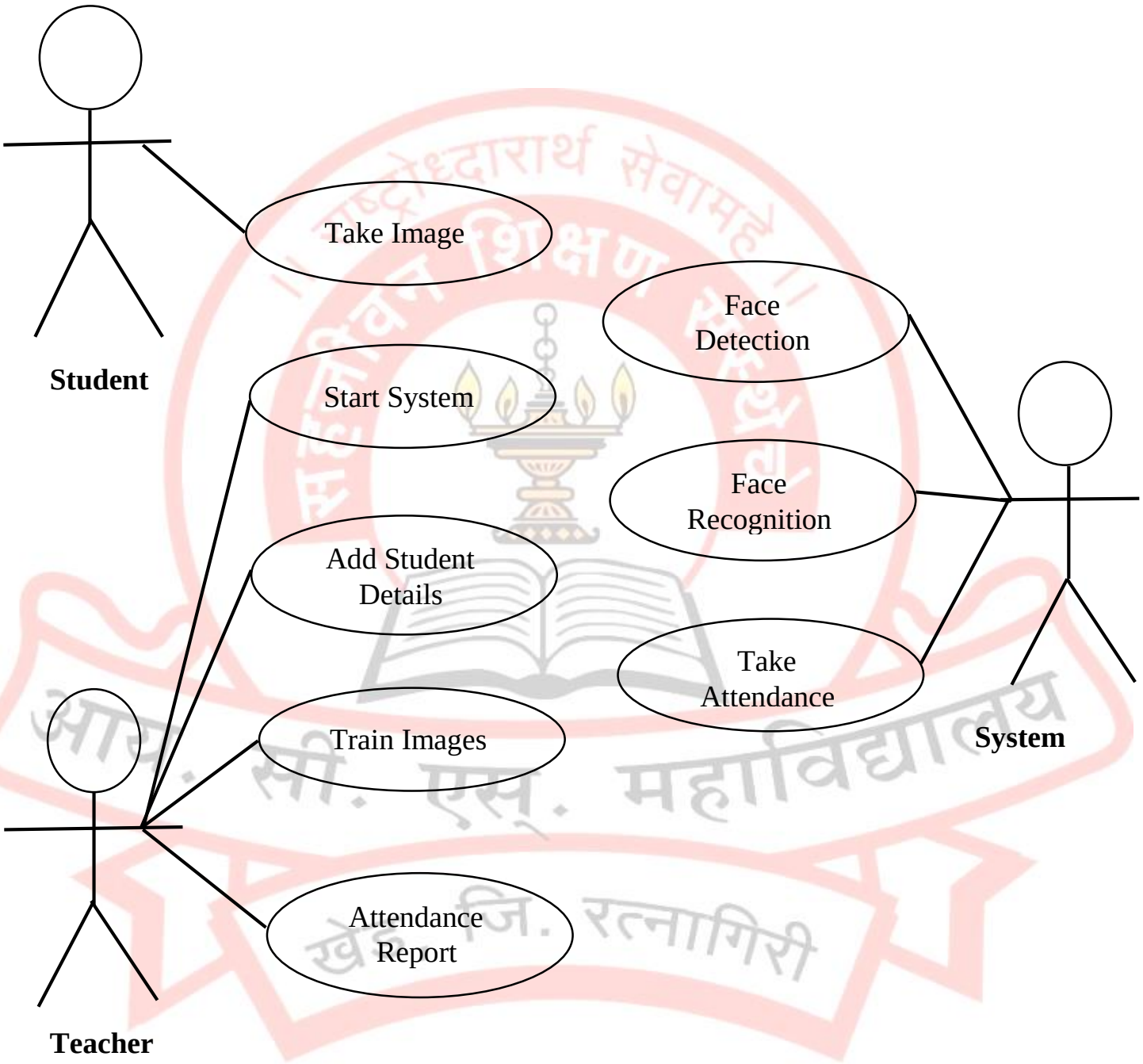

Fig 3.4.2 (Use Case Diagram)