ATTENDANCE MANAGEMENT USING FACIAL RECOGNITION

A MINI PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree

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IN

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SRI KRISHNA COLLEGE OF TECHNOLOGY

COIMBATORE -641 042

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BONAFIDE CERTIFICATE

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ACKNOWLEDGEMENT

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VISION & MISSION

SRI KRISHNA COLLEGE OF TECHNOLOGY

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To be recognized as a Centre of Excellence for stimulating the creation and exchange of knowledge by providing better service to enhance student progress through effective teaching and learning process there by leading to innovation, professionalism, teaching work and continuous improvement.

MISSION

- To impart high quality technical and ethical knowledge to the students
- To cultivate globally competent and collaborative IT graduates
- To nurture research and life-long learning culture in the department

PROGRAMME EDUCATIONAL OBJECTIVES

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DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Graduates will apply the principles of information technology, mathematics and related engineering field to solve real-world problems appropriate to the discipline and succeed in an information system career.

PEO2: Graduates will Contribute and communicate effectively in multi-disciplinary teams to successfully complete projects and perform services related to information system to meet customer business objectives

PEO3: Graduates will function ethically and responsibly, and will remain informed and involved as full participants in our profession and our society.

PEO4: Graduates will engage in life-long learning to remain current in their profession and be leaders in our technological society

PROGRAMME OUTCOMES & PROGRAMME SPECIFIC OUTCOMES

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DEPARTMENT OF INFORMATION TECHNOLOGY

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Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriatetechniques, resources, and modern engineering and IT tools including

prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO1: An ability to incorporate IT based solutions into multi-disciplinary environment.

PSO2: An ability to identify user needs inclusive of selection, creation, evaluation and administration of IT based infrastructure

PROJECT MAPPING WITH PROJECT OUTCOMES AND PROJECT SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Attendance Management using Face Recognition	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**

WEAK ASSOCIATION	MODERATE ASSOCIATION	STRONG ASSOCIATION
1	**2**	**3**

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ABSTRACT

ABSTRACT

This abstract describes an attendance management system with face recognition technology that provides a fast and efficient way of managing attendance records in organizations. The system uses advanced facial recognition technology to accurately identify individuals and mark their attendance automatically. The benefits of the system include increased accuracy, time-saving, cost-saving, and added security. The system includes features such as attendance marking, real-time monitoring, data management, customization, and integration with other systems. Implementing the system requires careful planning and execution, but the benefits make it a valuable tool for managing attendance records. Overall, the attendance management system with face recognition is a technological solution that helps organizations improve attendance management processes and reduce the risk of errors and fraud.

LIST OF FIGURES

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LIST OF ABBREVATIONS

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ABBREVATIVE	ABBREVATION
API	APPLICATION PROGRAM INTERFACE
CNN	CONVOLUTION NEURAL NETWORK
GPU	GRAPHICS PROCESSING UNIT
DLIB	A C++ LIBRARY FOR FACIAL RECOGNITION
GUI	GRAPHICAL USER INTERFACE
OCR	OPTICAL CHARACTER RECOGNITION

CHAPTER 1

INTRODUCTION

The attendance management system is an essential aspect of any organization, as it helps to track and manage employee attendance efficiently. Traditional methods of attendance tracking, such as manual attendance registers, are time-consuming and prone to errors. To overcome these limitations, many organizations are now turning to face recognition technology to automate the attendance management process.

This project aims to develop an attendance management system using face recognition technology. The system will use a webcam to capture images of employees, and then use a face recognition algorithm to identify the employees and record their attendance. The system will be developed using Python programming language, and will use the OpenCV library for face detection and recognition.

The project will also include a graphical user interface (GUI) that allows administrators to manage employee records, view attendance reports, and monitor the system's performance. Additionally, the project will focus on ensuring the privacy and security of employee data by implementing measures such as data encryption and access controls.

1.1 PROBLEM DEFINITION

Face recognition technology has gained widespread adoption in attendance management systems due to its accuracy and efficiency in identifying individuals. This technology uses computer algorithms to analyze and compare the unique facial features of an individual with a database of known faces to determine their identity.

In attendance management, face recognition technology can be used to automate the process of tracking employee attendance and to prevent time fraud by accurately identifying who is present and who is not. Additionally, the use of face recognition technology can enhance security by preventing unauthorized access to restricted areas.

However, there are also concerns regarding privacy and data protection that must be addressed when implementing this technology. Overall, the integration of face recognition technology in attendance management systems offers a promising solution for optimizing workforce management and increasing organizational efficiency.

1.2 REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENTS

Face Detection:

The system should be able to detect human faces in real-time, either through images or video streams.

Face Recognition:

The system should be able to recognize and identify individual students based on their facial features.

Attendance Tracking:

The system should be able to track attendance based on the identified faces and record attendance information in a database.

Integration with Existing Systems:

The system should be able to integrate with existing student information systems and databases, such as student records and schedules.

User Management:

The system should allow for user management, including user roles, permissions, and authentication.

NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements for the attendance management system using face recognition technology include security, accuracy, scalability, usability, performance, compatibility, and maintainability. The system must ensure the security and privacy of employee data, have high accuracy in recognizing faces, be able to accommodate a growing number of employees, be user-friendly, process attendance records quickly and efficiently.

1.3 PROJECT OVERVIEW

The attendance management system using face recognition technology is a Python-based project that aims to simplify the attendance tracking process for organizations. The system uses machine learning and computer vision algorithms to identify employees based on their facial features and record their attendance automatically. The system also generates reports that provide insights into employee attendance patterns and can be used to make informed decisions about workforce management. The system also includes non-functional requirements such as security, accuracy, scalability, usability, performance, compatibility, and maintainability to ensure its effectiveness and reliability.

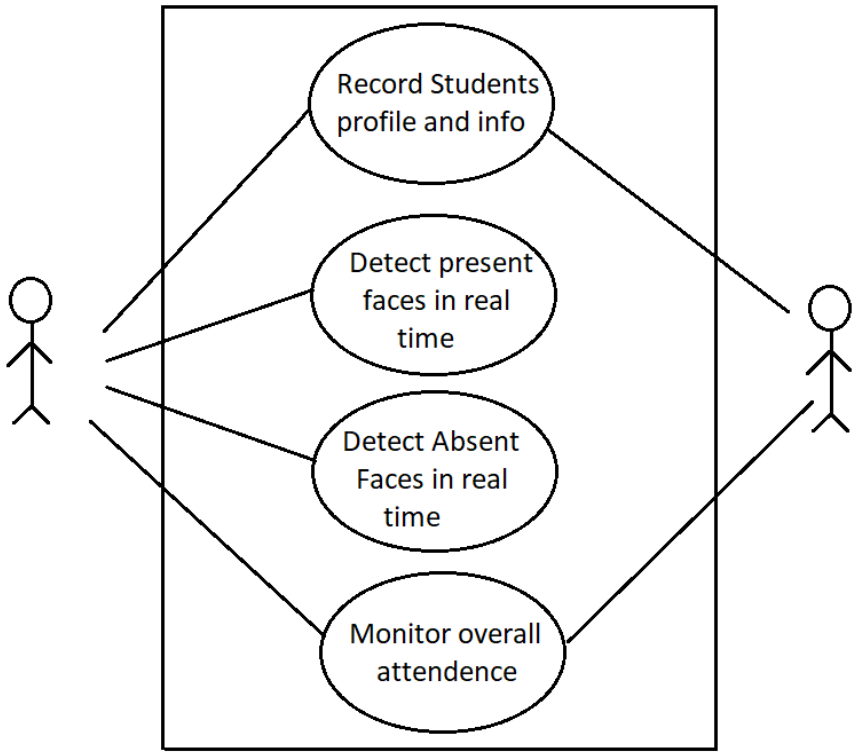

Figure 1.1 Use Case Diagram

Chapter 2 deals with the software packages required for the implementation of the project. It gives a brief description about the hardware tools and programming languages used for the development of this project.

CHAPTER 2

REQUIREMENT SPECIFICATIONS

This chapter explains the software and hardware requirements of this project that are as follows.

2.1 HARDWARE REQUIREMENTS

The hardware requirements for the attendance management system using face recognition technology include:

1. Computer or laptop: A computer or laptop is required to run the Python-based application.
2. Webcam or smartphone camera: A webcam or smartphone camera is required to capture the employee's image for enrollment and attendance tracking.
3. High-performance processor: A high-performance processor is recommended to ensure that the system can process attendance records quickly and efficiently.
4. Sufficient memory: The system requires sufficient memory to store the employee's photos and attendance records.
5. Graphics card: A graphics card with sufficient processing power is recommended to accelerate the performance of the face recognition algorithms.

6. Network connectivity: The system requires network connectivity to enable access to the attendance records and reporting features.

7. Secure storage: The system requires secure storage to ensure that the employee's data is protected from unauthorized access or theft.

2.2 SOFTWARE REQUIREMENTS

Developer-Side Requirements:

System	: Laptop/Personal Computer
Processor	: Core i3 processor
Storage	: 250GB Hard-disk
RAM	: 2GB
Function	: To develop, test and implement the project application.

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PROGRAMMING LANGUAGES

- PYTHON AND ITS LIBRARIES

PYTHON

Python is an important programming language in the development of the attendance management system using face recognition technology. Its ease of use, extensive libraries, open-source nature, cross-platform compatibility, and high-performance capabilities make it an ideal choice for developing complex applications. Python's simplicity and readability make it accessible to developers of all levels, while its extensive libraries for image processing, machine learning, and data analysis provide the necessary tools for developing advanced face recognition algorithms.

Additionally, Python's open-source nature has led to a vast community of developers contributing to its development, resulting in a rich ecosystem of libraries, tools, and frameworks. Python's cross-platform compatibility makes it versatile and capable of running on different operating systems, making it accessible to a wide range of users. Finally, Python's powerful libraries for numerical computing enable the attendance management system using face recognition technology to perform complex computations efficiently, resulting in accurate and reliable attendance reports.

LIBRARIES

OpenCV (Open Source Computer Vision Library)

OpenCV is a popular computer vision library that provides various tools for image and video processing. It is widely used for its powerful functions for face detection, face recognition, and feature extraction.

NumPy (Numerical Python)

NumPy is a Python library for numerical computing. It provides various data structures for handling arrays and matrices, which are widely used in image processing and machine learning.

Pandas

Pandas is a Python library for data manipulation and analysis. It provides functions for data cleaning, preprocessing, and analysis, which are useful in generating attendance reports.

Matplotlib

Matplotlib is a Python library for data visualization. It provides functions for creating various types of graphs, charts, and plots, which are used in generating attendance reports.

Tkinter

Tkinter is a Python library used for creating graphical user interfaces (GUIs). It is a standard GUI library that comes included with most Python installations and is available on all major platforms. Tkinter provides a set of widgets such as buttons, labels, and text boxes that can be used to create a variety of GUI applications

CSV

The csv module in Python is a built-in library that provides functionality for working with comma-separated values (CSV) files. CSV files are a popular format for storing and exchanging data, and are often used for data analysis and data manipulation tasks. The csv module provides a reader and writer object for working with CSV files.

CHAPTER 3

EXISTING SYSTEM

This chapter provides a complete understanding about the existing system and its failures.

The traditional method of taking attendance in institutions using a written format has several disadvantages. Firstly, it is a time-consuming process as the teacher has to manually mark each student's attendance, which can be challenging when dealing with large class sizes. Secondly, there is a possibility of errors in the recording of attendance due to human error, such as misreading handwriting or overlooking a student's name. Thirdly, there is a risk of fraudulent attendance as students can sign on behalf of absent classmates. Finally, it is difficult to maintain the confidentiality of student attendance records, as they can be accessed by anyone who has access to the attendance register. These drawbacks can be overcome by using digital attendance management systems based on biometric or facial recognition technology.

Face recognition technology can accurately identify students and record their attendance in real-time, reducing the possibility of errors and fraudulent attendance. The process of marking attendance manually is time-consuming, but a face recognition system can mark attendance instantly without requiring any manual intervention, allowing teachers to utilize their time in other productive activities. Face recognition technology provides an extra layer of security by ensuring that the right student is present in the classroom, reducing the possibility of unauthorized access.

CHAPTER 4

PROPOSED SYSTEM

4.1 ARCHITECTURE

The architecture used in the attendance management system using face recognition in Python is a client-server architecture. The client-server architecture is a common model used for network-based applications, where a client requests services or resources from a server, which then responds to the request. In this system, the client is the user interface, where users can input their information and interact with the system, while the server is responsible for processing user requests, performing face recognition tasks, and managing the attendance data.

The server-side of the system is responsible for receiving images from the client, processing those images using machine learning algorithms, and generating attendance reports. Overall, the client-server architecture provides a scalable and reliable way to manage attendance using face recognition technology in a distributed system.

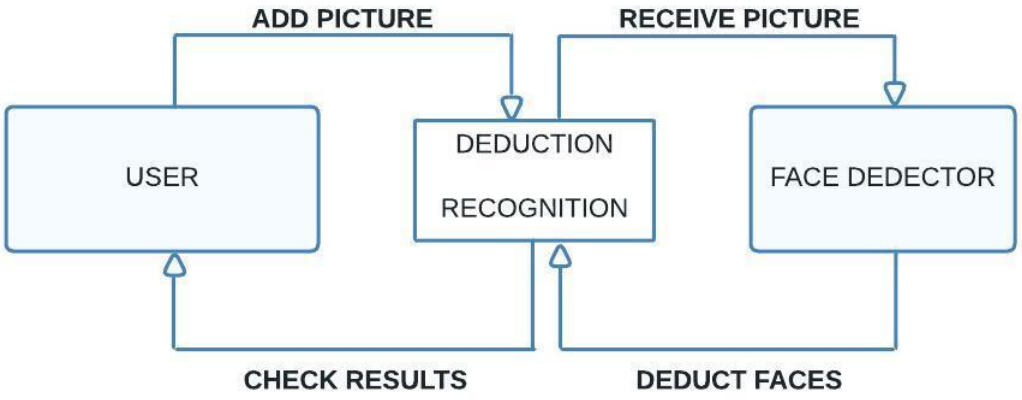


Figure 4.1 System Flowchart

4.2 METHODOLOGIES FOR PROPOSED SYSTEM

2D Facial Recognition

This method uses 2D images of a student's face to recognize them and record their attendance. It involves comparing the student's facial features with a pre-existing database of facial features to verify their identity.

Deep Learning

Deep learning is a subset of machine learning that involves training a neural network to recognize patterns and make predictions based on data. In the case of face recognition for student attendance management, deep learning algorithms can be used to analyze facial features and create a unique profile for each individual.

To create a deep learning model for face recognition, a large database of labeled images of students' faces is required. This data is used to train the neural network, which involves feeding the images into the model and adjusting the weights of the network until it can accurately recognize and classify the images.

The chapter 4 gave overall overview of the project methodologies and the project flow. The chapter 5 highlights about the modules in this system and its description.

CHAPTER 5

MODULES AND CODE IMPLENTATION

This chapter deals with the module description.

A module is a collection of source files and build settings that allow you to divide your project into discrete units of functionality. A project can have one ormany modules, and one module may use another module as a dependency. We module can be independently build, test, and debug each module.

5.1MODULES

Our online hall reservation system has the following modules:

Admin Module

- Login
- View student details
- Face recognition

LOGIN

Login is a process where users enter their credentials to access a system. It's crucial for attendance management as it enables accurate tracking of employee/student attendance.

VIEW STUDENT DETAILS

To view student details, an authorized user can log in to the attendance management system and navigate to the appropriate section. There, they can access information such as student name, department and class.

FACE RECOGNITION

Face recognition in attendance management involves using a system that utilizes facial recognition technology to accurately track employee or student attendance.

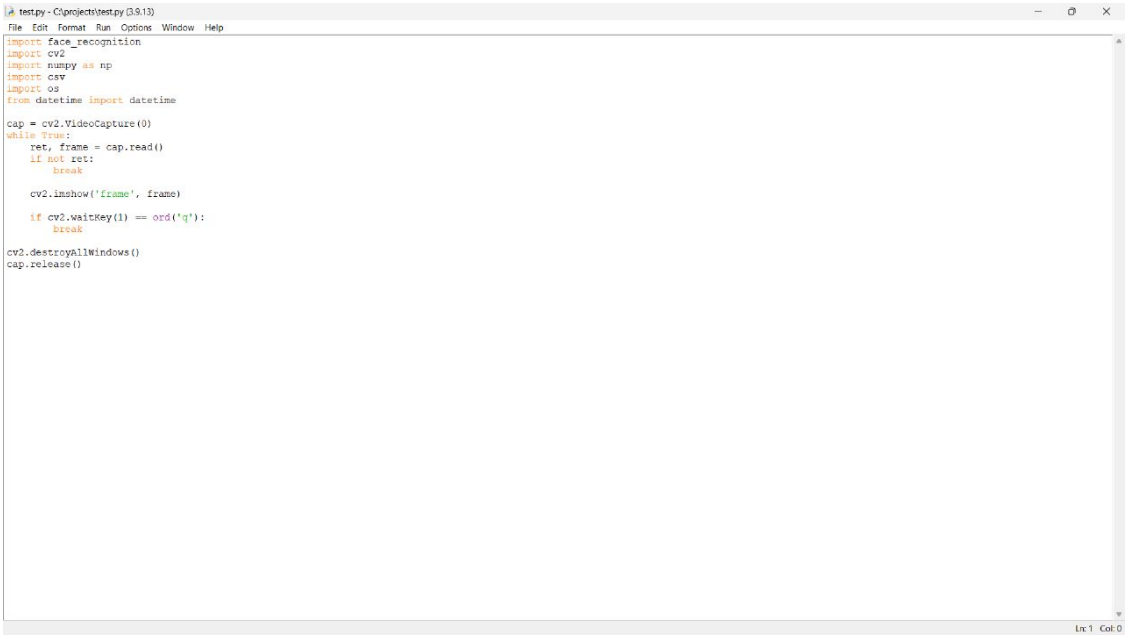
5.2 CODE IMPLENTATION

FIGURE 5.2.1 CREATION OF PROGRAM.PY FILE

In this file we have imported libraries such as face_recognition, cv2, numpy, csv, os, glob and datetime

FIGURE 5.2.2 TEST.PY FILE

In this image we have included test.py file which runs the face recognition of the students of the college.



CHAPTER 6

SYSTEM DESIGN

6.1 E-R DIAGRAM

An Entity-Relationship (ER) diagram is a visual representation of the data entities and their relationships in a system. Here's an explanation of an ER diagram for an attendance management system using face recognition:

Entities:

1. Student: This entity represents an employee and contains attributes such as Student_ID, Name, Department, and Position.
2. Attendance: This entity represents attendance records and contains attributes such as Attendance_ID, Student_ID, Date, Time_in, and Time_out.

Relationships:

1. An student can have many attendance records, but an attendance record can only belong to one employee. This is a one-to-many relationship between the student entity and the Attendance entity.
2. An attendance record must be associated with an employee. This is a mandatory relationship between the Student entity and the Attendance entity.

In terms of ER diagram notation, the student entity would be represented by a rectangle with the entity name at the top, and the attributes listed below. The Attendance entity would be represented by a similar rectangle with its own attributes listed. The one-to-many relationship between the two entities would be represented by a line connecting the two, with a crow's foot notation on the Student entity side to indicate the "many" side of the relationship.

Here's an example of an ER diagram for an attendance management system using face recognition:

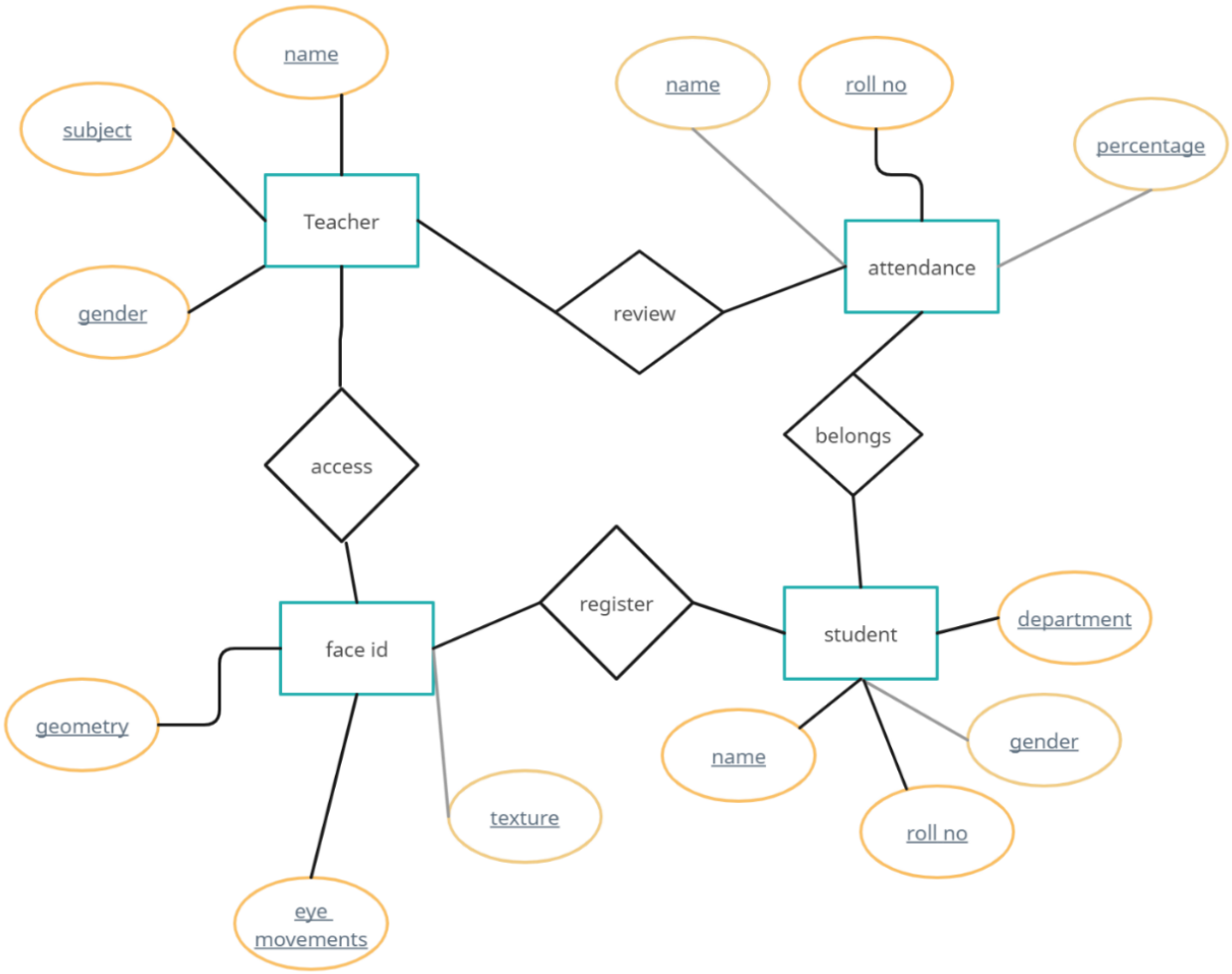


Figure 6.1 ER Diagram

The next chapter deals with the implementation of the project.

CHAPTER 7

IMPLENTATION DETAILS

7.1 SIGN UP

The process of logging in through face recognition for student attendance management is a modern and efficient method. The system uses a camera to capture an image of the student's face and then matches it with the database of registered faces. If the system finds a match, the student's attendance is marked automatically. This eliminates the need for manual attendance-taking, which can be time-consuming and prone to errors. Moreover, the system also ensures accuracy and prevents proxy attendance. It is a reliable and secure method that provides real-time attendance data and saves time and resources for schools and educational institutions.

7.2 PHOTOS INSERTION

To insert photos for employee enrollment in the attendance management system using face recognition technology, you can follow these steps:

1.Create a folder in your project directory to store the employee photos. For example, you can create a folder called "student_photos".

2.Use a webcam or a smartphone camera to capture photos of the employees you want to enroll in the system.

3.Save the photos in the "student_photos" folder with a unique name for each employee. For example, you can name the photo as the employee's ID number or name. Make sure that the file format of the photos is supported by the face

recognition library you are using, such as JPEG or PNG.

4.Develop a script or GUI that allows administrators to select and upload the employee photos to the system. The script or GUI can be developed using Python and a framework like Flask or Django.

5.Use the face recognition library to extract feature vectors from the employee photos and store them in a database. This step is crucial as it allows the system to recognize the employees during attendance tracking.

6.After the employee photos are uploaded and enrolled in the system, the face recognition algorithm will be able to identify the students and record their attendance automatically during the attendance tracking process.

It's important to ensure that the employee photos are of good quality, with proper lighting and clear facial features, to improve the accuracy of the face recognition algorithm. Additionally, it's essential to maintain the privacy and security of employee data by implementing measures such as data encryption and access controls.

7.3 FACE RECOGNITION

The face recognition process in this attendance management system involves several steps:

1. Face detection: The system uses the OpenCV library to detect faces in the image captured by the webcam. The library uses a pre-trained classifier to identify facial features such as eyes, nose, and mouth.

2. Face alignment: Once a face is detected, the system uses facial landmark detection to align the face in a standardized position. This step helps to reduce the effects of variations in lighting, pose, and facial expression.

3. Feature extraction: After the face is aligned, the system extracts unique features from the face, such as the distance between the eyes and the shape of the nose. These features are then converted into a feature vector, which is a mathematical representation of the face.

4. Face matching: The system then compares the feature vector of the captured face with the feature vectors of previously enrolled employees. If there is a match, the system records the attendance for that employee.

5. Enrollment: Before the system can recognize an employee's face, the employee must first be enrolled in the system. During enrollment, the system captures multiple images of the employee's face and generates a feature vector for each image. The system then stores these feature vectors in a database for later comparison during face recognition.

The face recognition process in this attendance management system is based on the principles of machine learning and computer vision.

Figure 7.1 Admin login page

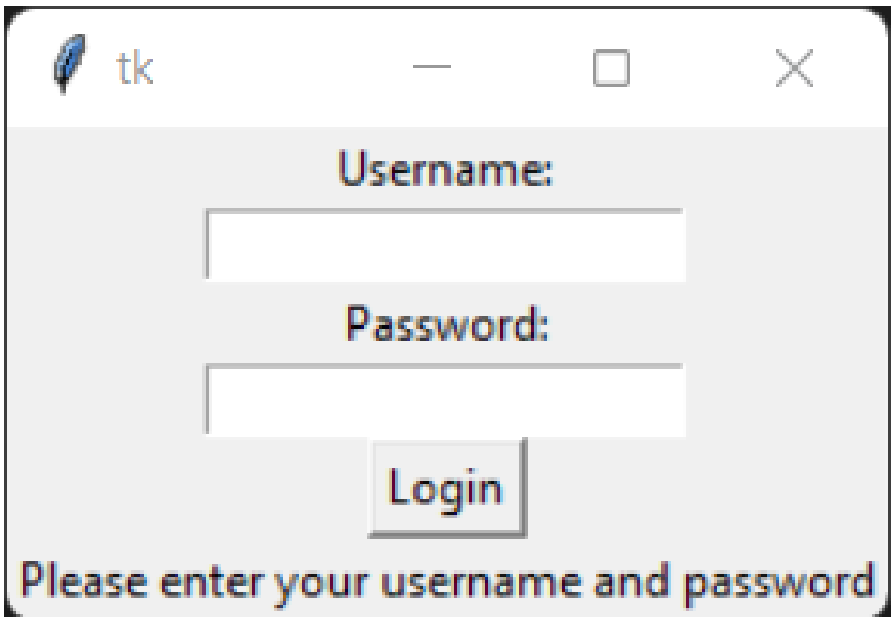


Figure 7.2 Admin features

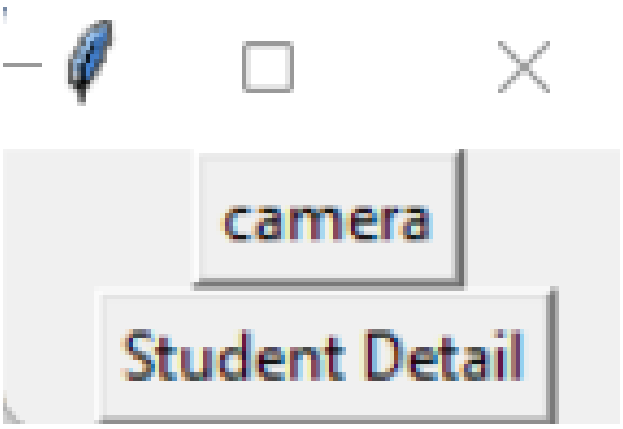


Figure 7.3 Facial verification of the Students

The face of the students will be recognized and the attendance is noted accordingly.

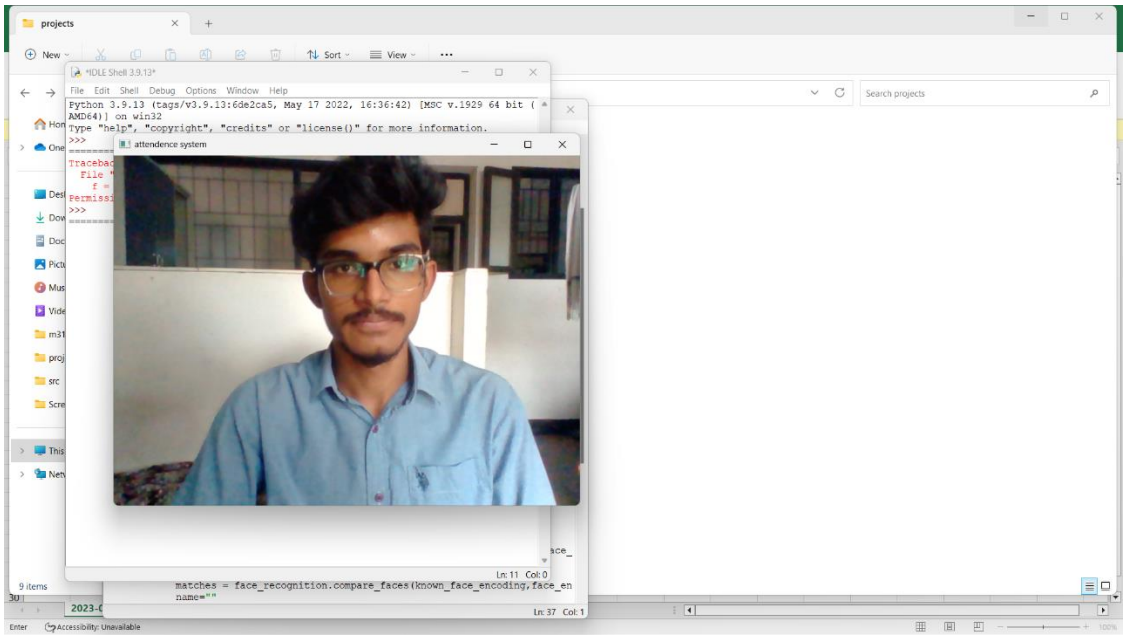
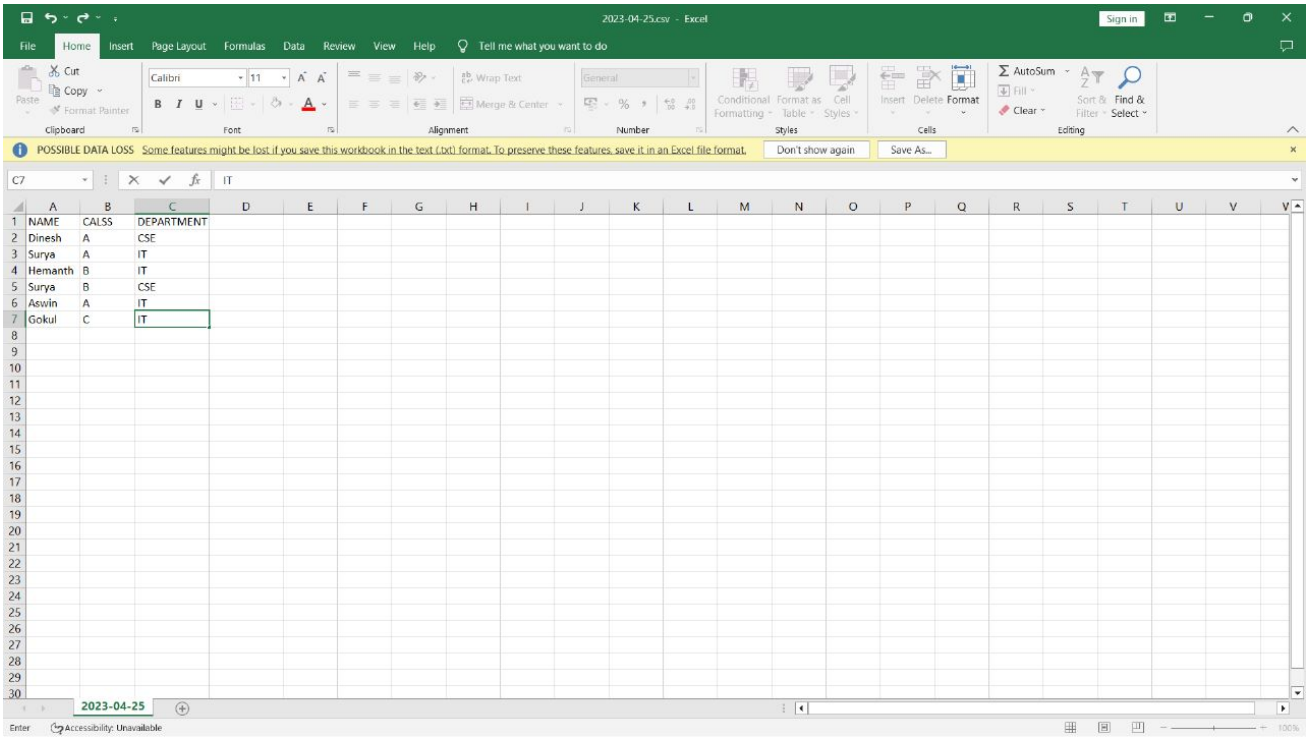


Figure 7.4 Updation of attendance in excel

Those who's face are recognized by the system, their attendance are entered in the excel sheet.



CHAPTER 8

TESTING

Testing of face recognition systems typically involves verifying their accuracy and reliability in correctly identifying individuals. This can be done through a variety of methods, including:

Dataset testing: A face recognition system can be tested by running it against a dataset of known individuals to see how accurately it can identify them. The dataset should be diverse enough to represent different genders, ethnicities, ages, and lighting conditions.

False positive/negative testing: This involves deliberately introducing fake images or faces that the system should not recognize (false positives) or failing to recognize known faces (false negatives) to see how the system handles these scenarios.

Performance testing: This involves testing the speed and accuracy of the system in real-world scenarios, such as scanning a crowd of people or identifying individuals in a video stream.

Security testing: This involves testing the system's vulnerability to hacking or spoofing attempts, such as using a photo or mask to fool the system into recognizing a false identity.

Overall, comprehensive testing of face recognition systems is important to ensure their accuracy and reliability in real-world scenarios and to address any potential security vulnerabilities.

CHAPTER 9

CONCLUSION

In conclusion, implementing an attendance management system using face recognition in Python can be an effective solution for accurately tracking employee attendance while also improving efficiency and security in the workplace.

The system involves collecting face data, using face detection and recognition algorithms, and tracking attendance by recording the time and date of each employee's presence. While there are potential challenges such as data privacy and protection that need to be addressed when implementing such a system, Python provides a flexible and powerful platform for developing and deploying these types of applications. With the increasing availability of face recognition libraries and tools in Python, attendance management using face recognition can be easily implemented with minimal development effort.

CHAPTER 10
REFERENCES

Here are some references related to face recognition student attendance management:

1."Face Recognition-Based Attendance Management System using Raspberry Pi" by Akshay D. Bhosale, Rajendra D. Kanphade, and Sachin V. Jadhav. International Journal of Computer Applications, Vol. 173, No. 9, February 2021.

2."Face Recognition-Based Attendance Management System using OpenCV and Python" by A. E. A. I. Abo-Madyan, M. A. Salem, and H. M. Abdelwahed. 2020 International Conference on Advanced Machine Learning Technologies and Applications (AMLTA).

3."Development of an Automated Attendance Management System using Facial Recognition Technology" by M. S. Kashefi, F. A. Bakar, and N. A. Aziz. 2019 6th International Conference on Electrical and Electronic Engineering (ICEEE).

4."A Facial Recognition Based Attendance System using Machine Learning" by R. Ramachandran, A. R. Shariff, and A. Gupta. 2019 International Conference on Intelligent Computing and Control Systems (ICCS).