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F.R.A.M.S
Face Recognition Attendance Management System

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Abstract: The student attendance management system is designed to improve the traditional attendance system in educational institutions by implementing face detection and recognition using OpenCV. The objective of this project is to enhance the efficiency and effectiveness of the current attendance system. The existing system suffers from inaccuracies and inefficiencies, necessitating an upgrade.

Face recognition technology is employed in this system because it provides a unique and reliable means of identifying individuals. By utilizing Haar Cascade for face detection and the LBPH model for face recognition, the system maintains a database of cropped face images associated with corresponding labels. The LBPH algorithm is used to extract facial features, enabling individual student training. Ultimately, the system generates a spreadsheet that records the number of students present in the classroom, accompanied by live image or video capture.

By incorporating face recognition technology, this attendance management system aims to address the limitations of the traditional approach, offering improved accuracy and efficiency in recording attendance.

Keywords: LBPH, OpenCV, Haarcascade,Face recognition, Face detection,Spreadsheet.

I. INTRODUCTION

Attendance is a crucial factor that can positively impact academic performance. Research indicates that class attendance is associated with improved performance in exams and final course grades. It has been observed that attendance has a greater influence on test scores compared to tutorial attendance, particularly for underperforming students. Furthermore, attendance is a controllable aspect of student behavior that can contribute to overall performance.

The process of manually marking attendance in a classroom during lectures is both cumbersome and time-consuming. It also presents the risk of proxy attendance due to the high number of students present. The conventional methods of attendance marking have proven to be challenging, highlighting the need for efficient and automated techniques, such as face recognition.

Facial recognition and image processing have emerged as captivating fields with significant potential. Facial recognition systems utilize unique features specific to each individual, surpassing other biometric methods like fingerprints and RFID. The proposed project aims to leverage facial recognition technology to create an attendance system that overcomes the limitations of traditional pen-and-paper methods. By doing so, it can enhance efficiency, prevent proxies, and save valuable lecture time.

The inspiration for this project stemmed from witnessing the time-consuming process of attendance marking in class, as well as the casual attitude of students who had already marked their attendance, causing further delays. Recognizing the immense scope and potential of image processing and recognition, we decided to delve into this field for our project. By undertaking this project, we aim to hone our skills and prepare ourselves for the challenges that lie ahead.

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II. PROBLEM STATEMENT

Current attendance management systems suffer from limitations associated with manual methods such as paper registers or swipe cards. These approaches are time-consuming, prone to errors, and vulnerable to proxy attendance. Security measures in traditional systems are often inadequate, allowing unauthorized access and potential data manipulation. Additionally, the lack of real-time monitoring makes it challenging to address absenteeism and irregularities promptly.

To address these issues, a comprehensive literature survey was conducted to analyze existing systems that utilize facial recognition techniques and algorithms for attendance management. Based on the findings, a descriptive framework was developed using relevant sources related to facial recognition and image processing.

The proposed Face Recognition Attendance Management System aims to overcome the shortcomings of traditional systems by leveraging advanced facial recognition technology. This system seeks to streamline the attendance recording process, eliminate proxy attendance, enhance security measures, enable real-time monitoring, and provide efficient reporting and analytics capabilities.

By implementing the Face Recognition Attendance Management System, educational institutions and organizations can expect improved efficiency and accuracy in attendance management. This system will save time and resources while ensuring more reliable and secure attendance records.

III. MODEL IMPLEMENTATION

This section focuses on the proposed techniques, methodologies, and concepts specific to facial recognition and image processing.

Facial recognition, as a biometric technique, involves determining whether the image of a person's face matches any of the face images stored in a database. However, automatic resolution of this challenge is difficult due to various factors such as facial expression, aging, and lighting conditions that can affect the images. Despite not being the most foolproof biometric technique, facial recognition offers several advantages over other methods. It is natural, feasible, and does not require assistance. The proposed system utilizes facial recognition to automate the attendance process for students or employees without their active involvement. A webcam is used to capture images, which are then compared with the database to mark attendance.

The facial recognition process can be divided into two main stages: pre-detection processing, which involves face detection and alignment, and recognition, which includes feature extraction and matching steps.

1. Face Detection:
The primary goal of this step is to determine whether human faces are present in a given image and identify their locations. The output is a set of patches, each containing a detected face. Face alignment may be performed to standardize the scales and orientations of these patches, making the face recognition system more robust and easily configurable.

2. Feature Extraction:
Once the faces are detected, the next step is to extract facial patches from the images. This involves converting the face patches into vectors with fixed coordinates or a set of landmark points.

3. Face Recognition:
The final step is to identify the faces. For automatic recognition, a face database is created. Multiple images are captured for each person, and their features are extracted and stored in the database. When an input image is processed, face detection and feature extraction are performed, and the features are compared with each face class stored in the database.

To facilitate the face recognition attendance management system, we have developed a graphical user interface (GUI) where student details are stored in a database. The system utilizes the webcam to capture images of students. The captured images are then processed, with faces detected and compared to those in the database, resulting in attendance marking.

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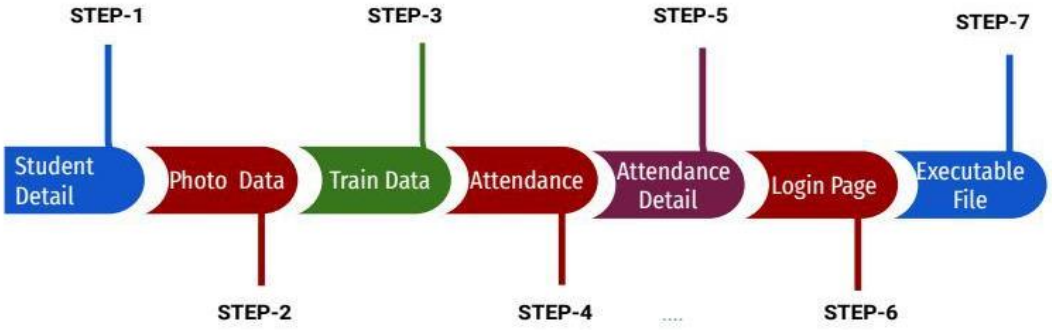
Project Roadmap:

This roadmap will give a brief information about the project and we can have the overall look on the functions of the project. This covers all the aspects of the face recognition based attendance system. It discusses the modules used in our system.



The sub-system description is as follow:

1. Student detail:
Through this all basic information of all the students will be added in the system which will be saved in the database. - Haar-cascade algorithm will be applied in this module to detect the face and save it in the photo module. The input of the photo will be through the camera.

2. Photo Data:
The face detected in the student module through the haar cascade algorithm will be saved in a folder. Around 100 gray scale image copies per student will be saved here along with their Id in JPG format which will be further used for training.

3. Train Data:
LBPH algorithm will be applied on the gray scale images present in the folder. After training is done, Trained image along with their respective ID will be saved in an XML file.

4. Attendance:
Through this module we will first ask for the subject name for which the attendance should be marked and then access the camera that will recognise the face. If face is recognised it will save the respective image data like Name, Roll No along with date and timestamp in the subject CSV file.

5. Attendance Detail:
The excel file can be imported here where all the attendance is saved.

6. Login and register page:
For user identification authentication so that only admin can access the system.

7. Executable file:
Convert all the python files into executable le so that it can be used as a desktop application.

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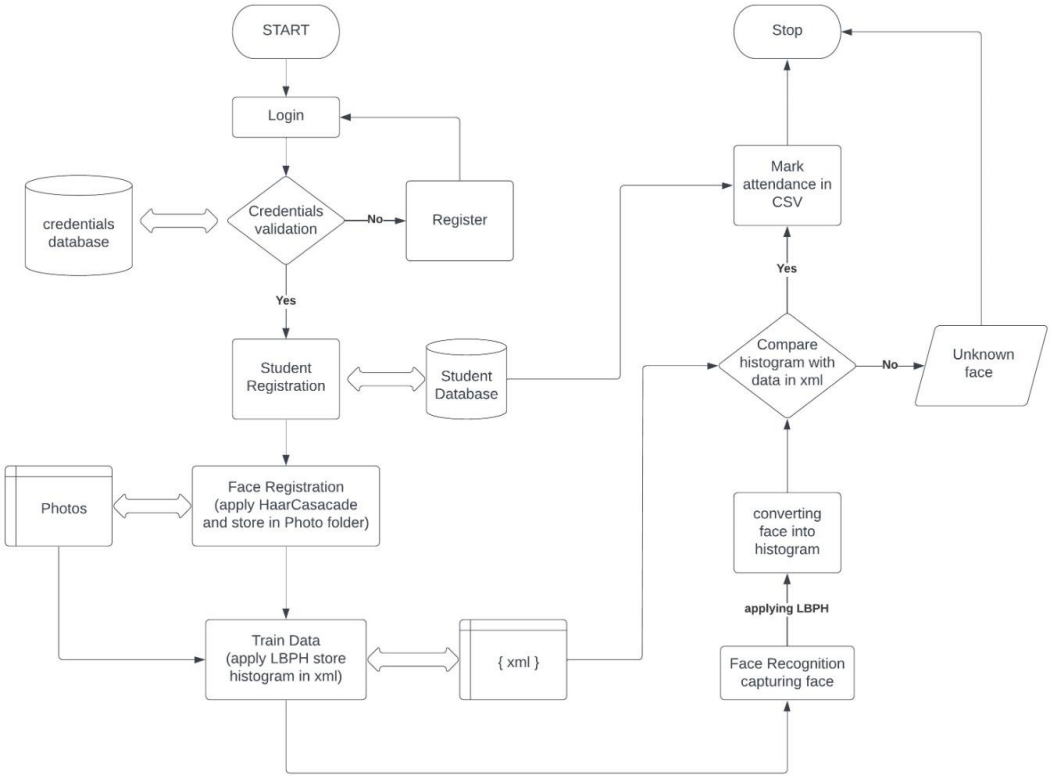
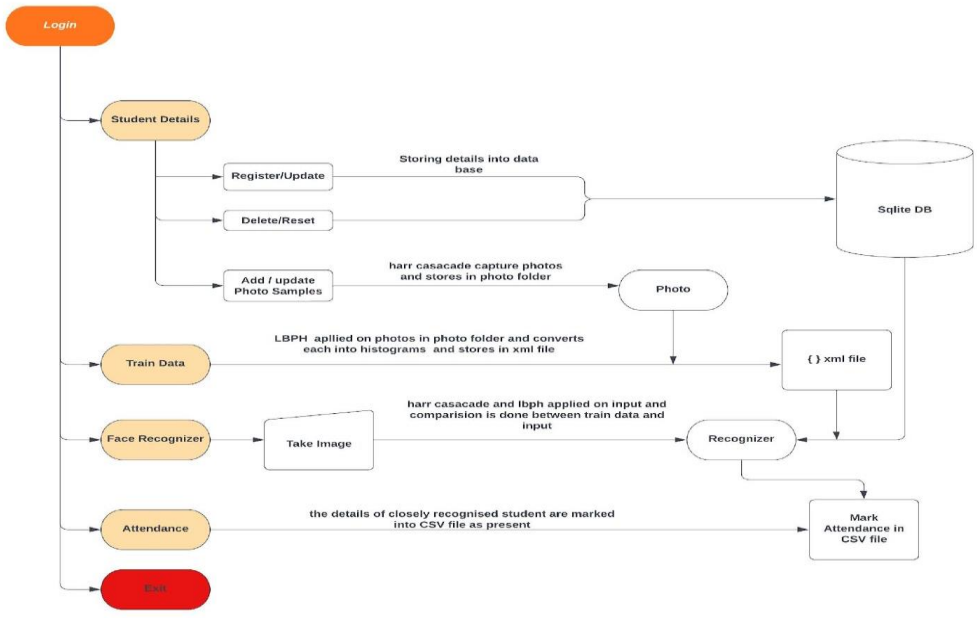
IV. SYSTEM DESIGN AND FLOW DIAGRAMS



Flow Diagram 1



Flow Diagram 2

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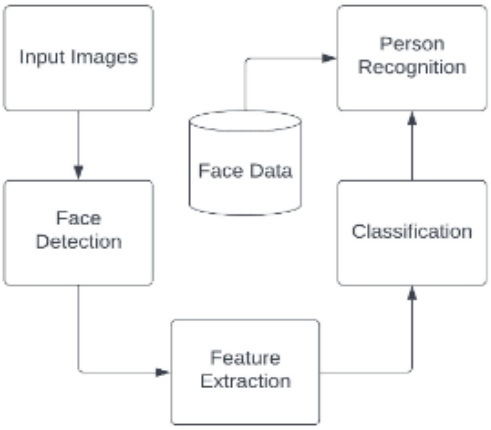
V. WORKFLOW OF MODEL



Database Creation:

The initial step in the Attendance System involves creating a database to store registered faces. Each individual is registered by detecting their face using a camera and capturing frontal face images. The images are then assigned an image ID and added to the database along with the corresponding Registration ID.

Training of Faces:

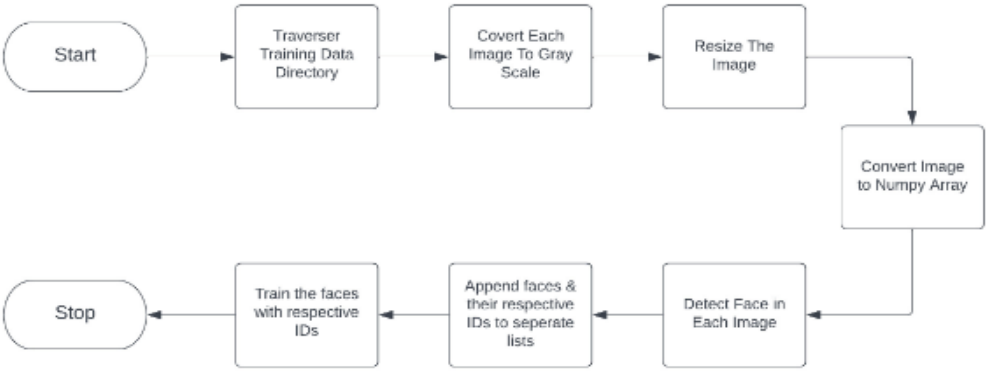
The recorded images are converted to grayscale format. To distinguish between different faces, the LBPH (Local Binary Patterns Histograms) recognizer is utilized, as varying resolutions may affect the recognition process. A portion of the image is selected, treating all other pixels as background pixels. A binary format is used to compare the selected portion with the center portion. If the intensity of the center portion is greater than or equal to that of its neighboring pixels, a one will be assigned.

Face Detection:

The data of the trained faces is stored in a .py format. The Haar cascade frontal face module is employed to detect faces.

Face Recognition:

The data of the trained faces is stored, and the detected faces are compared to the stored IDs of the students for recognition. Real-time face recording ensures the system's accuracy. The effectiveness of the system is contingent upon the condition of the camera used.



Flow-chart of the methodology used for Training Process

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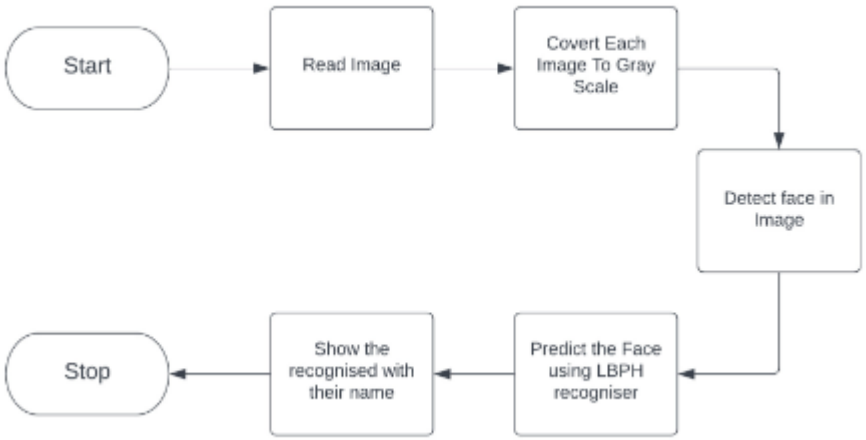

Flow-chart of the methodology used for Face Detection and Recognition

The training process begins by traversing the training data directory. Each image is first converted into grayscale. A central part of the image is chosen, and its neighboring pixels are thresholded against it. If the intensity of the middle part is greater than or equal to its neighbor, it is denoted with 1, and 0 otherwise. Next, the images are resized and converted into numpy arrays, which are the central data structure of the numpy library. The faces in the image are detected, and separate lists are created for each face, along with their respective IDs. Finally, the faces are trained with their respective IDs.

When the input image is captured by the phone's camera, it is first converted into grayscale. The Haar Cascade frontal face module is then used to detect the faces in the image. Using the LBPH algorithm, the faces in the image are predicted and recognized. The recognized faces are then displayed in a green box along with their names

VI. RESULT AND PERFORMANCE ANALYSIS

This article presents the design of a real-time face recognition attendance system utilizing video processing. It focuses on addressing several key challenges, including the accuracy of attendance marking, interface settings, and the stability of face recognition. Through thorough analysis and investigation, the research aims to develop an effective face recognition attendance system.

Upon implementing the project, experimental data demonstrates that the accuracy rate of the face recognition attendance system reaches up to 80%. The results indicate promising outcomes in terms of accurately recognizing individuals for attendance purposes.

By leveraging advanced video processing techniques and incorporating robust face recognition algorithms, the designed system offers a reliable and efficient solution for attendance management. The research conducted in this article provides valuable insights and contributes to the development of face recognition-based attendance systems.

Test Data	Accuracy Rate
2	89%
5	85%
10	80%

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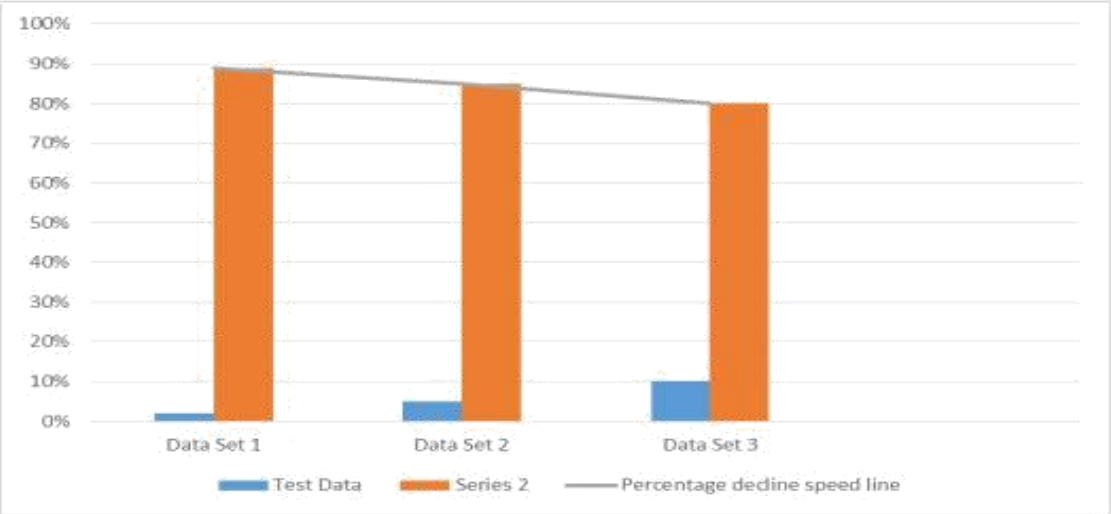

Test number and accuracy rate chart

A statistical table was created to evaluate the input taking, clarity, and training of photo samples for each student in the student attendance system, focusing on accuracy and efficiency. The purpose was to record the detection and recognition rate/speed of an image to assess the system's performance. The timing of various system functions was measured on a scale of 1 to 5 and mapped onto a graph for analysis.

The analysis revealed that the system performed well, and it took an average of 10 seconds to complete the training and testing of 4 photo samples. This information provides valuable insights into the system's speed and accuracy, demonstrating its effectiveness in the student attendance management process.

	Detection Rate	**Training Rate**	**Recognition Rate**
Photo Sample 1	5	4	5
Photo Sample 2	4.3	4.4	4.6
Photo Sample 3	3.6	3	3.2
Photo Sample 4	5	5	4.6

Comparison of data detection and recognition among 4 photo samples

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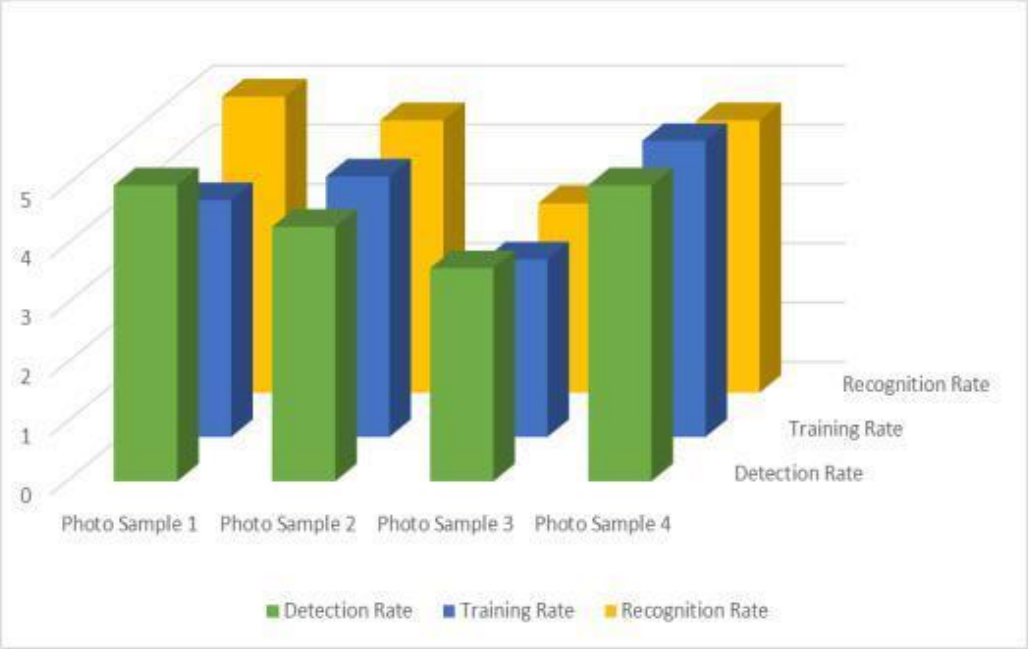

Comparison of data detection and recognition among 4 photo samples graph

VII. CONCLUSION

This paper introduces an efficient face recognition method using OpenCV for Attendance Management. The system utilizes the LBPH algorithm, which outperforms other algorithms with a confidence factor of 2-5 and minimal noise interference. The implementation of the Smart Attendance System demonstrates a strong correlation between the recognition rate and the threshold value. Therefore, LBPH is considered the most reliable and effective face recognition algorithm in OpenCV for accurately identifying students in an educational institute and preventing proxy attendance.

The main objective of this system is to develop a time-saving and user-friendly class attendance system using face recognition techniques. The proposed system utilizes face ID for attendance marking. It captures faces through a webcam, performs face recognition, and updates the attendance record for recognized students. This system benefits both faculty and students by providing a secure, reliable, and easily deployable solution. It does not require specialized hardware and can be implemented using a camera and computer. The implementation relies on OpenCV, Python, and SQLite programming languages, resulting in improved accuracy for the attendance management system.

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