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FACE RECOGNITION APPLICATION FOR OFFICE ATTENDANCE

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Abstract : An attendance system that utilizes facial recognition technology and a defaulter list utilizes facial recognition algorithms to identify and record attendance for individuals. When an individual is in front of the camera, the system maintains a database of their images, the system recognizes the face and records attendance accordingly. The system also has defaulter list, which includes the names of individuals employees who are expected to attend but have not done. The attendance records are used to create the defaulter list, which can be used to take the necessary actions, such as sending notifications to the individual person.

This paper presents a face recognition system of Haar Cascade algorithm for robust and efficient face detection and recognition. Using computer vision algorithms, the system extracts features from the face, such as eye distance, nose shape, and mouth shape, to recognize the person. The system can be utilized in various situations, such as schools, colleges, and offices, where attendance needs to be recorded on a regular basis. The attendance recording process can be automated by the system, which can save time and effort, and the defaulter list can ensure that everyone is included. Overall, an attendance system using face recognition with a defaulter list can be a useful to managing attendance and ensuring that individuals attend as required. The effectiveness of the proposed system is evaluated on various metrics including accuracy, precision, recall, and processing speed.

Keywords: **Face Recognition, Human Face Detection, Computer Vision, Haar Cascade Algorithm**

1. INTRODUCTION

Maintaining attendance records with day-to-day activities is a challenging task. There is always a chance of proxy attendance and the conventional method of calling students' names takes a lot of time. The attendance records of students are maintained using a system that uses face recognition. The administrator already keeps track of the daily attendance of students based on their subject.

Our system has the ability to identify multiple faces in real-time. The main objective of this project is to develop face recognition based automated attendance system. To boost performance, the test and training images proposed by this approach are restricted to frontal and upright facial images that consist of a single face only. To ensure that there are no quality differences between test and training images, it is important to capture them with the same device. Additionally students have to register in the database to be recognized. Face recognition consists of two steps: firstly, identifying the faces that have been detected, and secondly, identifying the ones that have been identified with the existing database. Numerous detection and recognition methods have been introduced. Face recognition works either in form of appear an based which covers the features of whole face or feature based which covers the geometric feature like eyes, nose, eyebrows, and cheeks to recognize the face.

2. LITERATURE REVIEW AND OBJECTIVE

[1] Face Recognition based Attendance Management System using Haar-Cascade Algorithm:

In this paper, we look at face detection in automatic attendance tracking systems using the Haar Cascade classifier algorithm with OpenCV. We focus on the scalability of the algorithm, which allows for real-time processing, which is suitable for organizations of all sizes. We also focus on the accuracy of face detection using this algorithm, as we want to minimize the errors that come from manual attendance tracking. We recognize that there are challenges, such as false positives and negativities due to appearance changes, accessories or hairstyles. Therefore, we focus on the technical expertise and the time it takes to implement and fine-tune the algorithm.

[2] Automated Attendance System Using Face Recognition using CNN Algorithm:

This paper introduces an automatic attendance system using the Convolution Neural Network (CNN) algorithm for face detection and recognition in classrooms, aiming for high accuracy. Leveraging CNN's proficiency in image recognition, the system ensures reliable student identification under varying conditions. It emphasizes the potential for continuous improvement with additional data while acknowledging the complexity of implementing and training CNN models, requiring deep learning expertise and suitable hardware. The paper also notes CNNs' sensitivity to data noise, urging careful consideration for optimal attendance tracking accuracy. urging careful consideration for optimal attendance tracking accuracy.

[3] Automated Class Attendance System based on Face Recognition using PCA Algorithm :

PCA, a valuable statistical technique, is applied in face recognition and image compression, particularly through the Eigen faces approach. This method utilizes a small set of characteristic images to describe variations in face images, showcasing PCA's role in identifying patterns in high- dimensional data. Noted for its simplicity, PCA is more accessible to understand and implement than complex algorithms. It achieves reduced dimensionality, speeding up computation and potentially lowering computational requirements. However, effective use of PCA mandates careful data preprocessing, and its adaptability to changes in datasets may be limited, necessitating retraining for optimal performance with new variations.

[4] Facial Recognition Attendance System Using Python and OpenCv :

In preparation for the Eigen Faces Recognizer, captured images undergo preprocessing to obtain grayscale and uniformly cropped faces. The algorithm's simplicity make it accessible for beginners in facial recognition, while its dimensionality reduction enhances computational efficiency. However, Eigenfaces exhibit limited discriminative power, potentially impacting accuracy by not capturing fine facial details crucial for distinguishing similar-looking faces.

[5] Deep learning based face recognition attendance system:

This paper introduces a novel deep learning-based face recognition attendance system. The model employs advanced techniques, including a CNN cascade for face detection and a CNN for generating face embeddings. The challenge was adapting these methods to smaller datasets, addressed through a new image augmentation approach. Despite the smaller dataset, the model achieved a 95.02% accuracy on real-time employee face images. The proposed model can be seamlessly integrated into monitoring systems, making it versatile for various applications.

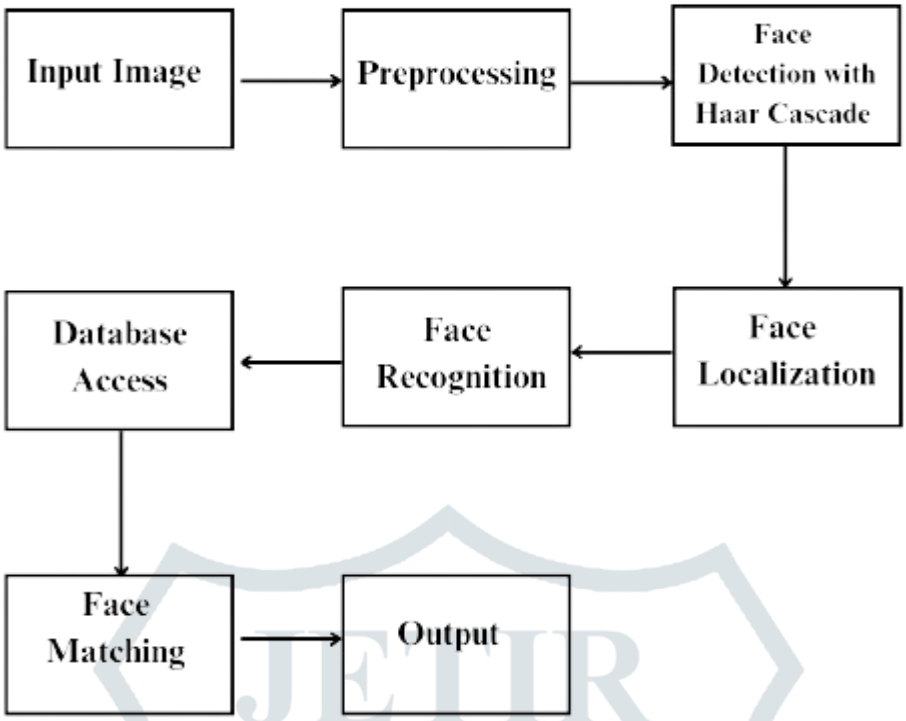
[6] Face Recognition Attendance System Based on Real-Time Video Processing:

This paper focuses on designing a face recognition attendance system using real-time video processing, capitalizing on the growing demand for face recognition technology in the era of big data. Four key aspects are addressed: the accuracy of face recognition during check-ins, the stability of real-time video processing, truancy rates, and interface settings. The proposed system demonstrates an 82% accuracy rate, reducing check-in time by approximately 60% compared to traditional methods. Truancy is significantly reduced, tackling issues like early departures.
The real-time video processing system enhances efficiency, eliminates naming complexities, and proves instrumental in guiding the development of attendance systems

3. MATERIALS AND METHODS

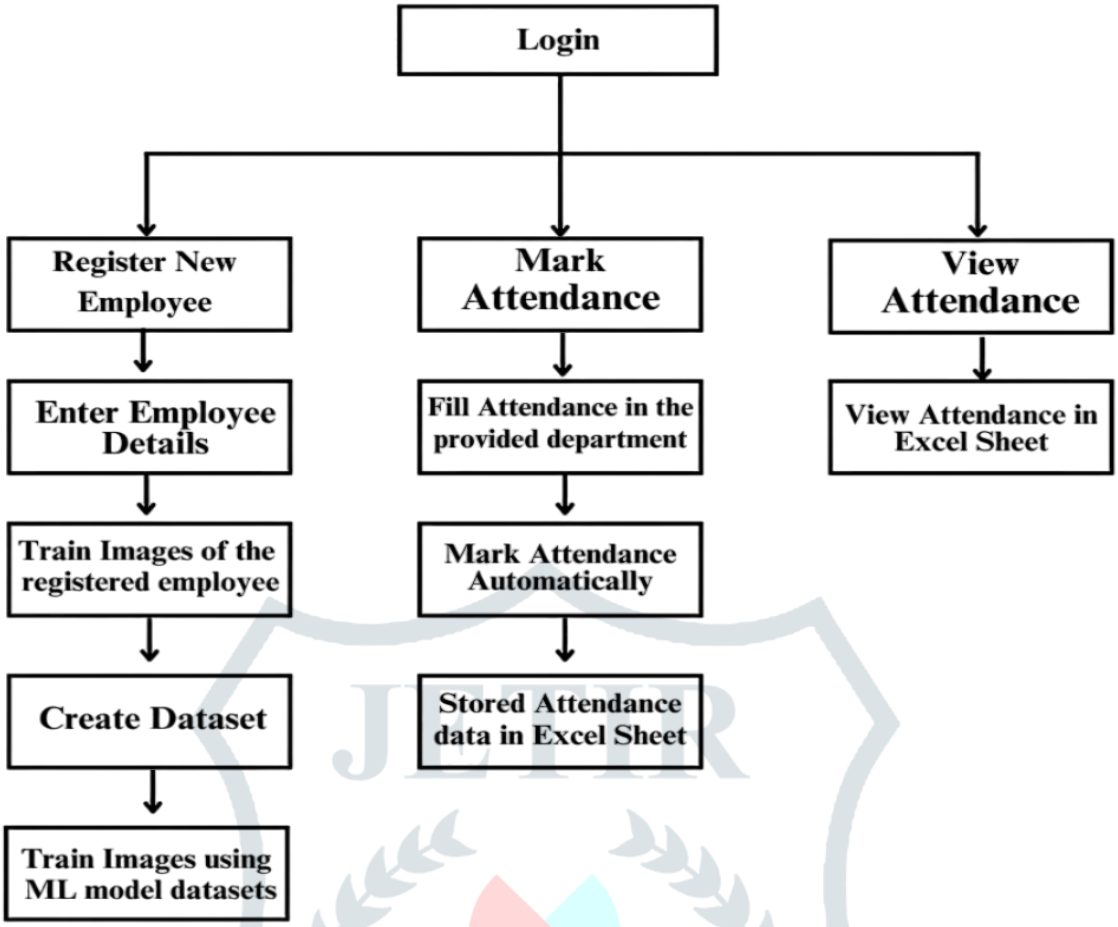
3.1 Methodology

The Facial Recognition Attendance System is a sophisticated software solution designed to modernize attendance tracking procedures. It employs cutting-edge facial recognition technology to automate the process across office workplaces, schools, and events.
Comprising three main components, the system starts with "Register a New Employee." Here, administrators input essential details such as name, ID, and department, while also capturing multiple facial images for accurate identification during attendance recording. Once registered, individuals interact with the system through Take Attendance." Using the Haar cascade algorithm, the system detects and analyzes facial features in real-time as individuals approach. By comparing these features with stored images, the system identifies individuals and marks their attendance, eliminating manual tracking and reducing errors. Administrators manage attendance data through "View Attendance." All records, including date, time, and individual identities, are stored in a structured CSV file format. This central repository enables administrators to generate reports, monitor trends, and perform further analysis. With features like automated recording, robust facial recognition, scalability, and efficient data management, the Facial Recognition Attendance System offers a sophisticated yet user-friendly solution for modern attendance management needs. By the strengths of Haar Cascade, the proposed face recognition system achieves a balance between efficiency and accuracy, making it suitable for real-time applications such as surveillance, access control, and biometric identification. The results demonstrate the potential of hybrid techniques in enhancing face recognition systems' performance in diverse and challenging environments.



Block Diagram of the Proposed Model

This block diagram encapsulates the main stages and interactions within a face recognition system that combines Haar Cascade for initial face detection for subsequent face recognition tasks. Each component plays a crucial role in enabling accurate and efficient face recognition in various applications



System Architecture

Workflow :

- The input image undergoes preprocessing to prepare it for face detection and recognition.
- The Haar Cascade classifier scans the preprocessed image to identify potential face regions.
- Detected face regions are extracted from the input image using the bounding boxes provided by the Haar Cascade.
- This process extract face region to generate features or predict the identity associated with the face.
- The system compares the extracted features or predicted identity with those stored in the face database.
- Based on the comparison results, the system outputs the recognized identity or notifies if the face is unrecognized.

Steps for Face Detection

1. Register a new employee

The module facilitates the addition of new employees to the system by capturing essential details such as name, ID, and department. It allows administrators to capture facial images of new employees for biometric identification purposes. Once entered, the system securely stores this information, associating each image with the corresponding employee's identity. The user interface is designed to be intuitive, guiding administrators through the registration process seamlessly. This module ensures comprehensive coverage for recognition accuracy and efficient onboarding of new
employees into the attendance system.

2. Take Attendence:

This module enables real-time attendance tracking using facial recognition technology. It automatically detects and analyzes facial features of individuals as they approach the designated checkpoint. Employees' facial images are captured and compared against the stored dataset for identification. The system then marks attendance automatically based on the recognized faces. In cases of unrecognized faces, administrators have the option for manual attendance marking, ensuring accuracy and efficiency in
attendance tracking.

3. View Attendence :

Authorized users can securely access and review attendance records through this module. It provides comprehensive attendance data, including timestamps, employee identities, and attendance statuses. Users can analyze attendance records using various tools such as filtering options and report generation. The module empowers administrators with valuable insights into attendance patterns and trends, facilitating informed decision-making. The user-friendly interface enables efficient navigation and extraction of insights from attendance records for organizational purposes.

3.2 Materials

- Software Requirement

1. User Interrface:
Design a user-friendly interface for administrators and users to interact with the system.
2. Image Processing:
Implement image processing techniques to enhance the quality of input images, handle variations in lighting conditions, and improve the accuracy of face detection and recognition

- Hardware Requirement

1. Computing Hardware:
A powerful CPU is necessary for real-time face detection and recognition tasks. Multi-core processors, such as Intel Core i7 or higher, or AMD Ryzen equivalents, are recommended for better performance.
2. GPU (Graphics Processing Unit):
Utilizing a GPU can significantly accelerate the processing of deep learning models used in face recognition algorithms
3. RAM :
Sufficient RAM is essential to handle the computational load of face recognition algorithms and database operations.

4. RESULTS

The result of a face recognition system using Haar Cascade algorithm typically involves accurate detection of faces followed by recognition or identification of individuals based on learned features or matching against a database of known faces.

Result of Face Recognition System:

Figure 1: Homepage of Face Recognition for Employee Attendance

Our trained model achieved an accuracy of 81% on the test dataset. This accuracy was calculated using the following formula:

Accuracy = Correct Predictions\ Total Predictions times 100

Confusion Matrix

	Predicted Positive	Predicted Negative
Actual Positive	41	9
Actual Negative	10	40

Results Summary

- **True Positives (TP)**: 41 (Correctly predicted positive instances)
- **True Negatives (TN)**: 40 (Correctly predicted negative instances)

- **False Positives (FP)**: 10 (Incorrectly predicted positive instances)
- **False Negatives (FN)**: 9 (Incorrectly predicted negative instances)

Accuracy Calculation

- The accuracy is calculated as follows:
- Accuracy = TP + TN \ {TP + TN + FP + FN} times 100
- Substituting the values:
- Accuracy = 41 + 40 \ {41 + 40 + 10 + 9} times 100 = 81%

CONCLUSION

The proposed computerized attendance management system offers significant advantages over the manual attendance system currently in use. In the manual system, the reliance on manual processes results in various shortcomings, including a lack of data security, increased manpower requirements, time-consuming procedures, extensive paperwork, and the necessity for manual calculations.

In summary, the proposed system stands out for its ability to overcome the drawbacks of the manual attendance system. It prioritizes data security, accuracy, and efficiency, ultimately providing a more streamlined and effective solution for attendance management. The project journey involves a comprehensive exploration of the background and context, defining the problem domain, specifying system requirements, creating a functional model, and finally, implementing and testing the system according to predefined test cases. The holistic approach taken in the development process ensures that the proposed system not only addresses current challenges but also aligns with the broader goals of improving overall efficiency and user experience.

FUTURESCOPE

In healthcare, facial recognition is expected to be adopted by more countries to enhance overall safety, reduce identification errors, and enhance the customer experience in settings such as hospitals and doctor's surgeries. Smart cities are driving the development of facial recognition, combining 5G, AI, edge technologies and the Internet of Things (IoT).

Facial recognition in Smart Cities is not limited to public safety. Similar to 'object recognition', facial recognition can be used to identify out-of-place objects, such as overflowing bins or broken bus shelters, and notify the relevant agency of the need for action. Around the Home Security systems are increasingly using facial recognition to improve security at and around the home, as well as to improve access and provide a seamless experience. This is especially true when deployed in smart homes or building developments.

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