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Research Paper

MULTIPLE FACIAL ATTENDANCE MANAGEMENT SYSTEM

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Abstract: The Multiple Facial Attendance Management System is an automated attendance monitoring solution developed using image processing and face recognition techniques. The system is designed to overcome the limitations of traditional attendance methods such as manual roll calls and paper-based attendance recording. In educational institutions, maintaining daily student attendance records manually is a difficult and time-consuming task for faculty members.In modern educational environments, intelligent attendance systems play an important role in managing student attendance efficiently. The proposed system automatically captures and recognizes the faces of students present in the classroom and records attendance without requiring manual intervention. This helps reduce faculty workload, minimizes attendance errors, and prevents proxy attendance.

The attendance records of students are maintained period-wise and stored securely in the college database. These records can be accessed by both administrators and faculty members for monitoring attendance and evaluating student performance. The system also provides accurate and organized attendance reports that can be used for academic analysis and administrative purposes.The proposed facial attendance management system is fast, reliable, contactless, and easy to use. By automating the attendance process, the system improves classroom efficiency, saves valuable teaching time, and provides a scalable attendance management solution for schools, colleges, and universities.

Index terms **-** *Face Recognition, Attendance Management System, Biometrics, Eigenfaces, Image Processing, Machine Learning, Computer Vision, Face Detection, Automated Attendance, Real-Time Monitoring.*

1. INTRODUCTION

The attendance of students plays an important role in schools, colleges, universities, and other educational institutions. Traditional attendance systems generally involve calling student names or roll numbers and manually recording attendance. This manual process consumes valuable classroom time, increases workload for faculty members, and may lead to errors or proxy attendance issues.To overcome these limitations, this project proposes an automated face recognition-based attendance management system. The system uses facial recognition technology to identify students automatically and mark attendance without requiring manual intervention. Instead of conducting roll calls, a camera installed in the classroom captures the faces of students present during the session.

The captured images are processed in real time using image processing and face recognition techniques. The system detects individual faces from the classroom image and compares them with the pre-stored student database. Once a student's face is successfully matched with the stored records, attendance is automatically marked in the system database.

The proposed attendance system is designed to be fast, accurate, and non-intrusive. It reduces time consumption, prevents proxy attendance, and improves the overall efficiency of attendance management. Since the process is contactless and fully automated, it also provides a more reliable and secure solution for educational institutions.The system can be effectively used not only during regular classroom sessions but also in examinations, seminars, workshops, and other academic activities where attendance monitoring is necessary. By eliminating physical verification and manual attendance recording, the system allows teachers and students to maintain better focus on academic activities without interruption.Overall, the proposed face recognition-based attendance system provides a scalable, intelligent, and efficient solution for modern attendance management in educational institutions and organizations.

2. LITERATURE SURVEY

2.1 Individual Stable Space: An Approach to Face Recognition Under Uncontrolled Conditions

AUTHORS: Xin Geng, Zhi-Hua Zhou, K. Smith-Miles

ABSTRACT: Xin Geng, Zhi-Hua Zhou, and K. Smith-Miles (2018) proposed a face recognition approach called *Individual Stable Space* to improve recognition performance under uncontrolled environmental conditions. The research was published in IEEE Transactions on Neural Networks. The methodology focused on feature space learning techniques that can handle variations in illumination, facial expressions, and pose. The proposed system created a stable feature space that improves recognition accuracy even in unconstrained environments. However, the system performance decreases under extreme environmental variations. The study concluded that the stable space approach significantly improves face recognition accuracy in real-world environments.

2.2 . Anti-Cheating Presence System Based on 3WPCA Dual Vision Face Recognition

AUTHORS: Winamo, Wiwien Hadikurniawati, Imam Husni Al Amin, and Muji Sukur

ABSTRACT: The research was conducted at Universitas Stikubank. The methodology used dual-camera vision with PCA-based facial recognition techniques to improve attendance reliability and prevent proxy attendance. The proposed system enhanced the accuracy and security of attendance monitoring. However, the requirement of dual-camera setup increased system complexity and implementation cost. The study concluded that dual-vision face recognition with 3WPCA improves the reliability of face-based attendance systems.

2.2. 3 WPCA-Based Facial Feature Extraction for Attendance Systems

AUTHORS: Winamo et al

The methodology involved extracting facial features and matching them with stored face datasets for attendance verification. The proposed system automated the attendance process and minimized manual effort. However, the recognition performance was sensitive to image quality and lighting conditions. The research concluded that PCA-based face recognition techniques can be effectively implemented in automated attendance management systems.

2.2.4 Prototype Model for an Intelligent Attendance System Based on Facial Identification

AUTHORS: Raj Malik, Praveen Kumar, Amit Verma, and Seema Rawat

ABSTRACT: The methodology focused on facial feature extraction and matching techniques for automatic identification of individuals. The proposed system reduced manual attendance work and improved efficiency in attendance tracking. However, the system faced limitations in scalability and was affected by variations in facial pose. The study concluded that facial identification methods are effective for developing intelligent attendance systems.

2.2.5 Convolutional Neural Network Approach for Vision-Based Student Recognition System

AUTHORS: Nusrat Mubin

ABSTRACT: The methodology applied deep learning techniques for facial feature extraction and recognition. The proposed system achieved higher recognition accuracy compared to traditional face recognition methods and improved attendance automation. However, the model required a large dataset and high computational resources for training and implementation. The study concluded that CNN-based recognition systems provide better accuracy and performance for student recognition and attendance applications.

3. METHODOLOGY

i) Proposed Work:

Every individual has a unique facial structure that can be used for personal identification. In this project, the face of an individual is utilized for automatically marking attendance. Student attendance plays an important role in schools, colleges, and universities because it helps monitor student participation and academic activities. Traditionally, attendance is recorded manually by calling the names or roll numbers of students, which consumes classroom time and increases manual workload.

The proposed system uses face detection and face recognition techniques to automate the attendance management process. Face detection is used to identify and locate the position of human faces from the captured classroom image or video frame. After detecting the face region, the face recognition module compares the detected face with the pre-stored student database to identify the student accurately.Once the student's face is recognized successfully, the attendance is automatically recorded in the system database without requiring any manual intervention. This automated approach reduces time consumption, improves attendance accuracy, prevents proxy attendance, and provides a fast and efficient solution for educational institutions.

ii) System Architecture:

The architecture of the proposed Real-Time Face Recognition Based Automated Attendance Management System is designed to automate attendance marking using image processing and machine learning techniques. The system consists of multiple interconnected modules that perform image acquisition, face detection, face recognition, attendance verification, database management, and report generation. The overall workflow ensures accurate and efficient attendance monitoring without manual intervention.

Initially, the classroom camera captures live video frames containing student faces. The captured images are sent to the preprocessing module where noise removal, image resizing, and normalization operations are performed to improve image quality. After preprocessing, the face detection module identifies and extracts facial regions from the image using OpenCV techniques. The detected faces are then forwarded to the feature extraction and recognition module implemented using TensorFlow and machine learning algorithms. This module compares extracted facial features with the trained student database to identify students accurately. Once a valid match is found, the attendance management module automatically marks attendance and stores the details in the database. Finally, attendance reports

and absence notifications are generated for monitoring and administrative purposes.

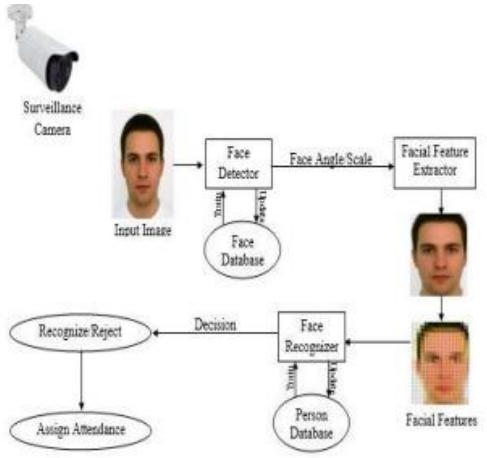

Fig.1. Proposed Architecture

iii) MODULES:

1. Data Acquisition Module

This module captures real-time images using a surveillance camera. It collects student face images under different conditions and stores them for further processing and training.

2. Face Detection Module

In this module, the system detects and locates human faces from the captured images. It separates face regions from the background using image processing techniques.

3. Image Preprocessing Module

The detected faces are normalized by adjusting size, angle, and lighting conditions. This step improves the quality and consistency of input images for better recognition accuracy.

4. Feature Extraction Module

This module extracts important facial features using the Eigenfaces technique (PCA). It reduces image dimensionality and converts faces into feature vectors.

5. Face Recognition Module

The extracted features are compared with stored features in the database. Based on similarity matching, the system identifies the student.

6. Database Management Module

This module maintains student details such as ID, name, email, and facial data. It stores and retrieves information required for recognition and attendance marking.

7. Attendance Management Module

Once a face is recognized, the system automatically marks attendance with date and time. It also maintains attendance records in a structured format (Excel/Database).

8. Notification Module (Optional)

This module sends alerts (e.g., email/SMS) to parents if a student is absent. It enhances monitoring and communication.

iv) ALGORITHMS:

1: Face Detection (Haar Cascade Method)

Step 1: Capture image/frame from webcam.
Step 2: Convert the image into grayscale format.
Step 3: Apply Haar Cascade classifier to detect face regions.
Step 4: Draw bounding boxes around detected faces.
Step 5: Extract and crop face region for further processing.

2: Feature Extraction (Eigenfaces - PCA)

Step 1: Collect training face images from registered students.
Step 2: Convert all images into grayscale and same size.
Step 3: Flatten images into vectors and compute mean face.
Step 4: Subtract mean and compute covariance matrix.
Step 5: Calculate eigenvectors (Eigenfaces).
Step 6: Project input face onto Eigenface space to get feature vector.

3: Face Recognition

Step 1: Capture real-time face and extract features.
Step 2: Compare input feature vector with stored

database vectors.
Step 3: Calculate distance (Euclidean distance).
Step 4: If distance < threshold → face recognized.
Step 5: Else → mark as unknown/reject.

4: Attendance Marking

Step 1: If face is recognized, fetch student ID and details.
Step 2: Check if attendance already marked for that session.
Step 3: If not marked, record attendance with date & time.
Step 4: Store data in Excel/database file.
Step 5: Display attendance in UI (as shown in your output screen).

4. EXPERIMENTAL RESULTS

The proposed Real-Time Face Recognition Based Automated Attendance Management System was successfully implemented and tested using Python, TensorFlow, OpenCV, NumPy, and Scikit-Learn libraries. The experimental evaluation was carried out using multiple student facial image datasets captured under different classroom environments, lighting conditions, and facial orientations. The system was trained using stored facial images and tested in real-time classroom scenarios for automatic attendance marking.

The experimental results demonstrate that the proposed system effectively detects and recognizes student faces with high accuracy and minimal processing time. The face detection module accurately identified facial regions from live video streams, while the TensorFlow-based recognition model successfully matched detected faces with the trained database. The attendance records were automatically updated in the database without manual intervention. The system also minimized proxy attendance issues and reduced the time required for attendance management compared to conventional manual methods.

The performance of the system was analyzed based on recognition accuracy, processing speed, attendance marking efficiency, and database management capability. The machine learning model achieved reliable performance even under moderate illumination variations and different facial expressions. Experimental observations indicated that preprocessing techniques and feature extraction methods significantly improved recognition consistency in real-time classroom conditions.

Accuracy: The ability of a test to differentiate between healthy and sick instances is a measure of its accuracy. Find the proportion of analysed cases with true positives and true negatives to get a sense of the test's accuracy. Based on the calculations:

Accuracy = TP + TN /(TP + TN + FP + FN)

$$Accuracy = \frac{(TN + TP)}{T}$$

Precision: The accuracy rate of a classification or number of positive cases is known as precision. Accuracy is determined by applying the following formula:

Precision = True positives/ (True positives + False positives) = TP/(TP + FP)

$$\Pr e\,cision = \frac{TP}{(TP + FP)}$$

Recall: The recall of a model is a measure of its capacity to identify all occurrences of a relevant machine learning class. A model's ability to detect class instances is shown by the ratio of correctly predicted positive observations to the total number of positives.

$$Recall = \frac{TP}{(FN + TP)}$$

F1-Score: A high F1 score indicates that a machine learning model is accurate. Improving model accuracy by integrating recall and precision. How often a model gets a dataset prediction right is measured by the accuracy statistic..

$$F1 = 2 \cdot \frac{(Recall \cdot \Pr e\,cision)}{(Recall + \Pr e\,cision)}$$

Fig2 Giving input for ID and Name

Fig4 Training Image

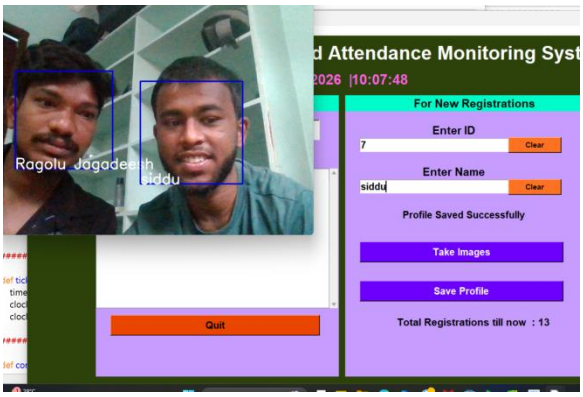

Fig5 Taking attendance

The Face Training Screen trains the facial recognition model using captured face images.

Features

- LBPH Face Recognizer
- Dataset processing
- Model training
- Save trained model

Functions

- Read captured images
- Extract facial features
- Generate trained recognition file

Purpose

To improve face recognition accuracy during attendance marking.

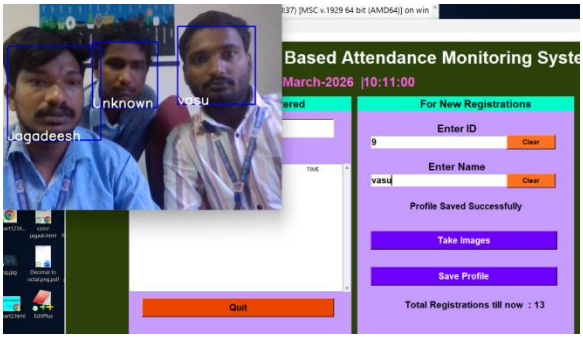

Fig6 results

This screen appears when the system detects a face that is not registered in the database.

Features

- Unknown person message
- Face mismatch alert
- Attendance rejection

Purpose

To prevent unauthorized attendance and improve security

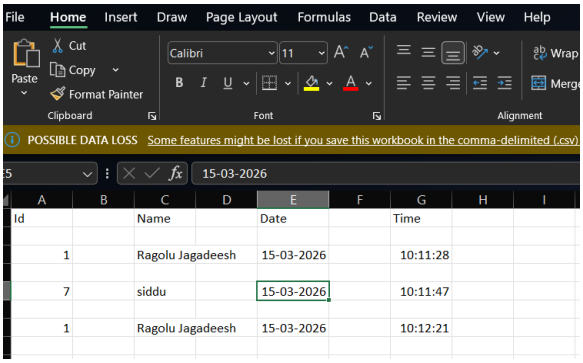

Fig 7: Attendance Record Stored in Excel Sheet

5. CONCLUSION

Thus, the aim of this paper is to capture the video of the students, convert it into frames, relate it with the database to ensure their presence or absence, mark attendance to the particular student to maintain the record. The Automated Classroom Attendance

System helps in increasing the accuracy and speed ultimately achieve the high-precision real-time attendance to meet the need for automatic classroom evaluation.

The Multiple Facial Attendance Management System using Image Processing is an advanced and efficient solution developed to automate the traditional attendance process. The system uses face detection and face recognition techniques to identify individuals and mark attendance automatically without manual intervention.

The proposed system successfully reduces the time required for attendance marking and eliminates problems such as proxy attendance, manual errors, and paperwork. By using OpenCV, Python, and LBPH face recognition algorithms, the system provides accurate and reliable attendance management in real-time.

The system is user-friendly, contactless, secure, and suitable for educational institutions, offices, and organizations. It improves efficiency, maintains attendance records digitally, and generates attendance reports automatically. The implementation of image processing and machine learning techniques makes the system more intelligent and effective compared to conventional attendance methods..

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