IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, November 2026
Impact Factor: 8.2

Attendance Monitoring Using Multiple Face Recognition for Students

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Abstract : *Attendance management is an important activity in educational institutions. Traditional attendance methods, such as calling student names or maintaining paper records, are time-consuming and may result in errors and proxy attendance. This paper presents an Attendance Monitoring System Using Multiple Face Recognition for Students, designed to automate attendance recording using computer vision and facial recognition technology. The proposed system detects multiple faces from a single image or video frame and compares the detected faces with previously registered student facial data. Recognized students are identified, and their attendance is automatically recorded in the database. The system is developed using Python, Fast API, and OpenCV-based image processing techniques. The backend provides functionalities for student management, face recognition, attendance recording, session management, and report generation. The proposed system reduces manual effort, saves classroom time, and improves the efficiency of attendance management. The system also provides a centralized approach to maintaining and retrieving attendance records. Further evaluation is required to measure recognition accuracy and performance under different classroom conditions.*

Key Words: Student Attendance, Multiple Face Recognition, Face Detection, Computer Vision, OpenCV, Python, Fast API, Automated Attendance System.

1. INTRODUCTION

Attendance monitoring is an essential activity in educational institutions for maintaining student records and evaluating classroom participation. Traditional attendance methods involve calling student names, signing attendance sheets, or manually entering attendance details. These methods require considerable time, especially in classrooms with a large number of students. They may also lead to human errors, inaccurate records, and proxy attendance.

With the development of artificial intelligence and computer vision technologies, face recognition has become a useful approach for automated identification. Face recognition systems identify individuals based on their facial features and compare them with previously registered facial data. This technology can be used to automate attendance and reduce the workload of faculty members.

The project, Attendance Monitoring Using Multiple Face Recognition for Students, aims to develop an automated attendance system that can detect and recognize multiple student faces simultaneously. The system captures an image containing several students, detects the faces, identifies registered students, and records their attendance automatically.

The proposed system uses Python for application development, Fast API for backend services, and OpenCV-based image processing for face detection and recognition. A database is used to store student details, facial data, attendance records, and session information.

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The main objectives of this project are:

[1] To automate the student attendance process using face recognition.

[2] To detect multiple faces from a single image or video frame.

[3] To identify registered students using stored facial data.

[4] To record attendance automatically and reduce manual effort.

[5] To maintain attendance records in a centralized database.

[6] To provide an efficient and user-friendly attendance management system.

II. PROBLEM STATEMENT

Traditional attendance management systems require faculty members to manually record student attendance. This process consumes valuable classroom time and becomes difficult to manage when the number of students is large. Manual recording may also result in incorrect entries, duplicate records, and proxy attendance.

Existing manual systems provide limited automation and make attendance tracking and report preparation difficult. Therefore, there is a need for an automated system that can identify multiple students simultaneously and maintain accurate digital attendance records.

The objective of this project is to develop an attendance monitoring system using multiple face recognition that detects and identifies students from classroom images and automatically records their attendance in a database.

The system aims to reduce manual work, improve attendance management efficiency, minimize recording errors, and provide convenient access to attendance information for faculty and administrators.

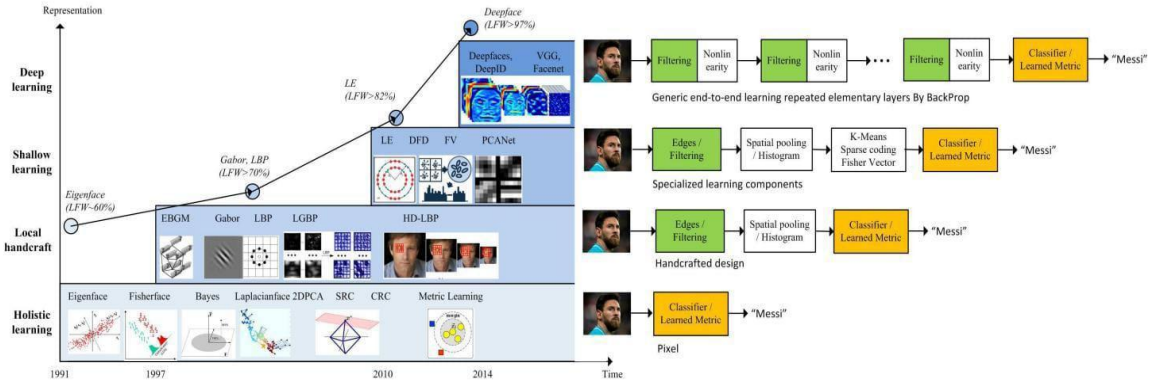
III. LITERATURE SURVEY

Face recognition has been widely studied as a biometric technique for identifying individuals based on facial characteristics. Earlier face recognition approaches used image-processing techniques and handcrafted facial features. Modern approaches use machine learning and deep learning techniques to improve face detection and identification performance.

Viola and Jones introduced an efficient object detection framework based on Haar-like features and a boosted cascade classifier. This approach became widely used for face detection because of its computational efficiency [1]. Schroff et al. proposed Face Net, a deep learning-based face recognition method that generates facial embeddings for identification and clustering. The method demonstrated the effectiveness of embedding-based approaches for recognizing faces [2]. OpenCV is widely used for image processing and computer vision applications. It provides functions for image processing, face detection, video processing, and real-time computer vision development [3]. Fast API is a modern Python framework used to develop high-performance web APIs. It supports request validation, structured application development, and integration with backend services [4]. Automated attendance systems based on face recognition have been developed to reduce manual attendance procedures. However, practical classroom implementation introduces challenges such as different lighting conditions, facial angles, occlusion, variations in image quality, and the simultaneous presence of multiple students.

The proposed system integrates multiple face detection and recognition with backend attendance management. It aims to provide a centralized system for student registration, face recognition, attendance recording, and attendance-session management

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IV. METHODOLOGY

The proposed Attendance Monitoring System follows a modular architecture consisting of face detection, face recognition, student management, attendance processing, backend API services, and database management.

Initially, student details are registered in the system, and their facial data is collected and stored for future recognition. During attendance monitoring, an image containing multiple students is captured or uploaded to the application.

The face detection module processes the image and identifies the individual face regions. Each detected face is passed to the face recognition module, where facial features are extracted and compared with the registered student facial data.

When a detected face matches a registered student with sufficient confidence, the system identifies the student and sends the information to the attendance module. The attendance module checks the active attendance session and records the student's attendance in the database. Duplicate attendance entries for the same student and session are handled to maintain consistency.

The backend is developed using Python and Fast API. The backend receives requests from the application, processes the required operations, interacts with the database, and returns responses. Separate API routers are used for authentication, student management, face processing, attendance, sessions, reports, and dashboard operations.

The system stores student information, facial data, and attendance records in a database. These records can be retrieved for attendance monitoring and report generation.

Functional testing is performed to verify student registration, face detection, recognition, attendance recording, database operations, and API communication.

V. IMPLEMENTED FUNCTION MODULES

A. Student Registration and Management:

The student management module is responsible for maintaining student information. It allows authorized users to register students and manage their details. Registered student information is associated with facial data to support the face recognition process.

B. Face Detection Module

The face detection module processes the input image or video frame and identifies the faces present in it. It locates individual face regions and extracts them for further processing.

The module supports the detection of multiple faces in a single image. Detection performance depends on image quality, lighting conditions, face visibility, and camera positioning.

C. Multiple Face Recognition Module

The multiple face recognition module identifies students by comparing detected facial features with previously registered facial data.

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The system processes each detected face individually and matches it with the stored student information. When a match is identified, the corresponding student details are returned.

This module enables the system to recognize multiple registered students from a single classroom image. Faces that cannot be matched reliably should remain unidentified.

D. Automated Attendance Recording

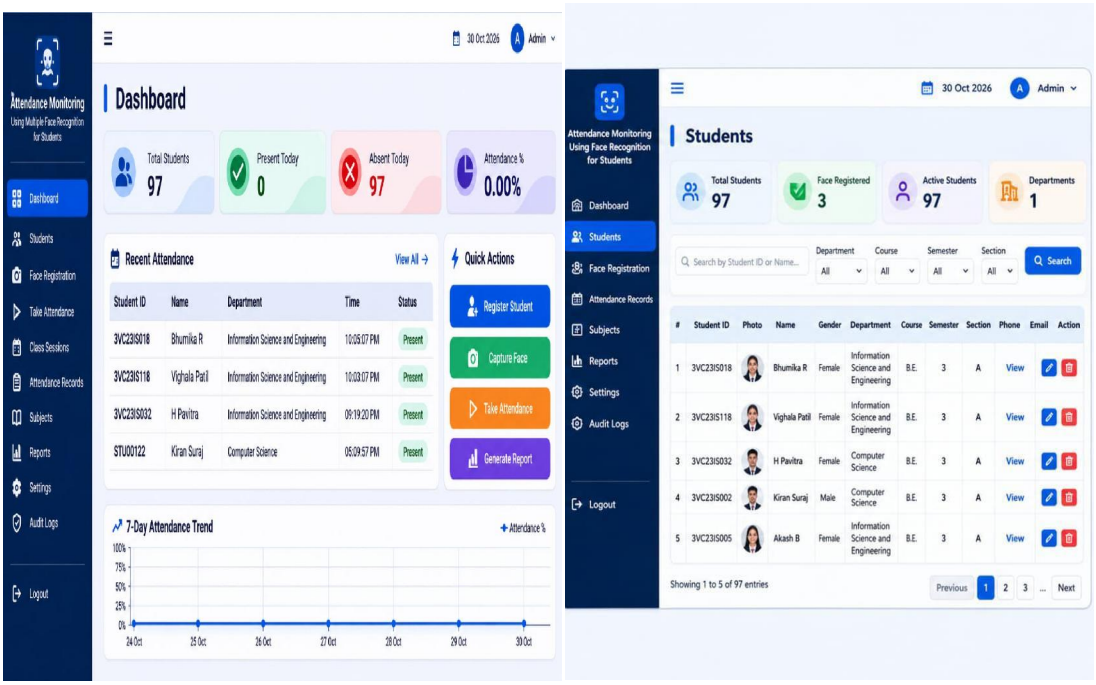
The attendance module records the attendance of recognized students automatically.

After successful face recognition, the student identity is passed to the attendance module. The module checks the corresponding attendance session and stores the attendance record in the database.

This process reduces manual attendance entry and helps avoid duplicate attendance records for the same student and session.

E. Attendance Session Management

The attendance session module manages attendance sessions and organizes attendance records according to the supported session details.



It provides the necessary association between students, attendance records, and sessions. This helps maintain organized attendance information and supports later retrieval.

F. Database Management

The database module stores and manages student information, facial data, attendance records, and session details.

The database supports inserting, updating, and retrieving records. It provides centralized storage for the attendance system and helps maintain consistency in attendance information.

G. Backend API and Authentication

The backend is developed using Python and Fast API. It provides API endpoints for communication between the frontend and backend.

Different routers are implemented for authentication, students, face processing, attendance, sessions, reports, settings, and dashboard operations.

Authentication and access control help restrict protected operations to authorized users. Request validation and error handling are used to support reliable application communication.

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H. Dashboard and Reports

The dashboard provides access to attendance-related information and application functionalities.

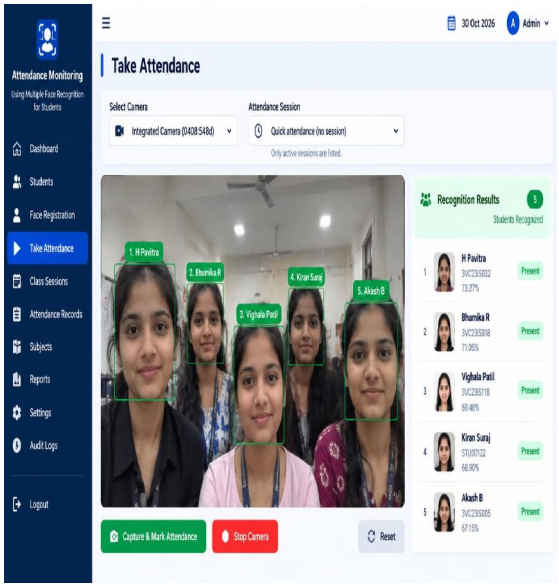
The reporting module helps faculty and administrators retrieve attendance records and review student attendance details. It supports the organized management of attendance information based on the features implemented in the application.

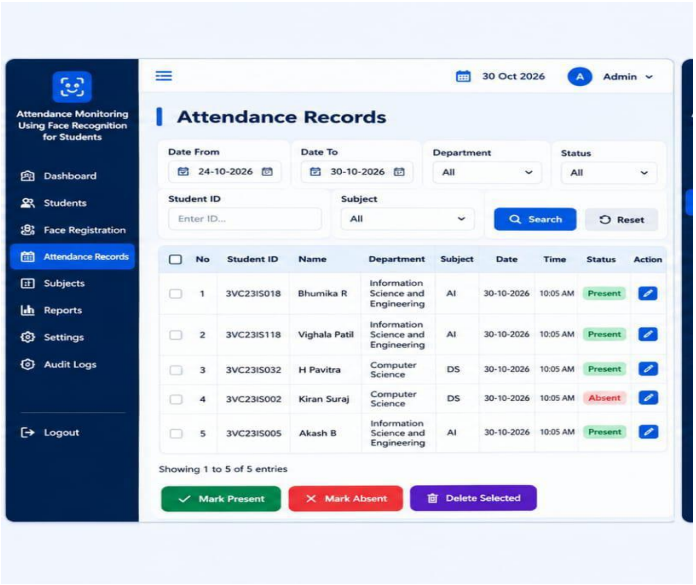
I. System Integration and Testing

All the modules are integrated into a single attendance monitoring application.

Functional testing is performed to verify student registration, face detection, face recognition, attendance recording, session management, database connectivity, and backend API operations.

Further testing is required to evaluate recognition accuracy, processing time, and performance under different classroom conditions.





VI. RESULT

The developed Attendance Monitoring System provides an integrated backend for student management and attendance monitoring using multiple face recognition.

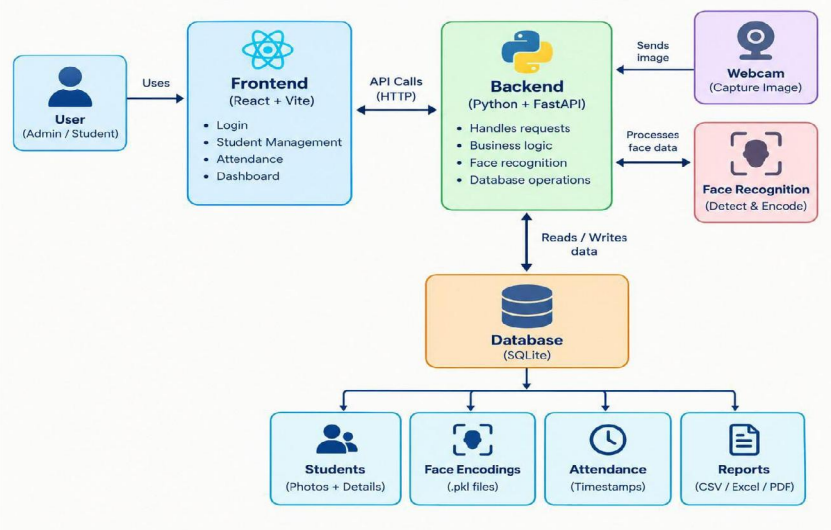
The system supports student registration, face detection, multiple face recognition, automated attendance recording, attendance-session management, database operations, and reporting functionalities.

The application is designed to detect multiple faces from a single input image and compare them with registered student facial data. Recognized students are identified, and their attendance is recorded in the database for the corresponding session.

The implemented modules demonstrate the integration of computer vision, backend services, and database management for automated attendance monitoring. The system aims to reduce manual attendance effort and improve the organization of student attendance records.

Quantitative evaluation of recognition accuracy, processing speed, false recognition, and missed face detection requires further testing under realistic classroom conditions.

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VII. CONCLUSION

Attendance Monitoring Using Multiple Face Recognition for Students presents an automated approach to student attendance management using computer vision technology.

The system combines multiple face detection, face recognition, student registration, automated attendance recording, attendance-session management, backend API services, and database integration into a single application.

The proposed system aims to reduce the time required for manual attendance, minimize recording errors, and improve the management of student attendance records. Python, Fast API, and OpenCV-based image processing provide the foundation for implementing the system.

The project demonstrates the potential of face recognition technology in educational institutions. However, reliable real-world deployment requires further evaluation under varying lighting conditions, facial poses, and classroom environments. Future enhancements may include improving recognition accuracy, optimizing processing speed, strengthening biometric-data security, and conducting large-scale classroom testing.

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