



Automated Attendance System Using Face Recognition

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Abstract: In educational institutions and workplaces, traditional attendance systems based on manual entry, which are time-consuming and prone to errors or proxy attendance. To address these challenges, an Automated Attendance System using Face Recognition offers a contactless and efficient solution. This system utilizes machine learning and computer vision to detect and recognize faces, ensuring accurate and real-time attendance marking. By integrating facial recognition with a database, it automates the process, reducing administrative workload and preventing fraudulent attendance. Additionally, security measures such as encrypted data storage and access control ensure privacy and reliability. This technology enhances efficiency, accuracy, and security in attendance management.

Index Terms - Face Recognition, Automated Attendance, Machine Learning, Computer Vision, Security, Privacy

I. INTRODUCTION

Traditional attendance systems, such as manual roll calls and RFID-based methods, often suffer from significant drawbacks. These methods can be inefficient, time-consuming, and vulnerable to various forms of misuse, particularly proxy attendance, where one student marks attendance on behalf of another. Such challenges create a need for a more reliable, automated, and tamper-proof solution to track attendance accurately and efficiently.

To overcome these limitations, **Automated Attendance Systems using Face Recognition** have emerged as a modern, secure, and contactless alternative. These systems leverage advancements in Machine Learning (ML) and Computer Vision (CV) to detect, analyse, and recognize human faces in real time. By eliminating the need for physical interaction, they enhance accuracy and minimize human intervention, making the process faster and more efficient.

The system is developed using **Python** and integrates a variety of powerful libraries and frameworks. **Flask** is used for building a user-friendly, web-based interface that allows administrators, teachers, and other stakeholders to manage attendance seamlessly. **OpenCV**, a widely-used computer vision library, is employed for facial detection and image processing tasks. To manage and store user data, **SQLAlchemy** is used as the Object Relational Mapper (ORM), providing a structured and scalable way to interact with the database.

The functionality of the system begins with the registration phase, where each student's facial images are captured using a webcam and stored in a dedicated folder named after their unique ID. This data is then linked to their academic profiles and saved in both a database and a CSV/Excel file for redundancy and easy access.

During attendance marking, the system activates the camera, detects multiple faces in real time, and compares the live scans with the stored images using a trained face recognition model. If a match is found, the corresponding student is marked as present, and the attendance is instantly recorded in the database. Additionally, the system logs this data in an Excel sheet, ensuring that records can be retrieved, reviewed, and analysed when needed.

1. Objective

The Automated Attendance System using Face Recognition aims to provide a following objective are defined to ensure the successful implementation of this system:

Develop a Contactless Attendance System:

- Implement facial recognition technology to automate the attendance process without physical interaction.

Ensure Accuracy and Reliability:

- Utilize OpenCV and machine learning algorithms to accurately detect and recognize faces in various lighting conditions.
- Minimize false positives and negatives to improve system reliability.

Eliminate Proxy Attendance:

- Authenticate each student based on their unique facial features, preventing fraudulent attendance marking.

Integrate a Secure User Authentication System:

- Implement Flask-Login for role-based authentication (student, faculty, admin) to restrict unauthorized access.

Enable Real-Time Attendance Tracking & Storage:

- Record attendance in real-time and store it securely in an SQL database.
- Generate Excel reports for easy data retrieval and analysis.

Develop a User-Friendly Web Interface:

- Design an intuitive web dashboard using Flask to allow students and faculty to view attendance records conveniently.

Enhance System Security and Privacy:

- Use password hashing for secure login credentials.
- Store facial data in an encrypted format to protect user privacy.

Enable Scalability for Various Institutions:

- Design a flexible and scalable system that can be implemented in schools, colleges, universities, and corporate offices.

Improve Processing Speed & Efficiency:

- Optimize the face recognition process to ensure quick detection and verification for real-time attendance marking.

2. Problem Statement

Attendance tracking is an essential process in educational institutions, workplaces, and organizations. Traditional attendance methods, such as manual roll calls, RFID cards, and biometric fingerprint systems, pose several challenges, including time consumption, errors, proxy attendance, and hygiene concerns. With advancements in artificial intelligence and computer vision, face recognition technology provides a contactless, secure, and automated solution to attendance management. This project aims to develop an Automated Attendance System using Face Recognition to overcome the limitations of existing methods.

3. Problem Statement

Who does the problem affect?

- Students, faculty, and administrators who need an efficient attendance tracking system.
- Educational institutions and organizations that struggle with attendance management and security

concerns.

What is the issue?

- Manual and RFID-based attendance systems are prone to errors, inefficiencies, and proxy attendance.
- Biometric methods (fingerprint/iris scanning) require physical contact, raising hygiene concerns.
- Traditional methods do not integrate well with modern digital infrastructure for data analysis and reporting.

When does the issue occur?

- During daily attendance marking in classrooms, workplaces, and events.
- When tracking attendance over long periods for performance evaluation and compliance reporting.

Where is the issue occurring?

- Schools, colleges, universities, offices, and government institutions where attendance monitoring is crucial.

- In organizations requiring accurate workforce management and payroll integration.

Why is it important to fix the problem?

- Eliminates proxy attendance: Prevents students/employees from marking attendance for others.
- Saves time: Automates attendance marking, reducing the administrative burden.
- Enhances accuracy: Provides real-time, error-free attendance tracking.
- Improves security: Ensures only authorized individuals can mark their attendance.
- Integrates with digital platforms: Enables data storage, analysis, and reporting for better decision-making.

II. Literature review

Traditional attendance systems rely on manual roll calls, or biometric methods such as fingerprint scanning. These methods have certain limitations, including time consumption, inaccuracy, and susceptibility to proxy attendance. Face recognition-based attendance systems aim to overcome these challenges by providing a non-intrusive, efficient, and accurate method for attendance management.

A Survey on Face Recognition Based Attendance System (2024) This paper provides an in-depth analysis of recent advancements in face recognition-based attendance systems. It synthesizes insights from multiple survey papers, offering a comprehensive overview of current methodologies, challenges, and future directions in the field.

Smart Attendance System Using Face Recognition (2023) This paper proposes a smart attendance system that captures facial images, preprocesses them, extracts features, and matches them with stored images to mark attendance. The system integrates with existing databases and generates real-time attendance reports.

A Real-Time Attendance System Using Face Recognition (2022) AttenFace is a standalone system that analyzes, tracks, and grants attendance in real-time using face recognition. It captures snapshots from live camera feeds, identifies students, and marks them as present based on their presence in multiple snapshots throughout the class duration. The system operates independently and can integrate with existing attendance tracking software.

Face Recognition Based-Automatic Attendance Management System (2020) This research focuses on automating attendance management using face recognition. It discusses the challenges and solutions in implementing such systems, including the use of machine learning algorithms for accurate face detection and recognition.

III. RESEARCH METHODOLOGY

The analysis of existing attendance systems highlights the limitations of traditional approaches and the potential of face recognition technology. The proposed Automated Attendance System using Face Recognition offers:

- Non-intrusive and contactless attendance marking
- High accuracy with minimal human intervention
- Prevention of proxy attendance
- Automated data storage and report generation
- Integration with real-time monitoring systems

By leveraging Python, OpenCV, Flask, and SQL databases, the proposed system aims to enhance the efficiency, reliability, and security of attendance management in academic institutions and organizations.

This literature survey establishes the foundation for the proposed Automated Attendance System using Face Recognition, addressing challenges in existing systems while highlighting the need for innovation in attendance management.

3.1. Proposed Solution

To address these challenges, the project will implement a Face Recognition-Based Automated Attendance System using Python, OpenCV, Flask, and SQL databases. The system will:

Capture and store students' facial images during registration.

- Use machine learning and deep learning algorithms to recognize and verify individuals in real time.
- Mark attendance automatically upon successful face detection.

- Store attendance records in a secure database and allow administrators to generate reports. By leveraging artificial intelligence and cloud-based technologies, the proposed system will provide an efficient, contactless, and secure method for attendance tracking.

3.2. System Architecture

1. User Interface

This module allows users (students and administrators) to interact with the system. It consists of:

- **Dashboard:** Users can register students and mark attendance.
- **Login/Signup:** Users authenticate via email-password authentication or OAuth.
- **User Profile:** Users can view their profiles and attendance records.

2. Authentication

Authentication ensures that only authorized users access the system. It supports:

- **Email/Password Authentication:** Users register and log in using their credentials.
- **OAuth Authentication:** Users can log in via third-party authentication services like Google or Microsoft.

3. Face Detection & Recognition

This is the core functionality of the system, which ensures accurate attendance marking:

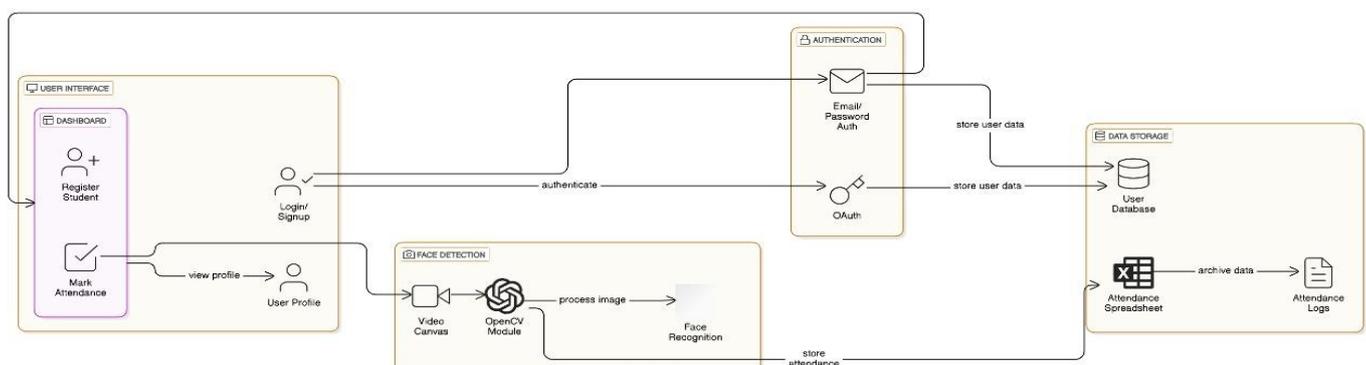
- **Video Capture:** A live video feed from a camera captures the student's face.
- **OpenCV Module:** The captured image is processed using OpenCV, applying face detection techniques.
- **Face Recognition:** The system compares the detected face with stored images in the database.
- If a match is found, the attendance is successfully marked.

4. Data Storage

Attendance and user details are systematically stored in:

- **Attendance Spreadsheet:** Attendance records are saved and archived for future analysis.
- **Attendance Logs:** These logs maintain attendance history.

Face Detection Attendance System Architecture



The above block diagram represents the architecture of an Automated Attendance System using Face Recognition. It consists of multiple interconnected components, ensuring a seamless flow from user interaction to attendance storage.

3.3. Use Case Diagram

The Use Case Diagram represents the interactions between different users and the system.

Actors Involved:

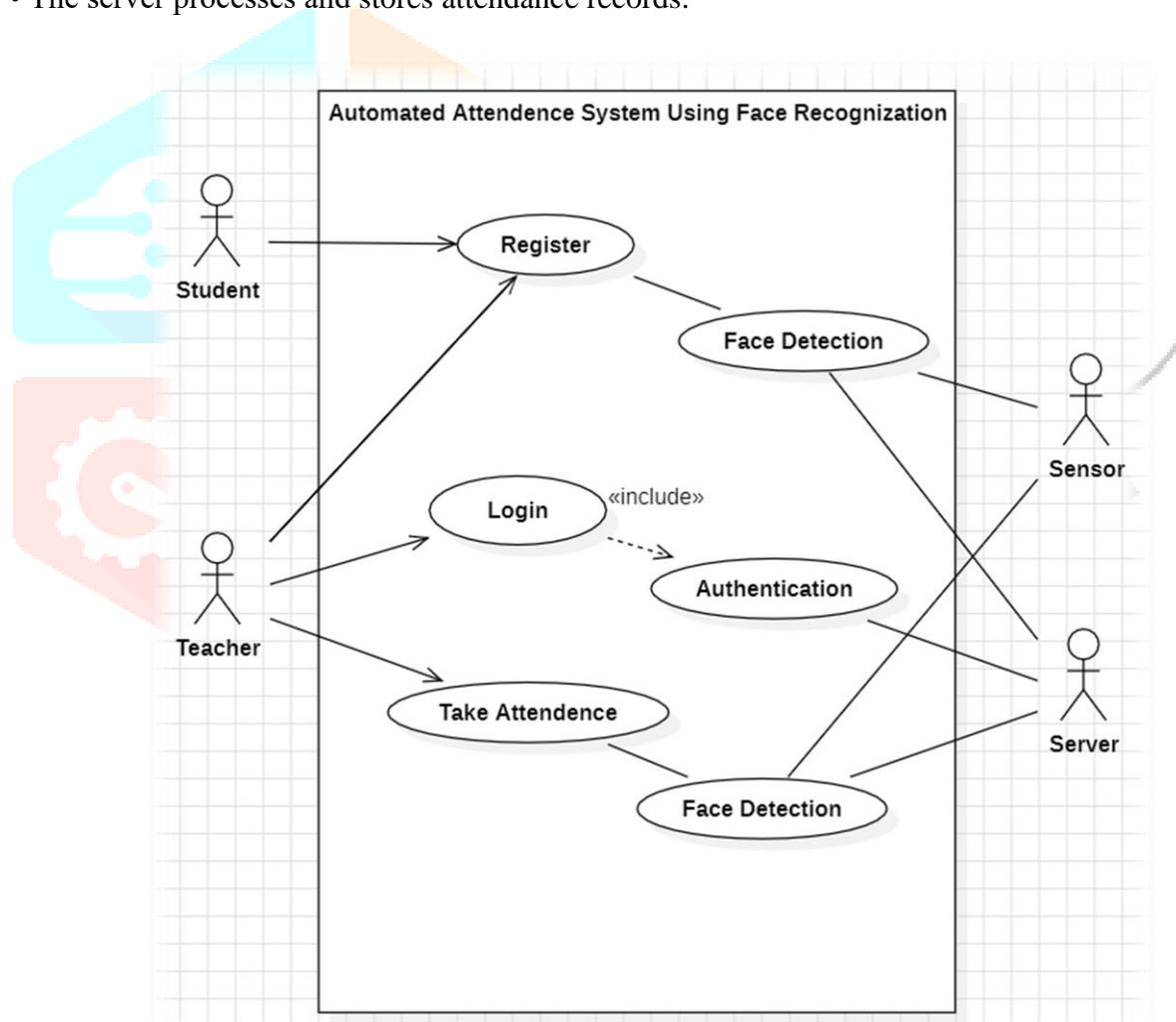
- Student – Can register, log in, and undergo face detection.
- Teacher – Can log in and take attendance using face detection.
- Sensor – Captures images for face detection.
- Server – Processes authentication and stores attendance records.

Use Cases:

- Register – Students register in the system.
- Login – Students and teachers authenticate using credentials.
- Authentication – The system verifies login credentials.
- Face Detection – System captures and recognizes faces.
- Take Attendance – Teachers use face detection to mark student attendance.

Flow:

- A student registers and logs in.
- The system authenticates the user.
- During attendance marking, the sensor captures images, and face detection verifies the student.
- The server processes and stores attendance records.



IV. RESULTS AND DISCUSSION

Home | Timetable | Attendance Table | View Profile | Attendance Overview | Logout

Success ✕

Attendance marked successfully!

Subject-wise Timetable

| Day | 8:15 AM - 9:15 AM | 9:15 AM - 10:15 AM | 10:30 AM - 11:30 AM | 11:30 AM - 12:30 PM | 1:15 PM - 2:15 PM |
|-----------|-------------------|--------------------|---------------------|---------------------|-------------------|
| Monday | SE | DSA | PPL | EM | MP |
| Tuesday | SE | DSA | PPL | EM | MP |
| Wednesday | SE | DSA | PPL | EM | MP |
| Thursday | SE | DSA | PPL | EM | MP |
| Friday | SE | DSA | PPL | EM | MP |
| Saturday | SE | DSA | PPL | EM | MP |

Timetable | Attendance Table

attendance_export.xlsx
Download complete

Attendance Table

Export Excel

| Student ID | Date | Day | CS101 | CS102 | CS103 | CS104 | CS105 |
|------------|------------|-----------|-------|-------|-------|-------|-------|
| 123 | 2025-03-26 | Wednesday | P | P | A | P | A |
| 4444 | 2025-03-26 | Wednesday | P | P | A | P | A |

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 Faculty Login

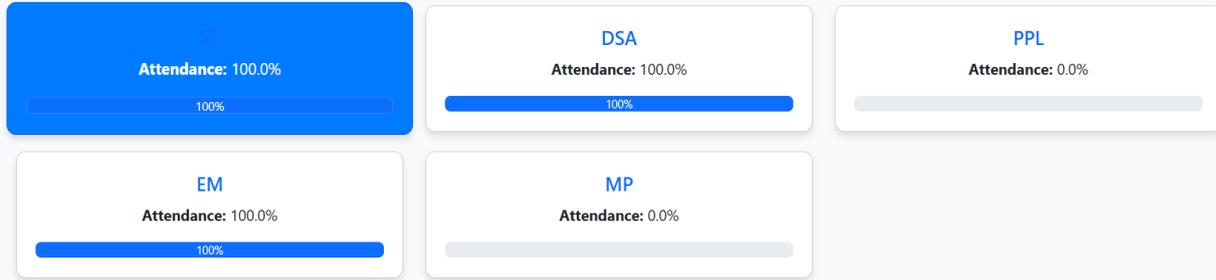
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Welcome, Tanvi Nitin Argade!

Your Attendance Details



Contact Us

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Quick Links

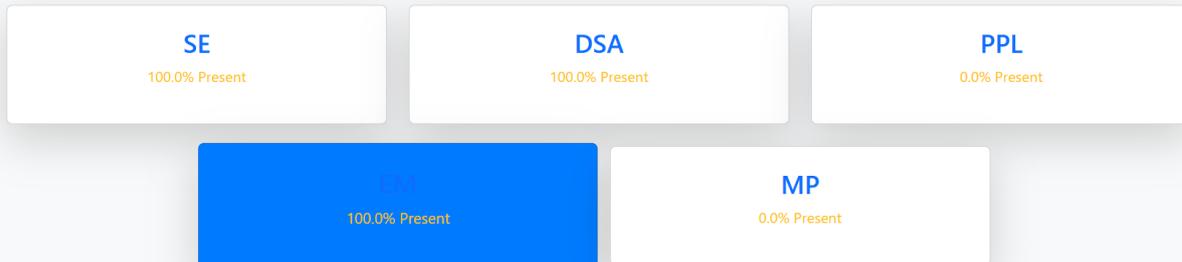
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Admin Dashboard

Overview of student attendance by subject



Present Students for SE

[←](#) [Export to Excel](#)

| Roll No | Name |
|---------|--------------------|
| S212072 | Tanvi Nitin Argade |
| S212076 | Payal Darekar |

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