A Real-time Research Project / Societal Related Project

Report on

ATTENDANCE TRACKER

Submitted in Partial fulfillment of requirements for B.Tech II Year II Semester course

By

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Under the guidance of

Mr.Seshu
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KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Accredited by NBA & NAAC, Approved by AICTE, Affiliated to JNTUH.

Narayanaguda, Hyderabad, Telangana-29

2024-25

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CERTIFICATE

This is to certify that this is a bonafide record of the project report titled **“ATTENDANCE TRACKER”** which is being presented as the **Real-time Research Project / Societal Related Project** report by

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In partial fulfillment for the II Year II Semester Course RTRP in KMIT affiliated to the Jawaharlal Nehru Technological University Hyderabad, Hyderabad

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Ms.ARTI
Mr.SESHU

Program Coordinator
(Mr Shailesh Gangakhedkar)

Submitted for Final Project Review held on ________________________________

Vision & Mission of KMIT

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- To be the fountainhead in producing highly skilled, globally competent engineers.
- Producing quality graduates trained in the latest software technologies and related tools and striving to make India a world leader in software products and services.

Mission of KMIT

- To provide a learning environment that inculcates problem solving skills, professional, ethical responsibilities, lifelong learning through multi modal platforms and prepares students to become successful professionals.
- To establish an industry institute Interaction to make students ready for the industry.
- To provide exposure to students on the latest hardware and software tools.
- To promote research-based projects/activities in the emerging areas of technology convergence.
- To encourage and enable students to not merely seek jobs from the industry but also to create new enterprises.
- To induce a spirit of nationalism which will enable the student to develop, understand India's challenges and to encourage them to develop effective solutions.
- To support the faculty to accelerate their learning curve to deliver excellent service to students.

DECLARATION

We hereby declare that the results embodied in the dissertation entitled **“**Attendance Tracker” has been carried out by us together during the academic year 2024-25 as a partial fulfillment of the B.Tech II Year II Semester Course “**Real-time Research Project / Societal Related Project**”. We have not submitted this report to any other Course/College.

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We are also thankful to **Mr.Shailesh Gangakhedkar**, **Real-Time Research Project** Program Coordinator for providing us with time to make this project a success within the given schedule.

We are also thankful to our Project Mentor **Ms. ARTI / Mr. SESHU**, for her/his valuable guidance and encouragement given to us throughout the project work.

We would like to thank the entire KMIT faculty, who helped us directly andindirectly in the completion of the project.

We sincerely thank our friends and family for their constant motivation during the project work.

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ABSTRACT

The Attendance Tracker Project by Facial Analysis presents a smart and automated solution for monitoring student attendance using facial recognition technology. Traditional attendance methods are time-consuming, prone to proxy attendance, and require manual record-keeping. This project leverages computer vision and deep learning techniques to streamline the process by identifying and verifying student faces in real-time through video input.

Using tools such as **YOLO (You Only Look Once)**, or other facial detection frameworks, the system accurately detects faces from a live or recorded video feed. These faces are then matched against a pre-registered student database to mark attendance automatically. The system can handle multiple faces simultaneously, making it suitable for classroom environments.

Key features include face detection, face recognition, real-time processing, and automatic logging of attendance data. The project ensures high accuracy, minimizes human intervention, and prevents fraudulent attendance. It represents a step forward in smart education systems, providing educational institutions with an efficient and secure way to manage attendance records.

CONTENTS

CHAPTER-I

INTRODUCTION

1.1 Purpose of the project:

The purpose of this project is to develop an intelligent, real-time attendance monitoring system that leverages face recognition technology to automatically identify and record the presence of individuals, such as students or employees, in a specific environment. This system aims to eliminate the inefficiencies and inaccuracies associated with traditional attendance-taking methods.

Manual attendance systems are not only time-consuming but also susceptible to human errors, such as incorrect entries or proxy marking. In educational institutions and workplaces where punctuality and presence are critical, such issues can affect productivity and fairness. Current alternatives like biometric scanners and RFID cards still require physical interaction and are not entirely foolproof. They may be manipulated or may fail due to hardware limitations or user errors.

To address these limitations, this project proposes the use of advanced computer vision and deep learning techniques. By integrating YOLOv8, a state-of-the-art object detection algorithm, with the face recognition library in Python, the system can detect and recognize faces in real-time video streams. Once a face is identified, it is matched against a pre-registered database, and the individual's attendance is marked along with the timestamp.

The proposed system functions without requiring any physical contact, making it more hygienic and convenient, especially in a post-pandemic world where touchless solutions are preferred. Furthermore, it operates continuously and silently in the background, reducing manual workload for teachers, HR personnel, and administrators.

This project also aims to enhance security by ensuring that only authorized individuals are recognized and recorded. Unauthorized individuals will not be allowed to manipulate or access the system. In the future, this system could be extended with features like alerting unauthorized entry, generating analytical reports, and integrating with other enterprise or academic platforms.

In summary, the core purpose of this project is to build a robust, scalable, and efficient face recognition-based attendance tracking system that saves time, minimizes errors, improves security, and adapts to the growing needs of smart environments**.**

1.2 Proposed System

The proposed system introduces an AI-powered, real-time attendance monitoring solution based on facial recognition technology. It is designed to overcome the limitations of traditional and semi-automated systems by offering a contactless, intelligent, and fully automated approach to attendance tracking.

At the core of the system lies the integration of YOLOv8 (You Only Look Once version 8) for fast and accurate face detection, and the face recognition Python library for precise face matching. YOLOv8 is known for its real-time object detection capability and is highly optimized for tasks involving dynamic environments such as classrooms, offices, or event spaces.

The system starts by capturing live video feed from a camera positioned at an entry point or inside a room. YOLOv8 processes this feed frame-by-frame to detect faces within the camera’s field of view. Once a face is detected, the frame is passed to the face recognition module, which compares the detected face with pre-stored facial encodings of registered individuals in the database.

If a match is found, the system automatically logs the person's attendance along with the exact date and time, eliminating the need for manual entry or physical scanning. The recorded data is stored in a structured format, such as a CSV file or database, making it easy to generate reports and analyse trends over time.

This system also features an administrative interface, where users can:

Register new individuals by uploading their facial images.

View, search, and export attendance records.

Receive alerts or notifications in case of unrecognized or unauthorized entries.

Moreover, the system operates seamlessly in real-time, requiring no user intervention after setup. It reduces workload for staff, increases accuracy, and ensures transparency and fairness in attendance marking.

To ensure security and privacy, all facial data is stored securely, and the system can be enhanced to work within a local network or private cloud infrastructure, ensuring data does not leave the organization unless authorized.

In summary, the proposed system is:

Contactless and hygienic,

Highly accurate and fast,

Scalable to large environments,

Capable of real-time monitoring and reporting,

Secure, with robust access control and logging mechanisms.

This modern approach aligns with the increasing demand for smart and automated systems in educational and corporate settings, making it a reliable replacement for outdated attendance systems.

1.3 Scope of the Project

The scope of this project is centred on the development and deployment of a real-time face recognition-based attendance system that is intelligent, automated, and scalable. It is designed to be implemented in educational institutions, corporate offices, and other environments where reliable attendance tracking is crucial.

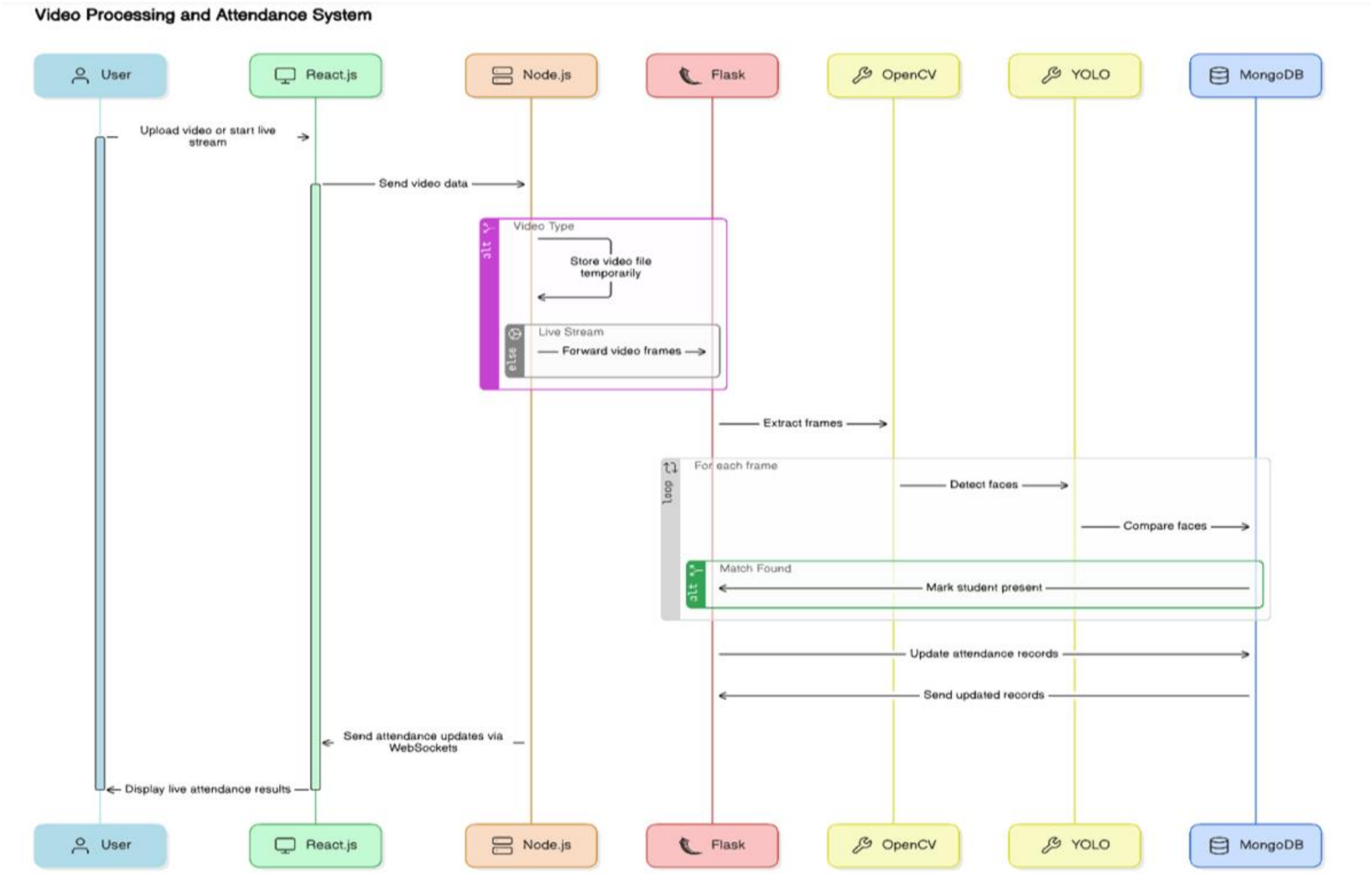
The system will use live video feeds to capture facial data and verify the identity of individuals through facial recognition technology. Once a person is verified, their attendance will be automatically logged with the current date and time, eliminating the need for manual attendance marking or physical identification methods like ID cards or fingerprints.
A key component of this project is the integration of YOLOv8, an advanced object detection model that ensures quick and accurate detection of faces in diverse lighting and background conditions. Coupled with the face recognition Python library, the system will accurately identify individuals even in group scenarios.
The application will include a user-friendly administrative interface, enabling authorized personnel to:
Register new users by uploading their facial images.
Update or remove existing records.
Monitor real-time attendance logs.
Generate daily, weekly, or monthly reports.
Export data in multiple formats such as CSV or Excel.

This project will also support local storage and optionally cloud-based backup systems, ensuring the safety and availability of data. Additionally, it will include basic security measures like access control, face data encryption, and alerts for unidentified individuals.

The project is designed to function with minimal hardware—only a camera and a local computer or server with moderate processing power—making it suitable for deployment in small to large-scale setups. It will be modular and flexible, allowing future upgrades like:
Integration with Learning Management Systems (LMS) or HR software,
Notification systems via email or SMS,
Mobile applications for real-time updates,
Multi-camera support for wider coverage.
This project also aims to provide analytics features, such as:
Attendance trends and patterns,
Frequency and punctuality reports,
Identification of irregular attendance behaviour.

In conclusion, the scope of this project covers the complete lifecycle of automated attendance—from real-time detection to data analysis—offering a smart, efficient, and future-ready solution for modern institutions.

1.4 Architecture Diagram



The diagram illustrates a real-time video-based attendance system that works as follows:

*User uploads a video or starts a live stream.
*React.js frontend sends the video data to the Node.js backend.
*Node.js forwards the video to a Flask server for processing.
*Flask uses OpenCV to extract frames and YOLO to detect faces.
*Detected faces are compared with known faces.
*If a match is found, the student is marked present in MongoDB.
*Attendance updates are sent back to the frontend via Web Sockets for live display.

1. User Interface Layer – React.js

At the front end, the **React.js** application serves as the user interface. It allows users (such as faculty or administrators) to:
Upload pre-recorded video files of classroom sessions, or
Start a live video stream from a webcam or IP camera.
Once the input is selected, the video is sent to the backend server for processing.

2. Middleware & Communication Layer – Node.js

The **Node.js** server acts as a bridge between the frontend and the backend processing components:
It receives the video data from React.js.
Depending on the input type, it either:
Temporarily stores the video file, or
Forwards video frames continuously in case of a live stream.
The server ensures efficient data flow between modules and enables **WebSocket** communication to stream real-time attendance updates back to the user interface.

3. Video Processing and Face Extraction – Flask + OpenCV

The **Flask** backend, in conjunction with **OpenCV**, is responsible for:
Extracting individual frames from the input video.
Preprocessing each frame to make it suitable for facial detection (e.g., resizing, grayscale conversion, etc.).
This modular structure allows for real-time frame-by-frame processing, regardless of the video source.

4. Face Detection and Recognition – YOLO + OpenCV

This is the core intelligence of the system:
YOLO (You Only Look Once) is used to detect faces within each video frame quickly and efficiently. YOLO's real-time object detection capabilities make it suitable for classroom environments with multiple students.
Once faces are detected, **OpenCV** is used for **facial recognition**, where the detected face embeddings are compared with those stored in the database.
If a face matches a registered student, the system identifies that student as **present** for that frame/session.

5. Attendance Management – MongoDB

The attendance information is stored and managed using **MongoDB**, a NoSQL database:
Once a student is recognized, their attendance record is updated in real-time.
MongoDB stores historical attendance logs, enabling easy retrieval and analysis.
Updates are sent back to the Node.js layer, which forwards them to the React.js frontend using WebSocket technology.

6. Real-Time Feedback and Reporting – React.js

The frontend interface receives live updates:
Users can see which students are recognized and marked present.
It provides a dashboard-style display of attendance results in real time.
Final attendance logs can be downloaded or exported for reporting.

Key Advantages of the System:

Automation: Eliminates the need for manual attendance.
Accuracy: Uses advanced algorithms to ensure reliable recognition.
Scalability: Supports multiple students in a single frame.
Security: Reduces the risk of proxy attendance or manipulation.
Real-Time Processing: Offers instant updates and feedback during live sessions.

CHAPTER-II

LITERATURE SURVEY

The rapid advancement of Artificial Intelligence (AI) and Computer Vision technologies has opened new avenues for innovation in educational environments. Particularly, the automation of attendance tracking and the analysis of student behaviour through visual data have emerged as key areas of interest. This literature survey aims to critically evaluate existing approaches, highlight their limitations, and identify opportunities for innovation that this project seeks to explore.

1. Vision-Based Attendance Systems

Several systems in recent years have employed face recognition techniques to automate student attendance. Classical approaches such as Haar Cascade classifiers and the Local Binary Pattern Histogram (LBPH) face recognizer—often implemented using OpenCV—have been widely adopted due to their simplicity and low computational cost.

Limitation: These methods, while functional in controlled settings, tend to perform poorly in real-world classroom environments. Their lack of robustness in scenarios involving varied lighting conditions, occlusions, and large crowds limits their practical usability. Additionally, their accuracy is often inadequate for high-reliability applications.

2. Deep Learning-Based Detection Models

To overcome the shortcomings of traditional methods, researchers have explored more sophisticated deep learning models such as YOLOv3/v4, Faster R-CNN, and MTCNN. These models offer significantly improved detection accuracy and are capable of identifying multiple faces or bodies within a single frame.

Limitation: Despite their improved accuracy, these models come with considerable computational overhead. Their high processing time and resource consumption make them less suitable for real-time deployment in standard classroom hardware configurations. As a result, their application in live educational settings remains limited.

3. Attentiveness and Engagement Detection

Beyond attendance, some studies have shifted focus to student attentiveness. Techniques involving eye-tracking, gaze estimation, and head pose detection—implemented using tools like Media Pipe and Dib—have shown promise in monitoring student engagement.

Limitation: While effective in analysing attentiveness, these approaches often exist in isolation from attendance systems. Their lack of integration into a unified framework, combined with challenges in scaling and deploying in real-time scenarios, limits their impact in practical educational settings.

4. YOLOv8 and Byte Track: A Promising Integration

Recent advancements in object detection and tracking—particularly the development of YOLOv8 and Byte Track—present new possibilities. YOLOv8 provides high-speed, high-accuracy detection optimized for real-time applications, while Byte Track excels in maintaining consistent object identities across frames, even in crowded scenes.

Opportunity: Despite their individual strengths, the combination of YOLOv8 and Byte Track has not yet been fully explored in the context of educational attendance and behavioural monitoring. This integration offers the potential for a robust, scalable, and real-time system capable of handling the complexities of real-world classroom environments.

CHAPTER-III

SOFTWARE REQUIREMENT SPECIFICATION

3.1 Functional Requirements

Functional requirements describe the key functions the system must perform. For the Attendance Tracker, these include user authentication, real-time engagement monitoring, data storage, and report generation. Each function is vital for achieving the system's goal of enhancing student engagement through AI-based monitoring

3.2 Non-Functional Requirements

Non-functional requirements define the system's quality attributes such as performance, scalability, reliability, and security. The Attendance Tracker must provide real-time feedback with low latency, maintain high availability, ensure secure access, and scale with user growth.

3.3 Technology Stack

Frontend

React.js:

- For UI development
- Uploading video
- Displaying live attendance updates

Backend

- Node.js:
  - Acts as a bridge between frontend and Flask
  - Handles video upload
  - Temporary storage for uploaded videos

  - Real-time communication between Node.js and React.js for live attendance updates

Video Processing / Face Recognition

- Flask (Python):
  - REST API to handle video frame processing
  - Communicates with OpenCV and YOLO for detection and recognition

- OpenCV:
  - Frame extraction and image processing
  - Pre-processing for YOLO input

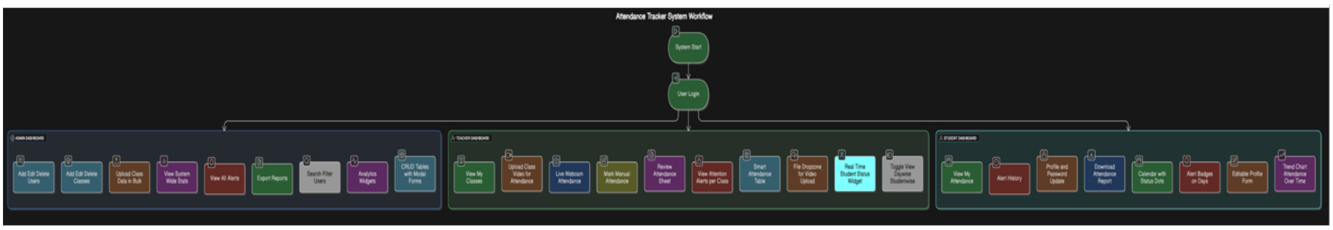
- YOLO (You Only Look Once, e.g., YOLOv8):
  - Face detection in each frame

- Face Recognition Library (e.g., face recognition, Dib, or Deep Face):
  - Compares detected faces with stored embeddings or images

Database

- MongoDB:
  - Stores student data and attendance records
  - Updates records as students are marked present

3.4 Use Case Diagram:



The use case diagram illustrates the interactions between **users** and the **functional components** of the Attendance Tracker System. It defines the roles and responsibilities of key actors and the services they can access.

Main Actor:

- **User (Admin / Teacher)**
  This is the primary user who interacts with the system through the interface.

Core Use Cases and Functions:

1. Video Management:

- **Upload Video**
  The user can either upload a classroom recording for attendance tracking.
- **Preview Video Feed:**
  The system allows users to view the stream in real-time for monitoring purposes.

2. Facial Recognition System:

- **Detect Faces:**

The system scans each frame for student faces using face detection algorithms.

- **Recognize Students:**
  Detected faces are matched against the registered student database.
- **Mark Attendance:**
  When a face is successfully recognized, the corresponding student is marked as present.

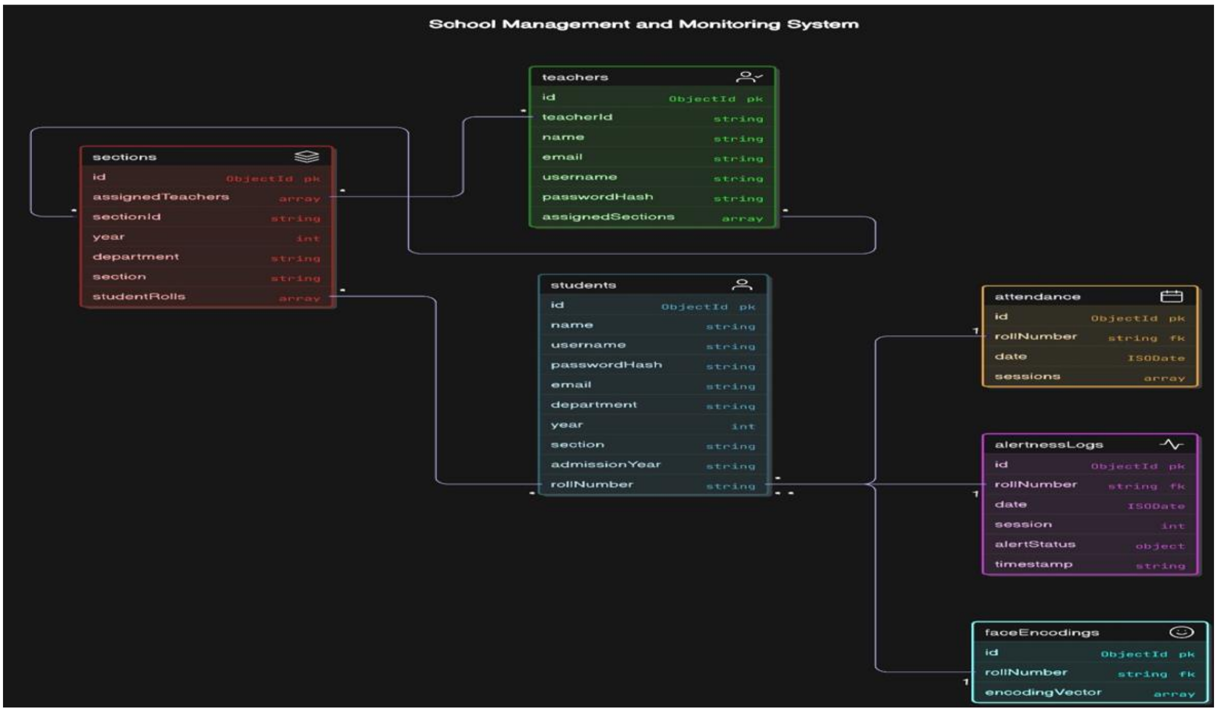
3. Attendance Management:

- **View Attendance:**
  Users can check attendance records in real time or retrieve past data.
- **Download Reports:**
  Attendance data can be exported in report formats such as CSV or PDF.
- **Update Records:**
  In case of errors, the admin can manually update or edit attendance entries.

4. User & Database Operations:

- **Register New Students:**
  Admins can add student profiles with facial data and other details.
- **Update Student Info:**
  Modify or delete student records as required.
- **Connect to Database:**
  The system interacts with a backend database (MongoDB) to store and retrieve all information.

3.5 Database Design:



The database design presented here outlines the structure of a **School Management and Monitoring System** tailored for an AI-based attendance tracker using facial analysis. It is built on MongoDB and includes several interrelated collections to manage user data, attendance records, and system functionality.

Key Collections and Their Roles:

1. teachers

- Stores teacher credentials and personal information.
- Fields include: teacherId, name, email, username, passwordHash, and assignedSections.

- **2. students**
- Maintains student profiles used in attendance tracking.
- Fields include: studentId, name, email, username, passwordHash, department, section, rollNumber, and admissionYear.

3. sections

- Organizes students and teachers into academic sections.
- Contains: sectionId, assignedTeachers, year, department, section, and studentRolls.

4. attendance

- Tracks attendance sessions and student presence.
- Includes: attendanceId, rollNumber, date, and a list of sessions per day.

5. alertnessLogs

- Logs the attentiveness status of each student.
- Fields: rollNumber, date, session, alertStatus, timestamp.

6. faceEncodings

- Stores unique face data required for recognition.
- Contains: rollNumber, encodingVector (array of facial feature vectors).

Overall Structure and Functionality:

- The system ensures **data consistency and traceability** by connecting students, teachers, and sections through IDs.

- Attendance and alertness logs provide a timeline of **student presence and engagement**.

- The facial encoding data supports **automated identification**, enabling contactless attendance marking.

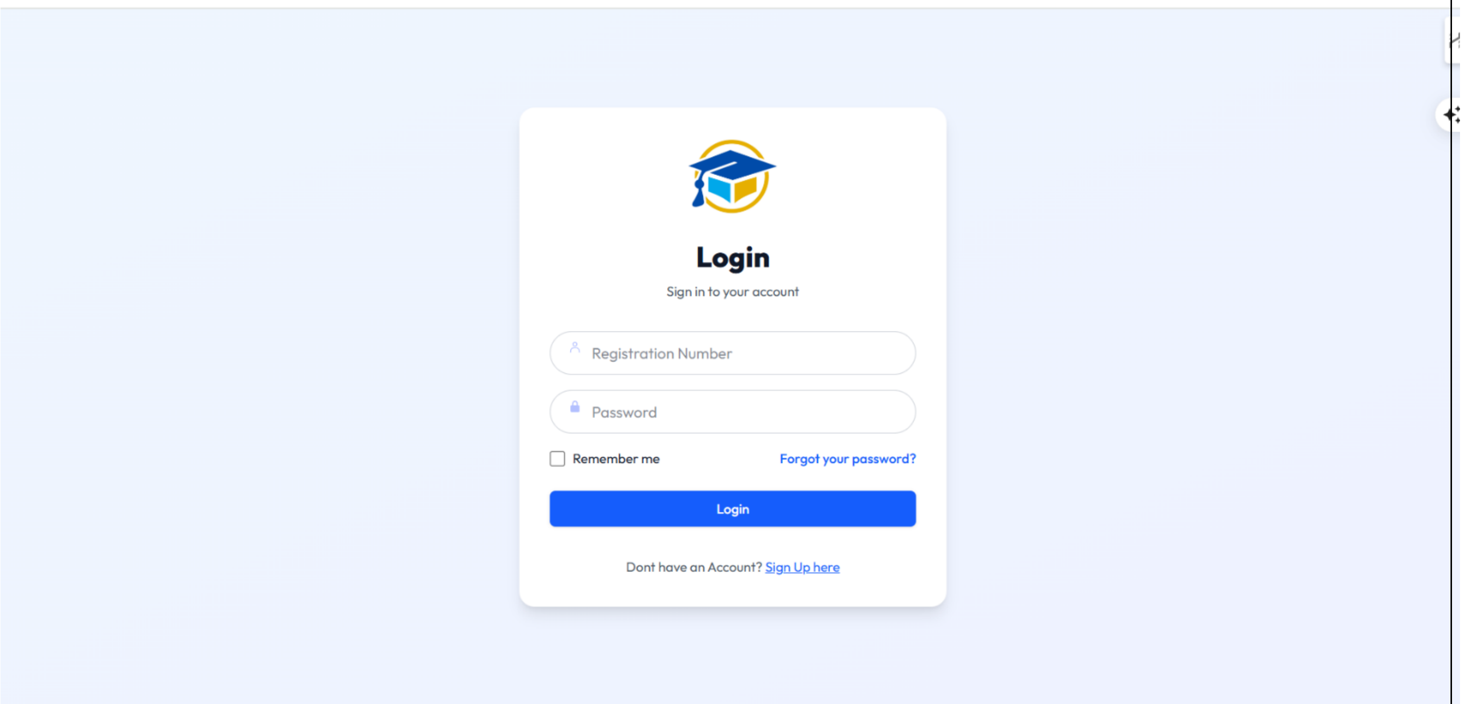
- The modular design allows **easy scalability**, supporting additional features like performance tracking or behavioral analysis.

3.6 Wire Frames

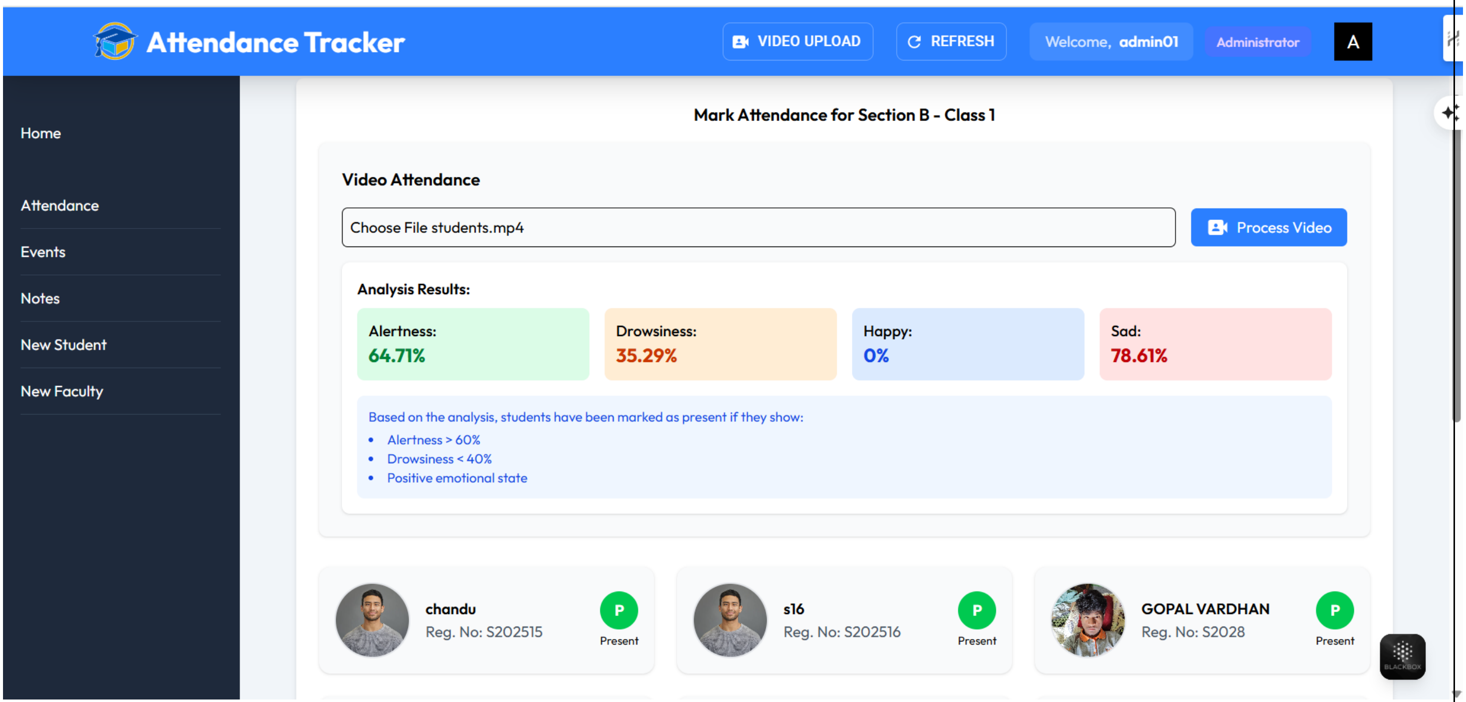
Login

:

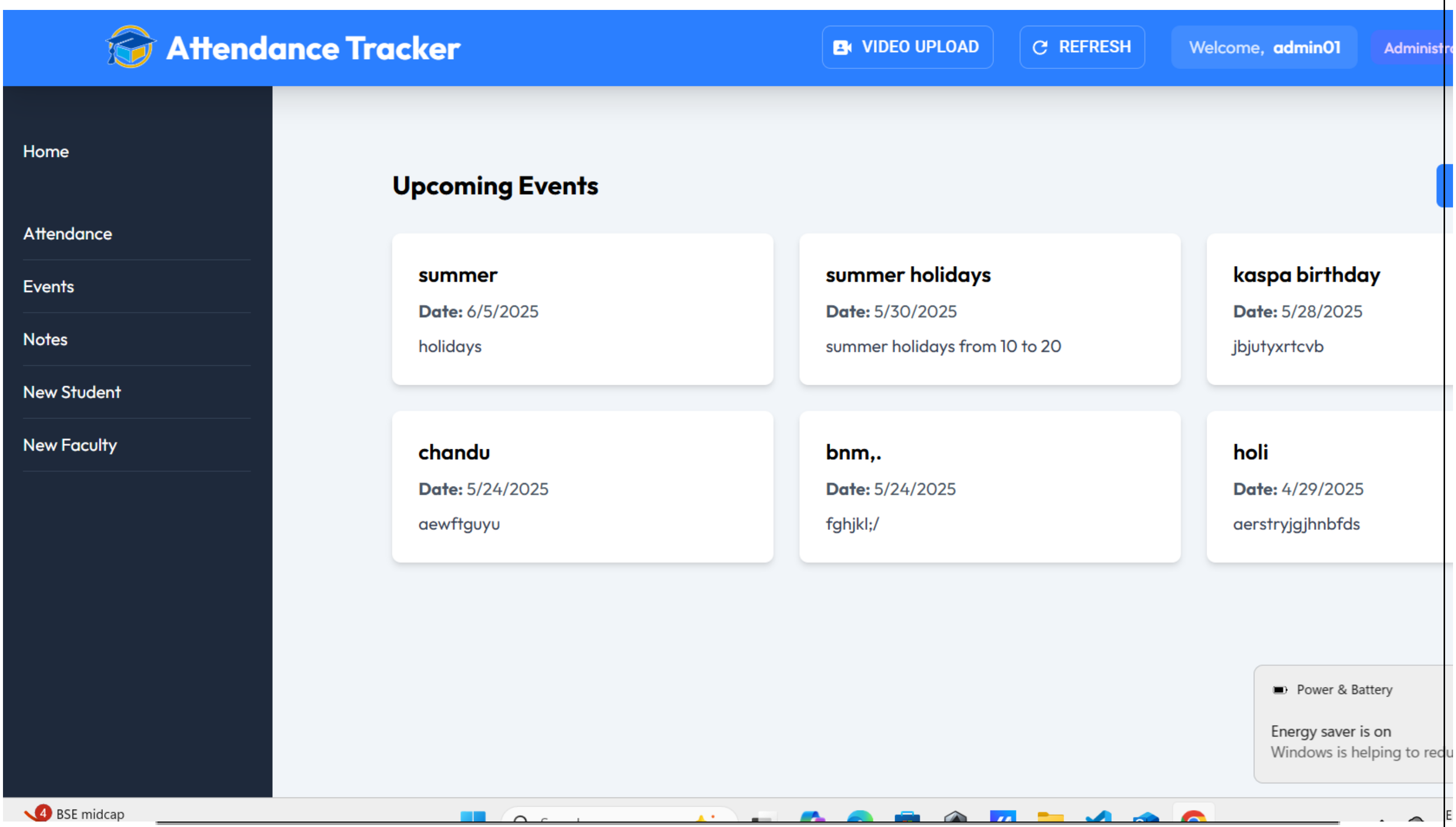
LOGIN PAGE



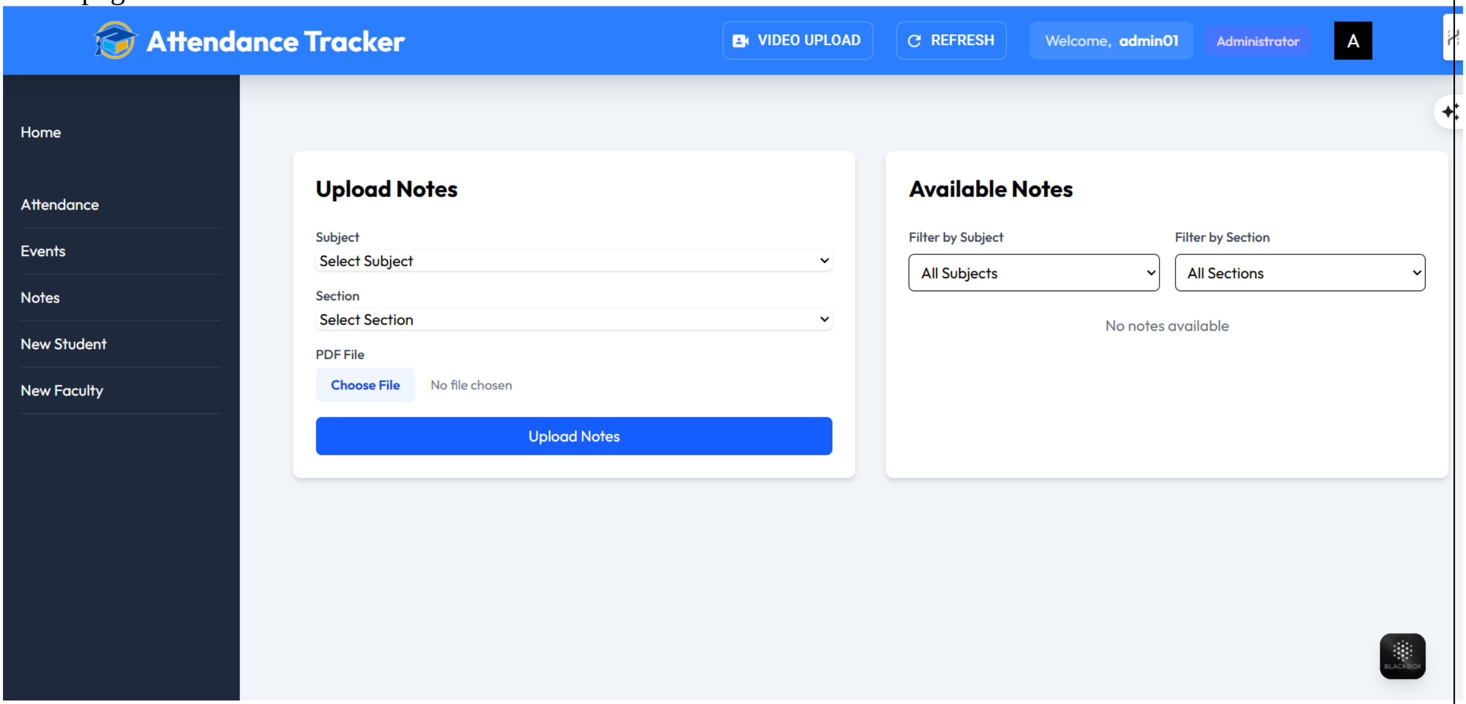
AdminDashboard :



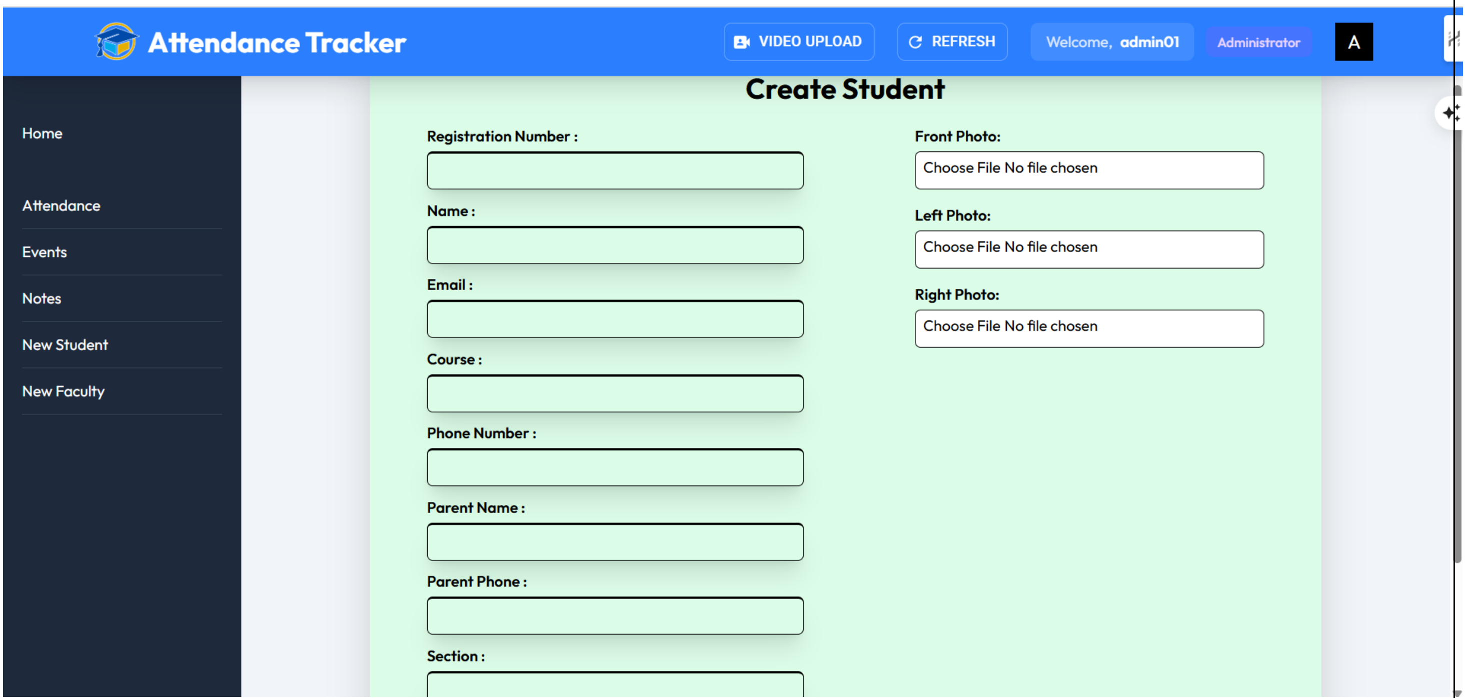
EVENTS



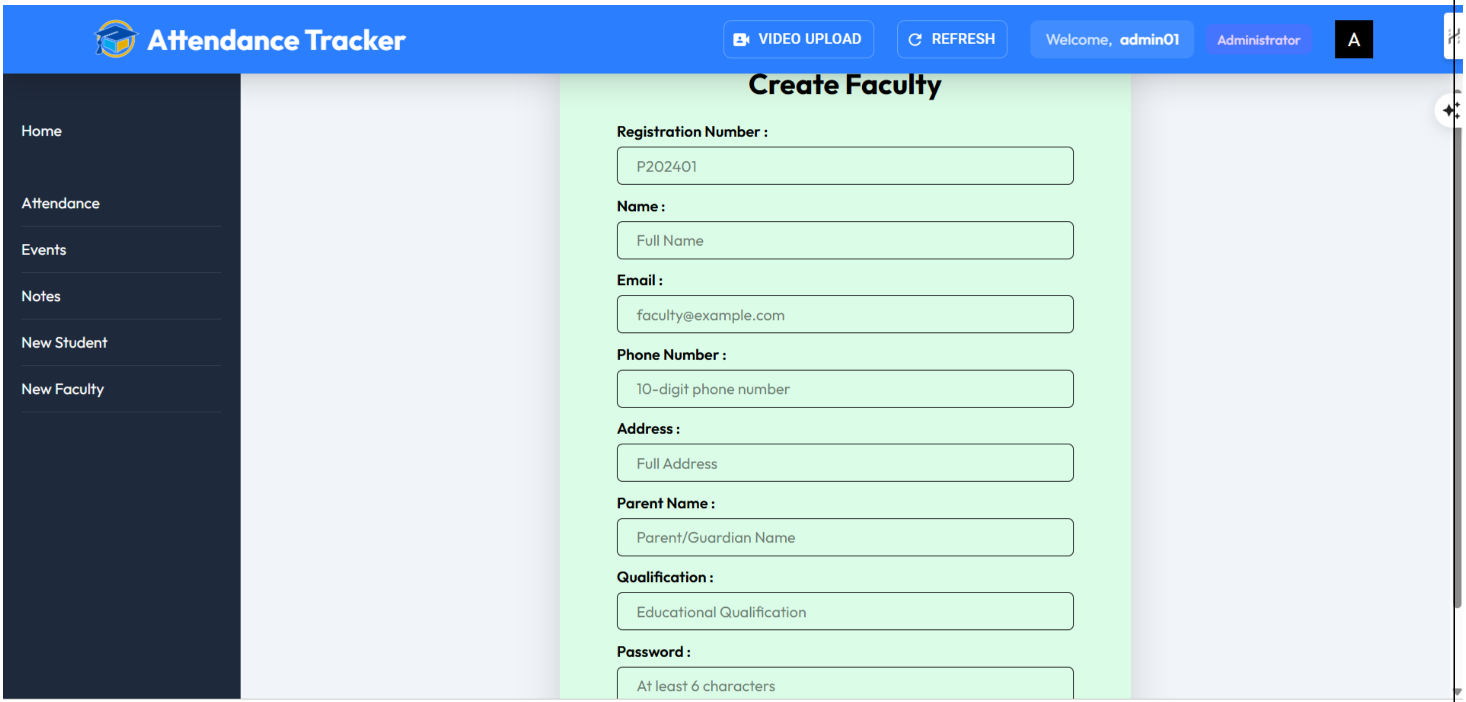
Home page of Admin:



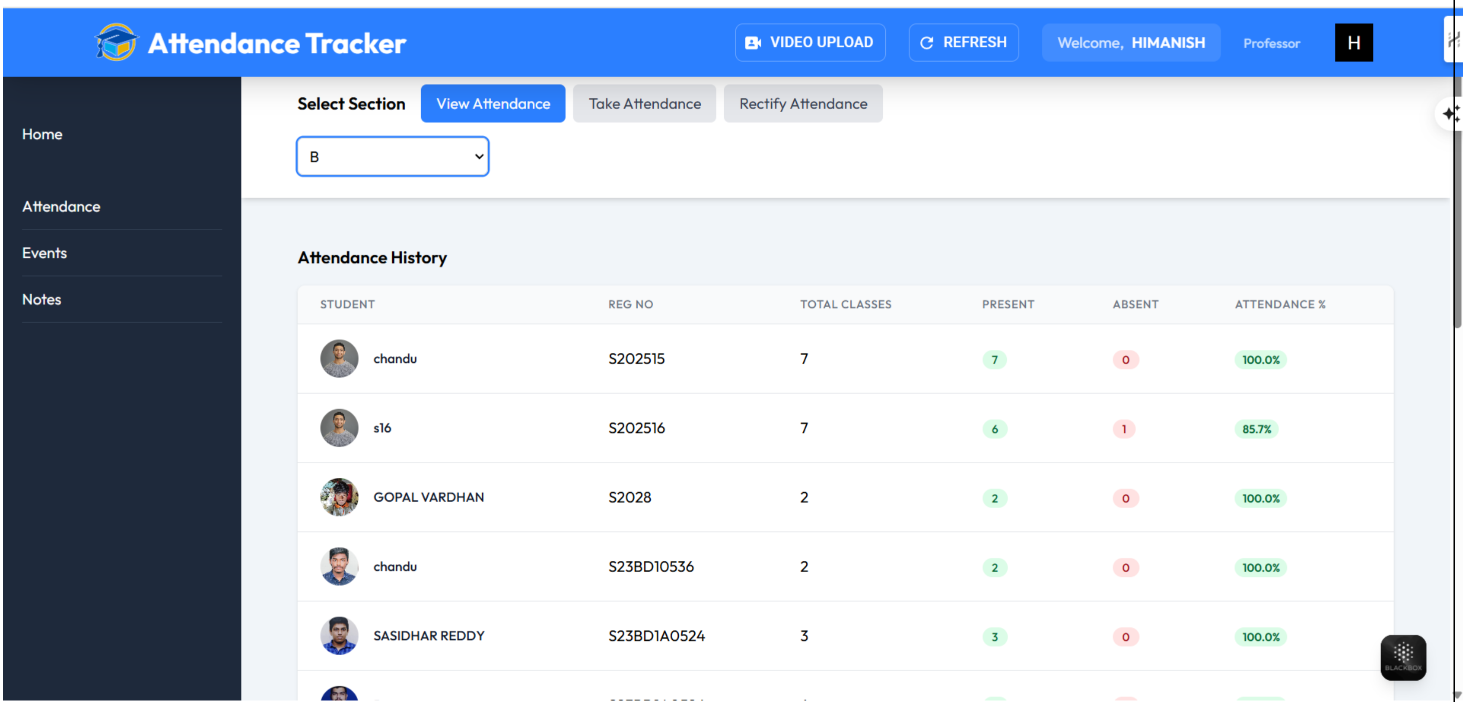
Option To Add New Student:

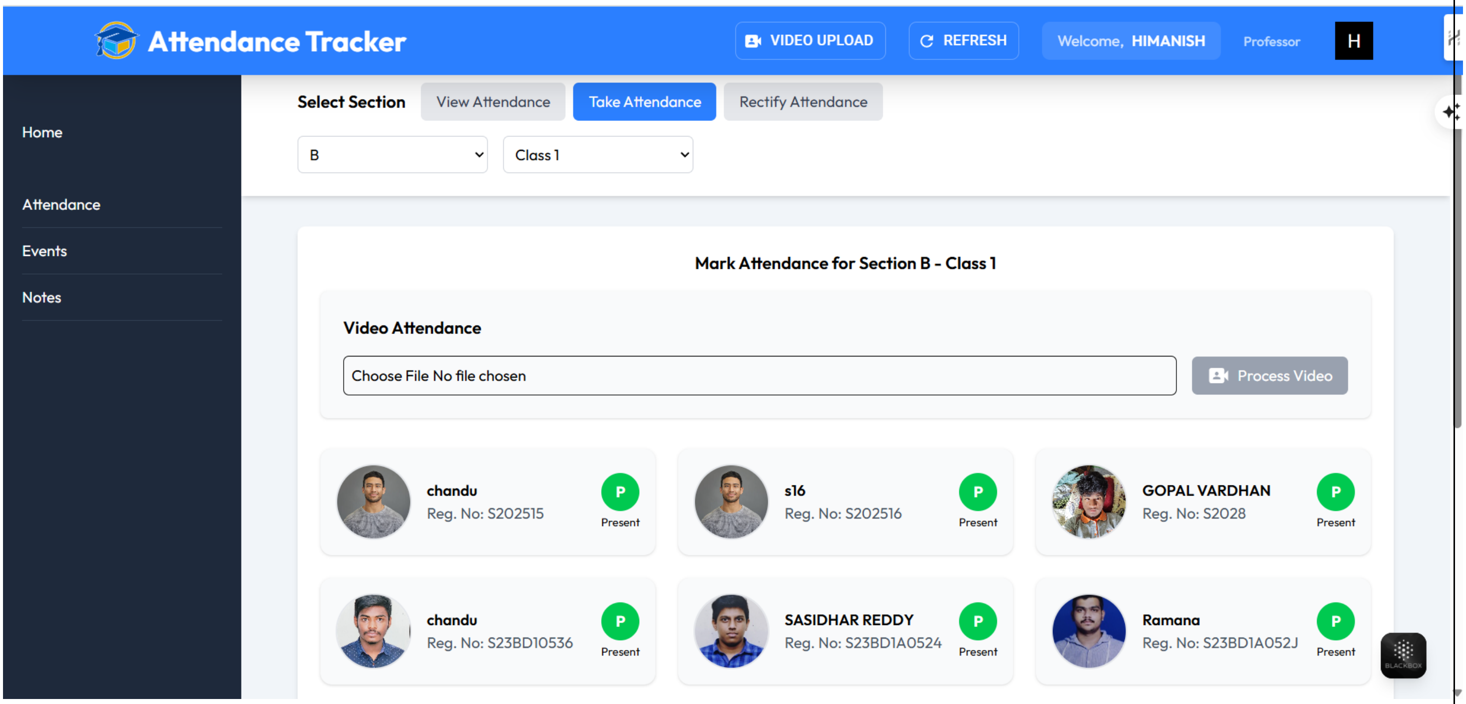


Option To Add New FACULTY:



PROFESSOR DASHBOARD




Attendance Tracker
VIDEO UPLOAD
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Events
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Select Section
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Take Attendance
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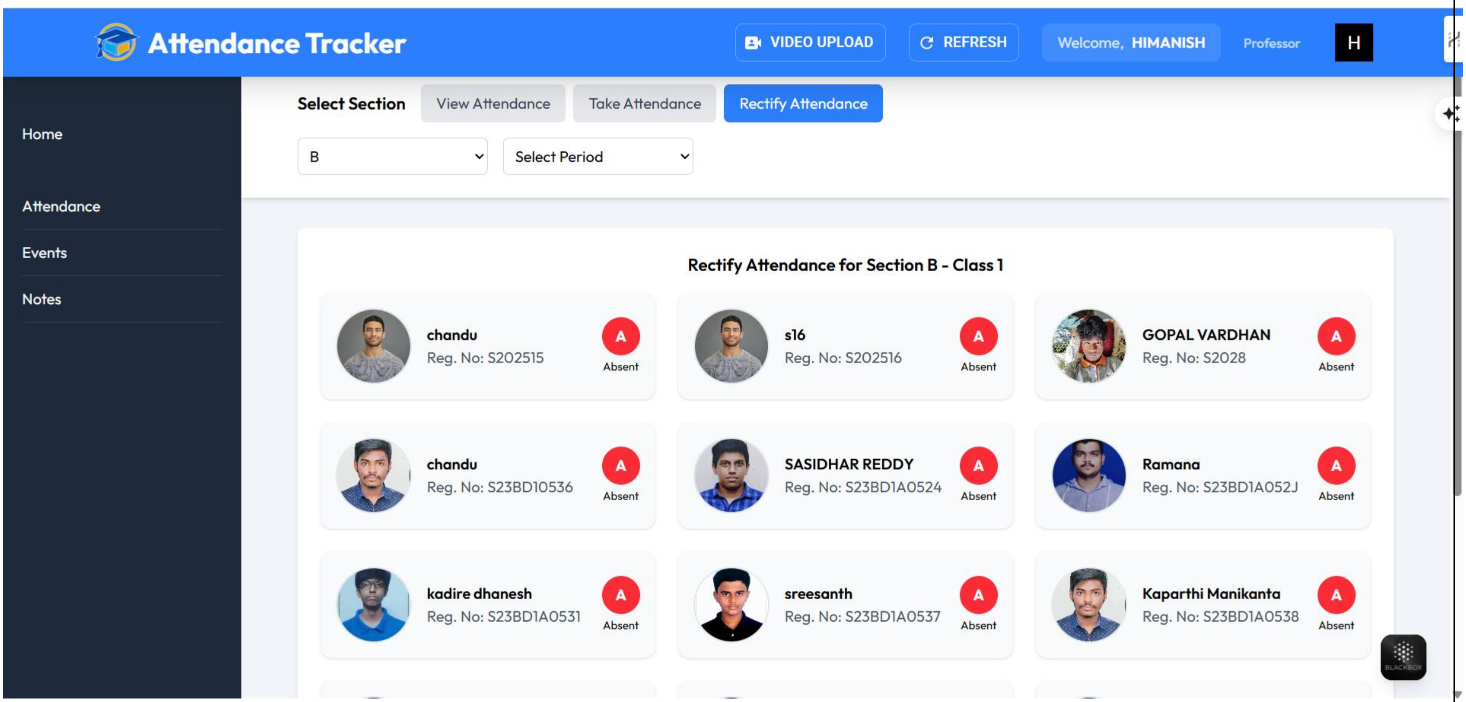
Attendance Tracker
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View Attendance
Take Attendance
Rectify Attendance
B
Select Period
Rectify Attendance for Section B - Class 1
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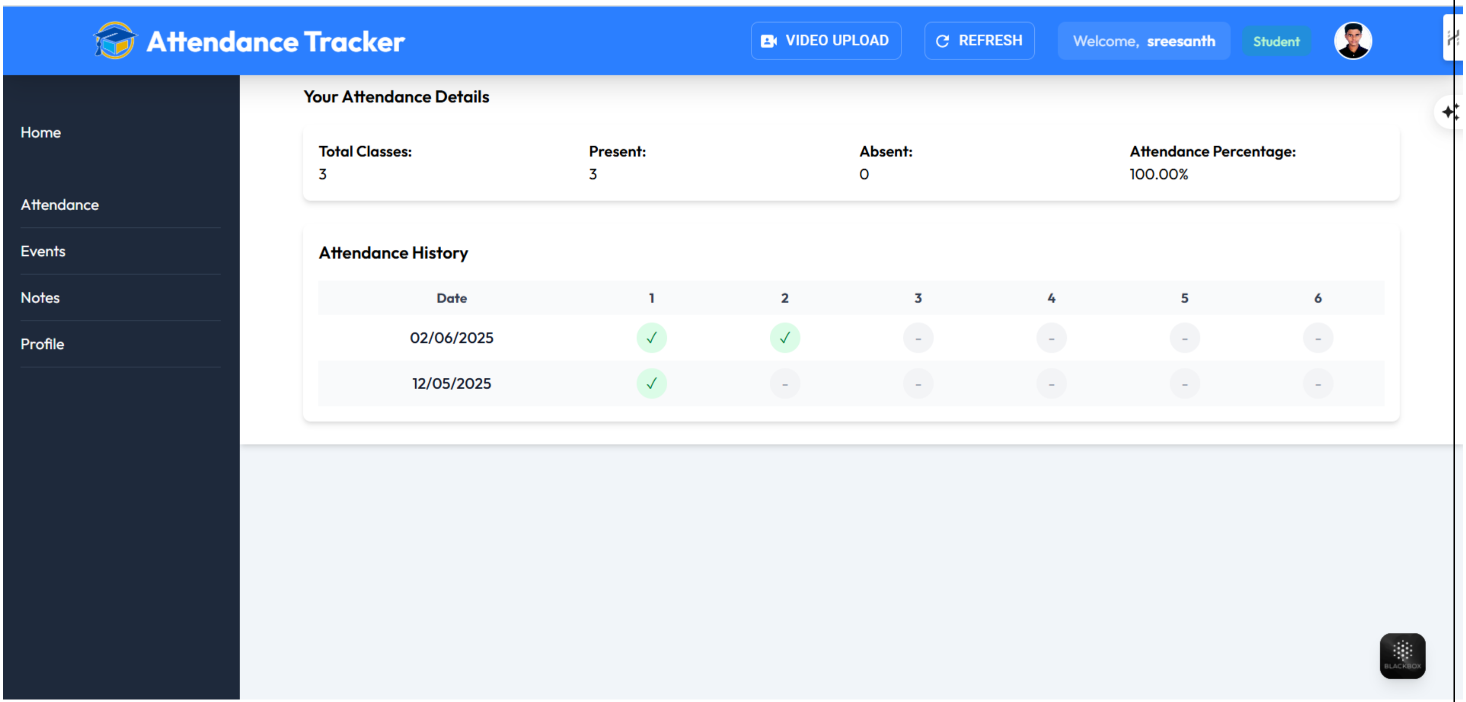
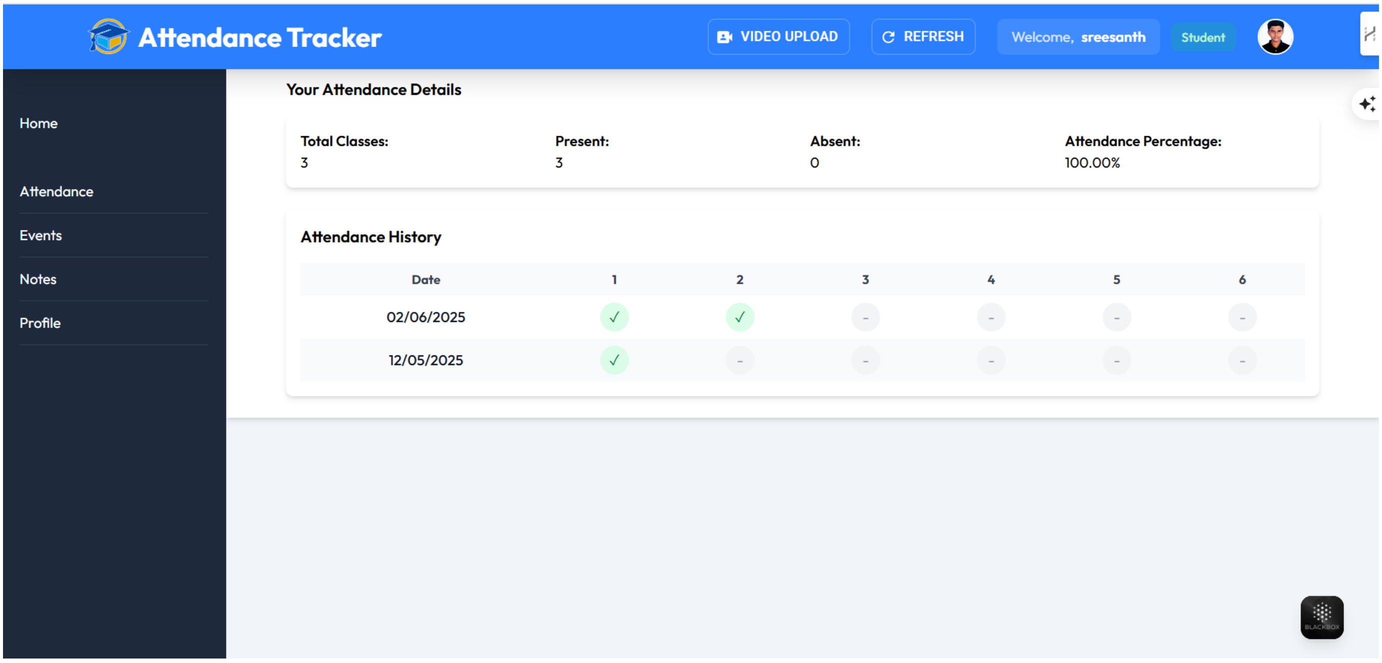


STUDENT DASHBAORD


Attendance Tracker
VIDEO UPLOAD
REFRESH
Welcome, sreesanth
Student
Home
Attendance
Events
Notes
Profile
Your Attendance Details
Total Classes:
3
Present:
3
Absent:
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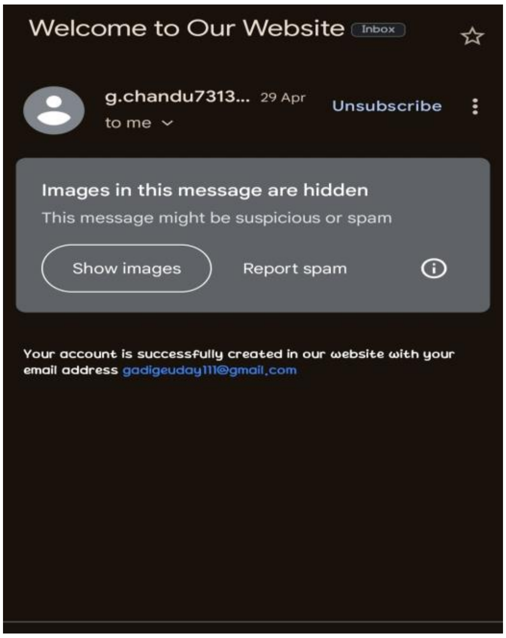
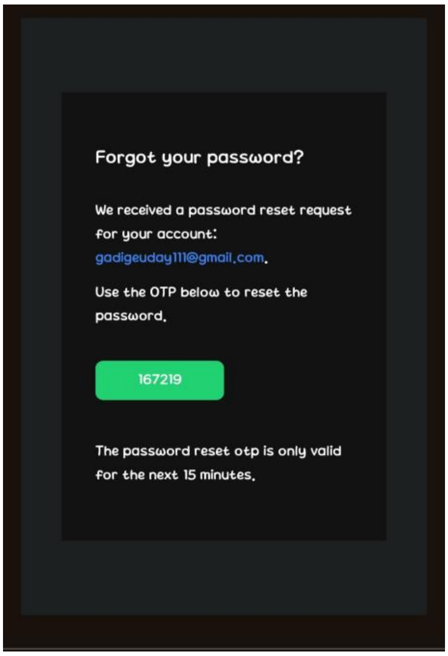
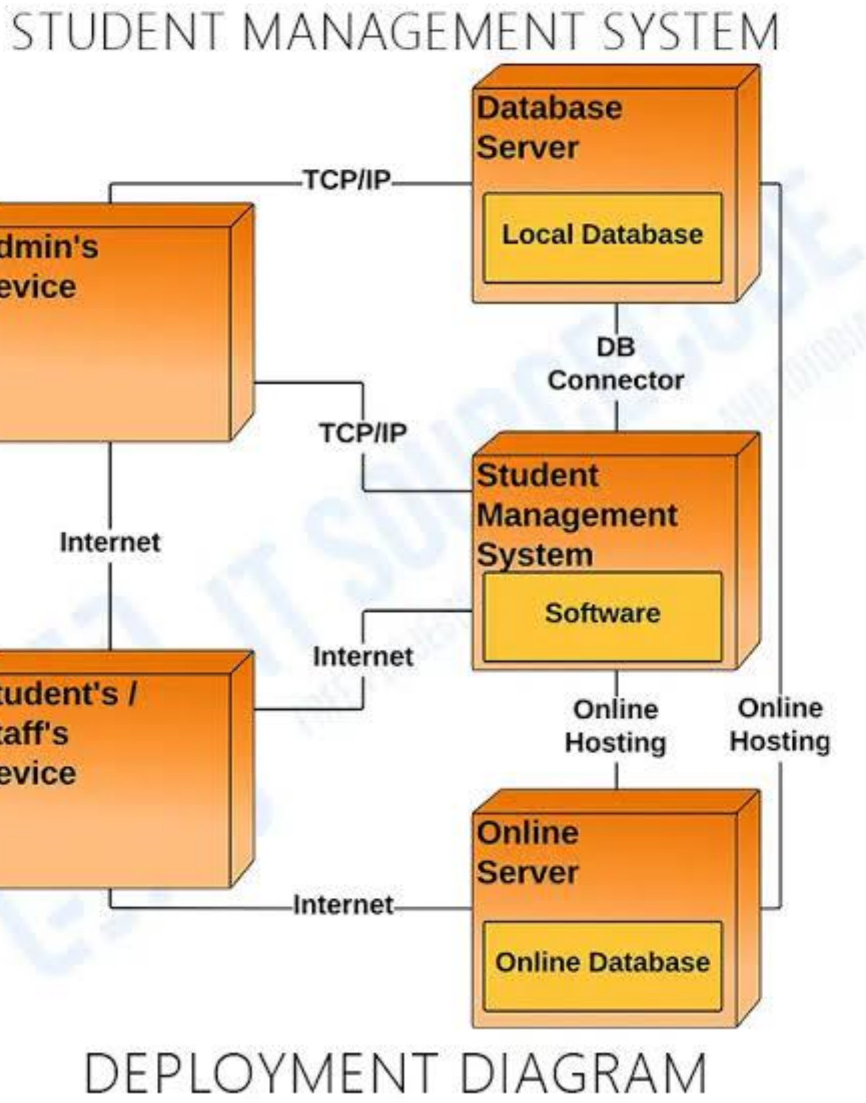

Welcome to Our Website
Inbox
g.chandu7313... 29 Apr
to me
Unsubscribe
Images in this message are hidden
This message might be suspicious or spam
Show images
Report spam
Your account is successfully created in our website with your email address gadigeuday111@gmail.com


Forgot your password?
We received a password reset request for your account:
gadigeuday111@gmail.com.
Use the OTP below to reset the password.
167219
The password reset otp is only valid for the next 15 minutes.

3.7 Deployment Diagram



This deployment diagram visually illustrates how different hardware and software components in a **Student Management System** interact across a network. It shows how the system is deployed over local and online servers, including communication flows and component responsibilities.

Key Components and Interactions:

🖥 1. Admin's Device

- Used by administrators to manage student records, update data, and oversee operations.
- Communicates with:
  - **Database Server** via **TCP/IP** for accessing the local database.
  - **Student Management Software** via **Internet** or **TCP/IP**.

📱 2. Student's / Staff's Device

- Interface used by students and faculty to interact with the system (e.g., for checking attendance, updating profiles, etc.).
- Connects to the **Student Management Software** and **Online Server** over the **Internet**.

🗄 3. Database Server

- Hosts the **Local Database**.
- Stores essential student data securely on-premises.
- Connected to the **Student Management Software** using a **DB Connector**.

💻 4. Student Management System (Software)

- Core software layer that handles business logic and data processing.
- Deployed on a server (local or cloud).
- Communicates with both the **Local Database** and **Online Database**.
- Interacts with all user devices via the **Internet**.

☁ 5. Online Server

- Hosts the **Online Database** for remote data access and redundancy.
- Ensures availability of student data to off-site users.
- Works in sync with the main software for real-time data handling.

How the System Works:

- Admins and staff can access and manage student data either via local (TCP/IP) or cloud (Internet).
- Students use their devices to interact with the system hosted online.
- Data is fetched and updated in either the local or online database based on the configuration.
- The **Student Management System Software** acts as a central hub, coordinating data flow between users and databases.

Benefits of this Deployment:

- ✅ **Scalability**: Supports both local and remote access.
- ✅ **Redundancy**: Local and online databases provide backup and availability.
- ✅ **Security**: Admin has direct TCP/IP access to internal resources.
- ✅ **Flexibility**: Accessible from anywhere with an internet connection.

Conclusion

The **Attendance Tracker** project marks a significant advancement in the way institutions handle attendance management. By replacing outdated manual methods with a smart, automated system, this project enhances **accuracy, efficiency, and reliability**. Leveraging cutting-edge technologies like **facial recognition (YOLOv8), real-time video processing, and a robust database backend**, it provides a seamless, user-friendly solution that reduces administrative workload and prevents fraudulent attendance.

Beyond mere attendance recording, the system lays the foundation for **data-driven decision making**, enabling real-time analytics, attendance trends, and performance monitoring. It ensures that both students and staff are held accountable, while offering transparency and easy access to attendance records.

In an era where automation and digital transformation are crucial, this Attendance Tracker stands as a scalable and future-ready solution, adaptable for **schools, universities, and workplaces** alike. With continued development—such as mobile integration, cloud scalability, and enhanced security—this project has the potential to redefine attendance systems across various sectors.

Future Enhancements

- **Mobile App Integration**
  - Develop Android and iOS applications to allow real-time attendance tracking and notifications for both students and faculty on the go.

- **Cloud-Based Storage & Sync**
  - Migrate data storage to the cloud (e.g., AWS, Firebase) for better scalability, remote access, and data redundancy.

- **Advanced Analytics Dashboard**
  - Implement dashboards with detailed insights such as attendance trends, heat maps, and performance reports for administrators and teachers.

- **Multi-Camera & Multi-Room Support**
  - Extend the system to handle multiple video feeds simultaneously for larger institutions with many classrooms.

- **Biometric Authentication**
  - Add support for fingerprint or iris scanning for multi-modal authentication, enhancing security and accuracy.

- **Offline Mode with Syncing**
  - Enable offline attendance tracking (e.g., in mobile apps) that syncs data with the server when internet connectivity is restored.

- **Integration with Learning Management Systems (LMS)**
  - Connect with platforms like Moodle, Canvas, or Google Classroom to sync attendance with course progress and grades.

- **Smart Alert & Notification System**
  - Implement email/SMS alerts for absenteeism, low attendance warnings, or class reminders.

- **AI-Based Behaviour Analysis**

- Extend facial recognition to analyse attention span, facial expressions, or engagement during lectures (ethically and with consent).

- **Role-Based Access Control (RBAC)**
  - Provide layered access for admins, teachers, students, and parents with appropriate permissions and dashboards.

- **QR Code/Beacon-Based Backup Attendance**
  - Introduce QR or Bluetooth-based options as a fallback in case of camera failure or privacy concerns.

- **GDPR-Compliant Data Privacy Features**
  - Add user consent management, data encryption, and deletion options to comply with global privacy
  - standards.

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