**PROJECT X ATTENDANCE APP**

**HIGH LEVEL DOCUMENTATION**

**I.Introduction**

**1.1 Purpose of the Study**

The purpose of this study is to design and develop a school-based attendance mobile application that streamlines the recording, monitoring, and management of student attendance. The system will provide separate access for students, instructors, and administrators to ensure efficient tracking, transparency, and data accuracy. It aims to reduce the workload of instructors, improve student accountability, and enable administrators to generate reliable attendance reports for academic management.

**1.2 Objectives of the Study**

The development of Project X aims to provide an efficient, secure, and reliable solution for automating student attendance in educational institutions. Specifically, the app seeks to:

* Capture real time and accurate student data such as full name, student ID, course, and schedule to ensure authenticity during attendance sessions.
* Automate the attendance process by utilizing QR code scanning eliminating manual data entry and reducing errors.
* Enable students to access their attendance records through the app, promoting transparency and personal accountability.
* Generate detailed, time-stamped attendance reports that can be accessed and analyzed by instructors and administrators for academic and administrative purposes.
* Enhance data security and reliability by implementing secure access controls and encrypted storage of attendance records.

### **1.3 Scope and Limitation**

**Project X** is a school-based mobile attendance application designed to automate and streamline the process of recording, monitoring, and managing student attendance. The system is developed specifically for educational institutions and will support three types of users: students, instructors, and administrators. Key features of the application include:

* Capturing real-time and accurate student data such as full name, student ID, course, and class schedule.
* Recording attendance through automated methods including QR code scanning verification
* Providing students access to their personal attendance records to promote transparency and accountability.
* Allowing instructors to manage and review attendance records efficiently.
* Enabling administrators to generate and analyze detailed, time-stamped attendance reports.
* Ensuring data privacy through secure access controls and encrypted storage.

Although Project X is designed to enhance the efficiency and reliability of attendance tracking, it has some limitations:

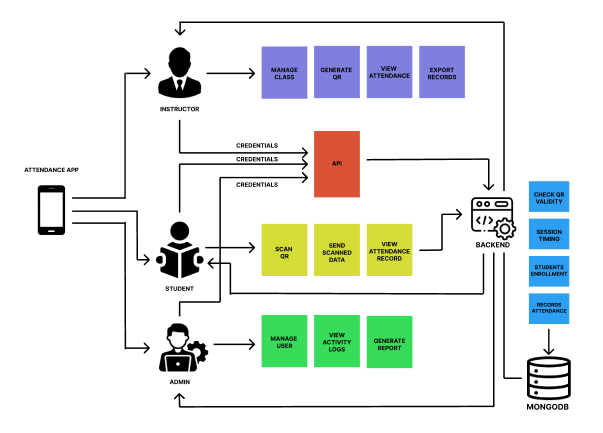
* The application relies on stable internet connectivity for real-time attendance verification
* GPS-based location verification is not implemented, limiting location-specific validation during attendance marking.
* The system does not include modules for grading, academic performance tracking, or integration with existing school management systems.
* The application is limited to mobile platforms and does not offer a desktop or web-based version in its initial release.

Despite these limitations, **Project X** provides a modern, practical solution for improving attendance management in schools, reducing manual effort, and promoting a more transparent academic environment.

### **1.6 Definition of Terms**

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| **Term** | **Definition** |
| **Project X** | A mobile application designed to automate and streamline the process of recording, monitoring, and managing student attendance in educational institutions. |
| **QR Code Attendance System** | A system feature that uses Quick Response (QR) codes generated for each class session, which students scan through the app to mark their attendance in real time. |
| **Role-Based Access Control (RBAC)** | A system mechanism that assigns different permissions and access levels to users based on their role—student, instructor, or administrator. |
| **Student Dashboard** | An interface within the app that provides students with a visual summary of their attendance records, including subject-wise statistics and alerts for low attendance. |
| **Instructor Dashboard** | An interface for instructors to manage attendance data, review student participation, and generate attendance reports for specific classes. |
| **Administrator Tools** | System functionalities exclusive to administrators that enable them to manage users, monitor app activity, and generate comprehensive attendance analytics. |
| **AES-256 Encryption** | A data protection method using the Advanced Encryption Standard with a 256-bit key to securely store sensitive information like attendance records. |
| **HTTPS with TLS 1.3** | A secure communication protocol ensuring encrypted transmission of data between the app and server using the latest version of the Transport Layer Security. |
| **Scalability** | The system’s ability to handle increased user traffic and institutional growth without compromising performance |
| **Portability** | The app’s capability to run smoothly on multiple mobile platforms, particularly Android and iOS. |
| **Database Integration** | The process of linking the app to a secure backend database that stores all user and attendance information for reliable data management |
| **Localization Readiness** | The app's ability to support translation and adaptation for use in multiple languages and regions. |

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**II. System Architecture**

*Figure 2.1 System Architecture.*

The system architecture illustrates the modular structure and workflow of the **Attendance Application**, showcasing how users interact with the backend infrastructure via a secure API. It adopts a **role-based design**, enabling distinct functionality for **students**, **instructors**, and **administrators**.

### **2.1 User Roles and Interfaces**

1. **Student Interface** Students access the mobile application to:
   * **Scan QR codes** generated for class sessions.
   * **Send scanned data** (along with timestamp and credentials) to the backend via the API.
   * **View their attendance record** in real-time.
2. **Instructor Interface** Instructors log in to the system to:
   * **Manage their class lists** (e.g., student rosters).
   * **Generate QR codes** for each session.
   * **View and monitor attendance** data for individual or group analysis.
   * **Export attendance records** when necessary.
3. **Admin Interface** Administrators have elevated access to:
   * **Manage user accounts** across all roles.
   * **View system activity logs**, including login attempts, API usage, and data changes.
   * **Generate institutional reports** based on attendance trends and user activity.

### **2.2 Core Components**

* **API (Application Programming Interface)** Serves as the central communication hub between the frontend (mobile app) and backend. All interactions login, QR scanning, data retrieval pass through the API. It validates credentials, processes requests, and ensures secure role-based access.
* **Backend Logic** The backend is responsible for:
  + **Validating QR code authenticity**, including expiration checks and session mapping.
  + **Tracking session timing** to prevent fraudulent entries.
  + **Cross-referencing student enrollment** before accepting attendance logs.
  + **Recording attendance data** to the database in real-time.
* **Database (MongoDB)** MongoDB stores:
  + **User credentials and roles**
  + **Session metadata**
  + **Attendance records**
  + **System activity logs**

Its NoSQL flexibility supports dynamic schemas, which is ideal for evolving attendance formats and rapid querying.

**III. Requirements**

### **3.1 Functional Requirements**

* **User Registration and Authentication**

The system provides secure user registration and login functionality for students, instructors, and administrators. OTP-based authentication is integrated to enhance account security.

* **Role-Based Access Control**
  + Each user role is assigned specific access and functionalities:
  + Students can view their attendance records.
  + Instructors can manage attendance for their assigned classes.
  + Administrators have full access to attendance data, user management, and system configurations.
* **QR Code Attendance System**
  + The application uses QR code scanning for real-time attendance marking. Each session generates a unique QR code, which students scan to register their presence. The system verifies the validity of the QR code, timestamp, and user data before logging attendance.
* **Attendance Logging and Management**  
  Attendance records are stored with accurate timestamps and linked to student details. Instructors can override entries if necessary, with justifications logged for audit purposes.
* **Student Dashboard**  
  Students are provided with a user-friendly dashboard displaying their attendance statistics, subject-wise breakdowns, and notifications for low attendance alerts.
* **Instructor Dashboard**

Instructors can generate and review attendance reports per subject, track student attendance history, and export data as needed.

* **Administrator Tools**  
  Administrators have access to system-wide analytics, user account management, and report generation features. The admin panel also includes activity logs for accountability and monitoring.
* **Database Integration**  
  All user information and attendance data are stored in a secure database with a schema designed to ensure referential integrity and optimized querying.

### **3.2 Non-Functional Requirements**

* **Security**  
  Data is transmitted using HTTPS with TLS 1.3 and stored using AES-256 encryption. The app enforces role-based access control and session management to prevent unauthorized data access.
* **Availability & Reliability**  
  The system maintains high availability during school hours and handles multiple concurrent attendance sessions without service disruption.
* **Performance**  
  QR code scanning and attendance logging are optimized to complete within 2 seconds. All dashboards load efficiently, even with large datasets.
* **Scalability**  
   The application architecture supports horizontal scalability, accommodating increasing numbers of users and institutions without performance degradation.
* **Maintainability**  
  Built with modular and reusable components, the app allows for future updates and maintenance with minimal impact on existing features.
* **Usability**  
  The UI is intuitive and responsive across various mobile devices. User workflows are simplified to reduce training needs and enhance adoption.
* **Portability**  
  The app functions smoothly on both Android and iOS platforms, ensuring accessibility across different devices used by students and staff.
* **Backup & Recovery**  
  Automated daily backups are in place for attendance data. A data recovery mechanism is implemented to restore records in case of failure or corruption.
* **Localization Readiness**  
  The system is structured to support future multilingual translations, allowing adaptation for institutions with diverse language needs.