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 5, Issue 2, December 2025
Impact Factor: 7.67

Student Attendance System Using QR Code

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Abstract: *In traditional educational systems, student attendance is often recorded manually using pen and paper, which is time-consuming, prone to errors, and difficult to manage. This project introduces a Student Attendance System using QR Code to automate and streamline the attendance process. The proposed system consists of a web-based module for professors to generate dynamic QR codes and a mobile application for students to scan the code. To prevent proxy attendance, the system utilizes encryption (AES) within the QR code and integrates device-specific validation (Device ID/IMEI) along with Geo-fencing. The data is stored in a centralized database, allowing for real-time reporting and analytics. This solution significantly reduces the time spent on roll calls, minimizes paper waste, and eliminates the possibility of fraudulent attendance, thereby enhancing overall academic administration.*

Keywords: QR code

I. INTRODUCTION

PROJECT IDEA

The project aims to develop a cross-platform solution (Web + Mobile) where the professor projects a QR code at the start or end of the class. Students, using the dedicated Android application, scan this code. The app captures the student's ID, the session data from the QR, the current timestamp, and the device's location. This data is sent to a central server which validates the request and marks the student present.

MOTIVATION OF THE PROJECT

- Academic Integrity: The increasing rate of proxy attendance undermines the academic environment.
- Time Efficiency: In a semester, hours of lecture time are wasted solely on calling out names.
- Digitalization: Moving towards a "Smart Campus" environment requires digitizing administrative tasks.
- Environmental Concern: Reducing the use of paper registers aligns with eco-friendly practices.

II. LITERATURE SURVEY

Existing systems include RFID-based systems (hardware intensive), Biometric systems (hygiene concerns and queues at the door), and Bluetooth Beacon systems (expensive). QR Code systems offer the best balance of cost-effectiveness (using existing student smartphones) and speed. Research shows that dynamic QR codes (which refresh every few seconds) combined with GPS are the most effective way to prevent cheating in digital attendance.

III. PROBLEM DEFINITION AND SCOPE

PROBLEM STATEMENT

Educational institutions struggle with maintaining accurate attendance records. The manual process is flawed, and existing biometric hardware is often expensive to install in every classroom. A solution is required that leverages the ubiquity of smartphones to create a secure, fast, and reliable attendance mechanism.

GOALS AND OBJECTIVES

- To design a dynamic QR code generation module.
- To develop a mobile app for scanning and data transmission.
- To implement a backend dashboard for analytics (attendance percentage, defaulter list).
- To ensure security against cloning and remote scanning.

DOI: 10.48175/568

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STATEMENT OF SCOPE

The scope includes:

- Faculty Module: Web portal to select subject, date, and generate QR code.
- Student Module: Android app to login (bound to device) and scan QR.
- Admin Module: Manage student/staff records and view overall analytics.
- Database: Store records securely.
- Limitations: Requires active internet connection and a smartphone with a functional camera.

MAJOR CONSTRAINTS

- Internet Connectivity: The system requires stable internet on both the teacher's PC and student's phone.
- Camera Quality: Low-resolution cameras may struggle to scan projected QR codes from the back of the class.
- Device Availability: Assumes every student possesses a smartphone.

METHODOLOGIES OF PROBLEM SOLVING AND EFFICIENCY ISSUES

- Dynamic QR Codes: The system regenerates the QR code every 5-10 seconds to prevent students from taking a photo and sharing it via WhatsApp.
- Session Management: The attendance window is open only for a limited time (e.g., 5 minutes) to ensure punctuality.
- Geo-fencing: The app checks if the GPS location matches the classroom coordinates before sending the API request.

OUTCOME

- A fully functional Android Application and Web Portal.
- Reduction in attendance taking time from 10 mins to 1 min.
- Automated report generation (Weekly/Monthly) in Excel/PDF format.
- Zero paper usage for attendance purposes.

APPLICATIONS

- Universities/Colleges: For daily lecture attendance.
- Corporate Training: Tracking employee participation in seminars.
- Conferences: Managing attendee check-ins.
- Examination Halls: Verifying student identity and presence.

IV. SOFTWARE REQUIREMENT SPECIFICATION

INTRODUCTION

The system is built using the Java/Kotlin for the Android App and the MERN stack (or PHP/MySQL) for the web backend. It relies on RESTful APIs for communication.

FUNCTIONAL REQUIREMENTS

1. User Registration/Login: Secure login for students and teachers.
2. Generate QR (Teacher): Create a unique encrypted code for the session.
3. Scan QR (Student): Decode the QR and extract session details.
4. Validate Data: Server checks if the session is active and if the student is valid.
5. View Reports: Students can see their own attendance; Teachers can see the whole class.

NON-FUNCTIONAL REQUIREMENTS

- Reliability: The system must handle concurrent requests (e.g., 60 students scanning at once).
- Security: Passwords must be hashed; API endpoints must be secured with tokens.

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• Usability: The UI must be simple and intuitive.
• Performance: QR scanning and validation response should take less than 2 seconds.

ANALYSIS MODELS: SDLC MODEL

The Agile Model or Waterfall Model is applied.
1. Requirement Gathering: Defined the need for anti-proxy features.
2. Design: Database schema (ER Diagram) and UI wireframes.
3. Implementation: Coding the App and API.
4. Testing: Unit testing (scanner logic) and Integration testing (server load).
5. Deployment: Hosting the web portal and distributing the APK.

V. SYSTEM DESIGN

SYSTEM ARCHITECTURE

• Client Side: Android App (Student), Web Browser (Teacher).
• Server Side: Web Server (Node.js/PHP), Database (MySQL/MongoDB).
• Logic: The teacher's device sends a "Create Session" request. The Server generates a token. The Teacher's screen displays this token as a QR. The Student's phone reads it, adds their ID + GPS, and sends a "Mark Attendance" request.

DATA FLOW DIAGRAMS

• Level 0: Input (Credentials, QR Scan) -> System (Attendance System) -> Output (Attendance Marked/Failed).
• Level 1:
• Teacher -> Generate QR -> Server.
• Student -> Scan QR -> Validation Logic -> Database Update.

UML DIAGRAMS

• Activity Diagram:
Teacher Logs in -> Selects Subject -> Generates QR -> (Parallel) Student Logs in -> Scans QR -> System Validates Location/Time -> Marks Present -> Updates Database.
• Use Case Diagram:
• Actors: Student, Teacher, Admin.
• Use Cases: Login, Generate Code, Scan Code, View Report, Manage Users, Export Data.
• Sequence Diagram:
1. Teacher -> Request QR -> Server.
2. Server -> Return QR Image -> Teacher.
3. Student -> Scan QR -> App.
4. App -> Send ID + QR Data + GPS -> Server.
5. Server -> Verify() -> Database.
6. Database -> Acknowledge -> Server.
7. Server -> Success Message -> Student App.

VI. SUMMARY AND CONCLUSION

SUMMARY

The Student Attendance System using QR Code was designed to address the inefficiencies of manual roll calls. By utilizing modern mobile technology, the system ensures secure, fast, and verified attendance. Features like dynamic QR codes and geo-fencing successfully mitigate the risks of proxy attendance. The system consists of a robust backend for data management and an intuitive frontend for ease of use.

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VII. CONCLUSION

In conclusion, the proposed system modernizes the academic administrative process. It successfully achieves the goal of saving time and resources while maintaining high data integrity. The transition from manual to digital attendance not only aids the faculty in better management but also instills discipline among students regarding punctuality. Future enhancements could include offline support and facial recognition integration for multi-factor authentication, making the system even more robust.