Reliable QR Attendance Tracker
Final Project Report

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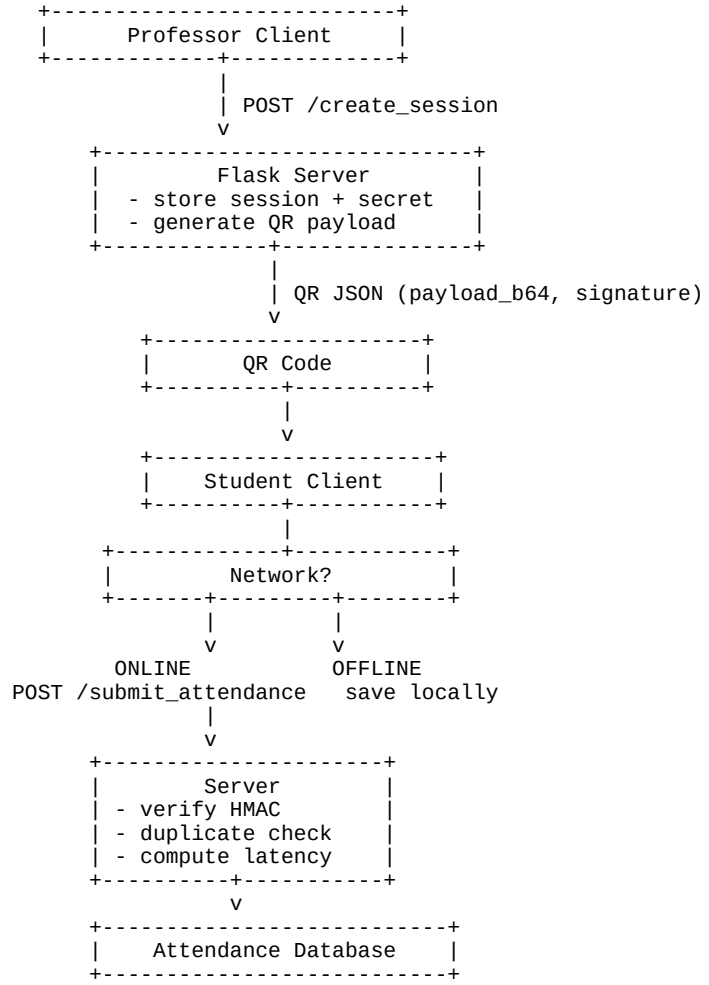
1. Introduction
This project implements a reliable QR-based attendance tracking system with secure HMAC signatures, offline queueing, and a Flask backend for real-time attendance storage. Students scan QR codes generated by the professor, and attendance is securely processed by the server with verification and latency tracking.

2. System Architecture

The system consists of two main components:
• **Flask Server**: Generates sessions, QR payloads, validates submissions, stores attendance.
• **Student Client**: Scans QR, handles online/offline modes, syncs automatically.

Below is the architecture ASCII diagram:



3. System Flow Diagram

The student flow highlights how QR scanning, offline queueing, and syncing work.

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1. Professor creates session -> server stores session and generates QR.
2. Student scans QR:
      - If online: sends submission immediately.
      - If offline: saves submission locally.
3. Server verifies HMAC, checks duplicates, computes latency.
4. When student reconnects online, queued submissions auto-sync.
5. Attendance stored in server_sessions.json.
```

4. Conclusion

This project successfully demonstrates a secure and robust QR-based attendance system with both online and offline reliability. Through HMAC signatures, duplicate protection, latency computation, and automatic syncing, the system ensures correctness and usability in real classroom environments. The modular architecture allows for easy extension into mobile apps or web dashboards in the future.