IoT based Biometric Attendance System

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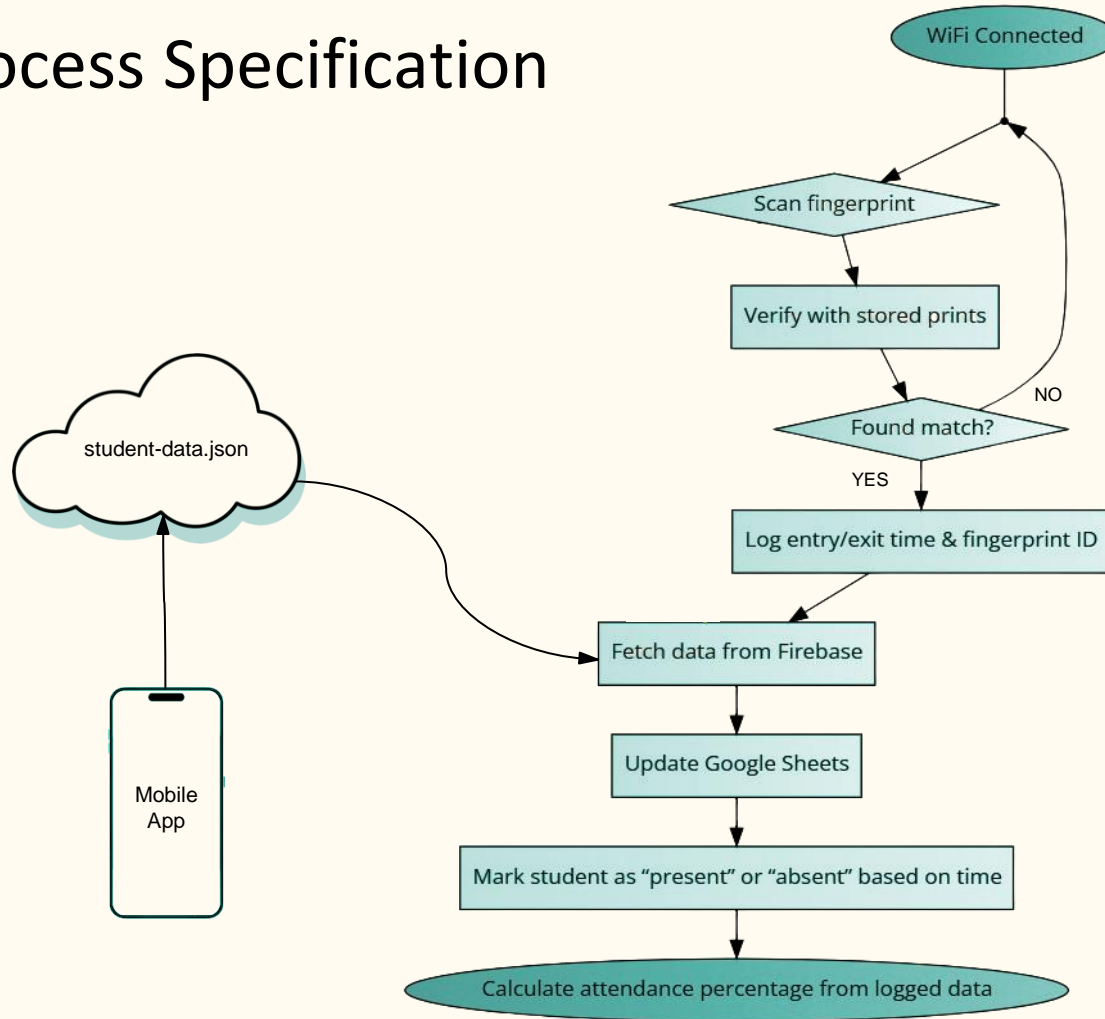
1. Purpose & requirements

Purpose:

- An IoT-based attendance system using fingerprint authentication to log student entry and exit times, stored in Google Sheets and Firebase.
- Records entry/exit times for each fingerprint scan. Calculates presence/absence and attendance percentage over time.

Requirements:

- Manages student data (name, ID, email) in Firebase for secure access and retrieval.
- Calculates each student's attendance percentage based on recorded entries.
- Cloud-based deployment on Firebase, with future integration for mobile data entry.
- Uses secure data transfer between ESP32, Firebase, and Google Sheets.

2. Process Specification

3. Domain Model Specification

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Physical Entity	• **Student:** Attributes include name, registration ID, and fingerprint ID. • **Fingerprint Sensor:** Captures biometric data for identification.
Virtual Entity	• **Firebase:** Stores student details. • **Google Sheets:** Logs attendance timestamps and updates details.
Device	• **ESP32:** Communicates fingerprints and timestamps to Google Sheets.
Resource	• **On-device Resources:** Fingerprint sensor and processing on ESP32. • **Network Resources:** Firebase (stores student data: name, email, ID, fingerprint ID) and Google Sheets (logs attendance timestamps and fetches student details from Firebase).
Service	• **Fingerprint Authentication Service:** Verifies fingerprints and sends data to Google Sheets. • **Attendance Logging Service:** Records timestamps in Google Sheets. • **Cloud Sync Service:** Syncs data between Google Sheets and Firebase for detail updates.

4. Information Model Specification

Data Structure:

- Student Data: Stored in Firebase with name, email, registration ID, and fingerprint ID.
- Attendance Log: Each entry in Google Sheets includes timestamp, fingerprint ID, and attendance status.
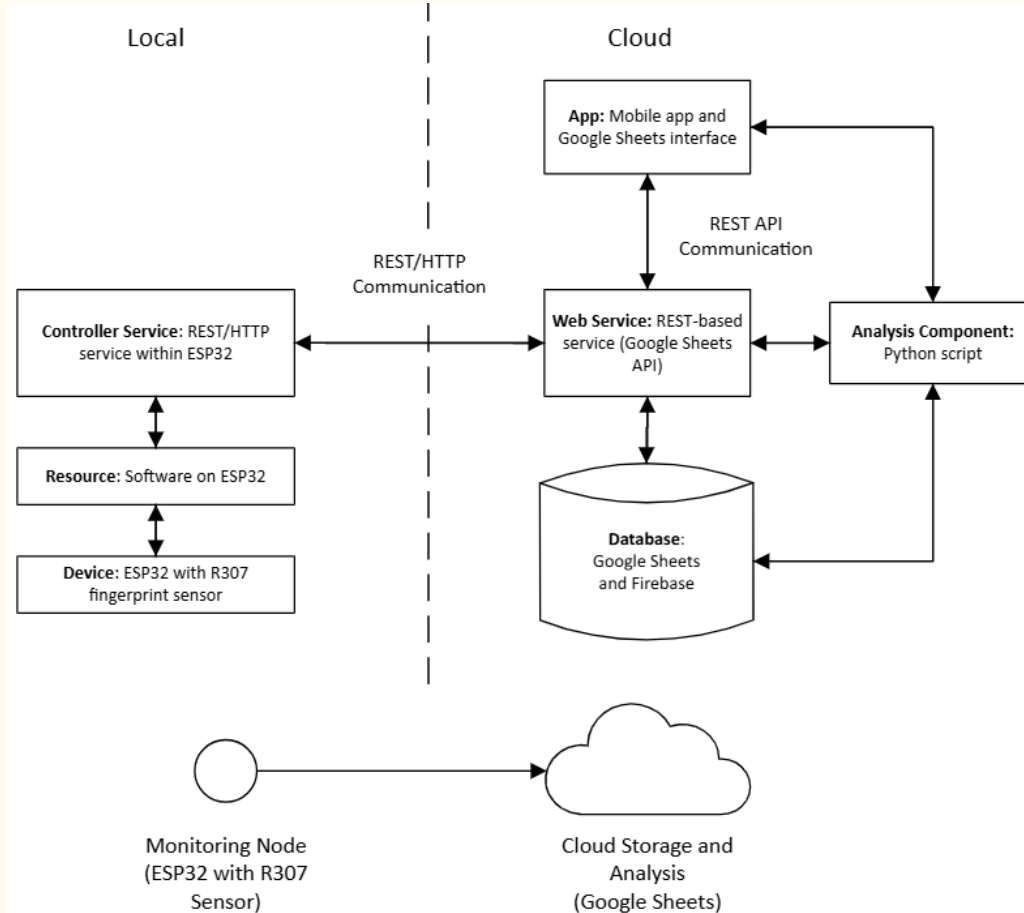
Data Flow:

The fingerprint ID from Google Sheets is cross-referenced with the Firebase database to populate student details.
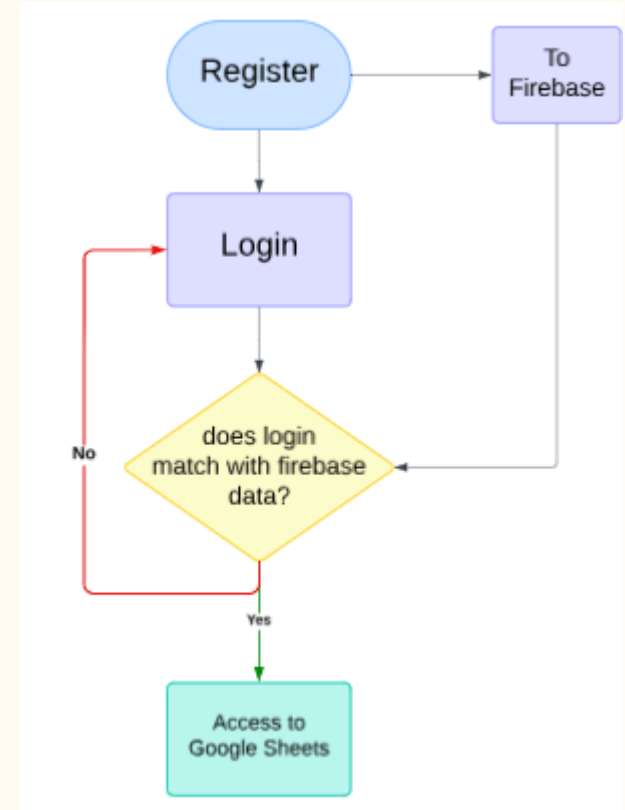
5. Service Specifications

- **Fingerprint Authentication Service:** Captures and verifies fingerprints via the ESP32 sensor.
- **Attendance Logging Service:** Logs the entry/exit timestamps in Google Sheets.
- **Cloud Sync Service:** Matches fingerprint ID in Google Sheets with student data from Firebase to retrieve and update student details.
- **Python Calculation Service:** Calculates attendance percentage and updates status in Google Sheets.

6. IoT Level Specification - IoT Level 3

7. Functional View Specification

Monitoring Node
(ESP32 with R307
Sensor)

Cloud Storage and
Analysis
(Google Sheets)
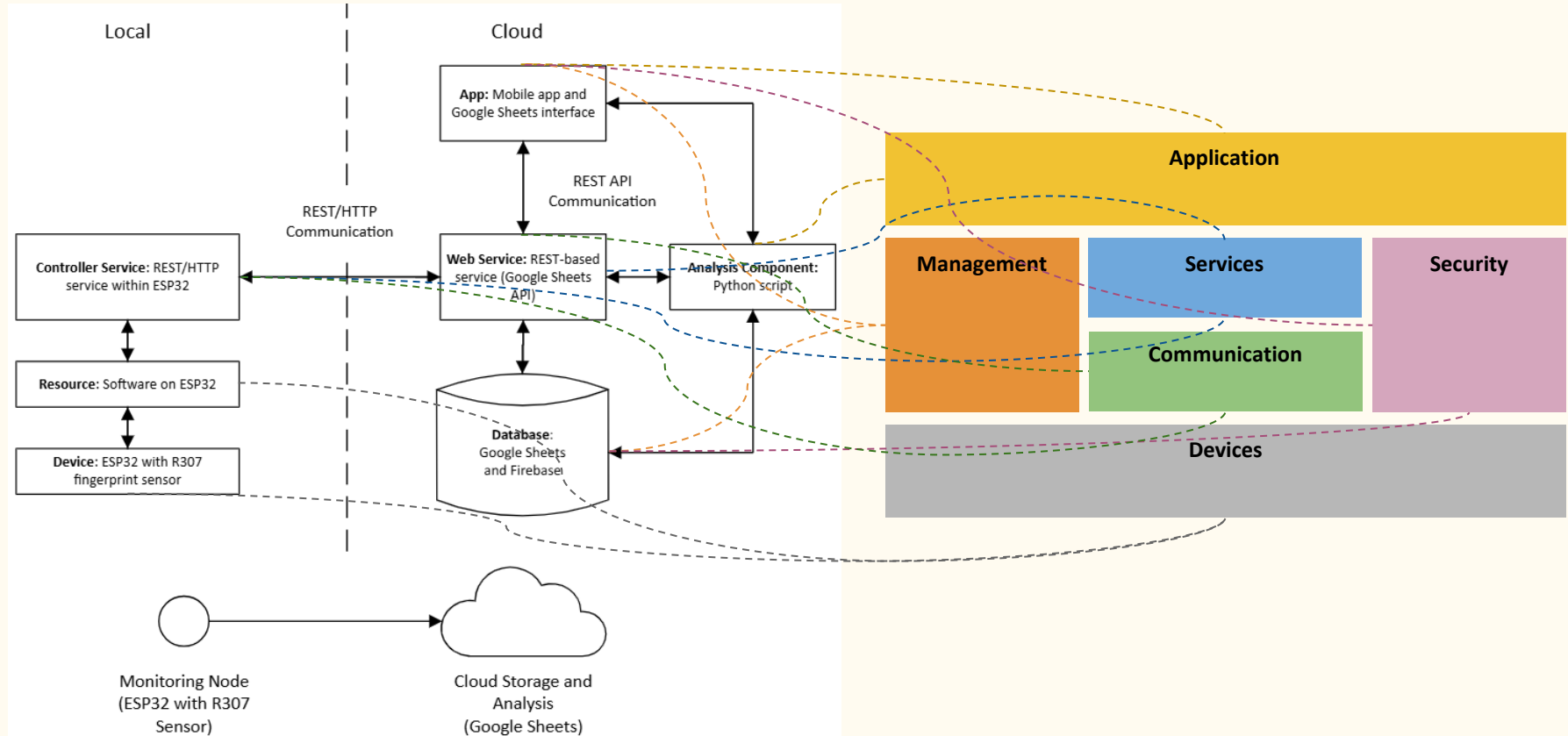
8. Operational View Specification

- **Normal Operation:** Fingerprint scans log times; attendance data syncs in real-time.
- **Error Handling:** Wi-Fi connectivity issues prompt reconnection.
- **Maintenance:** Add new student records in Firebase.
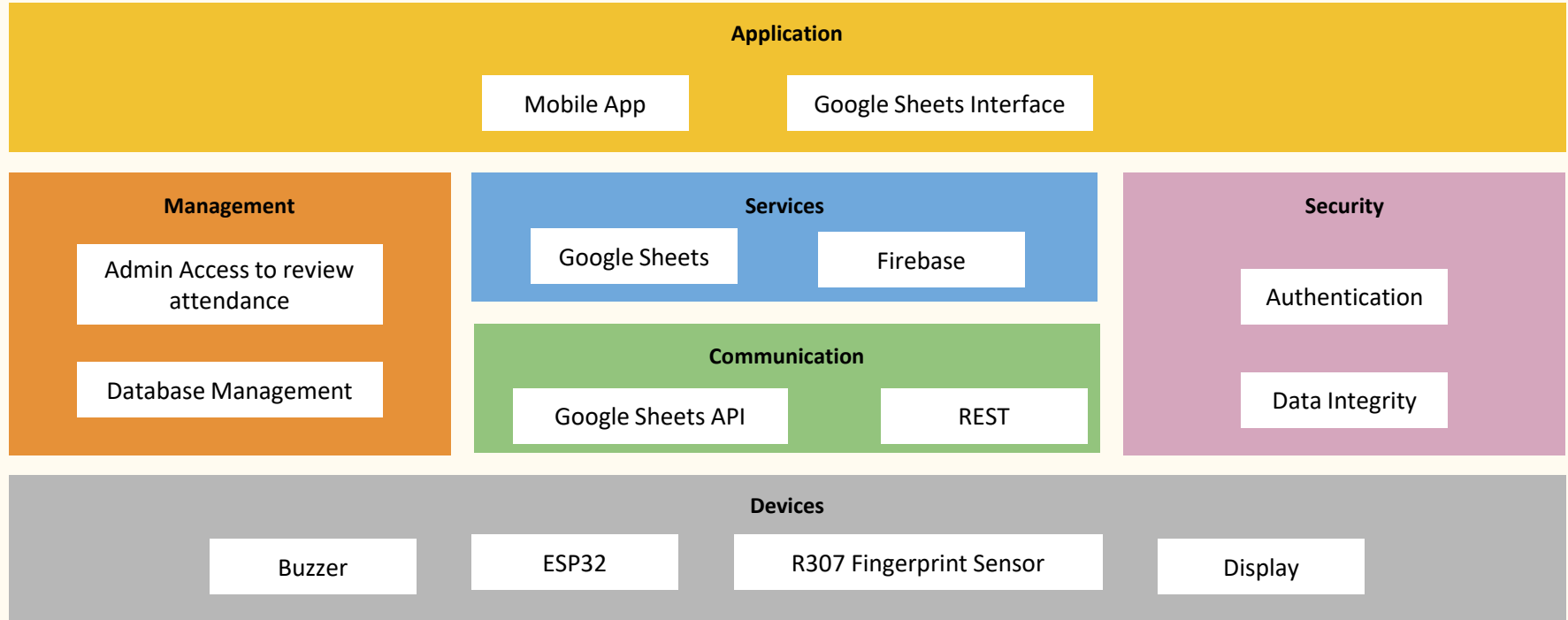
9. Device & Component Integration
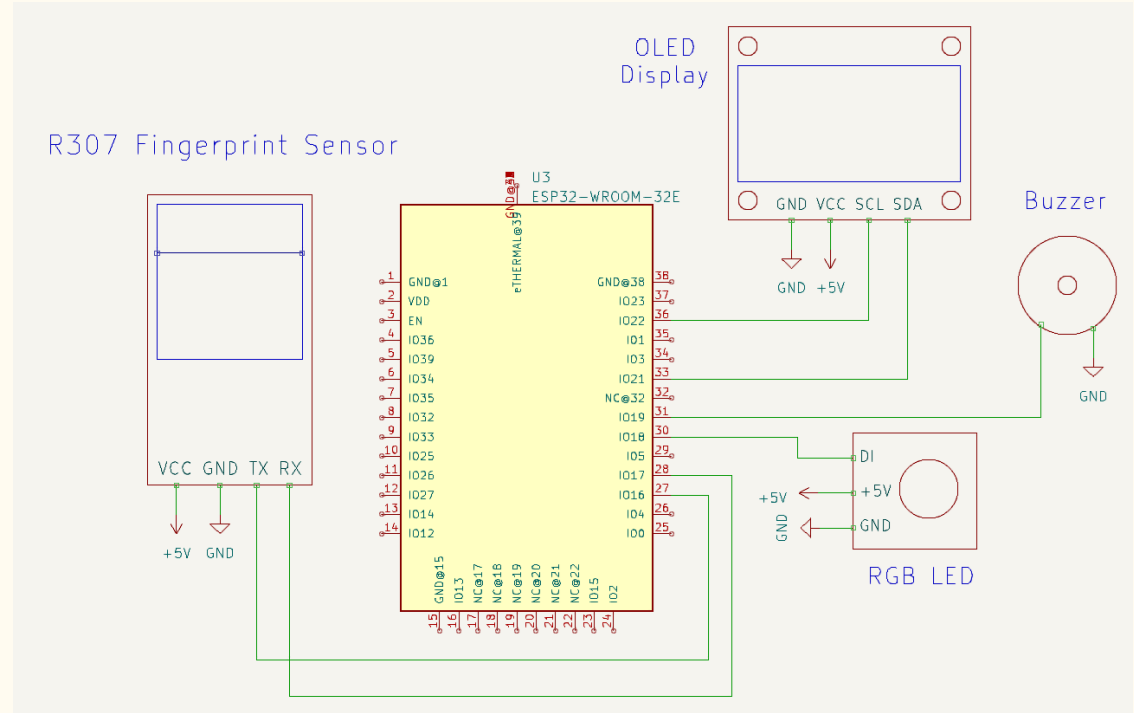
- **ESP32:** Interfaces with fingerprint sensor for biometric input.
- **Firebase:** Central storage for student data.
- **Google Sheets:** Manages attendance records, displaying data in a structured format.

10.Application Development

Mobile App:

- Purpose: Simplify student registration and attendance management.
- Backend: Firebase manages data sync and storage.

Google Sheets:

- Purpose: Stores attendance logs (fingerprint IDs, timestamps, attendance status).
- Backend: Python Script to enter attendance status on a particular date and calculate overall attendance.

Thank You