Project Title: Smart Desk Posture Reminder

Group Members & Roles:

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Course & Instructor Name: Android Programming Module 2 – Engr. Amparo

Date of Submission: August 19, 2025

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1. Introduction

Brief overview of the proposed system:

Smart Desk Posture Reminder is an IoT-based system that uses an ultrasonic sensor to monitor how far you are leaning forward from your chair backrest. If you keep a bad posture for too long, it logs the event to Firebase and can trigger a small buzzer as a reminder. The Android app shows real-time posture status, posture history, and sends alerts for prolonged bad posture.

Purpose and scope:

The purpose of Smart Desk Posture Reminder is to help users maintain healthy sitting habits by monitoring their posture in real time and providing reminders when poor posture is detected through an ultrasonic sensor, sending real-time reminders, and tracking posture history via a mobile app.

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2. Functional Requirements (MVP)

1. The system shall measure the distance between the user's back and the chair backrest using an ultrasonic sensor.
2. The system shall log poor posture events to Firebase when detected.
3. The system shall trigger a buzzer alert if poor posture is maintained for a set duration.
4. The mobile app shall display the user's real-time posture status.
5. The mobile app shall allow users to view posture history.
6. The mobile app shall send alerts for prolonged bad posture.

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3. IoT Specifications and Components

3.1. Hardware Components List and Description

Component Name	**Model/Version**	**Purpose**	**Key Specs**
Ultrasonic Sensor	HC-SR04	Measures distance between user's back and chair backrest to detect posture	2cm–400cm range, ±3mm accuracy, 5V operating voltage
Microcontroller	ESP32 DevKit V1	Process sensor data, control buzzer, and send posture logs to Firebase via Wi-Fi	Dual-core, 2.4GHz Wi-Fi, 3.3V operating voltage
Buzzer	Piezo Buzzer	Provides an audible alert when poor posture is detected for too long.	3–5V operating voltage, ~85 dB sound output
Power Supply	5V Adapter / Battery Pack	Supplies power to the microcontroller and connected components	5V DC output, 2A (adapter) / 2000–5000mAh (battery)
Smartphone	Android Device (v8.0+)	Runs the mobile app to display real-time posture status, history, and alerts	Android 8.0+, Wi-Fi/4G connectivity, ≥2GB free storage

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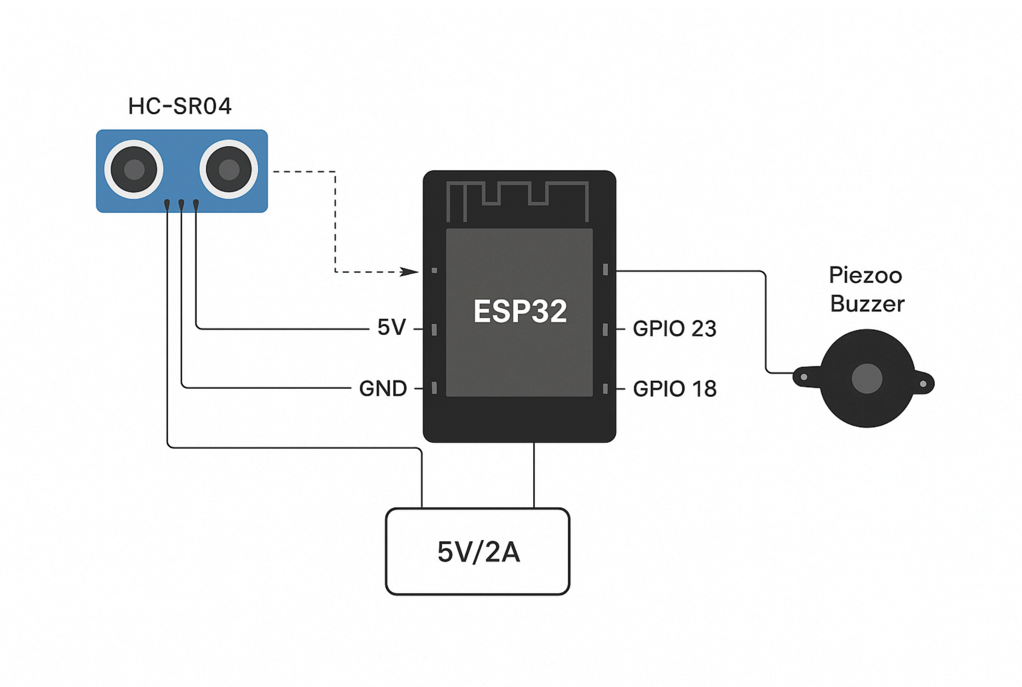
3.2. Connectivity Specifications

- **Protocol:** Wi-Fi 802.11 b/g/n
- **Data Transmission:** MQTT protocol over TCP/IP
- **Broker:** Firebase Realtime Database

3.3. Design & Schematics Diagram



4. Cloud Specifications

4.1. Selected Cloud Service and Justification

- **Platform:** Firebase Realtime Database
- **Reason:** Real-time data sync with Android SDK support and Lightweight JSON-based storage

4.2. Data Flow Description

1. Ultrasonic sensor measures the distance between the user’s back and the chair.
2. ESP32 processes the reading:
   - If distance exceeds threshold for >5 seconds → classify as “bad posture”.
3. ESP32 logs the event to Firebase Realtime Database using JSON format.
4. Firebase updates data in real time:

- Mobile app fetches posture status (“good” / “bad”).

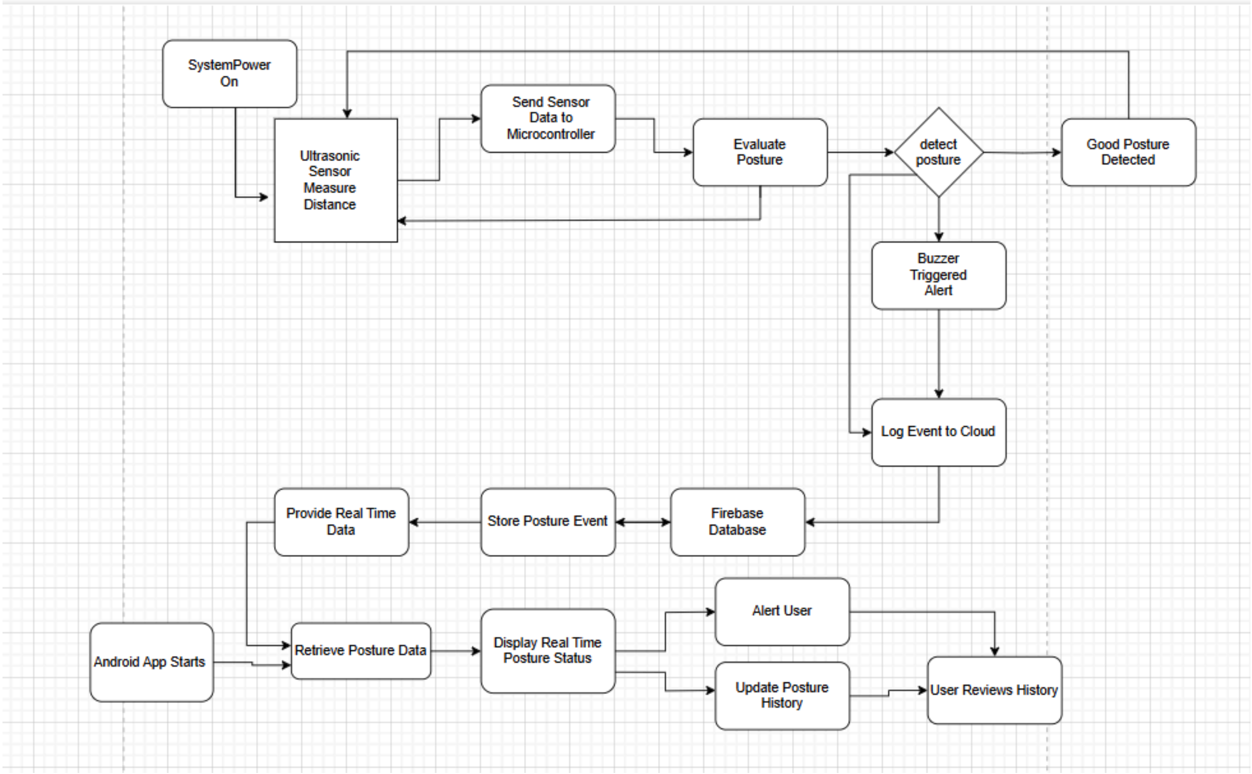
- Posture history is stored under user profiles with timestamps.

5. If prolonged bad posture is detected, ESP32 triggers buzzer + mobile app sends push notification.

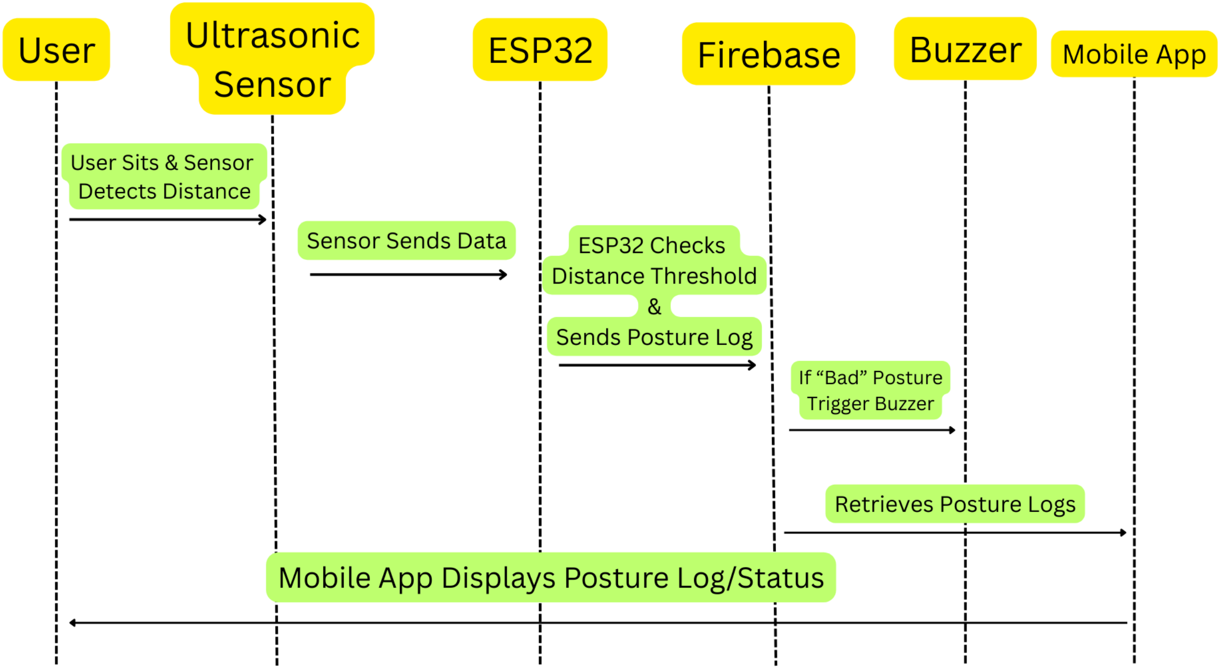
4.3. Database Structure & Security

```
"posture_logs": {

     "2025-08-19T09:30:00": { "status": "good", "distance_cm": 10 },

     "2025-08-19T09:45:00": { "status": "bad", "distance_cm": 25 },

     "2025-08-19T10:00:00": { "status": "bad", "distance_cm": 28 }

    }
```

4.4. Data Flow Diagram



5. System Diagram


User
Ultrasonic Sensor
ESP32
Firebase
Buzzer
Mobile App
User Sits & Sensor Detects Distance
Sensor Sends Data
ESP32 Checks Distance Threshold & Sends Posture Log
If "Bad" Posture Trigger Buzzer
Retrieves Posture Logs
Mobile App Displays Posture Log/Status

6. References *(APA format if applicable)*

Espressif Systems. (2023). *ESP32 Technical Reference Manual.* https://www.espressif.com/sites/default/files/documentation/esp32_technical_reference_manual_en.pdf