

## Project Summary: IoT Speaker Device Development

### Overview:

I am developing an IoT speaker device using the **Particle P2 module** for cloud connectivity and the **DFPlayer Mini** for MP3 playback. The device will play alert sounds via an external amplifier and speaker, designed for use in coffee shops to notify staff of incoming orders. This project aims to produce a reliable, easy-to-assemble, and cost-effective hardware solution, scalable for small production runs (5–100 units).

I plan to **assemble the units myself**, so the design should minimize soldering and prioritize connectors or headers where possible. Additionally, any practical deviations or optimizations to the design are welcomed, and I am open to deferring to your expertise and judgment for better solutions.

### What I Have:

#### 1. Core Components:

- Particle P2 module for cloud connectivity and control (firmware mostly developed).
- DFPlayer Mini for MP3 playback.

#### 2. Prototype:

- A breadboard prototype connecting the Particle board, DFPlayer, a basic 3W amplifier (using the DFPlayer's built-in amp), and a speaker.

#### 3. Firmware:

- Firmware is written for the Particle P2 and integrates with my cloud backend to trigger sounds based on events.

### What I Need Help With:

#### 1. Custom PCB Design:

- **Objective:** Create a custom PCB to consolidate the Particle P2, DFPlayer, amplifier, and power supply components into a compact, reliable design.
- **Requirements:**
  - Include connectors for:
    - A 6–10W speaker.
    - External power supply (see below for details).
    - Buttons for resetting and clearing Wi-Fi credentials.
    - LEDs for status indication (optional, not intrusive).
  - Integrate an external amplifier for 6–10W speaker output (not using DFPlayer's built-in 3W amp).

- Ensure stable power distribution to all components.
- Add a **u.FL connector** to allow for an optional external antenna to improve Wi-Fi reliability if needed.

## 2. Amplifier and Speaker Selection:

- **Amplifier:**
  - Choose a reliable amplifier that supports a 6–10W speaker.
  - Ensure compatibility with the DFPlayer Mini's audio output and the power supply.
- **Speaker:**
  - Select a speaker with clear sound output for noisy environments (e.g., coffee shops).
  - Match impedance (e.g., 4Ω or 8Ω) with the amplifier.

## 3. Power Supply:

- Use a **wall adapter** as the primary power source (e.g., 12V DC, 2A), with specifications matching the amplifier and overall system requirements.

## 4. Housing/Enclosure Design:

- **Objective:** Design a simple, compact enclosure to house the PCB and speaker.
- **Requirements:**
  - Form factor: A cube-like design with rounded edges, fitting within a small countertop space.
  - Material: Durable and professional-looking (e.g., plastic or similar material).
  - Features:
    - Vent or grille for the speaker.
    - Openings for power input, buttons, and optional external antenna.
    - Internal mounting for PCB and speaker.
  - Color: White or brand colors (dark blue or crema).

## 5. Assembly Considerations:

- Minimize soldering by using connectors or headers for components like the speaker, power input, and buttons.

- Ensure the design is easy to assemble, allowing for efficient integration of the PCB, speaker, and enclosure.

### **Additional Context:**

#### 1. **Self-Assembly:**

- I plan to assemble the devices myself and prioritize ease of assembly in the design. Components should use connectors or headers instead of requiring soldering wherever possible.
- The speaker should be user-replaceable, with a simple mounting mechanism to facilitate repairs or upgrades.

#### 2. **MP3 File Management:**

- MP3 files will be stored on an SD card for use with the DFPlayer Mini. The SD card slot should be accessible for file updates but protected within the enclosure to prevent accidental damage.

#### 3. **Antenna and Connectivity:**

- Add a **u.FL connector** for optional external antenna use to address potential Wi-Fi connectivity issues in noisy or signal-congested environments.

#### 4. **Functionality:**

- The system plays short MP3 audio files triggered by cloud events.
- Emphasis on loud and clear audio, not high fidelity.

#### 5.. **Target Use Case:**

- Designed for noisy environments (e.g., coffee shops) to alert staff of incoming orders.

### **Deliverables:**

1. Fully designed PCB, including schematics, Gerber files, and a Bill of Materials (BOM).
2. Component recommendations for amplifier and speaker.
3. Optional: 3D CAD design for housing/enclosure.
4. Optional: Firmware updates for integrating additional hardware components.

### **Ideal Freelancer Qualifications:**

- Experience with IoT device design, particularly using Particle modules.

- Familiarity with audio systems, including amplifiers and speaker integration.
- PCB design expertise (e.g., Altium, KiCad, Eagle).
- Optional: Experience with enclosure design and small-scale production.

**Budget and Timeline:**

- Budget: Open to discussion based on scope.
- Timeline: Targeting initial prototype within 4–6 weeks.