



Smart Music Player Project Proposal



Team Name	AURA
Category	Open

Problem Definition

Introduction

In modern lifestyles, music is a critical companion across daily activities—from home environments to workplaces and mobile settings. However, traditional music systems fail to meet the demands of today's interconnected, on-the-go users, creating friction in accessibility, control, and adaptability.

Through user observations and market analysis, 3 core limitations of conventional systems were identified:

1. **Inflexible Control** – Users rely on physical interaction with devices, restricting convenience in multi-room or remote scenarios.
2. **Fragmented Streaming** – Disjointed transitions between devices disrupt playback, and offline-only systems limit access to cloud-based content.
3. **Poor Cross-Device Synchronization** – Playlists and audio sessions cannot be seamlessly managed or synchronized across ecosystems (e.g., smartphones, smart speakers, PCs).

Problem Analysis

These limitations hinder user experiences in critical domains:

1. **Residential** – Inconvenient control and multi-room management reduce comfort in smart homes.
2. **Hospitality** – Businesses struggle to deliver synchronized, ambient audio across large spaces (e.g., hotels, restaurants).
3. **Corporate** – Offices face productivity losses due to inefficient audio systems in shared workspaces.

Root Causes for the limitations are:

1. **Technological Gaps:**
 - ❖ Legacy systems lack IoT-enabled wireless protocols (Wi-Fi 6, Bluetooth 5)
 - ❖ Absence of AI-driven automation for adaptive volume, playlist curation
2. **User Experience Flaws:**
 - ❖ No unified interface for remote or cross-device control.
 - ❖ Limited support for real-time collaboration (shared playlists).

Proposed Solution

Proposed Product- Multi Room Sound System

Our proposed solution is a Smart Music Player that combines IoT technologies with a portable, user-friendly design. The system will allow users to stream music from online services, control playback functions remotely via a web-based dashboard, and manage playlists effortlessly. Key features include:

1. **Remote Control** – Users can control the music player from any internet-enabled device using a Node-RED dashboard.
2. **Seamless Streaming** – The system will stream music or Internet radio without interruptions, ensuring a smooth listening experience.
3. **Dual Control Modes** – Users can control the player manually via physical buttons or remotely through the dashboard.
4. **Portability** – The compact design and low power consumption make the system suitable for use in various environments.

Uniqueness of the Solution

Our proposed solution differs from existing products by integrating:

1. **IoT-enabled Remote Access** – Users can manage their music from anywhere using a cloud-based dashboard.
2. **Multi-Room Audio Synchronization** – Ensures seamless playback across different spaces.
3. **AI-Powered Personalization** – The system learns user preferences to create personalized playlists.
4. **Energy-Efficient Smart Features** – Automatic volume control based on room occupancy or external noise levels.

Feature	Traditional Music Players	Smart Music Player
Local Storage Limitation	Yes	No
Remote Control Capability	No	Yes
Multi-Room Audio	No	Yes
AI-Based Customization	No	Yes
Wireless Connectivity	Limited	Yes

Technical Overview and Implementation

Technical Details

Hardware Components:

1. **Smart Speakers:** Wi-Fi-enabled speakers that communicate with the central hub for synchronized playback.
2. **Microcontroller-Based Sound Units:** Low-power microcontrollers (ESP32) for real-time processing and wireless connectivity.
3. **Audio Processing Module:** Ensures high-quality sound output, noise cancellation, and adaptive audio enhancement.
4. **Network Connectivity:**
 - ❖ Wi-Fi: Enables streaming and cloud synchronization.
 - ❖ Bluetooth: For local music playback from mobile devices.

Software Components:

1. **Cloud-Connected Web Dashboard:** Provides a centralized interface for remote control, playlist management, and real-time device monitoring.
2. **Mobile Interface:** A cross-platform mobile app allows users to control their music experience from smartphones and tablets.
3. **AI-Powered Personalization:**
 - ❖ Adaptive Volume Control: Adjusts volume based on ambient noise levels and user preferences.
 - ❖ Smart Playlists: AI-driven recommendations based on listening history and time of day.

Streaming and Multi-Room Synchronization:

1. **Cloud-Based Music Streaming:** Supports popular platforms like Spotify, Apple Music, and Internet Radio.
2. **Local Music Storage:** Allows users to stream saved files from a network-attached storage (NAS) system.
3. **Multi-Room Audio Synchronization:** Wi-Fi-Connected Smart Speakers communicate with the Snap Server, ensuring real-time synchronization.

User Scenario : A Day with Smart Music Player

Scenario: Sahan, a music enthusiast, wants a seamless and personalized multi-room audio experience throughout his day.

Morning Routine

- Sahan wakes up, and the AURA Smart Music System automatically starts playing his morning playlist at a soft volume in his bedroom.
- As he moves to the kitchen to prepare breakfast, the Dynamic Room Switching feature ensures his music follows him without interruptions.

Work Mode

- While working from his home office, Sahan switches to a focus playlist using the mobile app.
- The system adapts volume levels based on ambient noise and his preferences, ensuring a distraction-free environment.

Evening Relaxation

- Sahan hosts a small gathering, activating Zone-Based Audio Control to play upbeat music in the living room while keeping soft background music in the dining area.
- Guests can request songs via the web dashboard, allowing collaborative playlist control.

Night Mode

- As Sahan winds down, the system lowers the volume automatically based on time settings and ambient noise levels.
- Before going to bed, he switches to offline mode, ensuring music playback even if the internet connection drops.

Team Details



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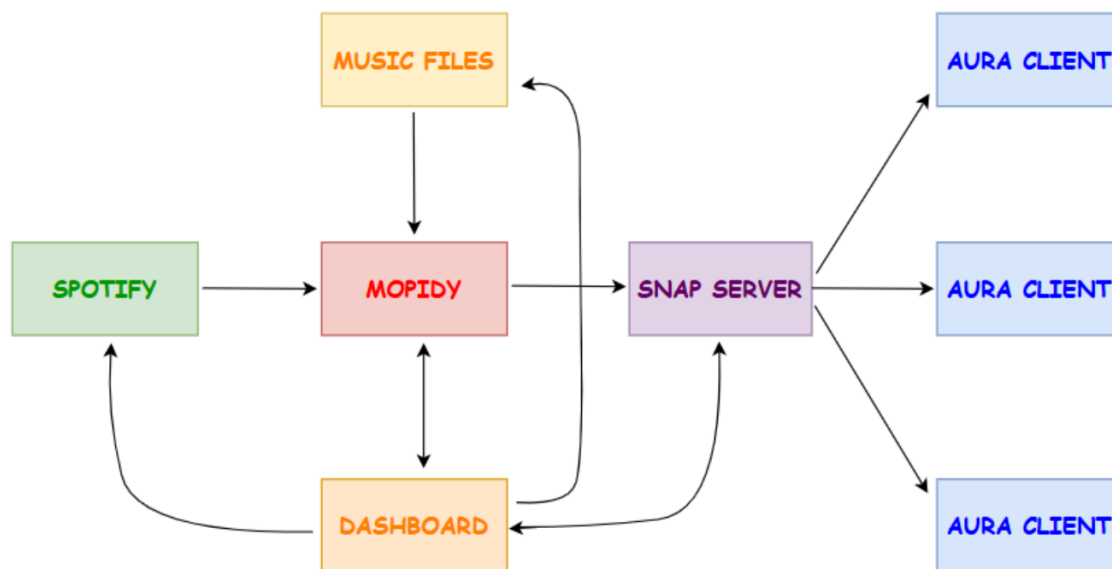
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Product Architecture



The AURA Smart Music Player follows a modular architecture that integrates multiple music sources, centralized processing, and multi-room audio distribution. The key components and their interactions are as follows:

Music Sources:

1. Spotify Integration: The system supports online streaming via Spotify. Users can control playback via a dashboard or direct commands.
2. Local Music Files: Stored music files can be accessed and played.

Mopidy (Music Server):

1. Acts as the core music server, managing playback and streaming requests.
2. Fetches music from Spotify or local files and processes user commands.
3. Communicates with the dashboard for user interaction.

Snap Server (Multi-Room Audio Distribution):

1. Receives audio streams from Mopidy and distributes them across multiple clients (rooms).
2. Ensures synchronized playback across all connected AURA Clients.
3. Works as the centralized streaming server for multi-room functionality.

Dashboard (User Interface):

1. Provides a web-based interface for users to control playback, volume, and manage playlists.
2. Interacts with both Mopidy (for music selection) and Snap Server

AURA Clients (Speakers):

1. Smart speaker clients connected to Snap Server.
2. Play the synchronized music in multiple rooms.