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1. Brief introduction __/3

This feature implements the Audio System for the Orange Ninja Game, adding an immersive layer to gameplay. The system handles all sound effects (SFX), background music (BGM), and event-triggered sounds to enhance player experience. Every key player action—such as jumping, attacking, or collecting items—has an associated sound cue, providing feedback and reinforcing the game's fast-paced and humorous tone. The background music dynamically shifts between calm exploration tracks and intense boss battle themes, maintaining excitement. Volume controls and mixing ensure a balanced audio experience across different devices and player preferences.

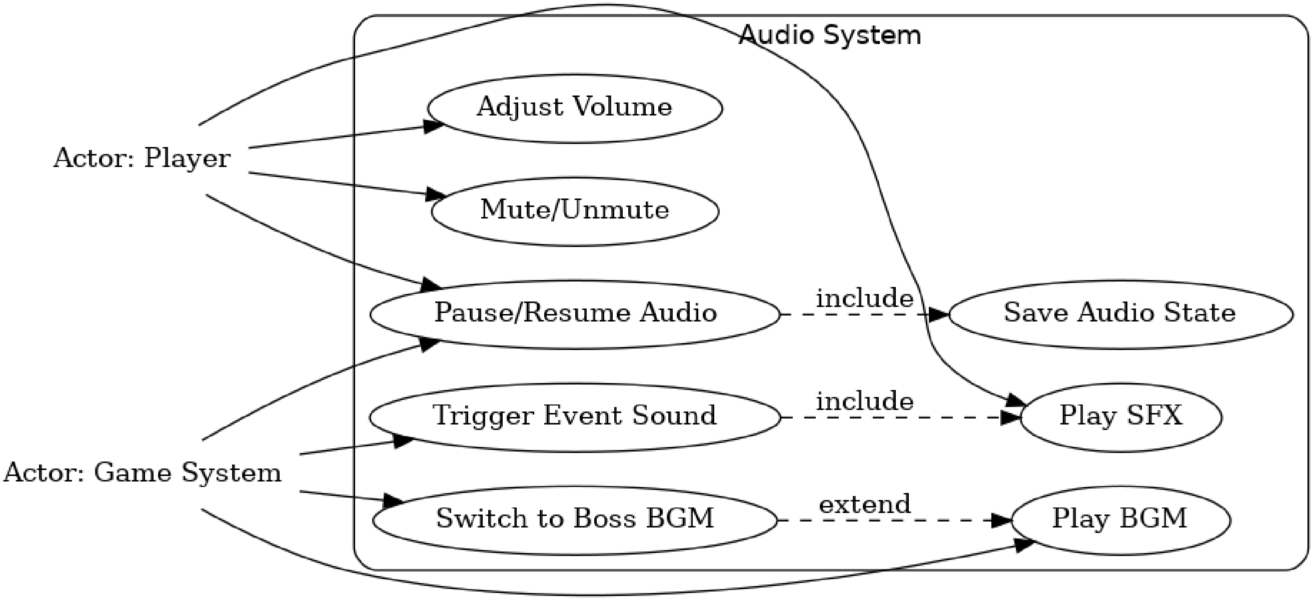
2. Use case diagram with scenario __14

Actors

- Player (primary)
- Game System (secondary)

Use Cases

- Play SFX
- Play BGM
- Adjust Volume
- Trigger Event Sound (include Play SFX)
- Switch to Boss BGM (extend Play BGM)
- Pause/Resume Audio (include Save Audio State)
- Mute/Unmute



Scenarios (one for each key use case)

2.1 Scenario: Play SFX

Summary: Play a short sound when a player or enemy event occurs.

Actors: Player, Game System

Preconditions: Audio system initialized; SFX asset mapped to event ID.

Basic Sequence:

1. Game System detects an event (e.g., player jumps, attacks, item pickup).
2. Audio System looks up SFX mapped to the event.
3. Audio System plays the SFX via mixer.

Exceptions:

- - Mapping missing → play default fallback SFX.
- - Output device unavailable → queue SFX and log error.

Postconditions: Appropriate SFX feedback produced.

Priority: 1 (must have) • **ID:** A01

2.2 Scenario: Play BGM

Summary: Start and loop background music for the current context (menu/level).

Actors: Game System

Preconditions: Context (menu/level) loaded; BGM track available.

Basic Sequence:

1. Context start event fires.
2. Audio System loads the context BGM.
3. Mixer starts playback with loop enabled.

Exceptions:

- - Track missing/corrupt → continue without BGM, log error.
- - Loop boundary pops/clicks detected → switch to seamless loop points.

Postconditions: Continuous BGM plays until context changes.

Priority: 1 (must have) • **ID:** A02

2.3 Scenario: Adjust Volume

Summary: Player changes SFX/BGM volume sliders in Settings.

Actors: Player, Game System

Preconditions: Settings menu open; mixer initialized.

Basic Sequence:

1. Player opens “Audio” settings.
2. Player moves SFX and/or BGM slider(s).
3. Audio System updates corresponding mixer bus levels in real time.
4. System persists settings to profile.

Exceptions:

- **-** Volume set to 0 → bus is muted (no output).
- - Save fails → keep changes in session memory; re-prompt later.

Postconditions: New volume levels applied and saved.

Priority: 2 (essential) • **ID:** A03

2.4 Scenario: Trigger Event Sound <<include>> Play SFX

Summary: Route a game event to its audio cue (dynamic dispatch to correct SFX).
Actors: Game System
Preconditions: Event bus active; event→SFX map exists.
Basic Sequence:

1. Event bus publishes gameplay event with parameters (type, intensity).
2. Audio System selects SFX variant (e.g., pitch/volume) based on parameters.
3. **<<include>> Play SFX** to render the chosen cue.
   Exceptions:

- **Step 2:** No variant matches → use default variant.
  Postconditions: Context-appropriate SFX plays.
  Priority: 1 (must have) • **ID:** A04

2.5 Scenario: Switch to Boss BGM <<extend>> Play BGM

Summary: On boss encounter, transition from level BGM to boss theme.
Actors: Game System
Preconditions: Boss encounter triggered; boss track available OR fallback defined.
Basic Sequence:

1. Boss start signal received.
2. Fade out current BGM over configured duration.
3. Load boss BGM track.
4. Fade in boss BGM and loop it.
   Exceptions:

- **Step 3:** Boss track unavailable → **<<extend>>** falls back to continuing current BGM.
- **Step 2:** Fade fails (latency spike) → perform immediate crossfade.
  Postconditions: Boss BGM active until boss defeated or encounter ends.
  Priority: 2 (essential) • **ID:** A05

2.6 Scenario: Pause/Resume Audio <<include>> Save Audio State

Summary: Pausing the game suspends audio; resuming restores it seamlessly.
Actors: Player, Game System
Preconditions: Active playback (SFX/BGM).
Basic Sequence:

1. Player presses Pause.
2. **<<include>> Save Audio State** (store BGM position, mixer levels, mutes).
3. Mixer suspends all buses or ducks to near-zero.
4. Player presses Resume; state is restored; playback continues.
   Exceptions:

- **Step 2:** State write error → resume with best-effort defaults (restart BGM from loop start).
  Postconditions: Audio matches pre-pause state as closely as possible.
  Priority: 2 (essential) • **ID:** A06

2.7 Scenario: Mute/Unmute

Summary: Toggle global mute quickly during gameplay.
Actors: Player

Preconditions: Mixer supports master bus mute.
Basic Sequence:

1. Player toggles mute.
2. Audio System mutes/unmutes master bus.
3. UI reflects current mute status.

Exceptions:

- **Step 2:** Hardware mute already engaged → show notice; keep UI in sync.

Postconditions: Global output matches player preference.
Priority: 3 (nice to have) • **ID:** A07

4. Data flow Diagram

The following Data Flow Diagrams show the high-level (Level 0) and detailed (Level 1) structure of the Audio System.

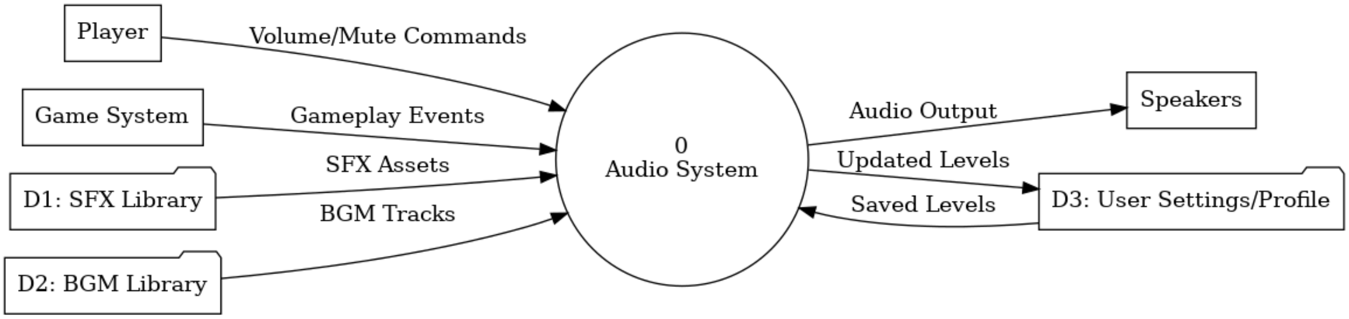
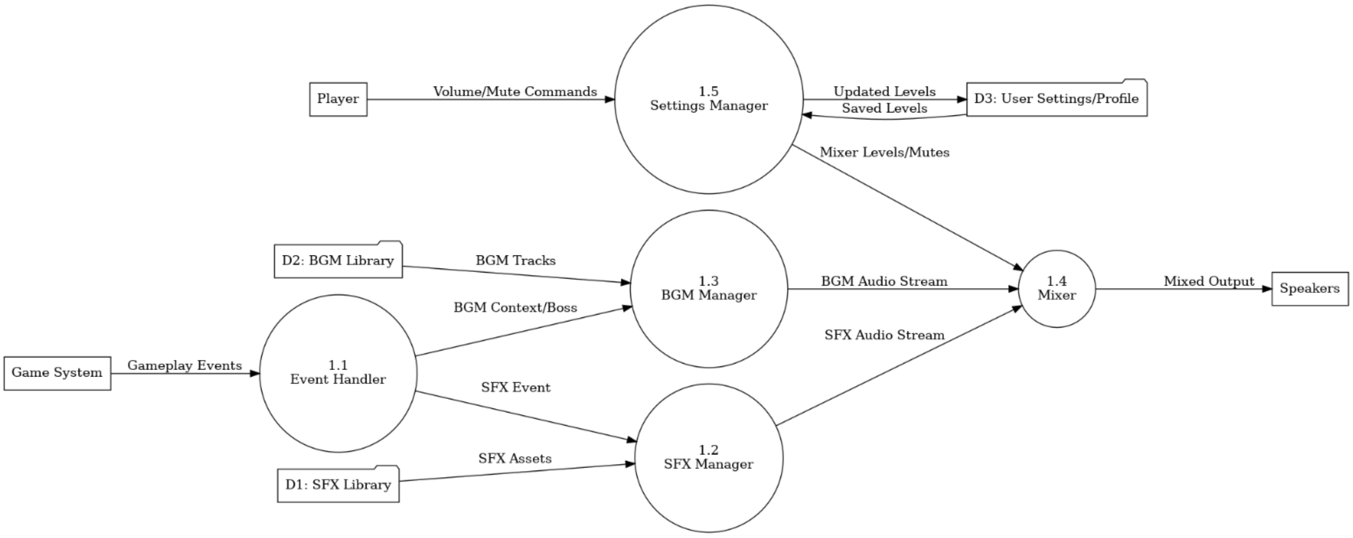


Diagram 1 (Detailed Decomposition):



Acceptance Tests ______9

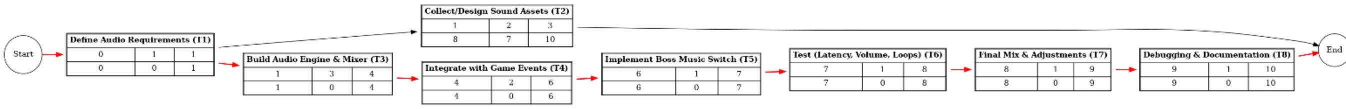
Test	Input/Steps	Expected Output
1 -Jump SFX	Press Jump key once	Jump SFX plays instantly(<=50 ms delay)
2 -Attack Spam	Press Attack 10x quickly	10 distinct attack sounds, no drops
3 – Item Pickup	Collect 3 items in 200 ms	3 overlapping pickup sounds play
4-Level BGM	Load Level 1	Level music starts looping in ≤0.5 s
5 – Pause/Resume	Pause at 01:23, wait 2s, resume	Music resumes from same spot.
6 – Volume Adjust	Set SFX=30%, BGM=70%	Mixer reflects new levels, saved
7 – Mute Toggle	Toggle Mute ON/OFF	Output silences and restores
8 – Missing Asset	Trigger sound that doesn't exist	Fallback sound plays, log warning
9 – Boss Switch	Trigger boss event mid-level	Crossfade to boss BGM, no silence

5. Timeline ________/10

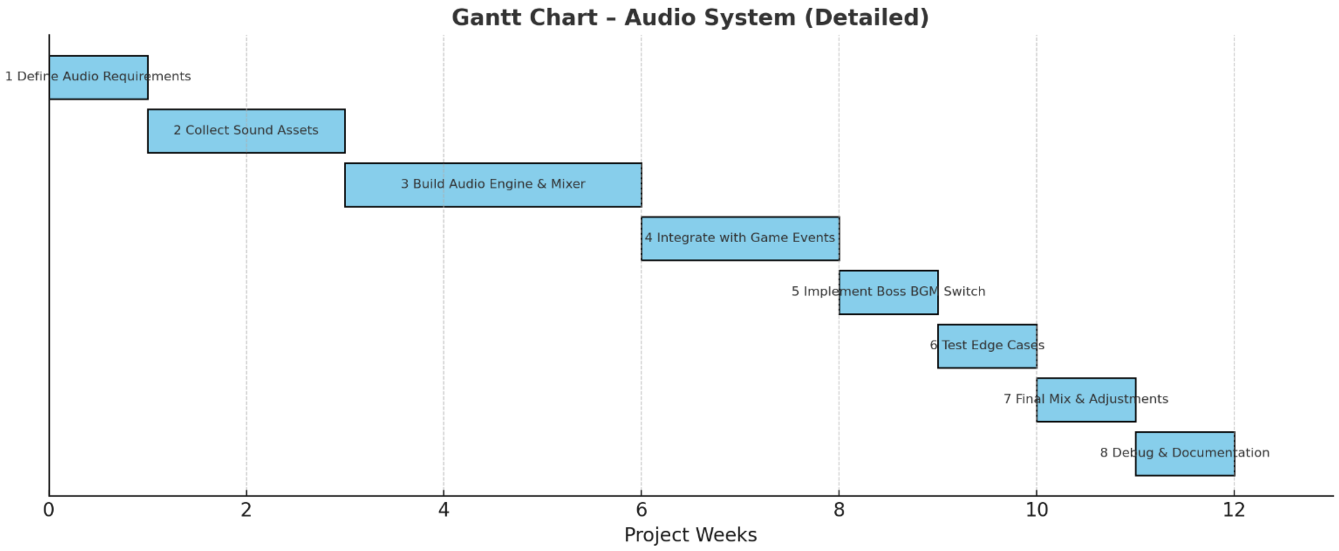
Task	Duration (PWks)	Predecessor Task(s)
1. Define Audio Requirements	1	-

2. Collect/Design Sound Assets	2	1
3 Build Audio Engine & Mixer	3	1
4.Integrate with Game Events	2	3
5. Implement Boss Music Switch	1	4
6. Test(Latency, Volume, Loops)	1	5
7. Final Mix&Adjustments	1	6
8. Debugging & Documentation	1	7

Pert Chart


Start
Define Audio Requirements (T1)
0 1 1
0 0 1
Collect/Design Sound Assets (T2)
1 2 3
8 7 10
Build Audio Engine & Mixer (T3)
1 3 4
1 0 4
Integrate with Game Events (T4)
4 2 6
4 0 6
Implement Boss Music Switch (T5)
6 1 7
6 0 7
Test (Latency, Volume, Loops) (T6)
7 1 8
7 0 8
Final Mix & Adjustments (T7)
8 1 9
8 0 9
Debugging & Documentation (T8)
9 1 10
9 0 10
End

Gantt timeline


Gantt Chart – Audio System (Detailed)
1 Define Audio Requirements
2 Collect Sound Assets
3 Build Audio Engine & Mixer
4 Integrate with Game Events
5 Implement Boss BGM Switch
6 Test Edge Cases
7 Final Mix & Adjustments
8 Debug & Documentation
Project Weeks