Software Engineering Department
ORT Braude College

Capstone Project Phase B – 61998

Musical minds - educational Music game for children

25-1-D-7

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https://github.com/netanelfar/MusicalMinds

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Abstract

Musical Minds is an educational game developed to enhance cognitive and auditory development in children aged 5–10 through fun, interactive music-based activities. Designed using the Unity engine, the game runs on both PC and mobile platforms and supports input from both physical MIDI keyboards and an on-screen virtual piano.
Players start by learning simple note recognition and gradually progress to playing full melodies, all within a child-friendly 2D environment. The game avoids overstimulating visuals and addictive mechanics, instead offering age-appropriate graphics and gameplay. A built-in scoring and progress tracking system allows parents to monitor their child's development in a safe and constructive digital space.
By transforming traditional music learning into an engaging experience, Musical Minds encourages consistent practice, improves musical perception, and supports a healthier approach to screen time. The project was developed by final-year software engineering students under the guidance of PhD. Sulamy Moshe.

Introduction

Musical Minds is an interactive educational system designed to develop musical hearing in children through a structured yet playful experience. Aimed at children aged 5 to 10, the game focuses on note recognition—the ability to hear a pitch and identify its position on a piano keyboard. This is a foundational auditory skill that supports broader musical and cognitive development, including memory, attention, and auditory processing.
The game is implemented in Unity, using a 2D environment compatible with both PC and mobile platforms. It supports MIDI keyboard input, allowing children to interact with real musical hardware while receiving feedback from the software in real time.
The learning process is divided into three game modes:

1. Free Play – encouraging exploration of sound and keyboard layout

2. Note Recognition – offering randomized tone-matching challenges

3. Follow the Song – training short-term musical memory through imitation of real melodies

These modes combine repetition, pattern recognition, and real-time feedback to support musical ear development without overwhelming the learner. The system rewards successful answers and provides hints or retries on failure.
From a software engineering perspective, the project uses a modular architecture, separating logic into major domains: audio handling, UI, game rules, and input interpretation. This approach enabled rapid prototyping, easier debugging, and future extensibility.
The primary target audience is children at the early stages of musical exploration—either independently or within school environments. Secondary users include parents and educators, who can use the system as a supportive tool to reinforce auditory learning.
Retrospective Note:
Compared to Phase A, this version of the system maintained all major planned elements, but we chose to simplify the visual and UX layers to better accommodate mobile screens and performance limitations. Additionally, while we originally considered including a parent dashboard, we narrowed the scope to focus on direct child feedback through scoring and visual cues.

Related Work

Integration of Gamification and Multimedia in Musical Minds

The design of Musical Minds was strongly influenced by research demonstrating the educational benefits of gamification and multimedia tools in music instruction. Studies have consistently shown that incorporating visual and auditory elements enhances student motivation, engagement, and preparation. For example, multimedia-enhanced classrooms have reported an 83% lesson preparation rate compared to only 32% in traditional learning settings (González-Peiteado & Rodríguez-López, 2021). These findings guided our choice to use colorful visuals, simple animations, and responsive sound cues throughout the game.

Gamification principles were applied most directly in the Sound Recognition mode, where children match played tones to the correct key. Based on research suggesting that real-time feedback and difficulty scaling promote deeper engagement and "flow states" (Hernández-de-Menéndez et al., 2020; Csikszentmihalyi, 1990), this mode features three difficulty levels and immediate performance indicators (e.g., red/green arrows and success sounds). These mechanisms support incremental learning and maintain motivation by clearly signaling progress and encouraging retry behavior.

The decision to support both a virtual on-screen piano and MIDI keyboard input was influenced by studies emphasizing the importance of accessibility and hardware flexibility in increasing practice frequency (Tobias & Fletcher, 2011). This also ensures compatibility across both PC and mobile devices, making the game usable in home, classroom, or music studio environments.

From a UI/UX perspective, we followed multimedia learning guidelines for young users by implementing large, touch-friendly buttons, minimal text, and a clean layout. These design choices reduce cognitive load and help children stay focused on the musical interaction (Mayer, 2009).

The scoring system—based on star ratings and progression indicators—was inspired by gamified learning environments shown to improve self-assessment and engagement (Flores et al., 2016). Although we originally considered a detailed parent dashboard, we refined the system to focus on child-friendly feedback. This promotes independent play while still allowing parents to observe progress visually.

In summary, Musical Minds uses gamification selectively—most prominently in the Sound Recognition mode—to create an engaging, age-appropriate, and educational experience. Multimedia elements and flexible interaction formats further support accessibility, motivation, and consistent musical practice.

Supporting Child Development Through Music-Based Interaction

The educational framework of Musical Minds is grounded in well-established research on the cognitive, motor, and emotional benefits of music education in early childhood. Studies have shown that structured musical activities, particularly piano training, support the development of attention, auditory processing, memory, and fine motor coordination (Li & Li, 2020; Coffey et al., 2017). These insights informed our decision to focus the game's core mechanics on structured musical ear training, built around sound recognition and imitation tasks.

To support cognitive growth, Musical Minds emphasizes repetition and immediate feedback, helping children internalize musical patterns while strengthening their listening and memory skills. The Sound Recognition mode repeatedly exposes players to tone groups, building auditory associations through interaction. This approach aligns with neurological research showing that repeated musical exposure strengthens synaptic connections in areas related to language and auditory comprehension (Weinberger, 2004; Dubas et al., 2022).
In the Melody Replay mode, where children are asked to imitate short melodies by ear, we deliberately divided each melody into blocks of three notes. This design choice was made to reduce cognitive load and enhance short-term auditory memory. By presenting small, manageable musical units, we allow children to focus on pitch accuracy and sequencing without being overwhelmed. This method is consistent with educational research on working memory capacity in children, which emphasizes the importance of chunking information for more effective learning (Baddeley, 2003). It also allows for faster error recovery, as children can retry only the last block rather than the entire melody, increasing confidence and reinforcing partial successes.

Emotional and social development were also considered during design. Music has been shown to enhance emotional regulation, empathy, and social understanding in children by stimulating brain regions involved in emotion processing and social cue recognition (Koelsch, 2010; Trainor, 2005). In response to this, we introduced celebratory sound effects, positive animations, and a light narrative tone to reinforce success and encourage emotional connection to the activity.

Creativity and confidence were further supported through the Free Play mode, which offers children a safe space to explore sounds without rules or penalties. This mode was inspired by informal learning theories that emphasize autonomy, experimentation, and playful discovery as drivers of long-term engagement and self-expression (Green, 2008).

While the original scope included a parent dashboard, we pivoted to prioritize in-game visual feedback that supports both independent play and parental observation. This decision was reinforced by child development experts who highlighted the value of light-touch parental involvement—such as encouragement and observation—over direct intervention at early developmental stages.

Overall, Musical Minds was designed to nurture cognitive, emotional, and motor development through accessible, playful, and structured musical interaction. The resulting experience aligns with research advocating for emotionally supportive, musically rich learning environments in early childhood education.

Applying Proven Musical Ear Training Methods

Musical ear training is central to the design of Musical Minds, and several evidence-based strategies were deliberately implemented to support auditory skill development in children. Research in music pedagogy emphasizes that learning by ear—hearing and reproducing sounds before reading notation—strengthens auditory-motor connections, tonal memory, and rhythm accuracy (Woody, 2000). Accordingly, Musical Minds avoids traditional sheet music and instead introduces musical concepts through guided listening, imitation, and interactive sound matching.

The Sound Recognition mode directly applies the principle of repetition and immersion, where players are repeatedly exposed to a fixed set of tones within a level. This allows for pattern reinforcement and gradual internalization of pitch relationships. Feedback is immediate and non-punitive, allowing players to retry until the correct association is made. This aligns with research suggesting that auditory discrimination skills improve significantly when learners are encouraged to explore errors and self-correct in real time (Hanna-Pladdy & Mackay, 2011).

The Melody Replay mode—focused on short-term auditory memory—follows a structured progression where melodies are broken into three-note blocks. This method, inspired by the cognitive strategy of "chunking," is known to reduce memory load while improving retention and sequencing accuracy (Baddeley, 2003). By allowing children to hear, store, and reproduce manageable melodic fragments, the game supports gradual skill acquisition while maintaining playability and attention.

We also incorporated elements of informal learning, such as auditory imitation, playful trial-and-error, and exploration without penalty. These are strategies often observed in natural learning environments and shown to foster creativity and internal motivation (Green, 2008). For example, Free Play mode allows children to experiment with both virtual and MIDI keyboards, encouraging intuitive sound exploration and reinforcing tonal memory in a low-pressure setting.

In addition, the interface avoids overwhelming visuals or notational systems, supporting a core aural-first philosophy. This is consistent with early music education frameworks that prioritize listening and sound reproduction over visual decoding, especially for children in early developmental stages (Gordon, 1997).

Finally, gamified feedback mechanisms—such as colored arrows, happy sounds, and encouraging animations—serve a dual purpose: they enhance enjoyment while reinforcing pitch recognition and timing accuracy. This approach reflects research indicating that positive reinforcement in aural training improves both persistence and musical accuracy (Persellin, 2002).

In summary, Musical Minds integrates established ear training methods by centering on listening, imitation, and playful repetition. These elements work together to build auditory skills foundational to broader musical fluency, while maintaining an age-appropriate and engaging user experience.

Research and Development

We began our development by conducting market research on top-rated music education apps (e.g., Simply Piano, Yousician) to understand common features, UX standards, and technical gaps. We found that most apps prioritize technique over listening and rarely target children directly. This led us to emphasize note recognition and musical exploration over formal training.

Our educational approach was guided by consultation with a child development specialist (a family member with a master's degree) and our academic advisor. Together, we reviewed literature on gamification, auditory development, and informal learning techniques. These insights led us to design a system focused on repetition, imitation, and playful discovery rather than notation or structured lessons.

We started development with Free Play mode, which acted as both a functional demo and a testbed for keyboard interaction and audio playback. From there, we implemented two structured game modes. One team member worked primarily on audio, MIDI support, and logic implementation, while the other focused on UI, layout, visual design, and documentation. This division was influenced by technical constraints, particularly with source control.

We used Unity 2022.3.45f1, with Visual Studio for scripting and GitHub for version control. After initial problems using Unity Cloud, we attempted a split-repository strategy for managing the project but eventually accepted a more centralized workflow. Additional tools included:

- Figma for UI prototyping
- Visual Paradigm for system modeling
- Canva for design and presentation materials
- Unity Asset Store for UI packs and audio samples

Weekly internal syncs and bi-weekly meetings with our advisor helped ensure consistent progress and gave us a chance to adjust based on feedback.

Retrospective Note:

Our original plan in Phase A included structured performance tracking, automated Unity tests, and a parent monitoring system. Due to time and workload constraints, we scaled back these features and focused on gameplay quality and educational effectiveness instead. Despite this, the core research-informed design process was carried out as planned.

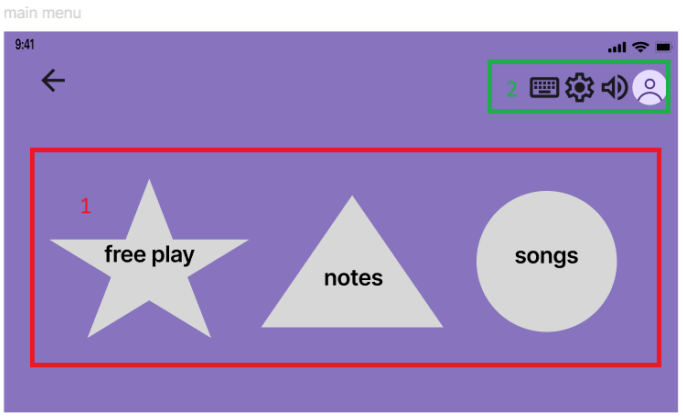
UI prototype

The user interface (UI) design of Musical Minds was developed with a focus on accessibility, clarity, and age-appropriate interaction. Our goal was to create an environment where young children could navigate the game independently, while also providing settings and controls accessible to their parents.

Main Menu

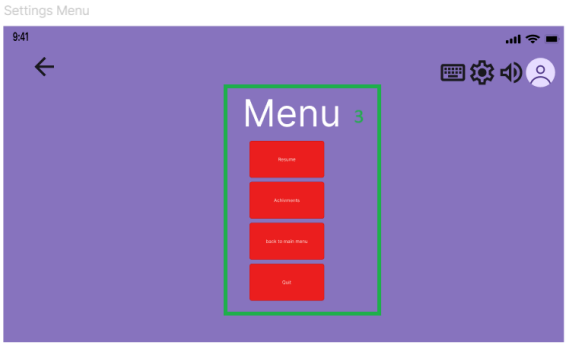
Our vision for the main menu was to create an interface that is simple, visually engaging, and accessible even to children who may struggle with reading. As shown in the figure, the area marked with the number (1) represents the game modes. Each mode is displayed using a distinct visual symbol, allowing children to identify their preferred mode based on experience rather than relying on text. This design supports intuitive navigation: after playing a few times, children can select their desired game mode quickly and independently, without needing to read the title. This approach reinforces our overall design philosophy — prioritizing clarity, accessibility, and ease of use for a young target audience.

The area marked as (2) in the figure was designed with a different target audience in mind — the parents. Unlike the game modes, which prioritize ease of access for children, this section is intentionally less intuitive for younger users. It contains settings such as keyboard size, general system preferences, volume controls, and user profile management. The idea was to allow parents to configure the system once, creating an environment tailored to their child's needs. By making this section slightly less prominent and less visually appealing to children, we aimed to reduce the likelihood of unintended changes by the child and ensure a more consistent experience during gameplay.



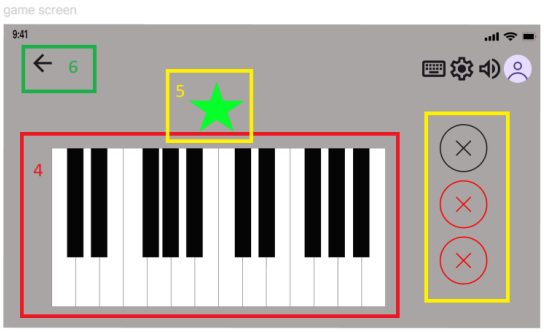
Settings Menu

In the next screen, we present our initial concept for the settings menu. This menu was designed to provide access to non-gameplay features such as system preferences and general controls. As shown in the area marked (3) in the following figure, we envisioned a simple layout with buttons for Achievements, General Settings, Return to Main Menu, and Quit Game. These options are grouped together to offer parents and more advanced users a clear way to manage the game environment without interfering with the child's core gameplay experience. The layout prioritizes clarity and functionality while maintaining a visual consistency with the rest of the UI.



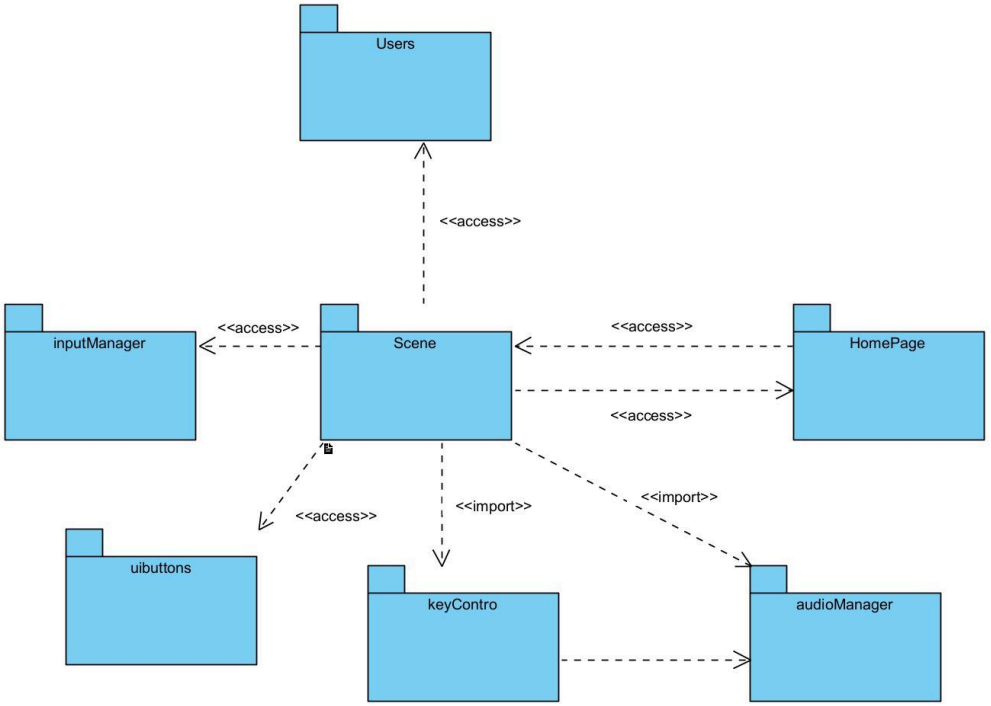
Game Screen

In the game screen, several key features were designed to support accessibility, usability, and progress tracking. The red square labeled (4) represents the virtual keyboard, which allows players to participate even if they do not have access to a physical MIDI keyboard. This keyboard can be dynamically switched between three sizes — 3, 4, or 5 octaves — depending on the player's preference or screen size. The yellow area labeled (5) shows the level progress indicator, enabling the player to visually track their advancement through the current exercise or song. Finally, the green area marked (6) contains the return button, which is consistently displayed on all screens and provides an easy way for the user to return to the previous menu or interface. This consistency reinforces intuitive navigation throughout the system.

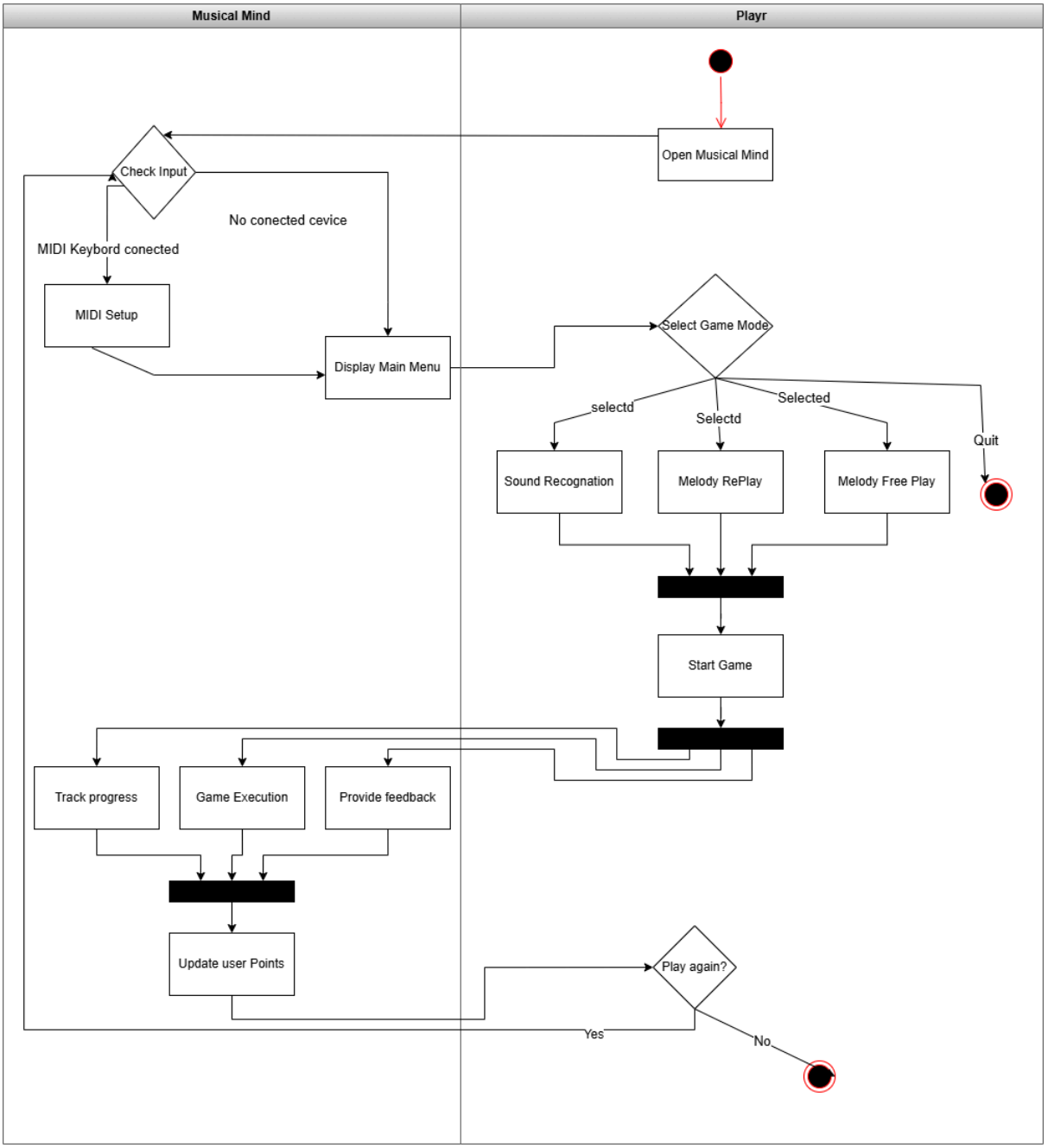


Project Review and Process Description

Package digram



Activity digram



Game Screens

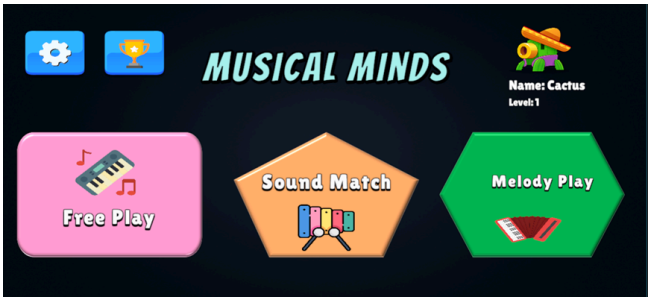
Main menu

In the screen below, we simplified the icons and navigation buttons to create a clean and intuitive interface. Our goal was to make the design visually distinct without overwhelming young users. Each mode is represented with bright colors and recognizable symbols to support independent navigation and enhance engagement.

- Free Play allows children to explore the virtual piano freely, encouraging creativity and familiarization with the notes.

- Sound Match is a listening-based game where players identify and match sounds to the correct keys, strengthening auditory skills.

- Melody Play challenges players to reproduce short melodies, helping develop musical memory and pitch recognition.



Settings(main menu)

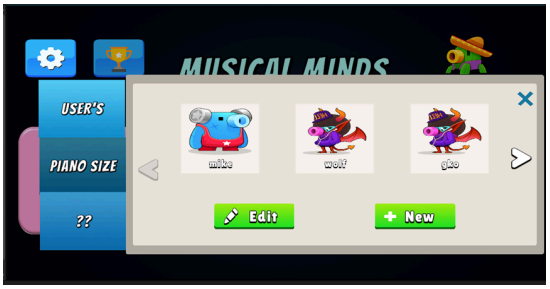
The following two screens show the settings accessible from the main menu. Users can manage their profiles by creating, editing, or selecting from existing ones, each represented by a fun character avatar. This supports personalized experiences for multiple players on the same device.

Players can also choose their preferred keyboard size — 3, 4, or 5 octaves — to match their screen space or the size of a connected physical MIDI keyboard. This helps accommodate different play styles and user needs.

Once again, we used large, clearly labeled buttons for the main interactive settings to support independent use by children. The layout is simple and straightforward to reduce cognitive load and prevent confusion. Button size and spacing were chosen to accommodate younger children's fine motor skills and ensure accessibility on touch screens.

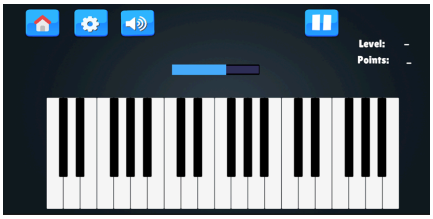
We prioritized a limited number of key settings and grouped them visually and spatially to prevent accidental interactions. This focused approach gives young players a sense of control while maintaining clarity and ease of use.

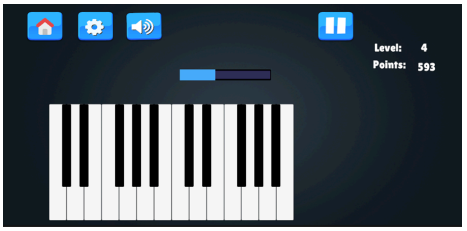
From a technical standpoint, the system supports local persistence, so selected users and keyboard sizes are retained between sessions, improving usability and consistency.
The third settings button is currently reserved for future features and is not yet implemented. We plan to expand the menu.

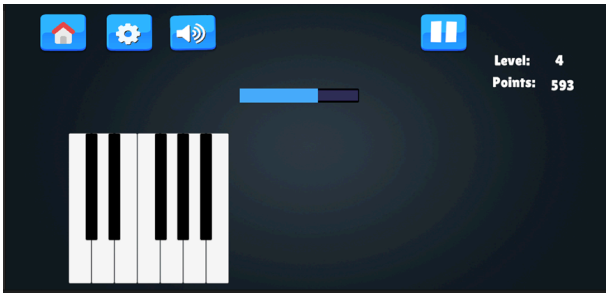


Game mods screens

Keyboard size options:

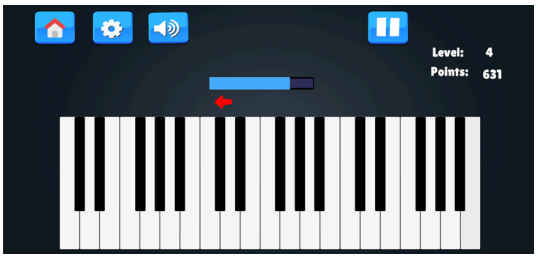


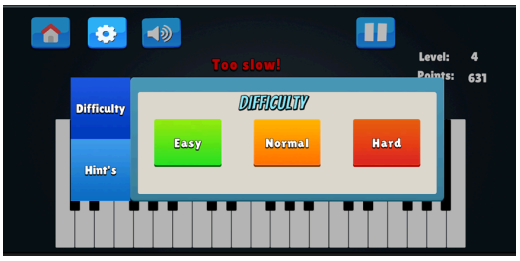


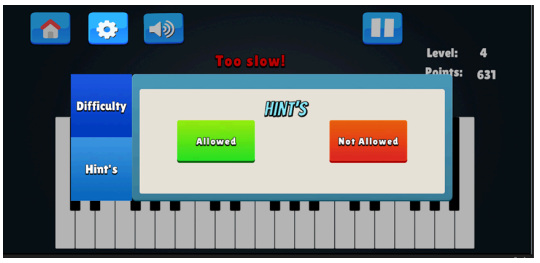


Sound match \ Note recognition

In this game mode, we focused on keeping the screen as clean and distraction-free as possible, allowing children to concentrate fully on listening and responding. All key elements — such as the timer and feedback — are placed in consistent, easily noticeable locations so children learn where to look without needing to search the screen.
Players hear a sound and must identify the correct key on the piano. If hints are enabled, a colored arrow (green or red) appears to guide the player by indicating how close their guess was to the correct note — offering meaningful feedback without revealing the answer outright.
The game includes three difficulty levels (Easy, Normal, Hard), each adjusting the speed, complexity, and margin for error to match a wide range of skill levels. These options help children progress at their own pace.
At the end of each round, players receive a performance summary, including how many notes they correctly identified and the points earned. This immediate feedback reinforces learning and motivates improvement.

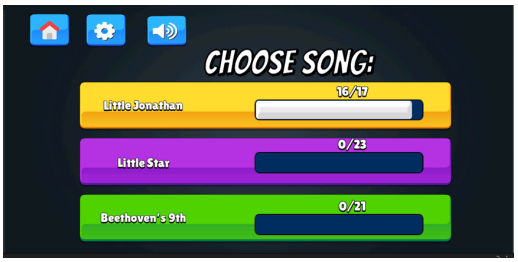


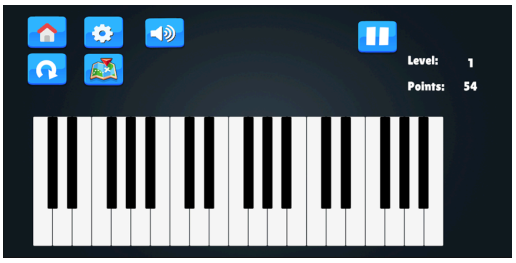


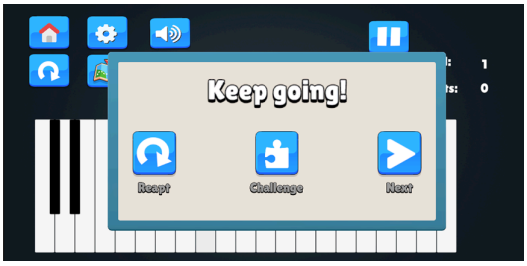


Melody play

In this game mode, each level introduces three new notes from the target melody. This gradual progression helps players build confidence and recognize patterns in the music. After successfully completing a level, players unlock a challenge mode, where they can attempt to play the entire song from the beginning up to the point they've reached. This encourages repetition, memory reinforcement, and a sense of accomplishment as the full melody comes together step by step.







Challenges

From both a technical and project-management perspective, Musical Minds presented several notable challenges:

1. Modular Piano Layout
   Designing a dynamic piano system that could adjust the number of octaves while maintaining a fixed layout and spacing was complex. It required custom UI logic and coordinate calculations to ensure consistent alignment and note mapping across different screen sizes.

2. MIDI Input Handling
   MIDI support had to provide low-latency, real-time detection of external keyboard presses. We used open-source libraries to intercept MIDI signals and integrated them with Unity's input system. Maintaining smooth feedback and visual synchronization under limited hardware resources was especially tricky on mobile devices.

3. Designing for Children
   Creating a UI and UX suitable for young learners was more difficult than expected. Iterations were needed to simplify visual clutter, reduce cognitive load, and calibrate challenge levels. We refined interface elements based on feedback from our child development consultant and advisor.

4. Source Control
   Unity Cloud was not an option due to cost and limitations. GitHub also proved problematic, especially when syncing scene files. This limited collaboration and forced a division of responsibilities that placed more technical work on one team member.

5. Health-Related Delay
   One team member was unable to participate for about a month, which required us to re-prioritize features and rely on pre-sprint work that was done ahead of the semester.

Retrospective Note:
The challenges we anticipated in Phase A (real-time input, limited testing access, Unity complexity) all materialized. However, we successfully worked around them by starting early, simplifying scope, and adjusting our collaboration methods.

Lessons Learned

Throughout the development of *Musical Minds*, we encountered both expected and unexpected challenges that shaped the final outcome of the project and taught us valuable lessons about software design, educational technology, and team collaboration.

First, we learned that **building educational software requires a different mindset than building entertainment-focused games**. While a game aims primarily to be fun, an educational system must balance engagement with pedagogical value. We spent considerable effort refining our reward mechanics and progression pacing to keep children motivated without undermining the learning process. Iterating on feedback from our child development advisor helped us better understand the cognitive limits and needs of young learners, especially in regard to attention span, frustration tolerance, and visual clarity.

Second, we realized that **early technical decisions have long-term effects**. Our choice to use Unity was the right one in terms of flexibility and support, but we underestimated the impact of Unity's scene management and file structures on collaborative development. Source control using Git proved difficult, and Unity Cloud was not a viable option. This created a bottleneck in our workflow and placed an uneven burden on one team member. In hindsight, we would have researched Unity-specific source control tools earlier and structured our collaboration around safer division of responsibilities.

Finally, on a project management level, we saw how **early planning helped us adapt to real-world disruptions**. When one team member was temporarily unavailable for health reasons, we were able to continue development by relying on pre-existing timelines and clear separation of tasks. However, we also recognized the importance of building in more flexible testing strategies and backup plans when working in a limited timeframe.

In summary, we learned the value of **clear roles**, **user-informed design**, and **adaptability** — lessons that will apply well beyond this specific project.

Project Metrics and Success Criteria

At the start of the project, we defined several criteria to evaluate the success of Musical Minds. These were drawn from our Phase A proposal and refined through discussions with our advisor. Below is an assessment of how well the final product met those metrics:

Metric	Goal	Achieved?	Notes
Note recognition gameplay	Accurate, progressive, and engaging	✅	Fully implemented in both random note and melody modes
MIDI keyboard integration	Real-time input with feedback	✅	Successfully supports external MIDI devices
Free play mode	Open-ended interaction for exploration	✅	Available on both PC and mobile versions
Educational value	Reinforce auditory development in children	✅	Design guided by child development advisor and literature
Fun and child-friendly design	Simple, colorful, intuitive	✅	Received positive advisor feedback, adjusted per suggestions
Visual/audio feedback	Immediate response to input	✅	Supported in all modes
Parent monitoring tools	Track progress over time	❌	Originally planned, dropped due to time constraints
Cross-platform performance	PC and mobile compatibility	✅	Tested successfully on both platforms
Automated testing	Implement Unity test scripts	❌	Not implemented; relied on manual testing

Conclusion:

The project met 7 out of 9 success criteria. Two criteria — parent tracking and automated testing — were re-scoped out due to time and resource constraints, a tradeoff we made to ensure higher quality in the core learning experience. Overall, we consider the project a successful fulfillment of our original educational and technical objectives.

Results and Conclusions

Musical Minds achieved its most important goals:

- Delivering an educational tool for developing musical hearing
- Supporting MIDI keyboards with real-time feedback
- Running smoothly across PC and mobile platforms
- Providing a balance of fun and structured learning

While we did not implement formal user testing, the game was evaluated by our professor and advisor throughout development. Their feedback led to multiple design revisions, including simplified menus, more intuitive visual cues, and adjusted pacing to match attention spans.

Our technical decisions proved effective. Unity allowed us to iterate quickly, and the use of audio samples provided accurate playback for glissando and note sequencing. Visual adjustments and memory-efficient layout choices helped us optimize the mobile version without compromising gameplay.

One of our biggest takeaways was the importance of pedagogical grounding in game design. Making a game is not the same as making an educational tool: the former focuses on fun, while the latter must provide value. The challenge is doing both—and we believe we succeeded.

Retrospective Note:

While we initially hoped to expand the system further (e.g., parent dashboard, full analytics, multiple profiles), we prioritized educational quality and playability. Based on user feedback, stable implementation, and our own learning process, we consider the project a success.

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Maintenance Guide

This guide outlines the complete process for setting up, running, and maintaining the *Musical Minds* educational game project. It is intended to help future developers and maintainers work effectively with the project's structure, tools, and components.

System Requirements and Tools

Before working on the project, ensure the following software is installed:

- Unity Hub – Download from https://unity.com/download
- Unity Editor (version 2022.3.45f1) – Install this specific version through Unity Hub.
- Git – (Optional but recommended) for version control and branching.
- A GitHub account (if collaborating or pushing changes back to the repo).

Project Setup (First-Time Installation)

1. Create a New Unity Project:
    - Open Unity Hub
    - Click "New Project"
    - Select "2D (Built-in Render Pipeline)"
    - Name the project (e.g., MusicalMinds)
    - Choose a location for the project folder
    - Click "Create Project"
    - Once Unity finishes creating the project, close it
2. Download the Game Assets and Settings:
    - Go to: https://github.com/netanelfar/MusicalMinds
    - Download the project via ZIP or use git clone from the main branch
    - Locate the following folders in the downloaded content:
        - Assets/
        - ProjectSettings/
3. Replace the Project Folders:
    - Navigate to your newly created Unity project folder
    - Ensure Unity is fully closed before replacing the folders to avoid conflicts
    - Replace the existing Assets/ and ProjectSettings/ folders with the ones you downloaded
4. Open the Updated Project:
    - Open Unity Hub again
    - Select the project you just updated
    - Unity might reimport assets on first load — wait until it completes

Run the Game

- In the Project window, open:
    - Assets/Scenes/HomePage.unity
- Click the Play button in the Unity Editor
- The game should start at the main menu and allow interaction through:
    - Mouse and keyboard
    - MIDI keyboard (if connected)

Project Folder Structure

The project uses a modular Unity folder structure for clarity and maintainability.

```
Assets/
├── bangers/                # Sound effects and background music
├── NonFreeUI/
│   └── Layer Lab/          # External UI assets
├── Packages/
│   └── MidiJack-master/    # MIDI input plugin
├── prefab/
│   └── MelodyPlayPrefabs/  # Melody Replay mode prefabs
├── Scenes/                 # All game scenes (MainMenu, Game Modes)
├── Scripts/
│   ├── FreePlay/           # Logic for Free Play mode
│   ├── HomePage/           # Main menu behaviors
│   ├── Melody Play/        # Logic for Melody Replay
│   ├── NoteRegonttion/     # Sound Recognition logic
│   ├── Scoring/            # Score tracking and feedback
│   ├── UIButtons/          # Button scripts and UI control
│   └── Users/              # Local user profile data
├── Simple UI/              # Generic UI elements
├── TEMPsceneUI/            # Temporary UI for development
├── TextMesh Pro/           # Text rendering system
└── unityuipackges/         # Custom UI modules
```

Core Scenes and Components

Scenes

- HomePage – Entry point for the game
- FreePlay – Open-ended play with MIDI/virtual keyboard
- SoundRecognition – Tonal matching with gamified feedback
- MelodyReplay – Memory-based imitation of short melodies

Key Prefabs

The key Prefabs that are sheared between all the game scenes are:

- KeyControl - Manages key presses and links them to note playback
- AudioManager - Controls audio playback for key sounds and effects
- InPutManager - Handles input from both keyboard and MIDI
- Piano - Visual representation of the piano keyboard

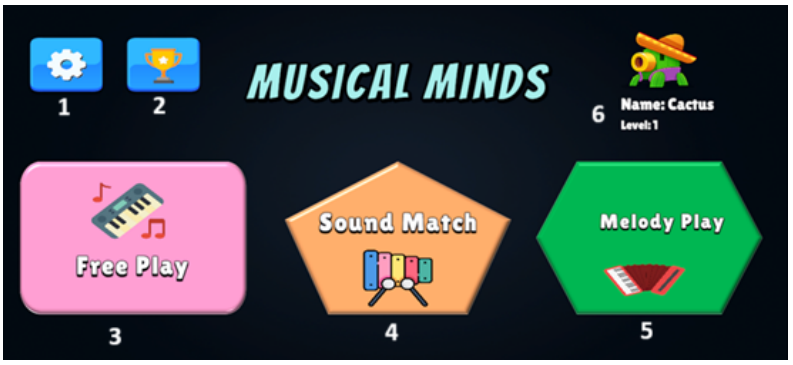
Git Branching (For Making Changes)

To safely make modifications or add new features:

1. Ensure you're working on the latest version of the main branch
    - git checkout main
    - git pull origin main
2. Create a new branch for your changes:
    - git checkout -b feature/your-feature-name
3. Work on your changes freely. When you're ready:
    - Stage and commit your changes
    - Push your branch
    - Create a Pull Request to merge it into main

User Manual – Musical Minds

Home Page



The **Home Page** is the central hub of *Musical Minds*, where players can select game modes, access settings, and manage profiles.

Each element on the screen is labeled below for easy reference:

1.Settings Button

Tap to open the **Settings Menu**, where you can:

- Manage user profiles
- Choose piano size
- Access future advanced options

➡️ *See "Settings Menu" section for full details.*

2. Achievements Button

View your earned trophies and accomplishments.
Achievements help track progress and reward learning milestones.

3. Free Play

Open-ended mode where players can explore the piano freely.
Ideal for creativity and familiarization with keyboard layout.

4. Sound Match

A musical memory game where players listen to a note and try to match it.
This mode strengthens ear training and note recognition skills.

5. Melody Play

Follow guided melodies to play full songs.
Encourages musical memory, timing, and hand coordination.

6. Profile Display

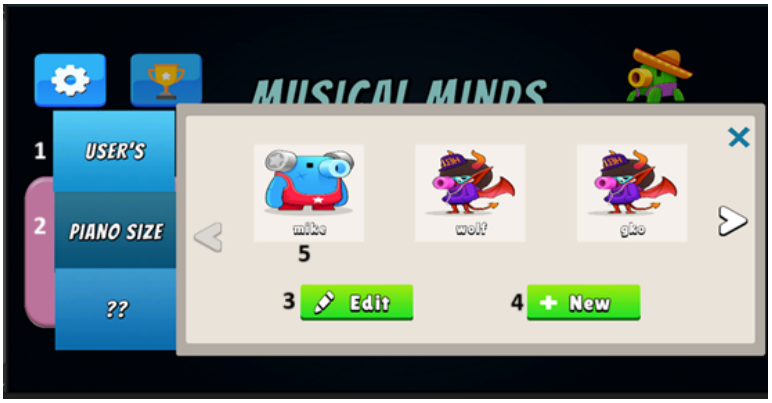
Shows the current player's:

- Avatar
- Username
- Level Progress

Settings Menu

Access the Settings by tapping the **gear icon (Home Page #1)**. The settings panel will appear on the left side with three key options:

1. USER'S – Profile Management

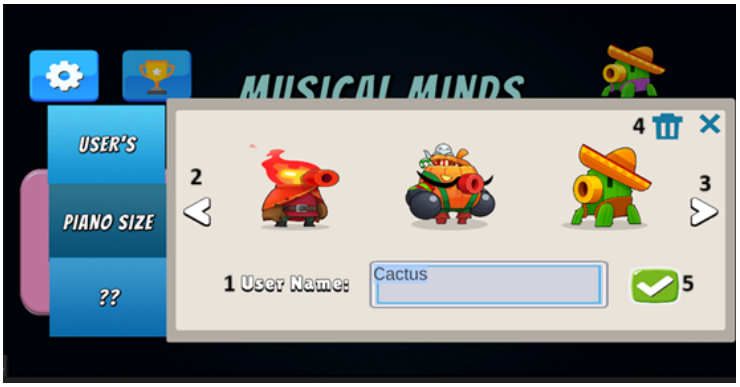


Tap to open the user selection and editing window.

Profile Overview Screen:

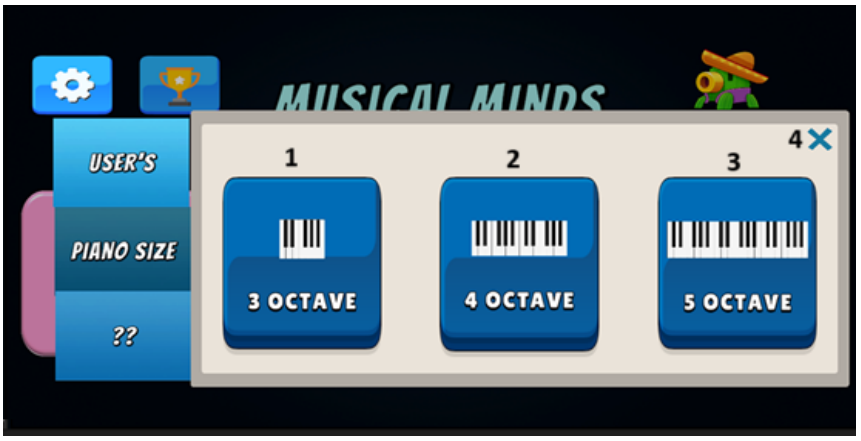
- **3. Edit Button** – Tap to rename or customize the selected user profile.
- **4. + New Button** – Tap to create a brand-new profile.
- **5. Profile Cards** – Displays existing users. Swipe left or right to view all saved profiles.

New/Edit Profile Screen :



- **1. User Name Field** – Type the name of the new or edited user here.
- **2 & 3. Arrow Buttons** – Navigate between avatar options.
- **4. Trash Icon** – Delete the currently selected profile.
- **5. Confirm Button (✅)** – Save the changes and return to the previous screen.

2. PIANO SIZE – Keyboard Range



Tap to customize how many octaves are shown on the virtual piano.

Piano Size Selection (Bottom Image):

- **1. 3 Octave** – Simple keyboard for younger children or smaller screens.
- **2. 4 Octave** – Balanced layout ideal for most gameplay modes.
- **3. 5 Octave** – Extended range for advanced songs and exploration.
- **4. Close Button (X)** – Exit this menu without making changes.

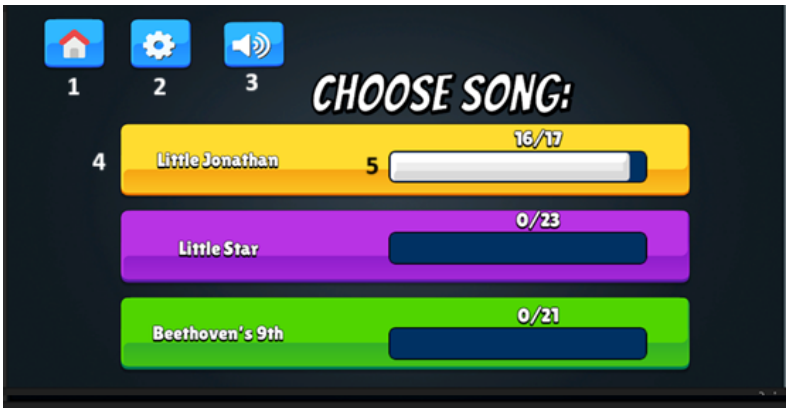
Your selected size will be applied immediately to all piano modes.

Melody Play Mode

The **Melody Play** mode allows players to learn full songs by following along with guided levels. This mode builds musical memory, timing, and hand-eye coordination.

Song Selection Screen

After tapping **Melody Play**, you'll be taken to the song selection screen.



- **1. Home Button** – Return to the main menu.
- **2. Settings Button** – Access user profiles, piano size, and more.
- **3. Audio Toggle** – Mute or unmute game sounds.
- **4. Song List** – Tap a song title (e.g., *Little Jonathan*, *Little Star*, *Beethoven's 9th*) to view its levels.
- **5. Progress Bar** – Shows how many levels you've completed out of the total for that song.

Level Selection Screen

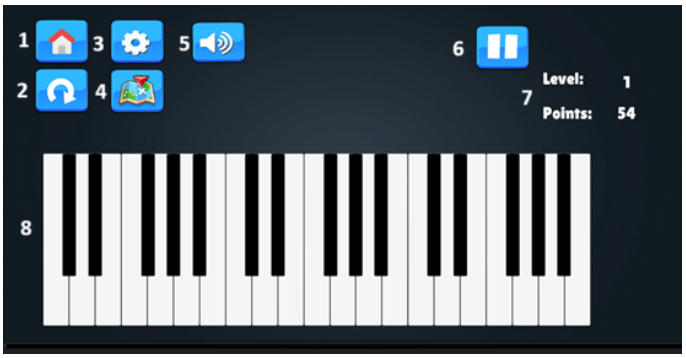
Once you select a song, choose a level to play.

- **1. Home Button** – Return to the main menu.
- **2. Back Button** – Return to the song selection screen.
- **3–23. Level Buttons** – Tap to start a level.
    - ✅ Green check – Completed
    - 🔒 Lock icon – Locked (must complete previous levels)

Levels must be completed in order to unlock the next.

Gameplay Screen

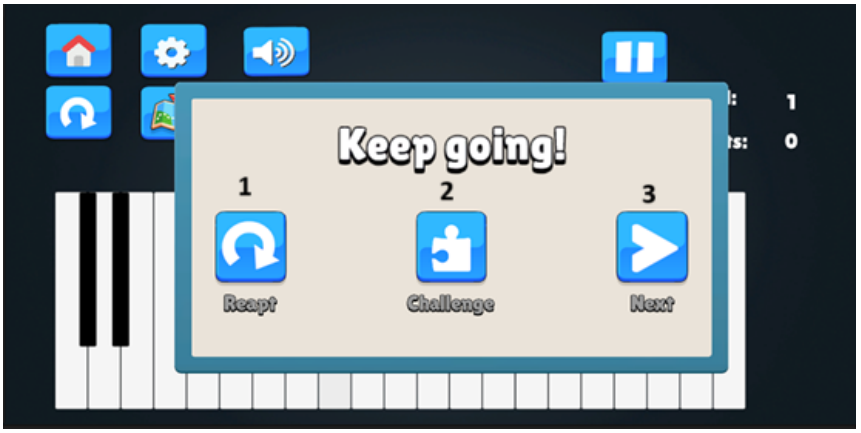
The interactive piano appears, and the player follows instructions to play the correct notes.



- **1. Home Button** – Exit to main menu.
- **2. Back Button** – Exit to level selection screen.
- **3. Settings** – Open settings menu.
- **4. Song Map Button** – View overall song progress.
- **5. Sound Toggle** – Mute or unmute gameplay audio.
- **6. Pause Button** – Temporarily stop the game.
- **7. Level Info** – Displays current level number and score.
- **8. Virtual Piano** – Tap the keys to play the melody.

Completion Menu

After finishing a level, you'll see a progress popup:



- **1. Recap** – Replay the same level.
- **2. Challenge** – Play a harder version of the level (if available).
- **3. Next** – Continue to the next unlocked level.

Sound Match Mode

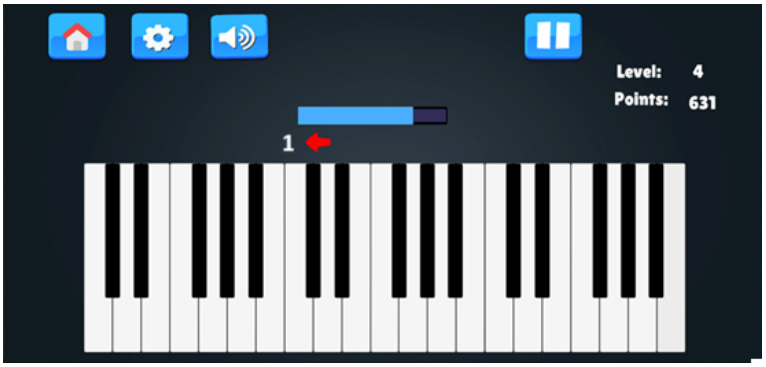
Sound Match is an ear training game designed to improve pitch recognition. Players listen to a sound and try to match it by playing the correct key on the virtual piano.

Game Screen Overview

Once you enter a level in Sound Match mode, the interface will display the following:

- **1. Home Button** – Exit to the main menu.
- **2. Settings Button** – Open profile and piano preferences.
- **3. Audio Toggle** – Mute or unmute sounds.
- **4. Feedback Text** – Shows messages like **"Too slow!"** if no key is pressed in time.
- **5. Timer Bar** – A visual indicator of how long you have to respond.
- **6. Pause Button** – Temporarily stop the game.
- **7. Level Info** – Displays your current level and points.
- **8. Virtual Piano** – Tap a key to play your answer.

HINT SYSTEM



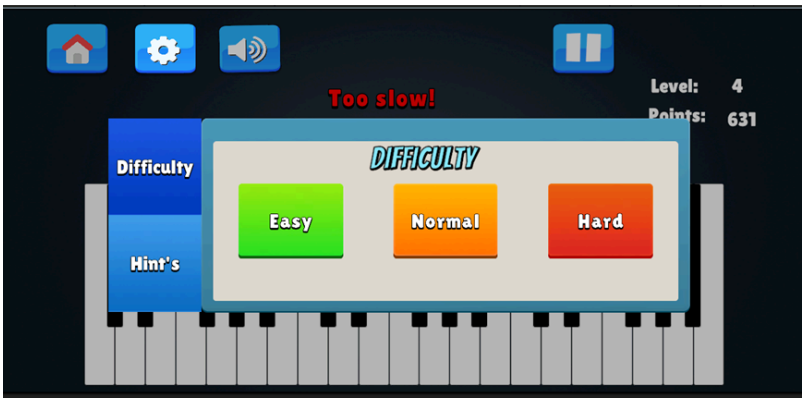
When **hints are enabled**, an arrow appears above the keyboard:

- 🔴 **Red** = far from the correct note
- 🟡 **Yellow** = getting closer but still not close enough
- 🟢 **Green** = almost there

This guides players toward the right pitch using intuitive visual feedback.

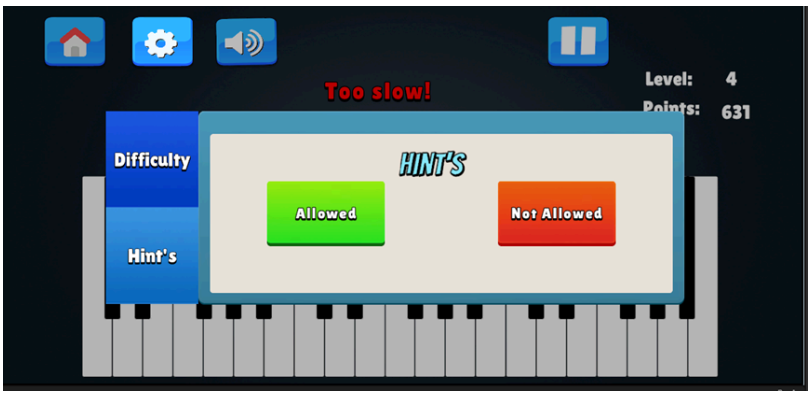
Game Options

While paused, players can access two important options:



Choose how challenging the Sound Match experience is:

- 🟩 **Easy** – Slower timer
- 🟧 **Normal** – Standard timer
- 🟥 **Hard** – Fast pace



Toggle hint system:

- 🟩 **Allowed** – Hint arrow is shown
- 🟥 **Not Allowed** – No assistance; rely entirely on hearing

Completion Screen

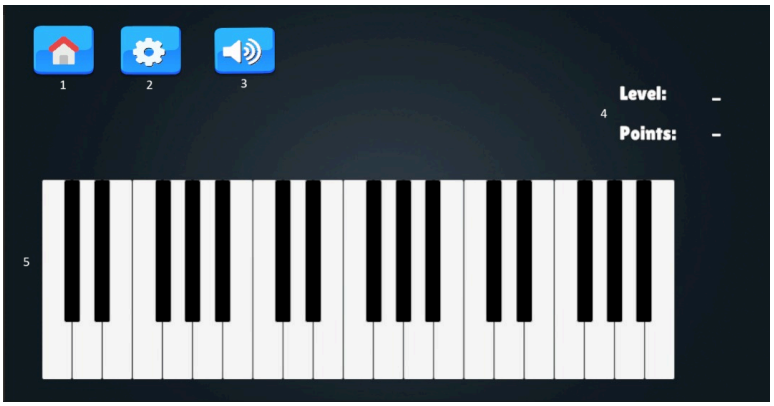
After finishing a level, you'll see your results:

- **1. Recap** – Replay the same level.
- **2. Home** – Return to the home page.
- **3. Points Earned** – Shows score from the level.
- **4. Identified Notes** – Indicates how many notes you matched correctly.

Free Play Mode

Free Play is an open-ended mode that allows users to explore the virtual piano without restrictions. It's perfect for creativity, experimentation, and practicing without time pressure or level constraints.

Interface Overview



Each button and section is labeled for easy reference:

- **1. Home Button**
  Tap to return to the main menu at any time.
- **2. Settings Button**
  Access profile management, piano size selection, and other preferences.
- **3. Audio Toggle**
  Mute or unmute piano sounds.
- **4. Level & Points Display**
  Displays placeholder indicators (`Level: -`, `Points: -`) as Free Play is not scored or level-based.
- **5. Virtual Piano Keyboard**
  Play notes by tapping the on-screen piano.
  - The keyboard size depends on your selected **Piano Size** in settings (3, 4, or 5 octaves).
  - Compatible with both touch and MIDI input (if connected).

What You Can Do in Free Play

- Improvise melodies and chords.
- Try out ideas before practicing them in Sound Match or Melody Play.
- Let younger children experiment without worrying about rules or progression.