# Music Player Application: QT GUI Application Utilizing Queues and Stacks

**Proponents:**

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Aaron Patrick Camba

Eyre Vincent Gonzales

## Chosen Application Theme

A music player application that allows a user to import and play songs from their local storage.

## Rationale for your choice

The proponents have chosen the Music Player Application as their main theme and implementation because it allows an effective demonstration and utilization of stacks and queues in a real-world scenario. Such application is common and is used widely by the masses, making it more familiar with any users that are new to the concepts of queues and stacks. Managing a playlist by adding and removing songs from it, importing songs from local storage, and tracking recently played songs are common tasks in music players, and using stacks and queues provides an efficient way to handle these operations and visualize their function in a simpler and functional way.

## Explanation of the Implemented Application and Its Features

Our application simulates a Music Player with the following features:

1. Stack Operations:

   - Push: Adds a recently played song to the stack.

   - Pop: Removes the most recently played song from the stack.

   - Peek: Views the most recently played song without removing it from the stack.

2. Queue Operations:

- Enqueue: Adds a song to the playlist queue.
- Dequeue: Removes the next song from the playlist queue then plays it.
- Peek: Views the next song in the playlist queue without removing it.

3. Graphical User Interface (GUI):

- Buttons for Each Operation: Users can interact with the application using buttons for push, pop, enqueue, and dequeue operations.
- Display Current States: The GUI displays the current states of the stack and queue, allowing users to see the songs in the stack and the playlist queue.

**Three Test Cases for the Chosen Application**

**Test Case 1: Queue Operations**

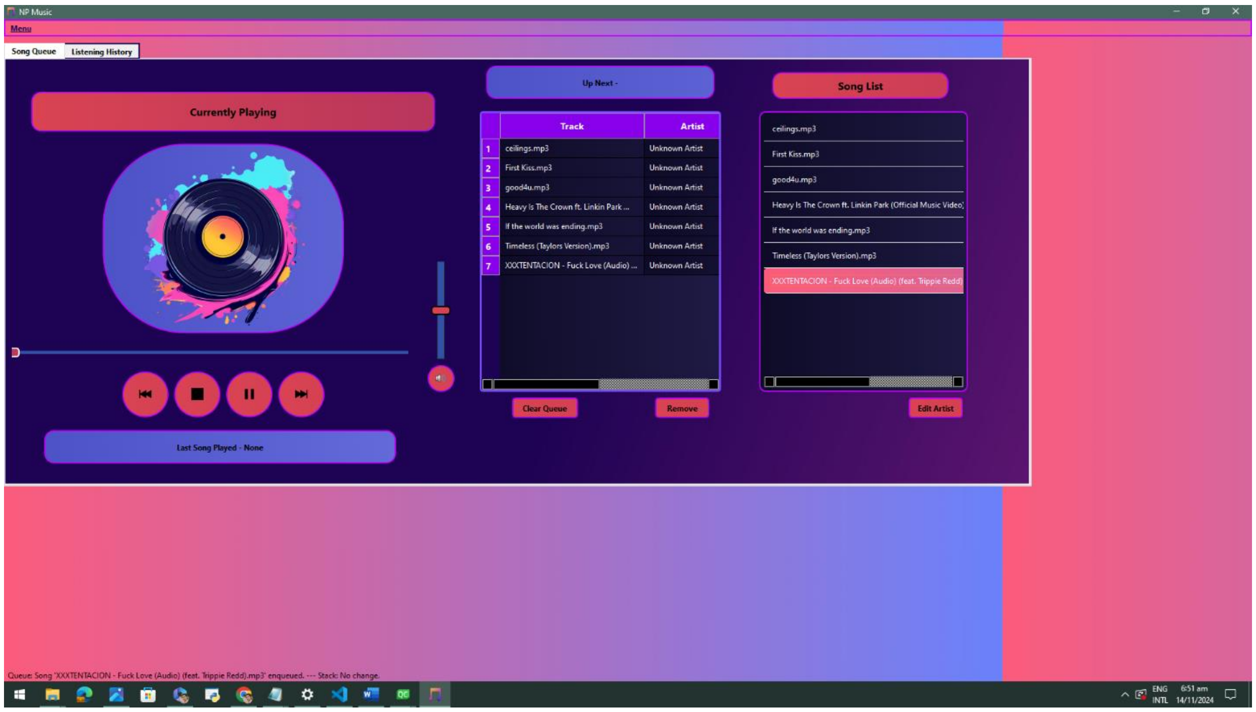
Objective: Verify that the queue operations (Enqueue, Dequeue, Peek) work correctly.

Steps:

***1. Enqueue Operation:***

- Double-click a song from the list widget to enqueue it into the playlist queue.
- Verify that the song is added to the end of the queue.

- Check the queue's state to ensure the song is present.



|   | Track | Artist |
|---|---|---|
| 1 | ceilings.mp3 | Unknown Artist |
| 2 | First Kiss.mp3 | Unknown Artist |
| 3 | good4u.mp3 | Unknown Artist |
| 4 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 5 | If the world was ending.mp3 | Unknown Artist |
| 6 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 7 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

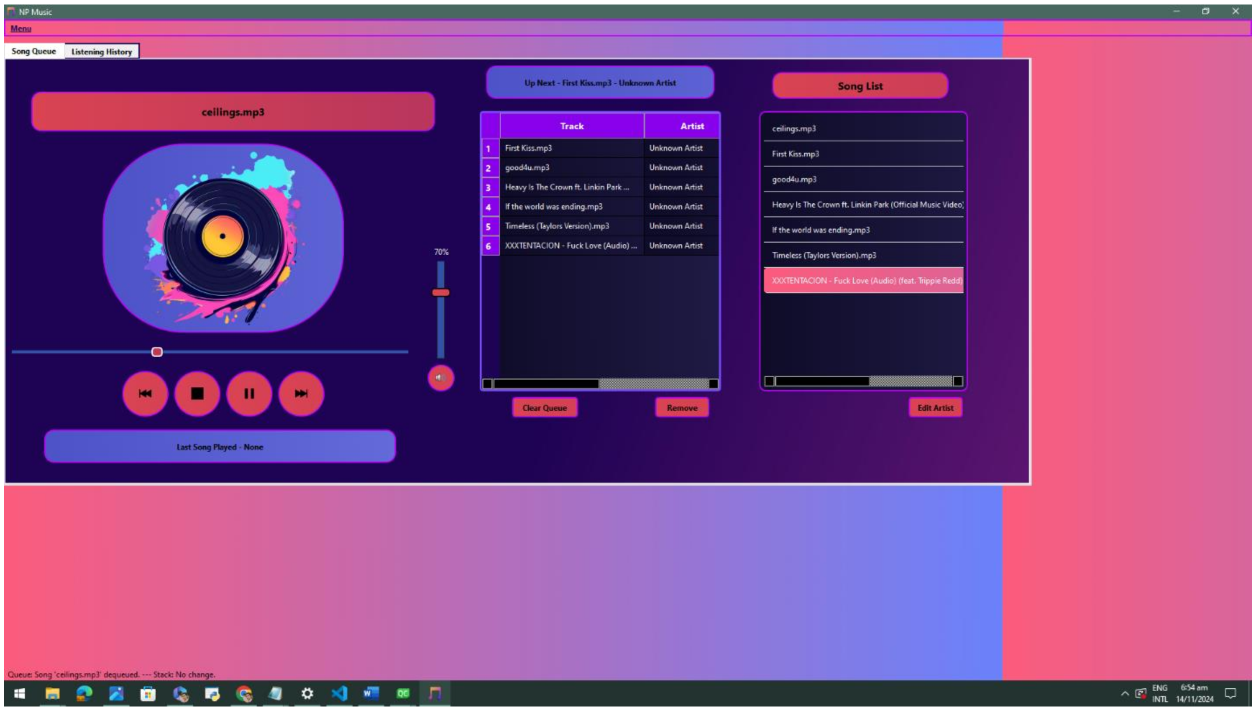
- ceilings.mp3
- First Kiss.mp3
- good4u.mp3
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

```
Queue: Song 'XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd).mp3' enqueued. --- Stack: No change.
```

### *2. Peek Operation:*

- Peek at the front song of the playlist queue.

- Verify that the correct song is returned without removing it from the queue and displays it the “**Up next – “**label.



| | Track | Artist |
|---|---|---|
| 1 | First Kiss.mp3 | Unknown Artist |
| 2 | good4u.mp3 | Unknown Artist |
| 3 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 4 | If the world was ending.mp3 | Unknown Artist |
| 5 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 6 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

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- First Kiss.mp3
- good4u.mp3
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

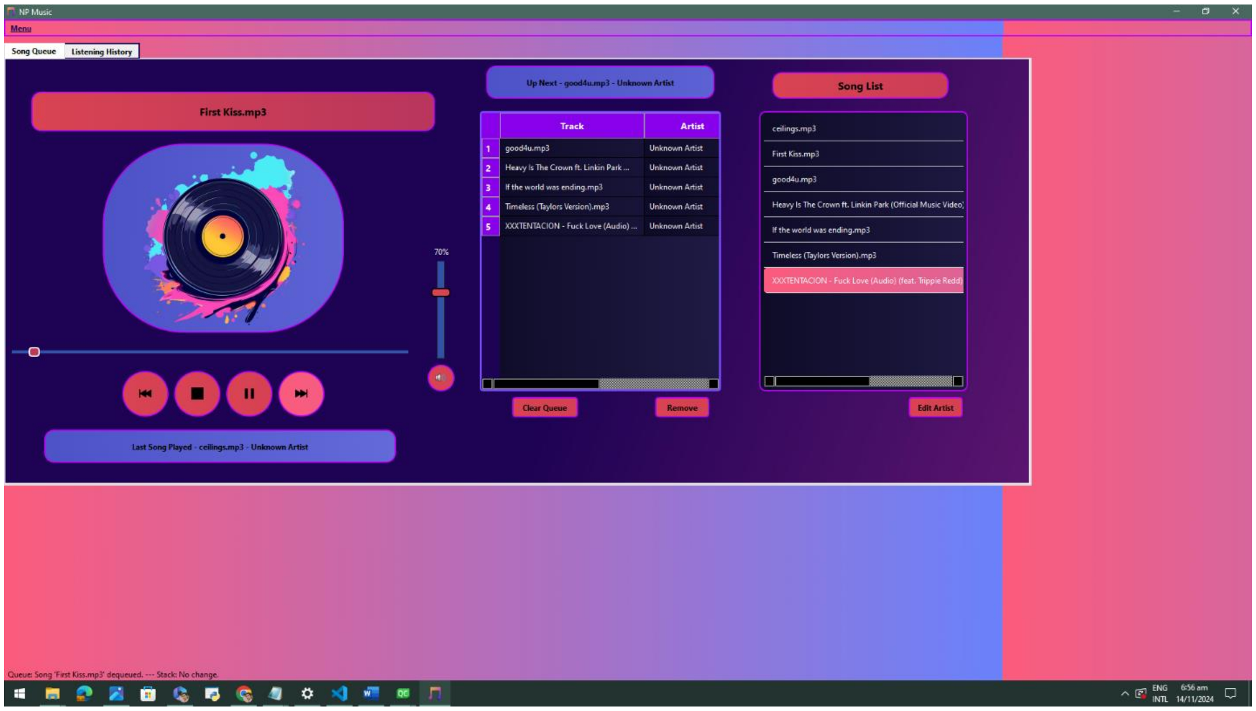
```
Queue: Song 'ceilings.mp3' dequeued. --- Stack: No change.
```

***3. Dequeue Operation:***

- Wait for a song to finish or click the **Skip Forward** button to dequeue the front song from the playlist queue.

- Verify that the correct song is dequeued and currently playing the song.

- Check the queue's state to ensure the song is no longer present.



Up Next - good4u.mp3 - Unknown Artist

| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 5 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

- ceilings.mp3
- First Kiss.mp3
- good4u.mp3
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Last Song Played - ceilings.mp3 - Unknown Artist

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.

**Expected Results:**

- The queue should correctly add, peek, and dequeue songs.

- The queue's state should be updated accordingly after each operation.

**Test Case 2: Stack Operations**

Objective: Verify that the stack operations (Push, Pop, Peek) work correctly.

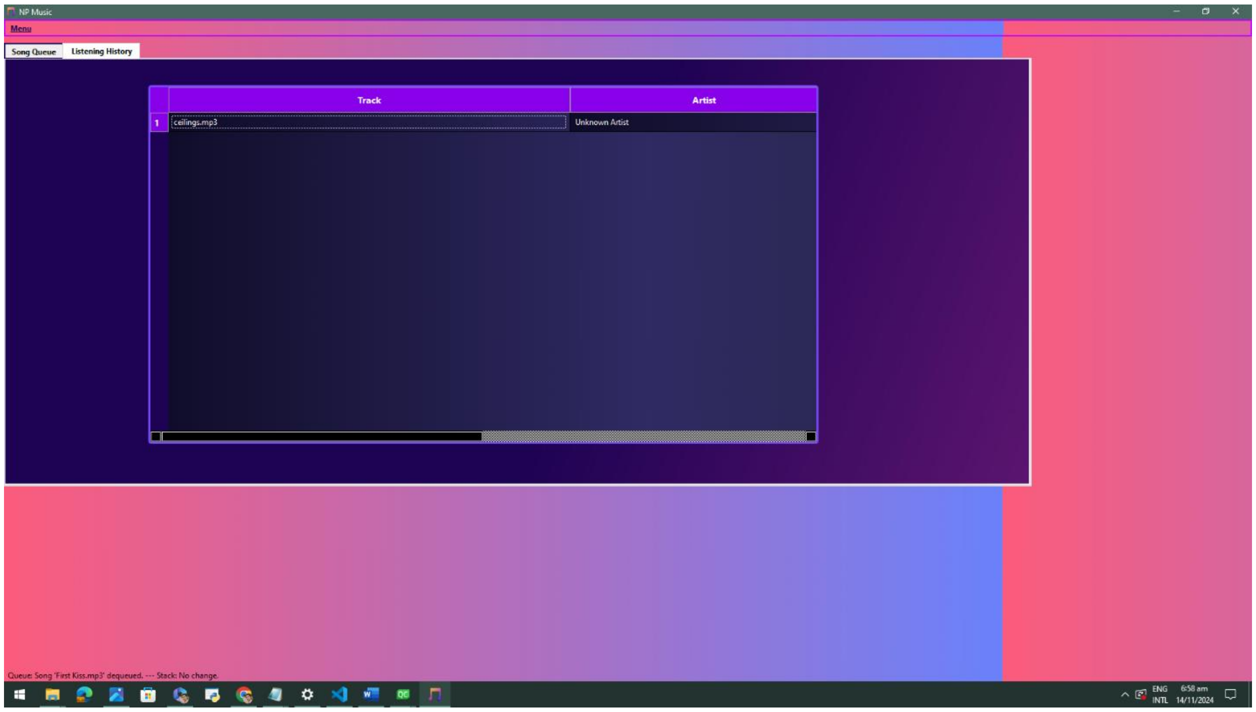
Steps:

***1. Push Operation:***

- Wait for a song to finish or click the **Skip Forward** button to skip the song and push it in the stack.

- Verify that the song is added to the History (Stack).

- Check if the song skipped song stopped playing after pushing.



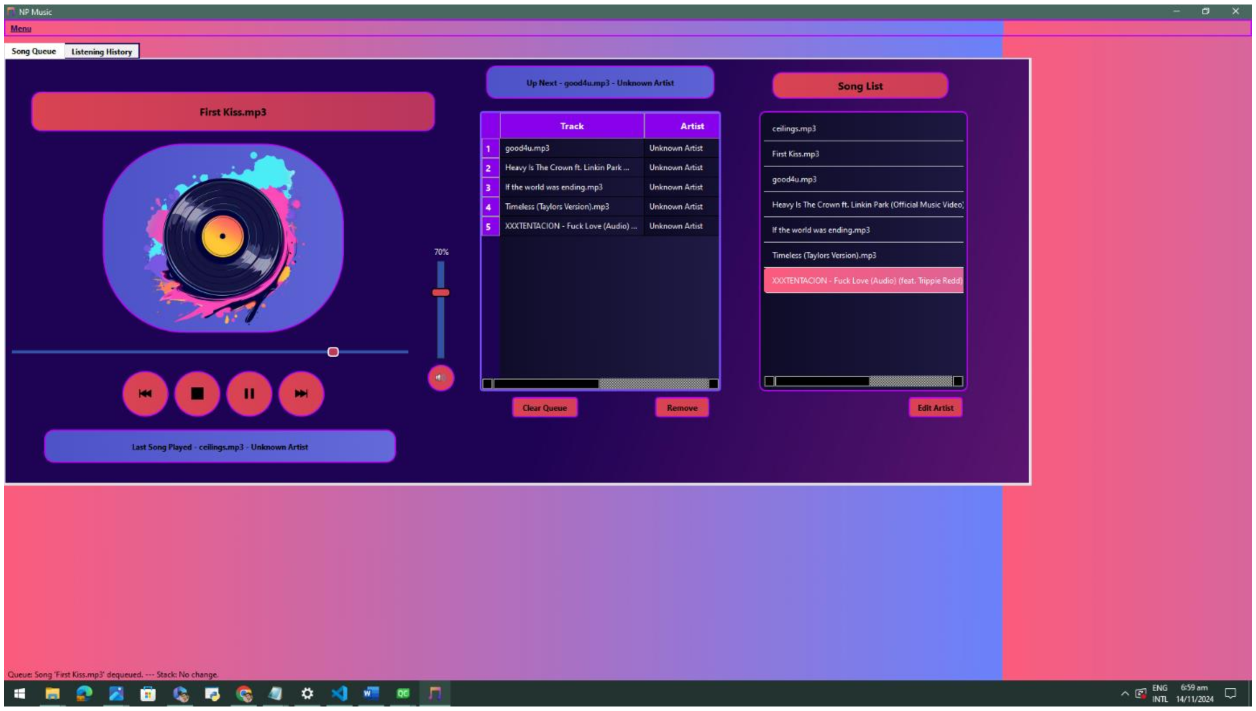
| | Track | Artist |
|---|---|---|
| 1 | ceilings.mp3 | Unknown Artist |

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.

***2. Peek Operation:***

- Peek at the top song of the stack.

- Verify that the correct song is returned and displayed in the **Last Song Played** label.



First Kiss.mp3

Up Next - good4u.mp3 - Unknown Artist

| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 5 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

- ceilings.mp3
- First Kiss.mp3
- good4u.mp3
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Last Song Played - ceilings.mp3 - Unknown Artist

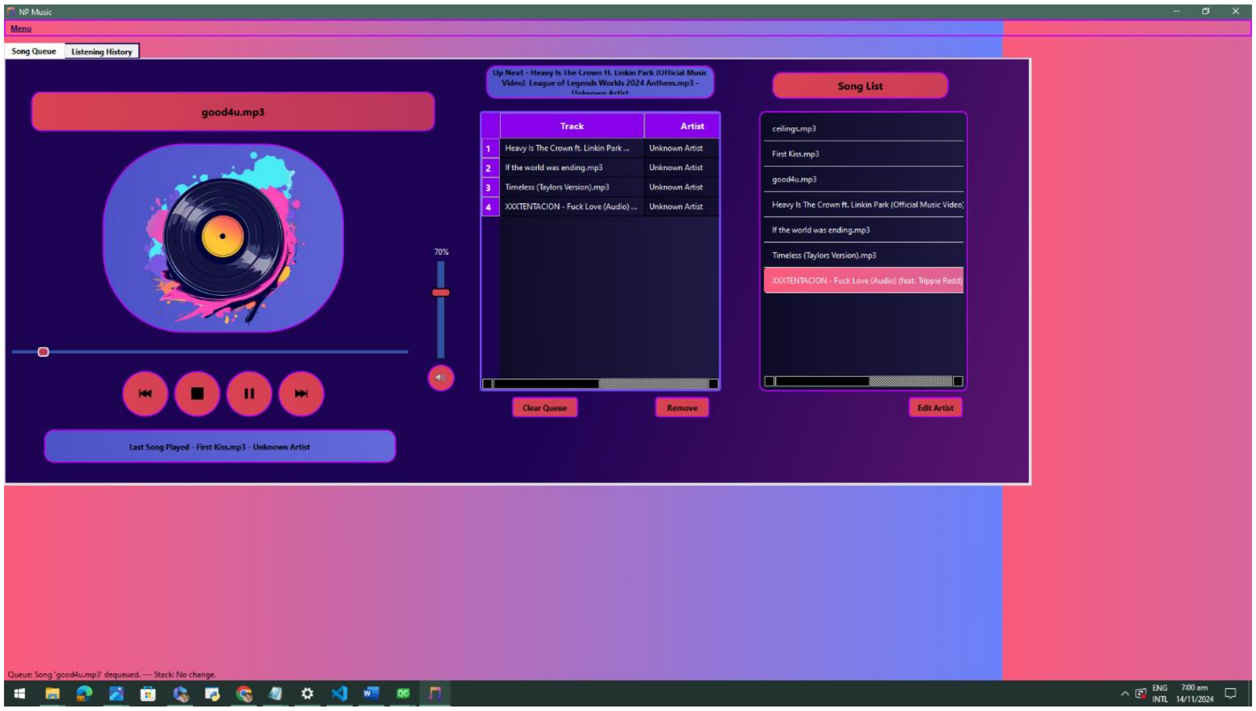
```
Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.
```

### *3. Pop Operation:*

- Click the **Skip Backward** button to pop the top song (Last song played) from the stack.

- Verify that the correct song is popped.

- Check the current song playing. it should be the last song popped.



good4u.mp3

Up Next - Heavy Is The Crown ft. Linkin Park (Official Music Video) League of Legends Worlds 2024 Anthem.mp3 - Unknown Artist

|  | Track | Artist |
|---|---|---|
| 1 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 2 | If the world was ending.mp3 | Unknown Artist |
| 3 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 4 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

ceilings.mp3
First Kiss.mp3
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Heavy Is The Crown ft. Linkin Park (Official Music Video)
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Last Song Played - First Kiss.mp3 - Unknown Artist

Queue: Song 'good4u.mp3' dequeued. --- Stack: No change.

**Expected Results:**

- The stack should correctly push, peek, pop and play the correct songs.

- The stack's state should be updated accordingly after each operation.

**Test Case 3: GUI Interaction**

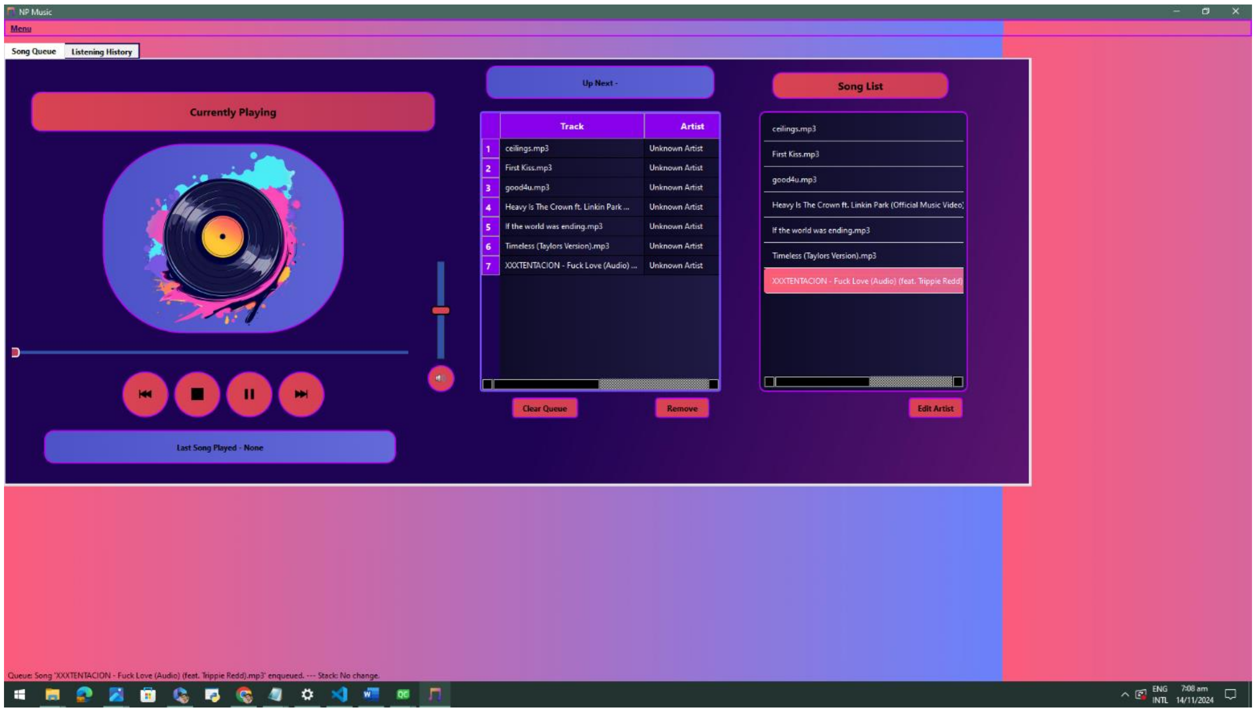
Objective: Verify that the graphical user interface (GUI) correctly reflects the state of the stack and queue and allows user interaction.

Steps:

***1. Push and Enqueue Operations:***

- Use the GUI buttons to play a song (push to stack) and double-click a song from the list widget to add it to the playlist queue (enqueue).

- Verify that the songs are correctly displayed in the stack and queue sections of the GUI.



|   | Track | Artist |
|---|---|---|
| 1 | ceilings.mp3 | Unknown Artist |
| 2 | First Kiss.mp3 | Unknown Artist |
| 3 | good4u.mp3 | Unknown Artist |
| 4 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 5 | If the world was ending.mp3 | Unknown Artist |
| 6 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 7 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

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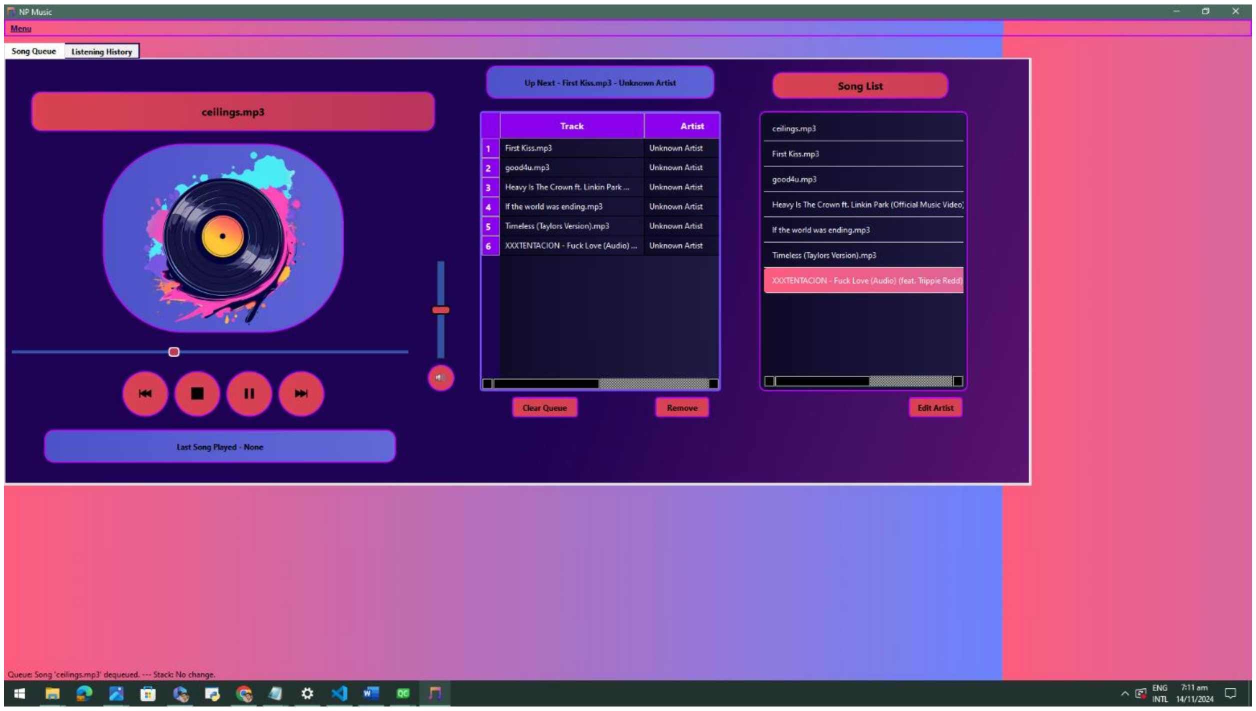
First Kiss.mp3
good4u.mp3
Heavy Is The Crown ft. Linkin Park (Official Music Video)
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

```
Queue: Song 'XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd).mp3' enqueued. --- Stack: No change.
```

## 2. Pop and Dequeue Operations:

- Use the GUI buttons to pop a song from the stack (Back button) and dequeue a song from the playlist queue (Forward button).

- Verify that the songs are correctly removed and the GUI updates to reflect the changes.



|   | Track | Artist |
|---|---|---|
| 1 | First Kiss.mp3 | Unknown Artist |
| 2 | good4u.mp3 | Unknown Artist |
| 3 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 4 | If the world was ending.mp3 | Unknown Artist |
| 5 | Timeless (Taylors Version).mp3 | Unknown Artist |
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First Kiss.mp3
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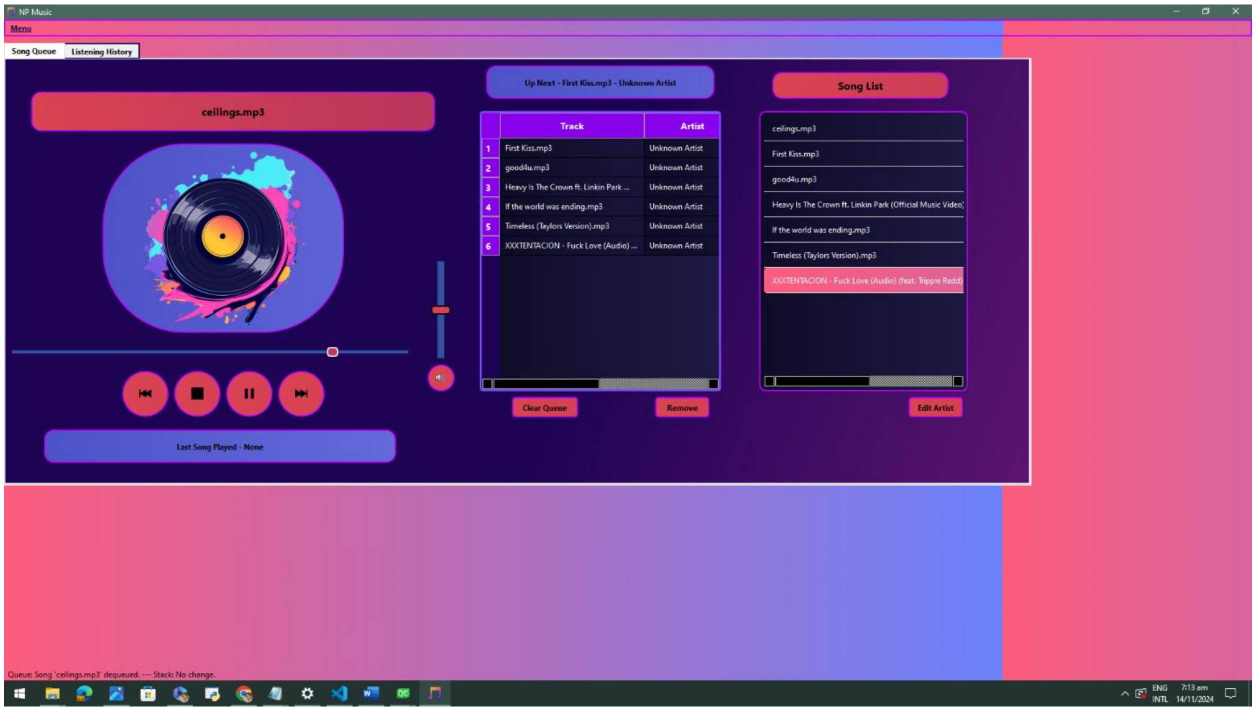
Heavy Is The Crown ft. Linkin Park (Official Music Video)
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Queue: Song 'ceilings.mp3' dequeued. --- Stack: No change.

## *3. Peek Operations:*

- check the labels **"Up next -"** and **"Last song played"** to peek at the top song of the stack and the front song of the playlist queue.

- Verify that the correct songs are displayed without removing them from the stack or queue.



| | Track | Artist |
|---|---|---|
| 1 | First Kiss.mp3 | Unknown Artist |
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| 3 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 4 | If the world was ending.mp3 | Unknown Artist |
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- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Queue: Song 'ceilings.mp3' dequeued. --- Stack: No change.

***4. Volume and Media Control:***

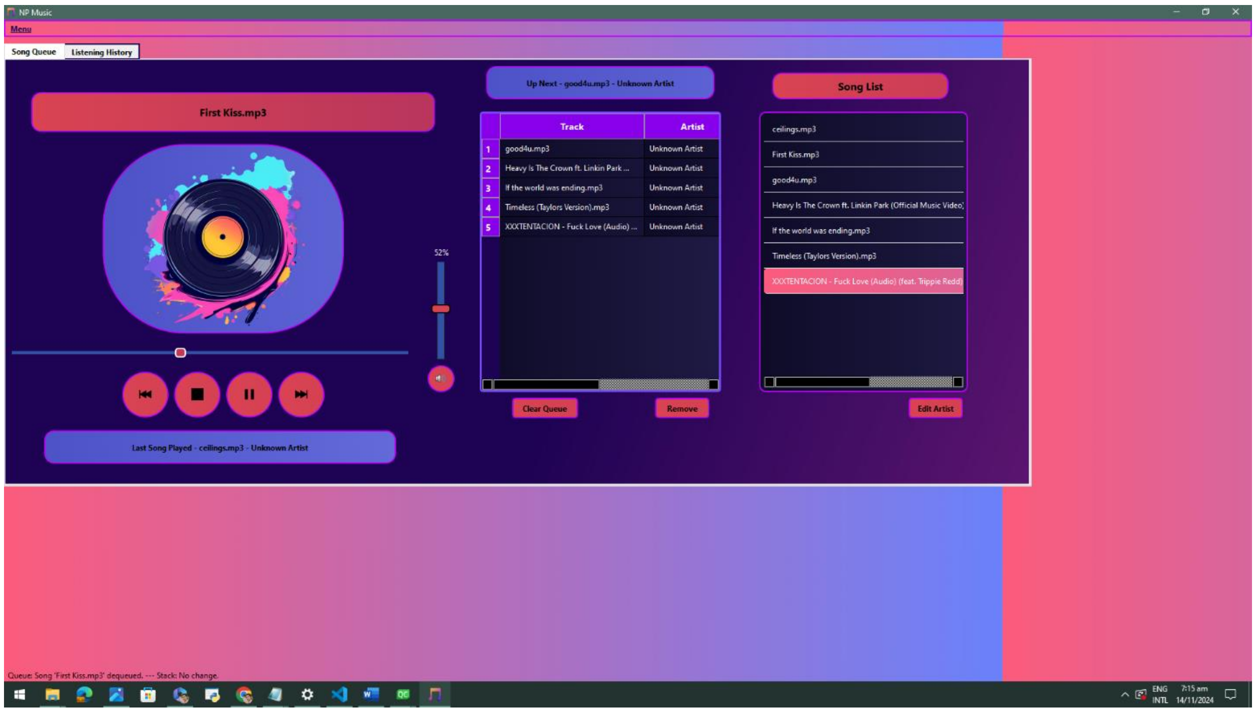
- Mute Operation: Click the "Volume" button to mute the audio. Verify that the audio is muted and the volume button icon changes to "Muted."

- Unmute Operation: Click the "Volume" button again to unmute the audio. Verify that the audio is unmuted and the volume button icon changes to "Volume."

- Volume Slider: Adjust the volume slider to different levels. Verify that the audio volume changes accordingly.

- Pause: Click the "Pause" button to pause the currently playing song. Verify that the song playback pauses and the "Pause" button changes to "Play."

- Play: Click the "Play" button to resume the paused song. Verify that the song playback resumes from where it was paused, and the "Play" button updates back to "Pause."



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | Timeless (Taylors Version).mp3 | Unknown Artist |
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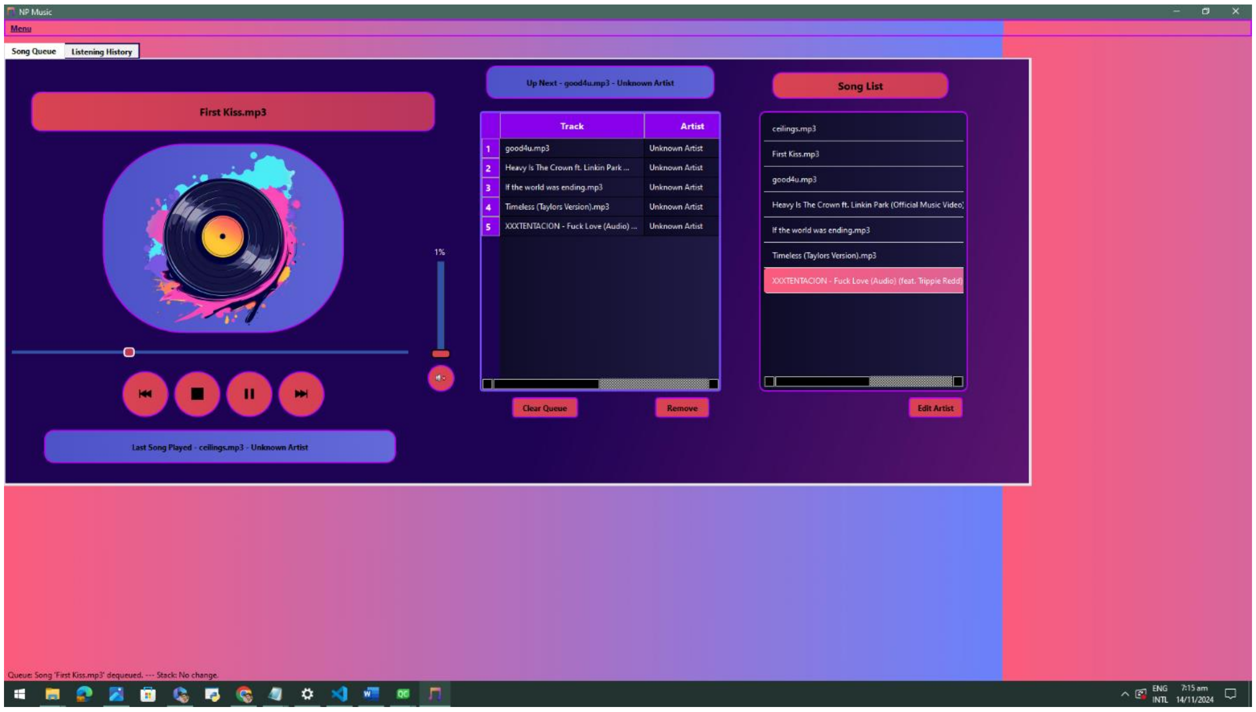
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | Timeless (Taylors Version).mp3 | Unknown Artist |
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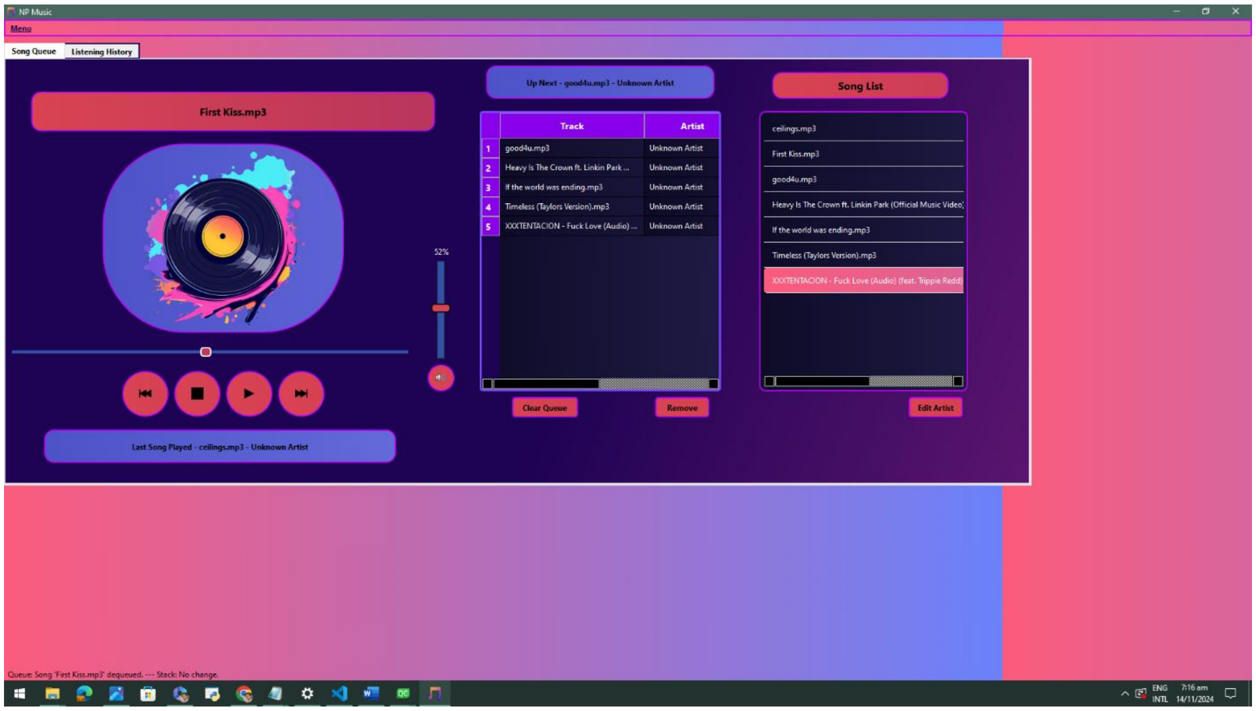
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | Timeless (Taylors Version).mp3 | Unknown Artist |
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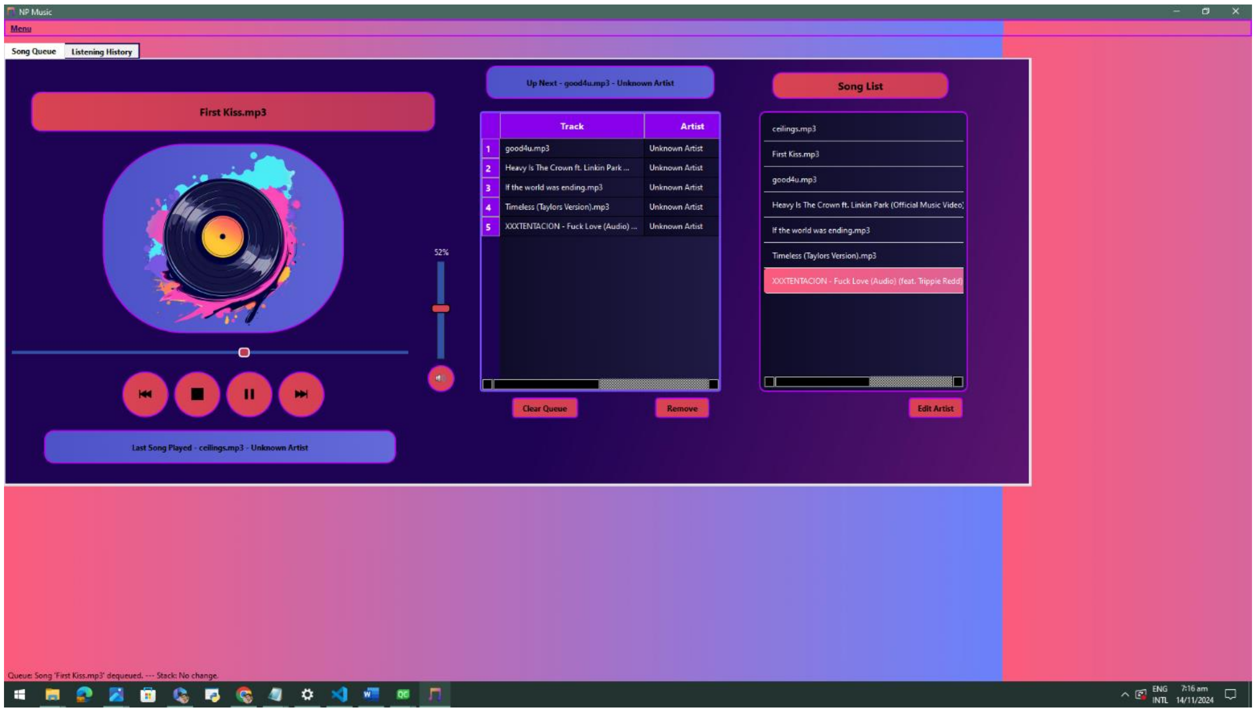
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

```
Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.
```



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
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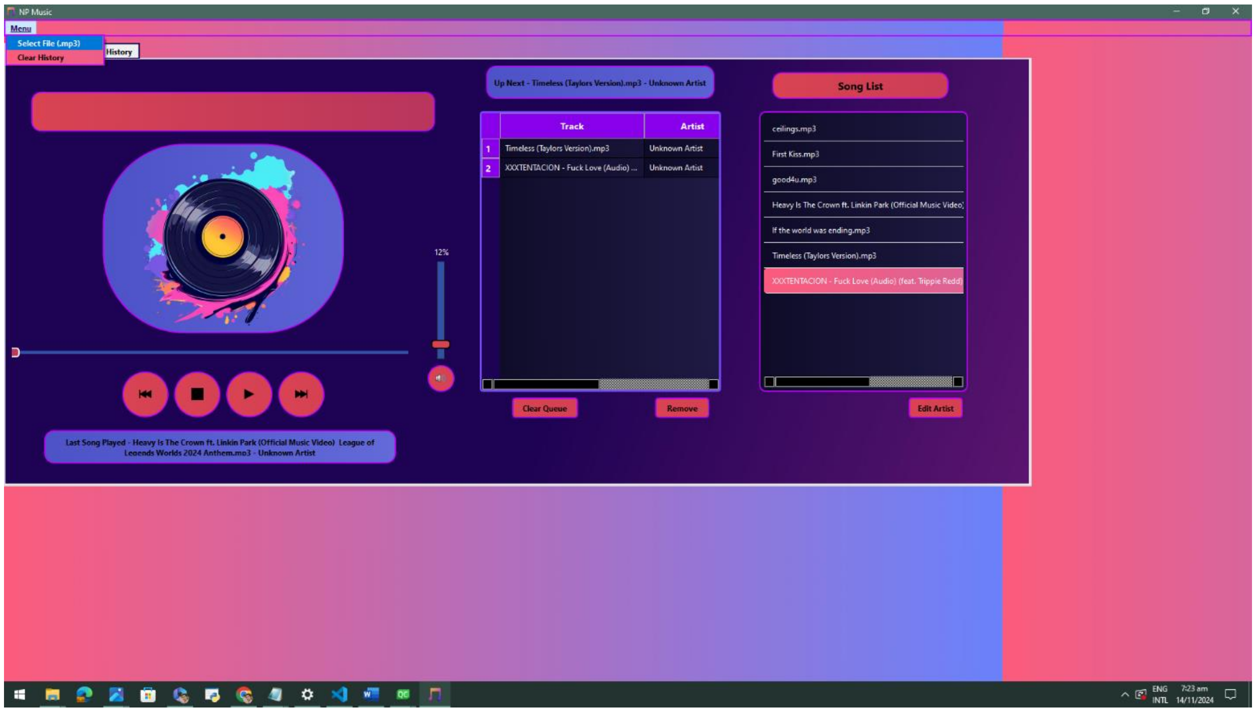
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

```
Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.
```

## *5. File Selection:*

- Open File Dialog: Click the "Select File (.mp3)" menu option to open the file dialog. Verify that the file dialog opens.

- Select MP3 File: Select an MP3 file from the file dialog. Verify that the selected file is added to the list of songs.



Up Next - Timeless (Taylors Version).mp3 - Unknown Artist

|  | Track | Artist |
|---|---|---|
| 1 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 2 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |

ceilings.mp3
First Kiss.mp3
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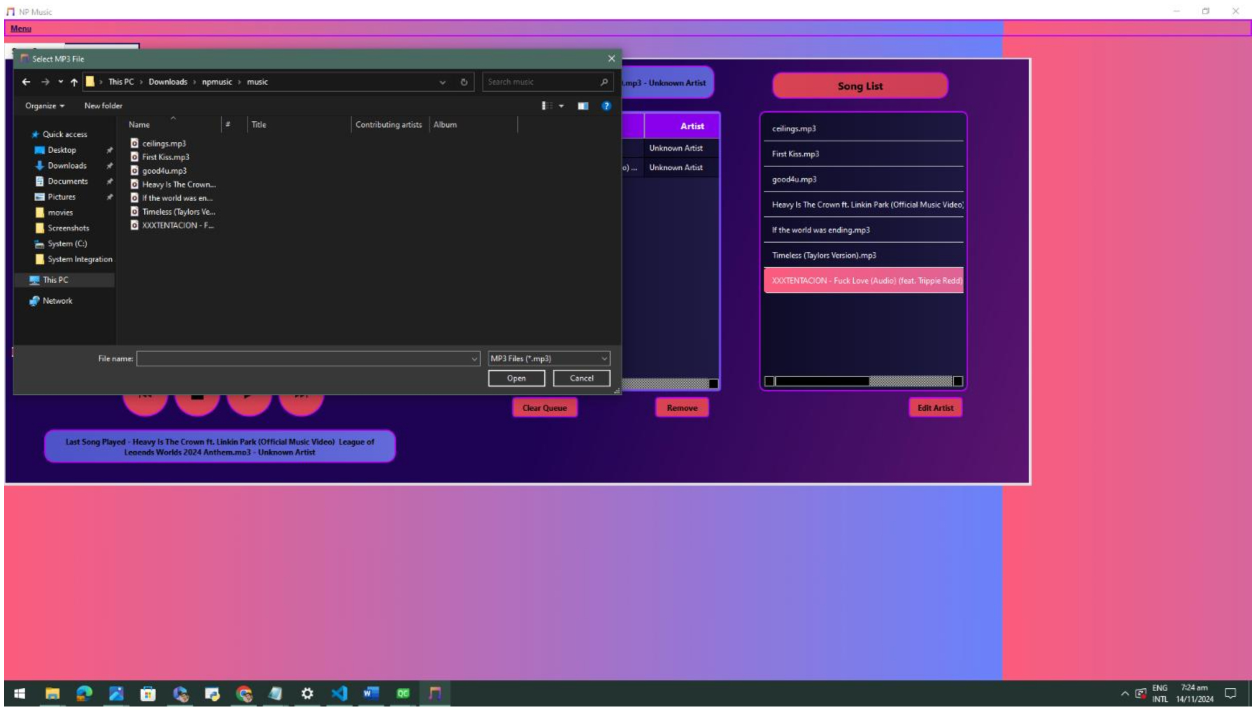
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Last Song Played - Heavy Is The Crown ft. Linkin Park (Official Music Video) League of Legends Worlds 2024 Anthem.mp3 - Unknown Artist



Last Song Played - Heavy Is The Crown ft. Linkin Park (Official Music Video) League of Legends Worlds 2024 Anthem.mp3 - Unknown Artist

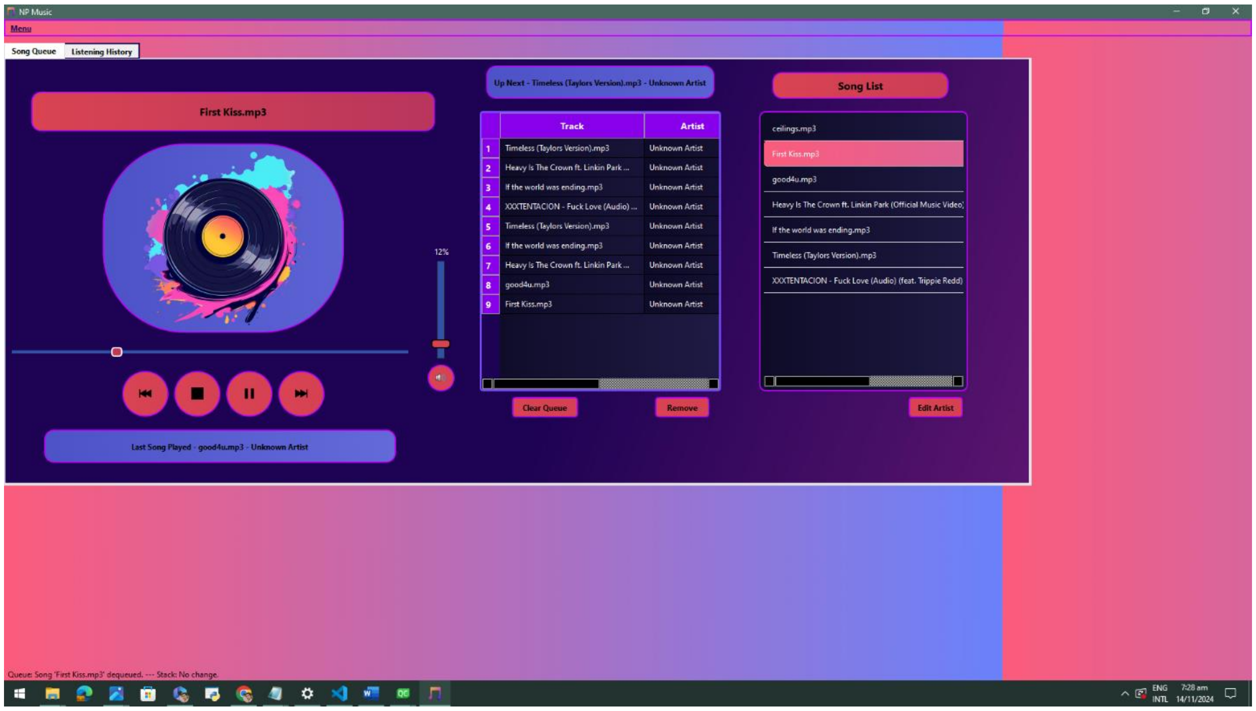
### *6. Clear Queue and Clear History:*

- Add Songs to Queue: Add multiple songs to the playlist queue.

- Add songs to History (Stack): Add multiple songs to the stack.

- Clear Queue: Click the "Clear Queue" button to clear the playlist queue. Verify that the queue is cleared and the GUI updates to reflect the changes.

- Clear History: Click the "Clear History" button to clear the Listening History. Verify that the history is cleared and the GUI updates to reflect the changes.



Up Next - Timeless (Taylors Version).mp3 - Unknown Artist

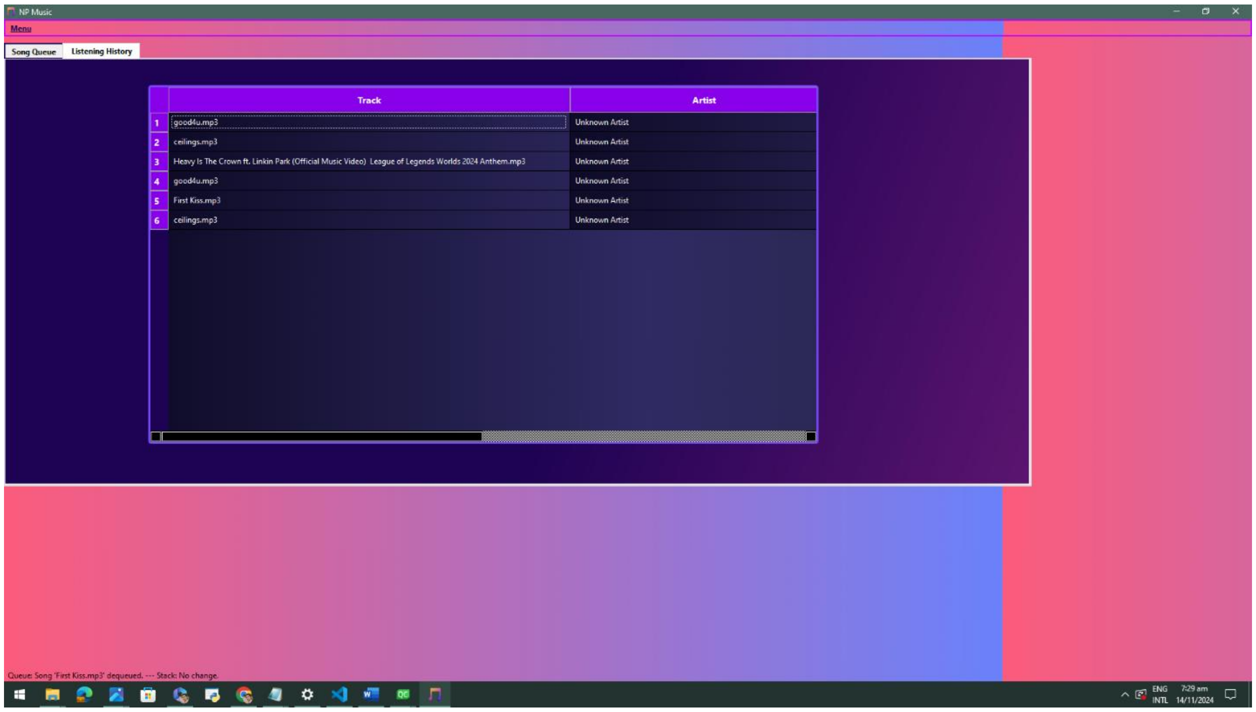
| | Track | Artist |
|---|---|---|
| 1 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 2 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 3 | If the world was ending.mp3 | Unknown Artist |
| 4 | XXXTENTACION - Fuck Love (Audio) ... | Unknown Artist |
| 5 | Timeless (Taylors Version).mp3 | Unknown Artist |
| 6 | If the world was ending.mp3 | Unknown Artist |
| 7 | Heavy Is The Crown ft. Linkin Park ... | Unknown Artist |
| 8 | good4u.mp3 | Unknown Artist |
| 9 | First Kiss.mp3 | Unknown Artist |

Song List

- ceilings.mp3
- First Kiss.mp3
- good4u.mp3
- Heavy Is The Crown ft. Linkin Park (Official Music Video)
- If the world was ending.mp3
- Timeless (Taylors Version).mp3
- XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

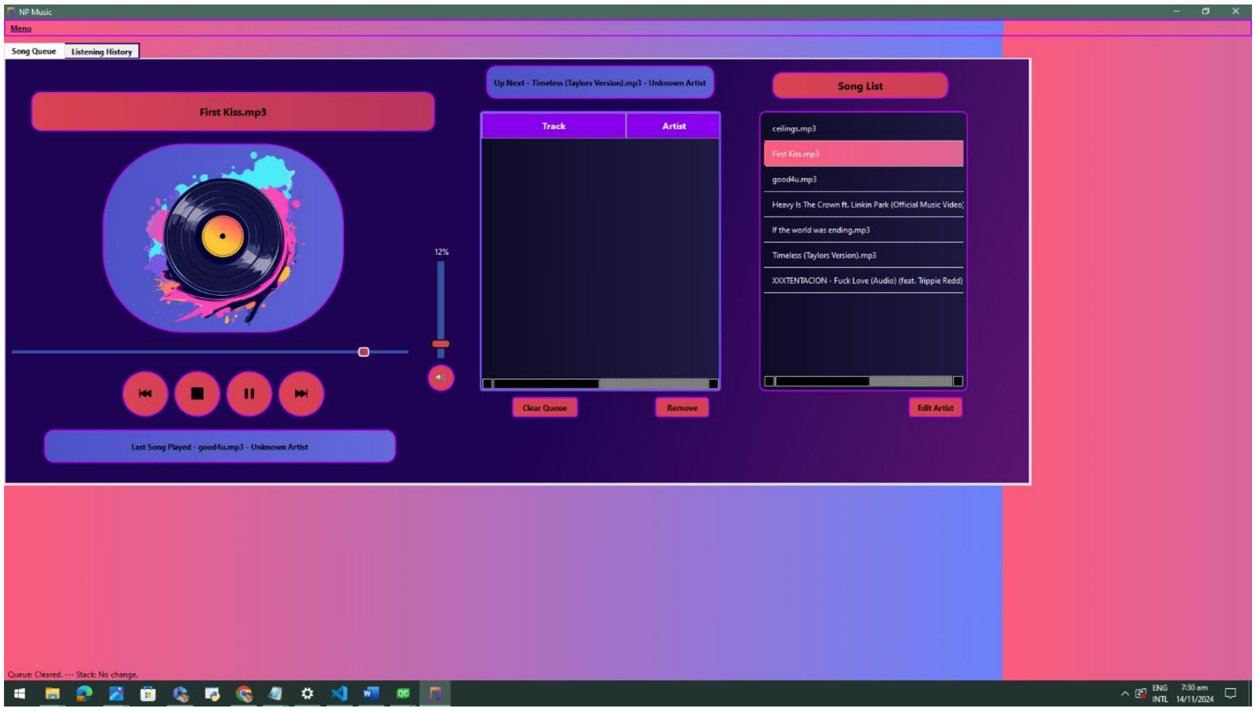
Last Song Played - good4u.mp3 - Unknown Artist

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Unknown Artist |
| 2 | ceilings.mp3 | Unknown Artist |
| 3 | Heavy Is The Crown ft. Linkin Park (Official Music Video)  League of Legends Worlds 2024 Anthem.mp3 | Unknown Artist |
| 4 | good4u.mp3 | Unknown Artist |
| 5 | First Kiss.mp3 | Unknown Artist |
| 6 | ceilings.mp3 | Unknown Artist |

Queue: Song 'First Kiss.mp3' dequeued. --- Stack: No change.



ceilings.mp3
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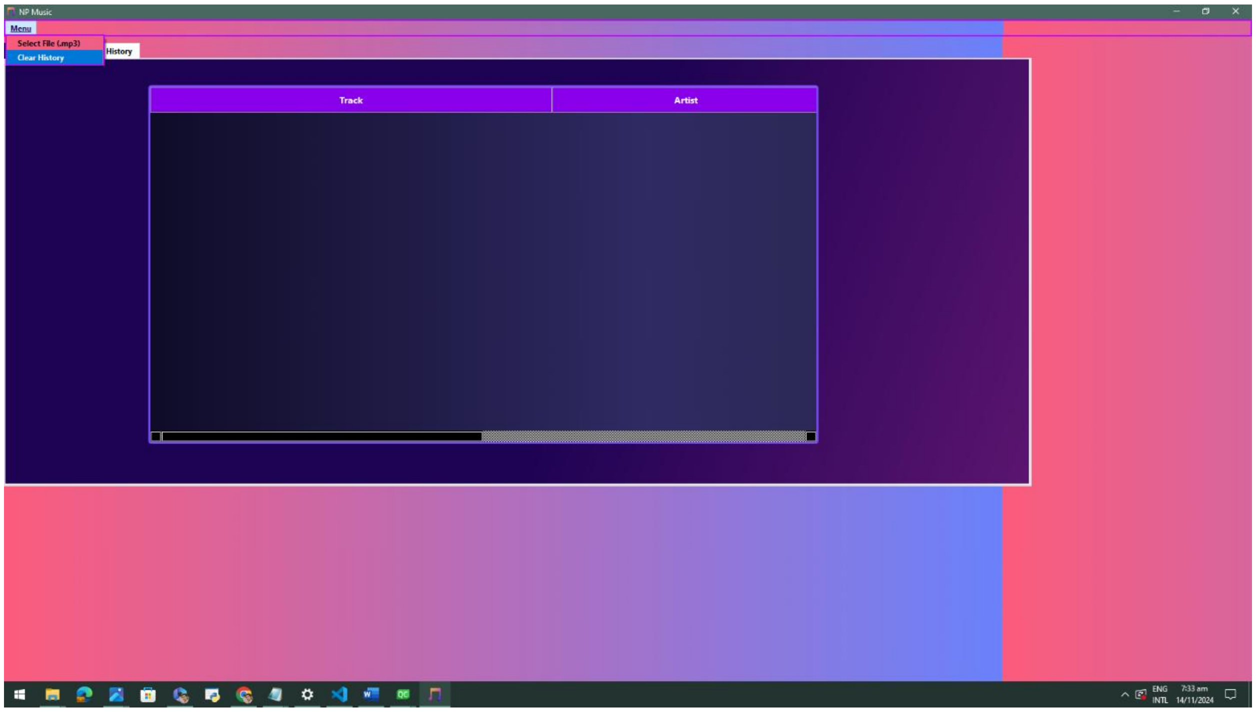
If the world was ending.mp3
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

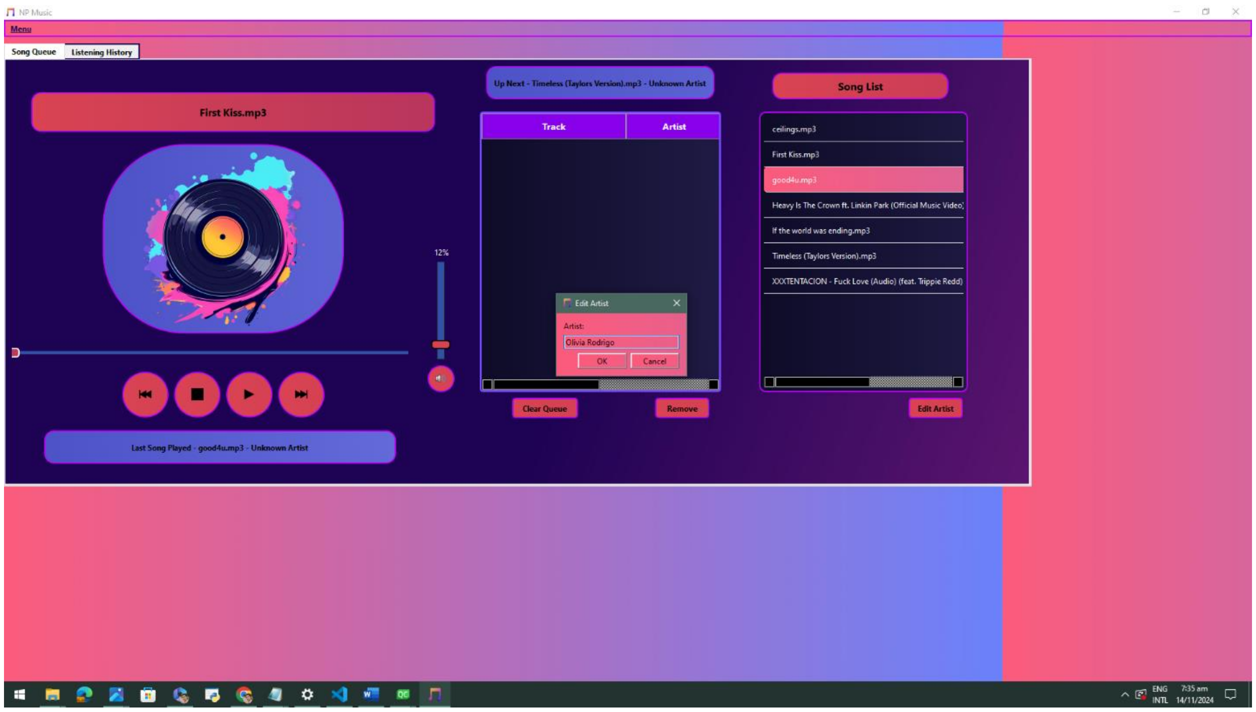
Queue: Cleared. --- Stack: No change.



## *7. Edit Track Info:*

- Select Song: Select a song from the list of all songs. Verify that the song is selected.

- Edit Track Info: Click the "Edit Track Info" button to edit the artist name. Enter a new artist name and confirm the changes. Verify that the artist name is updated in the list of all songs, the queue, and the stack (History).



First Kiss.mp3

Up Next - Timeless (Taylors Version).mp3 - Unknown Artist

Last Song Played - good4u.mp3 - Unknown Artist

ceilings.mp3
First Kiss.mp3
good4u.mp3
Heavy Is The Crown ft. Linkin Park (Official Music Video)
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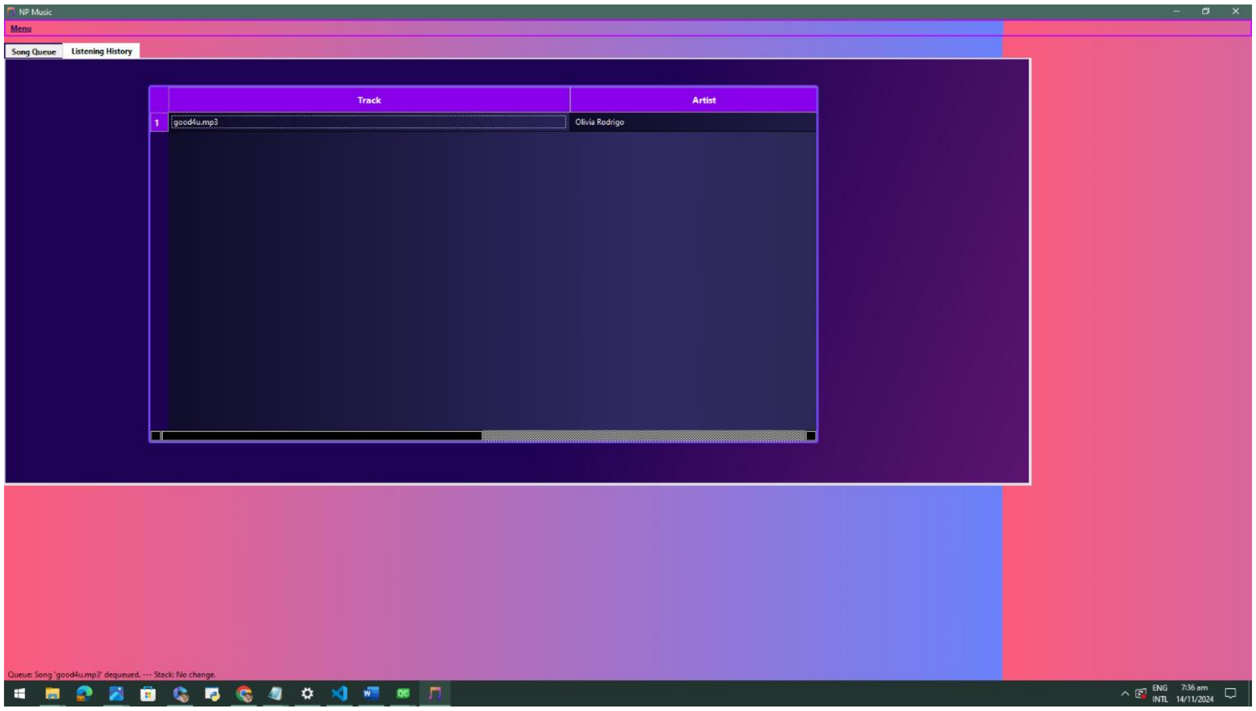
Timeless (Taylors Version).mp3
XXXTENTACION - Fuck Love (Audio) (feat. Trippie Redd)

Artist: Olivia Rodrigo



| | Track | Artist |
|---|---|---|
| 1 | good4u.mp3 | Olivia Rodrigo |

Queue: Song 'good4u.mp3' dequeued. --- Stack: No change.

**Expected Results:**

- The GUI should correctly display the state of the stack and queue.

- The GUI should allow users to perform stack and queue operations and update the display accordingly.

- The volume control should correctly mute, unmute, and adjust the audio volume.

- The file dialog should open and allow the user to select an MP3 file. The selected file should be added to the list of songs.

- The "Clear Queue" button should correctly clear the playlist queue. The GUI should update to show an empty queue.

- The "Edit Track Info" button should allow the user to edit the artist’s name. The artist’s name should be updated in the list of all songs, the queue, and the stack.

These test cases cover the core functionalities of your music player application and ensure that the application behaves as expected.

**Challenges Faced During Development**

Development:

1. Initial API idealization: The development was initially going to utilize an API within the QT development environment as to have access to Spotify data. This was scratched due to the difficulties and complications in relation to API implementation within QT, for time efficiency reasons this first idealization was scratched.

2. Handling Null Pointers: Ensuring that the “QTableWidgetItem” objects were not null before accessing them to prevent crashes.

3. Thread Safety: Making sure that all interactions with the GUI components were done on the main thread to avoid concurrency issues.

4. Debugging: Identifying and resolving issues related to the “QTableWidget” sorting while inserting items, which caused crashes.

Design:

1. Color Palette – The initial issue of choosing a color palette for the application took longer than expected, as there are a lot of considerations with colors in regard to text, buttons, borders and backgrounds.

2. QT CSS override- QT allows the user to design the parts of the application through the drag and drop UI menu or through coding it through the mainwindow.cpp. Initially the designs were made through the built-in designer in the drag and drop UI menu, but due to limitations and already established design in the code, it was ultimately decided to design a majority of the application through the mainwindow.cpp.

3. Static built-in buttons: Due to the buttons used in the application are from the QT library, it is static and thus their design cannot be changed directly. It is possible with more libraries being access liked qpaint and qpixmap, but it was decided to avoid such methods for the sake of time efficiency.

**Roles of Each Member and Their Contributions**

Developer: Ron Vincent Cada

-Implemented the core functionality of the application, including stack and queue operations, and integrated the GUI components.

Designer: Eyre Vincent Gonzales

-Designed the graphical user interface, ensuring that it was user-friendly and visually appealing.

Tester: Aaron Patrick Camba

Conducted thorough testing of the application, identified bugs, and provided feedback for improvements.