Serious Game Development for Dementia Care using Preferred Music, Music Therapy

Introduction

Using Music Therapy as a base for the design of a serious game aimed at improving the quality of life for patients living with dementia. Research has demonstrated that individuals with dementia may retain their capacity to respond to music, even in the advanced stages of the condition when verbal communication has become impaired (Baird & Samson, 2015). This research paper aims to leverage this insight to develop a serious game that benefits not only patients but also simplifies the experience for caregivers in terms of usability and implementation.

To ensure greater engagement and long-term use, patients are empowered by enabling them to incorporate their preferred music into the game, giving them control over the soundtrack which then enhances their experience. While there are existing studies on integrating music therapy into serious games, none have explored the unique approach of incorporating preferred music. Therefore, this study seeks to merge the effectiveness of serious gaming with the advantages of personalized music selection.

It is estimated that the amount of people living with dementia in 2019 reaching 57 million, studies have also predicted that these numbers will triple by 2050 to 153 million, further highlighting the importance of support (inretnational).

Method

This project encompasses the development of three distinct artifacts, all geared towards enhancing simplicity, usability, and overall enjoyment. These artifacts include:

- The Serious Game: Crafted with a deliberate focus on simplicity, the serious game is designed to ensure acceptance among patients as complicated technological interventions can be challenging.
- The Controller: Designed to be used as a drum, this controller accommodates up to four players. Its straightforward design ensures that users can grasp its functionality upon their first interaction.
- Preferred Music Script: Serves the purpose of analyzing the music uploaded by caregivers, dissecting it, and subsequently processing it to seamlessly integrate it into the game.

More information on each artifact can be found HERE

Conclusion

By integrating preferred music into a music therapy-based serious game, patient benefits are enhanced and long-term usability is promoted. The development of a user-friendly controller further ensures simplicity and understandability, thereby increasing the acceptability and feasibility of this intervention. In future studies data should be assebled from patients undergoing intervention

Bibliogrophy

Baird, A. & Samson, S. 2015. Music and dementia. Progress in brain research, 217:207-235.
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Tune Therapy

The serious game developed in Godot has a few different interfaces, the intro screen where instructions are given and the amount of players who will play is decided and then the main game screen where the actual gameplay happens.
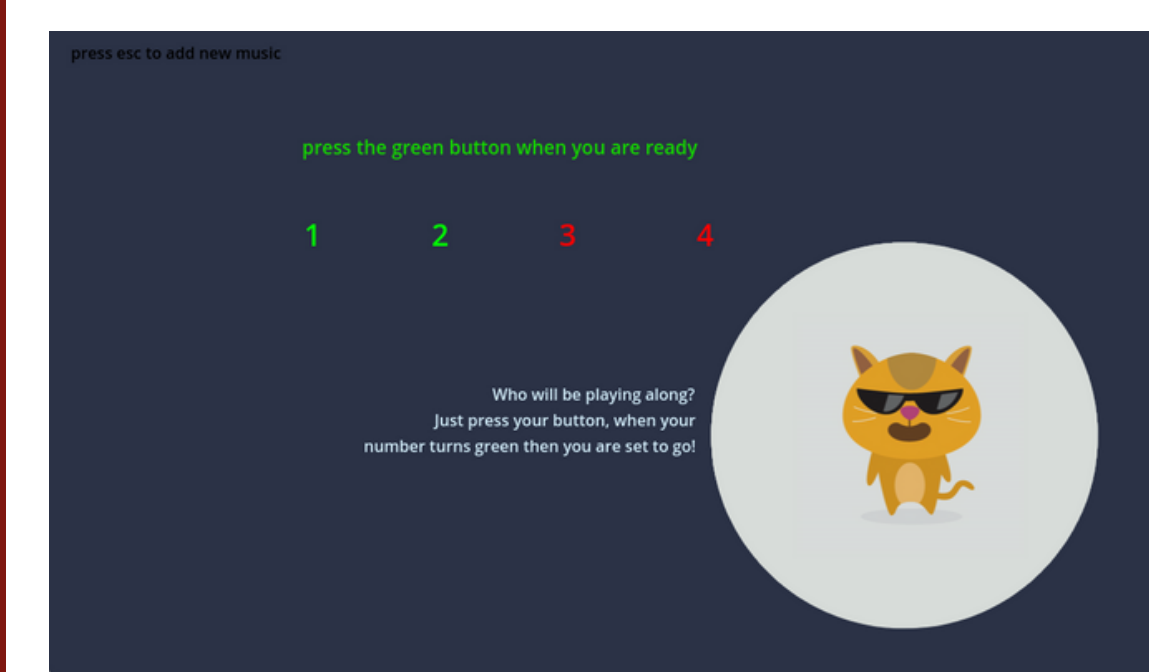

The last screen is not viewable by players as it is used to manage current songs, as well as upload new ones. This allows the game to be playable anytime instead of having to manage songs beforehand.

In addition, the game incorporates motivational reassurance through randomized voice clips. These clips are triggered by selecting a player at random and are tailored to the player's score, providing personalized motivation and encouragement.
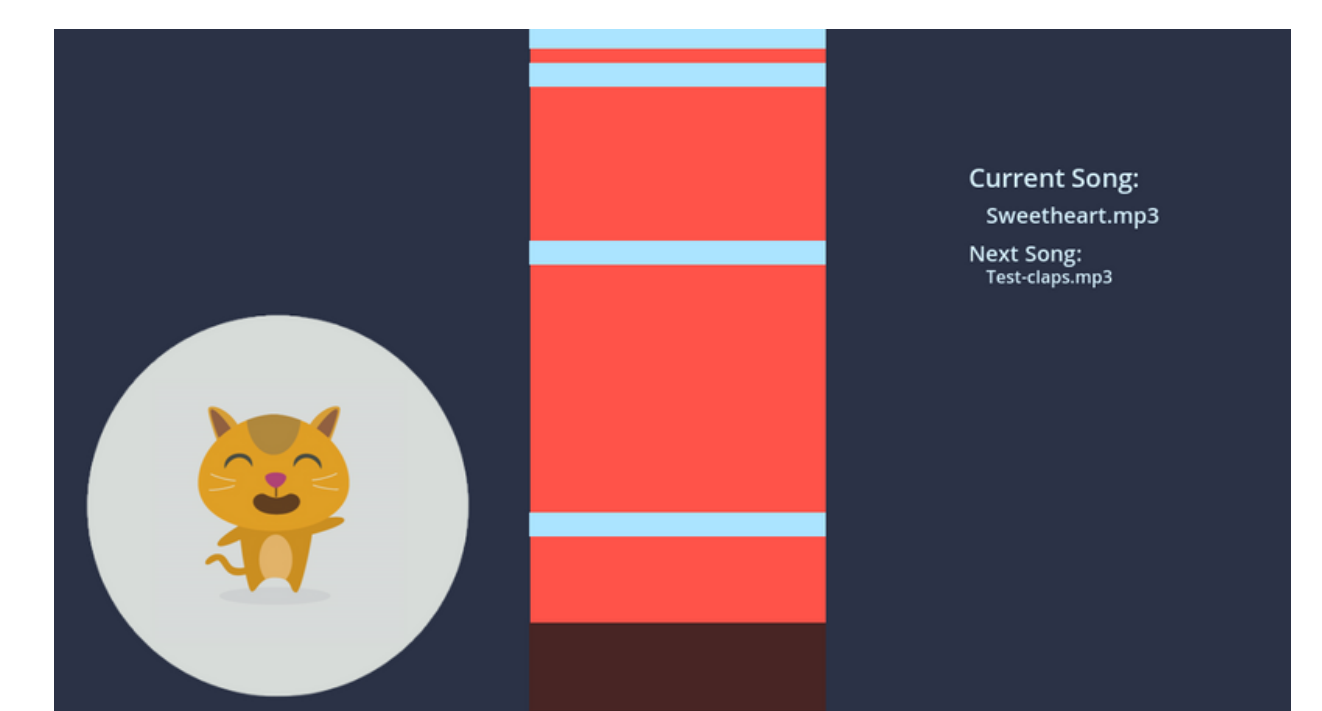

Controller

The controller comprises a central admin drum and four player drums. The central drum functions as a server, enabling automatic wireless connections for all players. This design eliminates any potential accidents caused by wires, ensuring a safer gaming experience.

The remote is built using key components, including a Raspberry Pi 3, a mini breadboard, and a sound sensor. This setup enables the device to accurately detect drum hits, facilitating smooth communication of the relevant information to the game.
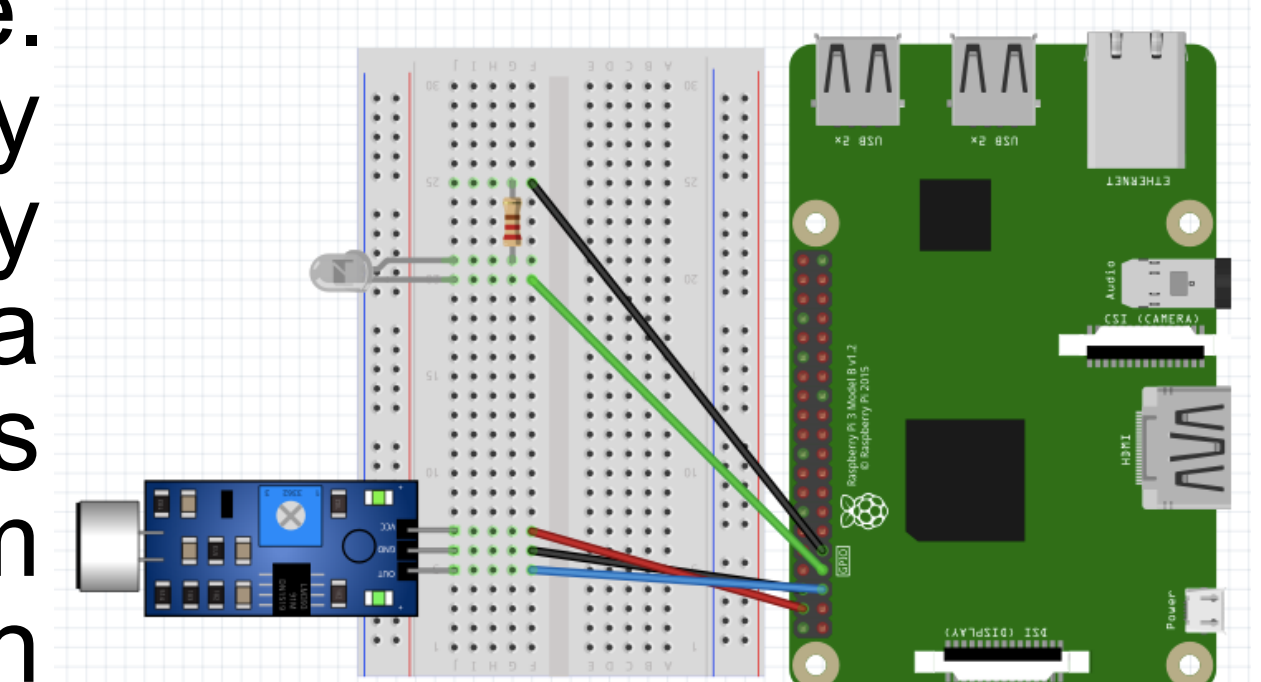
Preferred Music

A Python Script was written to analyze Mp3 files through the use of the librosa library. Mp3 files are converted to spectrograms using the short time fourier transform. From this it is divided into harmonic and percussive spectrograms as indicated below. The percussive spectrogram is then used to determine when drum beats are detected through the frequency of the sound as well as the decibels.
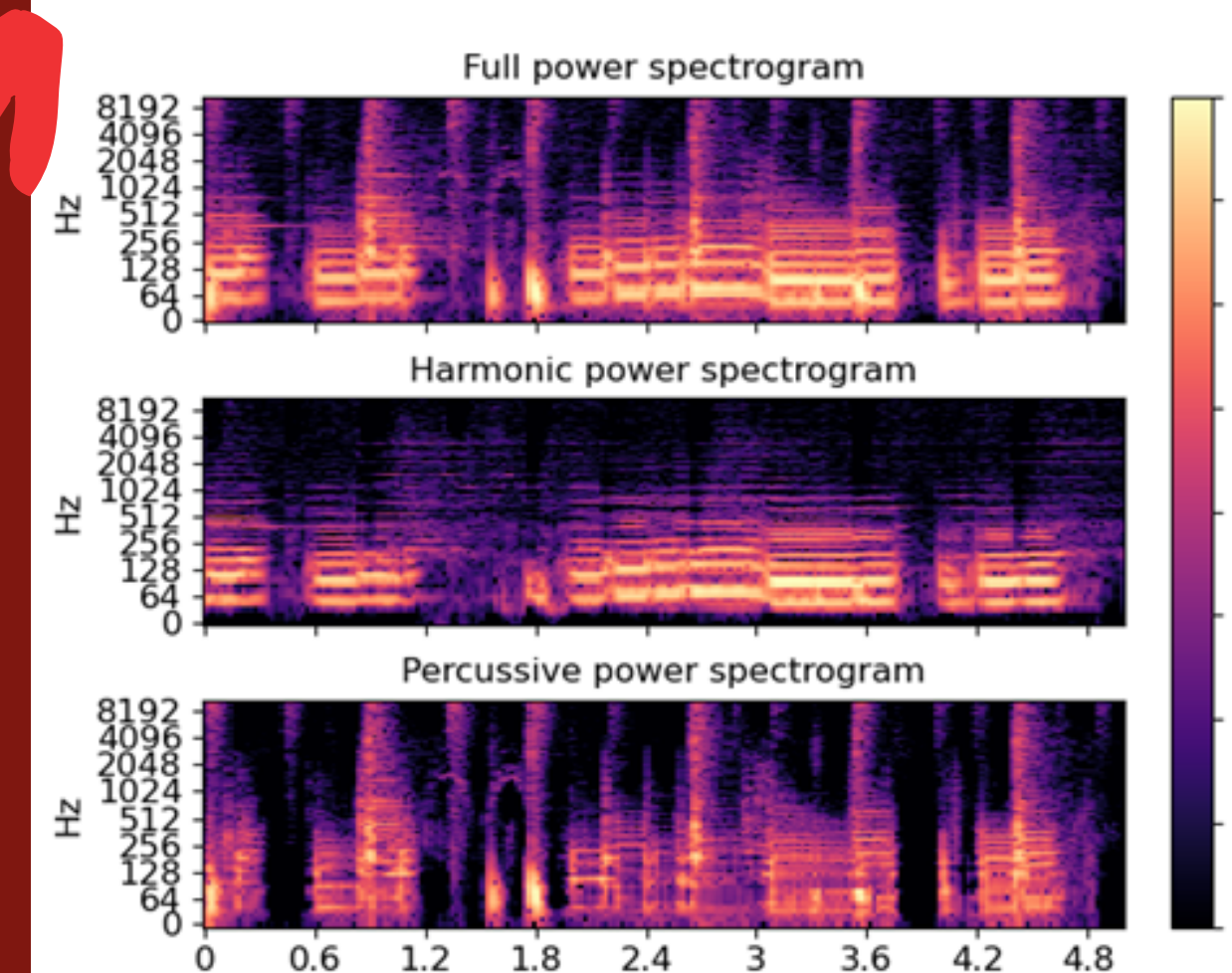
The timestamps are subsequently exported to a .txt file, which the game utilizes. The script is designed to ensure that the number of timestamps falls within an acceptable range before exporting the file. It functions as an executable file, automatically running each time a new song is uploaded through the game.

Results

To adhere to ethical principles, the Serious game's efficacy was assessed by engaging an expert reviewer, Dr. Susan Coetzer, a renowned Geriatrician. Her evaluation out of 10 encompassed the following key categories:

- Effectiveness 10
- Usability 8
- Engagement 9
- Integration of music therapy 10
- Implementation 9
- Accessibility 7
- Impact on Emotional Well-being 9
- Adherence and Long-Term Use 9