

Piano Therapy

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Introduction

- Stroke is the leading cause of serious long term disability
- Every 40 seconds, someone in the United States has a stroke
- Stroke-related costs in the United States came to nearly \$56.5 billion between 2018 and 2019

Home based rehabilitation as a solution

- Provides flexibility of location and time
- Inexpensive
- Might be the only accessible form of therapy for patients who live in remote areas
- Can be more engaging compared to traditional physical exercises

Home based rehabilitation

Games

Virtual Reality

Telerehabilitation

Sensors

Robotic Devices

Tablets

[2] Yu Chen, Kingsley Travis Abel, John T. Janecek, Yunan Chen, Kai Zheng, Steven C. Cramer, Home-based technologies for stroke rehabilitation: A systematic review, International Journal of Medical Informatics, Volume 123, 2019, Pages 11-22

Introduction

- Engagement and accessibility are crucial aspects for the success of a home-based intervention. [2]
- Stroke patients often give up on traditional exercises because they get monotonous and boring. We propose that playing musical instruments would be engaging and would provide both extrinsic and intrinsic motivation to boost learning.
- Offering piano learning via a tablet based application provides more accessibility.

[3] Chen YA, Norgaard M. Important findings of a technology-assisted in-home music-based intervention for individuals with stroke: a small feasibility study. Disabil Rehabil Assist Technol. 2023 Nov 1:1-11. doi: 10.1080/17483107.2023.2274397.

Research Questions

RQ1. Does musical feedback in a tablet-based piano learning application result in increased engagement for hand affected stroke patients?

RQ2. Does musical feedback in a tablet-based piano learning application result in improved note accuracy for hand affected stroke patients?

Hypothesis

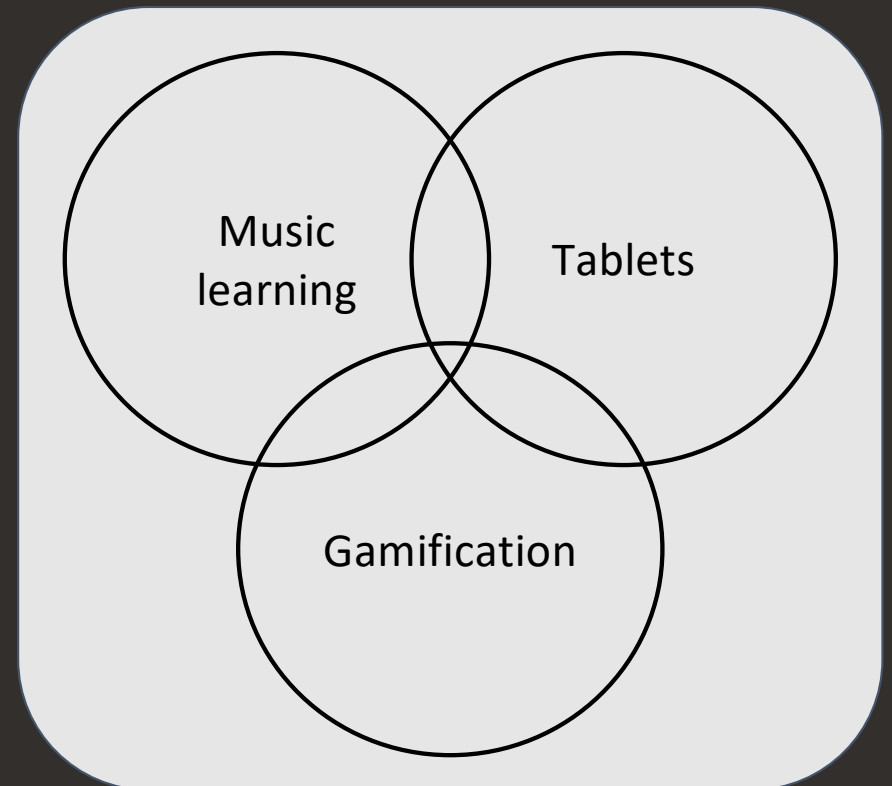
1. Musical feedback in a tablet-based piano learning application results in increased engagement
2. Musical feedback in a tablet-based piano learning application results in improved timing accuracy

Operational Definitions

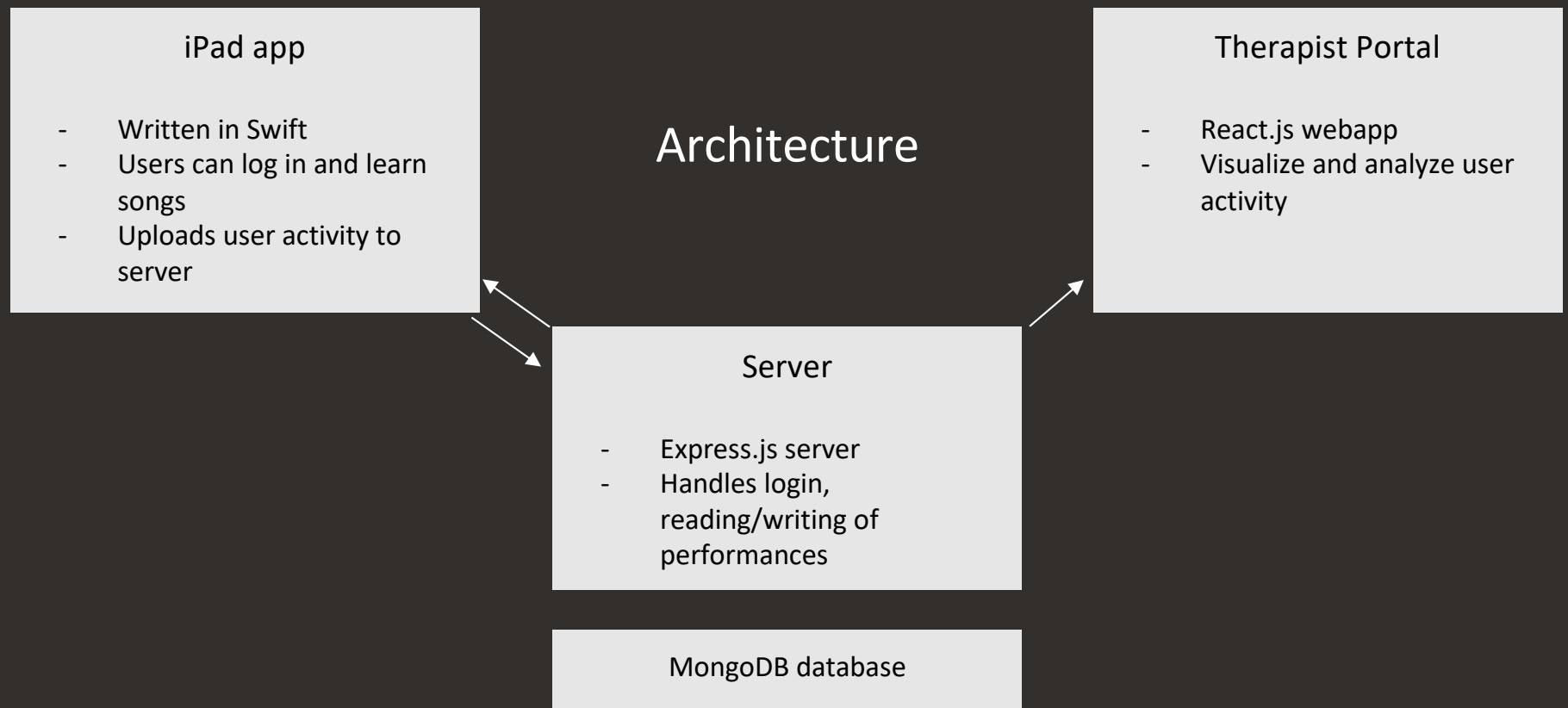
- Engagement
 - Total time spent
 - Average time spent per day (Total time spent/total number of days)
 - Usage trend
- Timing Accuracy
 - Delta time (Played note's time - expected time)
 - 0 is ideal

What is Piano Therapy?

- iPad application that helps you learn piano
- Catered to hand affected stroke patients
- Primary goal is rehabilitation



Methodology



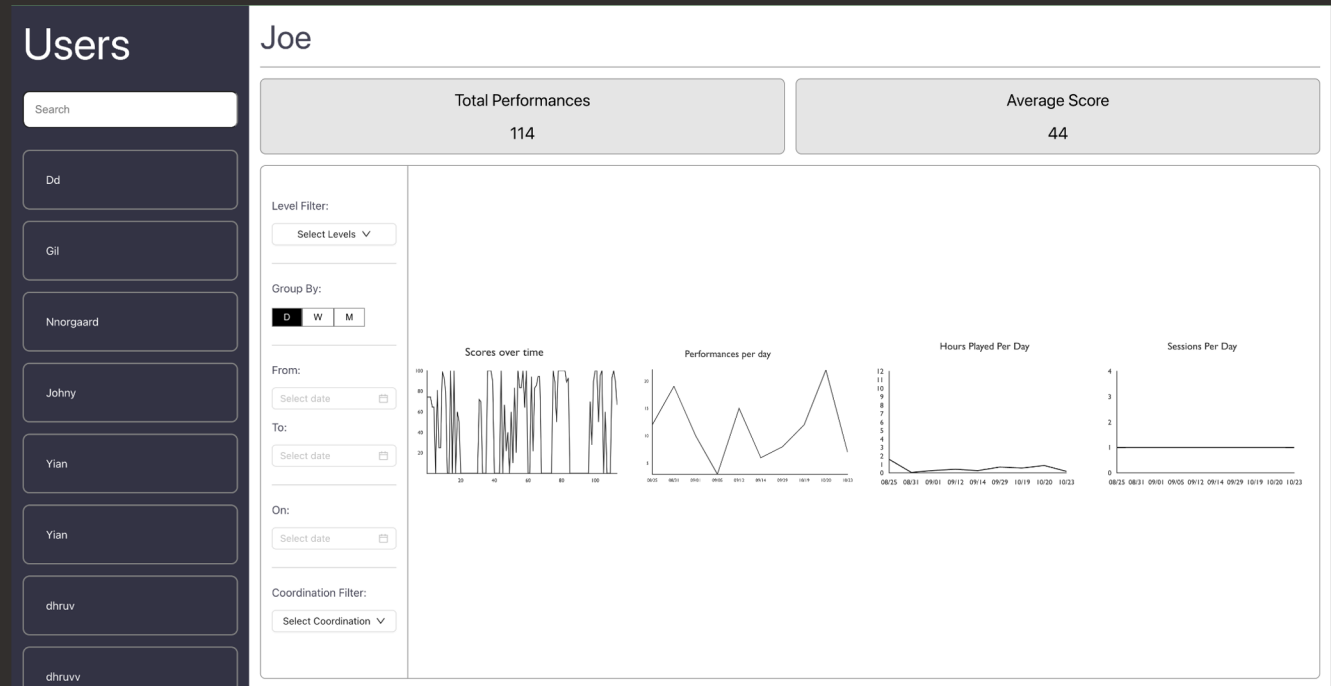
Methodology



Methodology

Therapist portal

- A web application that can fetch a user's activity, analyze and visualize relevant features
- Features
 - Playing performance
 - Engagement
 - Filtering by level, date ranges, hand, finger, target area of a particular exercise



Data collection

- Gave participants an iPad and MIDI keyboard to take home for 2 weeks
- Captured data points for each exercise
 - Tempo
 - Score
 - Detailed user activity
 - Notes played
 - Correct/Wrong/A bit off/Missed
 - Velocity
 - Delta time
 - Time stamps

Study Design

- Within subjects design
- One independent variable
 - Music vs non-music mode
 - Alternate mode everyday to counterbalance
- 36 songs in increasing order of difficulty
 - Participants need to cross a threshold score to get to the next song

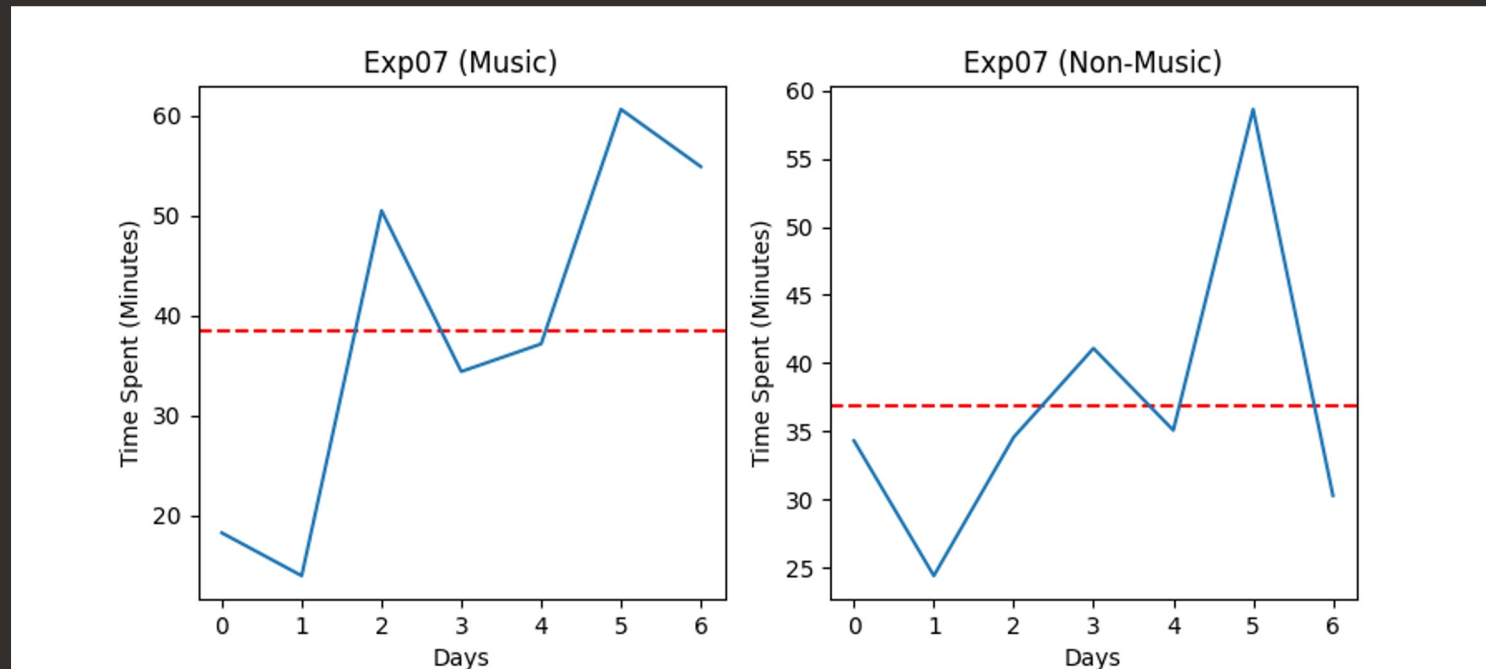
Preliminary Results

Engagement - Total time in minutes

	Music	Non-Music
Exp 06	98.59	99.95
Exp 07	269.9	258

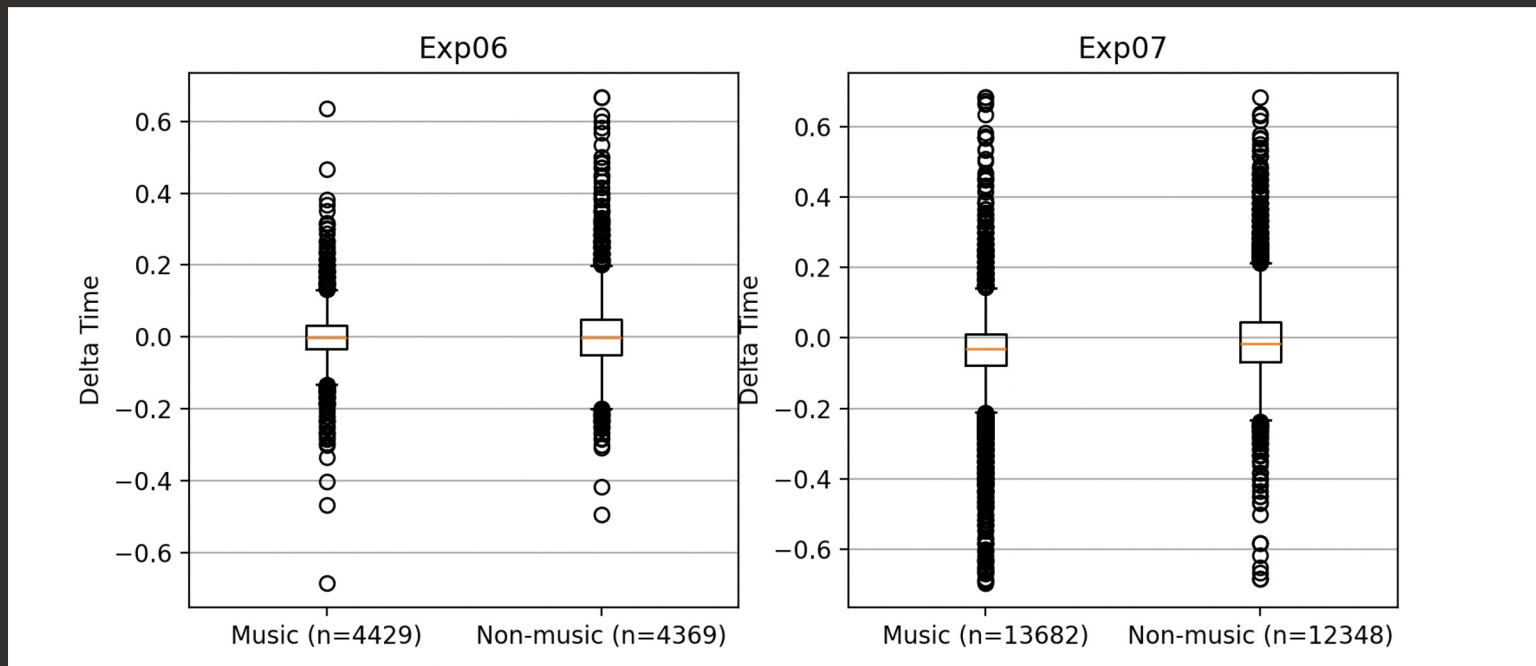
Preliminary Results

Engagement - Average use per day and usage trend



Preliminary Results

Timing accuracy - Delta time



p-value: 4.82e-07

p-value: 4.165e-179

Participant Video



Thank you