G.M. Walters Middle School,Fremont CA | Grade 8 | Gray Bae, Randall Kuhlmann
Kanya Annamalai and Tavisha Samarya

HarmoniTouch

A glove that will change the way the deaf perceive music.

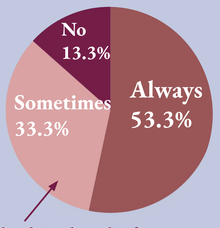
Problem Statement

We asked 51 people if they used music as a common ice breaker.

Over 466 million people face hearing loss, often leading to social exclusion.

Barriers to experiencing music widen this gap.

Aligns with UN Goal 10.2 for social inclusion by 2030.



We asked 15 hard of hearing (HOH) individuals if they have ever felt left out of conversations about music.

Objectives

Primary Objectives:

- Let hard-of-hearing users experience music through tactile vibrations.
- Design a comfortable, sign-friendly, user-first, wearable glove.

Secondary Objectives:

- We aim to make this product highly affordable and accessible for the deaf/hard of hearing community.

User Requirements

- The user needs to feel the beats and rhythms of the music through satisfying and enjoyable vibrations.
- HarmoniTouch is programmed to translate beats into vibrations produced by ERM vibration motors
- The user needs to be able to move their hand around without wires disconnecting
- All the tech and cables are neatly integrated into a wireless-compatible arm patch.
- The user needs the vibrations to vary in strength, reflecting the intensity of the music for a more immersive experience.
- The code ensures vibration strength is proportional to the music's intensity.
- The user needs the glove to be easy to wear for extended periods without causing discomfort or restricting hand movement.
- HarmoniTouch is made with a flexible and breathable cloth material.

Citations

1. National Association of the Deaf. "Community and Culture – *Frequently Asked Questions." Nad.org, National Association of the Deaf, 2019.*
2. Interview with Stefanie Ellis-Gonzalez, a deaf counselor at Ohlone College.
3. Interview with Trina Licht, a deaf Outreach Specialist at the California School for the Deaf.
4. Interviews with other staff and students at The California School for the Deaf.

We shared our idea with the deaf community. Engaging with the community ensured our glove met real needs. We plan to gather more feedback to improve our design!

Interviewees at the California School for the Deaf

Wifi Adapter; *To allow for wireless connection.*

Voltage Regulator; *Regulates the power from 9v→ 3v.*

Interior of Glove

Soft Cloth Glove; *Houses the motors.*

ERM Vibration Motors; *Gives off vibrations.*

Raspberry Pi 02W; *Located under the Adafruit, is the main microcontroller.*

9v battery; *Powers the motors.*

Adafruit Motor Driver; *Controls each motor.*

9v battery; *Powers the Pi.*

Voltage Regulator; *Regulates the power from 9v→ 5v.*

Exterior of the glove.

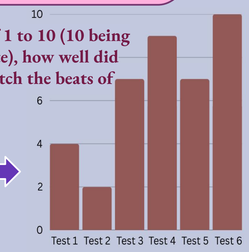
Testing

MotorTest.py
Our first and most important test was the motor test. We wrote a test code to evaluate our control over the motors and assess their capabilities.

AccuracyTest.py
We listened to the song and used our glove to evaluate its accuracy and similarities through vibrations. After each test, we refined our code.

Tests with users + user feedback
We asked 15 HOH individuals to test HarmoniTouch, and many provided **positive feedback**. A recurring concern among all of them was whether they could **still sign while using the glove**.

On a scale of 1 to 10 (10 being most accurate), how well did the glove match the beats of the song?



Design Process

Brainstorm
We made a list of inequities and their possible solutions.

Choosing an inequity
We weighed each of the inequities and chose the one with the biggest impact on society.

Initial Design
A glove that will translate beats from a song into vibrations.

Outreach
We talked to deaf and hearing staff members at California School for the Deaf (CSD).

Testing
We tested the actual product with staff members at CSD.

User Feedback
Many people brought up concerns about it being restricting and inaccessible.

Design Iteration
We fit the hardware into an arm-patch and made it wireless.

User Feedback
Users wanted a version of the glove that was more accessible to all.

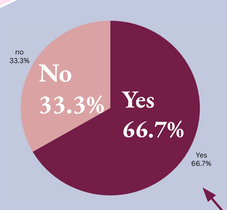
Next Steps
1. Find ways to make the glove cost effective.
2. Redesign the arm-patch for better accessibility.

Results

Summary of Results
HarmoniTouch allows deaf/HOH users to feel music in a new way, bringing people together regardless of their hearing ability.

Emotional Impact

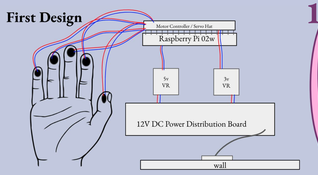
- Music supports healing and helps prevent mental illness.
- HarmoniTouch makes music something everyone can connect with.



We asked 15 HOH individuals if they would use HarmoniTouch.

Design Iterations

First Design



1 - Power supply + 9 volt battery

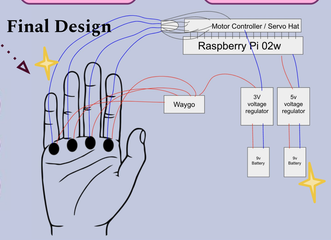
2 - Power distribution board + breadboard

3 +transistors

4 - 1 voltage regulator

5 +wifi adapter

Final Design



conclusion

Successes, Challenges, and Next Steps for This Project

By connecting with the hard-of-hearing (HOH) community, we've gained meaningful insight into their experiences and needs. Every challenge in coding and building pushed us to grow and adapt. Through continuous refinement and user feedback, we've worked to create a design that truly supports the HOH community — and we're committed to improving it until it meets their expectations.