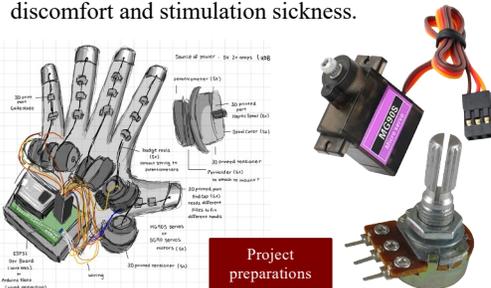


Introduction

Over the course of summer, I worked in Professor Heather Culbertson's lab under the mentorship of PhD student Yang Chen. In our research project, we studied ways to allow for users to feel touch in virtual environments, creating a much more immersive experience. This was not only targeted towards creating a more realistic and immersive experience for games, but also towards the helping the public.

Research Objectives & Impacts

The objective of the Professor's research is to find ways to help people through the study of haptics. Haptics is a very simple yet complex topic of study, dealing with humans' perception of touch, which is something we all use but can be easily neglected. Through studies, our Professor and her research team has found that touch is mainly just vibrations on the skin, therefore through different stimulations and applications, haptics can be added to many important parts of engineering and life. Specifically, my mentor focuses on finding ways to help people overcome stimulation sickness. VR only stimulates humans' visual perception, causing imbalances and may cause nausea. However, if more senses like touch are stimulated, it could potentially help make the virtual experience more realistic and therefore reduce discomfort and stimulation sickness.



Project preparations

Skills Learned

Throughout the project, we utilized 3D printing with both PLA and resin to manufacture the hardware needed:

Applications for 3D prints:



PrusaSlicer



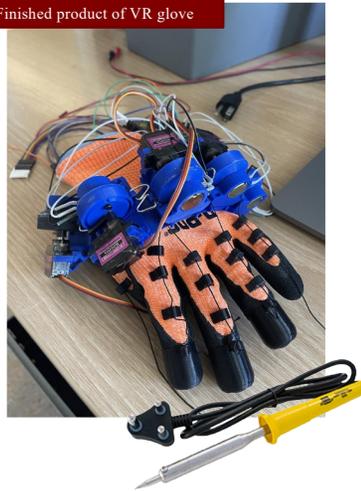
Preform/FormLabs

After getting all the hardware printed, often there were problems, so we had to do some post processing like sanding down rough edges

Wiring esp32 board (using a breadboard)
- soldering and circuits



Finished product of VR glove



After all the hardware was put together, we inspected an Arduino Code from GitHub and tested out the potentiometers on the glove.

Afterwards, we utilized the Unity software to build and code a piano demo for the gloves:

Learning how to create game objects as well as how to add physics to objects using meshing and rigidbodies



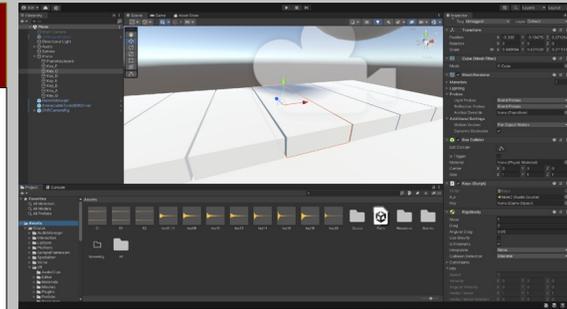
Through this project, I also learned and gained exposure to C++ code

```

1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4
5 public class Keys : MonoBehaviour
6 {
7     public AudioSource a_s;
8     string myname;
9     public GameObject key;
10    void Start()
11    {
12    }
13    void Update()
14    {
15    }
16    void OnCollisionEnter(Collision collision){
17        //print(collision.gameObject.name);
18        if(collision.gameObject.name != "Audio"){
19            print("colliding rm");
20            a_s.PlayDelayed(5);
21            //key = GameObject.Find("/PianoKeyboard/Key_C");
22            transform.Rotate(30, 0, 0);
23        }
24    }
25    void OnCollisionExit(Collision collision){
26        //print(collision.gameObject.name);
27        if(collision.gameObject.name != "Audio"){
28            a_s.Stop();
29            print("exiting rm");
30            //key = GetComponentInParent<Key_C>();
31            //key = GameObject.Find("/PianoKeyboard/Key_C");
32            transform.Rotate(-30, 0, 0);
33        }
34    }
35    public AudioSource getthisAudioSource(){
36        return a_s;
37    }
38 }

```

C++ code for piano demo shown in visual studio code



Relating to STEM

This experience not only allowed me to learn the manufacturing process of products, but also learn the software side through computer science. Throughout, I was able to apply my knowledge in many STEM topics from math to physics.

Next Steps

I am interested in continuing this research project with our lab into the school year:
- improving haptics experience through addition of MR fluid and vibrational devices
- increase versatility and help make the glove universally available
I hope to share the knowledge I have learned from this experience and be able to build upon the research that have been done.

Acknowledgement

Thank you so much to Professor Heather Culbertson for accepting me into the HaRVI lab and Yang Chen for mentoring me throughout my project. Thank you to Dr. Katie Mills and the SHINE team for giving me such a great opportunity here at USC; and thank you to Natalie Lim for being my lab partner.