



# Virtual Reality Haptic Feedback Gloves

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## Abstract

- The over-arching goal of this project is to develop advanced haptic feedback gloves designed to enhance virtual reality experiences.
- This is based on the work by LucasVR Tech<sup>1</sup> and Adam Curtis<sup>2</sup>
- The idea of a single potentiometer was the greatest preexisting main contribution. Contributions by me include: More accurate data and documentation of the price and effort that needs to be put in by the layman, modified 3D printing models, and greater depth of instruction to replicate the project. The project is expected to continue progress towards resolving its current greatest limitation in the inability to display and account for finger splay on the X axis.

## Introduction

- The glove creation process was extensively documented, including the process of 3D printing, to allow for reproducibility. Future work will add another potentiometer to measure finger splay.
- The main goal of the project is to use a potentiometer connected to a spool of spring which is ran along each finger to measure the rotation of each individual finger on the Z-axis. From the raw data from the potentiometers is sent via Bluetooth to a machine running SteamVR and the OpenGloves driver in tandem.
- From there, once the connection from our ESP32DevModule to our machine has been achieved and raw data is being actively transferred, that raw data is processed by the OpenGloves driver and turned into the positional data of each finger in SteamVR.
- Haptic feedback is then introduced by the addition of a servo motor that restricts the movement of the spool.

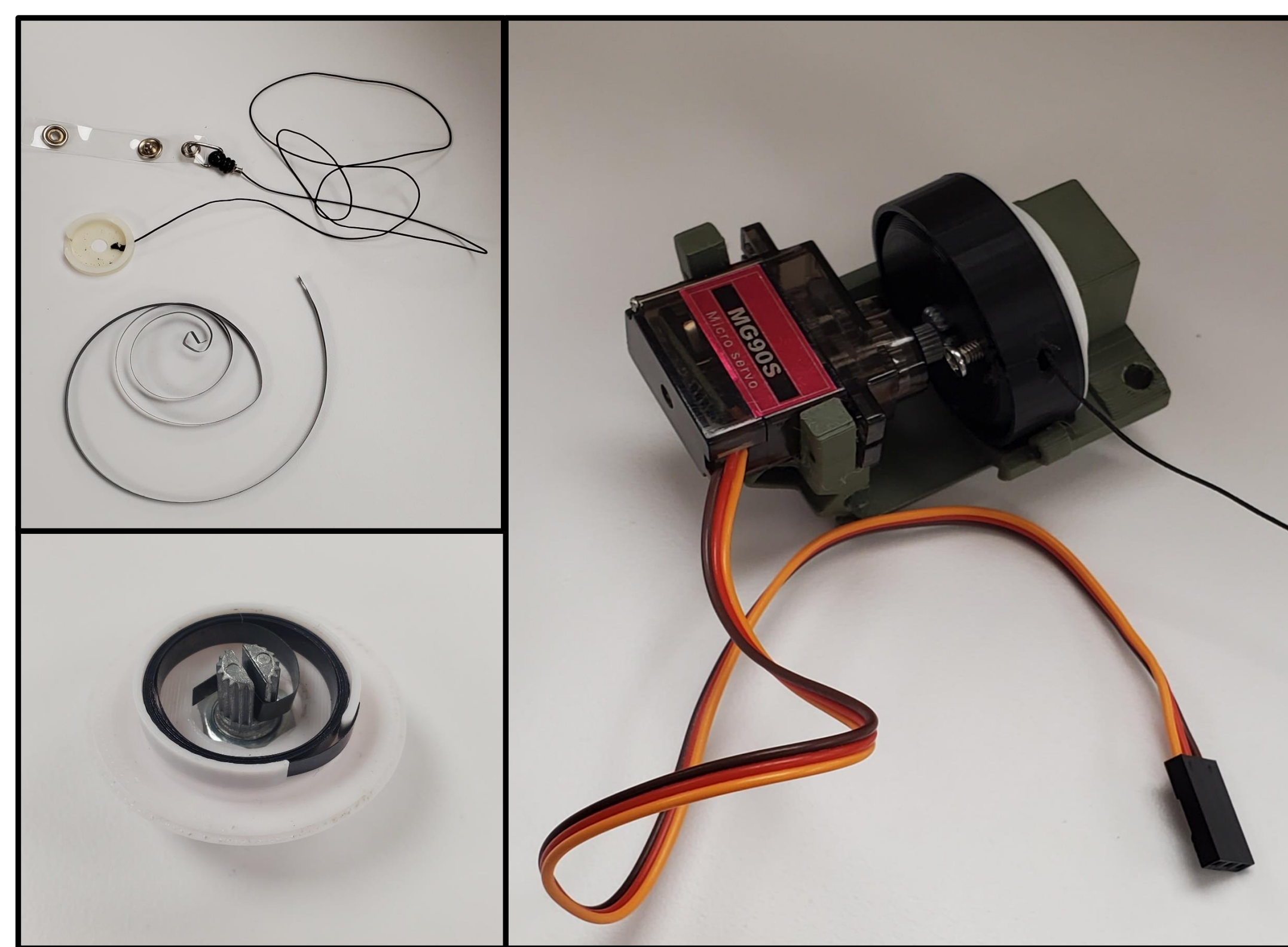


Figure 1: Example Parts(Left) and Haptic Module(Right)

## Methods and Materials

- Parts different from/Parts unlisted in source content:
  - Electronics Kit
  - Modified Slide\_Holder.STL model
- The original project was designed and printed with Ender 3 printers in mind, I repurposed these models for the 3D printers available to me, being the Bambu X1-Carbon and Prusha Mk.4.
- The wiring of the original project was achieved via soldering JST connectors directly to the ESP32DevModule, however I wanted to bring this down to a more accessible level to give the layman a more comprehensive approach to this project.
  - The use of a breadboard is a much more familiar approach to many, compared to the original sauntering of JST connectors.
  - With this, the wiring diagram is still followed yet now represented in differently<sup>3</sup>.

## Current State

- **Limitations of project at its current state:**
  - Inability to process finger splay
  - Reliance on SteamVR
- **Abilities of the project at its current state:**
  - The project does achieve its goal of bringing haptic feedback virtual reality gloves to the layman.
  - Because the drivers were based upon SteamVR, any VR headset with the ability to connect to SteamVR is able to take advantage of this project including but not limited to Meta Quest 2, Vive, Valve Index and more.
  - Haptic feedback is enabled for demonstration purposes and a game that has had the behavior coded into it.
- Implementation of haptic feedback into future games is currently in the works.

```
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```

Figure 2: Example serial data being sent to the machine via Bluetooth

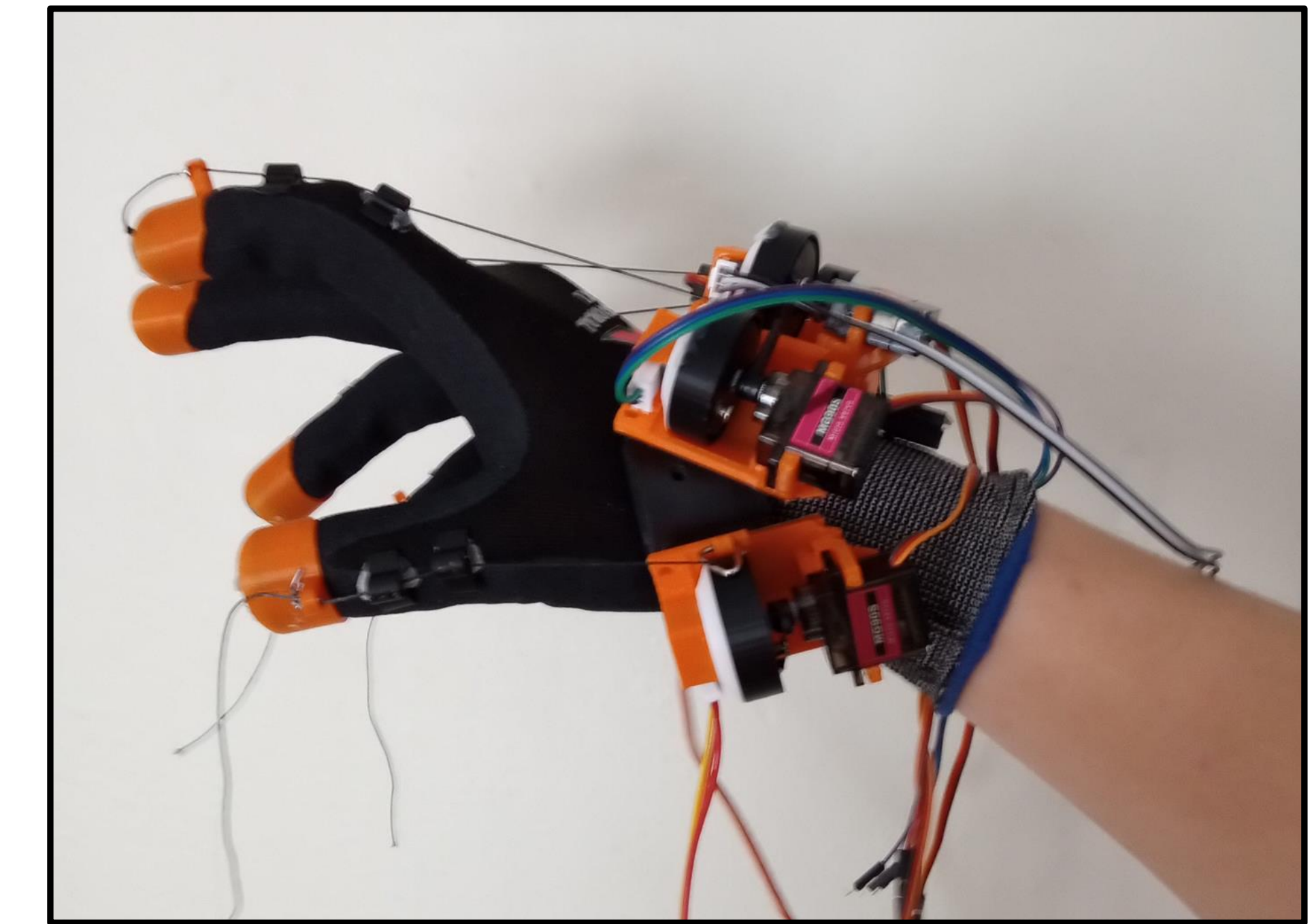
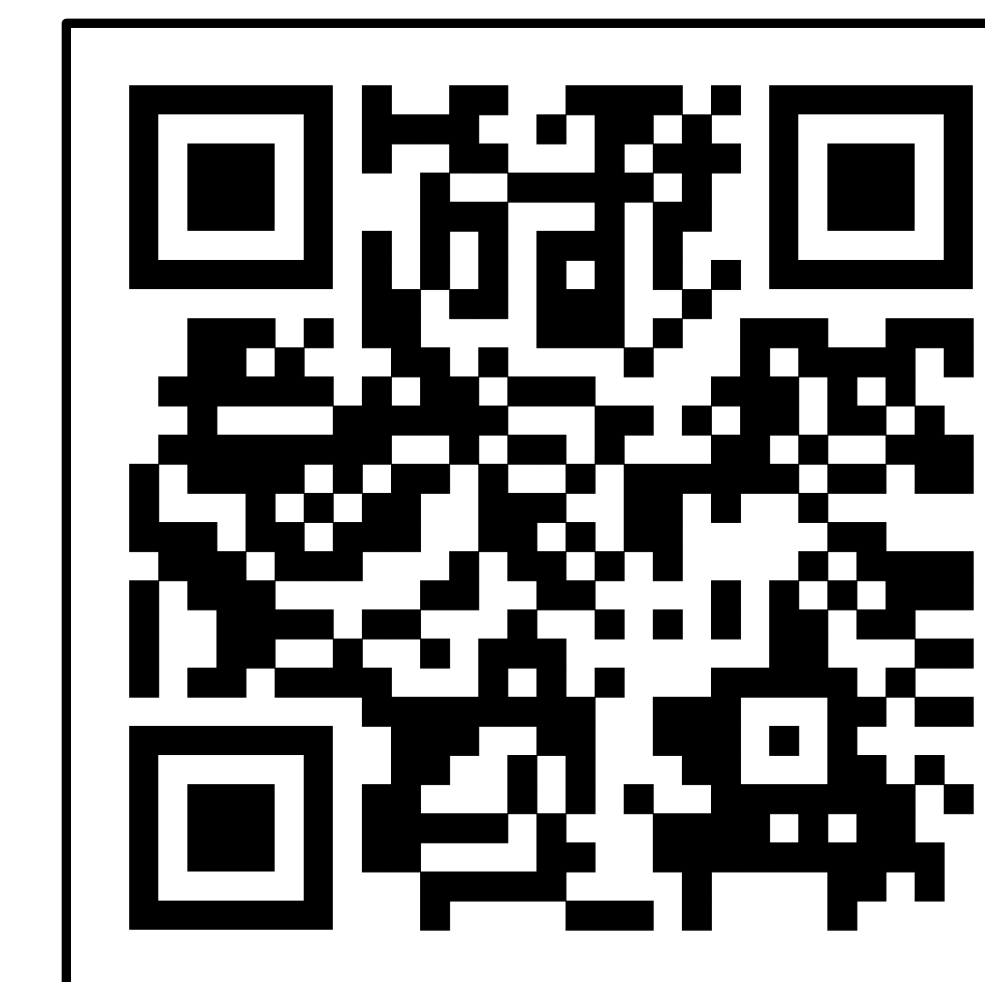


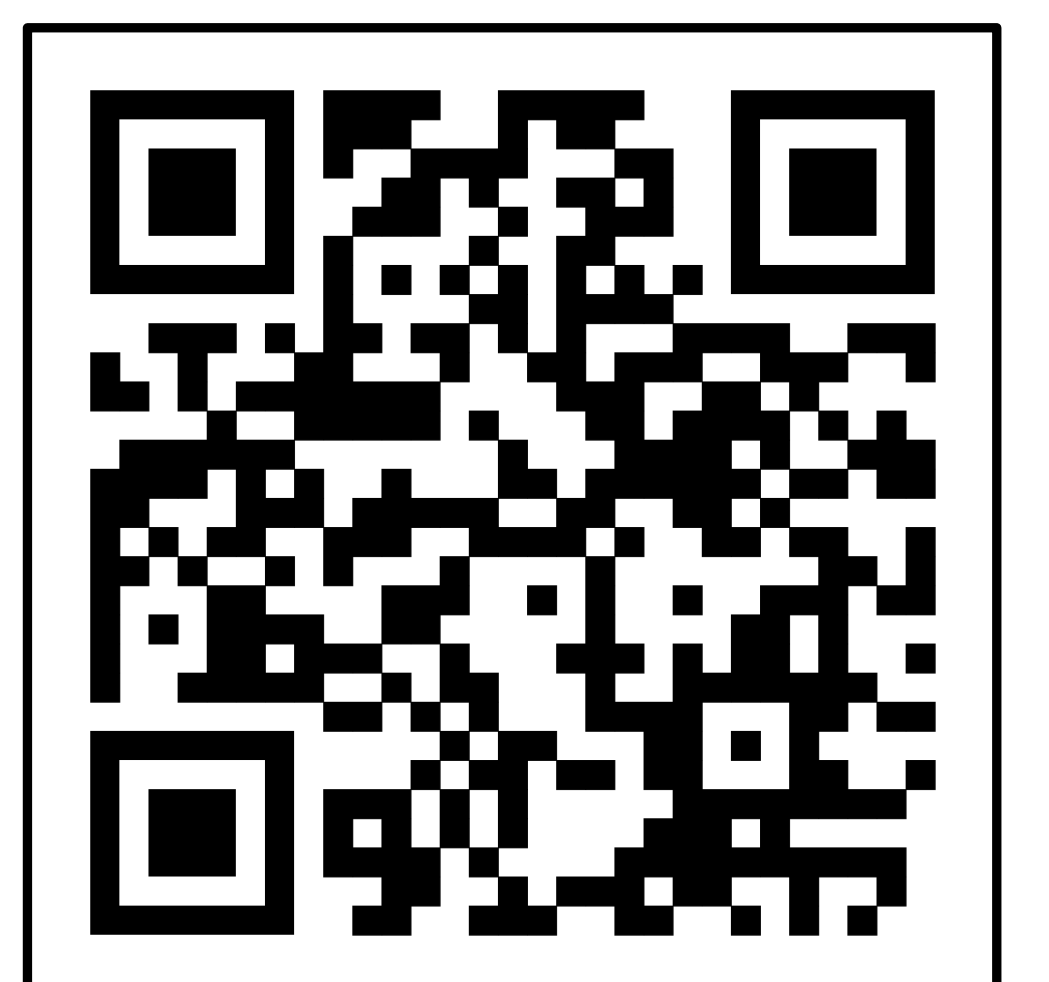
Figure 3: The glove being worn while grabbing an object in VR

## Future Improvements

- The next step to the project is found within Adam Curtis' "Remote Feelings" project. This design replicates the feedback of a robotic arm onto a person's hand via a haptic feedback glove.
- **This project contains a solution to this project's primary problem of the inability to process input of each finger on the X-Axis.**
  - It does this by using a joystick-style setup of two potentiometers assigned to each knuckle, which each measure the movement of your fingers via a 3D printed arm extending from the joystick to each fingertip.
  - The distinct advantage of this approach is XZ-axis measurement as apposed to the sole X-axis measurement of the approach described here.
  - The disadvantage with this approach is a significant increase in complexity required for driver development, wiring, and price.
  - So far, this project has given me great insight into the world of microcontrollers and embedded systems



LucidGloves  
GitHub  
Repository



Project  
GitHub  
Repository

## Contact

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## References

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2. <https://hackaday.io/project/183157-remote-feelings>
3. <https://github.com/LucidVR/lucidgloves/wiki/Prototype-4-Wiring-Diagram>