

# WRIST: A Wearable Radial Interface for Sensory haptic feedback

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## I. SYSTEM INTRODUCTION

Haptic feedback is critical for intuitive user-object interactions in virtual and augmented reality (VR/AR) environments [1]. Existing wearable haptic devices offer only a vibratory modality or depend on bulky external hardware that undermines portability and accessibility [2], [3]. To address this gap, we present WRIST (Wearable Radial Interface for Sensory haptic feedback), a low-cost (\$500), 3D-printed multi-modal haptic bracelet integrating radial squeeze and vibrotactile feedback via a single DC motor and five linear resonant actuators. Assembled using common hand tools and off-the-shelf electronics, WRIST can deliver up to 10 N squeeze force with an actuation time of 0.1 s. WRIST matches state-of-the-art performance while reducing costs by over 80% and eliminating external power and signal generators. Its modular design supports rapid assembly for VR/AR training, teleoperation, rehabilitation, and entertainment, enabling wider adoption of wearable haptic devices for extended reality environments.

## II. HANDS-ON DEMONSTRATION

The hands-on demonstration showcases radial squeeze and addressable vibration with a VR game and a serial command user interface. Users can interact with both setups.

### A. VR Environment

We developed two VR rooms with various interactable objects. Using custom scripts, we link in-game object interactions to haptic sensations using a serial output that commands the WRIST to actuate in real-time. In the first environment (Fig. 1), one button actuates all five vibrotactors upon full depression, while another button actuates all five vibrotactors at a magnitude proportional to the button's depression. The second environment is an archery range with a bow and arrow. When the user pulls back the bow string to shoot, WRIST squeezes the user's wrist at a force proportional to the pull distance – simulating the resistance a user would feel when pulling back a real bow string.

### B. Serial Command User Interface

We have also designed a serial user interface (Fig. 2) to directly interact with the WRIST device without needing a VR setup. This UI allows people to directly feel the different functions of the device.

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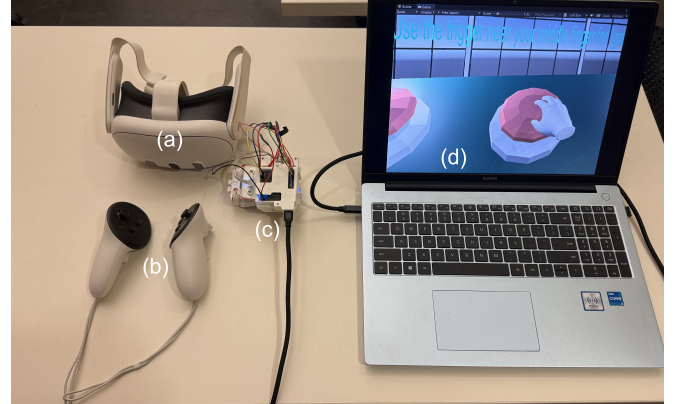


Fig. 1. VR Demo Setup: (a) Head mounted display Meta Quest 3 (b) Meta Quest 3 controllers (c) WRIST device, plugged into the laptop via a USB cable, and (d) computer featuring the Unity VR environment.

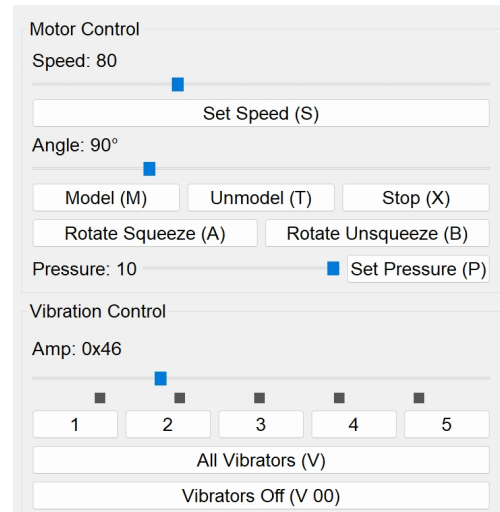


Fig. 2. User interface with buttons and sliders that allow users to freely choose the level of feedback they receive from the WRIST device.

## REFERENCES

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