

# Demonstrating Vibrotactile Feedback in Augmented Reality with the FingerTac

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## I. INTRODUCTION

Vibrotactile feedback has many capabilities, while being easy to implement and cost-effective [1]. Hence, many fingertip [2] and smartglove devices [3] devices incorporating vibrotactile feedback have been developed by researchers and industry. The FingerTac developed by Hulin et al. introduces a novel concept to vibrotactile thimble devices using linkages to transmit the vibration from the actuator on the back of the finger symmetrically towards the inner to reduce obstruction of the user and to enable augmented haptics [4].

## II. THE DEMONSTRATOR

To demonstrate the benefits of haptic feedback and understand its limitations using the FingerTac we developed an augmented reality interface using the HoloLens 2 and UI elements from the Mixed Reality Toolkit 2 (MRTK2) by Microsoft. The Interface consists of three spaces, that can be navigated using a menu. The first space demonstrates how vibration can augment incremental slider UI elements. The slider is grabbed by a pinching gesture. Moving the hand moves slider, which jumps to the next increment once the hand gets closer to it. The jump of the slider is augmented by vibrational feedback of the FingerTac. The presented sliders differ in increment size and the vibrational feedback is adjusted accordingly. The second space demonstrates the use of vibrational feedback for object manipulation tasks with restrictions. The user is presented with three virtual objects. Two of the objects can be manipulated with bounding boxes, the third object can be moved freely. The objects with bounds control attached allow transformation and scale respectively, both of which are constrained. The user is presented with feedback when selecting and releasing the object and when the constraint of a manipulation is exceeded. The third space presents the user with buttons for triggering vibrations for success and failure feedback.

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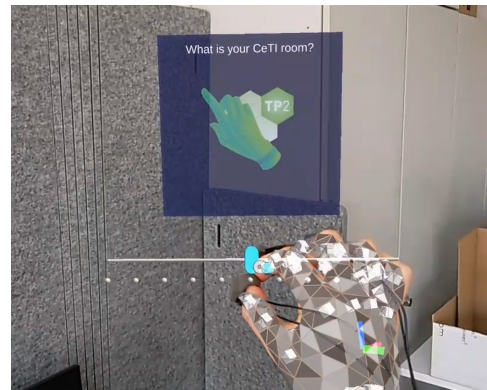


Fig. 1. A screenshot of the demonstrator from the perspective of the user showing a slider interacted with by the user wearing the FingerTac

## III. OUTLOOK

The demonstrated augmented haptics device has the potential to be beneficial for several real-world applications. We plan to investigate intuitive robot programming for industrial human-robot interaction applications. We also intend to compare the FingerTac against other available devices to better understand the advantages and disadvantages of different haptic feedback devices in terms of usability.

## REFERENCES

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