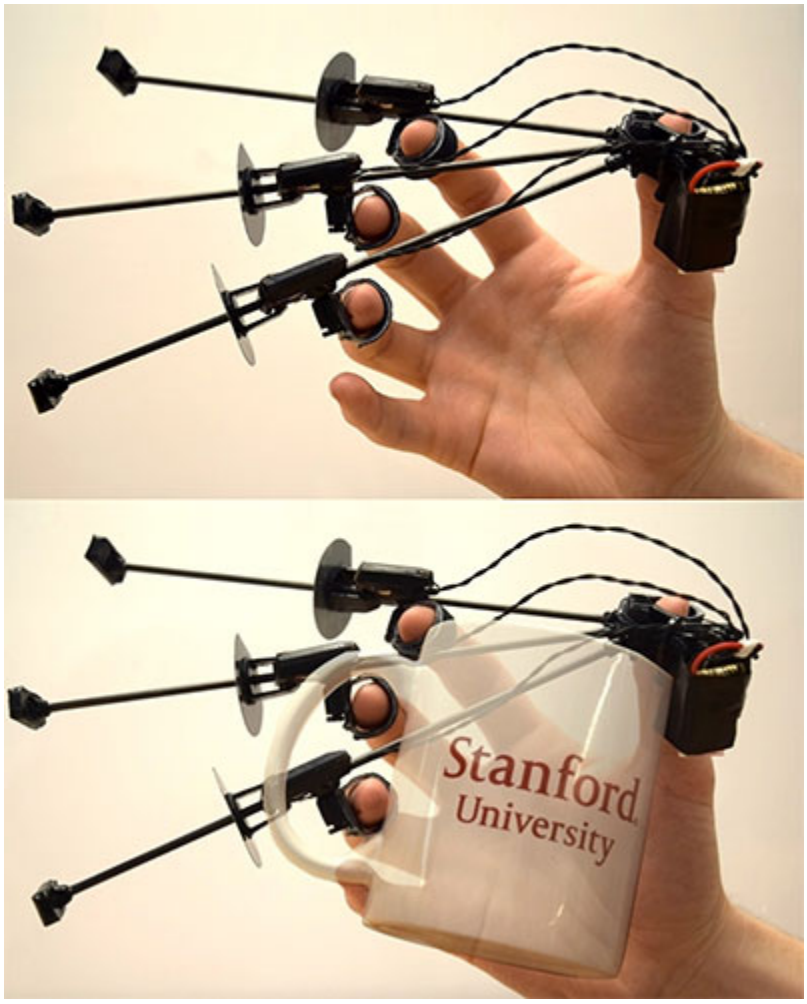
Docket #: S16-176

Wolverine: A Wearable Haptic Interface for Grasping in Virtual Reality

Stanford researchers have patented the "Wolverine," a mobile, wearable haptic device designed for simulating the grasping of rigid objects in virtual reality. This low cost, lightweight device recreates the feeling of pad opposition (precision) type grasps like gripping a rigid object by providing force directly between the thumb and three fingers. Leveraging low-power brake-based locking sliders, the system can withstand over 100N of force between each finger and the thumb, and only consumes 0.24 mWh (0.87 joules) for each braking interaction. Integrated sensors are used both for feedback control and user input: time-of-flight sensors provide the position of each finger and an IMU provides overall orientation tracking. "Wolverine" is lower cost, lighter, and more energy efficient than similar existing devices due to a simple braking mechanism, making it an attractive haptic device for virtual and augmented reality, gaming, and telerobotic applications.



"Wolverine" prototype holding cylindrical object (in this case, Stanford mug)
Image courtesy of SHAPE lab

Stage of Development – Prototype
The working 55gm prototype (including a 350mAh battery) simulates over 5500 full fingered grasping events with 6 hours of battery life. "Wolverine" is lower cost, lighter, and more energy efficient than similar existing devices due to a simple braking mechanism.

Applications

- **Haptic feedback** for telerobotics, virtual and augmented reality, and gaming - allows a user to grab, hold, and release rigid objects in virtual reality simulations.

Advantages

- **Low-cost-** - simple, low production cost mechanism compared to other haptic feedback devices.
- **Energy efficient-** - brakes lock rods into place and provide haptic feedback with a low energy consumption per braking interaction
- **Lightweight** - provides a more realistic tactile sensation compared to other haptic devices.
- **Convenient-** wireless, Bluetooth driven.
- **Designed for immersion-** no resistance when releasing objects.

Publications

- Hawkes, E. W., Choi, I., & Follmer, S. (2019). *U.S. Patent No. 10,248,201*. Washington, DC: U.S. Patent and Trademark Office.
- Choi, I., Hawkes, E. W., Christensen, D. L., Ploch, C. J., & Follmer, S. (2016, October). Wolverine: A wearable haptic interface for grasping in virtual reality. In *2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 986-993). IEEE. DOI:10.1109/IROS.2016.7759169
- Choi, I., & Follmer, S. (2016, October). Wolverine: A wearable haptic interface for grasping in vr. In *Proceedings of the 29th Annual Symposium on User Interface Software and Technology* (pp. 117-119).

Patents

- Published Application: 20170322626
- Issued: 10,248,201 (USA)

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