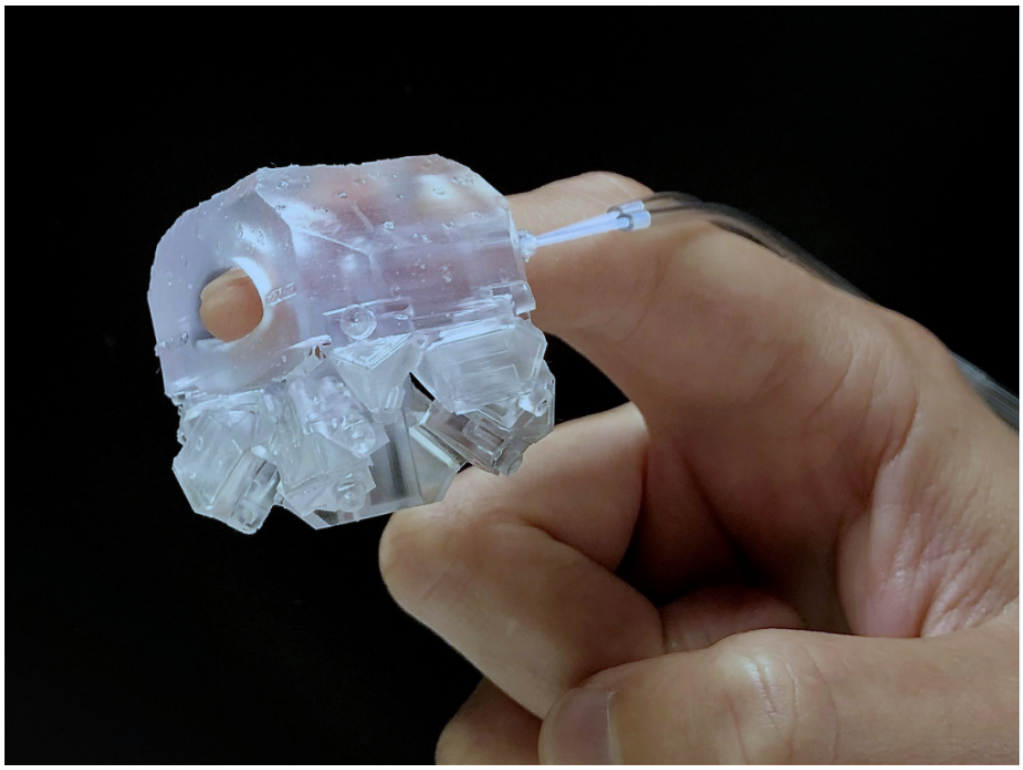
Docket #: S21-447

FingerPrint: a 3D printed, fingertip stimulating haptic device

Researchers in the Collaborative Haptics and Robotics in Medicine Lab at Stanford University have developed a monolithically 3D printed haptic device that provides skin pressure, linear and rotational shear, and vibration feedback. Thousands of mechanoreceptors in a finger pad allow us to distinguish various objects and their properties, such as rigidity, size, texture, among others. Engineering a compelling fingertip haptic device for stimulating such complex interactions must balance miniaturization, multifunctionality, and manufacturability. The origami inspired CHARM Lab fingertip haptic device design called 'FingerPrint' embeds foldable vacuum actuation and produces 4-degrees of freedom of motion on the finger pad with tunable haptic forces (including but not limited to 1.3 N shear and 7 N normal) and torque (25 N-mm), which provides a wide range of tactile and physical stimulation. The easy to manufacture, compact device is 40 mm long and 20 mm wide. FingerPrint is scalable beyond fingertip use for various tactile or physical skin stimulation of other human body parts, such as wrist, arm, legs, trunk, or face, making it attractive for consumer-oriented, medical, and research applications.

Stage of Development - Prototype



FingerPrint Prototype
Image courtesy the CHARM Lab

Applications

- **Haptic device** for:
  - Virtual and augmented reality, and gaming
  - Medical rehabilitation, training, research, and simulation
  - Pre-market haptic device prototyping and perception studies

Advantages

- **Easily customizable and scalable** beyond the fingertip
- **Easy fabrication** (3D printed monolithic structure)
- **Lightweight and compact**
- **Realistic & immersive** tactile stimulation

Publications

- Zhakypov, Z., and Okamura, A. M., (2022). FingerPrint: A 3-D Printed Soft Monolithic 4-Degree-of-Freedom Fingertip Haptic Device with Embedded Actuation. In *In IEEE Soft Robotics Conference (Accepted)*..

Patents

- Published Application: 20230259212
- Published Application: 20240038034
- Issued: 12,315,362 (USA)

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