

Feelium: A Touchable Blimp Body for Aerial Telepresence

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George Xi Wang¹, Henghao Li², Shan Lin², Yunge Wen³, Jiaqian Hu⁴, Yuhua Jin²

¹Stony Brook University, Stony Brook, New York, USA · ²School of Science and Engineering, The Chinese University of Hong Kong, Shenzhen, China · ³MIT Media Lab, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA · ⁴Middlebury Institute of International Studies at Monterey, Monterey, California, USA · Contact: george.x.wang@stonybrook.edu

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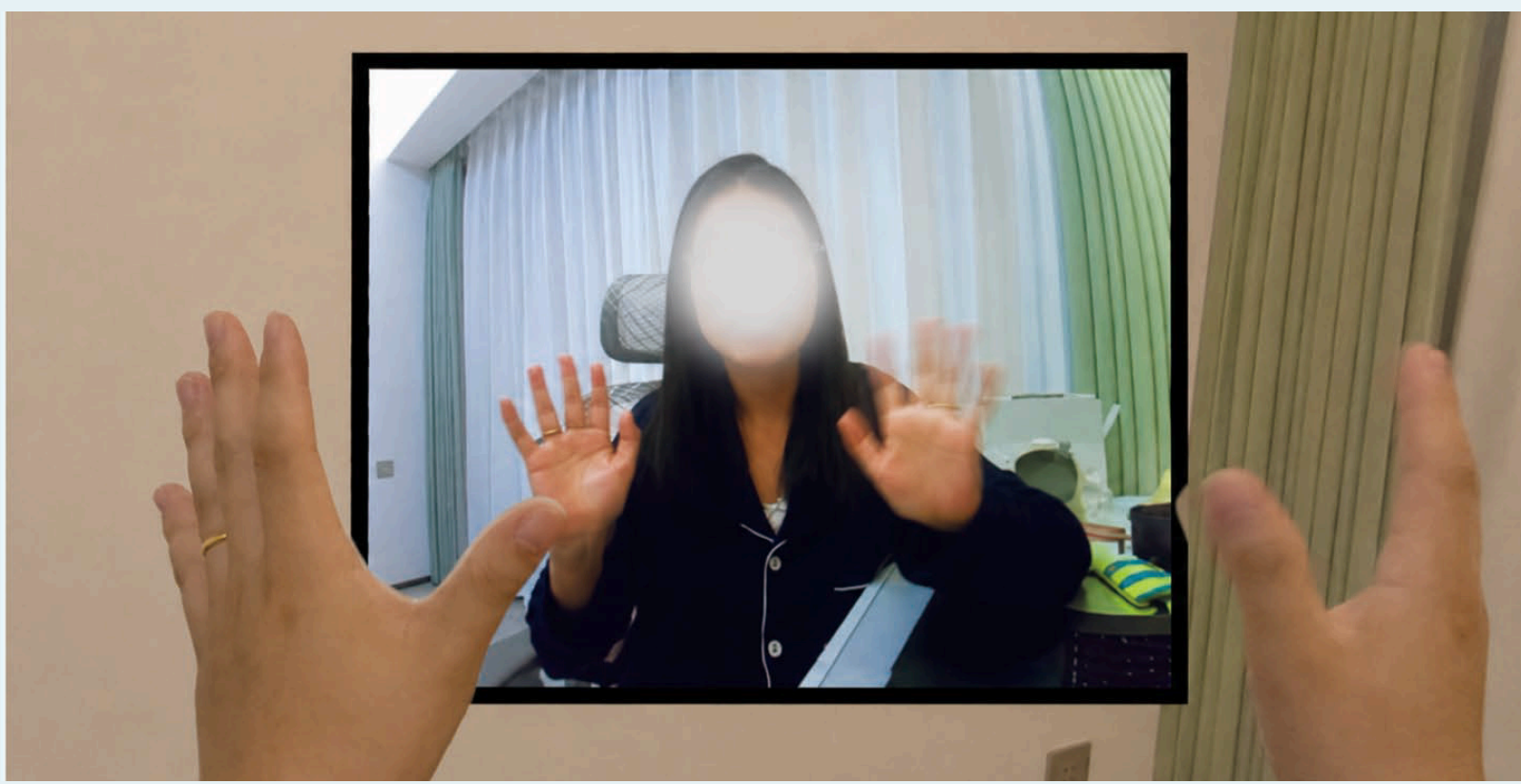


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Remote touch sensed on skin

The body hovers at arm's reach as a user touches the face projected on its skin; the envelope doubles as a large projected display.



Telepresence with two-way touch

A remote person inhabits the blimp: inside the headset, the blimp's live first-person view floats before the wearer, who raises their hands to answer a partner's wave.



Touch leaves a shadow

The same skin feels: a camera behind the membrane senses a partner's touch as a shadow, so touches are delivered into the wearer's view and answered with projected light.

Why Feelium

- Rotor drones make touch asymmetric, noisy, and transient.
- Blimps are soft, quiet, slow, and safe to touch, but prior systems mostly treat the envelope as output-only.
- Feelium connects the touched surface to the remote person inside, turning touch into a two-way channel for presence.

Core Contributions

- A flying-display blimp platform integrating first-person VR inhabitation and onboard envelope touch sensing.
- A design space of bare-hand interactions with the body, in five families ordered by distance from the body: proximity, surface contact, deformation, displacement, and change of ownership.
- A preliminary technical validation of touch sensing on an inflatable envelope.

System

- Body: 64 cm indoor helium blimp; 323.7 g total mass against about 360 g buoyant lift.
- Display: 24.9 g laser projector plus 180 degree fisheye lens; about 84 cm diagonal at 305.7 cd/m².
- VR: Apple Vision Pro first-person view over Wi-Fi, with six stabilized motion commands.
- Touch: an RGB camera detects shadow depth; a 32 × 24 thermal camera adds presence.

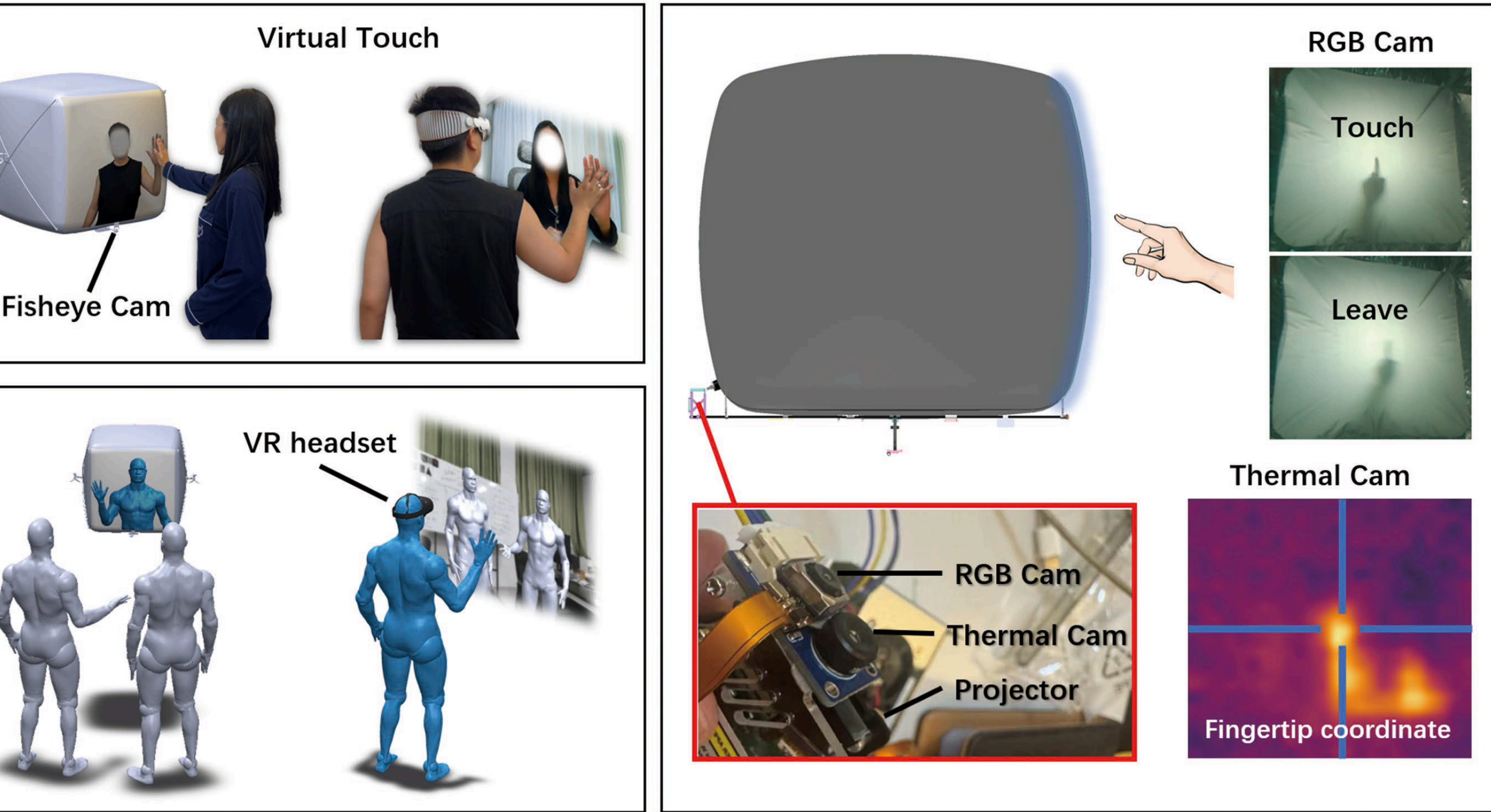
Touch Pipeline

- A slowly adapting reference image models the untouched, back-lit membrane.
- Per-pixel relative shadow depth estimates the fraction of back-light lost against that reference.
- A firm-press depth gate and a sustained-anchoring gate separate contact from near-hover.
- The fingertip centroid gives position; event segmentation distinguishes tap, hold, and swipe.

Selected References

Abtahi et al. 2017; Abtahi et al. 2019; Furumoto et al. 2021; Gomes et al. 2016; Nakajima et al. 2013; Nakanishi et al. 2014; Paulos and Canny 1998; Pham et al. 2025; Sumioka et al. 2013; Tobita et al. 2011; Xu et al. 2025b; Zhang et al. 2019.

System Overview



Left: the two-party experience. In Virtual Touch, a co-located partner presses a palm on the blimp's projected face while the remote wearer, inside VR, sees the touch land on their body and answers it. In VR headset, the remote person dons an Apple Vision Pro and inhabits the blimp, their avatar shown on the envelope so partners see who is inside.

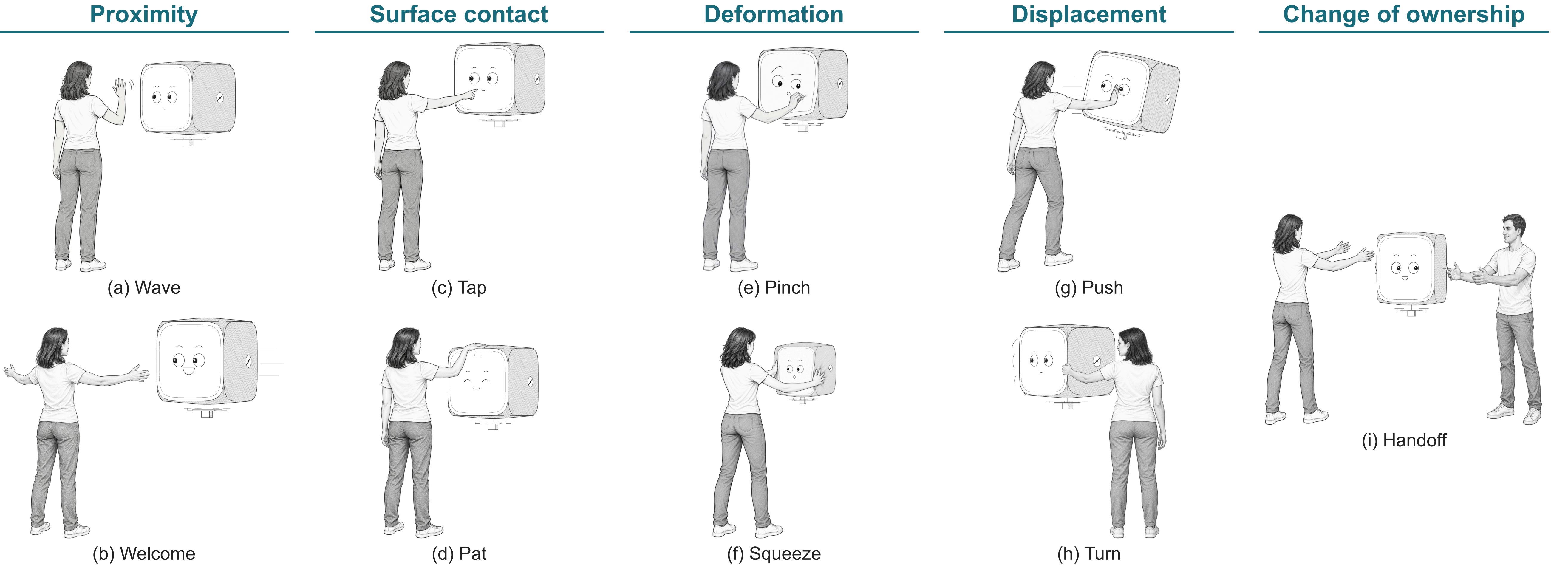
Right: the sensing module. Behind the membrane, an RGB camera, a thermal camera, and the projector share one onboard mount (red inset). The RGB camera reads a press as a shadow in the projector's back-light (Touch vs. Leave); the thermal camera adds presence and locates a warm fingertip coordinate.

Next Steps

- Render each family in the headset: an edge tint from touch force and frequency, a soft bulge where the membrane is pressed, and a blur that follows the body's motion.
- Tell commands from feelings: a gate that routes a tap on a projected button to the interface and a pat on the face to the emotional rendering.
- Sense the two missing families: whole-body displacement with an onboard IMU, and membrane deformation depth and location.
- User study: elicit how people touch, push and hand over the body when it stands for a live person, and test what the wearer should see.

Interaction Design Space

What people in the room do to the body with bare hands, in five families ordered by distance from the body. The first two could happen on a tablet; the last three need a soft, floating body.



Live demo on
Apple Vision Pro

