Docket #: S20-470

Tactile Gesture Interpretation for Safe Human-Robot Handovers

Stanford researchers have patented a robot–human handoff technique that uses the human receiver's grip stiffness as a cue for when to release an object. The robot presents an object to a person, then deliberately moves or perturbs the object with its arm to "interrogate" how firmly the person is holding it. Sensors on the robot arm (e.g., force/torque, tactile, or position sensors) measure the human's response to movement and can detect distinct interactions such as tap, touch, grab, and slip. The system computes the receiver's grip stiffness and uses the computed stiffness to decide whether it is safe to release the object. Sensing modalities, stiffness estimation algorithms, release thresholds, and interaction policies can be adjusted to accommodate different objects, users, and safety requirements.

By relying on local sensing and a simple stiffness-based decision rule, this approach makes handoffs more intuitive and reliable without heavy external sensing or complex signal processing. This physics based cue improves safety, reliability, and naturalness of object exchanges for consumer facing robotics, robotic surgery, industrial robots, prosthetics, touchscreen displays and more.

Stage of Development - Prototype

Applications

- Robotics
- Data Entry (Cell phone, tablets)
- Wearable and Remote Robots
- Prosthetics
- Consumer products

Advantages

- Low cost, robust, and low complexity - uses robust force sensors to inform handover process rather than fragile tactile sensors
- Increases safety - allows humans and robots to safely pass objects
- Adaptable and personalizable - thresholds or models can be tuned per user, task, or object

Publications

- Bianchini, B., Verma, P., & Salisbury, J. K. (2021, September). Towards human haptic gesture interpretation for robotic systems. In *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 7334-7341). IEEE. https://doi.org/10.1109/IROS51168.2021.9636015
- Bianchini, B., Verma, P., & Salisbury, K. (2020). Towards Human Haptic Gesture Interpretation for Robotic Systems. *arXiv preprint arXiv:2012.01959*. https://arxiv.org/abs/2012.01959

Patents

- Published Application: 20230173669
- Issued: 12,454,051 (USA)

Innovators

- J. Kenneth Salisbury Jr.
- Prateek Verma
- Elizabeth Bianchini
- Etienne Chassaing

Licensing Contact

Michael Spaid

Technology Licensing Associate 2

Email