

Student project:

Multi-tactile feedback device for robot hand wearers

Abstract

We are calling for a student who is motivated in working in robotics field specifically to build a device that mechanically relays multiple tactile sensing variables from the artificial skin to the user of a robot hand, as his/her (i) Bachelor thesis (ii) semester project / internship. (If you are interested in working on this as a (iii) master / diploma thesis, please tell us your concrete requirements).

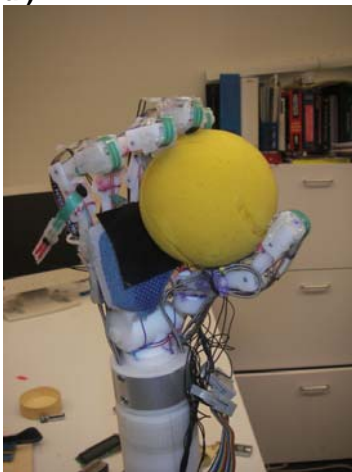
The keywords of this work are: human-robot interaction, haptic device, touch sense, assistive robotics.

1. Description

Human-robot interaction in prostheses robotics pursues integration of robotic devices (e.g. robot hand) as part of the user's body. Object manipulation involves numerous tactile receptors from the human skin that transmit information about the held object and contribute to decision about grasping. For humans that wear robot hand prostheses, this rich information is absent. A critical step towards dexterous manipulation with robot hand is the development of tactile feedback devices (haptic devices) and methodologies to relay information acquired by robot hand's sensors to the human user. Particularly information about forces and slippage speed between the object and the robot hand were shown to regulate the way users stabilize objects in their hand [1]. This project aims to develop a device that transmits these pieces of information to the robot hand wearer.

2. Haptics for Tactile Sense Restoration in Prosthetic Hands

a)



b)



Haptic devices for prosthetic applications. a) Yokoi Robot Hand holding a ball. The robot is tendon driven, and is equipped with pressure sensors and potentiometers; b) Vibration

actuators whose activation transmit the contact of objects with the fingers of a prosthetic hand [2].

3. What can you learn?

Knowledge and skills of robotics (designing the parts with a CAD soft and a 3D printer, leaning basics of microchip for the controlling motors, sensors)

4. Your major?

Having your major in engineer, computer science, physics, mathematics is ideal.

5. Reference

[1] Dana D. Damian, Alejandro Hernandez Arieta, Harold Roberto Martinez Salazar and Rolf Pfeifer (2011) *Slippage Speed Sensory Feedback Based on Artificial Ridged Skin-like Signals for Prosthetic Applications* (under review).

[2] N. Gurari and A.M. Okamura, *Sensory Feedback through Vibrations to the Torso*, Neuromorphic Engineering Workshop, 2008.

Topic : Multi-tactile feedback device for prosthetic hands

abstract	The goal of this project is to study the mutual adaptation in the human robot coupling when communication interfaces and morphologies are varied. The relationship patterns between human, robot and environment is aimed to be understood.
Task description Total: 2-4 months	<ol style="list-style-type: none">1. Acquiring basic background skills and knowledge of robotics: getting familiar with sensors, programming microchip, programming environment, hardware platform (1 month)2. Designing a first prototype of the tactile feedback device and conducting preliminary experiments (1 month)3. Trial and error, implementing a second generation of the tactile feedback device (1 month)4. Experiments with humans and analysis of experimental data (1 month)5. Writing your report
Requirements	Bring your motivation. We will teach basic skills of hardware. The required skill can be varied and the topics are diverse according to his/her specialty.
Skills you can obtain	Knowledge of robotics: sensors, controller board, actuators (servo).

7. Work environment and Contact

ETHZ-REL (<http://www.relab.ethz.ch>), and Artificial Intelligence Laboratory(<http://ailab.ifi.uzh.ch>).

Co-supervision by **Yeongmi Kim** (ykim@ethz.ch) and **Dana Damian** (damian@ifi.uzh.ch),

Looking forward to your contact!!

