



Specialization Projects

MICRO-553: HAPTIC HUMAN-ROBOT INTERFACES

Aims & Approach

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HHRI Specialization Labs Overview

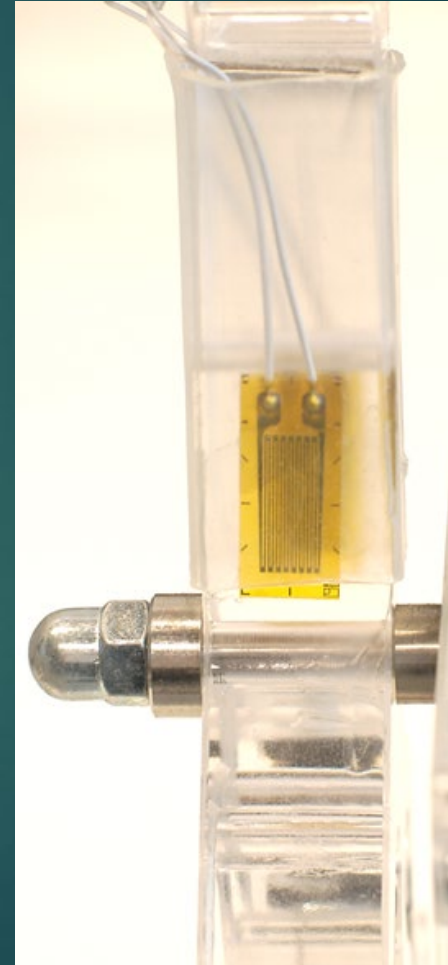
- ▶ Explore more in-depth topics in haptics
- ▶ More freedom in defining the details
- ▶ Several topics to choose from (limited numbers)
- ▶ Additional hardware/software tools

Projects

Control with force feedback

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- ▶ Use strain gauges to measure the interaction force
- ▶ Implement closed-loop impedance and/or admittance control with more advanced control loops



HHRI Specialization Labs Overview

EMG-based control of the haptic paddle

- ▶ Use electromyography (EMG) to measure the muscular activity and interact with the paddle
- ▶ Explore different ways of mapping the EMG measurements to paddle commands



Tele-operation between two haptic devices

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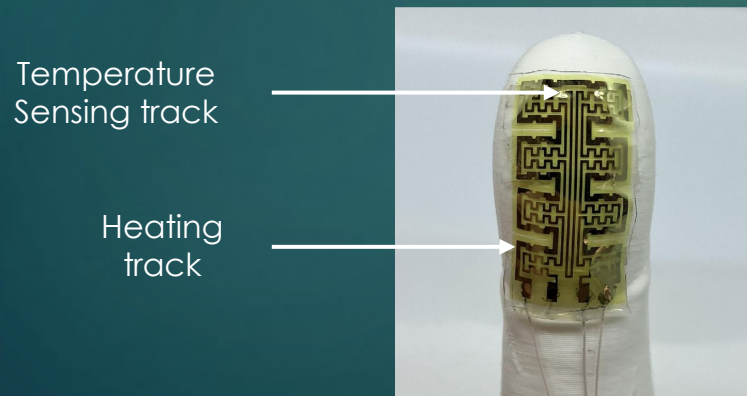
- ▶ Communication between 2 paddles to implement tele-operation
- ▶ Investigate the challenges due to communication (latency, etc.).



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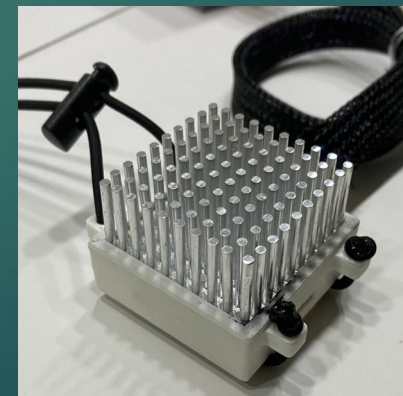
Electronic skin and thermal feedback

- ▶ Implement a closed-loop control of the thermal display
- ▶ Use the set-up in a real-time feedback task
- ▶ Design a psychometric experiment using the device



Active Thermal Skin Sensor

16.04.2024



Thermal Display

The haptic paddle will not be used in this project, Arduino instead!

Extension boards

- ▶ Analog amplifier boards → ADC
- ▶ EMG amplifier boards → ADC
- ▶ Digital breakout boards → DIO



Access new peripherals in the firmware

- ▶ EMG / strain gauges:

```
#include "drivers/adc.h"  
adc_GetChannelVoltage(ADC_CHANNEL_6);
```
- ▶ UART Extension:

```
#include "drivers/ext_uart.h"  
exuart_Init();  
exuart_SendByteAsync();  
exuart_GetByte();
```

Summary

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Project	#	Assistant
Impedance/Admittance Control	2	Giulia Ramella
Tele-operation	4	Aiden Xu
Thermal Feedback	4	Jonathan Louis Muheim
EMG Control	6	Mouhamed Zorkot / Giulia Ramella

Questions...?

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