

Electrotactile feedback for humans in collaborative robotic system

Level: Exam project, Bachelor thesis, Master thesis, or an internship

Duration: 2 to 6 months

Start: By agreement

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Institution: ETF Robotics

Overview and Technology: Collaborative robots (cobots) can work alongside humans through direct interaction and ensure the safe execution of complex tasks thanks to compliant behavior. Although the cobot is in the human's field of view, visual cues can translate a minimal piece of information about a complete cobot's state. Moreover, the eyes of human coworkers are dominantly on the task, and additional tracking of the robot could be cognitively demanding potentially leading to slower responses and reduced performance. The provision of informative feedback through alternative sensory modalities, such as electrotactile stimulation, may reduce visual dependency and help avoid the collision.

<p>Platforms / hardware</p> <ul style="list-style-type: none"> • Collaborative robot (cobot) • Programmable multichannel stimulation unit • Modular, flexible multi-pad electrode(s) 	<p>Software & tools</p> <ul style="list-style-type: none"> • MATLAB (MathWorks) • Simulink (MathWorks)
<p>Project options (projects can be modified based on student interests)</p> <ul style="list-style-type: none"> • Detailed survey of haptic tactile feedback modalities in collaborative robotic systems • Implementation and validation of the model including the cobot and the electrotactile stimulation system used for translating the information about the cobot's movement • Comparison of electrotactile and visual feedback in the sense of reaction time and recognition accuracy 	
<p>Expected outcomes</p> <ul style="list-style-type: none"> • Literature review • Project code and documentation/video • Final report in IEEE research paper form 	<p>Recommended background</p> <ul style="list-style-type: none"> • Robotics basics • Data acquisition and processing • Fundamentals in communication protocols based on textual commands • Diligence and independence in work

<p>Literature</p> <ul style="list-style-type: none"> • Štrbac, Matija, et al. "Integrated and flexible multichannel interface for electrotactile stimulation." <i>Journal of neural engineering</i> 13.4 (2016): 046014. • Hentout, Abdelfetah, et al. "Human–robot interaction in industrial collaborative robotics: a literature review of the decade 2008–2017." <i>Advanced Robotics</i> 33.15-16 (2019): 764-799.
