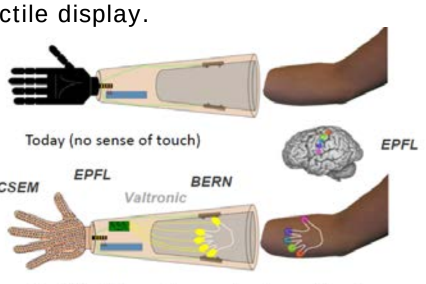
Bern University
of Applied Sciences

Research Group
HuCE – BME Lab
WiseSkin for tactile prosthetics

Project Description

Amputation of a hand or limb is a catastrophic event resulting in significant disability with major consequences for amputees in terms of daily activities and quality of life. Although functional myoelectric prostheses are available today, due to a lack of sensory function in the prostheses, there is not yet a solution for restoration of a natural sense of touch for persons using prosthetic limbs.

The goal of the WiseSkin project is to develop a tactile prosthesis that allows an amputee to feel pressure (in the future also - shear and temperature). This may significantly improve the quality of life for amputees. WiseSkin is a project sponsored by NanoTera and SNSF, which involves three main partners: CSEM, EPFL and BFH. The concept of WiseSkin is based on embedding miniature, soft-MEMS tactility sensors into a silicone based “skin”. It employs scalable, event-driven ultra-low-power wireless communication to convey the sensor data to the actuation control module enabling the sensors to be placed almost anywhere. A novel, stretchable subsystem for powering the device also serves as a waveguide for the wireless communication. Sensory feedback is based on the phantom mapping principle which is leveraged to provide natural sensation of touch by appropriate points on the amputee's residual limb using a tactile display.



What WiseSkin provides - a natural sense of touch

At BFH, the work involves investigating sensory feedback, system design, final integration and developing a functional prototype. For the sensory feedback system, we aim for a non-invasive sensory substitution system, i.e., we apply feedback to the superficial skin via a different modality or to a different location of the body [1]. The most commonly used sensory substitution feedbacks are: electrotactile, vibrotactile and mechanotactile as well as hybrid systems. The first approach is vibrotactile due to its small size, low power consumption and universal psychological acceptance. A testing system is being built up, involving an actuator array, the drivers for actuators and a microcontroller for generating signals to control stimulation patterns. The challenge is to find a suitable way to code the signal.

For the system design and final integration, one of the challenges is to develop a sensor fusion algorithm. Due to the limited space in the remaining stump, one-to-one mapping is not possible. Advanced signal processing allowing sensor data fusion is needed to convey precise information collected by the sensors to the actuators. Another challenge is to coordinate and integrate the whole system where the sub-systems have different data formats and power supply systems.

Project Partner

CSEM
EPFL

Project Team at HuCE

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