E-Skin-Integrated Robotic Hand Inspired by Human Tactile Perception and Cognition

Project manager

(selected in 2026)

TAKEI Kuniharu

Professor, Graduate School of Information Science and Technology, Hokkaido University



Leader's institution

Hokkaido University

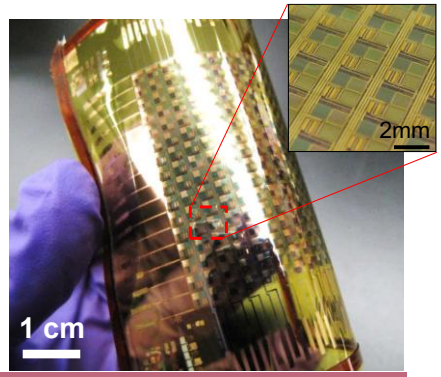
R&D institutions

Hokkaido University

Summary of the project

Our project aims to realize and electronic skin (e-skin) that mimics tactile perception and cognitive functions of human fingertips, and to develop a robotic hand equipped with this e-skin. Unlike conventional rigid sensors, e-skin is a soft and flexible sensor sheet that can bend and deform like human skin.

In this project, we will develop and integrate the e-skin based on previously developed by the PM (an example is shown in the lower right figure) with machine learning to reproduce the ambiguous and subjective aspects of human tactile perception, such as slip, roughness, softness, and tactile feel. Furthermore, by integrating this e-skin system into a robotic hand, we aim to realize a system that can learn and adapt, as humans do, while recognizing the state of the object being grasped. Through this research, we aim to establish fundamental technologies for a future society in which humans and robots can live together naturally, with humanoid robotics possessing human-line tactile perception and sensitivity and becoming part of the family.



Milestone by 2028

Our goal for 2028 is to equip the fingertips of a five-fingered robotic hand with the e-skin developed in this project, providing hand with human-like tactile perception and cognitive capabilities, particularly for ambiguous and subjective tactile properties such as slip, roughness, softness, and tactile feel. To achieve this goal, we have set a series of detailed milestones, including the measurement and spatial mapping of physical information such as pressure, temperature, softness, and texture using the e-skin; the extraction of subjective tactile information from these data using machine learning; and the development of a control system that performs sensing and analysis on the robotic hand and provides feedback based on the results.

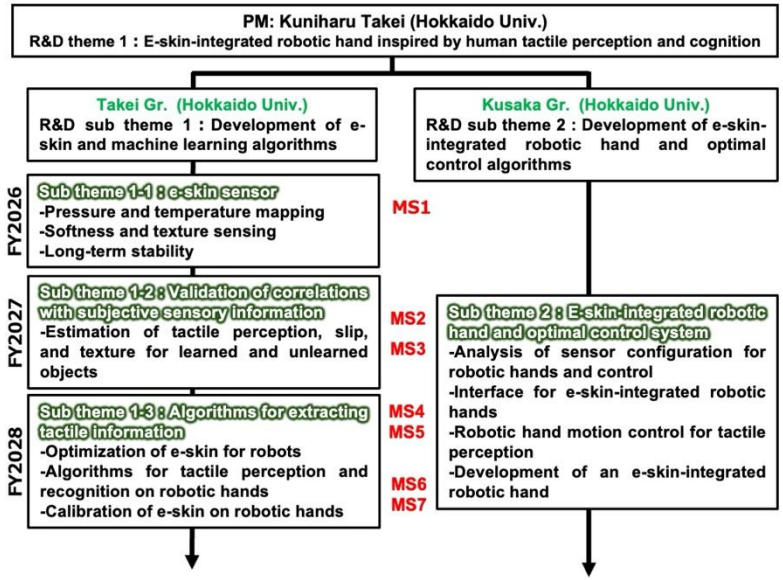
By defining these milestones in detail, we will systematically monitor research progress and accelerate research and development toward the final goal.

Project structure

We propose R&D theme 1 "E-skin-integrated robotic hand inspired by human tactile perception and cognition", and conduct the research and development through two groups.

R&D sub theme 1 "Development of e-skin and machine learning algorithms" will be led by Takei group, who serves as both the PM and PI. R&D sub theme 2 "Development of e-skin-integrated robotic hand and optimal control algorithms" will be led by Kusaka group (Hokkaido University).

Takei group has extensive expertise in e-skin technologies and machine-learning-based analysis of sensor outputs, while Kusaka group has specialized in robotics and robotic control systems. By integrating these complementary areas of expertise, we aim to realize an intelligent robotic hand capable of mimicking human tactile perception.



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