

Projection-based Tabletop Interaction for a Companion Robot for Older Adults

Ausgangslage

Many older adults living alone experience loneliness, inactivity, and low mood, and these signs often go unnoticed between care visits. Social robots can help, but most rely on speech or small built-in screens, which limits how engaging and accessible the interaction can be. PACO (Proactive AI Companion Robot for Older Adults) is a Swiss-Korean research project developing a tabletop robot that recognizes the user's state and responds proactively through dialogue, gestures, and projected visual content. A key component is projection-based interaction on the table surface: the robot projects content onto the table and around physical objects placed on it, turning everyday surfaces into an interactive medium. This requires accurate alignment between projector, camera, and physical objects, robust recognition of objects and hand interactions, and interaction concepts that suit older users. The Institute of Interactive Technologies (IIT) leads the projection-based interaction work in the project.

Zielsetzung / Methodik / Vorgehen

The goal of this project is to develop and validate the projection-based tabletop interaction module of a companion robot. It covers four aspects:

1. *Calibration.* The student develops a calibration procedure that aligns the projector, the camera system, and the table surface, so that projected content appears precisely on and around physical objects. The procedure should be fast, largely automatic, and robust to changes in robot placement.
2. *Object and interaction recognition.* A recognition pipeline detects and tracks relevant objects on the table as well as the user's hand interactions (e.g., touching, pointing, moving objects). The pipeline must run in real time on the robot's hardware and handle typical home conditions such as varying lighting and cluttered surfaces.
3. *Interaction design.* Together with stakeholders from home care, the student designs interaction scenarios for older adults, such as cognitive games, reminiscence activities, or guided physical activation, which combine projected content with physical objects.
4. *Validation.* The module is evaluated technically (calibration accuracy, recognition performance, latency) and through user studies with older adults, assessing usability, acceptance and engagement.

Verlangte Skills: Interest in human-robot interaction, interactive systems, and user-centered design; good programming skills; experience with computer vision is an advantage.

Teilaufgaben

The project can be carried out in 2 to 3 stages: consecutive projects P7 (analysis, calibration procedure, first recognition prototype), P8 (recognition pipeline, interaction design and prototyping of scenarios) and P9 (integration into the robot platform, technical validation and user study).

Studienart: [x] Vollzeitstudium
[x] Teilzeitstudium 50%

Projektorganisation: Einzelarbeit (im Umfeld eines Projektteams)

Projektförderung: Innosuisse

Arbeitsort: Windisch

Advisor: Prof. Dr. Kevin Kim

