Development Report:

The Development of Intra-House Mobility, Logistics and Transfer Solutions in PASSAge

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Within the ongoing research project, the Chair of Building Realization and Robotics is identifying, developing and validating robotic-based concepts for intra-house mobility, logistics and transfer to support elderly people within their home environment. The project is conducted jointly with several research and industry partners.

Keywords: in-house mobility, home care, assisted living, mobile robotics, ambient intelligence

In-house mobility is a major contributor to active and healthy ageing. However, to date, many assistive technologies have focused only on individual activities and activity areas (kitchen, bathroom, etc.) and the "interconnection" between them (requiring transfer and mobility solutions) has been neglected. Therefore, the authors looked to develop such solutions within the research project PASSAge (Personalized Mobility, Assistance and Service Systems in an Ageing Society). The research method follows an iterative design and engineering approach over three years in which three periodical cyclic solutions were developed, tested (with real, elderly test persons) and optimized [1].

A test apartment (**Fig. 1**) was built where typical mobility obstacles could be embedded, e.g., stairs, swinging doors etc., which the elderly test persons had to navigate using existing supporting devices such as the StairWalker from Thyssenkrupp Encasa, or a door opening device from Dorma.

To develop a seamless mobility chain, a mobile robot acts as a supporting system. Voice recognition or a touchscreen software, displayed on a tablet PC controls the mobile robot. Adding an automated platform to the StairWalker allows the robot to navigate the stairs completely autonomously, in order to carry the luggage in or out of the house. Through a rollator-robot-adapter, the mobile robot is able to connect to a rollator (**Fig. 2**, left) in order to carry this walking aid to the human user. This platform allows the user to carry a rollator automatically with the mobile robot, or at the same time when the user is using the StairWalker in order to climb the stairs (**Fig. 2**, right).

A master PC controls the mobile robot, which can also be controlled by the tablet-PC, and is linked to the door opening system, as well as the remote controller of the StairWalker through Arduino, as shown in **Fig. 3**.

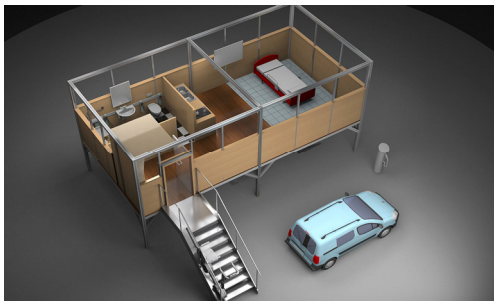

Fig. 1. A fully functional test apartment was built at TUM to simulate and optimize the robot-assisted mobility chain.

Fig. 2. Rollator-robot-adapter (left). StairWalker including transport platform (right).

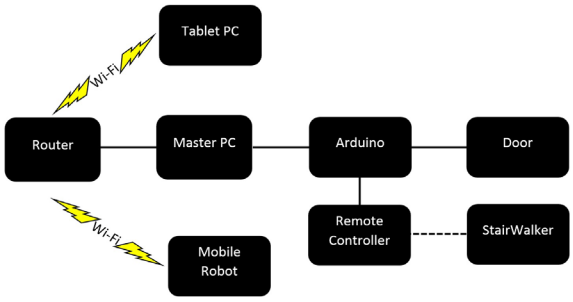

Fig. 3. Communication schematic of the mobile robot.

In this way, the mobile robot plays a central role in the apartment and helps develop a truly seamless mobility chain.

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References:

[1] B. Geilhof, J. Güttler, M. Heuberger, S. Diewald, and D. Kurz, "Weiterentwicklung existierender Assistenz-und Mobilitäts-hilfen für Senioren-Nutzen, Akzeptanz und Potenziale," 2014.