Accessible routes: Evaluation and implementation of an inclusive indoor navigation app for people with disabilities

D. Helmer[1], R. Weil[1], H. Hinkelmann[1], E. Reh[2], K. Szilvas[2], T. Hollstein[1,3]

Purpose Managing and guiding people in buildings and industrial facilities or on university campuses is still a challenge. There is no uniform concept that meets the different requirements of the various users. Few or no consideration is given to supporting the different needs of people with disabilities or older people with impairments. Particularly in situations requiring assistance or danger, it is necessary for people with disabilities to be able to rely on systems that provide them with special support. Dynamic changes such as the temporary unavailability of traffic routes are very important (Nguyen et al., 2022). People with disabilities are among the most vulnerable groups in building fires (Hostetter and Naser, 2022). A system is needed that offers both individual dynamic and situation-dependent support and at the same time provides emergency and special situations as well as sufficient inclusion support via a mobile app with offline fallback protection. **Method** For a safe guidance and management of individuals both indoors and outdoors, the specific disabilities of individuals must be taken into account. Our system aims specifically at assisting individuals with disabilities. Various support options have been explored for different scenarios of personal limitations and integrated into a holistic approach to technical support for personalized person navigation, designed with sustainability in mind. Common disabilities such as visual impairment, hearing impairment, and mobility limitations have been considered. People with different disabilities have, among other things, the same wishes with regard to what a suitable passenger guidance system should contain, for example the wish to avoid carpeted floors (Gupta et al.,2020). The foundation of our person guidance system is an inclusion compliant mathematical model of pathways within a building complex, including stairs, elevators, and ramps. The basic data is continuously updated and retrieved by the app to ensure it operates with real-time information. For example, in the case of navigating individuals with mobility impairments, automatically optimized barrier-free alternative routes can be offered. The geometries of the pathways are crucial for safely guiding individuals in special situations. Our approach utilizes self-designed person-counting sensors to initially detect enclosed individuals and to offer separate escape routes for them based on their limitations. Novel actuators developed at our research centre can dynamically display alternating escape routes. A high-contrast display shows pictograms or directional indicators tailored to different scenarios. Additionally, the actuator includes a speaker to produce statements or click sounds, such as tones at 880 Hz, which are acoustically very well locatable. **Results and Discussion** Our inGuide app utilizes Bluetooth Low Energy (BLE) beacons for position determination. Navigation is also possible without Bluetooth using QR codes. Navigation can be configured to be either visual or auditory, and can be supplemented by optoacoustic actuators capable of directing various individuals through multiple channels. Our system integration is shown in Figure 1. Conceptually, existing building technology systems such as lighting or electroacoustic installations can be incorporated to achieve maximum cost-effectiveness and sustainability of the procedures. Thus, the system is retrofittable in existing structures. Additionally, new constructions offer direct integration possibilities to ensure the most efficient deployment.

References

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Affiliation: [1]Frankfurt University of Applied Sciences, Frankfurt am Main, Germany; [2]SKILLsoftware GmbH, Frankfurt am Main, Germany; [3]Tallinn University of Technology, Tallinn, Estonia

Email: (*daniel.helmer, rene.weil, hinkelmann, hollstein)@fb2.fra-uas.de, (reh, szilvas)@skillsoftware.de

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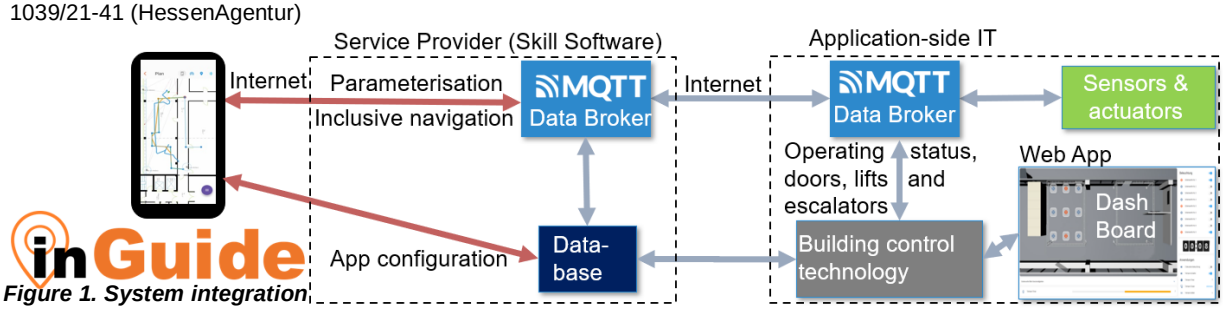

Figure 1. System integration