The design of a user interface for managing multiple cleaning devices

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The aim of this bachelor's assignment was to design an interface between a cleaner (the user of the system) and multiple, automated, cleaning devices. This assignment was part of research being done to incorporate technology in the cleaning branch. The assignment was given to the UT by Raad voor Arbeidsverhoudingen Schoonmaak- en Glazenwassersbranche (RAS). Thomas Raub and Roy van Zijl started this assignment. Information gathered by their research was used as a foundation for the creation of the interface. Thomas Raub looked into what the values were for cleaners and Roy van Zijl is working on prototyping technologies that can be used in the cleaning branch. To improve adoption an interface needed to be designed for cleaners to use the technologies. This was the focus of my bachelor's assignment.

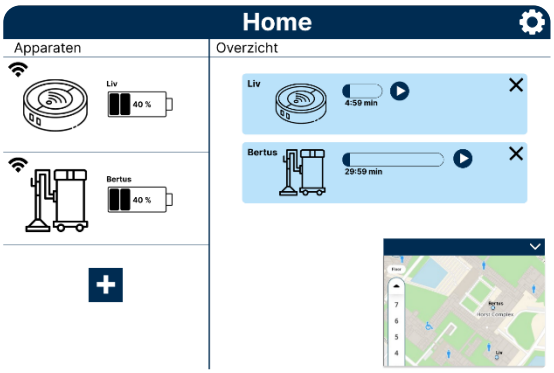
The cleaning branch deals with shortages in personnel[1]. The employees deal with a high physical workload and underappreciation from the public[2]. Cleaning technologies cannot replace human cleaners as social interaction for client companies is very important. Furthermore, technologies are not suitable for all tasks. For example, the floor scrubbing machines cannot reach edges or corners. This means that good Human-Machine Interactions (HMI) is required.

Cleaners were put at the centre of the design to achieve the best results for user-friendliness. An experience map shows the pains and gains of a cleaner during a shift which portrays the opportunities for improvement. Based on the experience map the key drivers "Job satisfaction", "Ease of use", and "Autonomy" were established. These are the foundation of the interface. The functions build upon this foundation. The functions include showing an overview of devices, battery status, progress, adding specifications, etc. Furthermore, requirements were set up that show what is needed for a successful functioning interface such as data safety, hygiene, ease of use, navigation, visual appearance, legibility, and data transfer.

The approach to validate the design was an iterative process between ideation, specification, realization, and evaluation. A questionnaire was held among 32 people, with knowledge of interfaces or people that resemble the target group, to make decisions on the possibilities explored in the ideation. A prototype was put together based on the questionnaire results. An improved interface was made with the results of usability tests among 11 people with knowledge of interfaces or people that resemble the target group. In the end, the improved interface was tested by the target group. Four cleaners, two at a time, evaluated the interface's usability. The interface was seen as easy to use, but testing with the working cleaning devices would still need to be done.

The improved digital interface offers an overview of the connected devices, displaying information such as location, errors, progress, and battery status. It also includes a maintenance tab with instructions, a history of route information tab for performance analysis, and a settings tab for Wi-Fi connectivity, device pairing, customization, and accessing support.

In this research, a perspective is given on the implementation of the developed interface. For which collaboration with suppliers of cleaning devices is needed. Together with a plan made with cleaner educators, RAS, and cleaners themselves. Concluding from recommendations given in the usability testing, the developed interface provides a user-friendly platform for collaboration between cleaner and cleaning devices.



1. Werknemersverzekeringen(UWV), U., *Factsheet Schoonmaak UWV*. 2019, April 17, UWV.
2. Raub, T., *Colleagues, not competitors: Development of a value-based design toolbox for responsible cleaning robotisation.* University of Twente Research Information, 2023, April 17.