Facility cleaning cobot

Case story

Cleaning in office areas and public buildings requires many hours of manual labor every day. This kind of work is an example of repetitive work that often requires awkward work positions and therefore wear down the cleaning staff. On the other hand, it is difficult to automate the cleaning tasks because the environment is unknown and constantly changes.

Many different types of substances must be cleaned, including solid particles (like coffee grains), liquids (like brewed coffee) and larger object (like peas). Also, furniture is moved around by the users from day to day and objects like cups, papers, and computer equipment are randomly placed on the tables.

Case story

The project “FacilityCobot Automating Facility Management by Collaborative Robots guided by Intelligent Sensors” funded by the Innovation Fund Denmark aimed at developing a facility cleaning cobot that could clean table surfaces in a canteen. The partners in the project were University of Southern Denmark, Enabled Robotics, UbiqiSense, K-Jacobsen A/S, ISS Facility Services A/S and SIGNAL ARKITEKTER ApS.

Enabled Robotics acted as system integrator in the project. The system consists of an ER-FLEX mobile cobot from Enabled Robotics including a UR5 arm from Universal Robots equipped with an end-of-arm tool for cleaning surfaces. Ubiqisense delivered room sensors that could locate the position of furniture in the room and feed that information to the cobot.

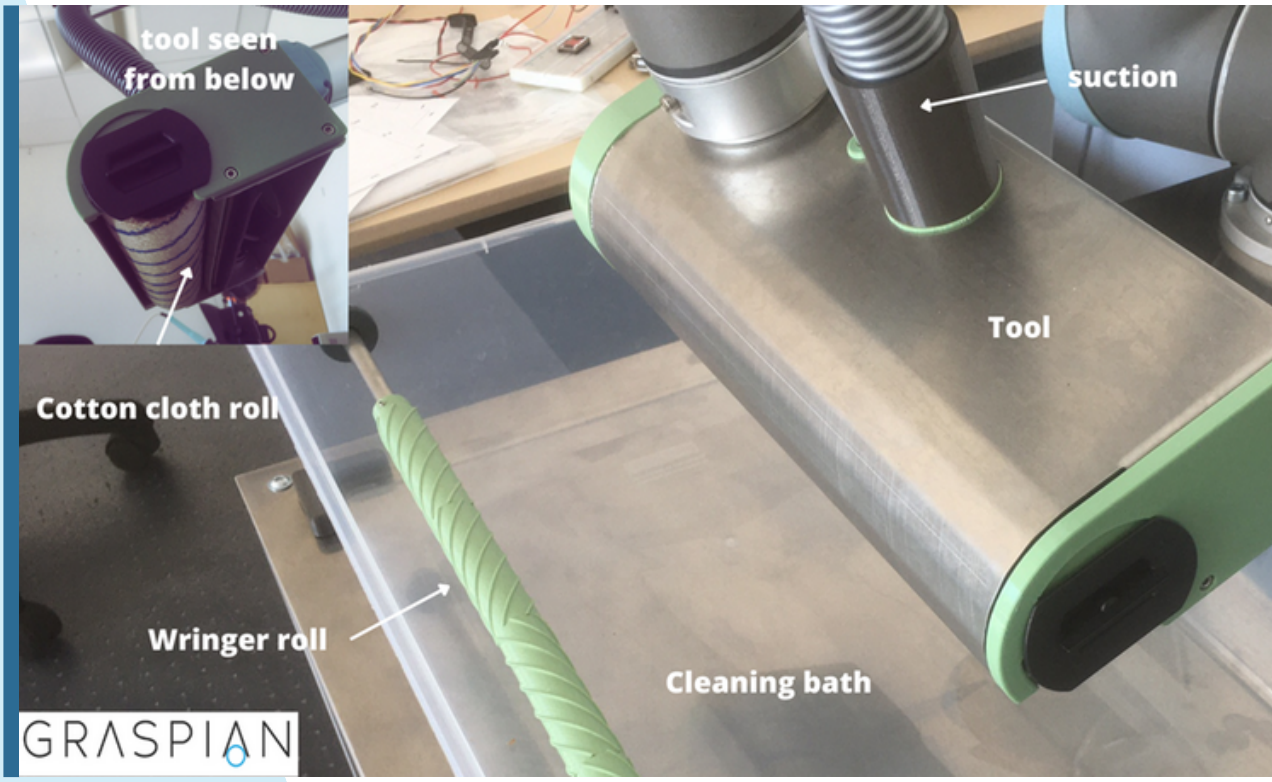
The challenge

When cleaning a desk manually, you typically wipe the desk with a wet cloth. Larger items, are brushed to the side of the table and into a bin. When the surface is wiped, suitable pressure is used so that the surface becomes clean. The cloth must be regularly rinsed in a mixture of water and detergent. After each rinsing, the cloth must furthermore be wringed so that it is suitably wet without adding too much water to the desk surface.

It was quickly identified by the project partners that there was no standard cleaning end-of-arm tool that could perform the cleaning tasks just described. Therefore, the system integrator Enabled Robotics engaged Graspian as a sub-supplier to the project to develop a customized end-of-arm cleaning tool.

Case story

The solution



Graspian developed the tool shown on the figure above, which consists of a motorized cotton cloth roll and vacuum suction as well as a cleaning bath with a wringer roll.

The tool is mounted on and controlled from the Enabled Robotics' ER-FLEX. The cotton cloth roller is rotating with a constant speed when the tool is on.

Before cleaning a desk surface, the cotton cloth roll is dipped in the cleaning bath containing water plus detergent. Hereafter, the cotton cloth roller is wringed free of access water by pressing it against the wringer roller.

Next, the tool is moved to the table for cleaning. The applied pressure is controlled through the force mode of the UR5. The tool is moved with the rotating cotton cloth in contact with the table surface.

Items are removed from the surface through suction and wiping with the wet cotton cloth roller.

The cleaning tool was tested to successfully remove a large range of items including coffee grains, dried espresso stains, herbs, peas, and grated carrots.

Conclusion

Manual cleaning of canteen desks is an example of repetitive work that often wear down the cleaning staff. The project "FacilityCobot Automating Facility Management by Collaborative Robots guided by Intelligent Sensors" aimed at developing a facility cleaning cobot that could clean table surfaces in a canteen.

Since no standard tool existed for this task, Graspian developed a customized end-of-arm tool to fit on the Enabled Robotics ER-FLEX collaborative mobile robot .

The Graspian tool was tested to successfully clean canteen tables with a range of common substances.