Title: Exploiting mobile manipulators for appliance interaction in the ROS environment

Abstract
This research activity is focused on the implementation of a real-time controller for mobile manipulators, in particularly devoted the interaction with appliances, according to the ROS-Industrial specifications. This will enable the use of mobile manipulators able to react to a changing environment and to the presence of humans. The mobile manipulation platform will mainly be used for the interaction with appliances and for servicing activities. The extension to industrial applications, such as automatic machine servicing and assembly, will be considered.

The reason why an automatic solution for the interaction with appliances is required is related to the number of tests the appliance must pass before entering into the market. The appliances constructors are looking for an automated and flexible solution for the testing to shorten the time to market, and the application of robotized solution seems very promising. The main issues in this development are the number of variants, the partially unstructured environment, the presence of the human in the scene, the non-precise placement of the robot base, the complexity of the involved manipulation tasks just to name a few.

The project has a significant potential impact on many manufacturing fields in which conventional human-centred production processes are implemented. This involves many fields, such as automotive, aerospace, food processing, switchgear cabling and so on. In the field of appliance testing, a research agreement has been already signed with ELECTROLUX Italia S.p.a. This activity aims at developing a mobile manipulator able to interact safely with appliances such as washing machines. The objective is to move from the actual human-driven 8-hours shift over 5 days a week to 24 hours, 365 days per year. In this way, a 60% reduction of the time to market is foreseen.
Activity Plan

The Project “Exploiting mobile manipulators for appliance interaction in the ROS environment” will be scheduled according to the following activity plan:
M1 - Study of the ROS-Industrial development requirements;
M2 – Development of the real-time mobile manipulator control infrastructure according to ROS-Industrial requirements;
M3 – Development of the real-time collision avoidance strategy for the mobile manipulator;
M4 - Implementation of the 3D environmental mapping with RGB-D cameras;
M5-M6 – Testing of the mobile manipulator control infrastructure;
M7 – Implementation of the appliance interaction tasks on the mobile manipulator;
M8 – Implementation of manipulation strategies for deformable objects like clothes;
M9 – Generalization of the appliance programming task;
M10-M12 – Experimental validation of the mobile manipulator control infrastructure.