Robotized and reconfigurable production cells

Introduction
The Group of Robotics, Automation and Biomechanics - GRAB – (University of Bologna) is committed to mobilize the expertise and resources needed to the realization of the project "Robotized and reconfigurable production cells", in collaboration with the industrial partner IMA SpA.
This project concerns the recruitment of a post-doc researcher that will supervise GRAB’s research with a full-time dedicated commitment.

The project
IMA’s philosophy is strongly based on research and innovation, therefore it recently acknowledged the importance to exploit autonomous and cognitive robotics technologies in its market sector.
GRAB has been selected with the final goal to design and develop a demonstrator, designed to be part of robotized production cells for machine automation. The demonstrator is meant to automatize the highest number of repetitive and burdensome tasks that human operators ordinarily perform to support automatic machines. The project especially focuses on refilling raw materials to be processed by the automatic machine such as reels and cardboards.

The aforementioned goal will be achieved by developing a system for flexible, collaborative packaging material loading on IMA machines in industrial shop floors.
In order to achieve this goal, the following topics were investigated so far: (i) analysis of existing commercial mobile platforms, (ii) analysis of IMA’s automatic machines, (iii) study of Safety Standards that regulate the use of robots in industrial applications, (iv) analysis of the real operating environment where the robot has to work in, (v) analysis of the requirements of the robotized production cell, (vi) definition of the rules of the robotized production cell, (vii) selection and acquisition of the robotic platform, (viii) design of strategies, devices and robot trajectories for the optimal manipulation of raw materials, (ix) customization of the robotic platform, (x) modifications of automatic machines in order to have them dialog and co-work with a robot.
Recently, a simplified demonstrator was realized. The demonstrator makes use of a commercial robotic platform (an autonomous mobile vehicle equipped with a compliant robotic arm), a raw material storage area and an automatic machine. The demonstrator shows: safely navigation in a non-structured environment, localization of both the storage area and the feeding locations, and pick-and-place of raw materials (in particular reels).

**Plan of activities**

Next steps of the project will concern the improvement of the simplified demonstrator in order to realize an advanced version with a TRL equal to 7. As for reel manipulation, the robot operation times and trajectories must be optimized in order to save time and increase the efficiency of the robotic application. As for cardboard manipulation, the main activities regard the refinement of strategies, devices and robot trajectories for the optimal manipulation of a pile of cardboards. Finally, the design of the robotized production cell needs to be optimized by testing mechanical components and, eventually, re-design them in order to be suitable for an industrial application. In particular, the work will be focused on: refinement of the robotic-platform customization, refinement of the *ad-hoc* mechanical devices used by the robot for manipulation (e.g. grippers), and refinement of the mechanical modifications of the automatic machine design.