



Polytec obtained the European Patent for its robotic solution that performs safe ladle sliding gate maintenance operations in the steel industry.

RoboHarsh: this is the name of the research project co-financed by the European Union through the Research Fund for Coal and Steel that, between 2016 and 2019, involved Polytec together with the Scuola Superiore Sant'Anna (SSSA) and PSC. The aim was to create a robotic cell to support the operator in the maintenance of the ladle sliding gate, a "critical" component for steel mills because, through this device, liquid steel flows after the refining and treatment processes. This operation requires a combination of strength, sensitivity, and extreme precision: cleaning and replacement of the heavy refractory components require considerable effort and must be carried out near the base of the ladle, which, although empty, is still very hot. In addition, erosive processes on the refractories and residues that must be removed generate a number of different conditions, which the maintenance technician must cope with. On the other hand, small misalignments or imperfect removal of solidified steel residues can lead to malfunctions and even leakage of liquid steel when the ladle is in operation, with serious consequences for the safety of the workers and the reliability of the production process. For this reason, maintenance operations are usually carried out manually by highly specialised workers.

Valentina Colla, coordinator of the project and of the SSSA team involved in the research, said: "The challenge was to create a system that was robust, precise, and reliable, but also adaptable to different steel plant layouts and situations and easy to use for operators. The implementation of a sophisticated artificial vision system and a powerful but intuitive man-machine interface with an integrated automation system made it possible to meet this challenge, thus upgrading the task of operator that becomes a supervisor, relieving him from the most onerous operations and limiting his exposure to high temperatures to a minimum, and instead allowing him to constantly monitor operations directly from the control desk, with an overall improvement in the management of each phase."

Andrea Faes, head of Polytec's Mechatronics Department, adds: "Our great knowledge of the environment and the steelmaking process enabled us to overcome the obstacles related to the critical meltshop environment, where fumes, dust, and several aggressive agents, including temperatures, make the implementation of human-robot cooperative systems more difficult. Each element was chosen considering the peculiarities of the process. From the engineering to the choice of components, the team worked with great dedication to achieve the final goal and create a prototype to be tested in the plant. The EX Ilva-plant in Taranto was willing to receive the prototype and, after the final tests were passed, it was definitively purchased. Today we are proud to say that this research and technological project has become a concrete solution available on the market."

The robotic cell developed does not completely replace human intervention but supports and improves it. The robot manipulates all the heaviest components, carries out cleaning operations with an oxygen lance and, using a sophisticated artificial vision system, thoroughly examines the device to analyse the wear condition of the components. Each operation is authorised and verified by operators from the pulpit who supervise the operations through a graphical interface that proposes, analyses, and processes the images collected by the vision system, providing useful information and suggestions to the operator, the final decision-maker.

Every technological innovation, in order to be successful, must be accompanied by a process of cultural change. It is the end users who provide the information that is essential for the continuous improvement of the actual machine functionality. This concept is also fundamental to the RoboHarsh project: the operators were involved from the earliest design stages, and a team of sociologists from the Technical University of Dortmund worked alongside to design an appropriate training course for the workers while also collecting an overall evaluation of the system's performance. Once again, Polytec's multidisciplinary and open approach proved to be the winning choice to realise concrete technological solutions and successfully meet the challenge of digital transformation in the most complex industrial processes.



Polytec is an Italian company that specializes in developing automation and robotics systems for critical industrial processes, including those in the steel, ceramics, and aluminum sectors, and operates in the renewable energy sector. Its in-house multidisciplinary expertise, coupled with continuous investments in technological research and development, have positioned Polytec among the global leaders in system integration, propelling the digital transformation of the industry. Central to this transformation is a new paradigm emphasizing both quality of life and sustainability. Polytec is a company within the BM Group, an Italian industrial conglomerate with over 300 direct employees spread across three core domains: industrial automation, mechatronics, and renewable energy.

Polytec press office:

Anna Zoppirolli, Chief Marketing Officer +39 348 3235583 anna.zoppirolli@bmgroup.com

Website <https://polytec.bmgroup.com>

LinkedIn <https://www.linkedin.com/company/bm-group-polytec-spa/> Polytec

Instagram https://www.instagram.com/bmgroup_polytec @bmgroup_polytec