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Editorial

Special Issue on Advances in Industrial Robotics and Intelligent Systems

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Robotics and intelligent systems are key technologies to promote efficient and innovative applications in the most diverse domains (industry, healthcare, agriculture, construction, mobility, etc.), performing and supporting activities that are not suitable to be performed by humans. Such activities are frequently time-consuming, repetitive tasks with low added value, physically demanding, and/or dangerous. Nevertheless, robotics and intelligent systems face several scientific and technological challenges related to their integration and interoperability with other systems, safety, flexibility, reconfigurability and autonomy. These challenges are especially relevant when robots operate in real unstructured environments and share the workspace with humans and other equipment.

This Special Issue collects research achievements, ideas, and applications of advanced intelligent robotic systems, covering diverse technologies and application domains. Generally, the contributions cover optimal path planning strategies and innovative designs for mobile manipulators, the integration of robotic and intelligent systems, grasping, manipulation, teleoperation, haptics, user experience approaches for collaborative robots, and multi-agent systems.

In the last few years, we addressed the emergence of mobile manipulators as versatile robotic machines, combining the best abilities of mobile robots and robotic manipulators. An interesting study reports a mobile manipulator unified framework for motion planning considering joint limits, joint velocity limits, self-collisions, and singularities [1]. A novel path planning strategy for the autonomous navigation of a mobile manipulator operating in inspection processes is proposed in [2]. A mobile manipulator, which operates as a healthcare and domestic assistant, demonstrated its capability to perform generic service tasks in non-standardized healthcare and domestic environments [3]. In [4], a robot-based framework is proposed to automatically plan trajectories designed for painting large objects, e.g., a car roof. A Simultaneous Localization and Mapping (SLAM) framework used to solve the problem of the poor positioning accuracy of mobile robots, by fusing horizontal and vertical lidar data with Inertial Measurement Unit (IMU) data, eliminates the motion distortion of the dual-lidar odometry [5]. A robot path planning method using midpoint interpolation increased the efficiency of optimization by minimizing the planning time [6]. An interesting study presents a design of a mobile robot with omnidirectional tracks, combining the advantages of a typical track drive with the omnidirectional Mecanum wheels [7].

A dual-arm robotic manipulator demonstrated the ability to manipulate large and heavy objects avoiding obstacles by using a hierarchical manipulation planner [8]. A position/force controller used to grasp objects through a robotic manipulator, find the position of the object to be grasped accurately, and apply the appropriate force to each finger to handle the object properly is proposed in [9]. In [10], a haptic teleoperation of impact hammers in mining operations is proposed, where the 3D model of the environment

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is used to estimate repulsion forces that are transferred to the operator via haptics so that the hammer does not collide with the structures of the mine. A multi-order attentional spatial interactive convolutional neural network for haptic recognition is detailed in [11]. It was validated on the recognition of letter shape (A–Z) with complex contours from a haptic acquisition platform based on three-scale pressure arrays. In [12], the optimization of robot placement was studied to reduce the overall robot joint wear, where a proper robot base placement results in an overall reduction in the wear of the joints of a robotic arm. An algorithm for verifying the correctness of multi-agent systems modeled as tracking bigraphical reactive systems and checking whether a behavior policy for the agents meets non-functional requirements is presented in [13]. A review of the recent literature on augmented reality-supported collaborative robotics from a human-centered perspective to solve issues related to operators' needs is proposed in [14]. The study elaborates on a structured framework driven by User eXperience approaches to design augmented reality interfaces.

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