

AEROSPACE ENGINEERING

MUR DM 117/Fondazione LINKS - Autonomous operations of heterogeneous robotic systems in real environment

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Context of the research activity	<p>The research will be focused on the design of algorithms for heterogeneous robotic systems operating in real, dynamic and possibly unknown environment. Reinforcement Learning algorithms and other approaches will be explored to include an intelligent system to handle hazardous and complex mission scenarios. Experimental activities will be performed, based on industrial and real-life challenges. One of the focus will be the combination of real world needs and theoretical approaches.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 117/2023 - CUP E14D23001970004</p>
Objectives	<p>The last few years have seen a growing interest in the development of intelligent vehicles capable of moving autonomously in space and being aware of their surroundings. Their great potential makes them ideal for the most varied fields of application: agriculture, manufacturing, land and aerial surveillance, naval operations, commercial transport, space exploration, and '3Ds' (Dangerous, Dull, Dirty) tasks. Despite the significant results achieved in terms of accuracy in real-time implementation of on-board algorithms for small autonomous systems, assessed solutions are not available and complex technical challenges still need to be addressed.</p> <p>A focus on mobile robots can be observed, since they are systems able to integrate technologies related to sensing, information processing, obstacle avoidance technique and multi-level modular approach. Moreover, machine learning techniques can be considered for testing algorithms and models, which empower computers to acquire knowledge, make predictions, or render decisions without the need for explicit programming tailored to each task.</p> <p>The scope of the research activity is to address the challenges pursuing the following high-level objectives, in which different fields will be considered.</p>

Two main fields will be analyzed: data-driven models and “intelligent” algorithms, able to handle uncertainties, hazards and dynamic environments. Additionally, the proposed on-board algorithms will ensure generalization techniques for heterogeneous agents for adaption to different contexts and perform effectively in real-world scenarios. A key aspect of this research will be the collaboration with an industrial partner, to apply the theoretical approaches to different scenarios.

Skills and competencies for the development of the activity

The candidate should have knowledge of robotic systems, in particular ground robot, learning algorithms and their training. Moreover, the candidate should have knowledge of aerospace systems, including drones. Finally, a basic knowledge in implementation on embedded systems and ROS.