

## **Human, Dynamic and Open Environments: A New Challenge for Robotics**

*Keynote talk – Field and Service Robotics Conference 2009*

One of the dreams of researchers in Robotics is to develop robots having the capability to “share” the human living space. Thanks to the recent technological progress in sensor technologies, robotics technologies, miniaturized mechatronic systems, and embedded computational power, this dream is gradually becoming a reality. In the past few years, some autonomous robots have already been successfully immersed in realistic human environments such as museums (robots for guiding visitors) or urban road environments populated by both autonomous vehicles and cars driven by human beings (the 2007 DARPA Urban challenge).

However, the successful deployment of autonomous robots among human beings still is still a real challenge: having some successful large experiments in realistic human environments is clearly a necessary but insufficient step; indeed, major issues such as “Robustness to uncertainty” and “Safety” have to be more deeply addressed. Consequently, previous approaches have to be deeply revisited under this point of view, and new models and methods have to be designed in three main complementary research directions: (1) Robust perception and understanding of the surrounding environment, which is highly dynamic, open, and partially known, e.g. some moving obstacles having unknown behaviours might suddenly show up; (2) Autonomous navigation with a special emphasis on the Safety issue, i.e. how to guarantee a given level of safety when taking goal-oriented navigation decisions in presence of the real world uncertainty; and (3) Impact of the human factor in the involved decisional processes.

In this talk, these three issues will be addressed and the most promising current developments and results in the related technical areas will be presented. More precisely, difficulties and approaches to solve the followings problems will be discussed: Robust detection and tracking of moving entities in urban road environments; Prediction of the future behaviours of the detected moving entities and probabilistic evaluation of the related risk of collision; Safe goal-oriented navigation decisions in uncertain environments; Human-robot interaction for the shared control of an autonomous mobile robot.