

Research group: Robotics Research Group - Project “MACP4Log”  
Head of group: Prof. Basilio Bona

### Contact Information

Postal address: Politecnico di Torino  
Dipartimento di Automatica e Informatica  
Corso Duca degli Abruzzi 24  
10129 Torino  
Italy

Street address: Corso Duca degli Abruzzi 24  
10129 Torino, Italy

Tel.: +39 011 5647023  
Fax.: +39 011 5647198

Email: [basilio.bona@polito.it](mailto:basilio.bona@polito.it)  
URL: <http://www.polito.it/LabRob>  
<http://www.polito.it/MacP4Log>

### Abstract:

The Robotic Research Group (RRG) from Politecnico di Torino coordinates the three-years (2008-2010) project “MACP4Log - Mobile Autonomous and Cooperating robotic Platforms for supervision and monitoring of large LOGistic surfaces”, aimed at the study and development of a prototype of a mobile robotic platform, with on-board vision systems and sensors, integrating a flexible wireless communication solution, able to move autonomously in large logistic spaces, and to communicate with a supervisor and other similar platforms to achieve a coordinated action to carry out specific tasks.



### **Detailed research information:**

The three-years (2008-2010) project “MACP4Log - Mobile Autonomous and Cooperating robotic Platforms for supervision and monitoring of large LOGistic surfaces” is aimed at the study and development of a prototype of a mobile robotic platform, with on-board vision systems and sensors, integrating a flexible wireless communication solution, able to move autonomously in large logistic spaces, and to communicate with a supervisor and other similar platforms to achieve a coordinated action to carry out specific tasks.

Logistic spaces are large areas where logistic societies or other transport enterprises receive, store and distribute large quantities of goods, mainly bulky ones, as containers, cars and other similar items. Other logistic spaces may include car-rental parking, intermodal rail nodes, etc.

The project is coordinated by the Robotics Research Group (<http://www.polito.it/LabRob>) from Politecnico di Torino; the research activity is carried on in collaboration with ERXA s.r.l. (a SME specialized in software for industrial robotics applications) and the Istituto Superiore “Mario Boella” (ISMB), a research institute active in several ICT fields.

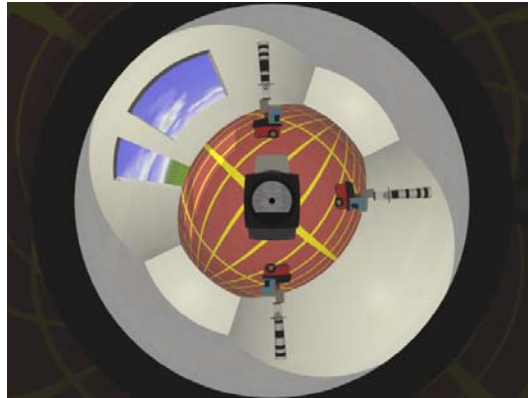
The main tasks to be performed by the robot team address the principal issues of potential logistic users and are given by:

- building and updating maps of both indoor and outdoor logistic spaces
- performing programmed and pro-active surveillance
- locating on the map specific items, as container, cars, etc., that can be marked by proper tags (e.g. license plates, container numbers, RFID) or unmarked, and should be distinguished by colour, shape and/or other physical characteristics
- achieving a full coordination of the team, always securing the wireless connectivity.



The robotic platform adopted is given by the Pioneer 3-DX (the team is currently composed by three rovers, distinguishable by means of a bar code), equipped with:

- proximity sensors: the embedded sonar ring and a laser scanner SICK LMS200
- vision sensors: a pan-tilt camera (use of an omnivision camera is currently under investigation)
- broadband wireless transmitter and receiver
- an on-board netbook



The environment where the robotic platform operates can be considered as slowly varying, since the robot tasks will be performed when the logistic spaces are relatively quiet (during the night or weekends).

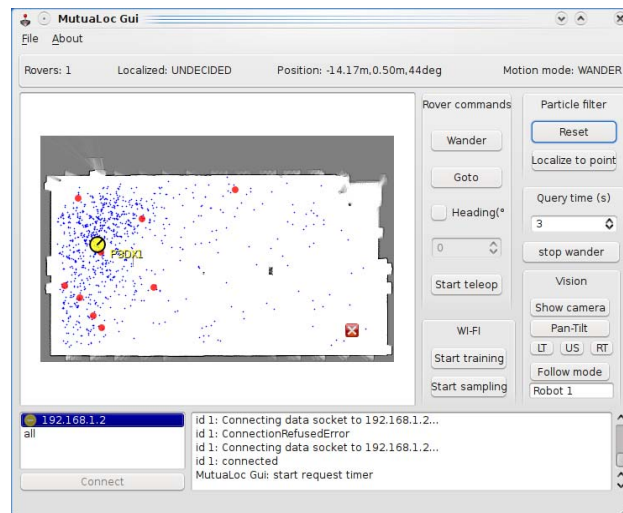
The mobile platform must be able to:

- autonomously move within substantially flat and uniform indoor and outdoor spaces, partially structured, with or without a given initial approximated map describing the environment;
- self-locate within the given/constructed map, by means of on-board sensors and cameras; passive or active markers may be present in the logistic surface;
- connect to the supervisor and upload heterogeneous data (video stream from cameras, data about positioning, logs, alarms, etc.);
- connect to other similar mobile platforms operating in the logistic surface to build a cooperative approach to the supervision goal;
- autonomously contribute to a cooperative task in a supervised team management.

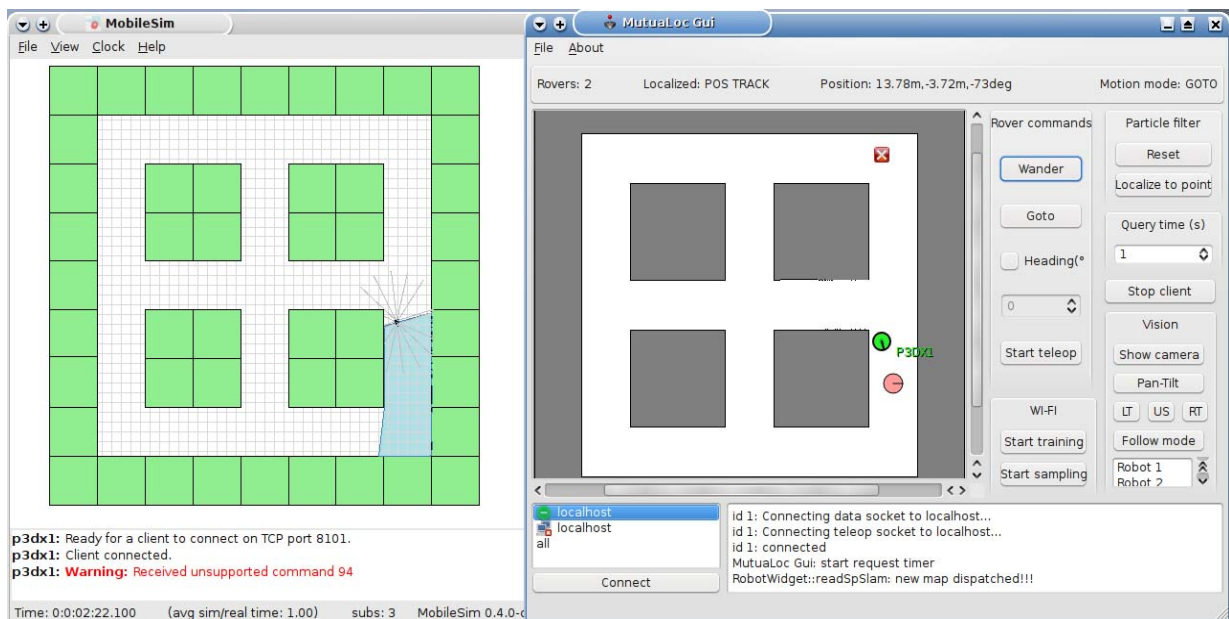


The already achieved results are mainly relative to the following localization and mapping issues:

- multi-robot collaborative localization in highly symmetrical environments (like the logistic areas), without any absolute information like GPS
- localization in presence of partial variations of the map
- localization using wireless networks
- multi-robot Rao-Blackwellized particle filters SLAM: measuring uncertainty issues and problems due to unknown initial correspondences and limited communication



Both simulation and experimental tests are used to validate the developed solutions. Simulations are performed using the Mobilesim software, based on the Stage library. Preliminary experimental tests have been already carried out in local environments; tests in a real logistic environment are planned for the last year of the project.



Detailed and updated information is available in the [project website](#).