PAL Robotics

LAAS-CNRS
07/02/2013

How may I help you?

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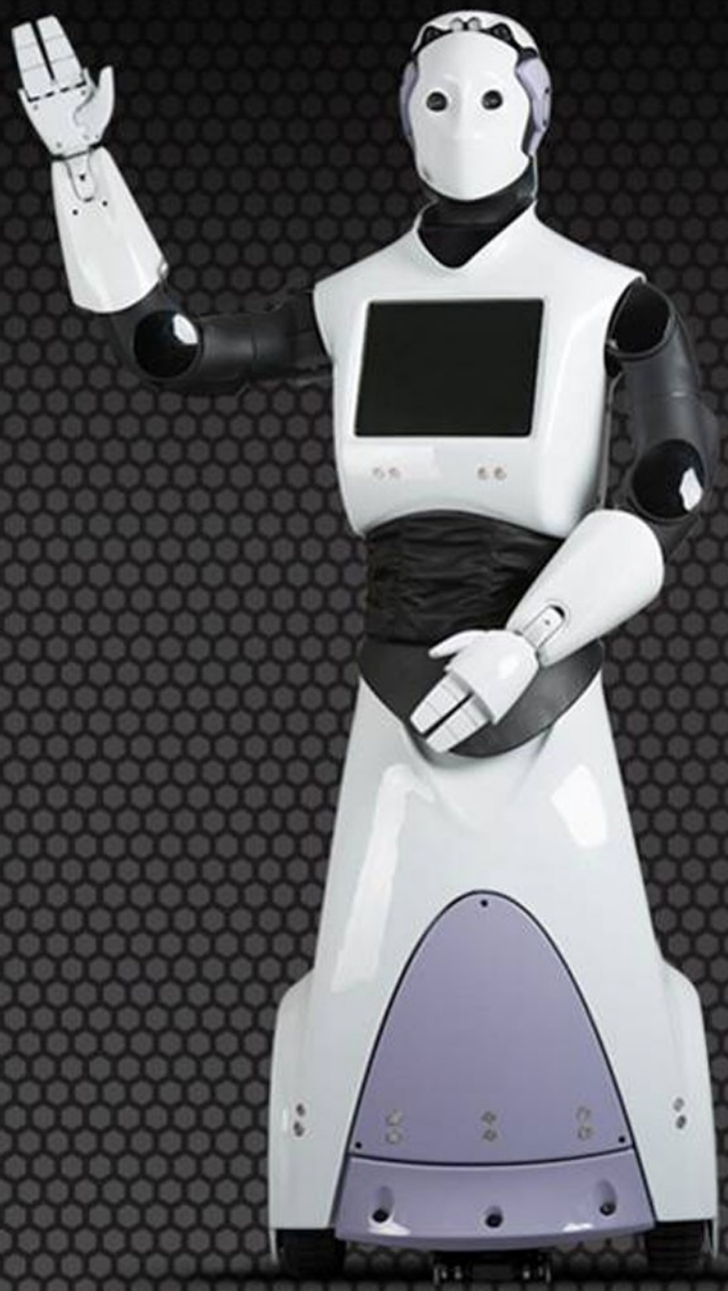

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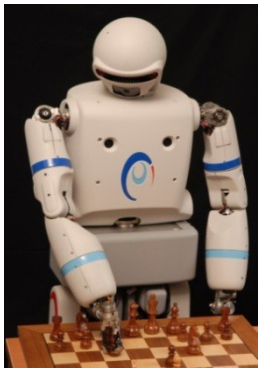
Laboratoire d'Analyse et d'Architecture des Systèmes

PAL Robotics: History

2004 2006 2008 2009 2011




PAL Robotics, created in 2004, becomes one of the most important companies in R&D of humanoid robotics

Sector	**ICT – Robotics**
Origin	**2004**
Nº of Employees	**31**
City	**Barcelona**
Investors	**PAL/ROYAL Groups Abu Dhabi**

PAL Robotics: Products

PRODUCTS:

- **Autonomous humanoid service robots** working as: guide, dynamic information point, advertisement tool, entertainer….
- Robotic modular parts, mobile bases

MARKETS:

- Service oriented market, public spaces: exhibition centers, shopping malls, museums,…
- **Customized automated systems**: R&D, light industry

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PAL Robotics: REEM-A vs REEM-B

REEM-A

REEM-A		REEM-B
1.40 m	Height	1.50 m
40 Kg	Weight	60 Kg
30	No. of motors	41
1.5 Km/h	Walking velocity	1.5 Km/h
1 Kg	One arm payload	6 Kg
90 minutes	Autonomy	120 minutes
Force/torque Stereo cam. Gyro + accelerometer	Sensors	Force/torque Stereo cam. Gyro+ accelerometer Laser rangefinder Ultrasonic

REEM-B

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PAL Robotics: REEM

- Humanoid
- Height: 1,65 m
- Weight: 90 kgs
- 22 degrees of freedom

- Wheeled mobile base (5 km/h)
- Transportation platform
- Lithium battery (8 h autonomy)

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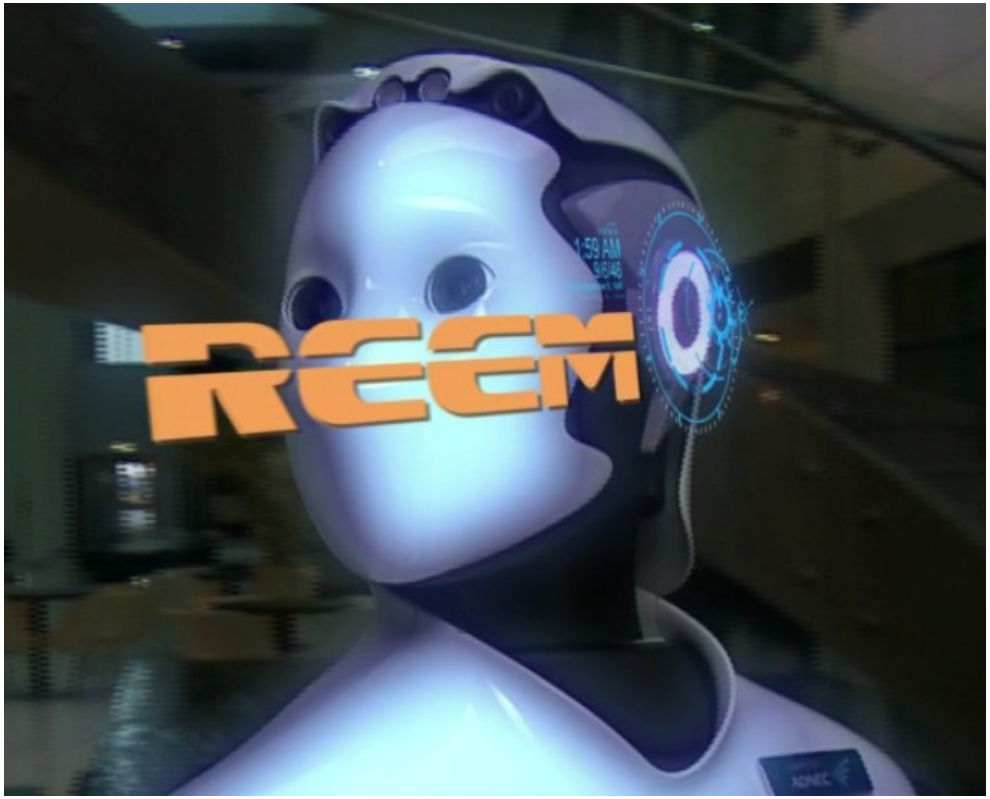
PAL Robotics: REEM



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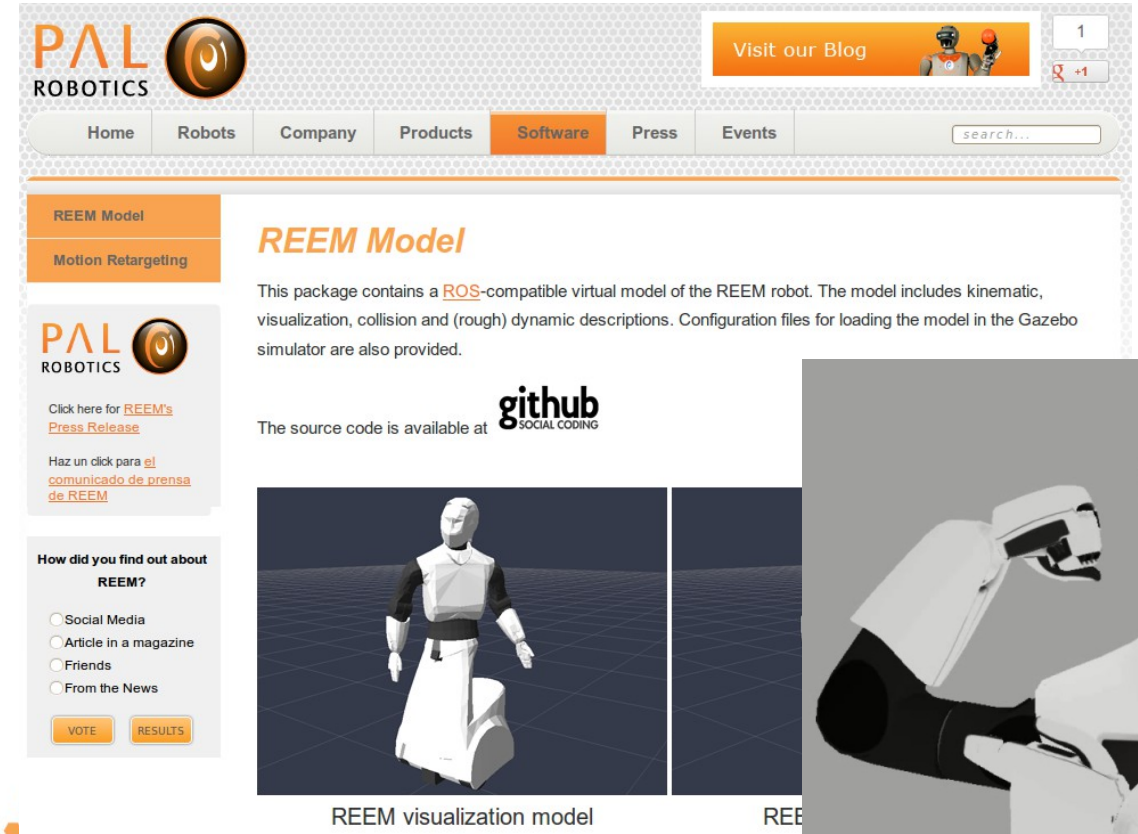
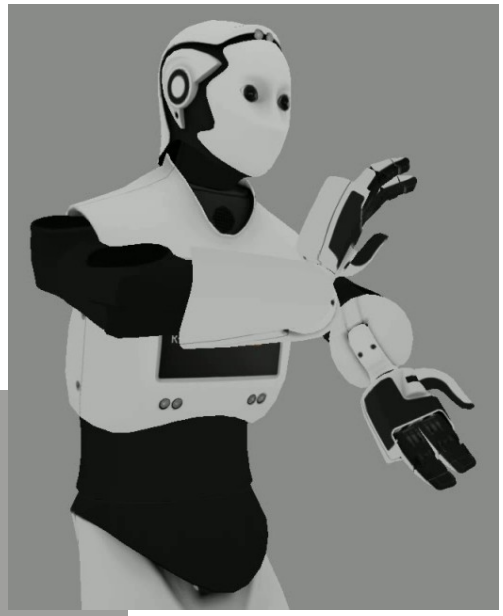
PAL Robotics: Released software

Potential customers can evaluate REEM before buying it.

http://www.pal-robotics.com/software





PAL Robotics: Speech Editor

- Multimedia contents creator that combine speech, video, movements and LED effects
- One-click execution on simulated robot or on real robot
- Easy to extend adding new features for any robot

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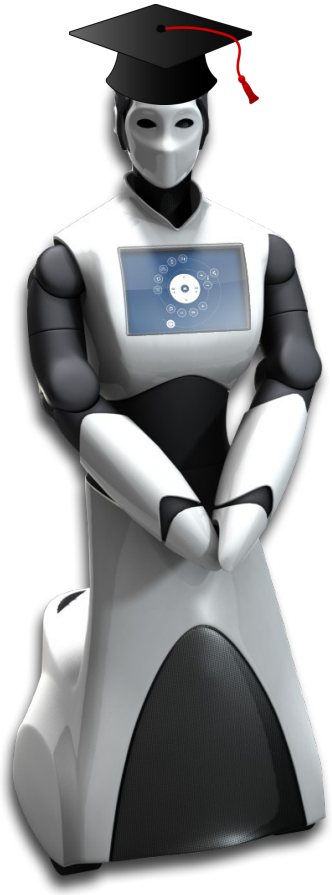
Academic Partnerships

Promote REEM as a **research platform**

- Expose students and researchers to **REEM**
- Get **high-quality feedback**

  from tech-savvy academics
- Academia: potential to become a **strong client**



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20 students studying in 6 countries...

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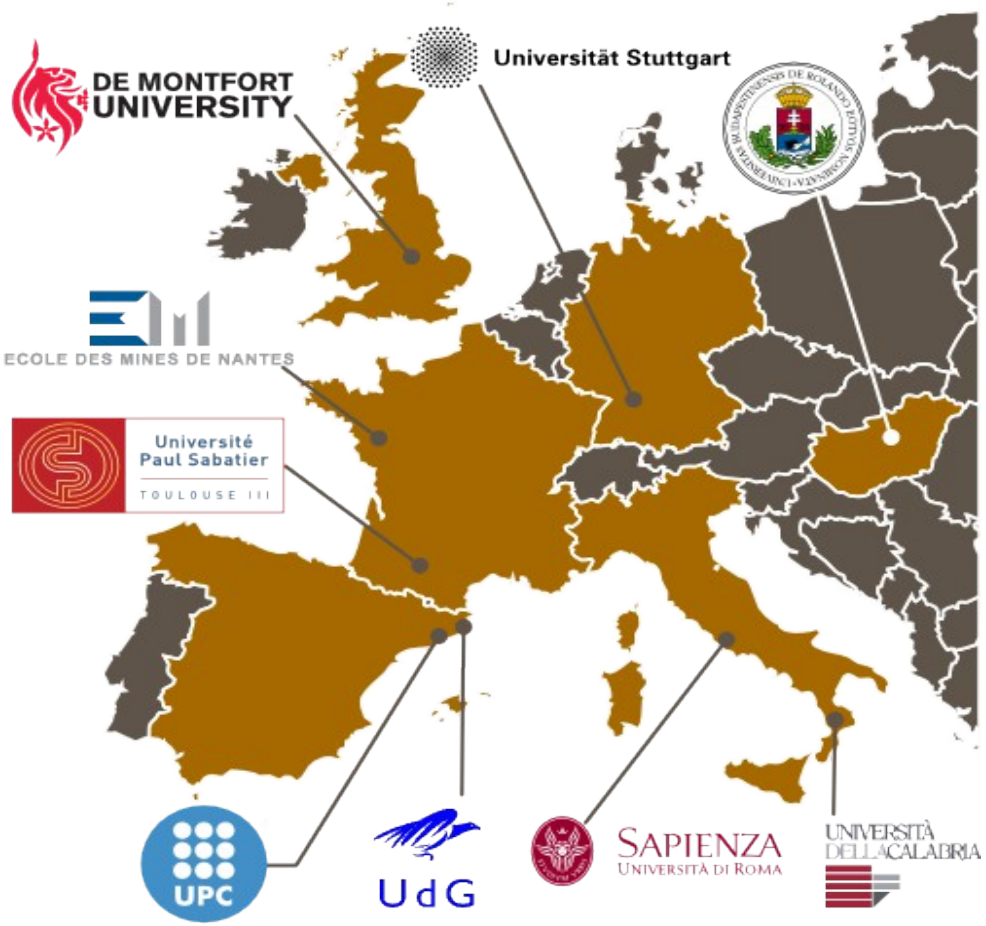
… coming from 9 universities



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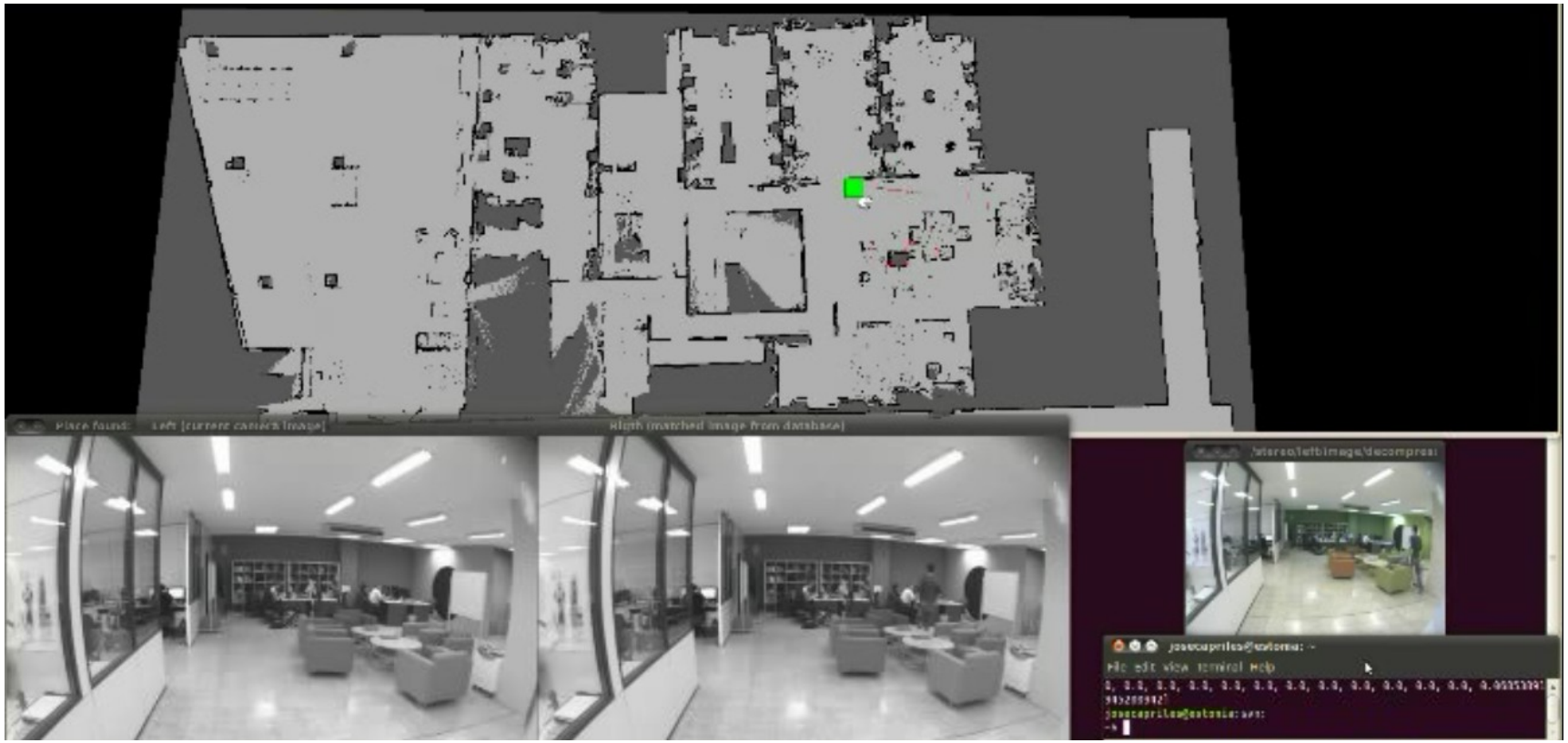
R&D: Navigation in crowded environments

Robot in real environments

R&D: Place Recognition

Robot topological localisation



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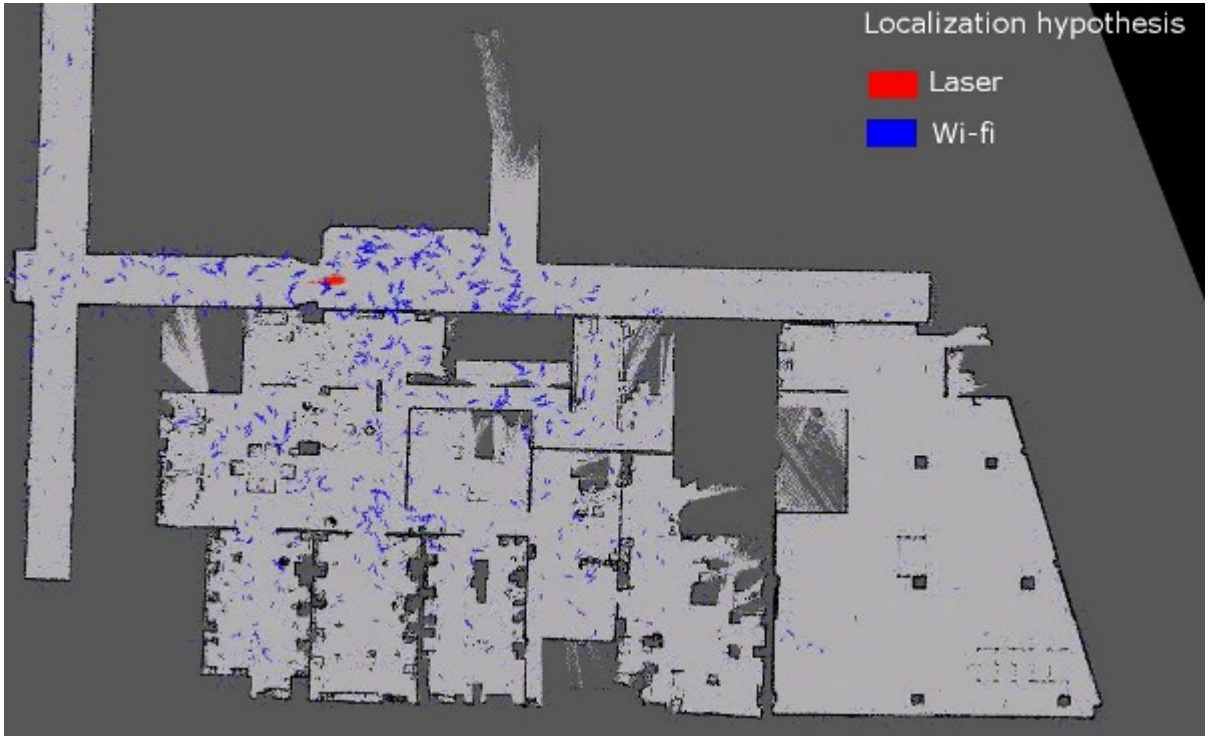
R&D: Wi-Fi Localisation



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R&D: Multi-Floor Mapping

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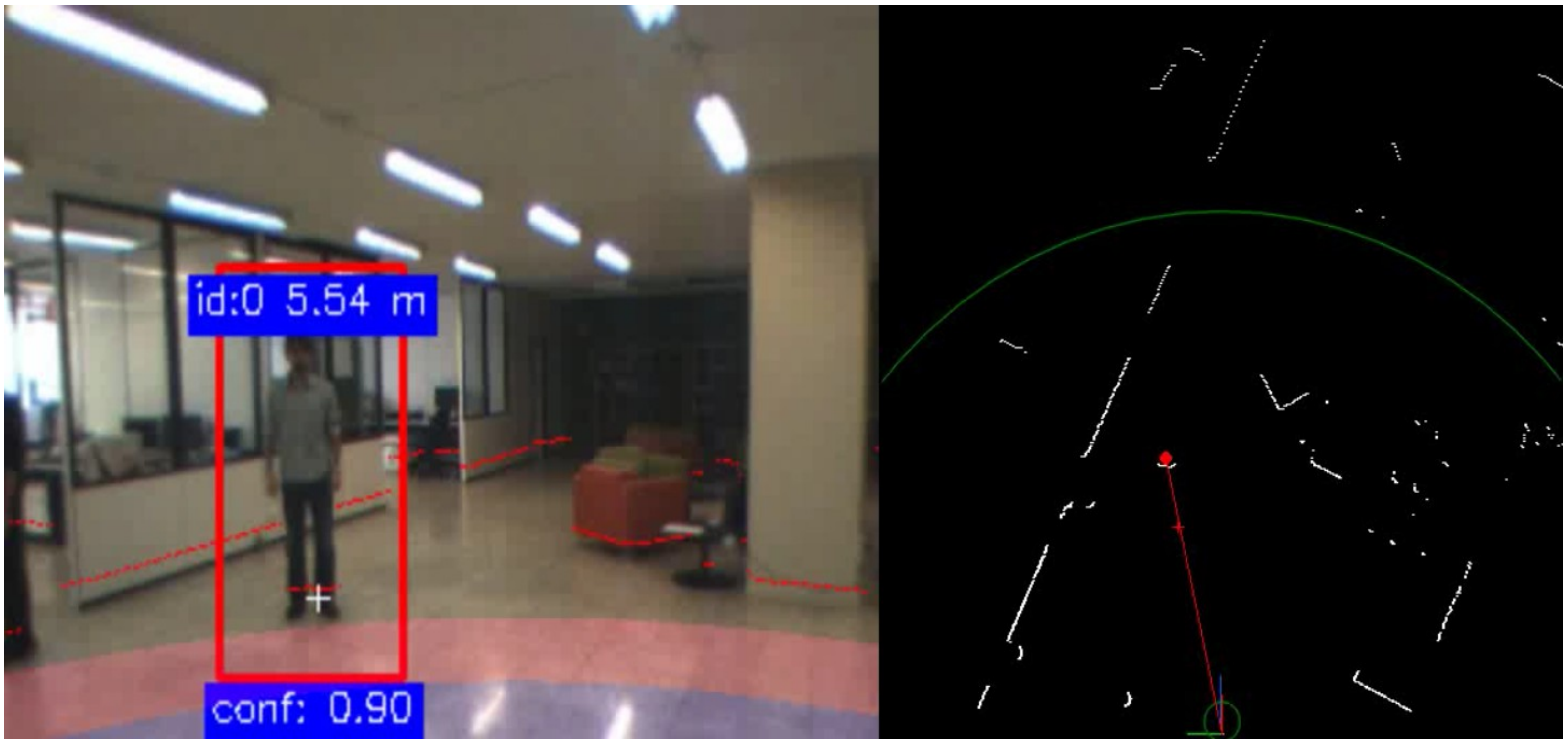
R&D: Person detection



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R&D: Face Tracking

Fast face tracking using **tracking-learning-detection**

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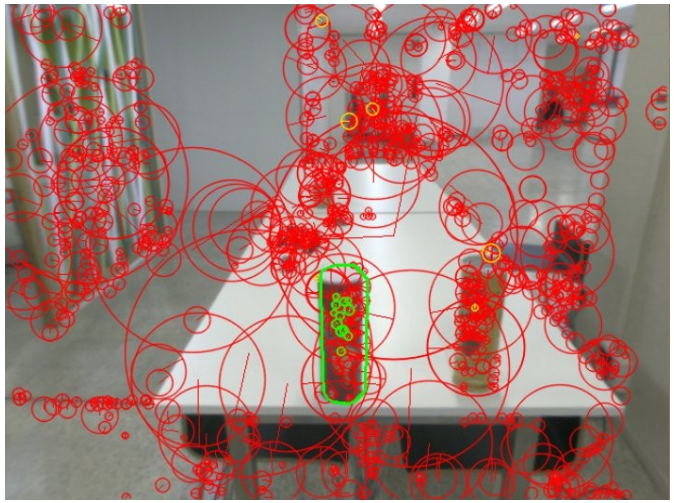
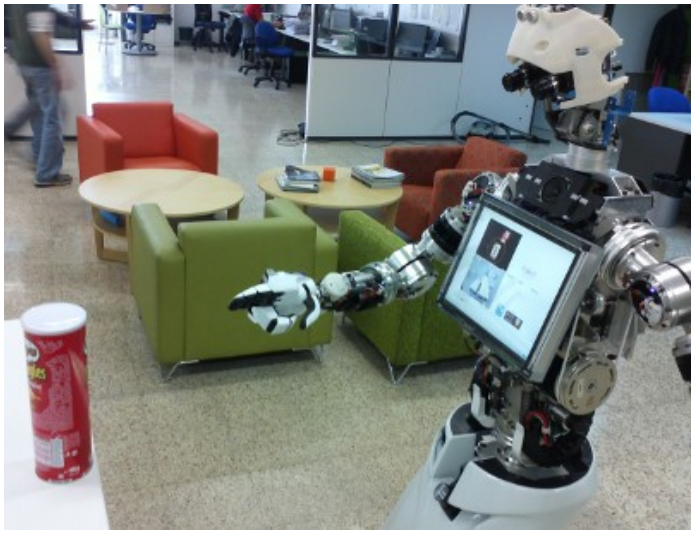
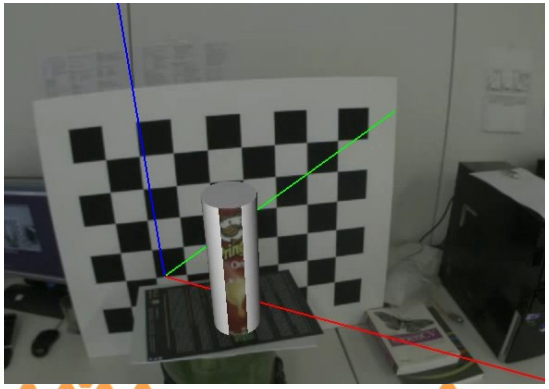
R&D: Object Recognition







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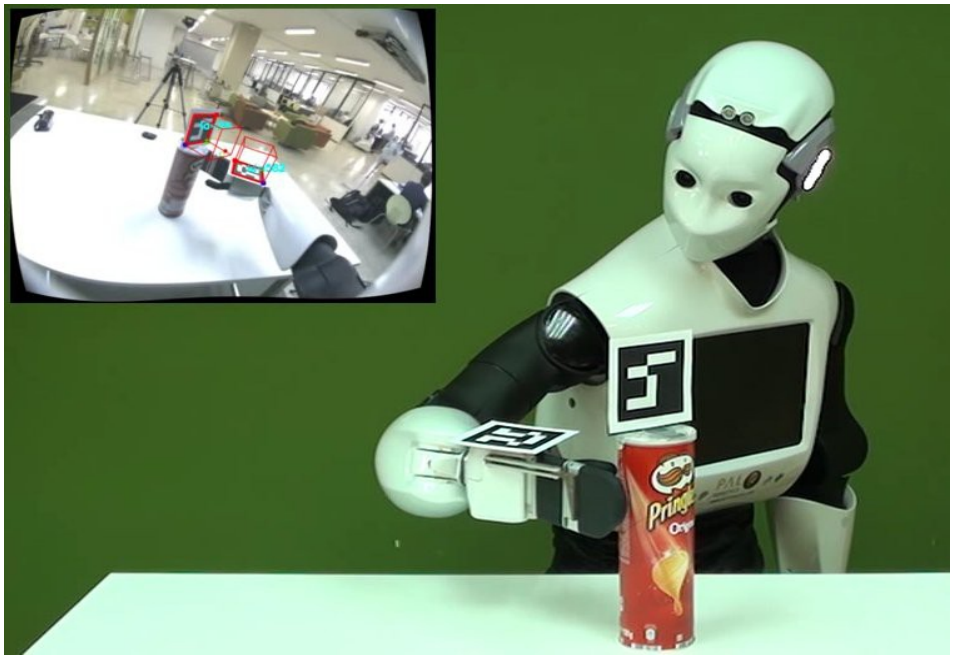
R&D: Visual Based Grasping

2 control laws:

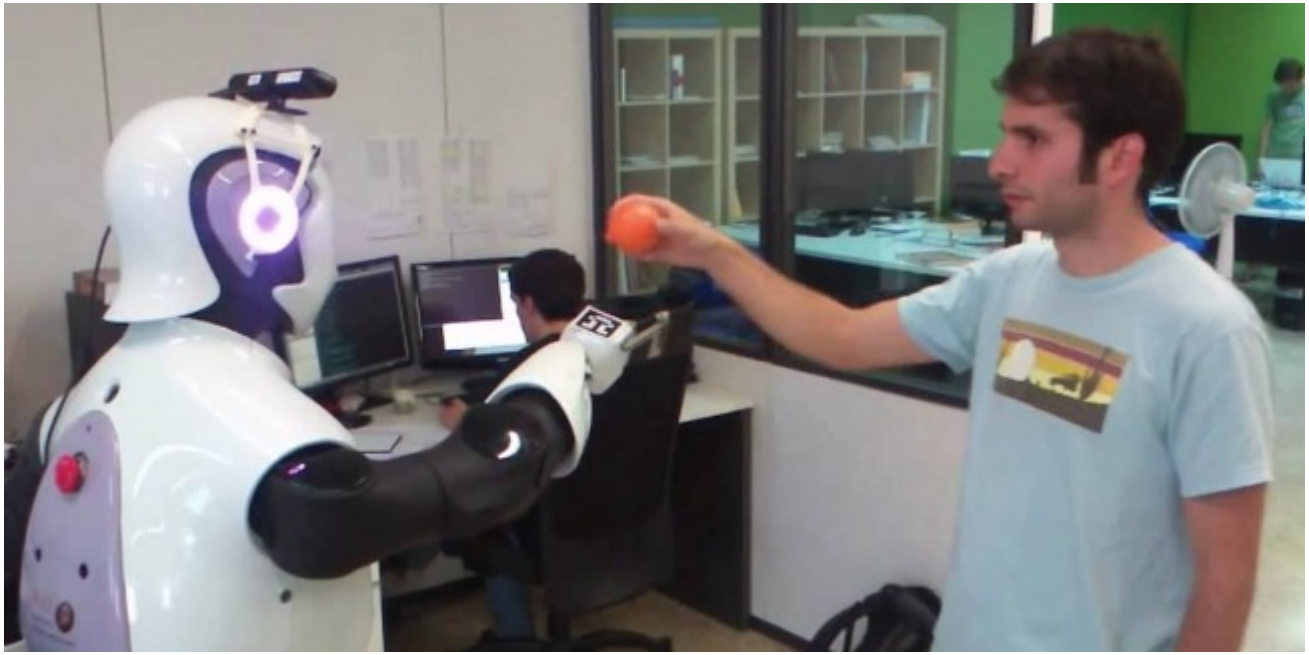
- Torso + right arm (9 dof)
- Neck (2 dof)
  with 2 feed-forward terms
  from the 1st control law



Secondary task:
Joint limit avoidance using projection operator by Marey and Chaumette (ICRA 2010)

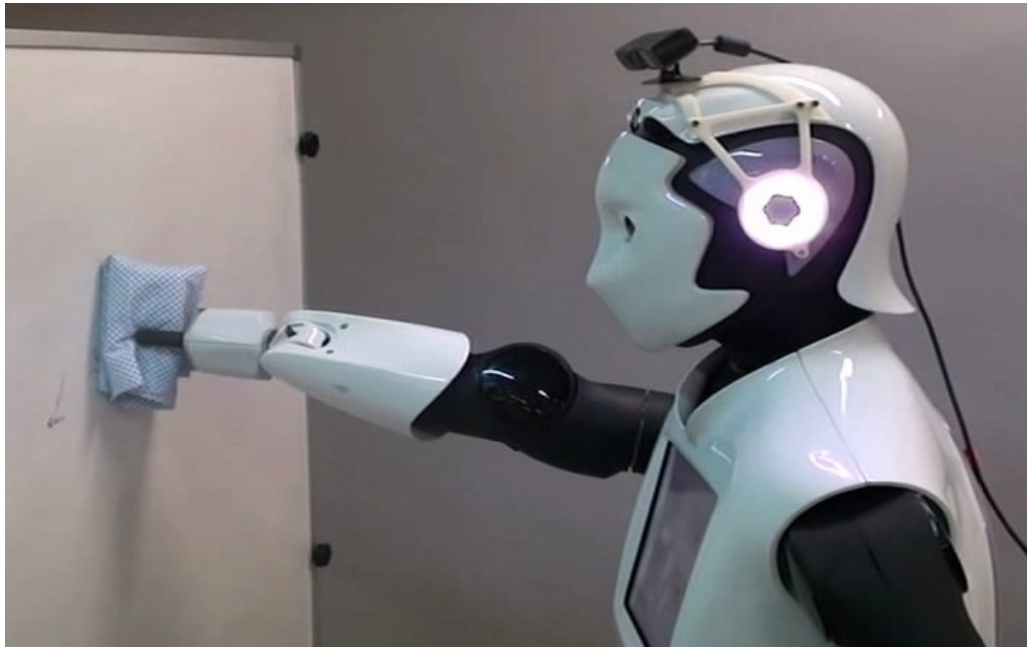
R&D: Robot Behaviours

Ball grasping demo



R&D: Robot Behaviours

Cleaning a board



R&D: Teleoperation

REEM mimics a person's motions. Used for:

- Entertainment.
- Easy programming of fluent and expressive motions.

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R&D: Motion Generation vs. Motion Recall

Comparative study of two ways of performing upper body motions
(submitted to IROS 2012)

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R&D: Walking Control

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R&D: Interests and Goals

- **Grasping**
  - Improve object recognition and pose estimation.
  - Visual servoing with self-collision avoidance
  - Robot base placement.
  - Compliant actuation and/or control.
  - Dynamic model identification.
  - Robot auto-calibration
- **Navigation**
  - Navigation in crowded environments.
  - Autonomous mapping and exploration.
  - Long term mapping.

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R&D: Interests and Goals

- **HRI**
  - Robust appearance descriptors for particle filter tracking of persons.
  - People gesture detection and recognition.
  - Detect people attention.
  - Sound localization.
  - Speech recognition in noisy environments.
- **Robot Autonomy**
  - Task planner integration.
  - Robot resource management.

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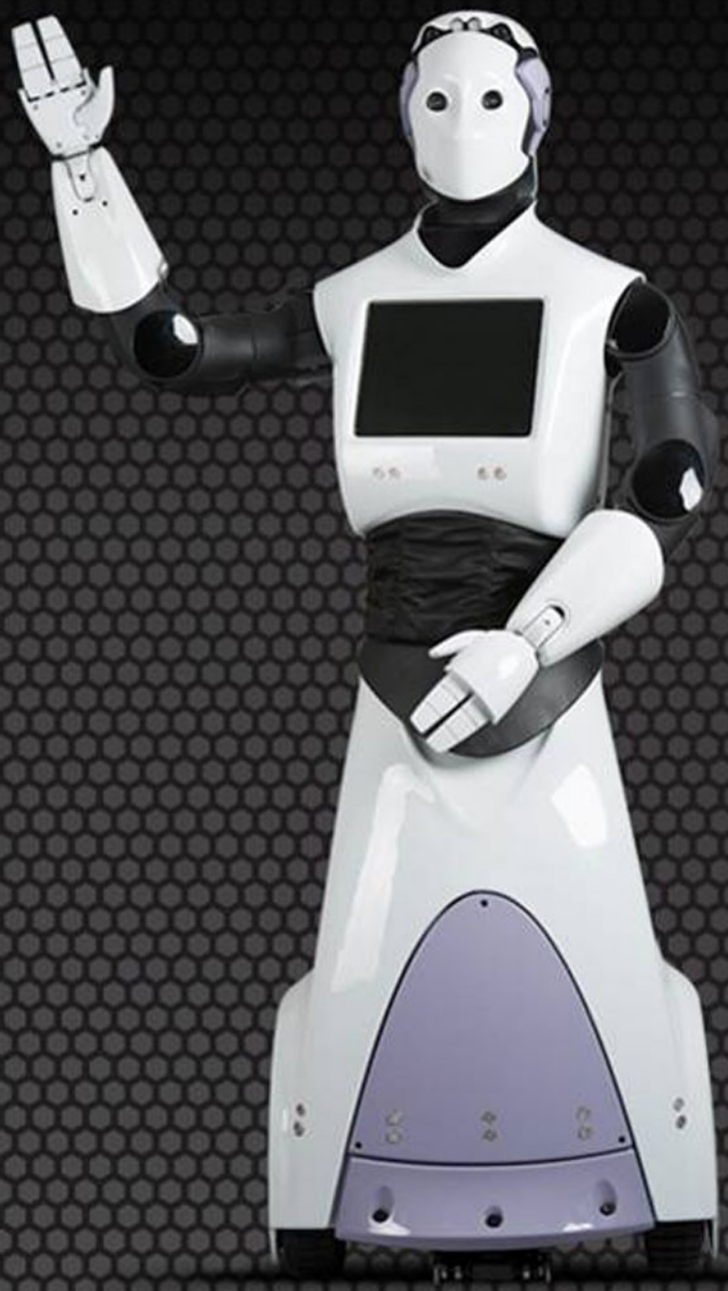

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