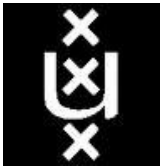
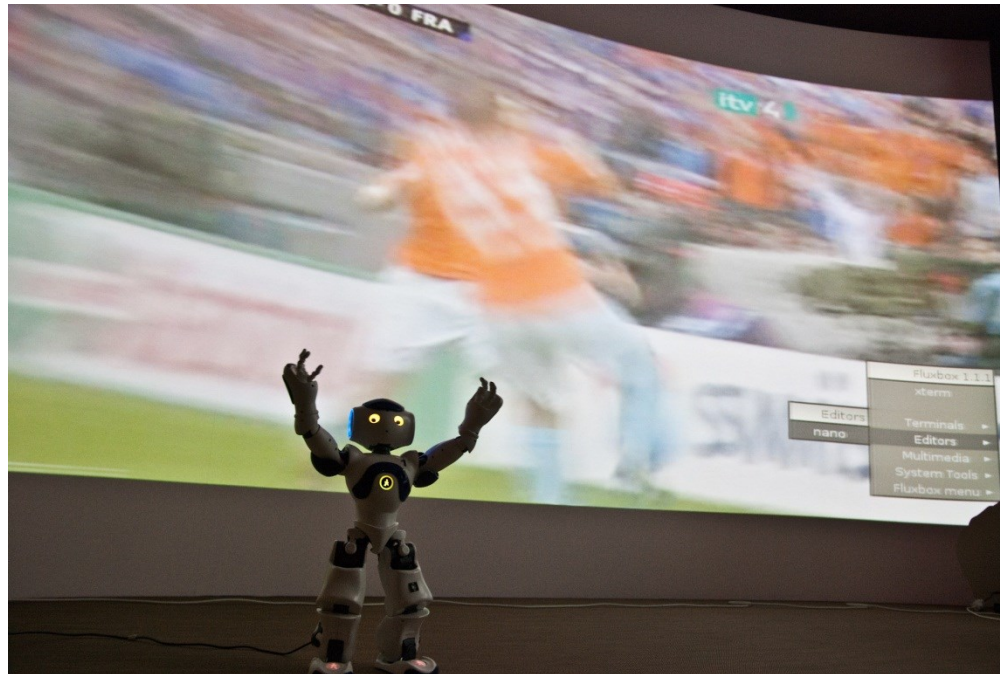


Ros Nao Tutorial



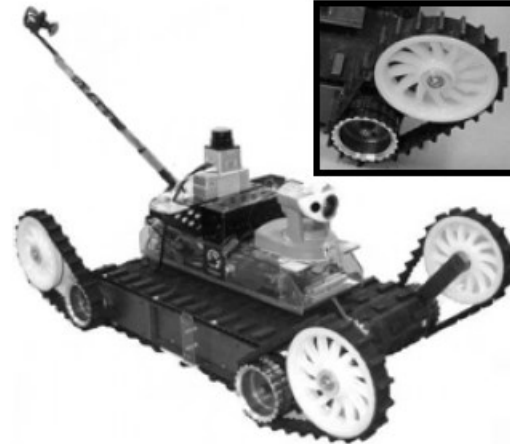
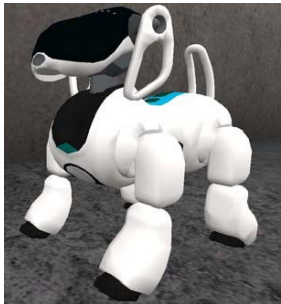
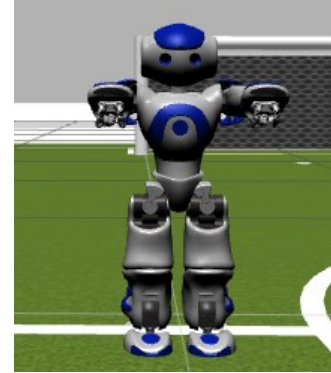
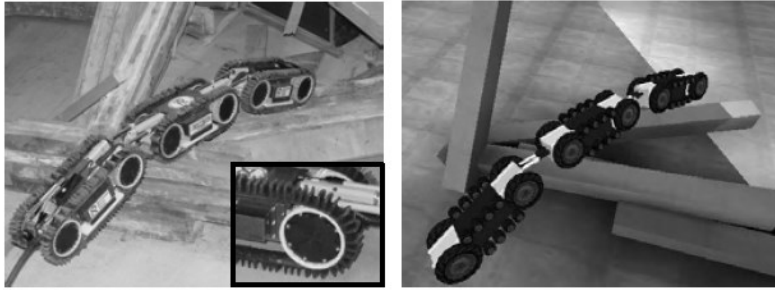
Universiteit van Amsterdam



Caitlin Lagrand, Michiel van der Meer & Arnoud Visser

Future of Rescue Robot Simulation workshop,
Leiden, March 4, 2016

Simulation & Real robots



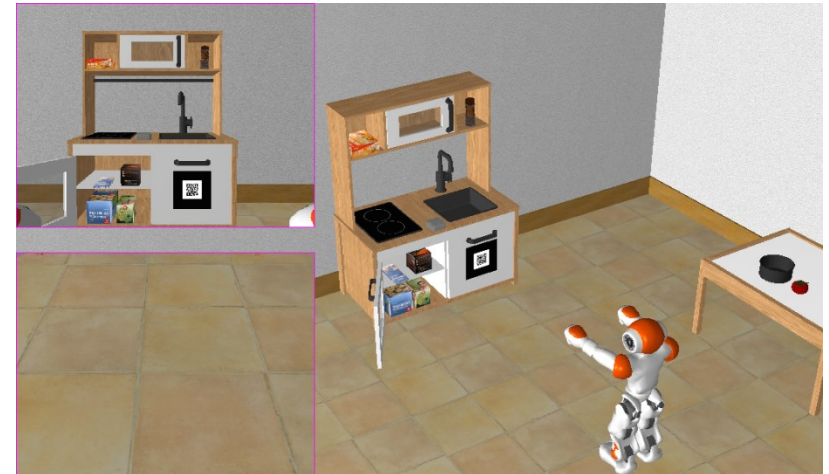
Humabot Challenge



www.irs.uji.es/humabot/



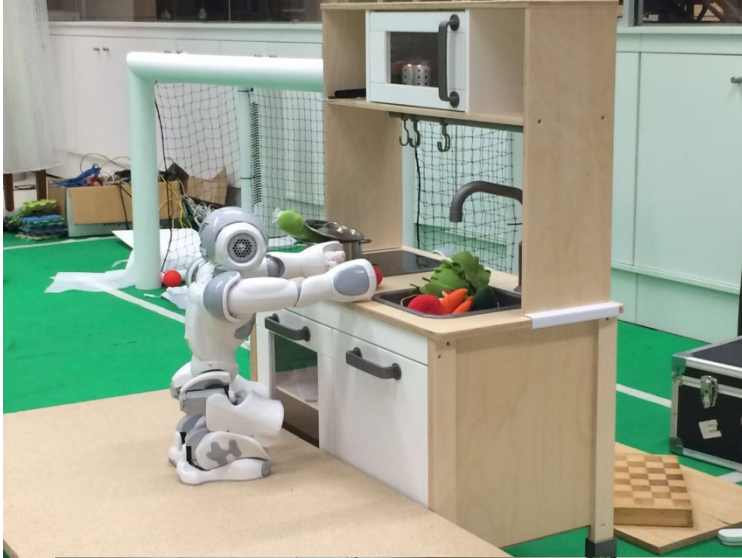
Humabot Challenge



[1] P. J. S. Enric Cervera, Juan Carlos Garcia, "Toward the robot butler: The humabot challenge," Robotics & Automation Magazine, IEEE (Volume:22, Issue: 2), 2015.



Standard Environment



DUKTIG
Play kitchen

RobotProgramming.Net



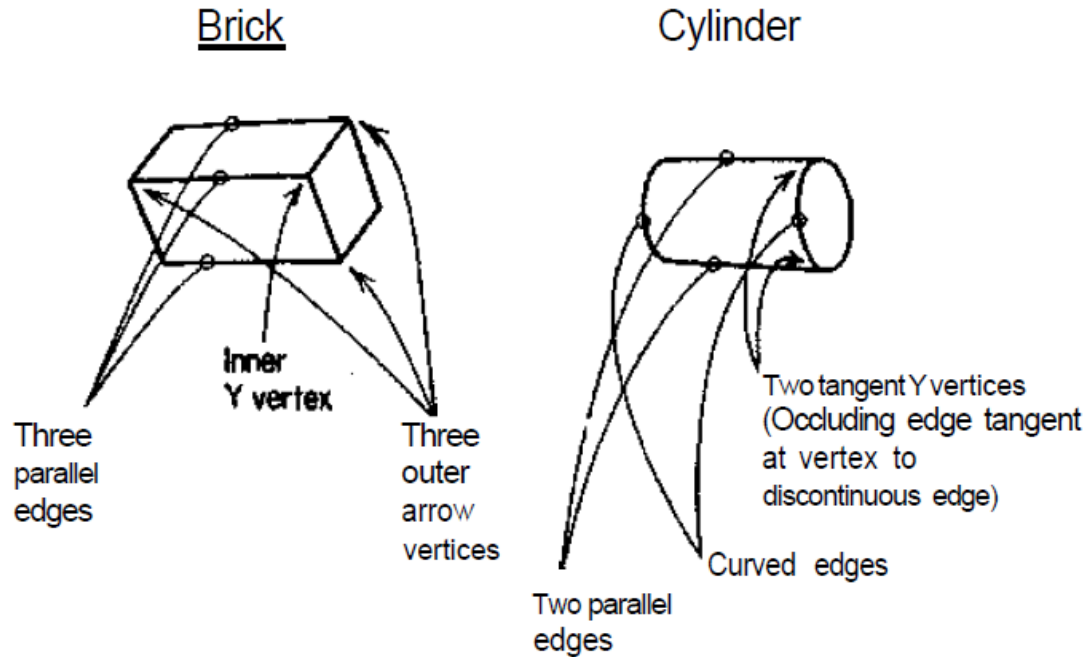
HUMABOT

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Bio-inspired perception

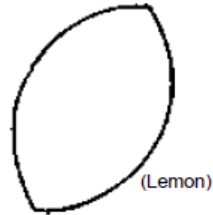
Some Nonaccidental Differences Between a Brick and a Cylinder



[2] I. Biederman, "Recognition-by-components: a theory of human image understanding." Psychological review, vol. 94, no. 2, p. 115, 1987.

Bio-inspired perception

Geons with Expanded and Contracted Cross Sections (—)



(Lemon)

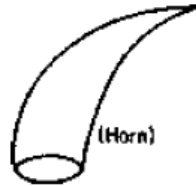
Cross Section:

Edge: Curved (C)

Symmetry: Yes (+)

Size: Expanded & Contracted (—)

Axis: Straight (+)



(Horn)

Cross Section:

Edge: Curved (C)

Symmetry: Yes (+)

Size: Expanded (+)

Axis: Curved (-)



(Gourd)

Cross Section:

Edge: Curved (C)

Symmetry: Yes (+)

Size: Expanded & Contracted (—)

Axis: Curved (-)

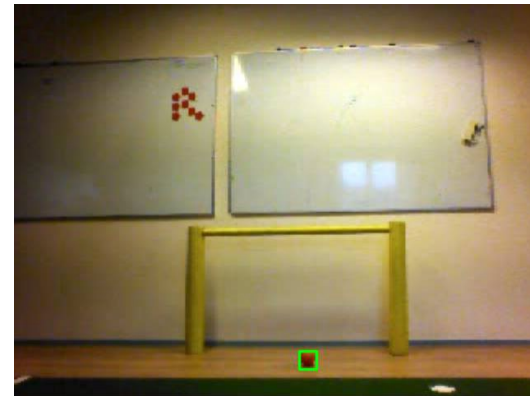
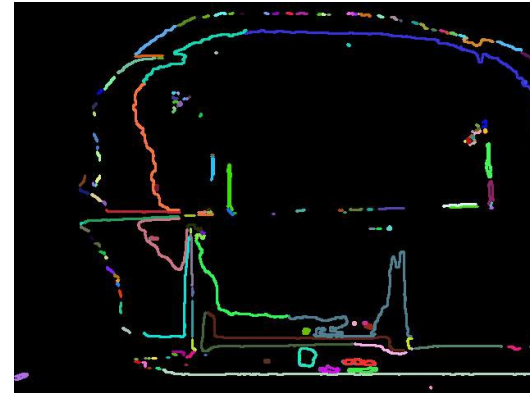
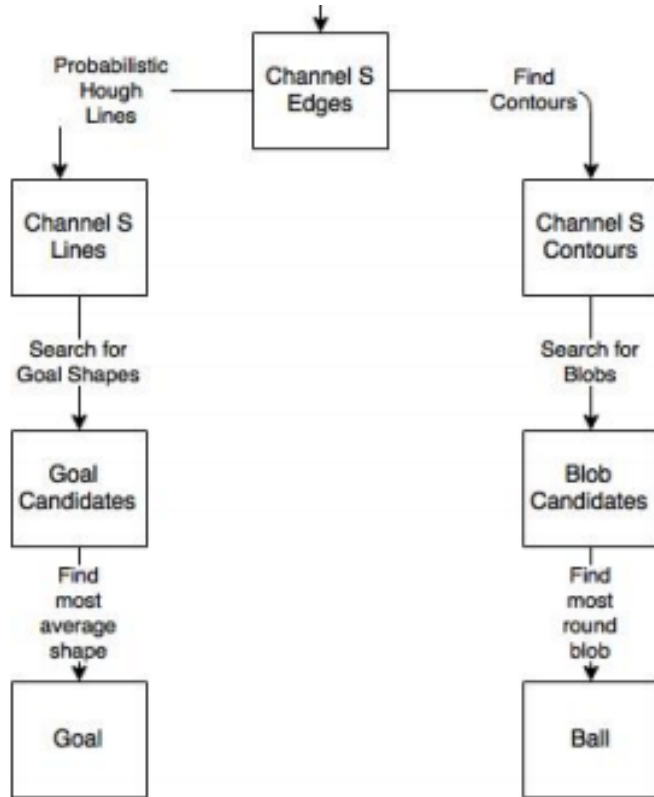
[2] I. Biederman, "Recognition-by-components: a theory of human image understanding." Psychological review, vol. 94, no. 2, p. 115, 1987.

Bio-inspired perception



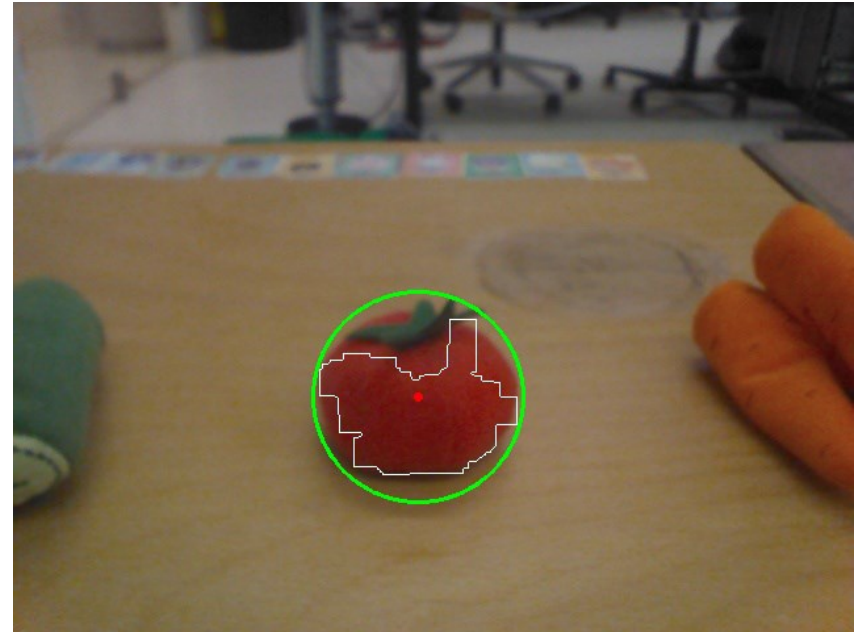
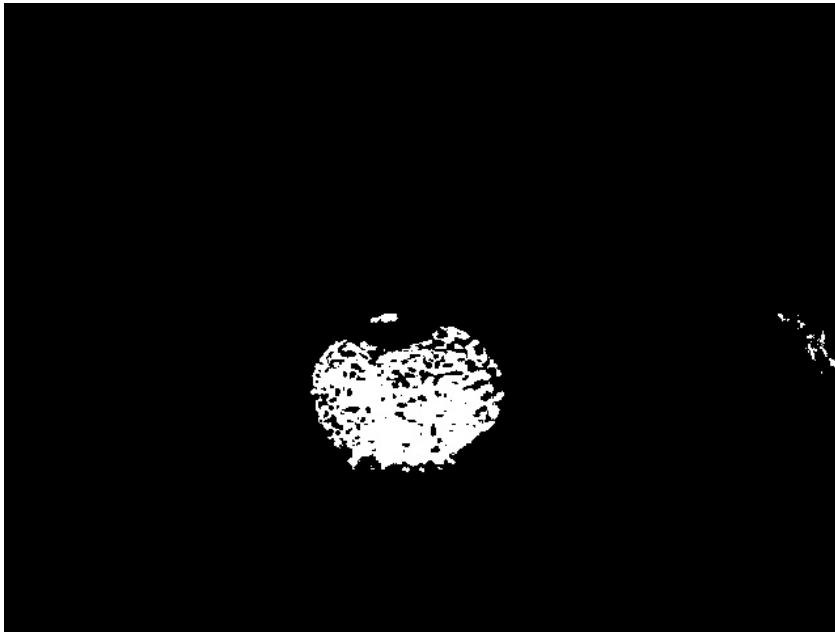
[2] I. Biederman, "Recognition-by-components: a theory of human image understanding." *Psychological review*, vol. 94, no. 2, p. 115, 1987.

Bio-inspired perception

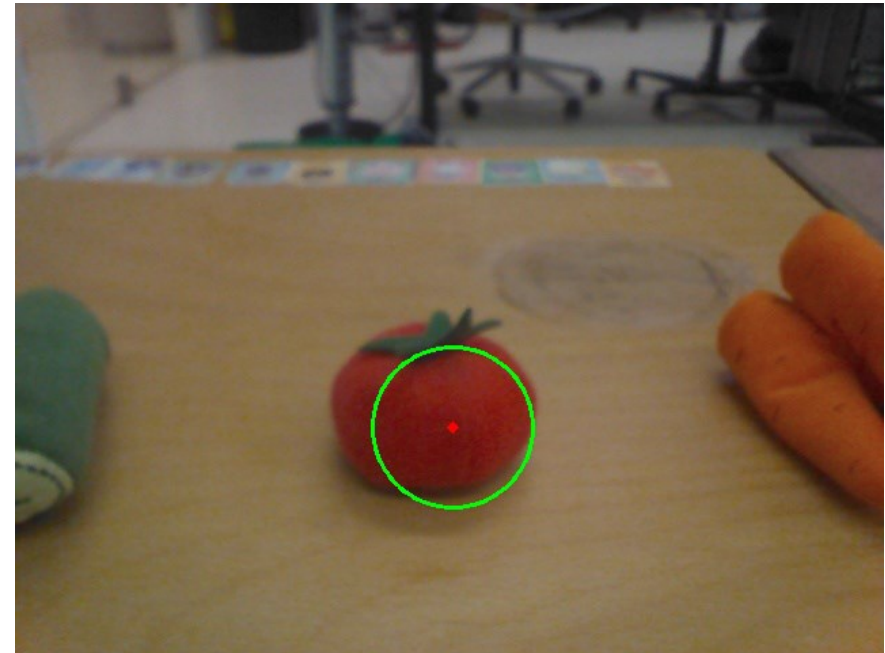
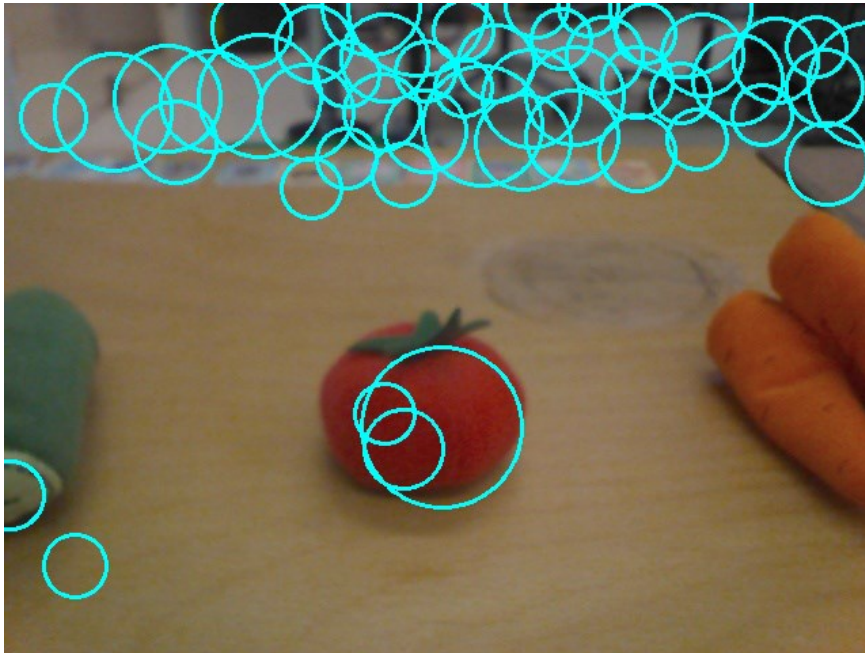


[2] G. E. Ras, "Cognitive image processing for humanoid soccer in dynamic environments," Bachelor thesis, Maastricht University, June 2015.

Colour based + Contours



Circle based + Colour



Colour invariant blob detection



Result

TABLE 1. RESULTS OF THE DIFFERENT DETECTING ALGORITHMS
1 MEANS DETECTED TOMATO, 0 MEANS DETECTED NOTHING

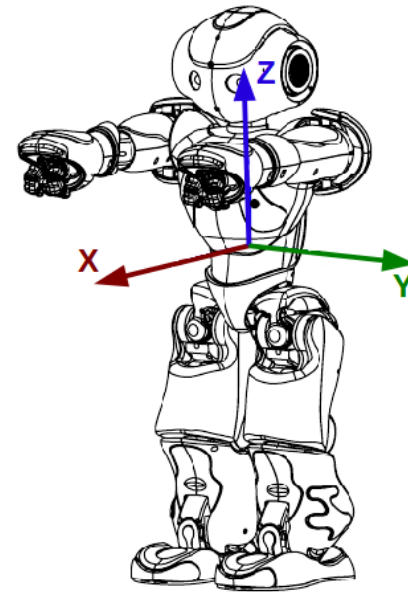
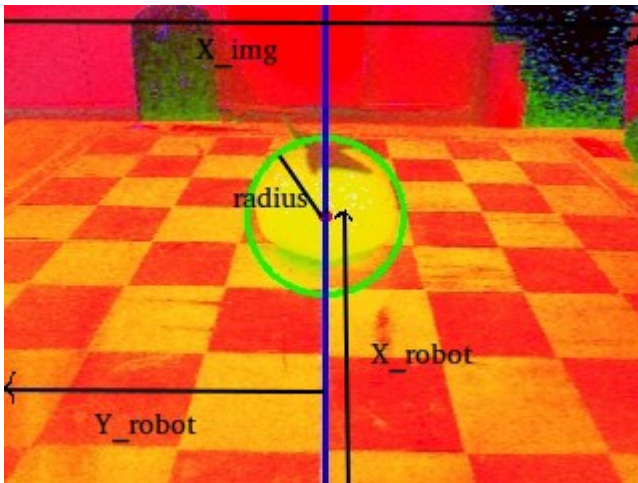
	color based	Circle based	Blobs
tomato	1	1	1
carrot	0	0	0
cucumber	0	0	0
garlic	0	background	0
lettuce	0	0	lettuce
all1	1	1	1
all2	1	0	garlic
all3	1	1	1 & background
without1	0	0	garlic
without2	0	0	carrot

Localization

$$X_{\text{robot}} = (\text{RADIUS_TO_METERS} / \text{radius})$$

$$Y_{\text{robot}} = (\text{REAL_WIDTH} / \text{radius}) * (\text{img_width}/2 - x_{\text{img}})$$

$$Z_{\text{robot}} = 0.35$$



Result

TABLE 2. RESULTS OF THE LOCALIZATION ALGORITHMS, IN METERS

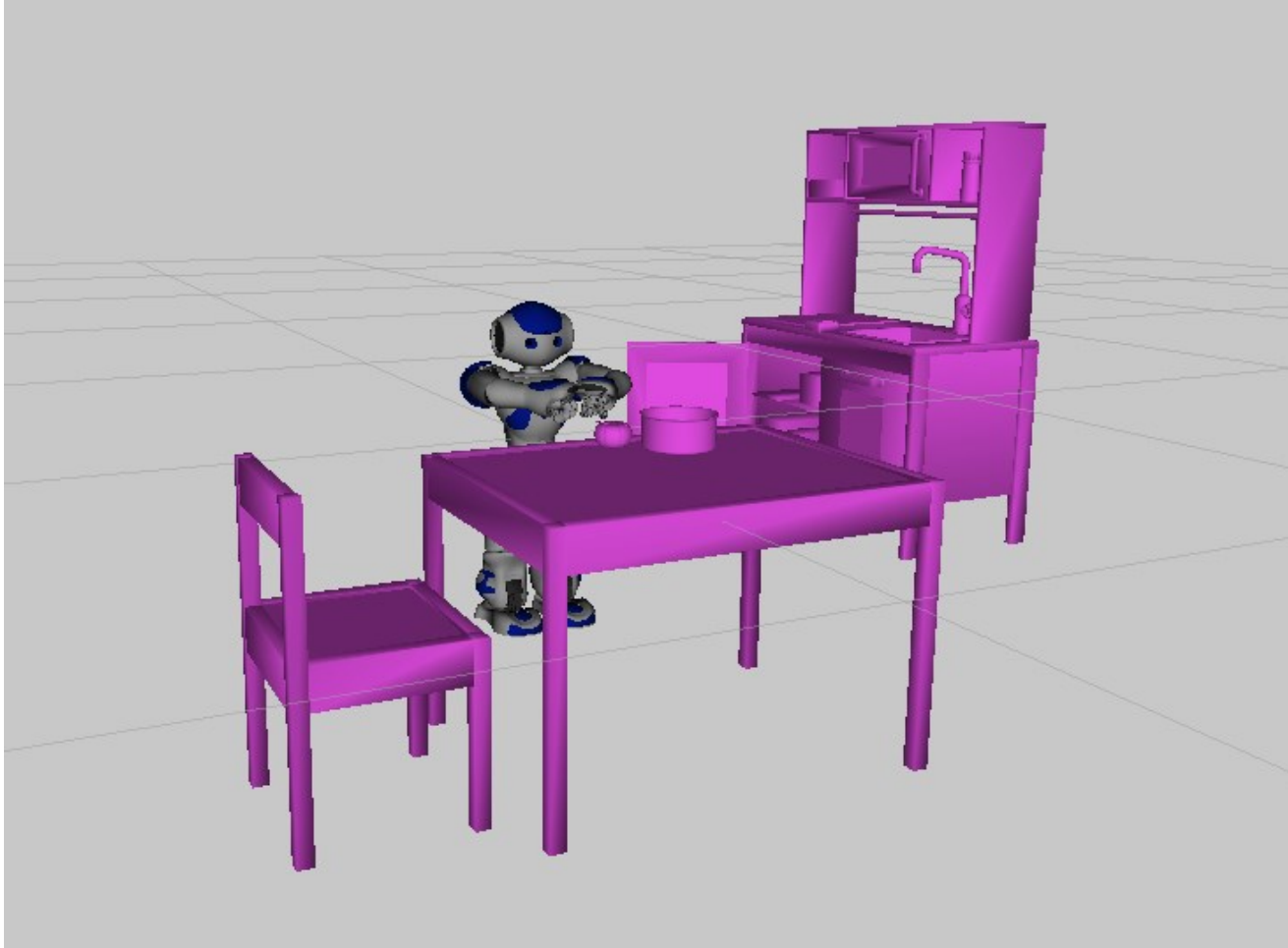
Real x	Real y	Estim. x	Estim. y	Diff. x	Diff. y
0.22	0	0.23	-0.006	0.001	-0.006
0.22	0.076	0.27	0.077	0.046	0.001
0.22	-0.076	0.27	-0.076	0.046	0.000
0.30	0	0.31	0	0.009	0
0.30	0.076	0.31	0.062	0.009	0.014
0.30	-0.076	0.39	-0.071	0.086	0.005
0.38	0	0.37	0.001	0.004	0.001
0.38	0.076	0.37	0.061	0.004	0.015
0.38	-0.076	0.54	-0.076	0.164	0.000

MotionPlanning

The image displays a software interface for motion planning, divided into several panels:

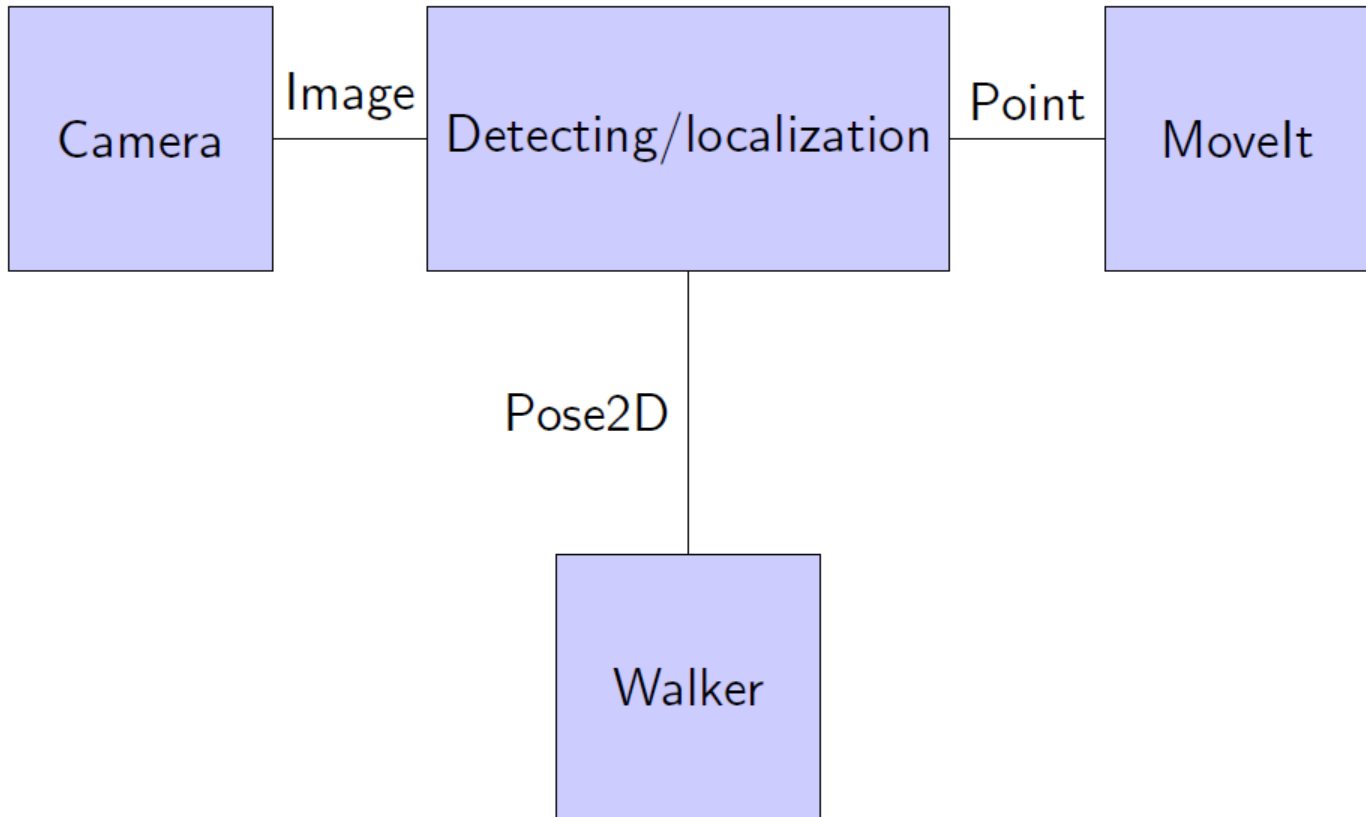
- Displays Panel:** Contains a tree view with categories like "Planning Metrics" and "Planned Path". Under "Planned Path", items include "Trajectory Topic" (with path `/move_group/display_pla...`), "Show Robot Visual" (checked), "Show Robot Collision", "Robot Alpha" (0,5), "State Display Time" (0.05 s), "Loop Animation", and "Show Trail".
- Motion Planning Panel:** Features tabs for "Context", "Planning", "Manipulation", "Scene Objects", "Stored Scenes", "Stored States", and "Status". It is divided into three sub-sections:
 - Commands:** Includes buttons for "Plan", "Execute", and "Plan and Execute". The "Time" is shown as 0.312.
 - Query:** Includes fields for "Select Start State:" and "Select Goal State:" with a dropdown menu set to "<random valid>" and an "Update" button.
 - Options:** Includes sliders for "Planning Time (s): 5,00", "Planning Attempts: 10,00", and "Velocity Scaling: 1,00". There are checkboxes for "Allow Replanning", "Allow Sensor Positioning", and "Allow External Comm.". A "Path Constraints:" dropdown is set to "None", and "Goal Tolerance:" is set to "0,00". A "Clear octomap" button is also present.
- Workspace:** Includes input fields for "Center (XYZ): 0,00 0,00 0,00" and "Size (XYZ): 2,00 2,00 2,00".
- Main View:** A 3D visualization of a robot model (white and blue) on a dark grid floor. A colorful, multi-segmented path is shown extending from the robot.
- Bottom Bar:** Contains a "Reset" button on the left and "30 fps" on the right.

Humabots environment



Environment ported from Webots to Rviz / MoveIt.

ROS pipeline



Result



Tutorial

Software for day 5

To have multiple robots in their own namespace, you could follow the instructions of the [pioneer3at_demo](#) provided by Stefan Kohlbrecher and Nate Koenig.

What is needed for to control a real robot is a working version of the simulation of a Nao robot.

- Follow the steps of the [ros Nao installation](#)
- `mkdir ~/naoqi`
- Download [pynaoqi-python2.7-2.1.4.13-linux64.tar.gz](#)
- `cp ~/Downloads/pynaoqi-python2.7-2.1.4.13-linux64.tar.gz ~/naoqi`
- `cd ~/naoqi`
- `tar xzf pynaoqi-python2.7-2.1.4.13-linux64.tar.gz`
- `echo 'export PYTHONPATH=~/.naoqi/pynaoqi-python2.7-2.1.4.13-linux64:$PYTHONPATH' >> ~/.bashrc`
- `python`
inside python shell
`>>> from naoqi import ALProxy`
`>>> quit()`

If this works, the NaoQi Python bindings are correctly installed. Continue with the ROS packages for the Nao robot.

- `sudo apt-get install ros-indigo-nao-robot`
- `sudo apt-get install ros-indigo-nao-bringup`
- `sudo apt-get install ros-indigo-naoqi-bridge`
- `sudo apt-get install ros-indigo-naoqi-extras`

[FutureOfRescue/day5.php](#)

Conclusion

In this workshop:

- we have a simulated arena from two virtual rescue competitions
- we have used two protocols
- we have have experimented with multiple robot settings
- we have seen that the ros-code could be directly applied to real robots



- **Robots, Games, and Research: Success stories in USARSim**
A [full day workshop](#) held at IROS 2009
Steve Balakirsky, Stefano Carpin and Mike Lewis
- **USARSim/MOAST: Highly Realistic Simulation and Control for Multi Robot**
A [full day workshop](#) held at ICRA 2006
Stefano Carpin, Mike Lewis, Adam Jacoff, and Stephen Balakirsky
- **Urban search and rescue: from Robocup to real world applications**
A [full day workshop](#) held at IROS 2004
Stefano Carpin, Andreas Birk, Daniele Nardi, Adam Jacoff and Satoshi Tadokoro