RACE – Simulation and Grasping

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Technical Aspects of Multimodal Systems

February 29, 2012

Outline

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Prerequisites

See the RACE wiki

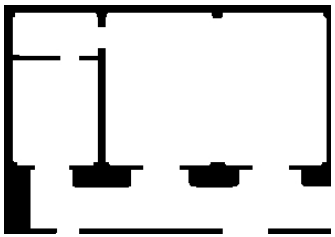
http://race.informatik.uni-hamburg.de/wordpress/wiki/index.php/Main_Page

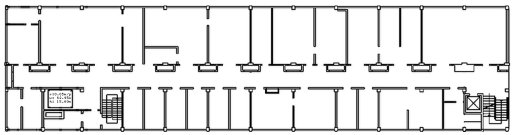
- Ubuntu (32bit), 10.10 (Maverick) or 11.10 (Oneiric)[1]
- ROS (Electric)[2]
- PR2 Electric PR2 Simulation Package[3]
- further questions: please ask

[1] http://www.ubuntu.com/download
[2] http://www.ros.org/wiki/electric/Installation/Ubuntu
[3] http://www.ros.org/wiki/Robots/PR2/electric

Outline

Simulator 3D Restaurant





Pro

to support seamless transition between virtual and real world (the rooms and tables setup matches the UHAM/TAMS floor)

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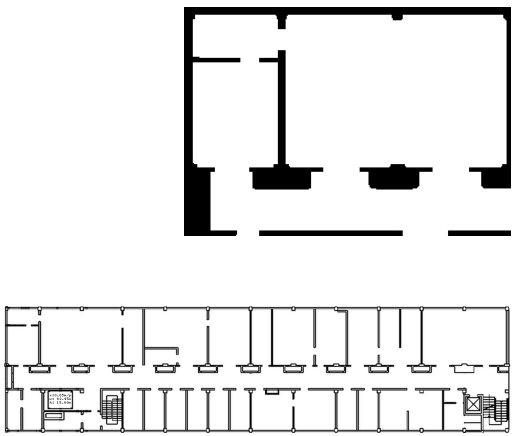

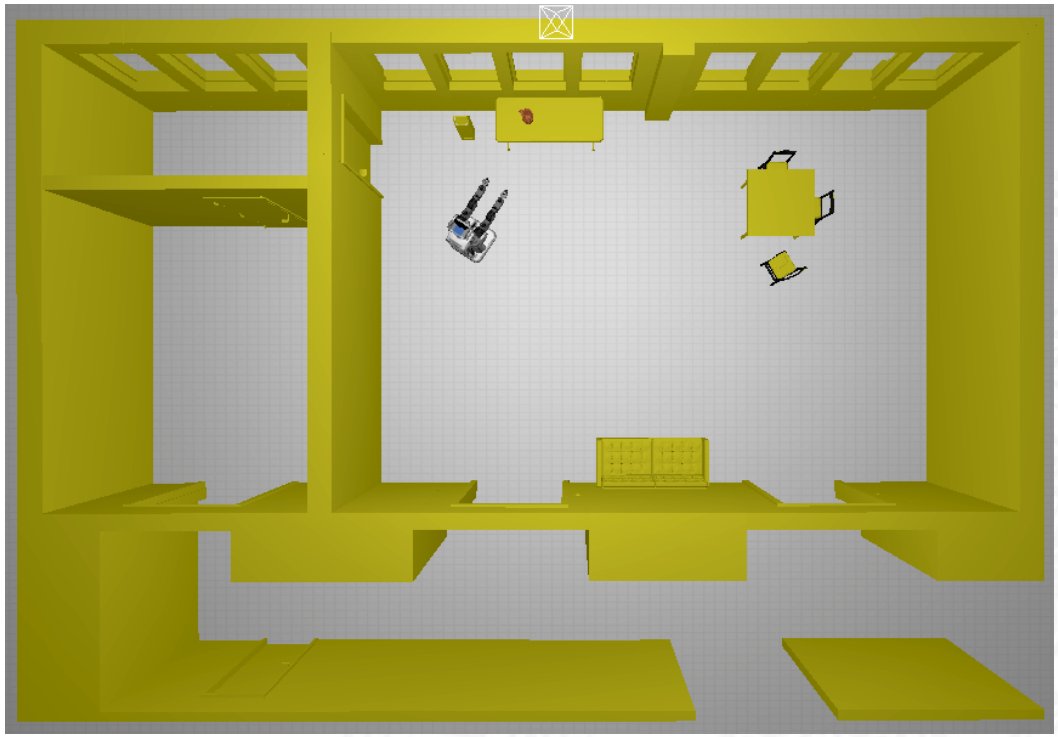

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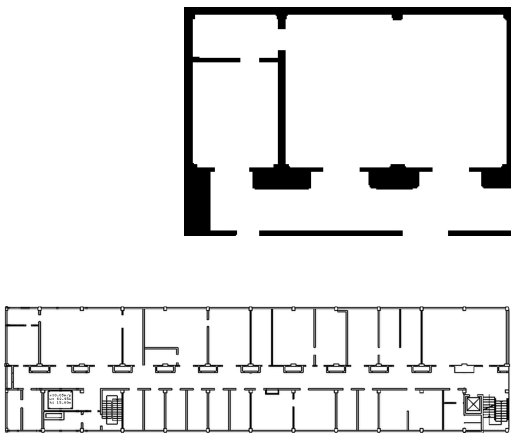

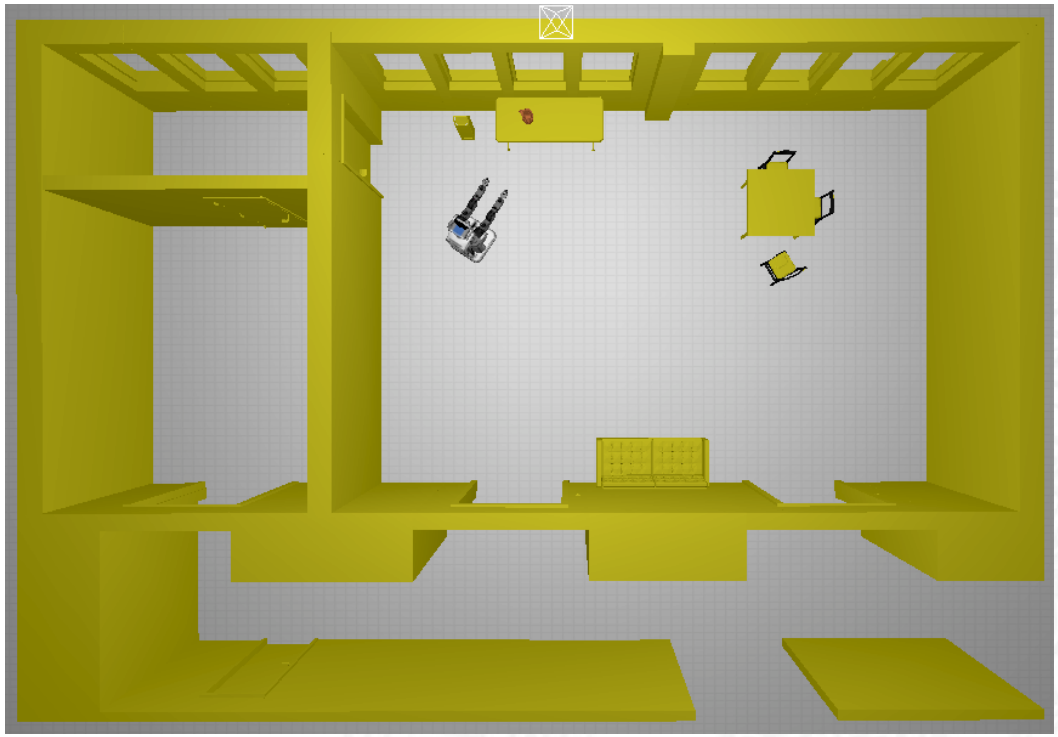

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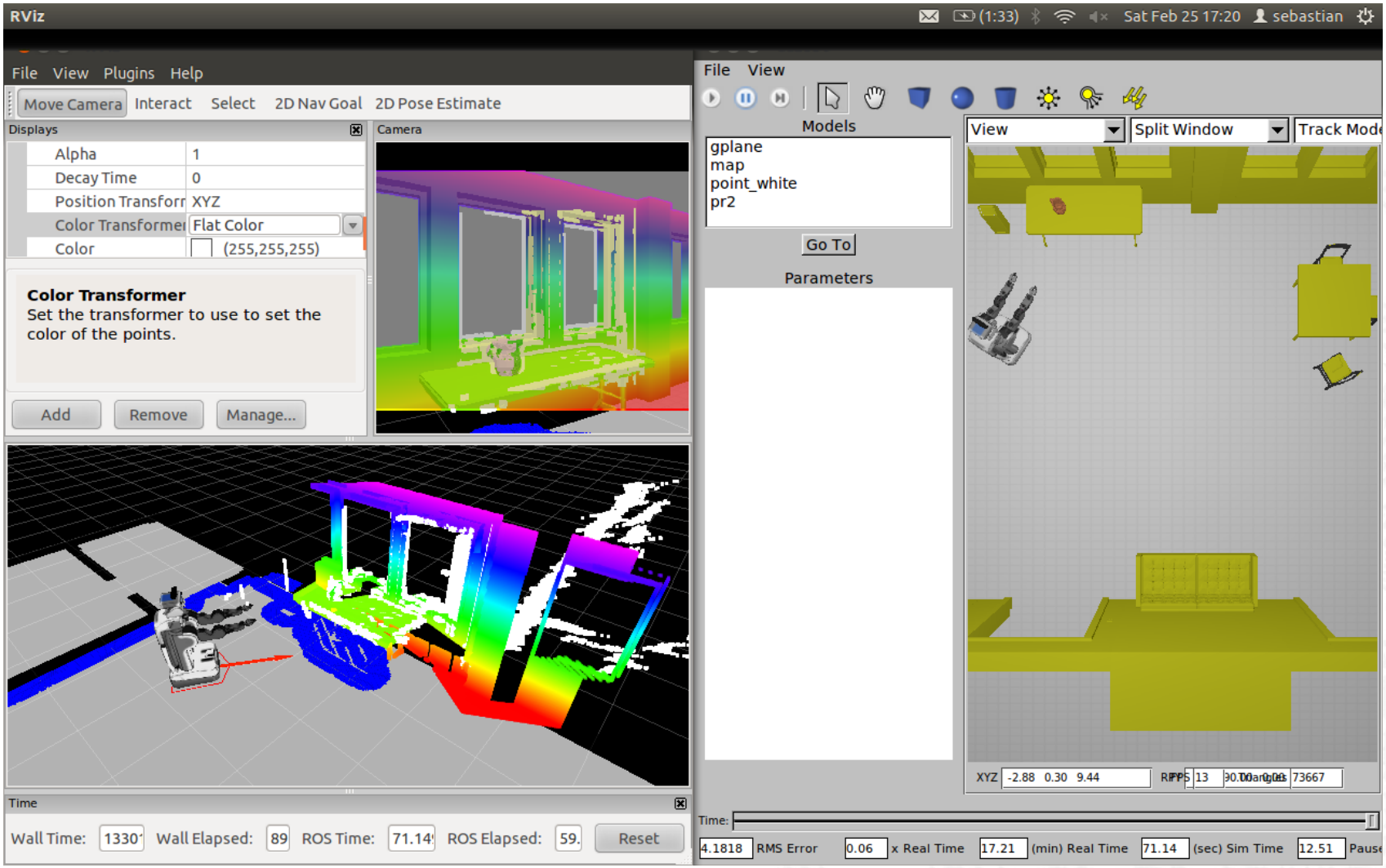
Sensor Model



Simulated Objects

- static
  - walls, tables, chairs
- dynamic
  - chairs, dishes, humans (simulated humans/PR2s)
  - physical properties (weight, center of mass, friction)

Outline

Grasping Constraints

PR2

- grasping is constrained by
  - sensor resolution and noise (better sensors, Kinect?, basically fixed)
  - physical Manipulator dimensions and moving accuracy (fixed within Project)

Outline

Difficult Objects

- thin objects, e.g. spoon, knife, fork
  - to be at least 3 cm above table top
  - to be at least 1.7 cm wide (horizontal diameter)

- fragile objects, e.g. thin glass
  - grasp force leads partially to breaking the glass (more sensitive grasp checking in advance?) $\rightarrow$ plastic glasses

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Difficult Objects (cont'd)

- dinner tray (mobile or to carry?)
- cart pushing stack[4]

[4] http://youtu.be/-VsHH4HaA9c

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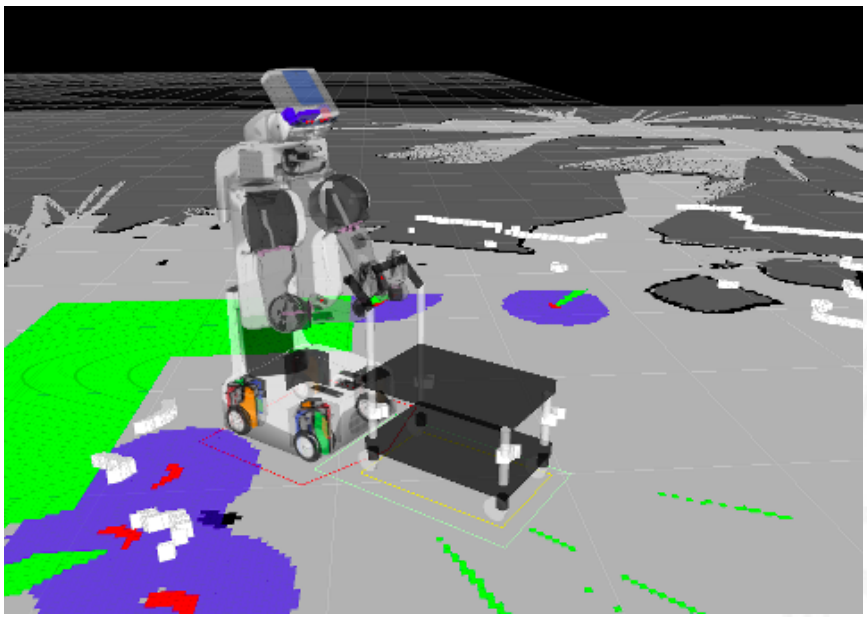

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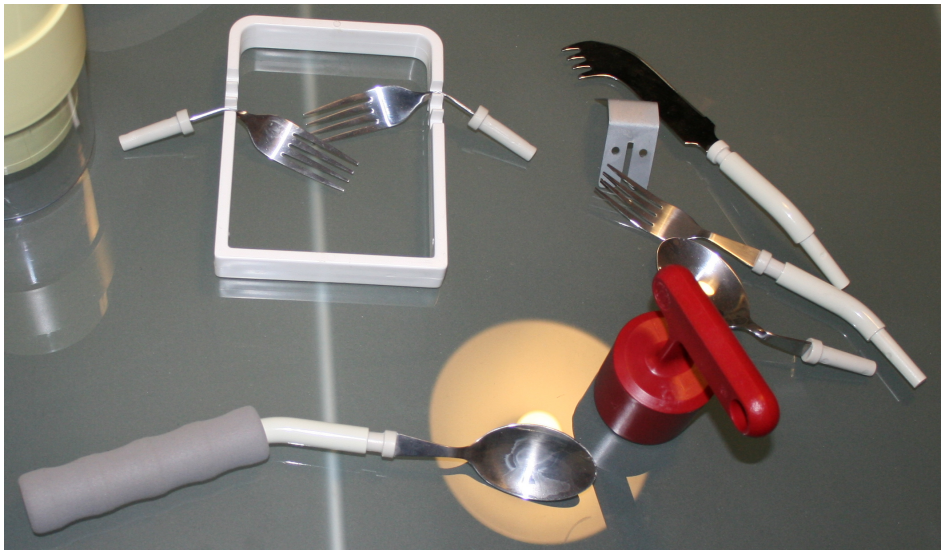
Impossible Objects (currently)

- flat objects, e.g. plate
  - problem: not detectable (colored plates?), not graspable due to no grasp point (higher plates, support block underneath?)

Impossible Objects (cont'd)

- wide objects (wider than gripper max), e.g. bowl
  - robot must not grasp from above due to hygiene reasons (detect and grasp bail)

Examples



DomoCasa Lab, Peccioli, Italy, Feb 2012

Outline

Issues

- which data to provide? (abstraction, sensors, kind)
- how and to which module (partner) shall it be delivered? (architecture)
- how to make partner communication more efficient (via mail, wiki etc.)?
- how to organize/create ROS Stack for simulator (3D restaurant)?
- organization of the restaurant environment? (objects, multiple rooms?, multiple guests? etc.)
- human robot interaction (touch interface $\rightarrow$ touchpad)

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Thank You!

Any questions?

WP5 Plan

WP/Task		Leader	1	2	3	4	5	6	7	8	9	10	11	12
WP5	Comparative evaluation of competence-enhanced robots	UHAM										M1		M2
T5.1	Robot control software architecture for evaluation	UHAM									D			
T5.2	Simulation infrastructure	UHAM									D			
T5.3	Sensor data acquisition	UHAM									D			
T5.4	Demonstrators	UHAM											D	
T5.5	Benchmarking and evaluation	ORU									D			D

Milestone number	Milestone name	Work package(s) involved	Expected date	Means of verification
MS1	Simulator	WP5	M10	Basic simulation infrastructure generates robot motion and sensing information as a basis for simulated experiences
MS2	Year-1 Demonstrator	WP1-WP5	M12	Successful demonstration of robot platform executing simple activities and recording experiences in basic infrastructure

- D5.1 Robot control software architecture and interfaces. (M9)
- D5.2.1 Basic simulator with simple static environment that enables Year-1 demonstration. (M9)
- D5.4.1 Year-1 demonstrator. (M11)
- D5.5.1 Suite of scenarios, benchmark and evaluation metrics. (M9)
- D5.5.2 Experiment data Year-1 demonstrator. (M12)

ROS Workshop Topics

- understand stack and learn how to modify (e.g. tabletop)
- debugging + error detection + tracing
- installation of other stacks on PR2
- how to create own stack?
- how are singularities handled?
- combination (chaining of stacks?
- compiling/tool chain, how to use/how does it work?
- optimization of rosbag

Further Reading