

BLG456E

Robotics

Project Ideas

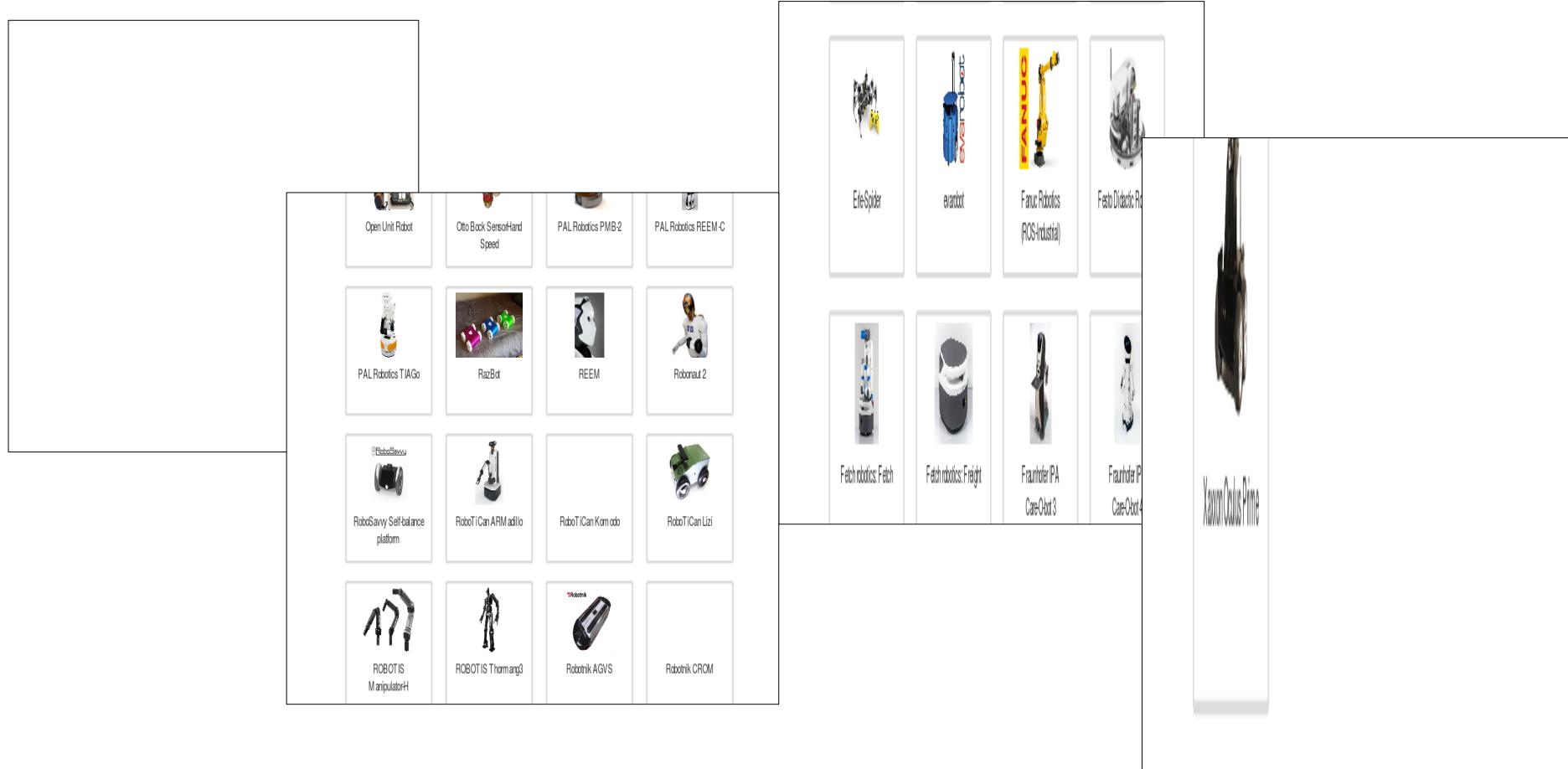
Presentation Contents:

- Platforms
 - Simulation
 - Real-world
 - Hardware
- Project ideas
- Previous years' projects

Lecturer:	Damien Jade Duff
Email:	djduff@itu.edu.tr
Office:	EEBF 2316
Office Hour:	1.30pm-5pm
Schedule:	http://djduff.net/my-schedule
Assistant:	Çağatay Koç
Course web:	Ninova
Slides:	Damien Duff & Sanem Sarıel-Talay

Full ROS robot list

<http://wiki.ros.org/Robots>



Sample project platforms: ROS + Gazebo

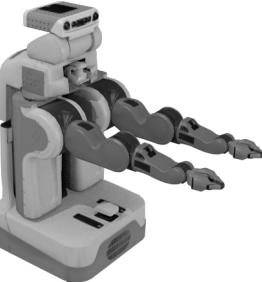


- **Turtlebot.**
 - Differential drive mobile robot
 - RGBD and bump sensors.
 - Exploration, motion planning, navigation, mapping.
- **Youbot.**
 - Holonomic mobile base with 5-DOF arm.
 - Mobile manipulation, holonomic motion.
- **Katana 450.**
 - 6-DOF fixed base robot arm.
 - Manipulation and interaction-learning.
- **Nao.**
 - Humanoid robot.
 - Walking, human-robot interaction.

Suggested project platforms: ROS + Gazebo



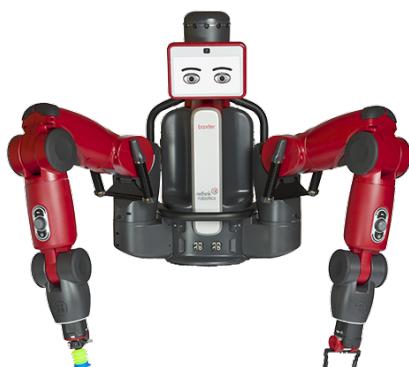
- **Husky AUV.**
 - Rough-terrain car.
 - Navigation, planning and exploration, platform constraints, different terrains.
- **Hector Quadrotor**
 - A robot that flies!
 - 3D navigation, control, planning, exploration.
- **PR2.**
 - A two-armed robot, many sensors.
 - Everything in one.
- **Shadow Robot.**
 - Human-like arm & hand.
 - Grasping, object learning, manipulation.



Suggested project platforms: ROS + Gazebo



- **Pioneer 3AT.**
 - Skid-steer mobile robot.
 - Used in our lab (gazebo simulator available on request).
- **Pioneer 3DX.**
 - Differential-drive mobile robot.
 - Used in our lab (gazebo simulator available on request).
- **Universal Robotics UR5.**
 - A modern “soft” robot arm.
 - Good for arm stuff.
- **Baxter.**
 - Soft-robot collaborative.
 - Used in our lab.



Suggested project platforms: Real-world



Kinect/ASUS Xtion sensor.

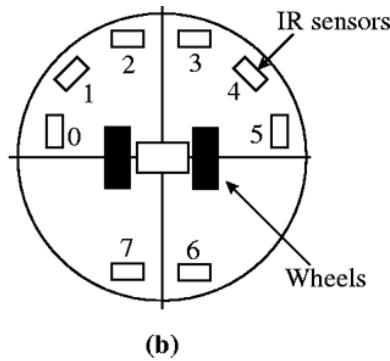
- An RGBD (RGB+depth) sensor.
- Mapping, object recognition, object reconstruction, object tracking, localisation, SLAM.

- **Must be used in Lab.**
- **Request to use.**
(first-in first-serve)

Suggested project platforms: Real-world



(a)



- Khepera II.
 - Small.
 - Differential-drive
 - Range sensors.
 - Webots simulation.
 - Learning, multi-robot.

- **Must be used in Lab.**
- **Request to use.**
(first-in first-serve)

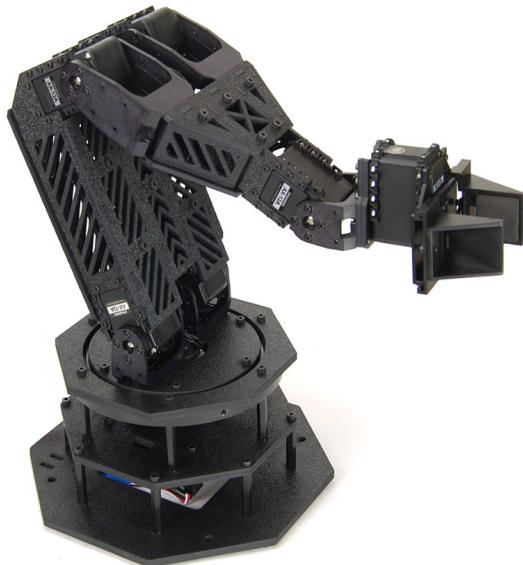
Suggested project platforms: Real-world



- **TeleMe 2.**
 - “Telepresence” robot.
 - Tablet PC controller.
 - Make autonomous.
 - We have built a ROS interface & Gazebo simulation.
 - Human-robot interaction.

- **Must be used in Lab.**
- **Request to use.
(first-in first-serve)**

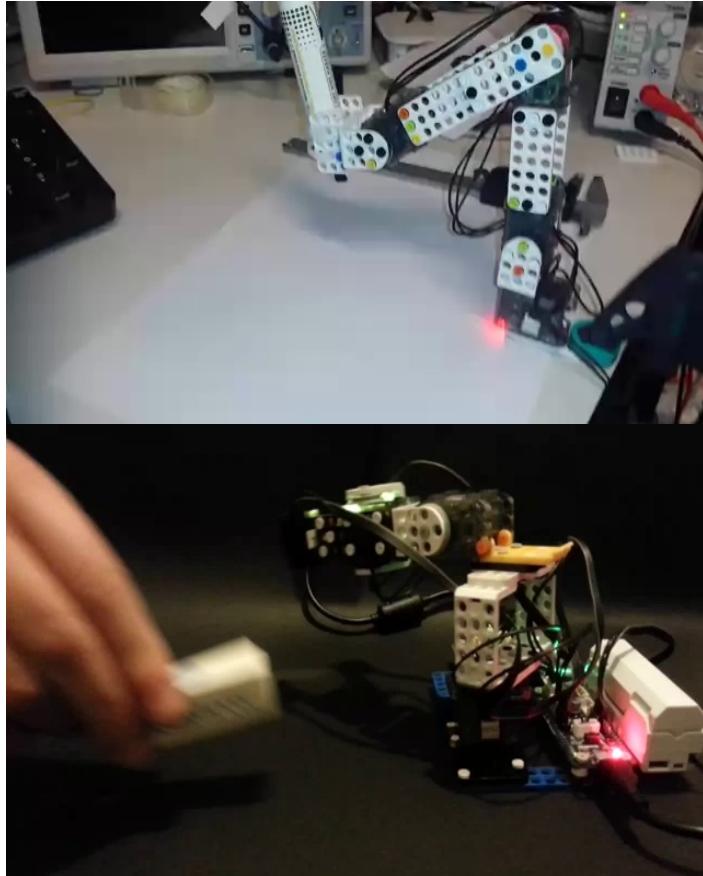
Suggested project platforms: Real-world



- PhantomX Reactor:
 - 5-DOF arm + gripper.
 - Lightweight.
 - Arduino interface.
 - Grasping, manipulation, kinematics.

- **Must be used in Lab.**
- **Request to use.**
(first-in first-serve)

Suggested project platforms: Real-world

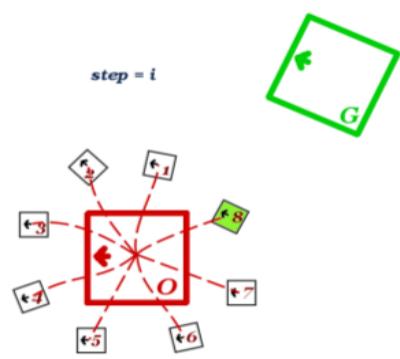


- CM9.04-based arm:
 - Simple arm.
 - Lightweight.
 - Microcontroller.
 - Grasping, manipulation, kinematics.

- **Must be used in Lab.**
- **Request to use.**
(first-in first-serve)

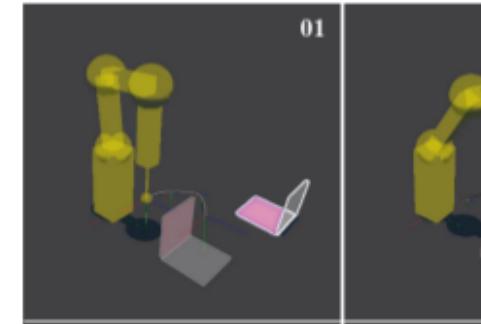
Suggested project platforms: Real-world

- Buy your own?
- Cheap platforms available.
- Electronics knowledge necessary.
- Can be expensive, depending on aim.



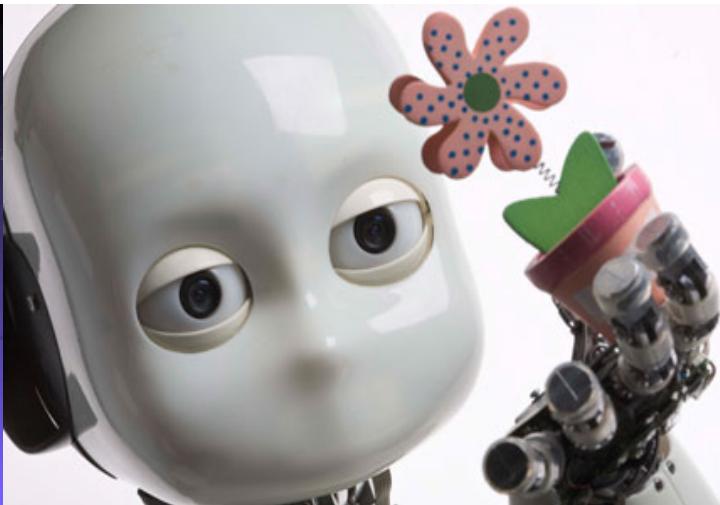
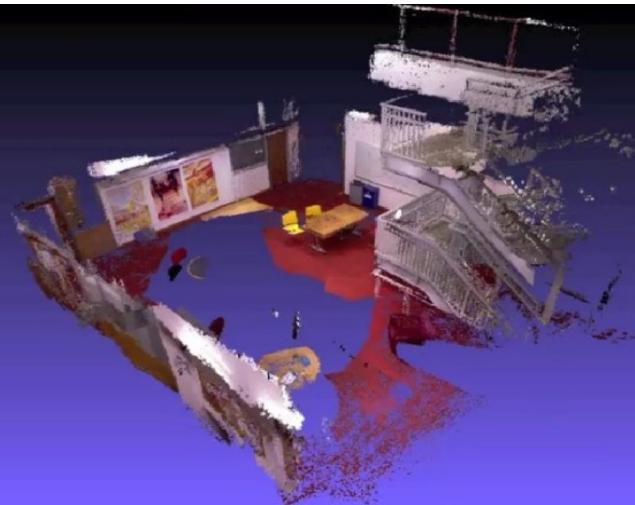
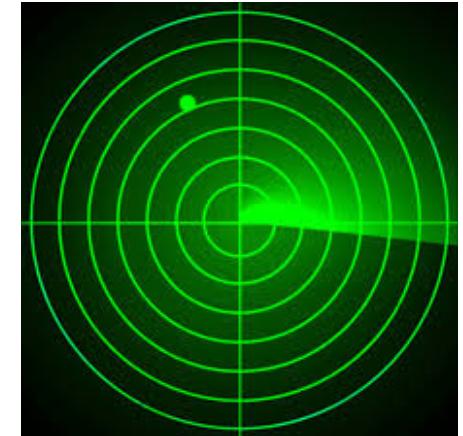
Project ideas I

- Robot learning how to move an object.
- Create a ROS model of a robot.
- Path planning speed maze.
- Robot arm reaching in clutter.



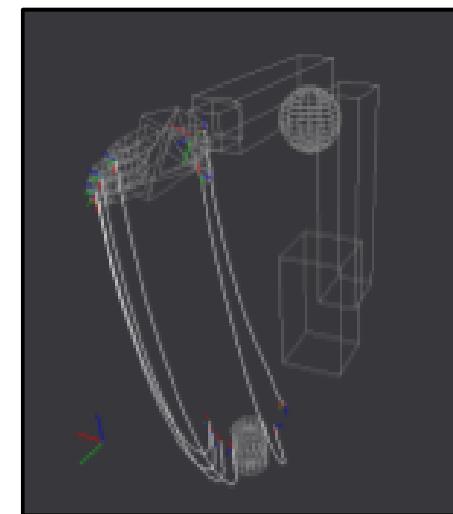
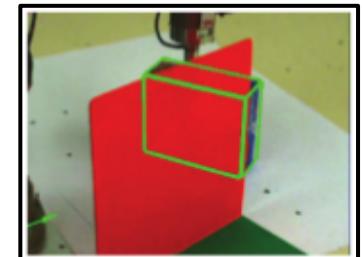
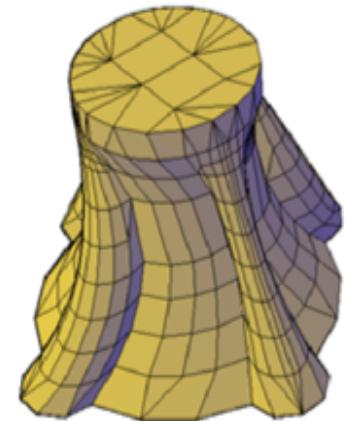
Project ideas II

- Localisation with multiple sensors.
- 3D mapping & planning.
- Robot self-modelling.
- 3D object learning & recognition.



Project ideas III

- Object modelling for robots.
- Planning with uncertainty.
- Task planning & motion planning
(e.g. re-parking).
- Etc.

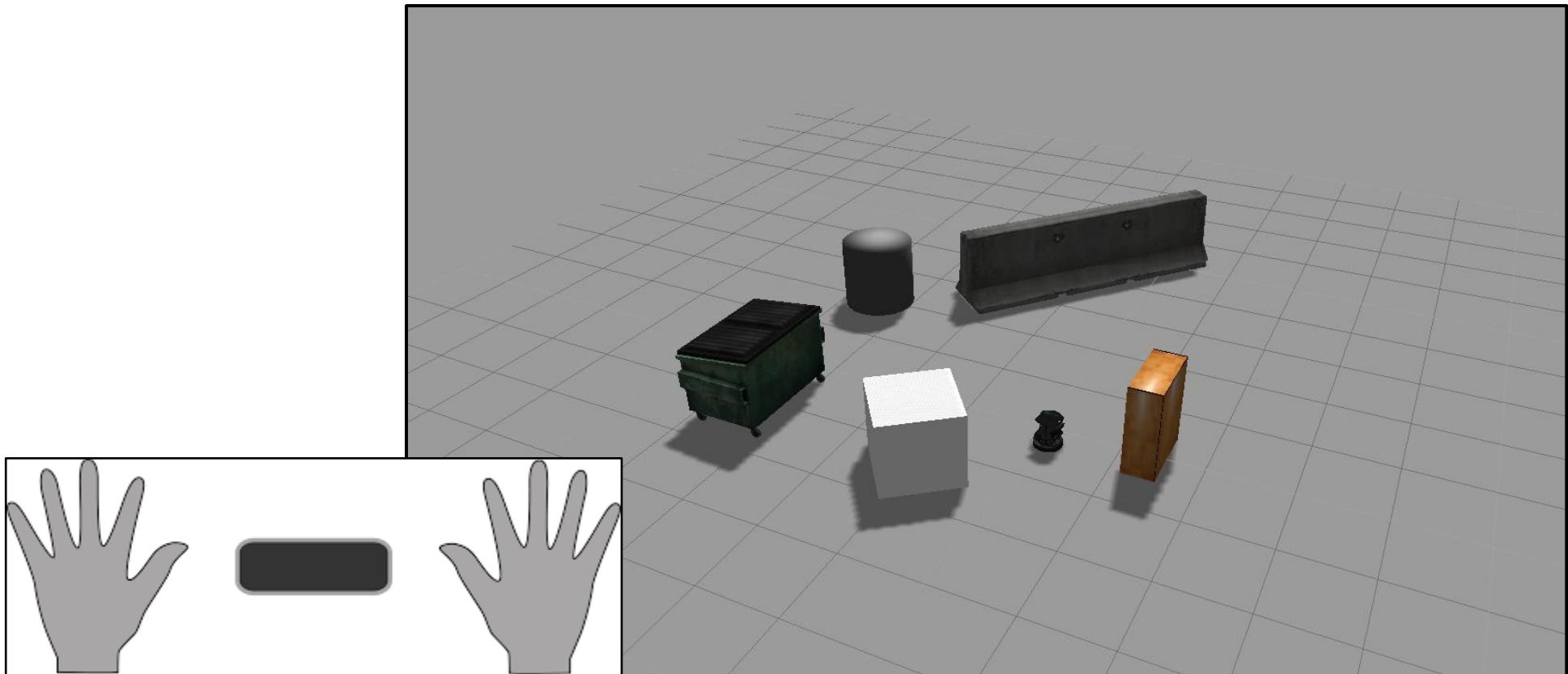


Projects from Previous Years (2016)

- <https://www.youtube.com/watch?v=2hc1fD10F8k>
- <https://www.youtube.com/watch?v=FG66yUn1h1o>
- <https://youtu.be/rJRIqzjis74>
- <https://www.youtube.com/watch?v=lojQ6psmjqw>
- <https://vimeo.com/199051719>
- <https://www.youtube.com/watch?v=fk1cj2Q-91Y>
- https://www.youtube.com/watch?v=82kSLFm4_S4

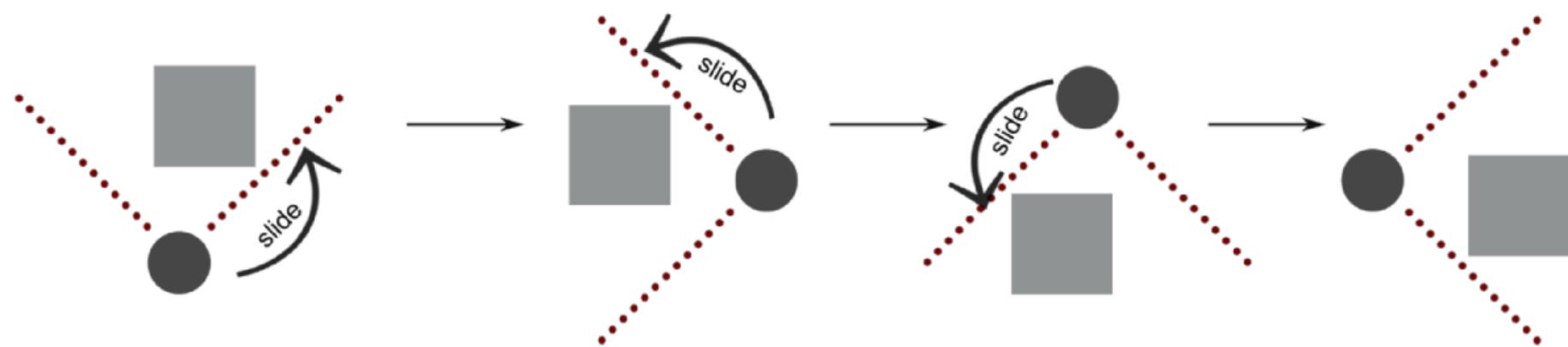
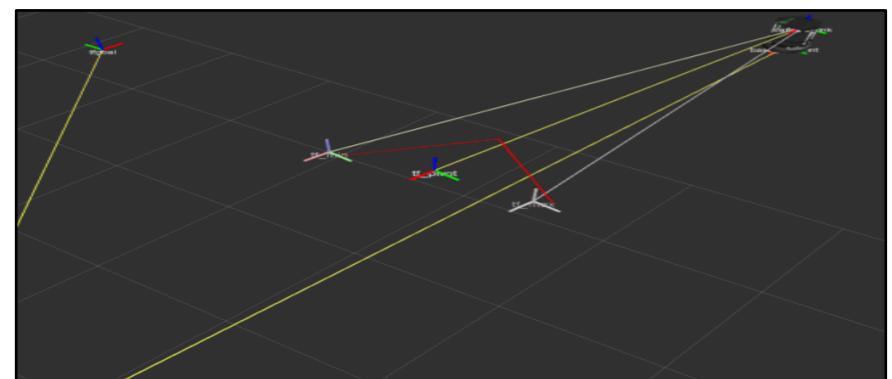
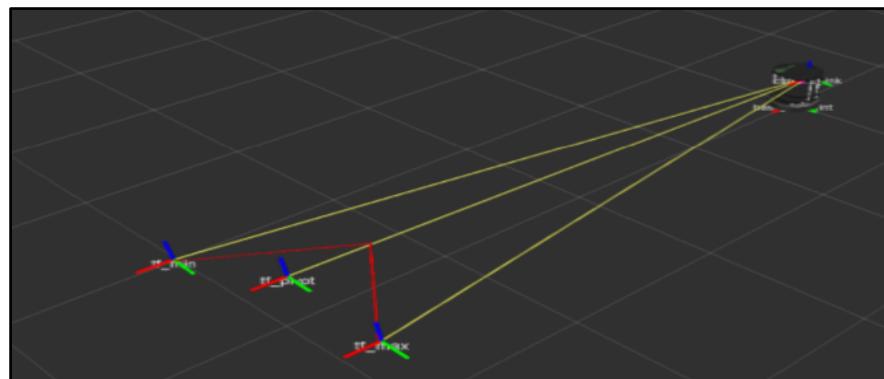
Projects from previous years

- Gesture control: Control a robot using gestures (LeapMotion).



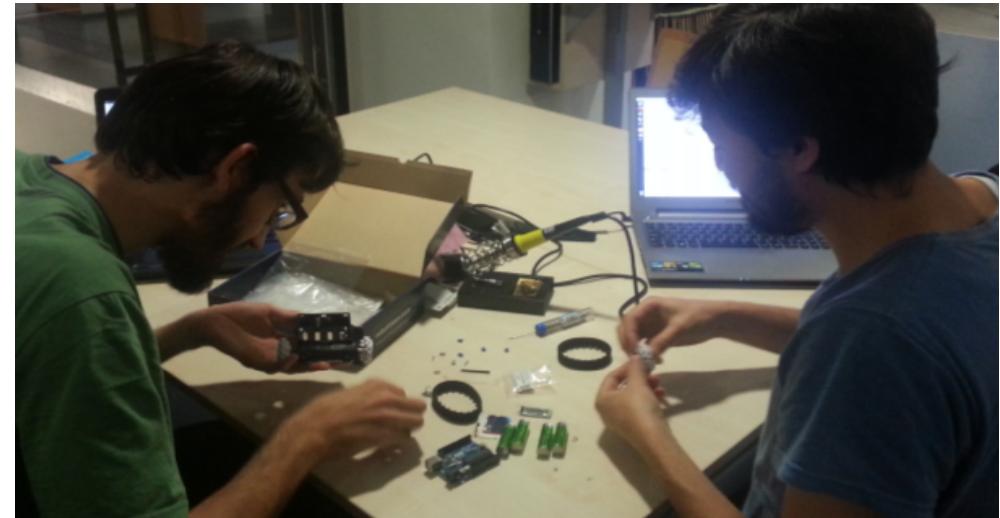
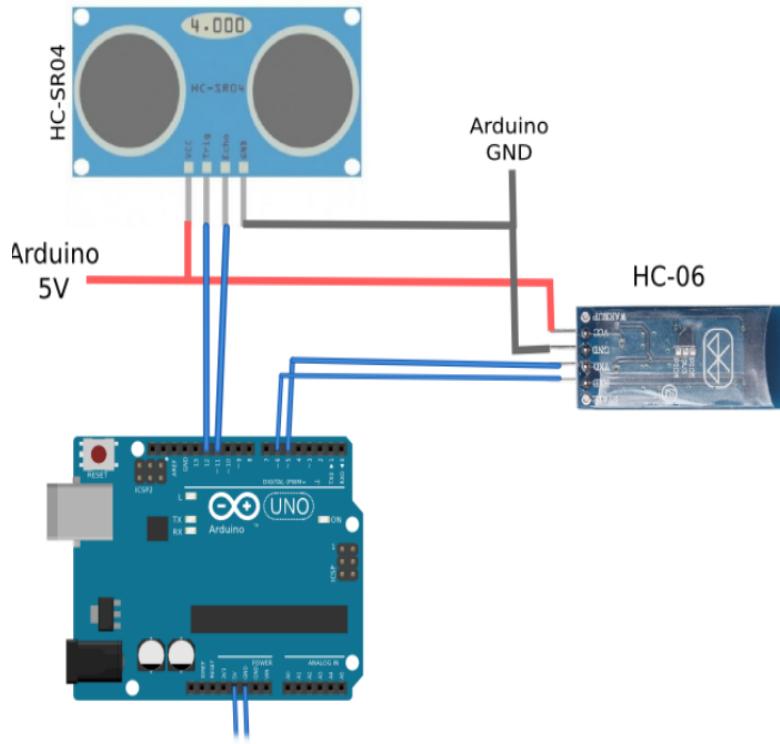
Projects from previous years

- Active perception: Driving a robot around an object to determine its properties.



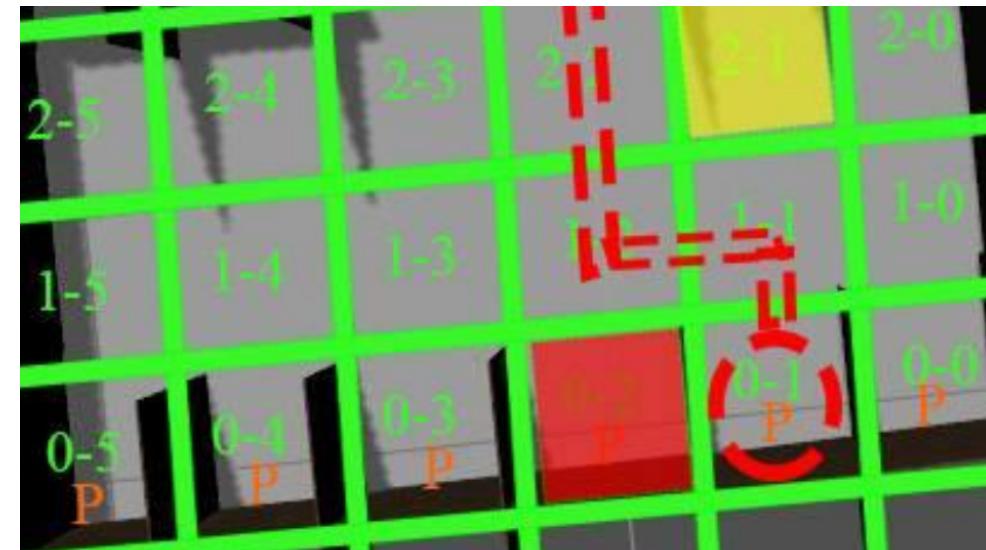
Projects from previous years

- Arduino robot: Android control of semi-autonomous arduino robot with range sensor.



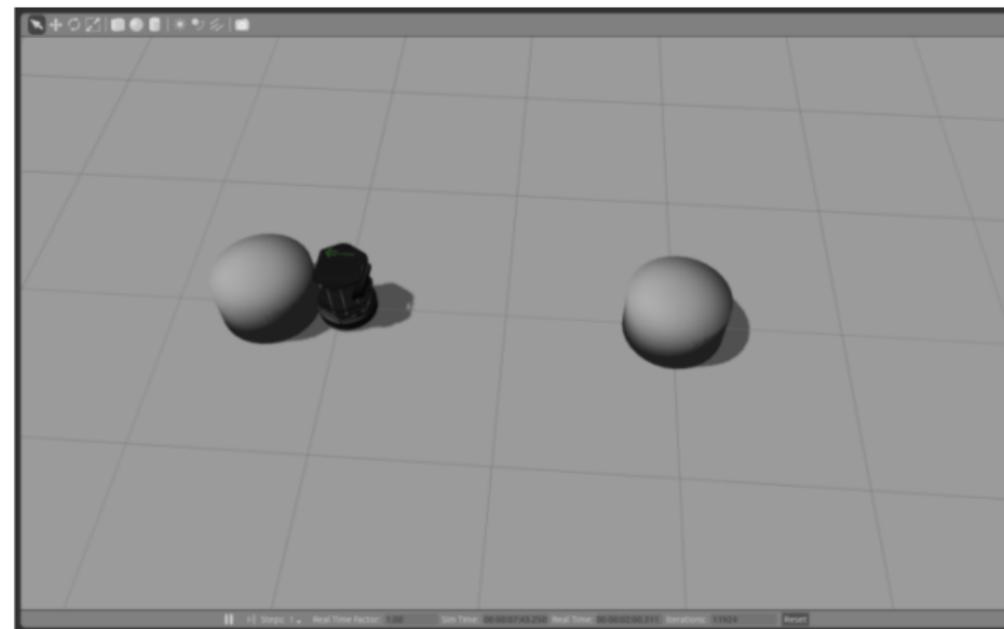
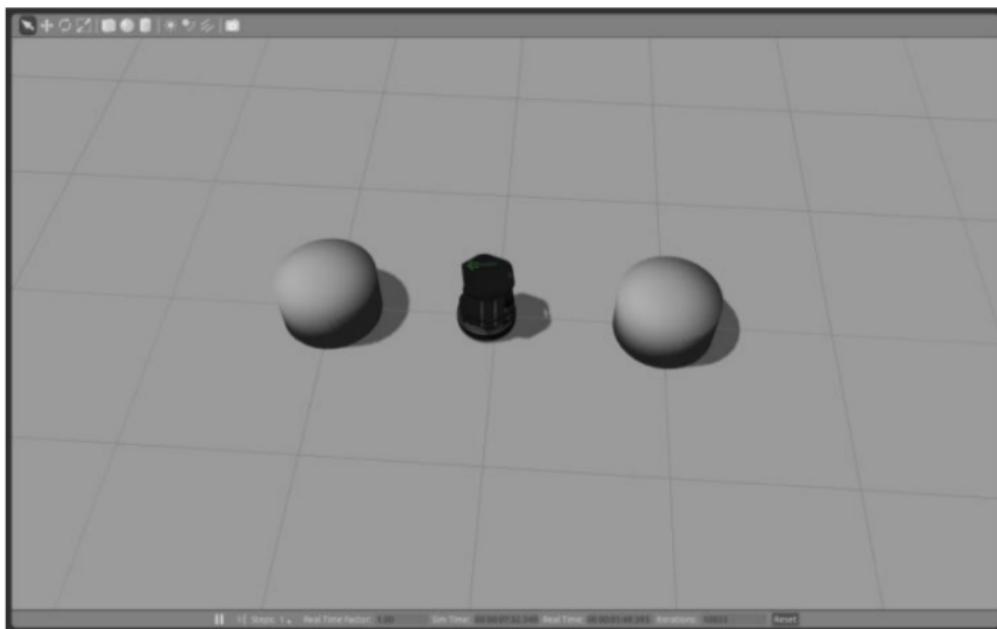
Projects from previous years

- Car parking: Park a car-like robot using gridding or motion planning.



Projects from previous years

- Turtlebot object pushing: Get the turtlebot to push objects reliably.



Projects from previous years

- Maze solving: Use and compare different approaches to solving a maze in Gazebo.



Illustration 9: Basic Wall Follower Map

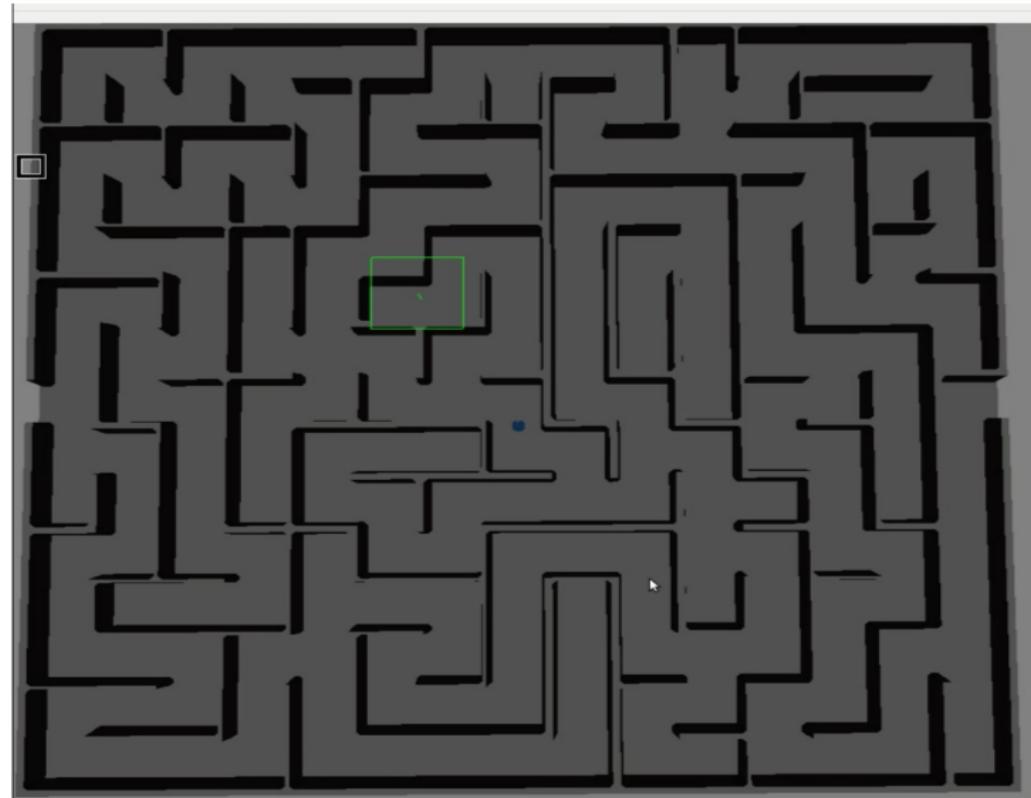


Illustration 10: Complex Wall Follower Map

Projects from previous years

- Exploration & mapping: Mobile robot exploration & mapping in Gazebo and comparison.

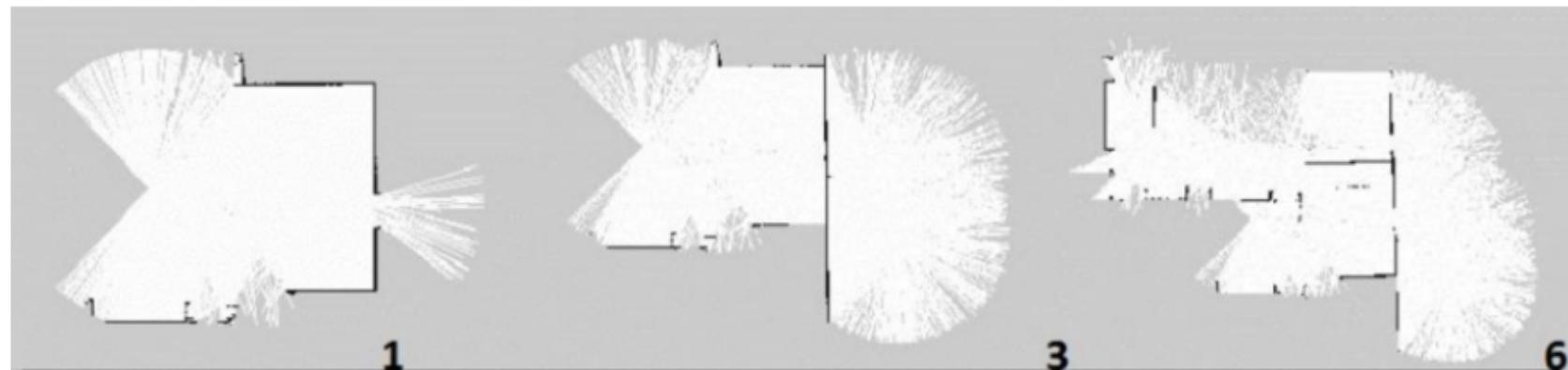
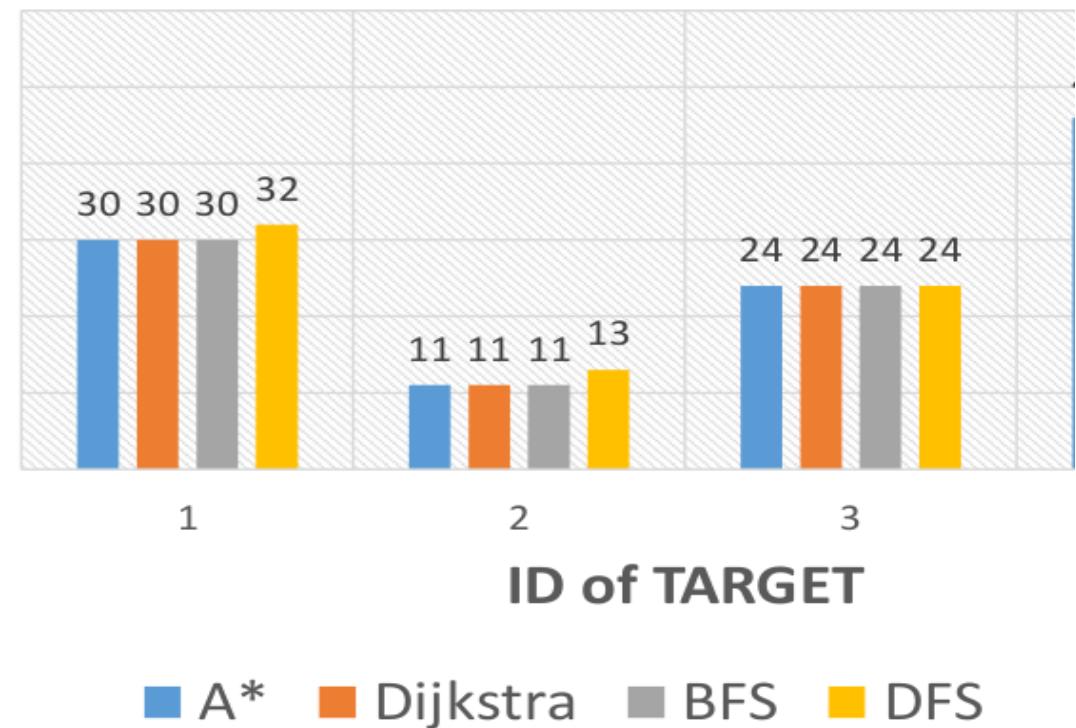
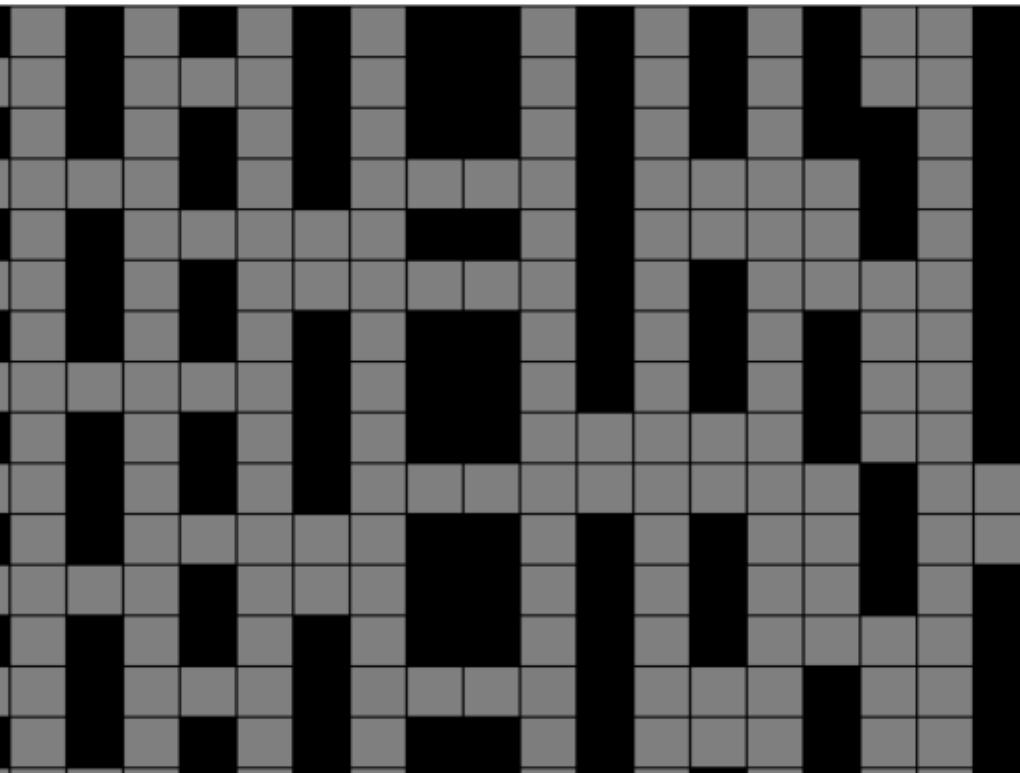


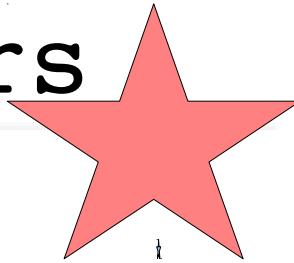
Figure 10 Our Approach - Discovered Areas

Projects from previous years

- Path planning: Quantitative comparison of different approaches to path planning using the Player simulator.



Projects from previous years



- Recycling: In Gazebo, a robot that finds, grasps and transports objects to a target area + an evaluation.

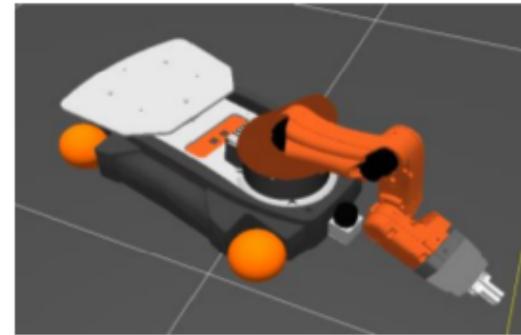


Figure 3-3: Second arm position

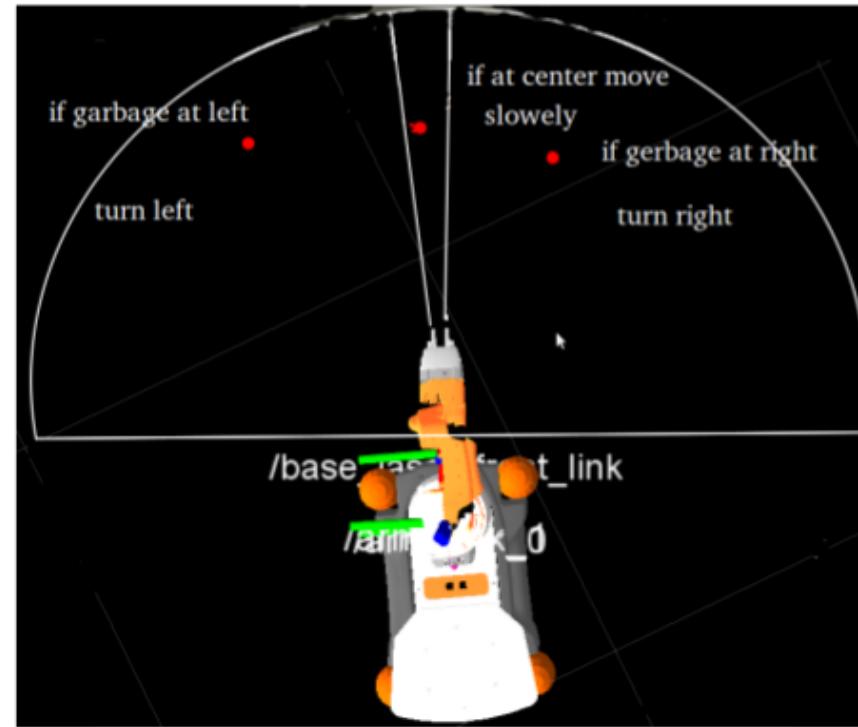


Figure 3-7: Robot adjustment

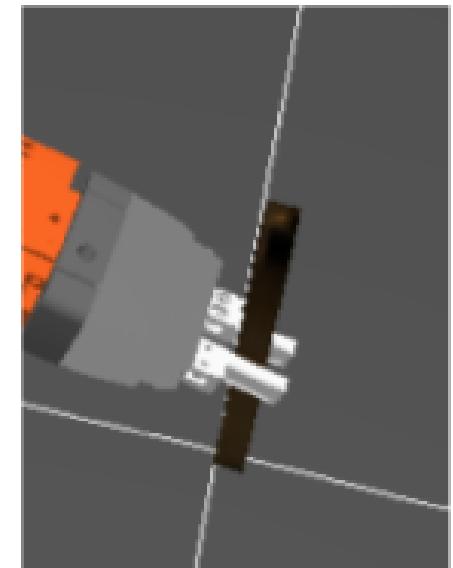
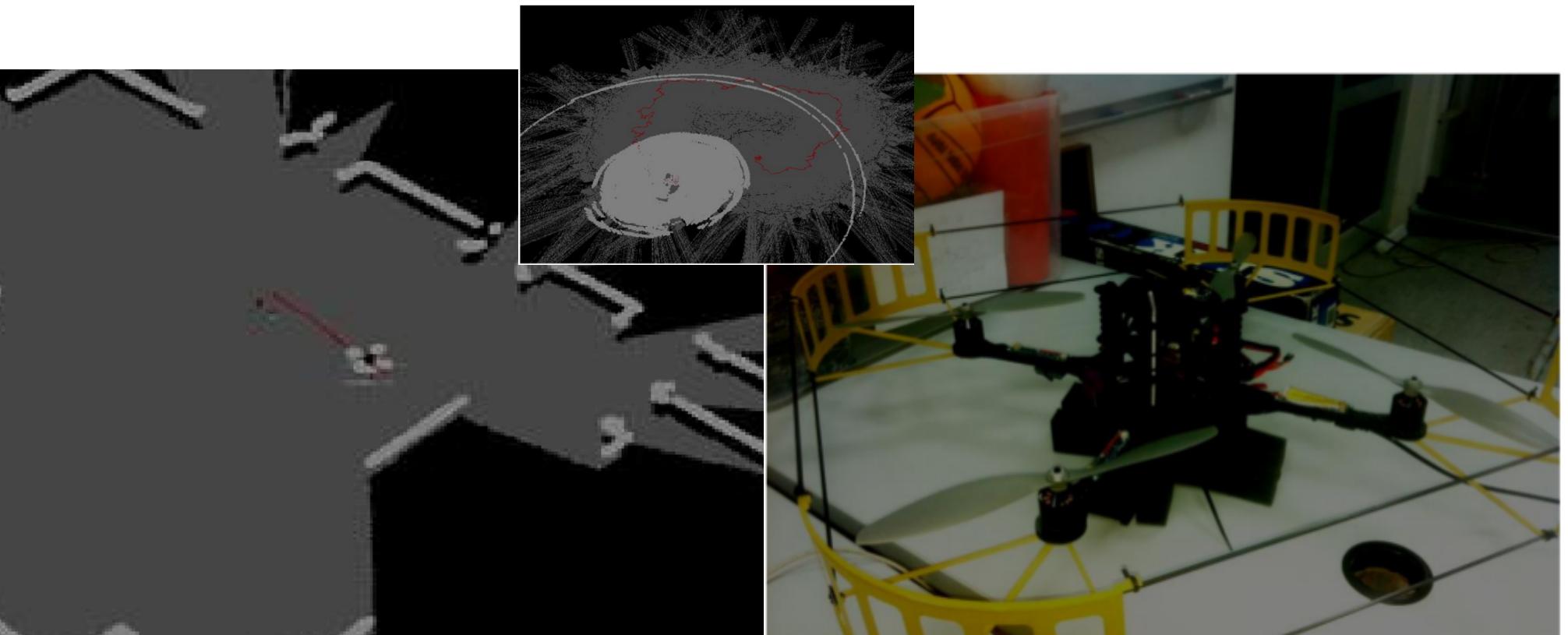


Figure 3-6: Stick as a garbage

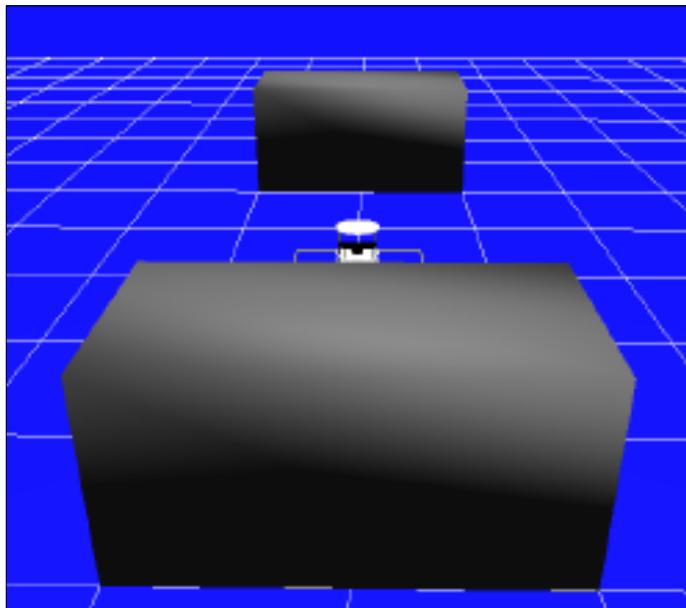
Projects from previous years

- Flying robot: Mapping, control and path-planning of quadcopter.



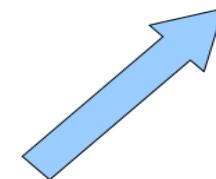
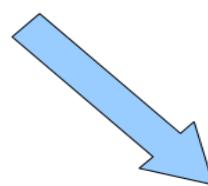
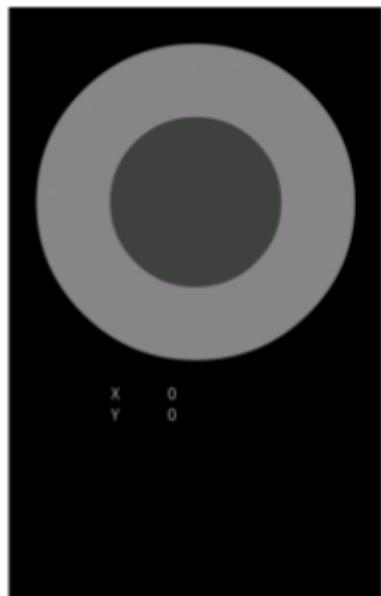
Projects from previous years

- Serving robot: Detecting, greeting and following people with Turtlebot+Kinect in Gazebo, following voice commands from a real microphone while mapping the world.



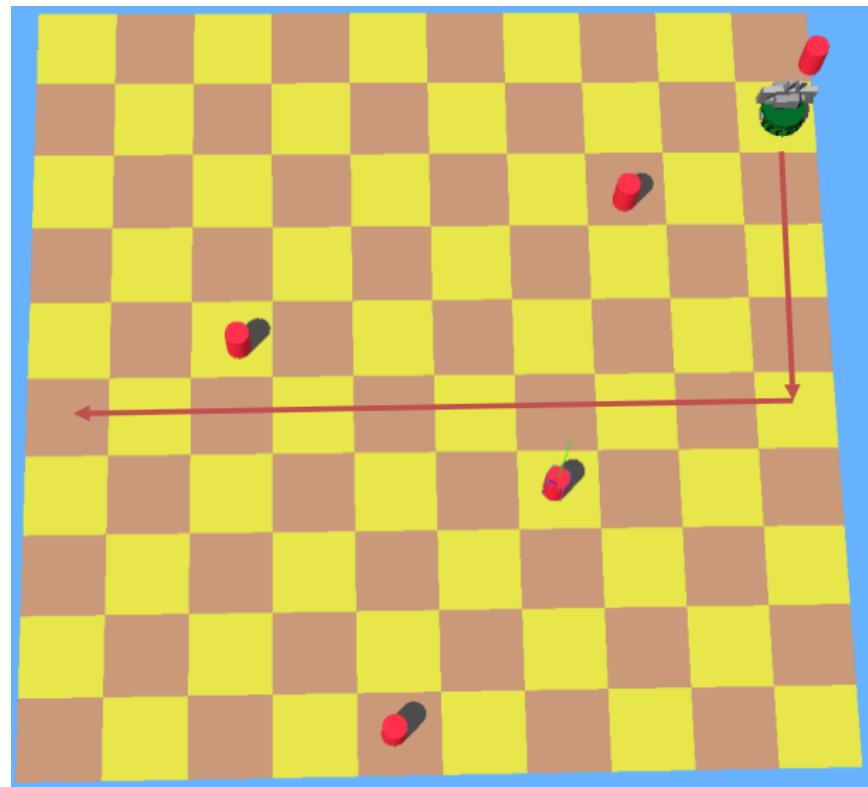
Projects from previous years

- Android Interface: An android interface via ROS with the Pioneer 3DX robot.



Projects from previous years

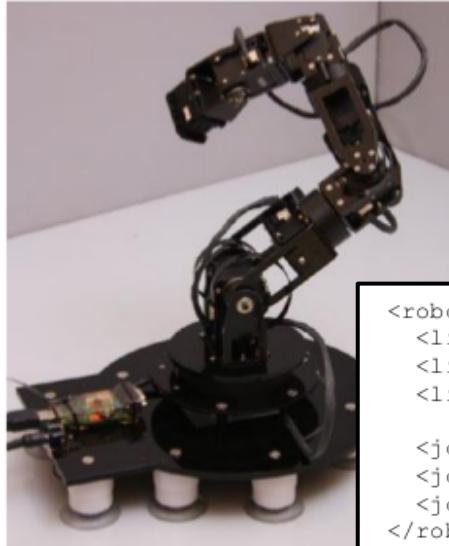
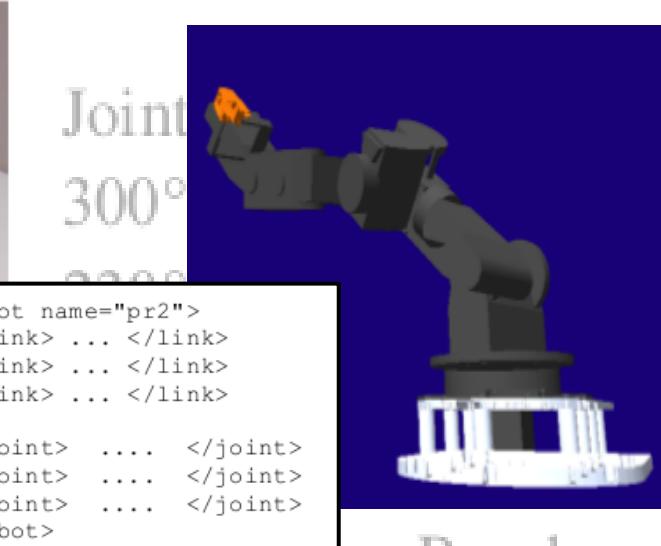
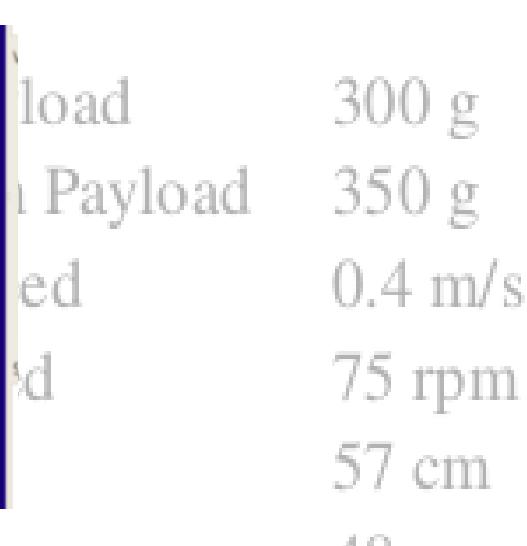
- Task planning: Multiple robots solving a puzzle in simulation.



Projects from previous years

- Model a robot: Use a CAD program to model a robot, then simulate it and move it in ROS.

Joint Name	
Shoulder Roll	
Shoulder Pitch	
Elbow Roll	
Elbow Pitch	
Wrist Roll	
Wrist Pitch	
Wrist Yaw	

		
Joint Name		
Shoulder Roll	Joint 300°	load
Shoulder Pitch		1 Payload
Elbow Roll		speed
Elbow Pitch		75 rpm
Wrist Roll	Spin	57 cm
Wrist Pitch		48 cm
Wrist Yaw	Articulated 210°	+/- 0.3 cm
	Articulated 220°	Hardware Interface USB

Projects from previous years

- Goalie: Make a reactive robot defend a goal in a robot football game (competition entry).



Projects from previous years

- Object transport: Find, grasp and transport objects in simulation with Pioneer 3DX.

