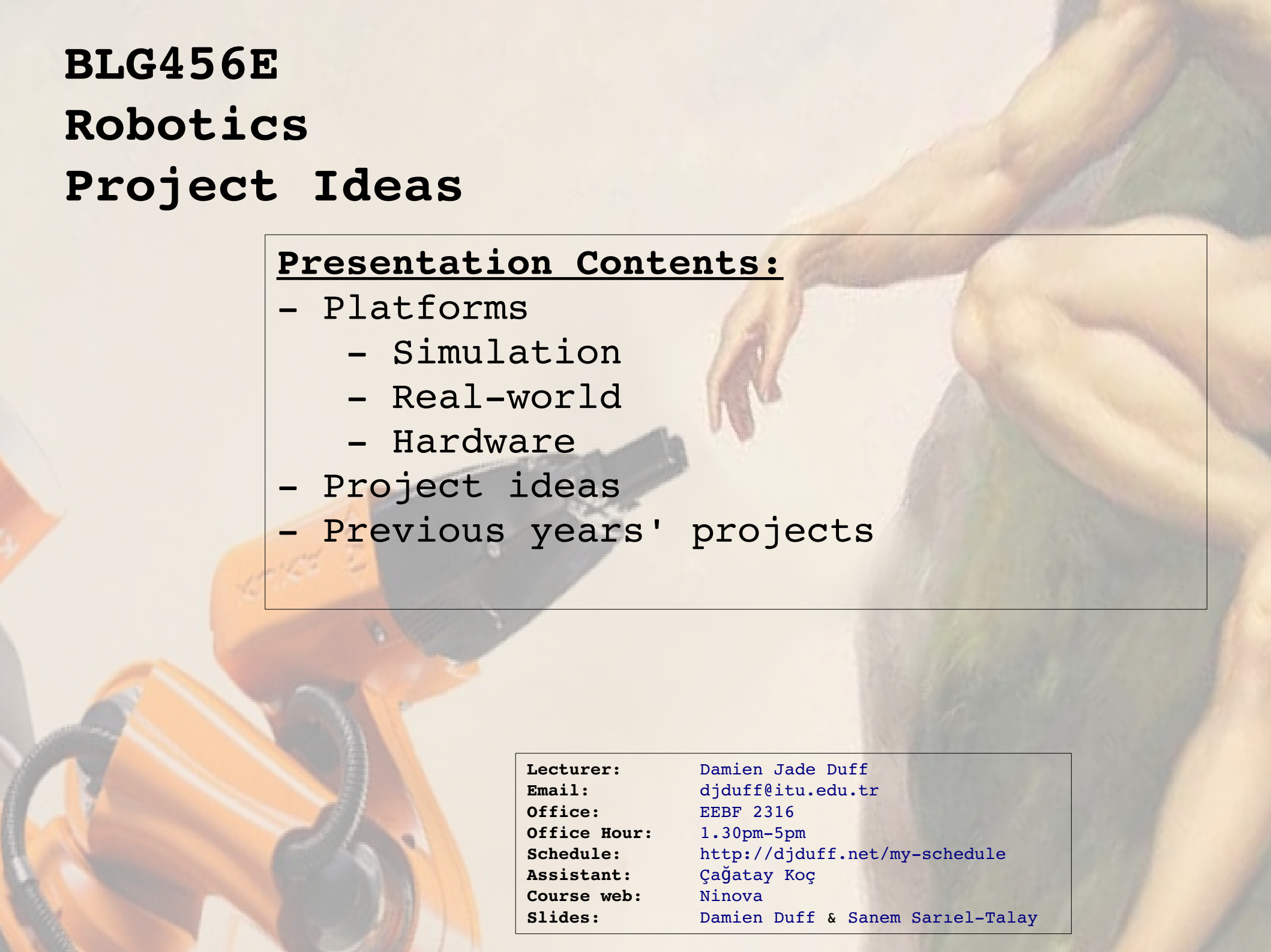
BLG456E
Robotics
Project Ideas

Presentation Contents:

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



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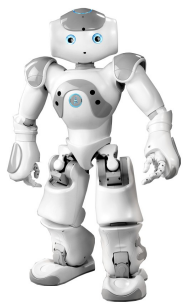
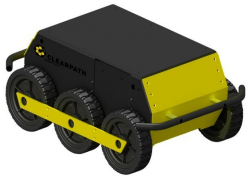
Assistant:	Çağatay Koç
Course web:	Ninova
Slides:	Damien Duff & Sanem Sarıel-Talay

Suggested 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.

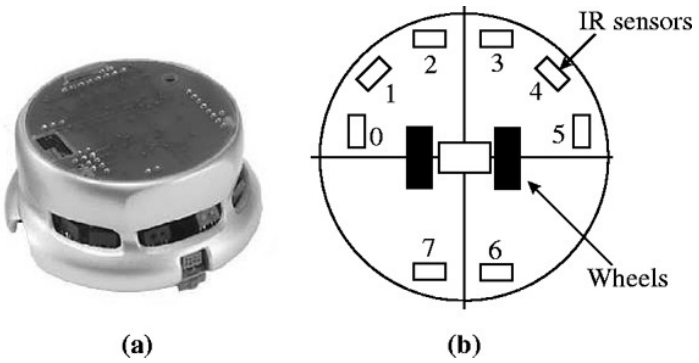
Suggested project platforms: Real-world

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



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

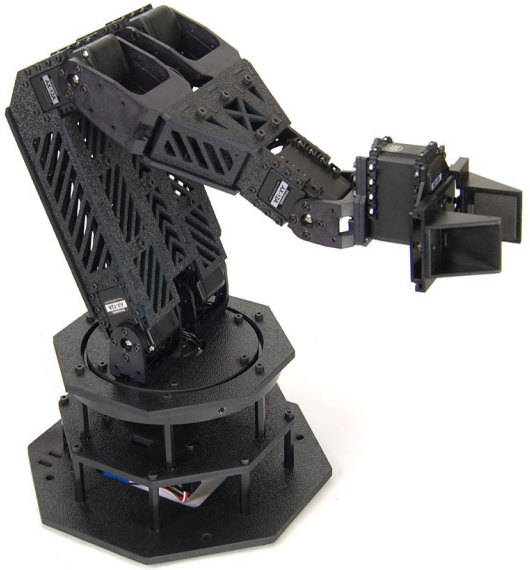
- **Must be used in Lab.**
- **Request to use.**
  (first-in first-serve)

Suggested project platforms: Real-world

- TeleMe 2.
  - “Telepresence” robot.
  - Tablet PC controller.
  - Make autonomous.
  - Make ROS interface.
  - Human-robot interaction.

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

Suggested project platforms: Real-world

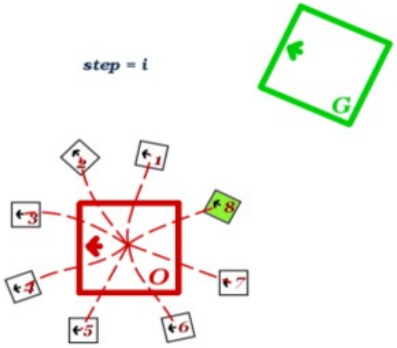


- PhantomX Reactor:
  - 5-DOF arm + gripper.
  - Lightweight.
  - Arduino interface.
  - Grasping, manipulation, kinematics.

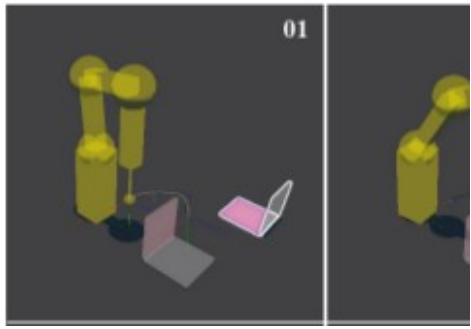
- **Must be used in Lab.**
- **Request to use.**
  (first-in first-serve)

Suggested project platforms: Real-world

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



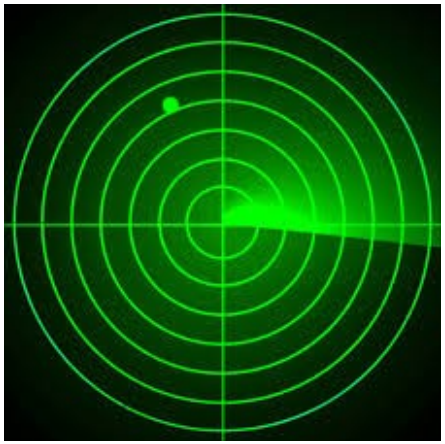
Project ideas I

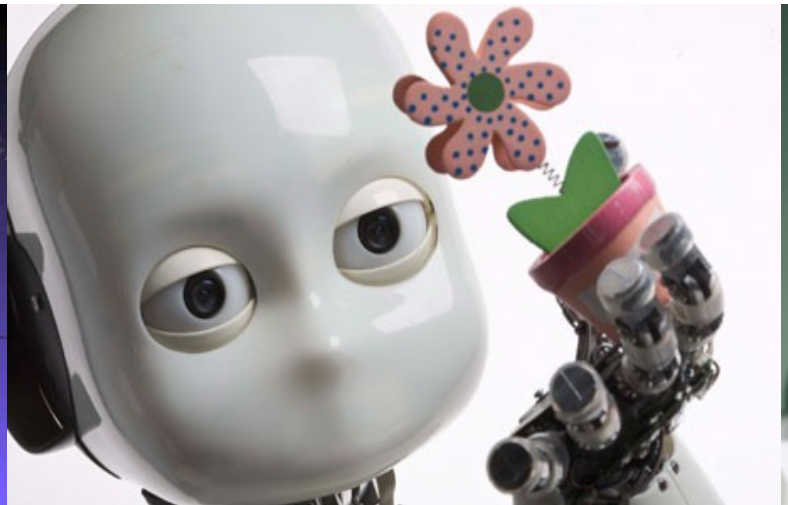


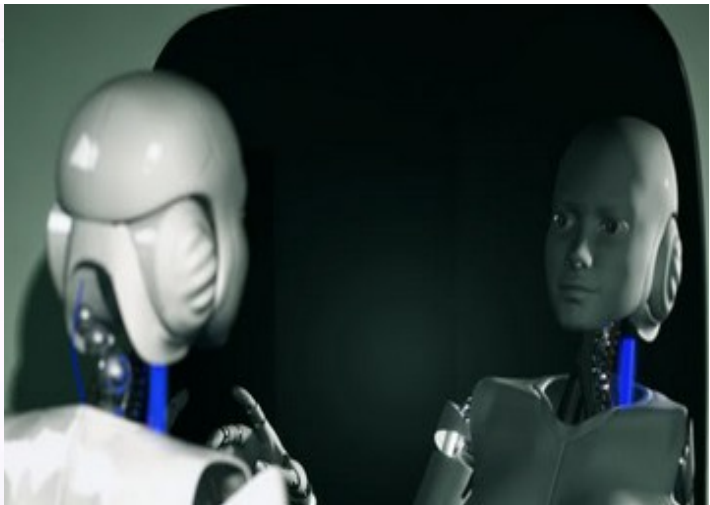
- Robot learning how to move an object.
- Create a ROS model of a robot.
- Path planning speed maze.
- Robot arm reaching in clutter.

Project ideas II

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

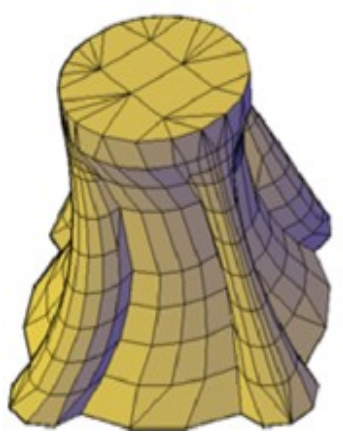




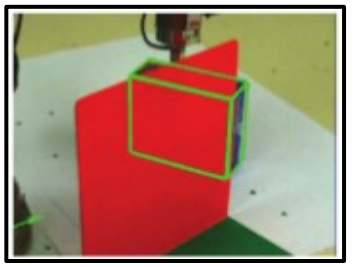


Project ideas III

- Object modelling for robots.

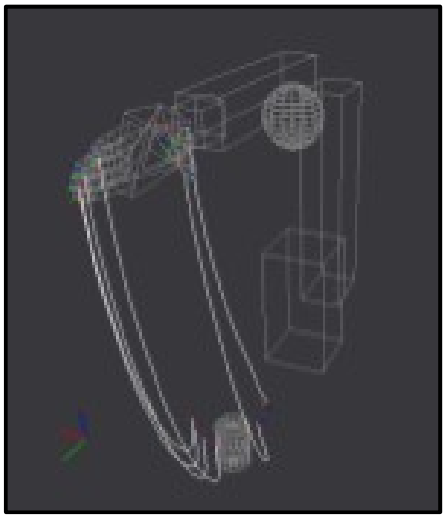


- Planning with uncertainty.



- Task planning & motion planning

  (e.g. re-parking).



- Etc.

Projects from previous years

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

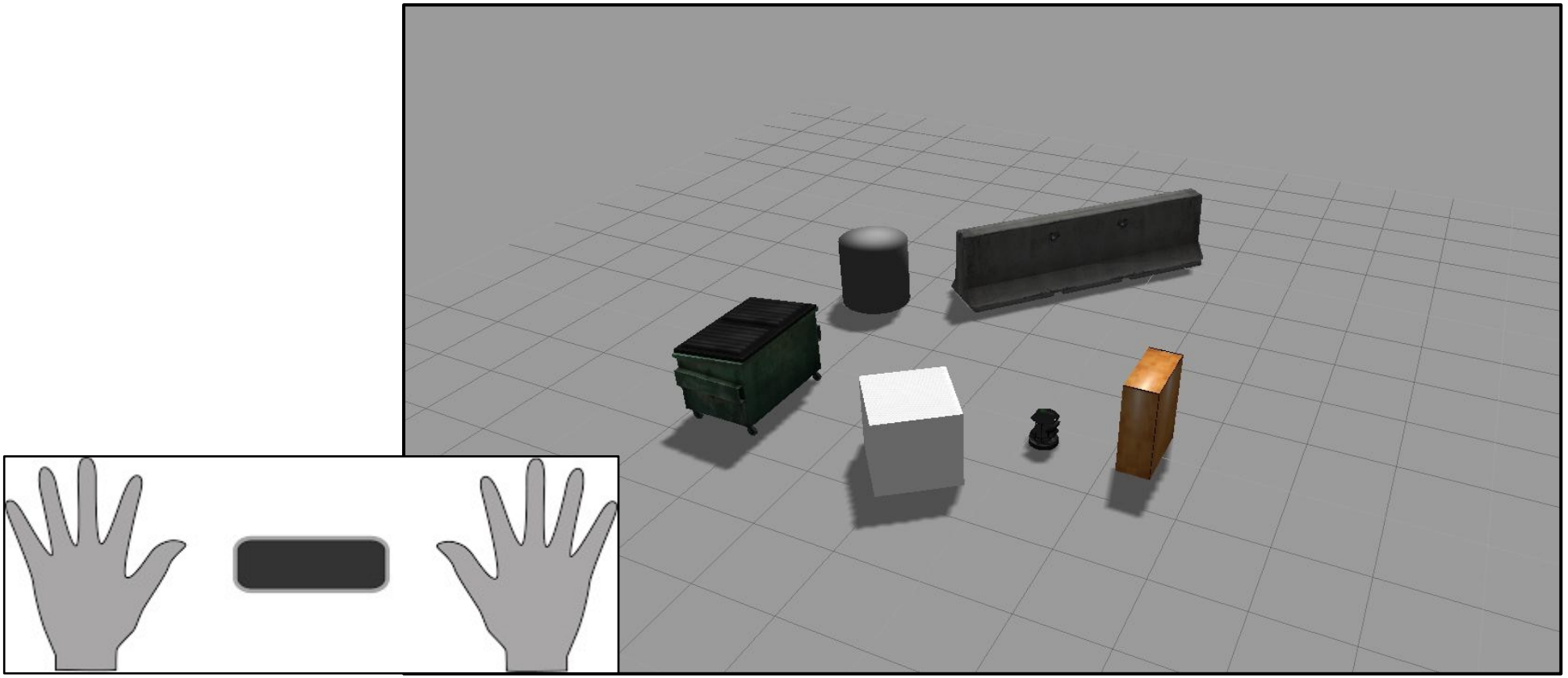
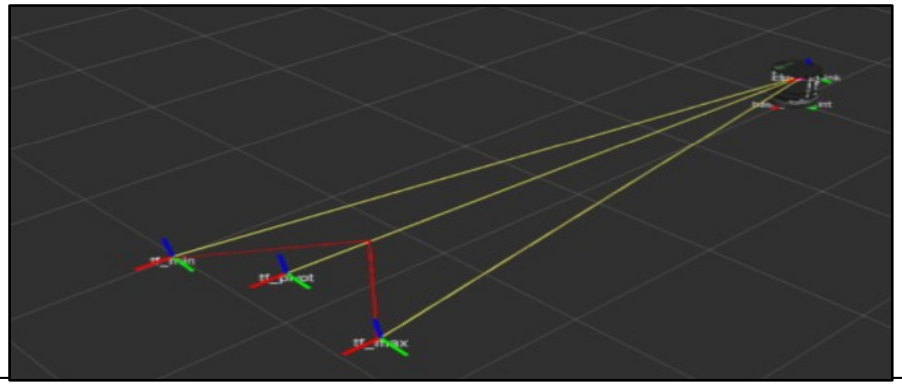
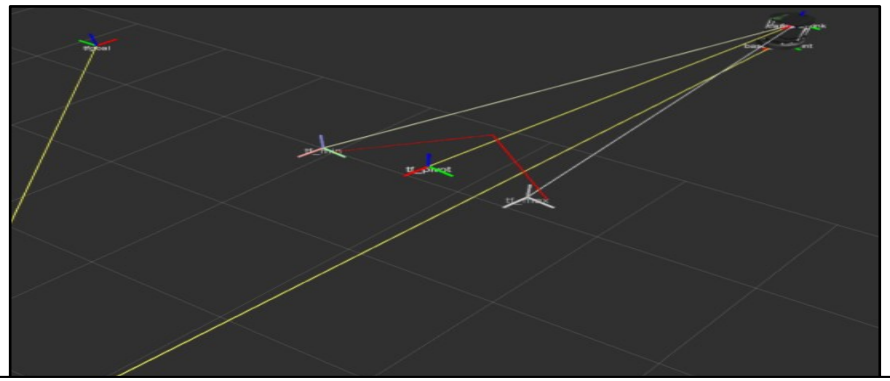


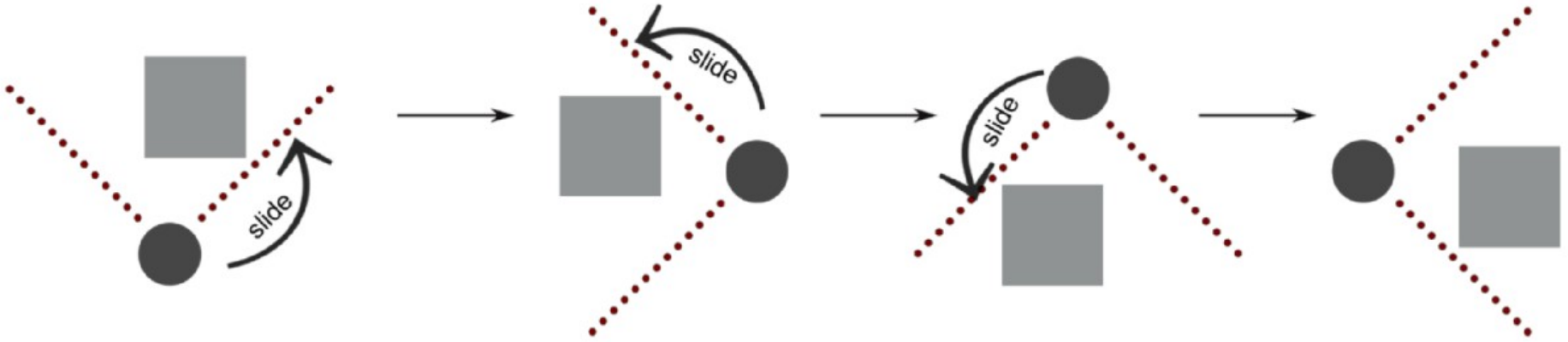
Image from http://uwyn.com/geco/docs/

Projects from previous years

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

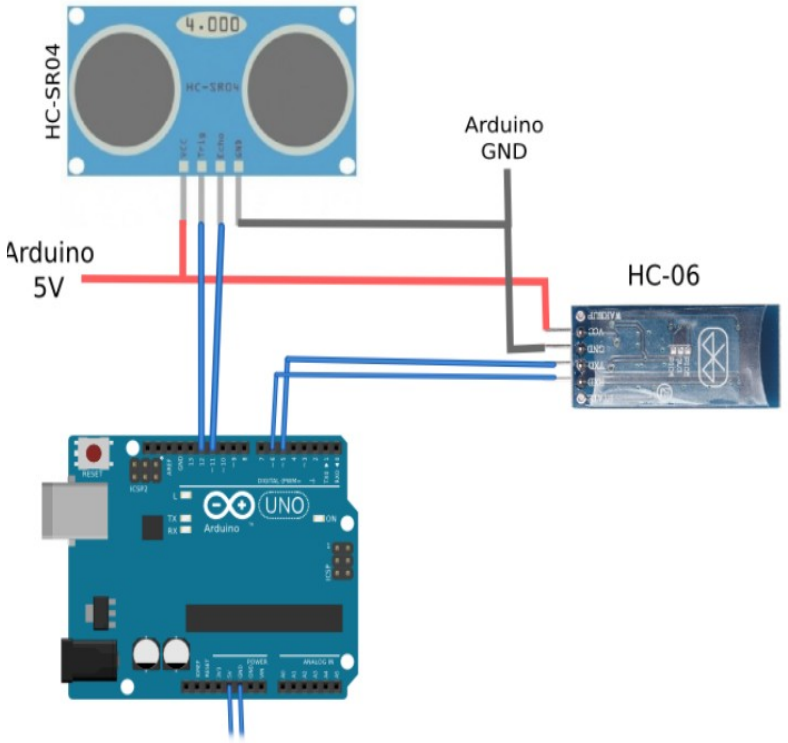


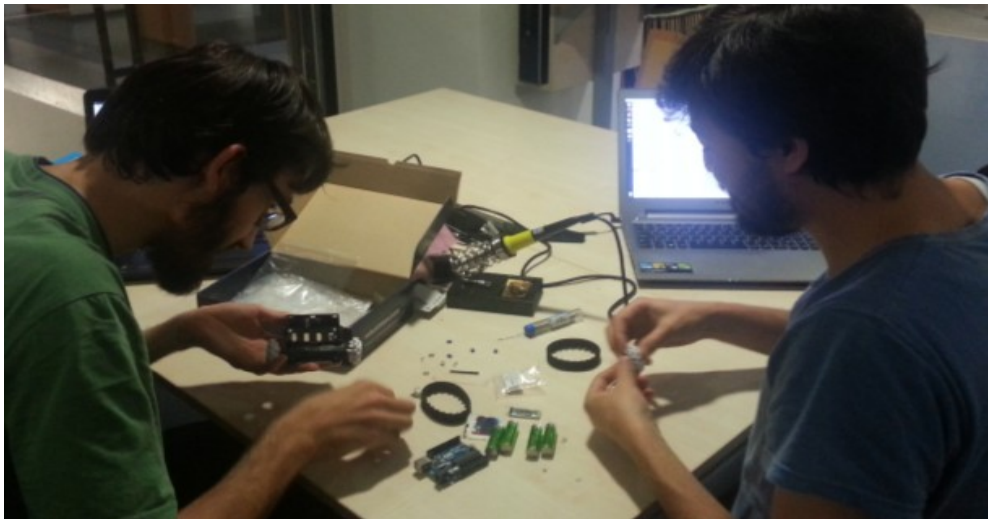




Projects from previous years

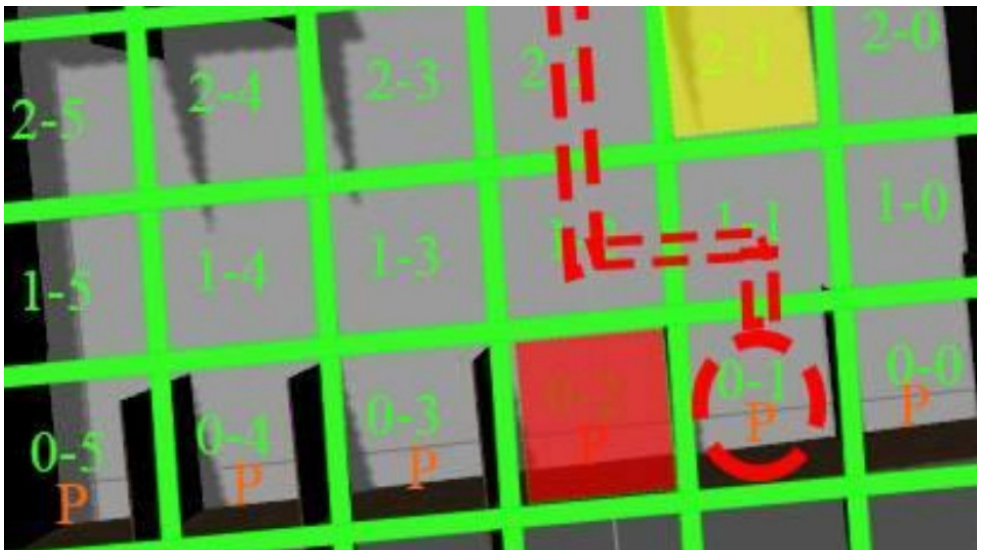
- Arduino robot: Android control of semi-autonomous arduino robot with range sensor.





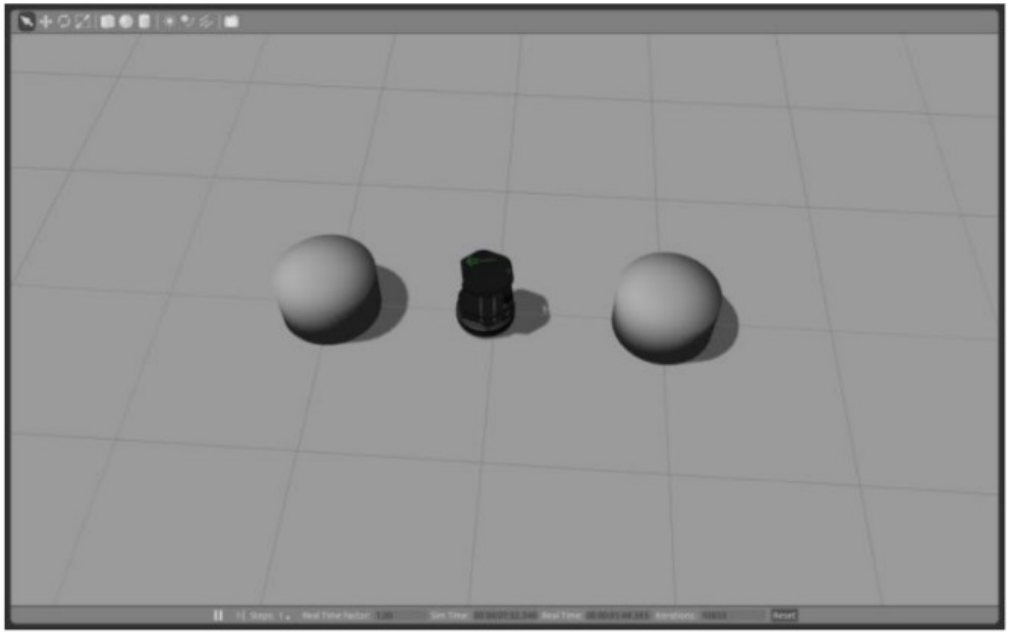
Projects from previous years

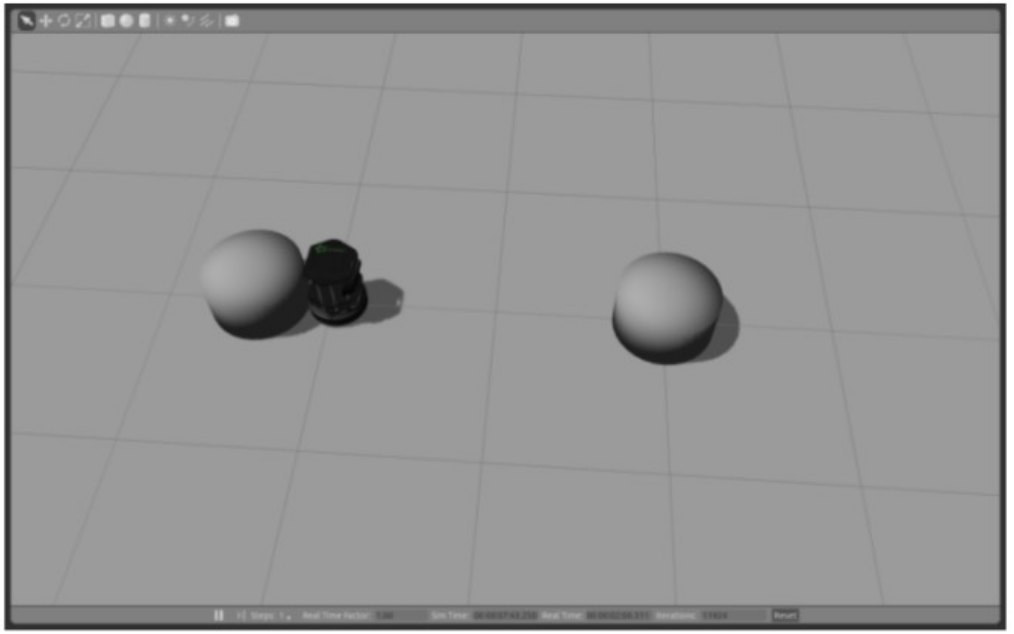
- Car parking: Park a car-like robot using gridding or motion planning.



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

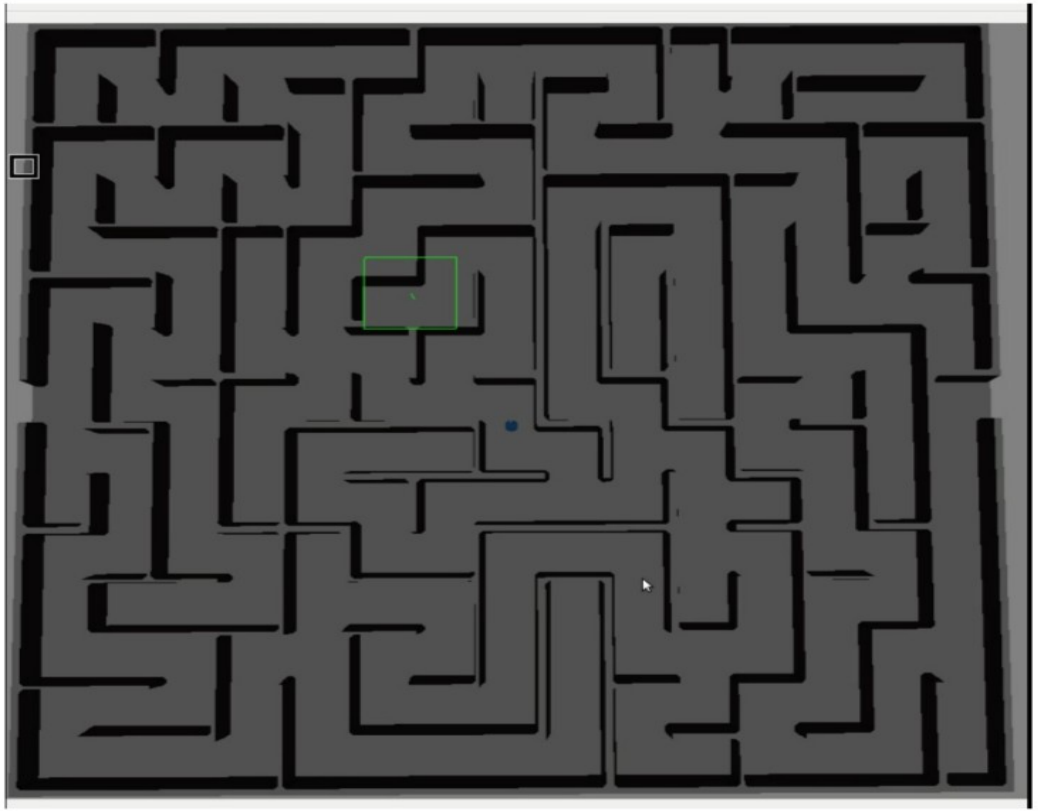


Illustration 10: Complex Wall Follower Map

Projects from previous years

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

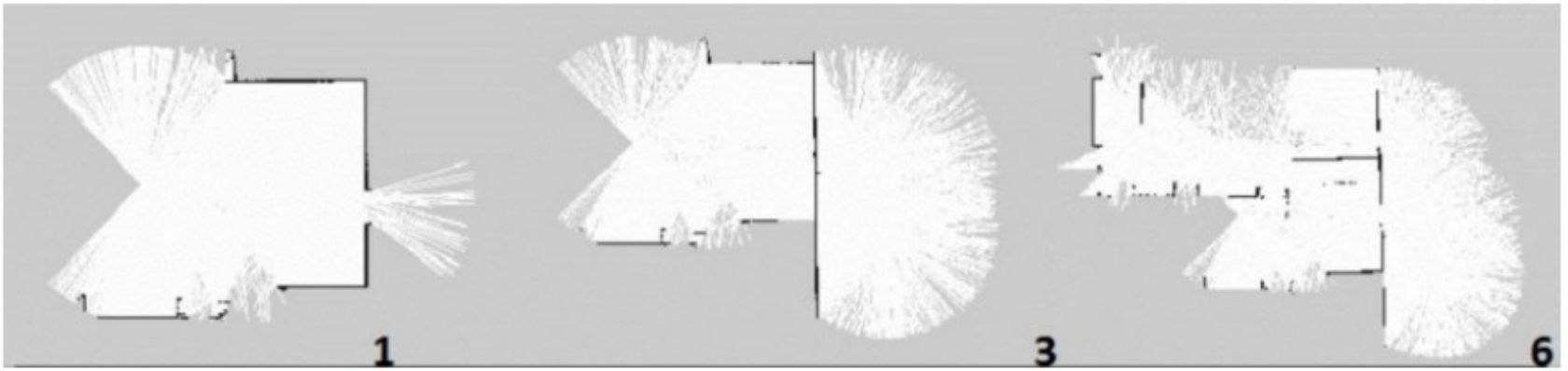
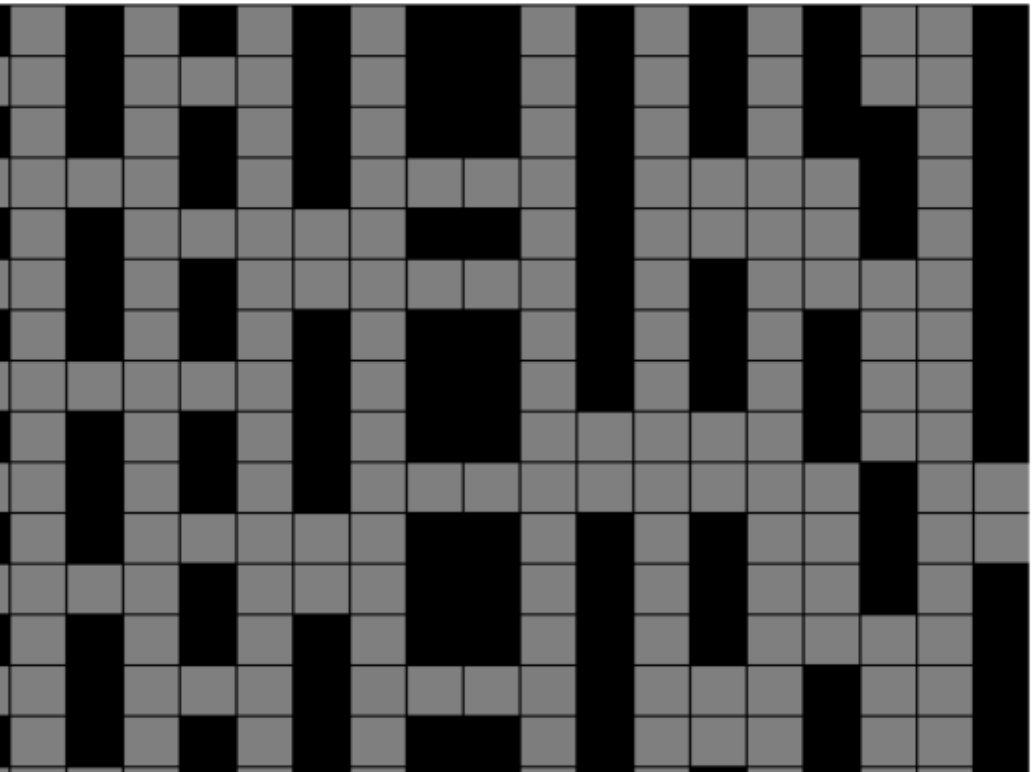
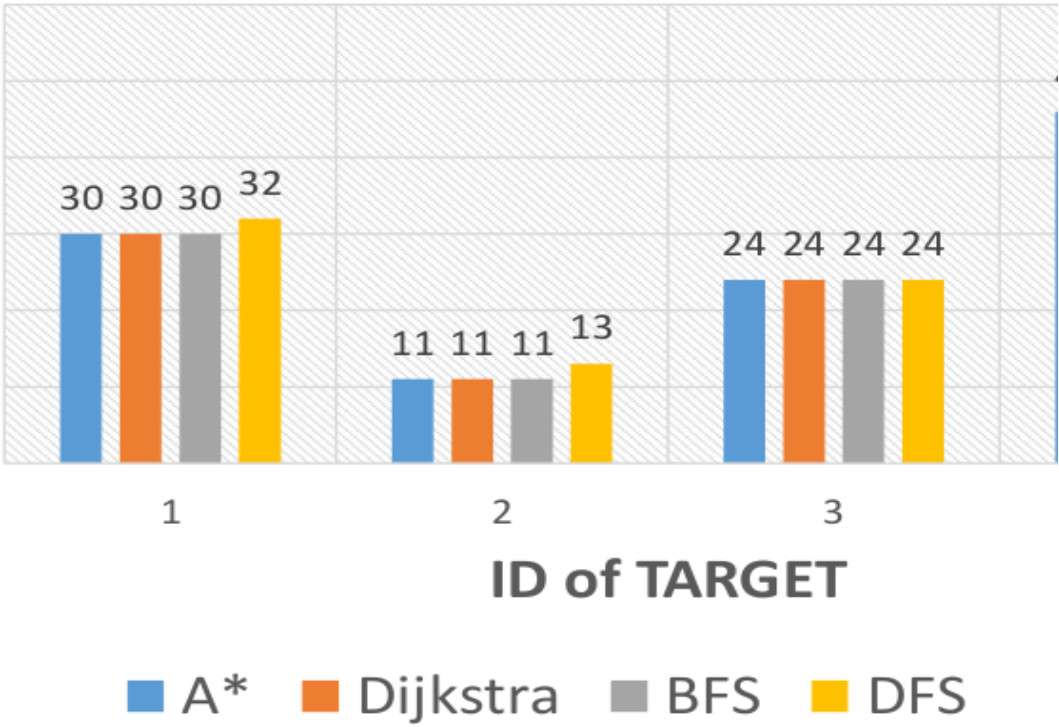


Figure 10 Our Approach - Discovered Areas

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.

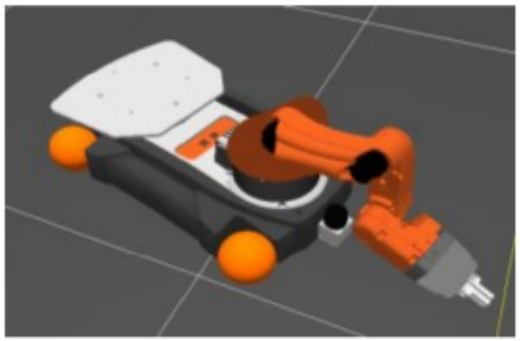


Figure 3-3: Second arm position

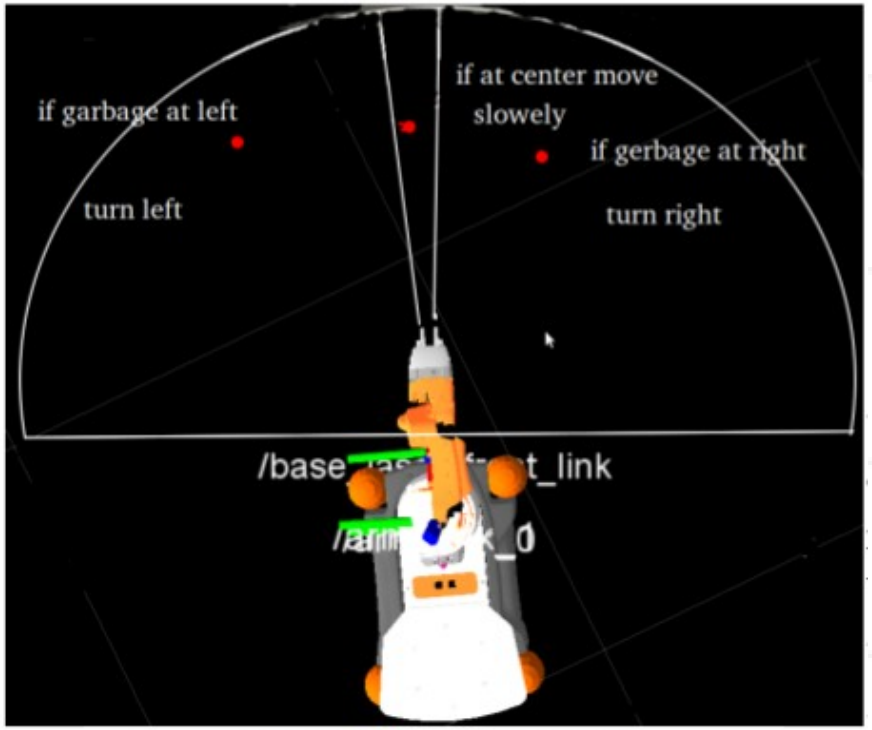


Figure 3-7: Robot adjustment

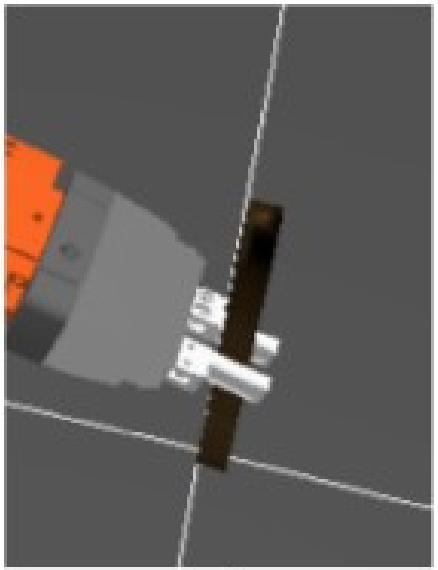
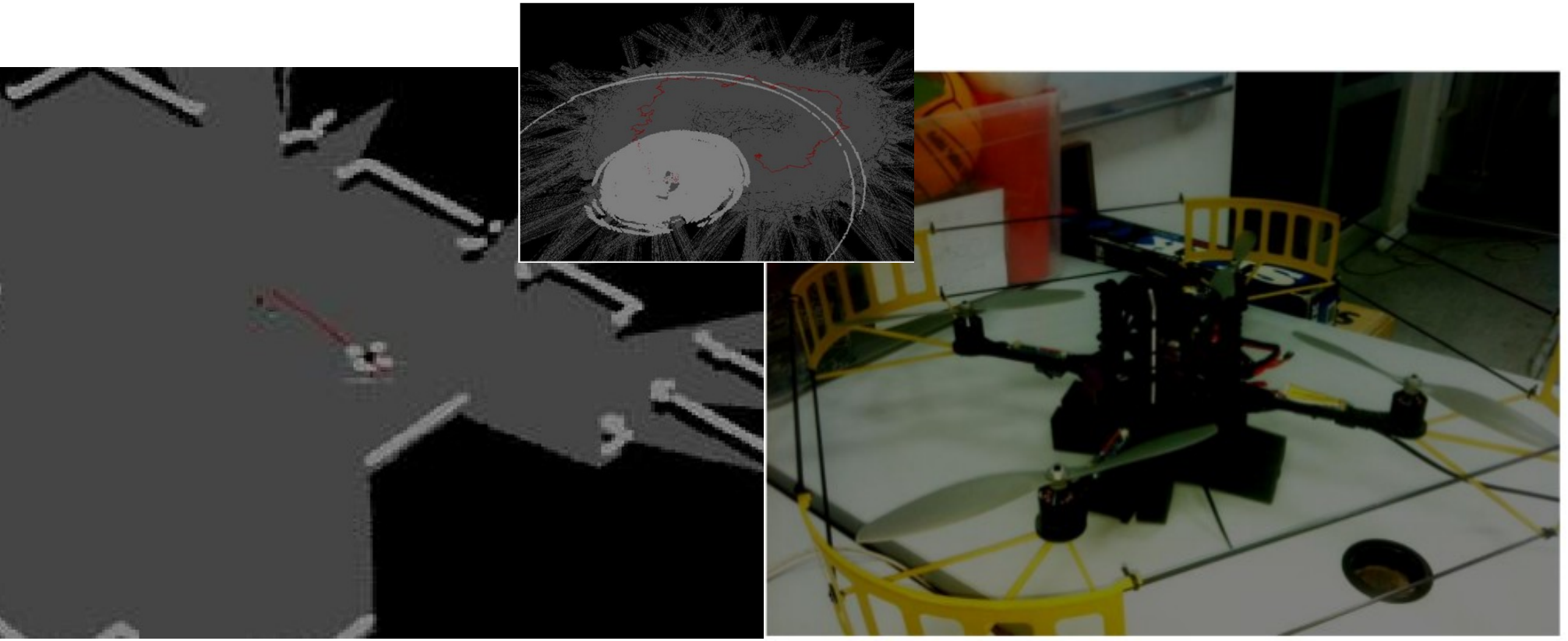


Figure 3-6: Stick as a garbage

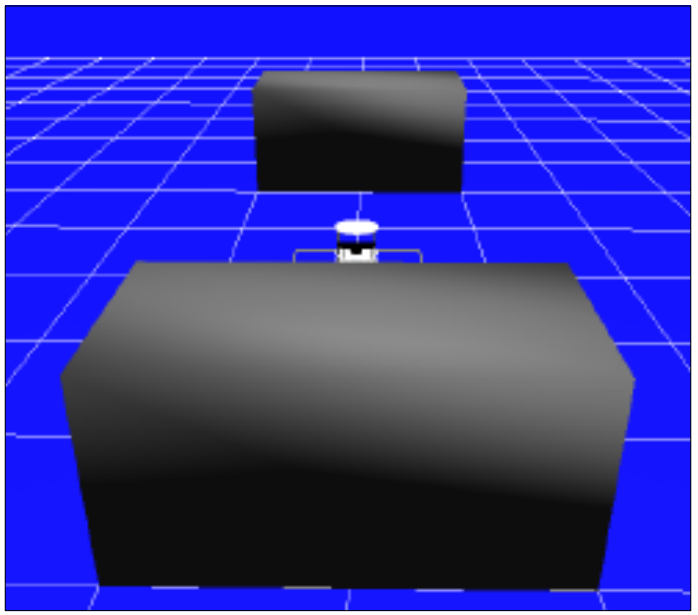
Projects from previous years

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



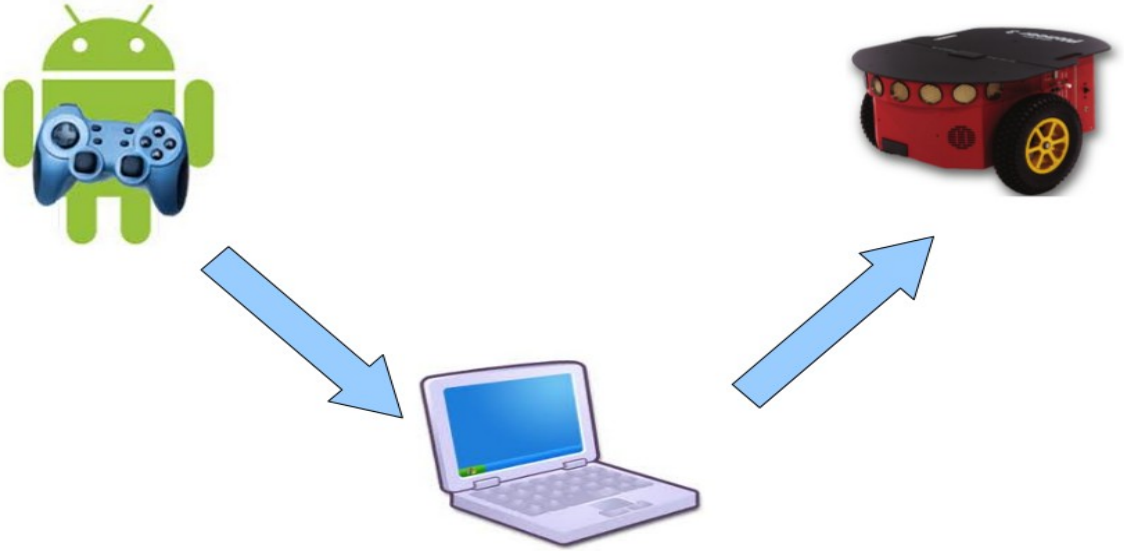
Projects from previous years

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



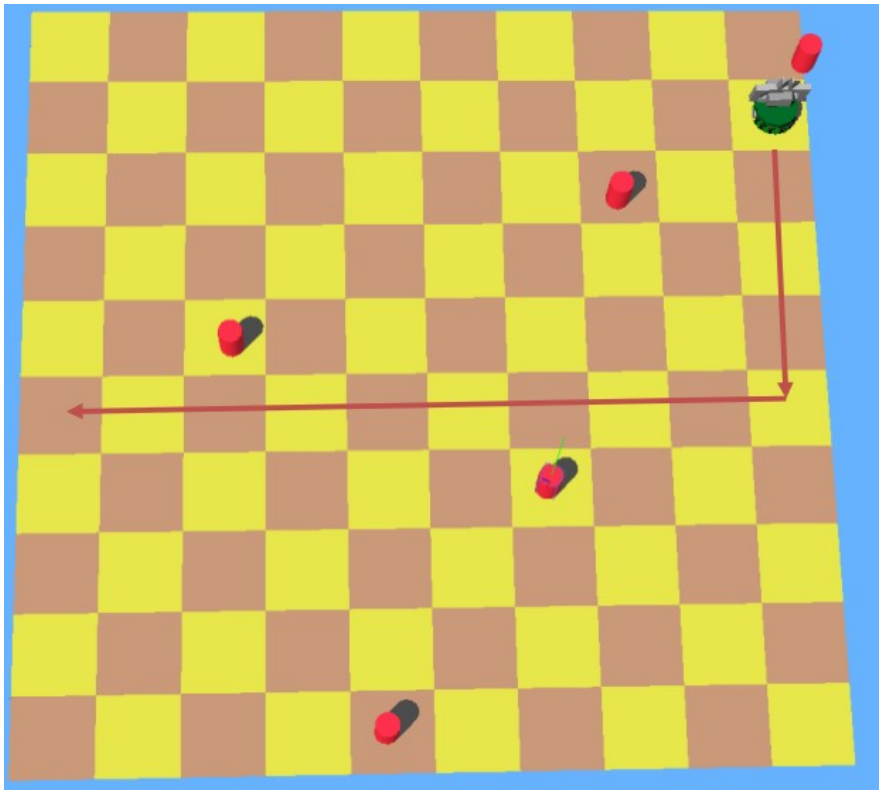
Projects from previous years

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



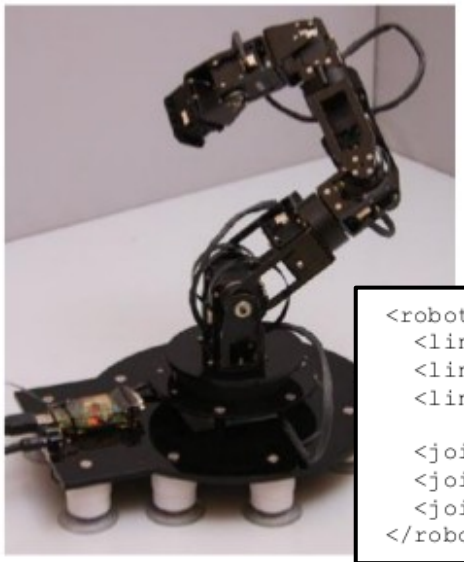
Projects from previous years

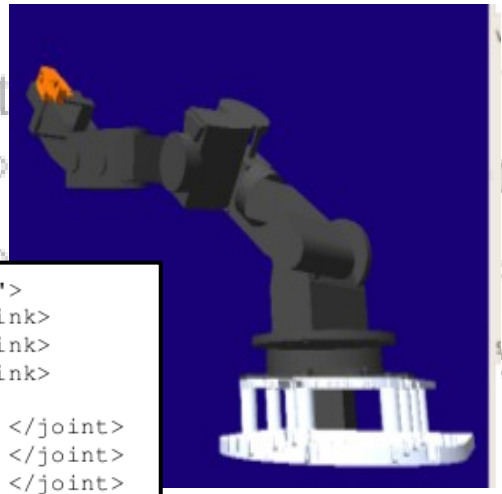
- Task planning: Multiple robots solving a puzzle in simulation.



Projects from previous years

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





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  <joint>  ....  </joint>
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</robot>
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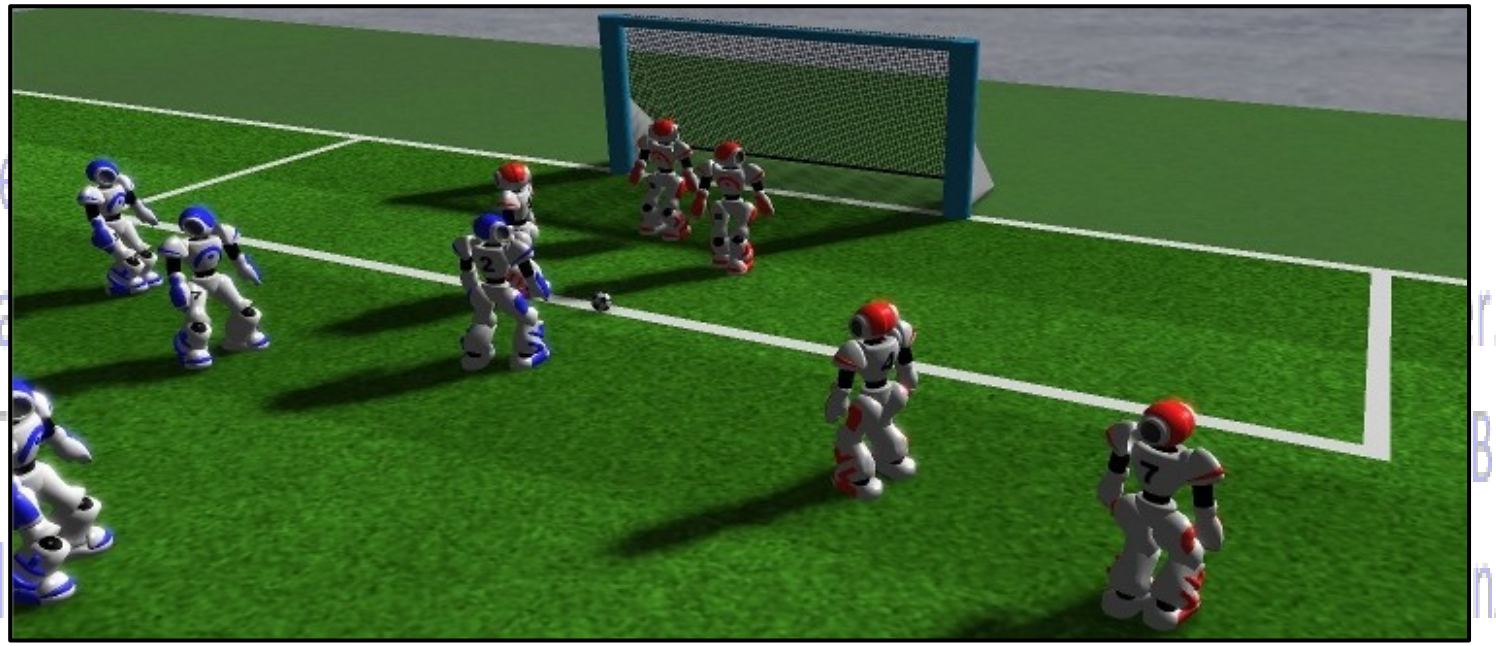
Joint Name				
Shoulder Roll		300°	Payload	350 g
Shoulder Pitch				0.4 m/s
Elbow Roll				75 rpm
Elbow Pitch				57 cm
Wrist Roll	Spin	300°	Reach	48 cm
Wrist Pitch	Articulated	210°	Repeatability	+/- 0.3
Wrist Yaw	Articulated	220°	Hardware Interface	USB

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.