Development of intelligent systems (RInS)

Task 2: Parking

Danijel Skočaj
University of Ljubljana
Faculty of Computer and Information Science

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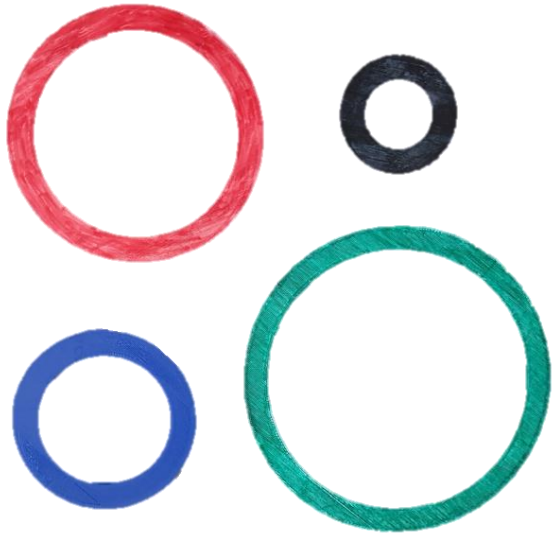
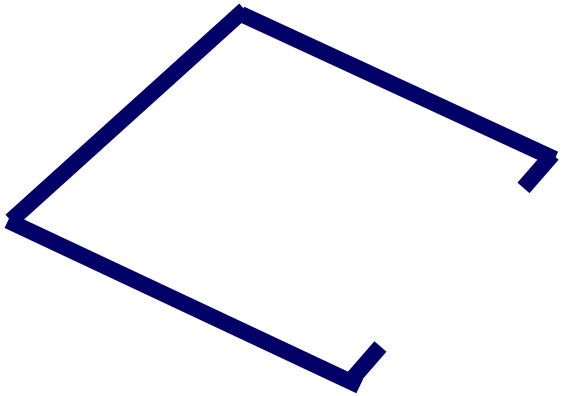
Rings and cylinders

- Four rings of different colours and different sizes
- Diameters:
  - app. 5 cm
  - app. 10 cm
  - app. 15 cm
  - app. 20 cm
- (Four cylinders of different colours)

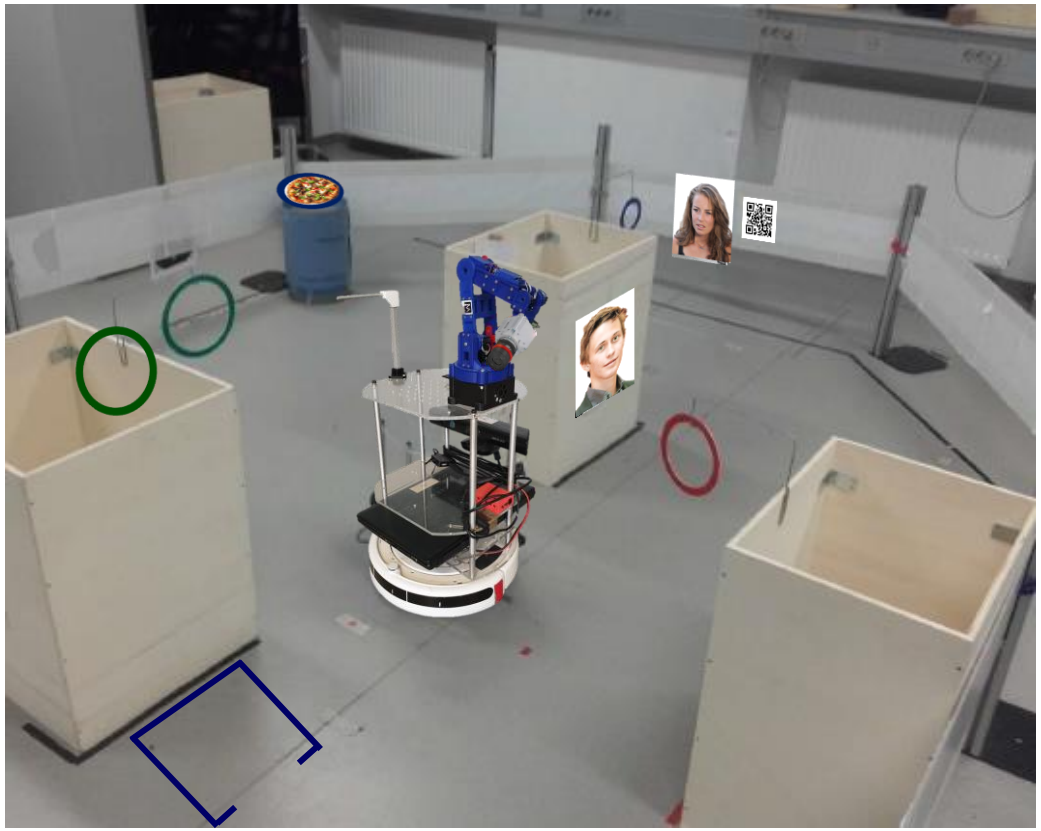


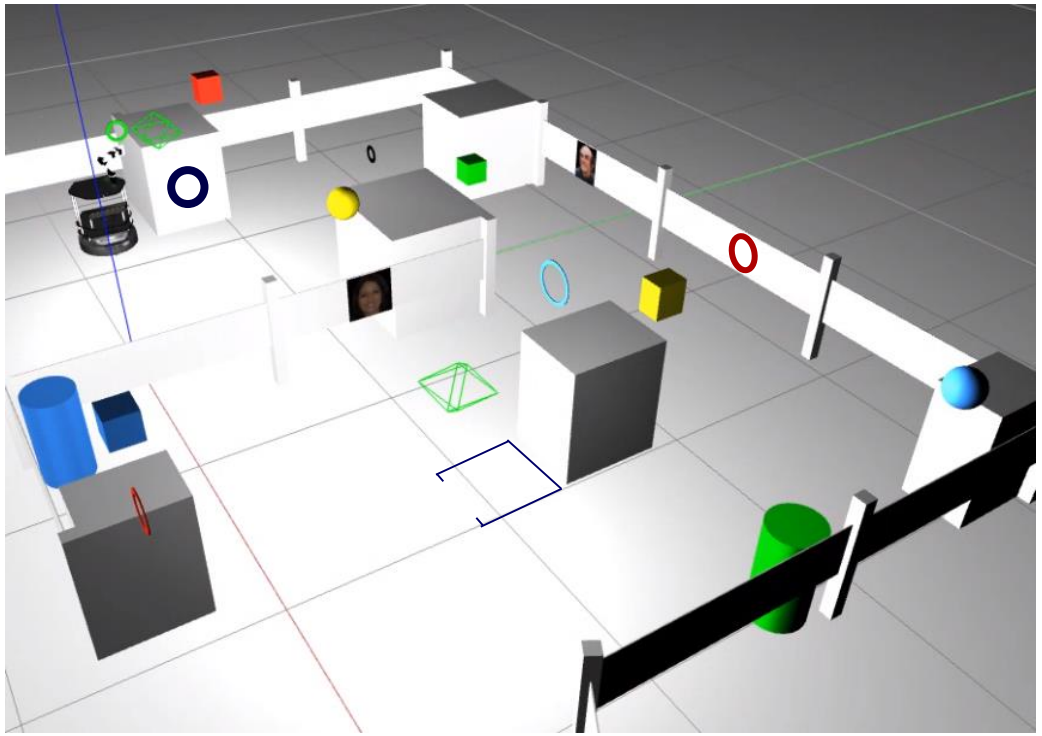
Parking robot

- Additional camera pointed towards the floor
- You can choose whether in front or in the back of the robot



Evaluation setup



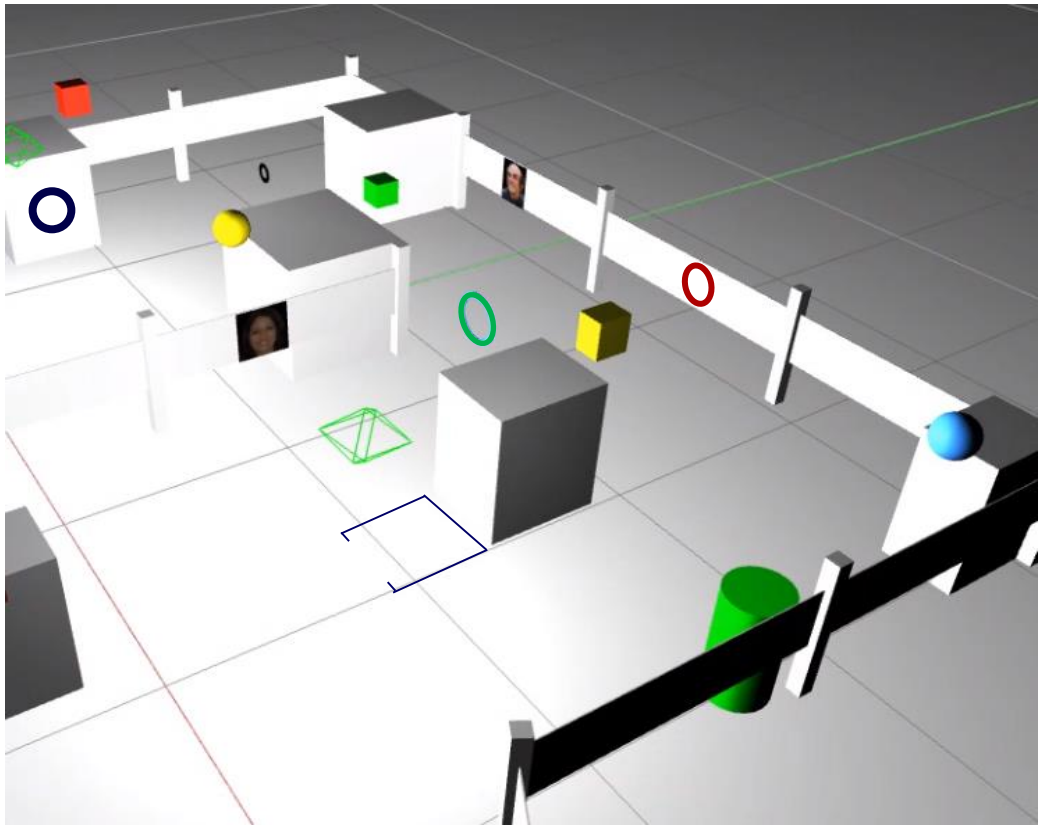


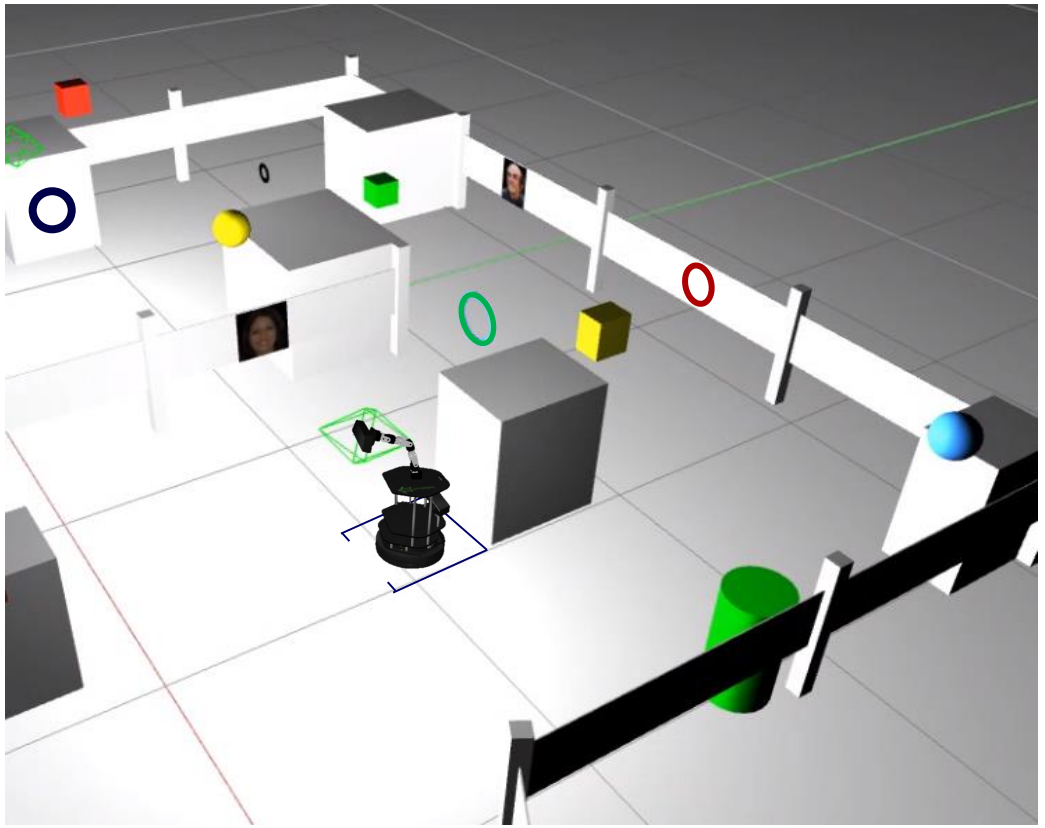
- in simulation…

Evaluation rules

- Setup:
  - fenced competition area
  - three rings of different sizes and colours at random places
  - three cylinders of different colours at random places
- Task:
  - build the map of the competition area
  - search the space and look for the rings (and cylinders)
  - recognize and say the colour of the rings (and cylinders)
  - approach the green ring
  - park into the parking space marked below the green ring
- Goals:
  - the robot should detect as many rings as possible
  - (the robot should detect as many cylinders as possible)
  - the robot should park as accurately as possible
  - perform the task as fast as possible

Parking





- The robot should be positioned completely within the boundaries of the parking space

Evaluation protocol

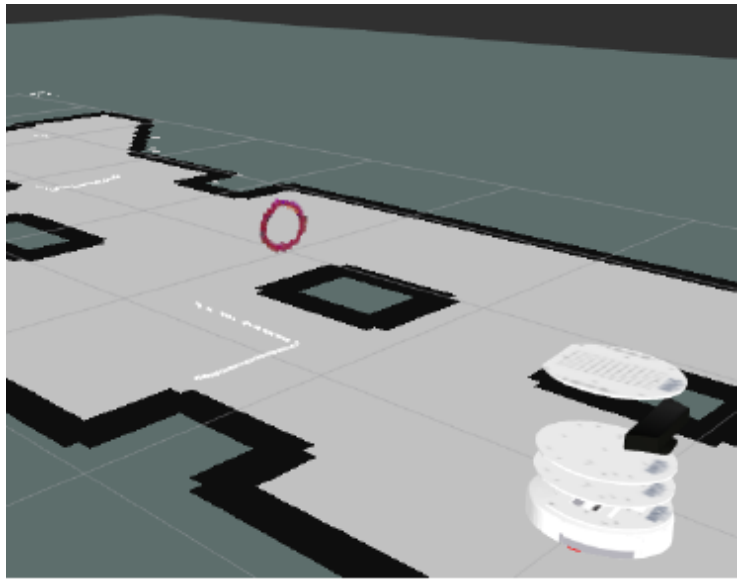
- The evaluation course will be set up in advance
- The teams will be allowed to build the map in advance
- The rings and cylinders will be positioned on the day of the evaluation
- The final parking place will be written on the day of the evaluation
- The robot has to operate completely autonomously
- The teams will be allowed to tune the parameters
- (You should preferably not manually set the goals for exploration of space)
  - It is therefore advisable to implement automatic exploration of space

Evaluation

- Measuring:
  - number of rings correctly detected (up to 3)
  - number of correctly recognized colours of the rings (up to 3)
  - number of cylinders correctly detected (up to 3)
  - number of correctly recognized colours of the cylinders (up to 3)
  - parking accuracy
  - number of false detections
  - the speed of execution
- But also:
  - Exploration strategy
  - Robustness of the performance
  - Repeatability
  - Innovation
  - Clarity of demonstration
  - Elegance of solution

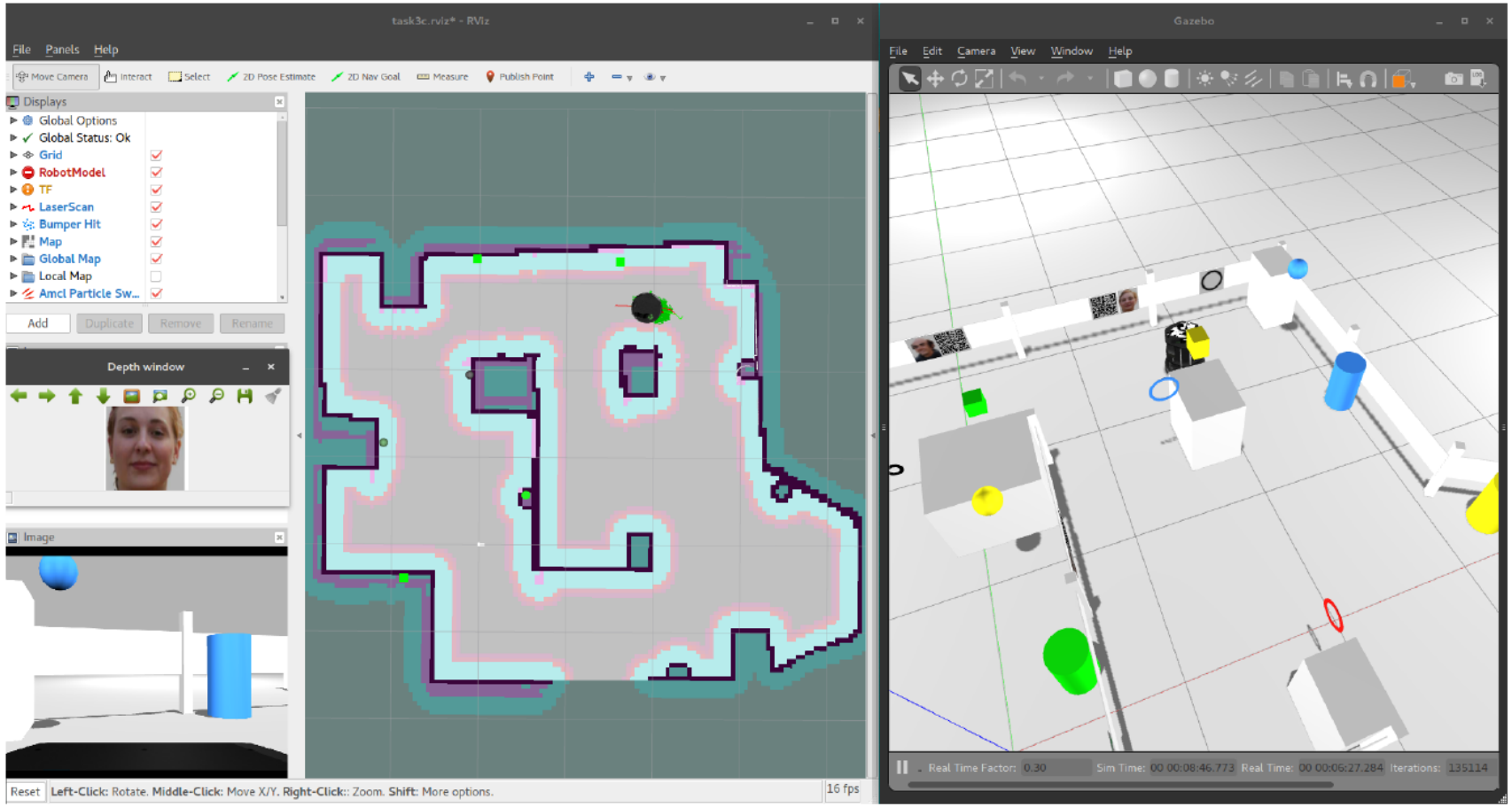
Demonstration

- Demonstrate what is going on in the robot
  - visualisation of deteted locations
    - mark locations in RViz
  - verbalisation of detections
    - simple speech synthesis



Presentation

- Gazebo, RVIZ, camera view as well as images of detected rings should be shown
- Close view of the approaching events and parking



Tasks

- System setup
  - Running ROS
  - Tele-operating TurtleBot
- Autonomous navigation
  - Autonomous control of the mobile platform
  - Acquiring images and 3D information
  - Simultaneous mapping and localization (SLAM)
  - Path planning, obstacle avoidance, approaching
  - Advanced fine manoeuvring and parking
  - Intelligent navigation and exploration of space
- Advanced perception and cognitive capabilities
  - Detection of faces, circles, 3D rings, 3D cylinders
  - Recognition of faces, food, digits, colour
  - Basic manipuation and visual servoing
  - Speech synthesis, speech recognition, dialogue processing (reading QR codes)
  - Belief maintenance, reasoning, planning

Task 1

Task 2

Task 3

Task 2 goals

- The main goals of the second task and competition are:
  - to improve the navigation
  - to search the space
  - to detect objects in 3D pointclouds
    - to robustly detect the rings
    - (to robustly detect the cylinders)
  - to relate 3D point clouds and colour information from RGB images
  - to recognize colours
  - to master fine manoeuvring of the robot