# Development of intelligent systems (RInS)

# Task 1: Autonomous navigation and human search

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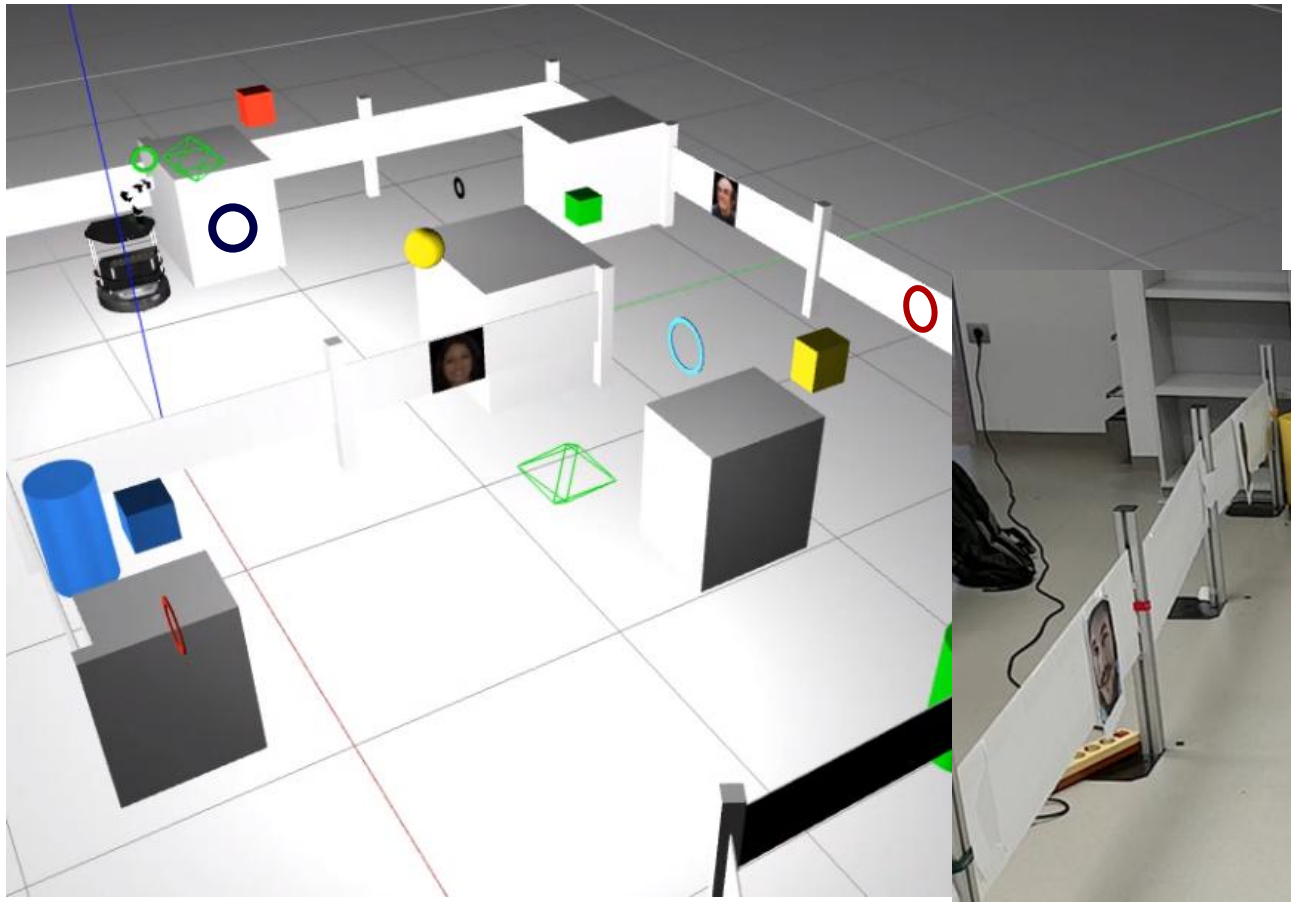
# Evaluation setup



First in simulator (T1s)

Until the end of semester
on a real robot (T1r)

# Taks T1r

- Setup:
  - fenced area
  - three printed faces at random places
  - starting position
- Task:
  - build the map of the competition area
  - search the space and look for faces
  - when a face is detected pass by or approach (and greet) the face
  - when all three faces are detected, stop
  - do not redetect the same face
  - do not have false detections
- Goals:
  - the robot should detect as many faces as possible
  - the robot should not detect something else as a face
  - perform the task as fast as possible
- Implemented on a real robot

# Task T1s

- Tasks from Task T1r+
  - detect 3D rings
  - recognise the colours of the rings
  - approach and say the ring colour
- Additional goal:
  - the robot should detect as many rings as possible
  - the robot should not detect something else as a ring
  - the robot should recognize colours
  - perform the task as fast as possible
- In Gazebo only

# Evaluation protocol

- The evaluation course will be set up in advance
- The teams will be allowed to build the map in advance
- The faces (and rings) will be positioned on the day of the evaluation
- The positions of the faces (and rings) should not be hand coded
- The robot search goal positions can be hand coded
- The robot has to operate completely autonomously
- The teams will be allowed to tune the parameters

- The teams should be ready before the start of evaluation
- Every team will be able to run their robot twice

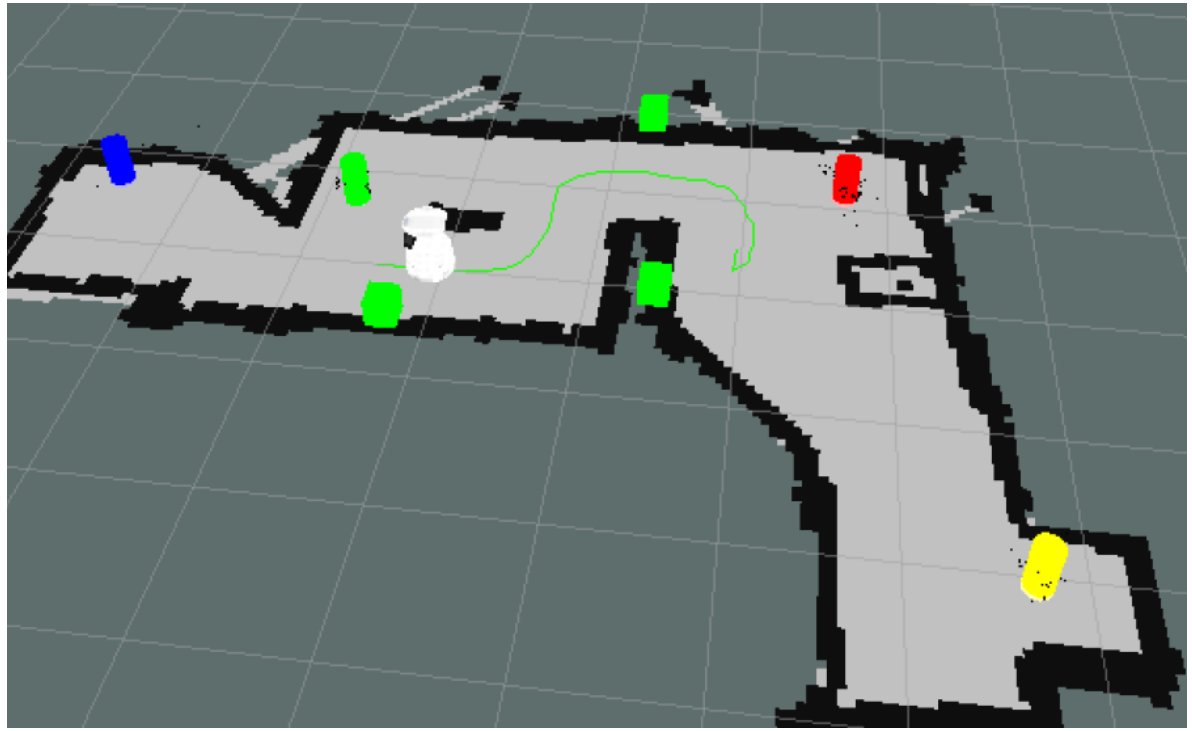
- T1s: The evaluation in simluation will be held on 4. 4.
- T1r: The performance of a real robot shuld be presented until 30. 5.

# Evaluation criteria

- Measuring:
  - number of faces correctly detected
  - number of faces correctly passed by or approached (and greeted)
  - number of redetected faces
  - number of false detections
  - the time until the robot stops
  - (number of correctly detected and approached rings and recognised colours)
- But also:
  - Robustness of the performance
  - Repeatability
  - Innovation
  - Clarity of demonstration
  - Elegance of solution
- Scoring:
  - T1s (in simulation): 15 points max
  - T1r (on real robot): 15 points max

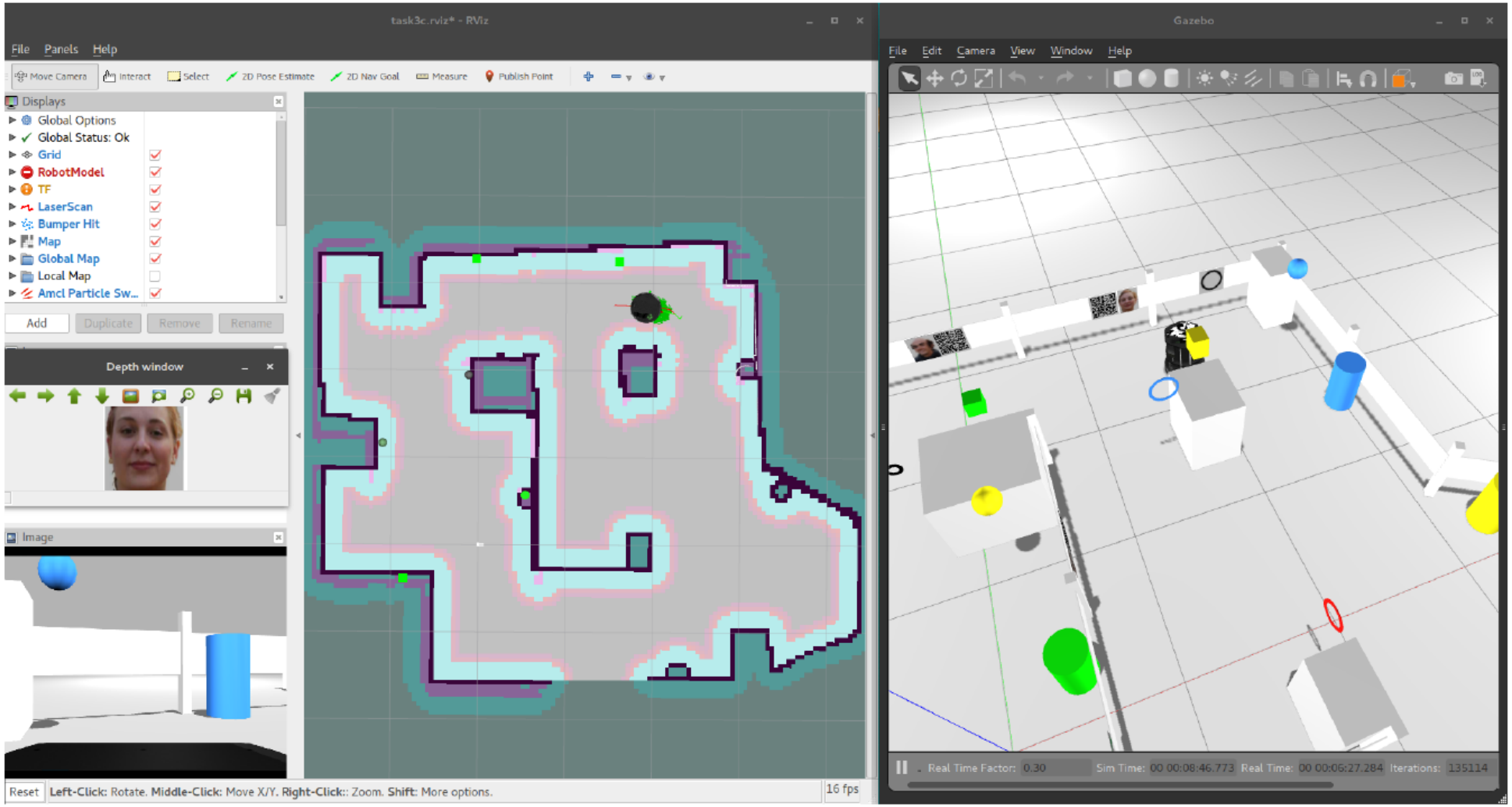
# Demonstration

- Demonstrate what is going on in the robot
  - visualisation of detected locations
    - mark locations in Rviz (also goals, detected colour, etc.)
  - verbalisation of detections
    - simple speech synthesis (greeting, colours)



# Presentation

- (Gazebo), RVIZ, camera view as well as images of detected faces should be shown



# Tasks

- System setup
  - Running ROS — Task 1r
  - Tele-operating TurtleBot — Task 1s
- Autonomous navigation — Task 2
  - Autonomous control of the mobile platform
  - Acquiring images and 3D information
  - Simultaneous mapping and localization (SLAM)
  - Path planning, obstacle avoidance
  - Advanced fine manoeuvring
  - Basic mobile manipulation
  - Intelligent navigation and exploration of space
- Advanced perception and cognitive capabilities
  - Detection of faces, 3D rings, birds
  - Recognition of birds and ring colours
  - Segmentation of the ground
  - Speech synthesis, speech recognition, dialogue processing (reading QR codes)
  - Belief maintenance, reasoning, planning

# Task 1 goals

- The main goals of the first task are:
  - to learn how to use ROS
  - to get familiar with the hardware
  - to set up the mobile platform (software and hardware)
  - to learn how to build and use a map
  - to learn how to set a goal and to instruct the robot to go to the goal position
  - to learn how to relate points in different coordinate frames
  - to use LIDAR
  - to use RGBD camera
  - to learn how to process imagess
  - to learn to work with 3D data
  - to robustly detect faces
  - to robustly detect rings
  - to search the space
  - to learn to work in Gazebo
  - to learn to work with a real mobile robot