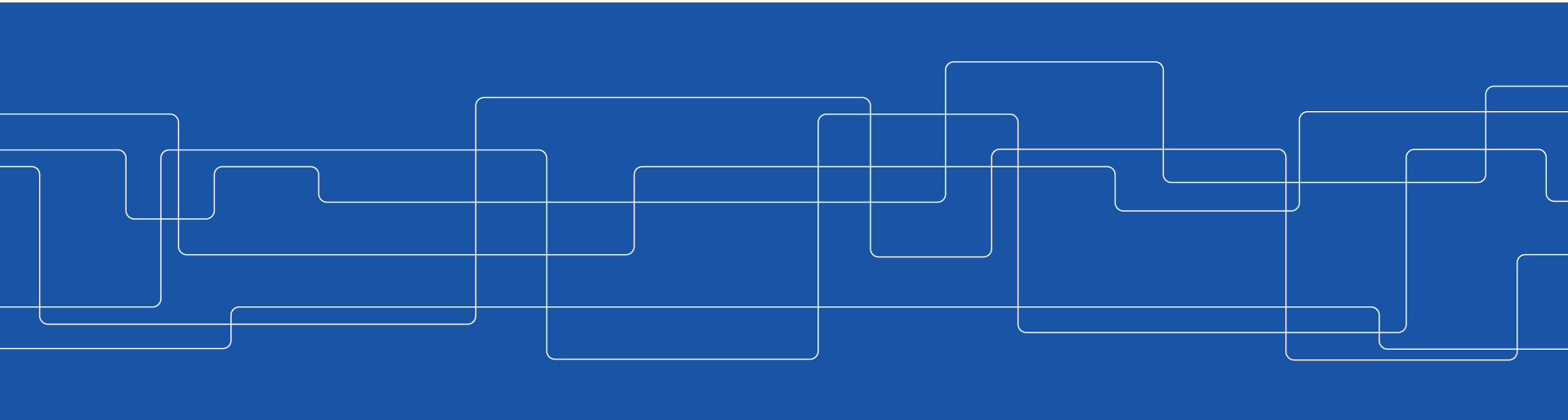




DD2410 Assignment 5:

Mobile manipulation

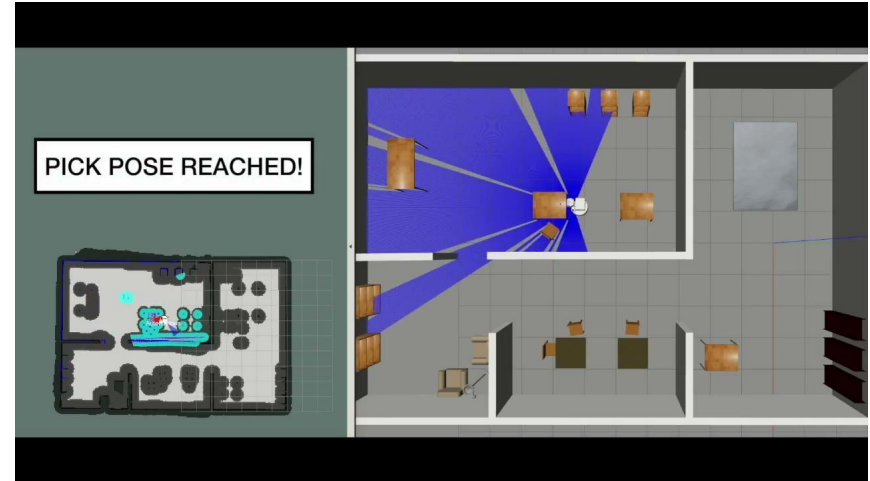
Ignacio Torroba (torroba@kth.se)



Autonomous navigation and manipulation

Context: Your boss (who's not an engineer) wants you to prepare three demos for a client with a collaborative TIAGo robot.

Your team has already worked extensively with TIAGo over the years. No need to start from scratch.





Tasks

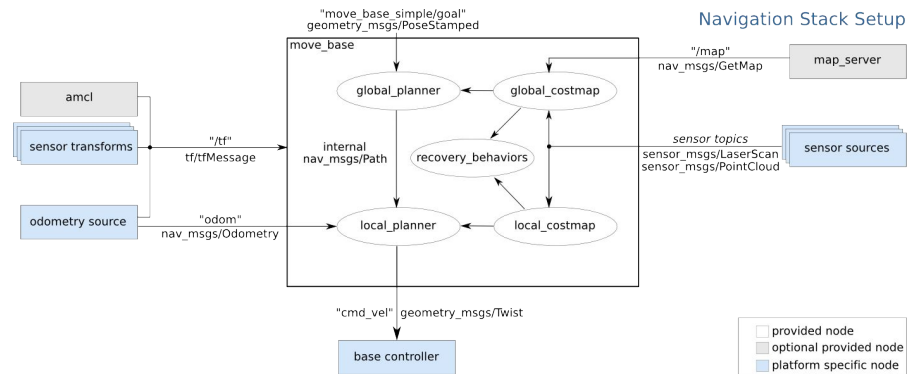
The general task is for the robot to pick up a cube from a table and place it on another one inside the flat:

- Level E: Pick&Carry&Place without exteroceptive sensing
 - No sensory input.
 - The tables are in front of each other
- Level C: Pick&Carry&Place with visual input
 - Only camera feedback available
 - The tables are in front of each other
- Level A: Pick&Carry&Place with full sensing and navigation capabilities
 - Access to all the onboard sensors
 - The tables are far from each other

What you are given

A working system with all the necessary modules for path planning, control, localization, sensing, manipulation, etc.

 **MoveIt!**



What you are given

A working system with all the necessary modules for path planning, control, localization, sensing, manipulation, etc.

MoveIt!

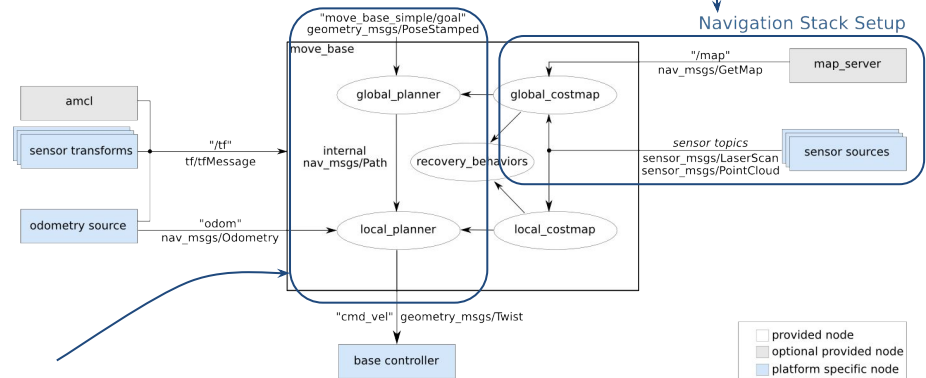
Assignment 2



GAZEBO

Assignment 3

Assignment 4





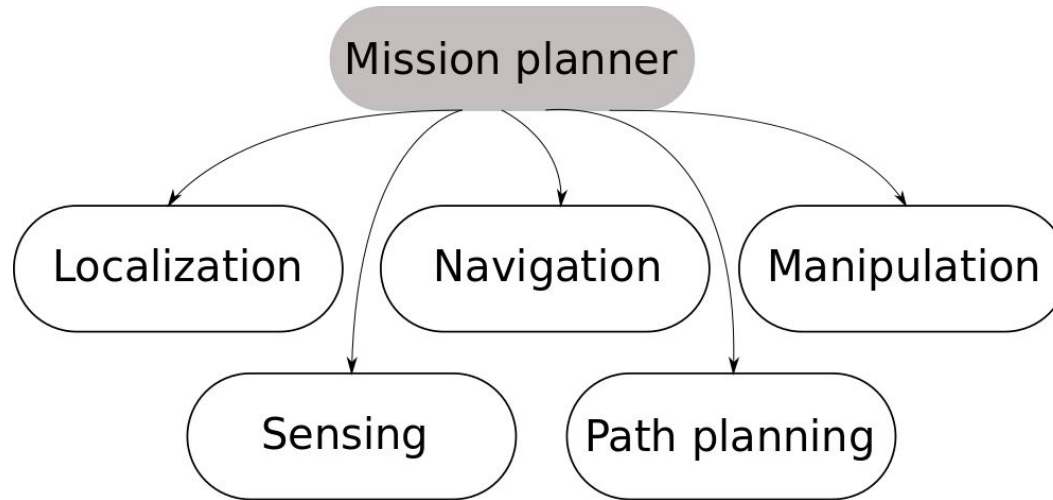
What you are given

- Three videos describing the demos.
- Some instructions on how to start and a dummy demo.
- A package **robotics_project**, containing two python scripts and a launch file. These are the **ONLY** files you **need** to work on.

Goal

The system is only missing the high level logic.

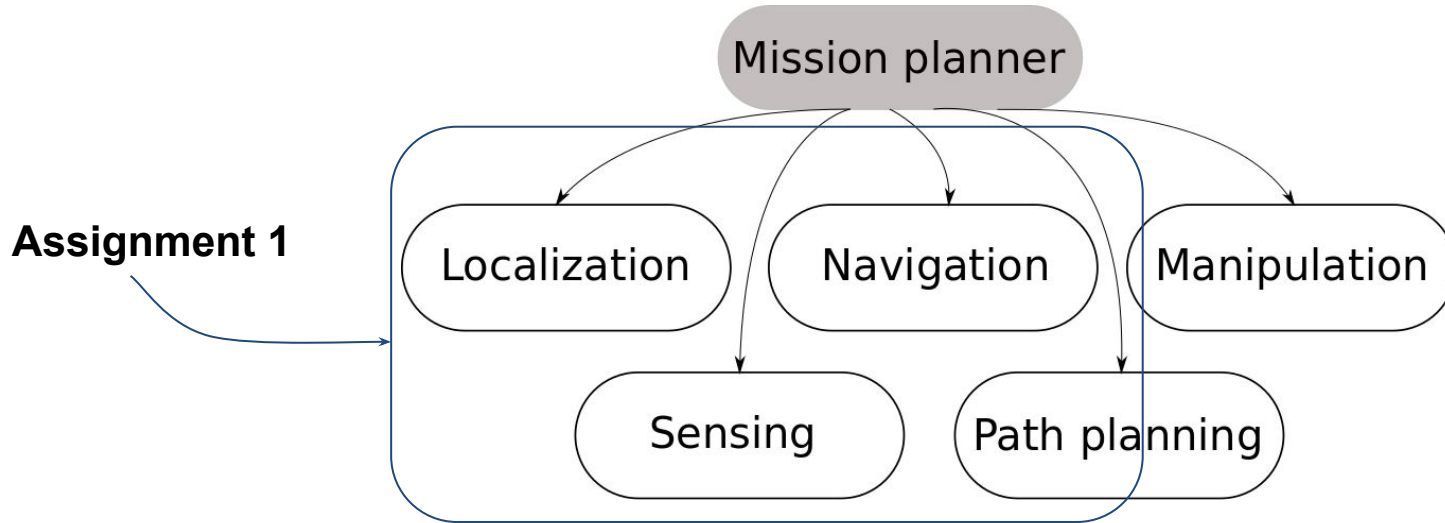
Implement a mission planner for three different tasks (E, C, A)



Goal

The system is only missing the high level logic.

Implement a mission planner for three different tasks (E, C, A)



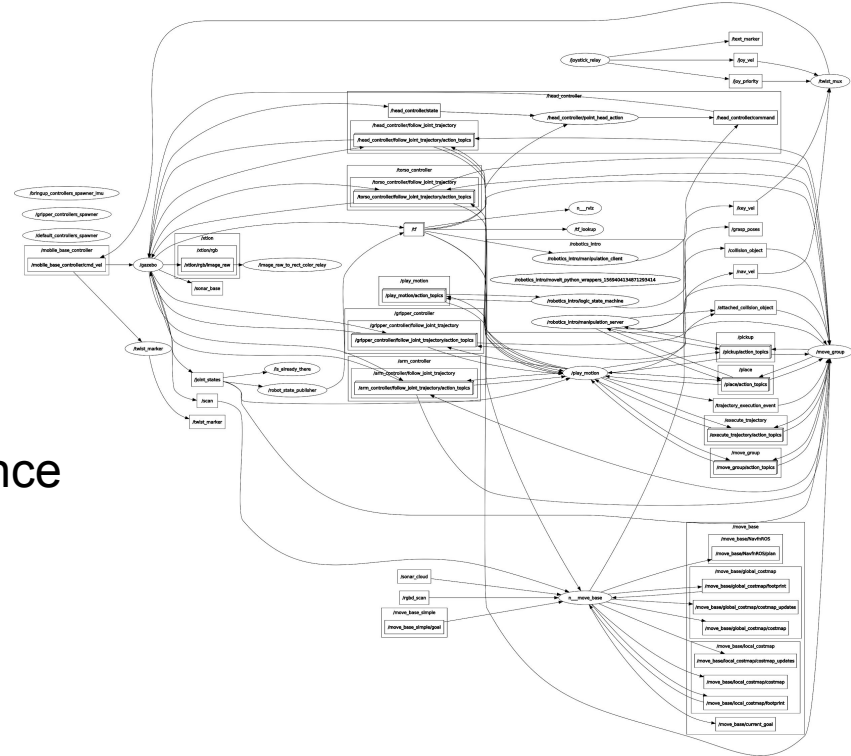


What you are expected to deliver

- For each level, a working demo you will show **live** to a TA.
- **High-level understanding** of your solution. Answer some questions i.e: Why are we asking you to make the robot spin in level A? Is the arm configuration always the same when picking? Why are some things seemingly randomly failing? Etc...
- We might ask you stuff from previous assignments or lectures when relevant

Challenges

- Big, messy system and no compiled docs (real life).
- **Stochastic environment**
- **Gazebo itself...**
- System setup and maintenance



Hints

- Don't try to brute-force it
- Subdivide, implement and test.
- Use the tools at your disposal: RVIZ, ros-commands, rqt_graph, rqt_py_trees, and many others.
- Read the error logs in terminal!





Installation

- PC rooms: instructions in Canvas.
- Personal laptops: we do not offer support beyond readme in repo.
- Advice: try to avoid VM or too old laptops (heavy project).
- Make sure you've done this from assignment 1:

```
$ cd ~
```

```
$ mkdir not
```

```
$ mv .nv .nvidia-settings-rc not
```



Evaluation

Groups of 2, **15 min** time slots with a TA:

- Working demo of the highest level you have achieved, running successfully 2/3 times (statistically significant!)
- **Individual questions about the assignment** (and so individual grades)

You will have to upload your code before the presentation (see canvas)



How to run the system

Launch Gazebo and RViZ

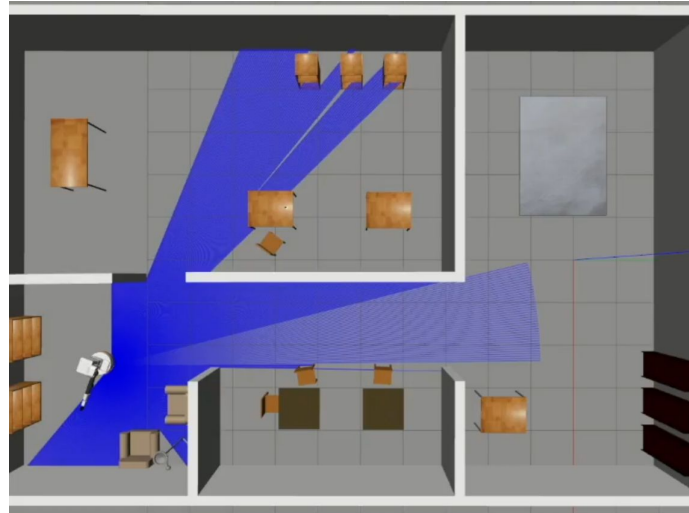
- `roslaunch robotics_project gazebo_project.launch`

Deploy the robot and start the mission

- `roslaunch robotics_project launch_project.launch`

Known “glitch”

- The graphical interface in Gazebo suffles the scenario once in a while.





Account maintenance (at KTH)

- The project takes up a lot of memory.
- You've been given enough, but it might take some tidying up to get things running: Firefox, ROS logs, vscode, Matlab. Run “\$ fs lq”
- You will not be able to log into your account if you've run out of memory, see this:

<https://intra.kth.se/en/it/it-arbetsplatsen/kth-ubuntu/kth-ubuntu-faq-1.613820>



Asking for help in a forum

When reporting a problem and asking for help (see my announcement in canvas):

- Provide context (how can one replicate it to analyze it?)
- Have you checked other existing forums? Stackoverflow, answers.ros.org, etc
- If we don't answer, it means the problem is part of the assignment :)
- Great if you help each other



Shameless ad

If you happen to enjoy this project, come see us again to play with real drones on

DD2419 Project Course in Robotics and Autonomous Systems

<https://www.kth.se/student/kurser/kurs/DD2419?l=en>