ME5413
Final Project Instructions

Friday, 8 Mar 2024

Final Project

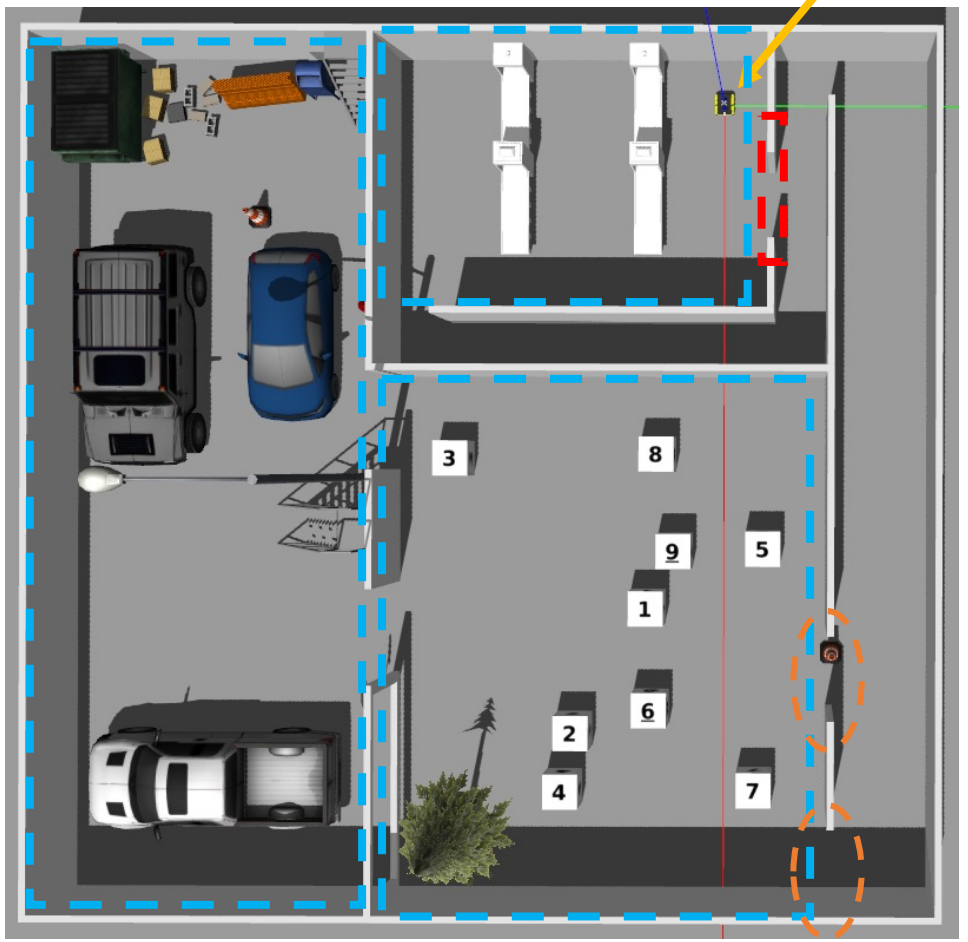
Overview

In this mini-factory environment:

- 3 target areas
- 1 restricted area

The aim of the project is to design a robot navigation software stack that can:

- From the starting point, move to the given pose within each area in sequence:
  - Assembly Line 1, 2
  - Random Box 1, 2, 3, 4
  - Delivery Vehicle 1, 2, 3

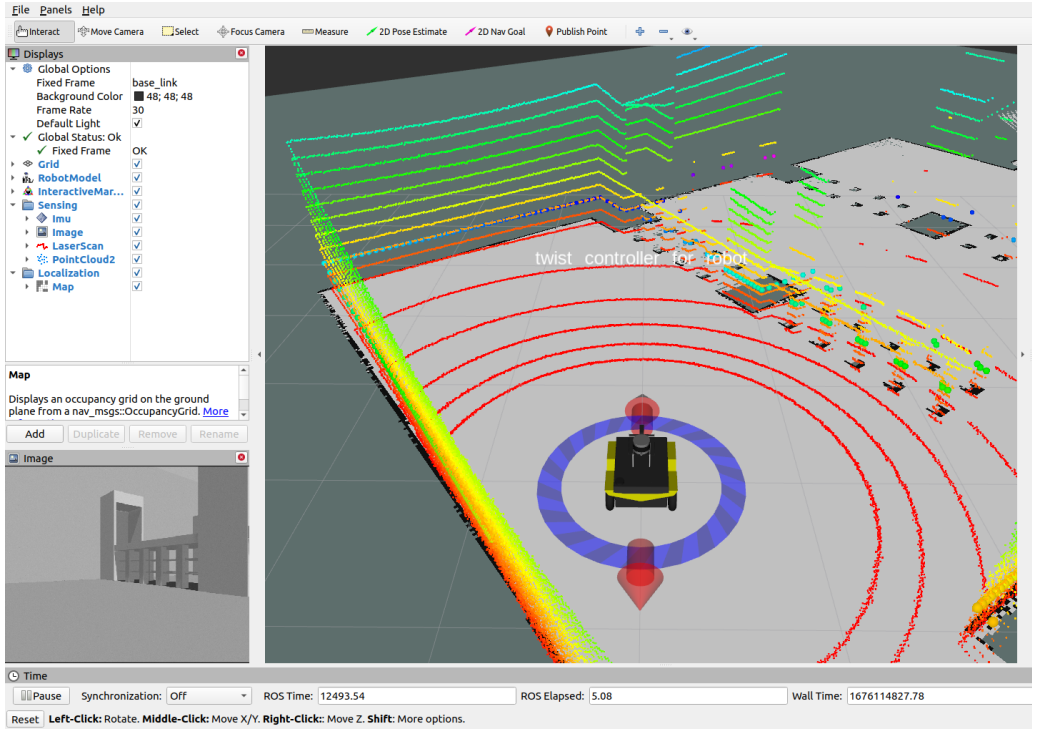


Final Project

Tasks 1: Mapping

- Map the environment using any algorithm you like
- Evaluate the performance of your SLAM algorithm by comparing your estimated odometry with the ground truth odometry

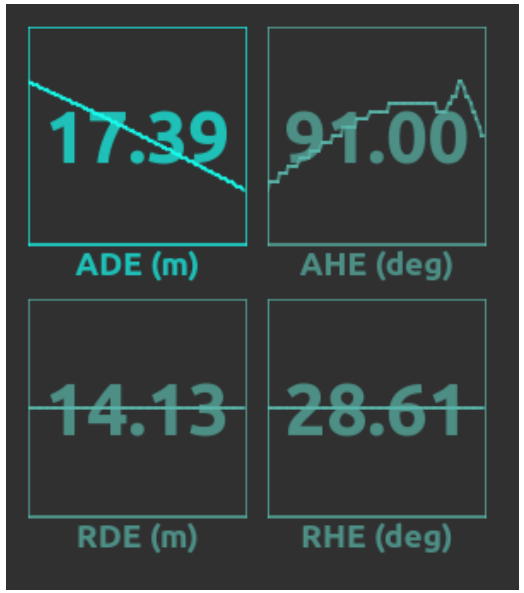
- In your report:
  - Describe your mapping pipeline in detail
  - Qualitatively and quantitatively analyse your SLAM performance (Figures and Tables)
  - Discuss the challenges you faced and your proposed solutions (with examples and comparisons)

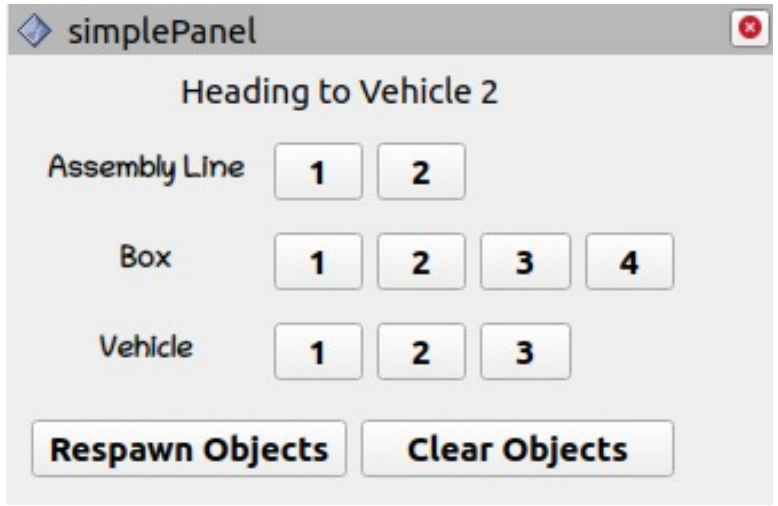


Final Project

Tasks 2: Navigation

- Navigate your robot through a given sequence of goal poses
- The accuracy is evaluated by calculating the differences between robot's final pose and the goal pose:
  - Position Error
  - Heading Error
- In your report:
  - Describe your navigation pipeline in detail
  - Qualitatively and quantitatively analyse the performance of your navigation stack in multiple metrics
  - Discuss the challenges you faced and your proposed solutions (with examples and comparisons)

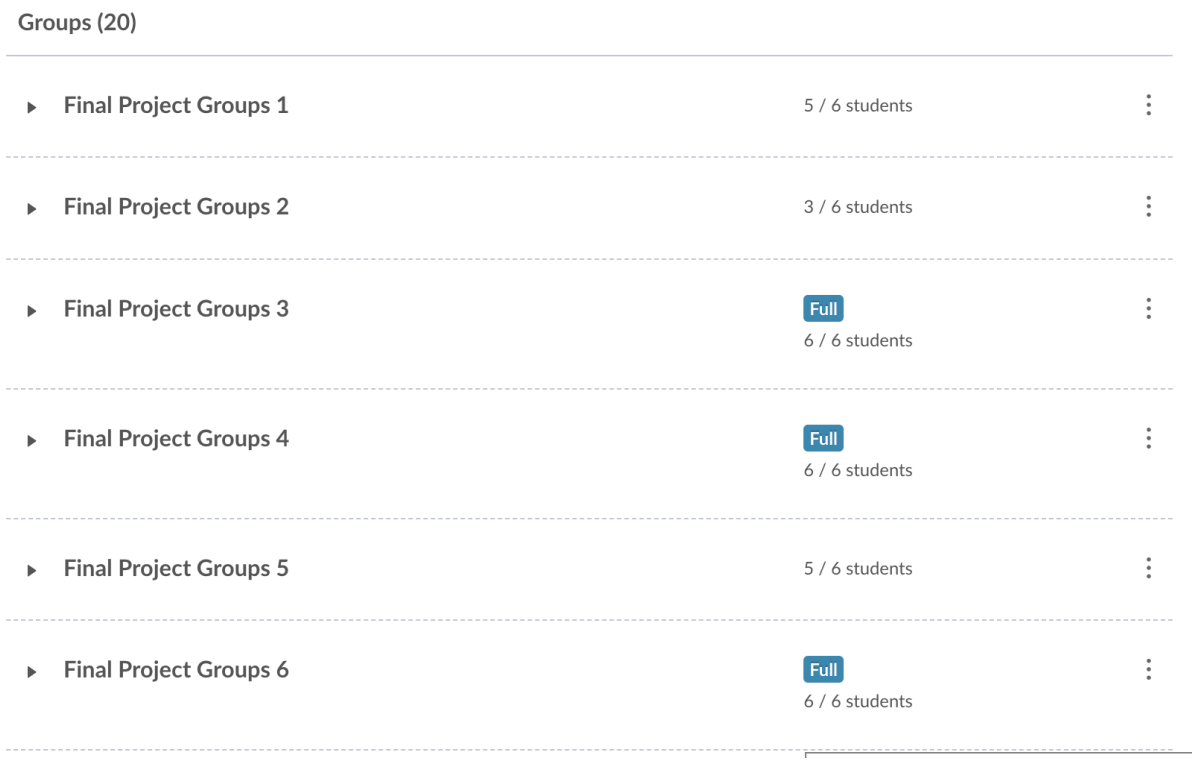




Final Project

Grouping

- Final Project groups:
  - 6 people from 2 or 3 homework groups
  - Total – 20 groups
  - Unassigned groups will be assigned by the TAs by Friday, 15 Mar 6pm
- Deadline: Sunday, 7 April 2024 23:59
- Presentations:
  - 12 April and 19 April
  - Presentation slot selection period: 8-15 Mar



Final Project

Presentation

- Presentation: 10 mins
- Live Demo: 5 mins
- Q&A: 3 mins

Date	12-Apr-24	Week 12		Date	19-Apr-24	Week 13
Slot No.	**Start Time**	**Group Number**		**Slot No.**	**Start Time**	**Group Number**
1	18:00:00			11	18:00:00	
2	18:18:00			12	18:18:00	
3	18:36:00			13	18:36:00	
4	18:54:00			14	18:54:00	
5	19:12:00			15	19:12:00	
6	19:30:00			16	19:30:00	
7	19:48:00			17	19:48:00	
8	20:06:00			18	20:06:00	
9	20:24:00			19	20:24:00	
10	20:42:00			20	20:42:00	

- Brief explanation of your robot system
  - Diagrams would be useful
  - The algorithms you used for each task
- Problems & Solutions
  - Describe the challenges you encountered and how you overcome them
  - Potential future work: how your system can be improved further
- Videos of your robot

Final Project

Submission

- Goal sequence is determined by group number.
- E.g Group 17:
  1. Assembly Line: 2
  2. Random Box: 2
  3. Delivery Vehicle: 3

- In your submission (GroupNumber.zip)
  1. Report (.pdf, 10 pages max, appendices no limit)
  2. Map file (any format)
  3. A video showing your robot running along the designated route (.mp4, less than 50 Mb)
  4. Presentation Slides (.pptx, less than 200 Mb)
  5. Link to your Github repo

Group	Assembly Line 1, 2	Packaging Area 1, 2, 3, 4	Delivery Vehicle 1, 2, 3
1	2	2	2
2	1	3	3
3	2	4	1
4	1	1	2
5	2	2	3
6	1	3	1
7	2	4	2
8	1	1	3
9	2	2	1
10	1	3	2
11	2	4	3
12	1	1	1
13	2	2	2
14	1	3	3
15	2	4	1
16	1	1	2
17	2	2	3
18	1	3	1
19	2	4	2
20	1	1	3

Final Project

Evaluation Metric

1. Peer Review
2. Overall Marking

Criteria	Ratings		Pts
Accuracy Compared to Ground Truth	10 to >0.0 Pts Full marks	0 Pts No marks	10 pts
Technical	30 to >0.0 Pts Full marks	0 Pts No marks	30 pts
Effort	20 to >0.0 Pts Full marks	0 Pts No marks	20 pts
Code Style Code Structure / Approach	20 to >0.0 Pts Full marks	0 Pts No marks	20 pts
Report	20 to >0.0 Pts Full marks	0 Pts No marks	20 pts
			Total points: 100

Final Project

FAQs

Q: Can I change the robot description file given in the project?

- Yes, you can modify the sensor configuration, by adding more sensors or new types of sensors, as well as their locations.
- However, you are not allowed to modify the mobile base.

Q: Can I use a different robot to do the mapping?

- No, it must be using the same robot mobile base. However, you can use a separate sensor configuration for mapping.

Q: Can I adjust the goal poses given in the config file?

- No in principle, but you can slightly adjust it within the vicinity (let's say within 0.1m)

Q: Is there any bonus tasks for the final project?

- If you can package your solution pipeline into a ROS pkg and publish it on GitHub, you will get bonus marks!
- Or demonstrate more advanced capabilities in this environment!