ME5413
Final Project Instructions

Friday, 21 Feb 2025

Final Project

Overview

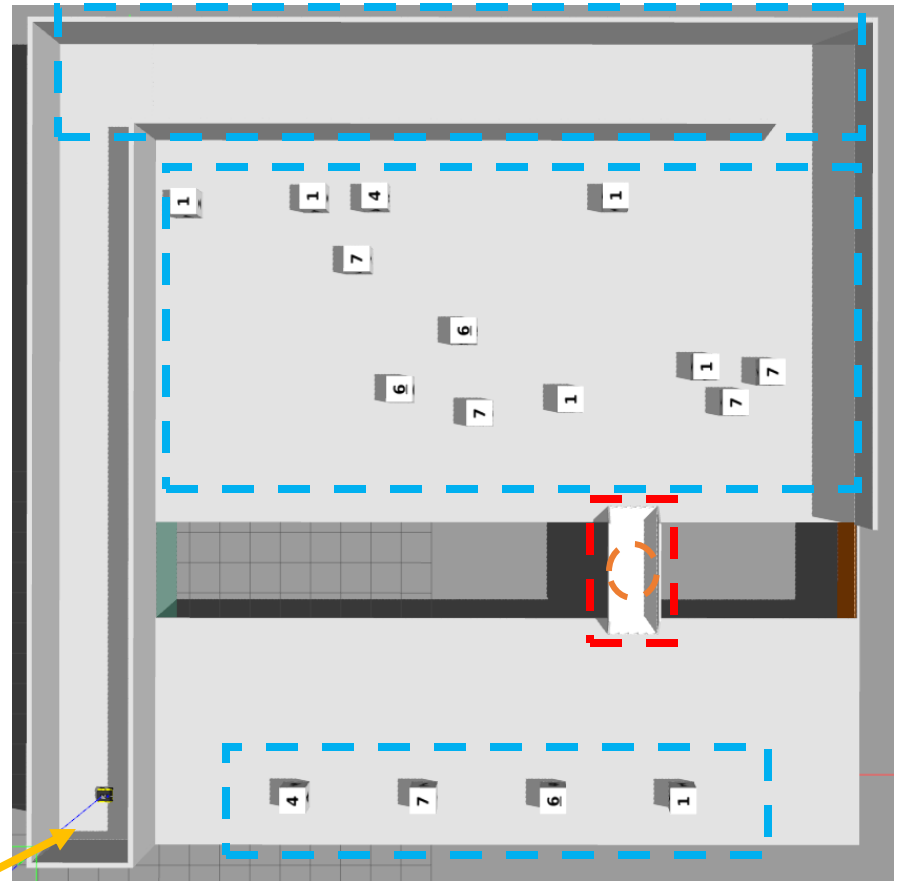
In this simulated environment:

- 1 Jackal Robot
- X randomly generated boxes
- 1 randomly generated bridge
- 1 timed blockade (10s) on the bridge
- 4 destinations

Your Task:

- Design a robot software stack that can:
  - Map the environment
  - Navigate autonomously
  - Perform the tasks on the right

1. Move & Avoid Obstacles



"Jackal"

2. Count the number of Random Boxes

3. Cross a Randomly Generated Bridge

4. Publish & Unlock the 10s timed Blockade

5. Find the Box with the least number of occurrences

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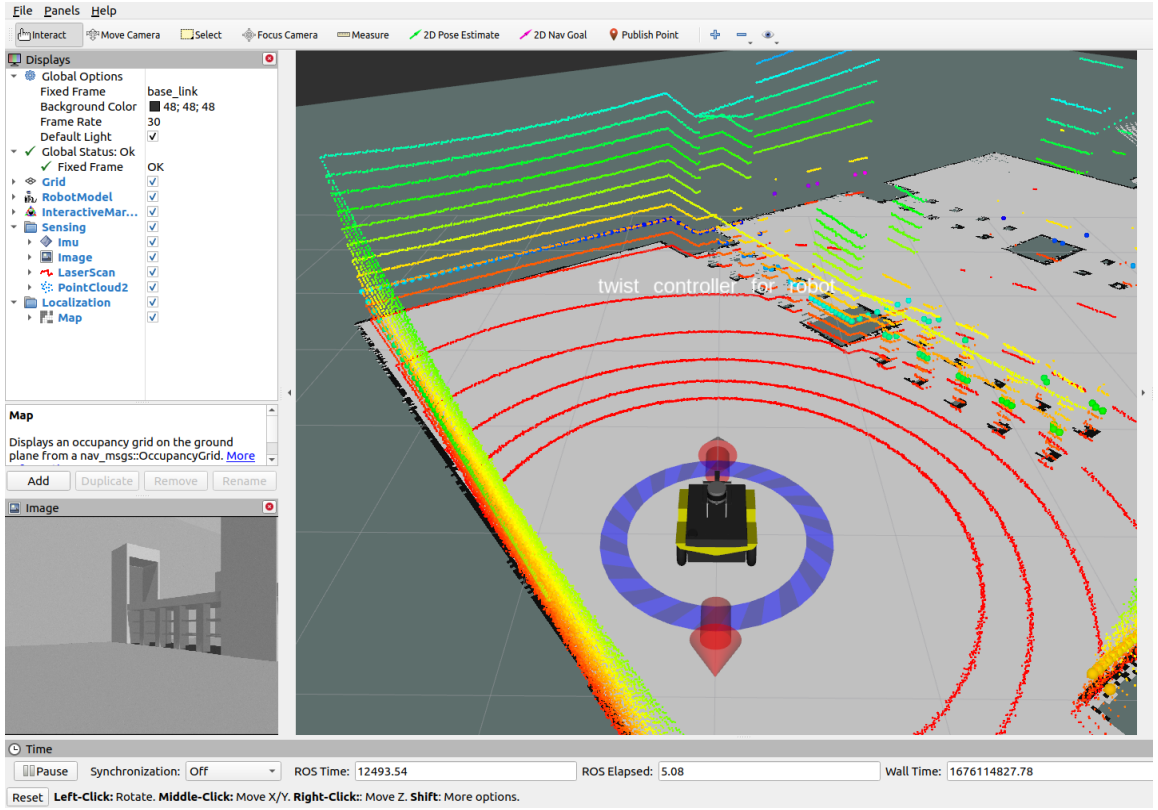
Tasks 1: Mapping

- 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)



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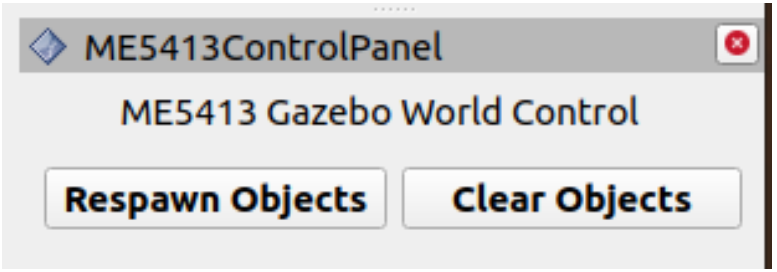
Tasks 2: Navigation

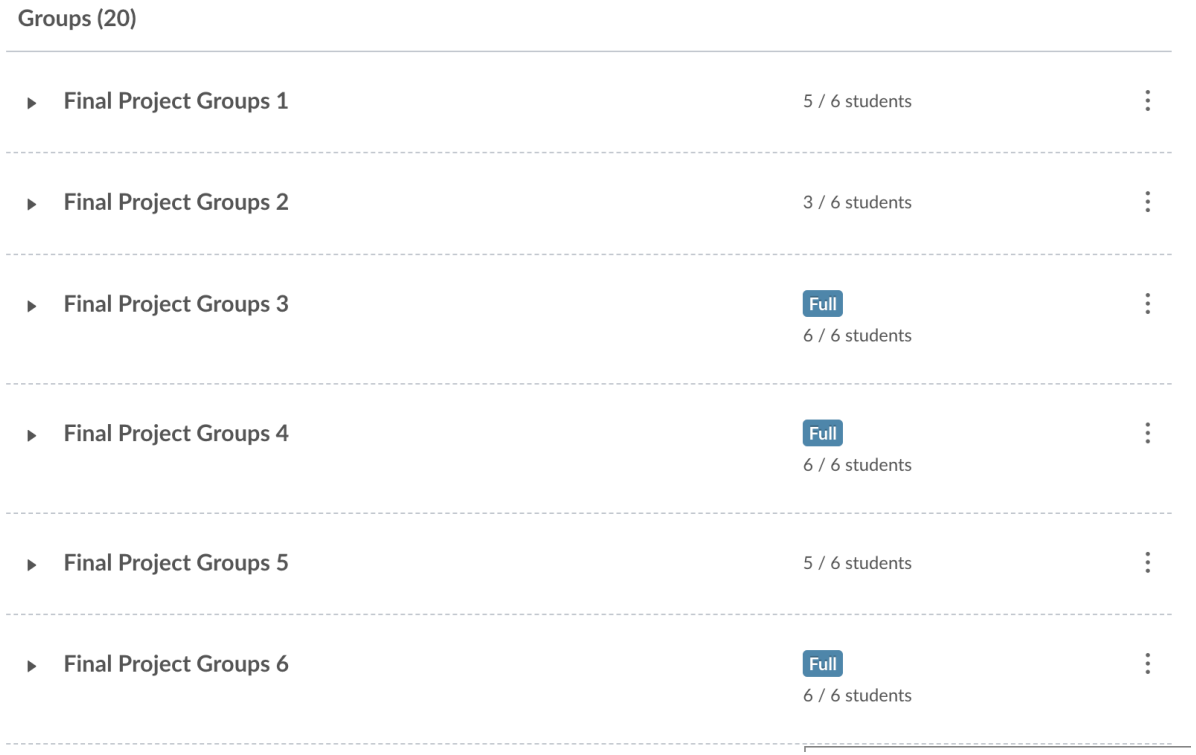
- Navigate your robot and perform the given sequence of tasks
- The score is calculated based on the number of tasks your robot can perform.
- In your report:
  - Describe your navigation pipeline in detail
  - Describe how your robot is designed to perform each task in detail
  - Qualitatively and quantitatively 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:
  - Max 6 people per groups
  - Total – 18 groups
  - Unassigned groups will be assigned by the TAs by Friday, 28th Feb 6pm
- Deadline: Sunday, 6 April 2025 23:59



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Presentation

- Presentations: (Friday 11 April)
  - Slides: 5 mins
  - Live Demo: 5 mins
  - Q&A: 5 mins
- 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
  - Show your Demo!

Date	11-Apr-25	Week 12
Slot No.	Start Time	Group No.
1	14:00:00	
2	14:18:00	
3	14:36:00	
4	14:54:00	
5	15:12:00	
6	15:30:00	
7	15:48:00	
8	16:06:00	
9	16:24:00	
10	16:42:00	
Break	17:00:00	---
11	18:00:00	
12	18:18:00	
13	18:36:00	
14	18:54:00	
15	19:12:00	
16	19:30:00	
17	19:48:00	
18	20:06:00	
End	21:00:00	---

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Submission

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 (must be public)

Rubric

Criteria	Ratings		Pts
Result Accuracy compared to the Ground Truth	10 Pts Full marks	0 Pts No marks	10 pts
Technical The correctness of your method	30 Pts Full marks	0 Pts No marks	30 pts
Effort The amount of work done	20 Pts Full marks	0 Pts No marks	20 pts
Code Style Readability; structure; naming convention; efficiency	20 Pts Full marks	0 Pts No marks	20 pts
Writing Clarity; comprehensiveness; conciseness	20 Pts Full marks	0 Pts No marks	20 pts
			Total points: 100

Final Project

Submission

Peer Review

- Everyone will rank your 5 teammates, for example:
    1. Christina
    2. Ziggy
    3. Dongen
    4. Yuhang
    5. Jiawei
- And give comments on their contributions
- Everyone's final marks will be adjusted +-%

Your review will be confidential, we won't leak it!

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 object position in the environment?

- 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!