ME5413
Final Project Instructions

Friday, 21 Feb 2025

ME5413 最终项目说明

2025 年 2 月 21 日星期五

NUS National University of Singapore | Advanced Robotics Centre

Final Project

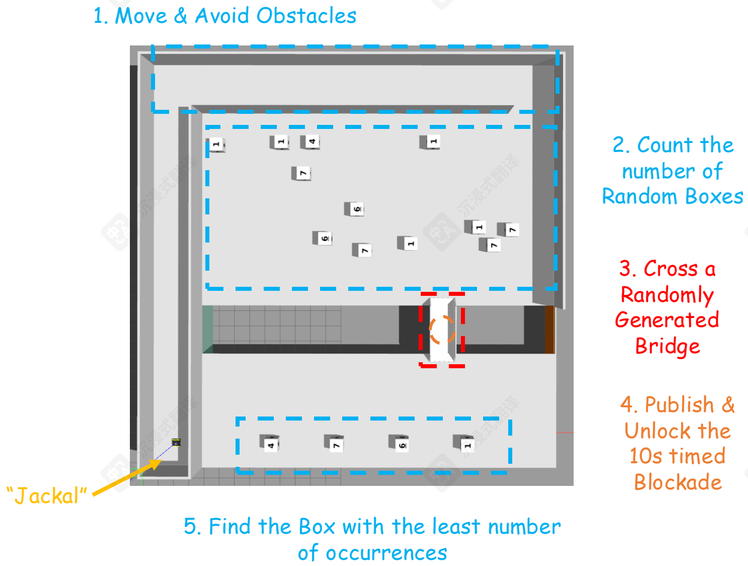
Overview

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



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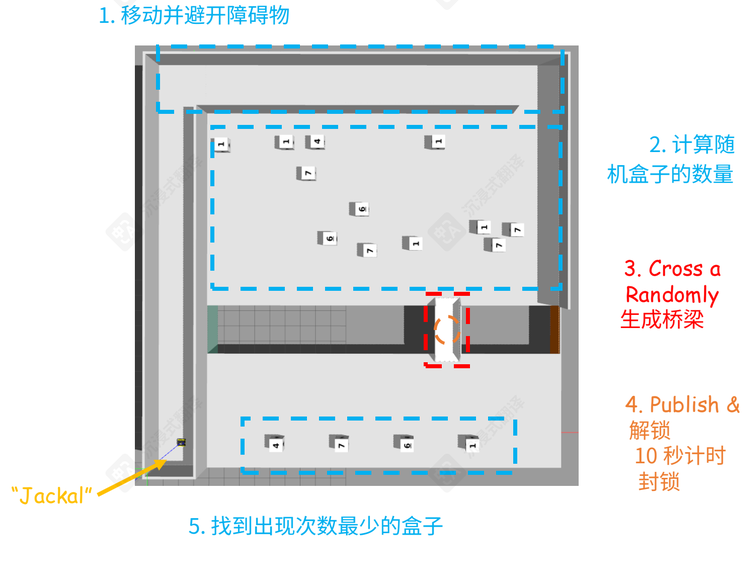
概述

在这个模拟环境中：

- 1 豺机器人
- X 随机生成的箱子
- 1 随机生成的 桥梁
- 对• 1 进行（10 秒）的桥梁封锁
- 4 目的地

您的任务：

- 设计一个能够的机器人软件栈：
  - 绘制环境地图
  - 自主导航
  - Perform the tasks on the right



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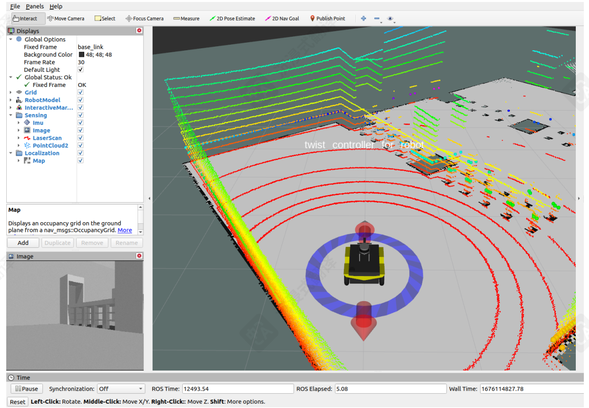
Tasks 1: Mapping

- 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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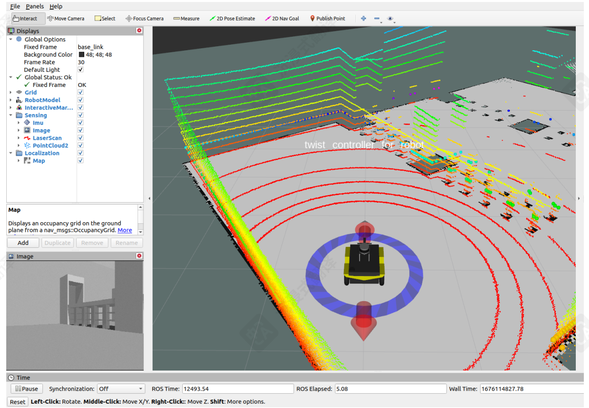
任务 1：映射

使用您喜欢的任何算法绘制环境地图

通过将您的估计里程计与真实里程计进行比较来评估您的 SLAM 算法性能

- In your report:
  详细描述您的映射流程
  对您的 SLAM 性能进行定性和定量分析（图表和表格）
  - 讨论你所面临的挑战以及你提出的解决方案（包括例子和比较）



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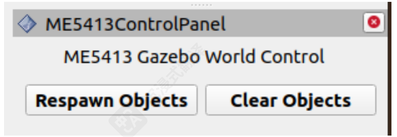
Tasks 2: Navigation

- 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)



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任务 2：导航

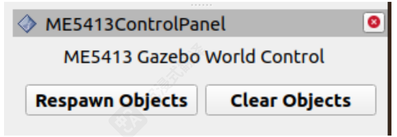
导航您的机器人并执行给定的任务序列

分数是根据您的机器人能执行的任务数量来计算的。

- In your report:

  详细描述您的导航流程。
  - 详细描述你的机器人如何执行每个任务的设计
  - 对性能进行定性和定量分析
    在多个指标下分析你的导航堆栈

  讨论你遇到的挑战以及你提出的
  解决方案（含示例和比较）



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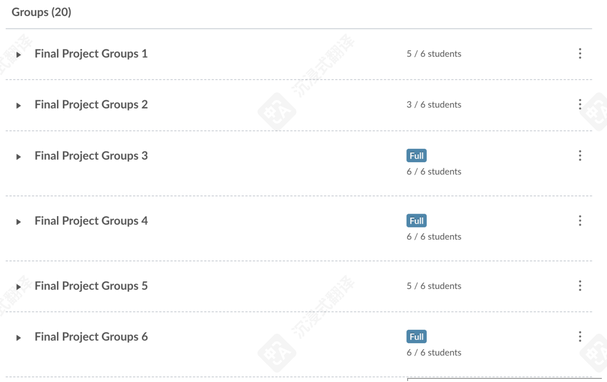
Grouping

- 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



Final Project

Grouping

ME5413 最终项目小组：

每组最多 6 人

总计 - 18 组

未分配的小组将由助教在以下日期分配：

2 月 28 日（星期五）晚上 6 点

- 截止日期：2025 年 4 月 6 日星期日 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	---

最终项目

演示

（周五 4 月 11 日）• 演示：

- 幻灯片：5 分钟
- 现场演示：5 分钟
- 问答环节：5 分钟

请简要说明您的机器人系统

图表将很有用

您在每个任务中使用的算法

问题与解决方案

描述您遇到的挑战以及您是如何克服它们的

未来潜在工作：如何进一步改进您的系统

您的机器人视频

展示您的演示！

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16	19:30:00	
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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

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提交

在您的提交中（ [组号].zip ）

1. 报告（ .pdf，最多 10 页，附录不限）
2. 地图文件（任何格式）
3. 展示您的机器人沿指定路线运行的视频（ .mp4，小于 50 Mb ）
4. 演示文稿（ .pptx，小于 200 Mb ）
5. 您的 GitHub 仓库链接（必须是公开的）

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
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Writing Clarity; comprehensiveness; conciseness	**20 Pts** **Full marks**	**0 Pts** **No marks**	20 pts

Total points: 100

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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!

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Submission

同行评审

例如，• 每个人将对你的 5 位队友进行排名：

1. 克里斯蒂

娜 2. 齐格 3.

东根 4. 余航

5. 贾伟

并对他们的贡献提出评论

每个人的最终成绩将调整 +-%

您的评审将保密，我们不会泄露！

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!

Final Project

FAQs

问题：我可以更改项目中给出的机器人描述文件吗?

是的，您可以修改传感器配置，通过添加更多传感器或新类型的传感器，以及它们的位置。

然而，您不允许修改移动底盘 .

问题：我可以使用不同的机器人进行制图吗?

不，它必须使用相同的机器人移动底盘 . However, you can use a separate sensor configuration for mapping.

问：我能否调整环境中物体的位置?

原则上不行，但您可以在附近稍微调整（比如说在 0.1 米范围内）

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!