Final Project

Assigned on October 8, 2023
Due in Week 16

Learning Outcomes

Why do we have a project in this course? The project gives you a chance to experiment with the algorithms and ideas studied in class in a real setting. This project is connected to CLO-4/C-5, as stated in the course syllabus. By the end of this project, you'll be able to achieve one or more of the following:

(a) develop a robotics project from start to finish;

(b) highlight the advantages and limitations of one or more algorithms utilized by mobile robots in a specific setting;

(c) investigate and become familiar with the terminology and current research in the domain of mobile robotics;

(d) tune standard algorithms to perform well in real settings;

(e) use new open-source tools/software, created and utilized by mobile robotics researchers, effectively.

Project Topic

You are encouraged to come up with your own project ideas and work on a project you're really passionate about. You're expected to design a complete mobile robot system for a chosen application in simulation. The project work is expected to primarily be computational, but you're welcome to develop a physical robot (if you're interested, talk to your instructor asap). Some possible interesting opportunities during the course of this project could be:

- Comparison of two or more algorithms in simulation environment

- Implementation of one or more algorithms on a physical robot

- Exploration of a tool/software in-depth

- Comparison of two or more algorithms using real datasets

Teaming

This is a team project. The exact number of group members is up to you, as long as the maximum number of members is four.

Deliverables Overview and Timeline

1. Project Proposal, 2% (October 20, 2023)

2. Functional Architecture, 3% (November 3, 2023)

3. Teaser Video, 2% (December 8, 2023)

4. Final Paper, 10% (December 8, 2023)

5. Code, 3% (December 8, 2023)

6. Individual Learning Goals, 10%

   - Identification of learning goals, 2% (October 20, 2023)
   - Revision and assessment plan, 2% (November 8, 2023)
   - Reflection and assessment, 6% (December 8, 2023)

Deliverables Details

- **Project Proposal**

  - This document describes the initial proposal and viability of the project.
  - Who is on the team?
  - What is the main idea of the project?
  - Why does your team want to pursue this project?
  - What are the constraints of the environment in which your robot will be operating? Does your system involve infrastructure changes to the environment?
  - What are the minimum functions that your robotic system will be performing (MVP)?
  - What topics/frameworks/algorithms are you planning to explore? (this can be fuzzy)
  - Outline a timeline for the major milestones of your project.
  - What are the biggest risks to you being successful on this project?

- **Functional Architecture and Testing Plan**

  - You'll expand the functional architecture submitted in the previous submission.

  - Each function from the previous diagram is to be expanded to outline all the sub-functions. The expansion is to continue to a level where it is clear how each function will be implemented.

  - You'll also outline a testing plan for the major functions of your design. The results of these tests are what are going to be included in your final documentation and what you'll use to convince your audience of your accomplishment.

  - Revise you timeline in light of this detailed functional architecture.

  - This is a sanity check for yourself that you indeed have started to make progress on your project and are on the right track. It is an opportunity to get feedback and discuss any revisions you may have made in your project goals.

- **Final Paper**

  - You'll submit your final documentation in an IEEE conference style (`http://ras.papercept.net/conferences/support/tex.php`) paper.

  - Your paper will include the problem formulation, its importance, what does your system do?, system architecture (details of different components of your project and how they fit together), results, and analysis of results.

  - Make sure to touch upon both code structure and algorithms.

  - Hopefully, you'll also have some graphics and videos to include in this paper.

- **Code**

  - Each group will be required to make their code publicly available on a git repository.

  - The code should be well-commented.

  - It should be accompanied by a comprehensive README.md or a webpage explaining the details.

- **Teaser Video**

  - This is a short video (not more than 2 minutes), in which you'll explain the problem that you have worked on and what you have achieved in your project.

  - The idea behind the video is that it should excite your peers to read your paper.

- **Individual Learning Goals**

- **Identification of learning goals.** Write up a list of three goals that you, as an individual, wish to achieve during the final project. Each goal's description should at most be one paragraph. These goals can take any form as long as they represent your own interests and learning objectives for the project. Explain what you hope to do or learn, how you will achieve it, why is it important to you. Make sure that each goal is stated in a clear manner, it is achievable, and you will be able to determine if you've achieved it and how well. These individual goals should also be reasonably aligned with the project goals. If you think there is a misalignment between project goals and your goals, comment on the reason and if something could be done to align the two.

- **Revision and Assessment Plan.** As the project gains definition, each of you may wish to revise your respective individual goals. This is the point to revise them or add clarity to your previous descriptions. You'll also be required to submit an assessment plan for each goal at this stage, i.e. How will you/I know that you have achieved each of your goals? How will we know how well have you achieved it?

- **Reflection and Assessment.** At the end of the project, each of you will assign yourself a grade that indicates how well you think you achieved your goals, and submit a narrative reflection explaining your progress towards each goal. This document should devote a section to each of your goals. Each section should include:
  * What is the goal?
  * What was the assessment plan?
  * Provide evidence in support of your achievement of that goal. This could be samples of code, link to a video, or a description of an activity you did.
  * How does the evidence link to your assessment plan?
  * What grade will you give yourself for this goal?

Grading:

Rubrics for each submission will be shared on Canvas.

Resources

Conferences

- ICRA
- IROS

- RSS

- IFRR (`http://ifrr.org/`)

Journals

- IEEE Transactions on Robotics

- IEEE Robotics and Automation letters

- Autonomous Robots

- Robotics and Autonomous Systems

Datasets

- IEEE Dataport

- `https://radish.sourceforge.net/`

- `http://www-personal.acfr.usyd.edu.au/nebot/victoria_park.htm`

- I'll add more later.