COSC81/281 – Principles of Robot Design and Programming – Fall 2021

Final project

The purpose of this document is to describe the objectives and the requirements for the final project.

The **main goals** of the final project are to give the opportunity to integrate several components together and to explore in greater depth some aspect of robotics. In general terms, the expectations are:

- The final project should be related to the content of the course: you could extend or refine a method we have seen in class or propose something totally different that ties with your interest and existing research project.
- The idea should demonstrate an integration of different components to enable more complex robot behaviors.
- The final project should include an **implementation** in simulation and/or with the real robot.
- The project should include a report in the form of a research paper, including citation of related work (details are at the end, and also will be discussed in class).
- The final project can be carried out as a team of max 4 people and the roles should be clearly identified. Each should have a role in writing code, presenting, and the report.

Examples of project include:

- The explorer: the robot starts in an unknown map and needs to build the full map of the environment.
- The patroller: the robot patrols a specified area, looking for intruders. If an intruder is spotted, it takes appropriate action.
- The follower: the robot should track an object and have the capability that when the target is lost (e.g., when turning a corner), after the object comes back into the scene, the robot should continue tracking the object or human. The robot should also be able to adjust its speed/distance according to the speed of the target.
- The deliverer: the robot will deliver packages from one pod to another. It will receive a sequence of people and places associated to location in the map. The robot should deliver such packages and must plan a path around the world to deliver the packages to the correct people and places.
- Maze escaper: the robot should be able to find its way out of a maze.

Note that these are ideas and assumptions should be identified. Stage is the simulator that can be used. For exploring other simulators, Gazebo is a 3D simulator that can be used http://wiki.ros.org/gazebo_ros_pkgs.

To write the report, including the parts that will be in the final report use the following IEEE template (also uploaded on Canvas):

LaTeX: http://ras.papercept.net/conferences/support/tex.php

Word: https://ras.papercept.net/conferences/support/word.php

To help you progressing, intermediate submissions are required in addition to the final report and code.

1. Proposal presentation. Due date and score, please see them on Canvas.

Each team is expected to propose an idea for a project, motivated by an application or open problem and described with a potential approach. Metrics for project success should be outlined. The project scope must scale according to the number of students in the team, and the individual contribution of each team member must be clear. The team should submit the presentation the day before the presentation. If not able to attend, submit a video.

Send before the due date the team composition. Slack can be used to form teams. The course staff is happy to help in case there are any problems.

Evaluation criteria:

- Is the presentation submitted on time?
- Content:
    - Does the topic relate to the content of the course in a meaningful way?
    - Does the proposal motivate the idea by an application or open problem?
    - Does the proposal describe a potential approach?
    - Does the proposal describe the metrics for project success?
    - Does the proposal show the contribution of each team member?
- Form:
    - Did the presentation make good use of the available time?
    - Did the presentation stay within the time constraints?

2. Related work/problem statement/proposed method. Due date and score, please see them on Canvas.

After deciding on the topic, submit the related work section of your report (approximately one page, not counting references cited), briefly describing “What has already been done on the problem addressed?”. Use complete references, and format them appropriately, similarly to the paper provided as an example.

Submit the formal problem statement, including assumptions made, and the proposed method. Both related work, problem statement, and method will be part of your final report.

Evaluation criteria:

- Does the report adequately summarize the current state of research in the topic area?
- Are there sufficient references?
- Are the references to published academic research?
- Are the references complete and appropriately formatted?
- Does the report clearly articulate the problem with its input and output?
- Does the report clearly articulate the assumptions?
  Does the report clearly indicate the proposed method?

3. Final Demonstration. Due date and score, please see them on Canvas.

The team should present the results obtained through a short presentation (the time will be decided according to the number of teams). If not able to attend, submit a video. It should:

- Give a clear statement of the problem.
- Give a concise description of the approach.
- Show the implementation and the degree of success with a live demo. The team should submit the day before the presentation and the code.

Evaluation criteria:

- Are the presentation and code submitted on time?
- Content:
    - Does the presentation clearly state the problem?
    - Does the presentation give a concise description of the approach?
    - Does the presentation include a live demo?
- Form:
    - Did the presentation make good use of the available time?
    - Did the presentation stay within the time constraints?

4. Final report and code. Due date and score, please see them on Canvas.

A full report in a research paper format that includes introduction, related work, problem statement, description of the approach and implementation, experiments, and conclusion must be submitted.

Evaluation criteria:

- Presentation
    - Is the paper complete? Correct length and format?
    - Is the writing style appropriate for an academic conference or workshop?
    - Is the paper free from grammar problems and typos?
    - Are appropriate, helpful figures included?
- Introduction
    - Does the introduction clearly state its objective?
    - Does the introduction clearly state the motivation?
    - Does the introduction highlight the work done?
- Literature
    - Does the paper cite relevant related work?
    - Does the paper explain its relationship to existing work?
- Method
    - Is the proposed algorithm stated clearly?
    - Are there sufficient details to understand and evaluate the method?
- Experiments
    - Is the experimental setup clearly described?
    - Does the paper discuss the observed effectiveness of the proposed method?
- Implementation:
    - Is the implementation complete and correct?
    - Does the implementation match the problem statement given?
    - Is the code clean and efficient?