

CSE 397/497-011

Real-time Image Processing for Autonomous Robot Systems

Final Examination: The RIP Grand Challenge (v.0.1, 31 Oct 06)

Exam Date: Thursday, 07 Dec 06, 0755 AM, PL450

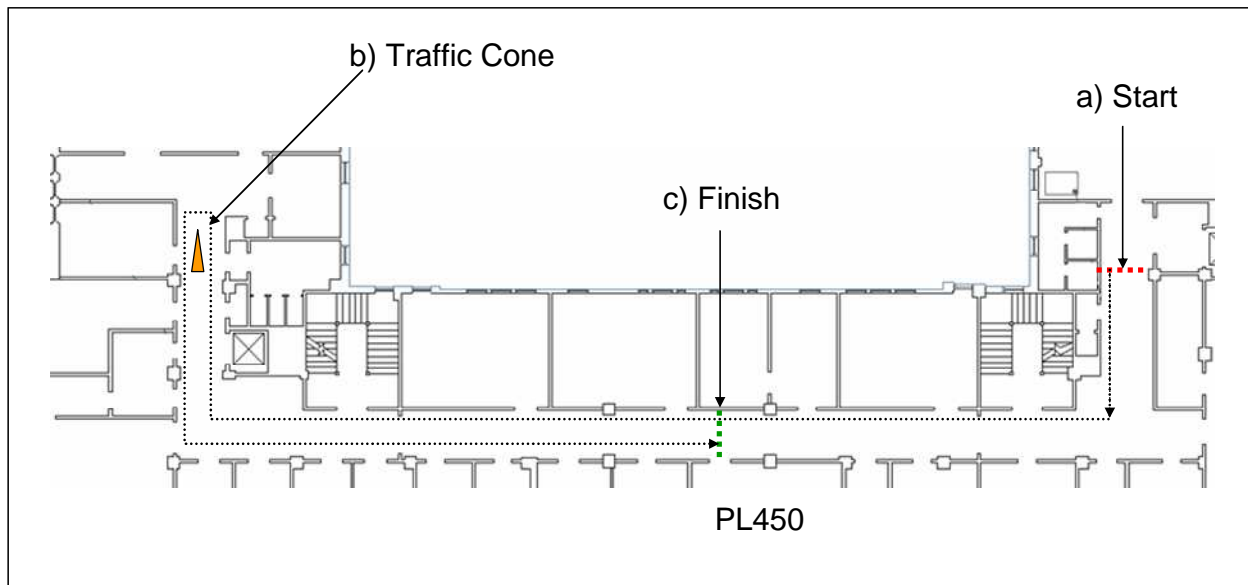


Figure 1: Course route for the RIP `06 Grand Challenge

A. Objective:

1. Integrate the algorithms implemented and discussed during class to derive a purely vision-based navigation solution to the RIP Grand Challenge.
2. This is your final examination, and is worth 20% of your grade. Final grades will be based on both the competition results and individual efforts.

B. Rules:

1. Hardware:
 - a. All students will be using the Pioneer P3-AT platform for this exam (Figure 2).
 - b. The P3-AT will rely entirely upon images from the Sony PTZ video camera for sensing.
 - c. No changes to the robot hardware are permitted.



Figure 2: Pioneer P3-AT to be used for all trials.

2. Software:

- a. Students are required to use the image processing library available on the computer. This includes a version of OpenCV, as well as an imaging library similar to what we have used in class.
- b. Installation of any other software is prohibited unless approved a priori by the referee.
- c. If additional software is installed, all teams will have access.

3. The course race is outlined in Figure 1 above.

- a. The robot will start at the west end of the 4th floor of Packard Lab (point a).
- b. It will navigate the corridors and migrate to the east end of PL. At this location there will be a small orange traffic cone (point b). For the run to be marked as successful, the robot **MUST** circle this traffic cone. These cones are available in the lab for your use.
- c. The robot will then proceed back towards the west end of PL. The finish line will be the doorway to the VADER Lab (PL450 - point c). The robot need only cross this line.

4. Each team will have three trials to obtain a successful run. The fastest time will be the team's official race time.

5. Unsuccessful runs will be ranked via the following hierarchy

- a. Completed route but failed to circle cone.
- b. Percentage of route complete while maintaining forward progress.

6. Trial Termination: A team's trial will end when any of the following occur:

- a. Successfully completes the course
- b. E-stopped due to impending collision.
- c. Collision with a wall, doorway, or other obstacle.

- d. Lack of forward progress: “Forward progress” is defined as progressing along the race route - i.e. increasing the percentage of the route that has been completed over time. The referee will establish the timeout period for forward progress.
- e. The maximum time to complete the run (5 minutes) is exceeded.

7. Source Code:

- a. Each team will provide the referee with an executable file, configuration file, etc. in a single directory at the beginning of the race.
- b. Source code may NOT be recompiled between trials.
- c. Teams are permitted to adjust parameters in a configuration file between trials SO LONG AS THIS DOES NOT REQUIRE THE SOURCE TO BE RECOMPILED. These are the only changes permitted to the team submission between trials.
- d. Image files may be included with your submission.

8. Revisions:

- a. This is a living document. The referee (Professor Spletzer) can make amendments to these rules at any time.
- b. Referee decisions regarding race conduct and results are final.

C. Turn-in / Grading:

1. This project constitutes your final exam and is 20% of your grade. THIS IS NOT A TRIVIAL TASK. If you do not make an effort, you WILL fail this exam. START IMMEDIATELY!
2. In addition to the executables for race day, each TEAM is required to submit a report outlining their approach. This should include, but not be limited to: results such as algorithms used, frame-rates achieved, performance during the challenge, performance during practice runs, problem solving, lessons learned, etc.
3. The team report is due 15 Dec 06.
4. Prior to the last day of final exams (20 Dec 06), each GRADUATE student is required to meet with Professor Spletzer to discuss their team’s outcome.