E160 – Autonomous Robot Navigation
2016 Competition

Introduction

1. OVERVIEW
The goal of this competition is to have students program their Jaguar Lite robots to autonomous navigate through a series of milestones spread across campus.

2. RULES
The following rules must be followed or face possible disqualification:

- Teams will be in groups of 2 or 4.
- Each team must program the robot to navigate across campus through a series of milestones.
- Each team will have 10 minutes to complete the course
- The robot should not travel faster than 0.50 m/s
- Milestones are considered reached by a robot if the entire robot's footprint passes into the milestone region.
- Any algorithm may be used.
- Teams will be disqualified for intentionally interfering other robots.
- Teams may only communicate twice with the robot during the competition, once to start the robot, and once to stop the robot. (Exceptions include scenarios involving safety).
- Hardware modifications are allowed provided they don't cause permanent damage/alterations to the robot and cost less than 40$. Such spending is to be covered by the students.
- Teams can modify the course for their own competition trials. The modification can only occupy a volume of 0.3m x 0.3m x 0.3m of the course space. The modification can be broken down into at most 3 parts. The modification must be stationary.
- There are multiple attempts allowed to qualify.
- There are only two attempts at the race.
- **The instructor has the final say on all rules and judging.**

3. COMPETITION POINTS
The team with the most points from their best of two final competition trials wins.
- 1 point will be awarded for every milestone achieved.
- 0.5 points will be taken away for every collision
- Points for achieving milestones can be obtained in any order.
- Points for achieving milestones can only be achieved once.
- Ties are broken in matches by determining who arrived at milestones first.

If there are any questions about rules, please ask the instructor before spending time on a strategy.

4. COURSE DESCRIPTION

The final course milestones will not be released until 24 hours after the qualification round. The start and next four milestones are shown below in Figure 1. All other milestones will be released within 24 hours of the qualification round.

5. ROBOT MODIFICATION

Each team must make at least one software or hardware modification to the jaguar robot system that is beyond what is required during the 5 labs. Students must present their proposed modification to the instructor with a presentation that should last no longer than 10 minutes. Be prepared to justify your modification either with educational goals or for competition strategy. Also, be sure to present technical justification regarding the feasibility of your modification.

Example modifications include:

- Implementing KF Localization
- Fusing gyroscope measurements into the PF
- Implementing SLAM
- Image processing system
- Constructing a differential GPS
- Etc.

During the final week of the semester, students are also required to present their modification to the entire class and its performance. A .ppt template will be provided.

6. IMPORTANT DATES

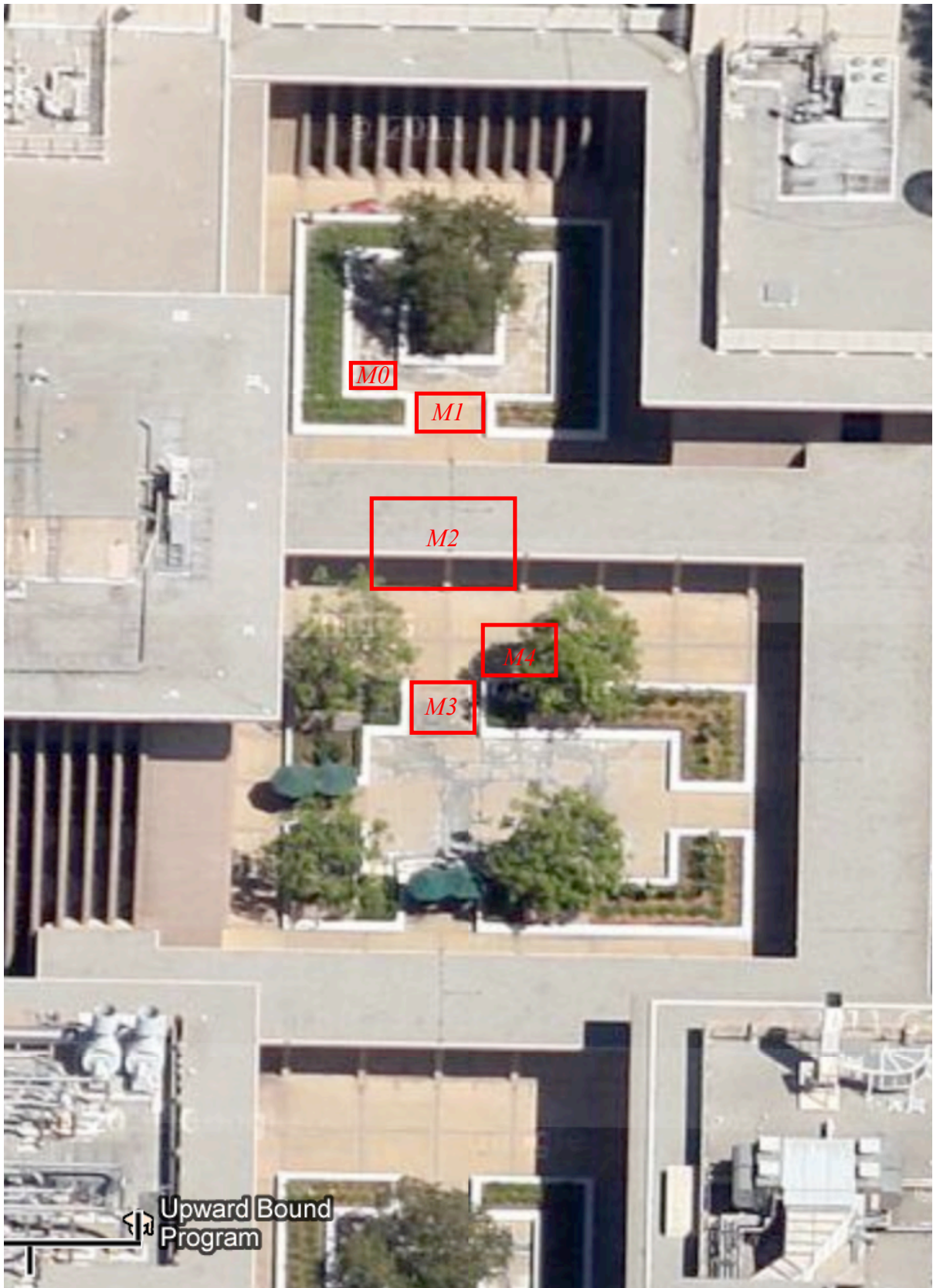| Deliverable	Due Date	
Competition Rules Released	10:00pm	Sunday, April 3rd, 2016
Preliminary Project Presentations to Professor	1:15pm	Thursday, April 7th, 2015
Qualifying Round	1:15am	Tuesday, April 19th, 2015
Final Competition	1:15pm	Tuesday, April 26th, 2015
Final Project Presentations	1:15pm	Thursday, April 28th, 2016

Figure 1: Course map.

7. GRADING

The competition is worth 25% of each student's final grade. Note, at the end of the course the instructor will request each student to email the percentage contribution that each student made to their group. This may affect competition grades.

Deliverable	Grade Points Breakdown (25 total)
Preliminary Presentation (2 grade points)	
Technical soundness of system modification	1
Novelty and relevance of system Modification	1
Qualifying Round (5 grade points)	
Starting at milestone $M0$	1
Receiving n of 4 competition points	Max(0, n)
Final Competition (12 grade points)	
Starting at milestone $M0$	1
Receiving n of 9 competition points	Max(0, n))
If p is the placement in the class	Max(0, 3 - p)
Final Presentation (6 grade points)	
Presentation format, spelling, speaking	2
System Modification Level of Difficulty	1
System Modification Performance Results	3