Overview

The goal of the mobile robotics final project competition is for each team to design a fire search robot. The robot will use localization, search, path planning and execution to rescue a lost (or kidnapped) robot, identify a light/heat source, drive the robot home and report on the location of the source. This would be akin to a sniffer robot entering a home to find the fire source and then reporting the location back to the firefighters at the entrance to the building.

The Game

The robot will be placed in the world at an unknown position, indicated as 'home'. All home positions will be a gateway in the world such as a dead end, corner, hallway or T-junction. The robot should then use a localization algorithm such as Partially Observable Markov Decision Planning with an a priori map to identify its place in the world. The robot should then make a distinctive audible signal or turn on a LED once the current position in the world is identified. The robot should then search the world to find the heat/light source. Once again, the robot is within 18" of the source it should make a distinctive audible signal or turn on a LED to indicate that it has found the source. Finally, the robot should then use a path planning algorithm such as wavefront propagation to move the robot back to the original start (home) position and indicate the source's location in the world on the LCD screen.

The Race

Two robots will be placed in two identical 6' x 6' worlds with 18" x 18" obstacles. The robots will be placed in the same home position and the beacons will be placed in the same location in both worlds. The robots will race to find the heat/light source and return home. The robot with the highest score will win the heat. This will be a double elimination competition so there will be a winner's bracket and a loser's bracket.

Heats

Each heat will be a maximum of 3 minutes. If neither robot has located the heat/light source and returned home by the end of 3 minutes, then the round score will be calculated on the portion of the task completed and both teams will earn the maximum time score. Each team is allowed one mulligan during the heat. A mulligan is one small adjustment to the robot's position to correct for odometry error. This may include a small nudge to the left, right, forward or back. The validity of the mulligan adjustment will be at the discretion of the judges.

Set Up Time

Once a heat has concluded, the next 2 teams have exactly 2 minutes to get their robots in the arena. Teams that are not ready in the ring at the bell forfeit that round and earn a score of zero.

World Map and Arena

The competition maps *(.txt format)*, topological and occupancy grid, will be uploaded onto Moodle and accessible no earlier than **12 am on Monday, 2/11/13**. The map will be a 4 x 4 array of integers encoded to represent the presence or absence of walls and obstacles. This map will represent a 6' x 6' arena with 18" x 18" cells. The robot's center of rotation will be placed in the starting cell at run time. The team has the option of selecting the robot's

orientation within the cell. The heat/light source beacon will be placed in any free cell in the world.

Seeding

The time trials for the competition seeding will be on **Tuesday, 2/12/13** in the Kahn room in the Union. All teams will be ranked from highest to lowest based upon their performance. They will then participate in a double elimination bracket, the bracket will be provided at the beginning of the elimination rounds.

Scoring

The team's score will be based upon the robot's ability to localize, find the source, identify the source's location, plan a path and then efficiently and accurately execute the path. The score breakdown is as follows:

- Localization (L) - 100 pts
- Find Source (F) - 200 pts
- Plan Path Home (P) - 300 pts
- Correct Source Location (S) - 400 pts
- Path Execution Time (T) - deduction in seconds
- Wall or obstacle hit (H) - 20 pt deduction/hit
- Distance from home (D) - 10 pt/inch from center of home cell

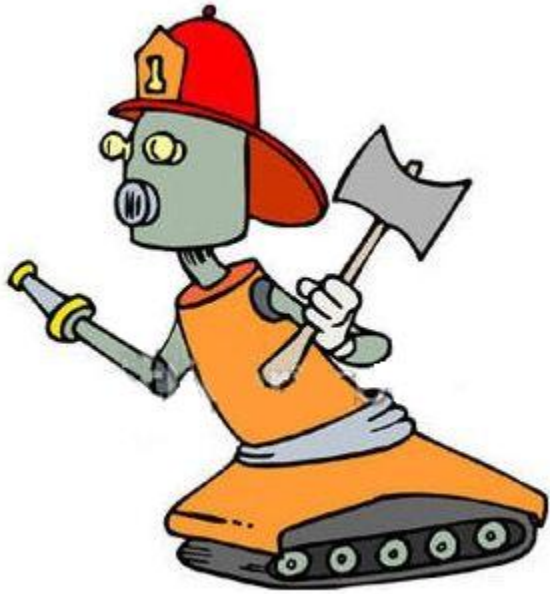The total team score is found by using the following formula:

$$SCORE = L + F + P + S - T - 20H - 10D$$

The team with the most points at the end of the heat wins. If there is a tie at the end of the heat, the two teams will start the round again with a new start position and goal location and continue this process until the tie is broken.

TEAMS

Robot	Members
Arbib	Devon Fritz, Ben Paras
Arkin	Ander Solorzano, Ruffin White-Magner
Asimov	Kyle Bristol, Brandon Kmetz
Braitenberg	Bradley Quamme, Amy Schleter
Brooks	Christina Powell, Evan Wilson
Edison	Kim Handoko, Igor Marques
Einstein	Peter Cisneros, Nick Zalah
Franklin	Kevin Collins, Colan Dray
Minsky	Vasileios Avramelos, Christian Joerg
Moravec	Lucas Araujo, Blake Vermillion, Dan Wiegand
Tesla	Robert Helfrich, Michael Pauly

The A-maze-ing
Fire Bot Race

Thursday, 2/14/13
2:30 p.m.