ECE 8843 Fall Semester, 2011

HOMEWORK 4 – ROBOT PATH PLANNING

Assigned: Nov. 9, 2011 Due: Nov. 23, 2011 – 3:05pm

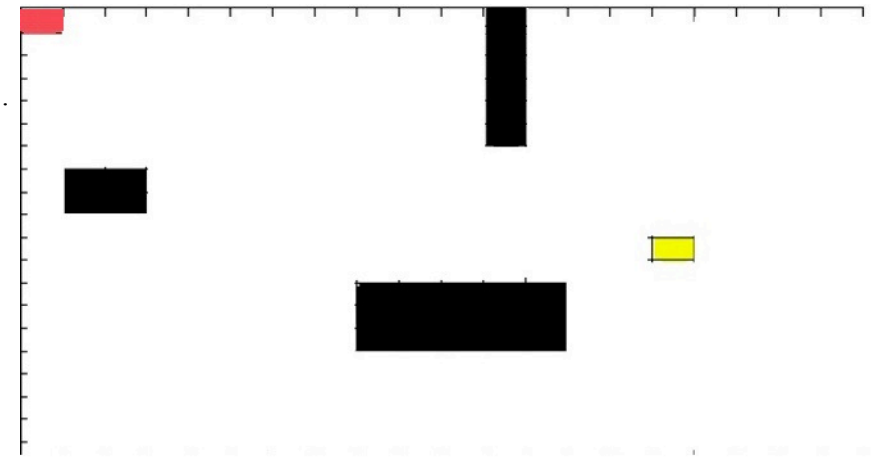
Robbyna is a robotic explorer located somewhere on a distant 2-dimensional planet. Unfortunately, she has been assigned to explore the most boring planet in the known universe. Having a perfectly rectangular surface, the planet holds no surprises for a would-be explorer. However, she has recently received a distress call from an astronaut who has crash-landed somewhere on the surface of the planet. Her goal is to utilize a path planner that outputs a set of *x, y* waypoint positions from the starting position to the goal position.

A. SETTING UP EVERYTHING. Obviously, for the path planner to function correctly, it needs to load the map of the environment into memory. The world map in which the robot will navigate is defined by the following parameters:

Origin x_position y_position orientation width height
Defines the starting (x,y, theta) position and size (width/height) of the robot
Goal x_position y_position theta
Defines the (x,y) location of the goal position
Obstacle x_position y_position width height
Defines the width and height of an obstacle, starting at (x,y)

And example "Planet.wld" as provided on t-square, and the corresponding map "Planet.jpg" is as shown.

Origin 0 0 0 1 1
Goal 15 10
Obstacle 8 12 5 3
Obstacle 1 7 2 2
Obstacle 11 0 1 6



B. GROWING OBSTACLES - You must write a function that grows the obstacles in the grid map, so that your path planner can represent the robot as a point.

C. ROADMAP MOTION PLANNING - Once you have your map in memory, and have grown the obstacles, you are ready to implement your path planner. Step 1) Discretize the space using either

Visibility Graphs, Voronoi diagrams, or Probabilistic Roadmaps. Step 2) Apply a search method (e.g. A*, breadth-first, etc.) to find a set of waypoints that enable to robot to traverse from the start to the goal position.

D. TEST COMPLETE SYSTEM. Test your complete system using the world map setup described earlier. Your resulting code should output a set of waypoint that transitions the robot from the start to goal position.

E. WRITE UP: PROVIDE THE FOLLOWING (submit as a single pdf file called *yourlastname*.pdf): 1) Resulting image or graph of your configuration (after growing the obstacles). Make sure to document the resulting dimensions of the obstacles. 2) Resulting image or graph that represents your derived roadmap. Indicate which roadmap method you used. 3) Resulting image or graph that highlights the path from start to goal. Make sure to indicate on the image/graph the waypoints found from using your search method.

F. SUBMISSION. For homework credit, turn in your code, a README documenting how to run your code, and your .pdf writeup.