Assignment 5, Due December 5th, 2011



Assignment 5, Due December 5th, 2011
(Worth 10%)

In all the questions use the provided Boebot robot.
This is a team assignment.

1) **35%**) Use the BoeBot robot to implement a random walk guided by the sonar sensor. Keep the sonar pointing forward and keep sensing until you come close enough to an obstacle, then stop and perform a random rotation, then continue driving forward. While driving use the speaker to emit a sound inversely proportional to the measured sonar distance.
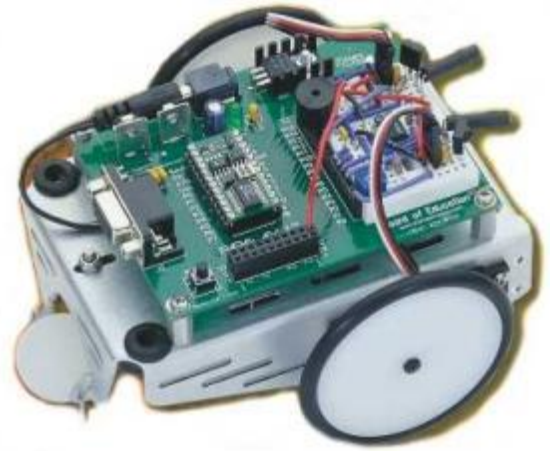
2) **35%**) Use the sonar sensor, facing 90 degrees to the right, to follow a wall. Implement a PD controller similar to assignment 4 in order to guide a robot along the wall. Calculate question 3 **a** and **b** first and then use the max/min values to find a good desired distane.

3) **30%**) Create a noise model for the sonar sensor. Place the sonar sensor to face straight forward. Place the robot at different distances from a planar surface oriented perpendicular to the sonar beam. Take repeat measurements from the sonar sensor from different positions and calculate the following:
   a. Maximum working distance (the maximum distance the sensor readings are reliable).
   b. Minimum working distance (the minimum distance the sensor readings are reliable).
   c. For 8 positions between maximum and minimum working distance and for the two extremes (maximum and minimum) take, at least, 10 measurements and calculate the average and the standard deviation.
   d. Plot the results from (c) together with ground truth measured by a ruler/tape between the sensor and the obstacle. Use 1 σ error bars around the mean to indicate the uncertainty.

Notes/Hints:

Questions 1 and 2 would be demonstrated in class on Monday Dec. 5th by each team.

The manual can be found in:
http://www.parallax.com/portals/0/downloads/docs/prod/edu/WebRoboticsv3.0.pdf

What to submit:
Submit the source code together with a written report through WebCT.