CPE 470-670 – Autonomous Mobile Robots

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Lab 5 – Handout

Line Following Contest

In this lab you will write a program that uses the light sensors on your robot to follow a line on the floor and the sound sensor to help the robot get back to its home location (which will be one of the corners of the arena). During this lab you will develop and test the programs mentioned below, the actual contest will take place at the beginning of the lab meeting on October 21.

References and general instructions

a) At this lab each team is provided with two light sensors. For the *line following* task you should mount them on your robot toward the front, and facing downward to the floor. More information about light sensors can be found in the on-line tutorial. It is highly recommended that you use the capability of reading raw data from your light sensor, in order to get a better range of values between white and black.

b) You can get ideas for your light-following program from your book (pages 286-292). The scanned version of these pages can be found at:

http://www.cse.unr.edu/~monica/Courses/CPE470-670/Resources/LineFollowing.pdf

c) In this lab you will also learn to use the HiTechnic Sensor Multiplexer in order to be able to connect more than 4 sensors to your controller. You need to download the file HTSMUX-driver.h from the resource directory:

http://www.cse.unr.edu/~monica/Courses/CPE470-670/Resources/Examples/

In the same directory there are example files demonstrating the use of the multiplexer.

Line following program

a) Using one light sensor on your robot, write one program for line following using either the *thresholding with hysteresis* concept (pages 288-290) or the *sensor histories* concept (pages 291-292). How does your robot perform?

b) Mount the second light sensor on your robot, such that the robot now has information from two sensors. How can you improve the performance of your robot in line following by using this additional information? Write a program that uses both light sensors for the line following task.

For the contest you should use the program that gives you the best performance from the above two.

Contest rules

a) Your robot will start away from the line to be followed, facing it at a random angle that will be decided at the beginning of the contest. The robot should detect when it reaches the line, then it should start following it, continuing until the end of the line on the mat. The end of the line will be indicated by a yellow piece of paper (same yellow as in previous lab). The robot should indicate by making a clearly audible sound that it had reached the end of the line and it is ready to search for the home location.

b) Each time your robot goes completely off the line, you will get one negative point.

c) If you get 3 negative points during the contest, you will have to do it again until you finish the contest with less than 3 negative points.

d) After reaching the end of the line, the robot should start searching for its home location in one of the corners of the mat. At this stage, you can help your robot get home using the sound sensor as follows: while the robot wanders searching for "home", if the robot is facing in the right direction, you can cheer and talk loudly to the robot as a sign that it can go straight from that point. If the robot is not facing in the right direction you should keep quiet, which would make the robot wander again.

e) The winner is the one who finishes the contest faster and with less negative points. The time has 50% of your total score (i.e. if you finish the contest the fastest, you will get 50% of the total score). The other half of the score is determined based on your time to get home. In addition, you will lose 15% of your total score with each negative point. For example if you finish the fastest with 1 negative point, your total score will be 50 + 50 – 15 = 85.