COMP 581: Introduction to Robotics

Fall 2018
Instructor: Prof. Ron Alterovitz
Lab Assistant: Armaan Sethi <armaan@cs.unc.edu>

Lab 1: LeJOS Overview and Your First Robot

Deadline

October 10, 2018 at the beginning of class. For the late policy, see the course syllabus. Before the due time, each team member should individually submit your team's code in a zip file on Sakai.

The Objective

The primary purpose of this lab is to get some experience with Lego Mindstorms EV3 and the LeJOS API. You will build your first mobile robot and familiarize yourselves with the motors and sensors.

Task 1: Read our LeJOS Tutorial

If you have not already set up the Lego Mindstorms EV3 with your laptop, start by reading the Tutorial on Setting up LeJOS with Java 8 for your Lego Mindstorms EV3:
Sakai → Resources → LeJOS Tutorial - Java 8.pdf

For more information, see:
https://sourceforge.net/p/lejos/wiki/Home/

Task 2: Odometry, Ranging, and Bumping

You should build a robot to accomplish the objectives below. Your robot must be built only using pieces from your Lego Mindstorms kit. You should design your robot such that the center dark gray button may be pressed without moving the robot and such that pushing the button does not disrupt any of the sensors. Your robot should remain in one piece at all times, its diameter with respect to the ground should not exceed 40 cm, and its diameter shall not change substantially during the task. All measurements will be made with respect to the *measuring point*: a distinct point of your choosing that is on the frontmost surface of your robot. Your robot should be designed to accomplish the task autonomously without any human intervention (except for

pushing the center dark gray button as required).

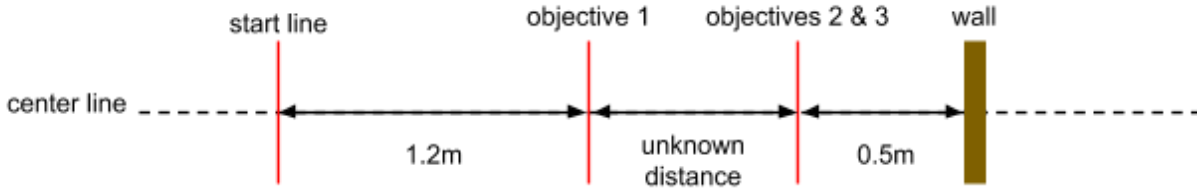
All the objectives in this lab are to be completed in a single run, without picking up your robot.

Objective 1 (Odometry): Your robot will be placed behind a starting line on a flat surface (on carpet in the Robotics Lab) and should wait to begin until you press the center dark gray button. Upon pressing the button, your robot should move forward in a straight line for 1.2 meters and stop. Immediately after stopping, the robot should beep. Here we will measure the distance from the starting line and deviation from the center line (movement left and right) and points will be awarded based on accuracy. To enable time for measurement, the robot should remain stopped until the button is pushed.

Objective 2 (Ranging): After completing the first objective, you will press the center dark gray button and your robot should resume moving forward. Somewhere directly in front of your robot will be a flat surface (like a wall or large object) that you can assume is at least 17 cm high and can be detected by the ultrasonic sensor. The robot should stop such that it is 50 cm from the flat surface (measured from the nearest point on the robot). Your robot should beep and pause until the center dark gray button is pressed.

Objective 3 (Bumping): After the previous two objectives, you will push the center dark gray button and your robot should now move forward and approach the surface. It should bump the surface with a bump sensor placed on the front of the robot. After bumping into the surface, the robot should move in reverse until it is 50 cm from the wall again.

A visual representation of the workspace looking down from the ceiling:



Points

Attempt: 35 points. You will receive these points simply by having LeJOS successfully installed, showing up to the Robotics Lab on the lab due time, and having your robot attempt the course.
Odometry: 20 points. 10 points will be awarded based on distance traveled and 10 points for minimizing deviation.
Ranging: 25 points. 15 points will be awarded for distance from wall and 10 points for deviation from the center line.
Bump sensing: 20 points. 10 points will be awarded for bumping the wall and reversing, 5 for achieving the correct distance from wall, and 5 for deviation from the center line.

Code

To complete this lab you will use a subset of the leJOS API:
http://www.lejos.org/ev3/docs/
Important: You may only use classes from the following packages in Java and the leJOS API: any class in the java.io, java.lang, java.util, lejos.hardware, and lejos.hardware.* packages. Note that the classes must be implemented in one of these packages; a class that simply inherits from one of these packages is not permissible. For example, you cannot use a class in lejos.robotics.

A robot relying on a Java class from a package not listed above will be disqualified.

In the comments at the top of the Java source file containing your main method, please include the names and PID's of all team members.

You should feel free to discuss concepts in the course with other students in natural language (e.g. English). You should not share any programming code with others and must write all the robot's programming code yourself. If you access any sources other than the textbook or documents on Sakai, you must cite them in comments at the top of your code and send an e-mail to the instructor with the citation. You must fully understand your code and be able to reproduce the algorithmic approach without references if asked. The Honor Code is in effect for these policies.

Good luck!