Lab 5. Omnibot "Drive and Aim" Contest.

Deliverables: **Each lab group must submit a *short* (~3-page) Lab Report, processing data collected during Lab 5, due Monday, May 21 (in the dropbox). As in Lab 4, be sure to MEASURE the position *and* angle at which the omnibot ends each trial for which you show motor data plots; the *motor* positions are not the only factors determining accuracy of robot *chassis* position!** We will also be using **video documentation**, to review transient behavior and laser-aiming performance as objectively as possible during each trial. Include plots for 2 sets of data:

1. Performance near the start of lab, using your controller from Lab 4 and a half-ellipse trajectory
2. Performance at the end of lab, documenting improvements in control and/or trajectory generation.

Overview

In this lab, teams will compete (for fun) to control the omnibot to do the following tasks:

1. Go from a designated start location to a designated goal, 4 feet (1.219 meters) away,
2. while ensuring that no part of the robot crosses an obstacle (see figure 1),
3. always pointing a laser at a target 3 feet (0.9144 meters) in front of the start location,
4. and completing the task within sixty (60) seconds.

As always, you are encouraged to explore various solutions, depending on your personal knowledge, interests, curiosity, and persistence.

The assignment requires that you have completed the tasks listed below. **We are creative/flexible about how you approach particular problems.** Include relevant presentations of data, such as plots of data (e.g., desired vs actual motor position over time), and a summary of the methodology and calculations required.). *Please be concise and efficient in your presentation; well-labeled plots are always appreciated – and often can be much more effective in communicating details than excessive text.*

Your tasks in this lab include:

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1. Design and test a simple solution early in lab. Use this as a "benchmark" to see how much you can improve your control and trajectory generation. Do not worry about performance in aiming the laser for this step: just look to check that behavior "seems about right" in pointing.

2. Examine log data and plot the error between commanded and actual motor positions. What happens to the error when the motors change direction? How does this affect the robot's trajectory and ability to aim well? Comment on this in your lab report, and also mention how you address this problem in your modifications to the control and trajectory generation.

3. Try improving your controller, to minimize errors. Suggestions include feedforward control and/or integral control.

4. Try improving your trajectory. Suggestions include "rescaling" your shape, correcting/modifying parameters uses for length and wheel radius of the robot, adding offset to motor commands to "null out" the true errors, and/or using a different (non-ellipse) path. Note that errors on the target depend on distance and orientation to the target and noise during motion may depend on exact wheel orientations.

Good luck, and have fun!

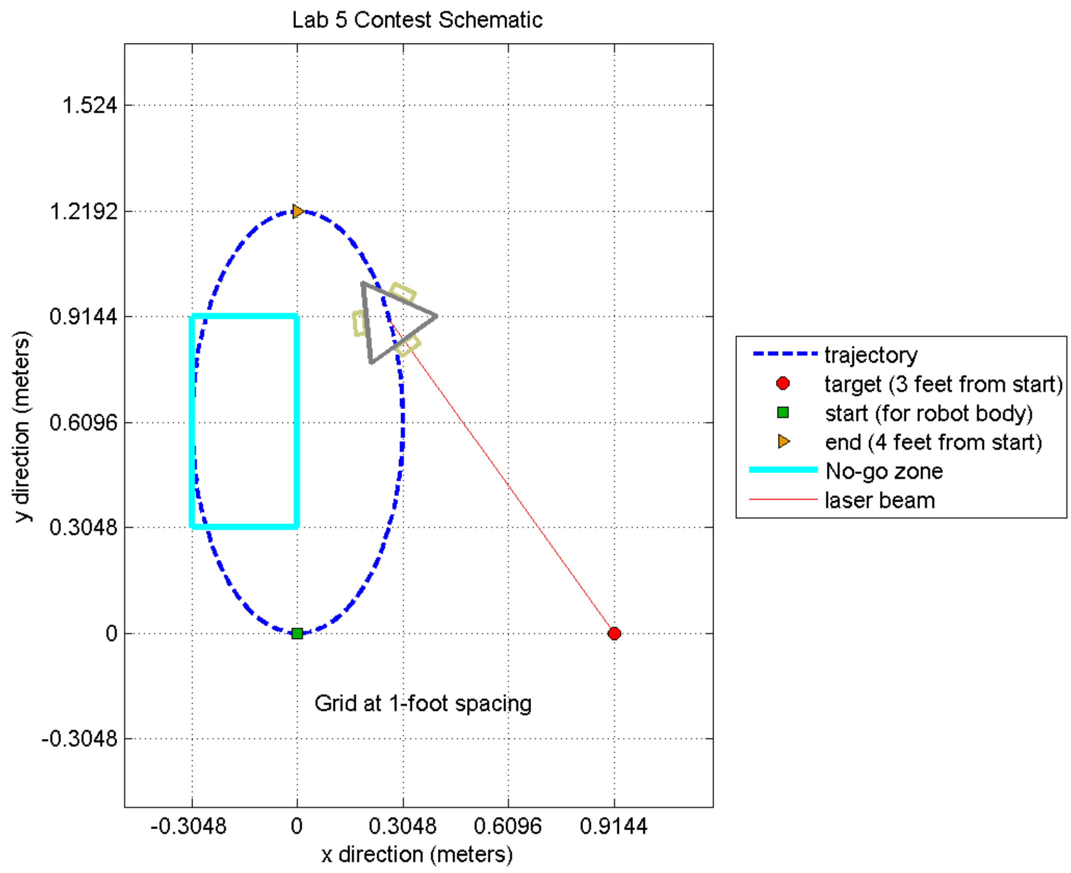

Figure 1. Schematic for the Omnibot Contest. Each team must design a controller that will move the omnibot from "start" to "end" while simultaneously pointing a laser at the "target" and avoiding the "no-go zone".