CSCE 236 Embedded Systems, Spring 2012
Project 2 Report
Making Robots Draw

Written Report Due: Friday, April 27th, 2012 (11am)

1 Overview

Below are a set of questions you must answer as **part** of your final report for project 2. Overall the report is worth 60% of your project 2 final grade. Each group only needs to submit a single report. The exception is Section 1.6, which is a group and self evaluation that each member of the group must submit individually.

This report should read as a coherent report with appropriate transitions between sections and an introduction and conclusion. In addition to answering the questions, you should also *describe* why the question is important and how the results impact your design decisions. Make sure to use complete sentences, paragraphs, and sections. Finally, make sure that any figures are properly labeled and are clear when printed (e.g. you can distinguish the different variables if you print it in black and white).

Writing may be less fun than coding (for me at least), but even if you end up in the most technical of jobs (perhaps as an assembly-level driver developer programmer for a mobile development phone company) you will still need to clearly describe and analyze system performance in written reports. There is no set page limit for this report (it is quality, not quantity), but I expect most will be between 5 and 10 pages. Break it up among your group members, but make sure the overall report is consistent.

1.1 Introduction, Conclusion, Grammar, and Style (10 pts.)

Your report should include an **introduction** to the project that gives an overview of the project goals and describes what you aim to achieve. The introduction should also describe the remaining sections of the report. You should also have a **conclusion** that summarizes the report and what you learned. You may also lose some points if the overall flow, grammar, and style of the report are inadequate.

1.2 Approach (10 pts.)

You should describe the overall approach you took in this project. In this section, you should make sure to describe the overall architecture of your code. You can discuss, for instance, how and where you used interrupts, the code API for the main functions you implemented (e.g. a turning function, a driving function), and how you structured the main loop in your code (you may want to include and describe pseudo-code). You should also discuss the physical layout of your robot and include a picture of your robot.

In this section, you should also describe how you approached the two different competitions (specified art and selected art). Did you use the same code for both? How did you parse and queue the serial commands for the specified art? Finally, describe any challenges you encountered and had to overcome (e.g. perhaps you found that you could not turn as accurately if you were constantly printing debug information).

1.3 Compass and Turning Characterization (10 pts.)

In this section you should characterize the performance of your compass and robot turning. Make sure to include a brief overview of how you interface with the compass. You should include a *discussion* and analysis of the following:

- Describe how you calibrated your compass. How consistent was the calibration of your compass robot? Did you find it worked better in some locations?
- Characterize and analyze the accuracy of the compass (e.g. if you turn it 45 degrees, does it report a rotation of 45 degrees?). Include a table or plot to help with this analysis.

- How did you implement turning using the compass? How accurate was this turning? Did you tend to overshoot your target angle? How did you implement turning the robot without changing the location of the pen? How accurate was this? Include tables or plots to help with this analysis.
- If you move in a straight line (without changing the angle of the robot), does the compass read the same value? Characterize, analyze, and discuss the impact of this.

Feel free to include additional information and discussion to help with the characterization of the compass and turning.

1.4 Encoder and Driving Characterization (10 pts.)

In this section you should characterize the performance of your wheel encoders and how well and accurately your robot can drive straight lines and curves. Make sure to include a brief overview of how you read and interface with the encoders and how you ensured data consistency between the main loop and interrupts (assuming you used interrupts to keep track of the encoder ticks). You should also include a *discussion* and analysis of the following:

- How did you mount your sensors on the wheels? Include a picture of your sensor mount. Did you find this mounting method worked well?
- How accurate can you drive a straight line? Perform an experiment where you tell your robot to go forward a specific distance and then back the same distance. Do this multiple times for a number of different distances. What is the X and Y offset from the start and end locations? Analyze these results (e.g. what do you think the source of error is from and is this an acceptable error).
- How did you implement drawing curves (for the select art part of the competition)?

Feel free to include additional information and discussion to help with the characterization of the encoders.

1.5 Performance Evaluation (10 pts.)

You should analyze the performance of your robot on both of the competitions (specified art and selected art). Did it perform as well as you expected? How could you have improved the performance and how would you go about doing so? You may want to include and analyze pictures from trial runs and from the competition.

1.6 Self and group evaluation (10 pts.)

This part should not be included in the report, but should be done by **each person individually**. Part of your grade will also be based on self and group evaluation. Each member of your group should complete the survey linked to below (also linked to on the course website) after the first competition date (specified art), but before the due date above (you will not receive any of these points if you do not complete the survey):

`https://docs.google.com/spreadsheet/viewform?formkey=dDdVd3V2RlRSM1Ztd1FUWU1fNWI4b2c6MQ#gid=0`

In addition, you should complete the class survey here:

`http://crseval.unl.edu/welcome/`

Both of these provide me with valuable information that will help me improve the course in the future.