ECE3 20F Final Report

Written Report: The final report is due at 11:55 PM Saturday, December 19, 2020.

- Only one report should be submitted per team.
- Submit it to CCLE under "Finals Week" | "Final Report and Code".
- There is no page limit. To paraphrase Einstein's quote on simplicity, the report should be long enough to tell the whole story, and no longer.
- Your target audience is not your instructor, but students in the next instance of EE3. Make it understandable to them.
- The more figures, graphs, and pictures, the better. Schematics (see *Introduction and Background*) must be electronic; no hand-drawn schematics. Suggest Scheme-It at the Digi-Key site. There are others. Do NOT use Eagle or other CAD software to generate schematics. A pin chart of the LaunchPad that is SPECIFIC TO THE RSLK is acceptable.
- It consists of the following sections. Your report must follow this outline. I grade more than 100 Final Reports, so I cannot waste my time looking all over the report to see if the required boxes have been ticked. I will TAKE POINTS OFF if the outline is not followed.

1. *Introduction and Background (10 pts):* This section describes activities prior to putting the car on the track for the first time. In one to two paragraphs, briefly describe the project goals, and the design that was selected. Then describe the basic theory required for understanding the path sensing system. This includes:
    - the path sensing circuitry (schematics required)
    - the calibration process
    - the sensor fusion process

    Circuit schematics are required; see the red text above. Description should include prose descriptions of how the circuit operates, curves, and any equations needed for interpreting voltages.

2) *On-Track Development Methodology:* You will be scored on your treatment of the control system *development process*; that is, the on-track testing of your control system's parameters (speed, starting position, number of trials, PLUS K_p, and K_d if you use PID; other quantities that you can change if not using PID). You will also be scored on the documentation of each trial's results (e.g., completes the track, or where on the track it failed; how much "hunting"; whether the hunting smooths out; etc.).

    NOTE: you will not be scored on your development of the cross piece detection, but you may include it if you wish. Briefly describe the procedures you followed to verify the operation of that subsystem. What did you do to assure yourself that the subsystem was working correctly?

    a. *Test Setup (10 pts):* Describe your test setup: the environmental and electrical characteristics OF THE TEST SETUP.

    b. *How the tests were conducted (10 pts):* Describe your test procedures. This includes descriptions of how you decided which parameters to evaluate early in the process, what you were looking for as the car ran on the track, which tracks you used to test which parameters, whether you used the serial monitor while the car was on the track, even how and where you placed the car on the track. NOTE: this section introduces you to one of the most important best practices when doing research or development; namely, the rigorous logging and documentation of the changes you made and the results of those changes.

c. *Data Analysis (10 pts):* show the analyses that you conducted on your test data. Provide graphs and tables of your testing results, as applicable. Put these tables and graphs in your report, not as a URL to Google Docs. If the tables are large, show the graphs in the text body and put the large tables in the Appendix.

d. *Test Data Interpretation (10 pts):* discuss the meanings that you associated with the analyses (the graphs and tables) you conducted. This discussion should be quantitative (that is, the numbers obtained in your test results should be discussed). If one of your tables shows a result such as "car left track on second right turn," that is a meaning embedded in the data. Look for trends, such as increasing the speed requires increasing K_d (or not). This is a low-level, more local, discussion.

3) *Results and Discussion:*

a. *Test Discussion (10 points)* Interpret the graphs and tables of your test results. Look at your interpretations (the meanings in 2d. Above) and discuss if they are appropriate to the project goals (or not), useful (or not), indicate that more work is required (or not), etc. NOTE: it is not enough to simply claim in one sentence that the data and interpretations are appropriate to the project goals. You must supply reasons why they are appropriate. This is a higher-level, more global, discussion.

b. *Race Day Discussion*

i. *(5 points)* Discuss how well your vehicle performed on Race Day. Provide links to videos, if any.
ii. *(5 points)* Discuss the limitations of your code and of the car and tracks.
iii. *(5 points)* Talk about how you would conduct the project differently, using what you have learned along the way.

4) *Conclusions and Future Work (5 pts):* Provide a brief discussion of how well your design met your goals. Briefly describe what you learned in doing your project. Describe some extensions you would like to do if you had more time, and how you would go about testing them.

5) *Illustration Credits (10 pts, not a separate section):* Illustrations are not references! That means that they DO NOT APPEAR in the list of references. ALL illustrations must be credited next to the illustration, unless you have developed them yourselves. Illustrations from Wikipedia should be credited to the illustration author. If you use a schematic generation site, you must credit the site. I will take off points if the credit is not next to the illustration.

6) *References (10 pts):* Remember: some of your work may be original, but some is surely not. If you did not think up an idea or a concept totally on your own, then you owe an acknowledgement to the source of the idea or concept. If you used software from the web, or consulted some books or articles (or online designs), or talked to others, then you must, in the main report, note that usage through a reference number inside square brackets (e.g., [1]) and include the corresponding reference in this section. If you are using one of the circuits supplied for the class (e.g., the path sensing circuit), you should note that in your report along with the diagram, but you don't need to cite a reference.

7) *Code*: Submit your code and report files to CCLE (under "Finals Week")