Final Project

The final project for this course will be a team based project where you design your own experiment and decide upon what you will be measuring. Some of the projects will be deployed in the field and thus there are variables which are difficult to control for which might make your final data collection fail. Some of the projects are challenging and the team may find more difficulties than expected. The following plan will allow you systematically develop and test an experimental platform such that you can still get an A on your project even if the world conspires against you.

The following plan will also allow you to complete a set of milestones such that you will have confidence that your system will actually work. Some of the projects require recording data over long periods of time, thus you want to be sure that everything works the first time.

All deliverables will be submitted as a team. In the end we will survey each team to make sure that the team feels the workload was balanced among the team members. Except in the case where there is evidence or a history that the work was uneven among team members, all team members will receive the same grade for the project.

Week 1, Formal proposal

After your first week, your team will submit a formal proposal that will explain in detail, what you plan to do. The proposal should contain the most of the following. Depending on the project some of these sections may not be needed. The bolded sections are required of everyone.

1. **Executive summary.** You should summarize in sufficient detail, what you hope to measure and how you plan to go about this. The summary should include general plans for system design, sensors, and experimental plan. This summary will be an elaboration of the pre-proposal that you submitted before spring break. The summary should clearly state what the objective is. How will we know if your project is successful?

2. System design. This section should clearly explain the system design. Be as specific as possible at this point. Even if plans change, you will benefit from trying to think everything through to the end. This section should explain how the experiment as a whole will work, not just the electronics. This section may be longer or shorter depending on the nature of the project. You should include relevant sketches and drawings of any non-trivial mechanical systems. You may use solidworks if appropriate or simply provide clear and neat hand sketches. You should also include details about any parts that are not standard and can easily be bought locally. Will you build everything on a protoboard or will you want a printed circuit board?

3. Safety and regulations. You should include any issues of safety which you may or may not have resolved at this time. For example, hooking up wires to human subjects requires certain fail-safes. Launching a weather balloon has many regulations. Please address any issues in your proposal. If you are unsure how to address them, just highlight the issues and we will help you. Many of you can ignore this section.

4. **Circuits.** You should draw and explain any circuits that you will need to build. Your circuit diagram should include parts (e.g. op-amp LMC6484) and values (R=100 ohms). You may use the student version of PSpice, LTSpice (http://www.linear.com/designtools/software/#LTspice), or sketch the circuits neatly by hand. You will also need to include details of how you will power your system if it is any different than we have done in the labs.

5. **Sensors and electronic components selected.** You should provide a table of any parts/sensors you need purchased from Digikey. Include a simple table which includes Digikey part number, description, quantity, and price. We will order all the parts for all teams after you submit the proposal. You do not need to detail common parts that we have used throughout the semester, i.e. common resistor, capacitor values, LMC6484 op-amps, etc.

6. **WEEK 2 TEAM-DESIGNED "LAB".** Next week, in class each team will conduct and turn in results the following week (as a team) of a self-designed team lab. This lab should be a concrete test of one subcomponent of your circuit (i.e. one set of filters), a proof of concept of your system, a preliminary test with a new sensor or measurement technique, or similar. Think of this as a lab where you are designing the experiment. The idea is that this should be one step along the way to completing your project – i.e. if you can't do this, you can't do what you are proposing.

7. Experimental plan. This section should detail your final experimental plan. Questions you will want to answer are; How long will your test last? How much data will you record? When will you conduct your test? This section in more important for teams with logistical challenges.

8. **Budget:** Please include an approximate budget for your project. If you don't have exact prices for all the small components, you can estimate.

Proposals are due the week of April 1-5 on your lab day. This proposal will count for 15% of your final grade for the project. A perfectly executed experiment with no proposal cannot get an A.

Week 2 lab report:

A report on your preliminary data is due the week of April 8-12 and will count as 15% of the final project grade. The style should be similar to a regular weekly lab.

Final report

Your final report will be due during the final week, on the day of our final, May 7.

Your final report should detail your final system and circuit design and experimental protocol in enough detail that a student wanting to replicate your experiment could do so. Please include pictures of your final experimental apparatus.

You should include a summary of your system testing and preliminary work detailing how you were certain that your final system would work.

Finally, you should include your final data and its interpretation.

If your experiment was not successful or original objective not met, then simply explain what went wrong. If you properly conducted all your testing, then a failed final experiment is not a project failure. Please explain what you would do differently if you had additional time.

The final report grade will be based on execution of the project and the writing of the report. A perfect project but poor report cannot get an A. Further, the degree of difficulty will be taken into account.

The final report is 70% of the grade for the project (the remaining components are the proposal and mid-term report).

Demo Day

The final for the course is officially scheduled for 8-11 am on May 7. During this time block (though only from 9:30-11:00) we will have an informal demo/poster day. On this day, we will set up on the fourth floor of the AC (in the classroom and out in the hallways). Each team will have some table space and will set up either a demo or make a simple poster based on their report. We will then have a chance to see what the other teams did and we will invite other students and faculty to attend. This is meant to be informal and fun, there should not be any serious additional work to prepare. The posters/demos are not graded. However, it will be a good chance for you to show us your project and give us the pitch in person before reading your report.