EECS C106A/C206A / BIOE C125

Final Project Guidelines

Fall 2018

Overview & Requirements

Your final projects must include **sensing**, **planning**, and **actuation**, which means you must be performing a real robotic task, on real hardware, using real sensors. Beyond requiring these three elements, the project is completely open-ended; we have included some examples and ideas at the end of this document to help you get started.

Dates, Deadlines, & Grading Breakdown

Mini-Proposal	10/05	5%
Final Proposal & Parts List	10/21	10%
Final Products		
Presentation	12/07	20%
Demo	12/07	20%
Report (website)	12/14	20%
Video	12/14	20%
Lab Cleanup	12/14	5%

Grading Scheme

Overall, we will be evaluating your project on its complexity, polish, the participation of all team members, and on the following characteristics:

- **Design**: How original or ingenious is your design?
- **Implementation**: Does your implementation work? How reliable is it?
- **Scope**: Does your project contain sensing, planning, and actuation?
- **Rigor**: Do you properly test/evaluate your project? Are your assumptions reasonable?

These characteristics will be evaluated on the following scale:

Mark	**Description**	**Equiv. Score** (undergraduate)	**Equiv. Score** (graduate)
5	Exceeds expectations	95-100%	90-100%
4	Fully meets expectations	90-95%	80-90%
3	Adequately meets expectations	80-90%	70-80%
2	Barely meets expectations	70-80%	60-70%
1	Does not meet expectations	0-70%	0-60%

We expect most projects to score around 3-4 in each category, but we are not opposed to giving everyone a 5 if all projects are great. **Note that you do not need all 5s to make an A on the project.**

Projects will vary in complexity, and in general, the more complex or risky the project, the less polished we expect it to be. In other words, if your project is very complex, then we don't expect it to work perfectly or reliably. If your project is relatively simple, however, we'll expect it to work reliably and consistently, as you'll have more time to devote to getting it working well. A project that is simple but well done (i.e., very reliable) may receive the same grade as a high-risk project that is functional.

Late Work Policy

In general, **no late project work will be accepted**. If you feel that you will be unable to make any of the deadlines listed above, let us know **before** the deadline explaining your situation and we will revisit this policy at our discretion.

Groups

Project groups should consist of **3-5 people**. If you would like to form a group that is larger or smaller, please talk to us **before** submitting your mini-proposal. Note that expectations will scale with the number of project group members: we will expect more polish, complexity, and reliability from larger teams. We will also of course expect that all members equally contribute to each team.

If you're having trouble finding a team, feel free to start a thread on Piazza!

Multi-Class Projects

If you are in another project course, you are welcome to complete a single project for both classes, provided the scope of the project is extended appropriately (i.e., you should not simply turn in the same project for both classes — the portion of the project that you turn in for EE106A should stand on its own). You may work with team members who are only enrolled in the other class, as long as you complete all the project requirements of EE106A as listed here. We may ask to see the report you submit to any other class to ensure that the amount of work completed is sufficient to cover both assignments.

Mini-Proposal (due 10/05)

A preliminary mini-proposal is due **10/05** at **11:59p** and should be submitted to Gradescope. This document should be about one page and contain the following:

- name and contact information of each team member (full name, SID, email address);
- (brief) qualifications of each group member (department, previous experience, etc.); and
- project idea(s) and a brief description thereof.

In the subsequent week, we will read over your mini-proposals, and the week of 10/15, we will meet with each group individually to discuss your ideas in lieu of regular lab section (information forthcoming).

Final Proposal & Parts List (due 10/21)

Incorporating your project meeting feedback, you will complete a finalized proposal, due **10/21** at **11:59p** to Gradescope. A LaTeX template for this proposal has been provided on bCourses; you are not obligated to use the template, but all listed components should be present and complete.

An important part of this final proposal is the **parts list**, or **bill of materials**. Each group will be allocated approximately $50 to spend on parts for their project (final amount forthcoming). You are not obligated to use these funds (you may complete the project using only existing lab hardware), and all purchased components must be returned to the lab on completion of the project. **If you plan on requesting materials, it's critical that they appear clearly and completely in your final project proposal, as that gives us plenty of time to order them for you in time for subsequent project deadlines.**

Final Demo / Presentation (12/07)

Final project demonstrations will occur **12/07** (the Friday of RRR week), time and location TBD. We expect that **all team members are present** for the demos, so if you have a conflict, let us know ASAP and we will do our best to accommodate you as we develop the final schedule. Exact expectations will be posted to bCourses.

Final Project Report (due 12/14)

Final project reports are due **12/14** at **11:59p**, and will take the form of a website. It will also include link(s) to the video(s) of your functional system that make up 20% of your final grade. Exact expectations will be posted to bCourses.

Teamwork / Peer Grading

To help ensure fair project grades, final scores will be modified based on peer evaluation. Each student will fill out a form evaluating both their own and teammates' performances. Exact instructions will be posted to bCourses.

Cleanup

The final 5% of your project grade will come from cleaning up your lab space and returning all project hardware; this must be completed by **12/14**. All laboratory space should look the way it did at the start of the semester. We will provide boxes and instructions as the date nears.

Example Projects & Ideas

A list of past projects has been posted to bCourses. Here's an additional list of potential ideas, inspired by current research and industry questions:

- Map a space with a few obstacles (e.g., using SLAM), and successfully plan through it using any of the path planners in MoveIt (or a different planner of your choice).
- Implement some sort of voice-control or person-following functionality. For example, have Baxter pick up an object verbally dictated by one of your team members.
- Coordinate action by two or more robots to accomplish a specified task, (e.g., have two Baxters collaborate to move an object, or have two Turtlebots collaborate to locate a hidden object).
- Track the surface of an object using position control and determine its curvature, using both vision and kinematic tools to control the manipulator.
- Implement impedance control on Baxter/Sawyer (a combination of position and force tracking).
- Measure the inertial moments of 2-DOF mechanisms.
- Test if an object is "pushable" based on sensor data that indicates its friction coefficient.
- Test if a surface is "pierce-able" using force and position measurements.
- Delineate the kinematic workspace of a single human or robot arm and two arms held together, with different degrees of freedom (including singularities) using Kinect.
- Test and classify the hardness and/or deformability of different materials using force sensors (e.g., wood, sponge, metal, textile).