

## 1 Introduction

The project component of this course is intended to give you practical experience in designing and implementing a complete embedded system product. You will:

- Determine what your product will do
- Research technologies and available components
- Design the circuit for the product
- Design the printed circuit board (PCB) for the product
- Submit all of the necessary data files required for fabrication of the circuit board
- Procure the necessary components
- Solder the components to the board
- Test the board
- Demonstrate a fully functional product
- Present your design to the public

While there will necessarily be several differences between your experience and a product design experience in "the real world", there will also be many important similarities. It is these fundamental similarities that will be reinforced by the project experience, while the differences can be taken care of via on-the-job training in a specific work environment.

You will be working on the project in teams of two or three. This will be an important exercise in teamwork skills. The overall project will comprise 35% of your final grade for the course. Each team member will receive an individual grade based upon the positive or negative effect that the member has had on the team. Formal processes will be in place to assess each student's contribution (both positive and negative) to the team.

## 2 Deliverables

An overview of the project deliverables and proposed schedule is described in the table below. More details will be provided throughout the semester. Each one of the deliverables below will be submitted by a team, not an individual.

Item	Description	Due Date
Project Selection	Your team is assigned a product to design	September 9
Functional Description	This document describes what your product will do from a "black-box" point of view	September 28
Prototype Circuit Boards	Submit prototype circuit board designs for testing/characterization	October 12
Preliminary Design Review	90% of the design is complete	October 26
Design Review	We will meet as a class and with your sponsor to review each design	Nov. 2/4
Parts Order	All parts must be ordered by this date	November 6
Circuit Boards	Circuit boards are sent out for manufacture	November 13
Software Review	90% of the software is complete	November 30
Completed Circuit	The final system is complete and demonstrated to the public	December 10

The Functional Description describes the proposed functionality of your product. This is an important document that must be **extremely** well-written and complete. It will either be deemed acceptable or returned back to you as unsatisfactory. You are encouraged to work on the document with me **well before** the submission deadline.

Once you begin your design you may find there are certain subcircuits that you would really like to prototype and experiment with. If you submit a circuit board design (in Eagle) by the deadline shown, it will be submitted for manufacturing and returned to you in about 5 days. You will need to purchase your own components (with approval from your sponsor). Prototype circuits from all project teams will be panelized into a single job limited to 12" x 16" thus the number and size of prototype boards may be limited.

The Preliminary Design Review is a meeting between me and your team to ensure that you are on track in the design process. You are expected to have a good understanding of the implementation challenges of your project and a good set of alternatives for how you will meet these challenges. You are also expected to have an initial schematic with the "simple" aspects of your design already captured, as well as a firmware implementation framework.

The Design Review is a public presentation with the class, myself, other faculty, and all project sponsors in the audience. You are expected to present your final design (mostly schematics and parts lists) and defend your design choices. All team members are expected to participate and address their roles in the design process.

After suggestions/changes from the design review are implemented, you will be ready to order electronic components. After these arrive, you can verify that the components match your printed circuit board layout, and you will then submit your circuit board for manufacturing. After the boards arrive, you will solder the components and build your final system. In the meantime, software development is proceeding at a rapid pace.

The Software Review is a meeting between me and your team to ensure that your software development is on track.

Your project must be complete by Thursday, December 10, at which time it will be presented to the public as a poster demonstration. Additionally, a live, working demonstration of your project to me and your sponsor is required. A large part of your project grade will depend upon you achieving a working project. A "working project" is defined as one that meets ALL the requirements set out in your Functional Specification.

Finally, you will be submitting written evaluations of your project members and I will also personally assess the contributions each team member makes to the project. These will be used to assign a *subjective* grade describing your contribution to the project. (NOTE: this is how it is in industry!)

In the extremely unlikely case that a team member is not performing his/her duties, I reserve the right to remove that member from the team, modify the functional requirements accordingly, and allow the remaining team members to continue working on a simpler project. The removed team member will receive an overall project grade of 0 (i.e., 35% of the overall class grade will be set to 0). Consider this an analogy to being fired from your job (or being removed from EGR485/486). And, yes, I have done it (twice). "Ejections" from EGR485/486 have been slightly more frequent.

### 3 What To Do Now

Your first task is to read this handout over and over again until you understand what is going on. Your project team will be announced as soon as all projects are finalized and teams are assigned (generally by the end of the first week of class).

Project teams will be chosen for a good mix of EE and CE students, a balance of skills, and complementary academic skills and habits. For example, projects that are more heavily oriented towards CE may have 2 CE's and 1 EE, and vice versa. As it is in industry, it is much more important to have a well-balanced team than to work with your friends.