Proposal Writing
ECE 2031
Design Proposal Assignment
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Why Do a Design Proposal?

- Open-ended design problems are a key part of your engineering education, and a proposal is “Step 1” of such a problem
  - And a requirement of this ABET-accredited curriculum

- You will have to think about an even more open-ended problem for your senior design project
  - This is an easier “practice run”

- No matter what career you pursue, you will very likely write or help write proposals.
Audience for a Proposal

- Engineers always have a customer – someone who is paying for the design
  - Management/marketing of the same company that employs the engineer
  - The firm who hires them for a single job, if they are independent consultants
  - Another large company, using the engineer’s company for “outsourcing”
  - A government agency, including DoD, DoE, DoT (both state and federal), etc.

- Customers (often called sponsors) write Requests for Proposals (RFPs)

- Responders (often called offerors or proposers) write proposals, which are usually evaluated competitively by the customer
Writing Your Proposal

- Your audience is Dr. Collins and Kevin
  - We know about the DE2Bot, SCOMP, etc.
- The RFP for this semester’s project will be all of the project specification:
  - Project lectures, proposal assignment sheet, etc.
- The proposal you write will address how your team plans to address the given requirements
- Your proposal will follow the format explained on the proposal assignment sheet
Think About the Big Picture

- What have we asked you to do for the project?
  - What are the technical requirements?
  - What are the demonstration requirements?

- Why do we want you to do this?
  - Your technical work serves a future purpose.
  - Your demonstration is the bulk of what we will actually see of your project.
Proposal Detail

● Each team’s proposal will be DIFFERENT – focus on YOUR unique aspects
  ○ Your software and any modified hardware
  ○ Application demonstration (lots of flexibility here)
  ○ What else?

● Proposals may have similar background information
  ○ Project summary, DE2 board features, Robot hardware, etc.
  ○ But this should be short and concise

● Assume the reader has good knowledge of the hardware
  ○ Don’t waste space writing about how the robot works - how to control the motors, sonar, etc.
  ○ However, do not immediately jump into your design without SOME background for context
  ○ The reader does not know what your software will look like, what strategy you will use in the demo, your team organization, etc.
Organizing Your Proposal

● All proposals will include the following sections/headings:
  ○ Executive Summary (ES)
  ○ Introduction
  ○ Technical Approach
  ○ Management Plan

● Additionally, some sections will contain relevant, descriptive subheadings
  ○ Subheadings will be determined by each team
  ○ Your goal is to make information easy to find
Executive Summary

- The entire proposal condensed into one paragraph – write it last!
- Allows an “executive” to quickly judge whether or not your proposal is worth consideration
- Briefly define the problem being addressed
- Briefly discuss the approach that will be used to solve the problem *and* explain the strength of the approach
- Consider it a separate document
  - Don’t refer to the rest of the document
What Makes a Good ES

- If it’s not in the ES, the reader will assume it’s not in the paper
  - Everything that you think will increase your chances of winning the contract should be in the ES
- Save intricate technical details for the body
  - Think “big picture”
  - If the reader wants more specific information, they know they can find it in the rest of the document
- Feasibility is just as important as technical merit
  - Realistic technical goals, AND realistic scheduling
Introduction

● Briefly describe the design problem and the project requirements
  ○ Show that you understand what you are asked to do

● Briefly describe your team’s solution to the problem
  ○ Enough that the document headings make sense

● Avoid too much detail that the reader should already know
  ○ Not important: how odometry works
  ○ Important: what you do with the odometry
Technical Approach

• This section contains all the “what” and “how” of your design
  ○ By far the largest section.
  ○ It should be technically detailed!

• Explain your team’s methods of fulfilling all of the design requirements, and why that’s the best approach.
  ○ Do not just state your intentions. How will you achieve them? Why that way? How do you know it’s possible?

• You should “sell” your idea as being effective, intuitive, robust, or any other desired traits

• Use descriptive subheadings
Technical Approach Topics

- Explain the intended design and operation of your software / algorithm / strategy
  - Again, focusing on what YOU are doing
  - Include traditional flowcharts or UML activity diagrams to describe program flow

- Describe how you plan to use the DE2 and robot hardware features
  - What devices are you going to use, and how will they work? How will you handle real-world concerns?

- If you plan to make any hardware modifications, what are they and how will they help you?
Real-world Concerns

- You already know that sonar sensors aren’t perfect, which means you need to test.
Kevin’s Test Results: Box

- Example: flat side of box is easy to see.
Kevin’s Test Results: Bucket

- Different objects have different responses.
Kevin’s Test Results: Bucket Data

- Cylinder is more difficult to see.
Kevin’s Test Results: Filtered Data for Bucket and Oblique Box

- Filtering can help in some cases, but some objects will just be invisible.
Technical Approach Topics for Demo

- How do you foresee the entire demo process playing out?
  - You have flexibility here. Be creative, but don’t promise the world if you can’t deliver.

- How does your plan maximize the effectiveness of your demo?
  - Trade-offs between difficulty and design time.
  - Using design freedoms to your advantage.
Management Plan - Timeline

- A Gantt chart will make up the bulk of this section of the proposal
  - “Show” the plan for the rest of the semester
  - Use Visio or any available tool to make a Gantt chart
- Still need a small amount of text in the document to give the chart context
  - Major tasks
  - Division of labor
  - Milestones
Realistic Timelines

- Do not force your plan into the available time.
- If you run out of time on the Gantt chart, you will run out of time in the project as well.
  - In that case, simplify your proposed design instead of trying to make your current plan fit.
  - It’s better to be realistic than to have to explain why you didn’t complete your proposed design.
- Consider how long something will actually take, double it, then add that time to the Gantt chart.
- You have already used 1/4 of your time!
Division of Labor

- Five people looking at the same piece of assembly code is not efficient (or effective).
- Consider what tasks can be done in parallel
  - Making the robot move (need a robot for this)
  - Testing sonar capabilities (need a robot for this)
  - Creating search algorithms (don’t need a robot for this)
  - Creating new FPGA hardware (can just use DE2)
  - Writing the proposal and presentation
  - Creating graphics, parsing data logs, etc.
Management Plan – Contingency

- Include your contingency plan, accounting specifically for how you will handle any problems that arise
- “If X does not work, Y will be used because it is already working and is easy to integrate.”
- Balance your contingency plan between “everything might fail” and “nothing will fail.”
The proposal can only be written once you have a well-defined plan for your project.

Experiment **before** proposing.

You have 3-4 group meetings before the proposal is due, and 2-3 after.

- Your proposal should reflect that 2/3 – 3/4 of your project is *already complete*.
- Brainstorm, design, and plan outside of lab so that you can use your time with the robot effectively
- Robots will be in high demand during open hours