This document provides guidelines on writing a great senior project report. It covers a suggested report outline, formatting, writing style, a refresher on engineering requirements, and resources. The goal of the senior project report is to document with clarity the work you have accomplished in your senior project. Use this guide to discuss with your advisor which sections are applicable to your project.

Report Outline

This section covers the recommended sections to include in most senior project reports. Since there is a range of senior projects, discuss with your advisor which sections are required for your project.

- **Title Page**
- **Abstract**
- **Table of Contents**
- **Introduction:** This summary will give the reader a sense of why your project is needed and allow all those involved or affected by the project to understand the broad goals and objectives of your project and what you will produce.
  - **Client:** If you are working for a customer, include an overview.
  - **Stakeholders:** Describe the broad groups and organizations will be affected by your project and who have vital interest in the project’s success, and how each informs your design thinking.
  - **Framed Insights and Opportunities:** Synthesize your emails/discussions/communications with your client and any stakeholders. Include and differentiate the needs of your client from other stakeholders.
  - **Project Goals and Objectives:** List the project goals and objectives. Goals are brief statements that give people an idea of what you want to achieve with your project. Objectives are more specific tasks that need to be accomplished in order to reach your goals. Objectives should be measurable so you can monitor progress toward your goal.
  - **Project Deliverables:** Outline what you will be producing (deliverables) during the project in the deliverables.
  - **Project Outcomes:** The outcomes describe what is possible if your project were to exist. Summarize what will now be possible given your completed project.
- **Background:** Include a discussion of what existing information (from literature, previous work, etc.) has a bearing on the project. Information should include a literature review, a discussion of applicable codes and standards, legal and ethical concerns, a look at existing products that solve similar problems, or any experimentation that helped develop the engineering specifications.
- **Formal Project Definition:** This section covers both customer requirements and the technical specifications that were derived from those customer requirements. The technical specification is a combination of engineering requirements, use cases, user stories, and personas. The section should include a discussion of how various specifications were developed from the customer requirements.
  - **Customer Requirements:** Provide the customer requirements (in table of bullet form).
  - **Engineering Requirements:** Formal engineering requirements detailing what your system shall do, generally non-functional in nature. You must include a requirements table using the format given in Table 1.
Customer and/or End-User Personas: Develop descriptive personas(s) of your customer and/or users. A persona is a fictional representation of your system’s users, describing who they and how they interact with your system. They are based on user data to help designers better understand their values, needs, goals, attitudes, interests, lifestyle desires, and behavior patterns.

Use Cases and/or User Stories: These are generally specify the functionality of your system. Provide an overview of the main users(actors) of your system. Develop a use case diagram (indicating the interaction between actors and your system) and set of use cases (fully-dressed format), or develop a set of user stories.

Design: The design section documents all aspects of your system design, including hardware, software and mechanical subsystems. It should include an overview of your design development (design concepts and prototypes) and insight into how you made design decisions (e.g., using decision matrices). Include appropriate artifacts such as functional block diagrams, schematics, flowcharts, etc. to document your overall system, hardware and software systems, and mechanical components.

Examples include:
- System-level schematics, state machine diagrams, process diagrams, and/or control system block diagrams
- Hardware functional block diagram, electrical schematics and circuits
- High-level software design documentation, such as block diagrams, state machine diagrams, and/or flowcharts
- CAD drawings of the mechanical system

System Testing and Analysis: Include appropriate test procedures and sufficient analysis of your test results should demonstrate to what extent your system meets the specifications (engineering requirement, use cases, user stories).

Conclusion and Future Work: Summarize your project, testing results and analysis. Include an analysis of the results in the context of the broader literature or previous designs. Discuss how you envision your work being extended.

Teaming: If you worked on a team, discuss how your team managed and assigned tasks and provide a summary of each team member’s contributions to the project.

Reflection: This section of the report gives you an opportunity to reflect on your senior project experience. Try to engage in meta-cognition (thinking about your thinking). How did you grow as an engineer? What lessons did you learn from your mistakes and triumphs?

Bibliography

Appendices: Material that is difficult to insert into the body of the report such as detailed persona narratives, use cases, decision matrices, Failure Mode Effects Analysis (FMEA), detailed testing plan and test cases, raw experimental data, Bill of Materials, code listing, CAD drawings, Gantt chart, etc.

- Senior Project Analysis form – see the end of this document for a copy.

Formatting

Use the sample Senior Project Cover Page Template (located on the last page of this document), 11-pt sans serif font such as Arial or Calibri, 1” margins, and doubled-spaced paragraphs. Include page numbers. Your advisor may provide a LaTex template.

Writing Style

Your goal is to write a report that is user-centered, persuasive, and clear. Structure your report so information flows naturally. Include transitions between paragraphs and sections. Use appropriate and consistent
grammar, punctuation, voice, and tense. Apply the paramedic method for clarity. All figures, diagrams, and tables should contain captions and be referenced and fully described in the text of the report. Appendices should be referenced and described in the body of the report. Cite all sources in the report and include references in the bibliography.

A Refresher on Engineering Requirements

When writing engineering requirements, recall that each one should have all of the following qualities: abstract, verifiable, unambiguous, and traceable. Each engineering requirement should state what the system must do, not how it does it. It should be testable. It should indicate one aspect of the system. And, it should relate to a customer requirement or customer need. Use a formal specification and compliance matrix to help write engineering requirements that possess these four necessary qualities.

Construct a requirements table containing the following columns:

1. Specification number
2. Parameter description: Short, descriptive name.
3. Requirement or Target (with units): The actual number the system must meet and units.
4. Tolerance: Such as Min, max, plus or minus a value.
5. Risk: Assess the risk of meeting each the engineering targets or specifications you set. Assign High (H), Medium (M) or Low (L) to each. High risk requirements should be thoroughly discussed in the report as they are typically hard to meet.
6. Compliance: Indicate the methods you used to verify the requirement by placing the relevant letter(s) in the cell. A for Analysis, T for Test, S for Similarity to Existing Designs, and/or I for Inspection.

Table 1: Sample Engineering Requirements Table

<table>
<thead>
<tr>
<th>Spec. Number</th>
<th>Parameter Description</th>
<th>Requirement or Target with units</th>
<th>Tolerance</th>
<th>Risk</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Response time</td>
<td>0.05 sec</td>
<td>Max</td>
<td>H</td>
<td>A, T</td>
</tr>
<tr>
<td>2</td>
<td>Code size</td>
<td>20 MB</td>
<td>Max</td>
<td>L</td>
<td>I</td>
</tr>
<tr>
<td>3</td>
<td>Data encryption</td>
<td>AES 256</td>
<td>Min</td>
<td>M</td>
<td>A, T</td>
</tr>
<tr>
<td>4</td>
<td>Power</td>
<td>3 W</td>
<td>Max</td>
<td>M</td>
<td>T</td>
</tr>
</tbody>
</table>

Ensure you adequately specify your system as you define parameters and target values. The following is a non-comprehensive list of parameter categories: Performance, Energy, Environmental, Usability, Ergonomics, Legal, Safety, Operation, Maintenance

Resources

Need help on your writing? You can find support at the Cal Poly Writing & Rhetoric Center. They offer a wide range of services and have open consulting hours at three locations across campus.

Statistics consulting is available through the Statistics Department Consulting Center. They offer a variety of services such as study design, data collection and management, and statistical techniques.
Senior Project Title

A Senior Project Report

presented to

the Faculty of California Polytechnic State University

San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science in Computer Engineering

By

Jane Codes

June 2019
Analysis of Senior Project Design

Please provide the following information regarding your Senior Project and submit to your advisor along with your final report. Attach additional sheets for your responses to the questions below.

Project Title: ___________________________________________________________

Quarter / Year Submitted: ___________

Student: (Print Name) ____________________ (Sign) ________________________

Advisor: (Print Name) ____________________ (Initial) __________ Date: __________

• Summary of Functional Requirements
  Describe the overall capabilities of functions of your project or design. Describe what your project does. (Do not describe how you designed it.)

• Primary Constraints
  Describe significant challenges or difficulties associated with your project or implementation. For example, what were limiting factors or other issues that impacted your approach? What made your project difficult? What parameters or specifications limited your options or directed your approach?

• Economic
  o Original estimated cost of component parts (as of the start of your project)
  o Actual final cost of component parts (at the end of your project)
  o Attach a final bill of materials for all components
  o Additional equipment costs (any equipment needed for development?)
  o Original estimated development time (as of the start of your project)
  o Actual development time (at the end of your project)

• If manufactured on a commercial basis:
  o Estimated number of devices to be sold per year
  o Estimated manufacturing cost for each device
  o Estimated purchase price for each device
  o Estimated profit per year
  o Estimated cost for user to operate device, per unit time (specify time interval)

• Environmental
  Describe any environmental impact associated with manufacturing or use.

• Manufacturability
  Describe any issues or challenges associated with manufacturing.

• Sustainability
  o Describe any issues or challenges associated with maintaining the completed device or system.
  o Describe how the project impacts the sustainable use of resources.
  o Describe any upgrades that would improve the design of the project.
  o Describe any issues or challenges associated with upgrading the design.

• Ethical
  Describe ethical implications relating to the design, manufacture, use or misuse of the project.

• Health and Safety
  Describe any health and safety concerns associated with design, manufacture or use.

• Social and Political
  Describe any social and political concerns associated with design, manufacture or use.
• Development
  Describe any new tools or techniques used for either development or analysis that you learned independently during the course of your project.