

Project Title: [Insert Descriptive and Informative Title]

Team Members: [List Full Names of All Contributors]

Stakeholder: [Name, Organization, and Email]

Faculty Advisor: Prof. Jonathan Muckell

Date of Last Update: [Insert Date]

Engineering Design Report

Overview and Instructions

This report documents the engineering design process for your capstone project. It is expected to be detailed enough to allow others to replicate your work.

- **Separate Reports for ECE490 and ECE491:**

If your team includes students enrolled in both ECE490 and ECE491, you will be working on separate reports with the ECE490 report focusing primarily on system design, constraints, requirements, and planning, and the ECE491 report expands upon their previous ECE490 report updating the design (as needed) and focusing on system testing, and recommendations.

- **Contextualization:**

If building on a multi-year project, focus on your team's unique contributions. Summarize prior work only to the extent needed to frame your design efforts.

- **Clarity and Replicability:**

Write for an informed technical audience. Diagrams, specifications, and justifications should enable replication by another engineering team. This is a critical requirement of effective engineering documentation.

- **AI Policy:**

You may use AI tools (such as ChatGPT or Copilot) to help improve the clarity, formatting, and presentation of your work. However, all content must be factually accurate and reflect your team's understanding and effort. Teams are encouraged to briefly document how AI tools were used (e.g., code formatting, writing assistance) to promote transparency and professional responsibility.

Submission Instructions

- Submit under team_deliverables on GitHub. There should be separate reports for ECE490 and ECE491 students. Keep updating your existing team report as you edit and refine it throughout the semester.

ECE490: First Semester Report Components

Problem Statement

Clearly articulate the problem your team is addressing. If part of a multi-year project, define the specific scope for the current academic year. Include:

- Background and motivation.
- Intended positive impacts on public health, safety, welfare, or relevant global, cultural, social, environmental, or economic factors.
- A compelling rationale for why the problem matters.

Inspiration

Provide background on prior work (academic, industrial, existing products on the market, and/or previous capstone teams) that informs your design. Identify:

- Gaps or limitations in previous efforts.
- Key insights that shaped your approach.
- Proper citations and credit where applicable.

Design Constraints

Enumerate key constraints shaping your design decisions, such as:

- Budgetary limitations
- Time constraints
- Equipment or materials availability
- Safety regulations or environmental considerations

Why this matters: Design constraints are critical to document because they define the real-world limitations (such as time, budget, and resources) that shape and restrict your available design options. They provide context for your engineering decisions and help justify trade-offs made during development.

System Requirements

List 5–8 of the most critical requirements for your system, divided into:

- **Functional Requirements:** Specific features or capabilities the system must perform.
- **Non-Functional Requirements:** Qualities or performance characteristics (e.g., reliability, usability, maintainability).

Each requirement should follow the **SMART** format:

Specific, Measurable, Achievable, Relevant, and Time-bound.

These requirements serve as the foundation of your design and decision-making process. They will also form the basis of your testing in ECE491, where you must demonstrate how well the system meets them. Be precise and thoughtful, as clearly defined requirements are essential for both guiding development and evaluating success

Ethical & Legal Considerations

Identify and address any ethical, legal, or regulatory issues that your project may raise. These considerations are an essential part of professional engineering practice and demonstrate your commitment to responsible design. In alignment with ABET Criterion 4, you should analyze the potential impact of your engineering solutions in global, economic, environmental, and societal contexts.

Examples of issues to consider include:

- Privacy or security risks
- Potential misuse of your system or technology
- Human subject interaction or informed consent
- Environmental or sustainability implications
- Liability and safety concerns
- Intellectual property and licensing

Why this matters: This section reflects your ability to recognize ethical dilemmas, assess possible consequences, and make responsible decisions that promote the health, safety, and welfare of the public while considering broader cultural and societal factors.

System Design

Provide a clear and comprehensive overview of your proposed system design. This is one of the most important sections of your report, as it captures the technical blueprint of your solution and communicates your engineering approach.

- Include multiple system-level diagrams, such as logical architecture diagrams, physical layouts, data flow diagrams, schematics, and block diagrams. Most systems will require more than one diagram to fully convey their design.
- Clearly depict subsystem breakdowns and interactions between components.
- Identify any engineering standards (e.g., IEEE, ISO, ANSI, etc.) that apply to your system or its components. Briefly explain how and why each standard was used or considered.
- Justify major design decisions, especially where trade-offs were made.

Note: Visualizations are essential. Diagrams should be well-labeled and accompanied by brief, clear descriptions that enhance the reader's understanding of how the system meets the stated requirements.

Bill of Materials

Complete the following table outline the bill of materials of your system needed to build your physical design.

Item	Part #	Item Cost	Quantity	Total Cost	Purchase Link

Include text to justify high-cost items and highlight cost-effective decisions.

Project Milestones

List the major milestones your team must complete to meet your project objectives. For each milestone, include a tentative completion date. Use bullet points to clearly indicate the sequence and timing of key tasks.

- Focus on high-level project goals and deliverables rather than individual tasks.
- Include estimated dates to guide project planning and accountability.
- Ensure milestones reflect realistic progress and align with the design and implementation timeline.

ECE491: Second Semester Report Components

Update your first semester components developed from last semester to make sure that the design documented reflects updated and changes.

System Testing

Describe how you validated your design:

- Testing methodologies used (unit tests, integration tests, simulations, field tests, etc.)
- Data collected and analysis methods
- Discussion of verification (meeting requirements) and validation (solving the stakeholder's problem)

Recommendations for Future Work

Critically evaluate system limitations and propose improvements:

- List and rank recommendations from most critical to least
- Provide justifications and context for each

Conclusion

Briefly summarize the project's key achievements (limit one paragraph):

- Major accomplishments
- Lessons learned
- Limitations and final thoughts
- Suggestions for future work (if not already stated above)