Preliminary Design Report

Team [Number] - [Project Name]

University Name

Department Name

Course Name

Team Members

First Last
email1@university.edu

First Last
email2@university.edu

First Last
email3@university.edu

First Last
email4@university.edu

Class Advisors

Dr. Advisor Name
advisor@university.edu

TA Name
ta@university.edu

Sponsors

Sponsor Name

sponsor@company.com

October 5, 2025

Contents

List of Tables

List of Figures

Abstract

This preliminary design report presents the initial design solution for [Project Name], an innovative [brief description]. The system incorporates [key technologies/approaches] to create [main functionality]. This report details our engineering requirements, functional decomposition, behavioral models, and project management plan based on feedback received from our initial proposal.

[Brief summary of key findings, approach, and expected outcomes - typically 150-200 words]

1 Comment and Response

This section summarizes major instructor comments and changes made based on feedback. The primary feedback from our initial proposal focused on [key areas of feedback]. In response, we have [specific changes made]. Additional concerns about [other areas] have been addressed through [solutions implemented].

2 Problem Statement

2.1 Need

[Describe the problem your project addresses. Explain why this problem is important and what current solutions are lacking.]

2.2 Background

[Provide context about existing solutions, technologies, and approaches. Discuss what has been tried before and why current solutions are insufficient.]

2.3 Objective

[Clearly state the project objectives. What will your system do? What are the key goals and success criteria?]

3 Requirements Specification

3.1 Marketing Requirements

- The system shall [requirement 1]
- The system should [optional requirement 1]
- The system shall [requirement 2]
- The system should [optional requirement 2]

3.2 Objective Tree

[Include a visual or textual breakdown of your main objective into sub-objectives. This helps show the logical structure of your project goals.]

3.3 Engineering Requirements

ER 1: Requirement Title

Rationale: Explanation of why this requirement is important

Verification:

- Specific measurable criterion 1
- Specific measurable criterion 2
- Verification method description

ER 2: Performance Requirement

Rationale: Justification for performance needs

Verification:

- Performance metric with specific values
- Testing methodology
- Acceptance criteria

ER 3: Safety Requirement

Rationale: Safety rationale and importance

Verification:

- Safety standard compliance
- Risk mitigation measures
- Verification procedures

Table 1. Engineering Requirements Summary

ER#	Engineering Requirement	MR	Justification
1	[Requirement description]	1	[Why this requirement is important]
2	[Performance specification]	2	[Performance justification]
3	[Safety specification]	3	[Safety rationale]

Table 2. System Specifications

Parameter	Value	Units
Operating Voltage	[X.X]	V
Power Consumption	[X.X]	W
Operating Temperature	[X to Y]	°C
Response Time	[< X]	ms

3.4 Impact Statements

Standards Impact

[Required - Discuss relevant standards (ASTM, IEEE, FCC, etc.) that apply to your project. Explain how you will ensure compliance and what testing/verification will be needed. Minimum 150 words.]

Economic Impact

[Discuss the economic implications of your project - development costs, potential market value, cost savings, economic benefits to users or society. Minimum 150 words.]

Environmental Impact

[Analyze environmental impacts - materials used, energy consumption, waste generation, sustainability considerations, end-of-life disposal. Minimum 150 words.]

Health and Safety Impact

[Examine health and safety considerations for users, developers, and society. Include risk assessment and mitigation strategies. Minimum 150 words.]

Social Impact

[Consider social implications - who benefits, potential for misuse, accessibility, cultural considerations. Minimum 150 words.]

4 Design

4.1 Design Summary

[Provide a high-level overview of your design approach. What is your solution and how does it address the identified problems?]

4.2 Functional Decomposition

4.3 Level 0: System Overview

[Describe the overall system function. What inputs does it take? What outputs does it produce? What is the main transformation or process?]

4.4 Level 1: Subsystem Breakdown

[Break down your system into major subsystems. Typically 3-7 major components.]

- **Subsystem 1**: [Description and function]
- **Subsystem 2**: [Description and function]
- **Subsystem 3**: [Description and function]
- **Subsystem 4**: [Description and function]

4.5 Level 2: Component Details

[Further break down each subsystem into specific components, modules, or parts.]

Subsystem 1 Components:

- Component A: [Specifications]
- Component B: [Specifications]

Subsystem 2 Components:

- Component C: [Specifications]
- Component D: [Specifications]

4.6 Behavioral Models

4.7 Overall System Behavior

[Describe how your system behaves in different states or modes. What are the main operational modes?]

4.8 State Descriptions

[Detail the behavior in each operational state]

Initialization State:

- System startup procedures
- Self-test operations
- Calibration processes

Normal Operation State:

- Primary functions
- User interactions
- Data processing

Error/Emergency State:

- Error detection
- Recovery procedures
- Safe shutdown processes

5 Project Plan

5.1 Work Breakdown Structure (WBS)

Sub-project: Hardware Development

Lead: Lead Name

Deliverables:

- PCB design and schematic creation
- Component selection and procurement
- Prototype assembly and testing
- Hardware validation and verification

Sub-project: Software Development

Lead: Lead Name

Deliverables:

- Algorithm development and implementation
- User interface design
- Testing framework creation
- Integration with hardware systems

Sub-project: System Integration

Lead: Lead Name

Deliverables:

- Hardware-software integration
- System-level testing
- Performance optimization
- Documentation and user guides

Sub-project: Validation and Testing

Lead: Lead Name

Deliverables:

- Test plan development
- Requirement verification testing
- User acceptance testing
- Final system validation

5.2 Gantt Chart

[Create a visual timeline of your project. You can include this as a figure or describe the timeline textually.] The project timeline spans [number] weeks with [number] major phases:

1. **Phase 1 (Weeks 1-X):** [Phase description and deliverables]
2. **Phase 2 (Weeks X-Y):** [Phase description and deliverables]
3. **Phase 3 (Weeks Y-Z):** [Phase description and deliverables]
4. **Phase 4 (Weeks Z-End):** [Phase description and deliverables]

Critical path activities include [list key dependencies and timeline-critical tasks].

Table 3. Project Cost Breakdown

Category	Estimated Cost	Actual Cost
Electronic Components	$XXX	$XXX
Mechanical Parts	$XXX	$XXX
Software/Licenses	$XXX	$XXX
Testing Equipment	$XXX	$XXX
Miscellaneous	$XXX	$XXX
Total	$XXX	$XXX

5.3 Cost Analysis

[Include explanation of cost estimates, any cost-saving measures, and budget management strategy.]

6 Implementation Examples

6.1 Algorithm Development

```
# Example Python code for your project
class SystemController:
    def __init__(self):
        self.state = "idle"
        self.parameters = {}

    def process_input(self, data):
        # Main processing logic
        if self.validate_input(data):
            result = self.core_algorithm(data)
            return self.format_output(result)
        else:
            return self.handle_error("Invalid input")

    def core_algorithm(self, data):
        # Your algorithm implementation here
        return processed_data
```

Listing 1. Core Algorithm Implementation

6.2 Hardware Interface

```
function processed_signal = filter_data(raw_data, sampling_freq)
    % Design filter parameters
    cutoff_freq = 50; % Hz
    filter_order = 4;

    % Create Butterworth filter
    [b, a] = butter(filter_order, cutoff_freq/(sampling_freq/2), 'low');
```

```
    % Apply filter
    processed_signal = filtfilt(b, a, raw_data);

    % Additional processing
    processed_signal = remove_offset(processed_signal);
end
```

Listing 2. Signal Processing Functions

6.3 Software Implementation

```
import numpy as np
import matplotlib.pyplot as plt

def process_sensor_data(raw_data, threshold=0.5):
    """
    Process sensor data with filtering and threshold detection
    """
    # Apply moving average filter
    window_size = 5
    filtered_data = np.convolve(raw_data,
                                np.ones(window_size)/window_size,
                                mode='valid')

    # Threshold detection
    events = filtered_data > threshold

    return filtered_data, events

# Example usage
sensor_reading = np.random.rand(100)
processed, events = process_sensor_data(sensor_reading)
print(f"Detected {np.sum(events)} events")
```

Listing 3. Data Processing Algorithm

6.4 System Configuration

```
$ git clone https://github.com/yourteam/project-repo.git
$ cd project-repo
$ pip install -r requirements.txt
$ python setup.py install
Installing dependencies...
Setup complete!
$ python main.py --test
Running system tests...
All tests passed successfully!
```

Listing 4. Development Environment Setup

7 Conclusion/Outlook

[Summarize the current state of your project, key achievements so far, and what you expect to accomplish in the remaining project timeline. Discuss any risks or challenges you've identified and how you plan to address them.]

The preliminary design presented in this report demonstrates [summary of approach]. Our engineering requirements provide [what they accomplish], while the functional decomposition ensures [what it ensures]. The project plan establishes [what it establishes].

Moving forward, the next phase will focus on [next steps]. Key milestones include [important milestones with dates]. Risk mitigation strategies have been developed for [key risks].

The team is confident that this design approach will result in [expected outcomes].

Appendix A: default

Appendix

A.1 Additional Technical Specifications

A.1.1 Detailed Component Specifications

[Include detailed specs, datasheets, calculations, or other supporting technical information]

A.1.2 Risk Analysis

[Detailed risk assessment with mitigation strategies]

Table 4. Risk Assessment Matrix

Risk	Probability	Impact	Mitigation
Component shortage	Medium	High	Multiple suppliers
Schedule delays	Low	Medium	Buffer time included
Technical challenges	Medium	Medium	Prototype early

A.1.3 Compliance Documentation

[Any additional compliance or regulatory information]