Some Gardens Grow in Hope

Project Four: *Power in Community*

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Project Summary

In Project Four, you are in an engineering design team that focuses on a real-world issue that a client in the community faces. Your team is required to come up with a solution that makes the client's daily living better.

To do this, your team will delve into the design space through the levels of the Engineering Design Process. First, you will determine the design requirements (i.e., function, constraints, and objectives) through problem framing and design exploration. Next, you will develop an initial prototype that centers on user interaction and is based on the design requirements. The design reviews will provide you with feedback to improve and iterate your prototypes. You will develop as well as a testing plan for your prototype. Lastly, you will develop a final design that embodies the lessons learned from every step of the design process and will present your final proposed design.

TIMELINE

WEEK	DATE	AGENDA
7	Mar 2 – 8	Milestone 0 and Milestone 1
8	Mar 9 – 15	Milestone 2
9	Mar 16 – 22	Milestone 3
10	Mar 23 – 29	Milestone 4
11	Mar 30– Apr 5	Dedicated Project Time (No Milestone)
12	Apr 6– 12	Presentation

Note: Based on the final presentations, top teams will be selected to pitch their project in final showcase. The final showcase of the project 4 is held on Wednesday, April 14th, in lectures.

TEAM FORMATION

Assigned teams of four students.

SUMMARY OF PROJECT OBJECTIVES

Working in a team of four students, you are required to:
1. Frame a design problem in terms of the needs of the client, objectives, constraints, functions, and metrics.
2. Follow an iterative design process of ideas generation, prototyping and testing.
3. Communicate your design quickly and effectively to non-team members and use feedback for validation of your design and/or to seek new ideas to refine your design.
4. Finalize your design and write a professional engineering report describing the process and outcome of your design project to a client.

SUMMARY OF PROJECT DELIVERABLES

Going through several milestones, at the end of the project, you will be required to:

1. Pitch your project in a video presentation.
2. Submit a *design project report* that documents your work throughout the project.

This project will also require you to: 1) complete a set of assigned administrative tasks inherent to the project, including completion of an *independent research summary*, 2) complete and submit a series of milestones throughout the project, 3) update your learning portfolio to reflect your progress and development, and 4) complete a self- / peer-evaluation at the end of the project.

SUMMARY OF PROJECT GRADING BREAKDOWN

Project 4 is worth **14% of your overall ENGINEER 1P13 grade (i.e., 14 marks out of 100**). Each deliverable is associated with 1 of 4 course modules (C – Computation, G – Graphics Design, M – Materials, P – Profession and Practice). Table 1 outlines the breakdown of Project 4 marks by course module. Table 2 lists each deliverable, the number of marks available for that deliverable, and the module associated with that deliverable.

Table 1. Breakdown of Project 4 marks by course module

COURSE MODULE	P4
Computation (C)	-
Graphics Design (G)	0.7
Materials (M)	-
Profession and Practice (P)	13.3

Table 2. List of deliverables

Deliverable	Deadline	Marks	Module
Admin Responsibilities	–	P/F	P
Milestone 0	End of Wk-7	P/F	P
Milestone 1	End of Wk-7	1.4	P
Milestone 2	End of Wk-8	2.5	P/G
Milestone 3	End of Wk-9	0.7	P
Milestone 4	End of Wk-10	2.5	P
Presentation prep	End of Wk-11	P/F	P
Final Presentation	During Wk-12	1.4	P
Final Project Report	Wed April 14th	5.0	P
Project Reflection	Wed April 14th	0.5	P
Learning Portfolio	Thu April 15th	P/F	P
Self- and Peer-Evaluation	Thu April 15th	P/F	P

Introduction

Alanna is recently retired from her position of the head of Midwifery. She is a painter, and a mother of two children. She has been diagnosed with three autoimmune diseases, including ankylosing spondylitis which causes inflammation of her spine and other joints leading to excessive bone growth and fusion of her vertebrae. She is a recent breast cancer survivor and is also coping with chronic lymphedema in her arms, chest, and back, with her dominant arm and shoulder being the most affected.

Currently, she can only paint for a few minutes at a time. To do so for a longer period of time, she must use her other arm to stabilize her dominant arm to minimize the weight-bearing on that side. Painting is particularly important because it plays a significant role in her healing process. She also enjoys sculpting, and it is one of the things she primarily spends time doing. Additionally, she enjoys gardening but has not been able to do so in years and would like to find ways to reintroduce that hobby into her life. Furthermore, she enjoys sewing but it hurts her hands. With increased nerve pain and her lymphedema means she cannot prick herself by accident without it being an infection risk. This has resulted in her no longer sewing. She meditates, stretches, and exercises daily. She also trains in adapted Brazilian Jiu Jitsu, as suggested by her rheumatologist. You are required to come up with a solution that would make it easier for her to carry out her daily tasks as all these challenges have made it particularly difficult to do so.
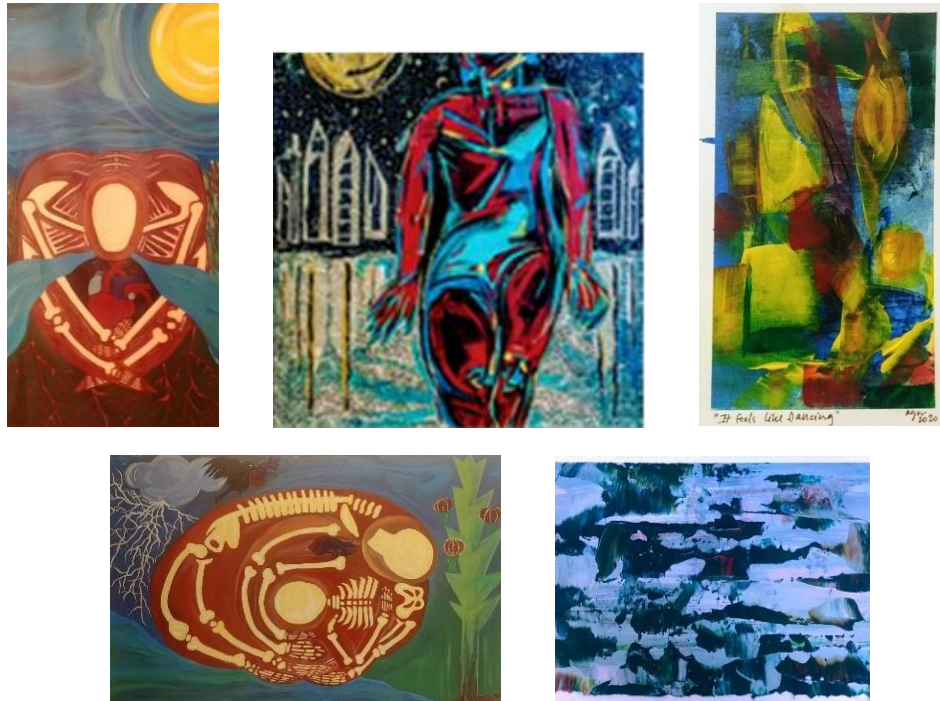

Figure 1: (top left) Tributaries of Grief (top middle) Metamorphosis in Centrifugal Motion (top right) It Feels Like Dancing (bottom left) Hope Cocoon (bottom right) The Textures of Dreams

Project Four Objectives

Your team has been approached with an opportunity to design a device to improve the daily life of your new client, Alanna. This challenge will require your team to 1) frame a design problem in terms of the needs of the client, 2) Follow an iterative design process of ideas generation, prototyping and testing, showing the ability to go 'backwards' in the design process when appropriate., 3) communicate your design process quickly and effectively to obtain feedback from non-team members, and 4) finalize your design and write a professional engineering report discussing the process and outcome of your design project.

This project requires that your team complete and submit several assigned deliverables by the appropriate deadline(s) and present your proposed design at the end of the Winter term during a scheduled Project Presentations. Listed below are the Project Objectives outlined in greater detail.

PROJECT OBJECTIVE #1:

FRAME A DESIGN PROBLEM IN TERMS OF THE NEEDS OF THE CLIENT, OBJECTIVES, CONSTRAINTS, FUNCTIONS, AND METRICS. EXPLORE THE DESIGN SPACE.

Your team has been presented with a real-world issue that requires you to come up with a solution that can improve your client's daily life. Your team will complete a set of exercises meant to conceptualize how you will design and fabricate this product. It is required that your team identify the needs of the client, the attributes and behaviours that a design solution should have or exhibit (i.e.., the *objectives*), the restrictions on the design solutions (i.e.., the *constraints*), the actions that the overall system is expected to perform (i.e., the *functions*), and the methods needed to evaluate how each objective is met (i.e., the *metrics*). Focusing specifically on the functions of your design, your team is required explore the design space by producing multiple, unique, and diverse design alternatives.

PROJECT OBJECTIVE #2:

FOLLOW AN ITERATIVE DESIGN PROCESS OF PROTOTYPE FABRICATION AND VALIDATION, SHOWING THE ABILITY TO INCORPORATE FEEDBACK IN THE DESIGN PROCESS WHEN IT IS APPROPRIATE.

Your team will follow an iterative design process moving from a preliminary conceptual prototype to a more detailed prototype that incorporates user feedback. You will test each prototype to evaluate the concept and performance of your design and record your observations. As you follow the design process you should be able to see an upward trend in performance and functionality of your prototypes, but if not, you may need to consider going backwards in the design process to test other

ideas or designs. Since we are learning online, it is possible that your prototypes will be entirely digital, or that your solution will be entirely software-based. More details about prototyping methods and validation will be provided in Design Studio/Lab B.

PROJECT OBJECTIVE #3:

COMMUNICATE YOUR DESIGN QUICKLY AND EFFECTIVELY TO NON-TEAM MEMBERS AND USE FEEDBACK FOR VALIDATION OF YOUR DESIGN AND/OR TO SEEK NEW IDEAS TO REFINE YOUR DESIGN.

Throughout the project, you will be given several opportunities to present your ideas and designs to non-team members such as TA's and IAI's, faculty mentors, and other students. Your team will be expected to communicate your design clearly and effectively to non-team members, answer questions about your design process, and apply feedback to improve and refine your design.

PROJECT OBJECTIVE #4:

FINALIZE YOUR DESIGN AND WRITE A PROFESSIONAL ENGINEERING REPORT DESCRIBING THE PROCESS AND OUTCOME OF YOUR DESIGN PROJECT TO A CLIENT.

The final stage of this project is to finalize your design and write a professional engineering report describing your design process and the result of your design project.

Project Four Schedule of Activities

Week #	Date	Activity	Complete **BEFORE** Design Studio/Lab B	Complete **DURING** Design Studio/Lab B
Wk-7	Tues Mar 2-Mon Mar 8	**Milestone 0** • Determine and document administrative responsibilities for each team member	Review the Administrative Responsibilities section of the P4 Project Module	*Team*: Complete Team Charter worksheet (Milestone Zero Team Worksheet)
		Milestone 1 • Complete a series of design exercises to frame the given problem and begin proposing concept solutions	*Individually*: Take notes from the Client Introduction visit and include these notes in the worksheet.	*Team*: Discuss objectives and draft initial problem statement
				Team: Complete Objective Tree, HOW/WHY LADDER, METRICS worksheet
				Team: Complete Project Plan worksheet
Wk-8	Tues Mar 9-Mon Mar 15	**Milestone 2** • Refine problem statement and perform functional analysis to aid in concept exploration	*As a team*, compile each team member's notes from the Client Q&A visit and include these notes in the worksheet.	*Team*: Generate refined problem statement
			Individually: Complete research assignment	*Team*: Complete Functional Analysis worksheet
				Individually: Complete Concept Exploration worksheet

Week #	Date	Activity	Complete **BEFORE** Design Studio/Lab B	Complete **DURING** Design Studio/Lab B
Wk-9	Tues Mar 16- Mon Mar 22	**Milestone 3** • Create initial prototype • Use decision matrix to evaluate design considerations • Participate in design review #1	*Team*: N/A *Individually:* *Come up with one refined concept in the form of an initial prototype. Include pictures of your prototype.*	*Team*: *Complete Decision Matrix worksheet* *Team*: Complete Design Review worksheet
Wk-10	Tues Mar 23- Mon Mar 29	**Milestone 4** • Create a prototype iteration and create testing plan • Participate in design review #2	*Team*: N/A	*Team*: Complete Prototype Iteration + Prototyping Test Plan worksheet *Team*: Complete Design Review worksheet
Wk-11	Tues Mar 30- Mon Apr 5	**Dedicated Project Time** • Student teams work towards finalizing their design • Presentation Prep	*Team*: N/A	*Team*: update your TA on team progress (Manager chairs meeting and Coordinator takes minutes) **There are no deliverables for this week**
Wk-12	Tues Apr 6- Mon Apr 12	**Pitch Video and Q&A** • Student teams present their video pitch to an IAI. • Students are expected to answer questions posed by evaluators about their design	*As a team*, create a pitch video demonstrating your design, its features, and advantages.	*Team:* present video pitch to evaluators and answer questions posed by evaluators about the design

Project Four Activity and Deliverables Schedule

In Project 4, Lab B and Design Studio are dedicated to the project which gives you the total of 5 hours per week to work on the project. Here is the overall breakdown of weekly activities based on the 5-hr project time. Depending on your Lab B and Design Studio schedule, you will complete these activities each week. Please be advised that the schedule is a proposed timeline, you do not have to be restricted by the schedule. The important point is that weekly tasks should be completed during the week and submitted by the assigned deadline.

Table 3. Proposed allocated time to weekly activities of project 4

Week #	# of hours	Project related activity
7 (Milestone 0 & 1)	Outside class time (individual)	Client notes
	1	Team development and project planning (Milestone 0)
	1	Initial problem statement (Milestone 1)
	1	Objective tree, How/why ladder/ Metrics (Milestone 1)
	1.5	Project refinement (Milestone 1)
	0.5	Prototype Plan (Milestone 1)
8 (Milestone 2)	Outside class time (individual)	Client notes and research assignment
	2	Refined Problem Statement
	1	Functional Analysis
	2	Concept explorations
9 (Milestone 3)	Outside class time (individual)	Refined Concept: Initial Prototype
	2	Decision matrix and prototyping
	2	Design Review
10 (Milestone 4)	2+1	Refined Prototype + Prototyping Test Plan
	2	Design Review
11	This week is project dedicated time so you can work as a team to finalize your design and get ready for the final presentation of the project	
12	2	Final presentation during Design Studio

Note: **The deadline to submit your weekly deliverables is on Tuesdays, 11:59pm (EST) for all sections.**

MILESTONE ZERO: TEAM DEVELOPMENT AND PROJECT PLANNING

Assessment Type: Team
Time Estimate: *1 hour of Week 7 Lab B/Design Studio*
Submission Deadline: 11:59 pm EST Tuesday, March 9th

Objectives and Requirements

For Milestone Zero, your team is required to formally document your team's personnel and the administrative roles and responsibilities each member will take on for the duration of the project. This formal documentation process is in the form of a **Team Charter**. Complete your charter on the *Team Charter* worksheet. Your worksheet must include the following:

1. **Team Personnel**: Record each team member's name (preferred name) and MacID in the Team Personnel table on the *Milestone 0 Cover Page* worksheet.

2. **Team Portrait**: Take a screenshot of your team during a virtual meeting. Ensure your camera is turned on so we can see you! Be creative! Include your photo on the *Cover Page* worksheet.

3. **Incoming Personnel Administrative Portfolio**: Record each team's administrative contributions on all projects up to this point, identifying their Project Lead roles

4. **Project Leads**: *As a team*, come to an agreement on who will take the **Lead** for each administrative task (**M**anager, **A**dministrator, **C**oordinator, **S**ubject Matter Expert)
   → Record each team members name next to their assigned role in the *Project Leads* table on the *Team Charter* worksheet
      • For a team of 5 students, there will be **two (2) Subject Matter Experts**
      • Otherwise, there can only be one team member for each role
   → Give consideration to each team member's administrative portfolio to ensure team members have the opportunity to take on different roles across projects
   → Each team member must sign next to their name, indicating their acceptance of the expectations and responsibilities specific to their assigned role
      • Refer to the *Administrative Roles and Responsibilities* section

Reminder for next week: Make sure that you take individual notes during the client visit in Lecture on Wednesday, March 10th, 2021, these will be handed in as part of milestone 2.

Submission Details

1. **Each Team Member**: upload screenshots of your *Team Charter* worksheet (all pages) to your online web Portfolio.
   → Photos should be uploaded to the *Milestones* subpage under the *Project-4* Page, and captioned "*Milestone 0 Worksheets*"
   → Click "Publish" on the top-right corner of the browser to reflect your changes online

2. **Project Administrator ONLY**: save your Milestone 0 *Cover Page* and *Team Charter* worksheets (both pages) as a single PDF, and submit it to the *Avenue Dropbox* titled **P4 Milestone 0 (Team) - DS Day**
   → Use the following naming convention: **Team#_P4_Milestone0.pdf**
   → This is a *team* submission that is the responsibility of the project *Administrator*
     • Submit all files as a *Group* on Avenue
   → Files missing from your submission will not be graded. **No exceptions**!

Grading of Milestone Zero

Milestone Zero is graded on a **Pass/Fail** basis. Failure to submit all worksheets will result in a **10% deduction to your Project 4 grade**.

PROJECT FOUR: MILESTONE 0 – COVER PAGE

Team Number:

Please list full names and MacID's of all *present* Team Members.

Full Name:	MacID:

Insert your Team Portrait in the dialog box below.

MILESTONE 0 – TEAM CHARTER

Team Number:

Incoming Personnel Administrative Portfolio:

Prior to identifying Leads, identify each team members incoming experience with various **Project Leads**

	Team Member Name:	**Project Leads**
1.		☐M ☐A ☐C ☐S
2.		☐M ☐A ☐C ☐S
3.		☐M ☐A ☐C ☐S
4.		☐M ☐A ☐C ☐S
		☐M ☐A ☐C ☐S

To 'check' each box in the Project Leads column, you must have this document open in the Microsoft Word Desktop App (not the browser and not MS Teams)

Project Leads:

Identify team member details (Name and MACID) in the space below.

Role:	**Team Member Name:**	**MacID**
Manager		
Administrator		
Coordinator		
Subject Matter Expert		

MILESTONE ONE: PROBLEM FRAMING

Assessment Type: Individual (1.1) + Team (1. 2, 1.3, and 1.4)

Time Estimate: **Prior to** and **During** *Week 7 Lab B/Design Studio*

> 1.1 = Individual, before Week 7 starts
>
> 1.2 = 1 hour, during Week 7 Lab B/DS
>
> 1.3 = 2.5 hours, during Week 7 Lab B/DS
>
> 1.4 = 0.5 hours, during Week 7 Lab B/DS

Submission Deadline: 11:59 pm EST Tuesday, March 9th

Objectives and Requirements

For Milestone One, your team is asked to discuss and formulate an initial problem statement that outlines the set of considerations (function and constraints) in the client problem. To accomplish this, teams should review notes from the introductory client meeting.

The outcome of this design studio/Lab B is an initial problem statement and a project plan that guides the focus of the project. The design activities described below are meant to inform your design decisions.

Note: Your team will use this important information for your design in the subsequent weeks *Individually,* take notes from the Client Introduction visit and include these notes in the worksheet.; there is no need to think of the final solution at this stage. A "solution-driven" approach to engineering often does not yield the best final design.

1.1 Client Notes (Prior Wk-7 Lab B/DS): *Individually,* take notes from the Client Introduction visit and include these notes in the worksheet.

1.2 Initial Problem Statement (During Wk-7 Lab B/DS): *As a team*, have a discussion on defining the primary function of your design for the client problem your team chooses to focus on. **Draft** an initial problem statement to include in your MILESTONE 1 work sheet. Remember to avoid solution-specific statements. For an example of a problem statement, see the lecture materials from "Review of Design Process" lecture – Monday, March 1st.

1.3 Objective Tree, How/Why Ladder, Metrics & project refinement (During Wk-7 Lab B/DS): *As a team*, create an objective tree AND/OR a how/why ladder for the client problem. You should justify the effectiveness of your chosen design tool(s) for this stage. Choose your top 3 objectives and provide a rationale for your choices, relating back to the client resources (your client visit notes, videos, Project 4 Module, etc.). Outline appropriate metrics for these objectives. For a review of these design tools, see the lecture materials from "Review of Design Process" lecture – Monday, March 1st.

1.4 Prototyping Plan- (During Wk-7 Lab B/DS): *As a team*, outline a project plan that indicates each team member's experience with physical and/or software prototyping, which may be from previous projects in the course, or any other relevant experience. Also, as a team, compile a list of potentially useful resources, materials, and/or tools for prototyping. Include a brief description for each.

Submission Details

1. **Each Team Member**:
    - Upload a ***.PDF** copy of *Wk-7 (Winter) – P4 Milestone 1 Worksheets INDIVIDUAL* document to the *Avenue Dropbox* titled **P4 Milestone 1 (Individual)**
        → Use the following naming convention: **macID_P4_Milestone1.pdf**
        → The Project Administrator must submit a copy as well
    - Upload photos of your team's worksheets to your **online web Portfolio**.
        → Photos should be uploaded to the *Milestones* subpage under the *Project-4* Page, and captioned "*Milestone 1 Worksheets*"
        → Click "Publish" on the top-right corner of the browser to reflect your changes online
2. **Project Administrator ONLY**:
    → Upload a ***.PDF** copy of *Wk-7 (Winter) – P4 Milestone 1 Worksheets TEAM* document to the *Avenue Dropbox* titled **P4 Milestone 1 (Team) - DS Day**
        → Use the following naming convention: **Team#_P4_Milestone1.pdf**
        → This is a *team* submission that is the responsibility of the project *Administrator*
            ▪ Submit all files as a *Group* on Avenue
        → Files missing from your submission will not be graded. **No exceptions**!

Grading of Milestone One

Milestone One is worth **1.4 marks of your total Project-4 grade (10%)**. Each team member will receive their own grade for Milestone 1.1. All team members will receive the same grade for Milestones 1.2, 1.3, and 1.4.

PROJECT FOUR: MILESTONE 1 – COVER PAGE

Team Number:

Please list full names and MacID's of all *present* Team Members.

Full Name:	MacID:

MILESTONE 1.1– CLIENT NOTES

Team Number: [   ]

You should have already completed this task individually <u>prior</u> to Design Studio/Lab B for Week 7.

1. Copy-and-paste each team member's client notes on the following pages (1 team member per page)
   → Be sure to indicate each team member's Name and MacID

We are asking that you submit your work on both the team and individual worksheets. It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their client notes with the **Milestone One Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone One Team Worksheets** document allows you to readily access your team member's work
  - o This will be especially helpful when completing the rest of the milestone

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Team Number:

Name:	MacID:
Copy-and-paste the notes from the introductory client visit for one team member in the space below.	

Team Number:

Name:	MacID:
Copy-and-paste the notes from the introductory client visit for one team member in the space below.	

Team Number:

Name:	MacID:
Copy-and-paste the notes from the introductory client visit for one team member in the space below.	

Team Number:

Name:	MacID:
Copy-and-paste the notes from the introductory client visit for one team member in the space below.	

*If you are in a team of 5, please copy and paste the above on a new page.

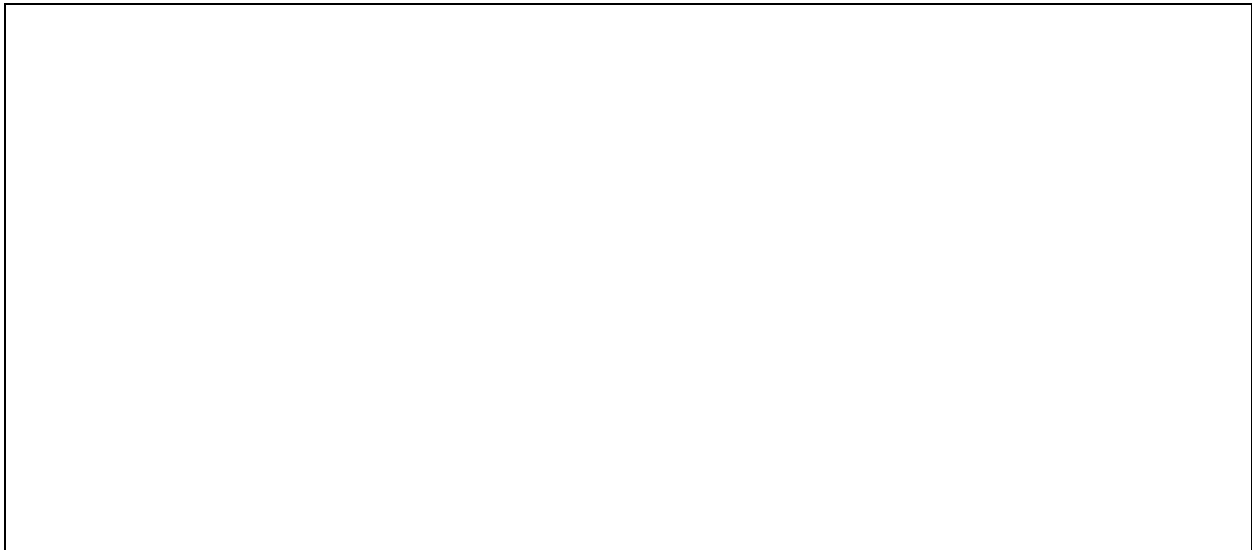## MILESTONE 1.2 – INITIAL PROBLEM STATEMENT

Team Number:

1. As a team, come up with an initial problem statement and include it in the space below.
   - → Make use of your client notes to define your primary function
   - → Remember to avoid solution-specific statements
     - ○ Focus on what your design *should* do for the client in a general sense (not *how* to do it)
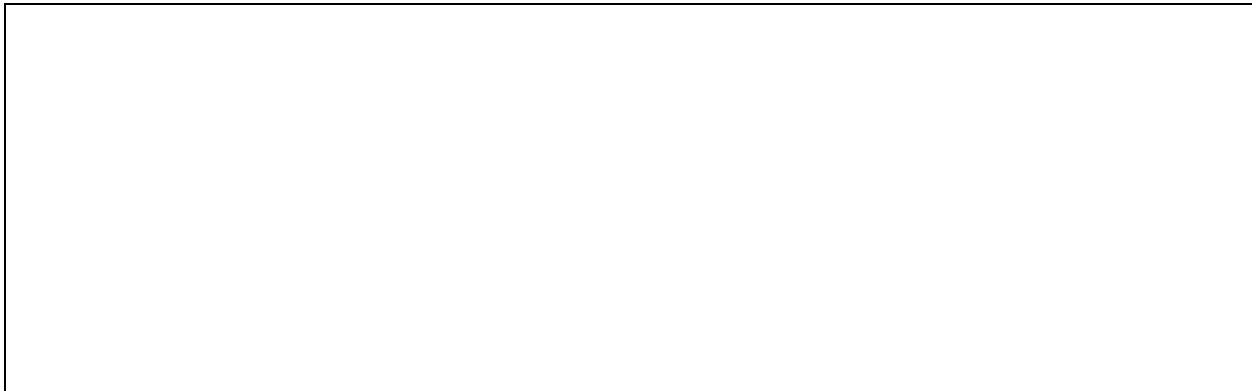
MILESTONE 1.3 – OBJECTIVE TREE, HOW/WHY LADDER, METRICS

Team Number:

1. As a team, use an objective tree and/or How/Why ladder, to refine and guide the focus of the project.
   → If your team chooses to do both, copy and paste the blank box on a separate page
   → Your diagram(s) can be hand-drawn or done on a computer. Please make sure it's well organized and *readable*.
2. If you need to see examples of each tool see "Review of Design Process" lecture – Monday, March 1st.

Justify your team's reasoning behind the choice of design tool(s):

1. What are your top three objectives (in no particular order)?

2. What is your rationale for selecting each of these objectives? Write maximum 100 words for each objective.

Objective 1:
Rationale:

Objective 2:
Rationale:

Objective 3:
Rationale:

3. Fill out the table below with associated metrics (including units) for each objective.
   Remember: Metrics should be something you can actually test or measure as part of your process (e.g., calculate weight of a part by iProperties in CAD, test results of a physical prototype).

Objective:	
Unit/Metric:	

Objective:	
Unit/Metric:	

Objective:	
Unit/Metric:	

MILESTONE 1.4 – PROJECT PLAN

Team Number: [ ]

1. As a team, outline a project plan where you:
   → Include a few sentences describing each team member's prior experience with physical and/or software prototyping
     - From previous projects in the course, or any other relevant experience
   → Compile a list of potentially useful resources, materials, and/or tools for prototyping

   Reminders:
   → The prototype can be either physical (e.g., cardboard and tape, 3D printed), digital (e.g., Inventor simulation or rendering), software (e.g., code for Raspberry Pi) or some combination of physical, digital and software
   → Keep in mind that there are no ENG 1P13 physical prototyping resources available to you because we are learning online, which is why we are asking you to take inventory of how you might accomplish prototyping as a group
   → As you think about how to prototype, remember that you will eventually need to validate your work somehow. Your validation approach will depend on what prototyping technique you use. Examples of validation approaches include (but are not limited to): hand calculation, physical test, software demonstration or simulation.

MILESTONE 1.1 – CLIENT NOTES - **INDIVIDUAL**

Team Number:

Complete this worksheet individually <u>before</u> coming to Design Studio/Lab B for Week 7.

1. Include your client notes from the introductory client visit

Name:	MacID:

At the beginning of Design Studio/Lab B, we will be asking that you copy-and-paste the above list into **Milestone One Team Worksheets.** It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their client notes with the **Milestone One Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone One Team Worksheets** document allows you to readily access your team member's work
  - o This will be especially helpful when completing the rest of the milestone

MILESTONE TWO: DESIGN EXPLORATION

Assessment Type: Individual (2.2 and 2.5) + Team (2.1, 2.3, and 2.4)

Time Estimate: **Prior to** and **During** Week 8 Lab B/Design Studio

> 2.1 = Team, before Week 8 starts
>
> 2.2 = Individual, before Week 8 starts
>
> 2.3 = 2 hours, during Week 8 Lab B/DS
>
> 2.4 = 1 hour, during Week 8 Lab B/DS
>
> 2.5 = 2 hours, during Week 8 Lab B/DS

Submission Deadline: 11:59 pm EST Tuesday, March 16th

Objectives and Requirements

For Milestone Two, your team is asked to refine your initial problem statement, using notes from the research assignment and from the 2nd client visit. Your team will also be performing functional analysis to aid you in your concept exploration.

2.1 Consolidated Client Notes (Prior to Wk-8 Lab B/DS): *As a team,* compile each team member's notes from the Client Q&A visit and include these notes in the worksheet.

2.2 Research Assignment (Prior to Wk-8 Lab B/DS): *Individually,* complete the research assignment outlined on the Milestone 2.2 worksheet.

2.3 Refined Problem Statement (During Wk-8 Lab B/DS): *As a team*, generate a refined problem statement. Having completed the initial problem statement in Milestone 1, the goal here is to generate a more comprehensive and precise problem statement. This will clearly define and communicate the problem your team is focusing on and it will most likely contain a few sentences.

Your refined problem statement should address and include the following elements:

- Who? (the user/client)
- Where? (the environment in which it will be used)
- Why? (the reason for solving the problem)
- What? (the key function and objectives that should be considered for your design)

Important Note: Remember not to include How? (the process/path your team will use to solve the problem)

2.4 Functional Analysis (During Wk-8 Lab B/DS): *As a team*, perform functional analysis using a morphological chart or your choice of design tool. Justify your choice of tool. For examples of applicable design tools, see "Review of Design Process" lecture – Monday, March 1st.

2.5 Concept Exploration (During Wk-8 Lab B/DS): *Individually*, convey at least two different possible solutions based on your team's refined problem statement, using your choice of method to communicate your solution (e.g., sketches, initial prototype, very basic CAD model).

Your solutions do not need to be refined or artistic, when reviewing the rubric, you will notice that there are no additional marks for aesthetics. However, they should clearly communicate a concept and be significantly different from each other. Include necessary annotations to help in the communication of your ideas.

Submission Details

1. **Each Team Member**:
   - Upload a ***.PDF** copy of *Wk-8 (Winter) – P4 Milestone 2 Worksheets INDIVIDUAL* document to the *Avenue Dropbox* titled **P4 Milestone 2 (Individual)**
     - → Use the following naming convention: **macID_P4_Milestone2.pdf**
     - → The Project Administrator must submit a copy as well
   - Upload photos of your team's worksheets to your <u>online web Portfolio</u>.
     - → Photos should be uploaded to the *Milestones* subpage under the *Project-4* Page, and captioned "*Milestone 2 Worksheets*"
     - → Click "Publish" on the top-right corner of the browser to reflect your changes online
2. **Project Administrator ONLY**:
   - Upload a ***.PDF** copy of *Wk-8 (Winter) – P4 Milestone 2 Worksheets TEAM* document to the *Avenue Dropbox* titled **P4 Milestone 2 (Team) - DS Day**
     - → Use the following naming convention: **Team#_P4_Milestone2.pdf**
     - → This is a *team* submission that is the responsibility of the project *Administrator*
       - ▪ Submit all files as a <u>Group</u> on Avenue
     - → Files missing from your submission will not be graded. **<u>No exceptions</u>**!

Grading of Milestone Two

Milestone Two is worth **2.5 marks of your total Project-4 grade (17.9%)**. Each team member will receive their own grade for Milestone 2.2 and 2.5. All team members will receive the same grade for Milestone 2.1, 2.3 and 2.4.

PROJECT FOUR: MILESTONE 2 – COVER PAGE

Team Number:

Please list full names and MacID's of all *present* Team Members.

Full Name:	MacID:

MILESTONE 2.1 – CONSOLIDATED CLIENT NOTES

Team Number:

You should have already completed this task individually <u>prior</u> to Design Studio/Lab B for Week 8.

1. Compile your team's notes from the client Q&A visit.

MILESTONE 2.2 – RESEARCH ASSIGNMENT

Team Number:

You should have already completed this task individually <u>prior</u> to Design Studio/Lab B for Week 8.

1. Copy-and-paste each team member's research assignment on the following pages (1 assignment per page)
   → Be sure to indicate each team member's Name and MacID

See individual worksheet for assignment specification (PAGE 52)

We are asking that you submit your work on both the team and individual worksheets. It does seem redundant, but there are valid reasons for this:

1. Each team member needs to submit their research assignment with the **Milestone Two Individual Worksheets** document so that it can be *graded*

2. Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work

   a. This will be especially helpful when completing the rest of the milestone

---

Team Number:

Name:	MacID:
Include your research assignment below.	

Team Number:

Name:	MacID:
Include your research assignment below.	

Team Number:

Name:	MacID:
Include your research assignment below.	

Team Number:

Name:	MacID:
Include your research assignment below.	

*If you are in a team of 5, please copy and paste the above on a new page.

MILESTONE 2.3 – REFINED PROBLEM STATEMENT

Team Number:

1. Write your initial problem statement below. This is what you have submitted for Milestone 1.2.

2. Outline the <u>Who</u>, <u>Where</u>, <u>Why</u>, and <u>What</u> elements of your problem statement. Then write the refined problem statement below. Refer to the provided Refined Problem Statement <u>rubric</u> provided.

- Who? –
- Where? –
- Why? –
- What? –

Refined Problem Statement:

MILESTONE 2.4– FUNCTIONAL ANALYSIS

<div style="text-align: right;">

Team Number: [   ]

</div>

3. Identify your team's choice of design tool to perform Functional Analysis and the rationale behind choosing it. For examples of design tools, see "Review of Design Process" lecture – Monday, March 1st.

Choice:

Rational:

4. Include a copy of your team's functional analysis below.

MILESTONE 2.5 – CONCEPT EXPLORATION

<div align="right">

Team Number: ☐

</div>

Complete this worksheet <u>during</u> Design Studio/Lab B for Week 8.

1. Include multiple images of your concept exploration, if needed
   - → Include 2 distinct concepts
   - → Include necessary annotations to help in the communication of your ideas
   - → These can be photos of hand sketches, photos of initial prototypes, screen grabs of basic CAD models
   - → Include your Team Number, Name and MacID on <u>each</u> concept
2. Insert your photo(s) as a Picture (Insert > Picture > This Device)
3. **Do not include more than *two* concept images per page**

> Make sure to include images of <u>each</u> team member's concept exploration

We are asking that you submit your work on both the team and individual worksheets. It does seem redundant, but there are valid reasons for this:
- Each team member needs to submit pictures of their concept with the **Milestone Two Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work
  - o This will be especially helpful when completing the next milestone

Team Number:

Concept 1

Name:	MacID:
Insert screenshot(s) of your concept below.	

Concept 2

Name:	MacID:
Insert screenshot(s) of your concept below.	

Team Number: [   ]

Concept 1

Name:	MacID:
Insert screenshot(s) of your concept below.	

Concept 2

Name:	MacID:
Insert screenshot(s) of your concept below.	

Team Number:

Concept 1

Name:	MacID:
Insert screenshot(s) of your concept below.	

Concept 2

Name:	MacID:
Insert screenshot(s) of your concept below.	

Team Number:

Concept 1

Name:	MacID:
Insert screenshot(s) of your concept below.	

Concept 2

Name:	MacID:
Insert screenshot(s) of your concept below.	

MILESTONE 2.2 – RESEARCH ASSIGNMENT

Team Number:

Complete this worksheet individually <u>before</u> coming to Design Studio/Lab B for Week 8.

1. Include your research assignment in the space provided

One of the key challenges of client-based design work is understanding the client and the context in which they will be using your potential solution. In any design project, designers rarely have unlimited access to the client and the information we obtain is limited by the questions that we think to ask. To address this challenge, designers often do additional external research so they can better understand the client's activities and environment, appropriate vs inappropriate materials, existing devices on the market etc.

Based on your notes from the client visit, identify and answer one question that:
- Can be answered by external research (external = not class materials)
- Is distinct from the questions being researched by your teammates
- Will help you in your design work

Good questions would be:
- What are the physical properties of art supplies used by our client (e.g., diameter, magnetism, friction)
- How do other artists with physical limitations work?

A bad question would be:
- What TV shows does my client like to watch? [Why is this bad? It cannot be answered by external research and it is irrelevant to the design process]

Your research assignment:
- State the question you plan to answer through your research
- Summarize your research findings (answer). Your answer should be a coherent, well-written summary of your research, not a "brain dump".
- You may include images, but do not forget to cite them properly.
- Aim for a length of about 500 words
- Properly cite your sources using IEEE formatted references and in-text citations. For information on referencing formats and choosing sources, see Design and Communication Workshop 1.

Team Number:

Name:	MacID:
What is your question?	
What is your answer?	
List of sources:	

At the beginning of Design Studio/Lab B, we will be asking that you copy-and-paste the same research assignment into **Milestone Two Team Worksheets.** It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their research assignment with the **Milestone Two Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work
    - This will be especially helpful when completing the rest of the milestone

MILESTONE 2.5 – CONCEPT EXPLORATION

Team Number:

Complete this worksheet <u>during</u> Design Studio/Lab B for Week 8.

1. Include multiple images of your concept exploration, if needed
   - → Include 2 distinct concepts
   - → Include necessary annotations to help in the communication of your ideas
   - → These can be photos of hand sketches, photos of initial prototypes, screen grabs of basic CAD models
   - → Include your Team Number, Name and MacID on <u>each</u> concept
2. Insert your photo(s) as a Picture (Insert > Picture > This Device)
3. **Do not include more than *two* concept images per page**

During this Design Studio/Lab B, we will be asking that you copy-and-paste the same photos into **Milestone Two Team Worksheets.** It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit pictures of their concept with the **Milestone Two Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work
   - o This will be especially helpful when completing the next milestone

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Team Number:

Concept 1

Name:	MacID:
Insert screenshot(s) of your concept below.	

Concept 2

Name:	MacID:
Insert screenshot(s) of your concept below.	

MILESTONE THREE: PROTOTYPING + DESIGN REVIEW

Assessment Type: Individual (3.1) + Team (3.2 and 3.3)

Time Allotted: ***Prior to*** and ***During*** *Week 9 Lab B/Design Studio*

> 3.1 = Individual, before Week 9 Lab B/DS
>
> 3.2 = 2 to 3 hours, during Week 9 Lab B/DS
>
> 3.3 = 2 hours, during Week 9 Lab B/DS

Submission Deadline: 11:59 pm EST Tuesday, March 23rd

Objectives and Requirements

For Milestone Three, your team will generate various initial prototypes then evaluate their effectiveness of your designs using a decision matrix. You will then discuss your top 2 designs with peers and science student mentors and record all feedback.

3.1 Refined Concept: Initial Prototype (Prior to and/or During Wk-9 Lab B/DS): *Individually*, each team member is required to come up with one refined concept in the form of an initial prototype. You may choose to make changes to one of your initial concepts from Milestone Two, combine the concepts, or even come up with an entirely new idea. In any case, you should note your thought process and how your concept has changed from the previous milestone. You are encouraged to seek feedback and discussions from your team members and/or the instructional team (IAIs, TAs, etc.). Include pictures of your prototype. The prototype can be:

- physical (e.g., cardboard and tape, 3D printed)
- digital (e.g., Inventor simulation or rendering)
- software (e.g., code for Raspberry Pi)
- combination of physical, digital and software

Keep in mind that initial prototyping means that you should not spend a lot of time perfecting the aesthetics of your prototype, since it is likely to change in response to the design review feedback. Aim for something that clearly communicates the function of your concept, but remember, the rubric does not award points for aesthetics.

If you are using CAD for your prototype, think about making your sketches easily editable so you do not have to start from scratch when you incorporate feedback or revisions. Refer to this **video** for a demonstration of how to do this.

3.2 Decision Matrix (During Wk-9 Lab B/DS): *As a team*, decide on an appropriate decision matrix to explore how each initial prototype might perform against your team's design considerations (functions, objectives, constraints, etc.). Include a rationale for your choice of

matrix. Your team will be using this design tool to justify your selection of your top two initial prototypes. Make sure that your headings in your matrix include descriptive names for your prototypes (ex. Use "Pencil with Hook" instead of "Design A"). For examples of decision matrices, see "Review of Design Process" lecture – Monday, March 1st.

3.3 Design Review (During Wk-9 Lab B/DS): *As a team*, discuss your initial prototypes and make note of all feedback. You will also discuss with and record feedback from science student mentors. More information on how design reviews will operate will be provided in design studio/lab B.

Submission Details

1. **Each Team Member**:
   - Upload a ***.PDF** copy of *Wk-9 (Winter) – P4 Milestone 3 Worksheets INDIVIDUAL* document to the *Avenue Dropbox* titled **P4 Milestone 3 (Individual)**
       → Use the following naming convention: **macID_P4_Milestone3.pdf**
       → The Project Administrator must submit a copy as well
   - Upload photos of your team's worksheets to your <u>online web Portfolio</u>.
       → Photos should be uploaded to the *Milestones* subpage under the *Project-4* Page, and captioned "*Milestone 3 Worksheets*"
       → Click "Publish" on the top-right corner of the browser to reflect your changes online

2. **Project Administrator ONLY**:
   - Upload a ***.PDF** copy of *Wk-9 (Winter) – P4 Milestone 3 Worksheets TEAM* document to the *Avenue Dropbox* titled **P4 Milestone 3 (Team) - DS Day**
       → Use the following naming convention: **Team#_P4_Milestone3.pdf**
       → This is a *team* submission that is the responsibility of the project *Administrator*
           ▪ Submit all files as a <u>Group</u> on Avenue
       → Files missing from your submission will not be graded. **No exceptions**!

Grading of Milestone Three

Milestone Three is worth **0.7 marks of your total Project-4 grade (5%)**. Each team member will receive their own grade for Stages 1 of the Milestone. All team members will receive the same grade for Stages 2 and 3 of the Milestone.

PROJECT FOUR: MILESTONE 3 – COVER PAGE

Team Number:

Please list full names and MacID's of all *present* Team Members.

Full Name:	MacID:

MILESTONE 3.1 – REFINED CONCEPT: INITIAL PROTOTYPE

Team Number: [   ]

1. Copy-and-paste picture(s) of each team member's refined concept (initial prototype) on the following pages (1 team member per page)
   → Be sure to clearly indicate who each refined concept belongs to
2. Include details on how concept was refined (what feedback was incorporated, what features are different than previous concept exploration, etc.)

We are asking that you submit your work on both worksheets. It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit picture(s) of their refined concept with the **Milestone Three Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone Three Team Worksheets** document allows you to readily access your team member's work
  - o This will be especially helpful when completing the rest of the milestone

---

Team Number:

Name:	MacID
Insert picture(s) of your refined concept (initial prototype) below.	

Name:	MacID
Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated (max. 200 words).	

Team Number:

Name:	MacID
Insert picture(s) of your refined concept (initial prototype) below.	

Name:	MacID
*Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated **(max. 200 words).***	

Team Number:

Name:	MacID
Insert picture(s) of your refined concept (initial prototype) below.	

Name:	MacID
*Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated **(max. 200 words).***	

Team Number: [ ]

Name:	MacID
Insert picture(s) of your refined concept (initial prototype) below.	

Name:	MacID
Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated (max. 200 words).	

*If you are in a team of 5, please copy and paste the above on a new page.

MILESTONE 3.2– DECISION MATRIX

1. As a team, use a decision matrix to aid you in choosing two concepts to proceed with.
   → Your concept titles should be descriptive (i.e., "Pencil with Hook" instead of "Design A")

Include your team's Decision Matrix below.

2. The numbers you associate with your criteria (objectives and constraints) will probably be an estimation at this point, so **your top two concepts may not always end up being the top two scoring from the decision matrix**. You should provide justification for your team's thought process in choosing the top two concepts. This should include, but is not limited to, explaining:
    → Your choice of decision matrix tool
    → Your rationale behind your choice of criteria
    → Why you prioritized criteria the way that you did (if ranking and/or weighing them)
    → What metrics you used to decide your scoring of concepts within the criteria

	Insert your team's top two concepts below.
Concept 1:	
Concept 2:	

Include your team's justification below.

MILESTONE 3.3– DESIGN REVIEW

Team Number:

Include your feedback from both your peers and the science students below.

Name:	MacID:
Include feedback from peers in this row.	
Include feedback from science students in this row.	

MILESTONE 3.1– REFINED CONCEPT: INITIAL PROTOTYPE - **INDIVIDUAL**

Team Number:

Complete this worksheet individually <u>before</u> coming to Design Studio/Lab B for Week 9.

1. Take picture(s) of your refined concept (initial prototype)
    → Be sure to clearly indicate who each refined concept belongs to
2. Insert your photo(s) as a Picture (Insert > Picture > This Device)
3. **Do not include more than *two* refined concept pictures per page**
4. Include details on how concept was refined (what feedback was incorporated, what features are different than previous concept exploration, etc.)

At the beginning of Design Studio/Lab B, we will be asking that you copy-and-paste your refined concept picture(s) into **Milestone Three Team Worksheets.** It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their refined concept picture(s) with the **Milestone Three Individual Worksheets** document so that it can be *graded*
- Compiling your individual work into this **Milestone Three Team Worksheets** document allows you to readily access your team member's work
    - This will be especially helpful when completing the rest of the milestone

Team Number:

Name:	MacID:
Insert picture(s) of your refined concept (initial prototype) below.	

*Limit screenshots to no more than 2 per page. For additional screenshots, please copy and paste the above on a new page

Name:	MacID:
Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated ***(max. 200 words).***	

MILESTONE FOUR: REFINED PROTOTYPING AND TESTING + DESIGN REVIEW

Assessment Type: Team

Time Estimated: Week 10 Lab B/Design Studio

       4.1 = 2+1 hours, during Week 10 Lab B/DS

       4.2 = 2 hours, during Week 10 Lab B/DS

Submission Deadline: 11:59 pm EST Tuesday, March 30th

Objectives and Requirements

For Milestone Four, your team will …

    4.1 Refined Prototype + Prototyping Test Plan (During Wk-10 Lab B/DS): *As a team,* create one refined prototype that incorporates the feedback from your design review. This can be purely physical, purely software, or a combination of both. In any case, team members who are not contributing to the prototyping process itself should take a larger role in the prototyping test plan. Discuss how the prototype was refined. You do not need to change the method of prototyping or the aesthetic quality of the prototype, focus on how you can make the concept more functional.

    Your team should refer to your metrics in developing a more detailed test plan that is <u>feasible</u> with the resources available. You should also outline specific ways that your team would test your prototype(s) <u>if</u> you had more time, money, tools, etc. Make sure to use IEEE style referencing if any research is done. Do not exceed 500 words.

    Include each team member's specific contributions to this stage, whether it is in the prototyping or test plan.

    4.2 Design Review (During Wk-10 Lab B/DS): *As a team*, discuss your refined prototype with another team and make note of all feedback. You will also discuss with and record feedback from science student mentors.

Submission Details

1. **Each Team Member**:

   - Upload photos of your team's worksheet to your **online web Portfolio**.
     - → Photos should be uploaded to the *Milestones* subpage under the *Project-4* Page, and captioned "*Milestone 4 Worksheets*"
     - → Click "Publish" on the top-right corner of the browser to reflect your changes online

2. **Project Administrator ONLY**:

   - Upload a ***.PDF** copy of *Wk-10 (Winter) – P4 Milestone 4 Worksheets TEAM* document to the *Avenue Dropbox* titled **P4 Milestone 4 (Team) - DS Day**
     - → Use the following naming convention: **Team#_P4_Milestone4.pdf**
     - → This is a *team* submission that is the responsibility of the project *Administrator*
       - ▪ Submit all files as a <u>Group</u> on Avenue
     - → Files missing from your submission will not be graded. **No exceptions**!

Grading of Milestone Four

Milestone Four is worth **2.5 marks of your total Project-4 grade (17.9%)**. All team members will receive the same grade for all the stages of the Milestone.

PROJECT FOUR: MILESTONE 4 – COVER PAGE

Team Number:

Please list full names and MacID's of all *present* Team Members.

Full Name:	MacID:

MILESTONE 4.1 – REFINED PROTOTYPE + PROTOTYPING TEST PLAN

Team Number:

1. Take picture(s) of your prototype iteration
   → Insert your photo(s) as a Picture (Insert > Picture > This Device)
   → **Do not include more than *two* pictures per page**

Insert picture(s) of your refined prototype below.

*Limit screenshots to no more than 2 per page. For additional screenshots, please copy and paste the above on a new page.

Team Number: [ ]

2. Include details on how design concept was refined (what feedback was incorporated, what features are different than previous refined concept (initial prototype), etc.).

*Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated **(max. 200 words)***

Team Number: [ ]

3. Create a detailed prototype testing plan. (Max 500 words)
    → Consider what is feasible with the resources you have
    → "Testing" can include analytic solutions such as hand calculations, motion simulations in Inventor
    → Explore what you might do if you had more time, money, tools, etc.
    → Use IEEE referencing if any research is done

Include your prototype testing plan below.

Team Number:

4. Fill out the table below, detailing each team member's contribution to this stage

Team Member's Full Name:	Contribution:

MILESTONE 4.2 – DESIGN REVIEW

Team Number:

Name:	MacID:
Include feedback from peers in this row.	
Include feedback from science students in this row.	
If applicable, include feedback from the client in this row.	

FINAL PRESENTATION: MAKE A CLIENT PITCH

Assessment Type: Team
When: During Week 12 Design Studio (DS-12)

Objectives and Requirements

As a *team,* you are required to make a client pitch of your design during DS-12. You will not be making a pitch directly to the client as they will not be present in DS-12. However, the top presentations will be selected to present during the last lecture of term in a final showcase at which the client will be present. The goal of the presentations is to convince the client to select your design as the one they would like to try out. The showcase has no bearing on your grades.

The presentation will have two parts:

1. **Pitch Video**

    The pitch video must meet the following requirements.

      → It must be no longer than a prescribed duration. The duration of the video will be announced ahead of time.
      → All team members must appear in the video (visually and/or audibly) and be part of the presentation.
      → The video must include a segment demonstrating how the user would use the design.
      → An outline of the design's benefits and how it improves over the existing alternatives.
      → An explanation of what makes the design unique and innovative.
      → A description of materials, costs, and construction.
      → The project must be identified by a name for the team and design. Include task/problem your design addresses. Include team members names, their MacID's, and the team name. This information must be clearly displayed at the beginning of the video.
      → The video must include subtitles.

In Design Communication Workshop 5 you will learn how to create and share videos.

2. **Question and Answer Period**

      → After a team has shown its pitch video the evaluators (TA's, IAI's, and instructors) will have an opportunity to task any questions they wish.
      → All team members must be present.

Submission Details

The video or a publicly accessible link to the video, must be submitted on MS Streams or Avenue prior to Week 12 Design Studio. Review the methods you learned in "Design Communication Workshop 5".

1. **Project Administrator ONLY**:
   - Upload the video or publicly accessible link to the *Avenue Dropbox* titled **P4 Final Presentation - DS Day**
     → Use the following naming convention: **Team#_P4_FinalPresentation.pdf** (or any *popular* video format)
     → This is a *team* submission that is the responsibility of the project *Administrator*
       ▪ Submit all files as a <u>Group</u> on Avenue
     → Files missing from your submission will not be graded. **No exceptions**!

Grading of Final Submission

The Final Presentation is worth **1.4 marks of your total Project-4 grade (10%)**. The grade will be based on how compelling your presentation is, the creativity and innovativeness of your design, and its value to the client.

FINAL SUBMISSION: DESIGN PROJECT REPORT

Assessment Type: Team
Time Allotted: Own Time
Submission Deadline: Please refer to Table 2: List of Deliverables

Objectives and Requirements

As a *team*, you are required to consolidate and present your work in a *Design Project Report*. Your report should: 1) concisely summarize your design solution, 2) document your design work (include dead ends and failures), 3) document any other work relevant to your design in an appendix, 4) include all deliverables related to administrative responsibilities also in an appendix.

> You are required to complete your Design Project Report using the template Word document that has been provided to you on Avenue-to-Learn
> - Content > 4-Design Projects > Student Resources > *1P13_Project_Report_Template.docx*

Your report should include a Title Page, Signed Academic Integrity Statement, and the following sections:

→ *Executive Summary*
- Introduce Problem
- Description of final prototype (include photo of your prototype on this page, not in the appendix)
- Benefits of this prototype for the client
- Next steps moving forward (How would you improve this device given more time/money/resources/etc.)

→ *Introduction*
- Relevant background information (Medical, Client specific, etc.)
- Refined Problem Statement
- Objectives and Constraints of your design
- Existing Ideas/Solutions (Patents & Commercial Products)

→ *Conceptual Design*
- Ideation (Design Space Exploration, Morph Charts, Brainstorming, Initial Sketching)
- Design Alternatives
- Decision Matrices
- Design Evaluation (Discussion of feedback from IAIs, TAs and Science Students, how this feedback impacted your design process)

→ *Final Proposed Design*
- Description of Final Design and how it works

- Specifications of your design
- Final Drawings
- Discussion of objectives/constraints met (using metrics)
- Construction/development methods (e.g., bill of materials, device construction, discussion of why certain materials/items would be used)

→ *Conclusions*

- Looking ahead (What steps would you take, given more time, to improve your device?)
- Looking back (Sample Reflection Questions: What did you learn about the design process through this project? What did you learn about team dynamics through this project? How would you structure your design process differently next time? What would you change about how your team worked together if you were to work together again?)

→ *List of Sources*

- Everything should be referenced with IEEE-style referencing

→ *Appendices*

- Section 1, 2 and 3 should all have their own Appendix containing the images relevant to that section. Anything in the appendix should be referenced in the report.
- Section 1 should include but is not limited to Patents, Commercial Products, Objective Trees, Medical Documents, Client Meeting Notes, etc.
- Section 2 should include but is not limited to Morph Charts, Decision Matrices, Sketches, Design Review Notes, Initial Prototype/Prototype Iteration pictures, etc.
- Section 3 should include but is not limited to Final drawings, Final Prototype pictures, Bill of Materials (for the final design), etc.
- Sections 4, 5, and 6 should all have their own Appendix containing the deliverables related to the Administrative Responsibilities.
- Section 4 should include the Preliminary Gantt Chart (Manager), Final Gantt Chart (Administrator), and Logbook of Additional Meetings and Discussions (Coordinator).
- Section 5 should include the Scheduled Weekly Progress Meeting Agenda's (Manager) and Minute's (Coordinator).
- Section 6 should include the Source Materials Database (Subject Matter Expert).

Submission Details

1. **Project Administrator ONLY**: upload your Design Project Report as a **PDF** to the *Avenue Dropbox* titled **P4 Project Report – DS Day**
    → Use the following naming convention: **Team#_P4_DesignReport.pdf**
    → Note that Turnitin.com will be used to check for plagiarism
    → This is a *team* submission that is the responsibility of the project *Administrator*
        • Submit all files as a *Group* on Avenue

Grading of Final Submission

1. *Design Project Report*:
    The Design Project Report is worth **5.0 marks of your total Project-4 grade (35.7%)**. Refer to the provided rubrics for more details.

PROJECT REFLECTION

Assessment Type: Individual
Time Allotted: Own Time
Submission Deadline: Please refer to Table 2: List of Deliverables

Objectives and Requirements

Based on what will learn in "Design Communication Workshops 6" during Week 10, you need to write a reflection essay on your project 4 experience. More details will be provided to you in "Design Communication Workshop 6".

Submission Details

Each Team Member: upload your reflection essay as a **PDF** to the *Avenue Dropbox* titled **P4 Reflection** using the **MacID_P4_Reflection.pdf** as naming convention

Grading of Learning Portfolio

Your reflection assignment is worth **0.5 marks of your total Project-4 grade (3.5%)**.

LEARNING PORTFOLIO ENTRY

Assessment Type: Individual
Time Allotted: Own Time
Submission Deadline: Please refer to Table 2: List of Deliverables in the Project 4 Module

Objectives and Requirements

Complete your **online web Portfolio** for Project-4, by uploading all worksheets and photos outlined in the previous pages, as well as documentation of any progress, rough work or extra content.

Submission Details

Each Team Member: ensure your online web Portfolio is complete and up to date
  → Photos and images should be uploaded to the appropriate subpage under the P4 Page
  - Milestone worksheets (*Milestones* subpage)
  - Final submission content (*Final Deliverables* subpage)
  - Extra documentation (*Log Book* subpage)
  → Click "Publish" on the top-right corner of the browser to reflect your changes online
  - Remember, you need to do this *every time* you make changes to your website
  → *You do not need to resubmit any work already submitted!*

Grading of Learning Portfolio

Your Learning Portfolio is graded on a **Pass/Fail** basis. Any team member who does not complete their learning portfolio will be penalized 5% of their Project-4 grade.

SELF-AND PEER-EVALUATION

Assessment Type: Individual
Time Allotted: Own Time
Submission Deadline: Please refer to Table 2: List of Deliverables in the Project 4 Module

Objectives and Requirements

Each team member is expected to contribute equitably and effectively to the team's overall performance, throughout the duration of the project. This contribution is evaluated through both a *self-evaluation* and a *peer-evaluation*. There are 3 components to the Evaluation:

(1) Individual Evaluation: Each team member will be asked to evaluate themselves and their peers on the following dimensions:

- Contributing to team's work

- Interacting with teammates

- Expecting quality

- Having relevant KSAs (Knowledge, Skills, and Abilities)

(2) Team Evaluation: Each team member will be asked to evaluate the overall team and their project experience on the following dimensions:

→ Working together in the Future

→ Team Conflict

→ Team Satisfaction

→ Psychological Safety

(3) Peer-to-Peer Comments: Each team member will be asked to provide comments to their peers based on the project experience. You are expected to adhere to the following:

→ Before you start writing, reflect on the project experience and evaluation you just completed.

→ Comments should include both positive feedback and constructive criticism.

→ Constructive criticism should not be overtly negative, should not include profanity, should be given with a purpose, and should focus on what your peer can do to improve in the future.

While writing Peer-to-Peer comments, consider the following resources:

→ **Belbin Team Roles Inventories:** This inventory recognizes that every team member brings different strengths and weaknesses to the team. Consider using the language and inventories in this document to provide feedback to your team members and yourself.

- o **Belbin Inventories Reference Article**

→ **Constructive Criticism:** These websites provide tips and tricks on what should be included in constructive criticism.

- o **6 Ways to Make Feedback Constructive**

- o **What is Constructive Feedback + Examples**

SUBMISSION DETAILS

Self and Peer Evaluations will be completed through a website called **CATME** (Comprehensive Assessment of Team Member Effectiveness). You will receive email prompts to your McMaster email from CATME when a Peer Evaluation is ready to complete and when the results are ready to view.

In the **Getting Started** folder on **Avenue to Learn** there is a CATME document you can refer to for resources and an overview of the software.

Grading of self and peer evaluation

Each team member will have a peer-evaluation score calculated as part of the self- and peer-evaluation. Depending on your own self-evaluation and your team members peer-evaluation, your peer-evaluation score can ***add or deduct*** a maximum of 5% towards your overall Project-4 grade.

Team members are expected to take the self- and peer-evaluation process seriously. This is an important learning opportunity in terms of being able to evaluate one's own work as well as give and receive feedback on the work of others. It is not intended as an exercise in padding each other's marks! Team members may be expected to justify their peer evaluation scores in a meeting with the Course Instructors, individually or as a team. Failure to justify your peer evaluation may result in an adjustment to your peer-evaluation score

Administrative Roles and Responsibilities

ADMINISTRATIVE RESPONSIBILITIES

Each team member is expected to contribute to the various administrative responsibilities inherent in any project. To accomplish this, each design project will require team members to assume one of four *Project Lead* administrative roles. The purpose of the Project Leads is to ensure administrative responsibilities are equitably distributed amongst *all* team members. Each Project Lead will have a unique set of expectations and responsibilities.

PROJECT LEADS

Project-4 requires that each team member assume one of four *Project Leads* over the duration of the project (**M**anager, **A**dministrator, **C**oordinator, **S**ubject Matter Expert).

Manager

The breakdown of the Project **Manager's** Expectations and Responsibilities is as follows:
- → *Expectations*:
  - Serve as the team's point-of-contact with the Instructors
  - Promote an equitable work environment
  - Assume a leadership role in identifying and managing team conflict
- → *Responsibilities*:
  - Assume the role of *Chair* during scheduled *weekly meetings*
  - Complete and submit a *Preliminary Gantt Chart*, at the beginning of the project

Administrator

The breakdown of the Project **Administrator's** Expectations and Responsibilities is as follows:
- → *Expectations*:
  - Monitors progress of deliverables to ensure team remains on track to meet deadlines
  - Ensures team members are aware of all project deadlines and expectations
- → *Responsibilities*:
  - Assume responsibility for *submitting all team deliverables*
  - Complete and submit an updated *Final Gantt Chart*, at the end of the project

Coordinator

The breakdown of the Project **Coordinator's** Expectations and Responsibilities is as follows:
- → *Expectations*:
  - Coordinate team meetings outside of weekly Design Studio's/Lab B's
  - Keep a record of all meetings and discussions outside of weekly Design Studio's/Lab B's, both in-person and online meetings
- → *Responsibilities*:
  - Assume the role of *Note-Taker* during scheduled *weekly progress meetings*
  - Complete and submit a *Logbook of Additional Meetings and Discussions*

Subject Matter Expert

The breakdown of the **Subject Matter Expert's** Expectations and Responsibilities is as follows:

→ *Expectations*:

- Assume responsibility for building a database that clearly documents the source of all information gathered and research conducted
- Assume responsibility for ensuring source materials are broad and reliable
- Assume responsibility for ensuring completion of the Project Report is collaborative

→ *Responsibilities*:

- Share a **Collaborative Working Document** of your *Design Project Report* (e.g., Google Doc, Microsoft Office SharePoint document) at the beginning of the Project
- Complete and submit a **Source Materials Database** at the end of the Project

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For a team of 5 students, there are **2** Subject Matter Experts
- The Source Materials Database can be completed jointly

SUBMISSION AND GRADING DETAILS

Each Project Lead has a number of administrative responsibilities that must be completed over the course of the project. A summary of the administrative responsibilities is outlined in the Table below.

Table 1: Project Lead Responsibilities

Lead	Administrative Responsibility	Deadline	Marks	Weight
Manager	Design Studio Chair	Ongoing	P/F	–
	Preliminary Gantt Chart	Prior to Wk-8 DS	P/F	–
Administrator	Submission of Team Deliverables	Ongoing	P/F	–
	Final Gantt Chart	Wed Apr 14 2021	P/F	–
Coordinator	Design Studio Note-Taker	Ongoing	P/F	–
	Logbook of Additional Meetings & Discussions	Wed Apr 14 2021	P/F	–
Subject Matter Expert	Collaborative Working Document	Prior to Wk-8 DS	P/F	–
	Source Materials Database	Wed Apr 14 2021	P/F	–

Failure to complete your assigned Administrative Responsibilities will result **10% deduction** to the individual students *Project 4 Grade* **for each occurrence** (i.e., 1.5/15 marks).

Design Studio Chair (Manager) and Note-Taker (Coordinator)

During each Design Studio/Lab B, beginning the 2nd week (Wk-8 DS), teams will have a scheduled *weekly meeting* with their IAI and/or TA. During these meetings, teams will provide an update on their progress, answer any questions that come up, and discuss plans for the next week.

Chair: The role of the Design Studio **Chair** is to: 1) prepare an agenda for each scheduled weekly meeting, sharing their agenda with their mentor/TA, and 2) lead team discussions during these meetings, ensuring all team members are provided an opportunity to offer their input.

→ *Submission and Grading Details*:
- Include an agenda for each weekly meeting in the *Scheduled Weekly Meetings* section (Section 5) of your *Design Project Report*
  - Each agenda should include date of the meeting and list all discussion items
- The Manager's role as Chair is graded as **Pass/Fail**

Note-Taker: The role of the Design Studio **Note-Taker** is to formally document team discussions during scheduled weekly meetings by recording meeting minutes.

→ *Submission and Grading Details*:
- Include the minutes for each weekly meeting in the *Scheduled Weekly Meetings* section (Section 5) of your *Design Project Report*
  - Meeting Minutes should include the date the meeting was held, a list of those in attendance and those absent, and a written summary of the discussion
- The Coordinator's role as Note-Taker is graded as **Pass/Fail**

Preliminary Gantt Chart (Manager)

The Preliminary Gantt Chart is a graphical representation of your team's proposed project schedule, outlining team meetings, planned progression of tasks, and all project deadlines.

→ *Submission and Grading Details*:
- Include *Preliminary Gantt Chart* in *Project Schedule* section (Section 4) of *Design Project Report*
- The *Preliminary Gantt Chart* is graded as **Pass/Fail**

Final Gantt Chart (Administrator)

The *Final Gantt Chart* is a graphical representation of your team's *actual* project schedule and should be overlaid on the *proposed* project schedule.

→ *Submission and Grading Details*:
- Include *Final Gantt Chart* in the *Project Schedule* section (Section 4) of the *Design Project Report*
- The *Final Gantt Chart* is graded as **Pass/Fail**

Submission of Team Deliverables (Administrator)

The Administrator is responsible for submission of all *team deliverables*, ensuring team deliverables are submitted to the correct location by the required deadline. This includes weekly Milestone worksheets and Final Deliverables. Individual submissions are ***not*** the Administrator's responsibility.

→ *Submission and Grading Details*:

- Milestone Worksheets:
  - Submit to appropriate *Avenue Dropbox* as outlined in *Milestone Instructions*
- Final Deliverables:
  - Follow submission instructions outlined in the Final Submission section
- The Administrator's role in submitting team deliverables is graded as **Pass/Fail**

Logbook of Additional Meetings and Discussions (Coordinator)

The *Logbook of Additional Meetings and Discussions* is a collective of documents, images, and screenshots that reflect team progress outside of scheduled Design Studio's/Lab B's. There is no standard format. In-person meetings can be documented either in a notebook or digitally. For online meetings and discussions on communication platforms (e.g., Slack, Messenger, Group Chat), a screen shot of conversations is sufficient. The only explicit requirements are that: 1) all meetings and discussions are consolidated, 2) meetings and discussions are chronologically presented, and 3) the date of each meeting/discussion is clearly indicated.

→ *Submission and Grading Details*:

- Include your *Logbook of Additional Meetings and Discussions* in the *Project Schedule* section (Section 4) of your *Design Project Report*
- The *Logbook* is graded as a **Pass/Fail**

Collaborative Working Document (Subject Matter Expert)

The Collaborative Working Document is an editable version of the *Design Project Report*, written in an online document that tracks user history and edits (e.g., Google Docs, Microsoft Office SharePoint document).

→ *Submission and Grading Details*:

- Share your *Collaborative Working Document* with the Course Instructors at prof1p13@mcmaster.ca
  - All team members should use easily identifiable names and not aliases
- The *Collaborative Working Document* is graded as a **Pass/Fail**

Source Materials Database (**Subject Matter Expert**)

The *Source Materials Database* is a comprehensive list of <u>all</u> source materials and resources that have been used throughout the project. This includes references cited in each *Independent Research Summary*, references cited in your Design Project Report, and any additional sources that directly or indirectly contributed to the overall learning experience but may not have been specifically cited in a written document (e.g., personal communications, websites, etc.). It is **not** the responsibility of the Subject Matter Expert (SME) to source all of these resources. Rather, the SME is responsible for consolidating sources collected by all team members in a single location.

→ *Submission and Grading Details*:
- Include your *Source Materials Database* in the *List of Sources* section (Section 6) of your Design Project Report
    - The *Source Materials Database* should adhere to IEEE referencing standards
- The *Source Materials Database* is graded as a **Pass/Fail**