PROJECT FOUR: MILESTONE 1 – COVER PAGE

Team Number: Thurs-51

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

Full Name:	MacID:
Maryam Butrus	butrusm
Areeb Jamal	jamala19
Amanda Pilgrim	pilgra1
Jeremiah Musselman	musselmj

MILESTONE 1.1 – CLIENT NOTES

Team Number: Thurs-51

You should have already completed this task individually prior to Design Studio/Lab 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
  - This will be especially helpful when completing the rest of the milestone

Team Number: Thurs-51

Name: Maryam Butrus	MacID: butrusm

Client Notes:

Client: Alauna
- Mother, retired from midwifery,

- Diagnosed with three autoimmune diseases

- Suffers from ankylosing spondylitis:
  - causing inflammation of the spine and other joints
  - leads to excessive bone growth and fusion of the vertebrae.

- Recent cancer survivor

- Suffers from chronic lymphedema in areas such as:
  - arms —> Dominant arm and shoulder most affected.
  - chest
  - back

- She enjoys doing the following:
  - Painting
  - Sculpting
  - Gardening
  - Sewing

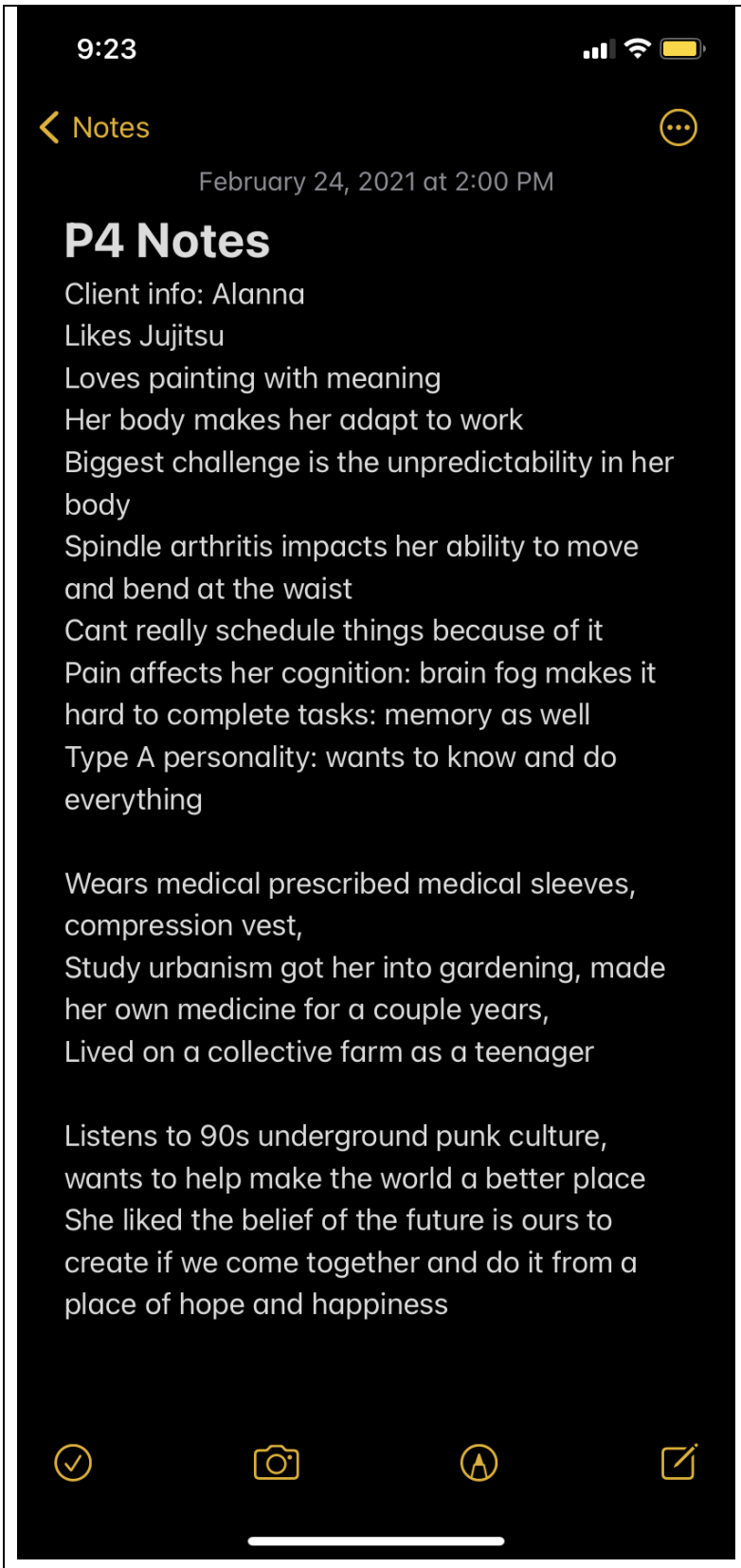
- Due to the difficulties she has encountered, she has had to quite some of the activites listed above.

- She has difficulties with painting for long periods of time.

- Sewing is seen as an infection risk to her due to increased nerve pain and her lymphedema.

Team Number: Thurs-51

Name: Areeb Jamal	MacID: jamala19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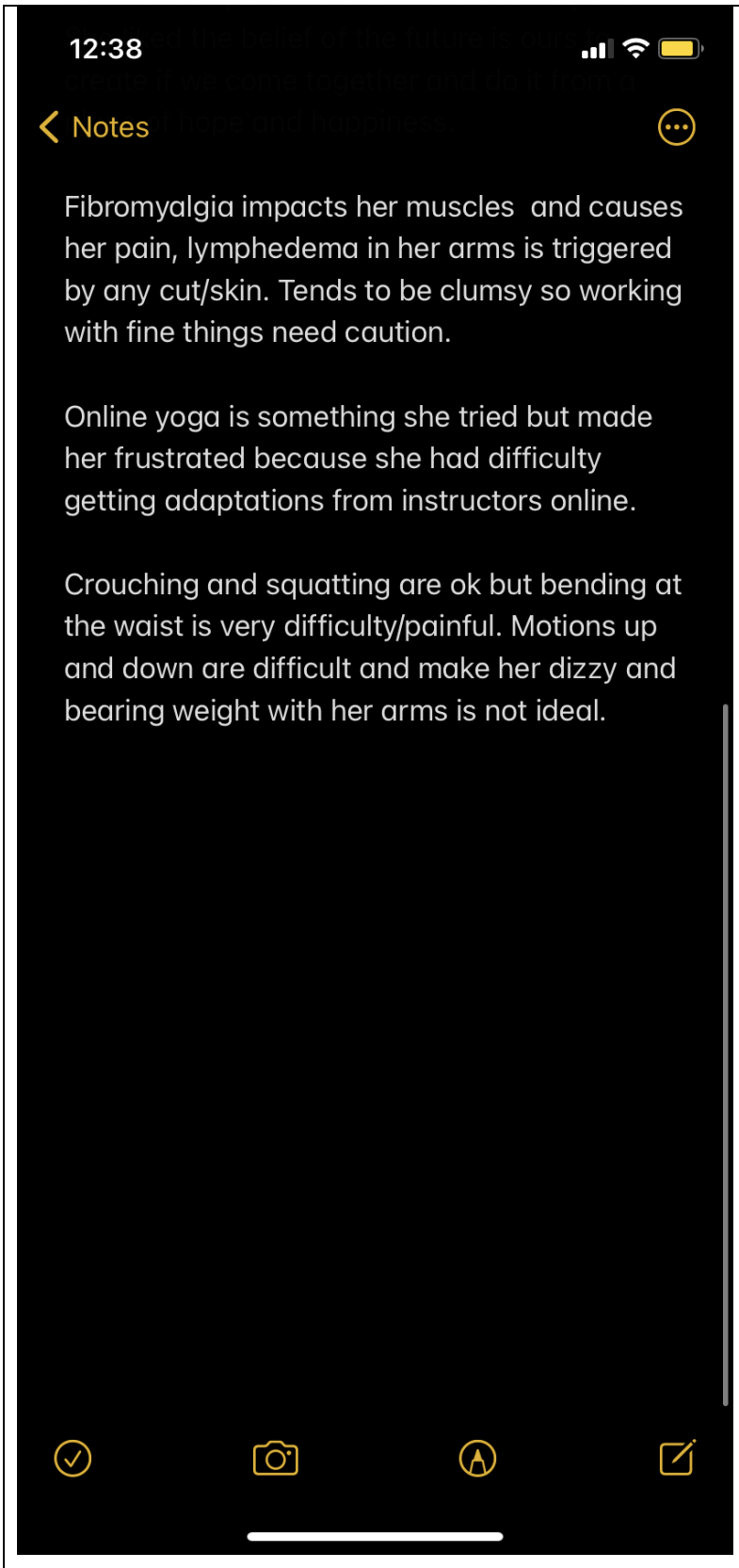
February 24, 2021 at 2:00 PM
P4 Notes
Client info: Alanna
Likes Jujitsu
Loves painting with meaning
Her body makes her adapt to work
Biggest challenge is the unpredictability in her body
Spindle arthritis impacts her ability to move and bend at the waist
Cant really schedule things because of it
Pain affects her cognition: brain fog makes it hard to complete tasks: memory as well
Type A personality: wants to know and do everything
Wears medical prescribed medical sleeves, compression vest,
Study urbanism got her into gardening, made her own medicine for a couple years,
Lived on a collective farm as a teenager
Listens to 90s underground punk culture, wants to help make the world a better place
She liked the belief of the future is ours to create if we come together and do it from a place of hope and happiness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Notes
Fibromyalgia impacts her muscles and causes her pain, lymphedema in her arms is triggered by any cut/skin. Tends to be clumsy so working with fine things need caution.
Online yoga is something she tried but made her frustrated because she had difficulty getting adaptations from instructors online.
Crouching and squatting are ok but bending at the waist is very difficulty/painful. Motions up and down are difficult and make her dizzy and bearing weight with her arms is not ideal.

Team Number: Thurs-51

Name: Amanda Pilgrim	MacID: pilgra1

Client Notes

Background on Client

- She has developed enough autoimmune diseases to be required to quit working.
  - They can also cause a lot of physical challenges performing normal everyday tasks.
- As well as the autoimmune diseases she has also been through a car crash, as well as had breast cancer. Which only added to her challenges.
- Some of the normal activities that she enjoys including painting, meditation, yoga, jujitsu, sculpting, and gardening.
  - Each of these simple hobbies has required some sort of adaptation.

Conditions

Lymphedema

This causes swelling or infection on any cuts or wounds.

Spinal Arthritis

Impacts ability to bend at the waist.

Fibromyalgia

Makes things on the body feel very uncomfortable.

Spondyloarthritis

Hobbies

Painting

One of the main challenges faced with this hobby is caused by hand spasms. These are painful muscle spasms that can make it difficult to hold onto a paint brush. One adaptation for this problem has been getting a new different type of paint brush, however, this also limits the type of paintings she will be able to do.

For example, she really loves creating detailed artwork with an intricate design using fine lines. However, now she can only do that in limited capacity, and it takes a long time to finish a detailed piece due to her body capabilities.

Sculpting

Clay has proven to be very difficult to use given her body limitations. Therefore, she has found other methods of sculpting through creativity. She uses found or collected objects to create a new vision out of them.

For example, she built a three-dimensional torso using hospital bracelets for the ribs along with wires connecting them. This became an extreme problem for her lymphedema.

Sowing and Quilting

A hobby that she used to love but can no longer do. She lacks in her hand eye coordination now making this a nearly impossible task.

Gardening

Used to grow herb gardens of her own medicine before her illness. Now she needs to plan the garden but get others to help her plant it.

Challenges

Predictability

She is unaware of when things are going to happen with her body. It is random depending on the day. Therefore, she is unable to make plans ahead of time because she doesn't know what she will be physically capable of doing prior to the day.

Brain Fog

When pain goes up she gets 'brain fog' which makes it difficult to complete tasks. This also impacts her memory. Which she uses paper notes to help her remember things.

Quarantine

Due to her treatment of five year post surgical oral kemo her health can be quite precarious. Also, she is unable to get an IV in her arm, so it must be put in her foot. This makes it very important for her to be extra careful during quarantine.

To adapt to the isolation, she came up with ways for movement in her own home. She also began to attend yoga classes, taking a teacher's course to ensure the movement was being done properly. She also uses meditation as a form of helping her mind during these times.

Stress

Stress causes her conditions to flare and act up. Which is why it has become important for her to manage stress internally.

Adapting

She needs to fully adapt how she uses her body. For example, working on her paintings on the floor rather than standing or sitting to work on them. She has a stool to put the canvas on to work on the painting from the floor.

Day to Day Activities

Daily tasks are planned in the morning and cannot be planned prior to the day because her body is too unpredictable. Sleep can impact this change.

- Sometimes she is required to rest all day so she can be with her children when they get home from school.
- Sometimes she can paint for hours along with doing other tasks plus take care of her kids at the end of the day.

pilgra1

Being a Parent

She has two children; one is nine and the other is eleven. It was hardest to parent them when it first started. However, she learned little things to help such as bringing a cane to the park and walking slowly, also not doing as much activity.

Optimization

Environment

A nice home environment that helps stay focussed on rising through the challenge. For example, having a studio that is its own space.

Physical

Small things that help:

- Handrails on the stairway.
- Having a sink in the studio.
- Having the studio, bedroom, and washroom all on the same level.

Products That Help

- Medical Prescribed Compression Sleeves, Gauntlets, & Compression Vest
  - It is used any time she is painting or exercising.
  - It helps to be more functional.
  - However, it is not very comfortable.
  - The compression vest helps with her torso.
- SI Brace or Belt
  - Helpful for walking.
  - Uncomfortable.
  - Does not use anymore.
- Posture Necklace
  - Homemade to help with posture.
  - Did not work very well.
- ***Desired*** Exoskeleton
  - Give her mobility that she no longer has.

Team Number: Thurs-51

Name: Jeremiah Musselman	MacID: musselmj

Background

- Healthcare
  - Midwife for over 15 years
  - Reproductive health
- Developed autoimmune diseases
  - Stopped working as a midwife
  - Car accident
  - Breast cancer
- Seeks to make the world a better place
- Started painting
  - Healing
  - Communicate inspiration and resilience
- Spends time doing…
  - Painting
  - Meditate
  - Yoga
  - Vision future painting
  - Adaptive Brazilian jujitsu
  - Sculpting
  - Gardening

Q & A

- Tell us more about your paintings?
  - Body makes her adapt to work
  - Struggles with holding paintbrush
    - Got new wider paintbrushes
    - Wraps something around the brush and her hand
  - Has many works in progress
  - Mediums
    - Acrylic paint, cold wax, collage, canvas
- Tell us more about your sculpting
  - Finds working with clay difficult and frustrating
    - Difficult on the hands
  - Using found or collected objects
    - Create new vision out of them
  - Lymphedema creates risk of infection when working with wires and sculptures

- Biggest challenges on a day-to-day basis
    - Absolutely no predictability of physical conditions
    - Lymphedema can be worse on some days
    - Small brushes can be hard to hold
    - Spondylarthritis is autoimmune in sacroiliac joints
        - Impacts mobility
        - Ability to bend at waist
        - Hard to clean up after kids
    - Difficulty lifting
    - Hard to schedule things due to unpredictability
        - Painting
        - Social life
        - Time with children
    - Brain fog
        - Difficult to complete tasks
        - Memory is impacted
        - Keeps notes to remember tasks
- Aspects of art that you have had to change due to disabilities?
    - Has to paint differently because it's hard to hold brush
    - Difficult to paint fine details
        - Takes a lot of time and focus
    - Used to sew and quilt but can't anymore
- Tools and products to help with spondylitis and lymphedema
    - Wears medical prescribed compression sleeves
    - Compression vest for torso
        - Wear during painting, exercising, lifting etc.
    - Belt
        - Used for walking, exercise
        - Uncomfortable
    - Homemade posture necklace
        - Didn't work very well, so she stopped using it
    - Blanket laid on the floor to paint on (laying down)
- What do you do in the garden?
    - Makes own medicine
    - Herb garden
    - Doesn't grow food anymore, but knows how to
    - Hard to do the physical planting
        - Wishes to be able to do that
- Any COVID related precautions?
    - Still undergoing chemo
    - Health is always at risk
    - Has been staying home since march
        - No jujitsu gym

                - Part of community
                - Has come up with home workouts
        - Attends yoga class online
- Talk more about stress management
    - Stress can impact physical pain and conditions to flare up
    - Has had to learn to manage stress because it is unavoidable
        - Stress comes from kids and overall busyness
- Has there ever been a specific activity that you wished you had help with
    - Dreams of having an exoskeleton
        - Wishes she could have mobility again
    - Has accepted that the way her body is now is beautiful and special
    - Does things on the floor
        - Painting
        - Jujitsu
        - Helps her feel physically secure
- What part of your body gives you the most trouble?
    - Differs from day to day
        - Spine one day, hands on another, some days both
    - Hard to sit still for long periods of time
    - Moves around from sitting to standing a lot during the day
        - Tries to listen to body to determine where to work
- What is your daily threshold?
    - Daily tasked are planned each morning
        - Doesn't plan tasks beforehand because abilities change day by day
    - Some days rests all day to prepare for kids coming home from school
    - Other days can paint for hours and cook and take care of kids
    - Sleep impacts daily threshold
        - Oral chemo causes some insomnia
    - Stress affects daily threshold
- Can we hear more about activism?
    - Activism comes from Mother
        - Taught her that we are obligated to leave the world a better place
            - Life philosophy
- How have you had to adapt as a parent?
    - Kids are 9 and 11
    - Can be challenging
        - For example, takes kids to park and can't get home
        - Has learned to not overexert
    - Used to love the physicality of parenting
    - Hard to parent because she is taking care of herself a lot
    - "Emotionally exhausting"
- Is your house optimized for your conditions?
    - Since she is renting it is hard to change things

- Has good hand rails
- Studio is in one room to avoid having to move around a lot

- What is the desired outcome from collaborating with the wonderful students of McMaster Engineering?
  - Wants to see tools to make painting easier/less painful
  - Tools to support body 'gently'
  - For us to see how compassion fits into engineering

*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: Thurs-51

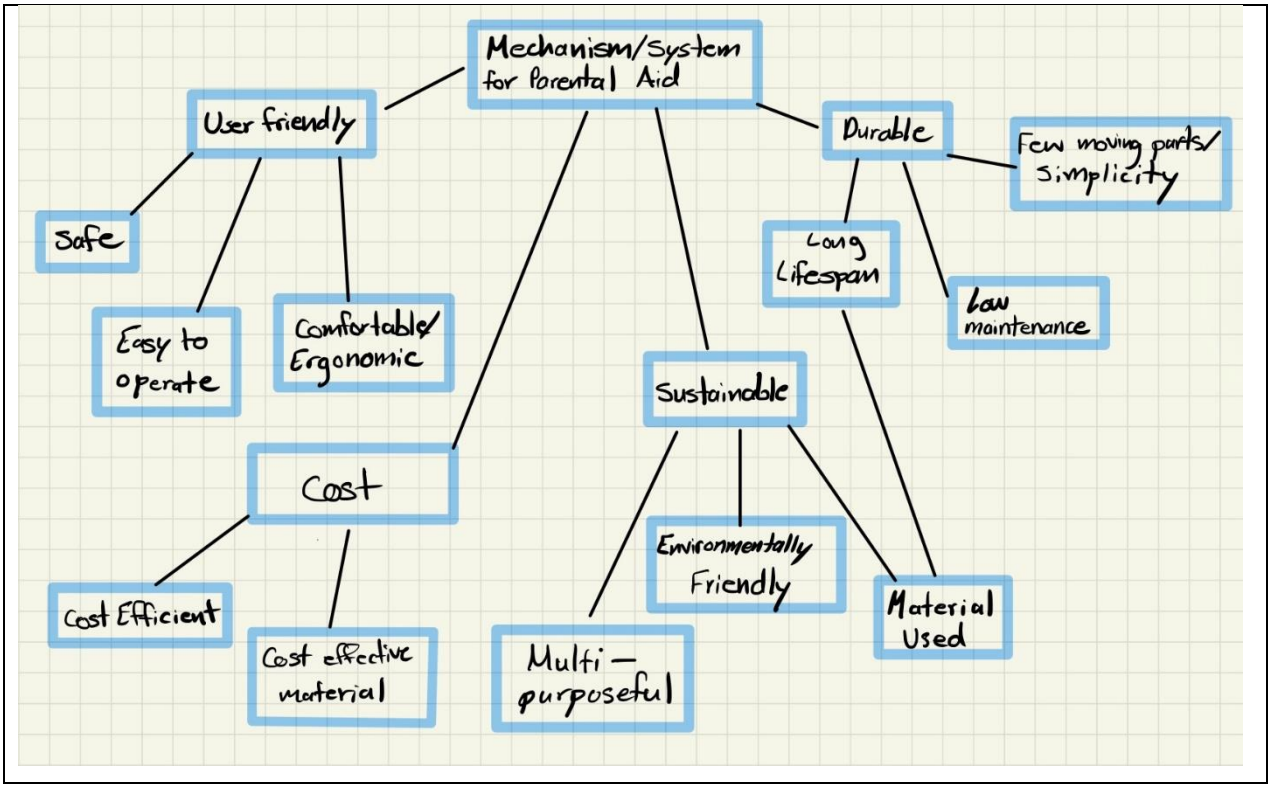
1. As a team, come up with an initial problem statement and include it in the space below.
   - → Make use of your client notes to define your primary function
   - → Remember to avoid solution-specific statements
     - Focus on what your design *should* do for the client in a general sense (not *how*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

Design a system or mechanism to help Alanna comfortably and efficiently garden, considering her immobility and physical challenges.

MILESTONE 1.3 – OBJECTIVE TREE, HOW/WHY LADDER, METRICS

Team Number: Thurs-51

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 – Wednesday, Feb 24th.



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

The reason our team chose an objective tree over a how/why ladder is because of the uncertainty and variety of problems at hand. An objective tree better visualizes the general problem and the objectives which need to be met by our future solution. The how/why ladder would work best if we had a specific problem to answer the why and how questions, however we have a generally vague task to fulfill (not knowing what parental tasks specifically).

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

User Friendly
Sustainable
Durable
Low Cost

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

Objective 1: User Friendly

Rationale:

It is important for the system/mechanism to be user friendly for Alanna to use in her day-to-day life. The engineered design should be safe for her to use as she navigates through her parental tasks. The product must also be easy to operate without requiring any additional work on her end. It is especially important that the system/mechanism is engineered to be comfortable/ergonomic given her physical conditions. The team believes this to be the most important objective to consider when refining the design.

Objective 2: Sustainable

Rationale:

It is important for the material of the system/mechanism to be easily obtained and last for a long time. The client should be able to rely on this product without the worry of needing to replace it frequently. It is also important that the system/mechanism is cost efficient, meaning it is not expensive to create. The product should also be environmentally friendly as Alanna values urbanism. Sustainability of the product is a key objective.

Objective 3: Durable
Rationale:

The system/mechanism must be durable as we do not know what it is going to be used for exactly. The product must be simple enough that it does not wear out over time, is low maintenance and be long lasting. This will allow Alanna to perform her specific task whenever and however many times she needs.

Objective 4: Low Cost
Rationale:

It is important for the material used to be cheap as we are on very limited budget. The system/mechanism must be cost efficient, having value for every dollar spent.

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:	User Friendly
Unit/Metric:	How comfortable/easy is the product to use. Rating %: Comfortability 90-100 5 points 80-89 4 points 70-79 3 points 60-69 2 points 0-59 1 point

Objective:	Sustainable
Unit/Metric:	Count how many parts of the product are recyclable.

Objective:	Durable
Unit/Metric:	Years of Lifespan/Fatigue Strength (MPa). Performance in stress/strain test to simulate years of usage.

Objective:	Low Cost
Unit/Metric:	Canadian Dollars (CAD)

MILESTONE 1.4 – PROJECT PLAN

Team Number: Thurs-51

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.

Prior Experiences:
Areeb:

- Basic Autodesk Inventor Techniques
- Computing (Python, Java)
- Simple Robotics (Highschool projects)
- Design Sketching
- Material Selection (Granta)
- Raspberry Pi
- Quanser Interactive Labs

Potentially useful resources:

- Cardboard
- Tape
- Glue
- Construction Paper
- Cardboard Tubes (Empty wrapping paper rolls)
- Autodesk Inventor to Model

Amanda:

- Autodesk Inventor (CAD)
- Computing (Python)
- Sketch Design (Engineering Drawings)
- Material Selection (Granta)
- Coding on Raspberry Pi

Potentially useful resources:

- PC with CAD
- Raspberry Pi
- Q-labs environment
- Cardboard
- Tape
- Construction Paper
- Glue

Maryam:

- Autodesk Inventor (CAD)
- Computing (Python)
- Sketch design (Engineering drawings)
- Material selection (Granta Edupack)

Potentially useful resources:

- CAD software
- Cardboard
- Tape
- Raspberry pi
- Python coding
- Q-labs
- Granta Edupack

Jeremiah:

- CAD (Autodesk Inventor)
- Computing (python, java)
- Engineering drawings
- Material Selection (GRANTA)

Potentially useful resources:

- Hardware store
- PC at home (CAD software)

Validation Techniques:

Stress simulation of designed model on Autodesk.

Physical test if solid model is made.