PROJECT FOUR: MILESTONE 1 – COVER PAGE

Team Number: TUES-22

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

Full Name:	MacID:
Yasmine Elkhouly	Elkhouy
Sana Khan	khans288
Alexander Hucik	hucika
Sameer Shakeel	shakes4

MILESTONE 1.1 – CLIENT NOTES

Team Number: TUES-22

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: TUES-22

Name: Yasmine Elkhouly	MacID: Elkhouy

Issues while painting include/general notes about her process of painting:

- In order to paint for long periods of time, client uses her other arm to stabilize her dominant arm to minimize the weight applied.
- Client often experiences muscle spasms while holding paint brushes.
    - Thus, she struggles to hold paint brushes in horizontal position/like a pen.
    - Leads to her gripping the paint brushes.
    - For larger brushes she grips it from the bottom and uses vertical movements.
        - **Would likely need a mechanism/system which allows her to maintain the position she would prefer to paint with.**
- While painting the client inconveniently rests her arm on the canvas (which is placed on a stool), while resting on her knees.
    - After long periods of time client lies on the floor with her arm resting on the ground or resorts to sitting on the ground while her arm rests on the canvas (which is placed on a shorter stool) (This option is inconvenient since the canvas is prone to break or bend)
    - Sits on the ground so she does not carry the weight of herself.
        - **Would likely need a mechanism/system which supports her arm while painting.**
- **Wants a solution that provides relief for the inconsistent/unpredictable issues she faces on a daily basis.**
    - **Something that will make it easier to make her paint will bring her comfort!**
- Prefers to be moving whilst she is painting.
- Small detail-oriented work is difficult due to constrains in movement of her hands.
- Struggle with weight-bearing on biceps triceps and peck muscles.
- Struggles with opening paint jars.
    - Uses food jars instead of typical paint containers.
    - Uses acrylic flip-top paints.
        - If dried paint is preventing top from opening, she struggles to fix this issue.
- Does not use a palette since it is too heavy to hold with her other arm.
    - Prefers not to use a palette.
    - Uses paint directly from food jars.

General Issues in day-to-day activities:

- Difficult daily tasks/movements include bending of her waist, picking up things left on the ground.
    - Claw-like mechanism works for picking up large objects but not smaller ones.
- Often forgets to utilize tools whilst in the struggles that need them.
    - **May need a mechanism that is convenient to always have on hand or a mechanism that cannot be misplaced easily.**
- Washing dishes and food preparation is difficult due to constrained movements of her hands.
    - For example: cannot cut squash.

- Often utilizes use of blender due to this issue.
- During COVID-19 she trained some Jiu Jitsu. Also, has shifted to learning yoga, took teacher training to learn how to adapt yoga poses to be safe for her body. Online yoga classes made her frustrated because she had difficulty getting adaptations from instructors online.
- Has extensive meditation practices and movement helps manage challenges that come along with such practices.
    - **A mechanism/system which utilizes movement as part of the solution.**

Specific Positions she finds comfortable/difficult:

- Crouching and squatting are relatively comfortable positions. Bending at waist very difficult/painful. any motions up and down is difficult and causes her to be dizzy.
    - **A mechanism/system that can be used in a comfortable position is essential. Preferably crouching, sitting, or squatting.**

Solutions/tools she has tried:

- Uses canes, tens machine, body pillows, rolling walker, vibrating heat belt on SI joint, acupuncture, self-acupressure, cupping, traditional Chinese medicine approaches, exercise, and movement.
- Wear's lymphedema compression gear during painting and exercise.
    - **Potentially implement a solution that could be used simultaneously and with ease with these tools.**

Team Number: TUES-22

Name: Sana Khan	MacID: khans288

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

Client Name: Alanna

Background
Background in health care and midwife (reproductive health in early 20s)
2016- autoimmune diseases
Got in car accident which caused injuries
Got diagnosed with breast cancer
Painting as a way to heal and communicate with world, resilience
Meditate, yoga, jiujitsu, sculpture
Physical problems sometimes

How body makes her adapt to her work
- muscle spasms cause her to struggle to hold paint brush
-used wide handled brushes

Mediums of Art
Attempted to work with clay and found it frustrating to work with it
Worked with found and collected objects for sculptures and creates new vision out of them
-ie. 3D Torso – used hospital bracelets to make bones and connected them with wire
-hurt her hands to try and maneuver the wires made it really difficult
-lymphidema-causes swelling and infection on arms, hands, or torso
-acrylic/oil paint with cold wax medium
-website: Inapowerfailure.com

Main challenges
- No predictability in body (can't know if lymphedema flares -difficulty lifting or painting)
- Difficult to hold smaller brushes
- Arthiritis impacts mobility bending at the waist is hard ie. Empty dishwasher
- Pain goes up so it causes brain fog which affects cognition and makes it difficult to complete tasks and memory is impacted (makes notes for herself)
- Hard sitting for a long time because of spinal issues so she lies down more to do stuff

Change in Art Styles
- Paint some pieces differently
- Prefer to paint intricate design with a lot of detail but can only do that to a limited capacity (due to lymphedema)
- They take time and concentration which is hard for her physically and mentally
- Moved to more simple type of paintings
- Love sewing with small details and quilt and can't do that anymore due to intricacy
- She is clumsy due to different hand eye coordination now which is frustrating

Tools to help her with some health problems
Lymphedema- wear compression sleeves up to middle of hand and a compression vest for torso
-Wear the sleeves in lifting, painting, exercising or lifting 5-10 pounds

Fibromyalgia- makes body feel uncomfortable ie. Wearing clothes can be uncomfortable and need to wear things that are softer or gentler on skin

Spondolo Arthritis- used SI brace/belt helpful for walking but uncomfortable -stopped using it
-Used a posture necklace to help stay more upright when working out (posture impacts pain) but it didn't' work well
-Learning to fully adapt and how to use her own body
-Paint on the floor or on the bed because it is helpful

Gardening
-Made her own medicine (grew an herb garden with all her medicine)
-Hard to plant is hard

How to adapt with the pandemic
Stayed home since march- not gone to the gym
-Exercise at home
-Meditate a lot (spiritual practice)
-How to stay calm, move
-Stress causes conditions to flare with clear predictability – how to manage internally (how to maintain peacefulness and let go of other things)

Wishes to have
-Exoskeleton- having access to full mobility (that she no longer has)
-Wish to hold things better
-Wish to have better stability that helps her get her balance and be able to do whatever she wants

Daily Tasks
-Planned each morning (listen to what body says)
-Some days rest all day to spend time with children
-Usually eat breakfast, make coffee
-Paint, clean, make dinner, and be with kids all at the same time
-Different each day, only know when she wakes up
-Oral chemo causes some insomnia
-Each day is different, threshold changes on day to day basis

How to look after kids and herself
-9 and 11 years
-Move slowly to get to the park use cane, can't really run after them
-Can't really physically play with the kids and she can't really do that now
-Hard to have energy with everyone and it is emotionally exhausting

Optimal Environment
-In a really nice space which allows to focus on rising through challenges

-Yoga, exercise, studio space
-Emotional and spiritual optimization (lives in Toronto)
-Everything close and accessible

Ideal outcome of working with us
-Tools that help make painting less painful
-Tools that support body with gentleness

Team Number: TUES-22

Name: Sameer Shakeel	MacID: shakes4

Name:
Alanna
Medical Condition:
-Spondylitis (affects mobility, she does better when she is moving)
-Lymphedema in arms and trunk (impacts ability to weight bear, must wear medical devices)
-Fibromyalgia (Causes pain in muscles, impacts her hands, detailed work is challenging)
About Her:
Alanna is an artist who enjoys making paintings, sculptures, and other things that have meaning. Painting especially is important for her as it gives an outlet for all the things that her illnesses and disabilities implicate on her life. She also enjoys Jiu Jitsu, yoga, meditation and gardening as other hobbies. Allana is also a mother who continuously pushes through and adapts to the challenges put in front of her to help her cope with her disabilities.
Struggles:
-Forearm and hand flaring/pain affects her the most when painting
-Can only paint in short periods of time
-Harder to work with smaller brushes, but it adds detail to her paintings
-Biggest challenges at home are things that involve bending at the waist, picking up things from the ground, using tools that are child-proof
-Being tired makes her condition more difficult
-When stress goes up, pain goes up, and the ability to adapt goes down
-Stress causes her ability to think go down (starts forgetting the tools and resources she has)
-Managing the dishwasher is difficult
-Washing by hand hurts arms and hands
-Food prep is harder; she needs to get precut stuff because cutting is a challenge
-Bottles with a flipping joint are easy at first but when paint gets stuck its harder to open
-She does not use a paint pallet because it is something heavier
-Instead, she uses a tray and places her small jars side by side, she likes having the shelf hold the paint rather than herself
Supports Currently Being Used:Currently Being Used:
-Tens Machine
-Vibrating Heat Belt
-Canes
-Compression Gear (vest arms and hands)
-Arthritis Gloves (ordered lymphedema gloves)
-Sacroiliac Joint Brace (helps for walking long distances)
-Body Pillows

Team Number: TUES-22

Name: Alexander Hucik	MacID: hucika

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

Project #4: Client Notes

Client's Name?

→ *Alanna*

What's the client's longest art piece (time to complete)?

→ *Took 8 months to complete.*
→ *Can only work for short periods of time.*

Anything that would make the client's healing process better?

→ *Lives with constant unpredictability with how her body feels.*
→ *Level of comfort in unpredictability would be incredible, as it would be easier to paint while her body hurts.*

Favourite art pieces?

→ *Frida Kahlo, The broken column.*
→ *Client's paintings, Hope Cocoon (painted while in a state of chronic pain and struggling).*

Client's mediums used in painting.

→ *Acrylic on canvas.*
→ *Prefers large pieces as small canvas is hard to work with.*
→ *Oil paints with cold wax.*
→ *Collage*
→ *Sculptures (found objects like wire, staples, metal etc.)*

How the client paints?

→ *Arthritis affects client's joints.*
→ *Ability to sit and stand affected.*
→ *Although she loves to move and stand while painting.*
→ *Wears compression sleeves on arms,*
→ *Has pain in muscles, specifically hands/wrists.*

→ *Small, detailed painting is difficult.*

Any specific body part that gets fatigued?

→ *Forearm feels as if on fire.*
→ *Has muscles spasms in hand.*
→ *Struggles with weight bearing in her, biceps, triceps, and pectoral muscles.*

Would setup time of a device matter?

→ *Not really, time is not a factor.*
→ *If she can set the device up on her own.*

How long each week does the client normally paint, and do other activities (yoga, meditation etc.)?

→ *Varies base on how her body feels.*
→ *Wants to do so much more than she can physically do.*
→ *Meditation helps, she has a meditation spot/space which she uses to calm herself.*
→ *Has been home since March 2020.*
→ *Has an idea wall to brainstorm her next art pieces.*

What drew the client to art?

→ *Struggling to learn to be her new self, drew the client to art.*
→ *Stopped painting in 2001 due to her midwifery job.*
→ *The stopped being a midwife due to struggling with her painful body.*
→ *Client then started painting to cope.*

How does the client hold utensil?

→ *Holds larger squeezy and square brushed in palm.*
→ *Client holds up her right forearm with left hand.*
→ *Likes to work on the floor and holds wrist.*
→ *Leans on canvas while sitting on stool.*

Does the client find any everyday tasks to be difficult?

→ *Picking things up and bending by the waist.*
→ *Difficult to cook, cuts vegetable in specific ways as she is vegan/vegetarian.*
→ *Struggles to open paint and gravitates towards specific paint brands.*
→ *Large lid jars are preferred over flip top.*

→ *Struggles with unpredictability because there is no constant part of her body that is always O.K.*

Does the client use a painting palette or an easel, any other devices?

→ *She does not use a painting palette to hold paints as it would be an extra weight to hold.*
→ *Her system works for her, as she keeps here paints on the shelf of her easel.*
→ *Uses a cane and sometimes a rolling walker.*
→ *Uses lymphedema compression gear during activities, on her torso, arms, and hands.*
→ *Loves movement because her pain is decreased during movement.*
→ *Has flares cause by her conditions which totally stop all her movement.*

When recovering what helps the client?

→ *Body pillows, Epson salts and fake sun light.*

How does the client use painting to improve her future?

→ *An outlet for all the client's emotions causes by the client's disabilities.*
→ *Painting helps propel the client forwards during her painful states and allow the client to be a more balanced parent.*
→ *Painting helps the client teach her children perseverance.*
→ *This also helps McMaster engineering students be better engineers in the future, to tackle diverse problems of any clients we may encounter.*

✷ ***Important note**: Improving the client's painting ability will subsequently improve her ability to perform her other activities like yoga, jujitsu, meditations, cooking and time with her children.*

What does the client's website name represent or symbolize?

→ *"In a Power Failure".*
→ *Symbolizes her how the client's life felt.*
→ *As if she was in a power failure due to her conditions she was diagnosed with and situations she experienced.*

*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: TUES-22

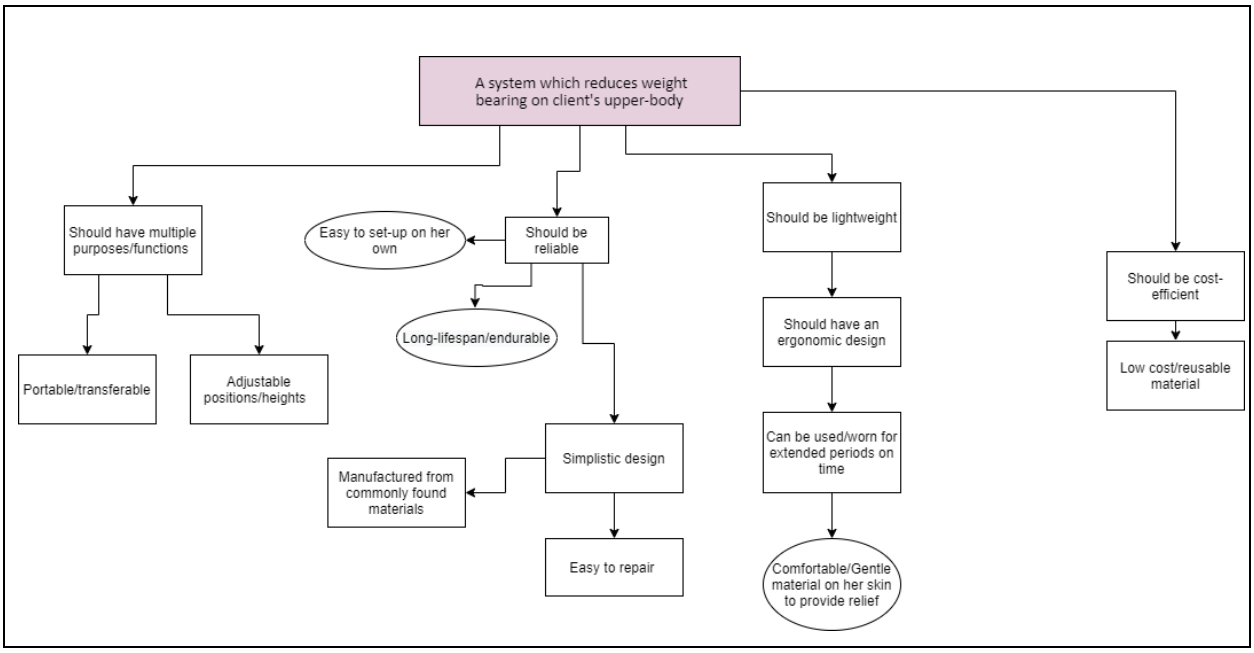
1. As a team, come up with an initial problem statement and include it in the space below.
   - → Make use of your client notes to define your primary function
   - → Remember to avoid solution-specific statements
     - Focus on what your design *should* do for the client in a general sense (not *how*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

Design a system which reduces weight bearing on the client's biceps, triceps, arms, and peck muscles to minimize the weight applied on their upper body and increase its functionality to carry out daily tasks with ease.

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

Team Number: TUES-22

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):

We have chosen to use the objective tree as our design tool since it allows us to map out the objectives and constraints in a more organized and visually pleasing way. Although both the how/why ladder and objective tree answer the questions of why going up and how coming down, we feel that seeing the objectives, and constraints more clearly through the different shapes is easier for us. In addition, the how/why ladder is restricted to only moving in an up or down direction whereas the objective tree allows us to branch out our thoughts off of one idea.

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

Should be ergonomic
Should be reliable
Should have multiple purposes/functions
Should be cost efficient

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

Objective 1: Should be ergonomic.

Rationale: The device should be ergonomic so that it does not further injure or cause discomfort to our client who already deals with Spondylitis, Lymphedema and Fibromyalgia. These disabilities reduce the client's mobility, cause muscle pain, and impair weight bearing abilities. Ergonomics are important for this device because they will promote a safe and comfortable environment for our client while working on artwork for long periods of time in awkward positions. We hope to achieve ergonomics by having a lightweight and ergonomic design, featuring gentle materials to reduce how much weight our client needs to bear and prevent further injuries.

Objective 2: Should be reliable.

Rationale: Since this device should be able to assist our client daily, it should be durable, and have a long-life span as our client should preferably not have to deal with issues relating to the reliability of the device. With the client already having to adapt to new problems every day, we hope that this device won't have to be a problem and can be something that she can be certain about every time she would use it.

Objective 3: Should have multiple purposes/functions.

Rationale: Our client faces multiple issues that arise during uncertain times due to her conditions; therefore, having a system which consistently supports her whilst she is experiencing these various unpredictable issues would provide her with a sense of relief. Also, our client often misplaces or forgets to utilize her support devices; thus, having one system which is functionally versatile would help prevent this issue as it reduces the amount of support devices she is required to use.

Objective 4: Should be cost efficient

Rationale: This device should be cost efficient and affordable. By using low cost, reusable

materials that are still effective and provide relief to our client as well as something that is easy to remake. As a mother, she already has many other expenses, and this system should not be a financial burden.

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:	Should be ergonomic
Unit/Metric:	Qualitative: → On a scale of 1-10 how well does the device fit our client's body. (1-being does not fit at all, 10-being perfect fit) → On a scale of 1-10, how comfortable is the material and or fabric used to manufacture the device. (1-being painful, 10-amazingly comfortable) → On a scale of 1-10 how easily is the device transportable around the client's home. (1-being not transportable, 10-being easily moved around) Quantitative: → Measured according to how much our system weighs (kg). → Measure device dimensions to complement the client's anthropometric data. (kg, m) → Use hazard recognition checklists. (For example, Kodak Ergonomics Checklist or ErgoPlus Quick Screen)

Objective:	Should be reliable
Unit/Metric:	Qualitative: → On a scale of 1-10, how often wouldOn a scale of 1-10, what is the build quality of the device need to be replaced/repaired?. (1-being very poor build quality, 10-being great build quality) → On a scale of 1-10, how quickly/easily can the device be repaired? Quantitative: → Measured according to how long our system would last for (Years).

	→ Measured according to how durable/strong the being material used is (MPa). → Measured according to how much weight our system can bear before failure (kg).

Objective:	Should have multiple purposes/functions
Unit/Metric:	Qualitative: → The number of functions our system has (how many different ways the client can use the device) → How many client issues it can resolve (how many issues has it helped the client overcome?) Quantitative: → Measured according to the angle of rotation our system can achieve (degrees) → Height adjustment of the system (metres)

Objective:	Should be cost efficient
Unit/Metric:	Qualitative: → How does the price of this device compare to other products that may offer similar solutions? → Can reusable materials be used to build the device? Quantitative: → Measured according to how expensive the manufacturing cost is (dollars)

MILESTONE 1.4 – PROJECT PLAN

Team Number: TUES-22

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.

Sana Khan – I took a computer science and computer engineering courses working with Java for 2 years and doing robotics in high school. I also have experience coding in Python from 1P13 design projects where I was on the computation sub team in project 2 as well as the computing labs. I have experience using Autodesk Inventor CAD software in 1P13 design projects, where I was on the modelling sub team in project 3 and graphics labs throughout the year. The graphics and computation labs have definitely helped me gain more experience working with and using these tools.

Sameer Shakeel – Prior experience includes two computer science classes (Java) and one technological design class (AutoCAD) taken in high school. Much more experience was gained within the last year through 1P13 projects, and labs. I learned a lot more of Python while on the computing sub-team for project 2 and learned Inventor while on the modelling sub-team on project 3. Other experience includes a CAD Designathon completed in January and some Hackathons completed in previous years.

Yasmine Elkhouly - More than one year coding experience with Java and Python from high school and teaching myself, as well as experience in 1P13 design project 2 and computing labs. I

have also participated in a few hackathons. I also took a computer engineering class during high school, so I have some experience with circuits. My experience with modelling includes 1P13 design project 3 and 1p13 graphics labs with Autodesk inventor. I have also participated in the McMaster CAD Design-a-thon, in which my team modelled a drinking game.

Alexander Hucik – The prior experience I have is using modelling software like google sketch up to model a piece of furniture I built in my high school woodshop class. In project 2 I was part of the computing sub-team. I was able to complete the project 2 task due to the computing labs which taught me basic python coding. In project 3 I was part of the modelling sub team. The graphics lab helped me further advance my modelling skills.

Useful Resources:

-Previous modelling/ computing labs and assignments, Previous lecture slides:

→ This will help us follow correct guideline and standards, and these labs and assignments have given us experience so that we can tackle further projects. We can reference these labs, assignments, and lectures to help us if we are stuck in project 4.

-Previous design projects.

→ We can learn from previous design projects because we now know what is expected from us. We can us planning methods like objective trees, morph charts, prototyping etc., to help us develop a design.

-Autodesk Inventor:

→ Solid models will allow us to create an accurate representation of our device and help us visualize and present our design.

-Python documentation library:

→ If we decide to include a software approach in our device, we can reference official python documentation and even the computing textbook to help us code.

-Microsoft OneNote:

→ Microsoft OneNote is great for drawing, so we can communicate our prototype using OneNote.

We have decided to approach this project using a physical and software approach, although this maybe subject to change as we progress throught the milestones.