

PROJECT FOUR: MILESTONE 3 – COVER PAGE

Team Number: TUES-22

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

Full Name:	MacID:
Yasmine Elkhoully	elkhoully
Sana Khan	khans288
Alexander Hucik	hucika
Sameer Shakeel	shakes4

MILESTONE 3.1 – REFINED CONCEPT: INITIAL PROTOTYPE

Team Number: TUES-22

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.)

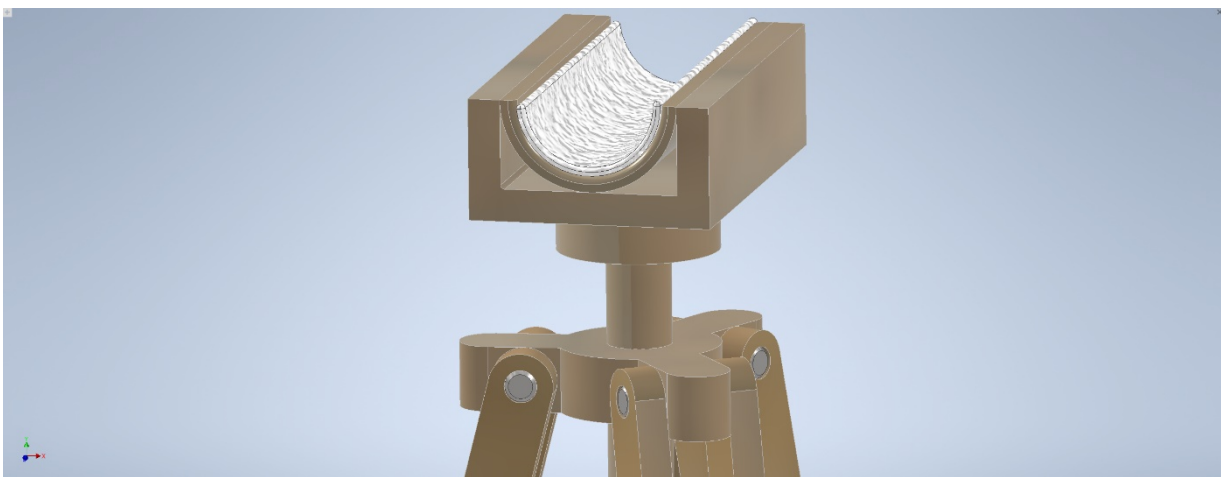
We are asking that you submit your work on both worksheets. It does seem redundant, but there are valid reasons for this:

- 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
 - This will be especially helpful when completing the rest of the milestone

Team Number: TUES-22

Name: Alexander Hucik

MacID: Hucika



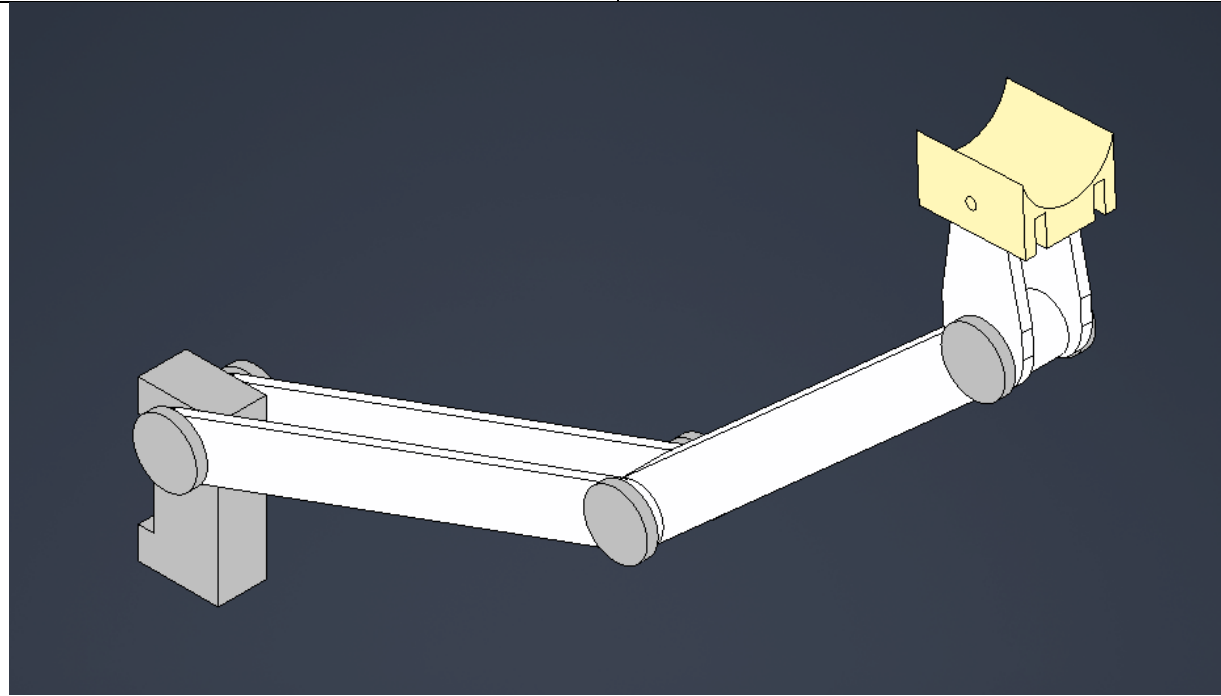
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Name: Alexander Hucik	MacID: Hucika
<p><i>Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated (max. 200 words).</i></p> <p><i>I took my sketch and basic prototype from milestone 2 and refined this concept using Autodesk Inventor CAD software. My thought process was how can I take my design from paper and make it into an accurate representation, and model parts that could be manufactured in the future. Now I can visualize the construction using an assembly and be able to modify and optimize my design based on feedback I will receive from my peers, TA's, and science students. My device's main function is to bear the weight of the client's arm while painting, as this is the main issue which causes pain and fatigue restricting her ability to paint. It resembles a tripod like structure with three adjustable legs, using large tightening knobs (for easy grip). There is a concave padded arm rest (with a non irritable material).</i></p> <p><i>Important feedback and considerations from our TA were:</i></p> <ul style="list-style-type: none">→ <i>The device should have freedoms of rotation and be height adjustable so that the client can paint in different positions without feeling constraint. Example, arm rest should rotate CW/CCW and up/down.</i>→ <i>The materials should not be sharp or uncomfortable due to the client's sensitive skin.</i>	

Team Number: **TUES-22**

Name: Sameer Shakeel

MacID: shakes4



Name: Sameer Shakeel

MacID: shakes4

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

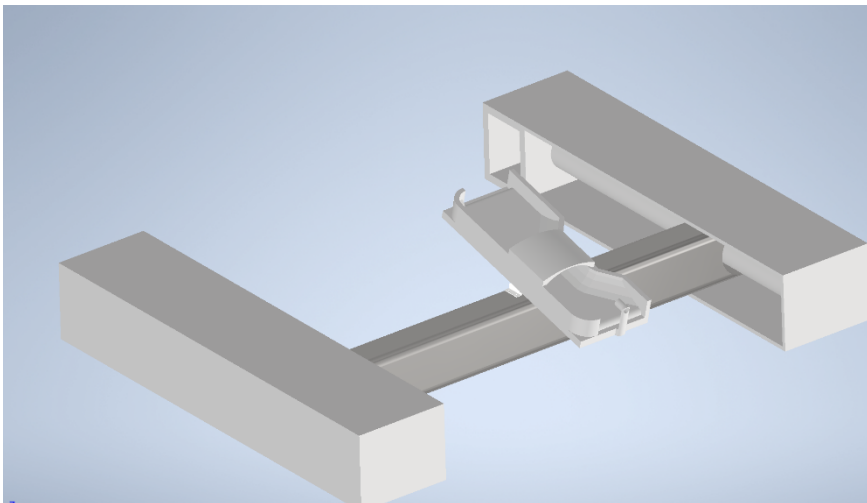
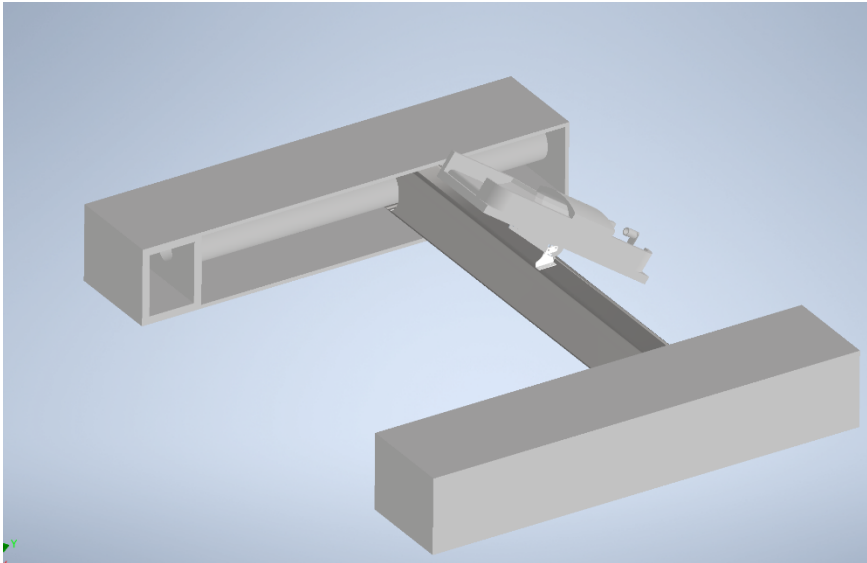
The goal of this prototype is to constantly reduce the weight bearing on Alanna's arm while she is painting. Ideally, as Alanna's arm moves, so will the mechanism through the joints, and when she stops, the mechanism will stop as well, allowing her to rest her dominant arm while painting. The initial goal was to tighten it to the easel Alanna uses; however, feedback given includes connecting this mechanism to a rod that allows it to rotate 180 degrees to allow for more movement. Additional feedback from peers also includes changes to allow the full stationary support of her arm while still being a lightweight mechanism, as currently, the bottom arm may give out if too much weight is applied to the arm rest. Suggestions were made to put the arm rest sideways and put the mechanism to the side of her to avoid it getting in her way, that change will likely be added. Lastly, adding padding to the arm rest and making it more comfortable needs to be changed as well.

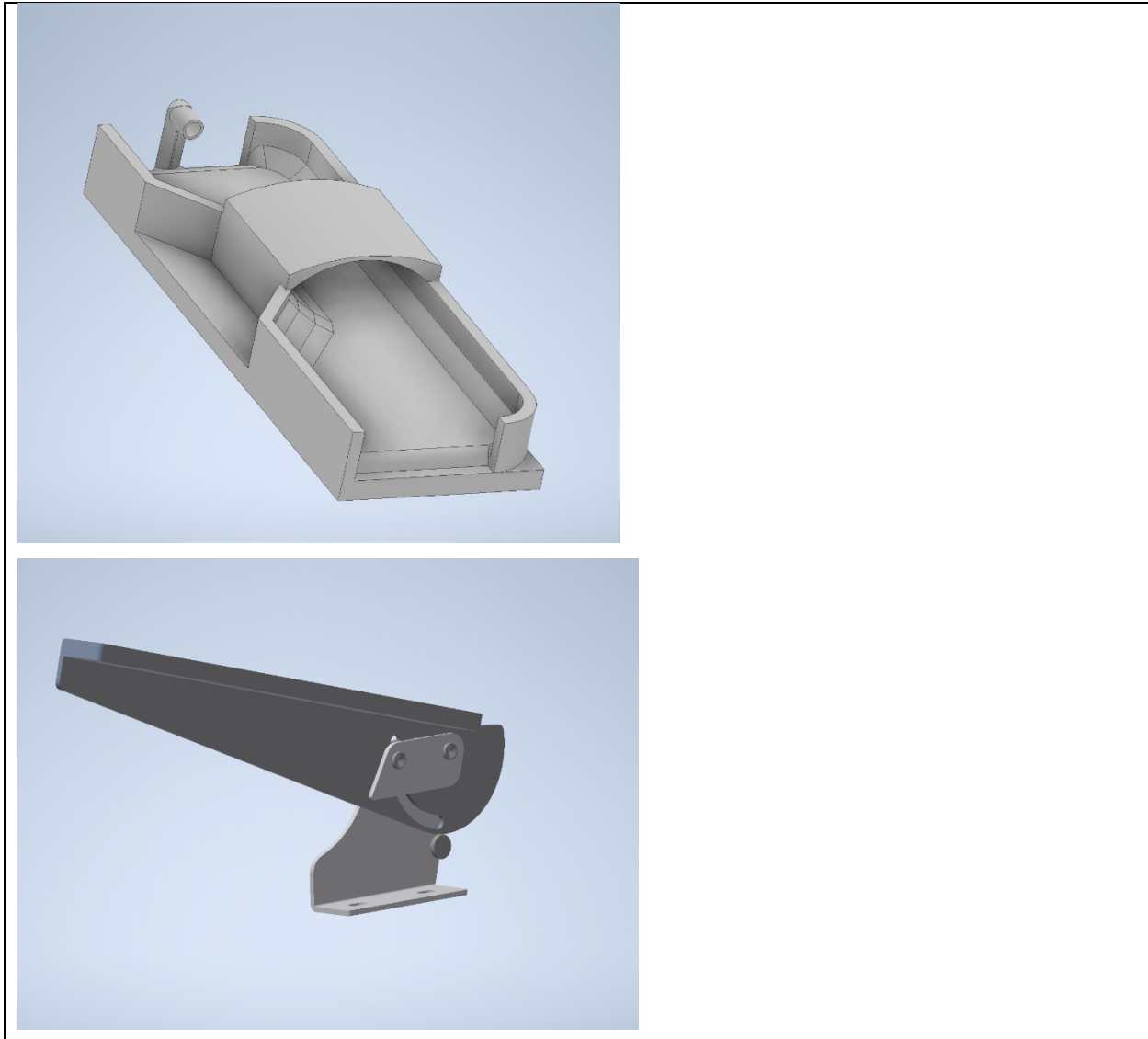
Team Number: TUES-22

Name: Yasmine Elkhoully

MacID: Elkhoully

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





Name: Yasmine Elkhoully	MacID: Elkhoully
<p><i>Include details on your thought process and how the concept was refined below, with notes on relevant feedback that was incorporated (max. 200 words).</i></p> <p>I wanted to create a multi-functional mechanism which allowed our client to paint on the ground or standing up. Therefore, I created a mechanism which would allow for a canvas to be placed underneath while painting on the ground, since this is the preferred position. While on the ground, an arm rest (padded with memory foam), free to rotate and lock about an axis, would bear weight and an adjustable strap for stabilization. The arm rest is attached to a rod which can move up and down and lock into the desired position. The mechanism also vertically attaches to an easel through the two holes on the supporting bars. In order to refine my mechanism, I considered attaching the arm rest to two retractable rods directly on top of the canvas, which it can slide on left to right and up and down on. This addresses a concern of the mechanism being too large to</p>	

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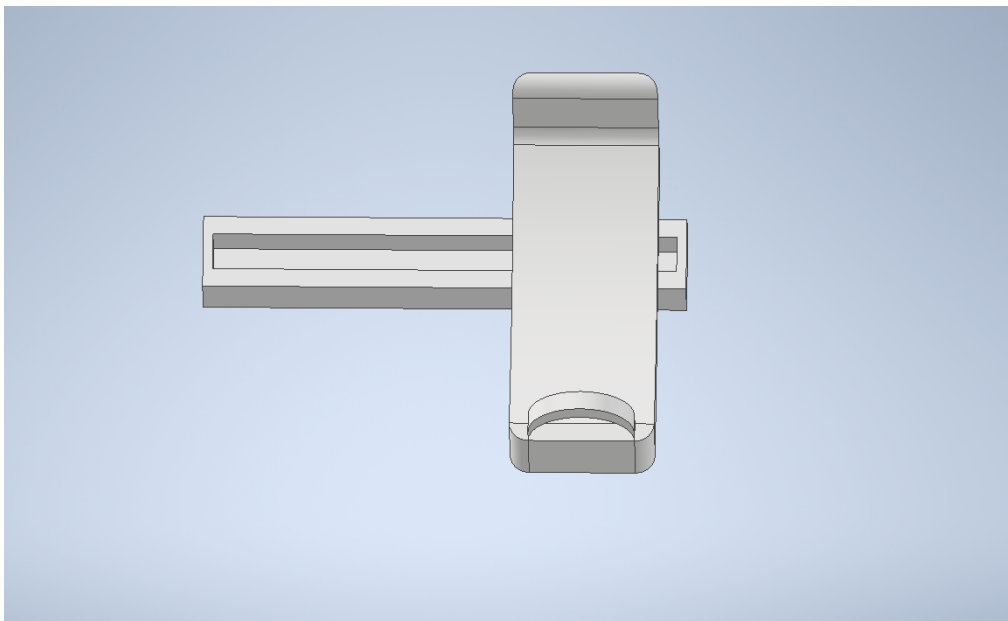
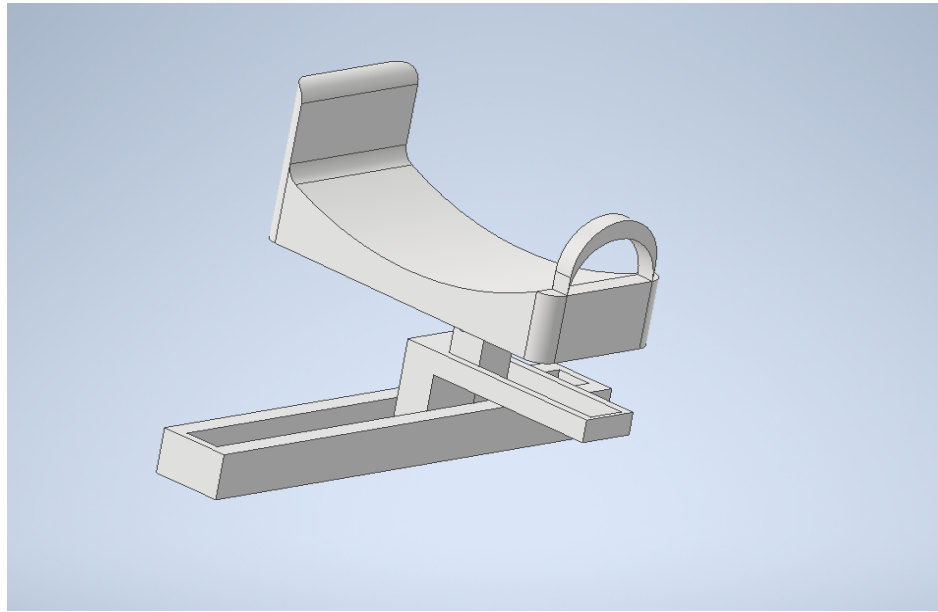
set-up and where she would be positioned while painting. This ensures she is comfortable while she is painting on the ground as bearing too much weight on her shoulders would be a major issue as she can position herself anywhere.

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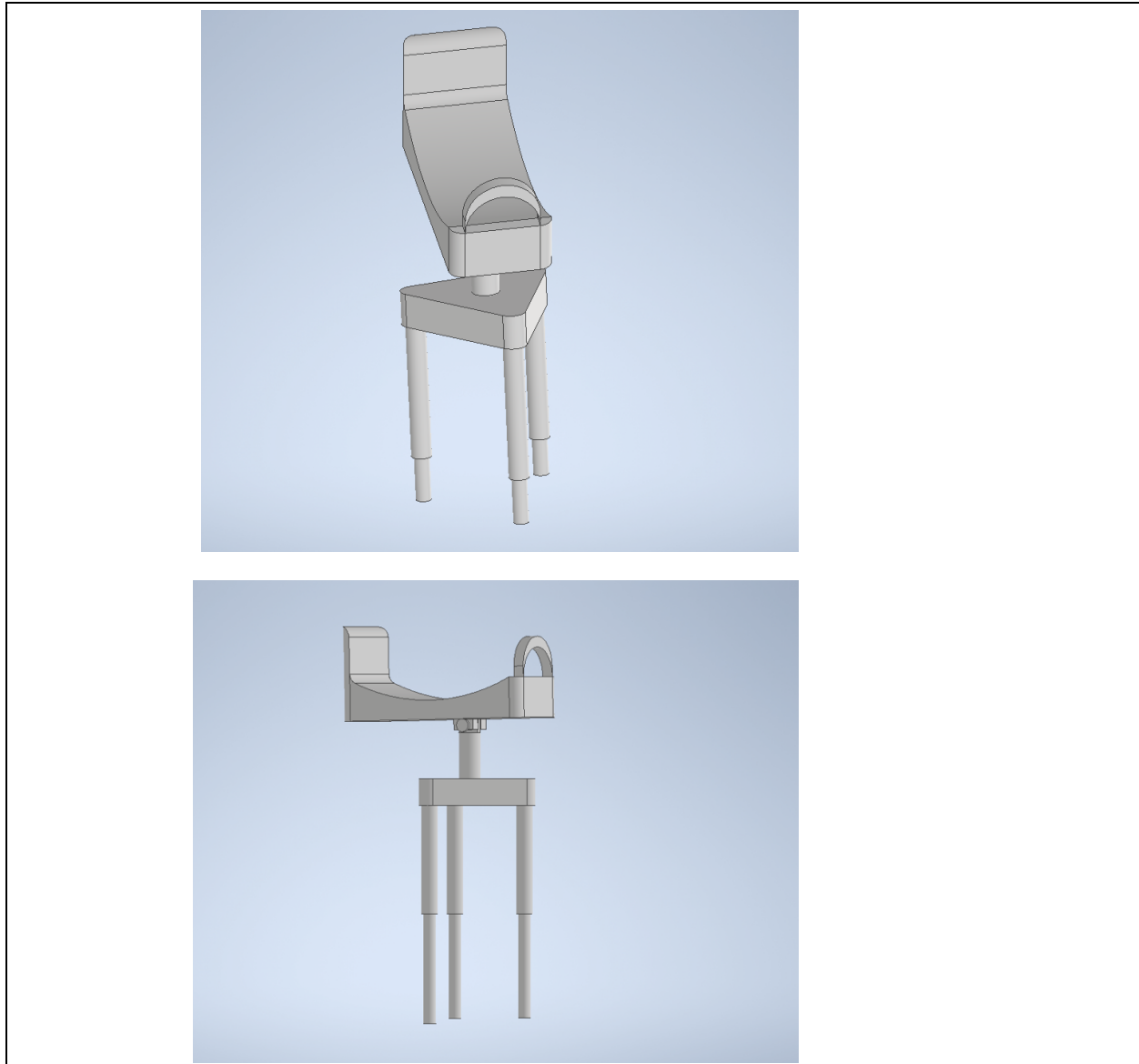
Name: Sana Khan

MacID khans288

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



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Name: Sana Khan

MacID khans288

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

I created a device that allows the client to be able to reduce the weight bearing of her own arm and have a wide range of motion to be able to paint without any restrictions. I built an arm rest attached to a height adjustable stand that she can use while painting standing up. Originally, I had something attached to her back, but we got feedback on how her back shouldn't be bearing too much weight or pressure, so I removed that aspect. The third and fourth screenshots represent this. The arm rest can rotate 360 degrees and up and down about a hinge. The legs are easily adjustable by becoming locked at the height she prefers with a mechanism that potentially uses her foot. I added in the feature where the arm rest can be removed and attached to a sliding

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rectangular base plate so that she can choose to paint laying down too. She can slide her arm side to side or extend it in and out. This is shown in the first and second screenshots. The arm rest would contain memory foam for comfort and a Velcro strap that she can wear or remove as she wants.

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

MILESTONE 3.2 – DECISION MATRIX

- 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.

As a team, establish a weighting factor for each criterion

- Move row-by-row
 - If Criteria 1 is preferred over Criteria 2, assign a 1. Otherwise, assign 0
 - If Criteria 1 is preferred over Criteria 3, assign a 1. Otherwise, assign 0
- Add additional rows/columns as needed

	Multi-purpose	Does not restrict movement	Easy to assemble	Ability to bear weight/Reliability	Ease of use /Simplistic design/ Realistic	Score
Multi-purpose	1	0	1	0	0	2
Does not restrict movement	1	1	1	0	1	4
Easy to assemble	0	0	1	0	1	2
Ability to bear weight/Reliability	1	1	1	1	1	5
Ease of use /Simplistic design/ Realistic	1	0	0	0	1	2

As a team, evaluate your concepts against each criterion using your weighting

- Add additional rows as needed

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		Tripod-Like Design		Linkage-Like Design		Canvas Holding Design		Arm-Rest Design	
	Weight	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating	Rating	Weighted Rating
Multi-purpose	2	4	8	3	6	4	8	3	6
Does not restrict movement	4	3	12	4	16	3	12	4	16
Easy to assemble	2	5	10	4	8	3	6	4	8
Ability to bear weight/Reliability	5	5	25	4	20	4	20	5	25
Ease of use/Simplistic design/Realistic	2	5	10	4	8	3	6	3	6
TOTAL			65		58		52		61

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

	<i>Insert your team's top two concepts below.</i>
Concept 1:	Linkage-Like Design
Concept 2:	Tripod-Like Design

Include your team's justification below.

We decided to go with the linkage and tripod idea as our top two concepts. They were the most optimal designs that would benefit the client and achieved our main objectives of weight bearing and not restricting movement. These are the most important criteria we need to take into consideration since she paints for a long time and not being able to bear the weight of her arm should not be the reason she cannot paint. For this reason, we saw that these two designs provide

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stability and comfort for the clients' arm. Secondly, a device that does not have enough functionality or degrees of freedom can be frustrating and cause difficulty or strain while painting and these two devices allow horizontal and vertical rotation to be able to paint in all directions and anywhere on the canvas. In addition, these two designs are lightweight, and easy to build/use which minimizes the clients set up time.

MILESTONE 3.3 – DESIGN REVIEW

Team Number: **TUES-22**

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

Name:	MacID:
<p><i>Include feedback from peers in this row.</i></p> <p>Tripod-Like Design</p> <ul style="list-style-type: none"> • Consider up and down motion. • Consider changing the tightening knob to something that will not cause her strain. <ul style="list-style-type: none"> ○ Consider adjusting height with a mechanism that uses her foot (she has good lower body strength) <p>Canvas Holding Design</p> <ul style="list-style-type: none"> • How comfortable is it for her when she is painting on the ground? • Consider changing the size of the supporting side-bars. • Consider how difficult it would be to attach the mechanism to the canvas (can she bear the weight of setting it up?) <p>Linkage-Like Design</p> <ul style="list-style-type: none"> • Extend arm rest. • Attach mechanism to a pole that allows for 180 degrees of rotation along the z axis. • Add tightening knobs to prevent a joint from giving out and having the mechanism drop down when weight is applied. • Adjusting the position of the mechanism so it is not an obstacle in her way as she paints 	
<p><i>Include feedback from science students in this row.</i></p> <p>Tripod-Like Design</p> <ul style="list-style-type: none"> • Incorporate hinge in the arm rest so she can have multiple degrees of freedom. <ul style="list-style-type: none"> ○ Specifically, movement from left to right. • Consider leg components on a smaller scale for painting on the floor. • Removable strap for adjusting pressure on her arm for stabilization. • Bending down to level of tightening knob may cause strain on her back. <ul style="list-style-type: none"> ○ Use something that incorporates her leg more than upper body (since she is leg dominant) ○ Potentially the use of an actuator 	

Canvas Holding Design

- Consider where she would be positioned when she is painting.
- If she is positioned on her shoulder this may cause strain