# PROJECT FOUR: MILESTONE 4 – COVER PAGE

Team Number: Tues-31

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

| Full Name: | MacID: |
|---|---|
| Luigi Quattrociocchi | quattrl |
| Ziad Ahmad | ahmadz18 |
| Avanish Ahluwalia | ahluwa6 |
| Michael Ferlisi | ferlisim |

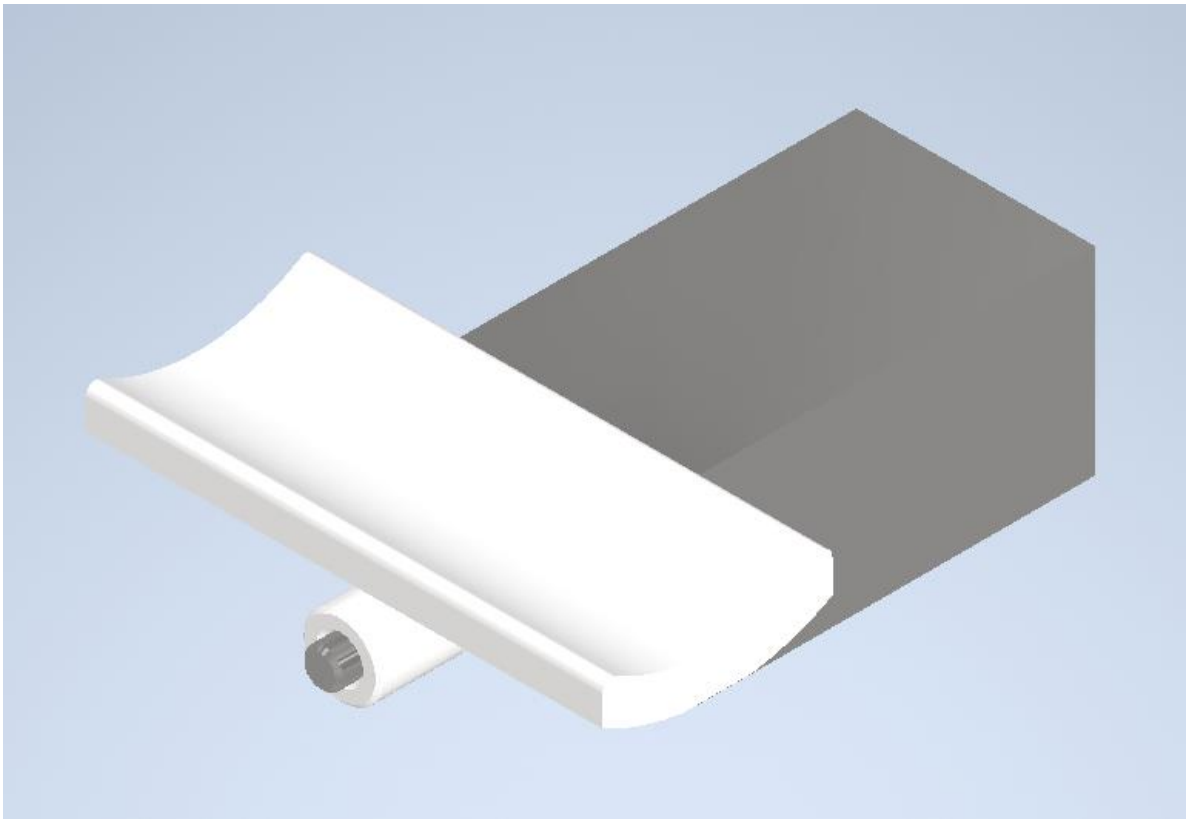
# MILESTONE 4.1 – REFINED PROTOTYPE + PROTOTYPING TEST PLAN

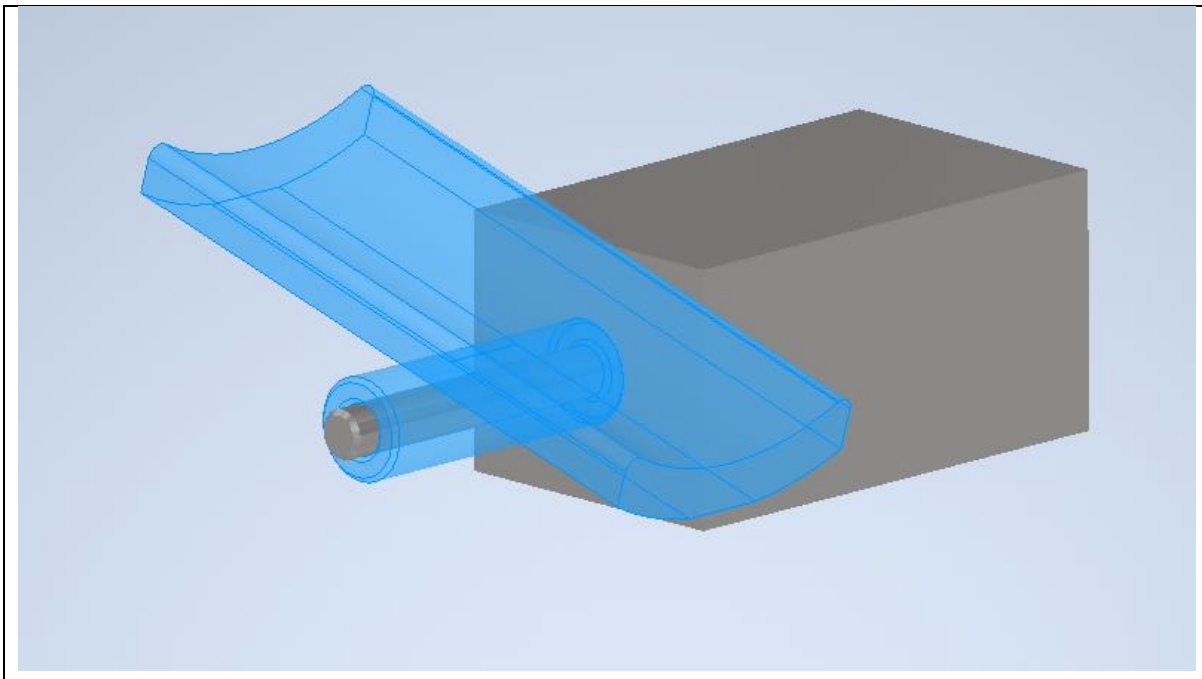
Team Number: Tues-31

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

**Design 1:**

*TV-stand-arm*



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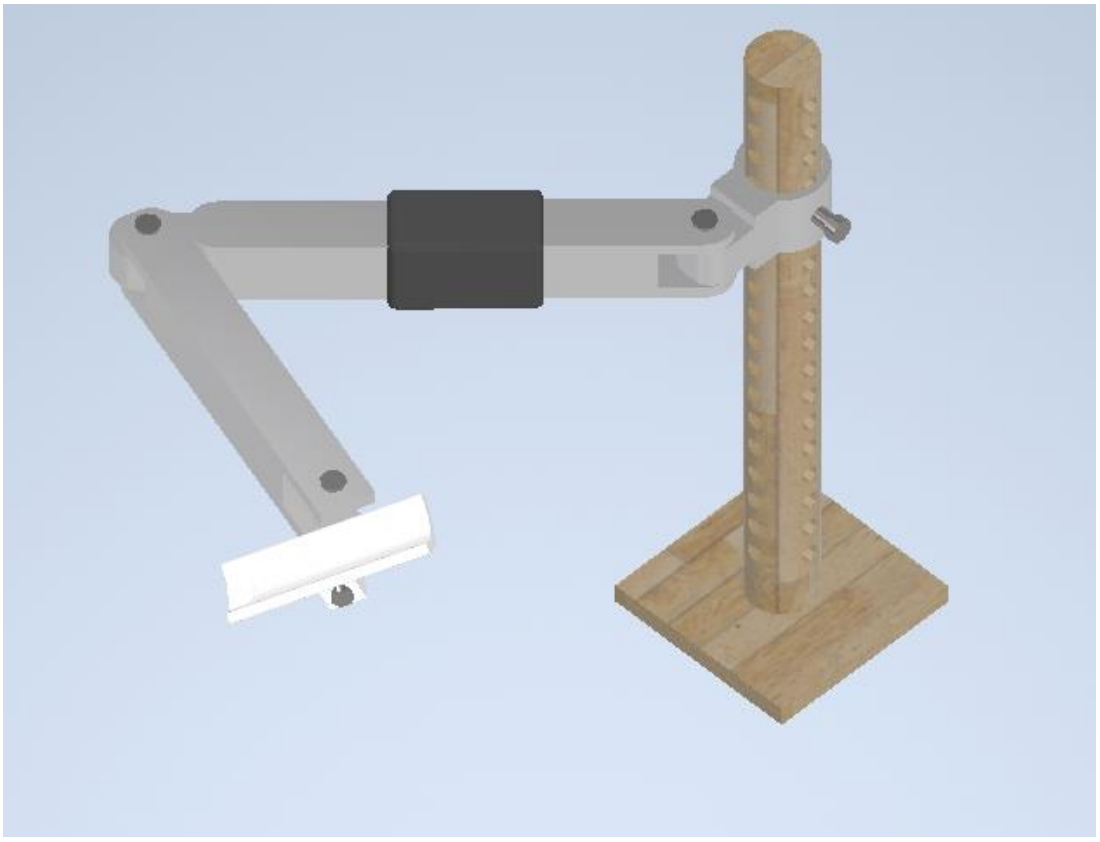
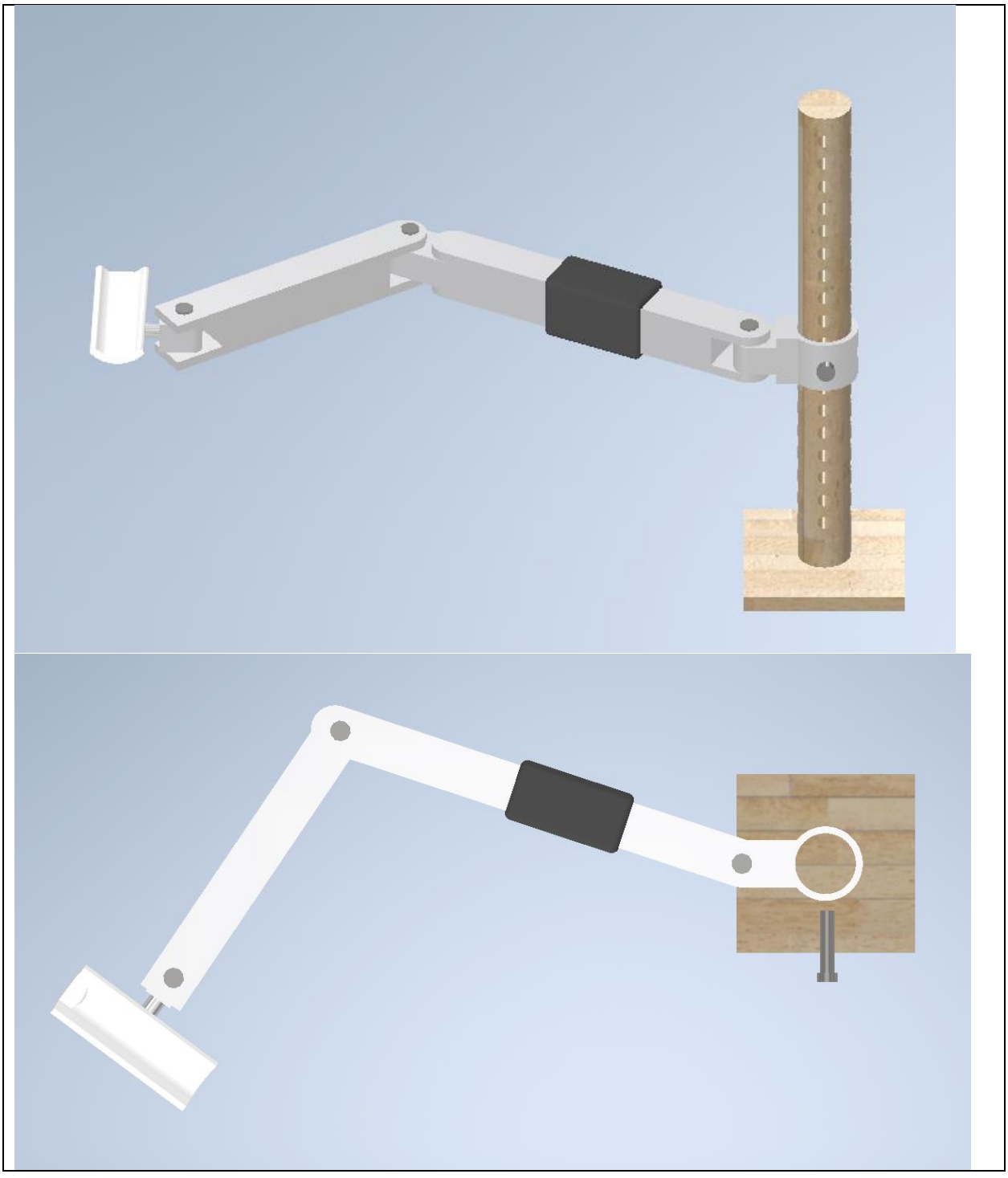
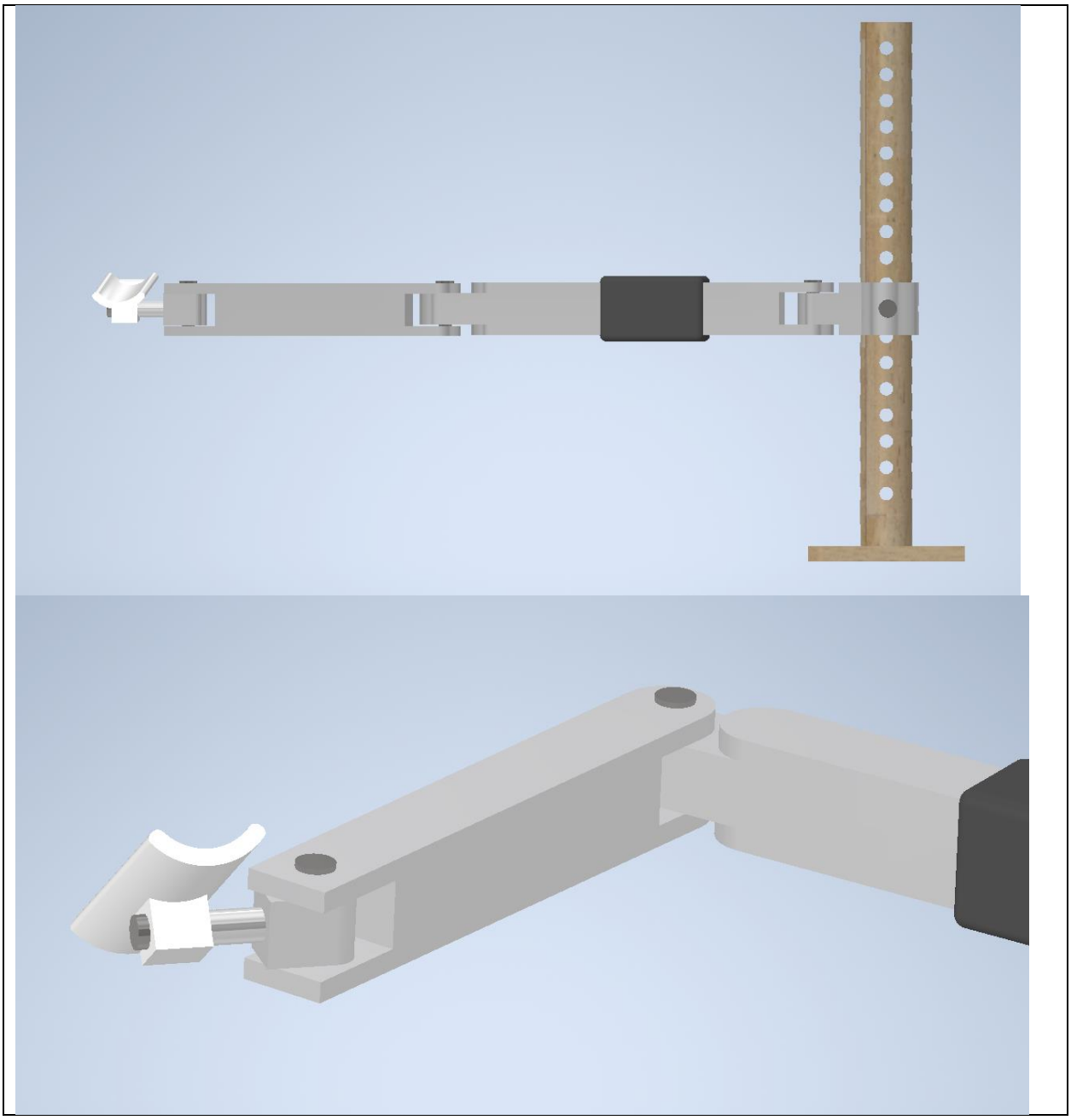
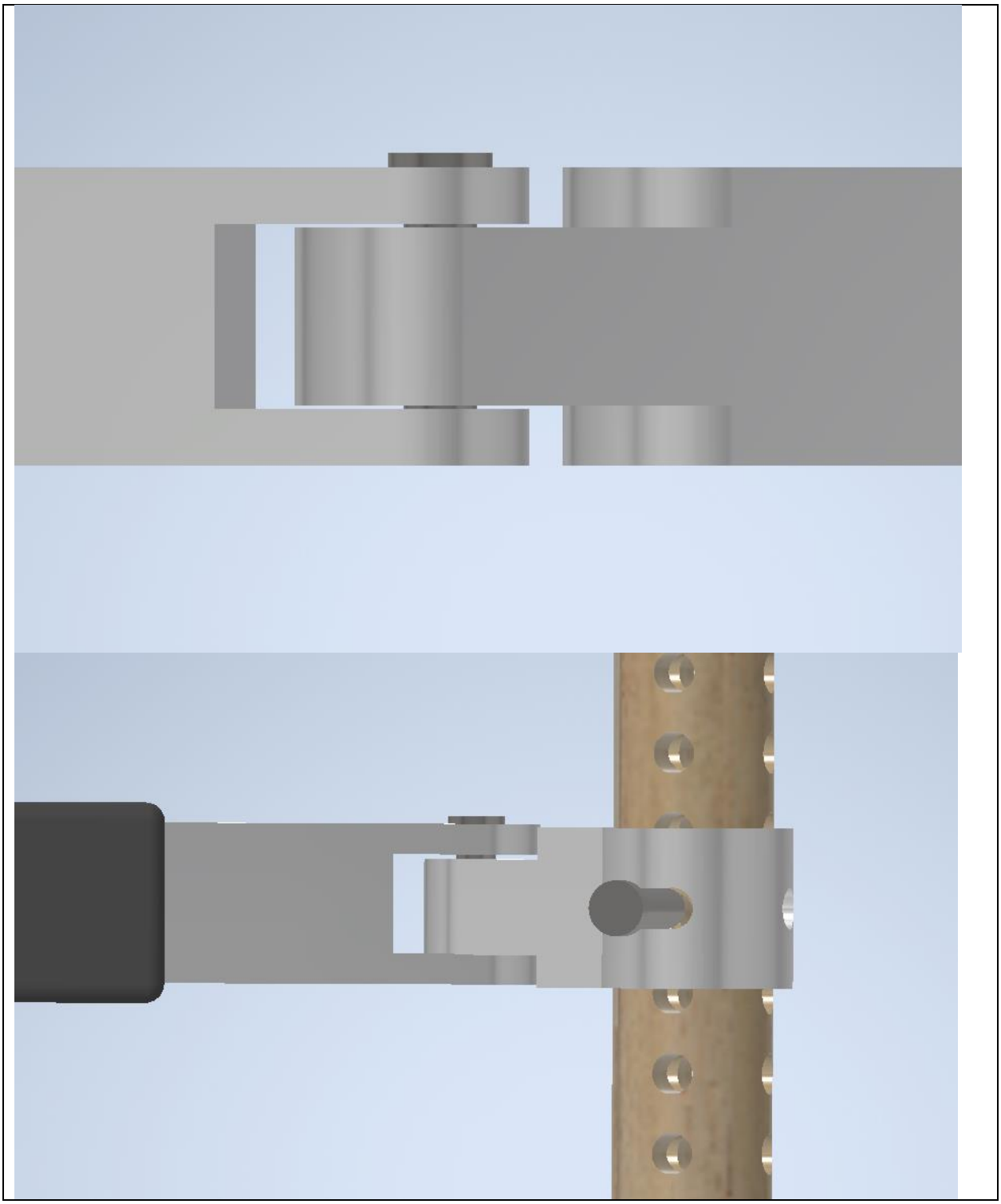
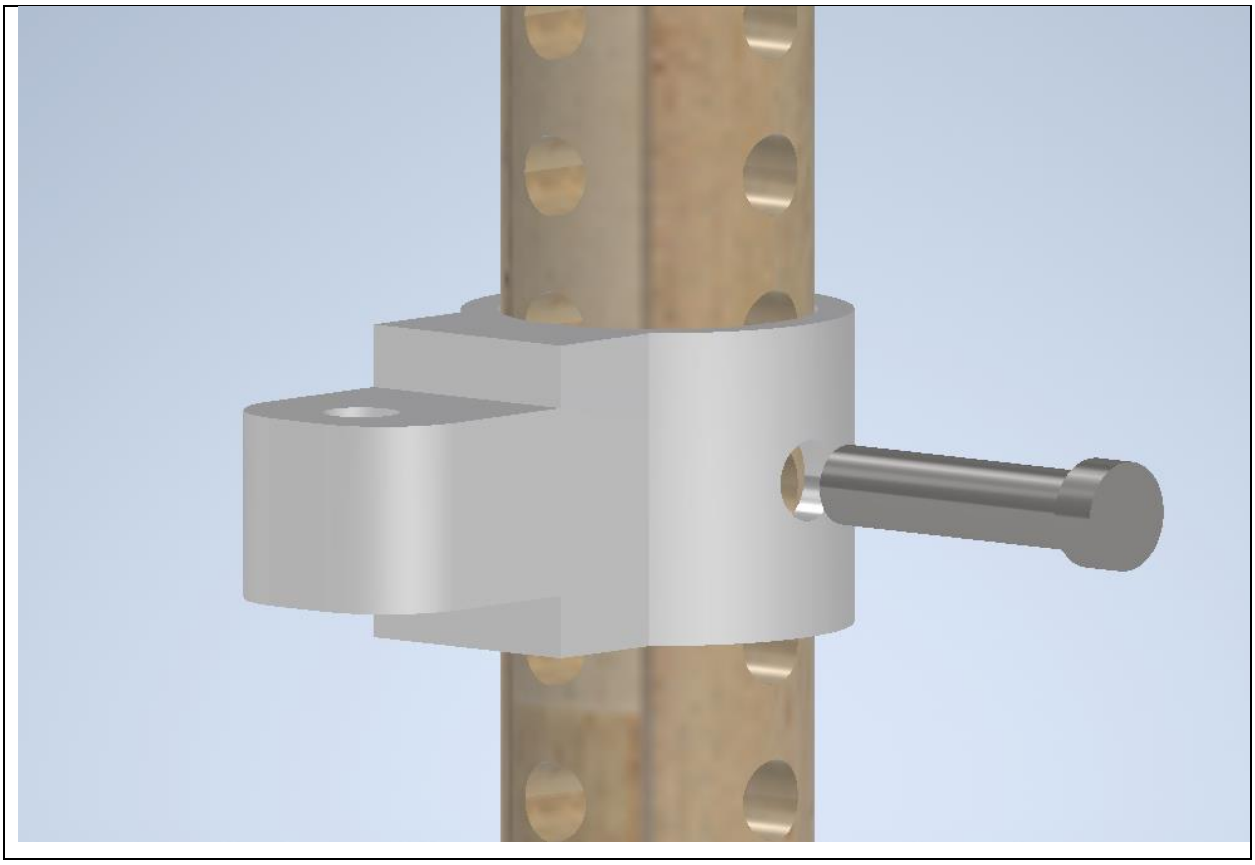
Refined prototype











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

Our refined prototype is similar to the initial prototype, but with some more features and improvements to the ease of use and comfortability objectives. The initial prototype had one moving joint only between the two arm joints as the first arm joint (close to pole) was connected to the pole, leaving movement for only the second arm joint (elbow to wrist design piece). With feedback provided in the first design review, we increased the range by creating an additional joint between the pole and the first arm joint to allow for wider coverage for the client to reach her canvas. Another refinement was to allow Alanna to adjust the height of the arm rest. This assists Alanna to figure out the most comfortable position depending on the change in elevation. The height would be adjusted by lifting the lightweight joints vertically and a peg at any vertical position. However, the design would also require a heavy base to prevent it from tipping over when force is applied on the armrest. Finally, we included a rubber grip on one of the arm segments for more maneuverability which didn't exist in the initial prototype, as recommended by the peer reviewers.

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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

Present Testing Plan

To test our refined prototype, we develop plans to test our three primary objectives, which are Strength, Comfortability, and Ease of Use.

The main objective of our design is to bear weight without failure. To test the strength of our design, we can determine values of some selected materials using Granta, and then evaluate the failure points of some variants of the design (varying geometry and selected materials) with a deflection hand-calculation. The geometry and material properties can be included in the MPI calculations, which gives an objective metric to the performance of a given variant of the design.

To test for the comfortability, the main concern is the surface at the end of the arm extension where Alanna would place her arm. The test for this objective would rank different materials for the armrest surface via a subjective scale based on user feedback. These materials can be bought from local craft stores that will then be used to cover the armrest. A small-group survey would be conducted asking participants to give a numerical score to each material. After all surveying is complete, the mean score of the sample would be taken as the final metric for comfortability. This test will yield the device's overall functionality of each material to provide Alanna the greatest amount of comfort.

To test for the ease of use, our CAD prototype would be dynamically simulated and the maximum extension in each direction would be measured. Autodesk Inventor's dynamic simulation tool would be used to move the joints, which would demonstrate the maximum distances for the ranges of motion of the device. The distances recorded would then be ranked on an objective scale based on the physical dimensions of an average 5% female body.

Future Testing Plan

Given that our design is on a larger scale, current test plans are limited to what can be done without getting parts and building a physical refined prototype. Methods used in the present testing plan utilize a computer or equation to approximately measure performance. Some improvements can be made though, assuming the group was given more resources (such as time, money, or tools).

Specifically, if parts were purchased or produced, and a physical prototype was built then the tests for strength and ease of use could be performed in the real world, rather than currently how we plan to use a deflection hand-calculation and CAD motion simulation, respectively. We can then physically test and move the joints providing an accurate response of the range of motion and determine the degrees of freedom. The strength can be tested through the solid model where we physically test the design by adding weight at the end of the arm and assessing for deformation and the highest possible stress that can be applied onto the design.

The comfortability test could be brought into the real world by surveying a larger scale of people of the same age as Alanna (disregarding covid restrictions) by asking them about their choice of most comfortable material out of the materials provided for the arm rest.

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

| Team Member's Full Name: | Contribution: |
|---|---|
| Luigi Quattrociocchi | Testing plans, Refined Prototype |
| Avanish Ahluwalia | Testing plans |
| Ziad Ahmad | Refined Prototype |
| Michael Ferlisi | Testing plans |

# MILESTONE 4.2 – DESIGN REVIEW

Team Number: Tues-31

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|---|
| ***Feedback From Peers:***<br>- *Add retractable wheels onto the baseplate for easy maneuver*<br>- *Create a large, weighted baseplate* |
| ***Science Student Feedback:***<br>- *The clamp should be easily adjustable (possibility of a larger grip/knob that will be easy for her to grab to screw/unscrew the clamp)*<br>- *Possibility of attaching the joint to a second pole that can be maintained in place by a stopper*<br>- *Add weight to the base to stabilize it and prevent it from tipping over when the arm is placed on the armrest.*<br>- *Add a polymer or rubber around the joints of the arm to add grip that can be used by the client to move the arm with her non-dominant arm.* |
| *If applicable, include feedback from the client in this row.* |