NN

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Interactive iPad Stand

Context

The aim of this project was to **create a unique assistive device for an older user**. Our client was a graphic and jewelry designer who typically worked on commissions every evening on the couch while using a pillow as a stand. My main role in the project was to **develop the mechanical systems** and **ensure ease of use** as well as stability.

Problem Statement

Develop an easily transportable iPad holder capable of flexible viewing angles and keeping track of work time for a unique user.

Methodology

We developed a list of needs and wants based on the users preferences and priorities.

Pain Points

- No current method of time tracking
- Uncomfortable
- Unstable

Needs

- 3 Axes of rotation
- Position locking
- Time tracking
- Lightweight
- Mobile
- Stable

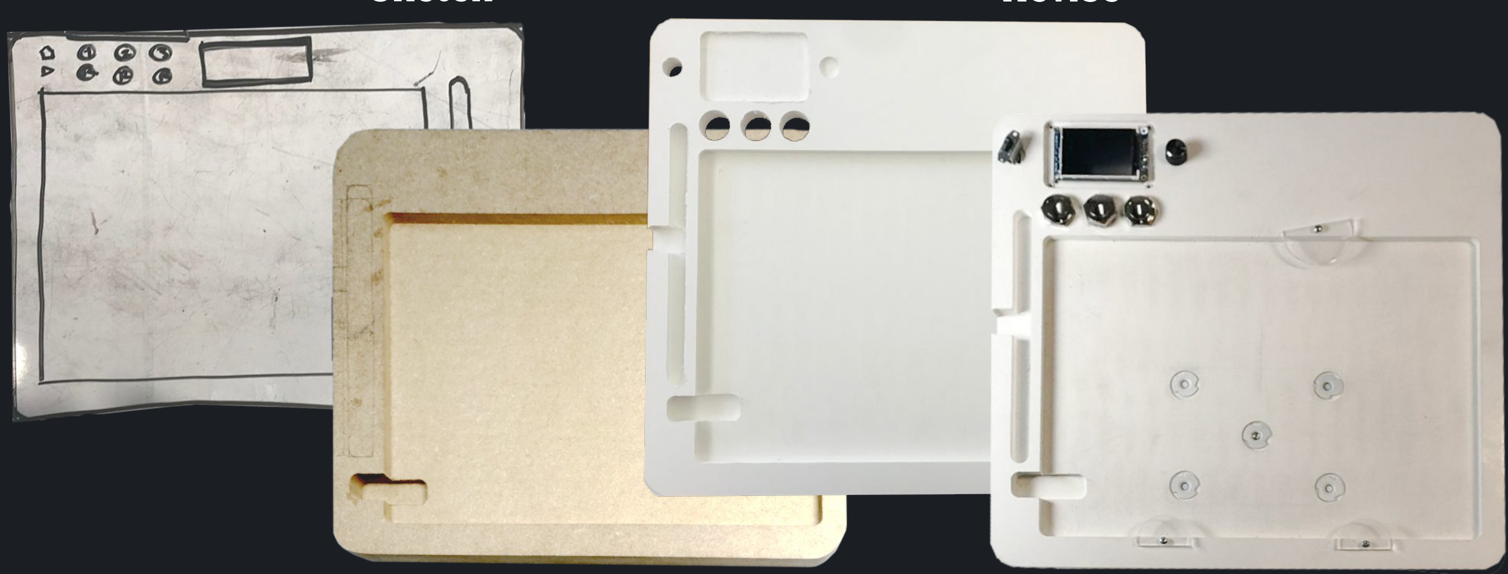
Wants

- Multi project tracking
- Optional cushioning
- Pen holder

Prototyping & Testing

We began with a contextual inquiry so we could identify pain points and understand the environment the user would be working in. With this information, we developed an initial prototype that we brought to the user to interact with and give additional feedback. Following this praxis, we developed two more prototypes with new adjustments, adding new features and dropping undesired features.

Sketch **Revise**



Prototype **Improve**

Final Design

Our final prototype was a stand that met all of our needs and wants. The body of the stand was milled medium density fiberwood with cutouts for pen storage, iPad seating, and electronics seating. The base was finished hardwood with the option for an attachable cushion. The Arduino powered electronics ran a built-in project time logging system.

The mechanical arm of the stand was capable of manipulation across 3 axes via a ball joint attached to a multi angle folding mount. This allowed the user to adjust the view angle as desired, manipulate how close or far the iPad was from him, and lock the stand in position.

3 Team Members

50 Hours

5 Usability Tests

4 Iterations

Main Takeaways

This was my first project working with an **individual user**, so taking into account his feedback and specializing the product to his needs was a very **divergent and exciting experience** as **compared to designing for a user group**. This process allowed for a **more streamlined feedback** and **redesign process**. The electronics system was the piece that took the longest to develop. In retrospect, this was the most intricate part of the design to incorporate, so developing it earlier in the process would have allowed for a more streamlined final design.

EasyAid

Context

For this project, we **developed a first aid kit geared for marketing towards both incoming and current college students along with their parents**. Through user research, we identified a **user population** of approximately **2.5 million new users** in the US **per year**. Through surveys, we determined **~75% of college students** who responded **already** had some form of **improvised first-aid kit** in their dorm.

Those surveyed indicated the most important factors to them when choosing a first aid kit were ease of use and versatility.

Problem Statement

Create a user-friendly first aid kit tailored towards the unique needs of a college dorm lifestyle.

Methodology

For this project, we developed a set of seven core principles which were the fundamental ideals behind our design process.

Pain Points

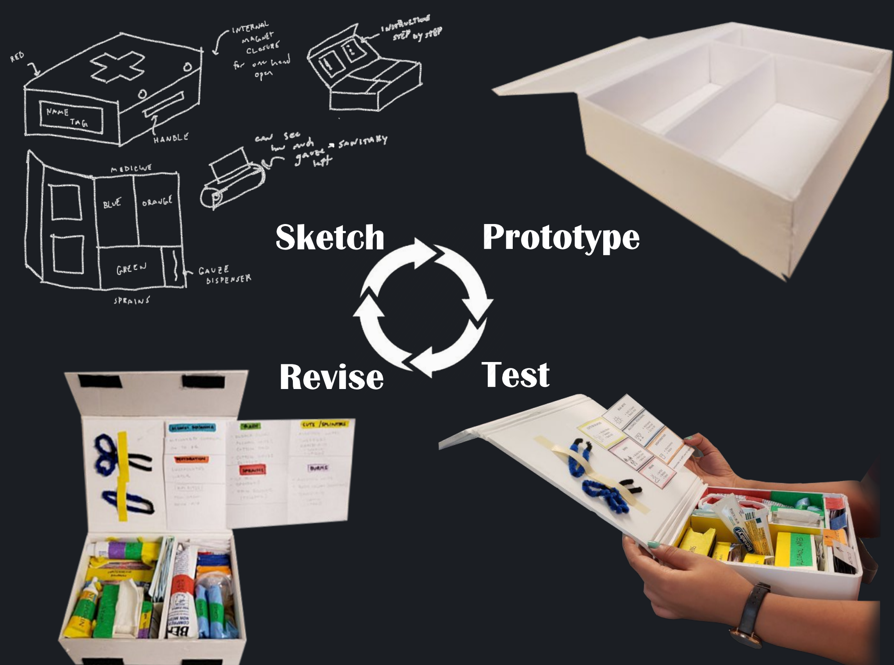
- Hard to open
- Hard to reassemble
- Lack of treatment instructions
- No organization
- Overly packaged
- Poor workflow

Treatments

- Alcohol Poisoning
- Bug Bites
- Burns
- Cuts
- Dehydration
- Gashes
- Headaches
- Sprains
- Upset Stomach

Principles

- Equitable Use
- Flexibility in Use
- Simple and Intuitive
- Perceptible Information
- Tolerance of error
- Low physical effort
- Size and Space



Prototyping & Testing

Our foremost priority was making sure that our design was universal. For each change or component, we made sure that equitable use and our principle set was applied.

We began our design process by drawing a series of sketches for several different model types, each resolving the pain points with different solutions.
We then made works-like models for two of the initial sketches. After, we iterated on the more successful design by conducting further user testing and revising new pain points.

Final Design

The final design was a works-like model constructed from foamcore. The model used color blocking to guide user workflow using our improved organization. This model also included new easy-dispensing systems for band-aids and gauze. These new systems allowed for easier access and allowed users to see when they needed replacements.

A final looks-like model would have a translucent red plastic body, featuring a glow-in-the-dark cross on the front for easy locating in the dark, and a handle that slides to become flush with the side. Users would also be able to order individual replacements for items.

Marketing

We also identified possible purchasing user profiles and created empathy maps for each of the user types to optimize the experience for each user type.

We determined that the best places to sell this product were in university stores and big box stores during the back-to-school season.

Think & Feel
- Useful in many emergency situations
- Child will be able to understand and use it quickly
- Thoughtful parent

Gain
Peace of mind

Parents / Friend

See
- Back to School
- Necessary items for college student
- Organized kit
- Easy to use instructions kit

Hear
- Recommended by other parents
- Great gift
- Used throughout college

Say & Do
- Purchase for their child
- Give as gift
- Recommend to others

Think & Feel
- Easy to use without special training
- Bring it to intramural events / activities
- Friends could use it
- Feel prepared for the unexpected

Gain
First-aid items for a variety of situations
Feeling prepared
Happy parents

Student

See
- Student sees it in the health center

Hear
- Recommended by friends
- Suggested by parents
- Last throughout college

Say & Do
- Purchase as a young adult
- Be prepared if an emergency occurs

4 Team Members

25 Hours

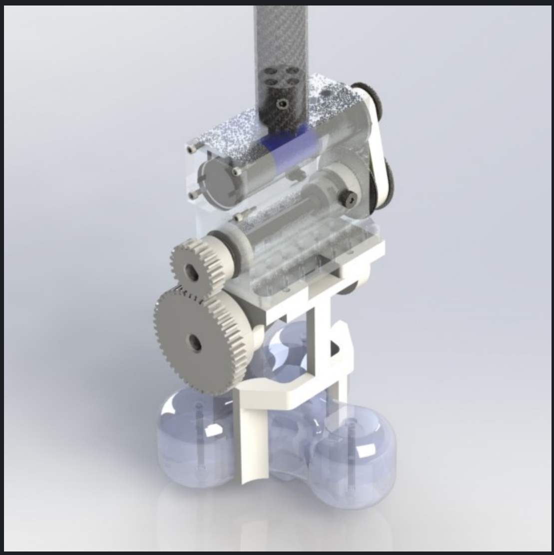
10 Usability Tests

4 Iterations

Main Takeaways

This project utilized a variety of **design tactics** that were new to me, such as **rapid ideation, design for marketing to a user population,** and **separating works-like and looks-like models**. This project required a works-like model, with considerations taken to outline a looks-like model. This process allowed for **more creativity** and **less restrictions.**

Swinging Gripper



Context

The aim of this project was to **design a gripping device** that would attach to a swinging 1-meter arm that had a motor affixed at the end. The gripper had to maintain a grip on a large steel object throughout several swings in a 180-degree arc. The object weighed 1.2kg and was shaped vaguely like a fidget spinner. I was the leader for this project.

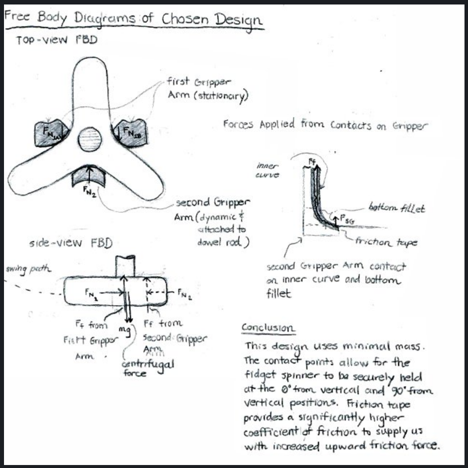
Problem Statement

Design a gripping device that is optimized to obtain the lightest weight while exerting sufficient gripping force .

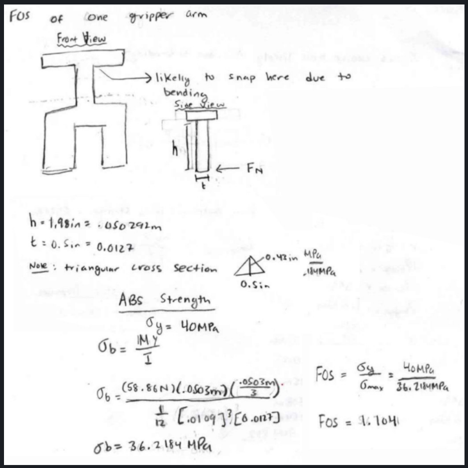
Methodology

For this project, we developed several ideas, mathematically verified their viability via Free Body Diagrams, then modeled and simulated the stresses the pieces would experience. From there, we optimized for decreasing mass, verifying that the the pieces could still withstand the stresses they would experience. After optimizing, we 3D printed several models, adjusting the infill to further reduce mass while maintaining structural integrity.

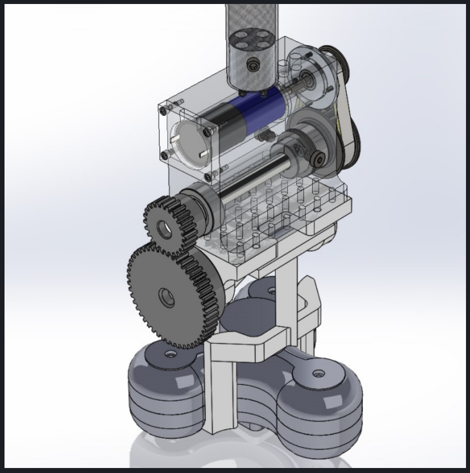
Brainstorm



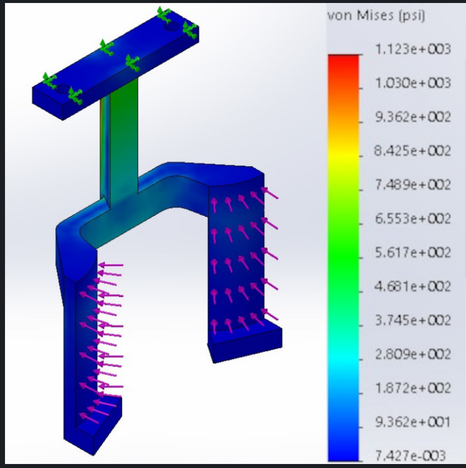
Calculate



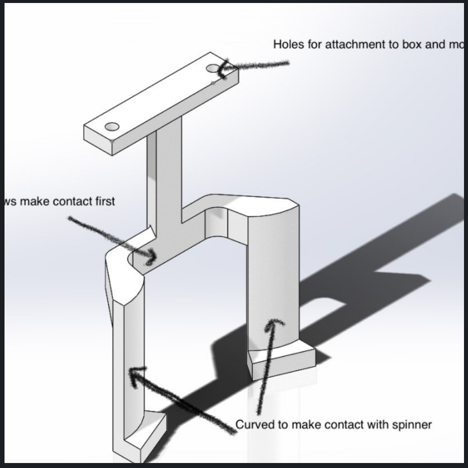
Optimize



Simulate



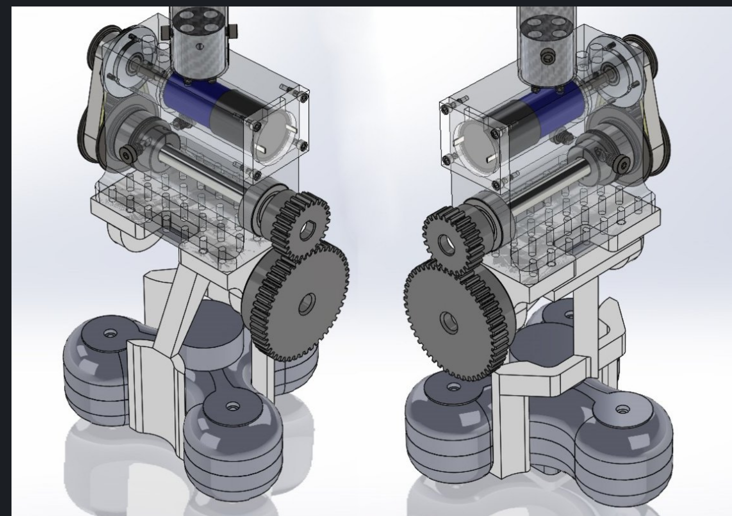
Model

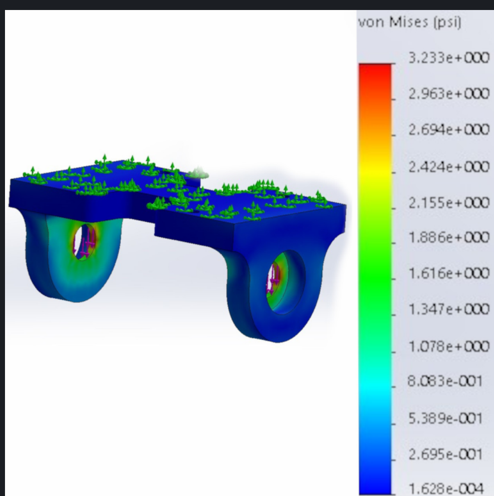


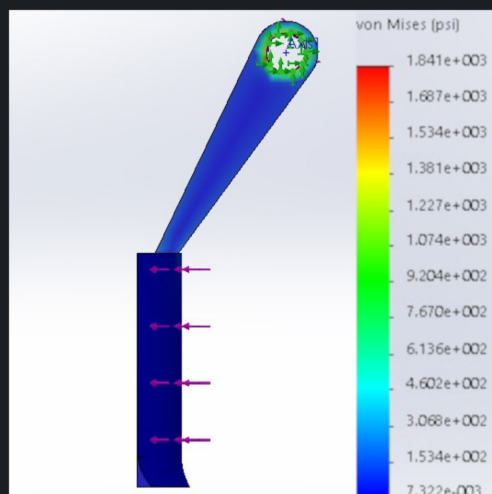
Final Design

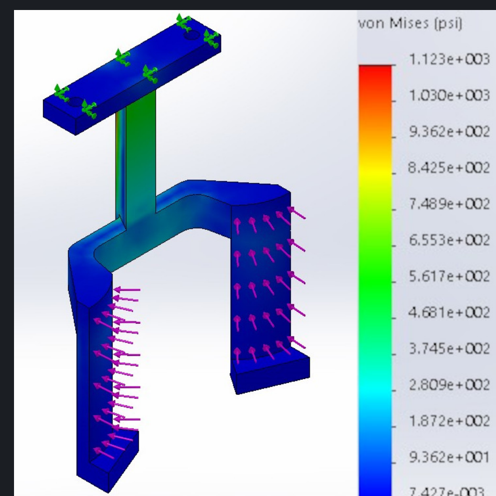
The final design for this project featured custom resin printed gearing to obtain an exact torque ratio, 3D printed, lightweight PLA claws that were form fitted to this particular object, and an overall very lightweight design. The gripper was able to pass many trials with no failures, showing reliability as well as durability.

Our gripper was able to perform the task with no failure, and was the lightest design of the 30 competing groups. We developed fitted shapes and then used stress and context testing to push our pieces to the extreme while still maintaining factors of safety we were confident in.









Final Calculations

Total gripper mass: 133g
Peak Force: 35.316 N
Factor of Safety with respect to dropping: 2.24

Component Failure

Factor of Safety with respect to component failure:
Contact stress in moving arm: 349.003
Bending in moving arm: 1.32
Bending of claws on gripper: 2.24
Small Gear: 50
Large Gear: 30
Stationary Arm: 1.104
Wooden Dowel: 8.565

Failure Mode

The weakest link in the design is the arm with two claws that connects the side of the gripper, as it has the lowest factor of safety. The **failure mode** would be due to **bending forces**.

Were this part to fail, the fidget spinner would fall, forcing disqualification. We made sure to compensate for this by making the arm a triangular prism.

6
Team Members

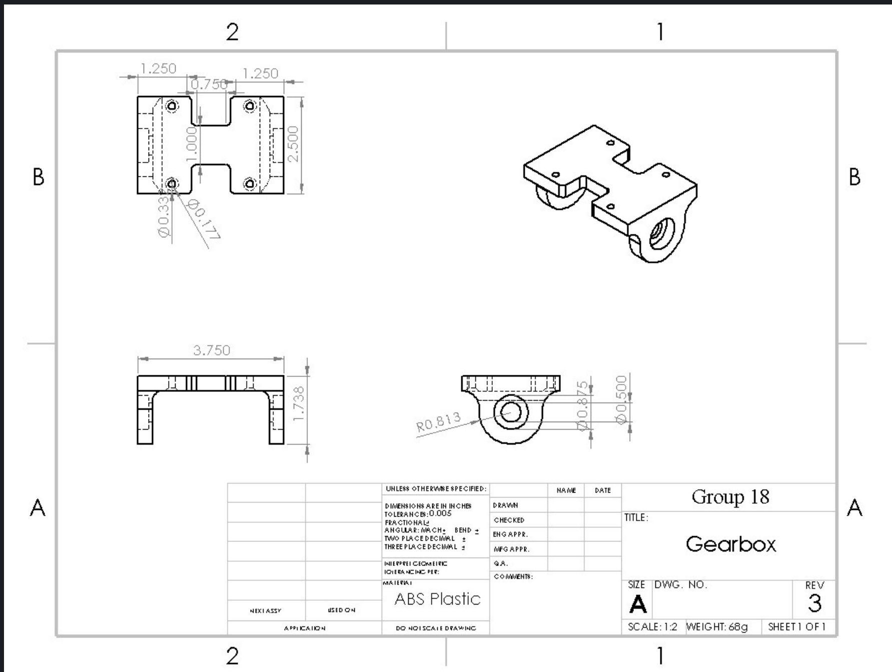
30
Hours

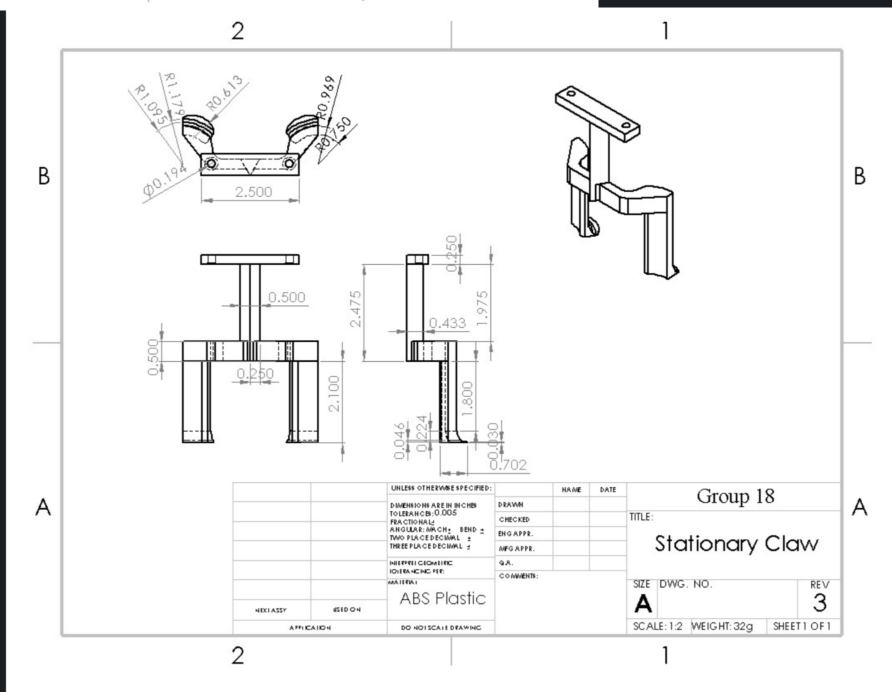
10
Stress Tests

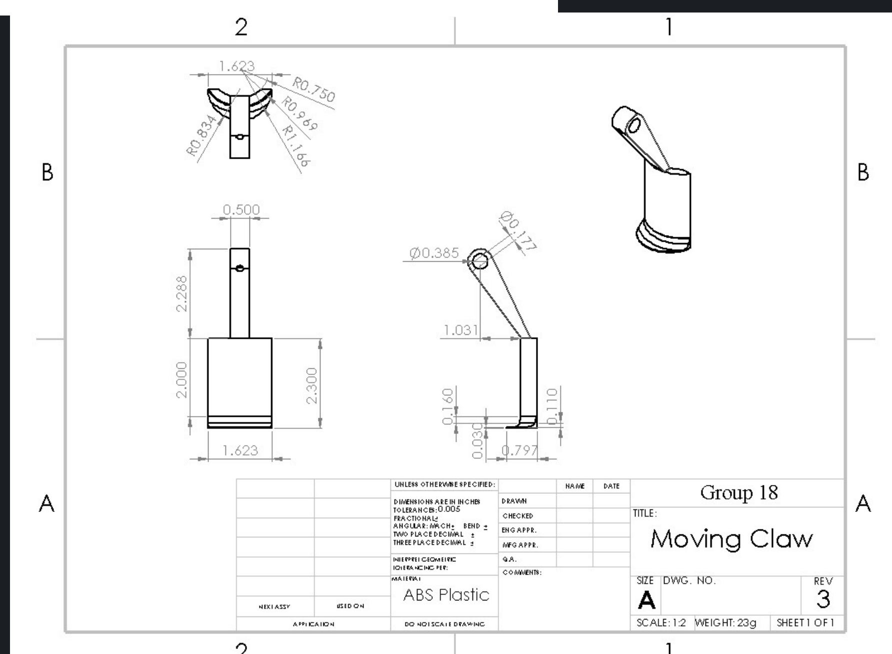
6
Iterations

Main Takeaways

The **main strength** in our process was **analyzing** the pieces with their corresponding **stresses and strains** and **removing unnecessary parts** of the claws. As the lead, I made the decisions when our team came to impasses and decided which routes were the most promising to follow. Working in this large group size allowed for a lot of different perspectives, which in turn allowed us to **combine ideas** that ended up being **greater than the sum of their parts**. I found **balancing personal judgement** and the **groups views** led to a **stronger project with few missteps**.


1.250
0.750
1.250
1.000
2.500
Ø0.33
Ø0.177
3.750
1.738
R0.813
Ø0.875
Ø0.500
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: 0.005
NAME
DATE
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
Group 18
TITLE:
Gearbox
MATERIAL
ABS Plastic
NEXT ASSY
USED ON
APPLICATION
DO NOT SCALE DRAWING
SIZE
A
DWG. NO.
REV
3
SCALE: 1:2
WEIGHT: 68g
SHEET 1 OF 1


R1.095
R1.179
R0.613
R0.969
R0.750
Ø0.194
2.500
0.500
0.500
0.250
2.100
2.475
0.250
0.433
1.975
1.800
0.046
0.224
0.030
0.702
Group 18
TITLE:
Stationary Claw
MATERIAL
ABS Plastic
SIZE
A
DWG. NO.
REV
3
SCALE: 1:2
WEIGHT: 32g
SHEET 1 OF 1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R0.750
R0.969
R1.166
R0.834
0.500
2.288
2.000
2.300
1.623
Ø0.385
Ø0.177
1.031
0.160
0.030
0.110
0.797
Group 18
TITLE:
Moving Claw
MATERIAL
ABS Plastic
SIZE
A
DWG. NO.
REV
3
SCALE: 1:2
WEIGHT: 23g
SHEET 1 OF 1