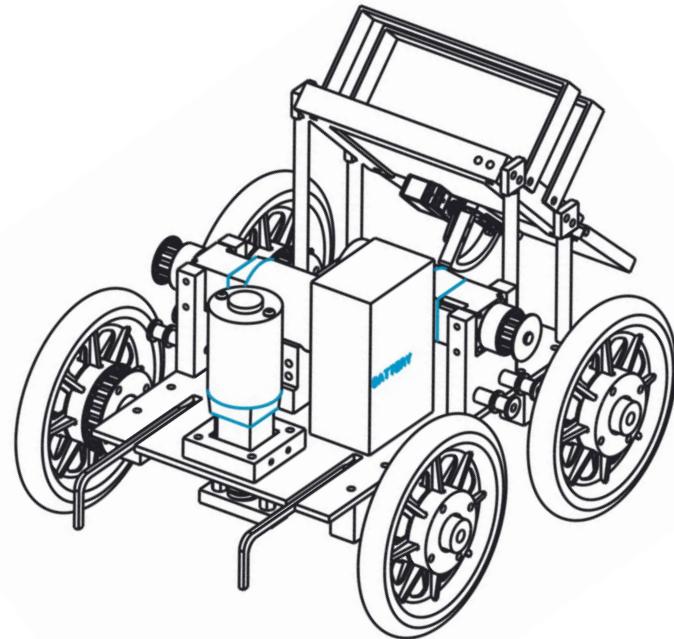


Final Design Presentation

Team “Trust The Process”

Justin Chae, Josh Coleman, Karla Soto-Cuevas,
Hudson Godfrey, Mohamed Hamza, Jonathan Melkun



Outline

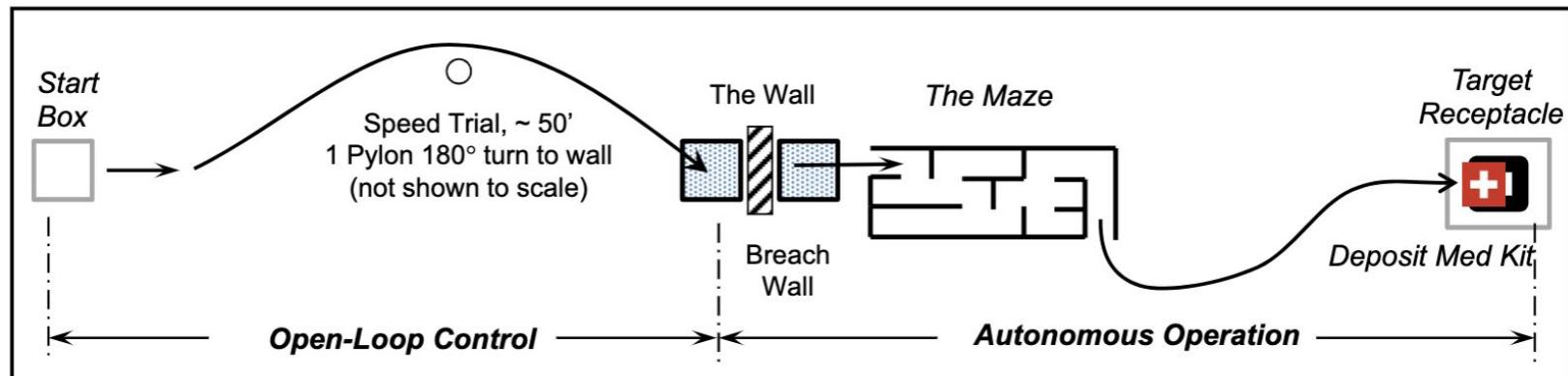
- 01** The Objective
- 02** Design Process
- 03** Specifications/Analysis
- 04** Project Management
- 05** Summary
- 06** Comments & Questions

01

The Objective

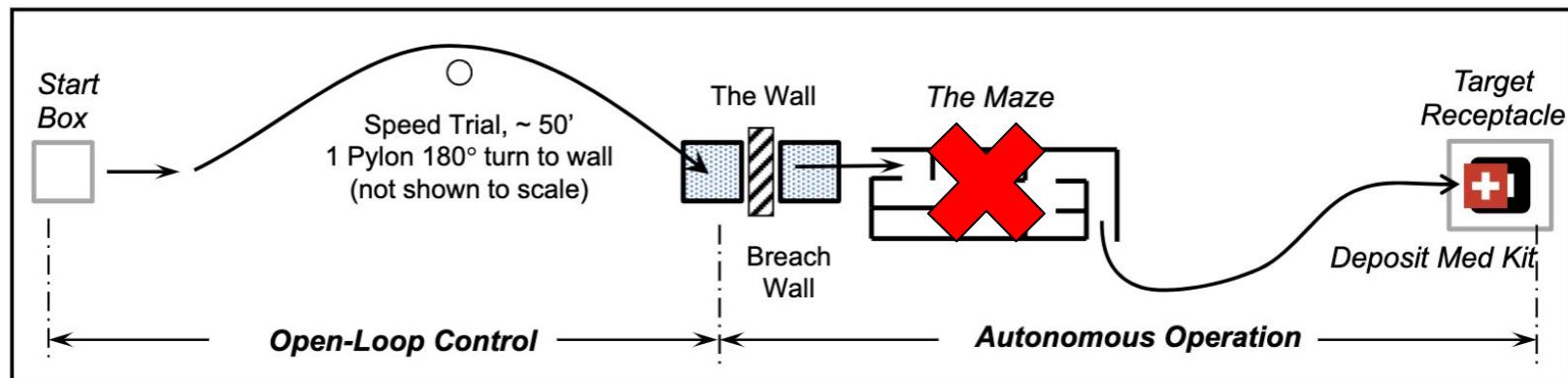
The Objective | Original Plan

- Course precursor:
 1. Drop test
- Course subsections:
 1. Obstacle course
 2. Wall traversal
 3. Maze navigation
 4. Med kit delivery



The Objective | Revised Plan

- Course precursor:
 1. Drop test
- Course subsections:
 1. Obstacle course
 2. Wall traversal
 3. ~~Maze navigation~~
 4. Med kit delivery



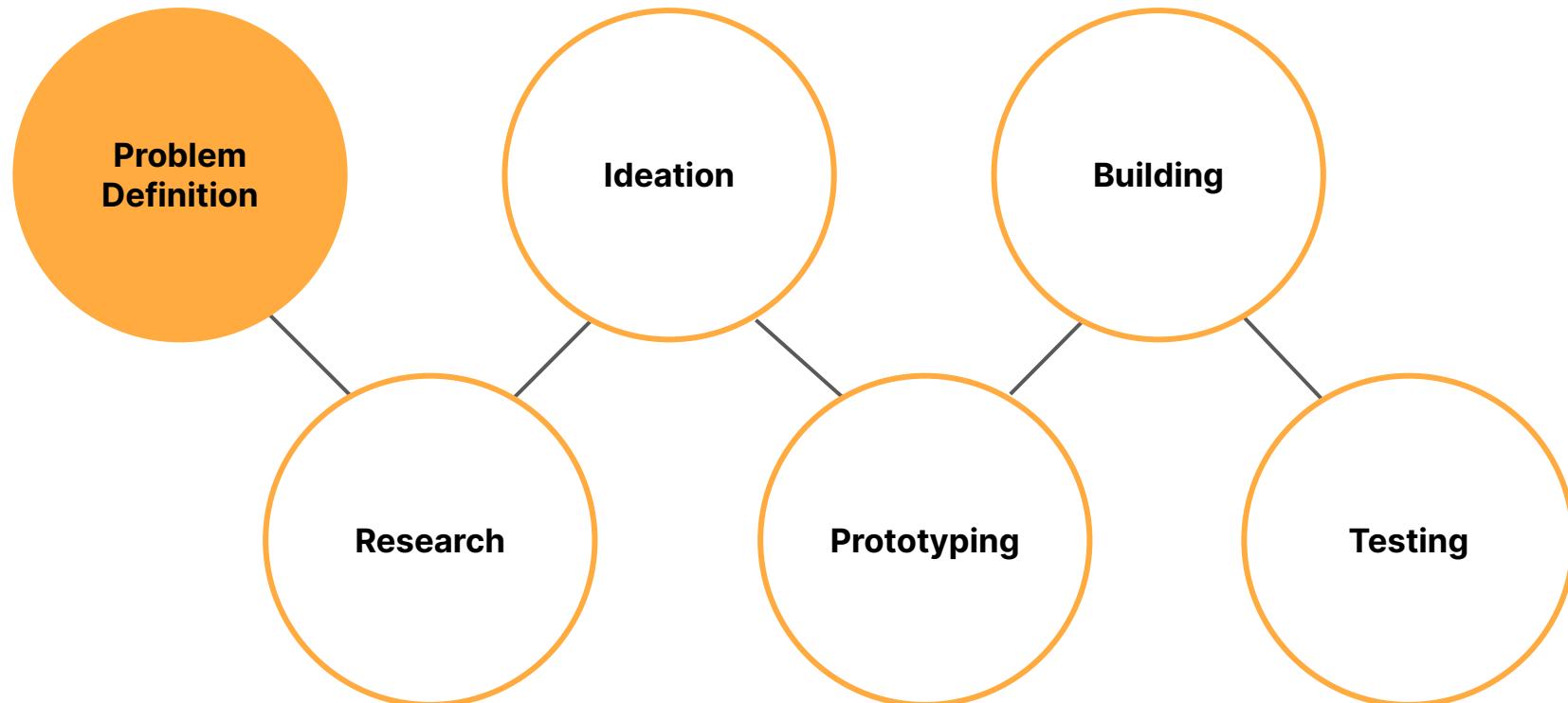
The Objective | Constraints

- Drop test → Durable construction
- Obstacle course → Easily maneuverable
- Wall traversal → Consistent performance
- Maze navigation → Physical size constraints
- Med kit delivery → Physical size constraints

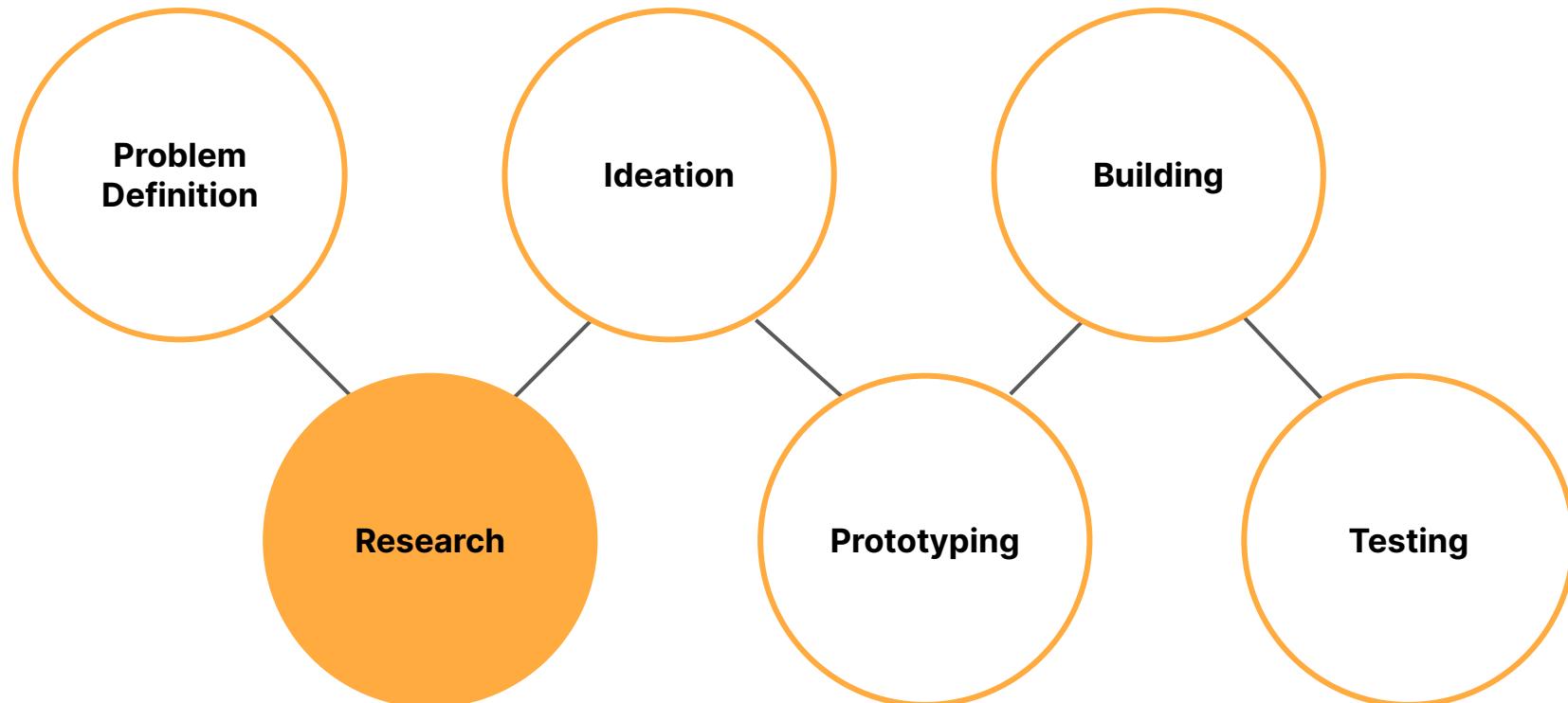
02

Design Process

Design Process | Problem Definition



Design Process | Research



Research



“The Animal”
1984 kids toy



Sand Flea Jumping Robot
Boston Dynamics

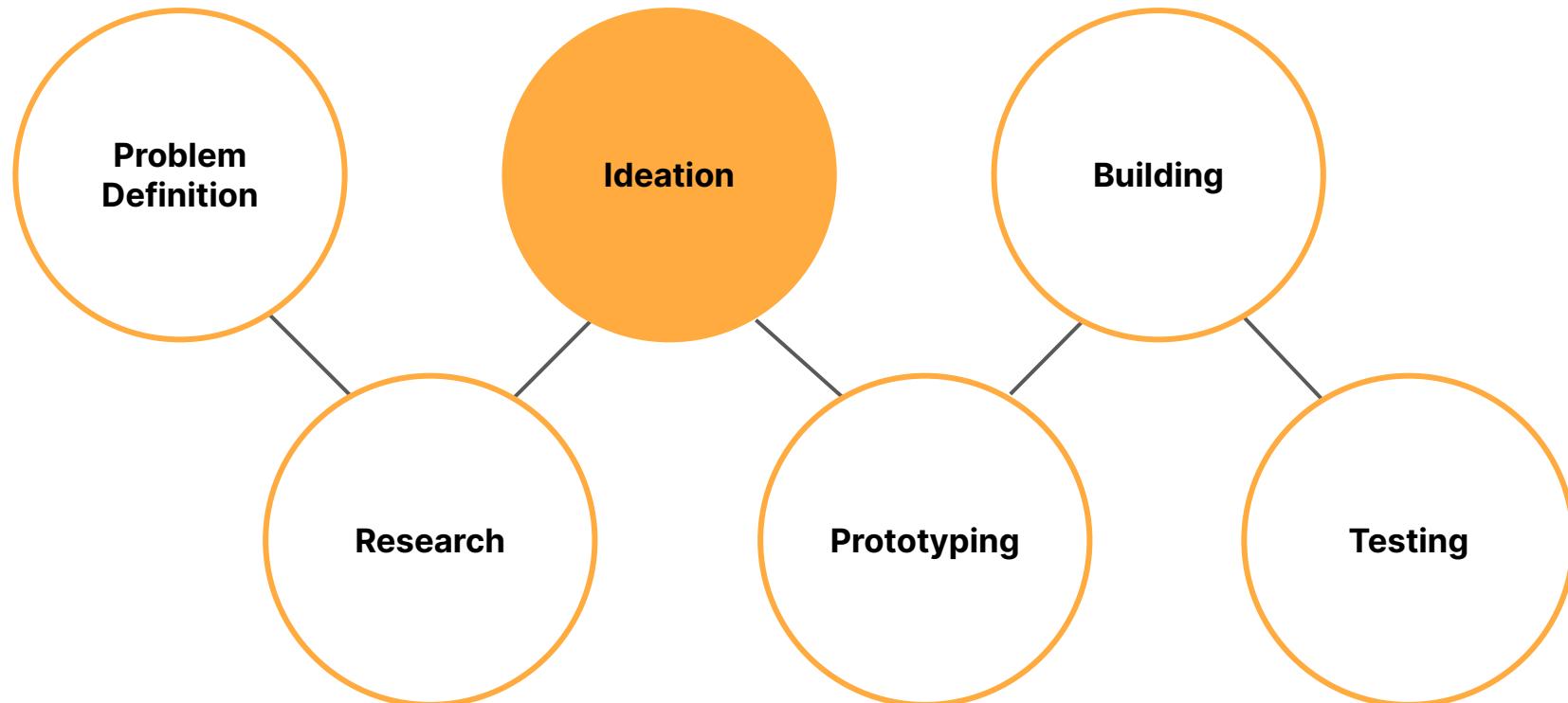


Hailfire Droid
Star Wars



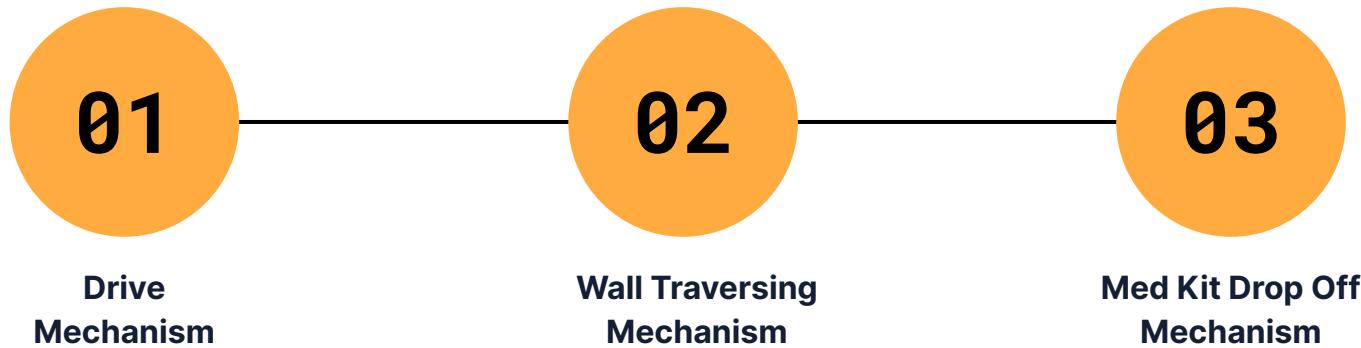
“Nano”
Hexbug

Design Process | Ideation



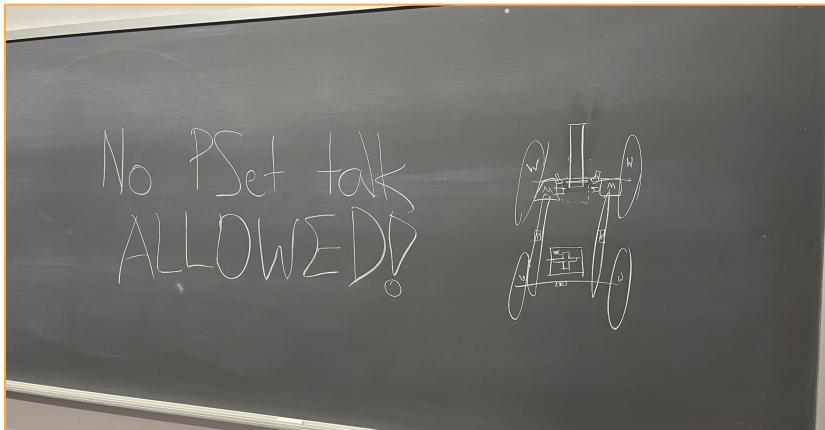
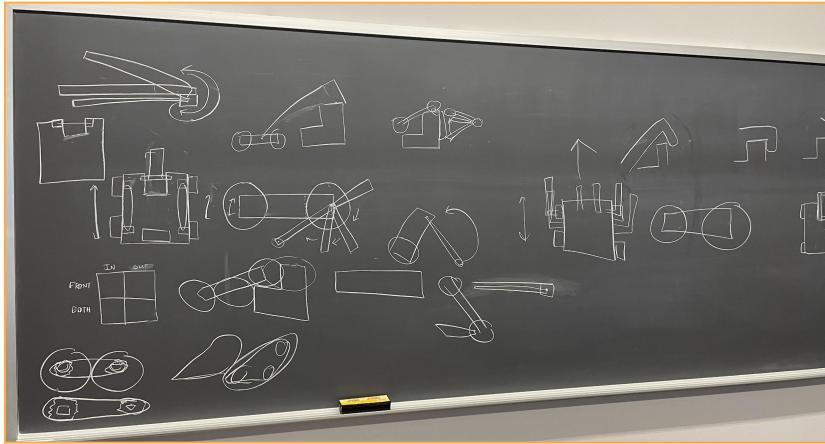
Design Process | Ideation

- Based on our problem definition, we defined 3 main subcomponents to the robot:

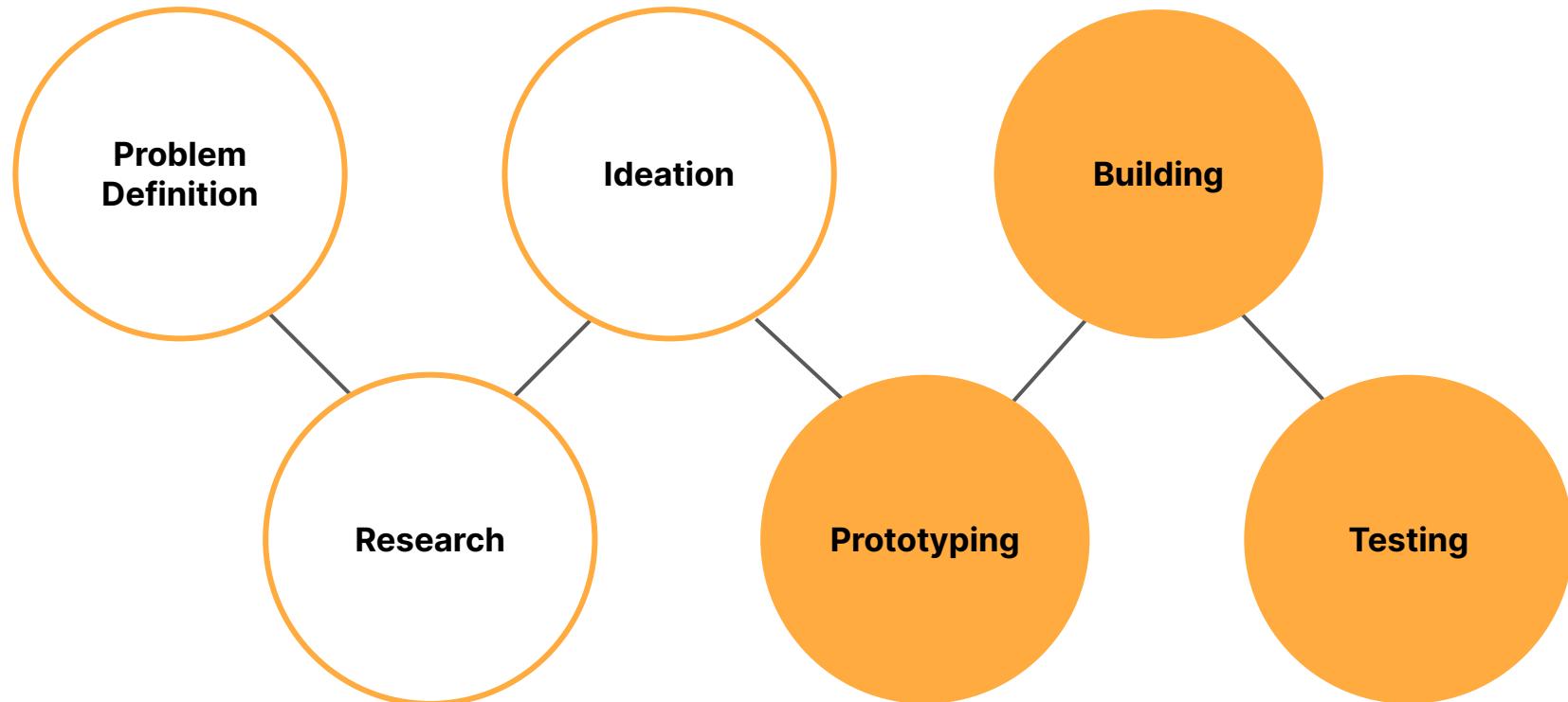


- We then compiled all of our ideas and began to brainstorm designs for each subcomponent
 - After one person pitched an idea, we discussed the pros and cons to the design through the lens of our initial design philosophy

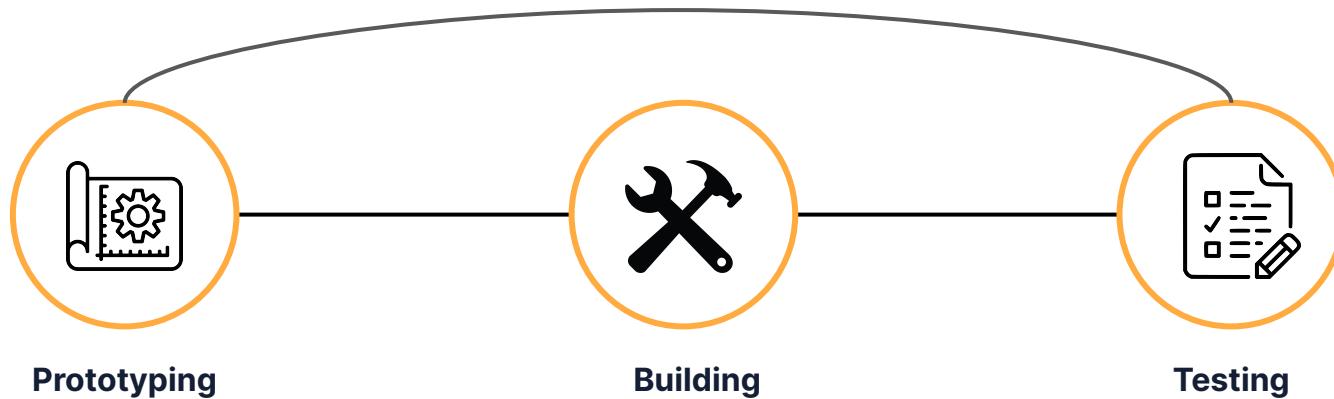
Ideation



Design Process | What's New?

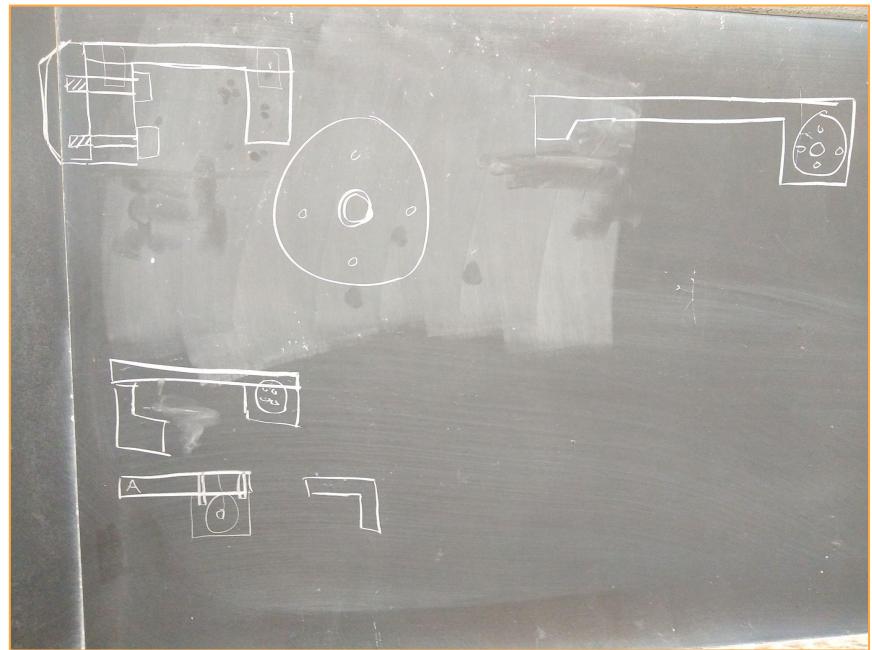
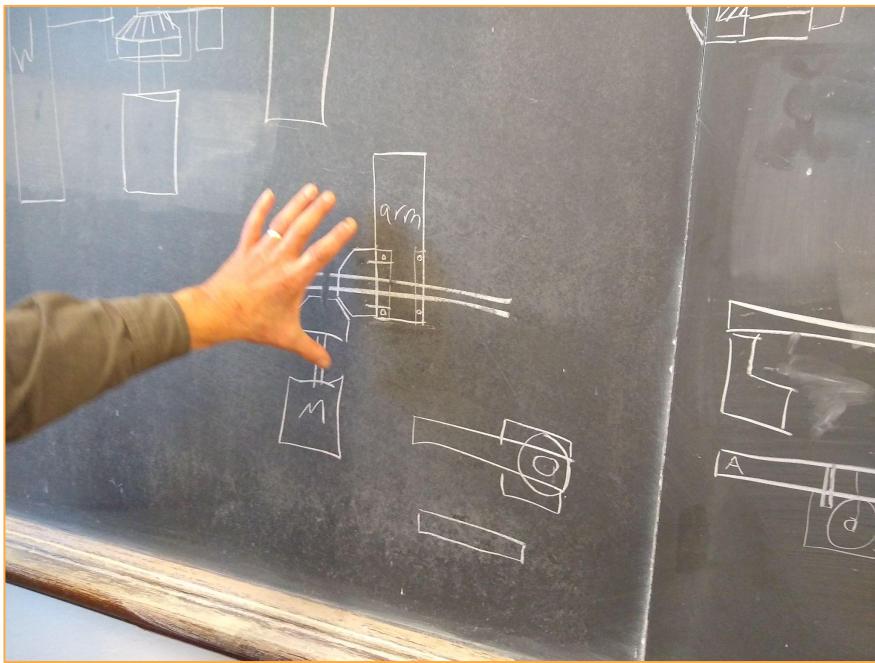


Design Process | What's New?

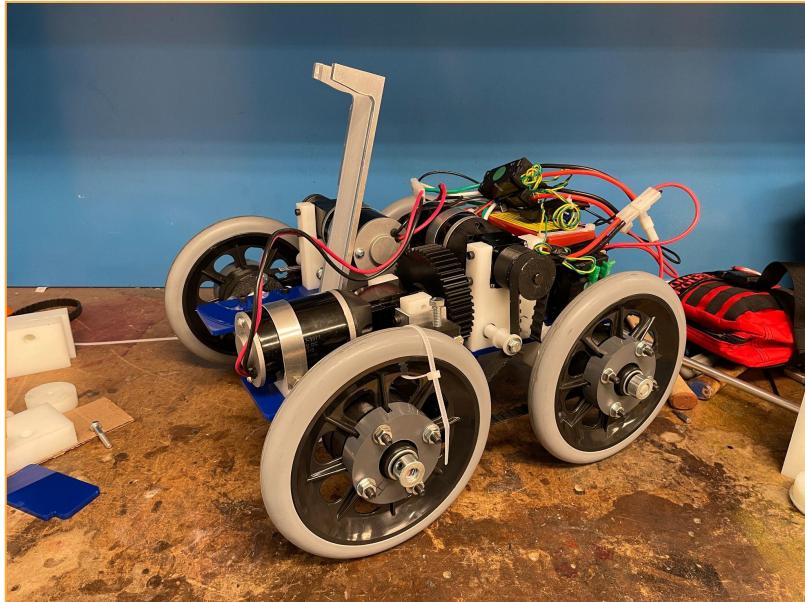


- Constant iteration of the above steps
- Resulted in the production of two complete SaRRs
- Versions 1 and 2

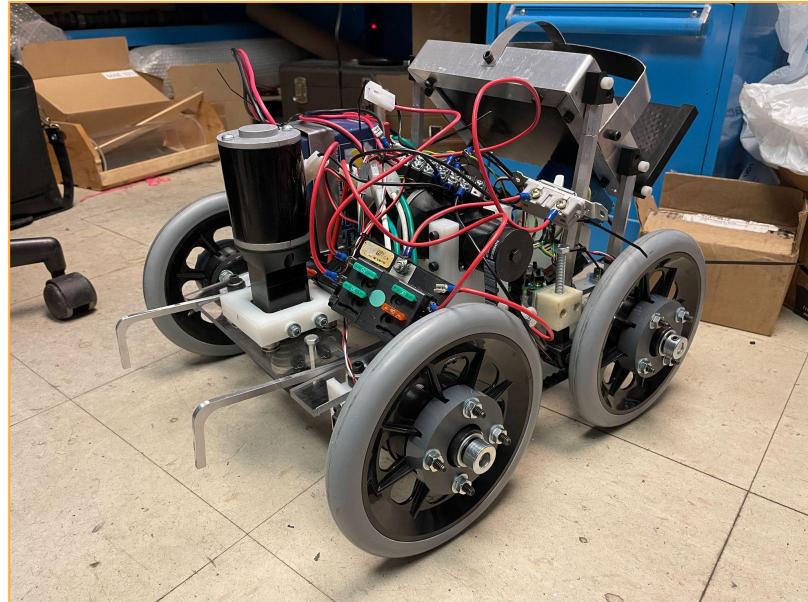
Design Process | Prototyping



Design Process | V1 vs V2



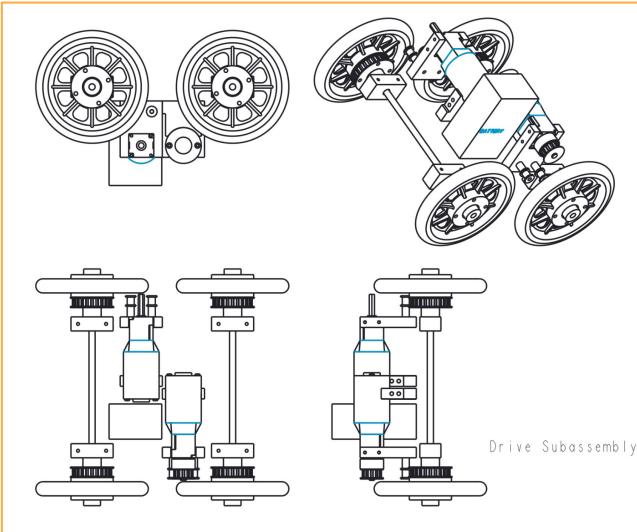
Version 1



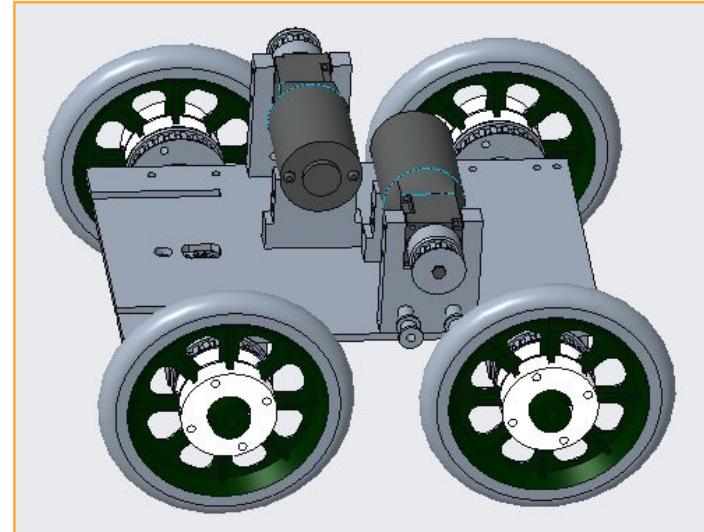
Version 2

Design Process | Drive System

- Necessities:
 - 4 wheel drive
 - High coefficient of friction wheels



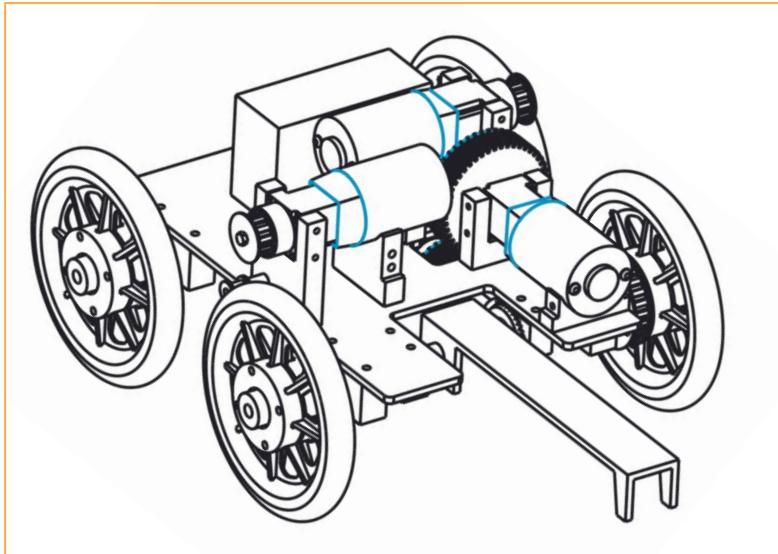
Drive System Subassembly Drawing



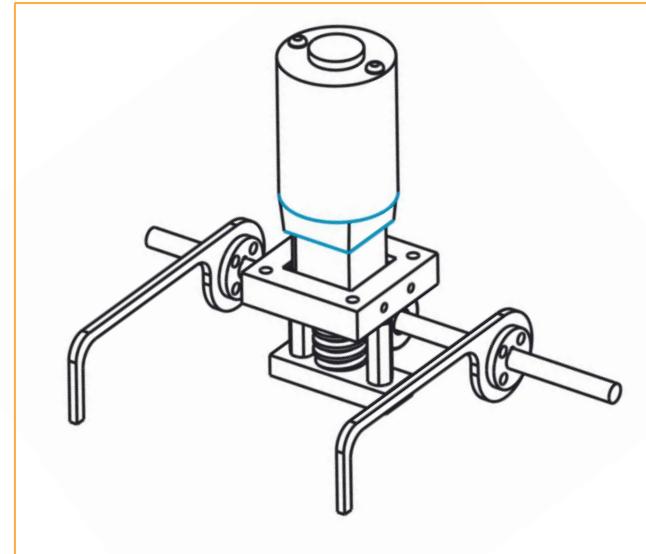
Drive System Subassembly Model

Design Process | Arm Mechanism

- Necessities:
 - Strong/durable arm
 - Nearly full range of motion/rotation



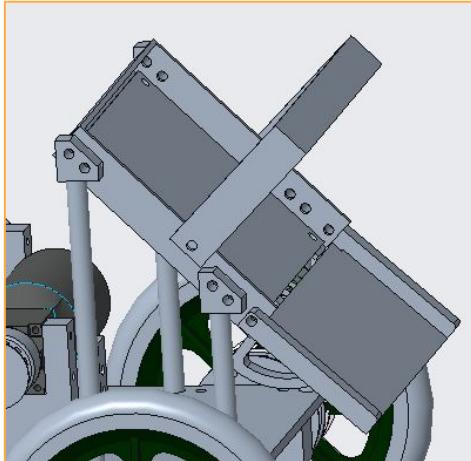
"The Process" V1 Arm Mechanism



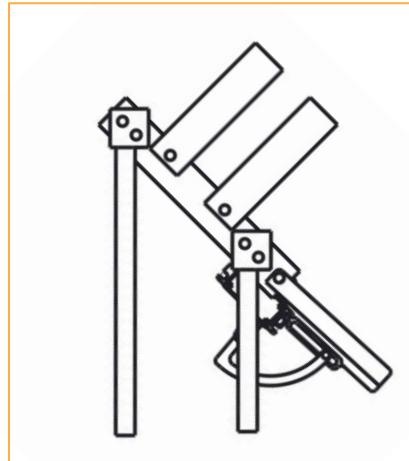
"The Process" V2 Arm Mechanism

Design Process | Med Kit Dropper

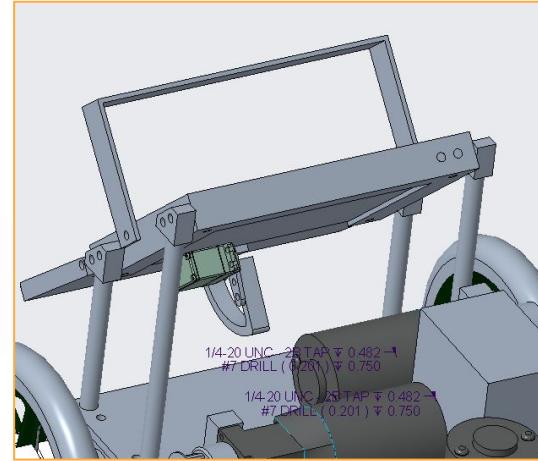
- Necessities:
 - Lightweight
 - Simple



Med Kit Dropper: Front View



Med Kit Dropper: Side View

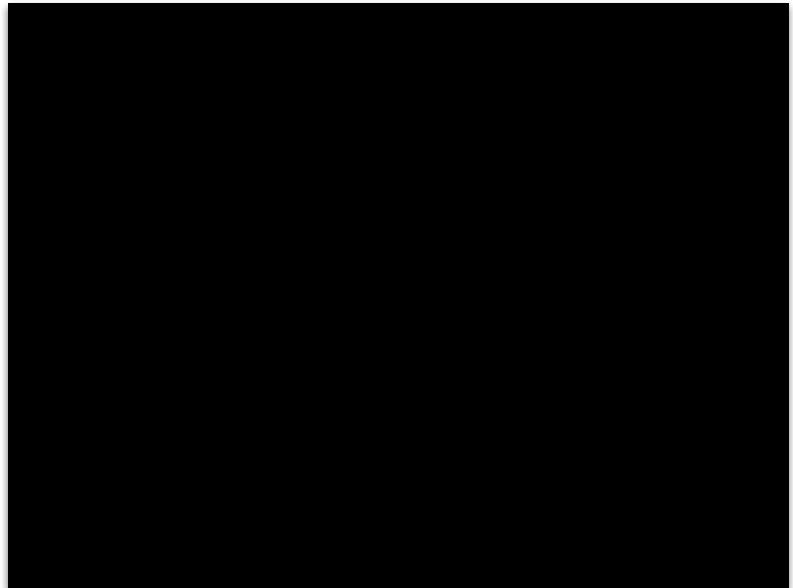


Med Kit Dropper: Back View

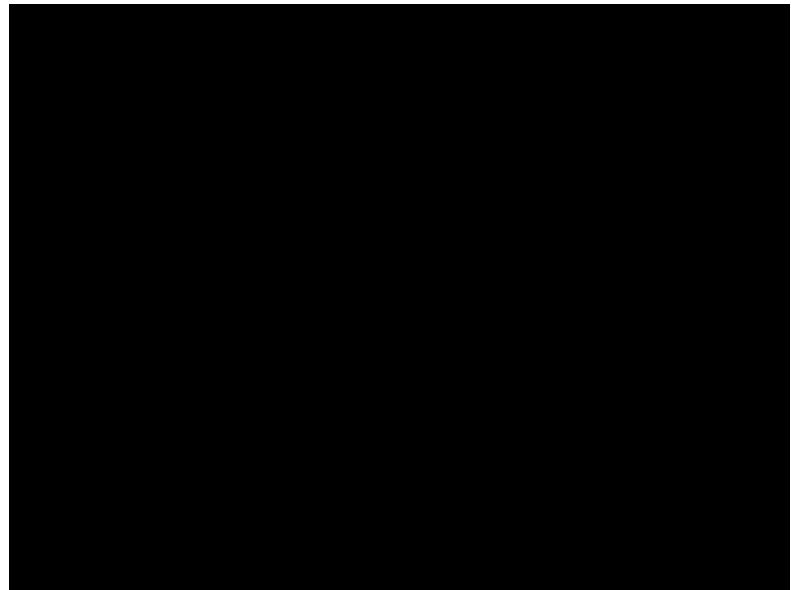
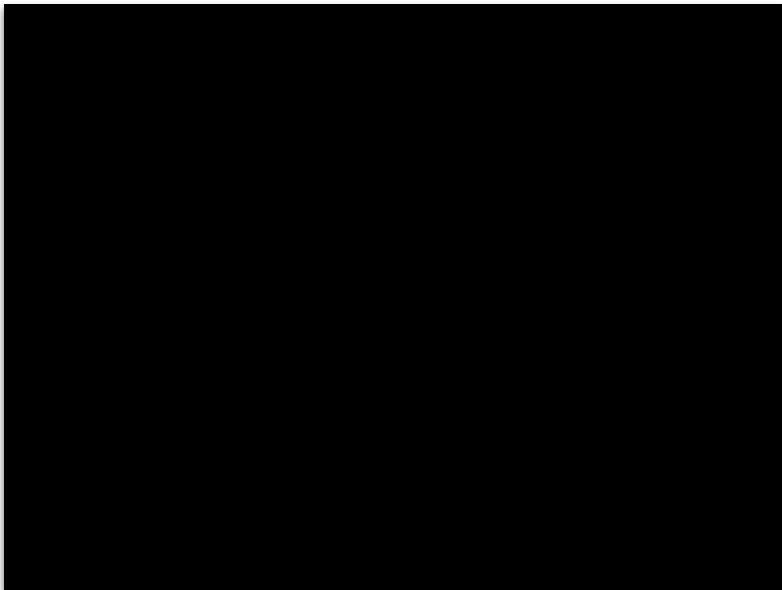
Testing Observations

After completing and testing V1, our team made the following observations:

- Drive
 - Overall very stable; needed better tensioning
 - Chassis was too weak; cracks formed in the acrylic
- Arm
 - 3D printed gears were too weak
 - Lead to cracking in the plastic



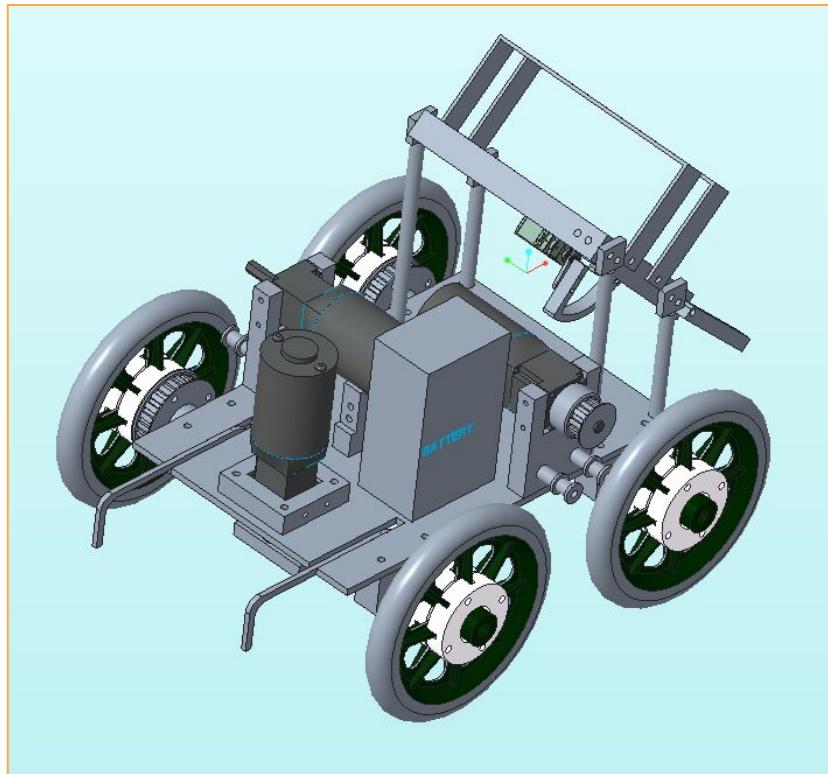
Testing Observations



03

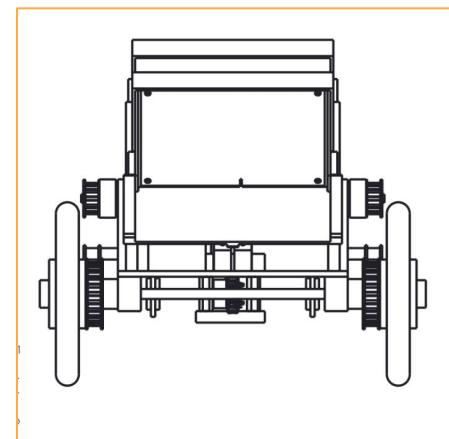
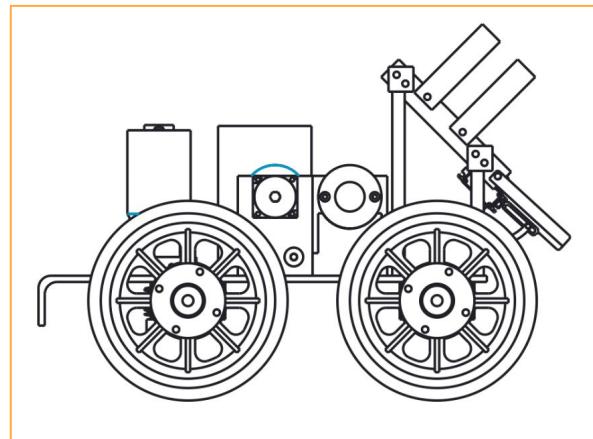
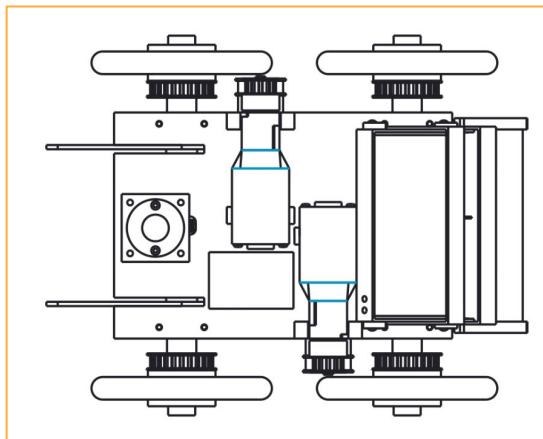
Specifications & Analysis

Specifications & Analysis | Overall Assembly



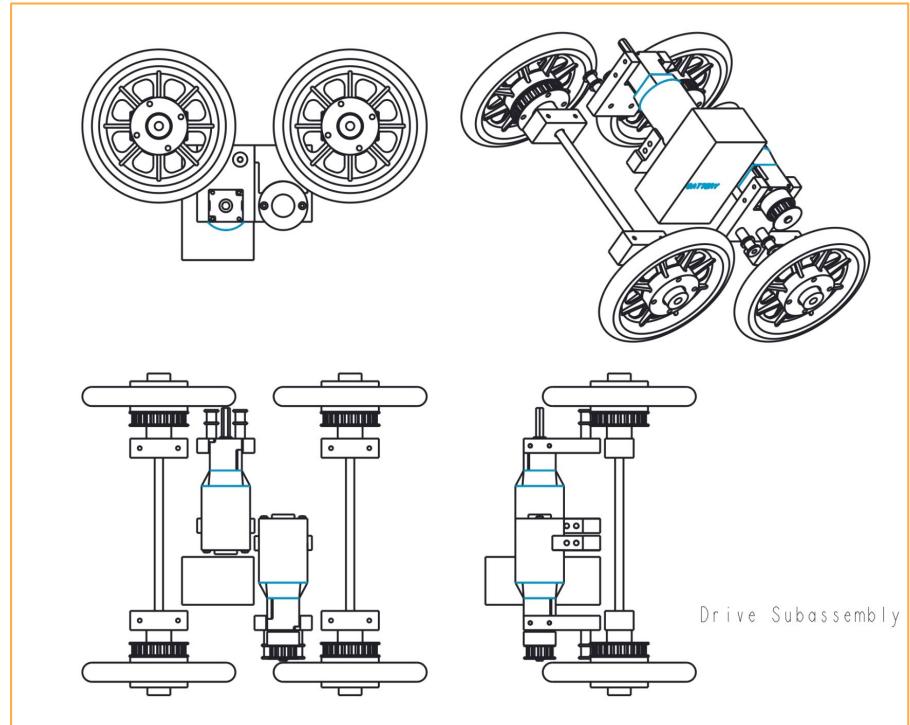
Specifications & Analysis | Overall Assembly

- Dimensions
 - 18" x 16" x 16"
- Power distribution
 - 3 motors & 1 servo



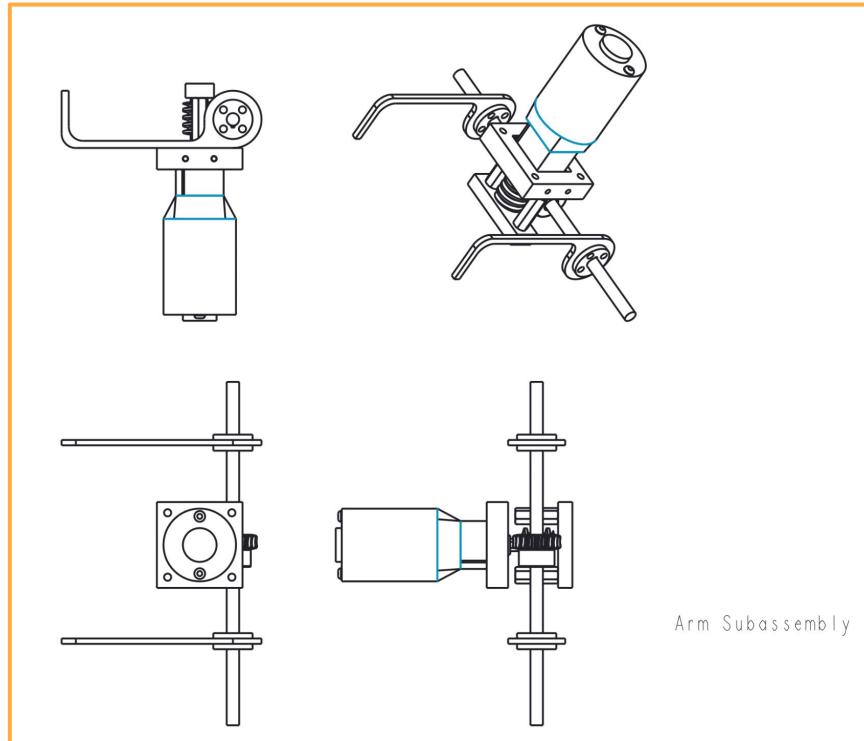
Specifications & Analysis | Drive System

- Dimensions
 - 18" x 16" x 8"
- Power distribution
 - 2 motors
- Wheels
 - Diameter: 8 inches
 - Material: rubber
- Differential steering
 - Each side of wheels are driven by belts



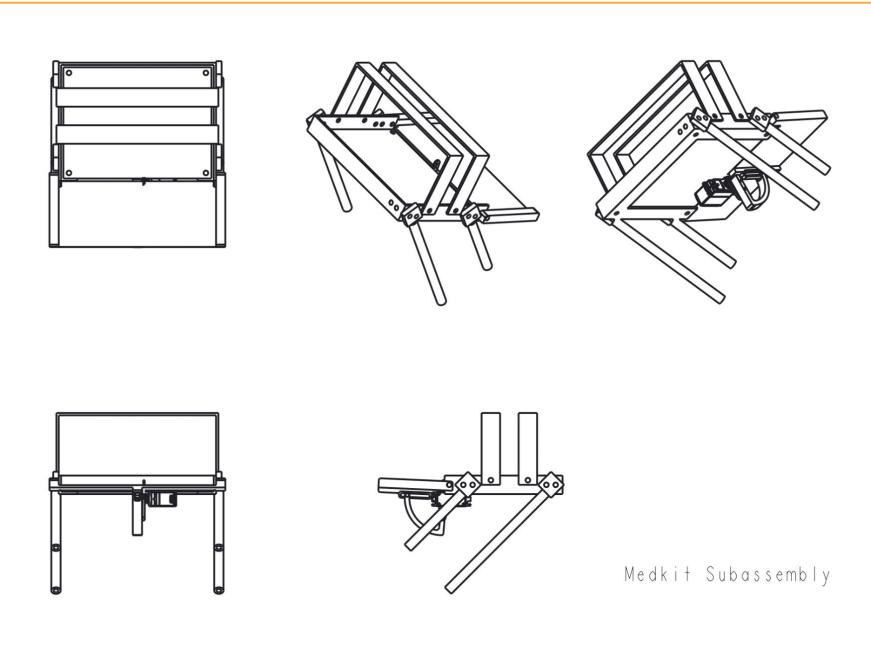
Specifications & Analysis | Arm Mechanism

- Arm
 - Dimensions: 7" x 0.1875" x 2"
 - Material: 6061 aluminum
- Power distribution
 - 1 motor with worm + worm gear
- Worm
 - Gear pitch: 12
 - Pressure angle: 14.5°
 - Material: cast iron
- Worm gear
 - Gear pitch: 12
 - Pressure angle: 14.5°
 - # of teeth: 18
 - Speed ratio: 18:1
 - Material: cast iron

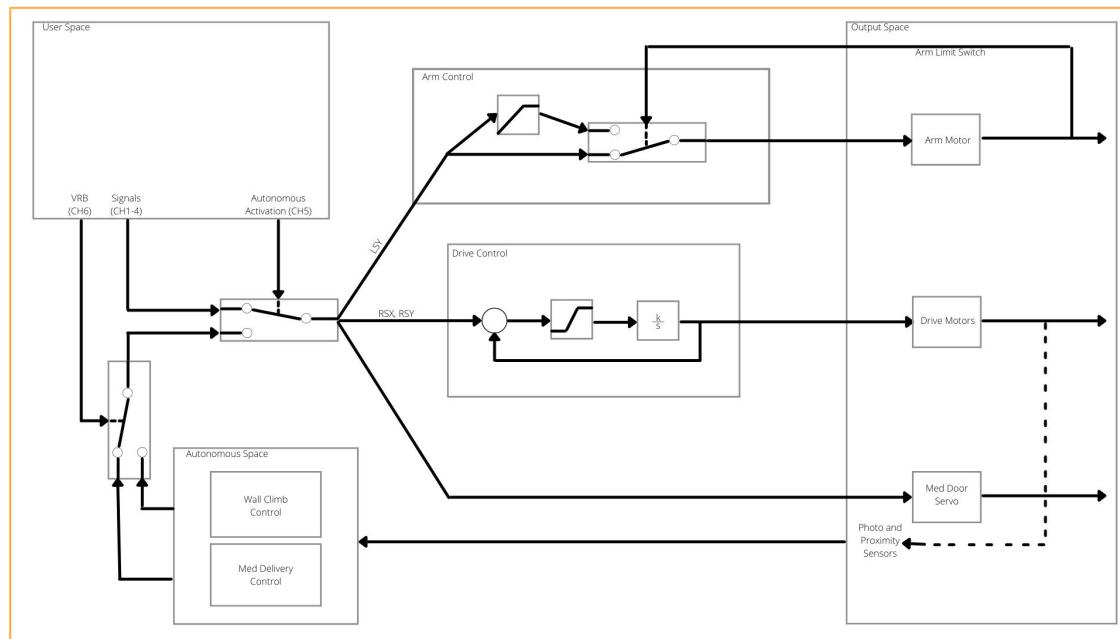


Specifications & Analysis | Med Kit Dropper

- Med kit dropper
 - Dimensions: 8.75" x 6" x 12"
 - Materials: 6061 aluminum
- Power distribution
 - 35kg servo
- Estimated cost: \$25
 - Utilized 3D prints for more intricate components



Specifications & Analysis | Autonomous Control System



Open Loop

Drive

Closed Loop

Arm

Closed Loop

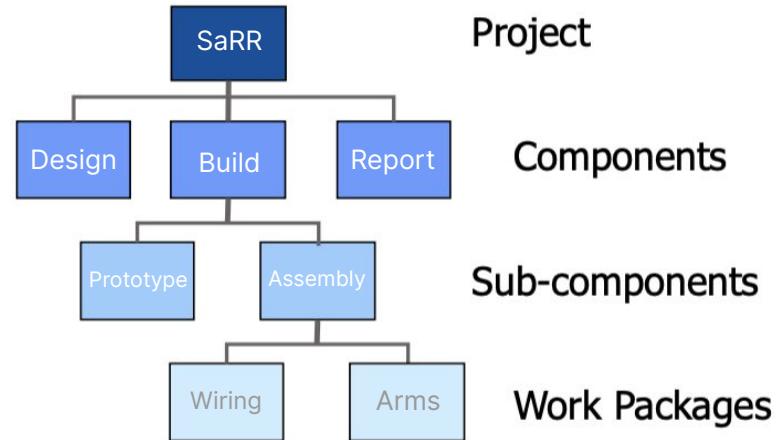
Med kit

04

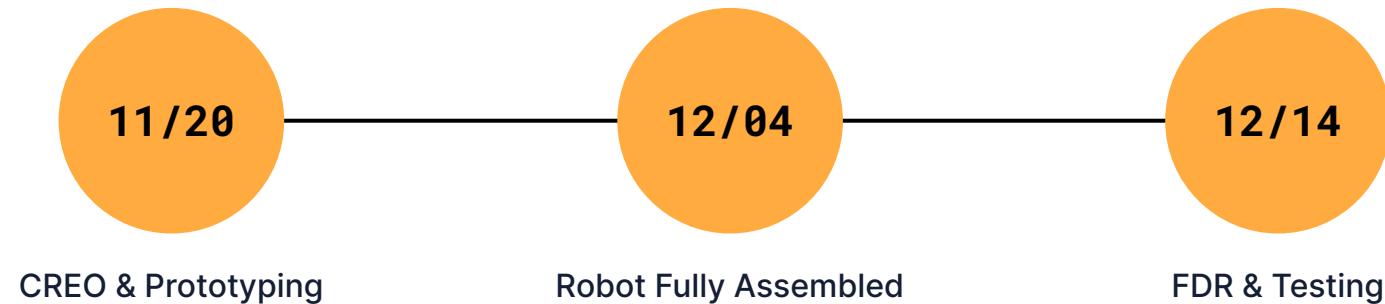
Project Management

Project Management

- Each member had a lead role and subcomponent group
- Original had one all-hands meeting outside of lab per week
- Shifted to more independent work schedules, while maintaining communication and upholding expectations
- Overall this system worked well but there were times of overlap between member roles



Expected Project Timeline



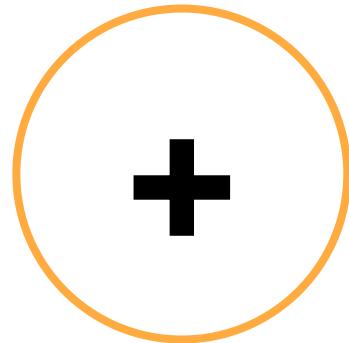
Actual Project Timeline



05

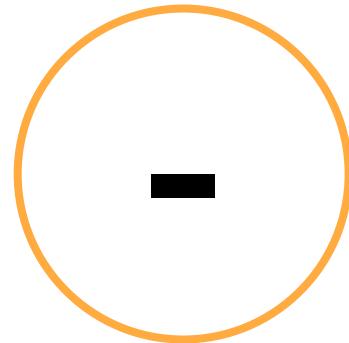
Summary

Summary



Pros

- Went with a go big or go home philosophy
- Didn't settle for shortcomings of V1
- Had fun and learned a wealth of lessons



Cons

- Not an adequate amount of time to test the V2 SaRR post-assembly

06

Comments & Questions

Thank you!