



The Mustaches: Final Presentation

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Problem Description

- Performance Tasks:

- Launch
- Deposit ghosts (balls)
- Deposit friends (balls)
- Egress

- Competition Parameters:

- 40-second autonomous run
- Fit within 24" L x 18" H x 12" W
- \$100 budget
- Use provided power sources

Goal: Maximize points scored in allotted time.

Problem Description

Sunroof (Friends Drop-zone)

Quadrants

Beacons

6 RPM

Centerpiece

Field Layout

Starting
Zone

Mystery
Machine

Customer Needs

- Rated from 1 (trivial) to 10 (crucial)
- Prioritize needs related to rules and scoring

Safety	5	General Safety
Geometry	4	Portable
	10	Fit within Size
Scoring	10	Move
	10	Score Max Points
	10	Autonomous
	9	Deposit Ghosts
	7	Deposit Friends
	8	Ghosts in Each Quadrant
	8	Efficient Functionality
Ergonomics	10	Affordable
	6	Aesthetics
Ease of Operation	9	Maintainable
	10	Assembly Time
	7	Reliable

Engineering Requirements

Requirements	Target	Importance
Weight	Weigh 20-25 lbs	4%
Size	23" x 17" x 11"	7%
Total Points Scored	At least 119 points	10%
Cycle Time	30 seconds	12%
Position Accuracy	± 2 inch	8%
Total Ghosts Deposited	3 Ghosts	5%
Total Friends Deposited	At least 3 Friends	7%
Ghost Distribution Success Rate	85%+	10%
Transit Time	Max 10s	6%
Deposit Time	Max 20s	6%
Cost	Less than \$100	8%
Aesthetics Jury	Team Rating of 8/10	2%
Extra Parts	1 for each critical	3%
Max. Setup Time	Max. 2:30 minutes	6%
Success Rate	90%+	6%

- Most important requirements:
 - Cycle Time
 - Total Points
 - Ghost Distribution Success Rate

Specification Sheet

- Catalogs target values for engineering requirements

- Based on:

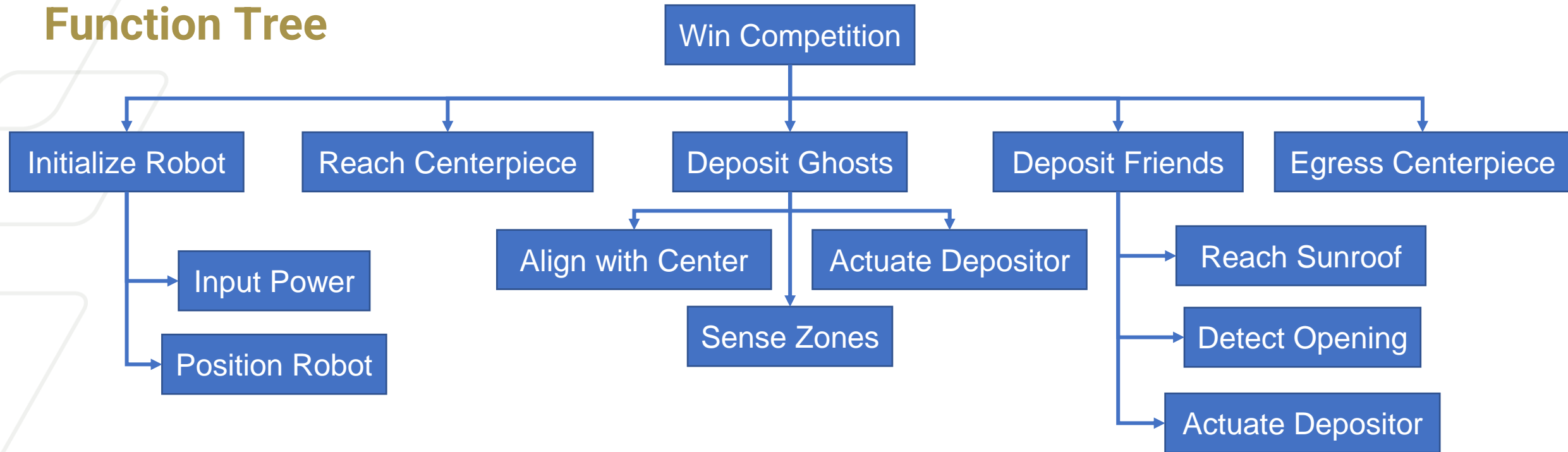
- Team goals
- Rules/Field
- Mechatronics Manual

			Issue Date: 7-Jun-22	
Changes	D/W	Specification	Responsibility	Source
17-Jul	D	Geometry		
	D	< 23" x < 17" x < 11" box	All	Rules
17-Jul	D	22.5" - 24.0" vertical extension	Josh	Field Geometry
		Energy		
	D	Use only allowed power sources	All	Rules
	W	< 30 sec cycle time	All	Team goal
	D	Operate on 110V standard	All	Rules
	D	< 100 psi air tank	Setup crew	Mech. Manual
		Ergonomics		
	W	> 8/10 aesthetic score	All	Team Jury
	W	< 25 lbs	All	Team goal

Specifications Sheet










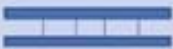










17-Jul		Maintenance		
	W	< 2:30 minute setup time	Setup crew	Team goal
	D	1 Additional part for critical features	Vaughn	Team goal
		Costs		
	D	\$100 max	All	Rules
		Production/Operation		
	W	Reach the center in 10 seconds	Siva	Team goal
	D	Deposit 3 ghosts in 15 seconds	Josh/Drew	Team goal
	D	Deposit at least 3 friends in 10 seconds	Josh/Vaughn	Team goal
	D	Complete at least partial egress	Siva	Team goal
	W	Account for position deviation of 4 inches	Siva/Drew	Team goal
	W	90% perfect score rate	All	Team goal

Function Tree

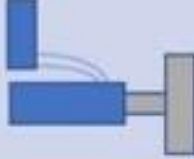












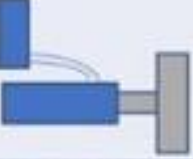









- Follows basic process flow
 - Broken down into subtasks
- Concepts developed for each subtask

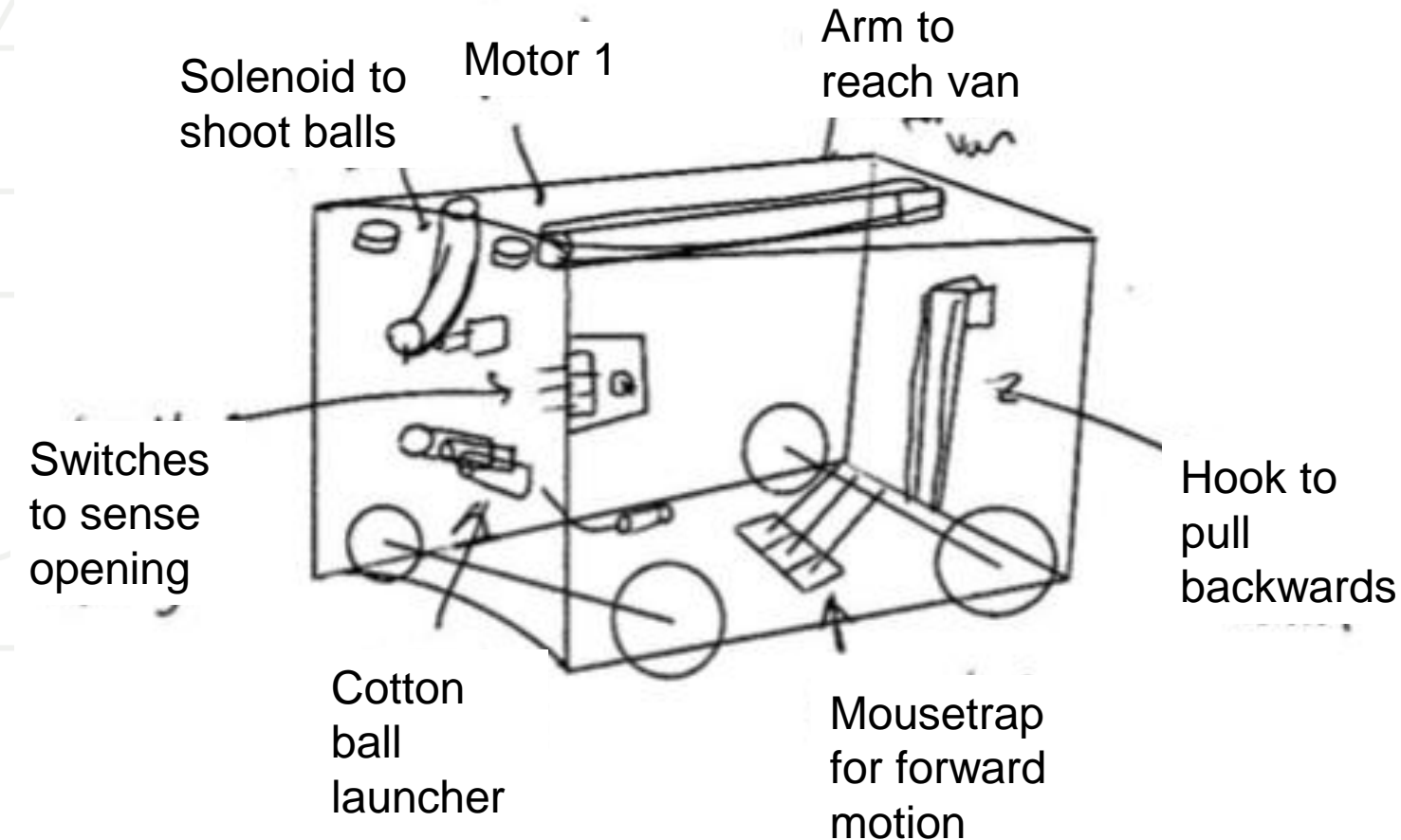
Concept Generation

Function	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
Power	Electricity 	Pneumatic 	Elastic 	Gravity 	
Position Robot	T-square 	Jig 	Laser 	Eyeball 	
Reach Center	Wheels 	Extending Rails 	Tank Treads 	Paddles 	
Align to Center	IR Sensor 	Ultrasound 	Button 	Timing 	
Sense Zone	IR Sensor 	Mechanical Flap 	Wheel/encoder 	Button 	

Concept Generation

Deposit Ghosts	Pneumatics 	Flywheel 	Hatch/Gravity 	Solenoids 	Rotating Wheel 
Reach Sunroof	Conveyor 	Second arm 	Piston 	Catapult 	
Detect Sunroof	Ultrasound 	IR Sensor 	Button 	Mechanical switch 	
Deposit Friends	Pneumatics 	Flywheel 	Hatch/Gravity 	Solenoids 	
Retract Mechanism	Reverse Motor 	Drive Backwards 	Elastic power 	Springs 	

Alternative 1



Advantages:

- Aesthetics
- 3 Buttons – Beacon detection
- Sabotage mechanism

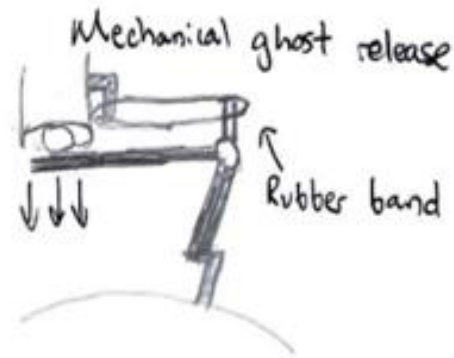
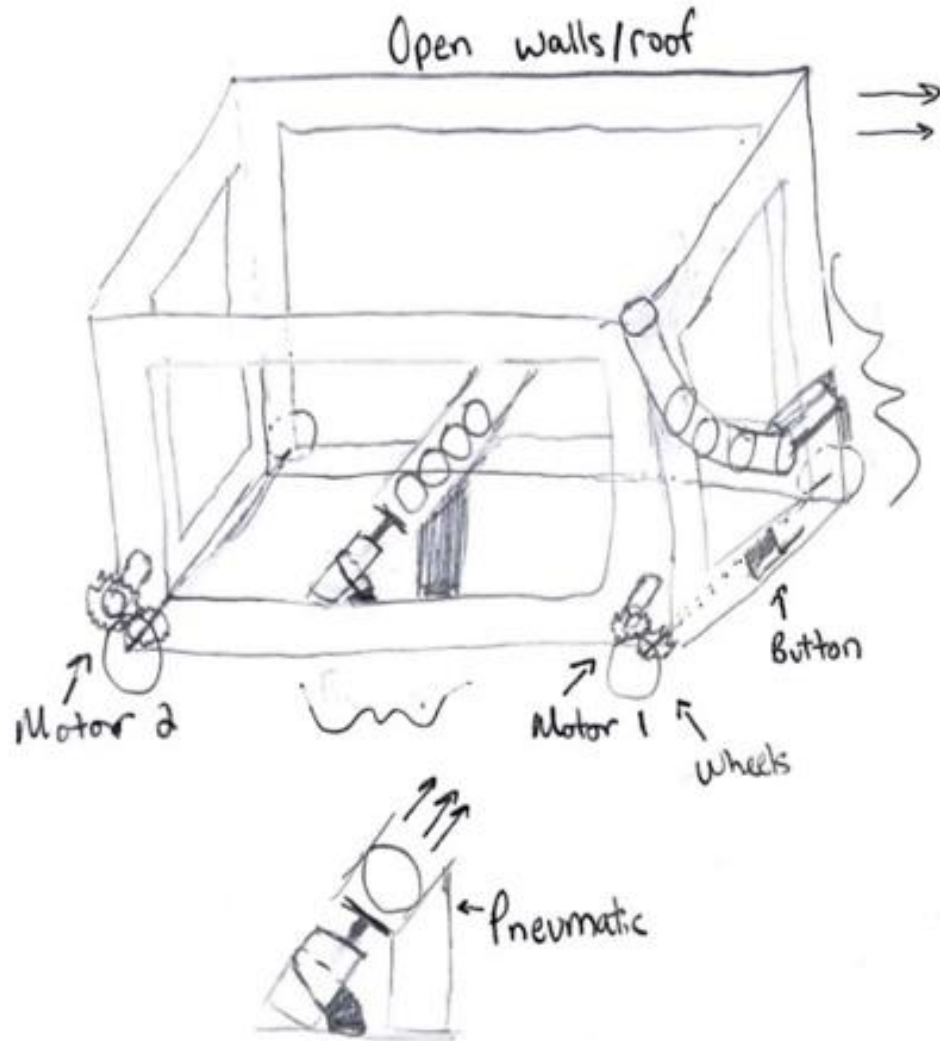
Disadvantage:

- Mousetrap Wheels:
 - Unpredictable Movement
- Full Box: Hard to maintain

• Evaluation Matrix Score:

• 405/492

Alternative 2



Advantages:

- Low assembly time

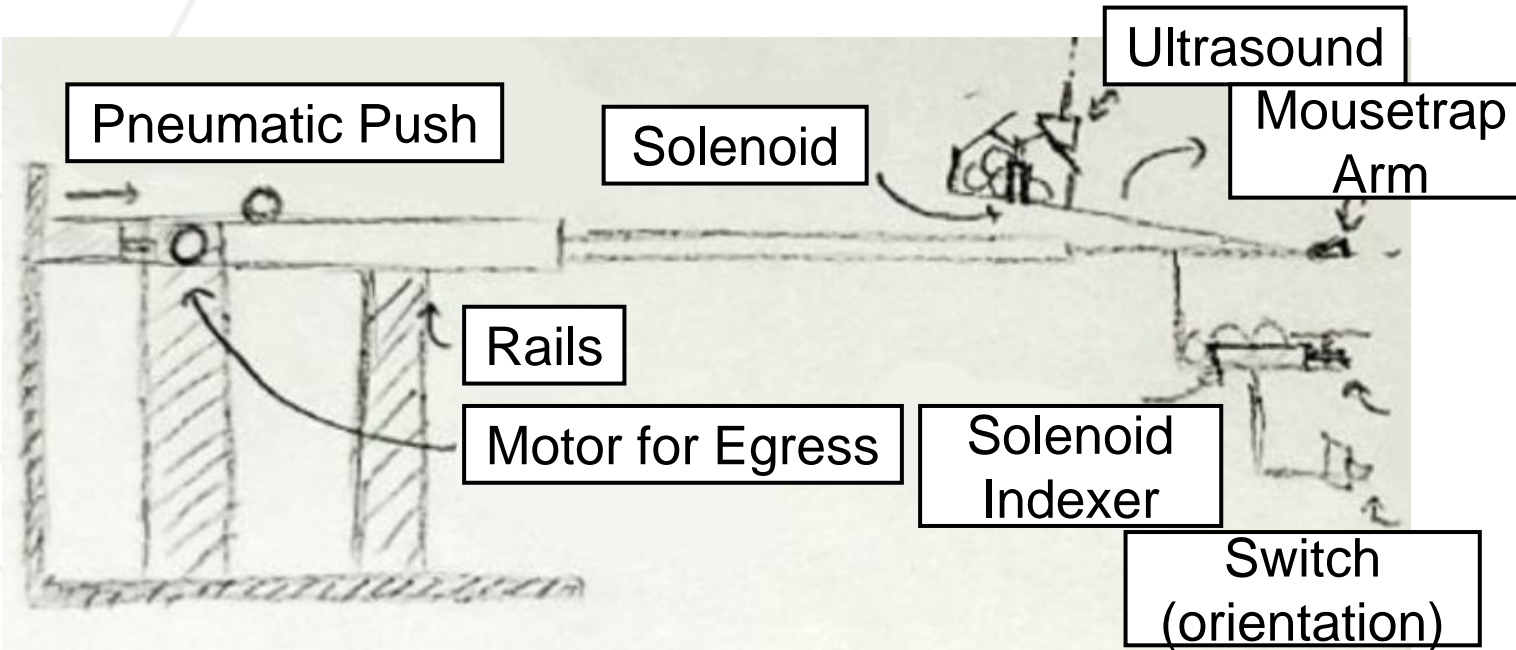
Disadvantages:

- Bulky Frame
- Pneumatic Launcher: Unreliable

• Evaluation Matrix Score:

- 434/492

Alternative 3



Advantages:

- Beacon-detecting button
- Open Structure: Maintainable

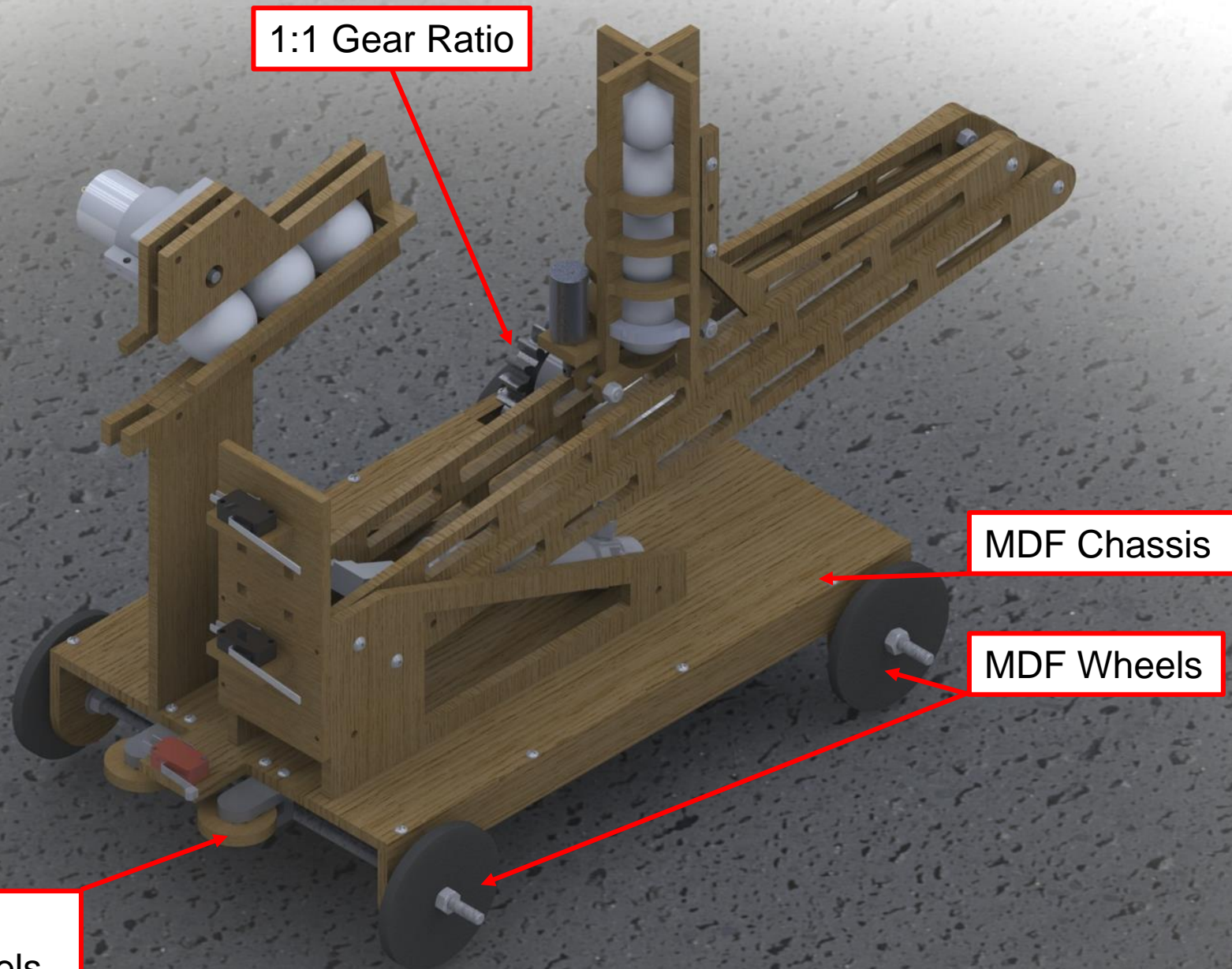
Disadvantages:

- Rails: Error propagates
- Tipping due to center of mass
- Partial Egress

• Evaluation Matrix Score:

• 415/492

Selected Design Concept



Volume

22.1"x15.1"x10.5"

Energy Sources

Electrical

Elastic

Matrix score:

459/492

Static Gate Lock

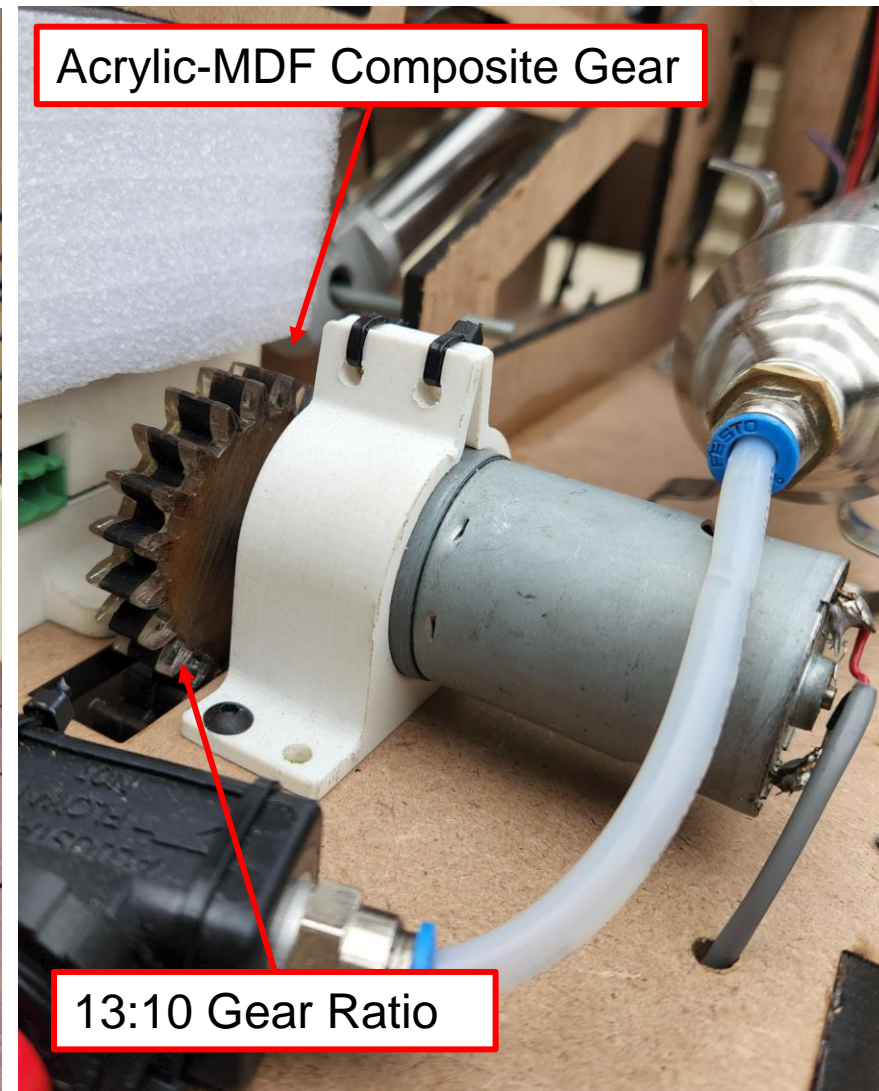
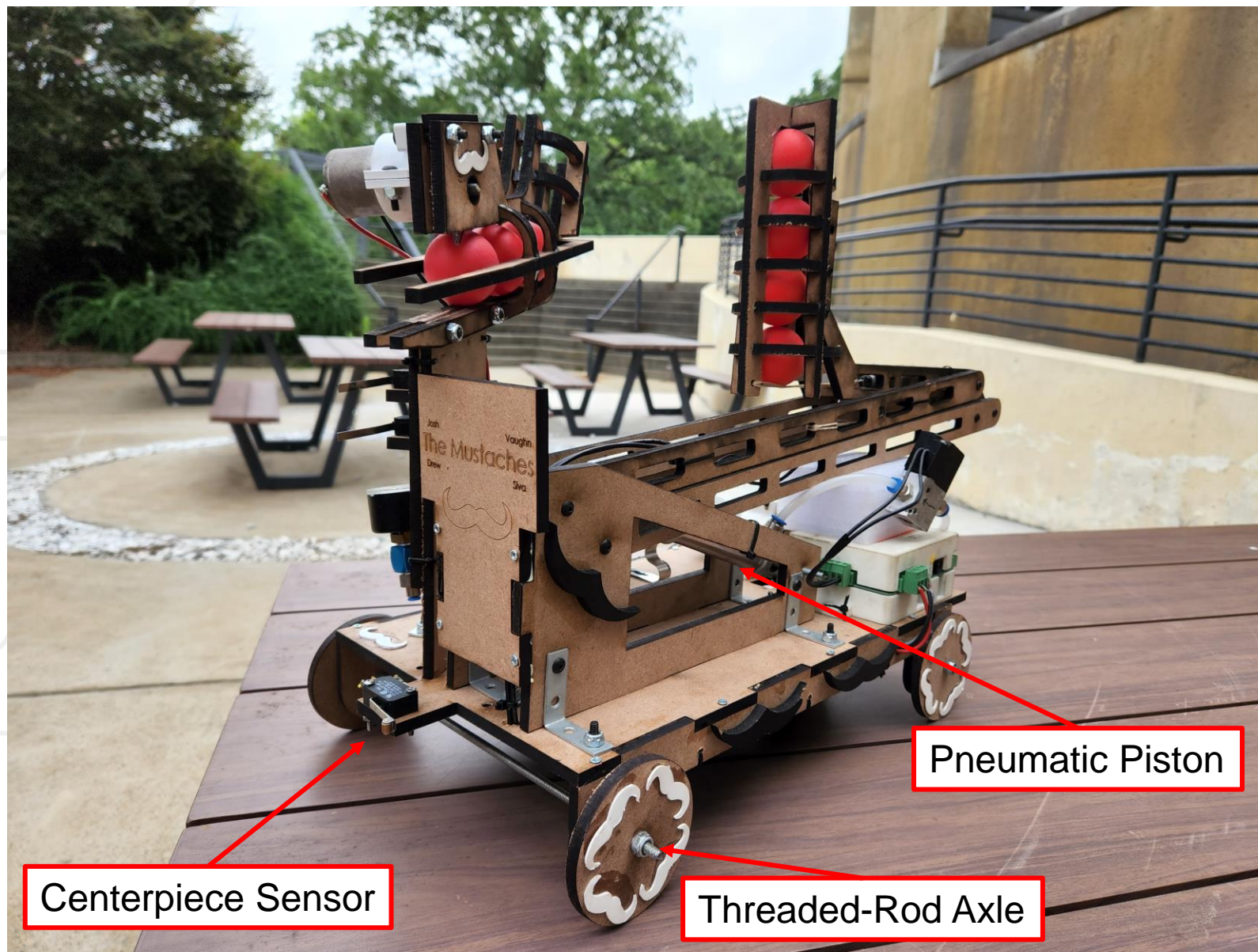
Motor-Driven Sorter

Elastic Drop Gate

Adjustable Beacon Sensors

4-Bar Lift

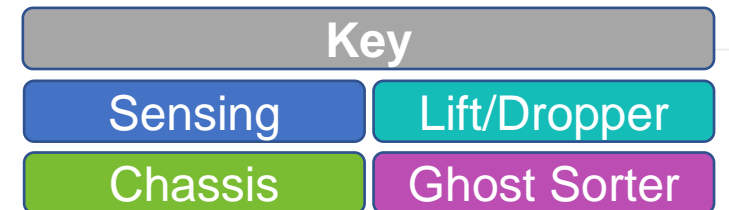
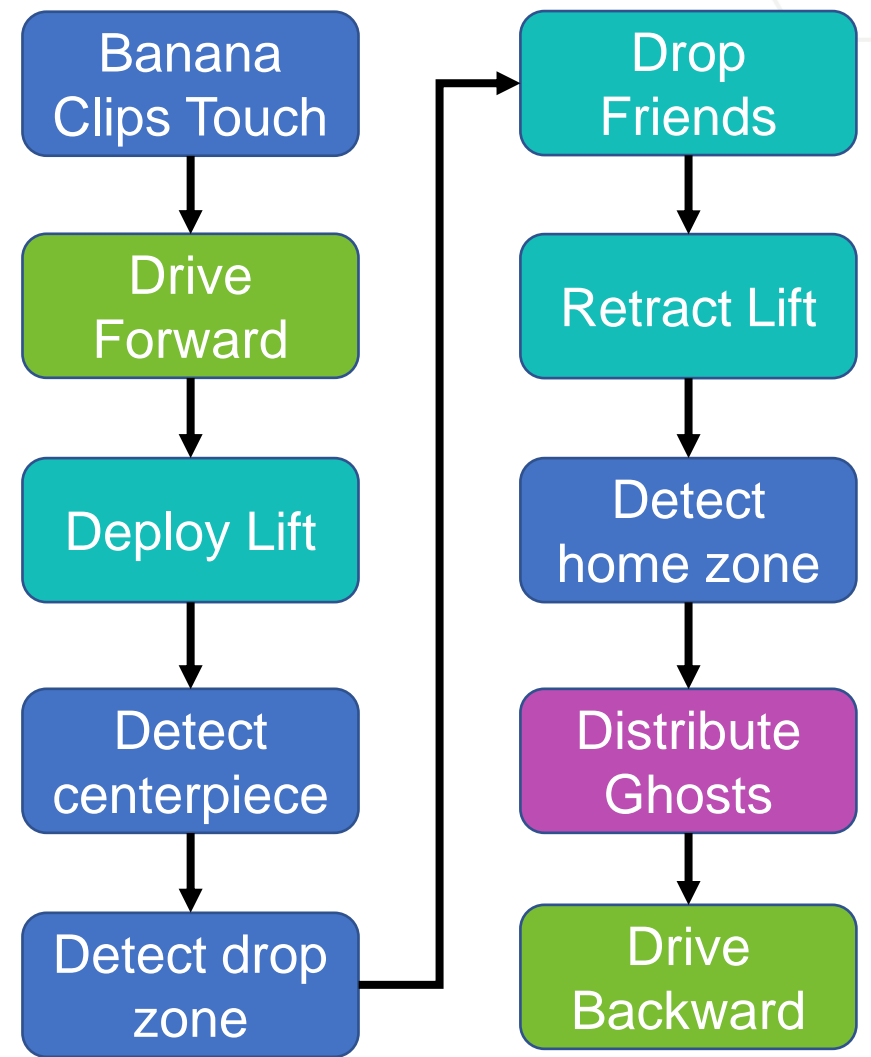
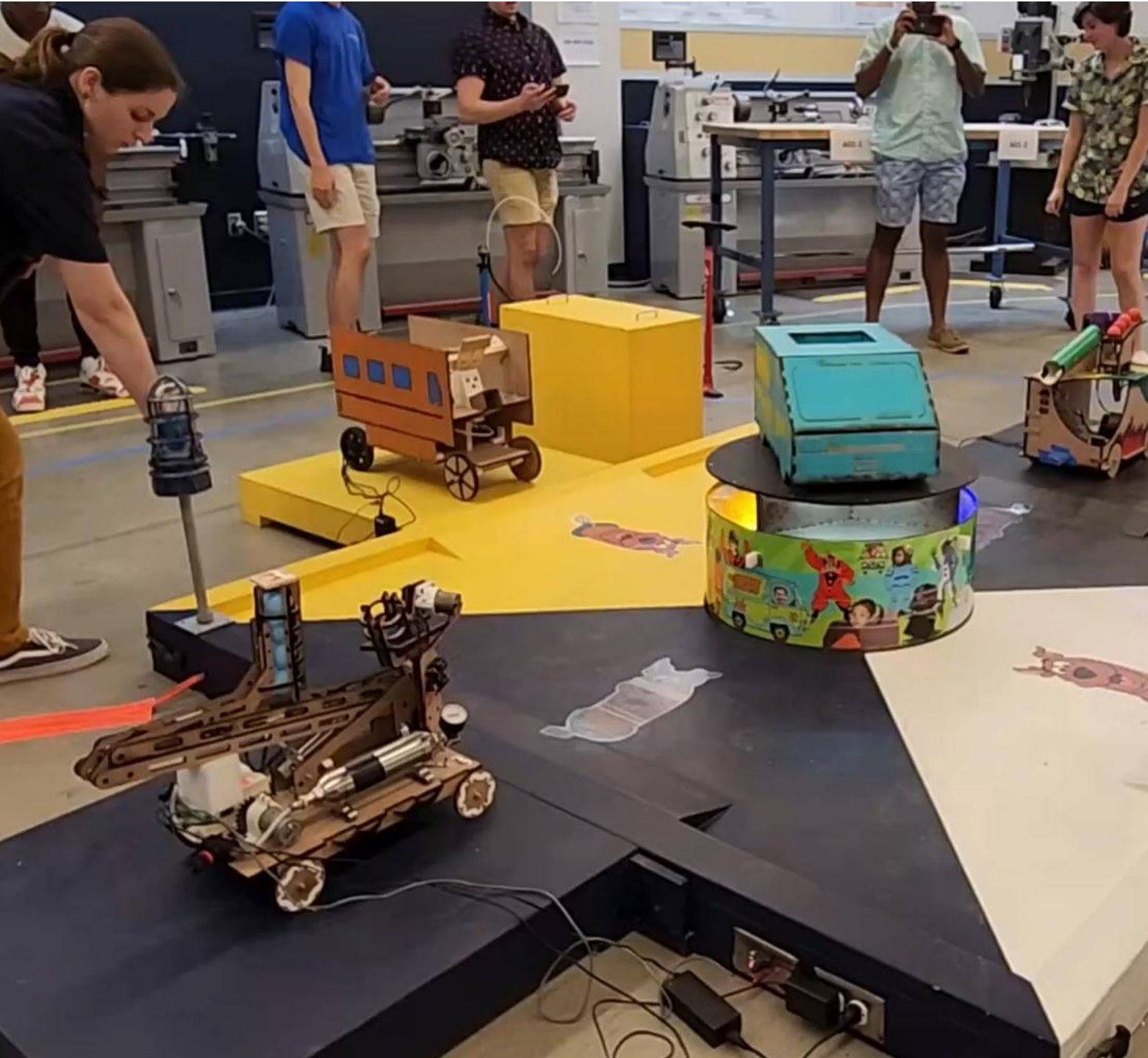
Final Design



Bill of Materials

Chassis	Lift	Friend Dropper	Ghost Sorter
1 x Chassis Top Plate	2 x Lift Support	1 x U-Mount Front	1 x Ghost Tower
2 x Chassis Side Plate	4 x Corner brackets	1 x U-Mount Side	2 x Ghost Ramp
2 x Threaded Rod Axle	4 x Parallel Arms	12 x Mount Ribs Short	16 x Ribs
4 x Wheels	2 x Horizontal Arms	2 x Mount Ribs Long	1 x Top Motor Mount
1 x 26-tooth Driven Gear	1 x Pneumatic cylinder	1 x Small Solenoid	1 x Bottom Motor Mount
1 x 20-tooth Driving Gear	1 x Transfer coupling	1 x Rubber band	1 x Ghost Indexer
2 x Acrylic Driving Gear	15 x #8-32 bolts		4 x #10-32 Bolts
13 x #10-32 Nylon Lock Nuts	20 x #8-32 Nylon nuts		4 x #10-32 Nylon Lock Nuts
1 x Large Motor	1 x 4 in. #10-32 threaded rod		1 x Button Mount
1 x Motor Mount	1 x Decorative plate		2 x Button Holder
8 x #4-5/8 Wood Screws	1 x Pneumatic tank		2 x Long-arm Button
2 x #8-32 Nylon Lock Nuts	3 x Rubber bands		4 x Zip Ties
			2 x L-Brackets
			1 x Small Motor

Approximate Total Cost: \$66.69



Results and Final Thoughts

- Interim Assessment:
 - Lift & friend dispenser broke
 - Power issues
- Testing:
 - Average score over 32 runs = 136.5
 - 10/12 perfect scores final day
- Competition Results:
 - First place in design review
 - Won final competition - 483 total points

Questions?