Engineering Notebook

502W

Team Number

The Swarm

Team Name

Ecole Alpha Secondary

School

09/25/2023	05/01/2024	1	of 1
Start Date	End Date	Book #	

VEX ROBOTICS

REC FOUNDATION

Robot

1.0

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Over under - At a glance

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Intake

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WPRA Halloween

Wedge

Coding

Salish Review

Improvement v3

502W's

Digital Engineering Notebook

This notebook is created through Google Slides

Why document digitally?

- Allows access from multiple devices anytime, anywhere.
- Allows for much better collaboration between teammates.
- Improves organization and overall neatness.

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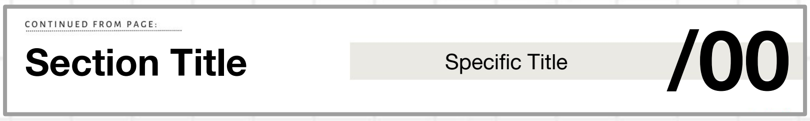
Notebook guide

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

How to read



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Section Title

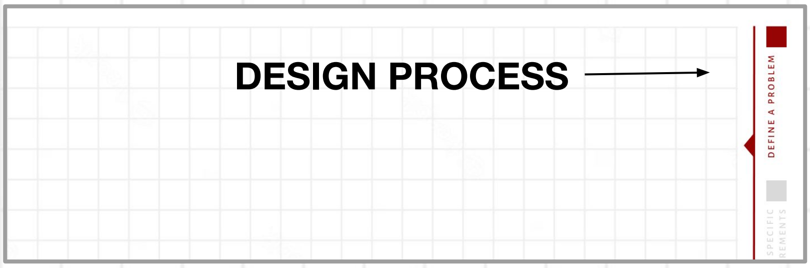
Specific Title

/00

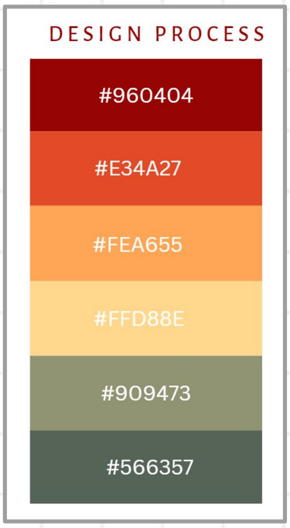
Section Title:
General title of each design process (does not change as we go through the steps)

Specific Title:
Specific title of each page, summarizing what the page is for (changes throughout the design process)

/00
Page number



Design process:
Located on the sides of every page
All greyed out means that we aren't currently in the design process
When in the process, whichever step we are in are coloured as followed:



	DESIGN PROCESS
1.	#960404
2.	#E34A27
3.	#FEA655
4.	#FFD88E
5.	#909473
6.	#566357

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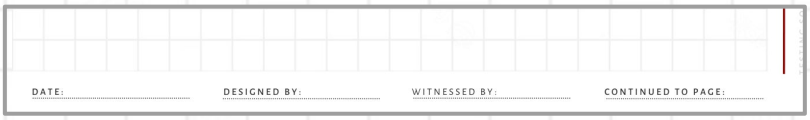
Notebook guide

Layout Overview



DATE: DESIGNED BY: WITNESSED BY: CONTINUED TO PAGE:

Progress:
Here is where we write down the dates and record who designed the mechanism, and who witnessed it. If continued to page is left blank, then it means that the section ends.

In our case:
Designed by refers to the designer of the mechanism
Witnessed by refers to the notebooker

KEY

TEST Section heading, typically for statements

TEST Subtitle directly related to the design process. Colour coded to the assigned design process colour

TEST Subtitles of categories to note under the large boxed statement

TEST Things of importance. Typically, includes an elaboration from regular text

TEST Regular text, most of our information and analysis will be written in this text

TEST Important things to note. Highlight colour is also assigned based on the design process stage

CONTINUED FROM PAGE:

Criteria

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Rubric Breakdown

IDENTIFY THE PROBLEM

- Identifying 1 specific objective
- Repetition needed for every new aspect of the bot
- Analyze each problem the objective is supposed to solve
- We must provide visuals

BRAINSTORM, DIAGRAM, OR PROTOTYPE SOLUTIONS

- Each possible solution must be broken down and analyzed
- Repetition needed for every new aspect of the bot
- We must list 3 or more solutions
- We must provide visuals
- Remember to cite sources of inspiration

SELECT BEST SOLUTION AND PLAN

- We must thoroughly describe how our final solution was selected through either testing or a decision matrix
- List a detailed plan to implement the solution
- Repetition needed for every new aspect of the bot

BUILD AND PROGRAM THE SOLUTION

- Detail on how a component is built and programmed
- We can consider including which parts are used
- Remember to stay consistent in quality
- Repetition needed for every new aspect of the bot

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Criteria

TEST SOLUTION

- We must test each solution
- Remember to stay consistent in quality
- Remember to test after each and every change
- Repetition needed for every new aspect of the bot

REPEAT DESIGN PROCESS

- This is for every new improvement on the robot
- We must clearly demonstrate that the design process is repeated

INNOVATION/ORIGINALITY

- Demonstrated though brainstorming and prototyping the initial design
- Proves that our robot is a combination of our ideas and that it isn't "holecounted" from another team

USABILITY AND COMPLETENESS

- How well another person could recreate our robot
- Achieved easily if all of the above criteria were followed

RECORD OF TEAM AND PROJECT MANAGEMENT

- Include budget and material constraints
- Include how our team collaborates together
- Essential for staying organized
- Include time allocation

NOTEBOOK FORMAT

- Organization and consistency

Design Process

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

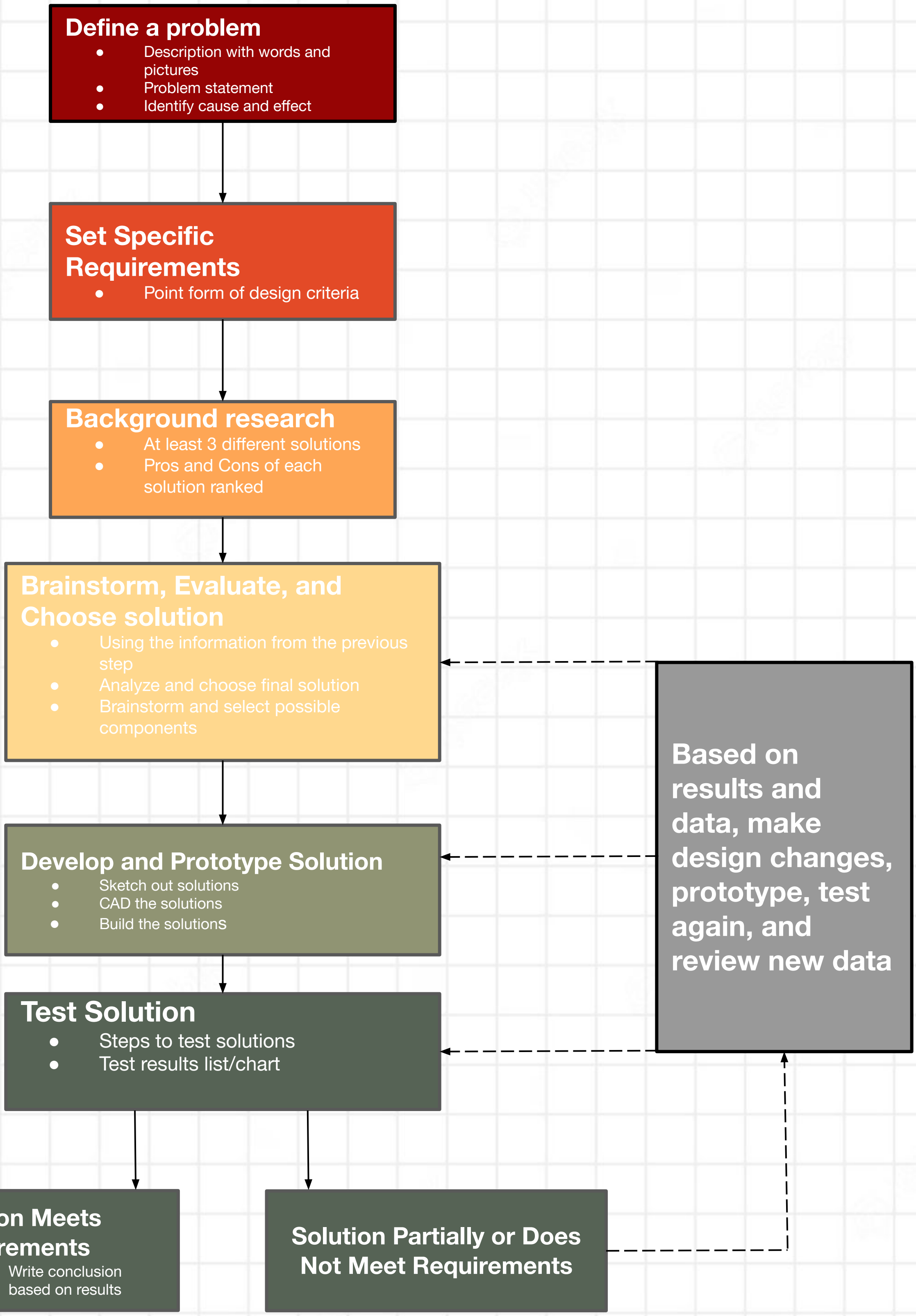
BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

TESTING SOLUTION

Design process

We've created our own design process based off of the engineering rubric to better fit with how we work



Define a problem

- Description with words and pictures
- Problem statement
- Identify cause and effect

Set Specific Requirements

- Point form of design criteria

Background research

- At least 3 different solutions
- Pros and Cons of each solution ranked

Brainstorm, Evaluate, and Choose solution

- Using the information from the previous step
- Analyze and choose final solution
- Brainstorm and select possible components

Develop and Prototype Solution

- Sketch out solutions
- CAD the solutions
- Build the solutions

Test Solution

- Steps to test solutions
- Test results list/chart

Solution Meets Requirements

- Write conclusion based on results

Solution Partially or Does Not Meet Requirements

Based on results and data, make design changes, prototype, test again, and review new data

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Design Process

Defining our Design process

I: DEFINE A PROBLEM

- The same as Identify the Problem on the rubric

2: SET SPECIFIC REQUIREMENTS

- We've added a branch off of the initial Identify the problem where we list all aspects that we want our component/improvement to "check off"

3: BACKGROUND RESEARCH

- Taking the "Brainstorm" aspect of Brainstorm, Diagram, or Prototype Solutions. As we feel that it is a very important aspect of the design process.
- We research and list all possibilities with pros and cons to each solution

4: BRAINSTORM, EVALUATE, AND CHOOSE SOLUTION

- Selecting the solution
- Brainstorming and evaluating, how the solution is to be built

5: DEVELOP AND PROTOTYPE SOLUTION

- Prototyping our final solution
- Building final solution
- Coding solution

6: TEST SOLUTION

- Selecting the final solution
- Determines if we need to go back to previous steps if not satisfied

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
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TESTING SOLUTION

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VII

General Estimation of Cost

Budget

Goal

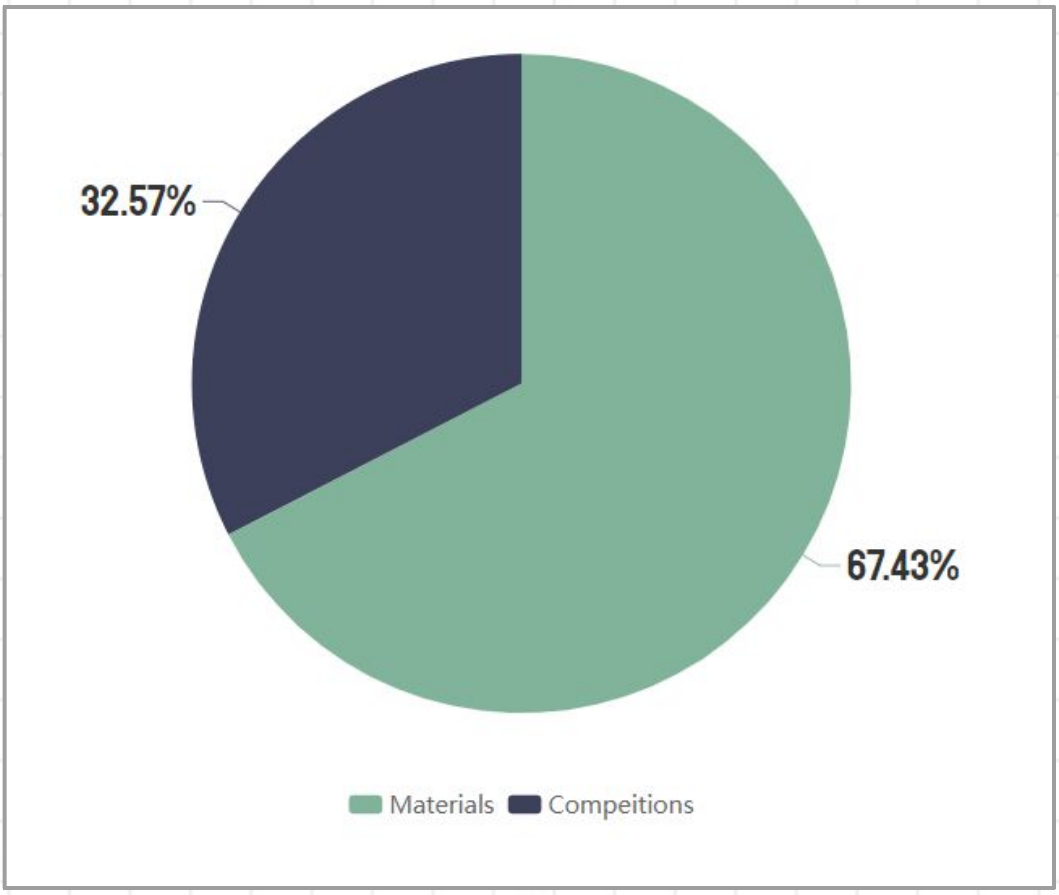
Going over a general budget for this year to make an estimation of total costs

ITEM	QUANTITY	COST
Parts	n/a	$2000
Field Elements	1	$574.99
Field perimeter	1	$799
Regional Tournaments	9	$810
Signature Events	2	$730
Provincials	1	$90

Total = $5003.99

All will be paid for by our district program except signature events or anything outside our province

Travel and accommodation fees are to be paid out of pocket



Materials:
$3373.99

Competitions:
$1630

Team Organization

PROGRAMS

- Organization - ClickUp and Excel
- Graphs and charts - Visualparadigm
- CAD - Onshape
- Simple digital images and diagrams - Canva
- Template - Photoshop and Illustrator

PHOTOS

- All photos are going to be taken from either a phone or a camera
  - Majority of images will be taken by an Iphone 14 Pro
- We hope to video record all of our matches for future analysis and game review

DRAWINGS

- All drawing are done by hand
- Black pen for mechanism
- Red pen for labeling

Why Google Slides?

- **Accessible**
  - All team members can access
- **Supports multimedia**
  - Videos, photos
- **Exporting options**
  - Can export in various formats, like pdf or powerpoint
- **Search and indexing**
  - Allows us to search for specific information within your notebook, which is helpful for quickly finding relevant engineering data.
- **Customization**
  - Templates
  - Image placement is easier than in docs

Time Management

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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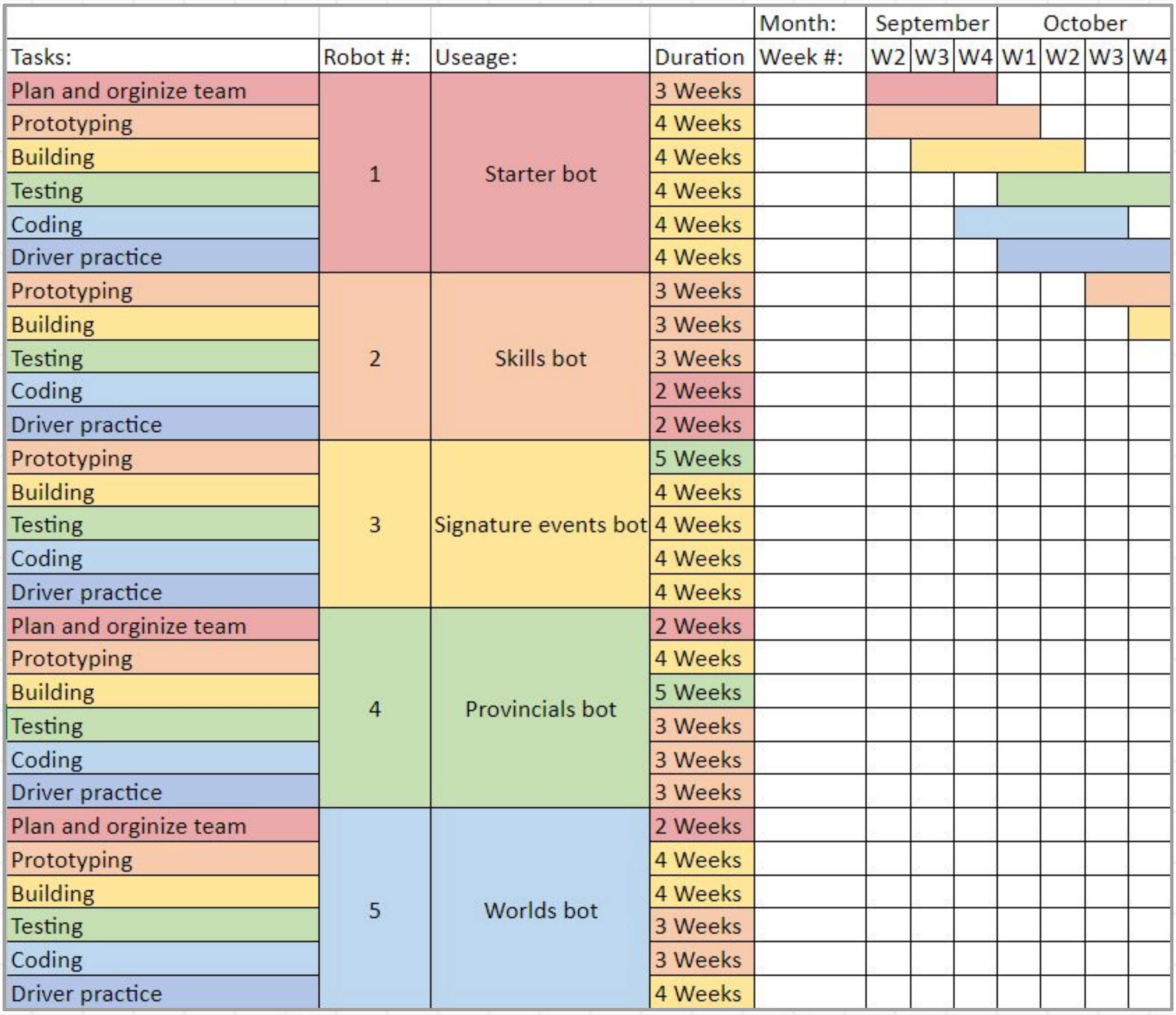
Goal

Creating a Gantt chart to manage and schedule our time



				Month:	September			October			
Tasks:	Robot #:	Useage:	Duration	Week #:	W2	W3	W4	W1	W2	W3	W4
Plan and orginize team	1	Starter bot	3 Weeks		🟥	🟥	🟥				
Prototyping			4 Weeks		🟧	🟧	🟧	🟧			
Building			4 Weeks			🟨	🟨	🟨	🟨		
Testing			4 Weeks					🟩	🟩	🟩	🟩
Coding			4 Weeks				🟦	🟦	🟦	🟦	
Driver practice			4 Weeks					🟦	🟦	🟦	🟦
Prototyping	2	Skills bot	3 Weeks							🟧	🟧
Building			3 Weeks								🟨
Testing			3 Weeks								
Coding			2 Weeks								
Driver practice			2 Weeks								
Prototyping	3	Signature events bot	5 Weeks								
Building			4 Weeks								
Testing			4 Weeks								
Coding			4 Weeks								
Driver practice			4 Weeks								
Plan and orginize team	4	Provincials bot	2 Weeks								
Prototyping			4 Weeks								
Building			5 Weeks								
Testing			3 Weeks								
Coding			3 Weeks								
Driver practice			3 Weeks								
Plan and orginize team	5	Worlds bot	2 Weeks								
Prototyping			4 Weeks								
Building			4 Weeks								
Testing			3 Weeks								
Coding			3 Weeks								
Driver practice			4 Weeks								

- This will serve as a general frame for us to follow and manage our time
- Flexibility in schedule is shown through overlapping blocker
- Periodically we will check in with the progress after each large block is done or supposed to be done, in order to make changes or to continue with our plan

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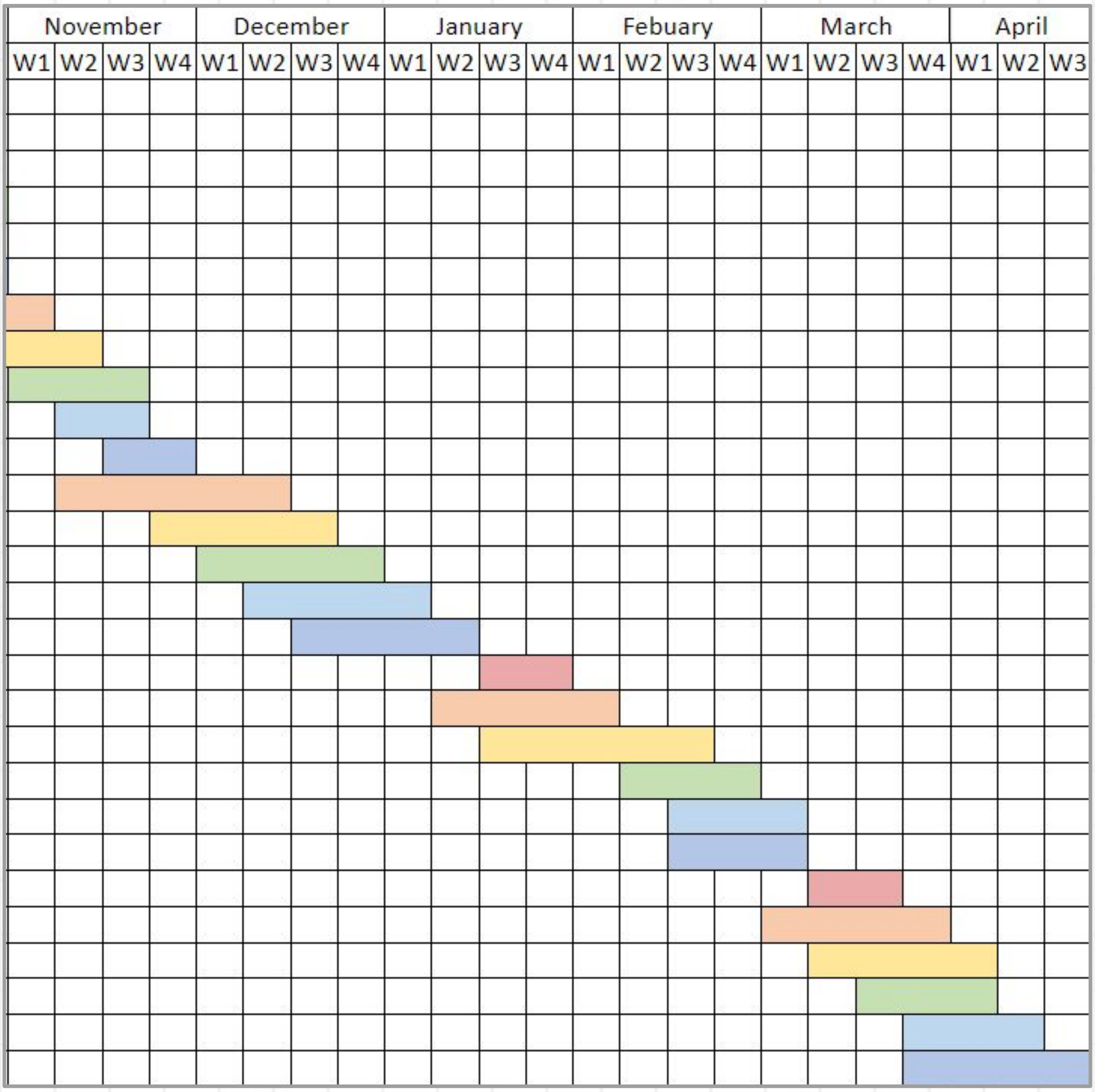
Time Management

Gantt Chart

X

We've decided to have multiple bots created in order for us to be constantly finding new ways to improve both ourselves and our performance in competitions



Why a gantt chart?

- Visual Representation:
  - Gantt charts provide a clear and visual representation of the project schedule. This makes it easy for us and team members to understand the timeline, dependencies, and the overall flow of tasks.
- Task Dependencies:
  - Show which tasks are dependent on the completion of others. This helps in understanding the path of the project and identifying tasks that can be started concurrently.

DEFINE A PROBLEM
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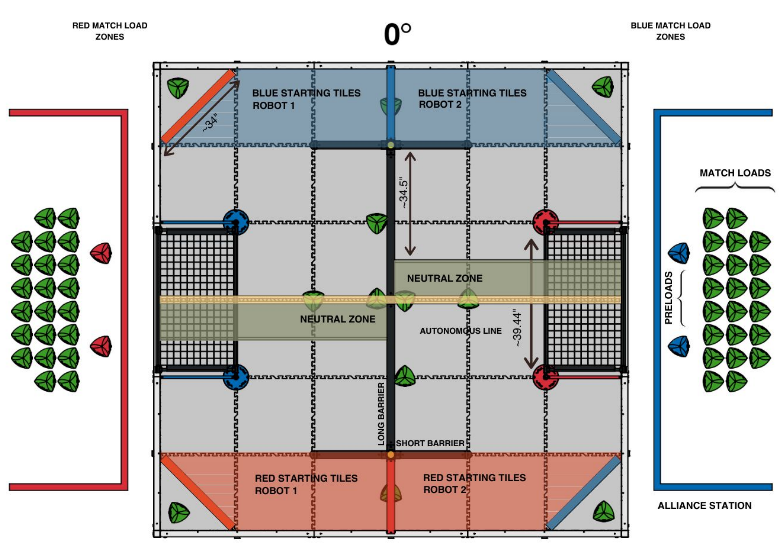
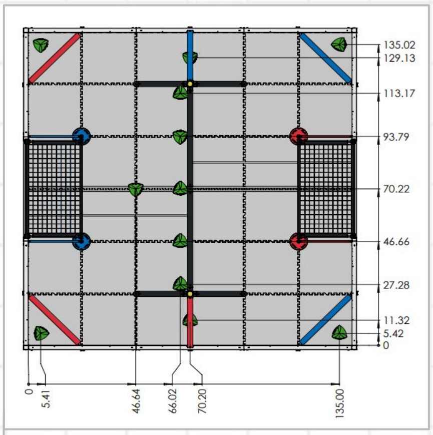


Audience View

Skills field



Match loads remain the same

Teams play as the red Alliance

Over Under: Challenge

Over Under is played on a 12’x12’ square field (configured as seen above)

2 Alliances — one “red” one “blue” — composed of 2 teams each

Both Alliances compete in matches consisting of a:

- 15-second autonomous period
- 1 minute 45 second driver control period

Over Under: Objective

The objective of the game is to attain a higher score than the opposing Alliance by scoring goals with triballs, descoring when permitted and elevating

A bonus of 8 points is awarded to the Alliance that has the most total points at the end of the autonomous period

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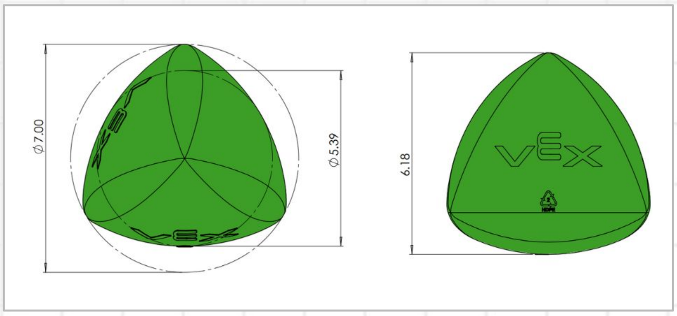
Game Analysis

Triball



Mass: 110 ± 20 Grams

Analysis

60 triballs total

-12 start on field

-1 in each match load

-8, split between both

Offensive zones

-44 match loads

-22 in each Alliance Station

-4 coloured preloads

-2 for each Alliance

Observation

Meissner Tetrahedron

2D Surface: Reuleaux triangle

- Curves of constant width

Can be dented very easily

- not solid plastic, is hollow in the middle
- issues can be fixed by blowing it up again via a small hole on the edge

When we push the triball by its flat surface. We should account for it to go in either 2 approximate directions. As it is quite impossible to perfectly put force into the centre point it is likely that the force is applied to the sides more increasing the chance of the triball rolling to the closest side to the point where force is applied.

When shooting or aiming a triball, we would try to put a larger amount force with more momentum closer to the centre point of a flare curvaceous for it to go straight out.

When pushing a triball it’s good to push from a non flat surface so you can   the direction of its first roll

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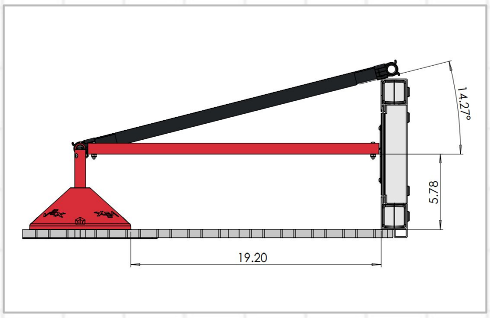
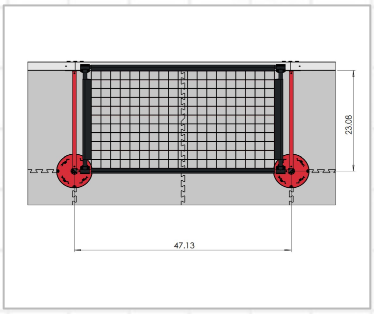
Game Analysis

Goal

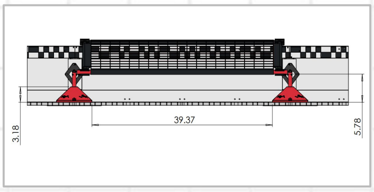




Analysis

2 goals, 1 per alliance

- -1 red
- -1 blue



Observation

Triball(6.18”) will not fit perfectly under the goal(5.8”)

- -additional force is needed

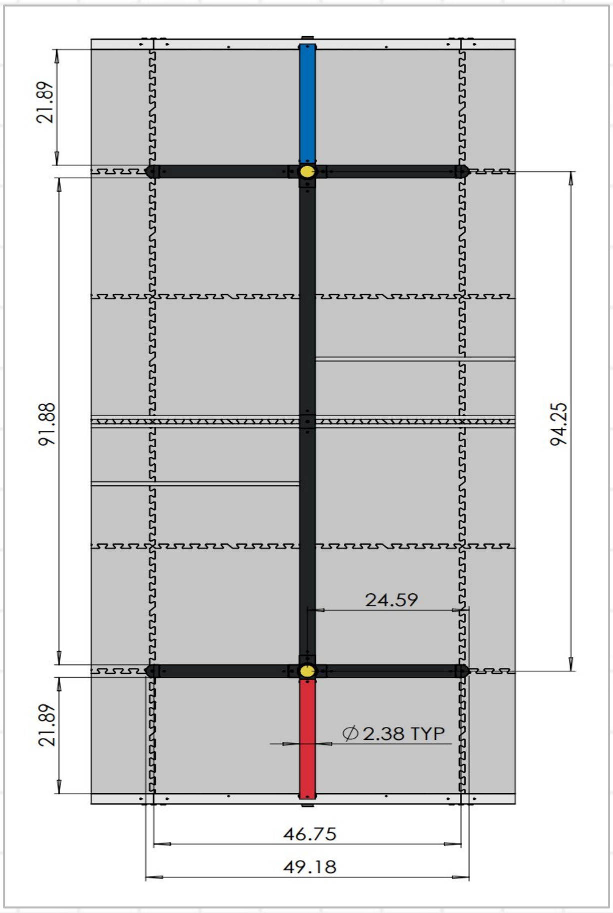
The goal can be opened from the top to help with scoring

Barrier

Analysis

Located at the centre of the field

- -separates the 2 offensive zones



Observation

Very solid

Stays firm

Same pipe diameter as the pipe

used for rollers during Spin-up

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Game Analysis

Analysis and Observations of Field Elements

/04

Barrier, Elevation Pole

Analysis

2 poles, 1 per alliance

-1 red

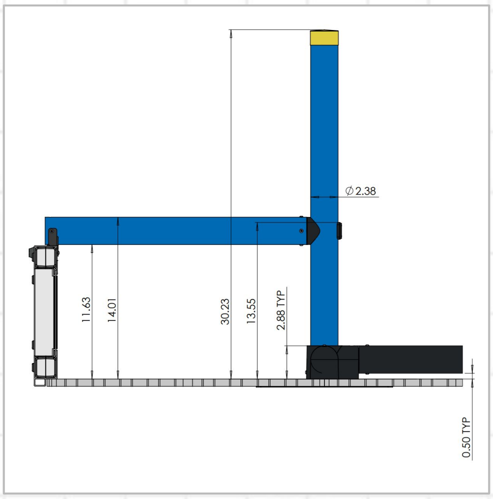
-1 blue

Observation

Not nearly as firm/stable as the long barrier

Will most likely shake a little when robots climb

Same pipe as the one used for rollers in Spin-up



Load Zone

Analysis

4 zones

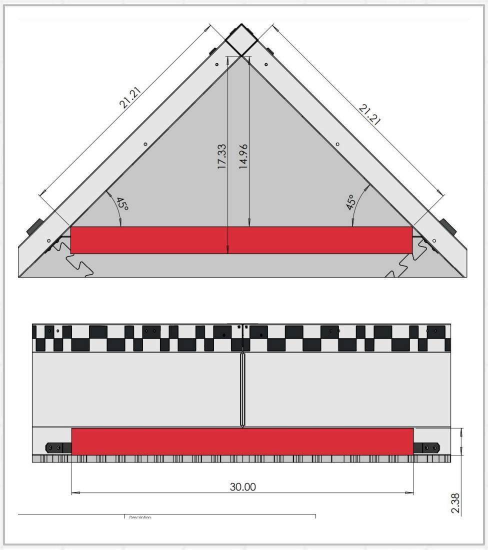
-2 red

-2 blue

Observation

Pipe moves from side to side along the metal holding it in place

It is free to spin as the pipe itself is not secured in place, only the metal holding it is



Measuring Stick

Analysis

Measures Elevation

Separates Tiers,

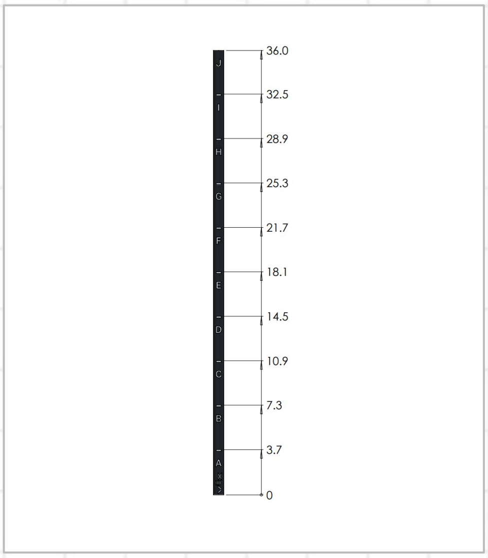
the highest tier gets the most points

With lowest being A to highest J

Observation

Can tie

Robot cannot reach tier I and J as it is above the cap and elevation pole



Inspection rules

Objective: Analyzing robot requirements

<R1> Robot: 1 per team

<R2> Adult may not design, build, or program

<R3> Pass inspection (else result in removal from Matches or Disqualification)

<R4> Size limit: 18”x18”x18”

<R6> Build only using official VEX V5 system

<R7> Parts allowed: Zip ties, Rubber bands, sting(< ¼”), hot glue

<R10> Easy removal of Triballs after a Match (without requiring power)

<R11> Number of Brain: 1

<R12> Motors: 88W in total (11W & 5.5W)

<R14> No modifications to electronic or pneumatic components

<R15> Modifications to non-electrical components are allowed

<R17> No metal surrounds the radio symbol on the V5 Radio

<R18> Custom Plastic Parts: all from a single 12” x 24” sheet 0.070” thick

<R19> Tape: only for non-functional decoration (labeling/wiring)

<R21> New VEX parts are legal

<R22> Air Tank: 1 or 2 (100 psi per tank)

<R23> Controller: 1 or 2 per bot

<R24> Custom V5 Smart Cables are allowed

<R25> Power: must be accessible without moving or lifting Robot

<R26> Code: “competition template” or functional equivalent

Reference : www.vexrobotics.com/over-under-manual#Sec3-Overview

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Game Analysis

Specific Game Rules

Objective: Understanding game rules

SG1 : Bot is placed within the starting tiles and not touch any other objects (other than 1 Triball)

SG2 : In-game expansion

Horizontal limit: 36”

Height limit: N/A

SG3 : Return Triball the field

Return to nearest Match Load Zone: by referees / team directed by referees

SG4 : Preload

Alliance Triball: 1

SG5 : Entangle with the net

Result: Disablement

(Referees could grant a 5-second “grace period” to free themselves)

SG6 : Loading triballs

a) placed onto Match Load Zone (# of triball: N/A) (Zone does not include the Bar)

b) match load onto bot : when contacting Match Load Zone or Match Load Bar (Triball must contact with bot)

SG7 : Triball Possession

Limit: 1

SG8 : When opponent alliance is double zoned, de-scoring from their goal is permitted

Definition of Double Zone: 2 robots in the same offensive zone

Exception:

when one robot of the alliance is in contact with the long barrier

SG9 : During Autonomous, robots must not leave their respective zones

SG10 : All robots are permitted to enter the neutral zone

SG11 : During the last 30 seconds. Robots may not disrupt other robots from elevating. (E.g. robots are unable to purposefully disrupt the barrier)

DEFINE A PROBLEM
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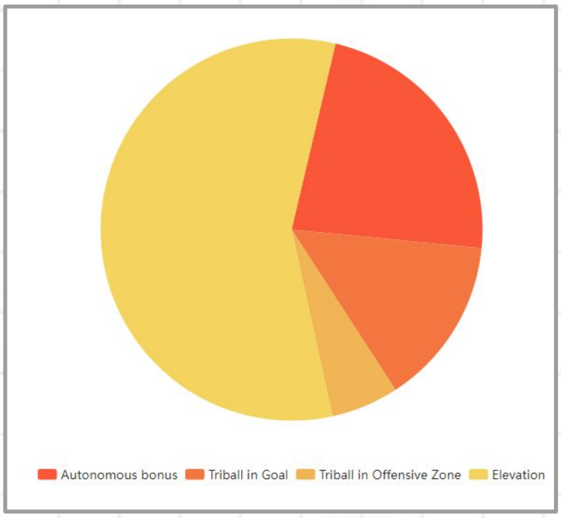
Scoring

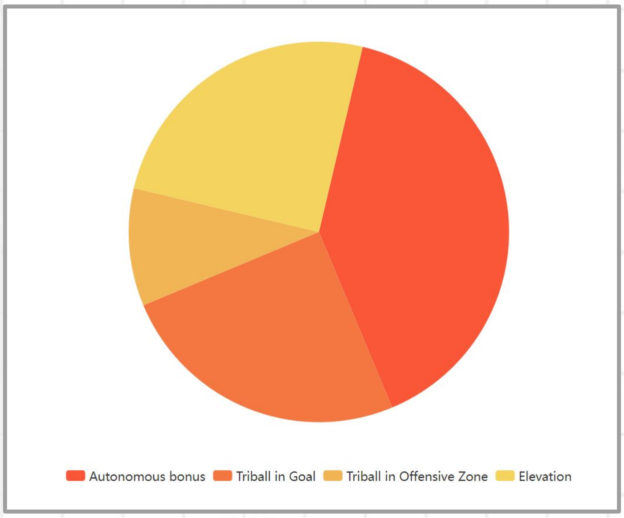
Points

- 8 points for Autonomous Bonus
- 5 points for each Triball in Goal
- 2 points for each Triball in Offensive Zone
- Elevation
    - ○ 20 points for Top Tier
    - ○ 15 points for 2nd Tier
    - ○ 10 points for 3rd Tier
    - ○ 5 points for 4th Tier

Pie Charts of Point division



When elevation is worth 20



When elevation is worth 5

We can note that elevation (yellow) on its own can play a great role in points as the range is so large

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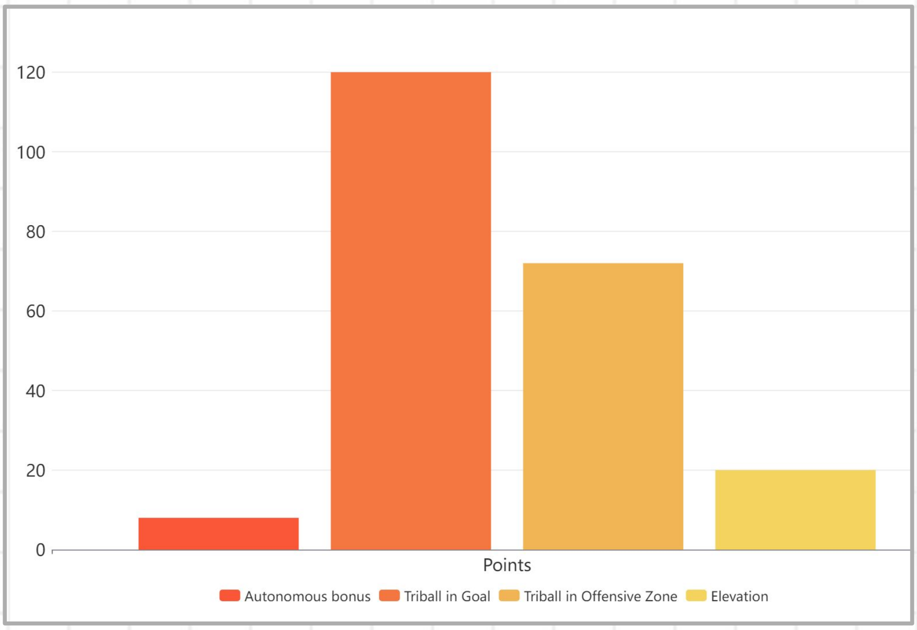
Total possible points in a match

We are under the assumption that all the match loads of one alliance can fit under the goal. As we currently do not have a field or elements

Which means the max would be:
24 Triballs in goal
36 Triballs in our offensive zone

- 8 points for Autonomous Bonus
- 120 points for each Triball in goal
- 72 points for each Triball in Offensive Zone
- 20 points for Elevation

Total: 220 points



When points are maxed out, we can clearly see that scoring the Triball inside the goal will give the greatest results

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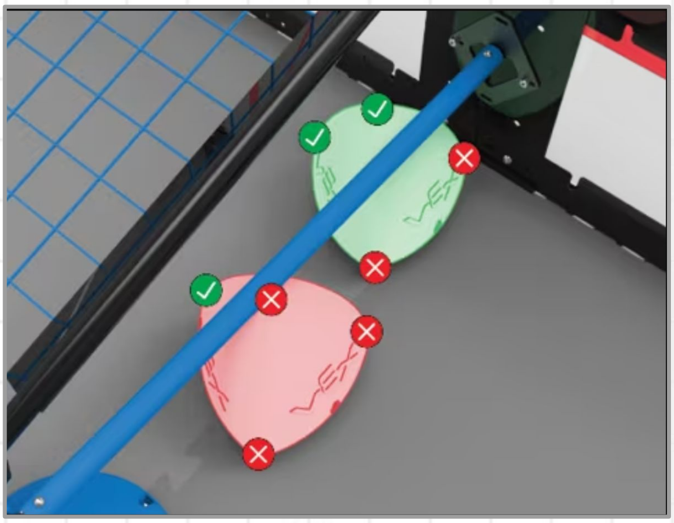
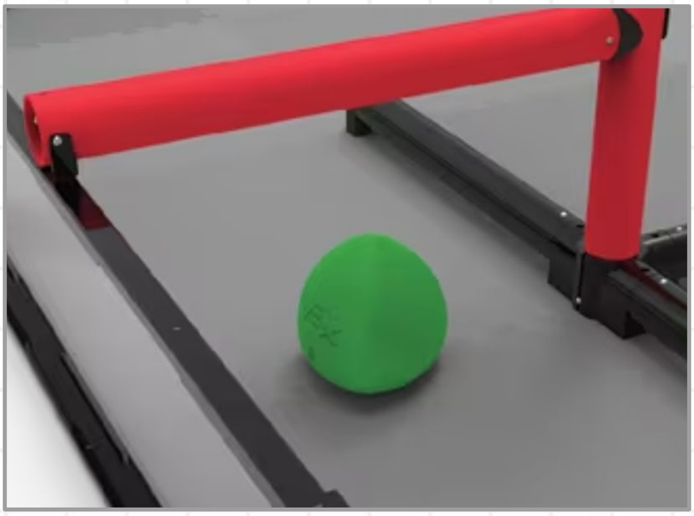
Breakdown of scoring

Triball

- Considered scored only when at least 2 corners of the triball are within the goal



- If in between both offensive zones, then it won't be scored on either side



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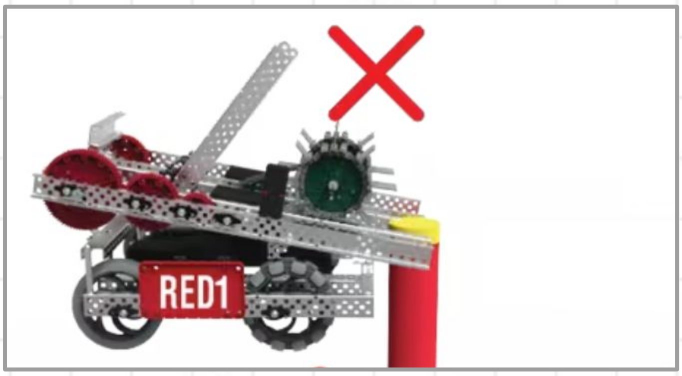
Game Analysis

Scoring Rules

Elevation

- Tier is scored to the lowest point of your robot relative to the ground at the end of each match or skills.

- A robot shouldn't be touching anything other than the elevation pipes.



- Like the yellow cap which is not considered to be a part of the barrier, as well as the field perimeter or any field elements or robots that are in contact with the ground. Doing any of these would result in your elevation tier not being scored

- Some strategies for elevating are:
  - Balancing on the long barrier with the help of a pole
  - Climbing the pole
  - Hanging on the bar
- Last 30 seconds of a match
  - Not permitted to contact the opposing team's elevation bar to prevent them from elevating
  - Major violation results in DQ

In short so long as you are off the ground, not contacting any elements or robots, and in contact with the barrier . Your elevation will be scored.

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Game Strategy

Observation

This year, this game requires a lot of cooperation between alliances, especially for things like getting an AWP. We predict that offense and defense will be very rigorous and violent, hence we must have a durable bot.

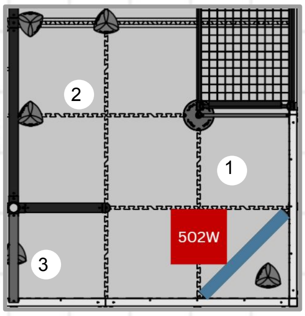
There are many different strategies that we can approach.
We will be going over our strategies for offensive and defensive play. As well as the scenario of having no partner.

Defensive

Starts on side closest to goal

Auton

We first push in our Preload into the goal(1), then we go around to push the triballs on our side into the goal(2). After that, we proceed to touch the bar(3). We will be able to get AWP is our partner scores their preload and also touches the bar.



We predict that it would be quite difficult getting AWP early season as it is likely that teams don’t have autonomous coded.

Solo AWP would be very difficult as it requires a half court shot into the goal.

Match

Option 1:

This is if, opponent teams are strong and cannot descore.

We immediately block the other team from match loading, which will prevent them from scoring the majority of points. As we continue to defend, our alliance finishes matchloading, drives over, and pushes the triballs into our goal. Once we get all possible triballs into the goal, we will both do defence. We use the last 15-20 seconds to prepare elevation and elevate.

Game Strategy

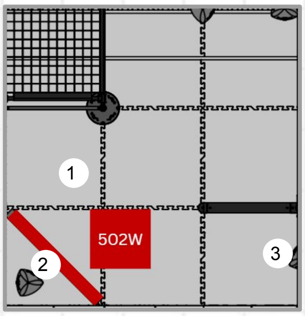
Option 2:
This is if, our opponent can descore
We immediately block the other team from match loading, which will prevent them from scoring the majority of points. As we continue to defend, our alliance match loads. Once a significant amount of triballs are over, we will push the triballs into the goal. Once we get all possible triballs into the goal, we will both do defence. We use the last 15-20 seconds to prepare elevation and elevate.

Offensive

Start on side furthest from goal

Auton

We first push in our Preload into the goal(1), then we go around to push the triballs on our side into the goal(2). After that, we proceed to touch the bar(3). We will be able to get AWP is our partner scores their preload and also touches the bar.



Match

Option 1:
This is if, opponent teams are strong and cannot descore.

We immediately match load to the other side. As we matchload, our alliance defends the other team's match loader. After we finish match loading, we drive to push our triballs into the goal. Once we get all possible triballs into the goal, we will both do defence. We use the last 15-20 seconds to prepare elevation and elevate.

Game Strategy

Option 2:

This is if, our opponent can descore

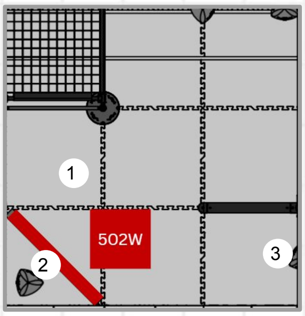
We matchload as our alliance team defends. Once a significant amount of triballs are over, our alliance will push the triballs into the goal. Once we get all possible triballs into the goal, we will both do defence. We use the last 15-20 seconds to prepare elevation and elevate.

No Partner

Start on side furthest from goal

Auton

We first push in our Preload into the goal(1), then we go around to push the triballs on our side into the goal(2). After that, we proceed to touch the bar(3). We will be able to get AWP is our partner scores their preload and also touches the bar.



We will not need to worry about descoring as we're the only team on our side

Match

We immediately match load to the other side. As we matchload, our alliance defends the other team's match loader. After we finish match loading, we drive to push our triballs into the goal. Then focus rigorously on defence. We use the last 15-20 seconds to prepare elevation and elevate.

Defence will be key to winning solo.

Plan

Robot plan

Based on the game strategy, we address robot mechanisms required below:

1. **Drivetrain**
   a. Our drivetrain will need to be strong to be able to withstand robots bashing against it.

2. **Shooting Mechanism**
   a. In order to match load to the other side in the most efficient way

3. **Intake**
   a. To pick up individual triballs and score them

4. **Mass pusher**
   a. To be able to effectively push all the match loaded triballs into the goal. Will save us a lot of time

5. **Climb**
   a. To score upwards to 20 points in game
   b. We predict that climb will be more common towards late season
   c. Climb may consume the most time out of all the other mechanisms

(This also our priority list)

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Ideal Characteristics

PERFORMANCE

- **Speed**
  - Essential for scoring more points, quick task completion, and offence/defence.
  - In Over Under, a robot must be able to quickly outmanoeuvre opponents to score as many points possible. We must determine the amount of speed a specific drivetrain can accommodate and how effective its acceleration is.
- **Agility**
  - Key factor for obstacle navigation.
  - In Over Under, a robot must be able to smoothly go over and under pipes. We must determine the abilities of each drivetrain in how fast it can turn or spin and how it can interact with the game elements (e.g. Going over the middle bar, under the goal, etc.).
- **Durability**
  - Important for controlling variables, against wear and tear.
  - In Over Under, a robot may be constantly hit from many directions due to offence or defence. We must determine how strong each drivetrain is and how much we can possibly reinforce it.
- **Customizability**
  - Allows us to better personalize the robot to suit the game
  - In competitive games, a robot must be capable of being able to adjust variables to better suit a task. For each drivetrain we need to determine how many factors can be manipulated, for instance, rpm, number of motors, pto, etc.
- **Pushing power**
  - Critical for defence and offence ((e.g. pushing robots to offset them either to score or prevent others from scoring).
  - There are 2 goals in Over Under, so naturally opponents may attempt to prevent us from scoring or vice versa. Blocking or pushing may also occur when preventing a robot from shooting the triball across the field. We need to determine how well each type of drivetrain is capable of pushing in any direction, and how well a robot can push others.
- **Pushing resistance**
  - Critical for defence and offence (e.g. being able to stay aligned in order to shoot, allows the driver to have a lower reaction time to being pushed).
  - In Over Under, opponents will attempt to offset us to prevent us from scoring or just shooting in general. We must determine how resistant the robot is to being pushed on all 4 sides
- **Ability to strafe**
  - Allows robot to move from side to side
  - In Over Under, strafing can improve agility.

DESIGN

- **Simplicity**
  - Inverse relationship with number of things that can go wrong, making the drivetrain more reliable.
  - We need to account for, the amount of factors that can go awry for each drivetrain
- **Ease of coding**
  - Likelihood of being unable to find errors is low and makes variables easily adjustable.
  - We need to account for how many factors require calculations and how effectively we can divide buttons/joysticks to control each drivetrain.
- **Ease of building**
  - Higher efficiency and easier to fix errors
  - We must account the amount of parts and connections required as well as any non-typical items required on the drivetrain

Ease of driving

- Raises reaction time, and allows the driver to remain focused on the game as opposed to the controls
- We must account for the total amount of controls required and possible ways of moving.

EXTRA ASPECTS

- **Size**
  - The more space a drivetrain can accommodate, the more features we can add.
  - We must account for the amount of usable space available on the drivetrain
- **Weight**
  - More weight equals to slower acceleration and motors have a higher chance of overheating
  - We must account the general weight of the drivetrain (I.e. weight of components)

CONTINUED FROM PAGE:

Drivetrain

POSSIBLE DRIVETRAINS

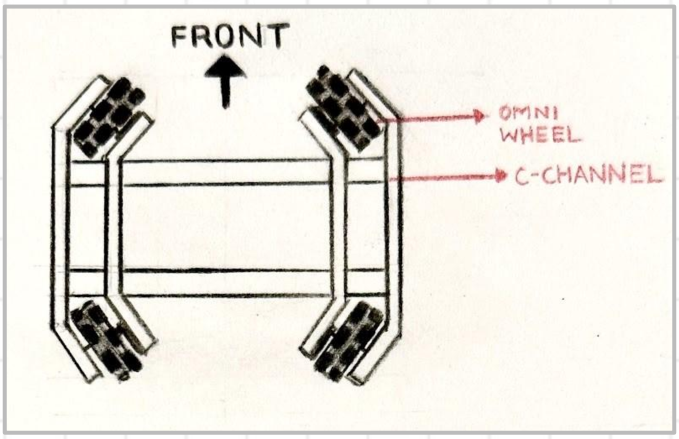
Holonomic/X Drive

PROS

- Manoeuvrability
- Fast
- Omnidirectional Movement

CONS

- Complex programming
- Large and bulky
- Not great for going over obstacles
- Unable to park
- Complex to build well



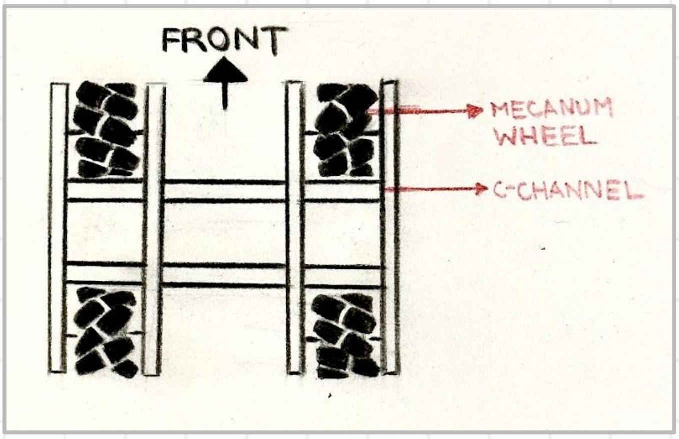
Mecanum Drive

PROS

- Versatility
- Simplicity
- Omnidirectional Movement

CONS

- Complex programming
- Low speed
- Heavy wheels add extra weight
- Low traction
- Design complexity
  - All wheels must be aligned



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Drivetrain

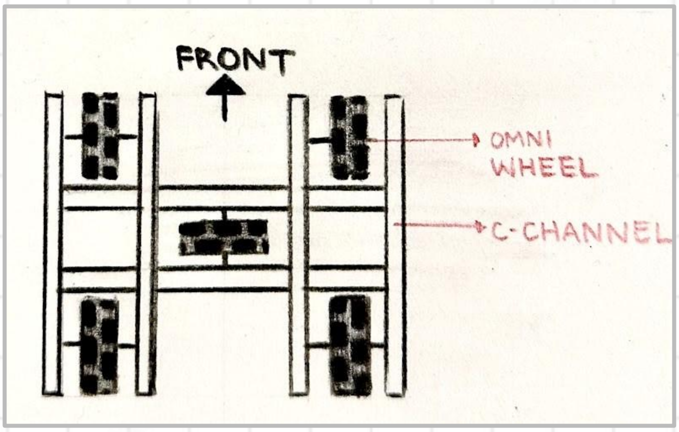
H Drive

PROS

- Versatility
- Improved stability
- Omnidirectional Movement

CONS

- Complex programming
- Large, added weight
- Must have 5 or 7 motors
- Not great for going over obstacles



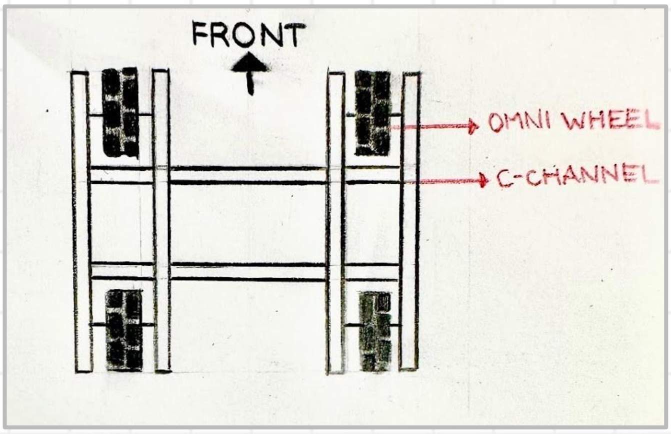
Tank Drive

PROS

- Stability
- Fast
- Simplicity
- Consistency
- Durability
- Able to park
- Good traction
- Popular

CONS

- Alignment difficulties
- Wide turning radius
- Limited manoeuvrability
- Less versatility
- Lack of Omnidirectional movement



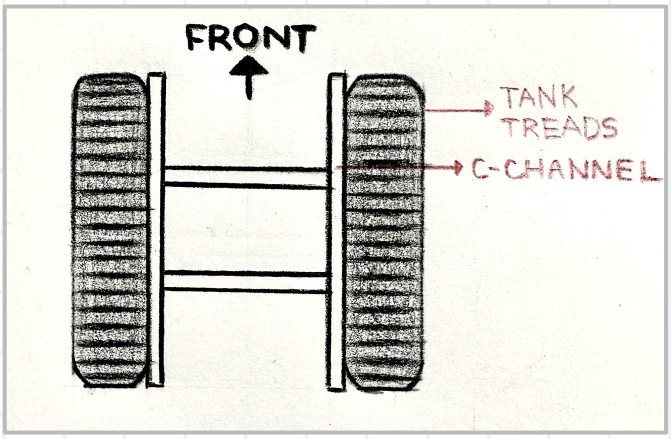
Tank Treads

PROS

- Stability
- Versatility
- Durability
- Great Traction

CONS

- Stability
- Complex programming
- Slow
- Heavy



Drivetrain

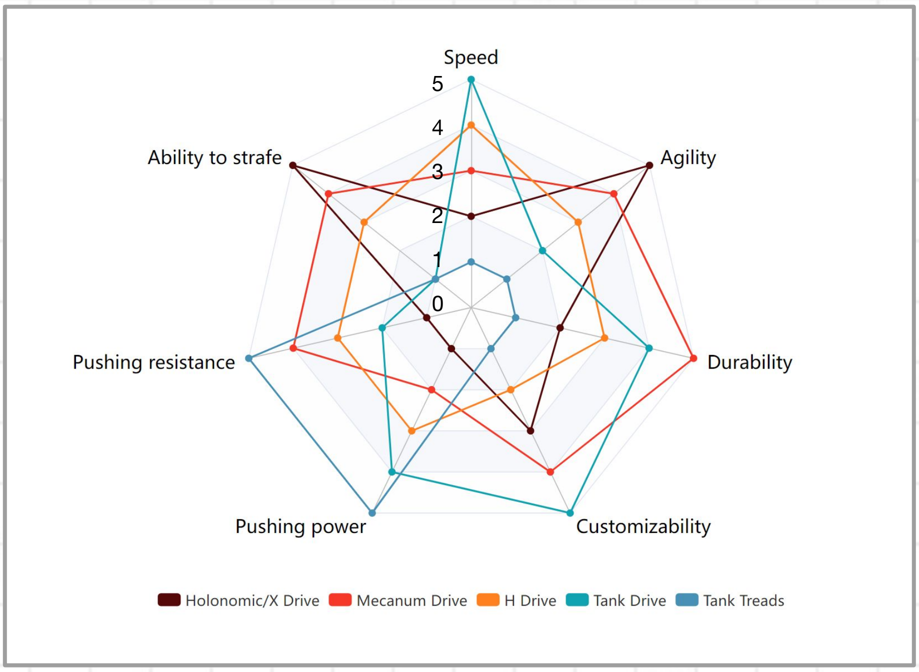
Drivetrain: Comparing options

Radar graphs and Tables

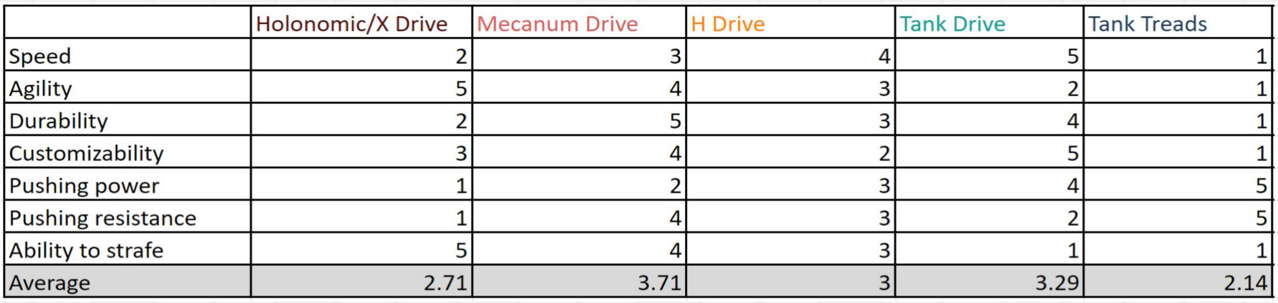
Robots are ranked from a scale of 1-5 compared to one another
5 being best and 1 being worst

Note: Being unable to do an action is considered a 1

PERFORMANCE



Table

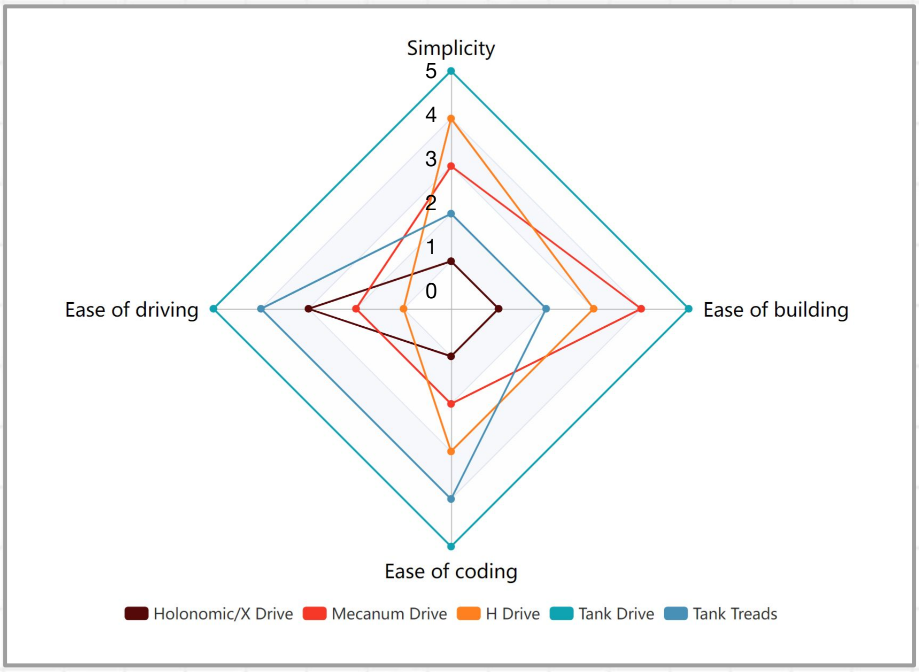


	Holonomic/X Drive	Mecanum Drive	H Drive	Tank Drive	Tank Treads
Speed	2	3	4	5	1
Agility	5	4	3	2	1
Durability	2	5	3	4	1
Customizability	3	4	2	5	1
Pushing power	1	2	3	4	5
Pushing resistance	1	4	3	2	5
Ability to strafe	5	4	3	1	1
Average	2.71	3.71	3	3.29	2.14

From the performance average, we can see that Mecanum Drive is the drivetrain with the most advantage in performance.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

DESIGN



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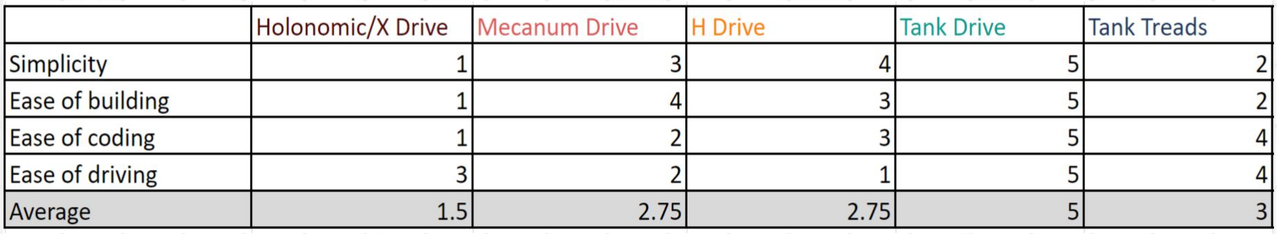
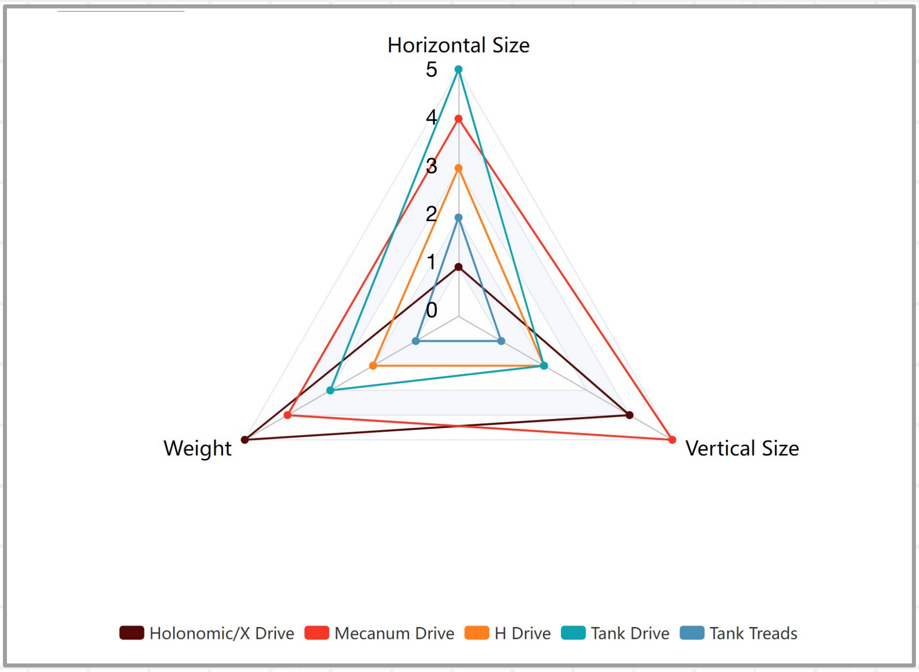


	Holonomic/X Drive	Mecanum Drive	H Drive	Tank Drive	Tank Treads
Simplicity	1	3	4	5	2
Ease of building	1	4	3	5	2
Ease of coding	1	2	3	5	4
Ease of driving	3	2	1	5	4
Average	1.5	2.75	2.75	5	3

From the design average, we can see that Tank Drive has the most advantage in design.

Drivetrain

EXTRA ASPECTS



Table

	Holonomic/X Drive	Mecanum Drive	H Drive	Tank Drive	Tank Treads
Horizontal Size	1	4	3	5	2
Vertical Size	4	5	2	2	1
Weight	5	4	2	3	1
Average	3.34	4.34	2.34	3.34	1.34

From the average of the extra aspects, we can see that Tank Drive and holonomic drive have equal advantage.

Final Conclusion for Drivetrain Selection

	Holonomic/X Drive	Mecanum Drive	H Drive	Tank Drive	Tank Treads
Performance Average	2.71	3.71	3	3.29	2.14
Design Average	1.5	2.75	2.75	5	3
Extra Aspects Average	3.34	4.34	2.34	3.34	1.34
Added Average	7.55	10.8	8.09	11.63	6.48

We make our selection after adding the averages of all 3 sections. We can see that Tank Drive has the greatest number after adding up the averages.

We will be selecting the Tank Drive

CONTINUED FROM PAGE:

Drivetrain

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Wheel selection

Omnidirectional wheels

4”

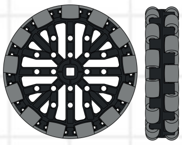
PROS

- Fast
- Most common wheel size
- Able to go over game elements

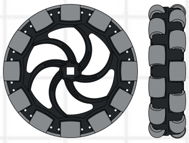
CONS

- Cannot use an 8 wheel configuration
- Poor centre of gravity
- Large, takes up space
- Does not have a balanced rpm

Antistatic



Original



	Width (in.)	Diameter (in.)
4" Original Omni Wheel	1.125	4.125
4" Anti-static Omni Wheel	1	4

3.25”

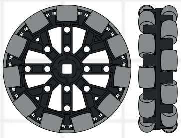
PROS

- Balanced
- Able to go over game elements
- Able to use an 8 wheel configuration

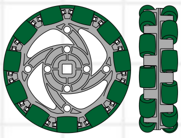
CONS

- Not great pushing power or speed
- 8 wheel configuration can quite long

Antistatic



Original



	Width (in.)	Diameter (in.)
3.25" Original Omni Wheel	1	3.25
3.25" Anti-static Omni Wheel	1	3.25

2.75”

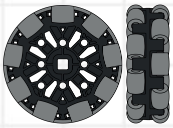
PROS

- Good centre of gravity
- Good pushing power
- Able to use a 8 wheel configuration

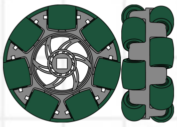
CONS

- Slow
- Unable to go over game elements

Antistatic



Original

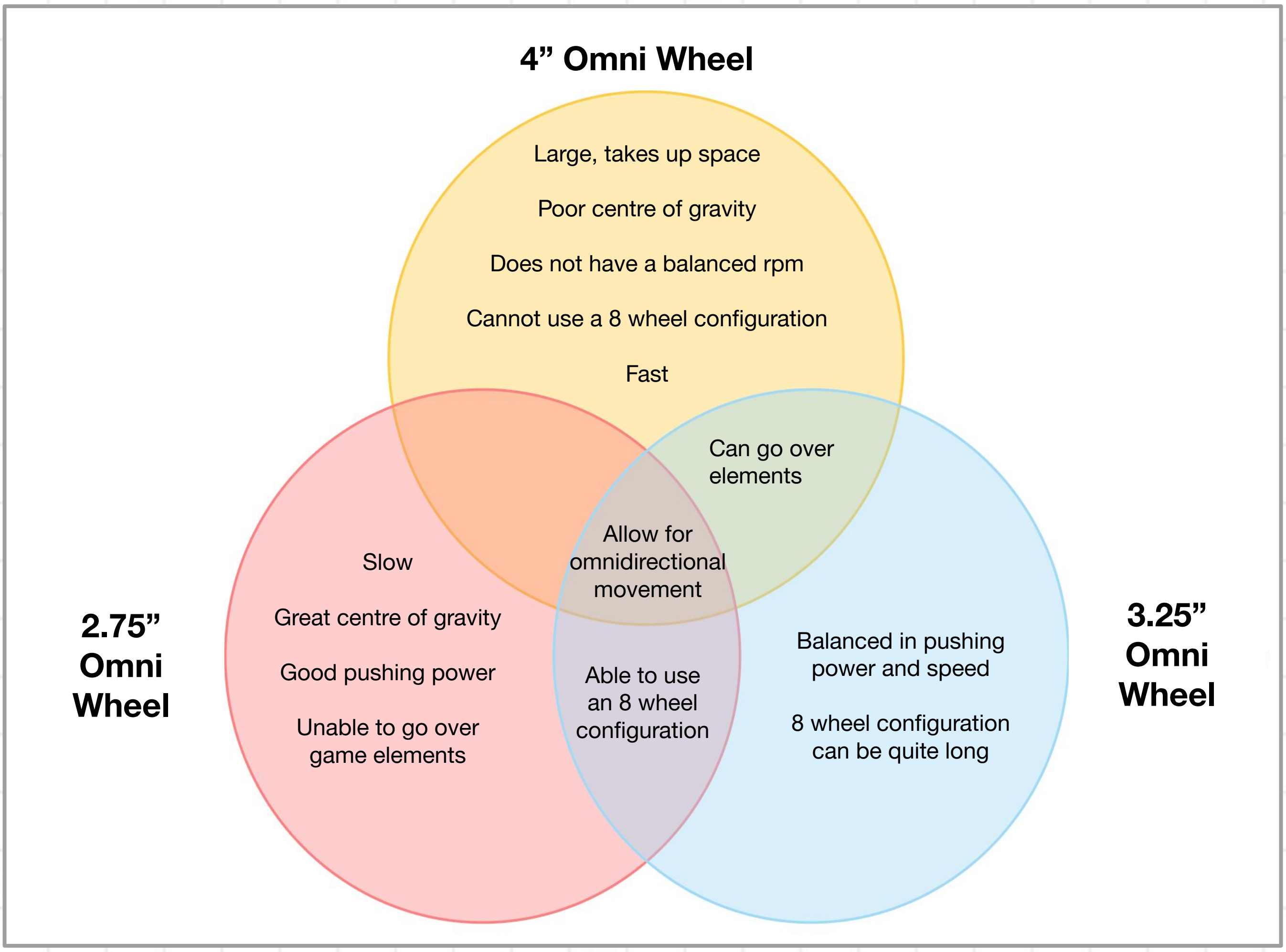


	Width (in.)	Diameter (in.)
2.75" Original Omni Wheel	1	2.75
2.75" Anti-static Omni Wheel	1.225	2.5

Drivetrain

Drivetrain - wheel selection

Venn Diagram


4” Omni Wheel
Large, takes up space
Poor centre of gravity
Does not have a balanced rpm
Cannot use a 8 wheel configuration
Fast
Can go over elements
Allow for omnidirectional movement
2.75” Omni Wheel
Slow
Great centre of gravity
Good pushing power
Unable to go over game elements
Able to use an 8 wheel configuration
3.25” Omni Wheel
Balanced in pushing power and speed
8 wheel configuration can be quite long

3.25” Omnidirectional Wheels suit our best interest as:

- They are the ideal size to make a compact but still decently fast robot
- They allow us to easily drive over the barrier, which may prove to be important during the game
- They’ll give us the most balance, which will be crucial to offensive and defensive play
- Gives us more room to play around with configuration
  - 6 or 8 wheels

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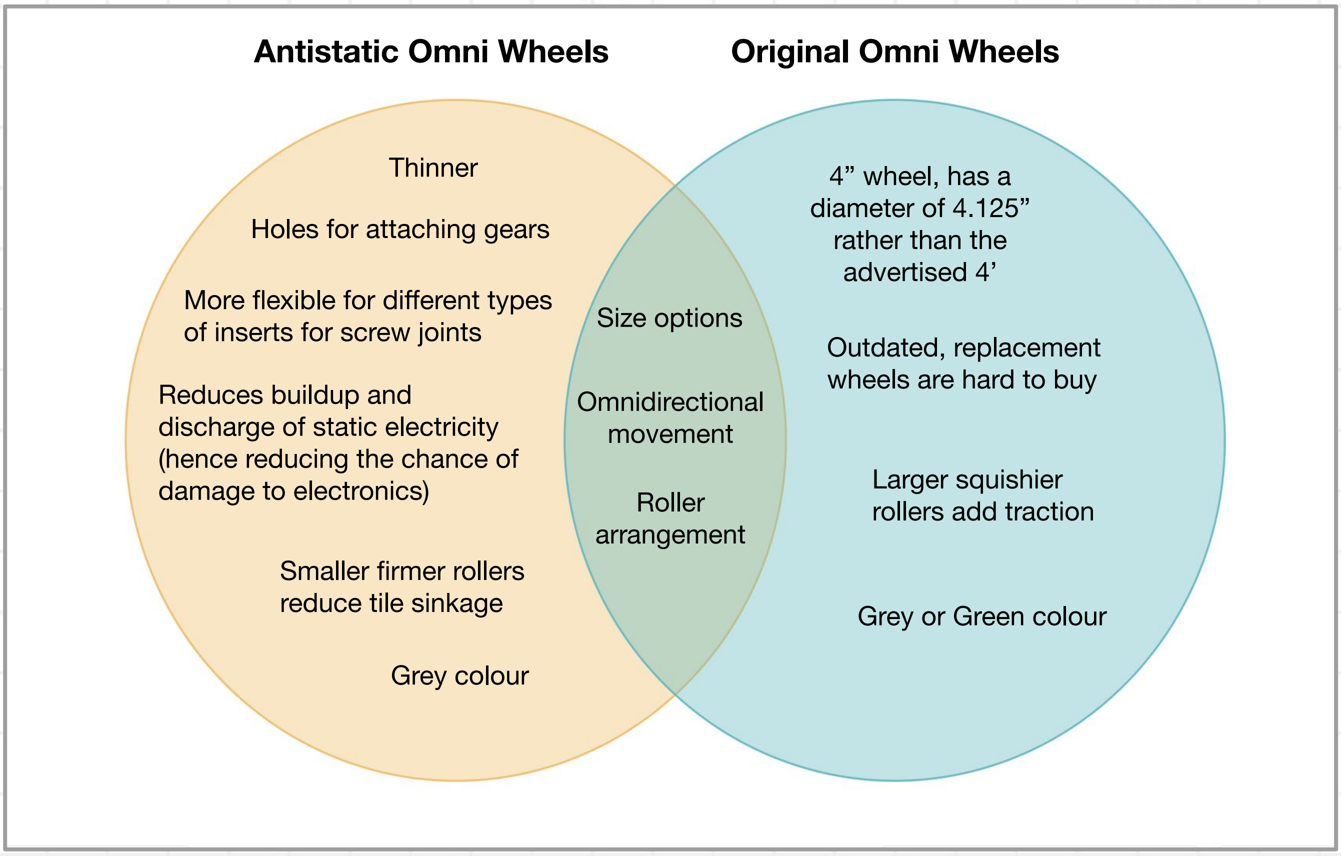
Antistatic vs Original Omni Wheel



Antistatic Omni Wheels

Thinner

Holes for attaching gears

More flexible for different types of inserts for screw joints

Reduces buildup and discharge of static electricity (hence reducing the chance of damage to electronics)

Smaller firmer rollers reduce tile sinkage

Grey colour

Size options

Omnidirectional movement

Roller arrangement

Original Omni Wheels

4” wheel, has a diameter of 4.125” rather than the advertised 4’

Outdated, replacement wheels are hard to buy

Larger squishier rollers add traction

Grey or Green colour

Antistatic Omni Wheels have an overwhelming advantage over Original wheels as:

- They are antistatic, which will better protect our electronics
- We will have reduced sinkage, so we’ll be able to have a more consistent performance with less force on the motors
- They are thinner, which allow us to create a compact drivetrain
- They have holes for screws, allowing us to directly screw the wheel to the gear
- They have more options for inserts, allowing us to screw joint the wheels

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Drivetrain

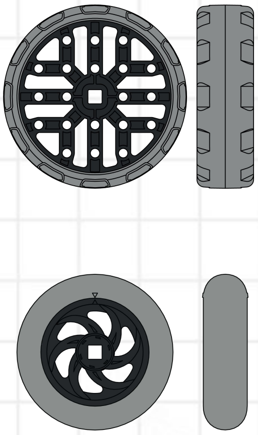
Traction wheels

PROS

- High amount of traction
- Uniform shape
- Helps prevent unwanted side to side movement (Ideal for defence)
- Helps improve and maintain stability

CONS

- May lead to more friction
- Heavy
- Slow turning as your wheels slide when you turn



Configuration

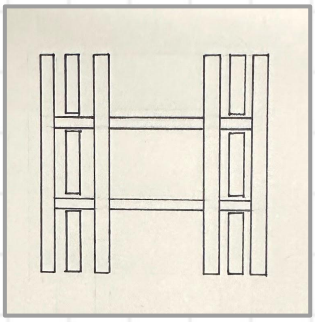
6 wheel configuration

PROS

- Simpler to build
- Less materials

CONS

- Less traction
- Harder to mount



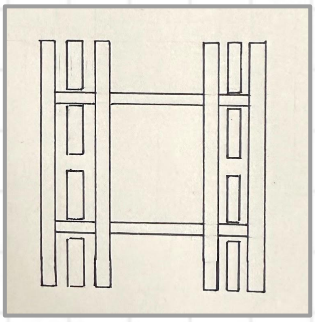
8 wheel configuration

PROS

- More traction to field tiles → better pushing power
- More convenient mounting size

CONS

- More material
- Longer (not necessarily better)
- Less length to work with



Selection

8 wheel configuration. Gives us more space to mount mechanisms on top (Note that the Triball is large and width). Allows us to maximize offence defence strategies.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

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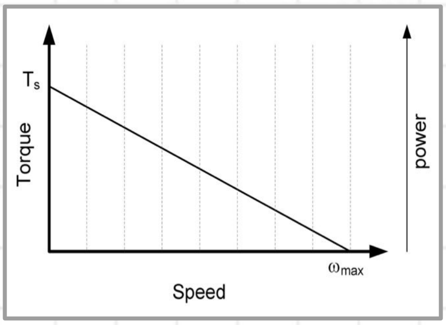
Drivetrain

11W motors

Note: Torque and speed are inversely related



Red Cartridge

Characteristics:

- Spins up to 100 RPM
- Used in mechanisms requiring extra strength
- 36:1 internal gear ratio

PROS

- Strong
- Good acceleration

CONS

- Reduced agility
- Slow

Green Cartridge

Characteristics:

- Spins up to 200 rpm
- Used in mechanisms requiring balanced strength and speed
- 18.1 internal gear ratio

PROS

- Balanced

CONS

- Loses speed to friction in the cartridge

Blue Cartridge

Characteristics:

- Spins up to 600 rpm
- Used in mechanisms requiring speed
- 6:1 internal gear ratio

PROS

- Fast

CONS

- Weak
- More friction compared to the other cartridges

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Drivetrain

Wheel selection & configuration

5.5 W motors

This year 5.5W motors are legal. Further analysis will occur once our order arrives

4 Motor vs 6 Motor drive

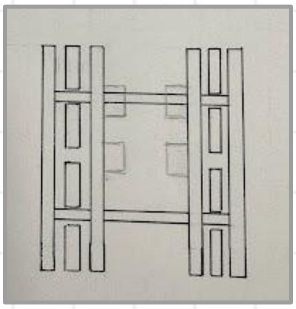
4 motor

PROS

- Balanced
- Similar performance as 6 motor drive
- Saves on motors for other mechanisms

CONS

- Slow acceleration
- Weak pushing power
- Overheating
  - Which will result in a very significant performance drop



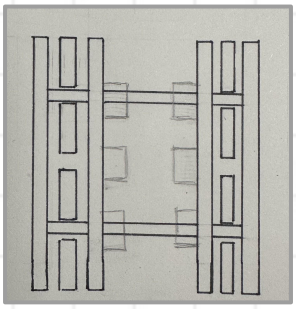
6 motor

PROS

- Good acceleration
- Power
- Less overheating

CONS

- Takes 6 of the 8 motors



Selection

We’ve chosen to go with the 6 motor drive as it is the “norm” to increase our chances of competing. As everyone else uses 6 motors, we will use 6 motors too to level our defence and offence.

We won’t need to divert more power to other components as other tasks required don't need nearly as much power (shooting mech 1 motor or pistons, intake 1 motor).

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Wheel Combinations

Objective: Finding the best wheel combination to suit our strategy

The most popular wheel combinations from season to season, are 4 omnis, 2 omnis with 2 traction wheels in between, and 3 omnis with a traction wheel in between.

Abbreviations

O = Omni
T = Traction

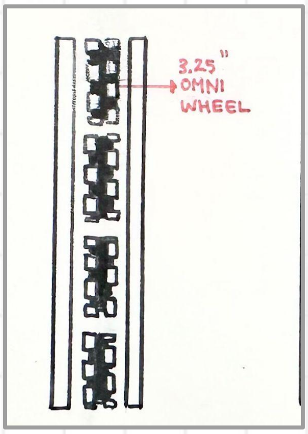
O O O O

PROS

- High-speed capability
- Excellent manoeuvrability

CONS

- Less traction than other wheel configurations
- Not as stable when being pushed from the side
- Much more drift



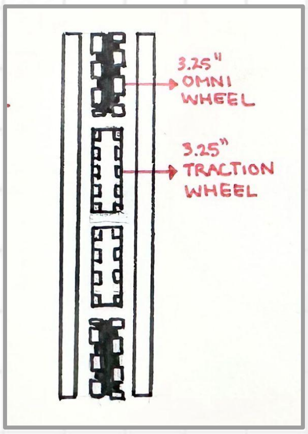
O T T O

PROS

- Good stability and traction
- Balanced in speed and control

CONS

- Not as agile as 4 omni wheel combination
- Slower turning



Drivetrain

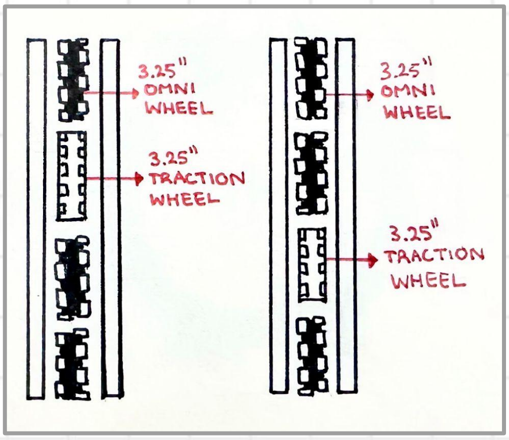
OTOO or OOTO

PROS

- Good traction
- Balanced

CONS

- Reduced agility
- Slow
- Off centre turning



Decision

We have decided to choose the 4 omni wheel configuration as we value manoeuvrability more so over traction as in the game we will be able to be flexible with offensive and defensive strategies as we will be able to quickly change positions.

Gear ratios

Objective

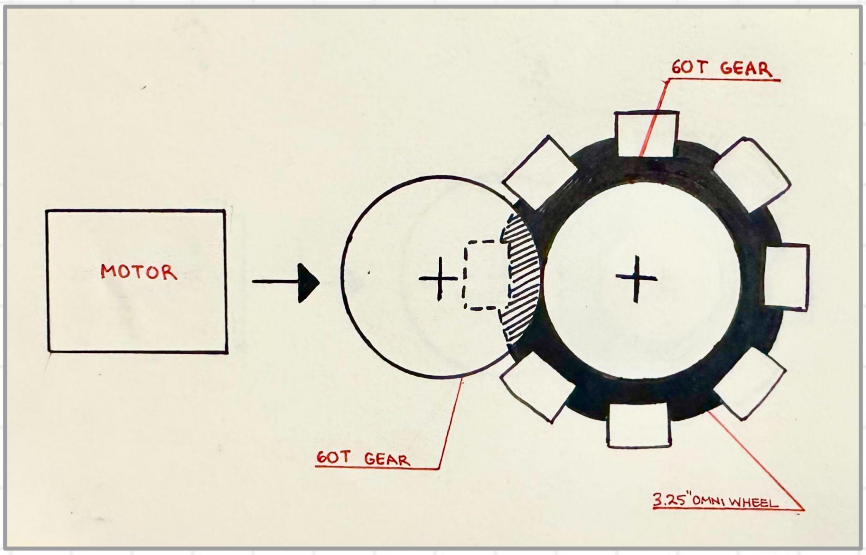
Selecting the best gear ratio that is both comfortable with our driver and also fits with our game strategy

Options

Option 1

Gear ratio

$$\frac{Driven}{Driving} = \frac{60T}{60T} = \frac{1}{1} \longrightarrow 1:1$$



Possible RPMs:

Input RPM x 1/1

- **100rpm x 1/1 = 100 rpm**
- **200rpm x 1/1 = 200 rpm**
- **600rpm x 1/1 = 600 rpm**

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Drivetrain

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TESTING SOLUTION

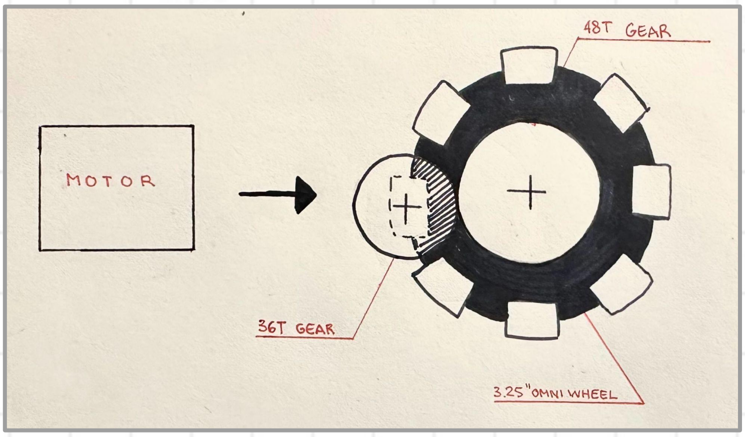
Characteristics/Capabilities

Equal speed and torque
Easy to directly control
Reduced Speed
Limited torque

Why this gear ratio?

Simplicity and versatility

Option 2



Gear ratio

$$\frac{\textit{Driven}}{\textit{Driving}} = \frac{48T}{36T} = \frac{4}{3} \longrightarrow 4:3$$

RPM

Input RPM x 4/3

100rpm x 4/3 = 133.3 rpm

200rpm x 4/3 = 266.7 rpm

600rpm x 4/3 = 800 rpm

Characteristics/Capabilities

Output torque is greater than input torque
Reduces max Speed

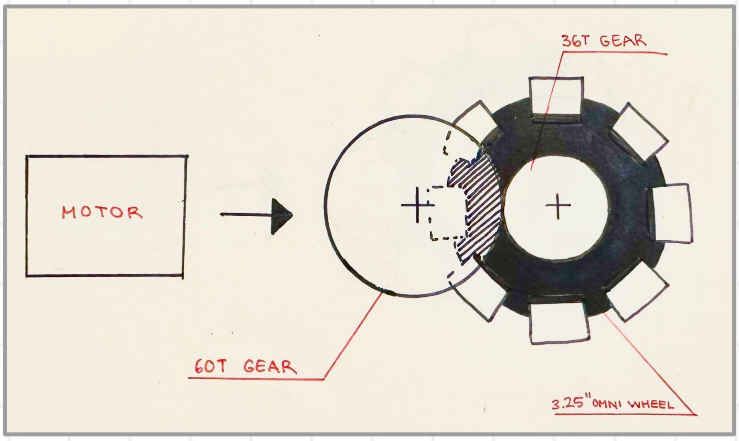
Why this gear ratio?

Versatility, can carry load as well as being capable of being easily controlled

CONTINUED FROM PAGE:

Drivetrain

Option 3



Gear ratio

$$\frac{\text{Driven}}{\text{Driving}} = \frac{36T}{60T} = \frac{3}{5} \longrightarrow 3{:}5$$

RPM

Input RPM x 3/5

100rpm x 3/5 = 60 rpm

200rpm x 3/5 = 120 rpm

600rpm x 3/5 = 360 rpm

Characteristics/Capabilities

- High torque
- Lower speed
- Great pushing power

Why this gear ratio?

We used this gear ratio at 360 rpm for worlds

Selection

4:3 with 600rpm motors
We chose to value speed over torque as having a more flexible bot will help us move smoothly through game obstacles.

Our Driver is also comfortable with this speed.

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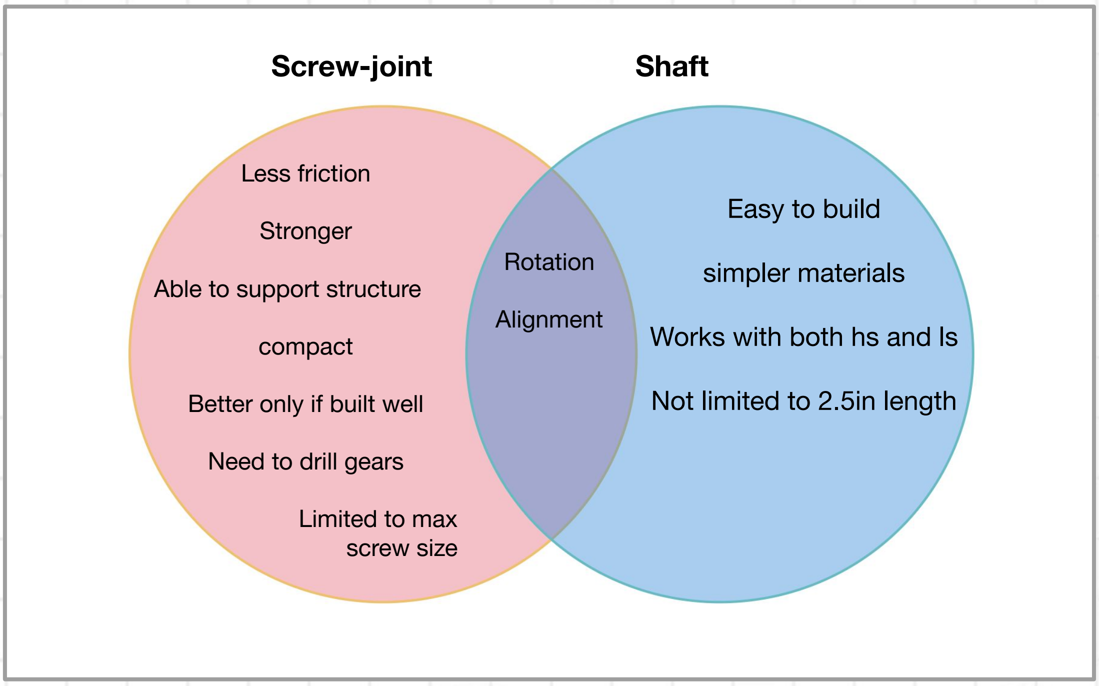
Screw-joint vs Shaft



Screw-joint

- Less friction
- Stronger
- Able to support structure
- compact
- Better only if built well
- Need to drill gears
- Limited to max screw size

Screw-joint and Shaft

- Rotation
- Alignment

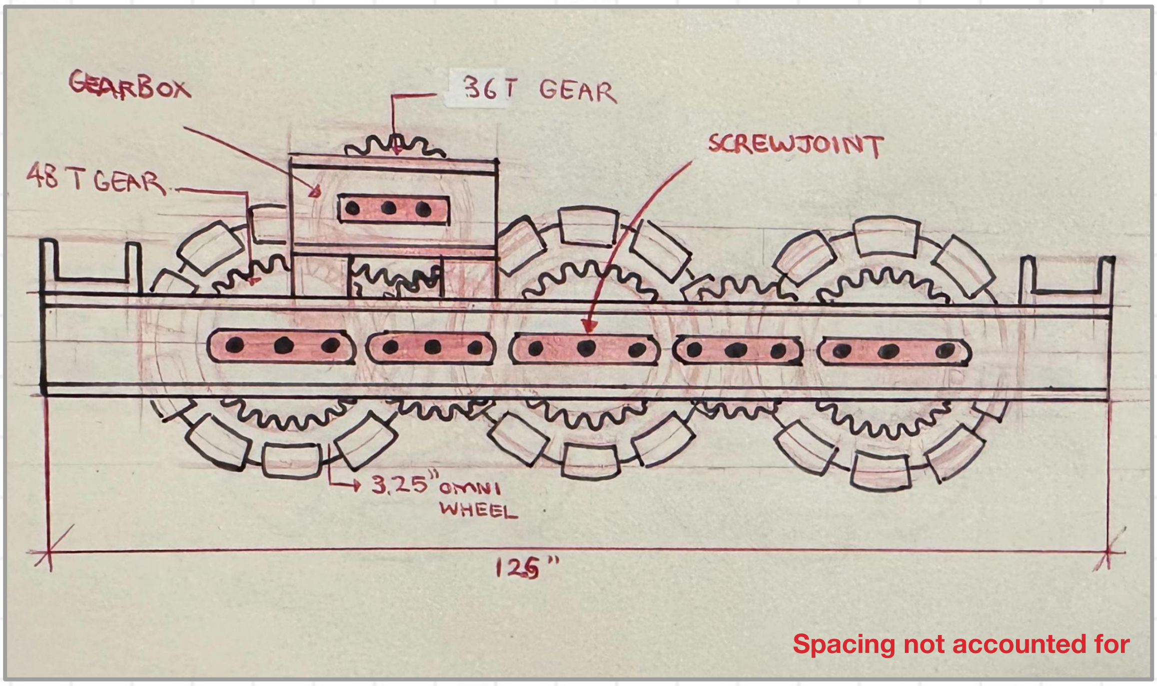
Shaft

- Easy to build
- simpler materials
- Works with both hs and ls
- Not limited to 2.5in length

screw-joints serve a greater purpose than shafts as it does a better job in supporting the structure

Sketch Plan

LIMITED RESOURCES. Initial prototyping will be done with 3 wheels and on one side only.



Spacing not accounted for

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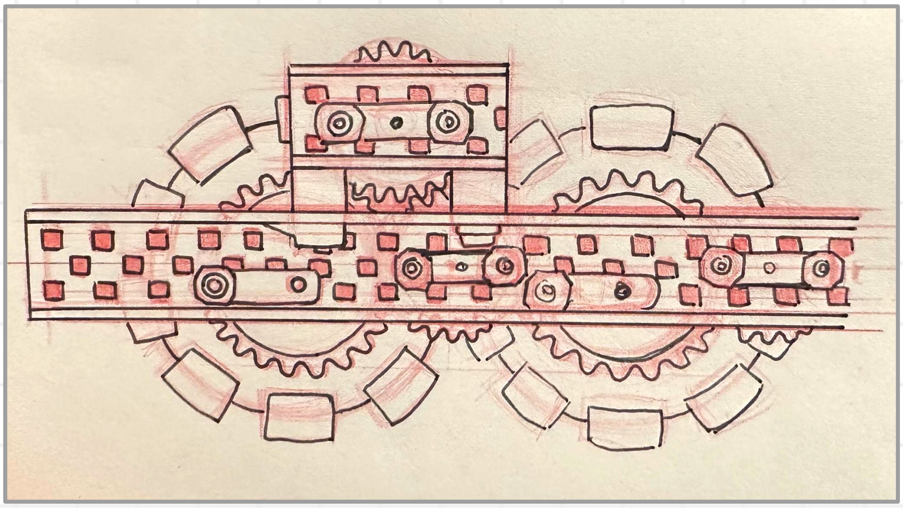
Drivetrain

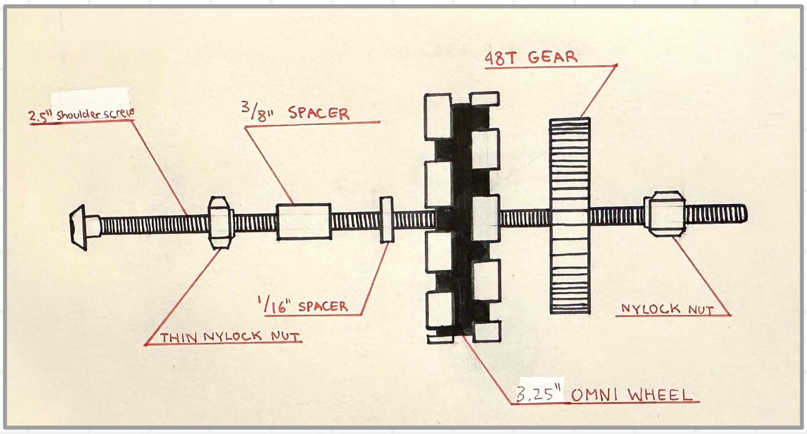
In order to achieve a 6 motor drive. We must use a gearbox when prototyping as we only have 3 wheels on each side

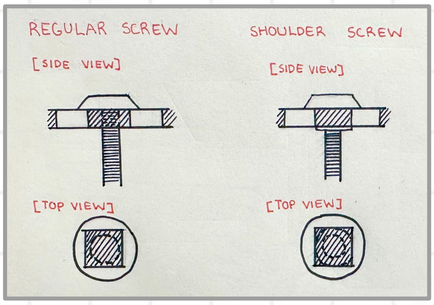
Spacing



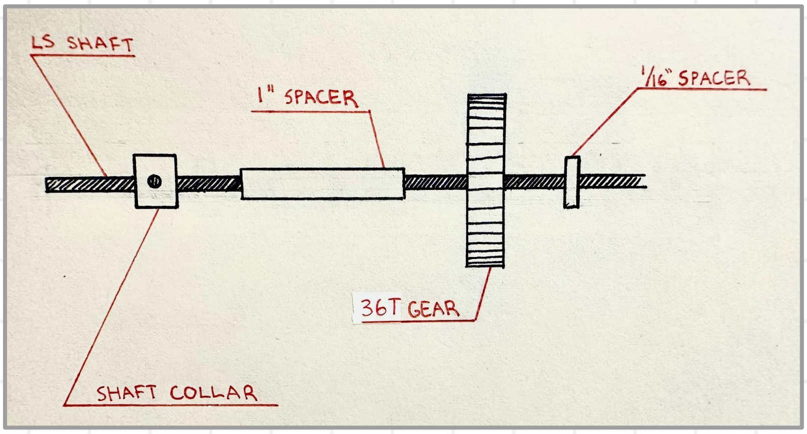
Gear offset in the gearbox to better save on space

Bearings are offset from one another in order to conserve space so that we can efficiently save on space





Shoulder screws better secure themselves inside the c channel, without the extra space which allows us to better support the robot



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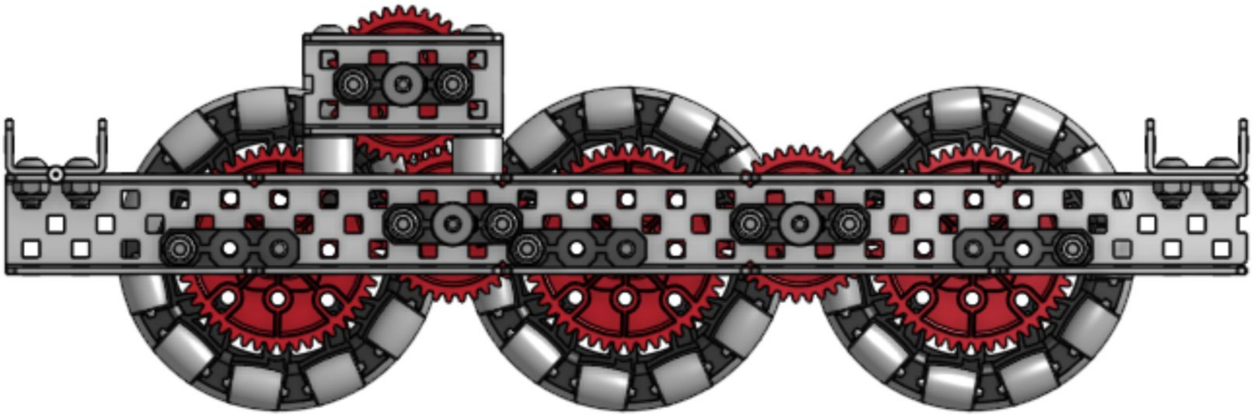
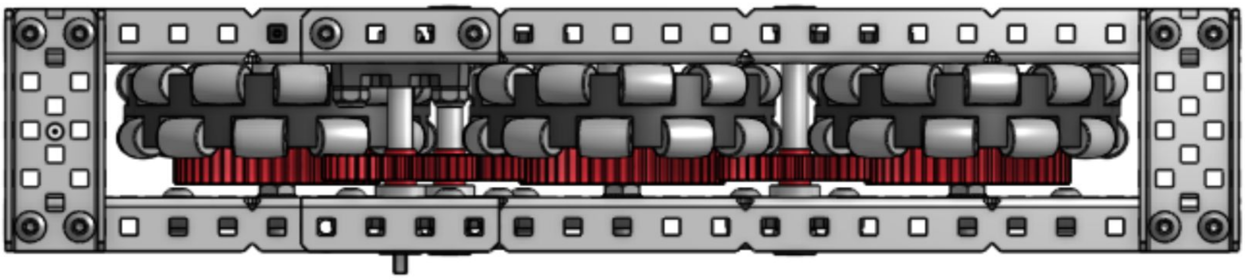
CAD

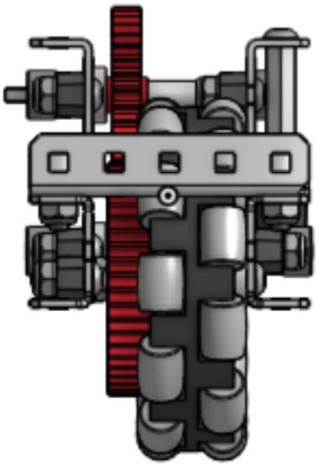
[SIDE VIEW]



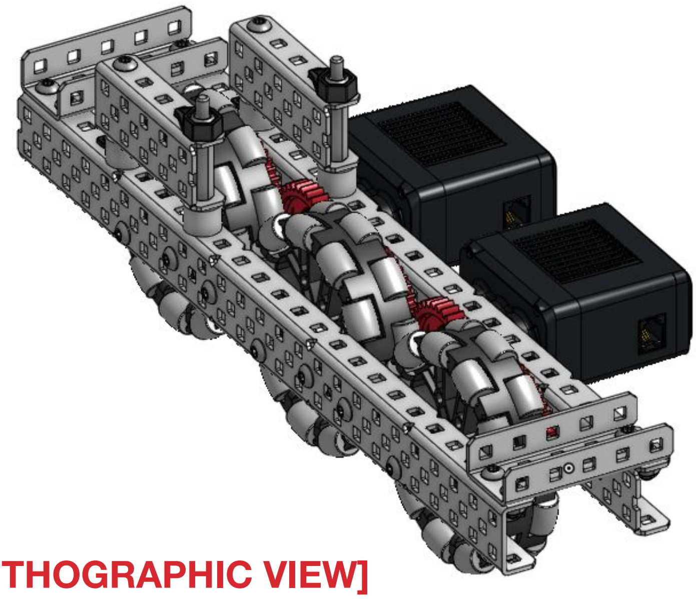
[TOP VIEW]



[FRONT VIEW]



2.5” wide



[ORTHOGRAPHIC VIEW]

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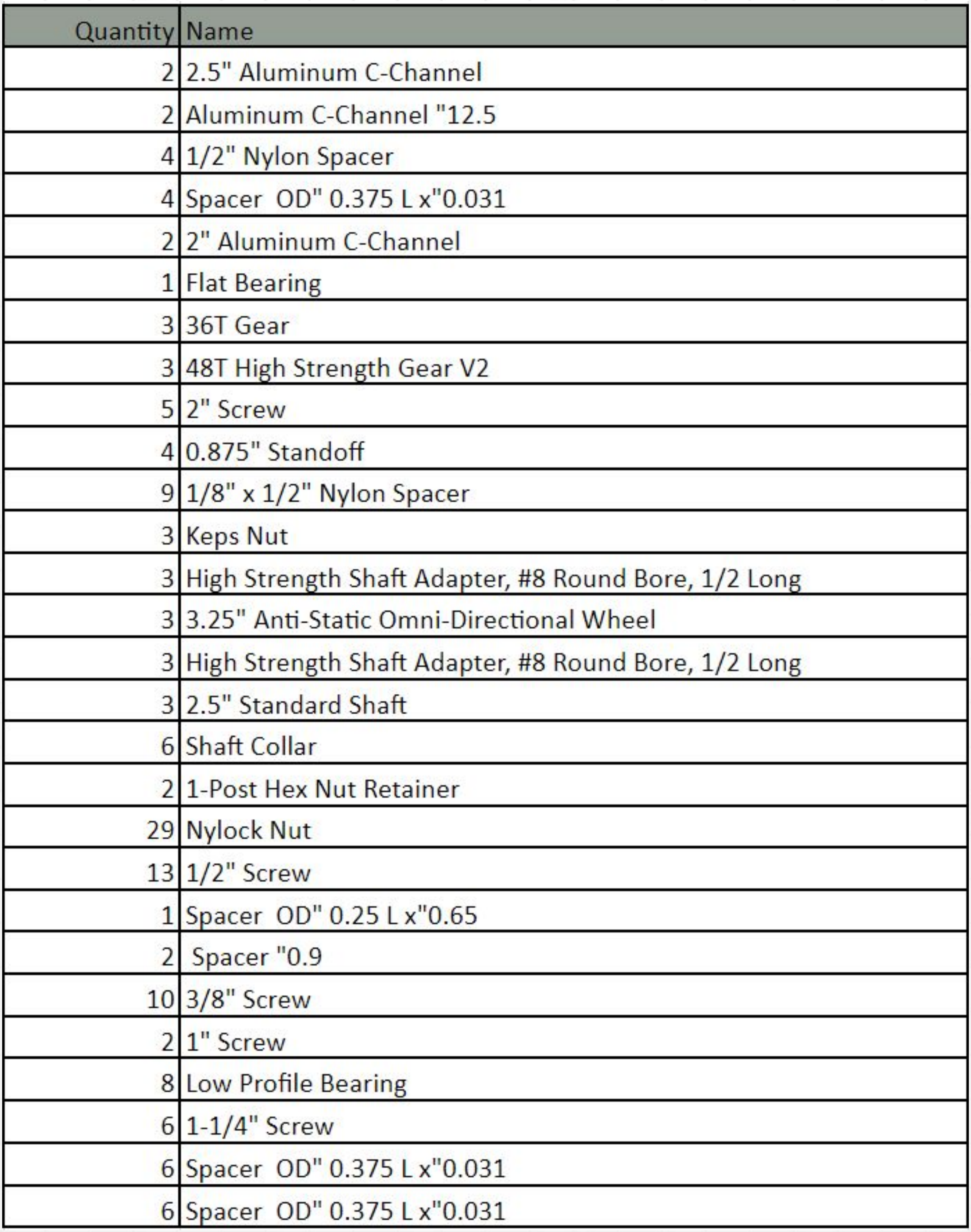

Quantity	Name
2	2.5" Aluminum C-Channel
2	Aluminum C-Channel "12.5
4	1/2" Nylon Spacer
4	Spacer OD" 0.375 L x"0.031
2	2" Aluminum C-Channel
1	Flat Bearing
3	36T Gear
3	48T High Strength Gear V2
5	2" Screw
4	0.875" Standoff
9	1/8" x 1/2" Nylon Spacer
3	Keps Nut
3	High Strength Shaft Adapter, #8 Round Bore, 1/2 Long
3	3.25" Anti-Static Omni-Directional Wheel
3	High Strength Shaft Adapter, #8 Round Bore, 1/2 Long
3	2.5" Standard Shaft
6	Shaft Collar
2	1-Post Hex Nut Retainer
29	Nylock Nut
13	1/2" Screw
1	Spacer OD" 0.25 L x"0.65
2	Spacer "0.9
10	3/8" Screw
2	1" Screw
8	Low Profile Bearing
6	1-1/4" Screw
6	Spacer OD" 0.375 L x"0.031
6	Spacer OD" 0.375 L x"0.031

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Drivetrain

Final Selection

Configuration:

4 omni wheel configuration. This wheel configuration fits best with our chosen game strategy. It will allow us agility, helping us massively with offence and defence.

Gear ratio:

3:4

Benefits

- This gear ratio provides a good balance between speed and torque. It allows our robot to quickly move across the field, making it agile.
- Our offensive abilities will also be improved as we will be enabled to cover more ground to score more points within a shorter time frame
- Gives us enough torque for defensive play (e.g pushing or blocking opponents)

Things to note

- Although we have torque. The amount that we have still reduces pushing power. So during matches we have to maximize our agility.
- Driving may require lots of practice to handle the speed.

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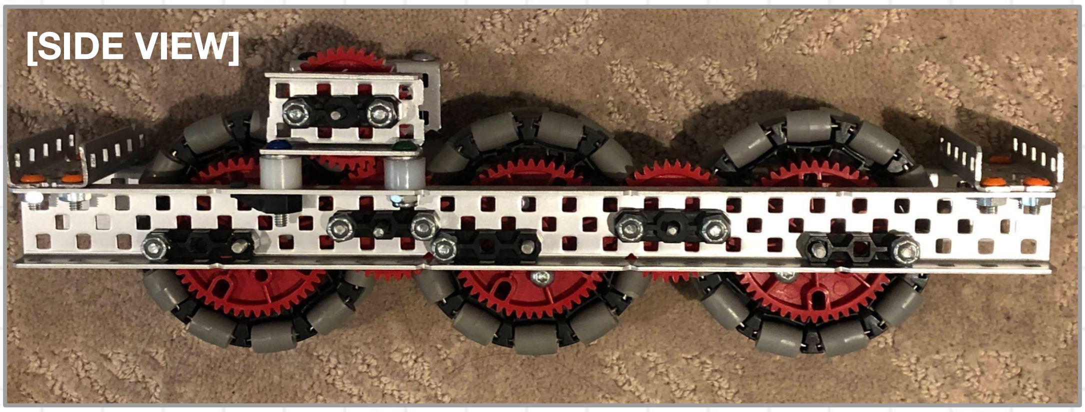
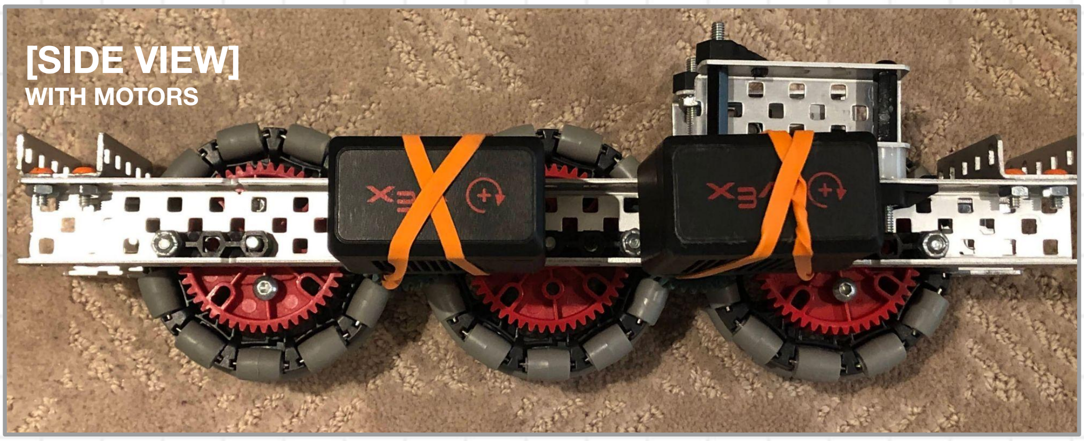
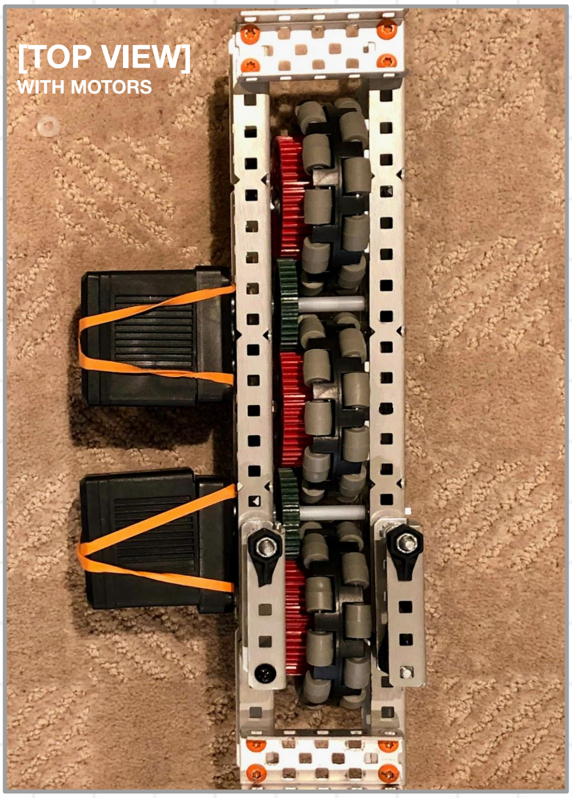
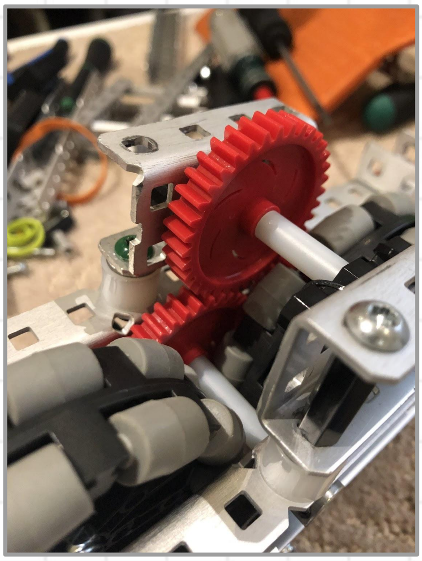
Prototype









[GEAR BOX]

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Drivetrain

INITIAL OBSERVATIONS

Wheels spin freely

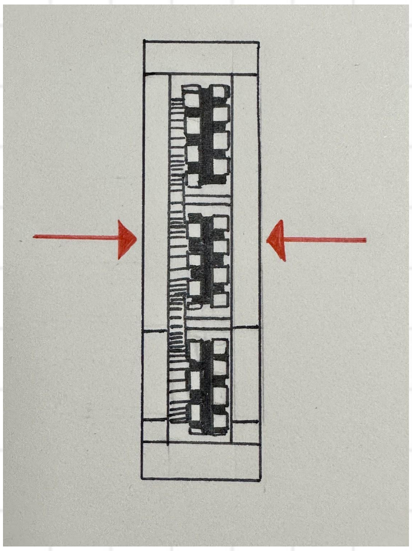
Overall, very square

CHALLENGES FACED

- **Gear placement**
  - We used low profile bearings placed on the side and not regular bearings in the centre to better make use of our space. Throughout the previous season, we've always had regular bearings placed in the centre for the drivetrain.
- **Alignment**
  - In order to make use of our space, we had to think creatively on how to efficiently use our space to achieve our desired length and width
- **Screw-joints**
  - As this is our first year using screw-joints we deliberated on whether to tighten the screws or to keep them loose. Ultimately we decided that it was best to tighten them as when tightened, the screw-joints remain still while the wheel spins on it, reducing the friction and better helping us control the robot.

CURRENT ISSUES

- **Once compressed from the side, the wheels don't spin as freely**
  - This means that when we are potentially pushed from the side as another alliance defends, friction increases, putting pressure on the motors.
  - All of that increases the difficulty of driving, which may cause us to lose significant time during a match



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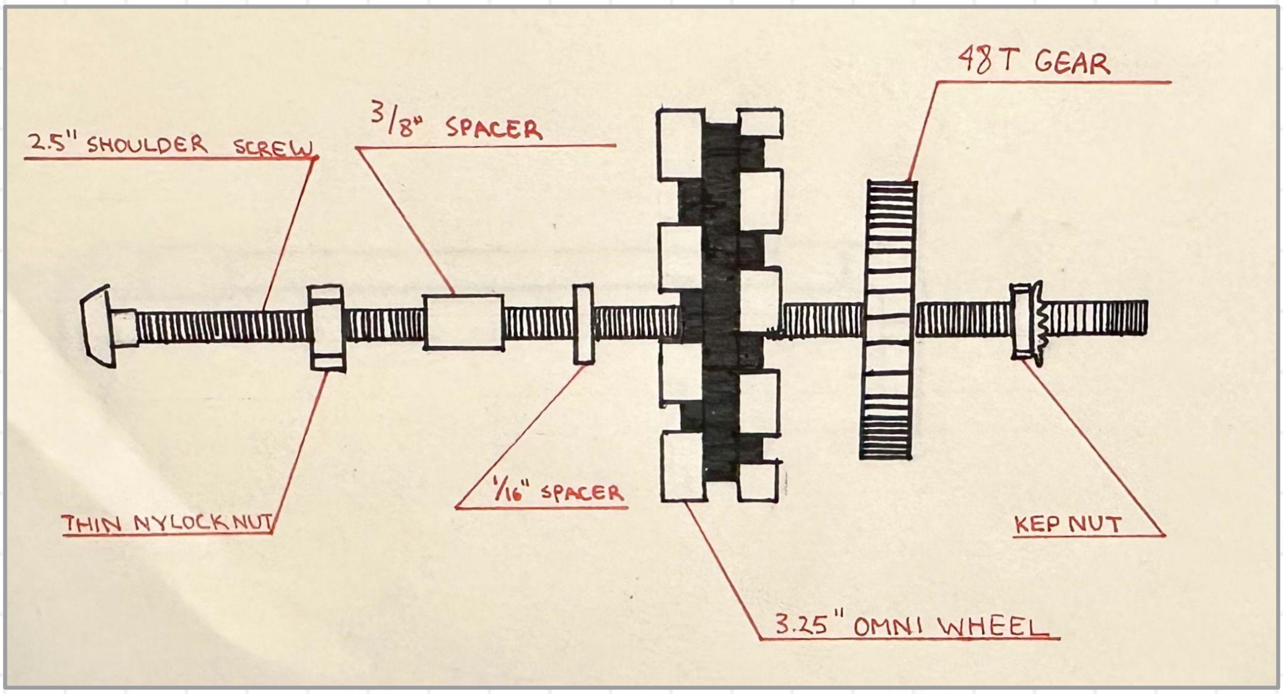
Drivetrain

SOLUTION

- **Replacing the nut on the screw joints with a kep nut**
  - Upon close examination of the prototype. We found that the spacing of the wheels and gears were not perfect, which leads to 2 possible solutions:
    - 1: Replacing the nut on the screw-joint with something smaller.
    - 2: Increasing the spacing of the driving gear
  - We chose option number 1 as finding the right spacer size for option 2 would prove to be more complex as there are fewer options(unable to use nuts as the driving gear is on a low strength shaft).



OTHER CHANGE

Took away the bearings on the motors to further reduce friction. Allowing for an ever better free spin

We've decided to go with this design for the actual drivetrain, now that all our parts have arrived

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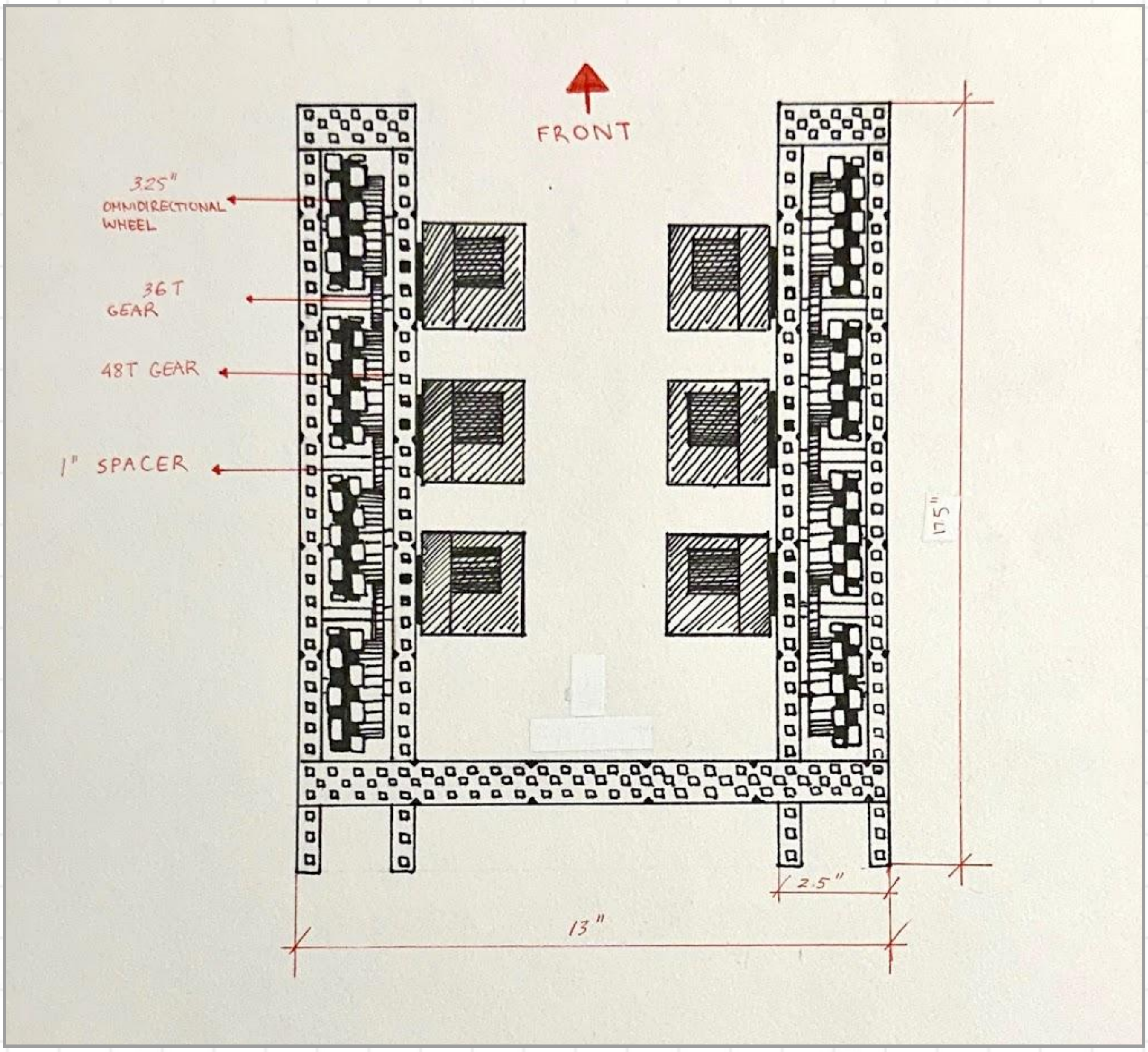
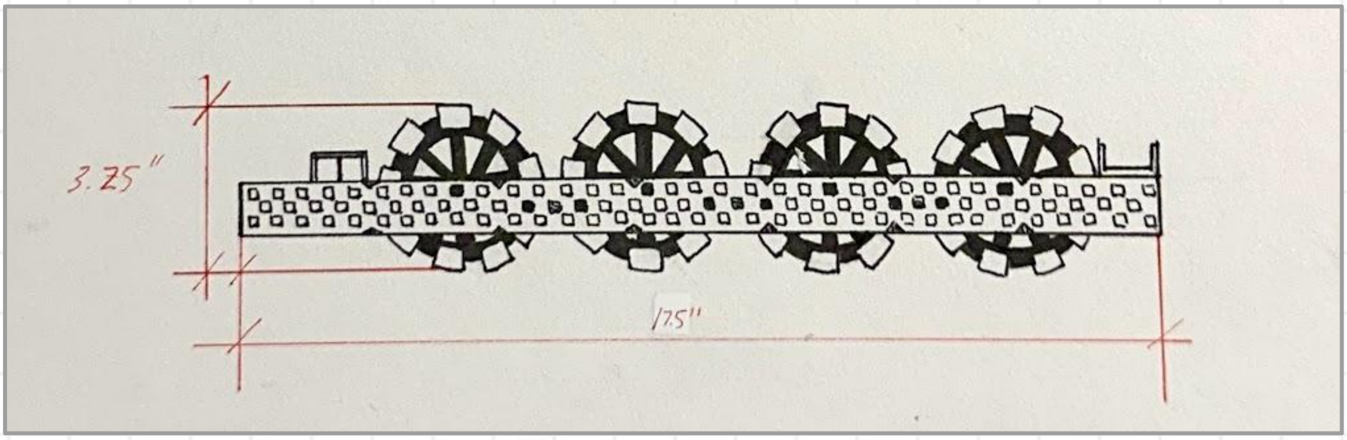
Drivetrain

Sketch Plan

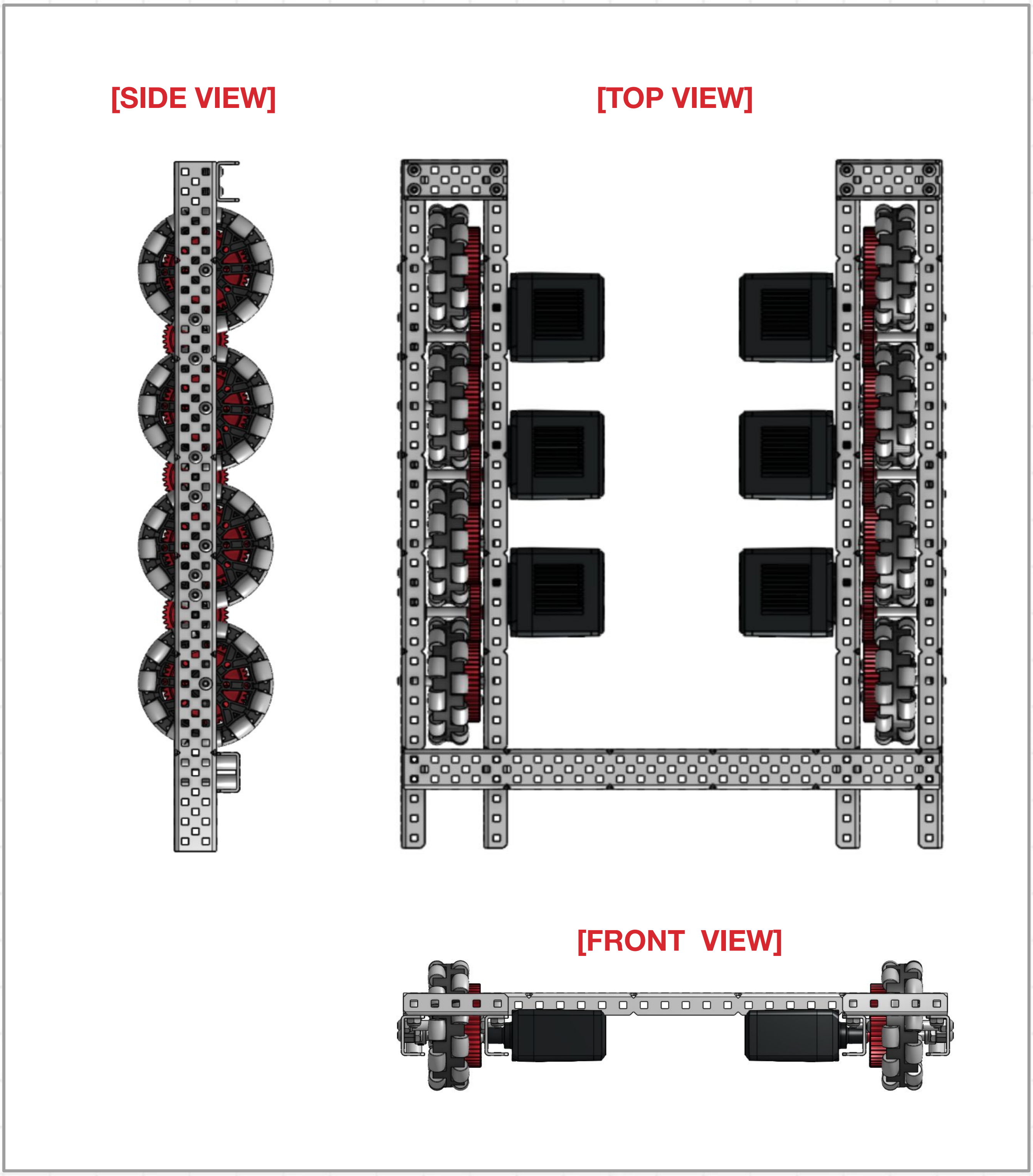




Drivetrain

As we've yet to select a shooting mechanism, we want a flatter bot, henceforth not stacking the motors, as it might have an effect on the mechanism

CAD Plan



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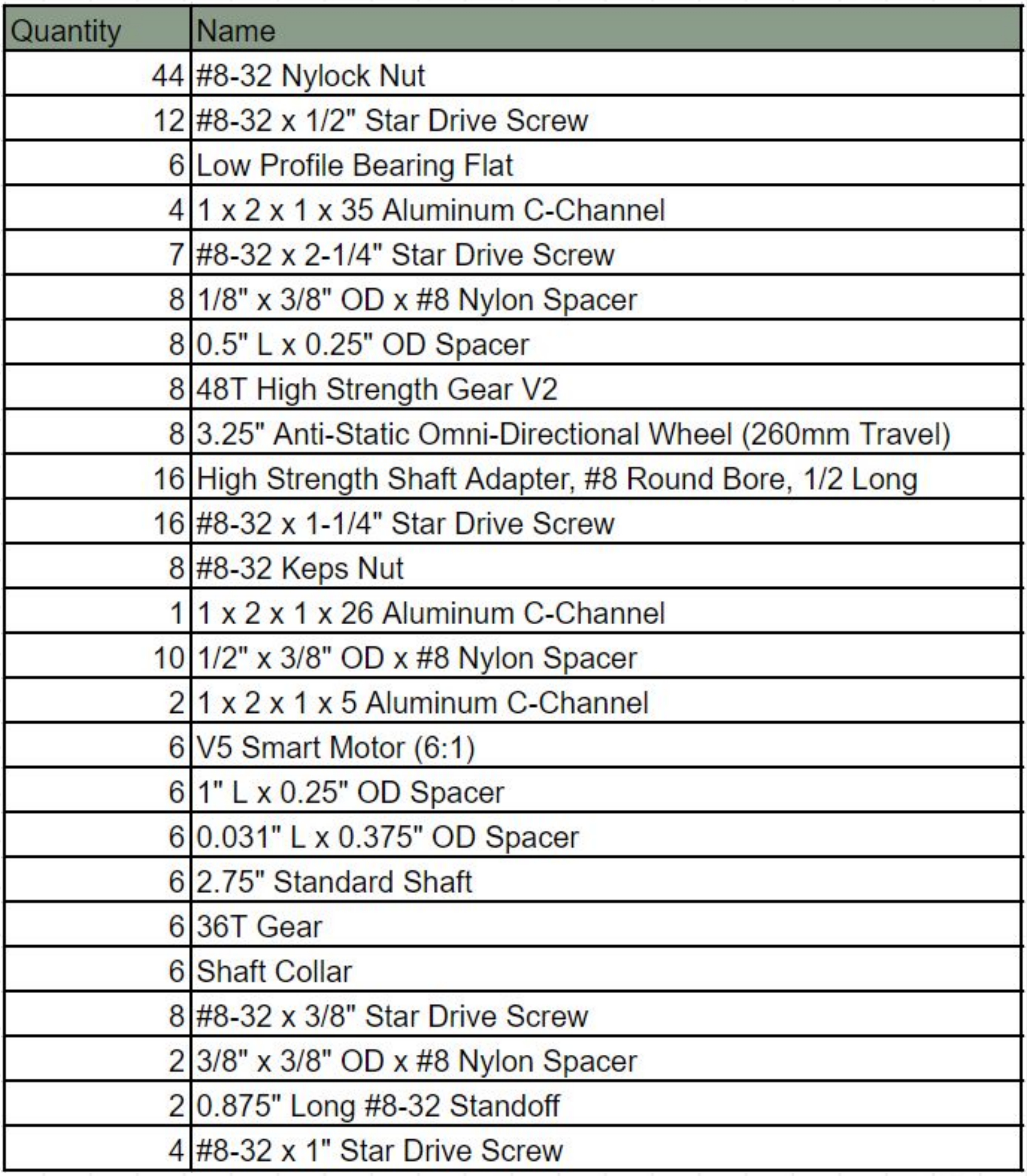

Quantity	Name
44	#8-32 Nylock Nut
12	#8-32 x 1/2" Star Drive Screw
6	Low Profile Bearing Flat
4	1 x 2 x 1 x 35 Aluminum C-Channel
7	#8-32 x 2-1/4" Star Drive Screw
8	1/8" x 3/8" OD x #8 Nylon Spacer
8	0.5" L x 0.25" OD Spacer
8	48T High Strength Gear V2
8	3.25" Anti-Static Omni-Directional Wheel (260mm Travel)
16	High Strength Shaft Adapter, #8 Round Bore, 1/2 Long
16	#8-32 x 1-1/4" Star Drive Screw
8	#8-32 Keps Nut
1	1 x 2 x 1 x 26 Aluminum C-Channel
10	1/2" x 3/8" OD x #8 Nylon Spacer
2	1 x 2 x 1 x 5 Aluminum C-Channel
6	V5 Smart Motor (6:1)
6	1" L x 0.25" OD Spacer
6	0.031" L x 0.375" OD Spacer
6	2.75" Standard Shaft
6	36T Gear
6	Shaft Collar
8	#8-32 x 3/8" Star Drive Screw
2	3/8" x 3/8" OD x #8 Nylon Spacer
2	0.875" Long #8-32 Standoff
4	#8-32 x 1" Star Drive Screw

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Drivetrain

Coding for the drivetrain

Let Y be controller Y position, ranging from -1 to 1 (forward/back)
Let X be controller X position, ranging from -1 to 1 (turning)
Rm is the right drivetrain velocity, ranging from -1 to 1
Lm is the left drivetrain velocity

Normally, classic drive code involves setting:

Rm = Y + X
Lm = Y - X

The curve profile of the drive is directly proportional by the ratio between the 2 sides of the drivetrain, Rm/Lm.
However, the problem with this code is that once Y+X or -Y-X reaches a value over 1, the ratio breaks down. This means that for higher speeds, the robot is unable to perform steeper turns. In other words, the curve profile of the drive is a function of how fast it is going.

Instead of simply capping |Y| and |X| when they are over 1, the proper solution is to proportionally bring both values down using division. This ensures the ratio remains constant across all ranges of speeds, capping the speed of the turn once motor speed > 100%. Overall, this means that the drive code is normalised and easier to work with.

In reality, you obviously don't want to be linearly mapping your controller Y and X position directly to the motor’s speed. You want smooth acceleration, and controllability while driving. This cannot be achieved with linear mapping, as there will be sudden starts and stops.

You want some sort of mapping to ensure non linearity. We do this by applying a custom function to our original input. It is essentially a glorified log curve, tunable to the driver’s preferences.

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Implementation:

1) read the controller input
2) apply custom curve to it to ensure smooth acceleration and deceleration.
3) create finalised motor speeds based on curvature and input data
4) Normalise values to ensure motor speed is never greater than 100%. This holds curvature profile constant.
5) Apply motor speeds!

Some problems that we experienced during drivetrain coding is that: Joystick values are actually given in values -127 to 127, not -1 to 1. We had to scale this down!

We also learned that you can set motor values either with -127 to 127, or from -100% to 100%. Using the wrong one sets a different speed to the motor!

For the future, we plan to tune our curves in a more optimal manner, as our driver is still overshooting some turns.

Here is our final drive code

```
int scaledY = (pros::E_CONTROLLER_ANALOG_LEFT_Y/100);
    int scaledX = (pros::E_CONTROLLER_ANALOG_RIGHT_X/100);
    int scaledY = master.get_analog(ANALOG_LEFT_Y);
    int scaledX = master.get_analog(ANALOG_RIGHT_Y);
    int leftSpeed = scaledY + (abs(scaledY) * scaledX);
    int rightSpeed = scaledY - (abs(scaled) * scaledX);
    if (rightSpeed > 1) {
      leftSpeed = rightSpeed / leftSpeed;
    }
    if (leftSpeed > 1) {
      rightSpeed = leftSpeed / rightSpeed;
//more scaling code
    }
```

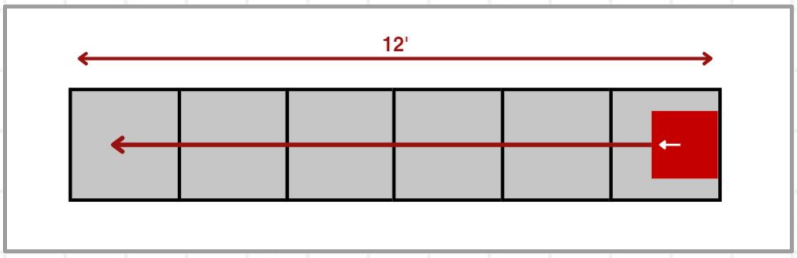
Goal

Testing the solution to see if it meets our set requirements.

TEST NO. 1 : SPEED

Procedure

I. Place robot on corner of the field
II. Start stopwatch
III. Drive robot forward until it touches the other side of the field
IV. Stop stopwatch



KEY

→	Direction
🟥	Robot Drivetrain

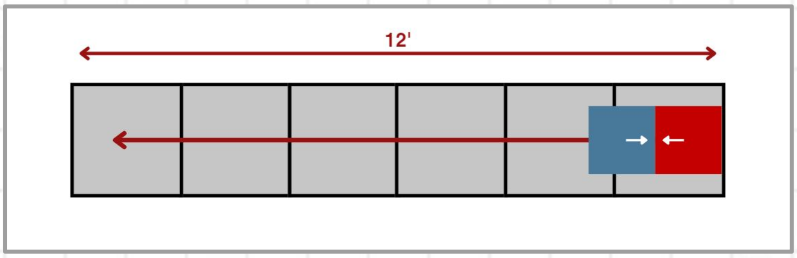
Test	1	2	3	4	5
	2.39s	2.42s	2.37s	2.38s	2.40s

Average: 2.39

TEST NO. 2 : PUSHING POWER

Procedure

I. Place robot on corner of the field
II. Place our "Spin Up" robot in front of drivetrain and start stopwatch
III. Drive robot forward until the "Spin Up" robot touches the other side of the field
IV. Stop stopwatch



KEY

→	Direction
🟥	Robot Drivetrain
🟦	Spin Up robot

Test	1	2	3	4	5
	4.04s	3.93s	3.98s	4.10s	3.97s

Average: 4.00

TEST NO. 3 : MOTOR LIFE

Procedure

I. Start stopwatch
II. Drive robot around field
III. When robot starts to have difficulty manoeuvring, stop stopwatch]
IV. Wait 10 minutes for motors to cool off, then repeat

Test	1	2	3	4	5
	2.49 min	2.52 min	2.55 min	2.46 min	2.51 min

Average: 2.5

Conclusion

Overall, we are very happy with our results

- **Robot will be able to drive across the field in around 2.4 seconds**
  - We will be able to drive to the other side of the field to score triballs into the field in around that time
- **Robot can push another robot across the field in around 4 seconds**
  - This means that we can confidently defend
- **Motors start to overheat at around 2 minutes and 30 seconds**
  - We should be cooling down the robot between matches

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Shooting mech

DEFINE A PROBLEM
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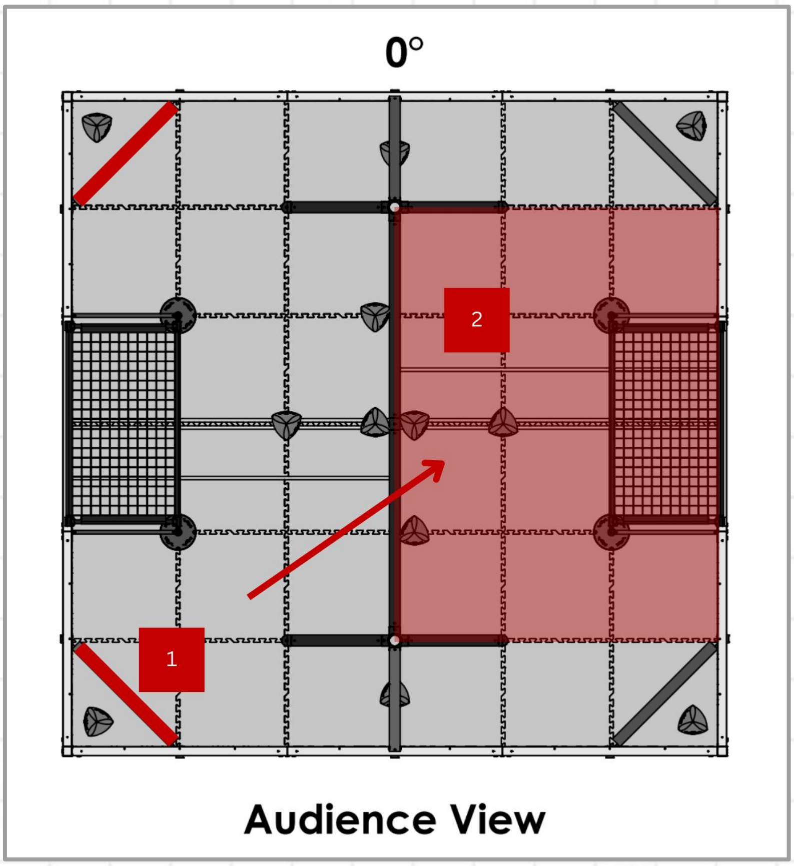
Goal

Selecting and building a shooting mechanism in order to efficiently move the triballs across the field when matchloading.

Why is a shooting mechanism important?

- Allows us to move the triball in the most efficient way (to the other side of the field)

- Allows us to match load more often/faster. As our first goal is to get the majority of the triballs to the side that you are scoring in (i.e nearest to the goal) so that either we or our alliance team can push them in.



KEY

🟥 : Matchload bars

: Alliance

▭ : General zone to aim

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Shooting mech

Ideal Characteristics of a Shooting mechanism

PERFORMANCE

- **Accuracy**
  - Being able to consistently hit a scoring zone is crucial.
  - Unlike the previous season, this season's scoring zone is much wider. Nevertheless, the closer you can get the triball to the goal the easier it is for you to push the triballs in.
- **Reliability**
  - The mechanism should be durable and have a minimal risk of jamming or misfiring.
  - We need to be able to use this mechanism constantly since in Over Under match loading is key to scoring the most points. So all failures will cost us many points, which will likely significantly lower our chances of winning a match
- **Consistency**
  - The performance should be able to shoot with the same accuracy over multiple shots
  - Allows us to efficiently use our time, spending more time match loading instead of repositioning over time.
- **Range**
  - Being able to shoot long distance vital for match loading as we must touch the bar in order to place the triball on the robot.
  - We must be able to shoot across the field in order to be near the goal(I.e across the barrier
- **Firing rate**
  - A fast firing rate allows for more shots in a shorter amount of time
  - The less time we spend on match loading the more time we have to push the triballs in the goal (in skills) as well as for playing offence and defence during matches

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Shooting mech

DESIGN

- **Simplicity**
  - Inverse relationship with number of things that can go wrong, making the mechanism more reliable.
  - We need to account for, the amount of factors that can go awry for each drivetrain
- **Ease of coding**
  - Likelihood of being unable to find errors is low and makes variables easily adjustable.
  - We need to account for how many factors require calculations and how effectively we can divide buttons for the mechanism.
- **Ease of building**
  - Higher efficiency and easier to fix errors
  - We must account the amount of parts and connections required as well as any non-typical items required on the drivetrain as well as any potential issues that may occur with this design

EXTRA ASPECTS

- **Size**
  - The bigger the shooting mechanism, the less space we'll have for other potential components
  - We must account for how much the space the mechanism will take in the robot
- **Weight**
  - Weight division impacts the robot's balance
  - We must account the general weight of the mechanism (I.e. weight of components)

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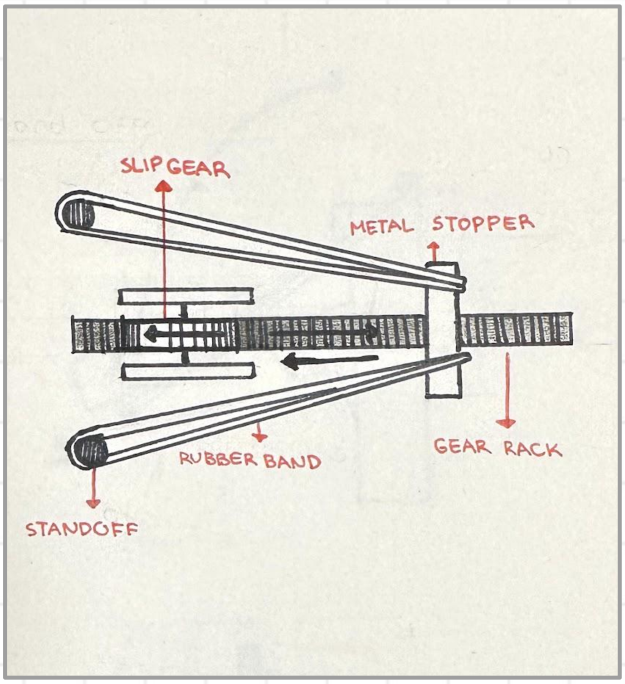
Shooting mech

POSSIBLE MECHANISMS

Linear Puncher

Characteristics:

- Shooting is powered by rubber bands
- Gear with shaved teeth that spins on a rack
- Once the gear loses contact with the rack, the elastic bands propel the rack forwards "punching" the object in front of it



PROS

- Compact
- Simple
- No energy is lost to spin

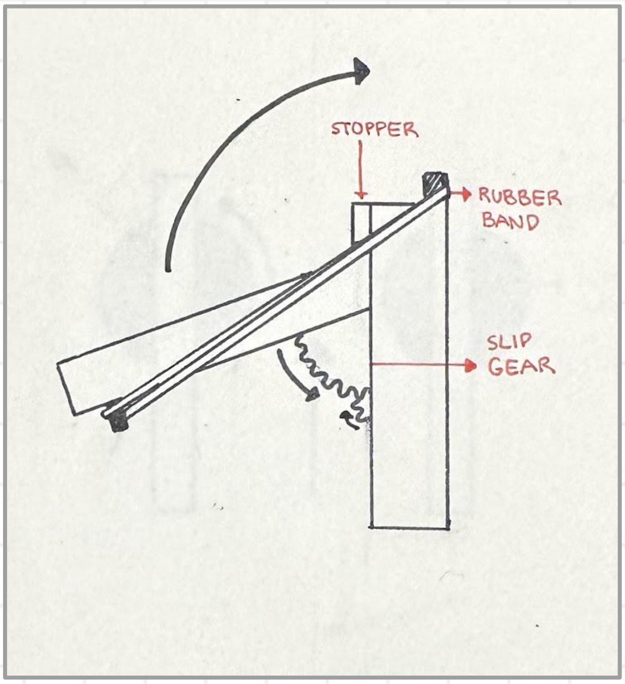
CONS

- Prone to wear and tear
- Friction

Catapult

Characteristics:

- Shooting is powered by rubber bands
- Utilizes rotational movement
- Rotates a mechanical arm



PROS

- Versatility
- Force is easy to tune
- Different ways to power

CONS

- Difficulty tuning for a specific firing distance
- Limited to a specific range of motion

CONTINUED FROM PAGE:

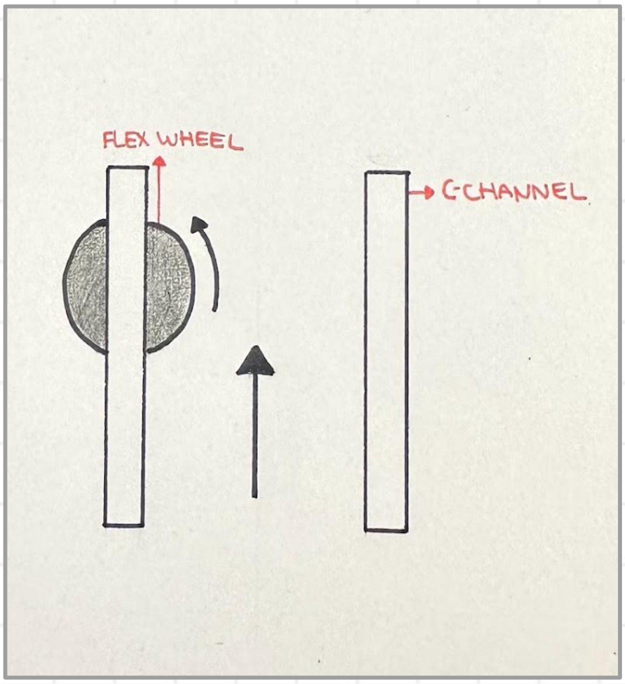
Shooting

Shooting mech - comparing options

Single Flywheel

Characteristics:

- Powered by a wheel spinning at a high rpm
- Uses a backplate (which can either be straight or curved) opposite to the wheel

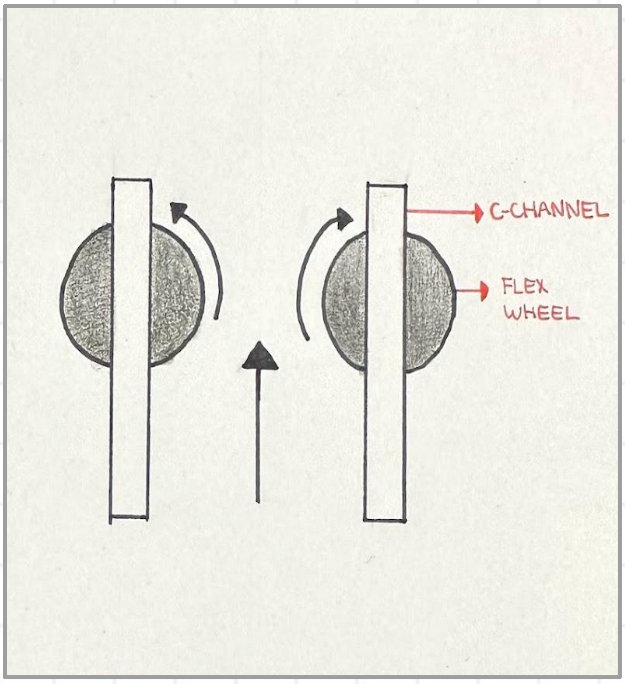


PROS	CONS
Precise	Large
Simple	Friction
Shoots far	Slow recovering rate

Double Flywheel

Characteristics:

- Same as the single flywheel with a few differences
- Instead of a backplate, it is replaced by another wheel spinning at the same rpm as the other
- Both wheels spin in opposite directions



PROS	CONS
Fast	Complex
Easy tuning	Heavy
Shoots straight forward	Large

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

DATE:
DESIGNED BY:
WITNESSED BY:

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Shooting mech

Sling

Characteristics:

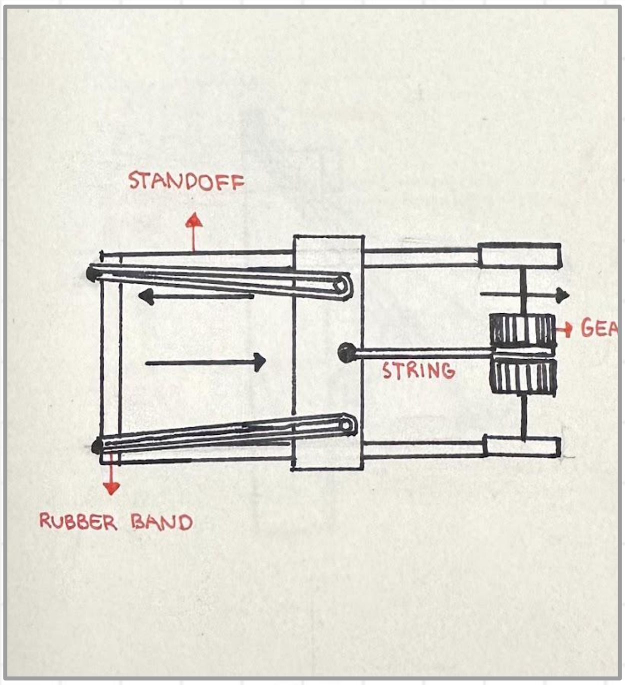
- Shooting is powered by rubber bands
- Sling is pulled back then released to shoot.

PROS

- Adaptability
- Rapid firing

CONS

- Complexity
- Reload time
- Limited range



Slapper

Characteristics:

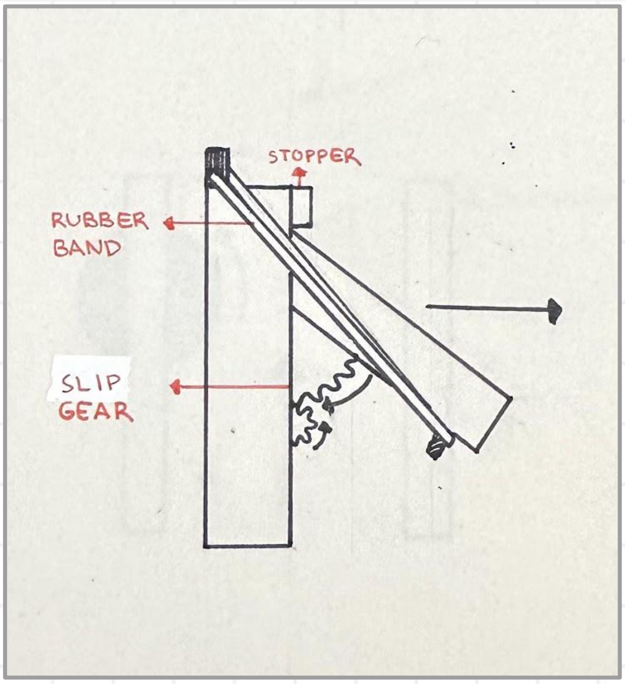
- Upside down catapult
- Utilizes rotational movement
- Rotates a mechanical arm

PROS

- Can push tribal in the goal
- Different ways to power (motor or piston)

CONS

- Easily blocked
- Difficulty tuning



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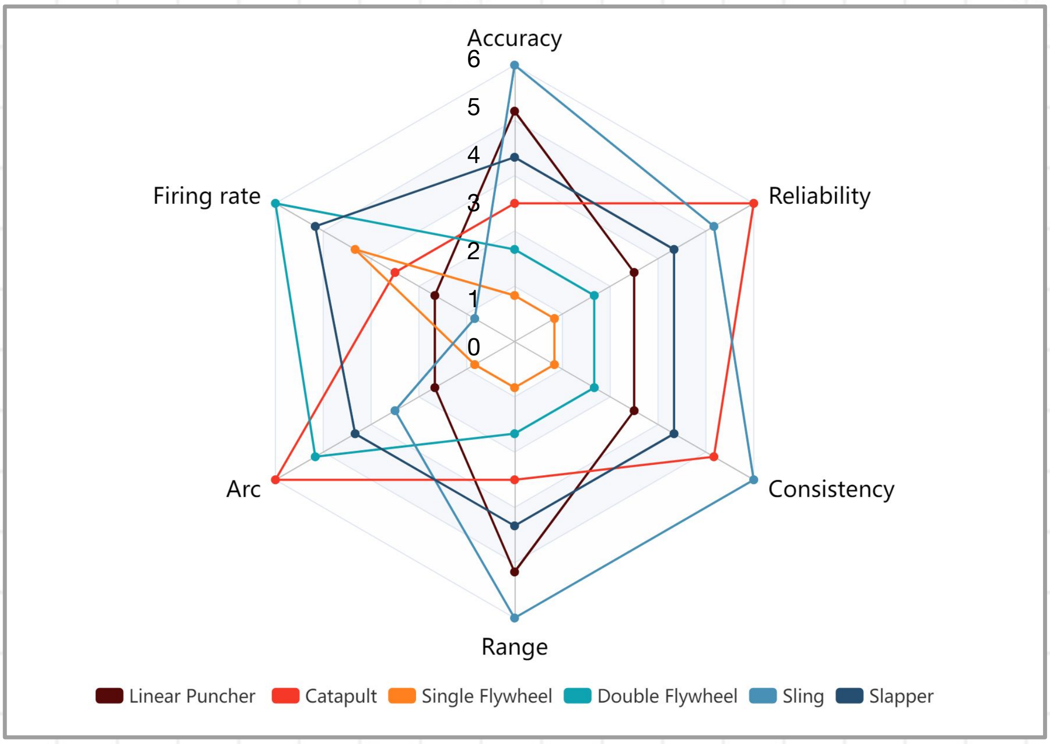
Shooting mech

Radar graphs and Tables

Robots are ranked from a scale of 1-6 compared to one another
6 being best and 1 being worst

Note: Being unable to do an action is considered a 1

PERFORMANCE



Table

	Linear Puncher	Catapult	Single Flywheel	Double Flywheel	Sling	Slapper
Accuracy	5	3	1	2	6	4
Reliability	3	6	1	2	5	4
Consistency	3	5	1	2	6	4
Range	5	3	1	2	6	4
Arc	2	6	1	5	3	4
Firing rate	2	3	4	6	1	5
Average	3.33	4.33	1.5	3.17	4.5	4.17

From the average of the performance, we can see that the catapult has an advantage.

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Shooting mech

DEFINE A PROBLEM
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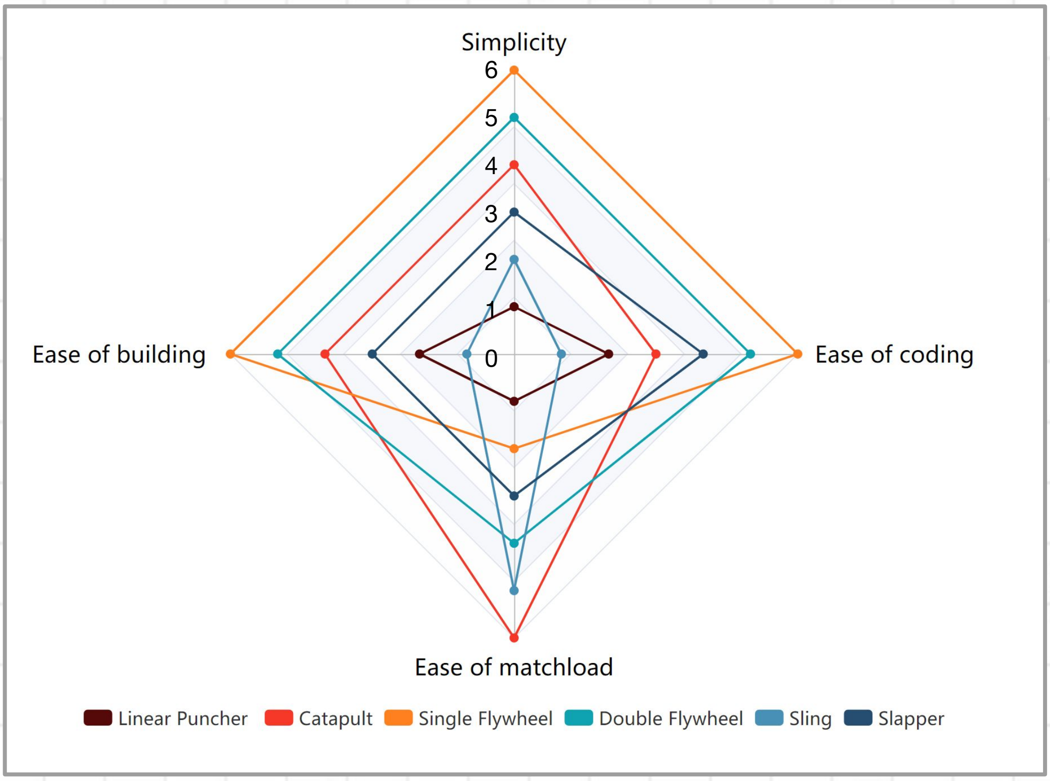
TESTING SOLUTION

DESIGN



Table

	Linear Puncher	Catapult	Single Flywheel	Double Flywheel	Sling	Slapper
Simplicity	1	4	6	5	2	3
Ease of coding	2	3	6	5	1	4
Ease of matchload	1	6	2	4	5	3
Ease of building	2	4	6	5	1	3
Average	1.5	4.25	5	4.75	2.25	3.25

From the average of design, we can see that the single flywheel has an advantage.

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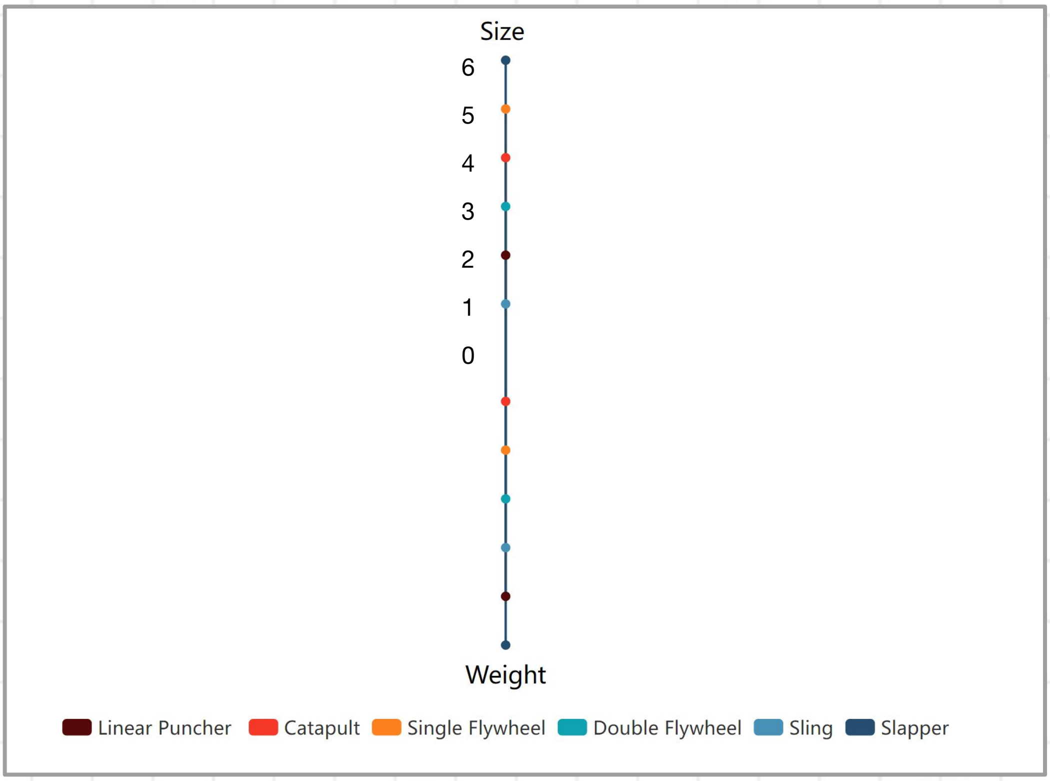
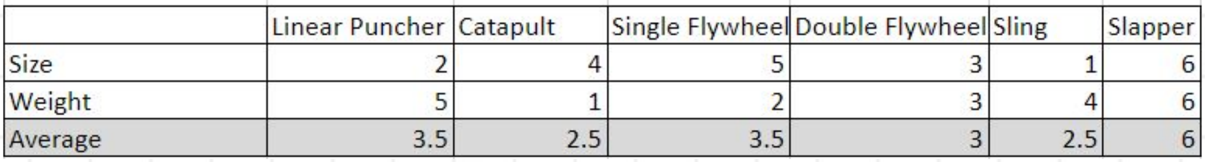
Shooting mech

EXTRA ASPECTS



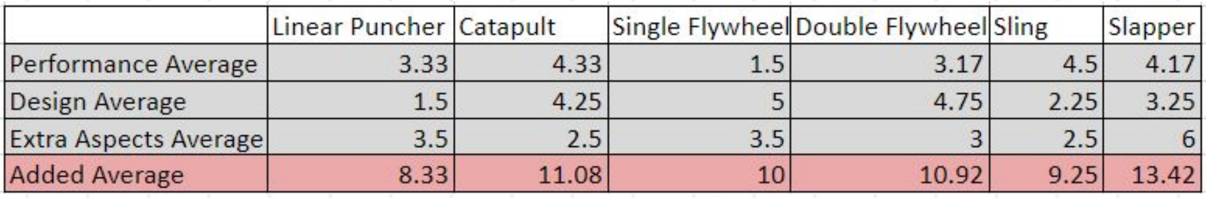
Table



	Linear Puncher	Catapult	Single Flywheel	Double Flywheel	Sling	Slapper
Size	2	4	5	3	1	6
Weight	5	1	2	3	4	6
Average	3.5	2.5	3.5	3	2.5	6

From the average of design, we can see that the slapper has an advantage.

Conclusion for Shooting Mechanism Design



	Linear Puncher	Catapult	Single Flywheel	Double Flywheel	Sling	Slapper
Performance Average	3.33	4.33	1.5	3.17	4.5	4.17
Design Average	1.5	4.25	5	4.75	2.25	3.25
Extra Aspects Average	3.5	2.5	3.5	3	2.5	6
Added Average	8.33	11.08	10	10.92	9.25	13.42

DEFINE A PROBLEM
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Shooting mech

DEFINE A PROBLEM
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Conclusion

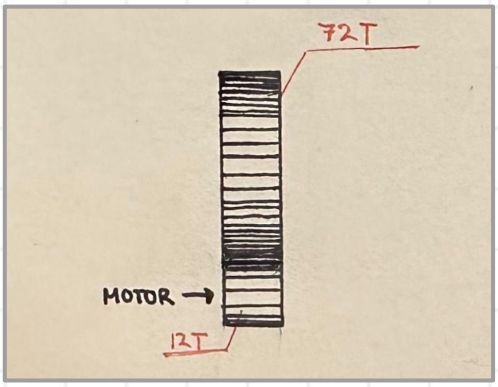
From the added averages, we can see that the catapult has the highest added average.

We will be selecting the catapult

Catapult Gearing

We chose 3 potential gear ratios for the catapult that we are most comfortable with. In 3 different cycle speeds.

Fast cycle: 72:12 → 8:1



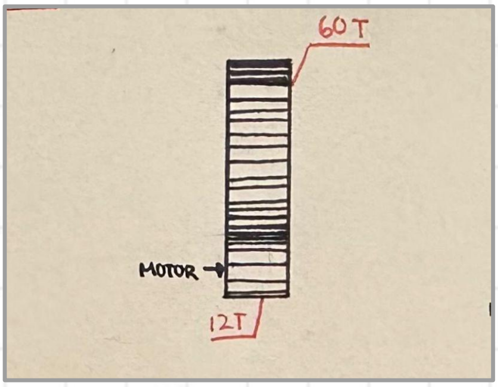
PROS

- Quick release
- Better for shorter distances

CONS

- Reduced power as trade-off for speed is reduced power
- Limited range and impact
- Hard to matchload without practice

Medium cycle: 60:12→ 5:1



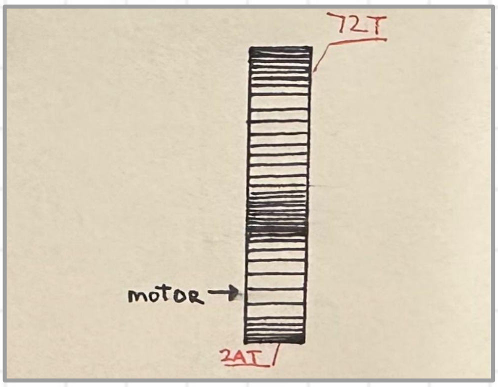
PROS

- Balanced in speed and power
- Moderate range

CONS

- Not best for extreme speed or power

Slow cycle: 72:24 → 3:1



PROS

- Max power
- High accuracy

CONS

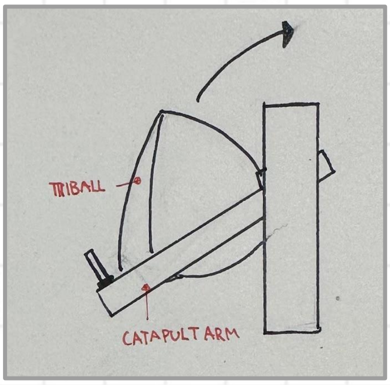
- Slower release

Match Loading

We have decided on two possible ways of match loading, each for different purposes

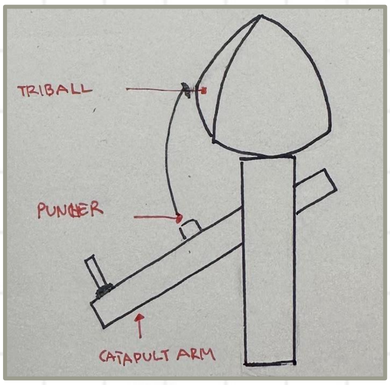
I: INSIDE THE CATAPULT (CATAPULT)

- Used when robot is being defended against
- Less likely to be knocked off/dislodged
- Distance travelled of triball will be shorter



2: IN FRONT THE CATAPULT (PUNCHER)

- Used in optimal situations
- Used in skills
- Triball will travel a bit further



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Shooting mech

DEFINE A PROBLEM
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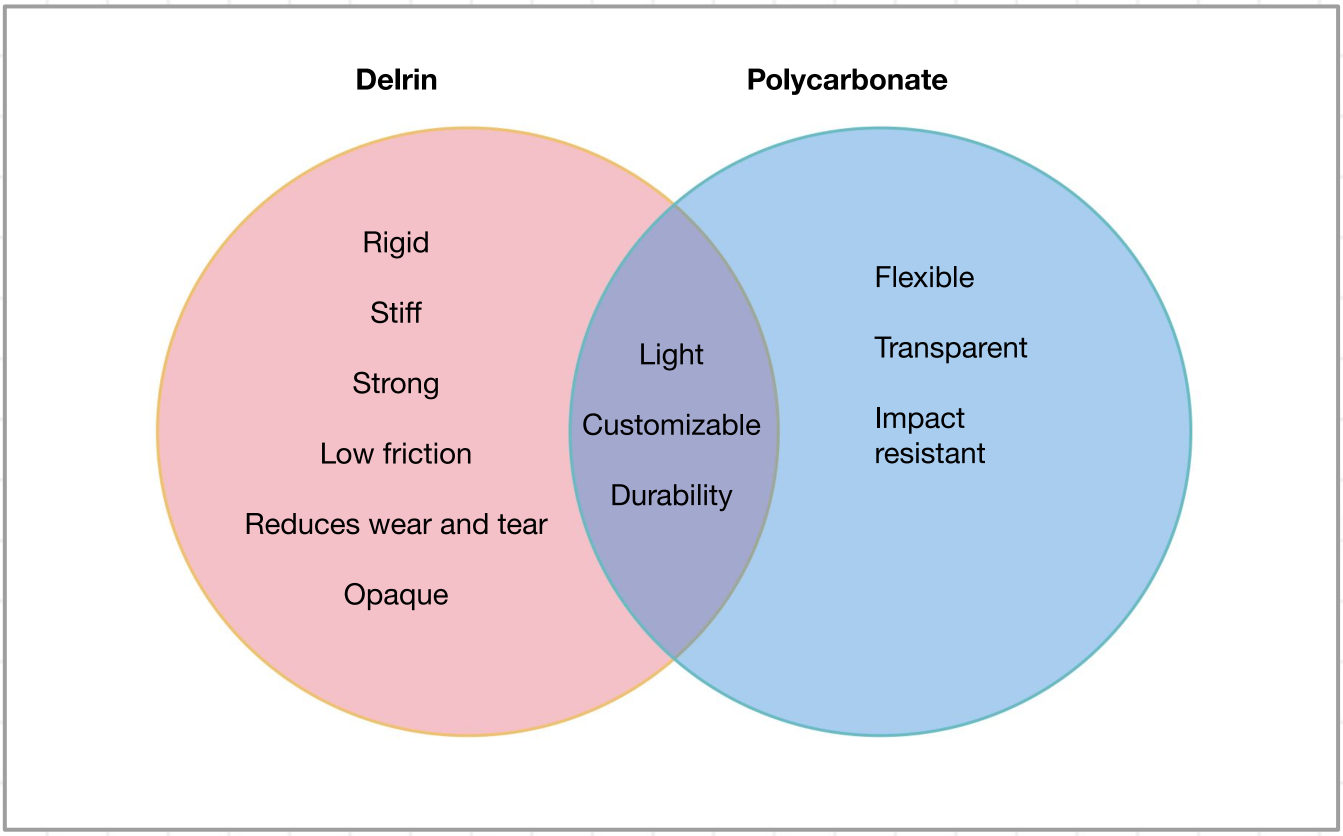
Plastic

Deciding what plastic to use to create a bottom surface for position 2

We currently have 2 types of plastic in stock

Delrin vs Polycarbonate



Delrin

Polycarbonate

Rigid

Stiff

Strong

Low friction

Reduces wear and tear

Opaque

Light

Customizable

Durability

Flexible

Transparent

Impact resistant

Selection

Polycarbonate

- Impact resistant and flexible, we've decided to use that to create a smooth surface to set the Triball on
- We do not need it to be durable as the plastic will be placed on a surface which will give it enough support

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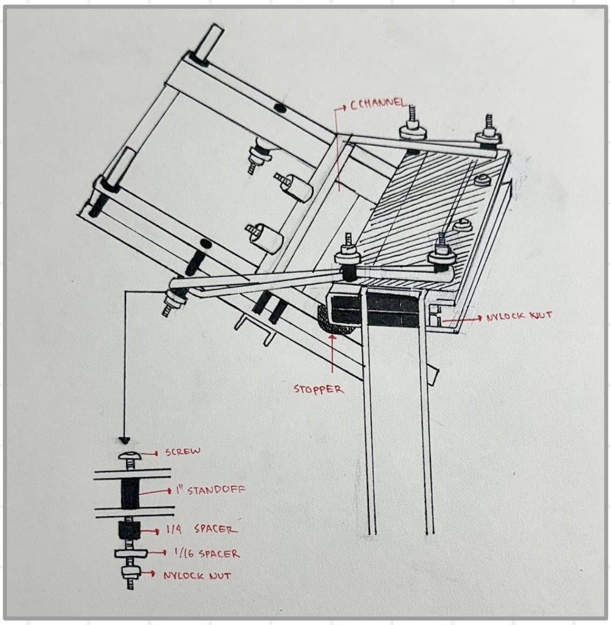
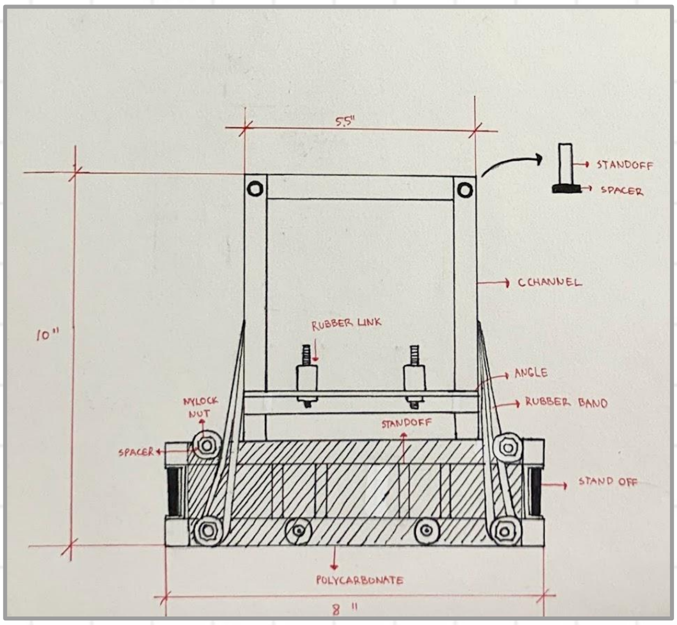
Shooting mech

Sketch Plan

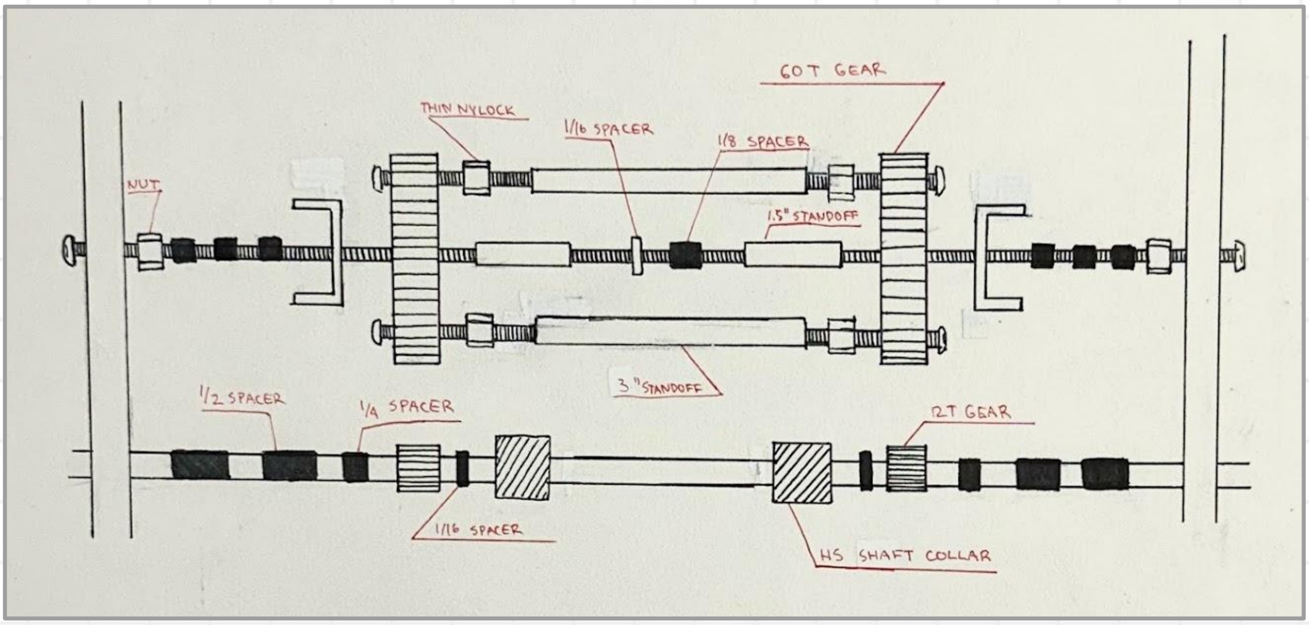
[ISOMETRIC VIEW]

[TOP VIEW]





Spacing of front



DEFINE A PROBLEM
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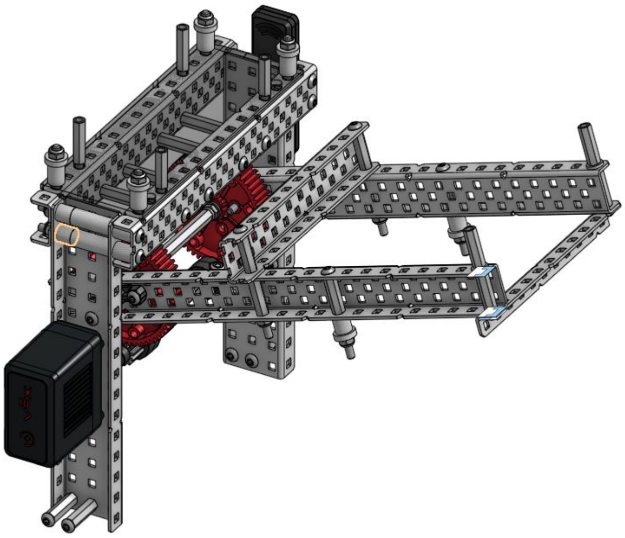
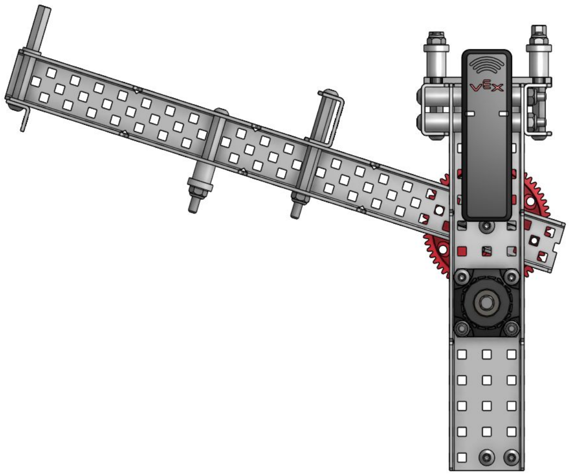
Shooting mech

Radar graphs and Tables

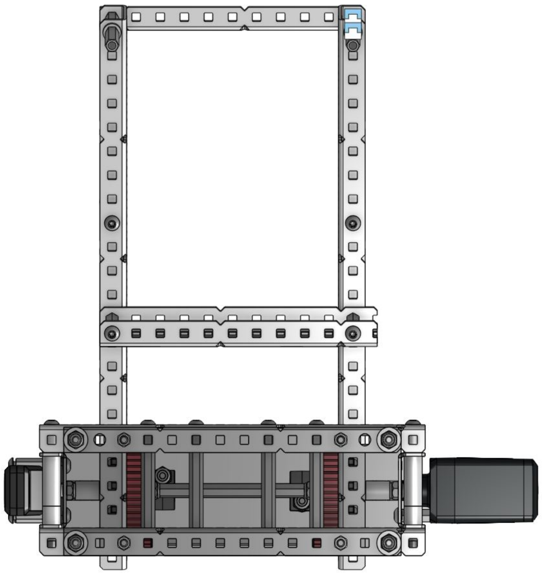
[ISOMETRIC VIEW]



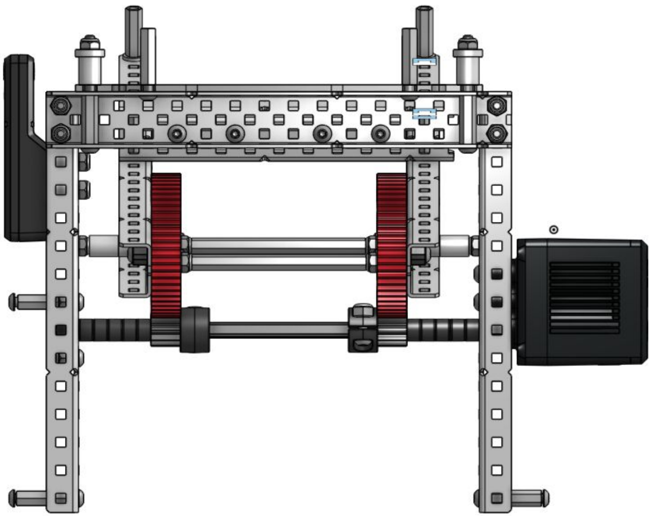
[SIDE VIEW]



[TOP VIEW]

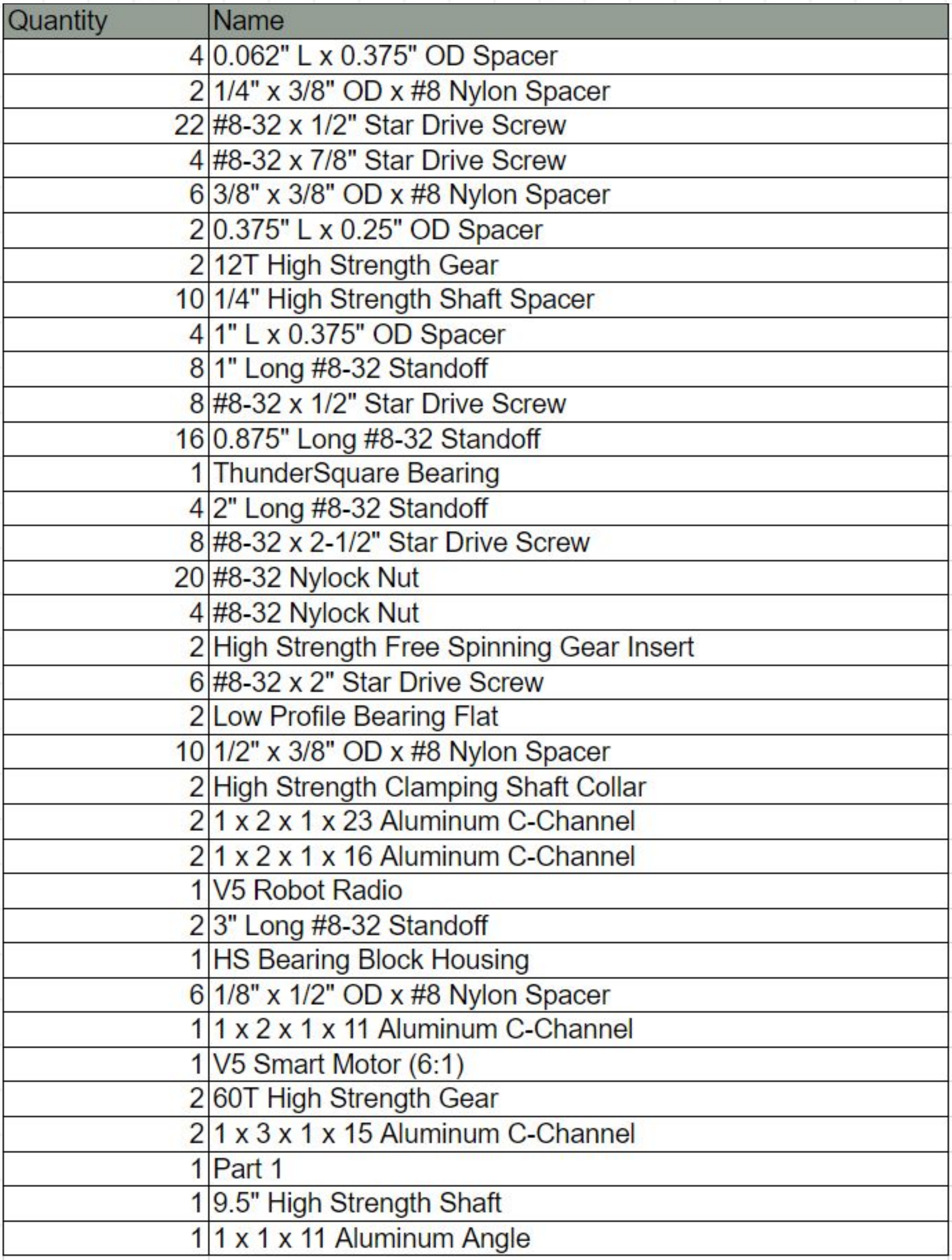


[FRONT VIEW]



Shooting mech - BOM

BOM



Quantity	Name
4	0.062" L x 0.375" OD Spacer
2	1/4" x 3/8" OD x #8 Nylon Spacer
22	#8-32 x 1/2" Star Drive Screw
4	#8-32 x 7/8" Star Drive Screw
6	3/8" x 3/8" OD x #8 Nylon Spacer
2	0.375" L x 0.25" OD Spacer
2	12T High Strength Gear
10	1/4" High Strength Shaft Spacer
4	1" L x 0.375" OD Spacer
8	1" Long #8-32 Standoff
8	#8-32 x 1/2" Star Drive Screw
16	0.875" Long #8-32 Standoff
1	ThunderSquare Bearing
4	2" Long #8-32 Standoff
8	#8-32 x 2-1/2" Star Drive Screw
20	#8-32 Nylock Nut
4	#8-32 Nylock Nut
2	High Strength Free Spinning Gear Insert
6	#8-32 x 2" Star Drive Screw
2	Low Profile Bearing Flat
10	1/2" x 3/8" OD x #8 Nylon Spacer
2	High Strength Clamping Shaft Collar
2	1 x 2 x 1 x 23 Aluminum C-Channel
2	1 x 2 x 1 x 16 Aluminum C-Channel
1	V5 Robot Radio
2	3" Long #8-32 Standoff
1	HS Bearing Block Housing
6	1/8" x 1/2" OD x #8 Nylon Spacer
1	1 x 2 x 1 x 11 Aluminum C-Channel
1	V5 Smart Motor (6:1)
2	60T High Strength Gear
2	1 x 3 x 1 x 15 Aluminum C-Channel
1	Part 1
1	9.5" High Strength Shaft
1	1 x 1 x 11 Aluminum Angle

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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DEFINE A PROBLEM
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TESTING SOLUTION

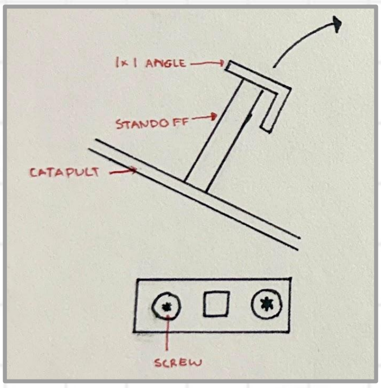
Slapper

Creating a “slapper” to contact with the triball in order to push it forwards

Standoffs + L

Characteristics:

- 1x1 aluminium stick out with standoffs



PROS

- Transfer all energy to triball

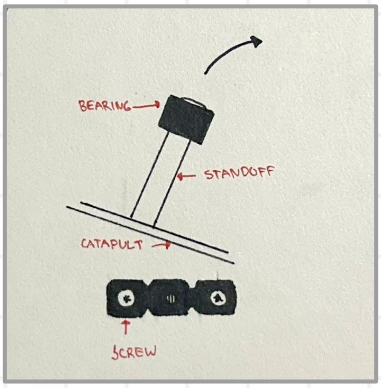
CONS

- Small contact point

Standoffs + bearing

Characteristics:

- Bearing stick out with standoffs



PROS

- Transfer all energy to triball

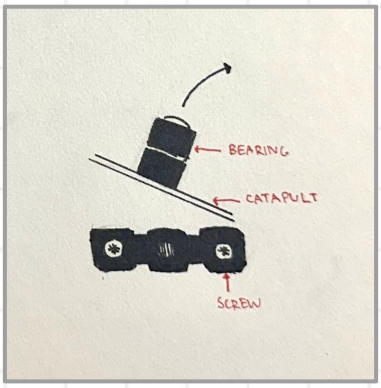
CONS

- Small contact point

Stacked bearings

Characteristics:

- 2 bearing stacked on top



PROS

- Transfer most energy to triball

CONS

- Smaller contact point

CONTINUED FROM PAGE:

Shooting mech

Shooting mech - Matchload slapper

Standoffs

Characteristics:

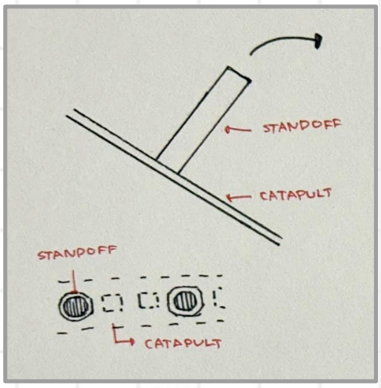
- 2 standoff

PROS

- Transfer all energy to triball

CONS

- Small contact point
- Damage triball



Rubber bumper

Characteristics:

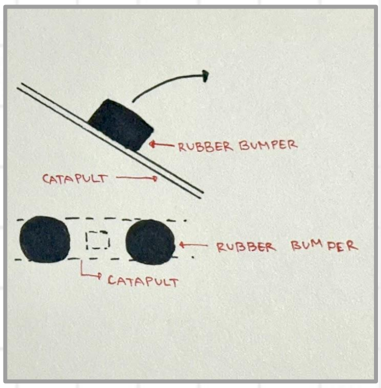
- Two rubber bumper

PROS

- Lager contact point

CONS

- Small amount energy transfer to rubber bumper



Conclusion

As we do not have rubber bumpers, which would have been our first choice. We're going with our 2nd choice of standoffs + L as we feel that it will have a larger point of contact with the triball

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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BRAINSTORM, EVALUATE, CHOOSING SOLUTION
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TESTING SOLUTION

CONTINUED FROM PAGE:

Shooting mech

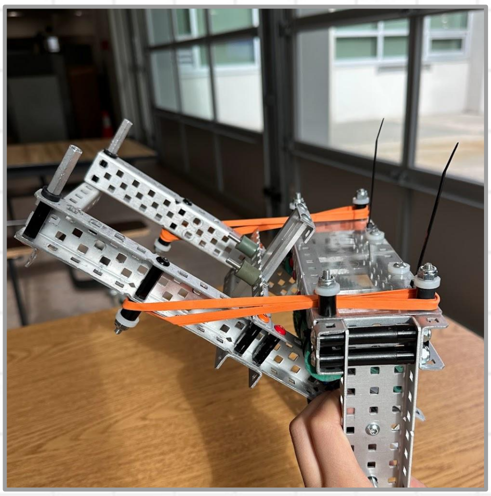
Pictures

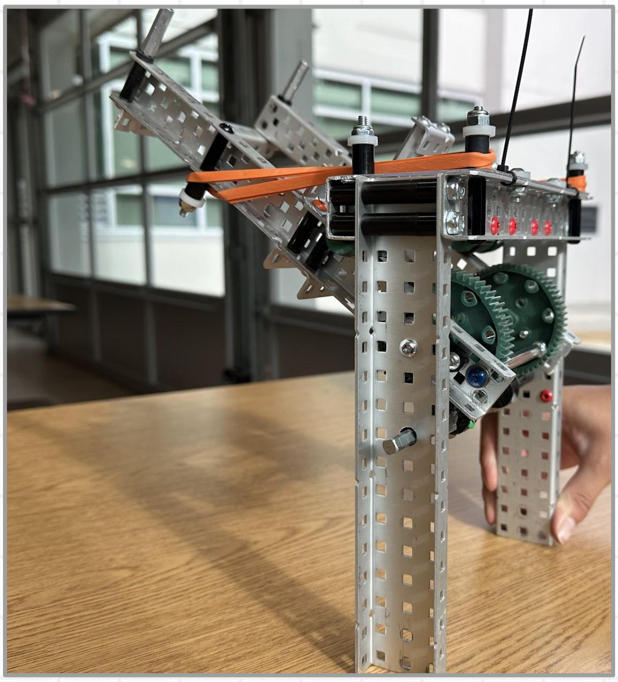
We chose to use orange bands as they are

- Strong
- Durable

We've added a stopper to help distribute the force when the catapult shoots up.

The 2 zip ties are to help the triballs not fall forward when matchloading in front





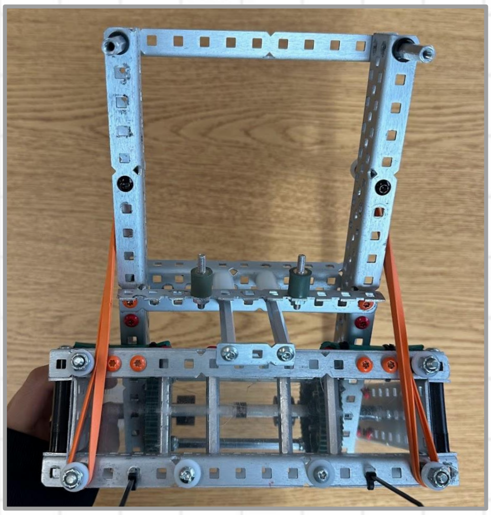
Placement for elastics are likely to change as we tune and test.
Here we attached them to spacers. Since they're smooth, they increase the lifespan of the bands

Catapult gears are attached with screw joints to better hold it together

Standoffs are placed between metal to reinforce it. Allowing the structure to be more durable

We have 2 rubber links and 2 standoffs to help keep the triball in place once we matchload into the catapult

- Needs to be secure as the only time we matchload into the catapult is when other robots are defending against us



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Shooting mech

Mounting

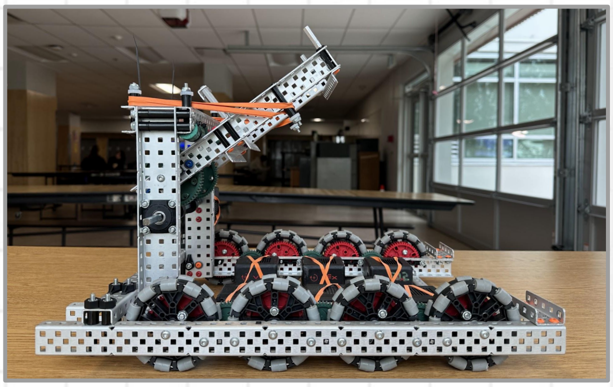
Placement: back of the robot towards the end

- Saves space for the intake and any other components we decide to add in the future

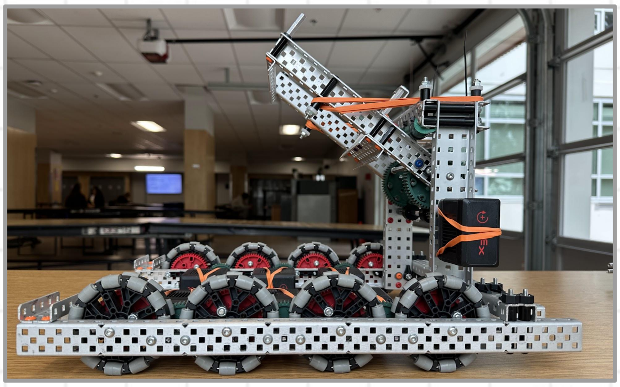
Considerations

Weight imbalance, as the catapult is not light. Hopefully we can balance out the weight by adding an intake, else our robot might get tipped over during matches.

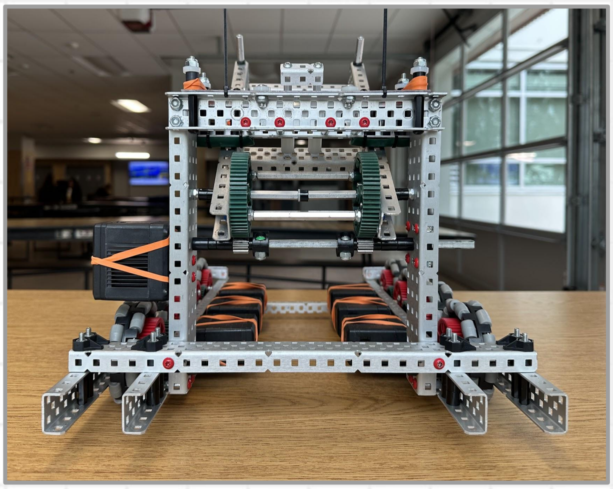
[RIGHT SIDE VIEW]



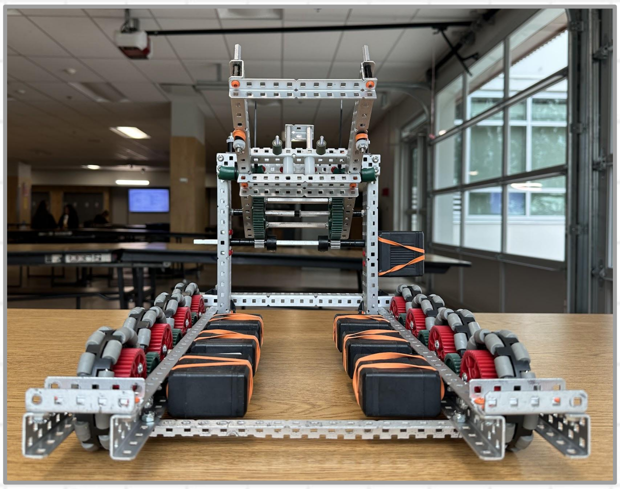
[LEFT SIDE VIEW]



[FRONT VIEW]



[BACK VIEW]



Shooting mech

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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TESTING SOLUTION

Goal

Testing best match load placements

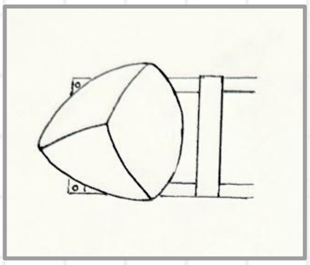
TEST NO. 1 : INSIDE THE CATAPULT

Procedure

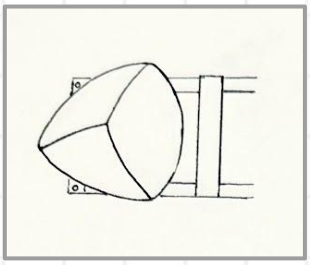
I. Find all possible Triball placements
II. Place robot in matchloading position(as if touching the bar)
III. Launch 3 times from each position
IV. Compare arc and final position

Here are 3 possible placements

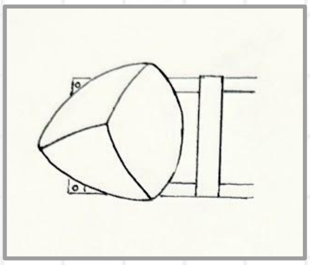
Position No. 1



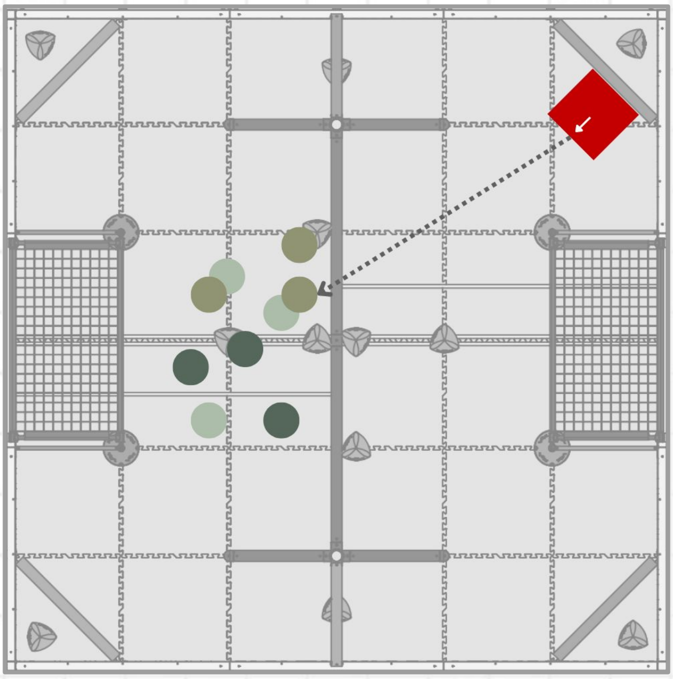
Position No. 2



Position No. 3



Initial landing points



KEY

🟥 Robot

········▸ Shooting direction

● Landing point of position no. 1

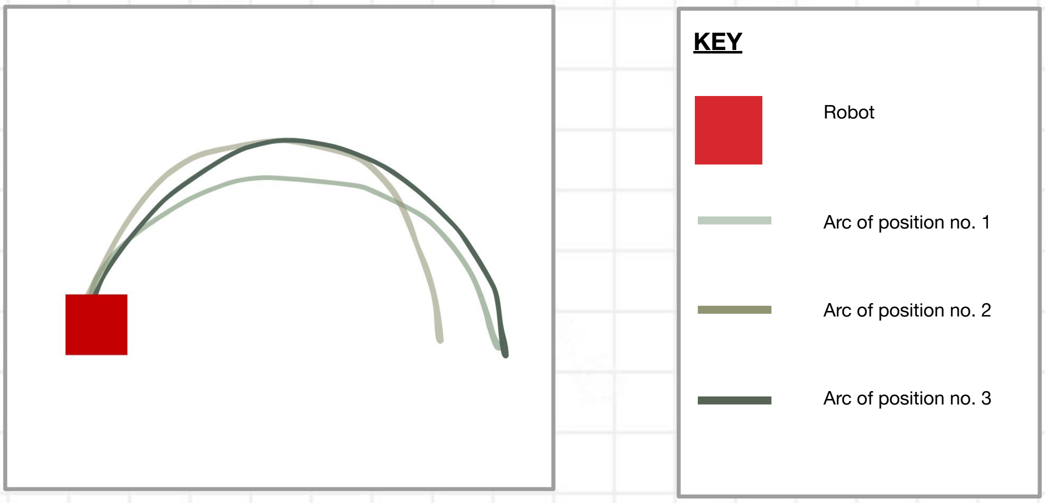
● Landing point of position no. 2

● Landing point of position no. 3

CONTINUED FROM PAGE:

Shooting mech

Arc



Note: After initial landing, Triballs roll in different directions in unpredictable ways

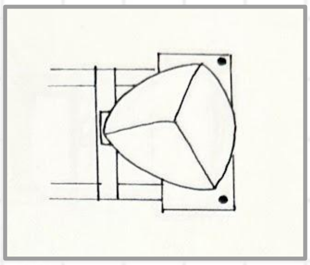
TEST NO. 2 : IN FRONT OF THE CATAPULT

Procedure

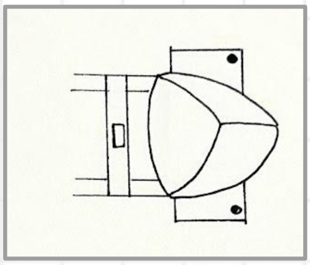
I. Find all possible Triball placements
II. Place robot in matchloading position(as if touching the bar)
III. Launch 5 times from each position
IV. Compare arc and final position

Here are 2 possible placements

Position No. 1



Position No. 2



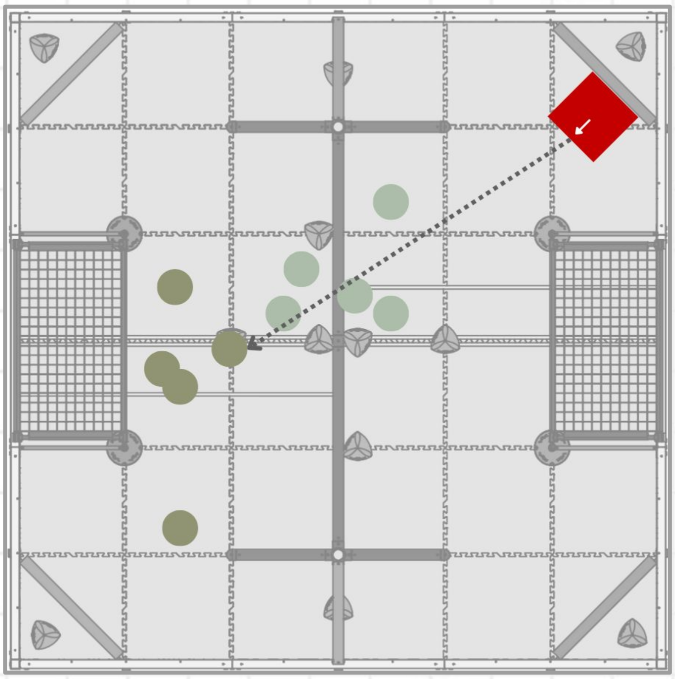
DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

CONTINUED FROM PAGE:

Shooting mech

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Initial landing points



KEY

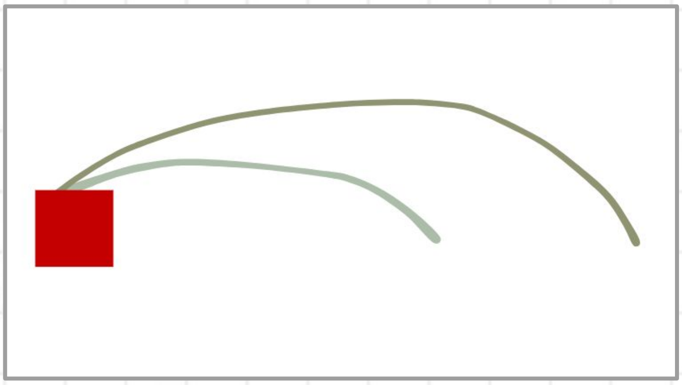
🟥 Robot

·········► Shooting direction

● Landing point of position no. 1

● Landing point of position no. 2

Arc



KEY

🟥 Robot

▬ Arc of position no. 1

▬ Arc of position no. 2

Conclusion

- Placement does not matter as much when we match load into the catapult
  - Position 3 is most ideal due to higher arc(can shoot over other robots) and longer distance
- When we match load in front of the catapult, position matters a lot
  - Position 2 is most ideal as due to longer distance covered

CONTINUED FROM PAGE:

Goal

Creating an intake to interact with triballs.

Why is an intake important?

- **Triball Collection**
  - intake can efficiently and reliably allow us to pick up Triballs from the field, allowing the robot to interact with and control them during gameplay.

- **Scoring Efficiency**
  - Quickly and accurately collecting game objects, the robot can spend more time scoring points rather than struggling to pick up or push triballs
  - This is especially important as we are only allowed to pick up 1 triball at a time

- **Autonomous Period Performance**
  - During the autonomous period of a match, where the robot operates without human input, an effective intake is crucial for completing specific tasks.
  - A robot with a reliable intake can autonomously score points or gain an advantage over opponents by efficiently scoring the triballs.

- **Strategic Gameplay**
  - Will help us score tribals individually with guaranteed precision

Ideal Characteristics

PERFORMANCE

- **Reliability**
    - The mechanism should be durable and have a minimal risk of jamming or misfiring.
    - We need to be able to use this mechanism constantly in order to smoothly pick up the triballs and putting it in the goal, after the inital groups of triballs are all pushed into the goal
- **Consistency**
    - Consistency is essential for precise and reliable gameplay.
    - The intake should consistently hold and transport triballs without dropping or mishandling them.
- **Speed**
    - Speed and efficiency are key to the later half of the match.
    - Allows us to efficiently use our time, spending more time to get more triballs within the allotted time
- **Grip and Traction**
    - The ability to grip and securely hold triballs but also to let them go (i.e out taking them) are important for scoring

DESIGN

- **Durability**
    - During matches, other robots may push our intake, potentially damaging it.
    - Our robot should also be able to withstand wear and tear throughout

EXTRA ASPECTS

Being able to cooperate well with the catapult

CONTINUED FROM PAGE:

Intake

Intake Designs

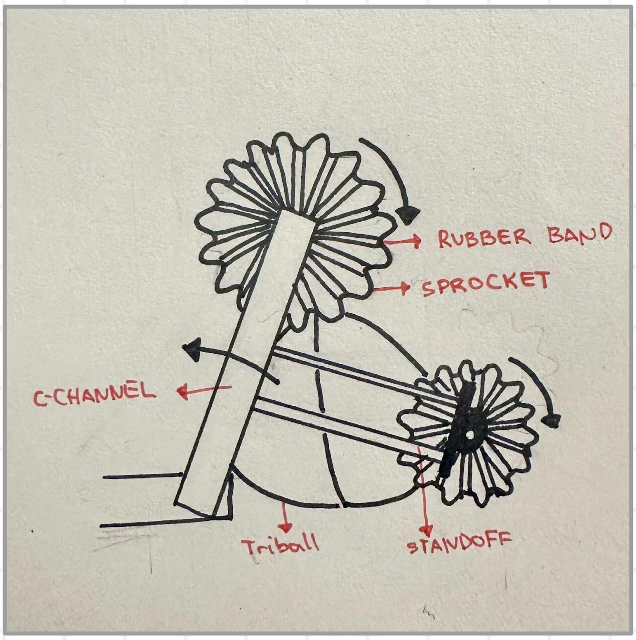
Possible designs in order to intake and score:

- Elastic Band Intake
- Side intake
- Flex Wheel Intake
- Claw Intake
- Flap Intake

Elastic Band Intake

Characteristics:

- 2 rubber band flywheel
- Build above the triball
- Pivots to allow scoring



PROS

- Larger intake
- More flexible space for tribal
- More gribl

CONS

- Risk of entanglement

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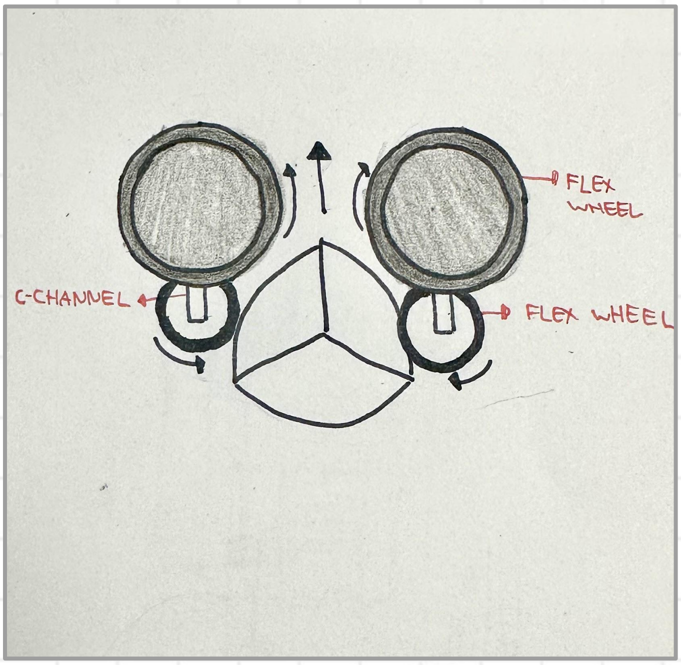
Intake

Side Intake

Characteristics:

- 2 flex wheels each sides
- Build on same level as triball



PROS

- Limit 1 triball
- Low risk of entanglement

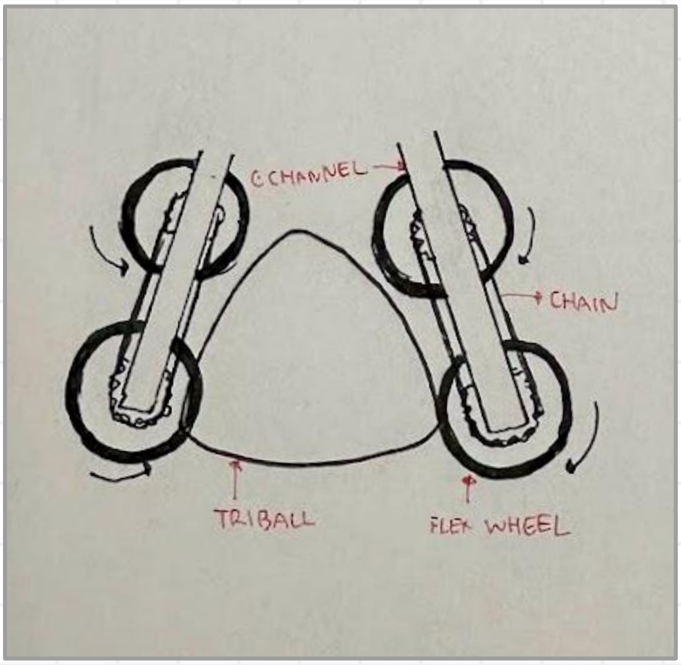
CONS

- Outtake rolls triball too far
- Smaller intake
- Risk of breaking
- Needs to flip out in the start of a game

Flex Wheel Intake

Characteristics:

- 4 Flex wheels per row
- Build above triball
- Pivots similarly to rubber band intake



PROS

- Low risk of entanglement
- Large intake

CONS

- Less flexible space for triball
- Less grib

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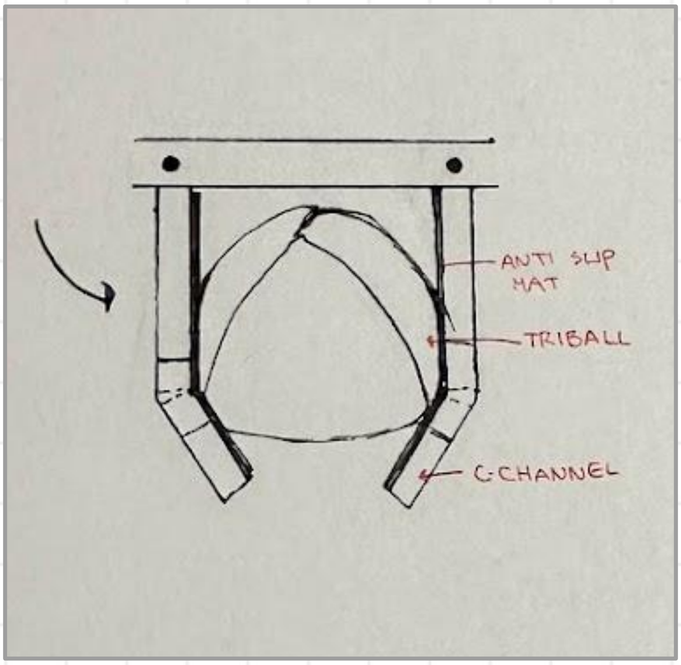
Intake

Claw Intake

Characteristics:

- Claw
- Build same level as triball



PROS

- More control on triball
- No need for a motor
- low risk of entanglement

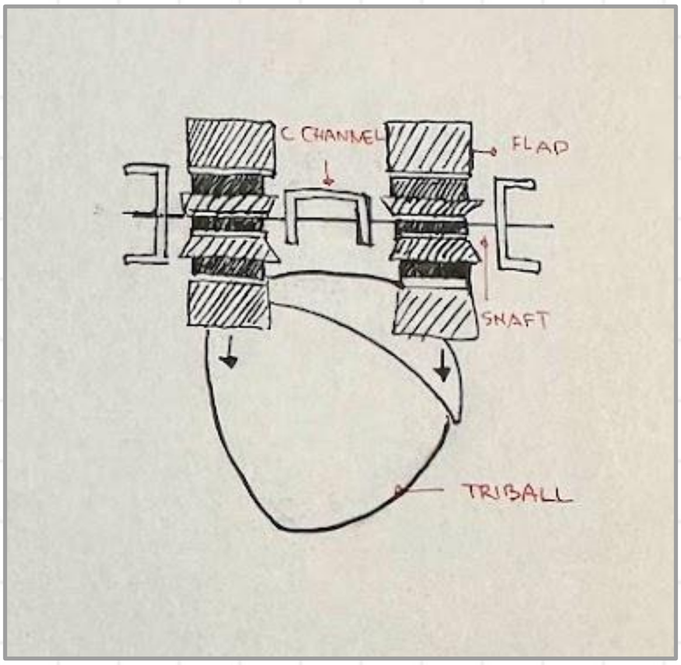
CONS

- Easy to miss target
- Needs to flip out at the beginning of a game
- Pistons can get bent

Flap Intake

Characteristics:

- Flaps attach
- Build same level as triball
- Pivots similarly to side intake



PROS

- Low risk of entanglement

CONS

- Small intake
- Mid grib

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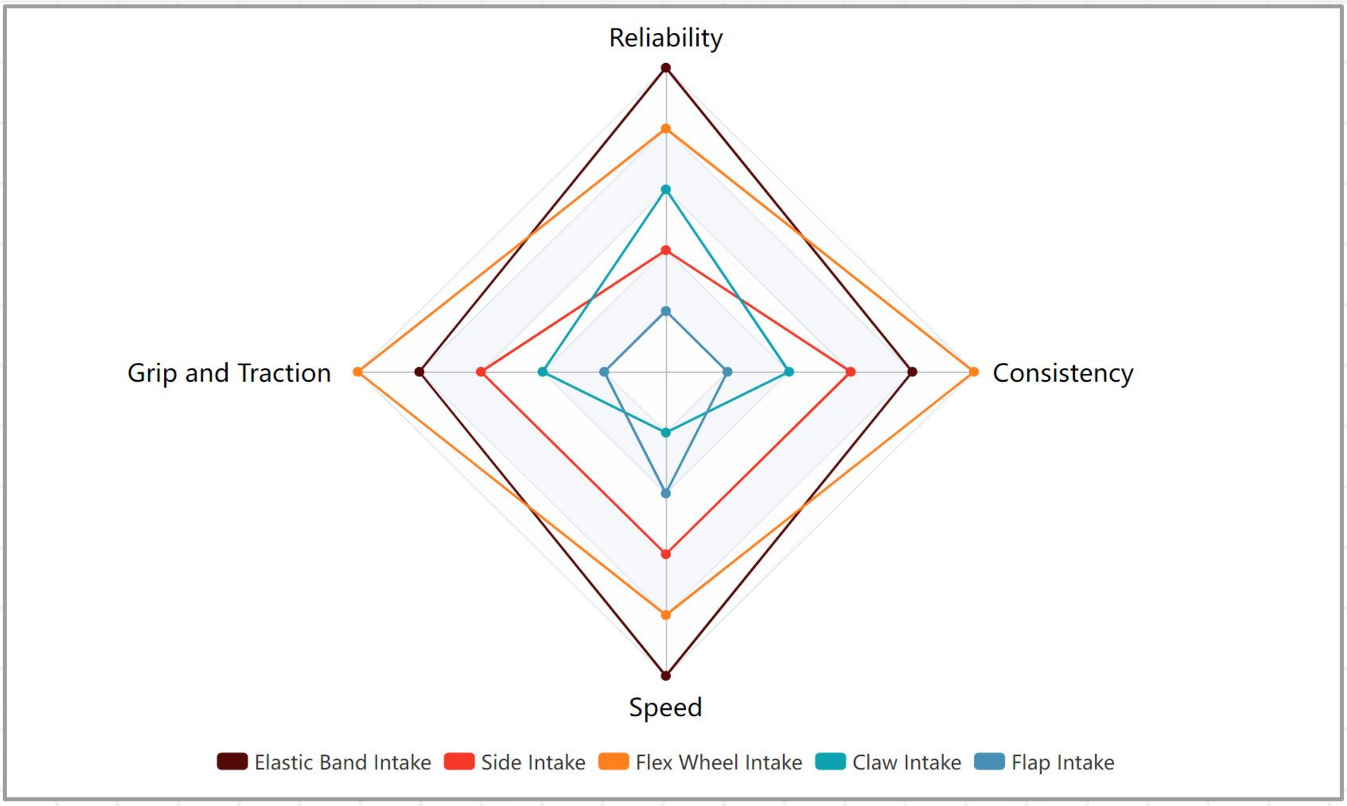
Intake

Radar graphs and Tables

Intakes are ranked from a scale of 1-5 compared to one another 5 being best and 1 being worst

Note: Being unable to do an action is considered a 1

PERFORMANCE



Table

	Elastic Band Intake	Side Intake	Flex Wheel Intake	Claw Intake	Flap Intake
Reliability	5	2	4	3	1
Consistency	4	3	5	2	1
Speed	5	3	4	1	2
Grip and Traction	4	3	5	2	1
Average	4.5	2.75	4.5	2	1.25

We value speed as we are required to only intake 1 triball at a time.
Based on the average pf performance, we've chosen to make an elastic band intake

Intake

ELASTIC BANDS

We have 4 options of elastic bands

- Soft stretch
- Colorful
- Red
- Orange

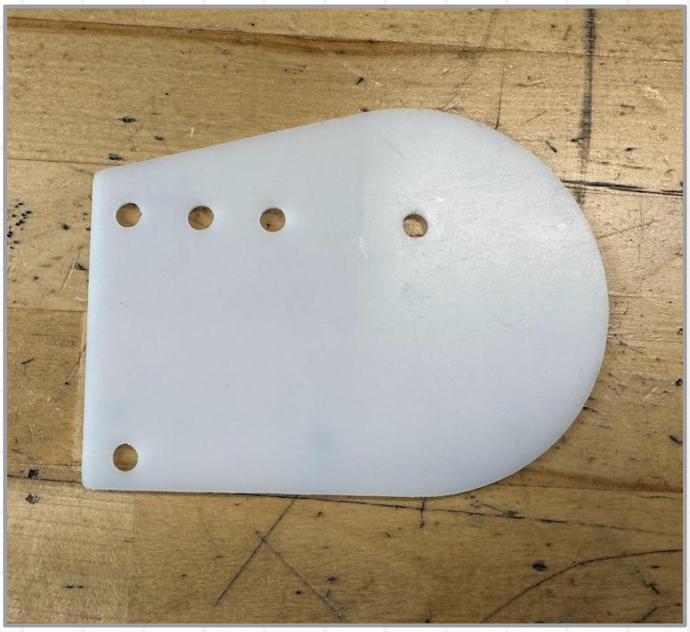
We've chosen to use soft stretch elastic bands as they are the stretchiest so it will be very helpful for intaking the triball, they are also pretty strong compared to the thing colorful rubber bands

INTERACTING WITH THE GOAL

Objective: creating sleds to allow the intake to slide off and on the top goal allowing us to smoothly score

We've chosen to use delrin as it is hard and durable, allowing us to frequently use them without worrying about it deforming or breaking

- We will be laser cutting them out and lining the intake on both sides



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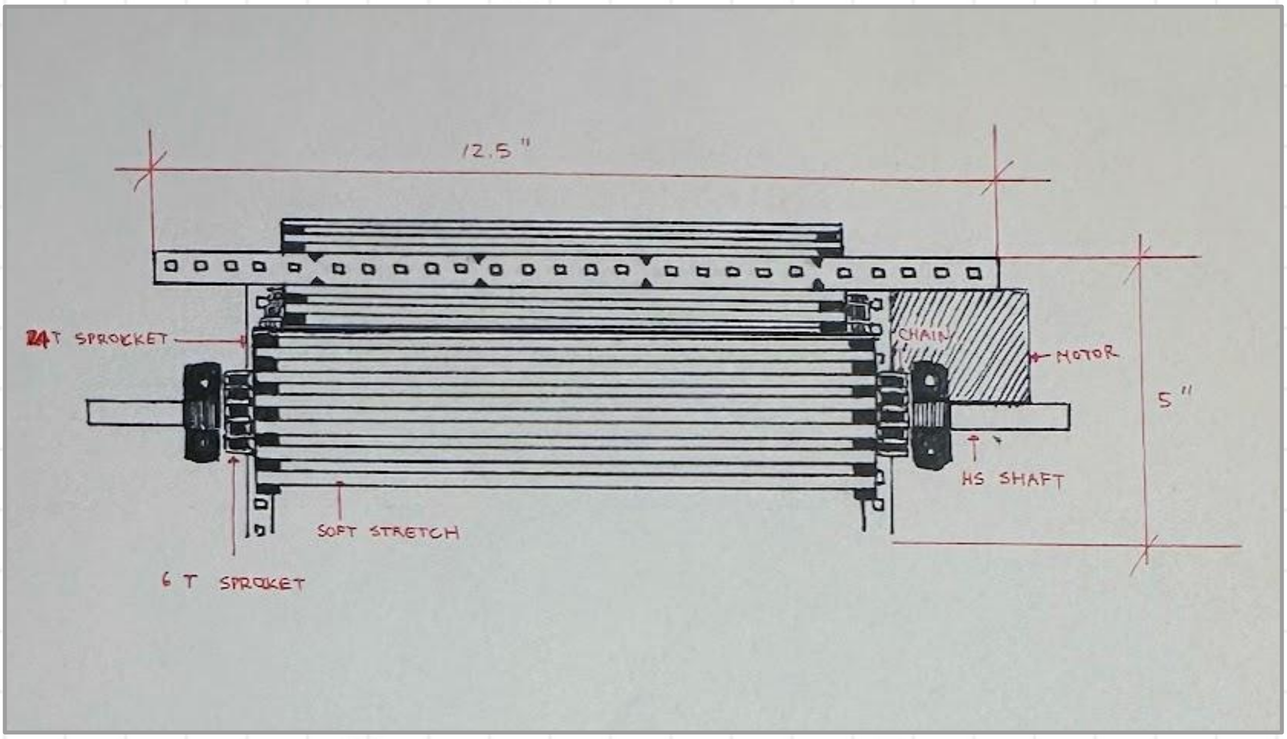
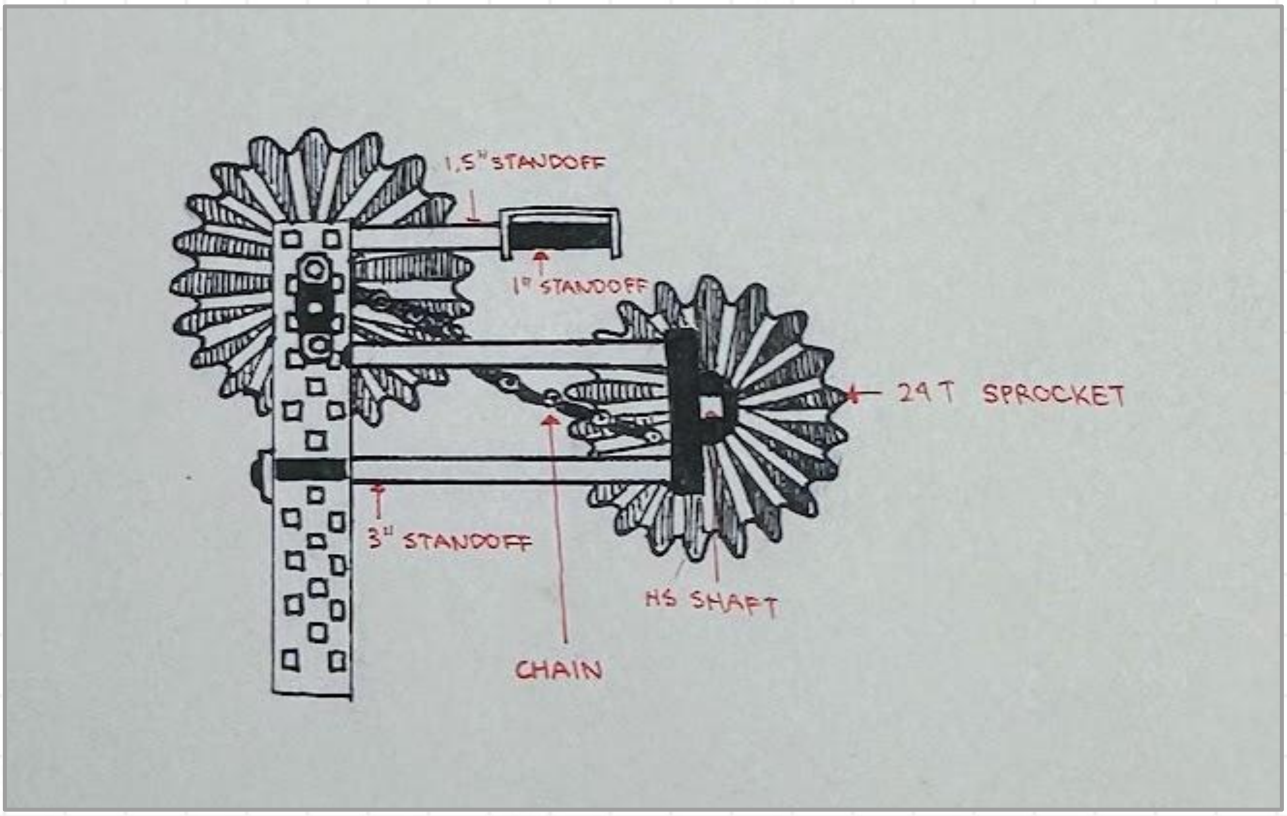
Sketch

[FRONT VIEW]



[SIDE VIEW]



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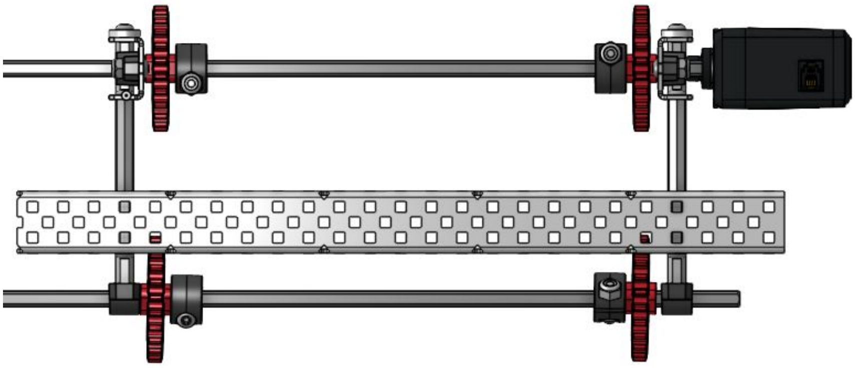
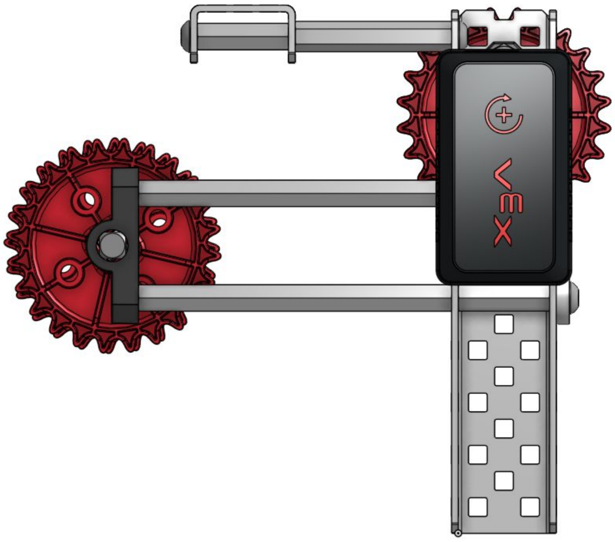
Intake

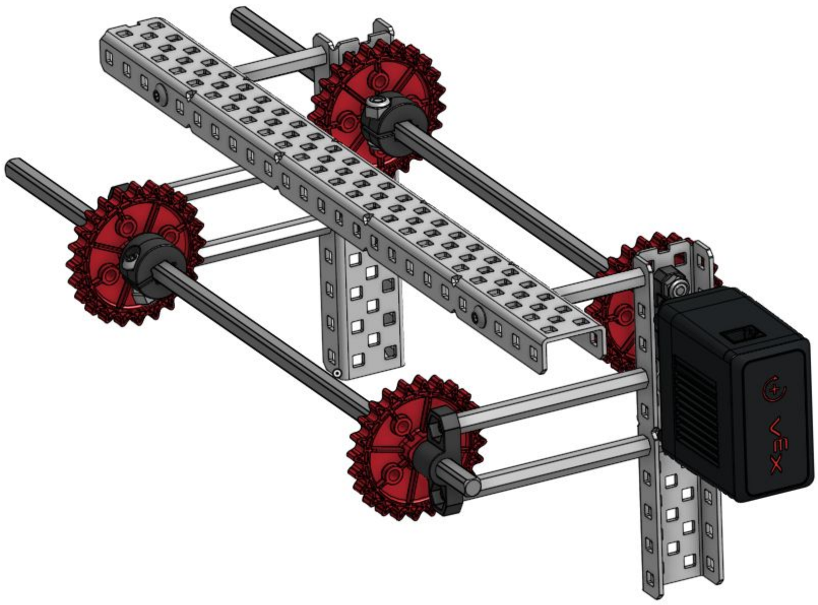
CAD



[TOP VIEW]



[SIDE VIEW]



[ISOMETRIC VIEW]

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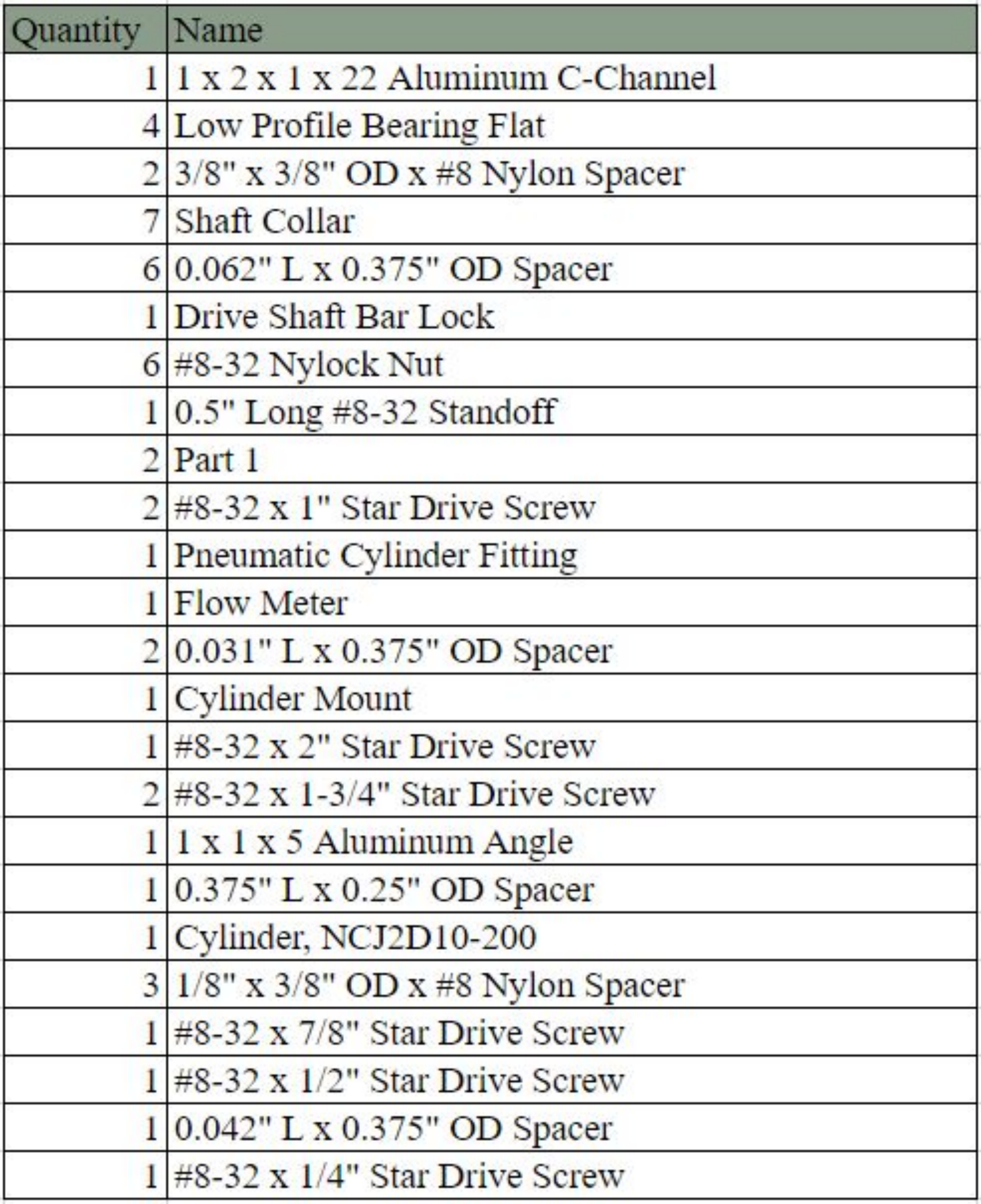
Intake

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

BOM



Quantity	Name
1	1 x 2 x 1 x 22 Aluminum C-Channel
4	Low Profile Bearing Flat
2	3/8" x 3/8" OD x #8 Nylon Spacer
7	Shaft Collar
6	0.062" L x 0.375" OD Spacer
1	Drive Shaft Bar Lock
6	#8-32 Nylock Nut
1	0.5" Long #8-32 Standoff
2	Part 1
2	#8-32 x 1" Star Drive Screw
1	Pneumatic Cylinder Fitting
1	Flow Meter
2	0.031" L x 0.375" OD Spacer
1	Cylinder Mount
1	#8-32 x 2" Star Drive Screw
2	#8-32 x 1-3/4" Star Drive Screw
1	1 x 1 x 5 Aluminum Angle
1	0.375" L x 0.25" OD Spacer
1	Cylinder, NCJ2D10-200
3	1/8" x 3/8" OD x #8 Nylon Spacer
1	#8-32 x 7/8" Star Drive Screw
1	#8-32 x 1/2" Star Drive Screw
1	0.042" L x 0.375" OD Spacer
1	#8-32 x 1/4" Star Drive Screw

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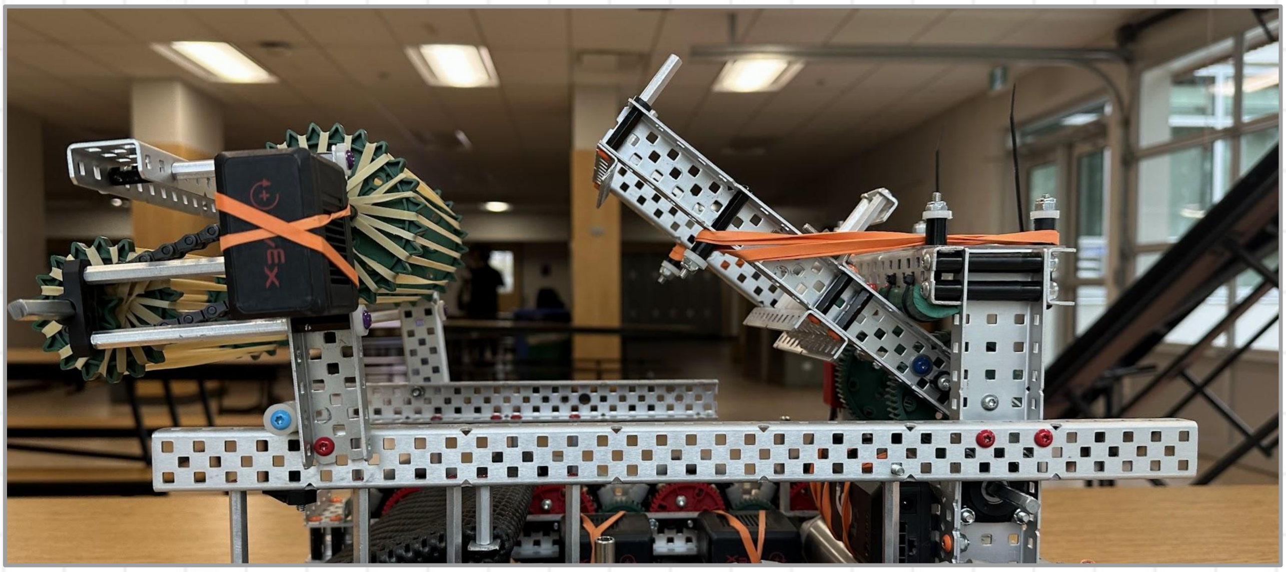
Intake

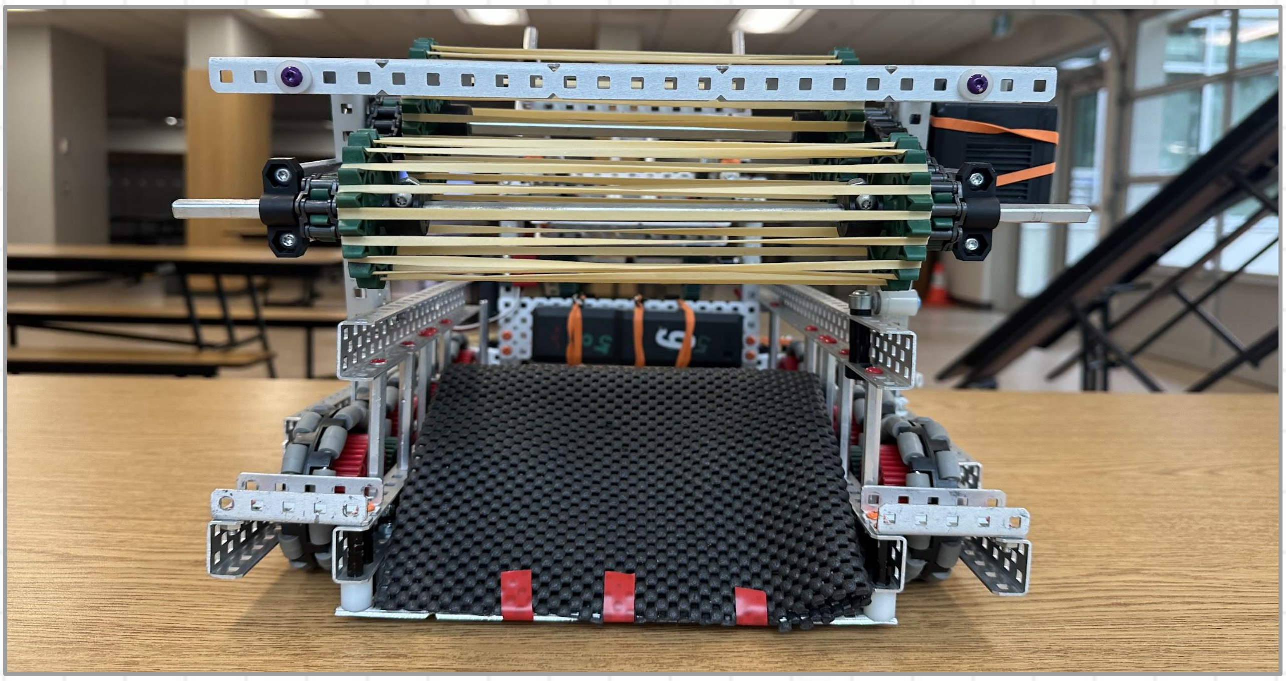
Images



After building the intake, we realized that we needed more space for the ramp

Ramp overview

- Anti Slip mat on metal sheet
  - Malleable
  - friction helps tribal keep in place after intake
  - Secured by zip ties and tape



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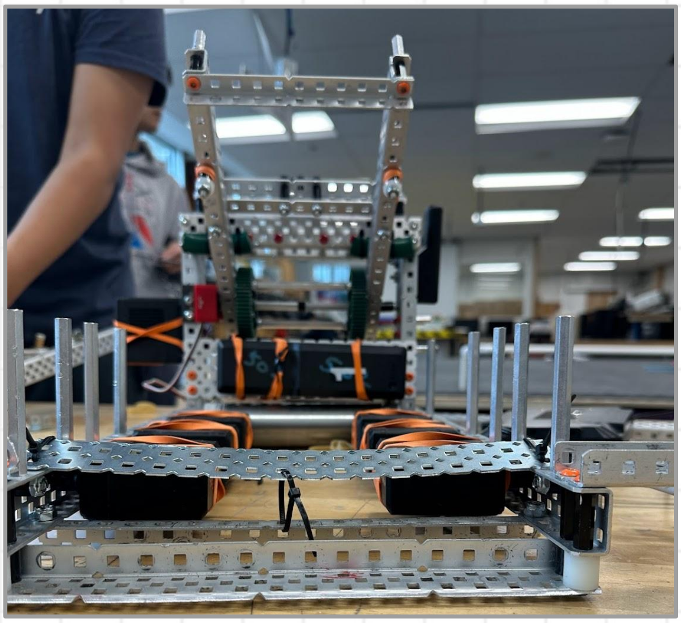
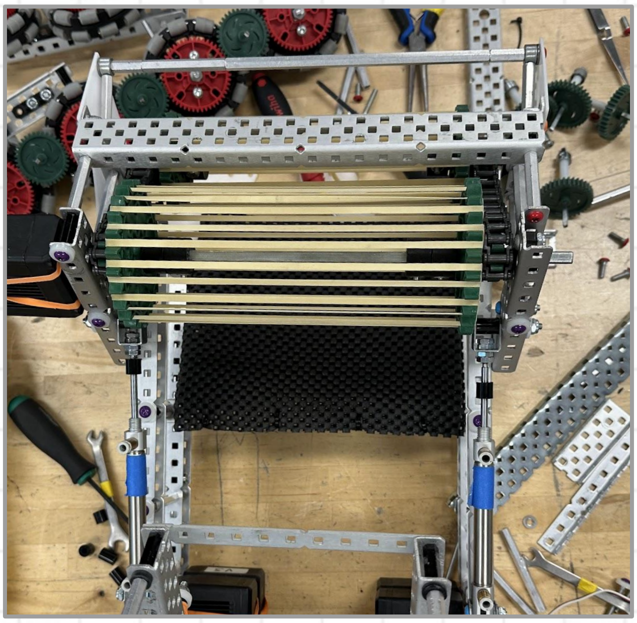
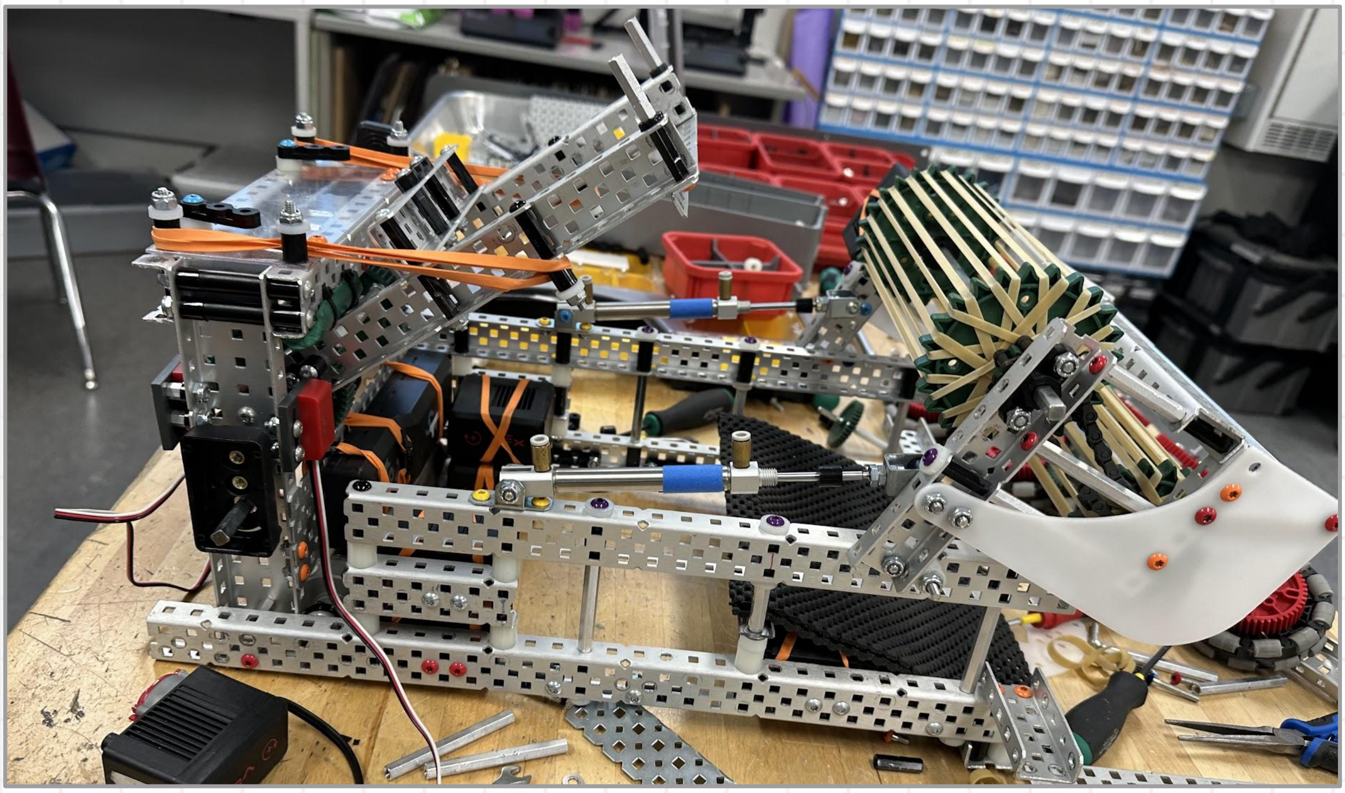
Intake

ISSUES AND SOLUTIONS

- While building the ramp, we realized that more space would be optimal. Henceforth, we've decided to stack our drivetrain motors in order to free up space for the ramp.
- Pistons were added to help raise and lower the intake, in order for us to stay within size







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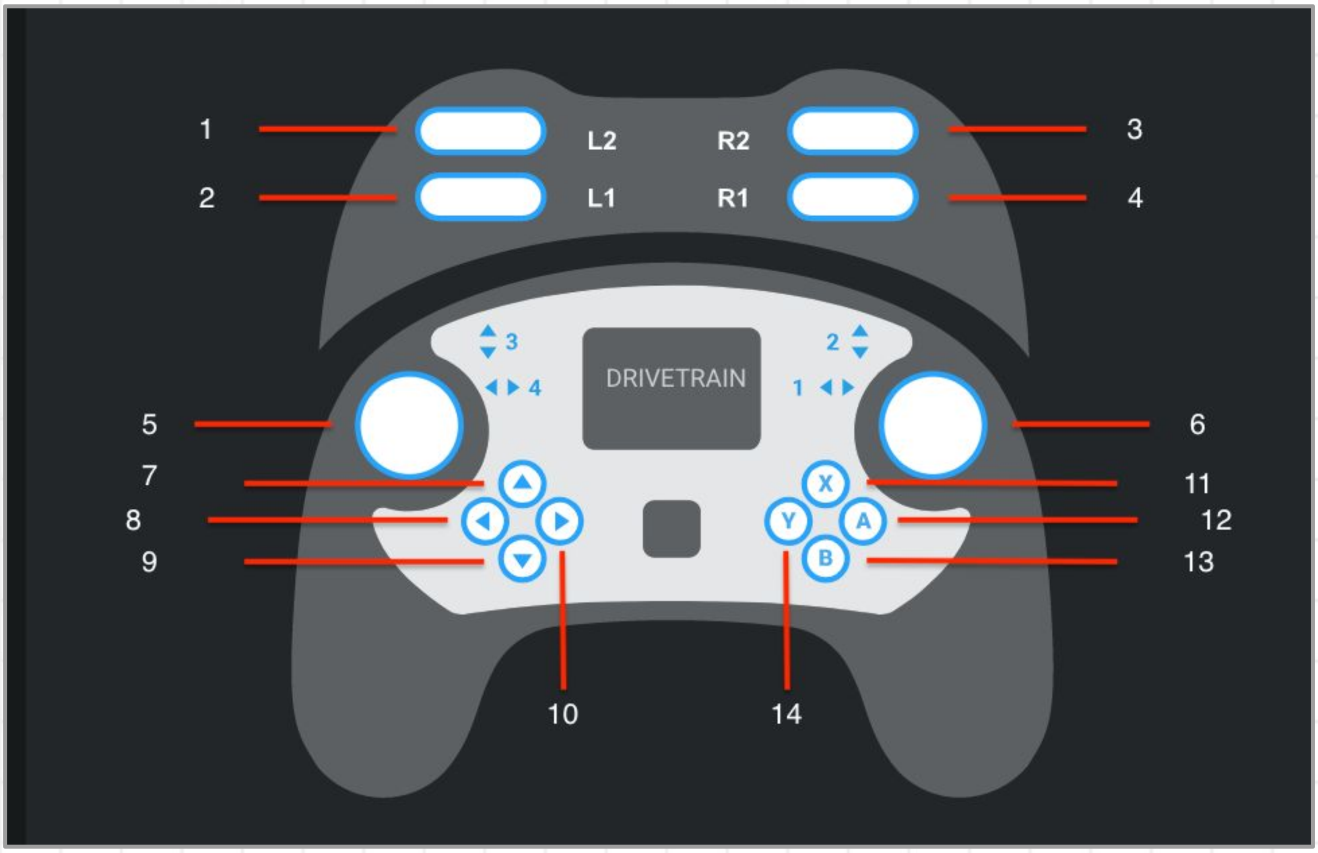
Intake

Coding



R2: *#3*

- Spin intake forward
- Used for intaking triball
    - whether it be into the catapult, or storing it inside the intake ramp

R1: *#4*

- Spin intake backwards
- Used for dispensing possessed triballs into the goal
- unjamming.

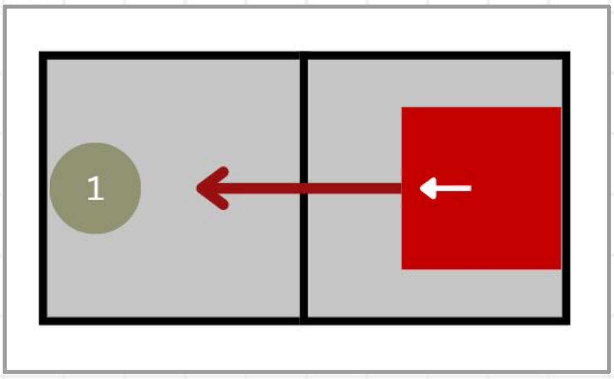
Goal

Testing intake

TEST NO. 1 : INTAKE FROM FRONT

Procedure

I. Place robot on field tile
II. Place Triball directly in front of intake (1) , 1 tile over
III. Spin intake and drive forward
IV. Reset and repeat 10 times, check for success rate



KEY

🟥 Robot

→ Pushing direction

● Triball

Test	1	2	3	4	5
	✓	✓	✓	✓	✓
	6	7	8	9	10
	✓	✓	✓	✓	✓

Success rate: 100%

TEST NO. 2 : INTAKE FROM SIDES

Procedure

I. Place robot on field tile
II. Place Triball on the front left side of intake (2) , 1 tile over
III. Spin intake and drive forward
IV. Reset and repeat 5 times, check for success rate

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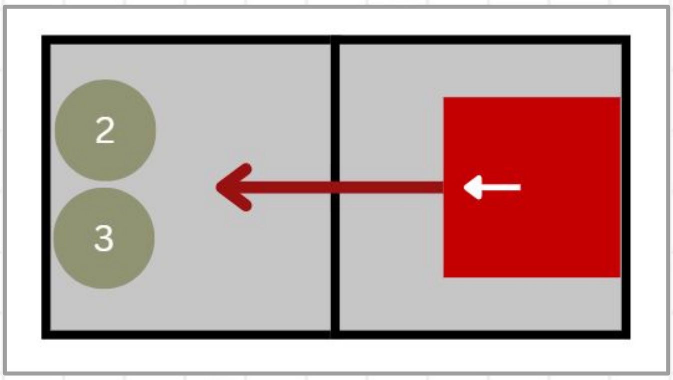
Intake

Procedure

I. Place robot on field tile
II. Place Triball on the front right side of intake (3) , 1 tile over
III. Spin intake and drive forward
IV. Reset and repeat 5 times, check for success rate



KEY

🟥	Robot
→	Pushing direction
●	Triball

Test	1	2	3	4	5
Left side	✖	✓	✓	✖	✖
Right side	✓	✖	✓	✓	✖

Success rate: 50%

Note: when intaking from the side, the triballs get pushed at times instead of getting picked up.

TEST NO. 3 : OUTTAKING TRIBALL INTO THE GOAL

Procedure

I. Place robot on field tile
II. Intake Triball
III. Spin intake and outake triball into diy goal
IV. Reset and repeat 5 times, check for smoothness and consistency

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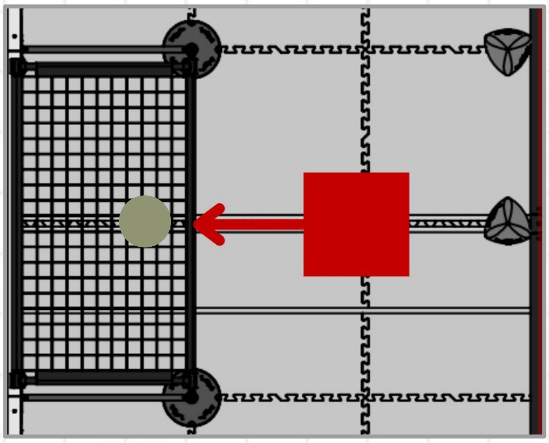
Intake



KEY

🟥	Robot
→	Pushing direction
●	Triball

Test	1	2	3	4	5
	✓	✓	✓	✓	✓

Success rate: 100%

Conclusion

- Intaking from the front is smooth and guaranteed success
- Intaking from the side varies
  - 50% chance that it works
  - We should try to avoid side intaking during matches due to it's inconsistency
- Outtaking into the diy goal is a success
  - Delrin slides smoothly on pvc pipe goal

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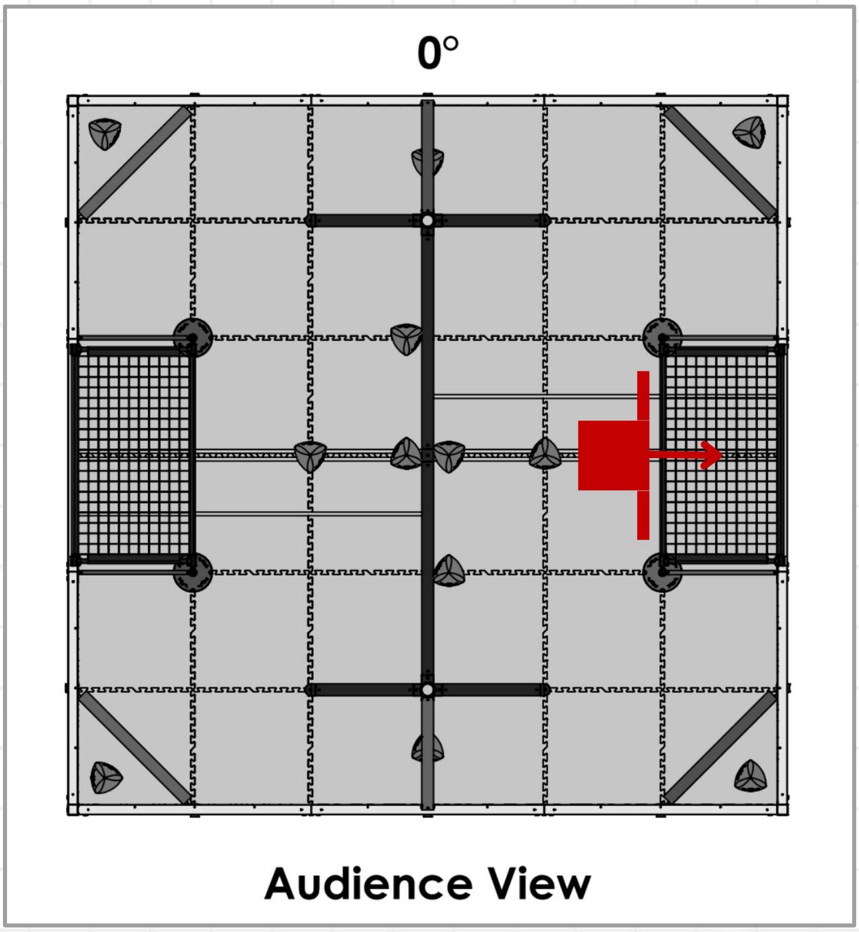
Wings

Goal

Creating an on-demand device that allows for the pushing of the triballs into the goal

Why are wings important?

- Allows us to quickly push the triballs in the goal
- Saves us from the possession limit of 1 triball
- Saves time from individually moving each triball



KEY

▬ : Wings

🟥 : Robot

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Ideal Characteristics of Wings

PERFORMANCE

- **On-demand deployment**
  - We must be able to quickly expand horizontally in order to push multiple triballs into the goal
  - This will allow us to use our time efficiently in order to score the most points
- **Rapid response time**
  - A faster response time allows use to quickly deploy and retract the wings in order to protect them from other robots around us
  - Saves on time for skills, allowing us to maximize time to score more.

DESIGN

- **Large expansion size (<35 inches)**
  - The larger the expansion size, the greater the mass, allowing for the robot to push as much triballs in the goal as possible
- **Robust**
  - During matches, other robots may ram into our robot, potentially making us go over size or damage the wings
  - We want the wings to be strong enough to push triballs in without issue.

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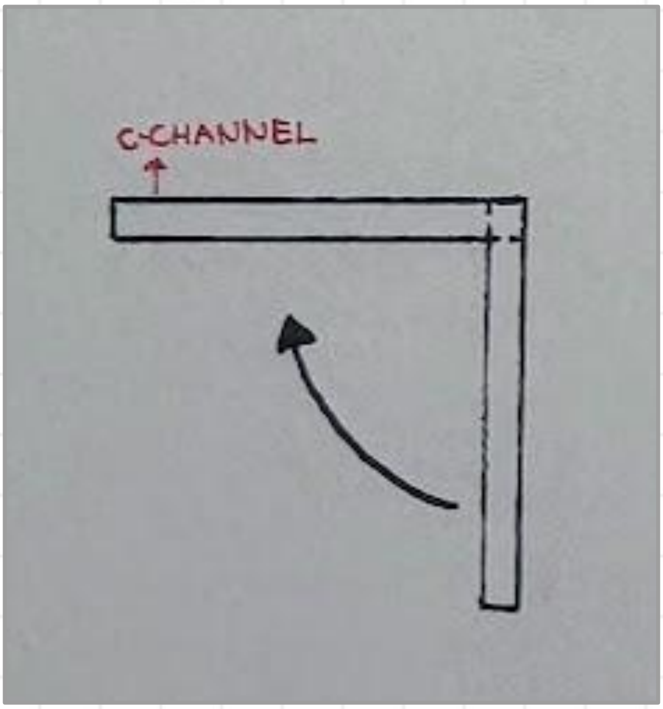
POSSIBLE WING DESIGNS

Open from side

Characteristics:

- Trigger by piston
- Locking mechanism
- More power to open, less to close

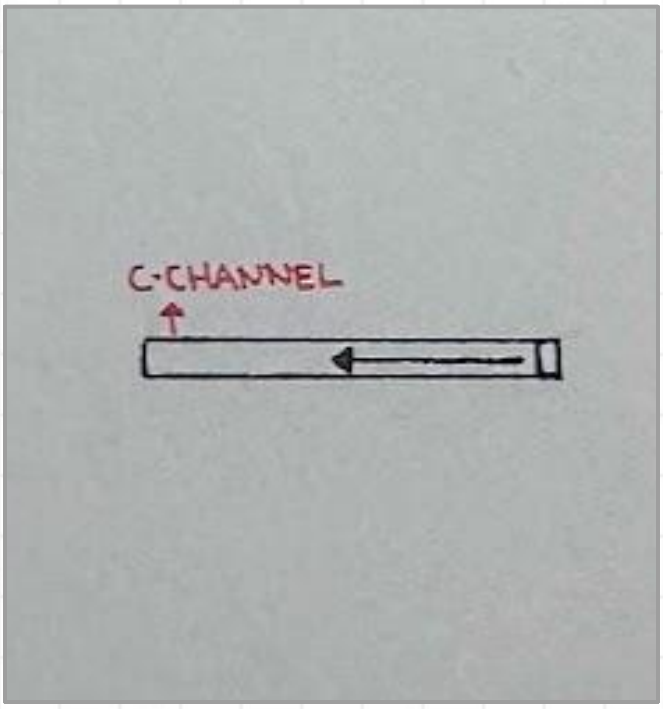


PROS	CONS
Strong	Complex
Can attach cover or sled	

Drop from top

Characteristics:

- Trigger by piston
- Hench
- Less power to open, more to close



PROS	CONS
Simple to build	Weak
Also use as a flag	Limited only 90°

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

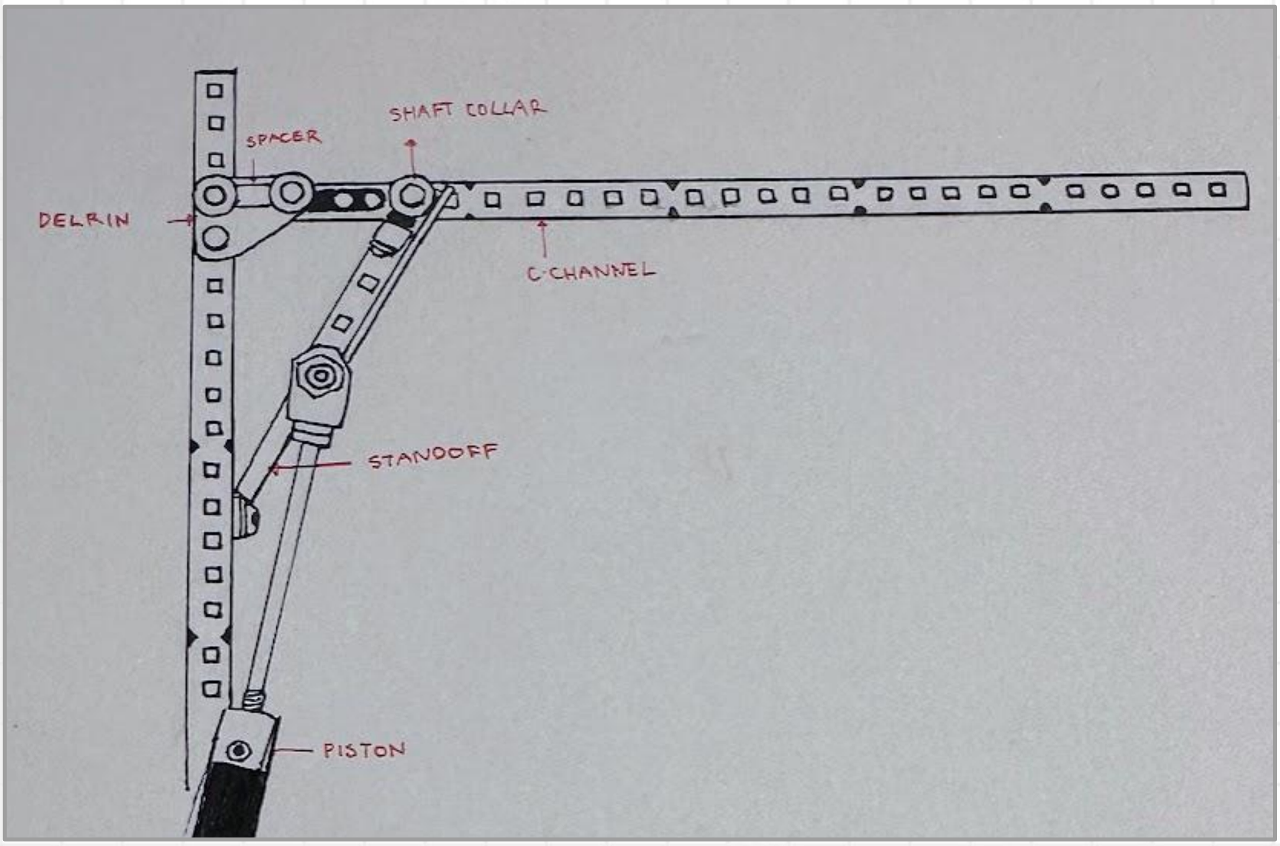
TESTING SOLUTION

CONTINUED FROM PAGE:

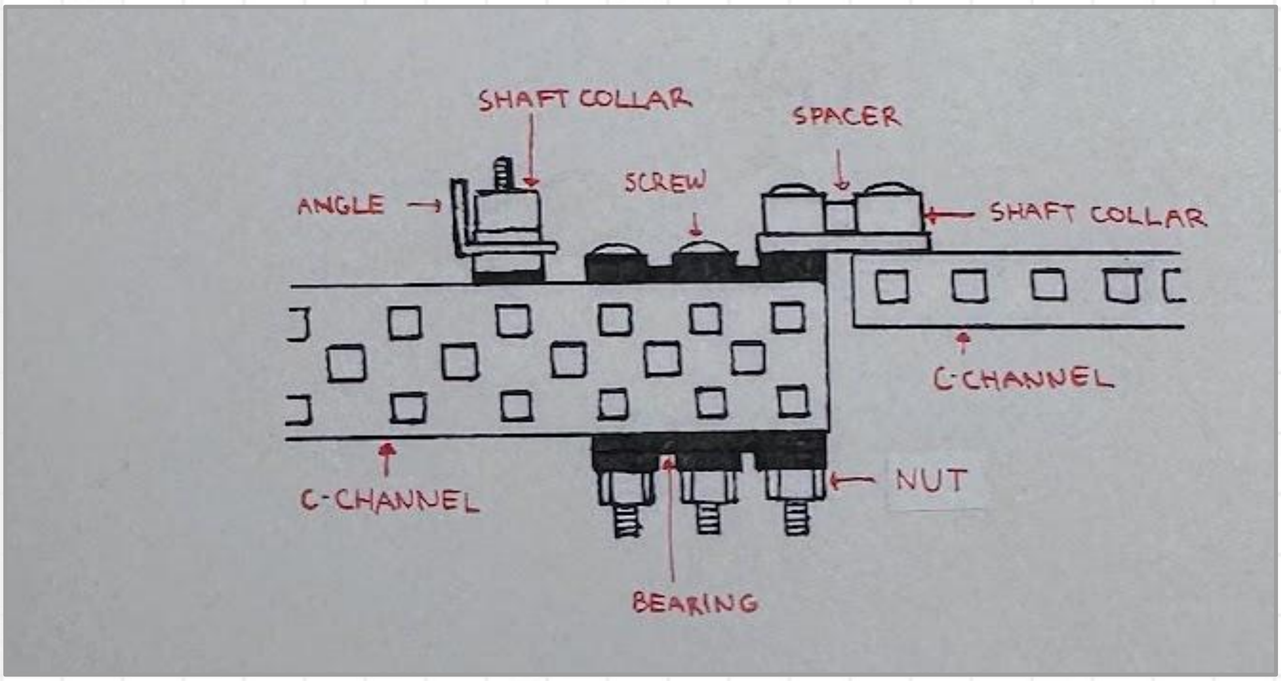
Wings

Sketch

[TOP VIEW]



[FRONT VIEW]



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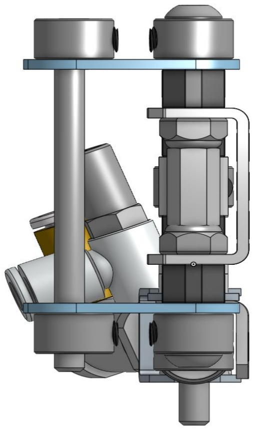
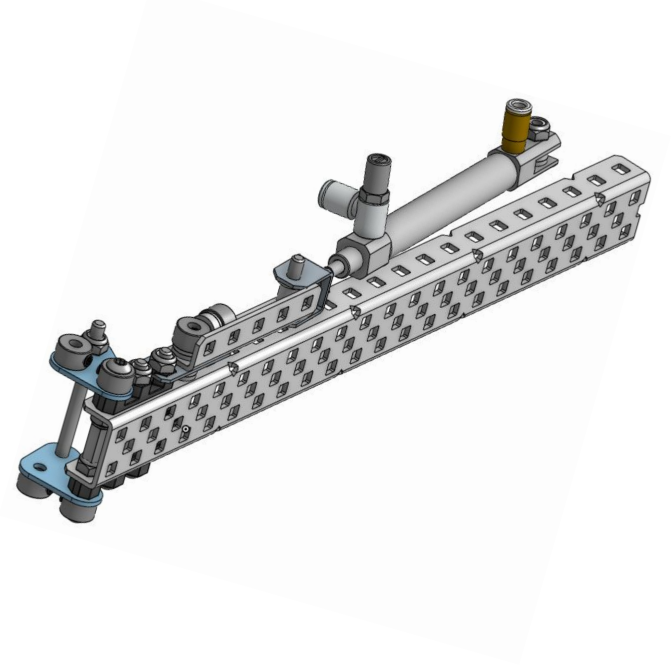
Wings

CAD

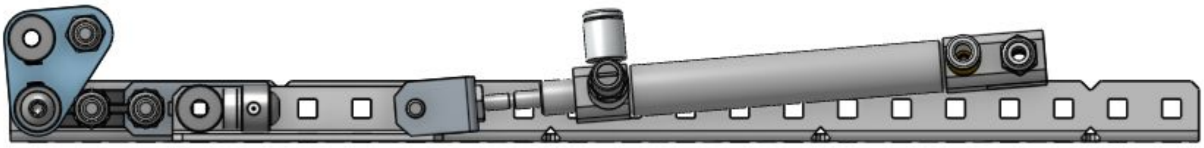
[FRONT VIEW]



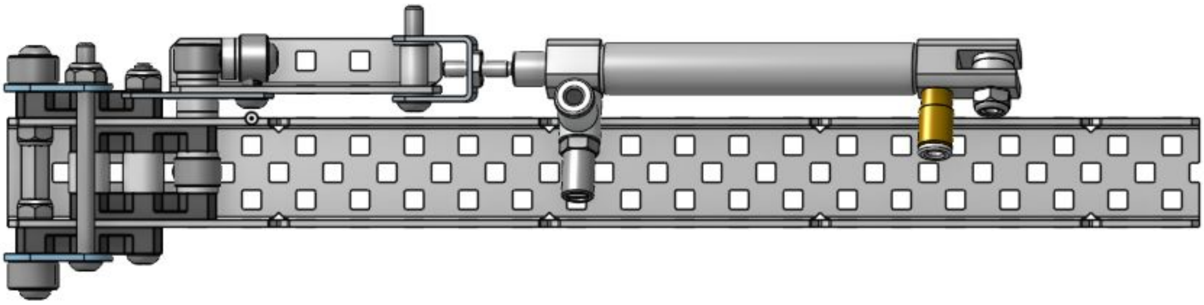
[ORTHOGRAPHIC VIEW]



[TOP VIEW]



[SIDE VIEW]



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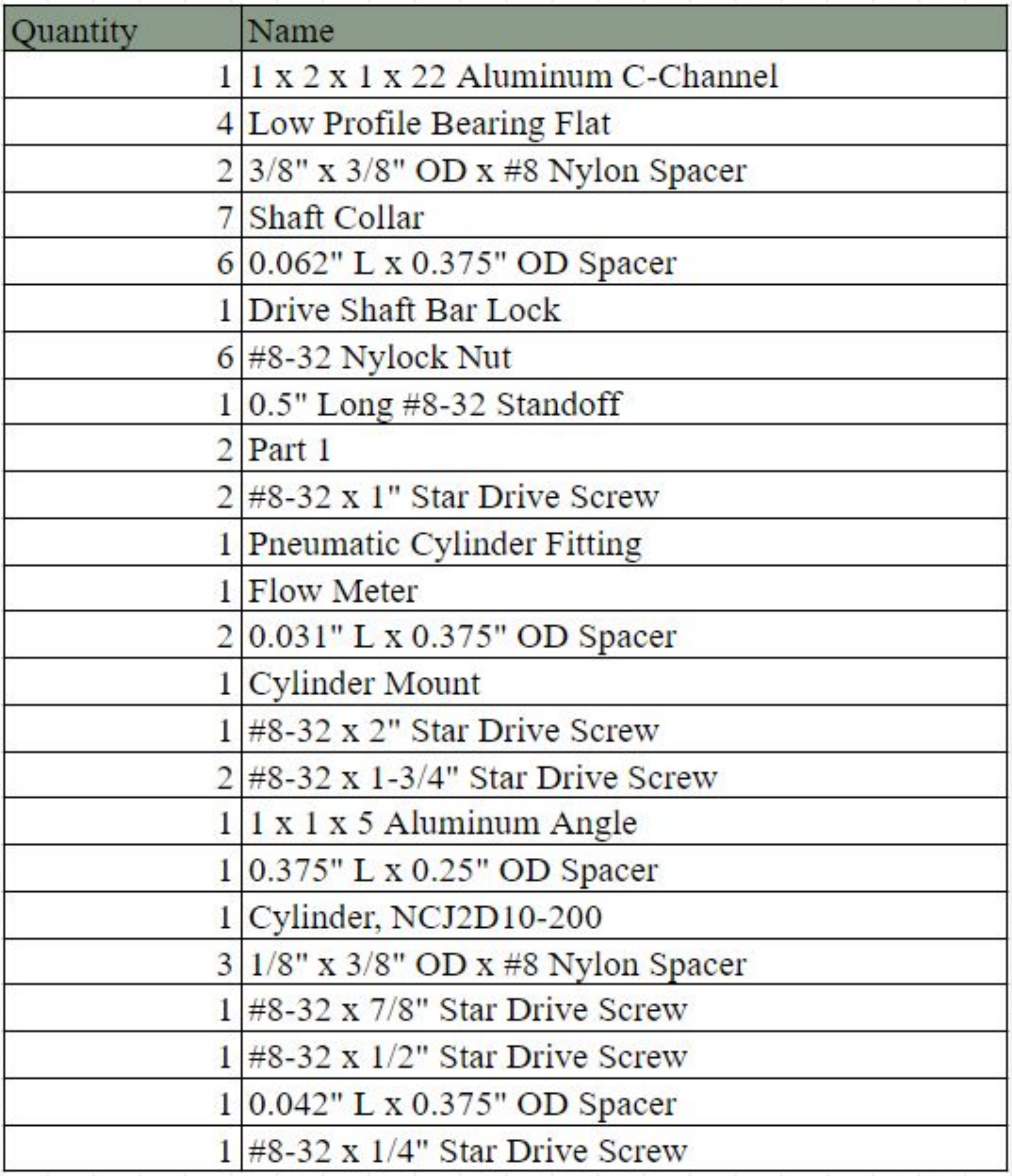
Wings

BOM



Quantity	Name
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7	Shaft Collar
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6	#8-32 Nylock Nut
1	0.5" Long #8-32 Standoff
2	Part 1
2	#8-32 x 1" Star Drive Screw
1	Pneumatic Cylinder Fitting
1	Flow Meter
2	0.031" L x 0.375" OD Spacer
1	Cylinder Mount
1	#8-32 x 2" Star Drive Screw
2	#8-32 x 1-3/4" Star Drive Screw
1	1 x 1 x 5 Aluminum Angle
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1	Cylinder, NCJ2D10-200
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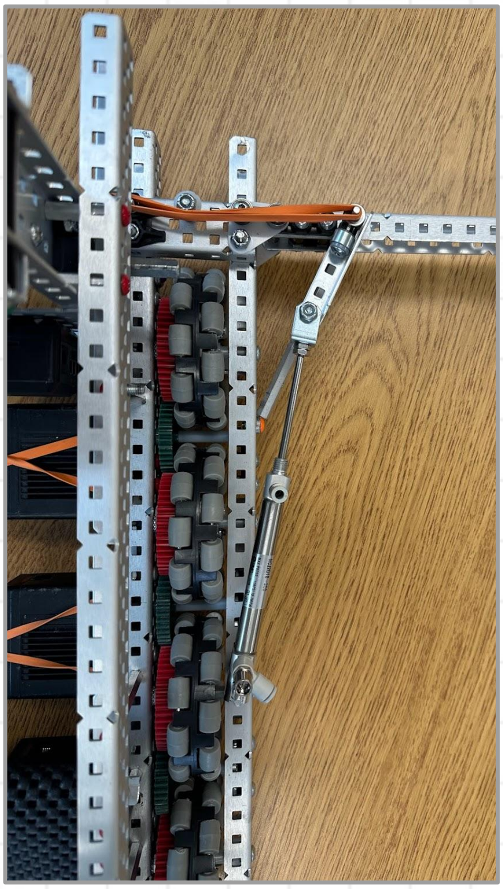
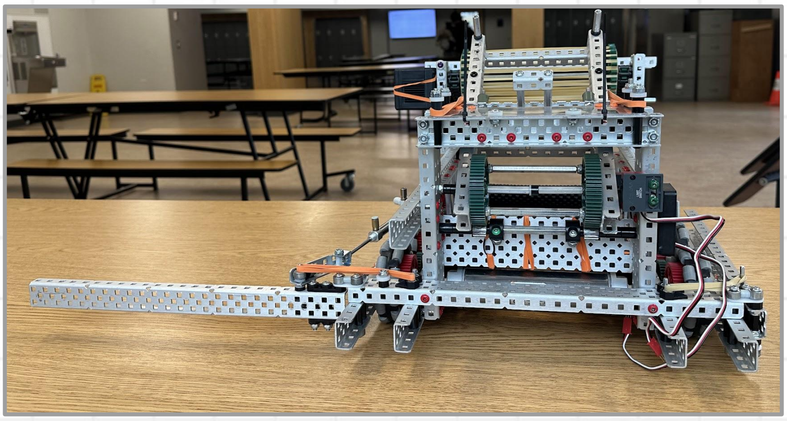
1	#8-32 x 7/8" Star Drive Screw
1	#8-32 x 1/2" Star Drive Screw
1	0.042" L x 0.375" OD Spacer
1	#8-32 x 1/4" Star Drive Screw

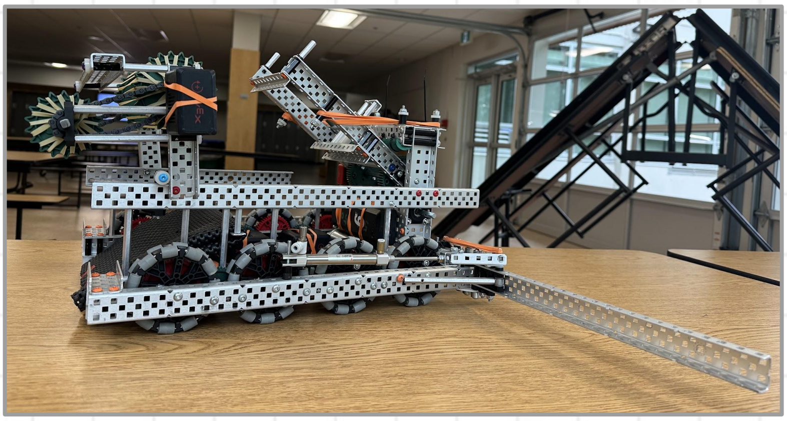
CONTINUED FROM PAGE:

Wings

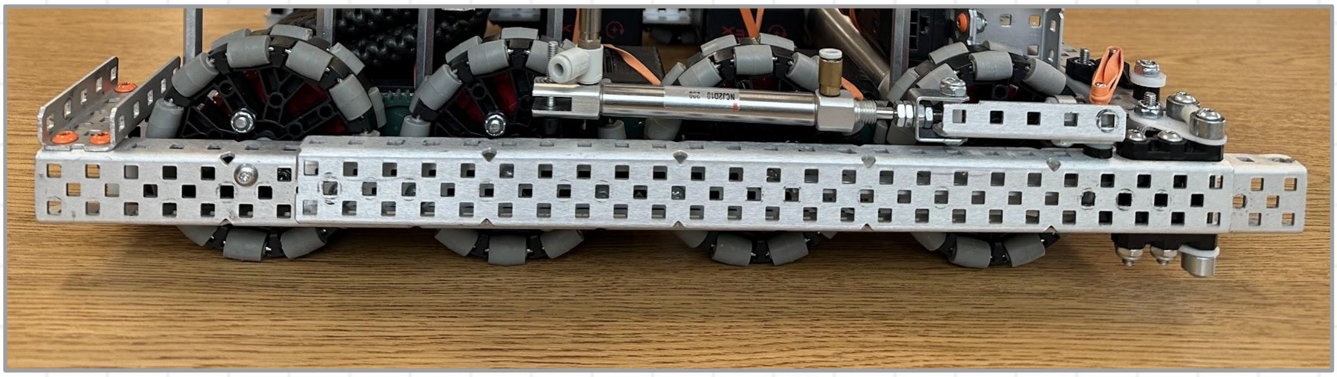
Images







- We chose to use elastics to help the wings to flip out smoothly
- No large issues occurred while building.
    - Process was pretty smooth
- Above are images of the wings in open position
- Below are images in closed position



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Wings

Non-blocking architecture required for wings are run in a separate task to ensure there is no interference with other aspects of the code.
The function is continuously ran in a separate loop.

Code features:

- 2 dedicated buttons for toggling wings ON and OFF, bound to A and B.
- Complex series of events for toggling the wings OFF to ensure no jamming occurs.
- Prevention of double-extension or double retraction.

```
void wing_task() {
  bool wingsOn = false;

  while (true) {
    if (master.get_digital(pros::E_CONTROLLER_DIGITAL_A) == 1) {
      if (!wingsOn) {
        // Turn on the wings
        Wings.set_value(true);
        pros::delay(1000);
        wingsOn = true;
      }
    } else if (master.get_digital(pros::E_CONTROLLER_DIGITAL_B) == 1)
{
      if (wingsOn) {
        // Turn off the wings
      Wings.set_value(false);
      pros::delay(50);
      Wings.set_value(true);
      pros::delay(50);
      Wings.set_value(false);
        wingsOn = false;
        pros::delay(50);
      }
    }
  }
}
```

Wings

Goal

Testing reliability of wings

Actuation Testing:

The actuation testing involved applying a pressure of 15 psi to open both wings of the system. In this test, the system consistently demonstrated reliable performance, successfully opening the wings in all 10 trials. This impressive 100% success rate indicates the robust actuation capabilities of the system when it comes to wing deployment.

Locking and Unlocking Testing:

To assess the system's locking and unlocking mechanisms, the testing was conducted at 10 psi. When locking the wings, the system showed a high degree of reliability, achieving a success rate of 90% in 9 out of 10 trials. This suggests that the locking mechanism is robust and dependable.

Unlocking the wings, however, achieved a success rate of 80% in 8 out of 10 trials. While this still indicates a good level of functionality, it also suggests that there may be some room for improvement in the unlocking and wing-closing aspect of the system.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

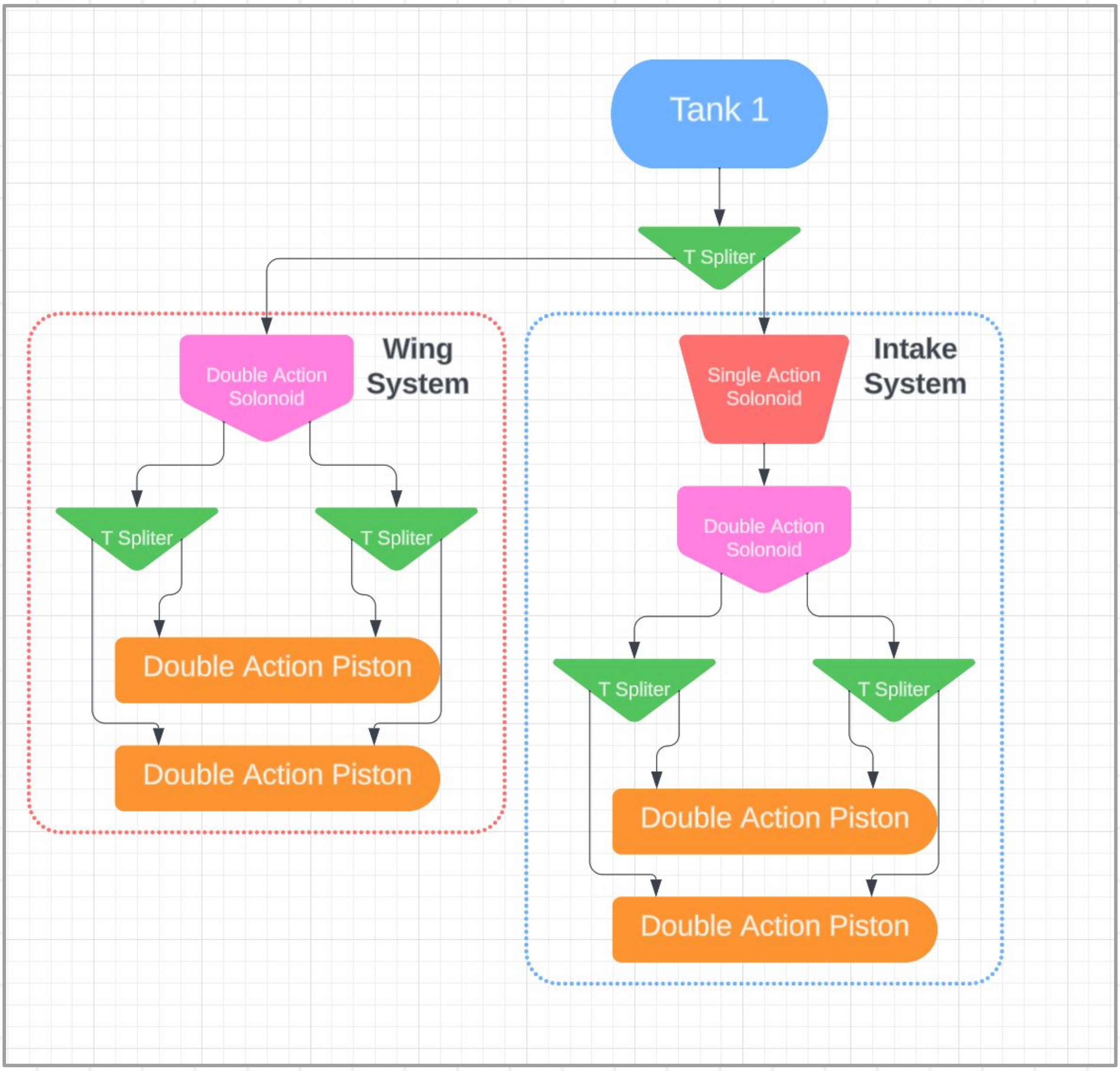
Testing

Ultimately, we decided to go with wings that open from the side.

A potential issue would be that it's easier to accidentally form a concave shape. But overall we think that it would take less air to retract and will keep flush to the side better .

This way when we are defended against we won't have to worry about our wings potentially getting hooked into something

Pneumatics Chart



Ports & Connections

PORTS AND CONNECTIONS

Overview

- Left motors on ports: 11,12,13.
  - 11 is reversed.
- Right motors on ports: 1,2,3.
  - 2 is reversed.
- Catapult port: 17
- Intake port: 20
- Full rack limit switch on 3-wire port: A
- Mid rack limit switch on 3-wire port: B
- Wing solenoid on port: F
- Intake solenoid (double action) : G
- Intake solenoid (single action) : H

Goal

Coding an autonomous program for game matches

Why is this program important?

- Repeatable and accurate compared to driver
- Can be faster and more responsive than driver
- Can help us gain an advantage of 8 points early on during matches
- If coded properly can be very accurate and consistent
- Will help us greatly in times when match results are very close
- AWP
  - The points earned from a successful Autonomous period can advance a team's standing regardless of the outcome of the rest of the match

What are some cons with this program?

- Time consuming to program
- Cannot actively respond to obstacles changing position
- Starting position must be the same for consistent results
  - If starting point is off the movement could be very different

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AUTONOMOUS

Autonomous - General understanding **/100**

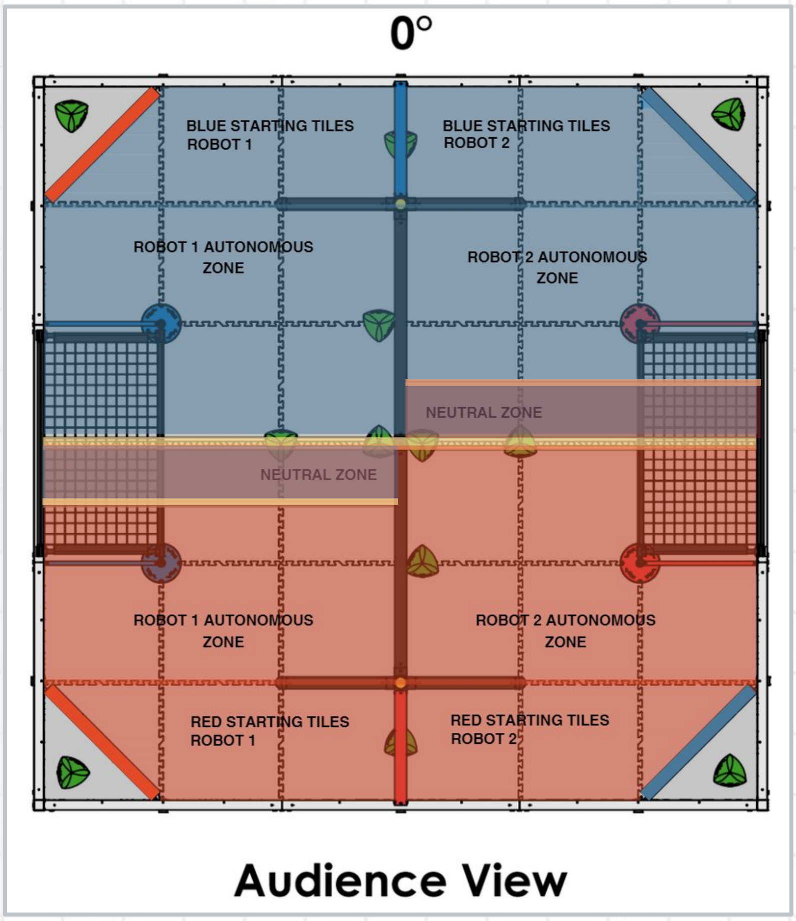
Rules

General Autonomous Rules

- Drivetrain members are not to interact with robots during the period

Game Autonomous Period Rules

- Robots may possess only one Triball at a time
- Robots must stay in their starting Zone during the Autonomous Period.
- Violations result in the Autonomous Bonus going to the opposing Alliance.
    - If both sides commit violations, then no autonomous bonus is awarded
- Alliances from both sides can all enter the neutral zone, though there is a chance of contact with the other side



KEY

🟨 Autonomous line

🟪 Neutral zone

🟥 Red alliance starting tiles and autonomous zones

🟦 Blue alliance starting tiles and autonomous zones

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

AWP requirements

Terms

Close side:
Refers to the side closest to the driver, the side with the match loading

Far side:
Refers to the side furthest to the driver, the side closest to the goal

Autonomous Win Point

- Awarded to any Alliance that completes 3 assigned tasks by the end of the Autonomous Period.

- Unlike the previous season (spinup), this year getting a AWP requires cooperation on both ends, else it would be nearly impossible
  - Half court shot is required for solo AWP

REQUIREMENTS FOR AWP

1. Remove a Triball from the Alliance's matchload zone

2. Score at least 1 Alliance Triball in the Alliance's own goal

3. End the Autonomous Period with at least one Robot contacting their own Elevation Bar

MAIN OBJECTIVE

Score as many points possible while also being able to obtain an AWP

AUTONOMOUS

Autonomous - Diagram

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
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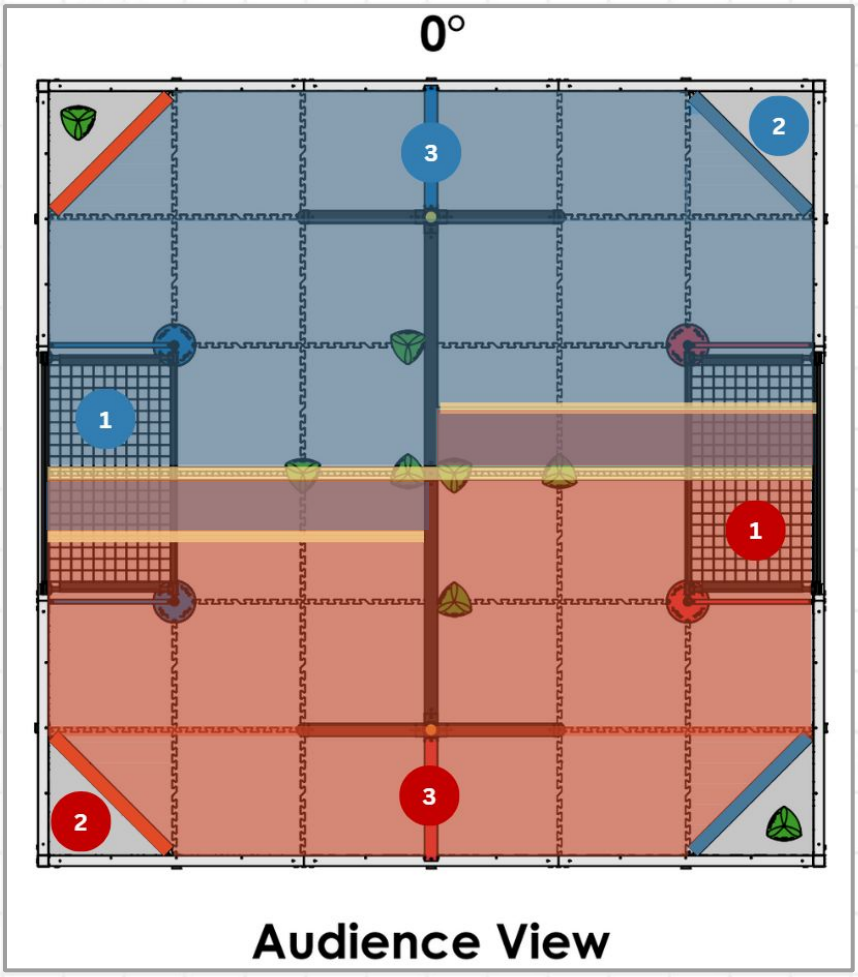
TESTING SOLUTION



KEY

🟨 Autonomous line

🟪 Neutral zone

🟥 Red alliance starting tiles and autonomous zones

🟦 Blue alliance starting tiles and autonomous zones

Observations

Close side:
Number 2 and 3 are achievable

Far side:
Number 1 and 3 are achievable

IDEAL CHARACTERISTICS

- **Consistency and Reliability**
  - The program must be consistent in order for it to accurately score the amount of points desired, to obtain an AWP, and to not cross the autonomous line

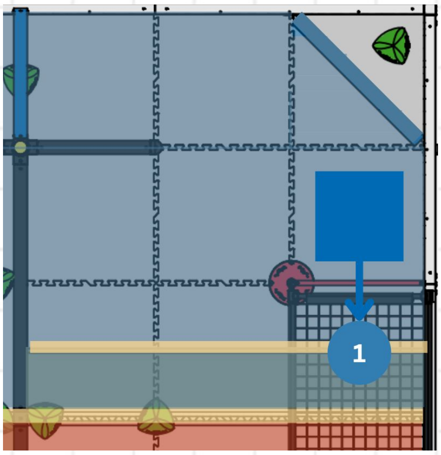
Routes and Strategy

Researching and coming up with possible routes for both sides

CLOSE SIDE

Route 1

- Pushing 1 Preload (1) into goal
- Scores 5 points



PROS

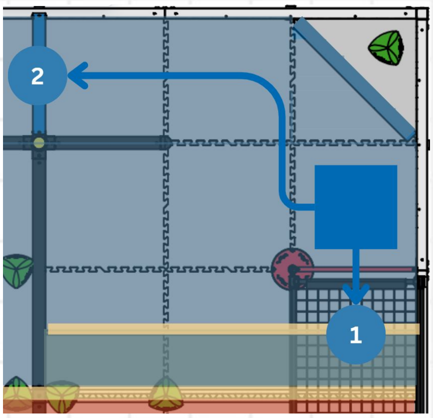
- Reliable
- Consistent
- Time efficient to code
- Risk free

CONS

- Sacrificing AWP (3/3)
  - Unable to get triball out of matchload
  - Relying on teammate to touch the elevation bar
- Does not maximize points scored during the period
  - Misses the 3 triballs

Route 2

- Pushing 1 Preload (1) into goal then touching the bar (2)
- Scores 5 points + Partial AWP



PROS

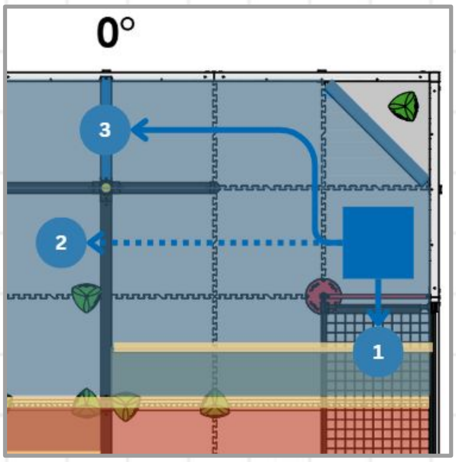
- Reliable
- Partial AWP (1/3)
- Time efficient to code

CONS

- Sacrificing AWP (2/3)
  - Unable to get triball out of matchload
- Does not maximize points scored during the period
  - Misses the 3 triballs

Route 3

- Pushing 1 Preload (1) into goal, shooting 2 triballs to alliance side (2) then touching the bar (3)
- Scores 9 points + Partial AWP



PROS

- Maximizes point scoring
- Partial AWP (1/3)
- Takes the middle triballs instead of letting the opponent score them into the goal

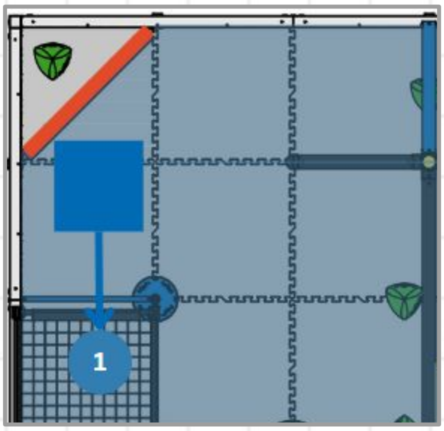
CONS

- Sacrificing AWP (2/3)
  - Unable to get triball out of matchload
- Time consuming, to code and test
- Potential for the catapult to jam

FAR SIDE

Route 1

- Pushing 1 Preload (1) into goal,
- Scores 5 points + Partial AWP



PROS

- Reliable
- Consistent
- Time efficient to code
- Risk free
- Partial AWP (1/3)

CONS

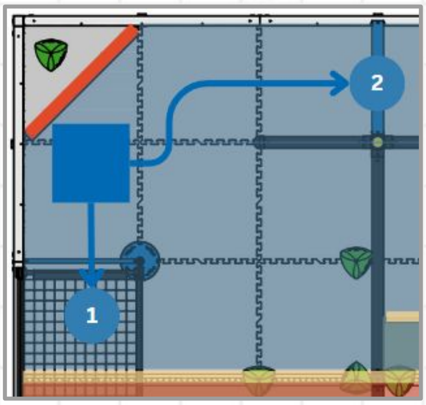
- Sacrificing AWP (2/3)
  - Relying on teammate to touch the elevation bar
- Does not maximize points scored during the period

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Route 2

- Pushing 1 Preload (1) into goal then touching the bar (2)
- Scores 5 points + Partial AWP



PROS

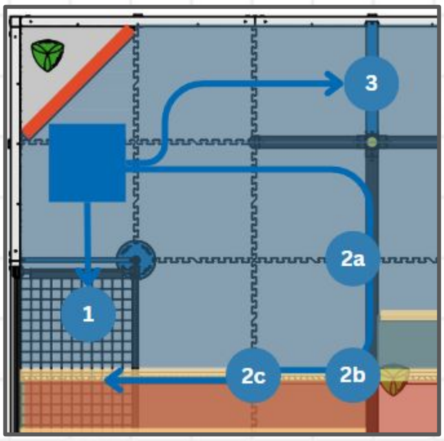
- Reliable
- Partial AWP (2/3)
- Time efficient to code

CONS

- Sacrificing AWP (1/3)
- Does not maximize points scored during the period

Route 3

- Pushing 1 Preload (1) + 3 triballs into goal (2abc), then touching the bar (3)
- Scores 20 points + Partial AWP



PROS

- Maximizes point scoring
- Partial AWP (2/3)
- Takes the middle triballs instead of letting the opponent have the triballs

CONS

- Sacrificing AWP (1/3)
- Time consuming, to code and test
- Potential for the catapult to jam

Final Routes

We've decided to go with route 1 for close side and route 2 for far side.

How did we finalize this decision?

This decision was finalized from considering these aspects

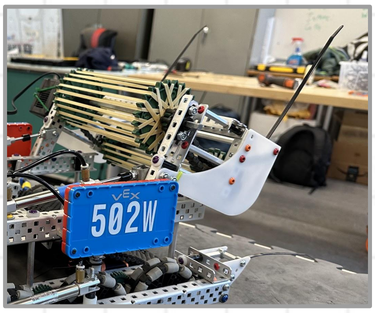
- ○ We have no field, so testing will be difficult
- ○ We have 1 triball from worlds, so too much time would be consumed in attempting to push more triballs into the goal

Hence, we've decided to go with those routes in order to use our time effectively

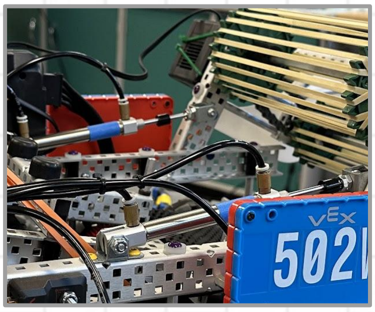
- This way we can get the most reliable autonomous program despite not having a field

In order to achieve these goals, we have implemented multiple autonomous-focused components on the bot

- Six 8-inch long zipties to extend the bot's size.
  - These are done to touch field elements
    - Match load bar
    - Elevation bar (needed for AWP)



- Piston actuated intake.
  - Being able to raise and lower the intake on-demand allows for versatile triball manipulation



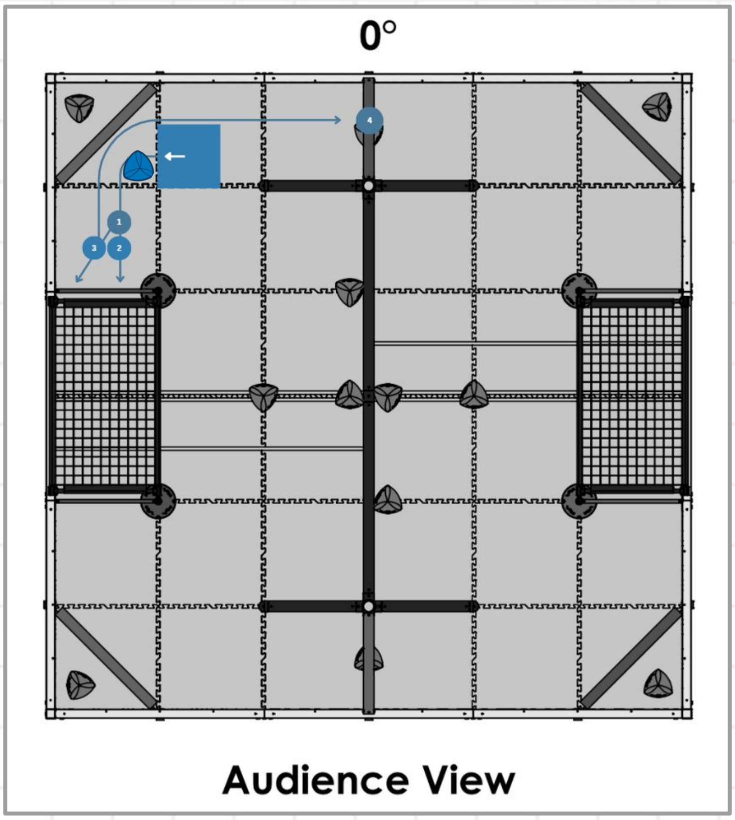
DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

FAR SIDE

Starting position

- Edge of the offensive side field tile

1. Drive to position 1
2. Push Triball into goal at position 2
3. Return to position 1
4. Push at position 3 to ensure that Triball is in goal
5. Drive to position 4, touching the bar

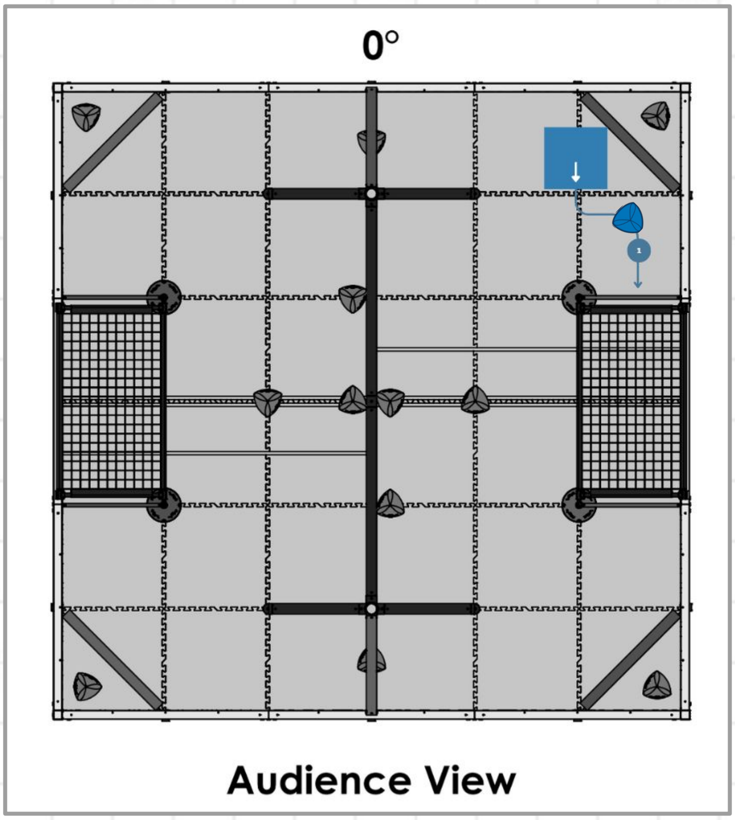


CLOSE SIDE

Starting position

- Centred between 2 offensive filed tiles, corner touching the matchload bar

1. Drive to position 1
2. Push Triball into goal



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Code

- Many autonomous functions are done through the EZ template library (allows for simple incorporation into our code).

- It supports basic movements such as straight drives, point turns, and swings (combination of drive and turn).

Throughout our skills route, we have incorporated all 3 types of movements within the routine.

We thought of tuned values such as PIDs as well as turn speeds, drive speeds, and exit conditions. The combination of the well-refined functions and thoughtfully coded routines results in consistency

FAR SIDE

```
 chassis.set_swing_pid(ez::LEFT_SWING, -45, 75);
 chassis.wait_drive();
 chassis.set_drive_pid(-15, 75, false);
 chassis.wait_until(10);
 chassis.set_turn_pid(0, 50);
 chassis.wait_drive();
```

CLOSE SIDE

```
chassis.set_drive_pid(20, 100, true);
chassis.wait_drive();
```

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Goal

Procedure

- Continuously running the program
- Aiming for 5 consistent runs in a row on both sides
- Tuning and fixing code along the way

this will ensure in reliability during matches, running this program multiple times will also allow us to quickly set up the robot placement on the field

FAR SIDE

8 runs total

Issues faced

Run 1: Triball wasn't angled right

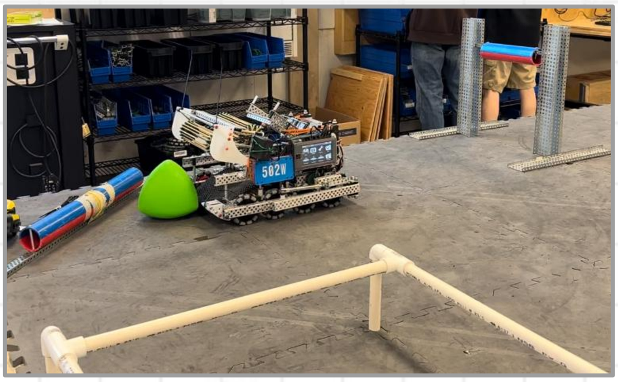
Fixed by facing the corner of the triball to the robot, so when pushed it will roll straight

Run 3: Shaky robot when pushing preload into goal

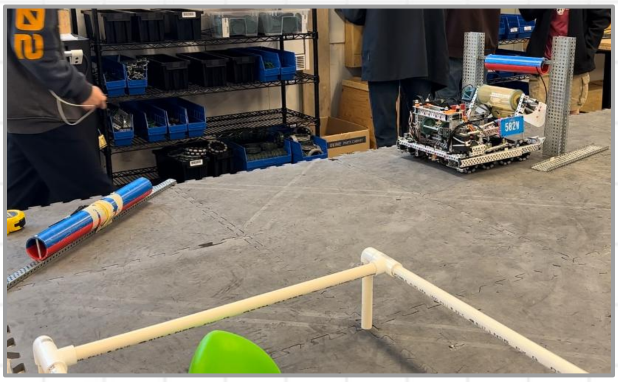
1 time issue, never occurred again

We were unable to figure out what caused the shakiness

START POSITION



END POSITION



CLOSE SIDE

5 runs total

No issues faced

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Autonomous

Programming skills - Why is it important?

Goal

Coding an autonomous program for skills

Why is this programming skills important?

- Helps us improve our coding abilities
  - Allows us to experiment with different algorithms
- Helps us improve our skills score
  - As skills is a combination of programming and driving
- Increases our chances of awards
  - Skills champion
  - Partial role in excellence
- Increases our chances of qualifying
  - To both worlds and provincials
  - After teams double qualify, they go down from skills score

What are some cons with this program?

- Time consuming to program and test
- Cannot actively respond to obstacles changing position
- Starting position must be the same for consistent results
  - If starting point is off, the movement could be very different

Autonomous

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

TESTING SOLUTION

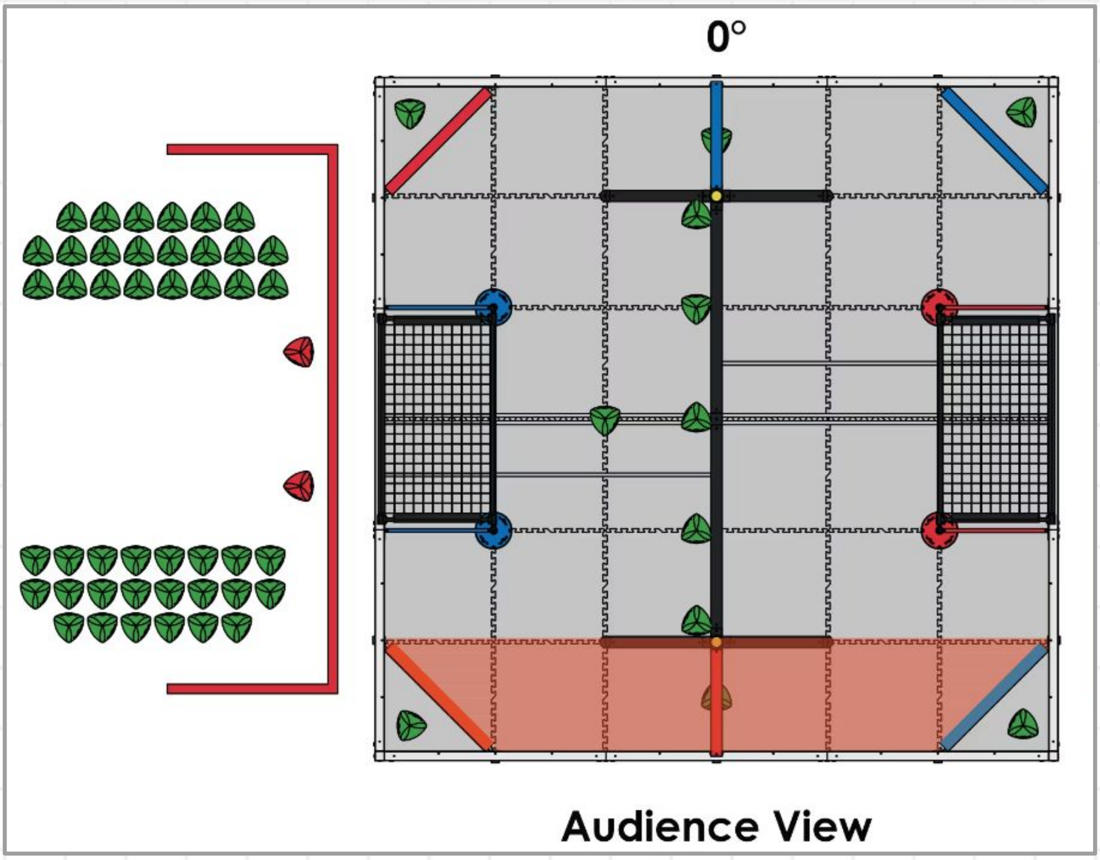
General Autonomous Rules

- Drivetrain members are not to interact with robots during the period

Skills Autonomous Rules

- Robot always plays as red alliance
- Drivetrain members are not to interact with the robot in any way other than match loading
  - Robot must be contacting the match loading bar
- Same rules as the game

SKILLS FIELD LAYOUT



KEY

▨ starting tiles

MAIN OBJECTIVE

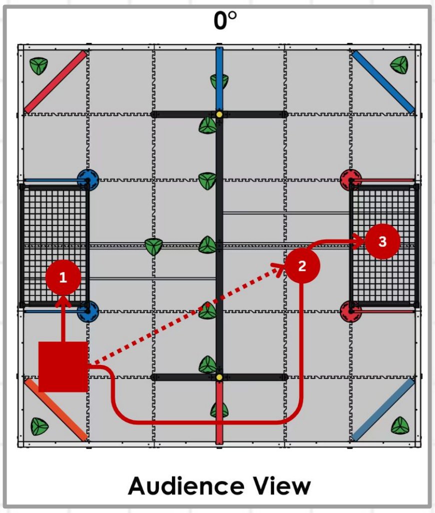
Score as many points possible

Routes and Strategy

We’ve come up with 3 possible routes

Route 1

- Push preload into goal
- Matchload to other side via catapult
- Drive to other side, push triballs into goal



PROS

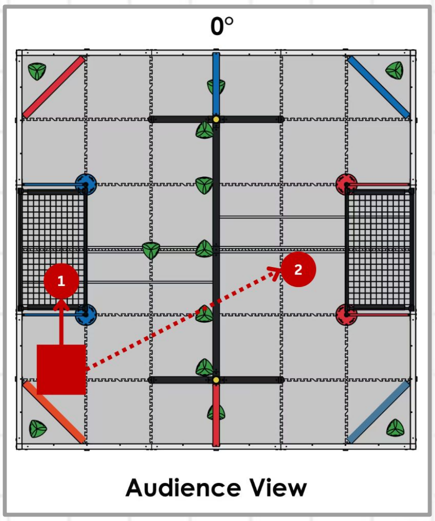
- Scores the most amount of points with our robot’s current abilities

CONS

- Requires practice match loading
- Requires complete field elements to test

Route 2

- Push preload into goal
- Matchload to other side via catapult



PROS

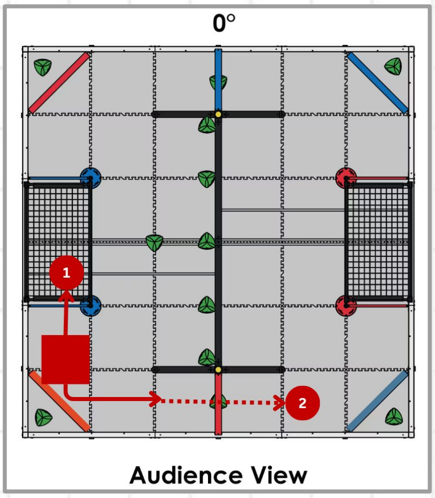
- Simple
- Not a lot of movement required

CONS

- Requires practice match loading

Route 3

- Push preload into goal
- Matchload to other side via intake



PROS

- Simple
- Not a lot of movement required

CONS

- Requires precision of match loading

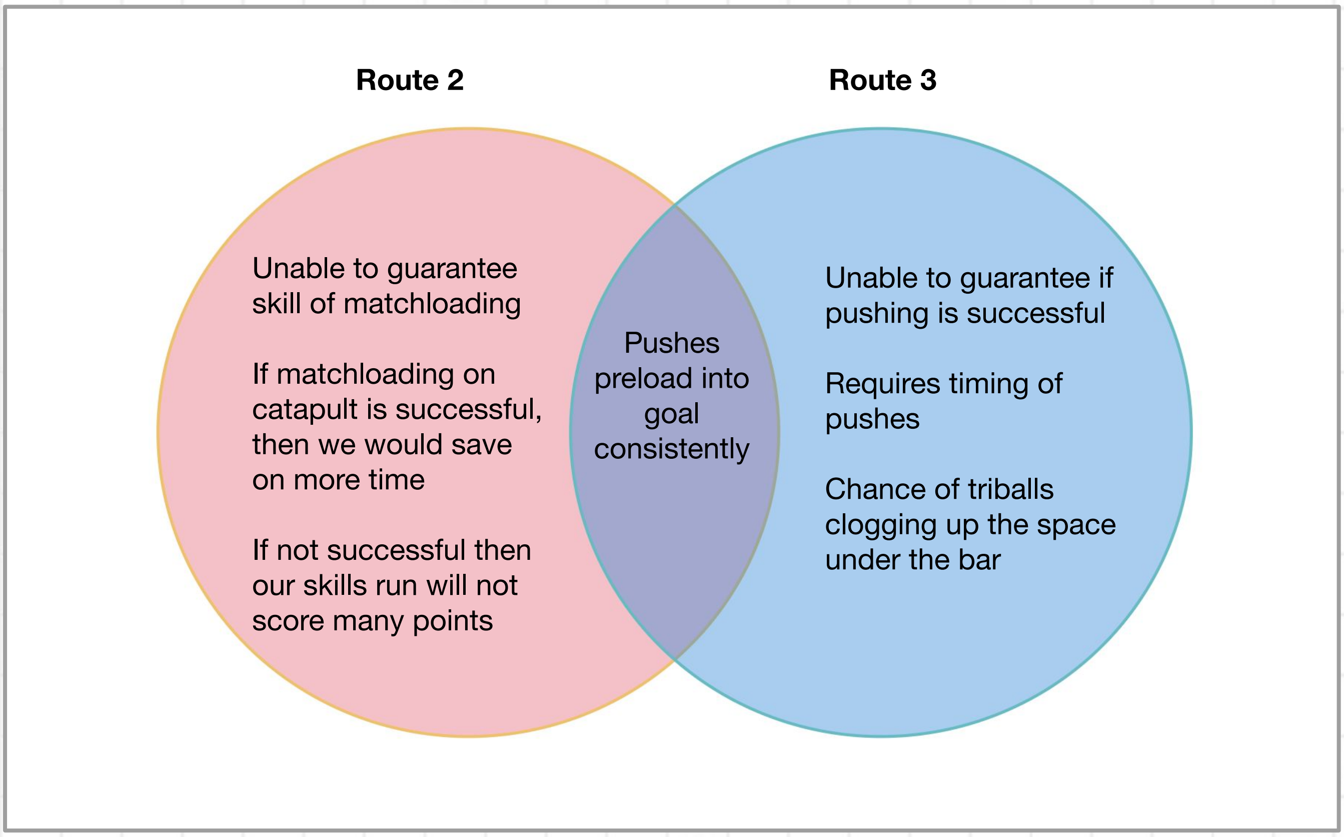
CONTINUED FROM PAGE:

Autonomous

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Final Route

Due to our situation with the field, we were deliberating between routes 2 and 3



Route 2

Unable to guarantee skill of matchloading

If matchloading on catapult is successful, then we would save on more time

If not successful then our skills run will not score many points

Route 3

Unable to guarantee if pushing is successful

Requires timing of pushes

Chance of triballs clogging up the space under the bar

Pushes preload into goal consistently

We first leaned closer toward route 2
But under the assumption that the catapult cycles once per second, most likely 2-3 seconds will be spent match loading each triball to get a hold of the timing

Since a skills run is 60 seconds (1 minute)

Pushing a preload into the goal taking 4 seconds.
We'd only manage to shoot around 18 - 28 triballs to the other side.
Totalling round, 41(18 x 2 + 1 x 5) points lowest and 61(28 x 2 + 1 x 5) points highest.

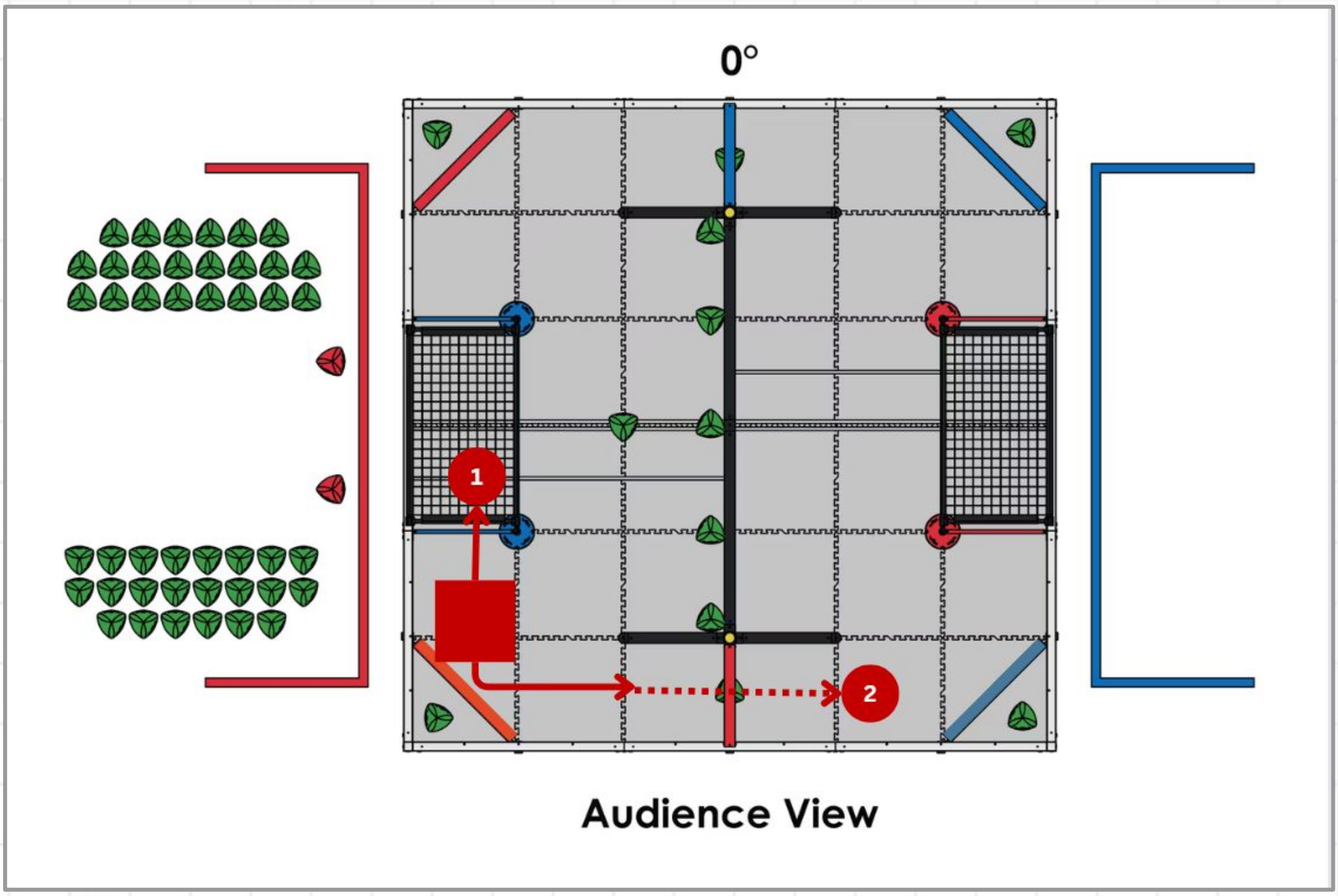
Which would not ensure all 44 match loads going over

Hence the most reliable choice is route 3

Coding

Route description

- Pushes 2 preloads in goal
- Rotates the bot towards the offensive zone without the barrier
- Runs the intake
- Place the matchloads on top of intake
    - It would allow them to roll into the offensive zone
- Occasionally we push the excess triballs into the offensive zone



2 matchloads are positioned in between the robot and (1)

Matchloaders are to matchload with precision

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Autonomous - Final result

Autonomous

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

```
Wings.set_value(true);
pros::delay(500);
Wings.set_value(false); //Open and closes the wing to push the triaball towards the goal
chassis.set_swing_pid(ez::LEFT_SWING, -45, 75);
chassis.wait_drive();
chassis.set_drive_pid(-15, 75, false);
chassis.wait_until(10);
chassis.set_swing_pid(ez::LEFT_SWING, -90, 75);
chassis.wait_drive();
chassis.set_drive_pid(-10, 75, false); //Pushes the preload triballs into the blue goal
chassis.wait_drive();
chassis.set_drive_pid(8, 75, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, -45, -75);
chassis.wait_drive();
chassis.set_drive_pid(22, 75, false);
chassis.wait_drive();
IntakeSA.set_value(true);
pros::delay(50);
IntakeDA.set_value(true); //Lower intake so we can place the triballs on-top
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
intake.move_velocity(127); //Turns the intake so we can place the triballs and they will roll to the other side
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
intake.move_velocity(-127);
chassis.set_drive_pid(24, 50, true);
chassis.wait_drive();
chassis.set_drive_pid(-24, 75, true); //Push the triballs through to the offensive zone
chassis.wait_drive();
intake.move_velocity(127);
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
intake.move_velocity(-127);
chassis.set_drive_pid(24, 50, true);
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chassis.wait_drive();
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
pros::delay(5000);
chassis.set_turn_pid(0, 50);
chassis.wait_drive();
```

Testing

Framework

- Continuously running the program
- Aiming for 5 consistent runs
- Tuning and fixing code along the way

this will ensure in reliability during skills runs , running this program multiple times will also allow us to quickly set up the robot placement on the field

We position ourselves around the filed tiles, so that we can catch the robot if it drives off the field

SETUP

Same as autonomous

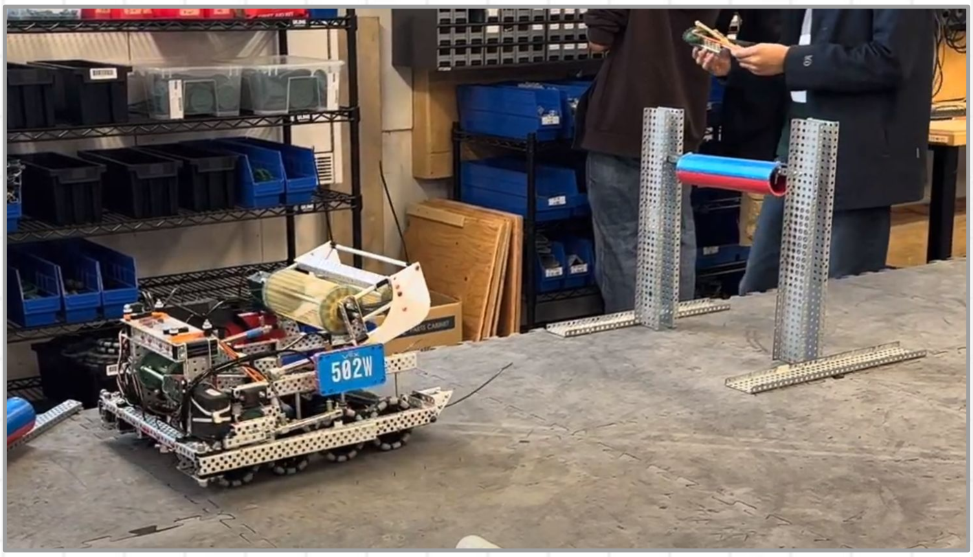
RUN

11 runs total

Issues faced

Run 1-4: Unable to matchload in a way that the triball rolls past the barrier

We tested out different angles and found the best one



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Controls

Controls

Buttons

LEFT JOYSTICK forward and backwards

RIGHT JOYSTICK turn right and left

R2 spins intake to intake triball in

R1 spins intake to unintake triball

L2 shoots the catapult and puts it into the low position

L1 puts the catapult to its mid position

LEFT ARROW cycles the catapult and when released it puts the catapult in the low position

RIGHT ARROW releases the catapult so that it can be restarted

UP ARROW moves the intake upwards

DOWN ARROW moves the intake downwards

A opens the wings

B closes the wings

Auto Overview

- We have our skills auto which pushes 2 triballs into the goal and turns the bot and spins the intake
- We have our far side auto which pushes 1 triaball into the goal and touches the elevation bar
- We have our close side auto which is taken from our skills auto which pushes 1 triaball into the goal

Predictions

We predict that we will place in the top 5 teams even without the field and a 200 skills score

Other Teams

Large range of skills

- Few good teams
- Few teams which would come unprepared

We expect most people to have catapults, intake and wings and be able ot match load the same speed or quicker than us

We expect a few blockers and a few climbs, but nothing too impressive

- Only A tier climbs either through hang or on barrier

Most people may have 1 triball auto

Goal

- We want to beat other people by strategizing more than the other teams
  - instead of having a better bot as we do not have a field
- We hope to be decent at match loading with dishwashing gloves
- Alliance with a decent team and make it to semi-finals
- For autonomous skills
  - We hope our auto would get 40 - 44 triballs and 2 pushed under the goal which would give us 90 points
- For driver skills
  - we would shoot 40/44 triballs over and push as many as we can into the goal with the remaining time our hope was that we would be able to get at least 110 points during driver

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OCT 2 WPRA REVIEW

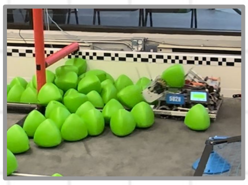
Skills results

Rank	Team	Driver Attempts	Driver Highscore	Programming Attempts	Programming Highscore	Total High Score
1	10012G	3	148	3	153	301
2	1010W	2	147	3	125	272
3	886N	2	134	3	89	223
4	1010X	1	107	2	80	187
5	604X	1	103	1	61	164
6	1010T	2	77	1	78	155
7	502W	1	129	1	25	154
8	10836E	3	81	1	35	116
9	1011T	3	62	1	44	106
10	502X	3	62	1	18	80
11	1010N	1	62	2	5	67
12	77174B	3	52	0	0	52
13	10012U	2	45	0	0	45
14	604Y	1	35	0	0	35
15	886Z	1	22	0	0	22

Skills summary

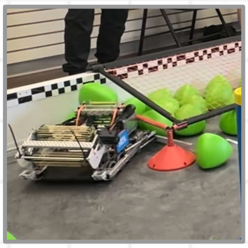
Autonomous

- We match loaded too fast for the robot to push. Causing the triballs to be unable to be pushed



Driver

- We forgot to retract wings which was a rule violation.
  - We were let off



- Match loading with gloves worked well despite the lack of practice

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Skills results

Rank	Team	Name	W-L-T	WPs/APs/SPs
1	886Z	Orion	5-1-0	12 / 24 / 543
2	10012G	Ten Ton Robotics	5-1-0	12 / 24 / 460
3	886N	Orion Notion	4-2-0	10 / 48 / 513
4	1010W	TenTon Robotics	4-2-0	10 / 20 / 504
5	1010X	TenTon Robotics	5-1-0	10 / 12 / 451
6	1010T	TenTon Robotics	4-2-0	9 / 36 / 489
7	604X	Orion	4-2-0	
8	502W	WonTon	4-2-0	9 / 24 / 478

Match Results

MATCH	RED ALLIANCE		SCORE	BLUE ALLIANCE	
Qualifier #3	10836E	77174B	**113 - 102**	**502W**	1011T
Qualifier #9	**502W**	604Y	**64 - 20**	1010G	866A
Qualifier #12	866A	1010A	**50 - 148**	886N	**502W**
Qualifier #15	**502W**	10012U	**117 - 109**	886Z	502X
Qualifier #20	9181S	1010W	**97 - 106**	**502W**	502X
Qualifier #27	**502W**	604X	**100 - 112**	1010N	886N
QF #2-1	1010S	9181S	**86 - 68**	**502W**	502X

Wins vs Losses

Total Win rate: 71.43%
Win: 5
Lose: 2

Qualifier Win rate: 83.33%
Win: 5
Lose: 1

Awards: Judges

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OCT 2 WPRA REVIEW

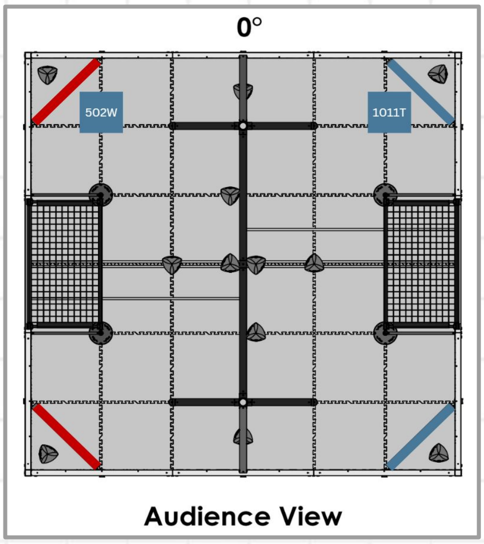
Detailed analysis of each match

Q3 - BLUE ALLIANCE

Game Strat

We chose to play offensive and matchload as we had the auton program on our side whereas they had none. Our catapult worked more consistently than their bot's.

Starting Position



Characteristics of our Alliance robot

Same as ours
(Catapult, rubber band intake, wings but w/o locking)

502W
Play: Offence, matchload
Starting position: Far side (auton)

1011T
Play: Defence
Starting position: Close side (no auton)

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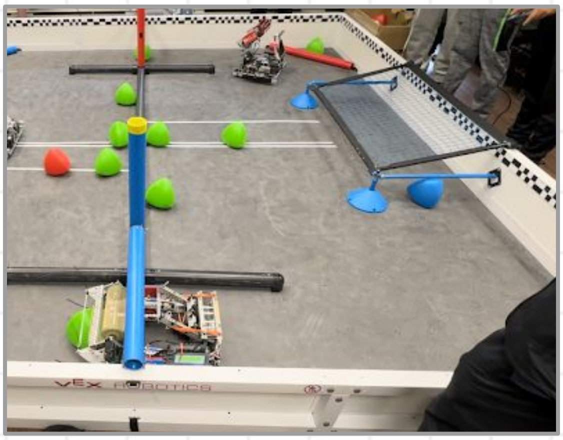
OCT 2 WPRA REVIEW



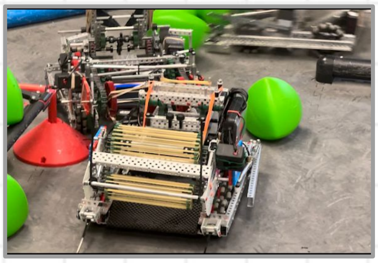
Match Observations

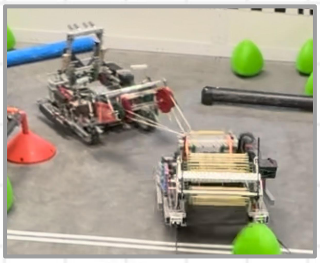
Autonomous

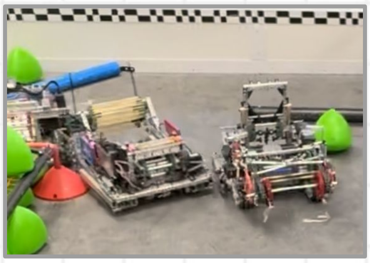
- Shaky robot when pushing preload
- Preload went in goal
- Touched elevation bar with zip ties
- Our robot went over the autonomous line, causing us to lose the points

Gameplay

- Math loading was successful, first few triballs did not go over the pipe as we angled the robot wrong(resulting in the triballs hitting the elevation bar. After adjusting, all was fixed
    - Out of all our matchloads (22), 22 were loaded, 15 successfully went over the pipe and 7 did not go over.
    - % Across: 68.18%
      % Not over: 31.82%
- We were winning until we entangled with 77174B
    - How did the entanglement occur?
        - Defence against 77174B, after we finish matchloading.
        - 77174B lowered intake onto us
        - We got entangled
        - We tried to escape entanglement, as we didn't know what to do
        - Resulted in us breaking their elastic bands(located on intake)
        - We received a warning from the refs
    - What could we have done better?
        - Stayed in place and waited when entangled







DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

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OCT 2 WPRA REVIEW

Performances of Robot Components

What went well

- Catapult consistency
  - Easy to matchload
  - Majority of triballs went over the pipe
- Drivetrain performance
  - No error in controlling

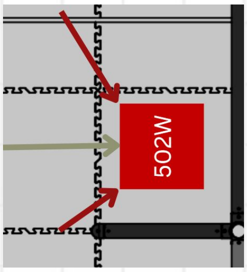
What needs improvement?

- Intake
  - Not consistent
  - Takes multiple tries to successfully intake the Triball
  - Not smooth when out taking the Triball into the goal

Intake visualisation

🟥 = ≥ 3 tries

🟩 = ≤ 2 tries



End results

Lost by 62 points

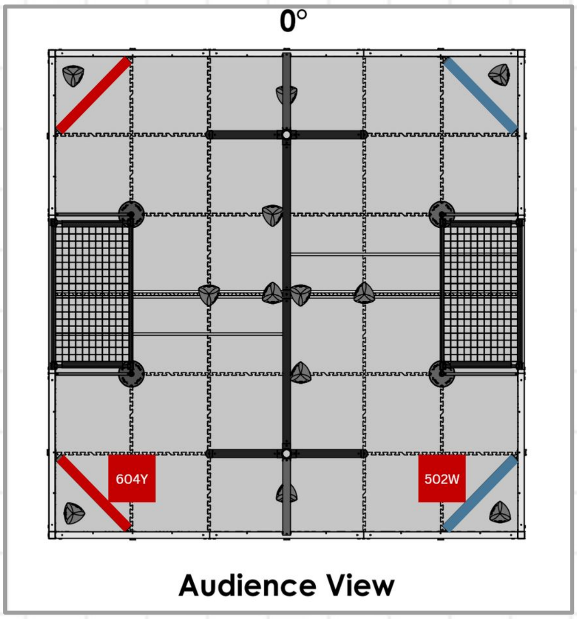
Q9 - RED ALLIANCE

Game Strat

We chose to play offensive and matchload as we had more confident with our matchloading abilities. Our alliance had auto on both sides. We decided to focus on defending against 1010G as opposed to their alliance as they seem to be the matchloader of the other team, and they have a more consistent bot, hence upping their chance of winning this match

Characteristics of our Alliance robot

Same as ours except with a blocker.
(Catapult, rubber band intake, wings but w/o locking)



502W
Play: Offence, matchload
Starting position: Far side (auton)

604Y
Play: Defence
Starting position: Close side (auton)

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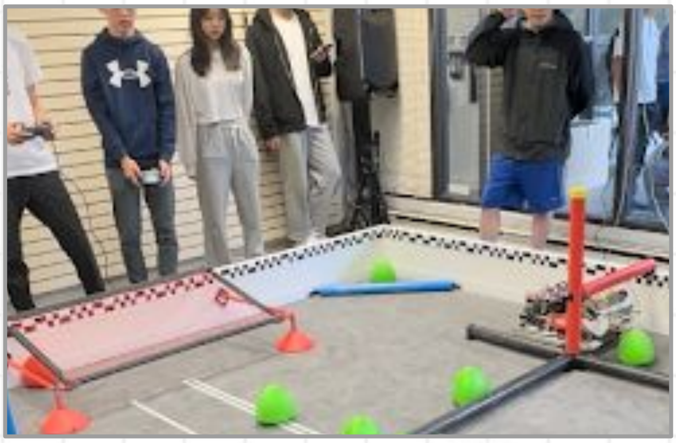
OCT 2 WPRA REVIEW

Match Observations

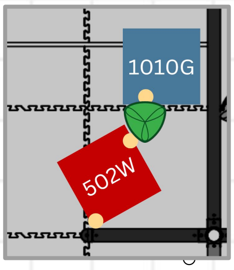
Autonomous



- Robot was no longer shaky
- Preload went in goal
- Touched elevation bar with zip ties,
- We fixed the previous error (driving past the line)
- Overall success

Gameplay

- Math loading was successful after getting defended against(pushed around and missing 6 we decided to break free and focus on offence or defence.
    - Out of all our match loads (22), 17 were loaded, 11 successfully went over the pipe and 6 did not go over.
    - % Across: 50%
      % Not over: 27.27%
      %Not loaded: 22.73%
- Our alliance's defence against 1010G was successful, the opponent alliance was not able to match load at all
- Mid-match, as we were scoring into our goal, 010G tried to prevent us from scoring, which resulted in bot of us getting caught on a triball, where none of us were able to move
    - How did this event occur?



        - 1010G defence against us, while we attempt to score.
        - A triball was between us (=   3 contact points)
        - As we got pushed with the triball, we got caught on the short barrier
        - Led to us tipping over onto our back
        - The momentum from pushing us over made 1010G roll onto the triball
        - That propped them up preventing them from moving
    - What could we look out for?
        - Triballs when getting pushed, as they are round and pointed you can easily get propped up from getting stuck on top of them
        - Our surroundings to note any other game elements that could play a role in this event occurring again
- We decided not to ask our alliance to help set us right as that would also enable 1010G to get free. They scored enough points to guarentee a win and then focussed on preventing 866A from scoring

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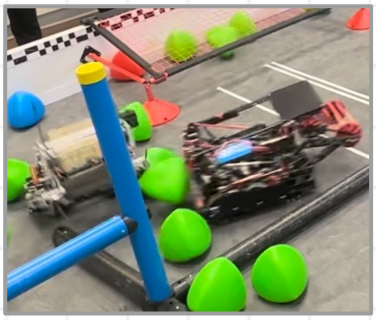

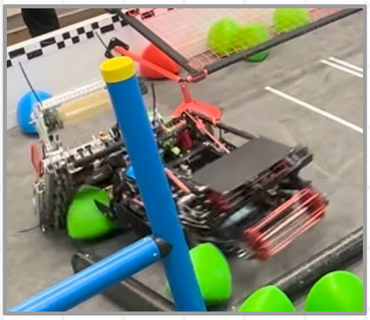

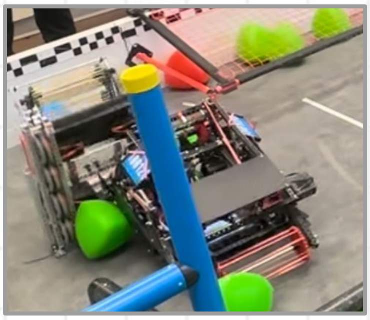

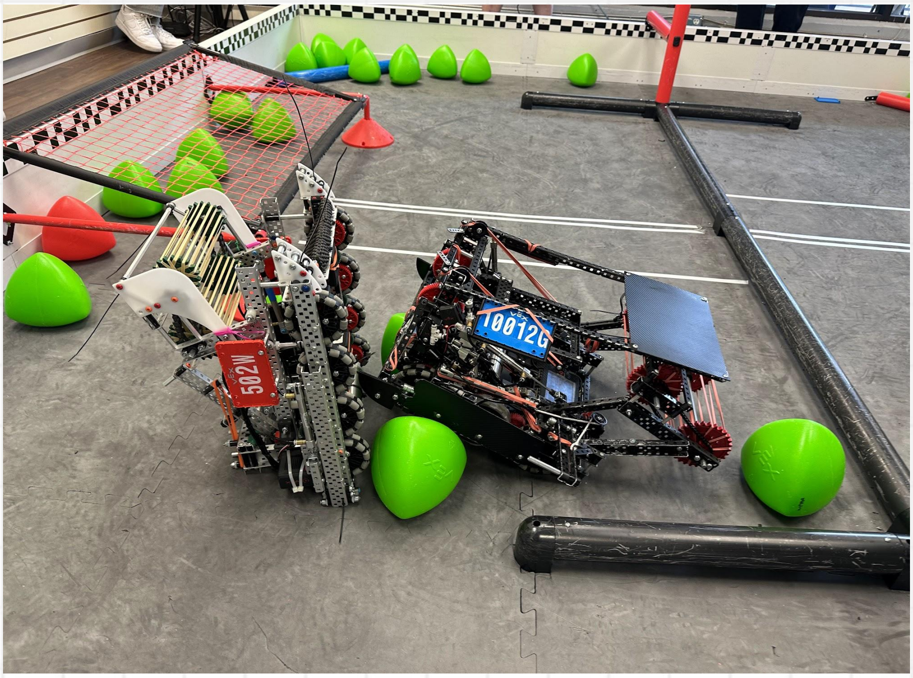

Here we can note that, as we were very back heavy, getting tipped over with the use of other game elements isn't very hard

In future games we should take note of triballs in the vicinity while playing defence as we like 1010G could get caught them

Performance of Robot Components

Same as the previous match

End results

Won by 44 points

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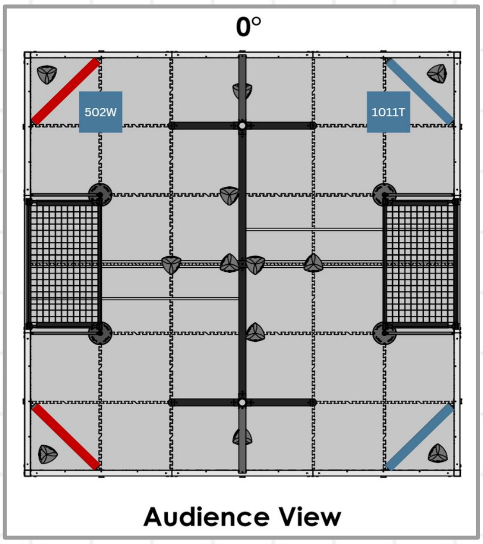
OCT 2 WPRA REVIEW

Q-12 - BLUE ALLIANCE

Game Strat
We chose to play defense and block the opposing alliances bot to prevent them from match load as we had the auton program on the far side

Starting Position



Characteristics of our Alliance robot

Puncher , grabber / blocker

502W
Play: Defence, blocking
Starting position: Far side (auton)

886N
Play: Offence, matchload
Starting position: Close side (with auton)

Match Observations

- **Autonomous**
  - **Shaky robot when pushing preload, caused by an issue with the PID**
  - **Preload went in goal**
  - **Touched elevation bar with zip ties**
  - **Robot crashed into our alliance since our intake sticks out and the end positions were both at the elevation bar**

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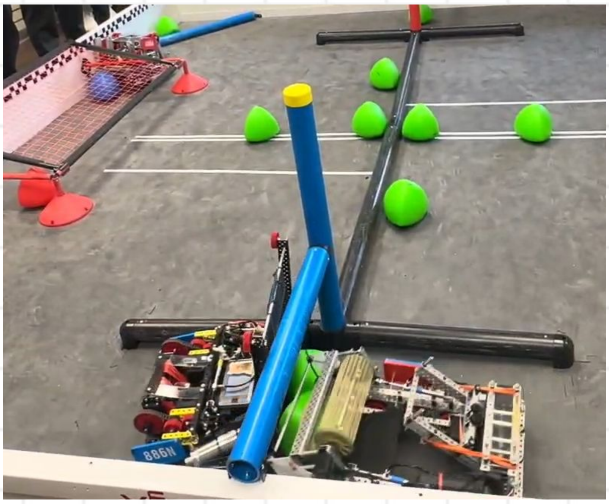
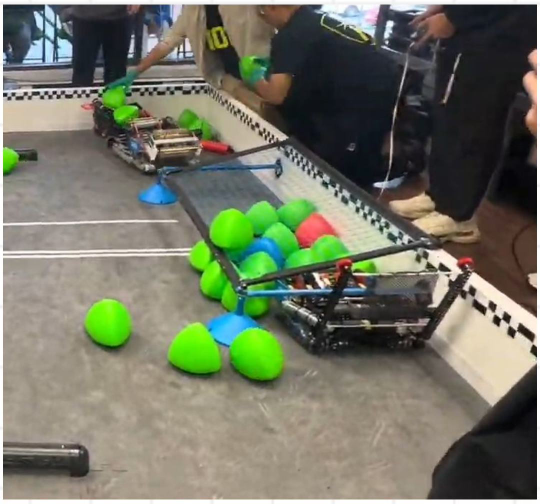
OCT 2 WPRA REVIEW

Gameplay

- Playing defence and blocking the opposing alliance from match loading was very effective and our defence was strong
  - Out of all our teammates match loads (22), 16 were loaded, 16 successfully got to our side.
  - % Across: 100%
    % Not over: 0%
    % Not loaded: 27.3%
- Our team mate was able to get 8 over with there puncher at the start of the game but they quickly got blocked by opposing team and had do place triballs on the intake





Performances of Robot Components

What went well

- Defending opposing alliances match loading
  - The robot did not get pushed around as much as we expected and the drivetrain was able to push the other bot away from the match load bar successfully
- This was the first match where we got AWP

What needs improvement?

- Intake
  - Still not consistent even after minor tweaks
  - Takes multiple tries to intake
  - Not smooth when out taking into the goal

End results

Won at 148 points

OCT 2 WPRA REVIEW

Q-15 - RED ALLIANCE

Game Strat

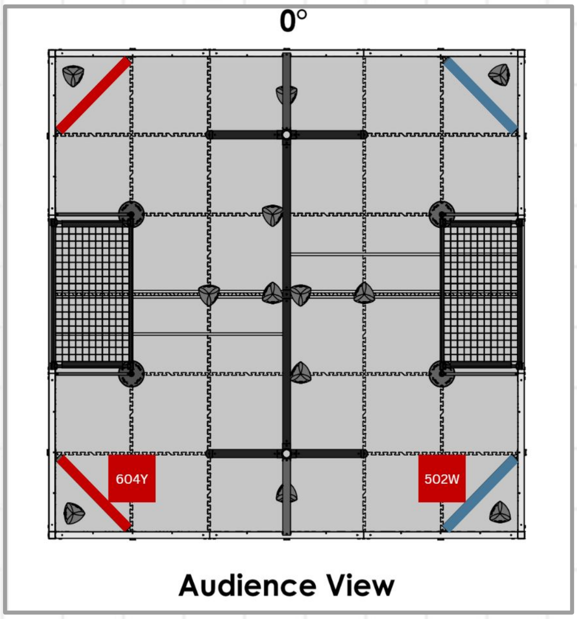
We chose to play offensive and match load as we had more confident with our match loading abilities. Our alliance had auto on both sides. We decided to focus on defending against 1010G as opposed to their alliance as they seem to be the match leader of the other team, and they have a more consistent bot, hence upping their chance of winning this match

Characteristics of our Alliance robot

Same as ours except with a blocker.
(Catapult, rubber band intake, wings but w/o locking)

502W
Play: Offence, matchload
Starting position: Far side (auton)

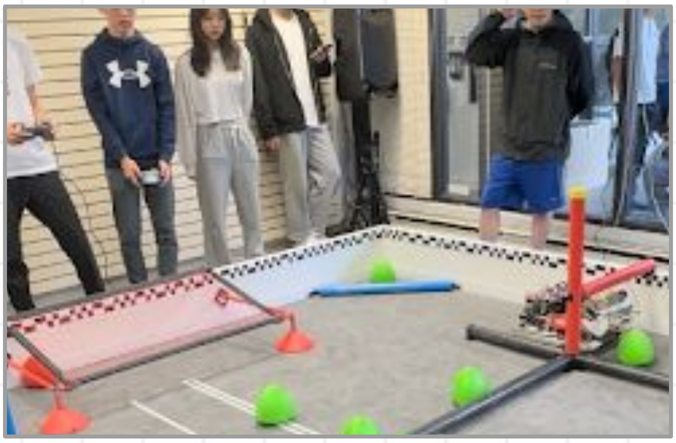
10012U
Play: Defence
Starting position: Close side (auton)



Match Observations

Autonomous

- Robot was no longer shaky but was driving slow
- Preload went in goal
- Touched elevation bar with zip ties
- Blue alliance won



DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

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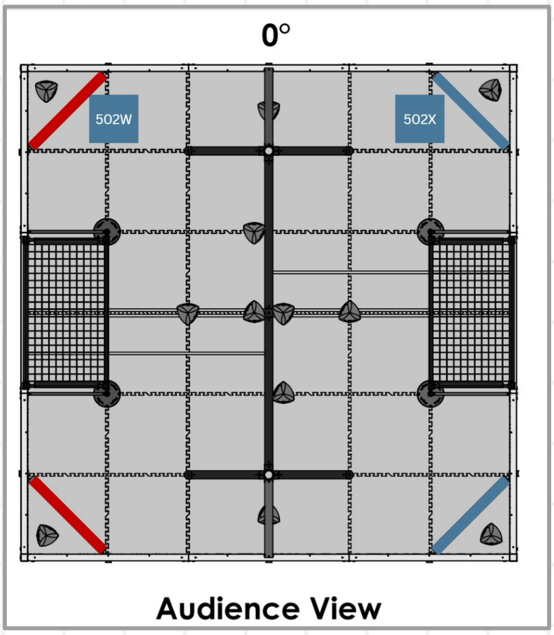
OCT 2 WPRA REVIEW

Q20 - BLUE ALLIANCE

Game Strat

We chose to play offence and match load as 502X is able do descore tribals from the opposing alliances goal

Starting Position



Characteristics of our Alliance robot

Climb and able to descore

502W
Play: Offence, match loading
Starting position: Far side (auton)

502X
Play: Defence, descore
Starting position: Close side (with auton)

Match Observations

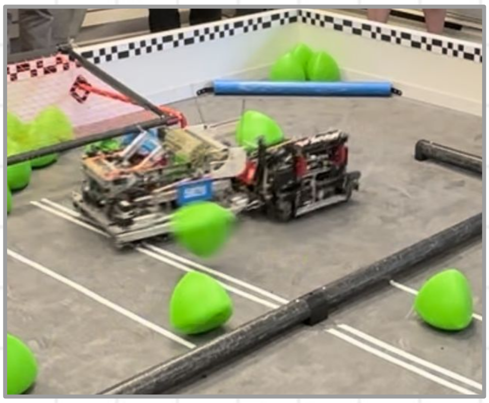
- **Autonomous**
  - **Our preload did not go in to the goal**
  - **Touched elevation bar with zip ties**
  - **502X preload went into goal**

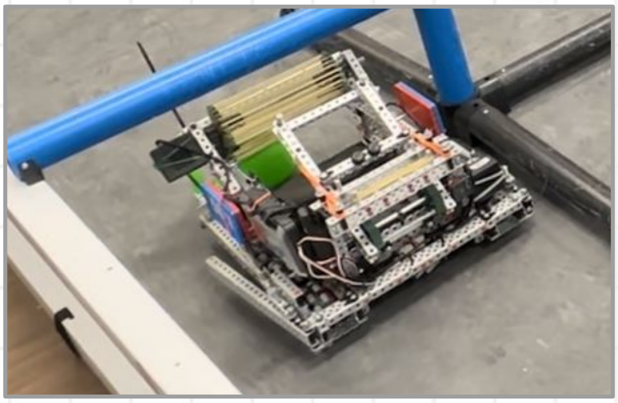
CONTINUED FROM PAGE:

OCT 2 WPRA REVIEW

Gameplay

- Playing defence and blocking the opposing alliance from match loading was very effective and our defence was strong
  - Out of all our teammates match loads (22), 22 were loaded, 14 successfully got to our side.
- Our match loading was not the best and we were not in sync
- 502X defence was very good and prevented opposing alliance from match loading
- Near the end of the match we got a tribal stuck under the catapult arm
- No one was able to climb at the end of the match





Performances of Robot Components

What went well

- Most of our machloads went over

What needs improvement?

- Intake
  - Still not consistent even after minor tweaks
  - Takes multiple tries to intake
  - Not smooth when out taking into the goal

End results

Won at 106 points

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OCT 2 WPRA REVIEW

Q27 - RED ALLIANCE

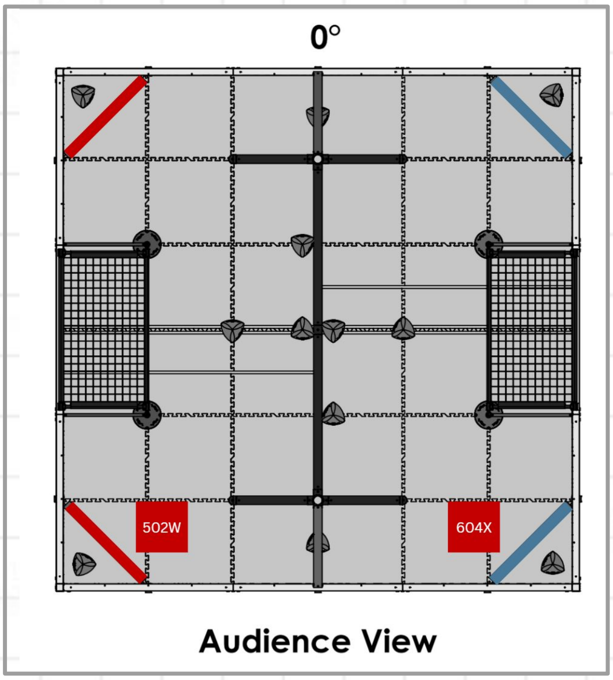
Game Strat

We chose to play offensive and match load as we had more confident with our match loading abilities. Our alliance had auto on both sides. We decided to focus on defending against 1010G as opposed to their alliance as they seem to be the match leader of the other team, and they have a more consistent bot, hence upping their chance of winning this match

Characteristics of our Alliance robot

Same as ours except with a blocker.
(Catapult, rubber band intake, wings but w/o locking)

Starting Position



502W
Play: Offence, matchload
Starting position: Far side (auton)

604X
Play: Defence
Starting position: Close side (auton)

Match Observations

Autonomous

- Preload went in goal
- Touched elevation bar with zip ties
- Blue alliance won

CONTINUED FROM PAGE:

OCT 2 WPRA REVIEW

Gameplay

- Our match loading was not very good since 886N's defence was very good and blocked almost all of our match loads
    - Out of all our match loads (22), 20 were loaded, 11 did not go over.
- Our alliance's defence was not good and they were not able to prevent our opponent from match loading through there intake, since they were blocked and let our opponents score in
- Mid-match we got jammed on the matchload bar and we were not able to reposition ourselves to successfully get the triballs over the barrier

Performances of Robot Components

What went well

- Autonomous went well and we go the triball into the goal and touched the elevation bar with zipties

What needs improvement?

- Intake still needs improvement and has the same issues
    - Still not consistent
    - Takes multiple tries to intake
    - Not smooth when out taking into the goal

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OCT 2 WPRA REVIEW

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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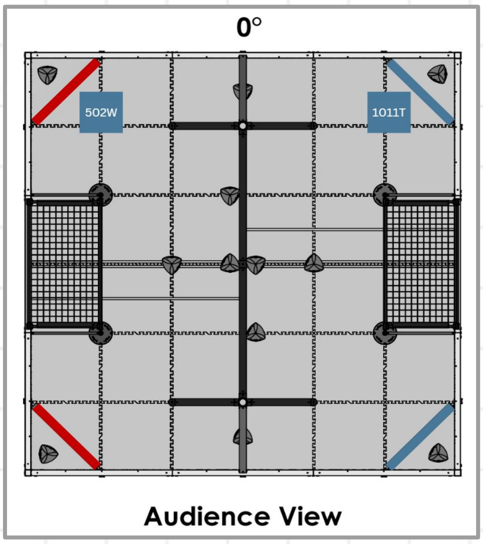
TESTING SOLUTION

QF 2-1 - BLUE ALLIANCE

Game Strat

We again chose to play offence and match load as 502X is able do descore tribals from the opposing alliances goal and has 8 motor drive

Starting Position



Characteristics of our Alliance robot

Climb and able to descore and 8 motor drive

502W
Play: Offence, match loading
Starting position: Far side (auton)

502X
Play: Defence, descore
Starting position: Close side (with auton)

Match Observations

- **Autonomous**
  - **Our preload did not go in to the goal**
  - **Touched elevation bar with zip ties**
  - **502X preload did not go into the goal**

OCT 2 WPRA REVIEW

Gameplay

- Playing offence and match loading was very effective and 502X defence was decent
  - Out of all our match loads (22), 22 were loaded, 17 successfully got to our side.

- Our match loading was much better and we only missed 5 triballs
- 502X defence was not very good and did not prevented opposing alliance from match loading most of their triballs
- Near the end of the match 502X got stuck under the goal and was told to stop driving since it would cause damage to the goal net if he continued
- No one was able to climb at the end of the match

Performances of Robot Components

What went well

- Most of our machloads went over

What needs improvement?

- Intake
  - Still not consistent even after minor tweaks
  - Takes multiple tries to intake
  - Not smooth when out taking into the goal

End results

Lost by 18 points we got 68 points

Overall this tournament was a success

- We learned that we were pretty good at matchloading
- We've also observed other teams robots and discussed strategy.
- We found that most robots had catapults and were operating off of the same strategy as us
- This tournament concluded, or proved our general idea that this season has a much heavier reliance on driver skill

We also received the judges award

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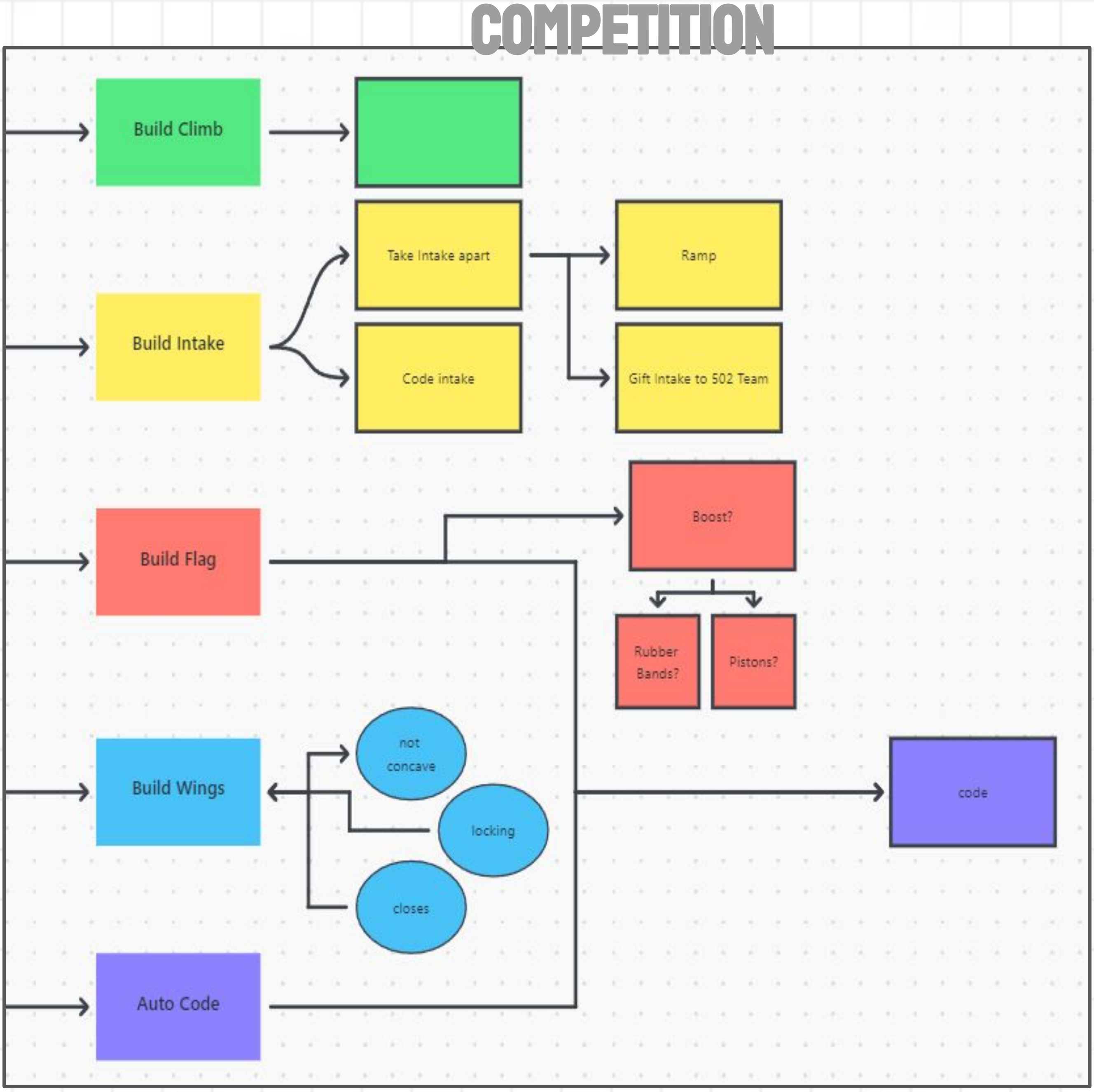
OCT 2 WPRA REVIEW

SUMMARY OF MAJOR ISSUES

- **Drivetrain**
  - The bots weight is unbalanced
  - this leads to tipping and difficulty driving over the barrier
- **Wings**
  - They would not lock properly
  - Would not consistently close
- **Catapult**
  - When match loading the trajectory of triballs are inconsistent
  - Inconsistent trajectory
- **Intake**
  - When intaking triball the intake occasionally jams
  - 2
- **Autonomous**
  - Since we had no field the programs were not tested and hardly worked

OCT 2 WPRA REVIEW

TO DO LIST FOR NEXT COMPETITION



We hope to follow through with this plan in order to ameliorate our robot for the next comp

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Fixing intake

Goal

Improving our intake based on our observations, and its previous performance from the tournament

Why should we improve the intake?

- **Triball often gets stuck and cannot get out when the intake reversed**
- **Can’t reliably intake triballs everytime, sometimes triball would stay outside the intake ore roll away**
- **Other teams have better and more reliable intake design**

Being able to stop the triball from going too far up into the bot

Why would this be beneficial?

- Reduce times triball accidentally load into catapult by reducing intake space
- Increase area for intake to be load triball onto catapult
- Longer arm, lager swing, more power

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Climb

Goal

Selecting and building a climb in order to score more points during skills and matches.

Why is a climb important?

Having a climb mechanism is important, as it plays a pivotal role in winning games:

- If an alliance is the only alliance that climbs, then they receive 20 points
  - At our first competition, every single game we lost was within 20 points. Which we had a climb on any of those games we lost, we would have won them.
- Early season, not many teams have climb as they are focus on other aspects of their robot
- It's a quick way to score 5+ points during skills
  - Equivalent to 1+ triballs scored into the goal
- This means a climb plays a deciding role in games.

Ideal characteristics

PERFORMANCE

- **Speed**
  - Essential for scoring more points
  - In Over Under, a faster climb equates to more time spent of scoring or defending, which will boost our advantages to winning a match even more
- **Durability**
  - Important for controlling variables, against wear and tear.
  - This season, we are constantly rammed into and in order to have a consistent climb, then our mechanisms should be able to handle other robot's defence as climbing within the last 15 seconds are ideal.
- **Consistency and reliability**
  - Allows us to be sure of amount of points scored and guarantees them.
  - A reliable climb will allow us to keep to a guaranteed tier for the future, where other robot may have different climb tiers
  - A climb must be able to work in order for us to even spend time to climb as opposed to using the last few seconds to score more points

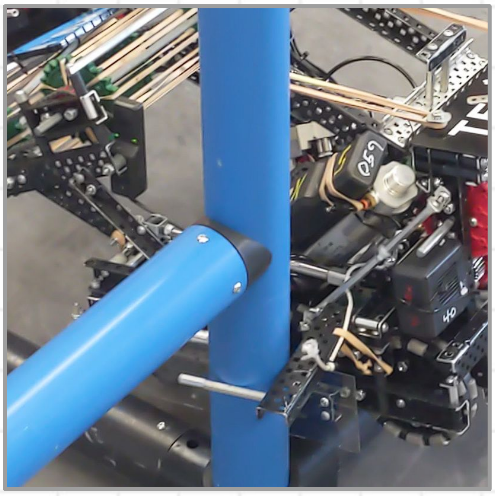
DESIGN

- **Simplicity**
  - Inverse relationship with number of things that can go wrong, making the climb more reliable.
  - We need to account for, the amount of factors that can go awry for the climb
- **Ease of coding**
  - Likelihood of being unable to find errors is low and makes variables easily adjustable.
  - We need to account for how many factors require calculations and how effectively we can divide buttons/joysticks to control each drivetrain.
- **Ease of building**
  - Higher efficiency and easier to fix errors
  - We must account the amount of parts and connections required as well as any non-typical items required on the climb.

POSSIBLE SOLUTIONS

Balancing on barrier

- This solution involves simply driving on top of the barrier and attempting to balance on the pipe.
- Oftentimes, a part of the robot will also extend, so it can get caught on the side of the elevation bar.
- This allows for easier balancing. At summer scrims and early events, we have seen this mechanism widespread.



Credit: 1010W

As we have observed through many games, this method is the most commonly used. We suspect it's a combination of the ease of building and most teams already having a good centre of gravity that motivate them to use this climb.

PROS

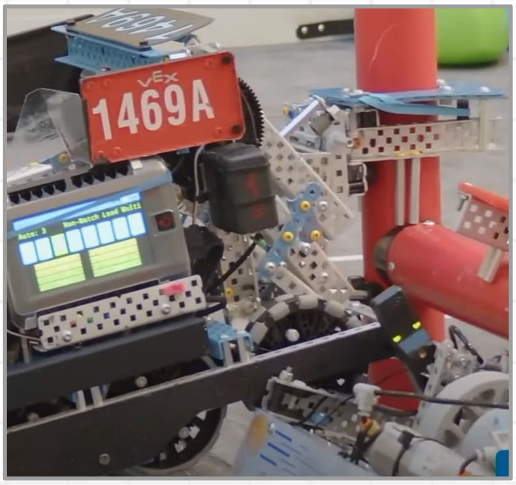
- Easy to build.
  - Only 1 extending part necessary
- Allows for consistent climb
- Good centre of gravity

CONS

- Requires lots of driver practice
- A well-balanced center of gravity is required to balance, meaning only some bots can adopt this method
- At best, this method is only about 50% effective.
- Maximum of A tier climb

DR4B

- A double-reverse-four-bar arm uses c-channels to create linkage mechanisms for linear movement.
- A DR4B could extend upwards, grasp onto a point on the elevation bar
  - Through mechanisms such as a claw or passive lock) and "pulling" the bot up.



Credit: 1469A

We've seen several implementations of this idea through platforms such as Youtube and BiliBili, and throughout this time we've had many observations, both good and bad.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

CONTINUED FROM PAGE:

Climb

PROS

- It is common for such elevations to achieve climb tiers of D or higher.
  - This means that you will almost always get the highest possible points awarded to the climb.
- The expandable height of the robot can also be doubled as a makeshift blocker, which is extremely useful for blocking matchloads.

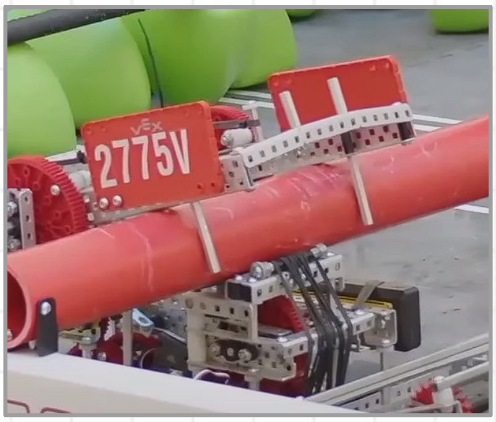
CONS

- Extremely large mechanism
- Requires at least 2 motors
- Climb can STILL be as inconsistent as the balance method.
- The packed metal offsets COG, meaning going over the barrier is impossible

4 Piston controlled Pull-up bar

- A less commonly seen method is to create a bar that "pulls up" the robot.
- Some teams use piston powered, some teams used pneumatic powered.
- This bar is often doubled as a matchload blocker.

Throughout MOA, we have seen wide success for teams with this method, as it address many of the crippling issues faced by other mechanisms.



Credit: 2775V

PROS

- Medium climb
  - B - C tier
- Almost instant elevation.
  - Only takes about 3 seconds to elevate
- Extremely consistent
  - little driver skill required
- No motors needed. Only pneumatics.
- Compact, does not require a robot redesign

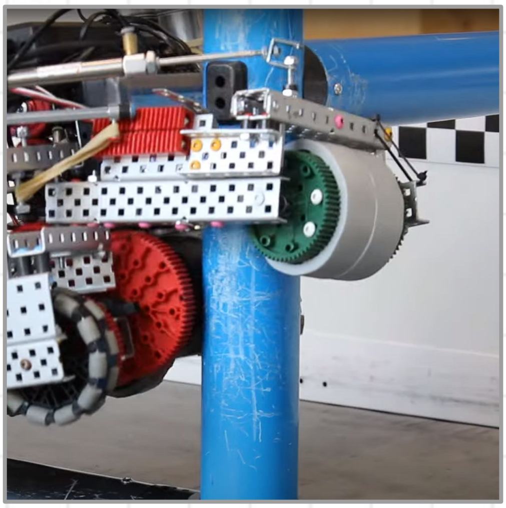
CONS

- High air pressure required
  - most likely will have to dedicate a single tank just for elevation
- Potential issues fitting under the elevation bar

CONTINUED FROM PAGE:

PTO clamp + flex wheel/claw

- This solution is essentially your latch-onto-the-pole and climb with a flex wheel design.
- It involves a latching mechanism for the flex wheel to remain in contact with the pole.
- Then, a PTO engages the flex wheel, allowing 6 powerful motors to climb all the way to the top of the elevation bar.
- Alternatively, the flex wheel can be replaced with a claw, and the robot will essentially do a 360 on itself to elevate.



We have seen several teams do this online, and has many interesting pros and cons to it.

PROS

- Extremely high climb
- More consistent than everything so far

CONS

- Large and bulky mechanism
- PTO necessary for power
- Slow climb
  - takes 10 seconds to fully elevate (although it might not be necessary to overkill)
- No good storage method for climbing flex wheel - it's often exposed

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Analysis

We've narrowed down all possible designs to 3 possible choices as we hope to achieve a B tier climb which will give us a higher advantage in game and in skills account for the equivalent points of 2 triballs scored in a goal : DR4B, PTO clamp, and a pull up mechanism

DR4B

- DR4B is an extremely LARGE mechanism.
- We've observed that it takes up almost ½ of the space on the bot.
- Coupled with the fact that the DR4B requires at least 2 motors in order to have the necessary power to elevate, and the true cost of it becomes clear:
- In order for the DR4B to be viable, we must design our WHOLE bot around the mechanism.

In other words, in order to implement this design, we would need to tear down and build the bot again, most likely with significantly reduced functionality in order to implement this.

Therefore, we will NOT be creating a DR4B climb.

PTO CLAMP

- Overall, this bulky mechanism, although functional, still bears too many consequences to make it worthwhile to create. Once again, the necessity of the PTO to have the required torque,
- Massive flex wheel that needs to hang out in order to climb means that this mechanism will significantly interfere with other mechanisms.

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Therefore, this design is still too much of a sacrifice to implement.

PULL UP

- Overall, this mechanism seems like by far the most effective one.
-
- Lightweight
- doubles as a blocker
- Does not require any motors to create
- Requires very little driver skill.
- This design also seems like the most viable because it does not have any of the downsides of the other methods.
  - For example, the simplicity of this mechanism means there is no significant redesign of the robot needed.
  - This means no PTO, motor reallocation, or any of that sorts is required.

We will be doing more investigations into this design in the upcoming days.

We will be building a pull up mechanism and will aim for a B tier climb

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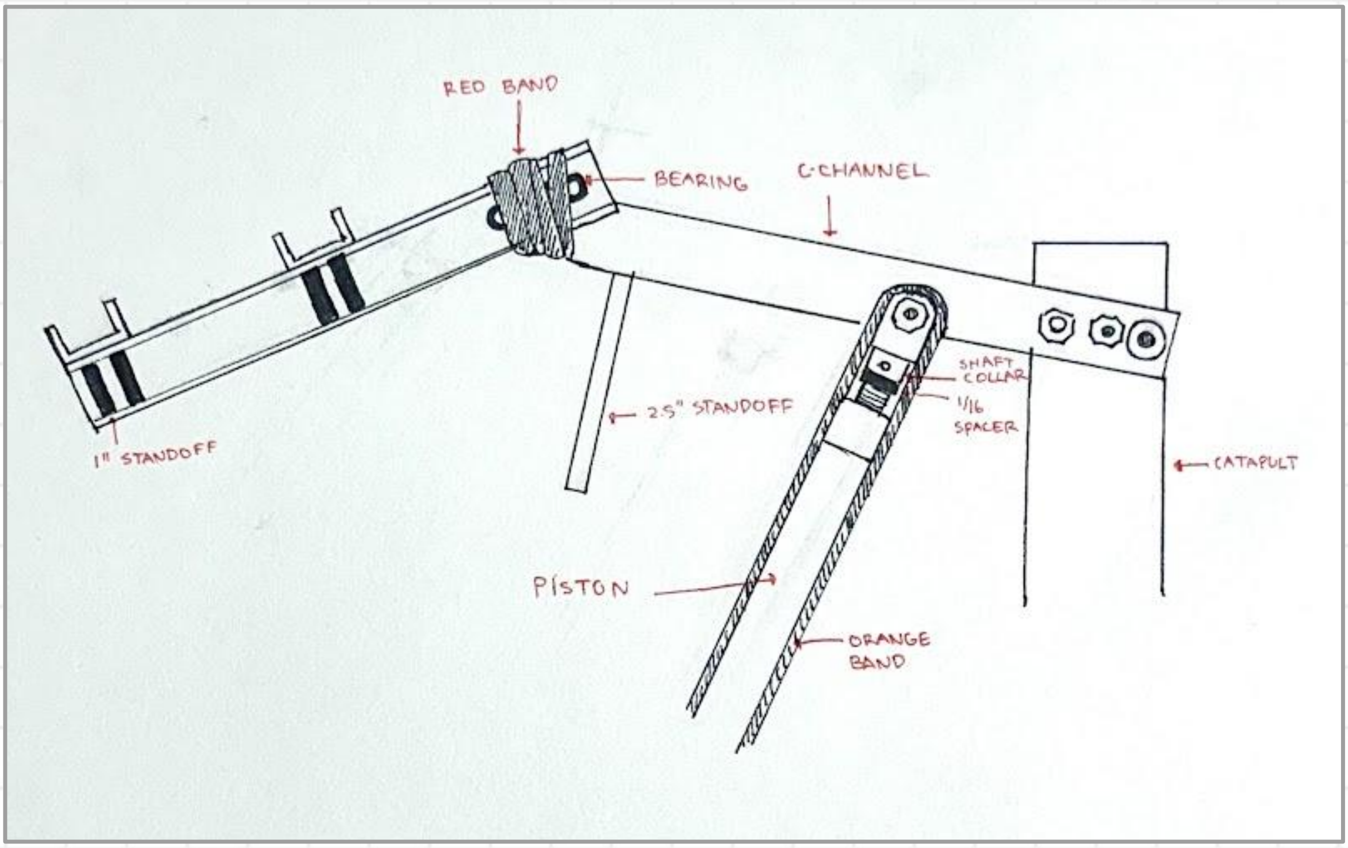
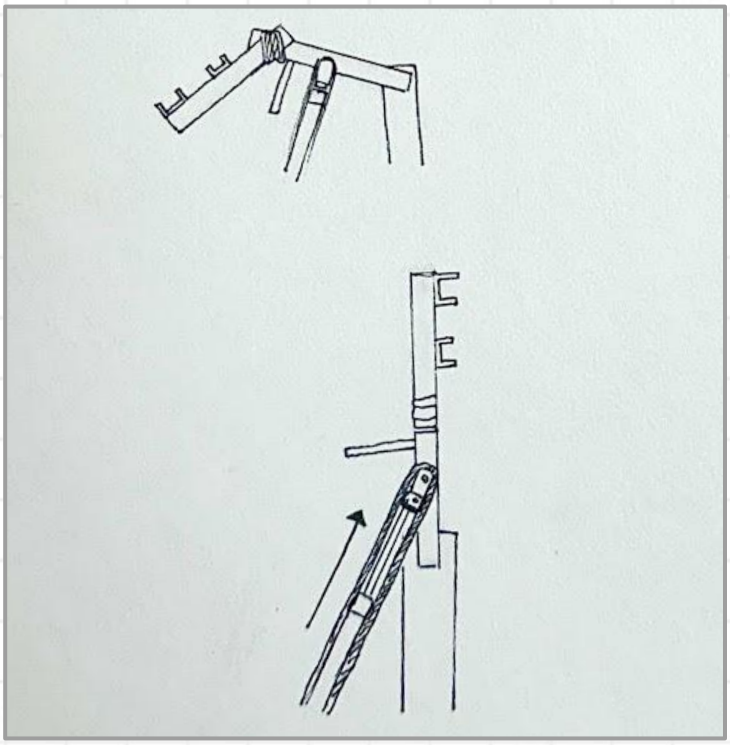
Climb

Sketch



We’ve decided to power our mechanism with 4 pistons pulled down by elastics



When pistons are down, the climb is also down. This will be able to allow s to stay within size and to go under the bar

When 4 pistons extend, climb is up as well as the blocker. This way we will be able to block teams as well as climb

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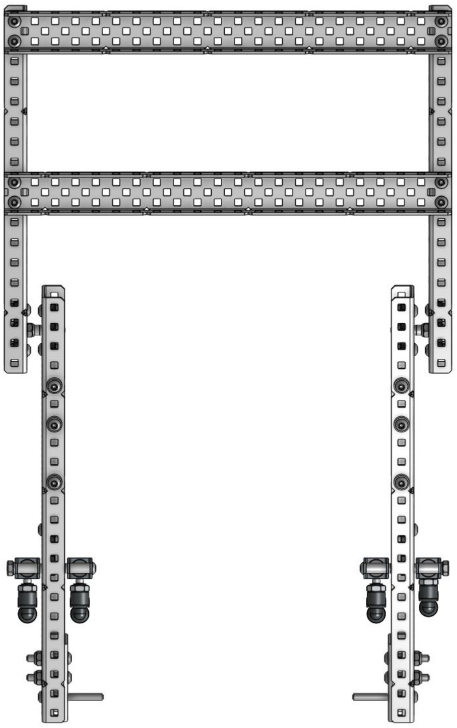
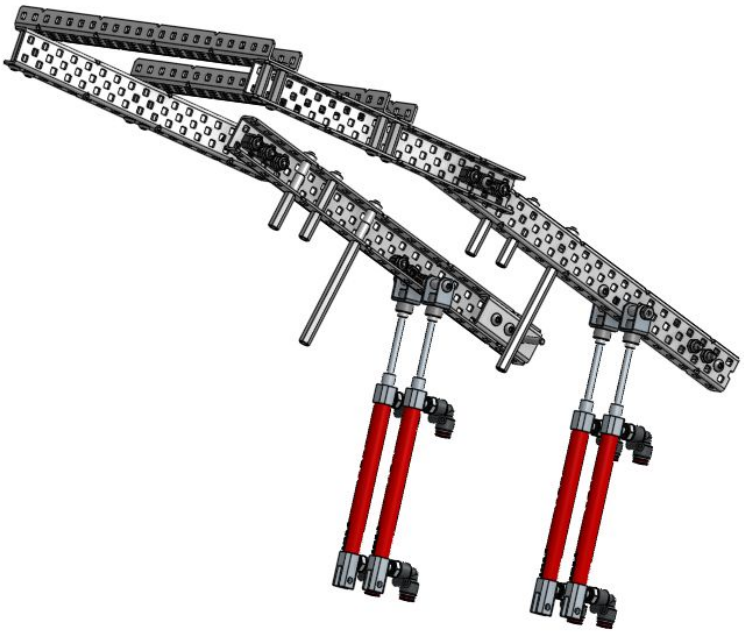
Climb

CAD

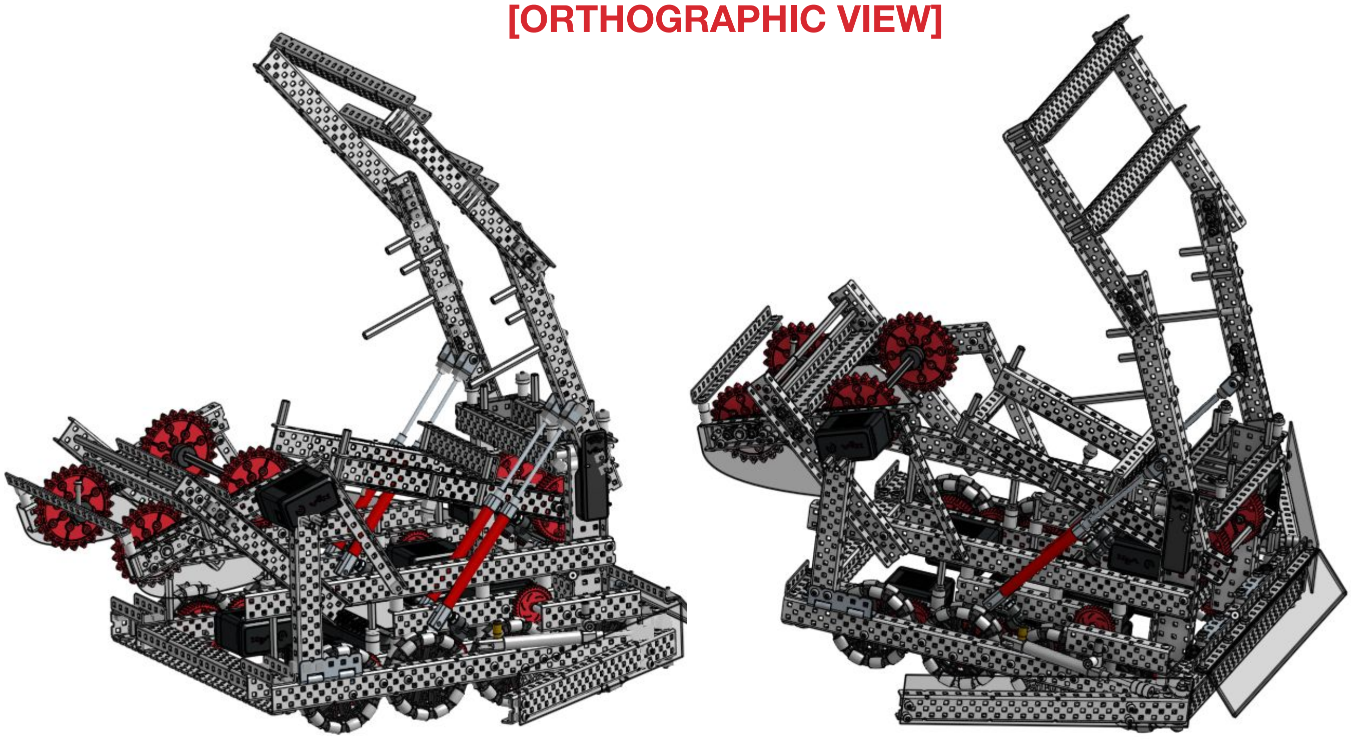
[TOP VIEW]



[SIDE VIEW]



[ORTHOGRAPHIC VIEW]



DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Testing

Testing parts of the climb mechanism

TEST NO. 1 : NEW VS OLD PISTONS

At first glance, 2 visual differences are that the brass inserts are now offset from the lower mounting hole, allowing for easier mounting. Additionally, the threaded shaft at the end of the cylinder is now the standard 8/32 size, the same size as normal screws.

TEST 1 PERFORMANCE

Is there an increased performance with the new pistons? New solenoids?

- For this, we compared the old 50 mm stroke cylinders with the new ones.
- Through a PSI pressure gauge and a scale, we tested them on things like air consumption, strength, and responsiveness.
- Our conclusion is that the 50mm cylinders in both the old and the new are practically identical in terms of performance.
- Additionally, the 25mm and 75mm pistons perform relatively on the basis of output power.

TEST 2 POWER

Does T-splitting a tank into 2 pistons half the power of each of the pistons?

- We directly filled a tank with 100 PSI. Across the T-splitted and non-T-splitted pistons
- There seemed to be no significant performance drop between individual pistons for a 1, 2, and 4 piston parallel configuration.

- This means that having 4 pistons wired up to 1 tank can exert 4 times the power compared to 1 piston wired up to 1 tank.
- In other words, power increases linearly with number of pistons. Good to know for the climb!

TEST 3 TANK PERFORMANCE

Do the new tanks have a significant difference in performance? How worthwhile is it to use the new tanks?

- Apparently, the new tanks have 200mL of capacity, compared to 150mL on the previous ones.
- This should mean that there is a 33% increase in storage.
- Throughout our tests, we counted the amount of times that each solenoid could fire.
- We also used the PSI meter to gauge how much air (well, PSI) is in the tank.
- We observed about a 35% more performance with the new tank, in both storage and PSI decrease.
-
- Therefore, the newer tanks are far better.

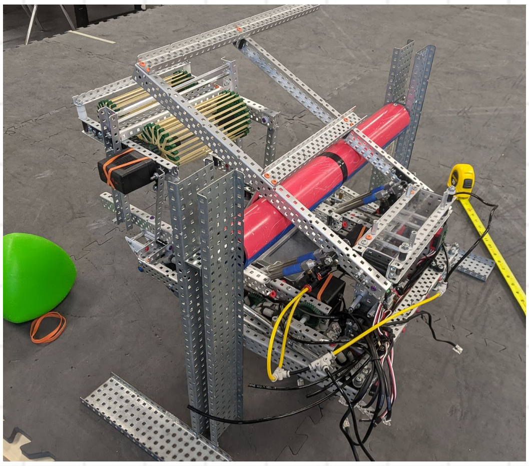
Overall, the new pneumatics are way better than the old ones

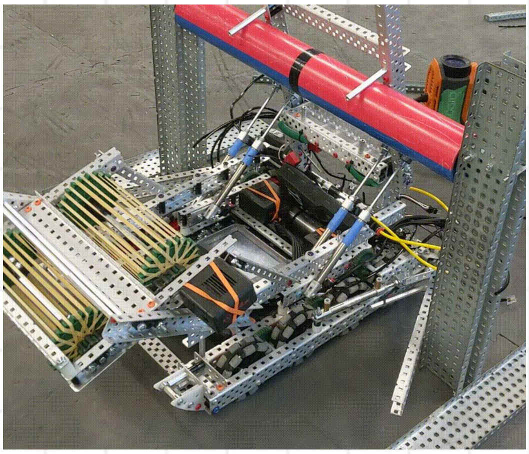
Conclusion

- If the pistons are not strong enough, then adding more pistons attached to the same tank will INCREASE total output power.

- Because all 3 length of pistons have very similar output power, it would be the wisest to use the LONGEST piston, as that way you can achieve the MOST mechanical advantage (longer action can be translated into more leverage)

- After mounting 4 long pistons onto climb, the climb is still not strong enough to rapidly lift up the bot to B tier, even at 100PSI.
  Keep in mind, we were still using the smaller tanks. If we were to use the larger ones, the climb would be much stronger. However, there is no space on our bot to place the tanks, so we will have to cope with elastics for now.
  - The solution is to add more rubber bands. After adding elastic bands to the piston, then the bot still barely climbed. In order to solve this, we increased the leverage that the piston
  - Final result: B tier climb that barely has enough power. 8 elastic bands needed.





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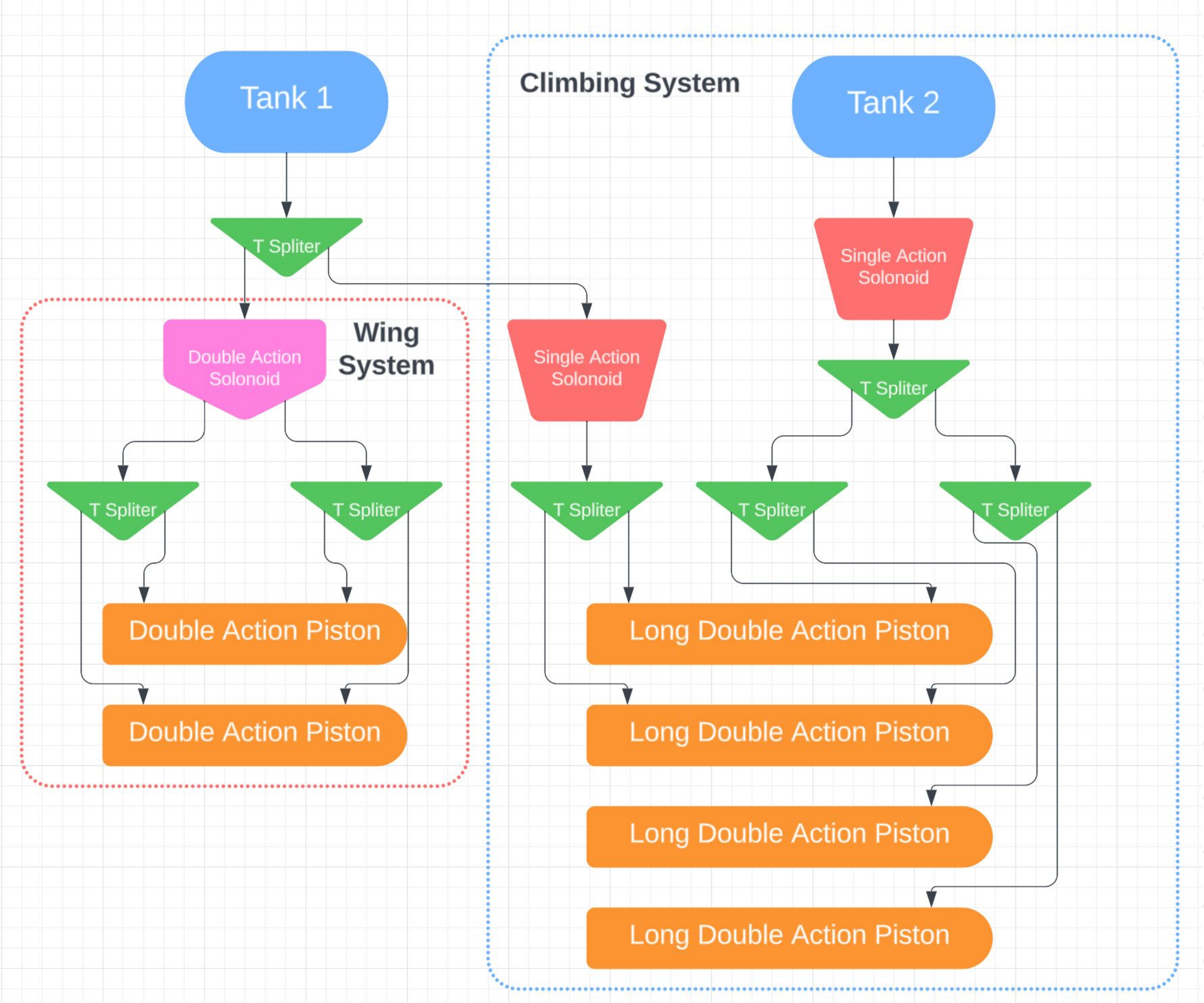
Pneumatics

Pneumatic chart

This illustrates our allocation of tanks

As well as management of tubes



Goal

Selecting and building a mechanism in order to get the triballs out of the matchload zone

Why is a flag beneficial?

It will allow us to get more points

- Help with match load, and avoid being pushed out match load zone
- During autonomous period we are able to get triball out of matchload zone
  - Will help us get awp, allowing us to raise our rank in qualifications
- At our first competition, we had to rely on using zip ties to touch loading zone bar for match load, and give up load zone triball during autonomous. If we added a flag, we could match load more reliably and score more point during autonomous. This means it would help us get more points during comp and less errors in match.

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Flag

Ideal characteristics

PERFORMANCE

- **Power**
  - Less power to trigger
  - We won't be using it unless during autos and matchloading
- **Durability**
  - Important for controlling variables, against wear and tear.
  - In Over Under, a robot may be constantly hit from many directions due to offence or defence.
- **Customizability**
  - Allows us to better personalize the robot to suit the game
  - In competitive games, a robot must be capable of being able to adjust variables to better suit a task. For each drivetrain we need to determine how many factors can be manipulated, for instance, rpm, number of motors, pto, etc.
- **Placement**
  - Not entangle with other parts
  - Should be touching the bar while we match load
- **Size**
  - Able to fit in the size limit

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DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

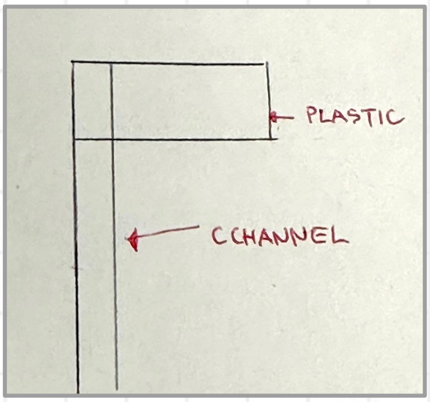
Flag

Create solution to getting triball out of matchload

C channel with polycarb

Characteristics:

- 10.2 inch C channel connected to the side of the bot
- Polycarb bend 30° attached to tip of C channel



PROS

- Long
- Scoop steal triball from net

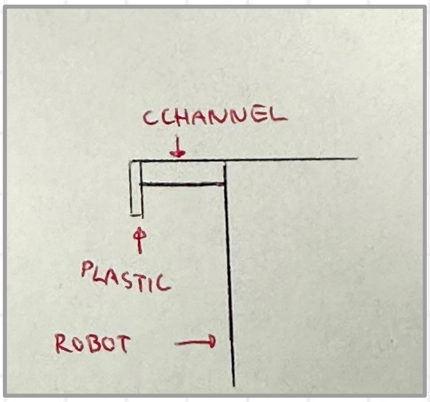
CONS

- Hard to control
- Big / heavy

Blooper

Characteristics:

- C channel attach to hunch
- Flip hunch to use



PROS

- Small & compact
- Grip onto load zone bar
- Light weight

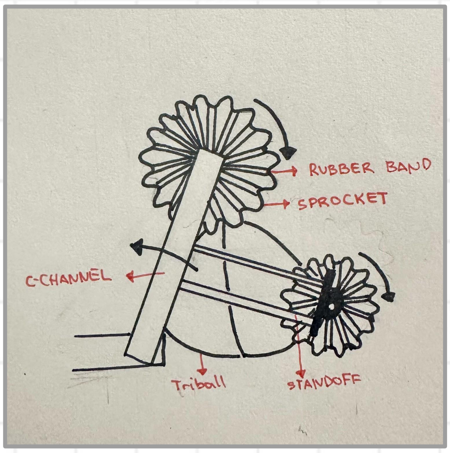
CONS

- Short

Longer intake

Characteristics:

- Intake long enough to get triball out load zone



PROS

- Intake triball to bot/catapult
- No new attachment

CONS

- Only for intaking

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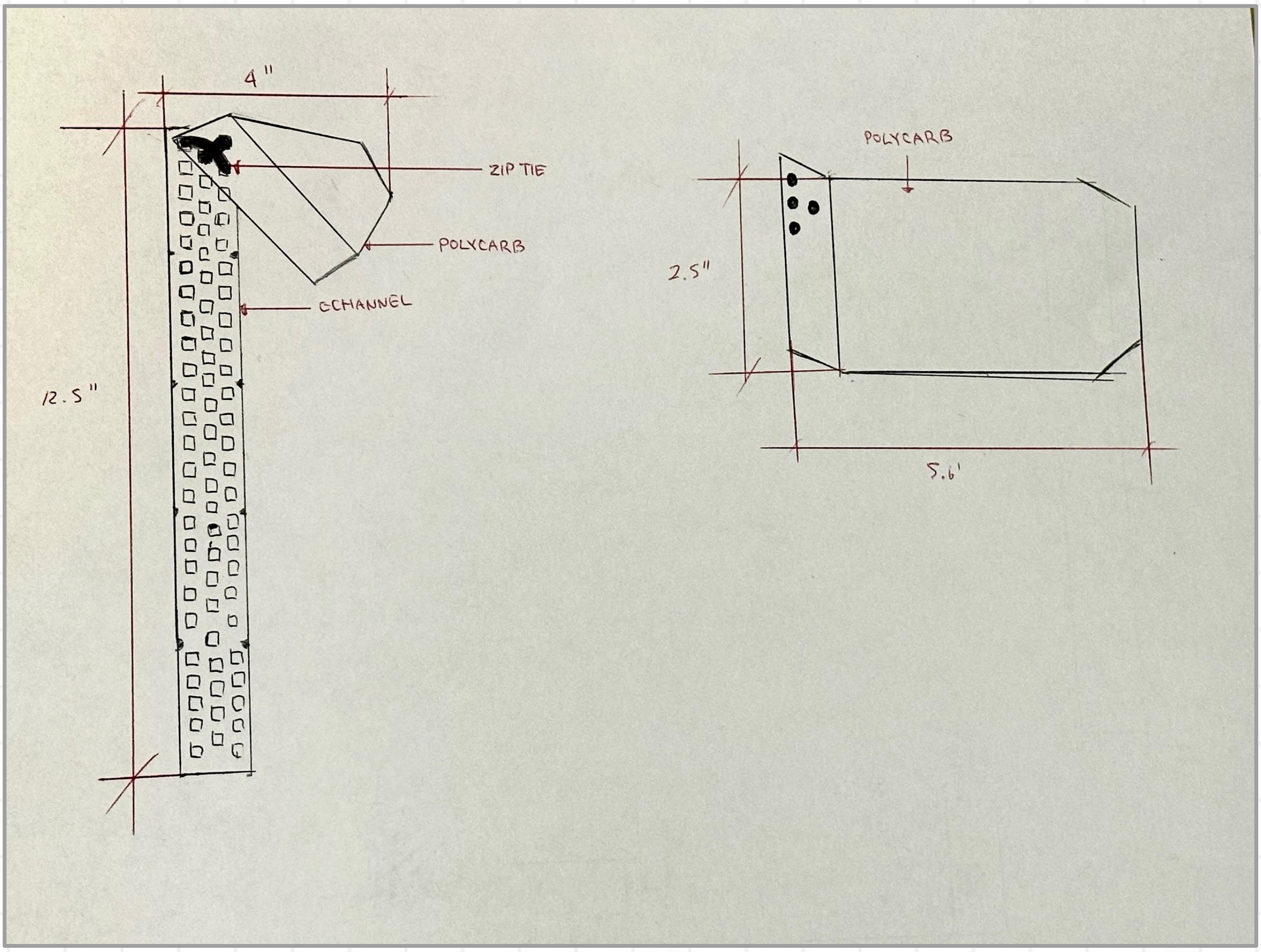
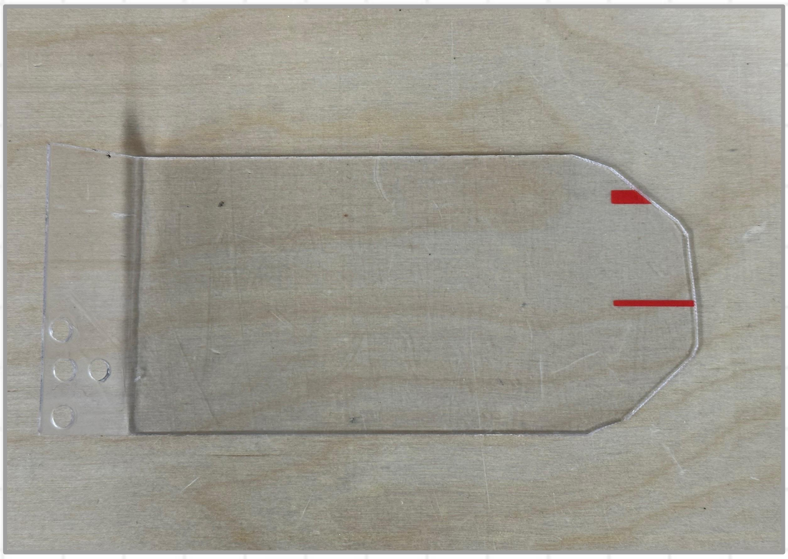
Flag

Prototyping flag

Sketch



Cut polycarb



- We bent the polycarb after heating it to achieve our desired angle
- Holes were created with a hole puncher

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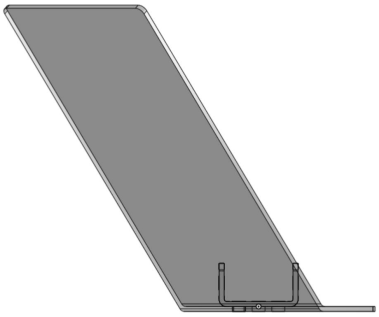
Flag

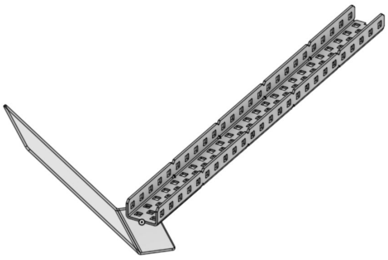
DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Cad

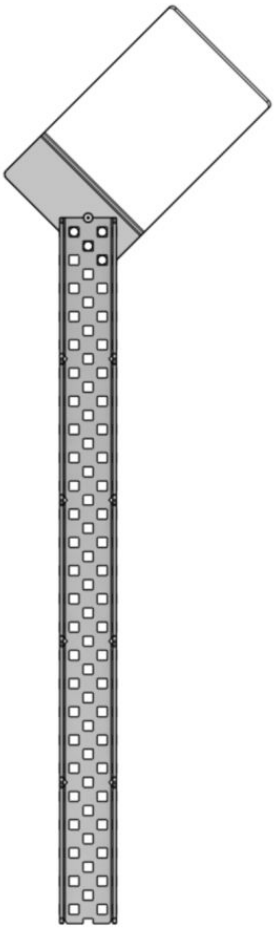
[TOP VIEW]



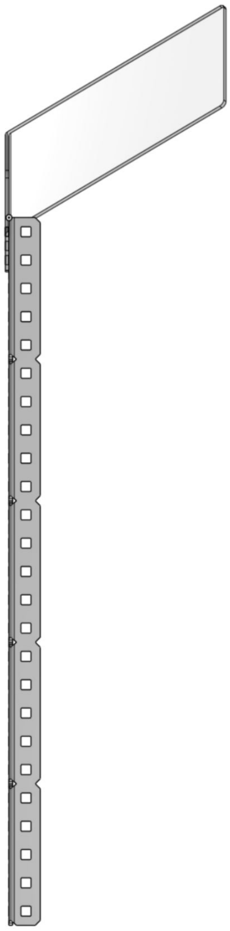
[ISOMETRIC VIEW]



[SIDE VIEW]



[SIDE VIEW]

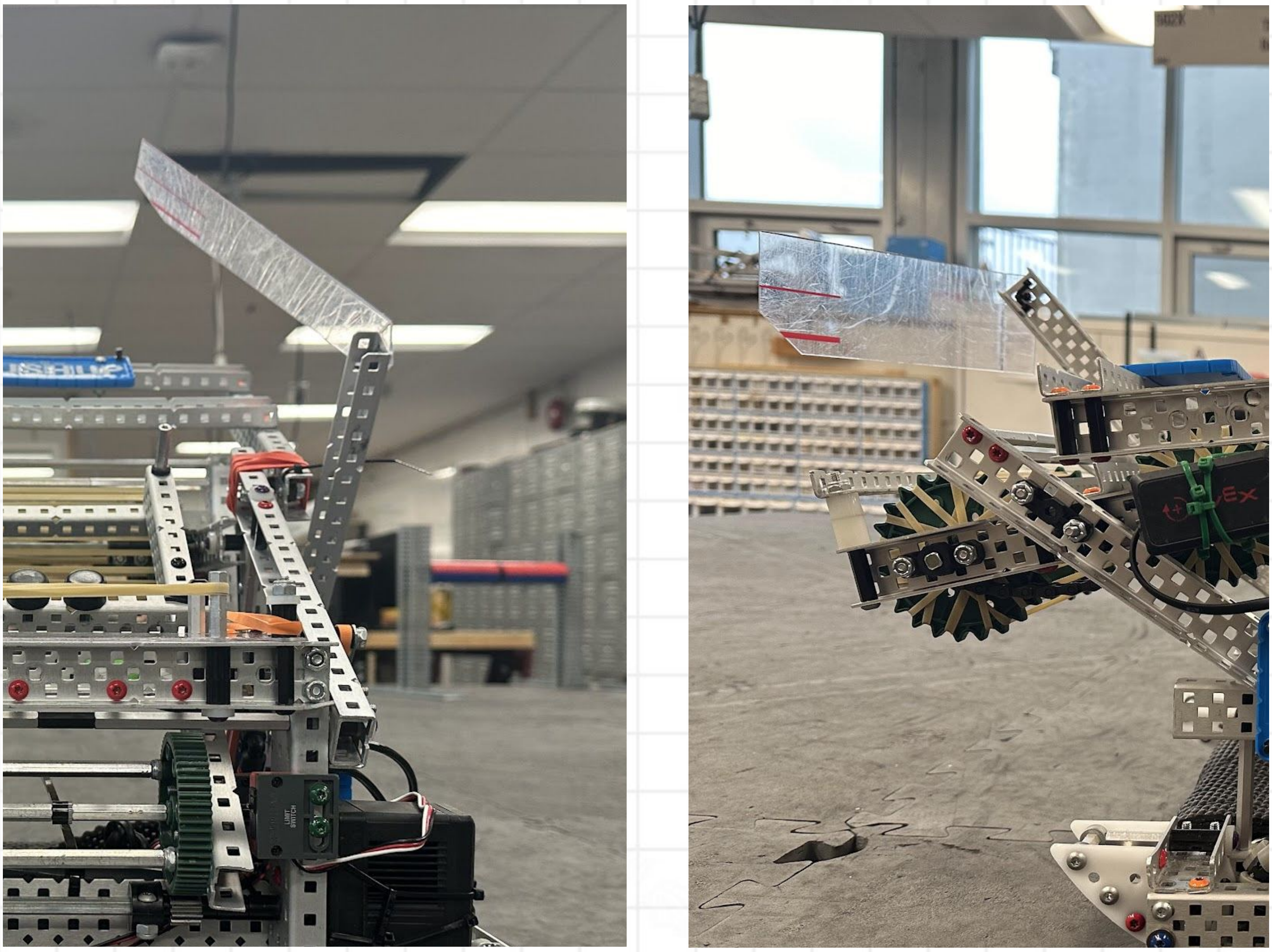


Flag

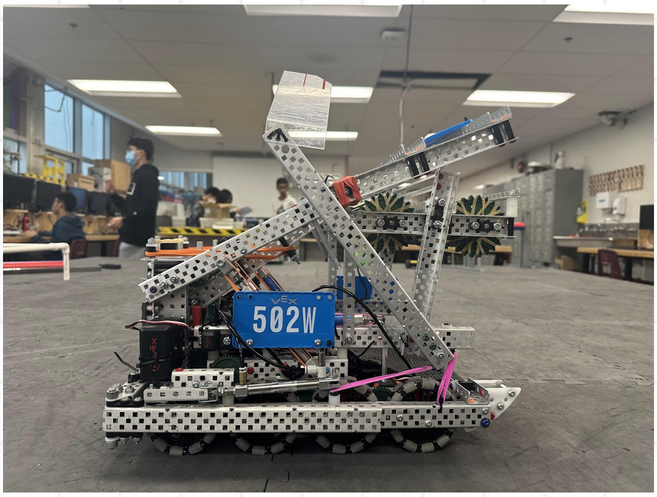
Building flag

Photos

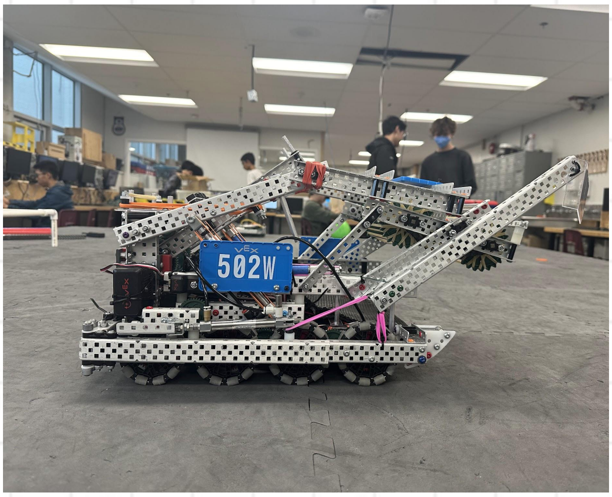
These 2 images are the flag in up positon



Flag in starting position



Flag in game



DEFINE A PROBLEM
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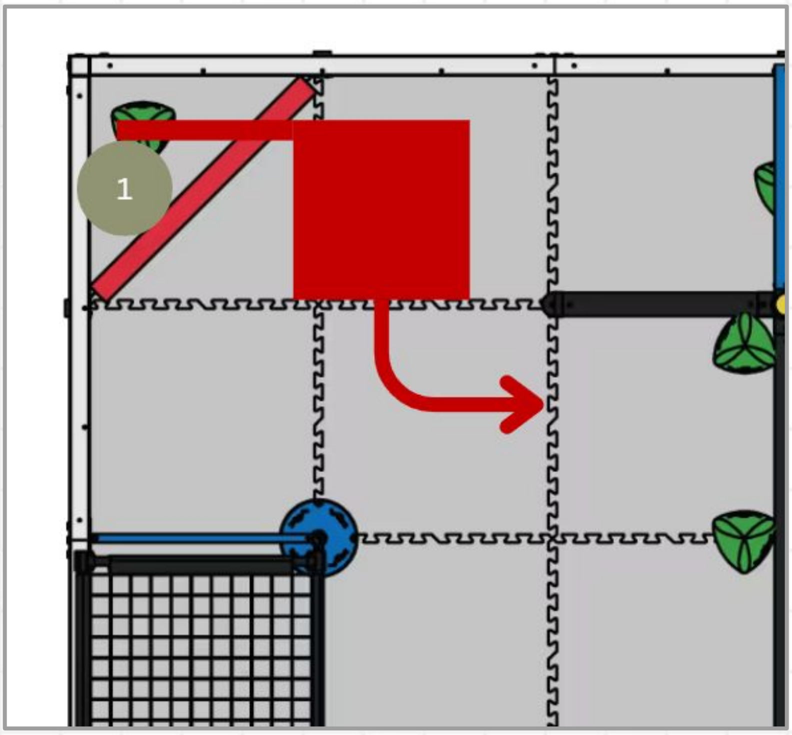
Testing

Testing the flag

TEST NO. 1 : GETTING TRIBALLS OUT OF BARRIER

Procedure

I. Place robot on field tile near the matchload zone
II. Move Triball to position 1
III. Turn robot 90 degrees
IV. Reset and repeat 10 times, check for success rate of triballs coming out of matchload zone



- Flag goes down
- Once robot turns, flag should scoop the triball out

Test	1	2	3	4	5
	✓	✓	✓	✓	✓
	6	7	8	9	10
	✓	✓	✓	✓	✓

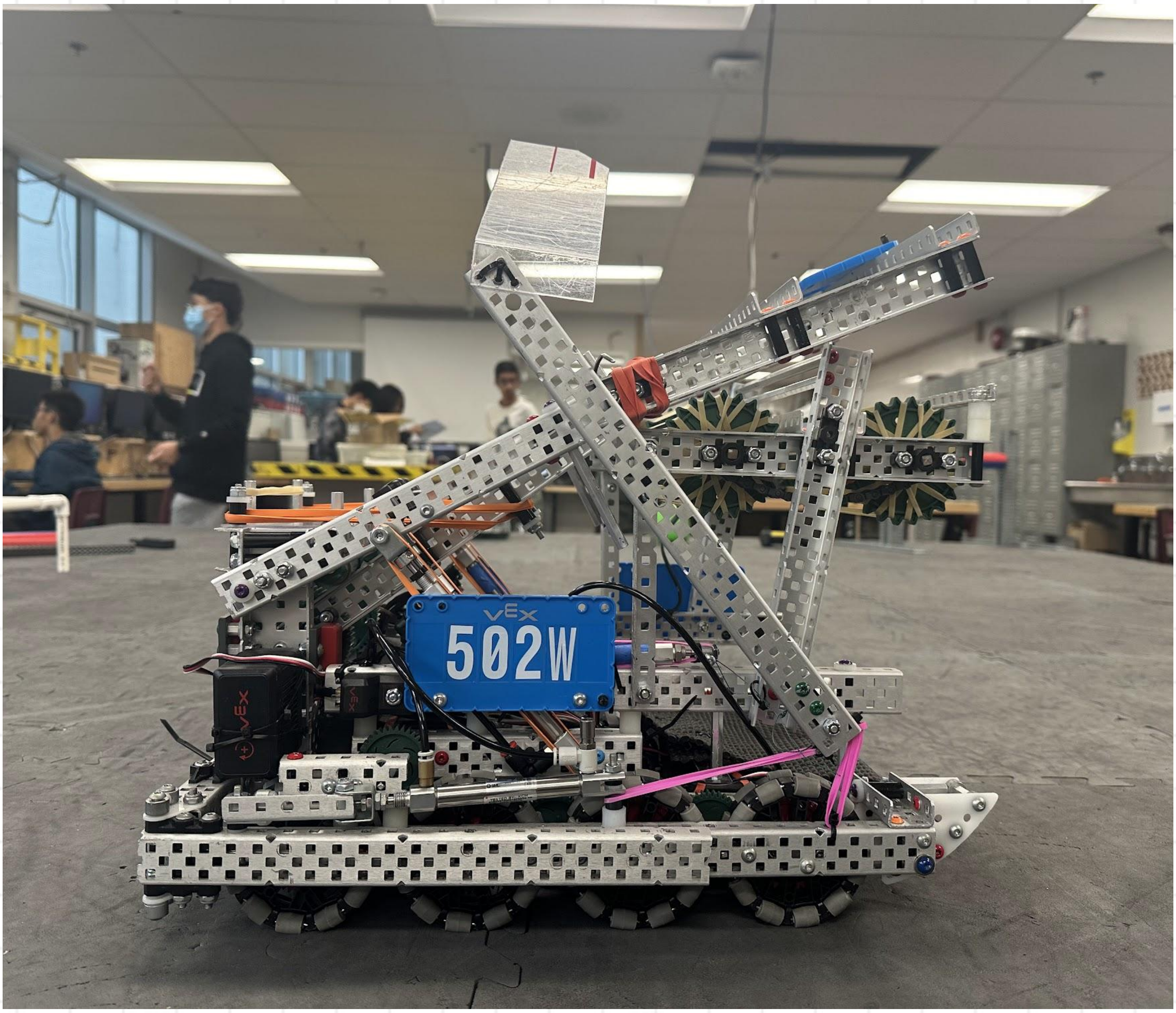
Overview

Conclusion

We found it successful when getting the triball out of the matchload after trying it out 10 times.

A potential issue would be it jamming, but we decided not to use the flag unless we are doing close side auto

Here is an image of our comp ready bot



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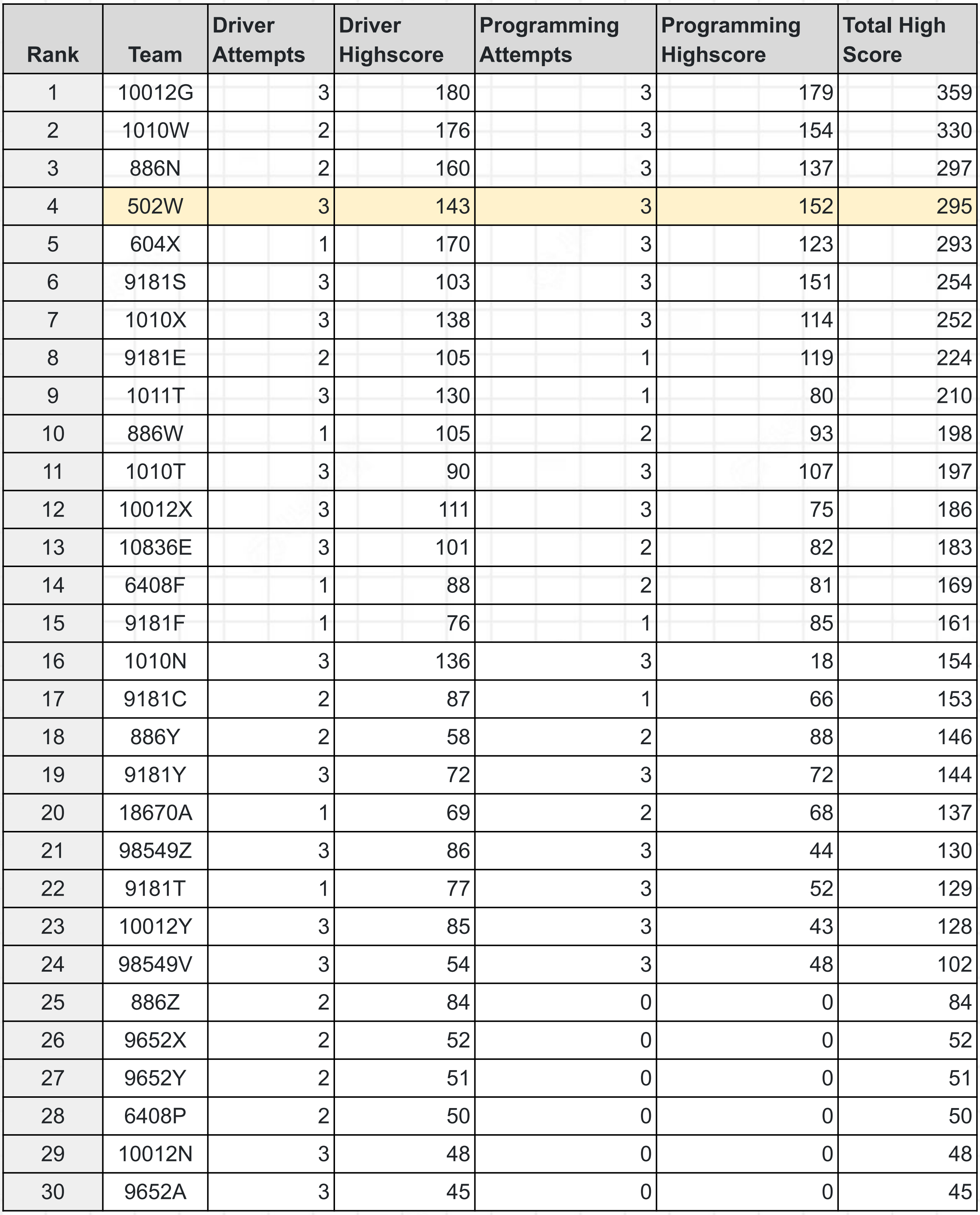
OCT 21 SEAQUAM REVIEW

Skills Results



Rank	Team	Driver Attempts	Driver Highscore	Programming Attempts	Programming Highscore	Total High Score
1	10012G	3	180	3	179	359
2	1010W	2	176	3	154	330
3	886N	2	160	3	137	297
4	502W	3	143	3	152	295
5	604X	1	170	3	123	293
6	9181S	3	103	3	151	254
7	1010X	3	138	3	114	252
8	9181E	2	105	1	119	224
9	1011T	3	130	1	80	210
10	886W	1	105	2	93	198
11	1010T	3	90	3	107	197
12	10012X	3	111	3	75	186
13	10836E	3	101	2	82	183
14	6408F	1	88	2	81	169
15	9181F	1	76	1	85	161
16	1010N	3	136	3	18	154
17	9181C	2	87	1	66	153
18	886Y	2	58	2	88	146
19	9181Y	3	72	3	72	144
20	18670A	1	69	2	68	137
21	98549Z	3	86	3	44	130
22	9181T	1	77	3	52	129
23	10012Y	3	85	3	43	128
24	98549V	3	54	3	48	102
25	886Z	2	84	0	0	84
26	9652X	2	52	0	0	52
27	9652Y	2	51	0	0	51
28	6408P	2	50	0	0	50
29	10012N	3	48	0	0	48
30	9652A	3	45	0	0	45

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OCT 21 SEAQUAM REVIEW

Skills Results

Rank	Team	Driver Attempts	Driver Highscore	Programming Attempts	Programming Highscore	Total High Score
31	604Y	2	42	0	0	42
32	18670B	3	38	0	0	38
33	9594M	1	33	0	0	33
34	502Z	2	29	0	0	29
35	614A	3	26	0	0	26
36	9594U	1	24	0	0	24
37	502B	3	23	0	0	23
38	1010E	3	21	0	0	21
39	9652Z	1	20	0	0	20
40	6408H	1	20	0	0	20
41	6408E	2	19	0	0	19
42	1011Z	1	16	0	0	16

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OCT 21 SEAQUAM REVIEW

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Match Rankings

Rank	Team	Name	W-L-T	WPs . APs . SPs
1	9181X	9181X	6-1-0	17 / 48 / 479
2	886N	Notion	7-0-0	16 / 48 / 542
3	502W	WonTon	6-1-0	14 / 48 / 538
4	604X	Orion	5-2-0	14 / 40 / 533
5	1010N	TenTon Robotics	5-2-0	13 / 36 / 543
6	886W	Orion	6-1-0	12 / 56 / 465
7	1010X	TenTon Robotics	5-2-0	12 / 56 / 448
8	9181E	Eggs	5-1-1	12 / 44 / 475
9	886Z	Orion	5-2-0	12 / 32 / 447
10	1011X	Ten Ton Robotics	5-2-0	11 / 36 / 450
11	18670A	Mt Seymour Robotics	5-2-0	11 / 32 / 411
12	1010W	TenTon Robotics	5-2-0	11 / 24 / 581
13	10012G	Ten Ton Robotics	5-2-0	10 / 40 / 480
14	1011T	Ten Ton Robotics	5-2-0	10 / 28 / 531
15	886Y	YaBaDaBaDoo	4-3-0	10 / 28 / 526
16	9652X	Southpointe Academy	5-2-0	10 / 16 / 577
17	10836E	ROBOSTORM KINGFISH	5-2-0	10 / 8 / 612
18	9181K	9181K	4-3-0	9 / 40 / 493
19	9181S	Storm	4-3-0	9 / 40 / 451
20	9181F	Frenzy	4-3-0	9 / 40 / 430
21	9181Y	Seaquam Seahawks	4-3-0	9 / 24 / 555
22	1010T	TenTon Robotics	4-3-0	9 / 20 / 592
23	1010E	TenTon Robotics	4-3-0	8 / 40 / 448
24	604Y	Orion	4-3-0	8 / 36 / 636
25	9181C	C-Channel	3-4-0	8 / 32 / 368
26	10012Y	Ten Ton Robotics	4-3-0	8 / 16 / 522
27	9181T	Thunder	3-3-1	7 / 24 / 509
28	10012N	Ten Ton Robotics	3-4-0	6 / 32 / 482
29	6408F	Syntechs Robotics HWSS	3-4-0	6 / 20 / 434
30	6408H	Syntechs Robotics HWSS	3-4-0	6 / 20 / 428

OCT 21 SEAQUAM REVIEW

Match Ranking continued

Rank	Team	Name	W-L-T	WPs . APs . SPs
31	502Z	The Swarm	3-4-0	6 / 16 / 473
32	6408E	HWSS Syntechs	3-4-0	6 / 8 / 545
33	614A	UTG Kitsilano	2-5-0	5 / 32 / 532
34	9594U	RoboCavs	2-5-0	5 / 28 / 425
35	9652A	Southpointe Academy	2-5-0	5 / 12 / 482
36	98549V	Burnsview Griffins	2-4-1	5 / 12 / 416
37	1011Z	Ten Ton Robotics	2-4-1	5 / 8 / 483
38	1010A	Ten Ton Robotics - Arcsine	2-5-0	5 / 8 / 437
39	98549Z	Burnsview Griffins	2-5-0	4 / 24 / 511
40	9652Y	Southpointe Academy	2-5-0	4 / 12 / 552
41	6408P	Syntechs Robotics HWSS	1-6-0	3 / 32 / 510
42	10012X	Ten Ton Robotics	1-6-0	2 / 24 / 495
43	9652Z	Southpointe Academy	1-6-0	2 / 20 / 360
44	18670B	Mt Seymour Robotics	1-6-0	2 / 16 / 482
45	9594M	RoboCavs	1-6-0	2 / 16 / 291
46	502B	The Swarm	1-6-0	2 / 8 / 371

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OCT 21 SEAQUAM REVIEW

Match Results

MATCH	RED ALLIANCE		SCORE	BLUE ALLIANCE	
Qualifier #6	10012X	**502W**	**136 - 68**	98549V	614A
Qualifier #15	9181K	6408H	**42 - 176**	9181X	**502W**
Qualifier #30	9594M	10012G	**118 - 127**	**502W**	886N
Qualifier #36	886W	**502W**	**127 - 81**	604X	6408P
Qualifier #55	6408F	**502W**	**66 - 136**	9594U	9181E
Qualifier #62	9652Z	**502W**	**119 - 106**	9181Y	1010T
Qualifier #76	9181T	502Z	**57 - 151**	**502W**	18670A
R16 #1-1	9181X	**502W**	**173 - 96**	10012Y	9652A
QF #1-1	9181X	**502W**	**167 - 109**	1011T	604Y
SF #1-1	9181X	**502W**	**152 - 129**	10836E	10012X
Final #1-1	9181X	**502W**	**80 - 155**	886N	1010W

Wins vs Losses

Total Win rate: 80%
Win: 8
Lose: 2

Qualifier Win rate: 85.81%
Win: 6
Lose: 1

Awards: Excellence Award - High School

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q6 - RED ALLIANCE 136 - 68

Game Strategy

Match load then score, defend, climb

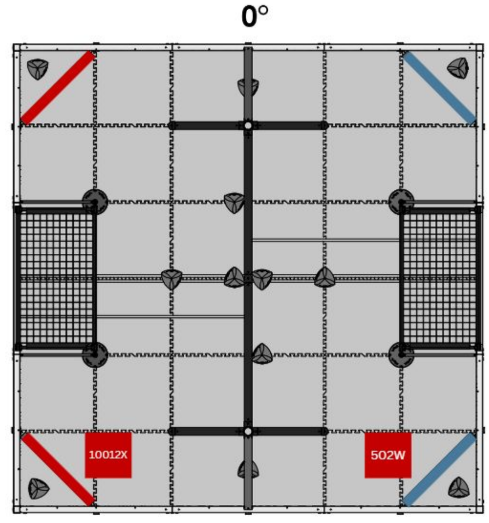
Characteristics of Alliance/Opponent robot

Opponent (614A) has flat bot, avoid double zone

502W
Starting position: *Far side (auto)*
Play: *Offence, Match load, Block, Scoring*

10012X
Starting position: *Close side (auto)*
Play: *Defence, Scoring*

Starting Position



Audience View

Match Observations

Autonomous

- 1 in
- 1 missed
- 2 didn't go in

Gameplay

- Shoot: 100% (22/22)
- Over : 100% (22/22)
- While we matchload, alliance scores
- Driver forgets to rack catapult, when going under bar (wastes on time)
- After macthloading, we went to defend (preventing the other robot from continuing to matchload), alliance continues to score
- Intake got stuck in up position, preventing climb

CONTINUED FROM PAGE:

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q 15 - BLUE ALLIANCE 42 - 176

Game Strategy

Match load, then block opponent while alliance score

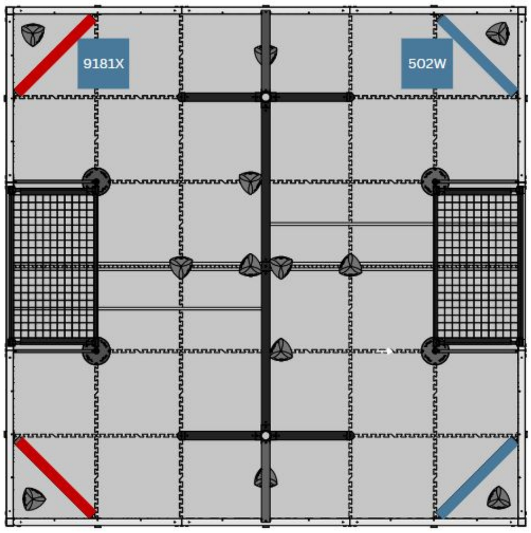
Characteristics of Alliance/Opponent robot

Opponent (9181K) has flat bot, avoid double zone

502W
Starting position: *Close side (auto)*
Play: *Offence, Match load, Block*

9181X
Starting position: *Far side (auto)*
Play: *Defence, Scoring*

0°



Audience View

Match Observations

Autonomous

- 1 in
- 1 missed
- 1 didn’t go over (intake failed)

- Second intake failed

Gameplay

- Shoot: 100% (22/22)
- Over : 86.4% (19/22)

- We matchload, alliance score
- We block, alliance puch triball our side
- A tier climb

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q 30 - BLUE ALLIANCE 118 - 127

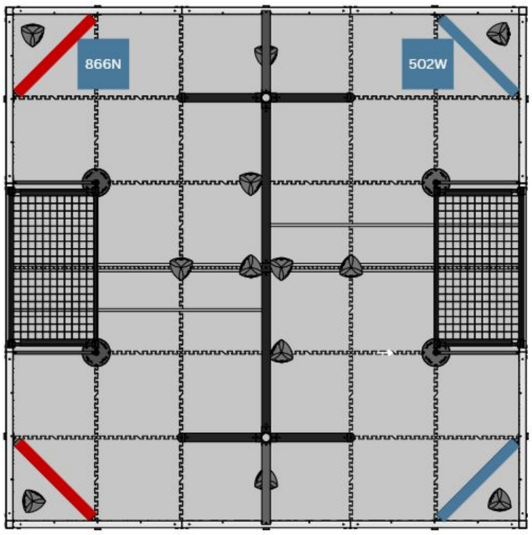
Game Strategy

Match load while alliance score, then we also go score

Characteristics of Alliance/Opponent robot

Alliance has flat bot

0°



Audience View

502W
Starting position: *Close side (auto)*
Play: *Match load*

866N
Starting position: *Far side (no auto)*
Play: *Score, defence*

Match Observations

Autonomous

- 1 in
- 1 missed
- 1 over

Gameplay

- Shoot: 100% (20/22)
- Over : 75% (15/20)
- Alliance didn't stop opponent match load
- No climb, opponent(9181C) got in our way

CONTINUED FROM PAGE:

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q 36 - RED ALLIANCE 127 - 81

Game Strategy

We chose to start close side since we had a auton and were confident with our match loading

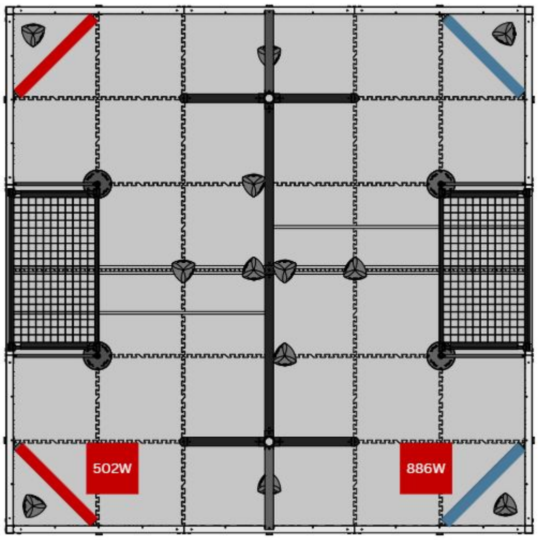
Characteristics of Alliance/Opponent robot

Alliance able to match load

502W
Starting position: *Close Side*
Play: *Defence, Blocking*

886W
Starting position: *Far side*
Play: *Match Load*

0°



Audience View

Match Observations

Autonomous

- 0 in
- 3 missed (pre-load)
- 0 over
- Touched elevation bar with flag

Gameplay

- Shoot:% (22/22)
- Over : 68.1% (15/22)

- Blocking was very effective
- Opponents defence wasn't very good

CONTINUED FROM PAGE:

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q55 - RED ALLIANCE 66 - 136

Game Strategy

We defence and score, alliance match load

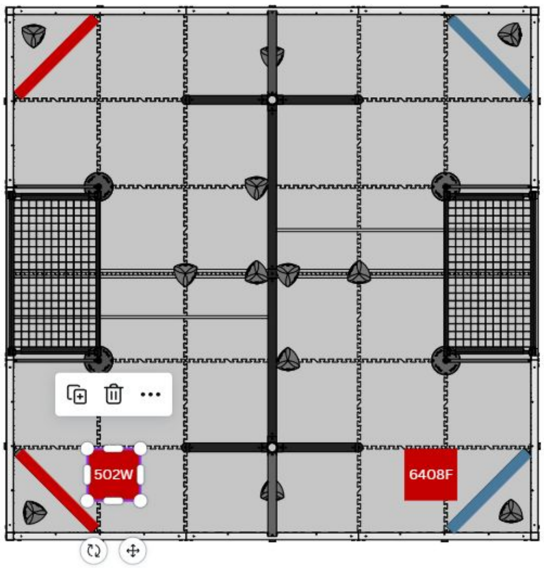
Characteristics of Alliance/Opponent robot

Opponent(9181E) has flat bot

502W
Starting position: *Close side(auto)*
Play: *Defence, score*

6408F
Starting position: *Far side(no auto)*
Play: *Match load*

0°



Audience View

Match Observations

Autonomous

- 2 in
- 0 missed
- 1 didn't go over

Gameplay

- We match load for alliance, most of them didn't go over cuz of the catapult
- Alliance disconnected(dead)
- Most triball was on opponent side so we couldn't score much
- No climb, flag was in the way

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OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q62 - RED ALLIANCE 119 - 106

Game Strategy

We match load, alliance defence and score

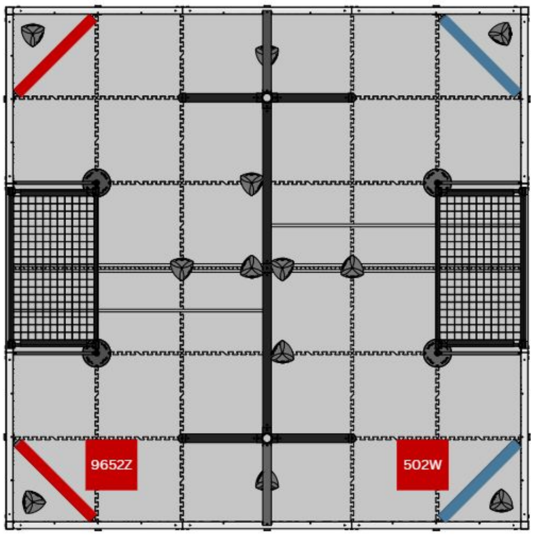
Characteristics of Alliance/Opponent robot

Opponent(9181Y) has flat bot

502W
Starting position: *Far side (auto)*
Play: *Match load*

9652Z
Starting position: *Close side (no auto)*
Play: *Score*

0°



Audience View

Match Observations

Autonomous

- 3 in (pre-load)
- 1 missed
- 0 didn't go in

Gameplay

- Shoot: 100% (22/22)
- Over : 72.7% (16/22)

- We match load while alliance score them
- Opponent(9181Y) has flat bot
- No climb, flag was in the way

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OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

Q76 - BLUE ALLIANCE 57 - 151

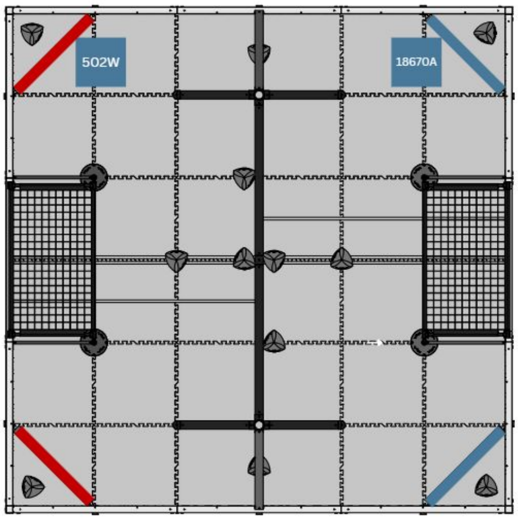
Game Strategy

We defence and score, alliance match load

Characteristics of Alliance/Opponent robot

Alliance has flywheel launcher, fast match load
Opponent(9181Y) has flat bot

0°



Audience View

502W
Starting position: *Far side (auto)*
Play: *Defence, score*

18670A
Starting position: *Close side (auto)*
Play: *Match load*

Match Observations

Autonomous

- 4 in (pre-lead)
- 0 missed
- 0 didn’t go in

Gameplay

- Alliance match load in short amount of time, then stop opponent scoring
- Opponent(502Z) could not shoot far, which helped us score more
- Opponent(9181Y) has flat bot
- Our intake got suck in up position in one point
- A tier climb

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OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

QF - RED ALLIANCE 167 - 109

Game Strategy

We match load, alliance defence and score

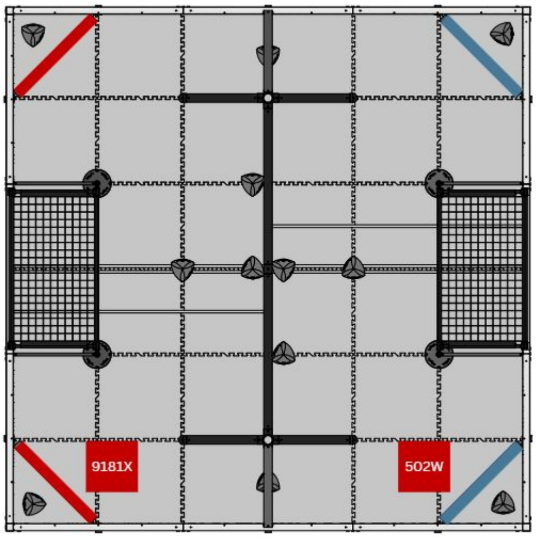
Characteristics of Alliance/Opponent robot

Alliance able to match load

502W
Starting position: *Far side (auto)*
Play: *Match load*

9181X
Starting position: *Close side (auto)*
Play: *Defence, score*

0°



Audience View

Match Observations

Autonomous

- 4 in (pre-lead)
- 0 missed
- 0 didn't go in

Gameplay

- Shoot: 100% (22/22)
- Over : 81.8% (18/22)

- Alliance defence and score while we match load
- Opponent did not match load all triballs
- Opponent(9652A) disconnected
- We both went scoring
- A tier climb

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

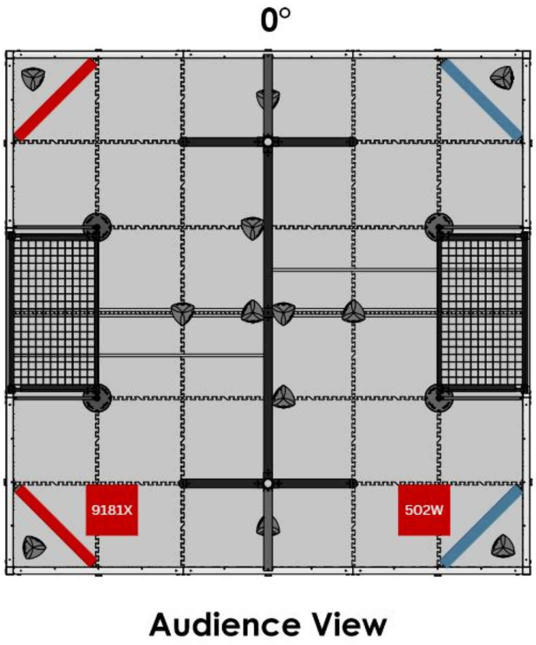
SF - RED ALLIANCE 152 - 129

Game Strategy

Same as last round, QF

Characteristics of Alliance/Opponent robot

Alliance able to match load



502W
Starting position: *Far side (auto)*
Play: *Match load*

9181X
Starting position: *Close side (auto)*
Play: *Defence, score*

Match Observations

Autonomous

- 4 in (pre-load)
- 0 missed
- 0 didn't go in

Gameplay

- Shoot: 100% (22/22)
- Over : 72.7% (16/22)

- Alliance defence while we match load
- Then we score and alliance continue to defence
- A tier climb

CONTINUED FROM PAGE:

OCT 21 SEAQUAM REVIEW

Detailed analysis of each match

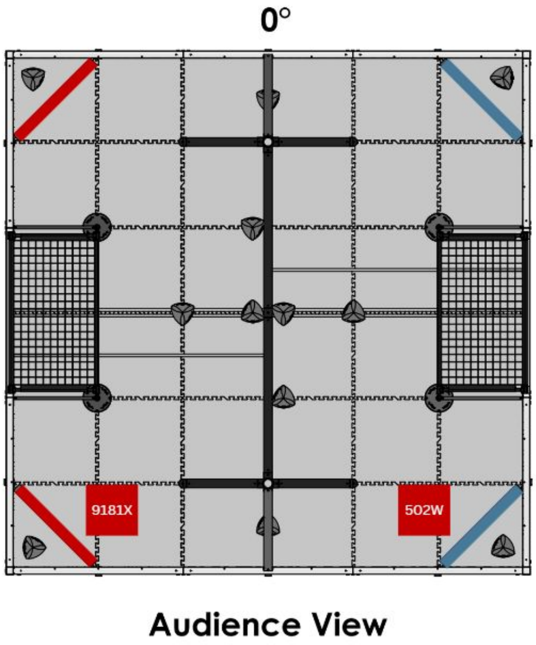
FINALS - RED ALLIANCE 80 - 155

Game Strategy

Same as last round, QF

Characteristics of Alliance/Opponent robot

Alliance able to match load



502W
Starting position: *Far side (auto)*
Play: *Match load*

9181X
Starting position: *Close side (auto)*
Play: *Defence, Score*

Match Observations

Autonomous

- 0 in
- 4 missed (pre-lead)
- 0 didn't go in
  - Intake didn't go down

Gameplay

- Shoot: 100% (22/22)
- Over : 63.6% (14/22)

- Alliance defence and score while we match load
- Then we stop opponent from scoring
- A triball got stuck under our bot while pushing against opponent, causing us could not move
- No climb, since we got stuck and couldn't move

Improvements

Goal

Improving the drivetrain and flag

Why is fixing drivetrain important?

- Getting flipped over significantly lowers our chances of winning a match
    - It prevents all movement
- Makes our robot stronger in defence
- Helps us better with offence

An improved drivetrain can be the determining factor between winning or losing a game

Why is fixing flag important?

- Flag jams the climb
    - Improving it will allows our other components to work
- Helps win awp

An improved flag will interfere less with our mechanism as well as winning us awp

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Improvements

Requirements

Drivetrain

TRACTION WHEELS

Helps against pushing and with pushing

BALANCE

Helps us prevent beaching

FLEXIBILITY

Helps us move around freely without being constrained by the robot's movement

Flag

SMALLER SIZE

Less likely to jam climb and other robot components

DURABILITY

Robot will be constantly hit, so new flag should be durable enough to withstand hits in order to be reliable

DATE:

DESIGNED BY:

WITNESSED BY:

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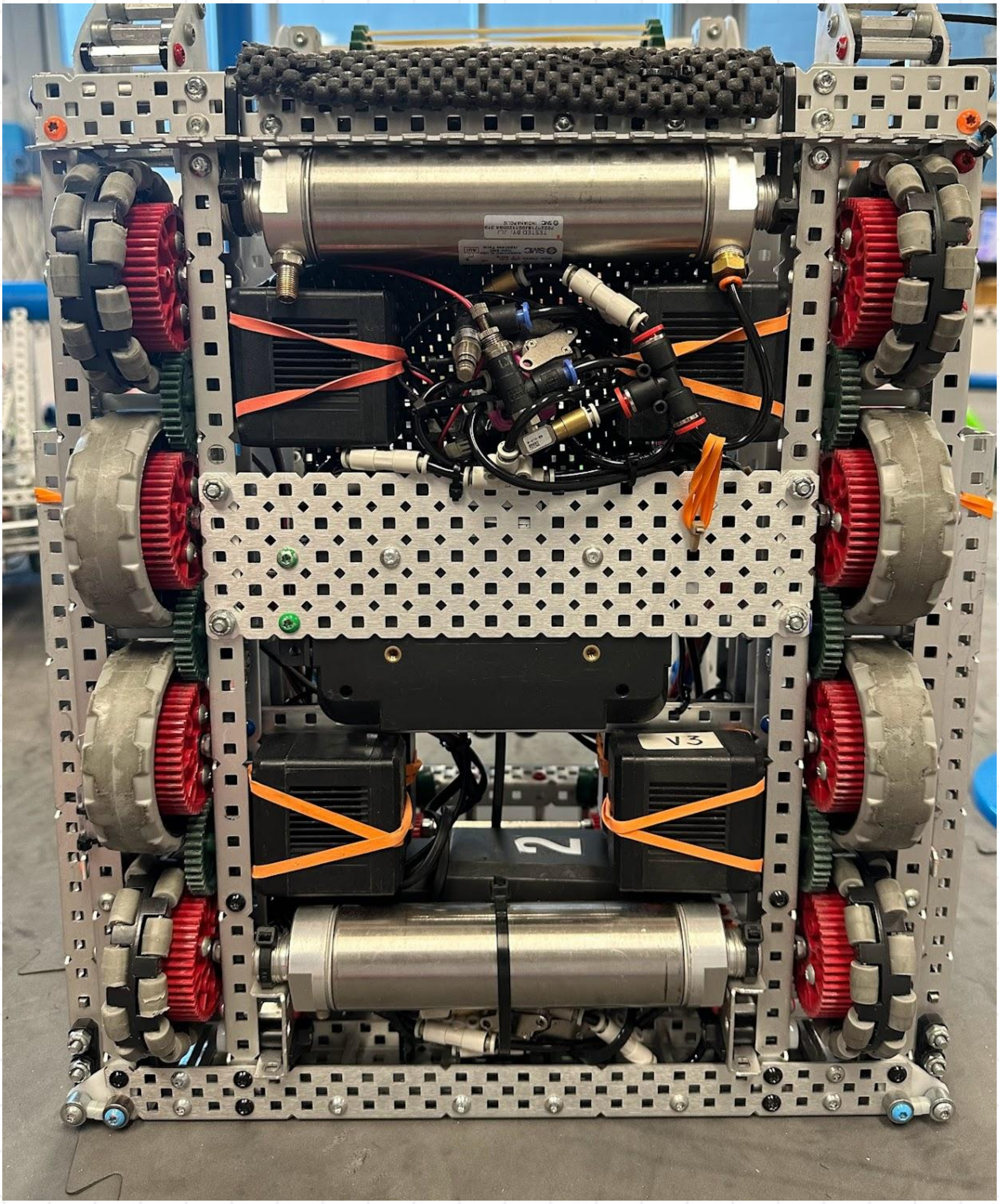
Improvements

Adding traction wheels

Here is an image of our improved drivetrain



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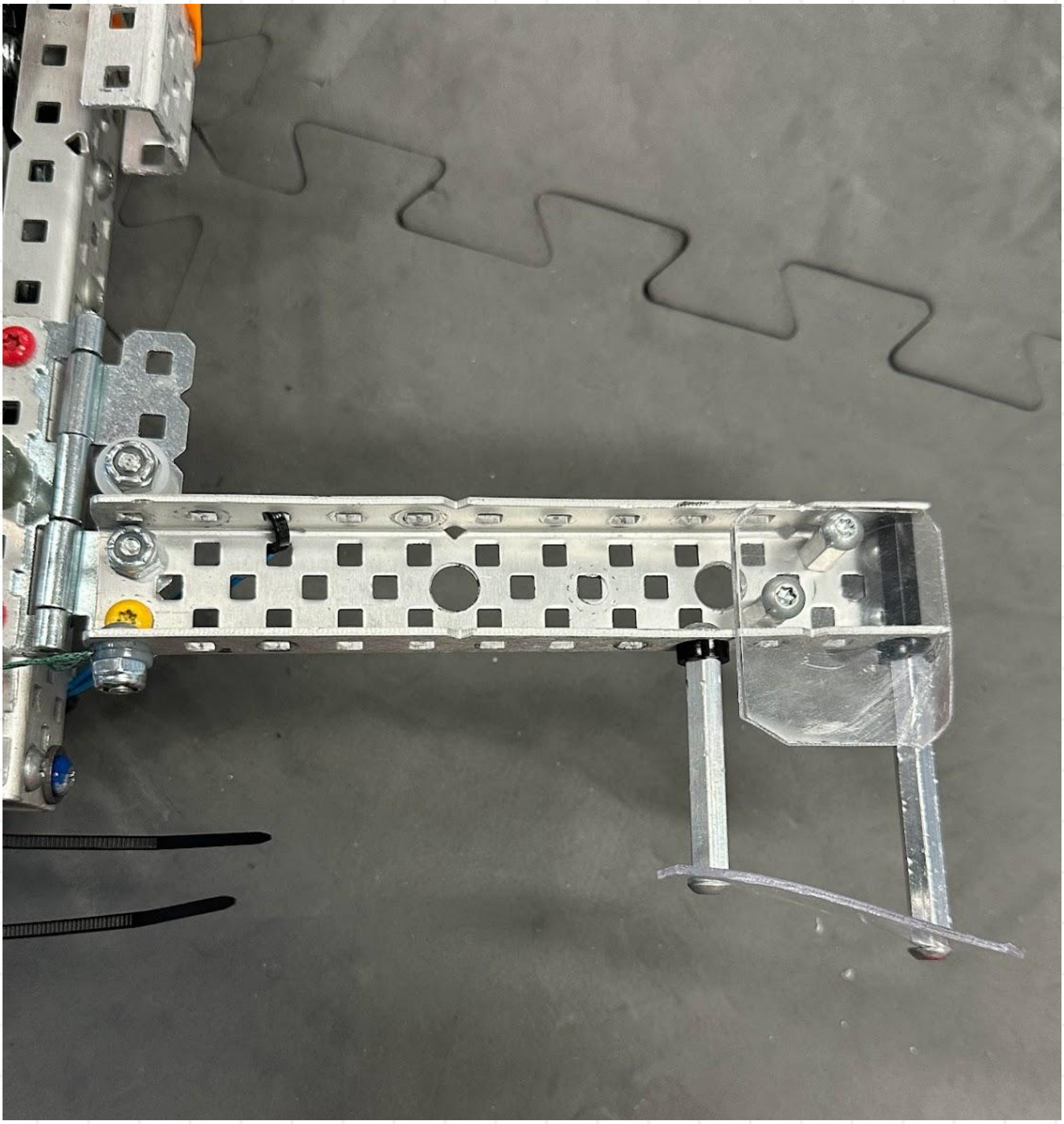
Improvements

Upon driving the robot around, our driver felt more confident pushing and defending against other robots.
Traction wheels allow us to stay in place while getting pushed or being pushed

We've also added a blooper in place of a flag on the side of the drivetrain to help us get the triball out of the matchload zone



Skills route path: Summary

- ○ Start by placing the bot on the edge of the offensive side field tile. Placing the robot relative to a universal starting point across field allows for consistent movement no matter the environment.
- ○ Triball preload is placed within the intake ramp, while the intake itself is raised up by the pistons. When driving forward, the triball moves with the robot. When driving backwards, the triball remains stationary. This position was chosen because the placement allows for complete manipulation of the tribal, even when turning.
- ○ Manipulate the preloaded triball into the net. Through a series of 45 and 90 degree swings, push the triball into the net.
- ○ Drive to the elevation bar. This is done in order to fulfill an autonomous requirement: Touch the elevation bar at the end of autonomous period. During this phase, we utilise the many zip ties on our robot to guarantee at least 2 points of contact on the elevation bar.

In summary, our chosen autonomous route allows for ease of coding (given the lack of a field) while still fulfilling many AWP requirements with a high degree of consistency.

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OCT 29 REVIEW
WPRA Halloween

Skills Results

Rank	Team	Driver Attempts	Driver Highscore	Programming Attempts	Programming Highscore	Total High Score
1	10012G	2	190	2	175	365
2	886W	1	156	2	132	288
3	1010T	1	141	1	140	281
4	502W	1	168	1	110	278
5	604X	1	120	1	140	260
6	1010Y	1	101	1	80	181
7	9181S	1	155	1	14	169
8	10012Y	2	112	0	0	112
9	886N	1	0	1	101	101
10	1010X	0	0	2	95	95
11	1010A	1	72	1	21	93
12	604Y	3	78	0	0	78
13	1010B	1	61	0	0	61
14	28101A	1	56	0	0	56
15	10012K	2	49	0	0	49
16	1011Z	1	24	1	2	26
17	98040C	1	15	0	0	15

DATE:

DESIGNED BY:

WITNESSED BY:

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OCT 29 REVIEW
WPRA Halloween

Match Ranking

Rank	Team	Name	W-L-T	WPs . APs . SPs
1	10012G	Ten Ton Robotics	5-0-1	16 / 40 / 567
2	502W	WonTon	6-0-0	15 / 32 / 529
3	10012Y	Ten Ton Robotics	4-1-1	12 / 28 / 642
4	604X	Orion	4-1-1	11 / 8 / 583
5	1010Y	TenTon Robotics	3-3-0	10 / 32 / 617
6	1010T	TenTon Robotics	5-1-0	10 / 16 / 507
7	886W	Orion	3-3-0	9 / 24 / 504
8	9181S	Infinity	3-3-0	7 / 24 / 551
9	1011Z	Ten Ton Robotics	3-3-0	7 / 24 / 535
10	886N	Notion	3-3-0	7 / 20 / 488
11	28101A	Coping Seething Malding	3-3-0	7 / 8 / 495
12	98040C	Slippery Penguin	2-4-0	6 / 24 / 542
13	1010A	Ten Ton Robotics - Arcsine	3-3-0	6 / 4 / 495
14	1010X	TenTon Robotics	2-4-0	5 / 16 / 470
15	604Y	Orion	0-5-1	3 / 32 / 571
16	10012K	Ten Ton Robotics	1-5-0	3 / 28 / 507
17	1010B	Ten Ton Robotics	0-6-0	0 / 8 / 416

Match Results

MATCH	RED ALLIANCE		SCORE	BLUE ALLIANCE	
Qualifier #1	**502W**	1011Z	**123 - 94**	10012K	1010Y
Qualifier #6	9181S	98040C	**83 - 149**	604X	**502W**
Qualifier #13	**502W**	28101A	**123 - 113**	10012Y	9181S
Qualifier #15	1010Y	**502W**	**143 - 54**	604Y	1010X
Qualifier #20	604X	1010A	**97 - 140**	**502W**	10012Y
Qualifier #25	1010B	1010T	**88 - 138**	10012G	**502W**
QF #1-1	10012G	**502W**	**155 - 105**	604Y	10012K
SF #1-1	10012G	**502W**	**0 - 108**	1010Y	9181S

Wins vs Losses

Total Win rate: 87.5%
Win: 7
Lose: 1

Qualifier Win rate: 100%
Win: 6
Lose: 0

Awards: Amaze Award

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OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

QI - RED ALLIANCE 123 - 94

Game Strategy

We match load, Alliance try to defence and score

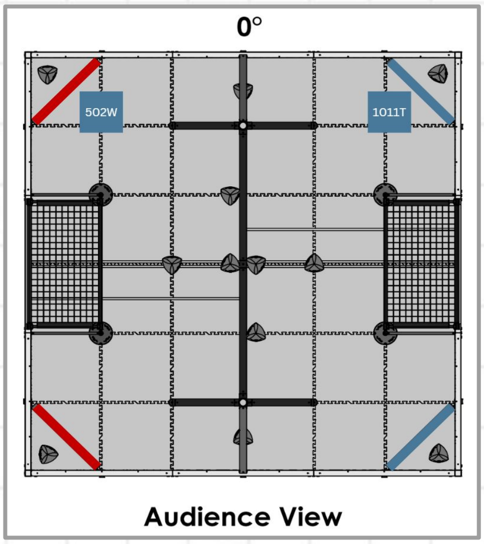
Characteristics of Alliance/Opponent robot

Opponent(1010Y) has an elevated launcher & small platform, little push could disturb their match load.

502W
Starting position: *Close side*
Play: *Match load*

10011Z
Starting position: *Far side*
Play: *Defence, Score*

Starting Position



Match Observations

Autonomous

- 1 in (pre-load)
- 2 missed
- 0 didn't go in
  - Missed #1 triball

Gameplay

- Shoot: 100% (22/22)
- Over : 95% (21/22)
- Opponent did not match load all their triballs
- Entangled with opponent(1010Y)
  - 40s(remain) to game end
  - we rammed to them which lifted our drivetrain on top of theirs
- No climb
  - Our entanglement lead to us couldn't climb

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OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

Q6 - BLUE ALLIANCE 83 - 149

Game Strategy

We defence and score, alliance match load

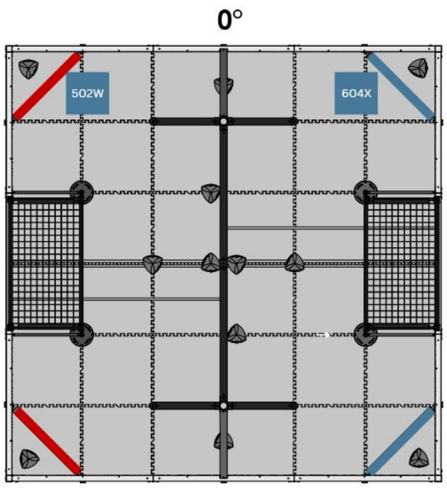
Characteristics of Alliance/Opponent robot

Opponent(98040C) has a flat bot for descoring, avoid double zone
Opponent(9181S) has a blocker, try side load then push

502W
Starting position: *Far side*
Play: *Defence, score*

604X
Starting position: *Close side*
Play: *Match load*

Starting Position



Audience View

Match Observations

Autonomous

- 1 in
- 2 missed
- 1 didn't go in (pre-lead)

Gameplay

- Alliance successfully match load all triballs
- We blocked most of opponent triball
- Double zone
  - Opponent(98040C) descore 3 triballs
  - Then we scored them back
- B tier climb

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OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

Q13 - RED ALLIANCE   123 - 113

Game Strategy

We match load and score, alliance defence

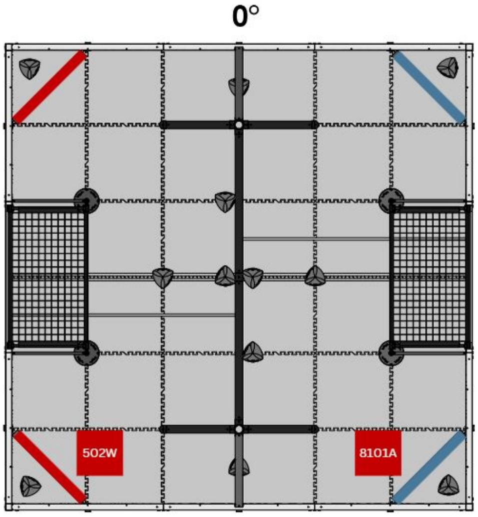
Characteristics of Alliance/Opponent robot

Opponent(9181S) has a blocker, use catapult

502W
Starting position: *Close side*
Play: *Match load, score*

8101A
Starting position: *Far side*
Play: *Defence*

Starting Position



Audience View

Match Observations

Autonomous

- 1 in (pre-load)
- 0 shot over
- 1 missed
- 1 didn’t shoot over
  - Triball#1 missed,
  - Triball#2 didn’t intake to catapult

Gameplay

- Shoot: 100% (22/22)
- Over : 63.6% (14/22)

- We got blocked but still manage to shoot most triballs over
- Alliance stopped opponent side push once
- B tier climb, helped us win the game

OCT 29 REVIEW
WPRA Halloween

Detailed analysis of each match

Q15 - RED ALLIANCE 143 - 54

Game Strategy

We defence and score, alliance match load

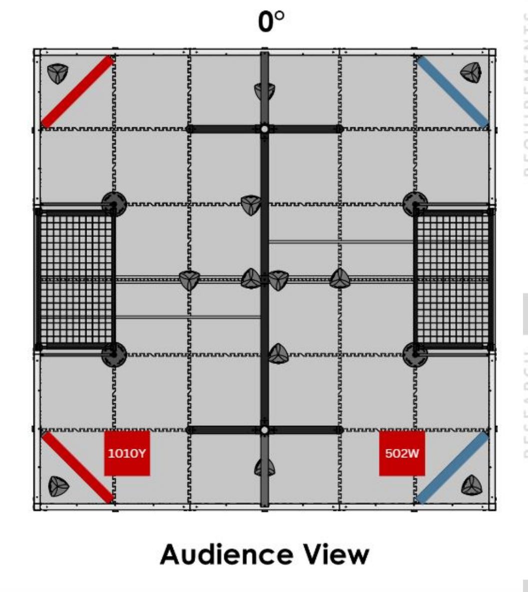
Characteristics of Alliance/Opponent robot

Alliance(1010Y) has an elevated launcher

502W
Starting position: *Far side*
Play: *Defence, Score*

1010Y
Starting position: *Close side*
Play: *Match load*

Starting Position



Match Observations

Autonomous

- 4 in (pre-load)
- 0 missed
- 0 didn't go in

Gameplay

- Alliance did not match load all triballs, but shot over few
- We spend most of our time stopping opponent match loading
- Opponent couldn't shot over so we score them in our goal
- Alliance B tier climb

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OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

Q20 - BLUE ALLIANCE 97 - 140

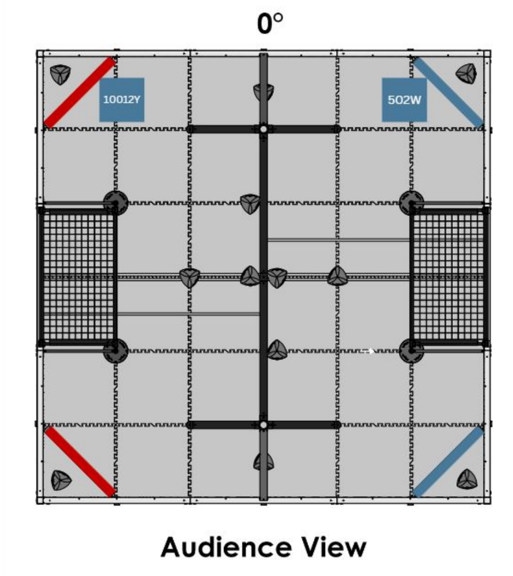
Game Strategy

We defence and score, alliance match load

Characteristics of Alliance/Opponent robot

Alliance(10012Y) had A tier climb

Starting Position



Audience View

502W
Starting position: *Close side*
Play: *Defence, Score*

10012Y
Starting position: *Far side*
Play: *Match load*

Match Observations

Autonomous

- 1 in (pre-lead)
- 0 shot over
- 1 missed
- 1 didn't shot over
  - Triball#1 missed,
  - Triball#2 didn't intake to catapult

Gameplay

- We helped alliance match load, opponent tried to push but couldn't stop us match load
- Opponent stand at our match load causing us couldn't match load second time, but we still got it
- Opponent slow at match load so we had many time to score
- Alliance A tire climb, opponent block our way to climb bar so alliance climbed

OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

Q25 - BLUE ALLIANCE 88 - 138

Game Strategy

We defence and score, alliance match load

Characteristics of Alliance/Opponent robot

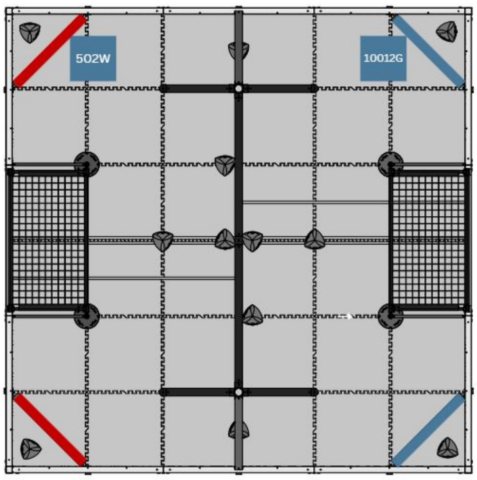
Opponent(1010B) has a flat bot for descoring, avoid double zone
Alliance has blocker; can elevate on bar, A tier climb

502W
Starting position: *Far side*
Play: *Defence, score*

10012G
Starting position: *Close side*
Play: *Match load*

Starting Position

0°



Audience View

Match Observations

Autonomous

- 0 in
- 4 missed (pre-lead)
- 0 didn't go in
  - Triball#1 missed
  - Entangled with opponent(1010T) when going for triball#2

Gameplay

- Alliance match load all triballs
- We stopped Opponent match load first half of game
- B tier climb, alliance couldn't elevate on bar

CONTINUED FROM PAGE:

OCT 29 REVIEW WPRA Halloween

Detailed analysis of each match

QF - RED ALLIANCE 155 - 105

Game Strategy

We defence, alliance match load and score

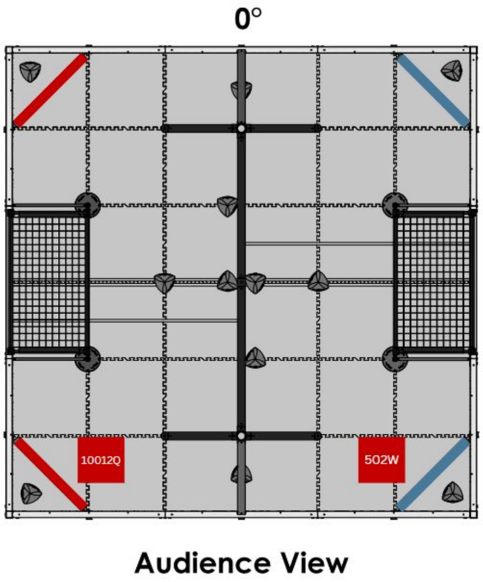
Characteristics of Alliance/Opponent robot

Alliance has blocker; can elevate on bar, A tier climb
Opponent didn't have anything special

502W
Starting position: *Far side*
Play: *Defence*

10012G
Starting position: *Close side*
Play: *Match load, Score*

Starting Position



Match Observations

Autonomous

- 3 in
- 0 missed
- 1 didn't go in
  - Catapult start shooting for some reason
  - Triball#2 jammed under catapult

Gameplay

- Our catapult didn't work for entire round
- Alliance went in some trouble but still manage to match load all triball
- We delayed opponent match load making then shoot last minute, they didn't have time to score all
- No climb, our catapult was in the way; alliance A tier climb

OCT 29 REVIEW
WPRA Halloween

Detailed analysis of each match

QF - RED ALLIANCE 155 - 105

Game Strategy

We defence, alliance match load and score

Characteristics of Alliance/Opponent robot

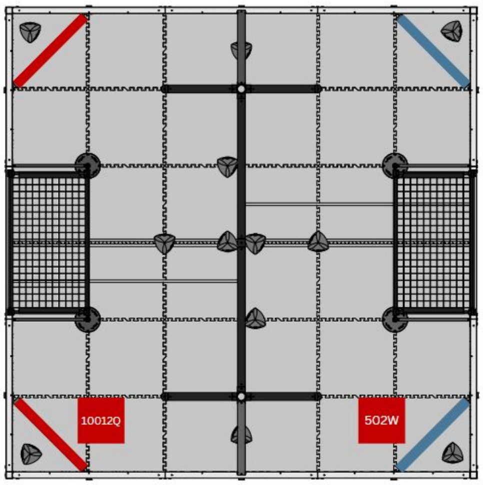
Alliance has blocker; can elevate on bar, A tier climb
Opponent didn’t have anything special

502W
Starting position: *Far side*
Play: *Defence*

10012G
Starting position: *Close side*
Play: *Match load, Score*

Starting Position

0°



Audience View

Match Observations

Autonomous

- 3 in
- 0 missed
- 1 didn’t go in
  - Catapult start shooting for some reason
  - Triball#2 jammed under catapult

Gameplay

- Our catapult didn’t work for entire round
- Alliance went in some trouble but still manage to match load all triball
- We delayed opponent match load making then shoot last minute, they didn't have time to score all
- No climb, our catapult was in the way; alliance A tier climb

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

CONTINUED FROM PAGE:

OCT 29 REVIEW
WPRA Halloween

Detailed analysis of each match

SF - RED ALLIANCE 0 - 108

Game Strategy

Same as last round, QF

Characteristics of Alliance/Opponent robot

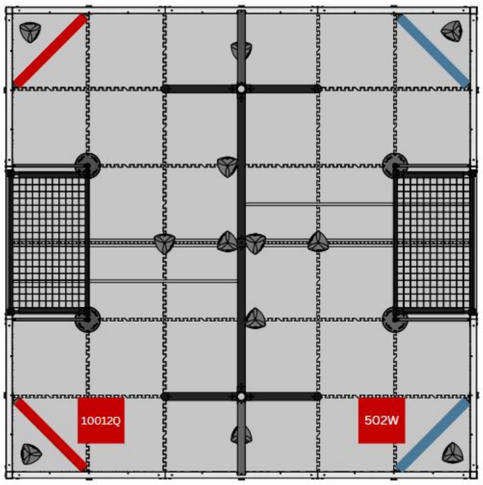
Opponent(1010Y) has an elevated launcher & small platform, little push could disturb their match load.

502W
Starting position: *Far side*
Play: *Defence*

10012G
Starting position: *Close side*
Play: *Match load, Score*

Starting Position

0°



Audience View

Match Observations

Autonomous

- 3 in (pre-lead)
- 1 missed
- 0 didn't go in
  - Alliance shoot a triball over, moving triball#3

Gameplay

- We tried to block opponent(1010Y) match load but their launcher was too high
- We push opponent(1010Y) away from match load bar, causing them can't match load
- Alliance match load all triballs
- B tier climb, alliance A tier climb
- Our team got **DISQUALIFIED** for blocking opponent(1010Y) from elevating <*SG11*>
- We were trying to go to our climb bar from close side but got blocked by opponent(1010Y), and was force to go from other side

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Wedge

Goal

Creating a wedge to better help us ameliorate defence and offence as well as pushing triballs with more ease.

Why is this a wedge important?

- **Defensive Strategy**
  - A wedge can be used as a defensive mechanism, as it allows a robot to push or deflect opponents, disrupting their strategies and potentially preventing them from completing tasks or scoring points.
  - This is particularly helpful in this game where interaction between robots is a key element for defence and offence

- **Scoring Mechanism**
  - Can have prop triballs up making them easier to move around
  - Will help push triballs over the middle barrier

What are some cons of having a wedge?

- **Size Constraints**
  - May make us go out of size as we are already close to the size limit for inspection

Ideal Characteristics

PERFORMANCE

- **Sturdy and Durable**
  - A wedge should be constructed from robust materials to withstand the physical stresses and impacts it may encounter during competition.
  - This ensures the wedge remains effective throughout the entire event without succumbing to damage.

- **Lightweight**
  - While being sturdy is important, it's also crucial to keep the wedge as lightweight as possible.
  - Allows for more flexibility in the overall robot design.

- **Low Ground Clearance**
  - This characteristic enables the robot to exert maximum control over the positioning and movement of other robots as well as being able to push triballs

- **Strategic Positioning**
  - Should be strategically positioned to maximize its effectiveness in pushing opponents, disrupting their strategies, or manipulating Triballs

- **Minimal Interference with Other Components**
  - The design of the wedge should minimize interference with other components of the robot
  - It should not obstruct the movement of wheels, impede the functionality of sensors, or interfere with other mechanisms critical to the robot's overall performance.

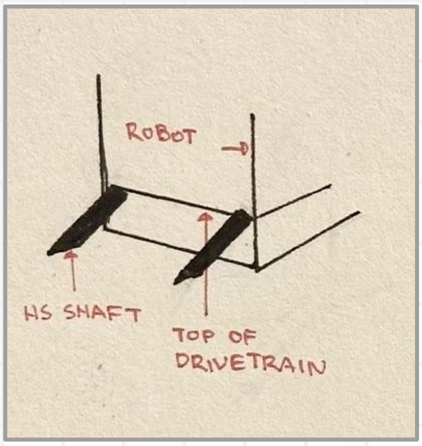
Wedge

Possible Designs

Forks

Characteristics:

- Long narrow pieces of metal, HS shafts
- Multiple spaced across the length of a robot



PROS

- Great for defensive play
- Exploits small uneven surfaces so we can successfully lift other robots

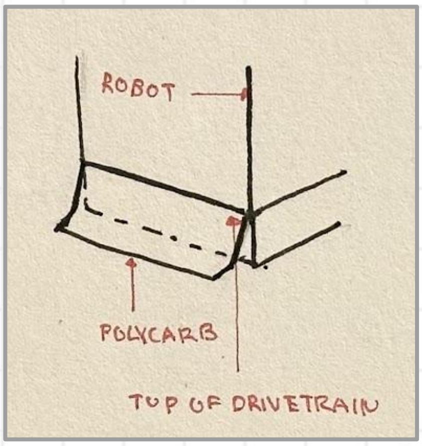
CONS

- May get stuck under the barrier
- Will get caught wth many game elements

Polycarb

Characteristics:

- Unibody wedge
- Spans across an entire side of the robot



PROS

- Easier to wedge under robots
- Easier to push triballs over the barrier
- Light

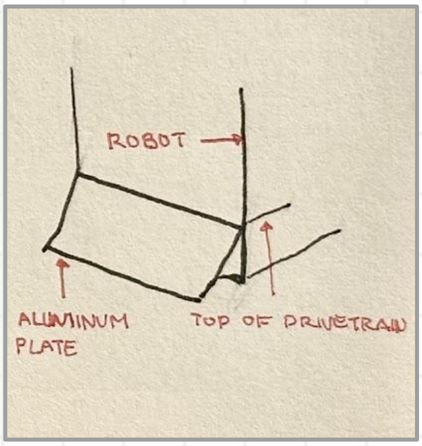
CONS

- Large in size

Aluminum

Characteristics:

- Unibody wedge
- Spans across an entire side of the robot
- Bent aluminum



PROS

- Easier to push triballs over the barrier

CONS

- Takes up space
- Heavy

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

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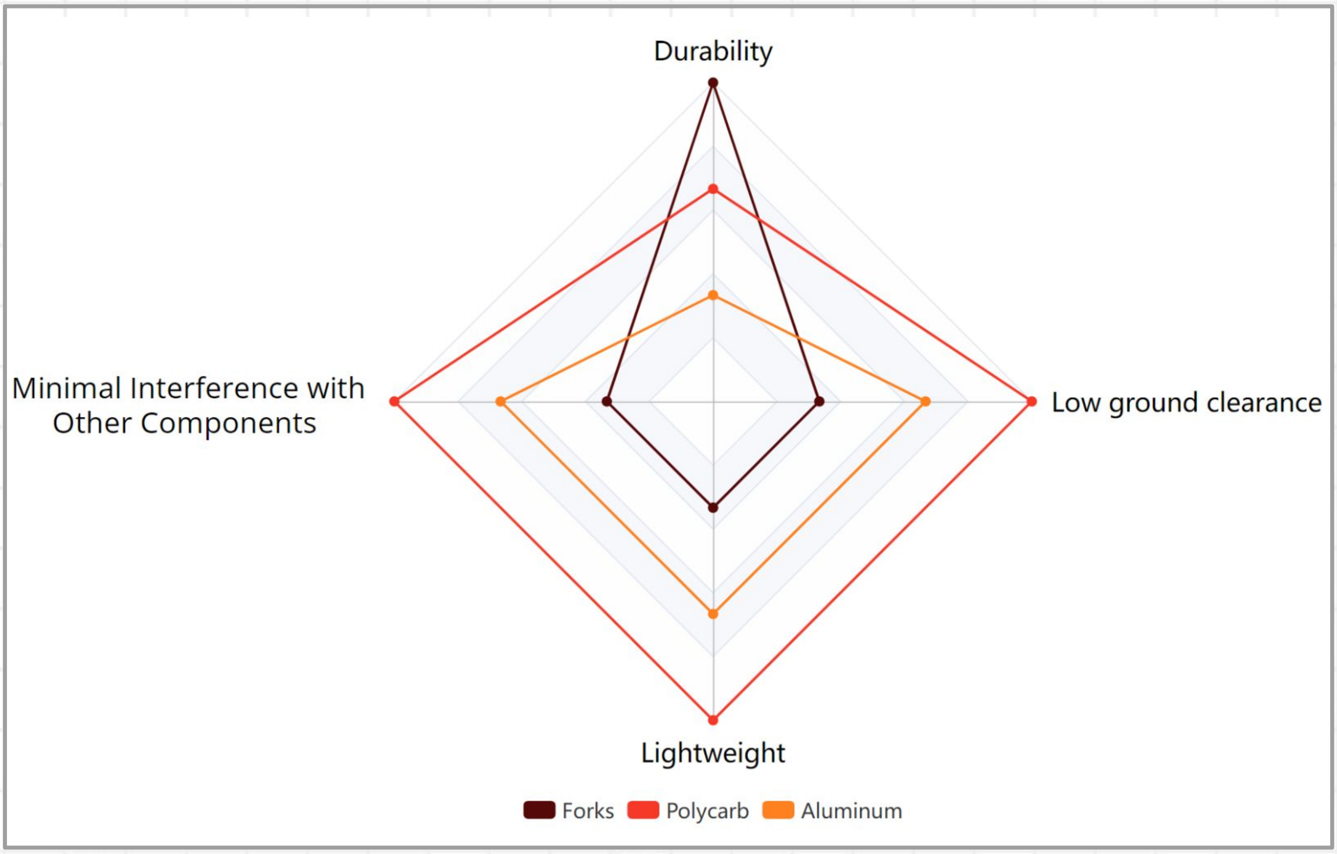
Wedge

Decision Matrix

Wedges are ranked from a scale of 1-3 compared to one another 3 being best and 1 being worst

Radar Chart



Table

	Forks	Polycarb	Aluminum
Durability	3	2	1
Low ground clearance	1	3	2
Lightweight	1	3	2
Minimal Interference with Other Components	1	3	2
Average	1.5	2.75	1.75

We can note that the polycarb wedge has the highest added average
Hence we will be creating polycarb wedge

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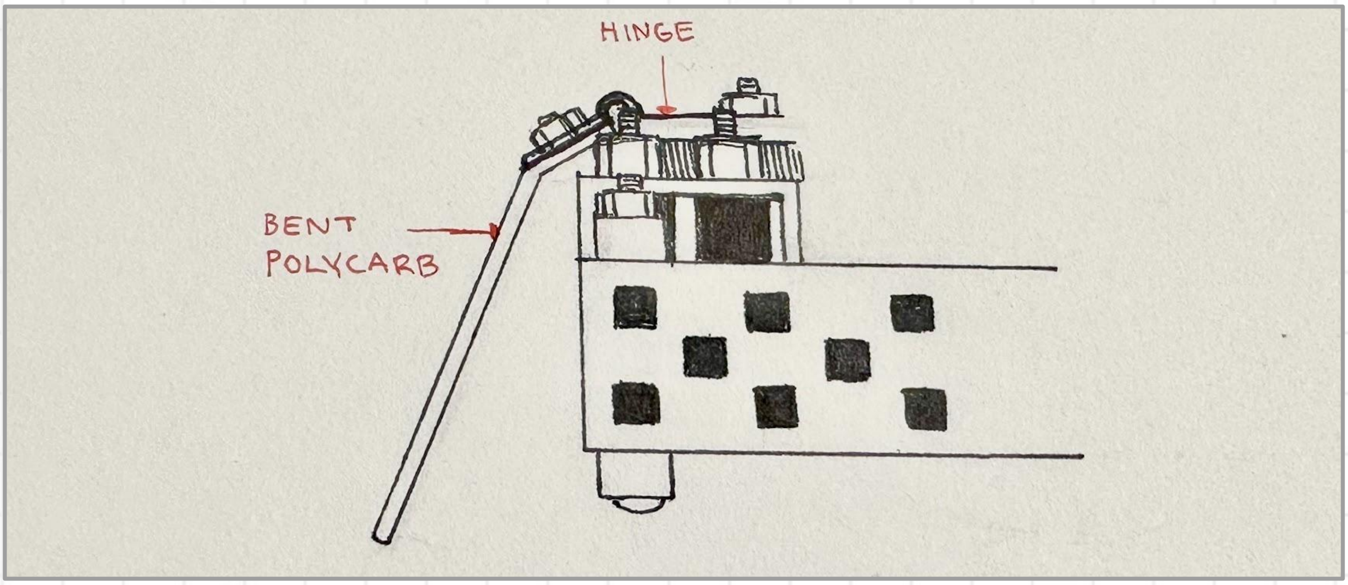
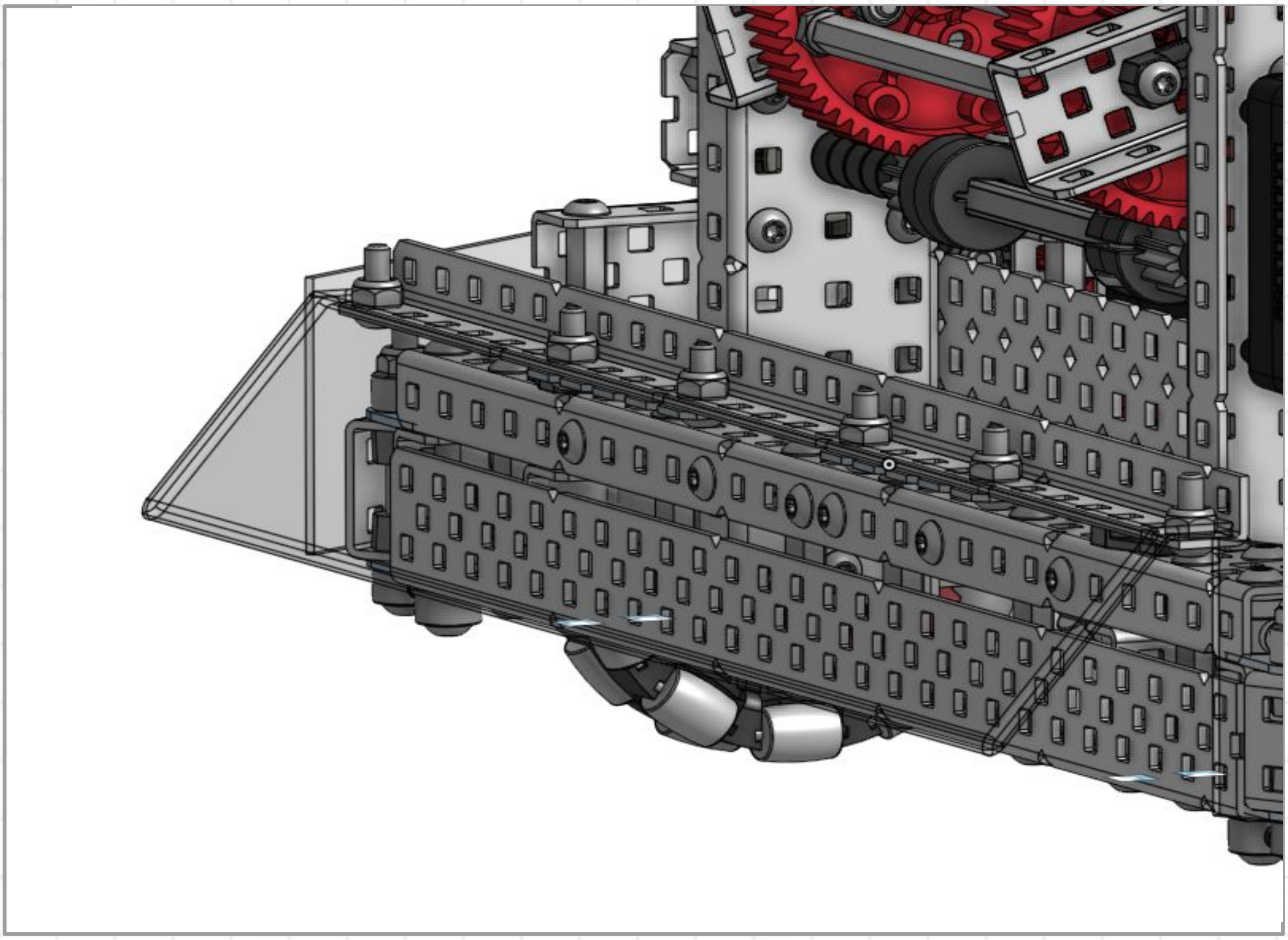
Wedge

Prototyping wedge

Sketch



CAD



DATE:

DESIGNED BY:

WITNESSED BY:

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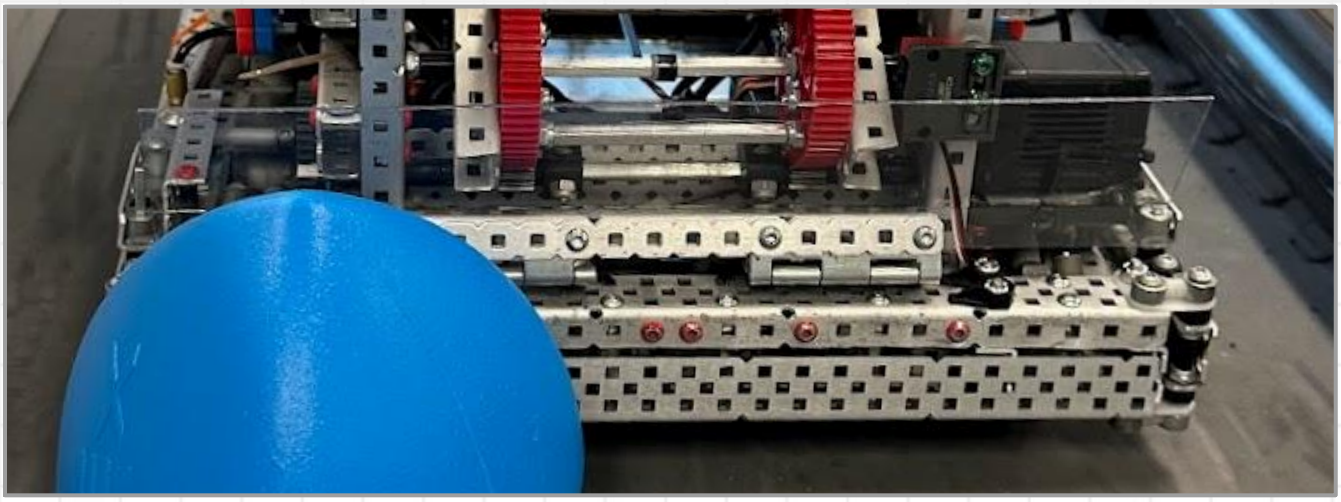
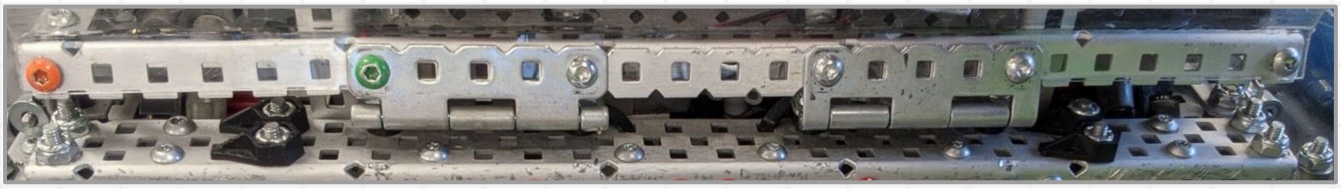
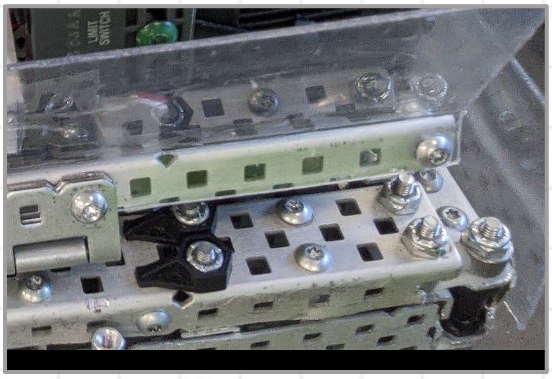
Wedge

Pictures



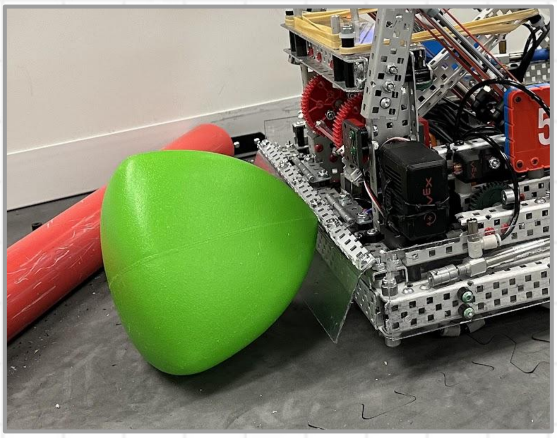
Hinges allow us to put the wedge in an “up” position in order to stay in size





During matches, we will start with the polycarb wedge in up position and as the robot drives forward the wedge will fall down.

We’ve decided to mount the wedge to the back of the robot under the catapult. This is the only place to mount the wedge



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Wedge

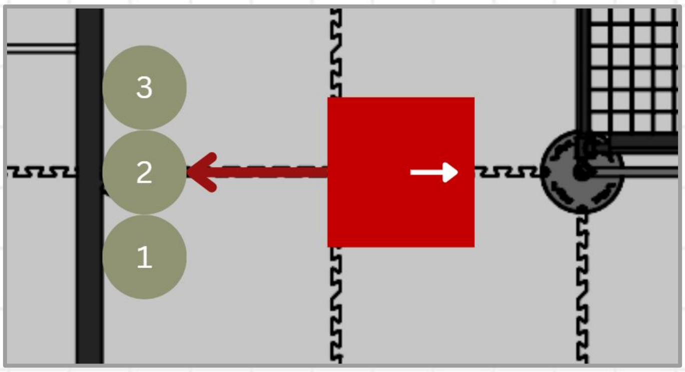
Goal

Testing wedge

TEST NO. 1 : PUSHING TRIBALLS OVER BARRIER

Procedure

I. Place robot on field tile (1 tile behind barrier)
II. Place 3 Triballs directly in front of intake (1 , 2 , 3) , 1 tile over flush to the barrier
III. Drive backwards
IV. Reset and repeat 10 times, check for success rate



KEY

🟥 Robot

→ Pushing direction

● Triball

Test	1	2	3	4	5
# Over	3	2	3	3	3
Test	6	7	8	9	10
# Over	2	2	3	3	3

Conclusion

We can successfully push 3 triballs over the barrier for the majority of times, so we can confidently use our wedge in game without it getting caught or not working.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

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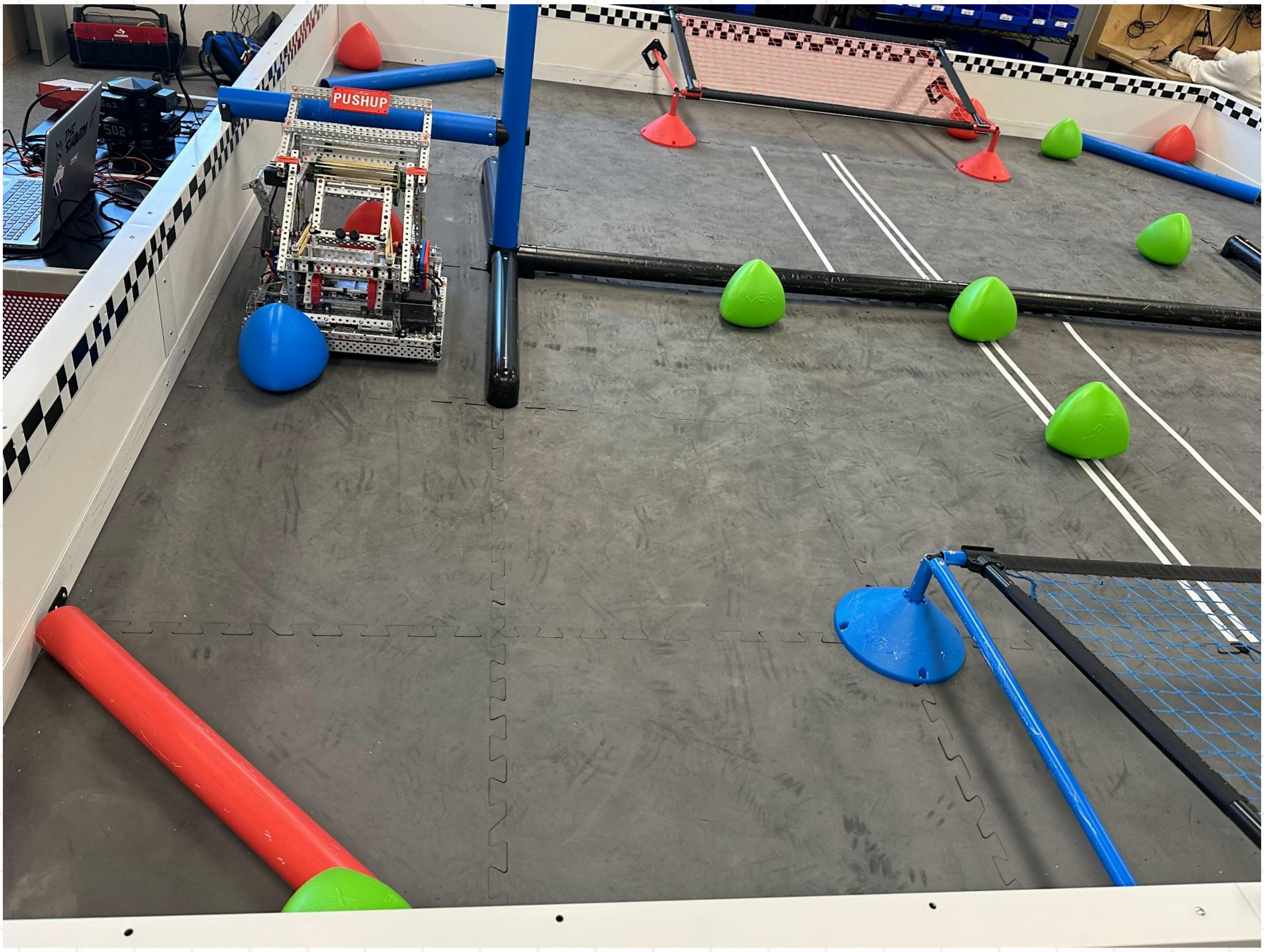
Wedge

Our field arrived



We are now able to test mechanisms As well as code

We hope that this will be able to boost our performance by yet another notch

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Code

Setting goals for code

Goal

Improving all our code now that we have a field

Why is this program important?

- Repeatable and accurate compared to driver
- Can be faster and more responsive than driver
- Can help us gain an advantage in skills, auto
- If coded properly can be very accurate and consistent
- Will help us greatly in times when match results are very close

What are some cons with this program?

- Time consuming to program
- Cannot actively respond to obstacles changing position
- Starting position must be the same for consistent results
    - If starting point is off the movement could be very different

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Ideal characteristics

MAIN OBJECTIVE

- **Auton**
  - Score as many points possible while also being able to obtain an AWP
- **Autonomous skills**
  - Score as many points possible, prioritizing getting the triball into the goal

CONSISTENCY

- **Auton**
  - Be able to stay within the zone
  - Be 95% successful
  - Determined through testing, and shifting triball position by a little bit
- **Autonomous skills**
  - Be able to score within a desired ranged of scores.
  - Range should be less than 10 points difference

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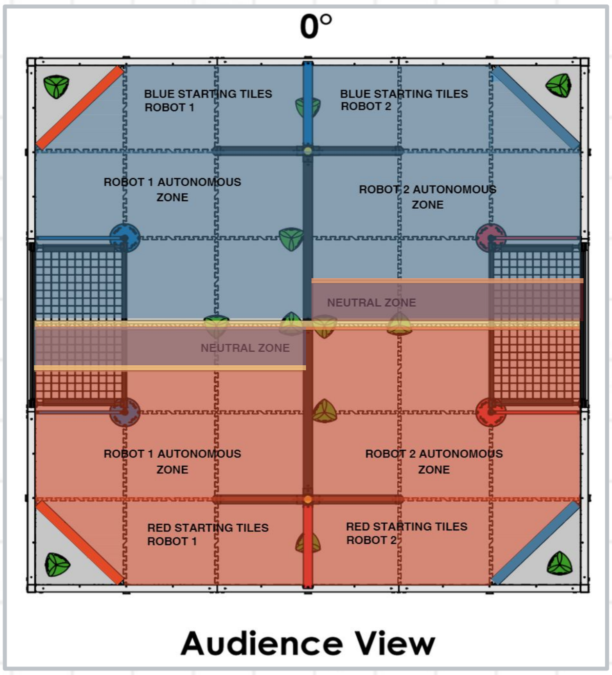
Code

Overview of the field for coding

Game Autonomous Period



KEY

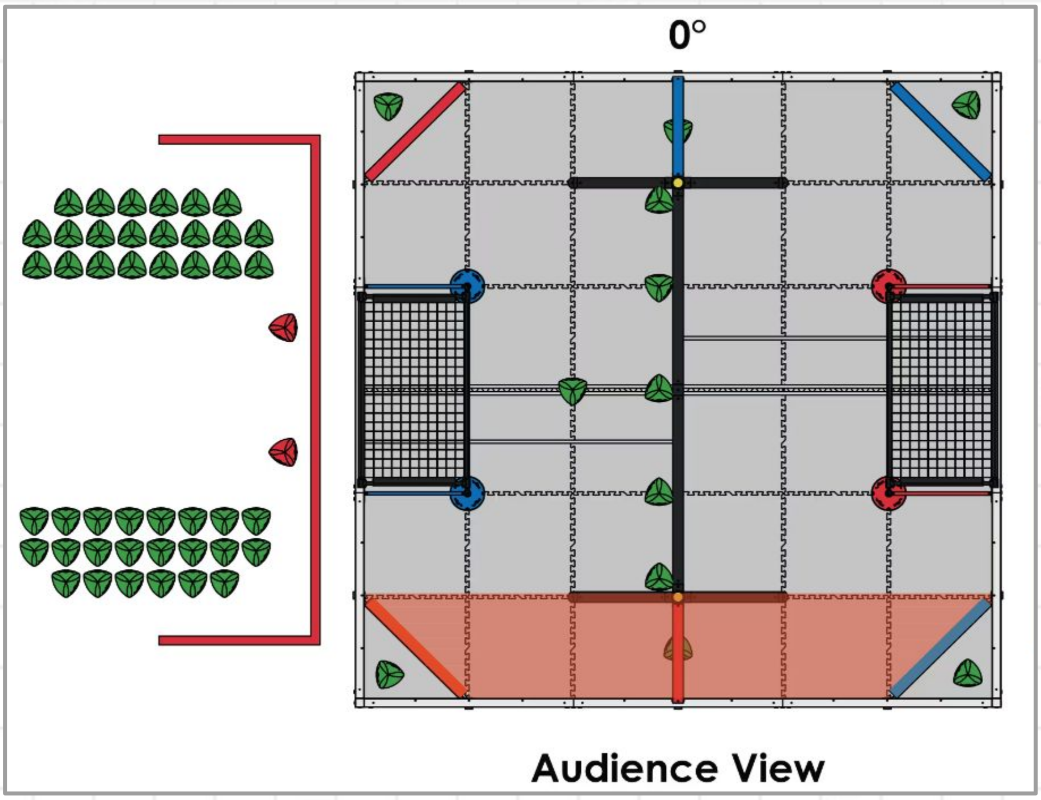
🟨 Autonomous line

🟪 Neutral zone

🟥 Red alliance starting tiles and autonomous zones

🟦 Blue alliance starting tiles and autonomous zones

Skills Autonomous



KEY

🟥 starting tiles

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Chosen routes

GAME AUTOS

Far side: 6 triballs, 4 triball rush

Close side: 1 in 2 over and touch bar, 1 in and touch bar, 1 in 3 over rush

SKILLS AUTO

Same as driver skills

1. Start on right side
2. Push both preloads into the goal
3. Matchload to other side (all 44)
4. Drive over to the other side
5. Push triballs into goal
    a. 2 times into the side
    b. 4 times at the front
6. Climb
    a. B tier (10 points)

We estimate 160 points during auto skills

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Code

Autonomous skills code

```
flag.set_value(false);
climbPrime.set_value(true); //Lifting blocker to release intake
chassis.set_angle(-120); //Starting angle
chassis.set_drive_pid(-32, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(14, 100, true);
chassis.wait_drive();
chassis.set_turn_pid(-14, 100);
chassis.wait_drive();
climbPrime.set_value(false);
cata.move_velocity(90); //Spinning catapult motor at 90% for matchloading
cata.move(115);
chassis.set_drive_pid(6, 75, true);
chassis.wait_drive();
flag.set_value(true);
pros::delay(31500); //Wait for matchloading
flag.set_value(false);
cata.move_velocity(0); //Stops the catapult
cata.move(0);
pros::Task myTask(cata_task); //Starts catapult task to keep catapult down
prime = true;
chassis.set_swing_pid(ez::RIGHT_SWING, 45, -100);
chassis.wait_drive();
chassis.set_drive_pid(-12, 100, true);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, 0, -100);
chassis.wait_drive();
chassis.set_drive_pid(-72, 100, true); //Crossing to the other side of the field
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, -60, -100); //Pushes the side of the goal
chassis.wait_drive();
chassis.set_drive_pid(-30, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-30, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(8, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, -90, 100);
chassis.wait_drive();
chassis.set_turn_pid(-15, 100);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, -90, -100);
chassis.wait_drive();
chassis.set_drive_pid(-10, 100, false); //Pushes the side of the goal again
chassis.wait_drive();
chassis.set_turn_pid(0, 100);
chassis.wait_drive();
chassis.set_drive_pid(36, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, 90, 100);
chassis.wait_drive();
climbPrime.set_value(true); //Opens the blocker to use air before we use the wings
chassis.set_drive_pid(26, 100, false); //Crossing to the middle of the goal
chassis.wait_drive();
```

DEFINE A PROBLEM
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BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Autonomous skills code

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Code

```
chassis.set_turn_pid(0, 100);
chassis.wait_drive();
chassis.set_drive_pid(-31, 100, false); //Push in the middle of the goal
chassis.wait_drive();
chassis.set_drive_pid(18, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, 90, 100);
chassis.wait_drive();
chassis.set_drive_pid(16, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(30, 100);
chassis.wait_drive();
Wings.set_value(true);
chassis.set_drive_pid(-29, 100, false); //Push from the right side with wings
chassis.wait_drive();
Wings.set_value(false);
chassis.set_turn_pid(0, 100);
chassis.wait_drive();
chassis.set_drive_pid(18, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, -90, 100);
chassis.wait_drive();
chassis.set_drive_pid(22, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(-30, 100);
chassis.wait_drive();
Wings.set_value(true);
chassis.set_drive_pid(-29, 100, false); //Push from the left side with wings
chassis.wait_drive();
Wings.set_value(false);
chassis.set_swing_pid(ez::LEFT_SWING, 30, 100);
chassis.wait_drive();
chassis.set_drive_pid(18, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(0, 100);
chassis.wait_drive();
Wings.set_value(true);
chassis.set_drive_pid(-29, 100, false); //Push from the middle with wings
chassis.wait_drive();
Wings.set_value(false);
chassis.set_swing_pid(ez::RIGHT_SWING, -110, 100);
chassis.wait_drive();
intake.move_velocity(-50);
intake.move(-64);
chassis.set_drive_pid(36, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, 0, 100);
chassis.wait_drive();
climbPrime.set_value(true);
prime = true;
chassis.set_drive_pid(44, 100, false);
chassis.wait_drive();
climbPrime.set_value(false);
climb.set_value(false); //Climb
```

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Testing

TESTING PROGRAMMING SKILLS

In matches we must be able to quickly manoeuvre around the field in order to reach our desired destination. In order to smoothly move about, we must familiarize ourselves with the field

This will allow us to maximize our gameplay skills and strategies as well as helping gain time in skills.

Procedure

I. Drive around the field in route 1
II. Drive until the robot is able to move smoothly across the route 3 times in a row
III. Move to route 2
IV. Repeat step II
V. Move to route 3
VI. Repeat step II

Results

Our scores

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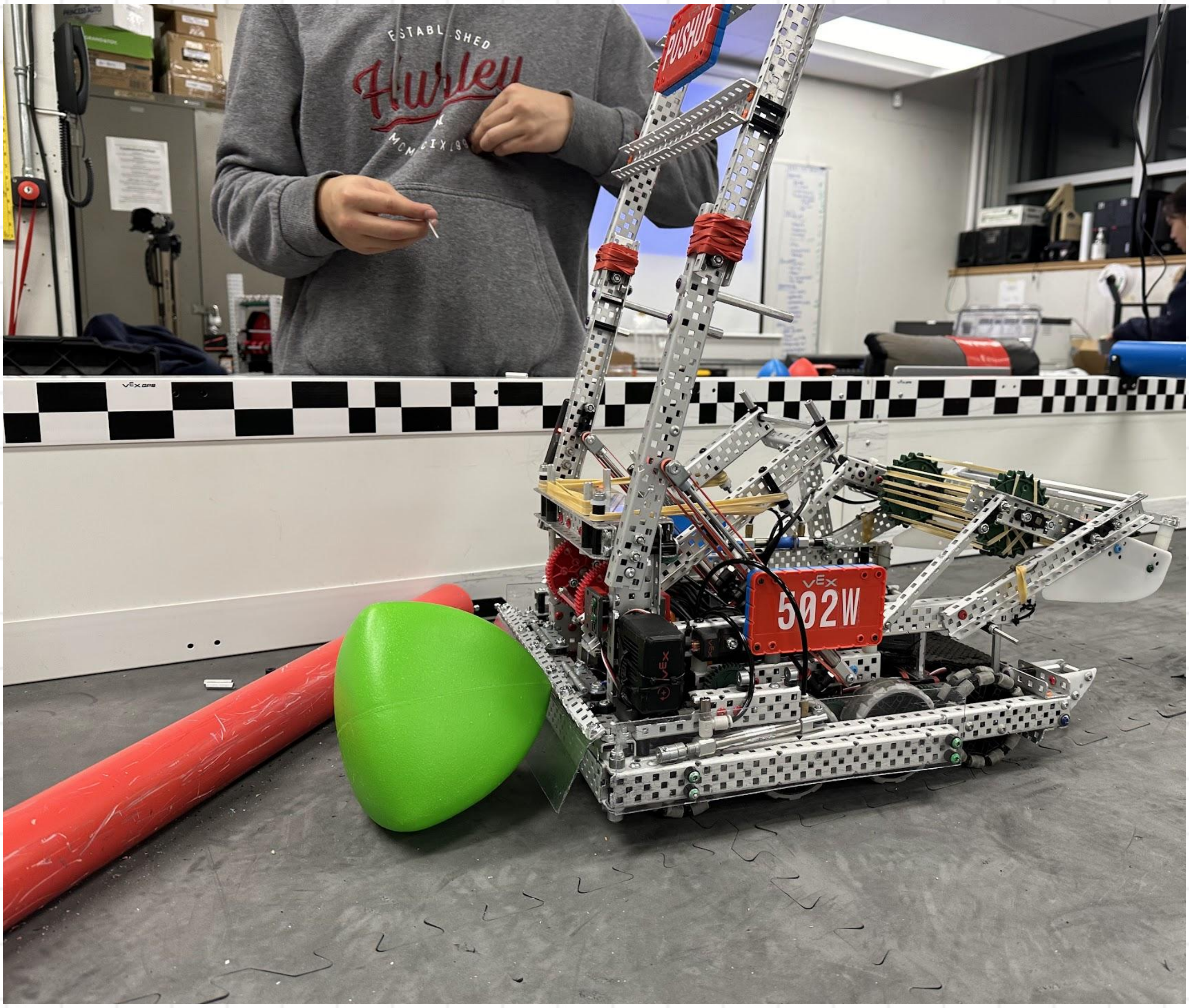
Overview

Here is our comp ready robot



With our new additions and driver practice we hope to perform significantly better than in previous comps

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Nov 4th Salish Review

Goal

Reviewing tournament

Skills

Rank	Team	Driver Attempts	Driver Highscore	Programming Attempts	Programming Highscore	Total High Score
5	502W	1	152	3	143	295

Qualification rank

Rank	Team	Name	W-L-T	WPs . APs . SPs
4	502W	WonTon	5-1-0	12 / 48 / 439

Matches

MATCH	RED ALLIANCE		SCORE	BLUE ALLIANCE	
Qualifier #11	6408D	1011Z	**77 - 153**	**502W**	34300N
Qualifier #17	34300P	6408E	**39 - 171**	34300D	**502W**
Qualifier #32	**502W**	604X	**160 - 37**	502X	10012U
Qualifier #37	**502W**	6408H	**144 - 64**	87265B	1010A
Qualifier #49	886Y	1010W	**175 - 130**	502A	**502W**
Qualifier #68	**502W**	10012S	**137 - 92**	18670A	502Y
R16 #1-1	604X	**502W**	**250 - 42**	34300S	1011N
QF #1-1	604X	**502W**	**173 - 108**	1010A	886Z
SF #1-1	604X	**502W**	**188 - 105**	1011T	10012Y
Final #1-1	604X	**502W**	**74 - 150**	10012G	1010W

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Improvements

Observation

Skills

- Auto get sucks when pushing triballs to offensive zone ⅓ time
- Triballs get stuck in offensive load zone

Game

- Auto did not work reliably (starting position)
- Intake left chain fell off, right chain still in contact, intake still work
- Intake motor got ram and broke
- Catapult stop shooting during match load
- Drivetrain works smoothly
- Climb worked nearly every time
- No intake jam problem
- Blocker works
- Wings was not used during match

Conclusion

CONTINUED FROM PAGE:

Practice

Goal

Practicing driver runs to improve our skills score and in game performance

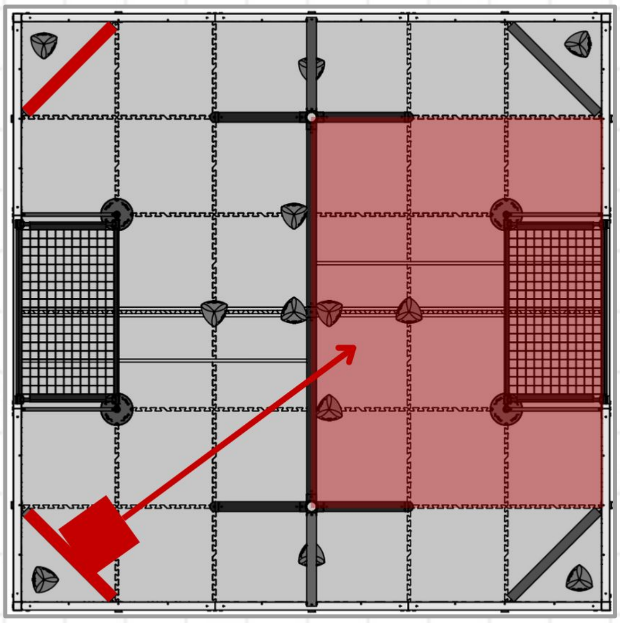
PRACTICE NO. 1 : LINING UP THE CATAPULT

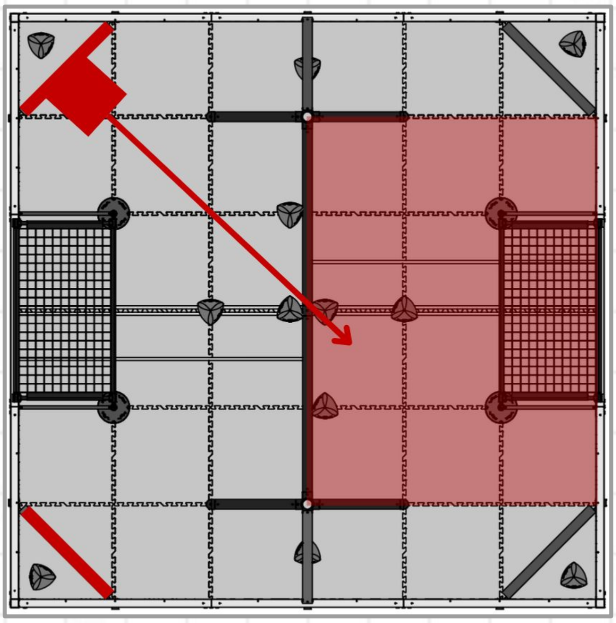
In matches we won't always have the perfect postition to angle our catapult to matchload, but through practice we will be able to quickly get the position needed saving us a few seconds to start matchloading.

All the time saved will help score more points in skills, and save more time left for the climb at the ends

Procedure

I. Start 2 or 3 tiles away from match load bar
II. Angle robot in matchloading position(as if touching the bar)
III. Cycle and matchload 5 triballs
IV. If all 5 land in the zone we are aiming for then it is considered a success
V. Repeat until we have 5 times in a row where we can angle it
VI. Repeat entire process on the other side





DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

PRACTICE NO. 2 : MANOEUVRING ACROSS BARRIERS

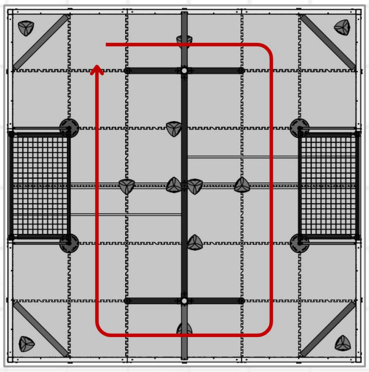
In matches we must be able to quickly manoeuvre around the field in order to reach our desired destination. In order to smoothly move about, we must familiarize ourselves with the field

This will allow us to maximize our gameplay skills and strategies as well as helping gain time in skills.

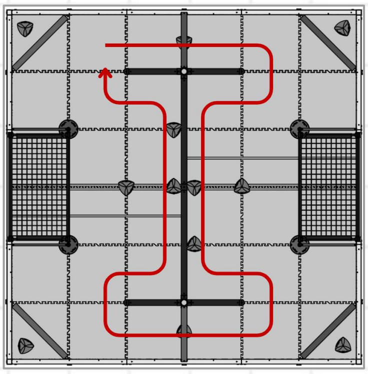
Procedure

I. Drive around the field in route 1
II. Drive until the robot is able to move smoothly across the route 3 times in a row
III. Move to route 2
IV. Repeat step II
V. Move to route 3
VI. Repeat step II

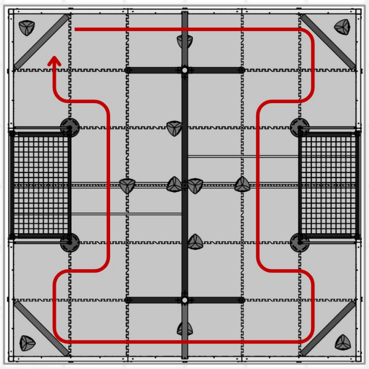
Route no.1



Route no.2



Route no.3

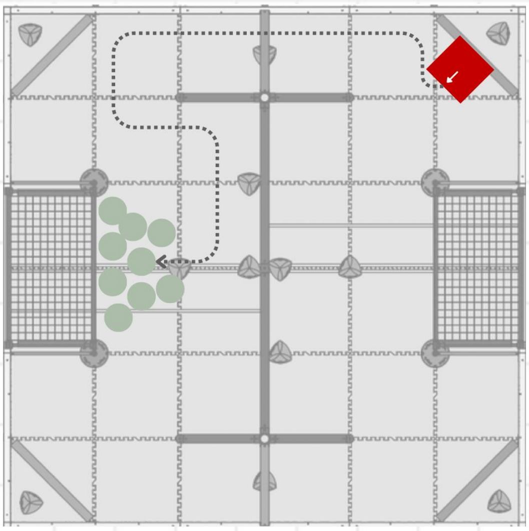


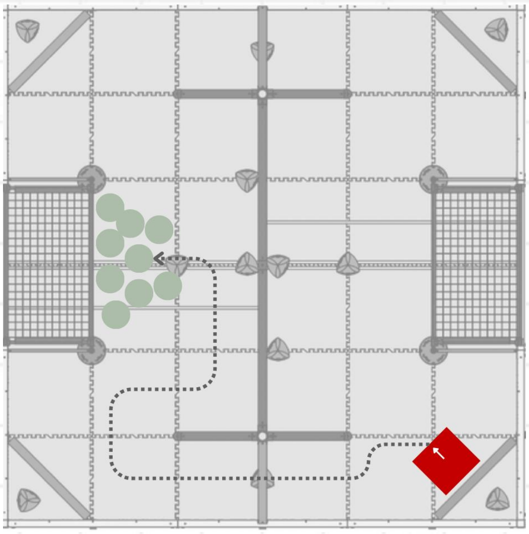
PRACTICE NO. 3 : PUSHING TRIBALLS IN THROUGH FRONT

Procedure
- Place robot in position of matchloading(touching the bar)
- Place a group of 10 or so triballs in front of goal
- Drive over and push triballs in goal from the front of the goal
- Repeat until over 5 triballs can get pushed into the goal every time for 5 times with less than 3 pushes

Practice

Plowing practice

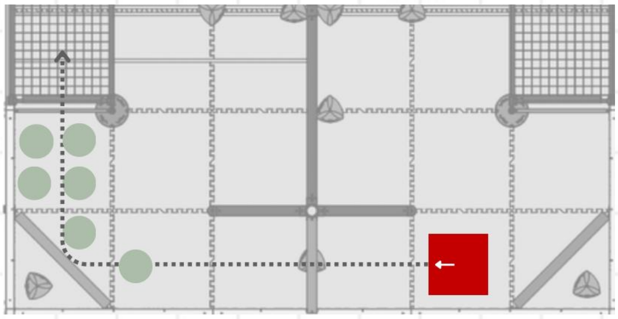


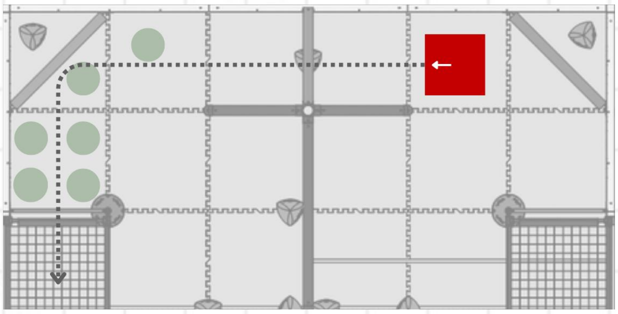


PRACTICE NO. 4 : PUSHING TRIBALLS IN THROUGH CORNER

Often during games, a large amount of triballs gather in the corner. And most of the time when teams attempt to score those triballs on the side, they either get pushed away or pushed into the match load zone. Costing them both time and points

Procedure:
- Start from other side of the field under the bar(right side)
- Place a 6 of triballs in the corner of the right
- Drive over, turn and try to push majority of triballs in without pushing triballs away or getting triballs into the match load zone.
- Repeat until we can score 4 triballs, 5 times in a row
- Repeat on left side





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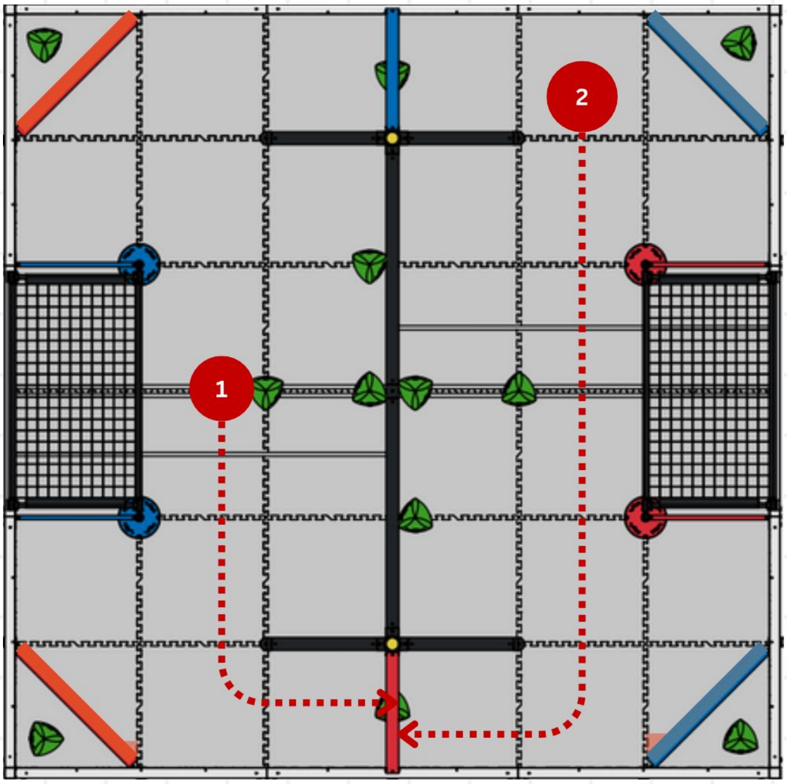
PRACTICE NO. 5 : CLIMB

We want to spend the least possible time on climb so we can focus on defence. So we want to be able to quickly drive and get into position as smoothly as possible do maximise our chances of getting a higher skills score or just winning a match

Procedure
- Start on position 1
- Try to drive as fast as possible to climb
- Repeat until we can to get a consistent climb in under 7 seconds
- Move robots starting position to position 2
- Repeat until we can get there and climb in less than 10 seconds



Position 1 was determined based off the places where we usually are during skills or matches where we are scoring.

Position 2 was determined because usually when we defend that's the furthest possible position were we could possibly defend matchloading

Practice

Goal

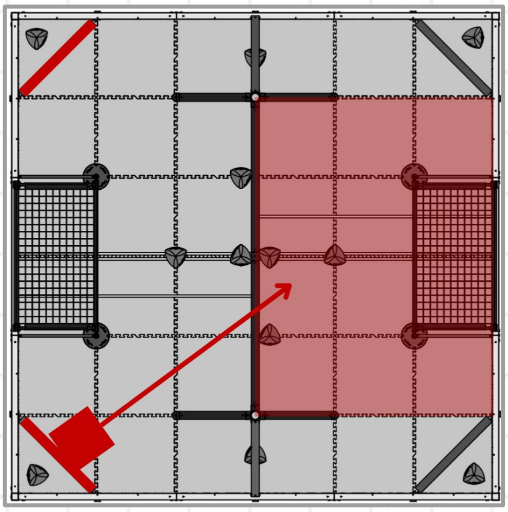
Practicing driver runs to improve our skills score and in game performance

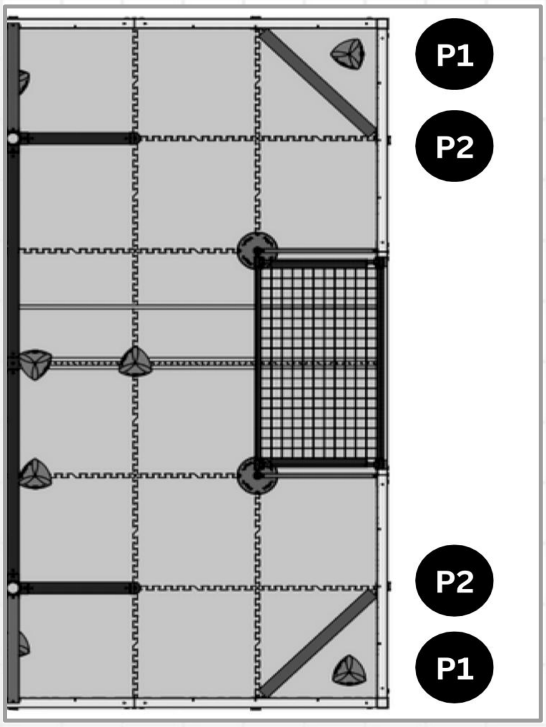
PRACTICE NO. 6 : MATCH LOADING

This is so we can consistently get majority of triballs over the middle barrier as we've noticed in previous rounds we've always missed 3-4 triballs. We've also noted that all teams match load from the same side

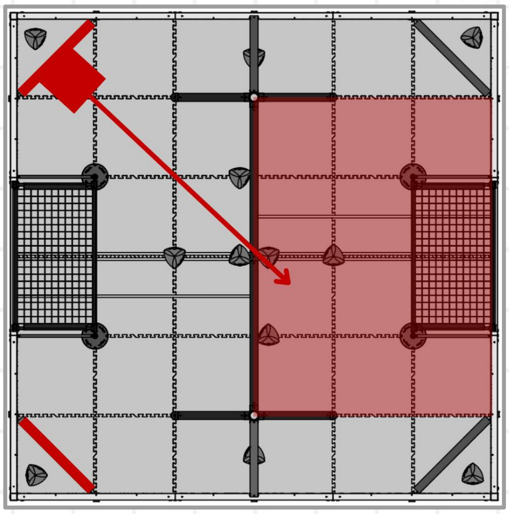
Procedure

I. Procedure
II. - Place robot in match loading position
III. - Cycle catapult
IV. - Matchload
V. - Count amount missed
VI. - Repeat until all are over save for 2 triballs missed for at least 3 trials
VII. - Repeat on the other side





P1 and P2 refer to the position of two teammates where we will be match loading from



Robot 2.0

WEEK 1

WEEK 2

WEEK 3

ROBOT REBUILD

Goal

Rebuilding our robot

Why rebuild our robot?

- Our current robot has already won us a tournament with no major issues in need of addressing
- Rebuilding our bot will be the fastest way to ameliorate all aspects or components of our bot
- Will allow us to try out new ideas without being constrained by what we already have
- We'll be able to aim for higher goals and skills score
- We'll be able to implement knowledge gained through all match analysis and other robots in our new
- Improves our abilities in both building and coding
- Increases our chances of gaining awards and winning tournaments
- Will make us seem like a better choice to alliance with

Overall, rebuilding our robot will be a rewarding experience for us. We look forward to bringing our new robot to the upcoming tournament at Heritage Secondary on December 9th

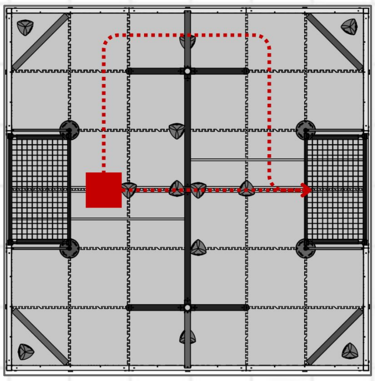
DATE: 11/20/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

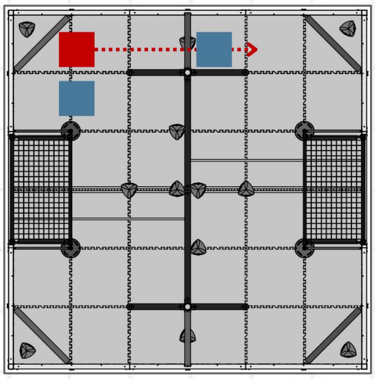
Setting requirements that we want our robot to achieve

TOP 3 MAJOR REQUIREMENTS

- **Going over the barrier easily**
  - Our old robot took multiple tries to successfully get over the middle barrier, costing us a lot of time during matches.
  - Being able to go over will allow us to use even better game strategies, as we can now manoeuvre with ease throughout the entire field.



- **Strong against defence**
  - We found that blockers are becoming more common now and we should be considering how to match load in the presence of a blocker.
  - Currently, we tap the triballs on the side of the bot and push it through the barrier, but this will not be idea in situations where both members of an alliance defence against us.



- **Less Overheating**
  - Due to a combination of factors, our current bot would heat up very often. We found that on average, every 1.5 matches, the motors wouldn't perform as well.
  - Less overheating would guarantee us a robot in peak performance for a longer period of time and so that elimination rounds are not as stressful and taxing on the robot.

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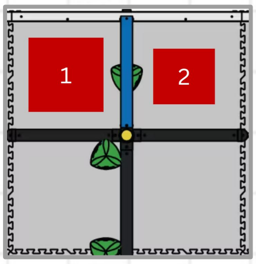
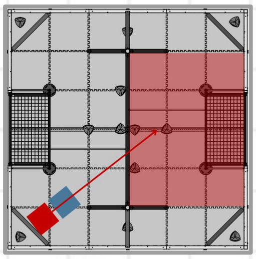
COMPONENTS

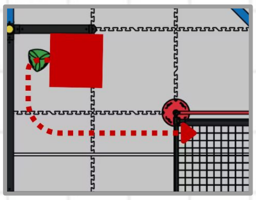
- **Drive train**
  - Allows us to drive around
  - We want to make a smaller drivetrain (therefore a smaller bot) which will give us more manoeuvrability while navigating the field. See difference between #1 and #2



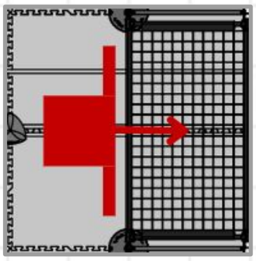
- **Shooting mech**
  - Allows us to matchload
  - We want to be able to matchload past blockers and other robots pushing us allowing us a higher chance of winning matches



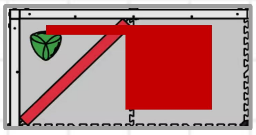
- **Intake**
  - Allows us to possess a triball
  - Our main goal is to have a smoother intake, allowing us to score more frequently and with control



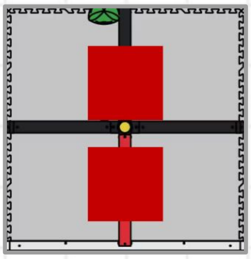
- **Wings**
  - Allows for us to efficiently use our time and push a large quantity of triballs in to the goal
  - We will aim for stronger wings which will allow us to use less caution when activating the mechanism



- **Blooper**
  - Helps us get awp during autos
  - We want consistent awps hence a more consistent mechanism



- **Climb**
  - Gains us the equivalent of 1-4 triballs scored in the goal(5-20 points)
  - We want to be able to partner climb in any way possible as that will win us a match. With lowest possible points being 15 total and highest being 35



DATE: 11/20/2023 DESIGNED BY: RL WITNESSED BY: TC

PLANNING

Goal

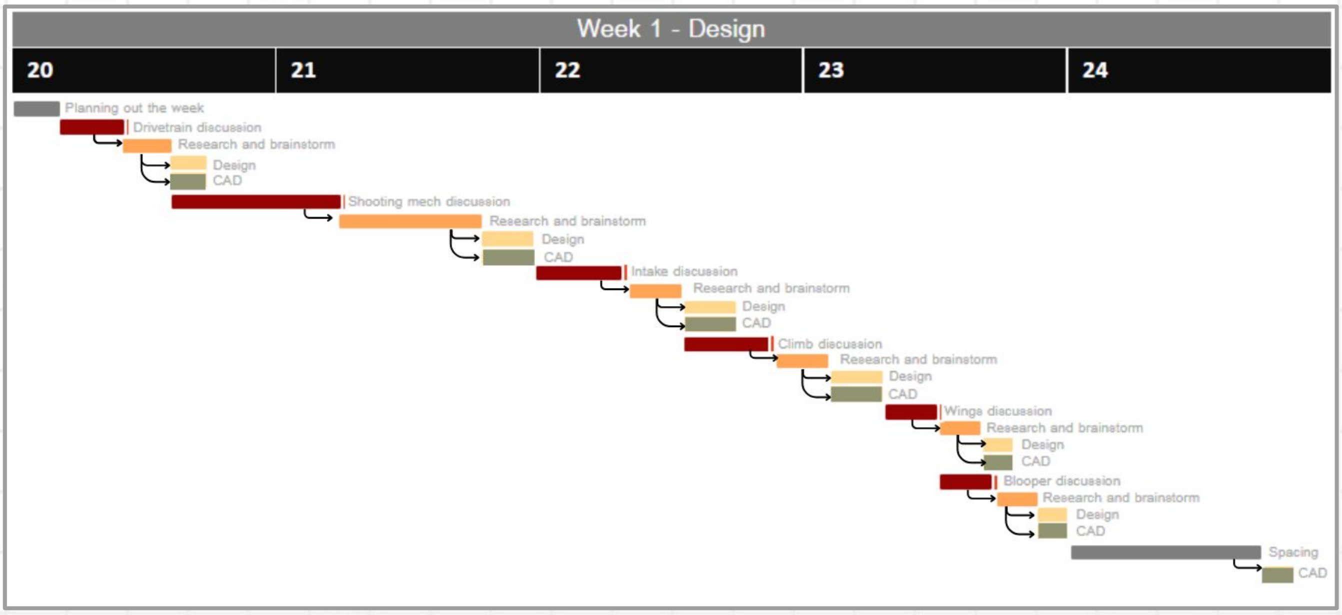
Organizing our time in order to efficiently make use of it and complete the rebuild

PLAN

We have 3 weeks to get a complete a robot, in order to efficiently maximize our use of time we've decided to split the weeks as the following:

- Week 1 → Design and Cad
- Week 2 → Build
- Week 3 → Code and practice

Here is a Gantt chart showing a detailed plan of week 1



We've decided to color code the process we will follow with the design process of the mechanism, that also is shown on the sides of the notebook.

🟥 Identify Problem 🟥 Set Specific Reqs 🟧 Research 🟨 Select solution 🟩 Develop solution

We will follow this schedule to our best, and we will also be checking in with the chart mid-week on November 22nd to see if any changes need to be made. At the end of the week, we will confirm that all is done and create a new Gantt chart for week 2.

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DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Goal

Making a drivetrain

What needs to be improved from our previous drivetrain?

- Our old drivetrain gear ratio of 3:4 at 450 rpm paired with 3.25 wheels proved to be slightly too fast to be in our driver's comfort zone
- Lowering the speed of the drivetrain will allow us to spend less time grappling with the speed in practice, therefore making it possible for us to allocate more time on skills, offence or defensive routes and strategies we want to try.
- We also want to aim for a smaller size as this will give us more space to manoeuvre around the field as stated previously

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Speed**
  - We want to lower our speed but not so much that we have a disadvantage over other teams. So most likely what changes we will make will not be very significance. We only want to lower it enough so that our driver feels more in control. Having the confidence to do will in skills and during games
- **Power**
  - Pushing power will greatly impact our odds of winning or losing a match. Defence is always important as well as offence, where we hope to withstand pushes and be able to stay our ground. This will be beneficial as we hope to match load a lot more with our new robot
- **Manoeuvrability**
  - We want to be more at ease navigating the elements. This will allow us to efficiently use time to travel around the field during matches. Giving us a more competitive edge.

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CONSTRAINTS

RULE CONSTRAINTS:

Our drivetrain should fit within an 18” x 18” x 18” cube as stated in <R4>
We want our drivetrain to be smaller than 13” x 17.5” which was the size of our previous drivetrain,

MATERIAL CONSTRAINTS:

None

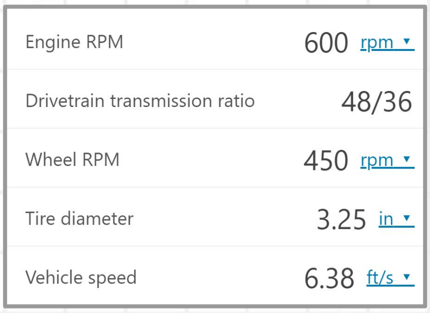
TIME CONSTRAINTS:

Drivetrain is to be completed on Monday, November 27th

Goal

Finding possible ways we can tick off these goals while still staying within the constraints

SPEED

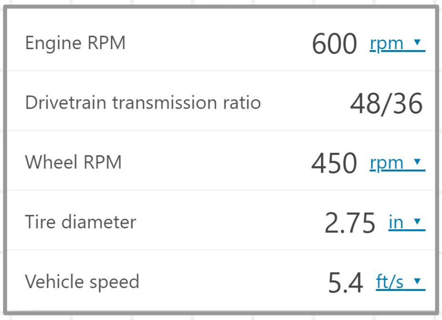


Engine RPM	600 rpm ▾
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm ▾
Tire diameter	3.25 in ▾
Vehicle speed	6.38 ft/s ▾

For reference, this was our original gear ratio and rpm (shown on the left) → 4:3 at 450rpm

Our goal is to lower the speed of the drivetrain by a little bit so that we feel more in control when driving the robot. We’ve decided to use ft/s for speed as our field is measured in feet (12’ x 12’)

Below are possible solutions



Engine RPM	600 rpm ▾
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm ▾
Tire diameter	2.75 in ▾
Vehicle speed	5.4 ft/s ▾

Solution 1

The simplest solution is to change the wheel size from 3.25” to 2.75”. Note that with this change, our drivetrain speed will be 0.98 ft/s slower than originally.

CONSIDERATIONS:
Will we still be able to go over the middle barrier with a smaller wheel size?

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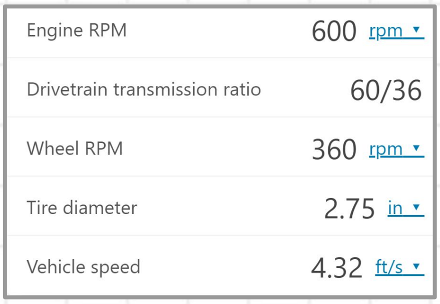
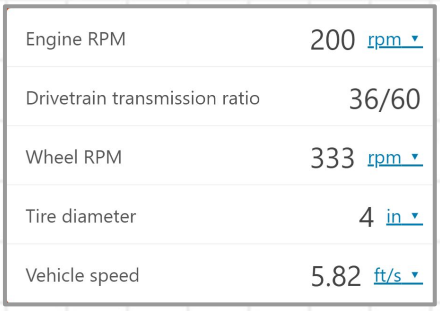


Engine RPM	600 rpm
Drivetrain transmission ratio	60/36
Wheel RPM	360 rpm
Tire diameter	2.75 in
Vehicle speed	4.32 ft/s

Solution 2

This will involve us changing a lot of components. The gear ratio will be changed to 5:3 resulting in 360rpm. Wheel diameter will be changed to 2.75” as well. This drivetrain will be 2.06 ft/s slower than our previous

CONSIDERATIONS:
Will we still be able to go over the middle barrier with a smaller wheel size?
Will we be able to fit in our self set constraints?

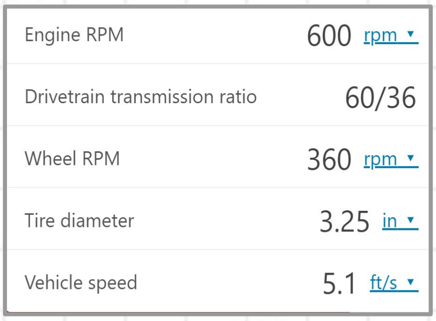


Engine RPM	200 rpm
Drivetrain transmission ratio	36/60
Wheel RPM	333 rpm
Tire diameter	4 in
Vehicle speed	5.82 ft/s

Solution 3

This will involve us making the most changes. Virtually all components will be changed. This will allow our drivetrain to be 0.56 ft/s slower than our previous.

CONSIDERATIONS:
Do we want less input rpm for speed costing us torque?
Will we be able to fit in our self set constraints?



Engine RPM	600 rpm
Drivetrain transmission ratio	60/36
Wheel RPM	360 rpm
Tire diameter	3.25 in
Vehicle speed	5.1 ft/s

Solution 4

This will involve us only changing gear ratios. This wil allow our drivetrain to be 1.28 ft/s slower than our previous.

CONSIDERATIONS:
Will we be able to fit in our self set constraints?
Will we want a lower rpm?

Summary of solutions

In total, we have 4 solutions which have a range of speeds. We’ll be either 0.56 ft/s to 2.06 ft/s slower than our previous robot.

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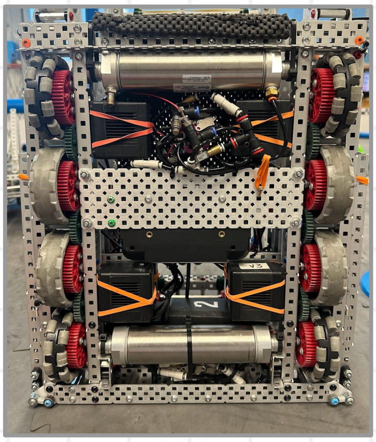
POWER

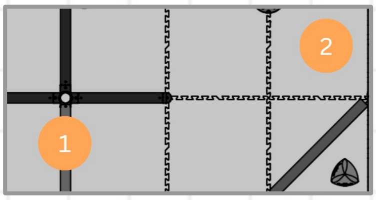
On last bot, we had previously used 4 omnidirectional wheels on each of the drivetrain but ended up changing them to 2 omnidirectional wheels with 2 traction wheels in between which significantly increased our pushing power which came at a cost of us getting caught in the walls. Note that this drivetrain won us a tournament and prevented us from tipping over ever since we changed wheels.



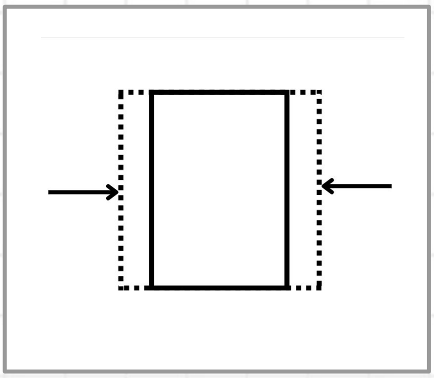
We've decided to revert to our old combo IF we use smaller wheels, but we will keep this wheel combination if we use the same size wheels or larger. This way we won't get tipped over in any way

MANOEUVRABILITY

We wish to decrease size to increase manoeuvrability around the field, especially under the barriers (1), as well as scoring triballs into the goal from the corners (2).

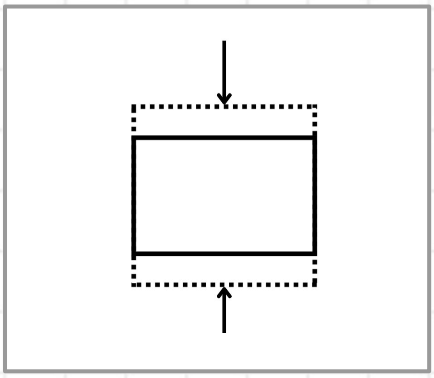


Below are possible solutions



Solution 1
Decreasing width of the drivetrain, give us more space in between the barrier and the wall (under the elevation bar)

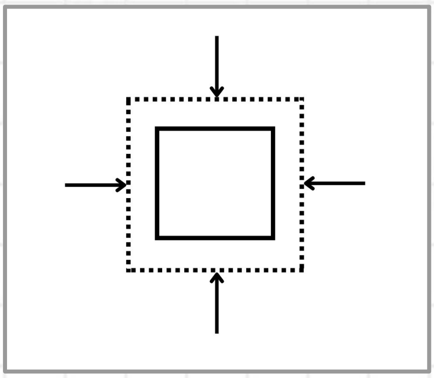
CONSIDERATIONS:
We should try to leave space for tracking wheels as we were not able to add them to our previous bot



Solution 2

Decreasing length of drivetrain, gives us more space in the corners when trying to score as we will have more space to manoeuvre around.

CONSIDERATIONS:
We should try to leave space for tracking wheels as we were not able to add them to our previous bot



Solution 3

Decreasing both length and width of the drivetrain, gives us more space in both the corners and under the elevation bar.

CONSIDERATIONS:
Is there enough space for other components? Including tracking wheels?

Summary of solutions

In total, we have 3 solutions which have a range of speeds. The solution chosen will be heavily dependent on our selection for our speed related goal.

Note:

When selecting final solutions, we will do a decision matrix based off of our first goal/requirement speed, then go down from it to manoeuvrability. We will try to think holistically as we go through the matrix.

We look forward to selecting a drivetrain solution that will be able to help us significantly improve our performance, whether it be in driver skill, offence/defence or manoeuvrability throuthoughtout the field

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Goal

Selecting a design

DECISION MATRIX

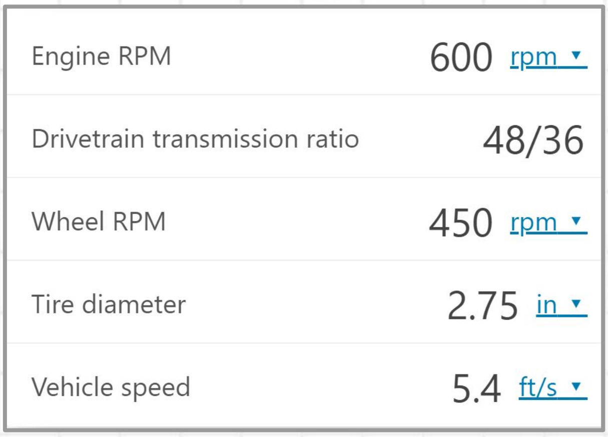
Speed

	How much slower	Ranking
Solution 1	0.98 ft/s	2
Solution 2	2.06 ft/s	3
Solution 3	0.56 ft/s	1
Solution 4	1.28 ft/s	4

Since we want only a slight change in speed, we can note that solution 1 and 3 seem to be the closest and with only a small difference in speed

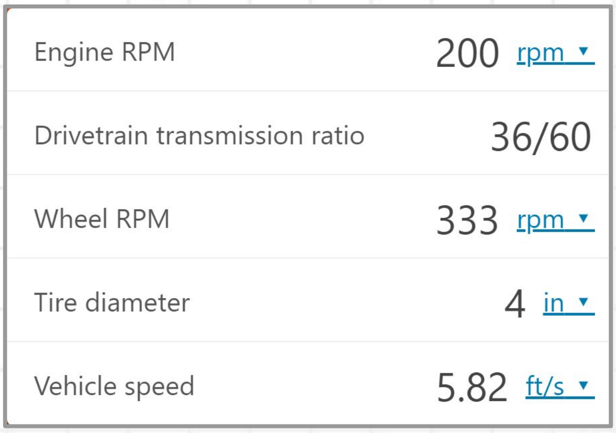
With this ranking we can narrow down our choices to solutions 1 and 3
We will be renaming them to A and B for ease of following

Solution 1 → A



Engine RPM	600 rpm ▾
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm ▾
Tire diameter	2.75 in ▾
Vehicle speed	5.4 ft/s ▾

Solution 3 → B



Engine RPM	200 rpm ▾
Drivetrain transmission ratio	36/60
Wheel RPM	333 rpm ▾
Tire diameter	4 in ▾
Vehicle speed	5.82 ft/s ▾

We will now compare these 2 solutions (now A and B) to our solutions for Manoeuvrability. We've already decided to make no changes on the power requirement in terms of wheel types.

Initial observations and connections

A - pros

- Lower centre of mass which makes it harder to flip over
- Allows us to save more space for adding components on top since the wheels are 2.75"
- Significantly decrease our drivetrain size, aligning us with either solution 1 or 3 of the manoeuvrability requirement
- 600 RPM motor helps us manoeuvre around easier

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A - cons

- May be difficult getting over the middle barrier or even getting on it
- May required more motors to work harder to achieve the desired movement. This increased workload can lead to motor overheating, reducing the overall lifespan of the motors

B - pros

- Easy to get over the barrier
- More torque (from 200 rpm motors) allowing us to defend easier

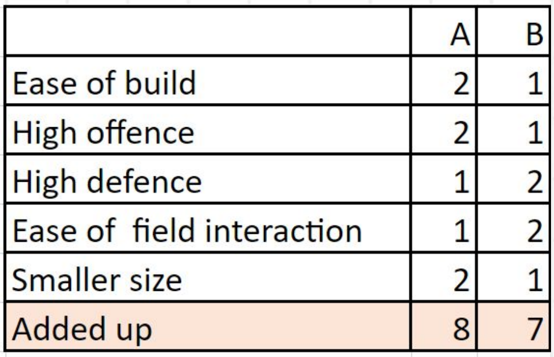
B - cons

- May increase size instead of decreasing size
- Bulky drivetrain giving us less space to work with robot mechanisms
  - Larger wheels, larger gears = larger bot
- Easier to tip over

After these pros and cons we can note that A will be suitable for all our requirements where B does not seem to fit with our goal of decreasing robot size (As larger drivetrain = larger robot)

- On the right, we have ranked them on 5 must have requirements that we have set which will be essential for games. 2 being the higher likelihood. Then we add up scores to see which is higher.

- We can see that they are both very close but solution A seems to be winning by a point



	A	B
Ease of build	2	1
High offence	2	1
High defence	1	2
Ease of field interaction	1	2
Smaller size	2	1
Added up	8	7

Conclusion

We will be going with solution A, with the 8 omnidirectional 2.75” wheels as before, aiming to have a robot narrower in width compared to our previous robot.

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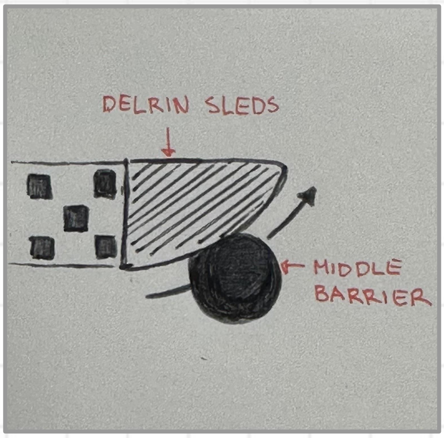
Goal

Designing the drivetrain

ADDRESSING POSSIBLE ISSUES

Going over the barrier



- We will be implementing sleds, so that we can easily slide over the barrier
- Previously we had delrin sleds, and we found that they've lasted us very long and that sleds proves to be essential for allowing us to get over the barrier
- Delrin is very durable and that is why we’ve chosen to use delrin as our material instead of any other plastic

Overheating

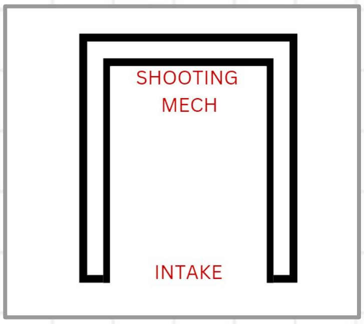
- A combination of factors allow for overheating, mainly weight on a robot.
- We won't be able to do anything other than to aim for better weight imbalance and less sinkage into the tiles
  - Hence why we’re using 4 wheels to have better contact with the ground.
- Another cause of overheating is friction
  - We will be screw jointing the drivetrain together for 2 reasons. The first being that it allow for a smoother free spin putting less stress on the motors and the second being that it helpps brace the drivetrain Together
  - Our previous bot was the first time we experimented with screwjoints, and we found out that the significantly help brace our drivetrain as opposed to low strength shafts (they are stronger and more secure)

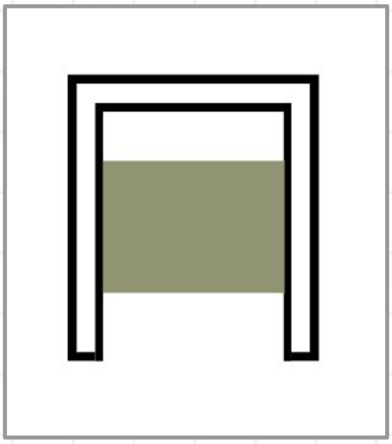
After addressing all possible issues, we are now able to proceed to designing the drivetrain on CAD

DESIGN SPECIFICATIONS

- 8x 2.75” Omni wheels
- 8x 36T Low Strength gears
- 8x 48T High Strength Gears
- 6x Low Strength Shafts cut to 3.5”
- 8x 2” Screws
- 1x Delrin Sheet
- 4x 1x2x1x29 (29 hole) C-Channel
- 3x 1x2x1x20 (20 hole) C-Channel
- 4x 1x2x1x10 (10 hole) C-Channel
- 2x 1x3x1x22 (22 hole) C-Channel
- As well as spacers, standoffs, bearings and nylocks that remain subject to change

While creating the drivetrain we must consider future components, namely the intake and shooting mechanism
We’ve decided to create a U shaped configuration to leave space for triball possession. Leaving the other side to the future shooting mechanism.



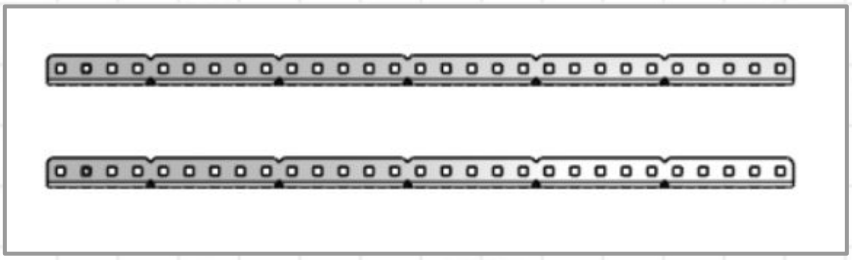


Another component in need of addressing are tracking wheels. We should be able to leave space in the centre of the drivetrain (look to the green square on the left) in order for us to successfully mount them in the future.

<u>How will we be able to keep that area clear?</u>

- Currently, we have 6 motors
- In order to leave that area empty we will have to make gearbox and stack motors
- Since the intake is in on the bottom side, we want to keep that area clear as well
- The only solution is to stack motors on the end of the drivetrain (see white space in between green bos and drivetrain frame)

CAD - GUIDE

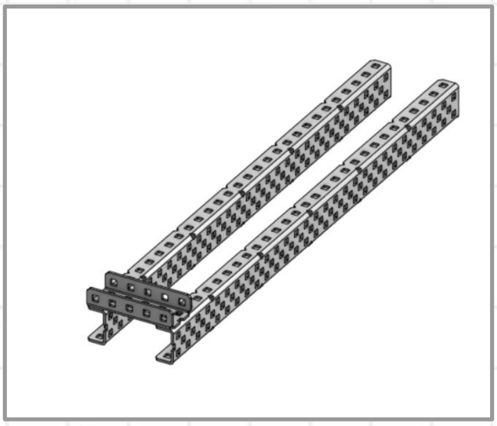


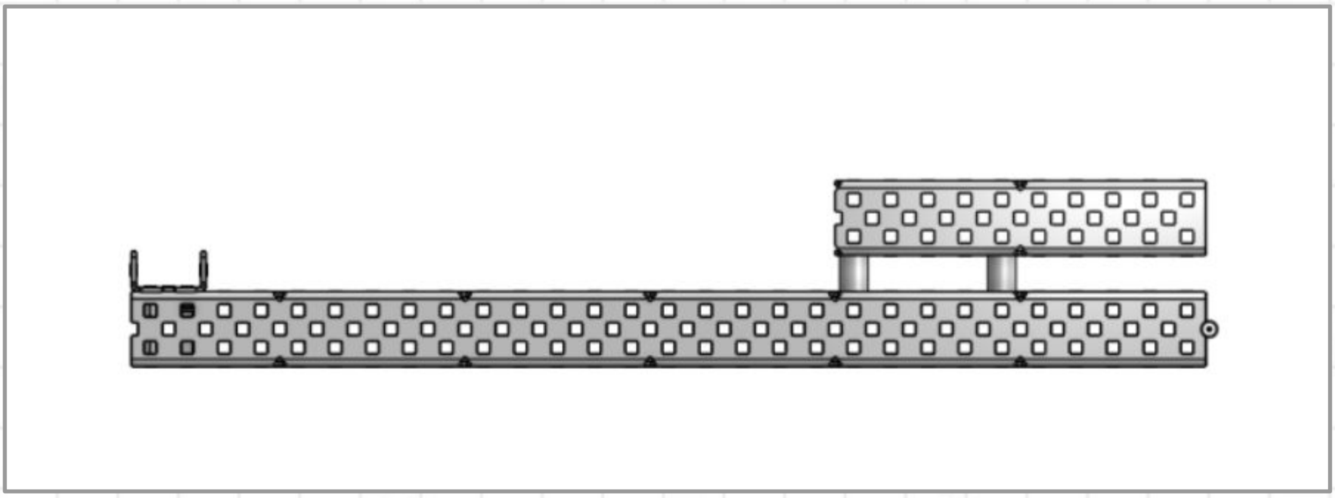
1)

First we make the sides of the drivetrain using our 29 hole C-Channels lined up side by side. We use 2 for each side of the drivetrain.

2)

Then we add a 5 hole C-Channel on the ends, connecting the 2 longer C-Channels. This will give us 2 benefits. The first being extra bracing, and the second being that we'd be able to keep the drivetrain sides square while lining things up. It's a good guide to show us which side is on top as well so that we don't mix anything up in the future.



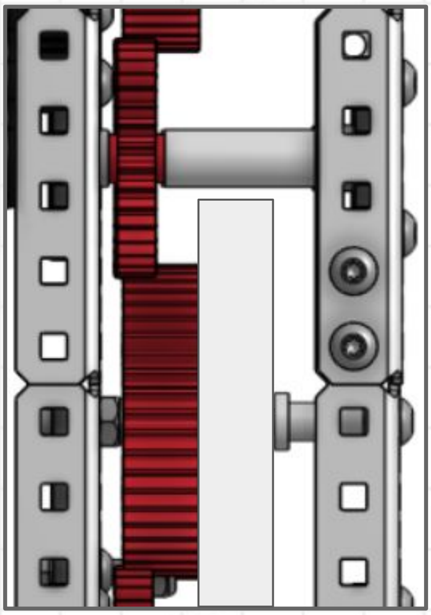


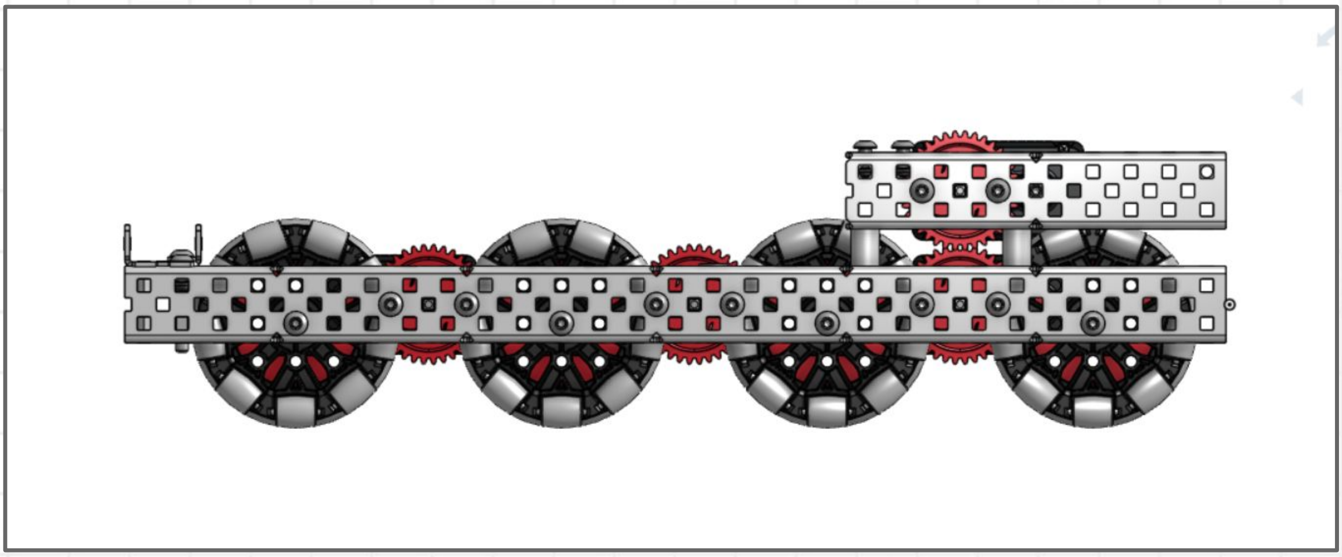
3)

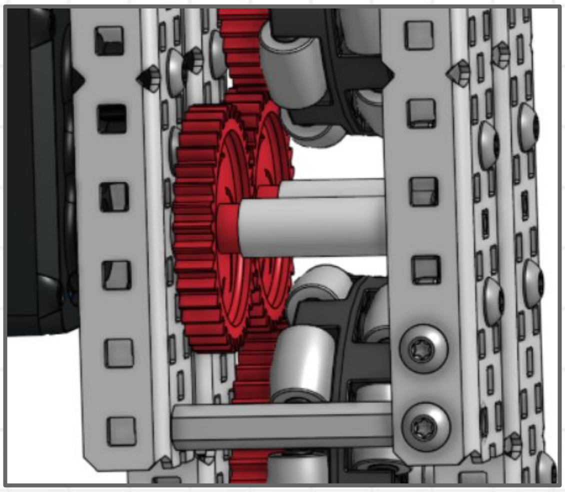
The next step is to add two 10 hole C channels on the end for the gearbox. They're secured by a screwing them onto the two 30 hole C-Channels. We've chosen to use ½" nylon spacers to hold them up, located on the 6th and 10th hole away from the end. We've chosen not to secure the end until we connect the 2 halves of the drivetrain together.

4a)

Then we start adding our wheels and gears in between the C-Channels. Look to image on the right for spacing. The grey box represents the 2.75” omni wheel. We’re alternating between screw joints and ls shafts just like we did on our previous bot. On the image found below after 4 holes from the left, the wheels are spaced 6 holes apart on the bottom holes of the C channel. As for the 36T gears, they are located on the 8th hole away from the left side. The subsequently they are spaced 6 holes apart as well, with 2 screws on the sides securing bearings on the other side of the C-Channel.







4b)

The image to the left shows a closeup image of our spacing for inside the gearbox. We’re using two 1.5” standoffs to brace the two ends of the C-Channel. We have our 36T gear aside a 1” thin nylon spacer. Located directly above the bottom 36T gear.

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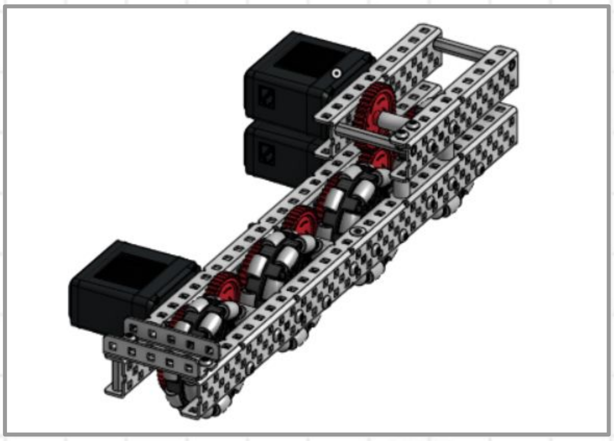
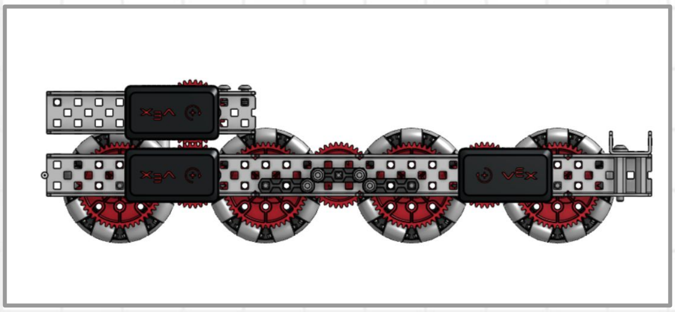
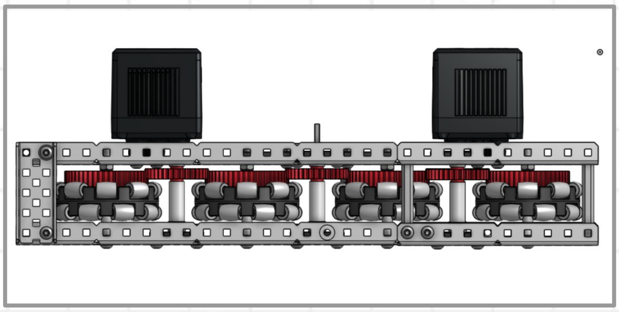
5)

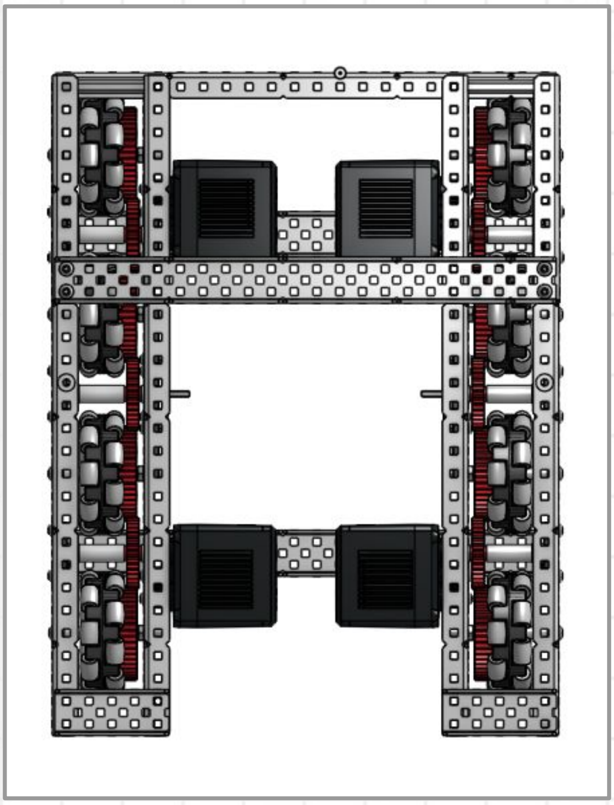
Adding the motors. We take our 3 600 rpm motors and add them to the sides of the drivetrain. We attach 2 motors for the gearbox, the 7th hole in the centre row away from the back of the drivetrain, mounted on top of one another. Our final motor will be placed 8 holes away from the front of our drivetrain.







6) We mirror the process to create the other side of the drivetrain



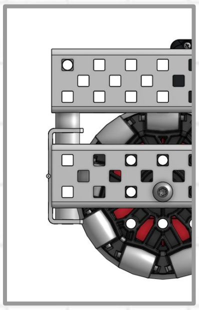
7)

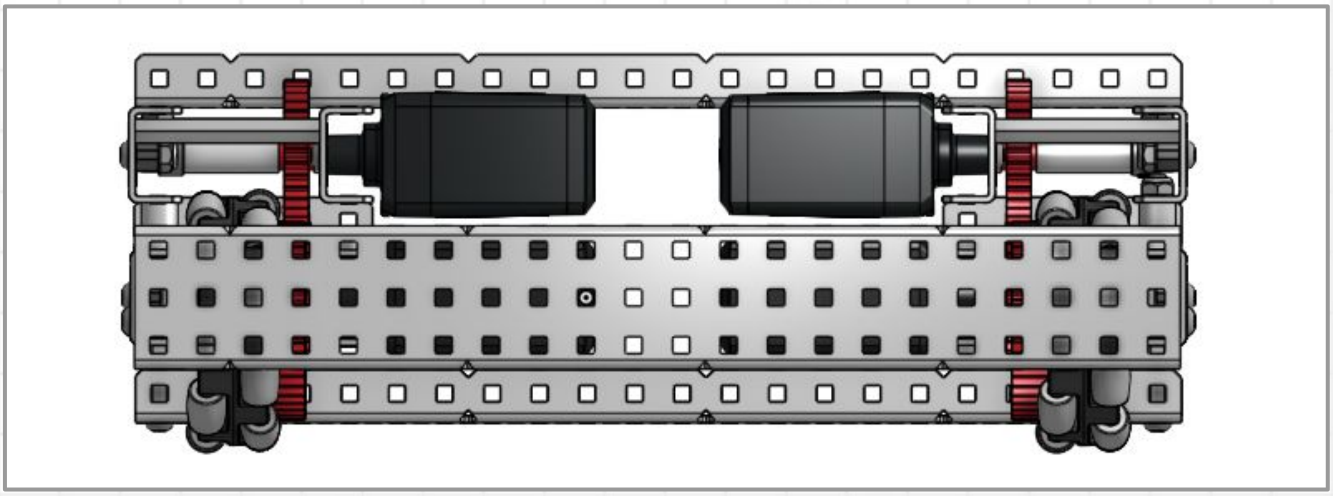
Now we add bracing as we put the 2 sides of the drivetrain together. On the top we use one 20 hole C-Channel attached directly onto the drivetrain gearbox located 8 holes away from the back of the C channel.

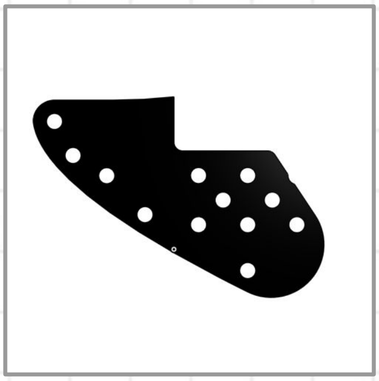
On the bottom of the drivetrain we secure two other 20 hole C-Channels on standoffs with the first being located 8 holes away from the front and the second being 6 holes away from the back of the drivetrain

8)

We attach the 22 hole long 3 hole wide C-Channel on the end to complete the U shape of the drivetrain. This will be the back of our drivetrain. There are 2 ⅜” spacers between the C channel and the back of the drivetrain. On the other side of the top of the C-Channel, we have a ¼” spacer attached to the end of the C-Channels forming the gearbox.

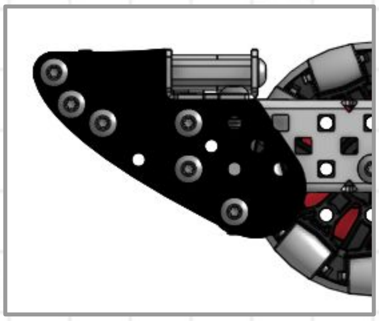


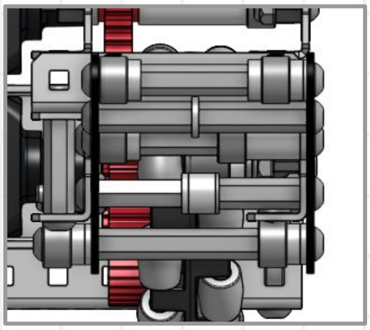


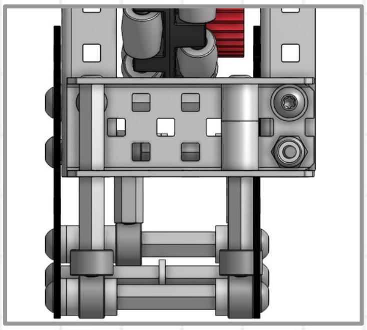


9)

Creating the sleds and attaching them. We will be using 4 sleds total and we’ll be adding 2 on both sides of each side of the drivetrain.
Bracing may seem complicated, screws go through every hole and in between we’ve created boxes with standoffs, spacers, and shaft collars.
This will allow us to have a strong bracing and survive through wear and tear during matches, as well as allowing us to constantly go over the barrier at all times.







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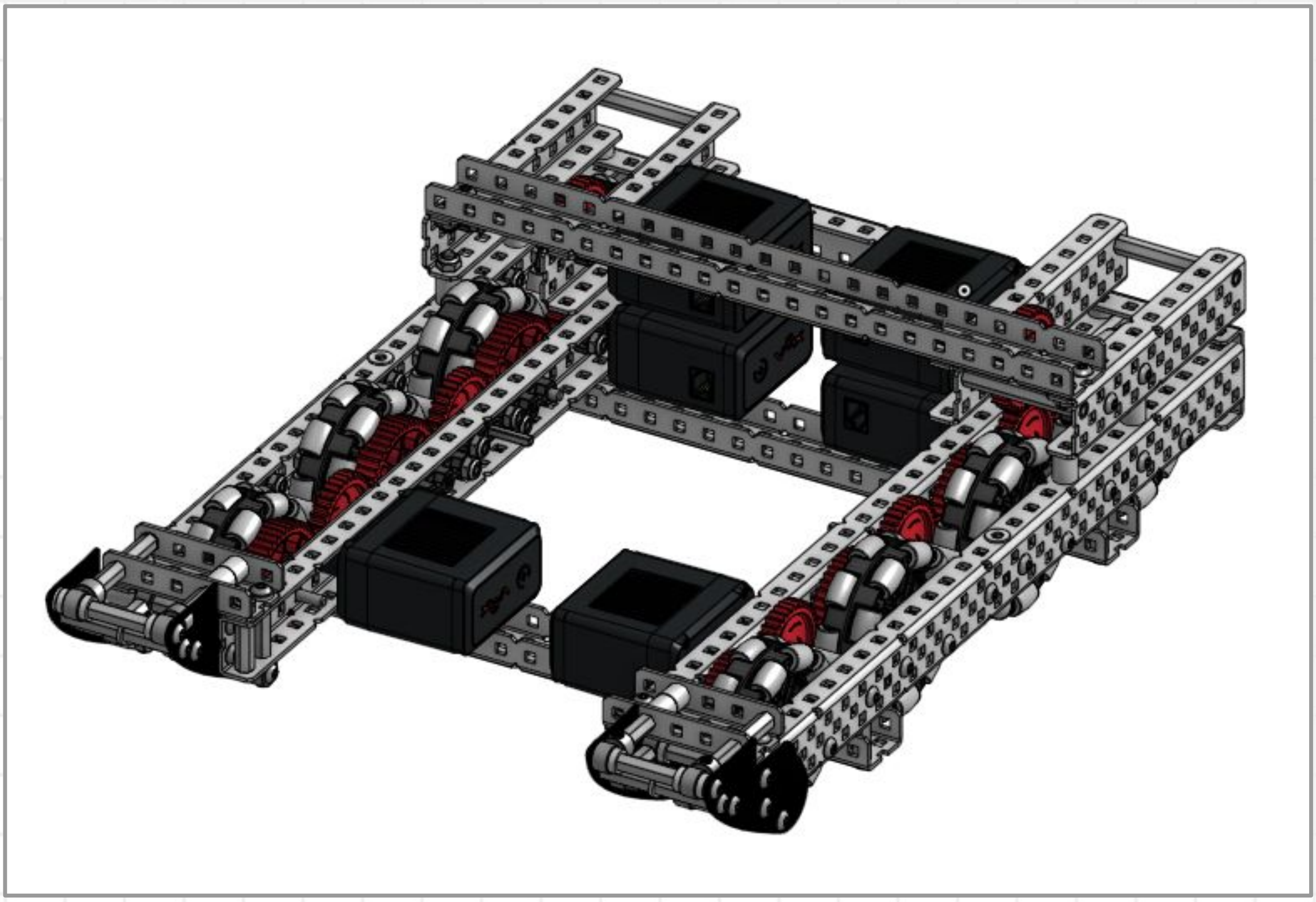
DRIVETRAIN

Finished cad

This is our completed drivetrain in isometric view.



REFLECTION

Does this drivetrain match our requirements?

- **Speed**
  - We've lowered our speed by 0.98 ft/s
- **Power**
  - Requires more testing
- **Manoeuvrability**
  - We've narrow our drivetrain size by a lot compared to our previous robot.
  - The dimensions of the drivetrain are now around 16.5" x 10"

We look forward to building the drivetrain the next week

DATE: 11/20/2023 DESIGNED BY: RL WITNESSED BY: TC

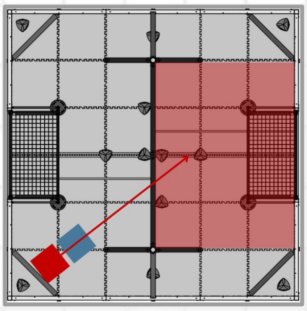
SHOOTING MECH

Goal

Making a shooting mechanism

What needs to be improved from our previous shooting mechanism?

- Our main goal is to be better at match loading during matches as we found out that when faced with a blocker and another robot defending against us match loading is nearly impossible
  - On the right shows our goal. We still wish to be able to match load into this zone when we have a robot defending us with a blocker



Goal

Setting specific requirements to achieve

MAIN GOAL

- **Shooting over blocker**
  - As said above, shooting over a blocker will help us gain a huge advantage over other teams when facing blockers. We will also be seen as a more desirable alliance partner due to our ability to do so.
- **Maintaining Speed**
  - We want to maintain a similar match loading speed to our previous catapult (perhaps by using the same gear ratio)
- **Good grouping**
  - Good grouping is essential to skills. We wish to have all our match loads land in the zone right in front of the goal so we can push them in with ease and efficiency. If we manage to achieve this, then our skills score will be able to raise significantly.

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CONSTRAINTS

RULE CONSTRAINTS:

Our shooting mechanism should fit within an 18” x 18” x 18” cube as stated in <R4>
So it cannot be higher than 18” when in starting position.

MATERIAL CONSTRAINTS:

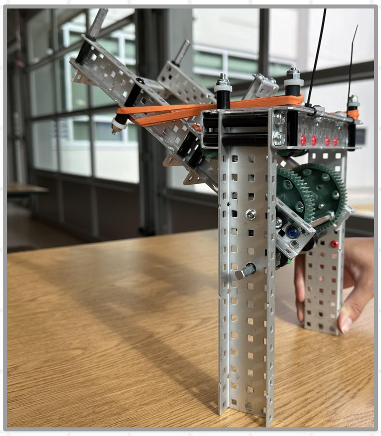
None

TIME CONSTRAINTS:

Shooting mechanism is to be completed on Thursday, November 30th

Goal

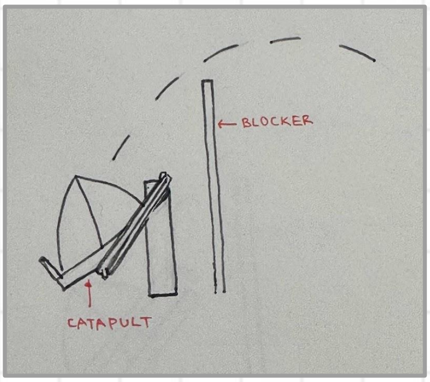
Finding possible ways we can tick off these goals while still staying within the constraints



Our previous robot had a catapult with a gear ratio of 5:1

Overall, we were happy with the speed of it, and we found that match loading the catapult seemed to be easy to adjust to. What we found out needed improving was the grouping of our robot. Not all triballs landed in the desired zone even when we matchloaded them properly and we were barely able to get over shooters

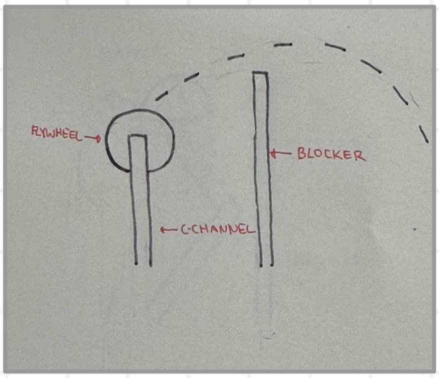
Below are possible solutions



Solution 1

Add more bands onto catapult. This will allow us to have a more powerful catapult, allowing us to shoot over potential blockers. This will increase the distance covered by the triball as well.

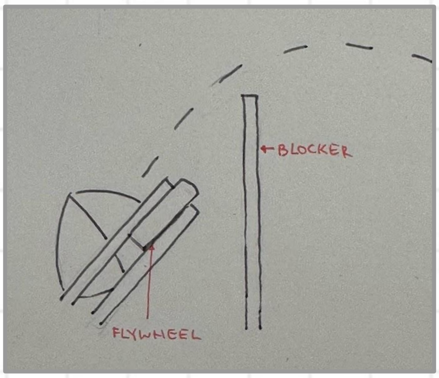
CONSIDERATIONS:
More bands = more strength = more stress on motors?



Solution 2

Flywheel on a stick. This will allow us to have higher shooting mechanism which will allow us to shoot over the blocker. This design would be very easy to build and matchload for, as well as allowing us to potentially descore

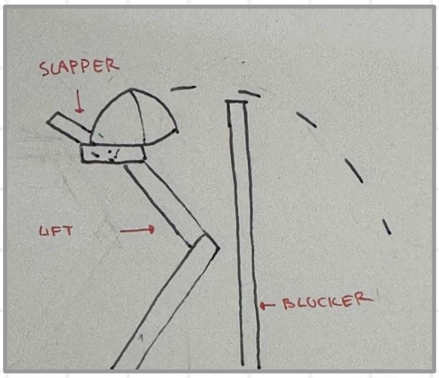
CONSIDERATIONS:
How will weight imbalance work?



Solution 3

Angled Flywheel. This mechanism was very popular during the previous season “Spin Up”. Angling a flywheel will allow us to customize the arc which will allow us to try out different angles in both skills and going up against a blocker

CONSIDERATIONS:
A flywheel mechanism like this will take up a lot of space



Solution 4

Elevated shooter. Consists of a lift and a slapper. This allows us to shoot from 2 possible positions; up and down. Allows for customization as well, making it very easy for us to shoot over a blocker while achieving good grouping.

CONSIDERATIONS:
Unable to intake into the mechanism with ease

Summary of solutions

In total, we have 4 solutions who are all very different. We will be proceeding to detailed pros and cons of each solution.

DATE: 11/21/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Selecting a design

Initial observations and connections

While observing, we always keep our goal of good grouping in mind

Solution 1 - more bands on catapult

Pros

- Stronger catapult
- Simple to build, saves us the most time
- No need to adjust speed and code
- Firing with a higher arc and a higher range

Cons

- More stress on motors with the added tension
- Range may be too far to achieve desirable grouping
    - A great amount of triballs may land on the goal
- No customization

Solution 2 - Flywheel on a stick

Pros

- Simple, easy build
- Easy to matchload
- Arc can be adjusted based off of matchloading angle
- Folding down can give us a shorter robot which will allow us to descore

Cons

- Can't guarantee the greatest grouping without extensive practice on match loading
- Unable to matchload well when robot is getting pushed

Solution 3 - Angled flywheel

Pros

- Fast matchloading
- Customizable outside of matches

Cons

- Large and takes up space
- Motors may overheat

Solution 4 - Elevated shooter

Pros

- Customizable both in game and outside of game
- Guarantees best grouping
- Folding down can give us a shorter robot which will allow us to better matchload for skills
- Holds against being pushed

Cons

- Lift may be difficult to build
- Unable to intake into it efficiently
- A LOT of tuning required

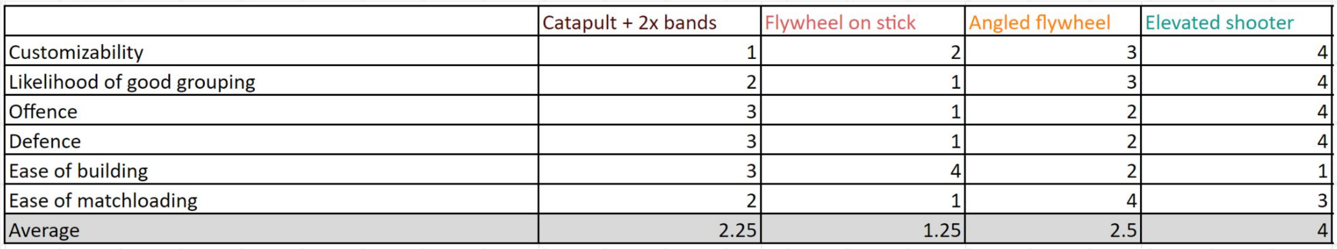
DECISION MATRIX

We've decided to rank our solutions from 1 to 4. 4 being the best and 1 being the worst. Here are a list of ideal characteristics we'd look for when determining the final solution

- **Customizability**
  - Allows us to easily control variable allowing for a smoother gameplay and easier adjustments, maximizing our use of time and scores.
- **Likelihood of good grouping**
  - This is our second goal to achieve.
- **Offence**
  - Meaning how good it is when faced with other robots defending against it, whether by a blocker or simply by being rammed into. Will it offset the mechanism by enough that it can't shoot properly?
- **Defence**
  - Can we incorporate a good blocker, will weight imbalance be a factor of its downfall?
- **Ease of building**
  - Allows us to quickly stay within the time constraints
- **Ease of matchloading**
  - The easier it is to grasp, the higher our skills score and our speed will be able to increase.

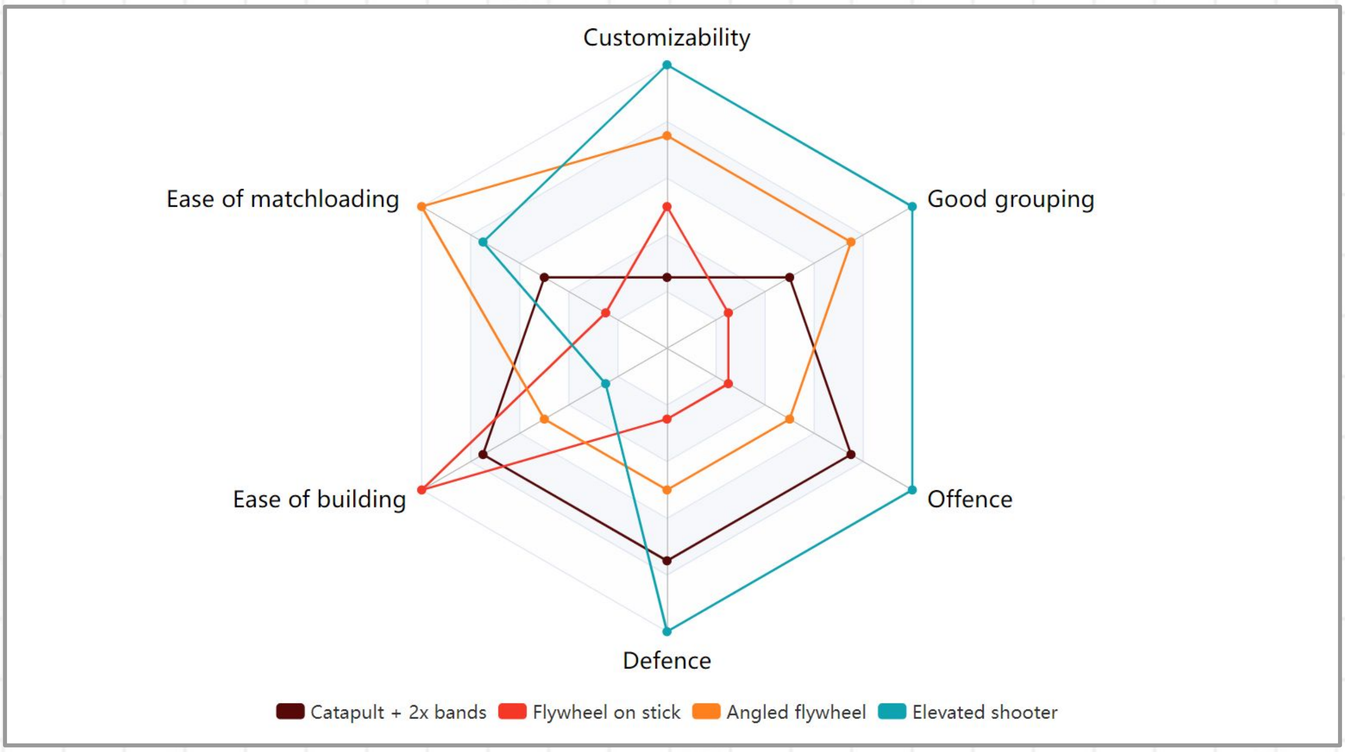
SHOOTING MECH

Selecting solution



	Catapult + 2x bands	Flywheel on stick	Angled flywheel	Elevated shooter
Customizability	1	2	3	4
Likelihood of good grouping	2	1	3	4
Offence	3	1	2	4
Defence	3	1	2	4
Ease of building	3	4	2	1
Ease of matchloading	2	1	4	3
Average	2.25	1.25	2.5	4

Here is a radar chart to help us visualize our rankings



Above, we can clearly see that the elevated shooter has the highest stats, which also happens to be the most difficult to build. We've decided to try our best at building it within the time constraints.

We will be building an elevated shooter

Similarly to our previous robot we will be incorporating a climbing mechanism onto our lift as well

DATE: 11/21/2023 DESIGNED BY: RL WITNESSED BY: TC

SHOOTING MECH

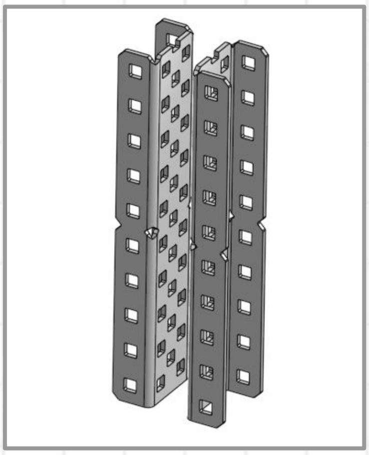
Goal

Designing the shooting mechanism

DESIGN SPECIFICATIONS

- 1x High Strength Shaft
- 1x 60T High Strength Gear
- 2x 12T High Strength Gear
- 2x Rubber Bumpers
- 2x 1x3x1x11 (11 hole) C-Channel
- 1x 1x5x1x11 (11 hole) C-Channel
- 1x 1x2x1x7 (7 hole) C-Channel
- 1x 1x2x1x10 (10 hole) C-Channel
- As well as standoffs, screws, nylocks and spacers that remain subject to change

CAD - GUIDE



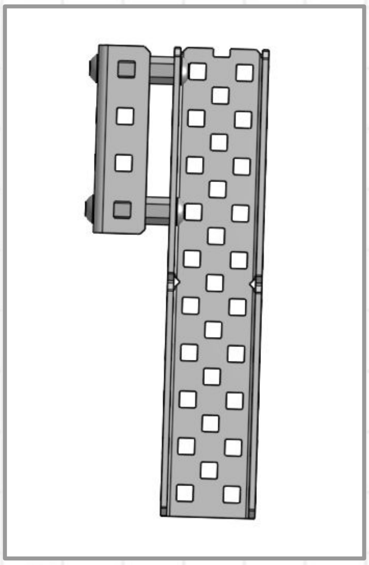
1)

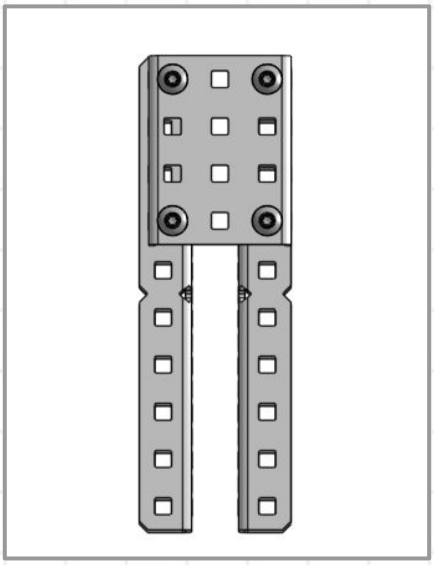
First, we make the sides of the slapper by vertically aligning our two 20 hole C-Channels in preparation to build the rest of the slapper mechanism

2)

We then take our 4x3 hole C-Channel and attach them onto the two 20 hole C-Channels using four ½” standoffs on each corner.

This will be the part of the mechanism that “slaps” the triball across the field





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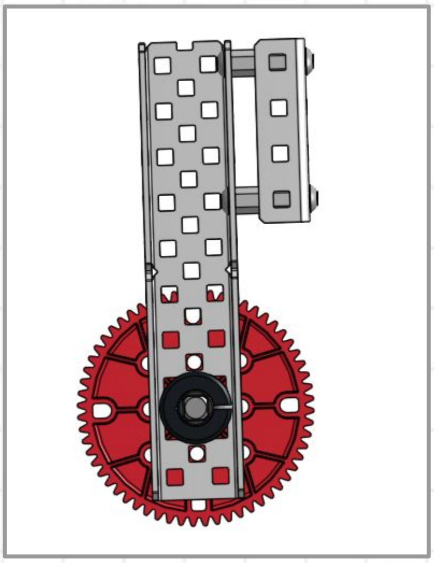
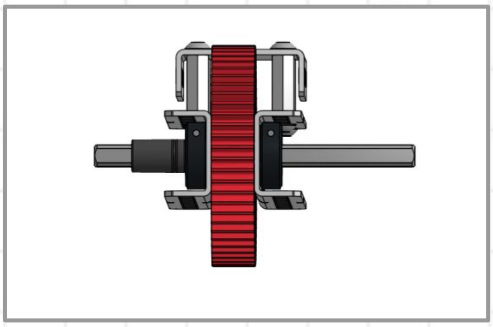
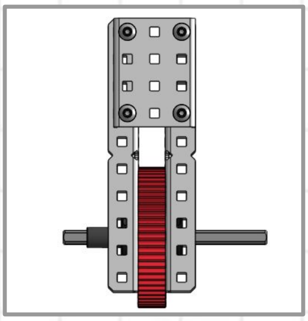


3)

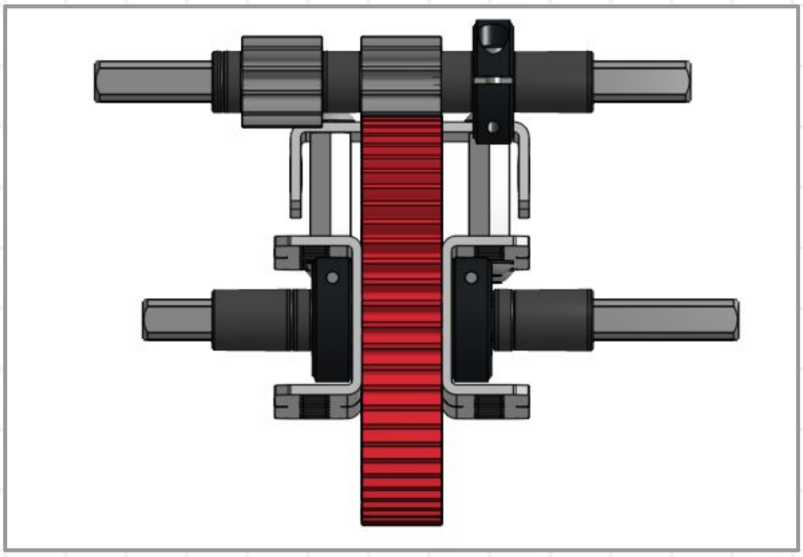
We put the HS shaft through the 2nd hole counting from the bottom and attach the 60T gear in between the two 20 hole C-Channels. This will be our driven gear.

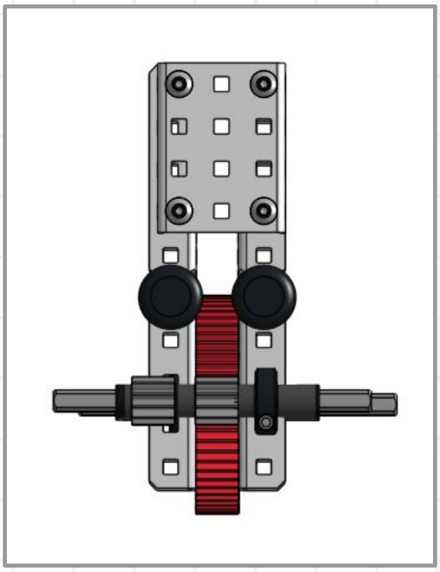




4)

We now take another HS shaft and create the driving gear. Look to image on the right for proper spacing.





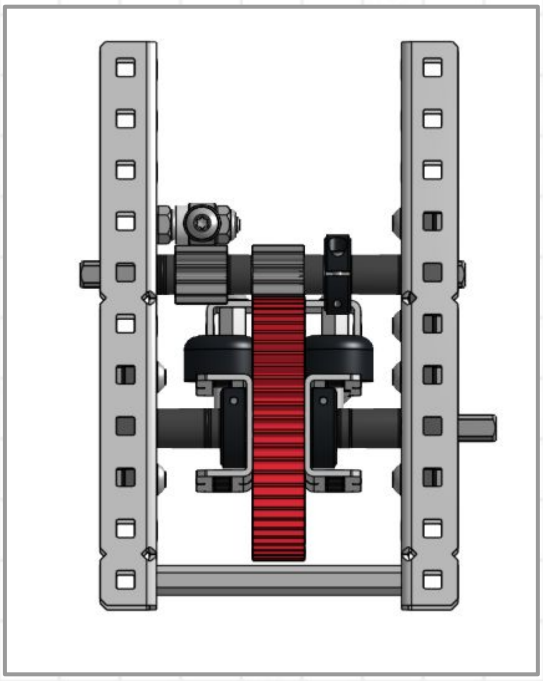
5)

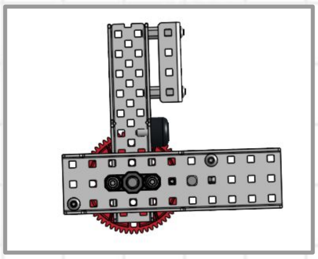
We add 2 rubber bumpers on each of the 20 hole standoffs. They are located 6 holes down from the top. The rubber will help absorb the shock of this mechanism when it makes contact with the stopper. This means that over the long term, our slapper mechanism will be able to survive thought extended periods of wear and tear.

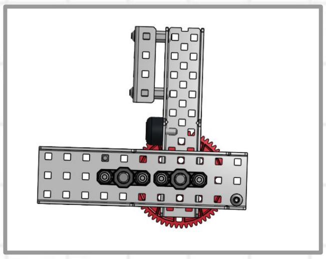
SHOOTING MECH

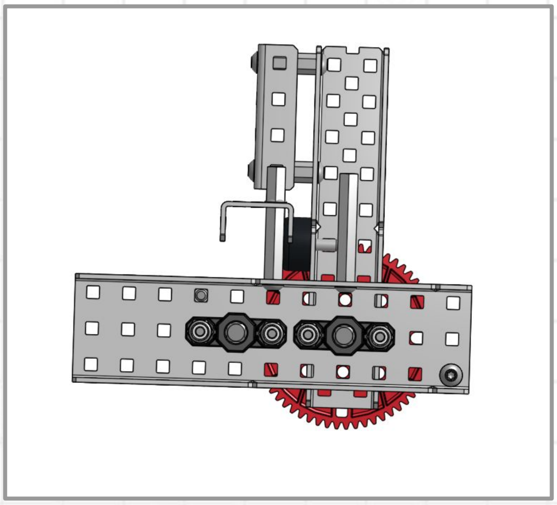
6)

We add our 2 pieces of 11x 3 hole C-Channels on the sides. This will be the main structure of our slapper mechanism. On the left side of the mechanism we add 2 bearings side by side located 2 holes away from the back. And on the right we add 1 bearing 1 hole away from the front. We hold our structure together with the HS shafts as well as one 2” standoff







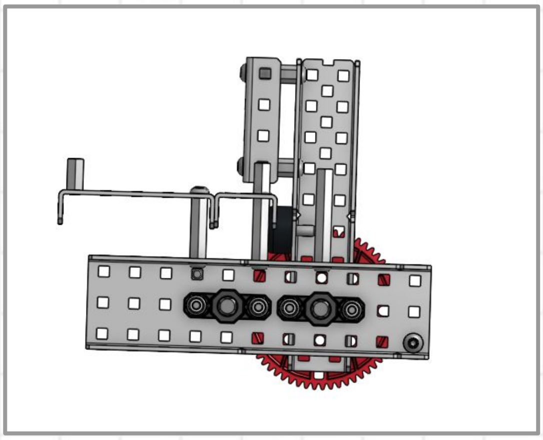


7)

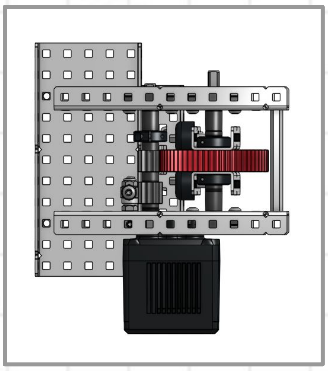
Our stopper consists of one 7 hole C-Channel. This is attached on by to 1” standoffs located 6 holes away from the front of the mechanism. We then add two ⅜” standoff on top of the 1” standoffs, forming a “sandwhich”. We then add two 1.5” standoffs on wither side located 2 holes to the right of our first standoff. This will be where we put our bands in the future.

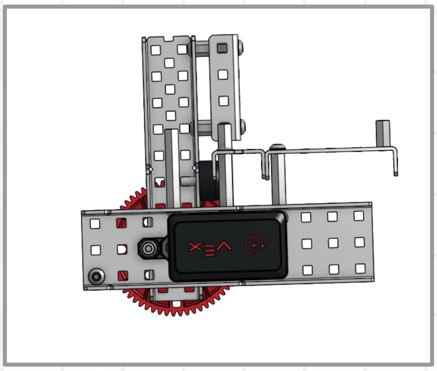
8)

We take our 11 x 5 hole C-Channel as a stand for our triball. This will allow us to have a higher arc. We attach this by using two 1” standoffs on the end located on the 4th hole from the front. We also add two ½” standoffs on the other end of the C-Channel to help us keep the triball in place.



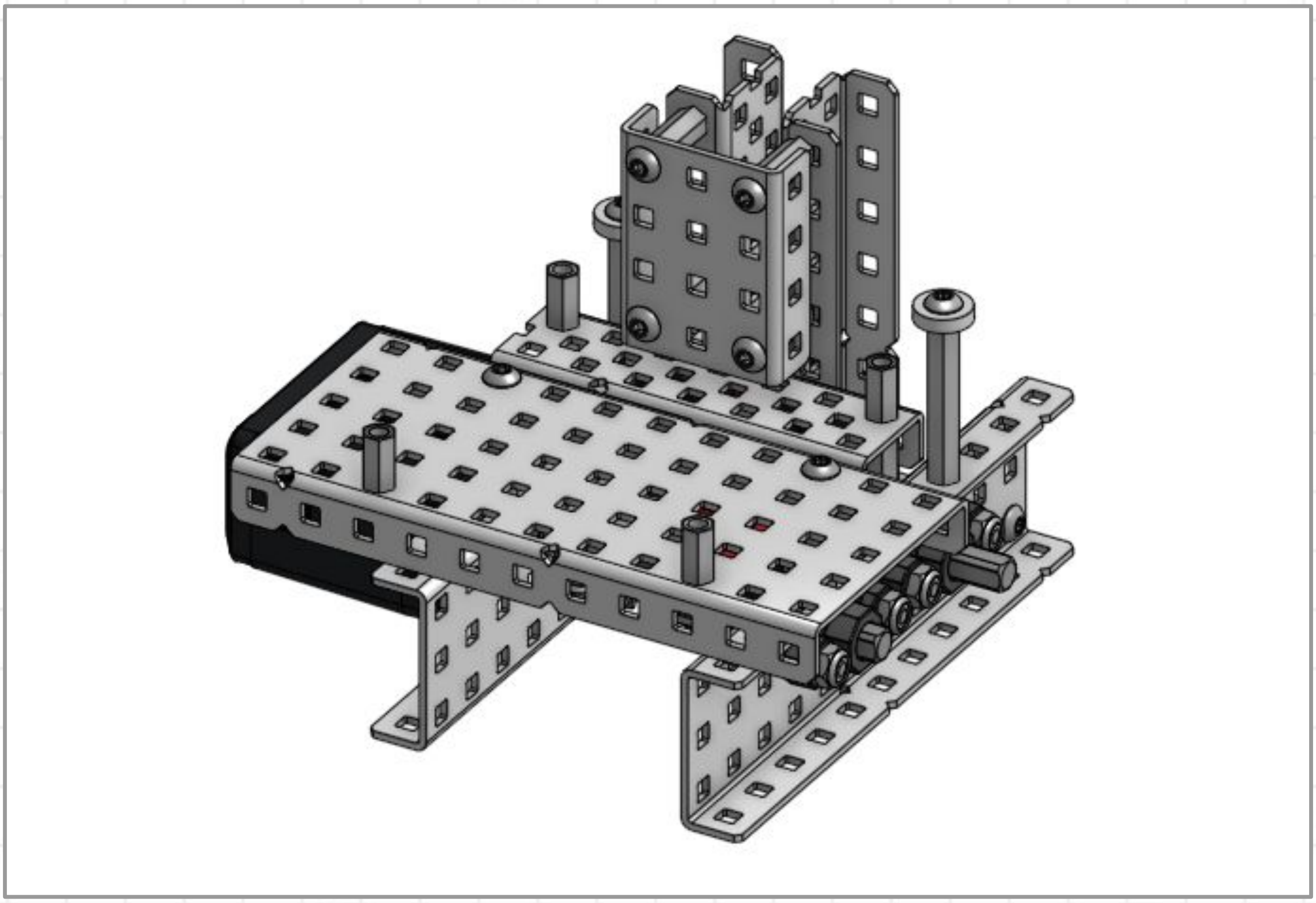
DATE: 11/21/2023 DESIGNED BY: RL WITNESSED BY: TC





9)

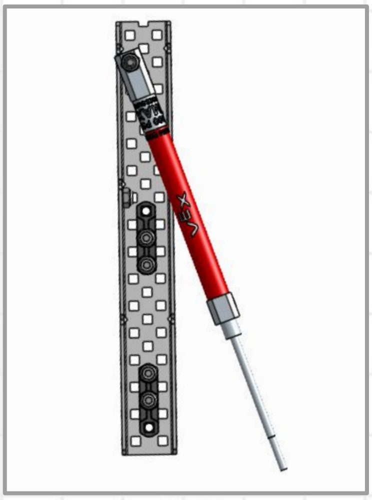
Adding the motor. This will be located where we previously left space on the right side without the bearing. The motor connects to the HS shaft with our 12T gears

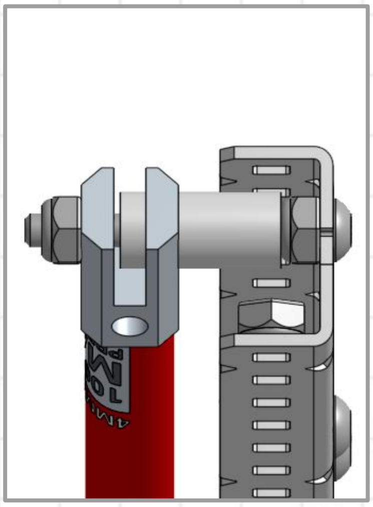


This is our slapper mechanism. Overall it should have a very similar speed to our catapult, making this mechanism easier to matchload. One thing to note is that we will also be shaving down our 60T gear to make a slip gear. Because of our design, we will want to shave down the minimum amount of teeth required for it to slip, which is 3 teeth.

We will now be proceeding to the lift.

SHOOTING MECH



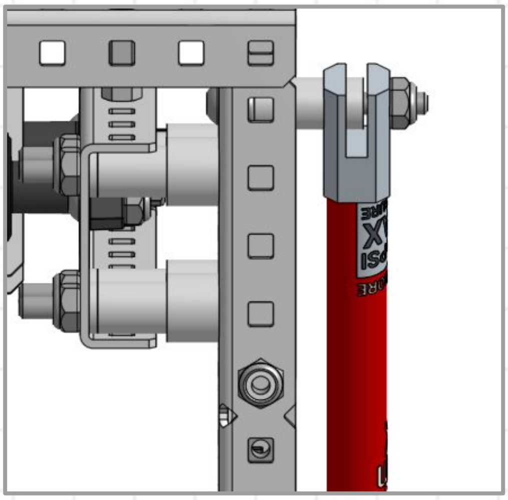


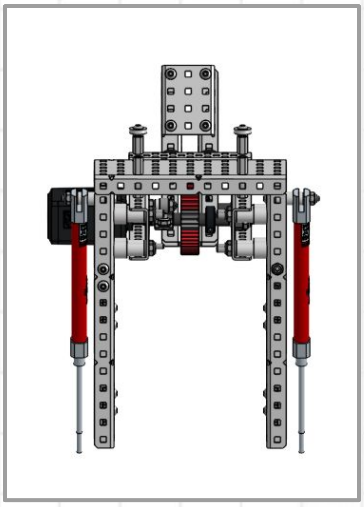
10)

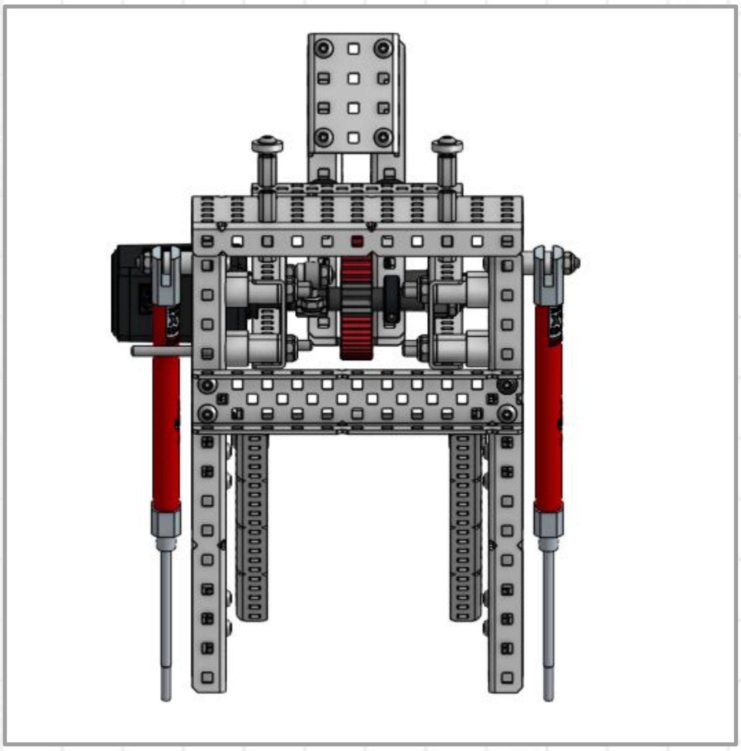
We first take a 16 hole C-Channel. We then attach the piston onto the top (see left image for spacing) and 2 bearings located on the 2nd middle hole and 7th middle hole of the C-Channel relative to the bottom. We mirror this process on the other side.

11)

We then take the 2 components and we attach them onto the front 2 holes of the slapper mechanism with nylocks and 3 nylon spacers (1/16”, ¼”, and ½” respectively). This forms our initial frame.

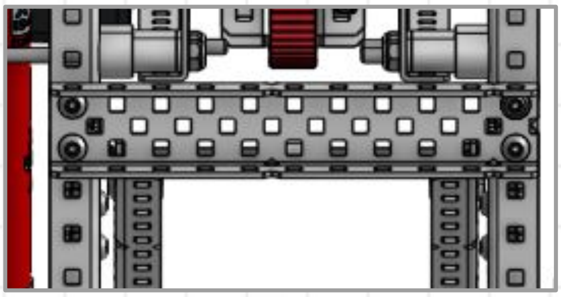






12)

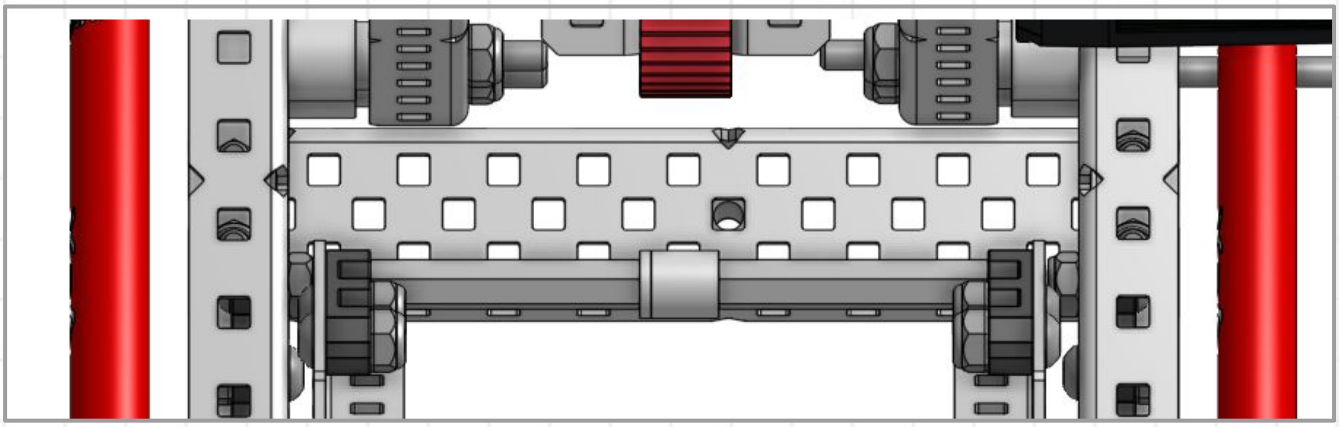
We now use a 11 hole C-Channel and we mount it flat on the two 16 hole C-Channels, on the 6th and the holes from the top. This gives us extra support as the force of the slapper is quite strong.



DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

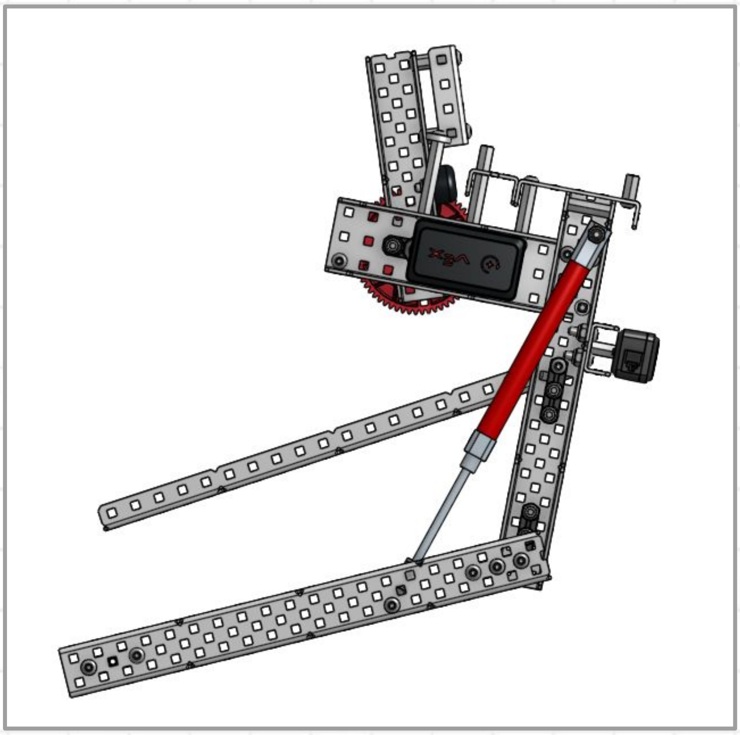
13)

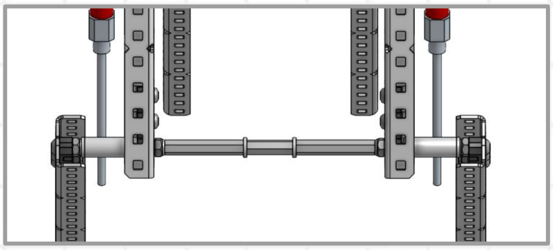
Now add our Ls on with two long screws securing them in place. This will be a crucial component of our lift.

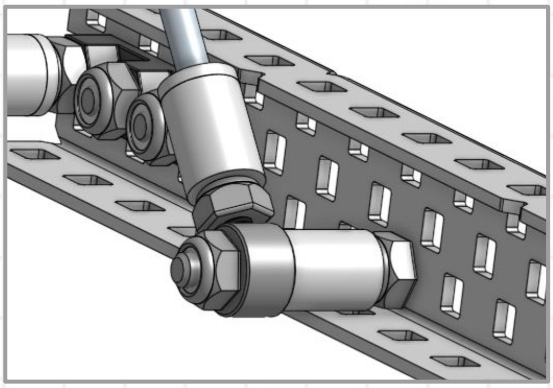


14)

We take two 20 hole C-Channels, securing them onto the bottom bearing. This will be the main component of the lift that rotates and bends. We attach them with spacers and standoffs as supports. See image on the bottom for detailed spacing





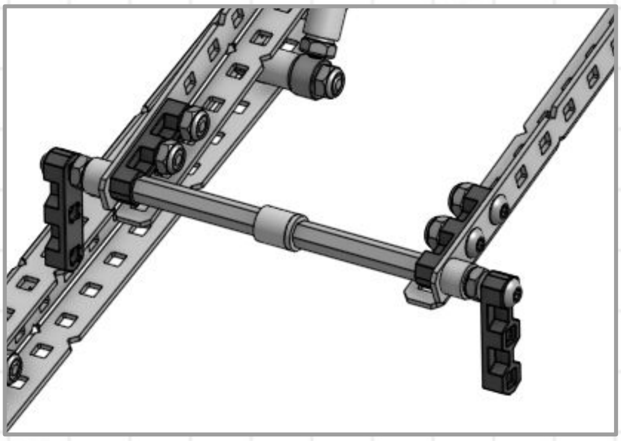


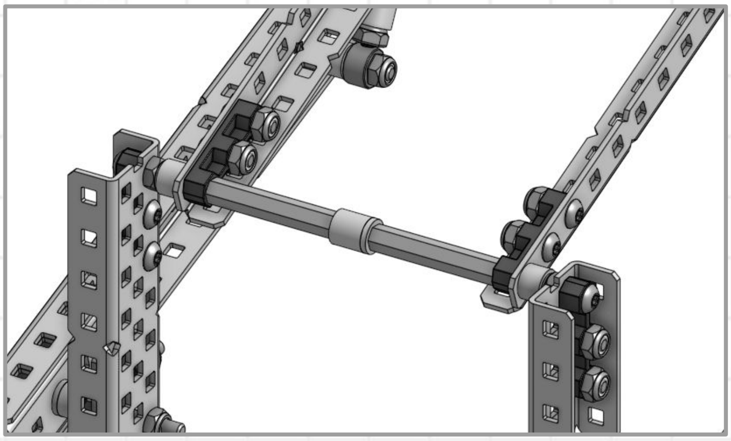
15)

We then attach the pistons onto the newly added C-Channels via screwing the tip into a shaft collar. See image to the left for detailed spacing. The pistons will be in charge of raising and lowering the elevated shooter, hence they must be on very tight.

16)

We now add bracing to the 2 Ls. We've added a bearing on the end of each L as the Ls will be pivoting as the lift rises and falls. In the centre we have 2 standoffs with a ½" spacer in between, help together by a threader.



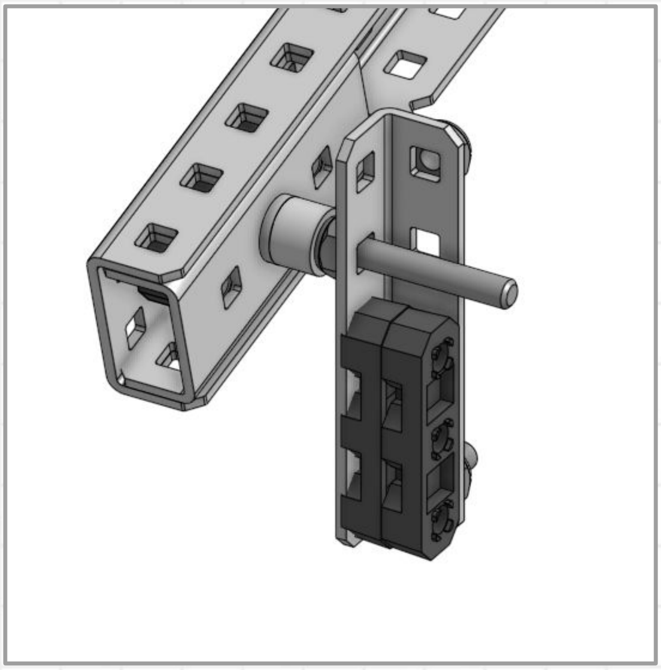


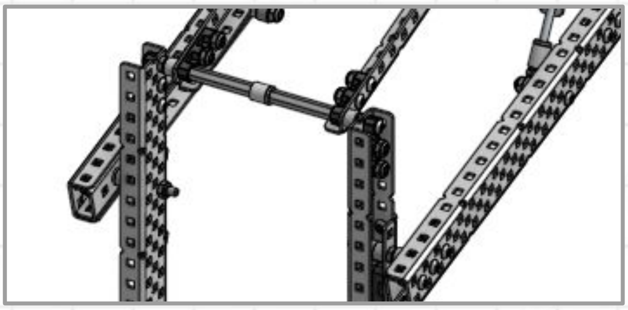
17)

We now take two 20 hole C-Channels which will be mounted on the drivetrain, and we attach the bearings and screws on. The long screws will be what spins as the 2 ls pivot.

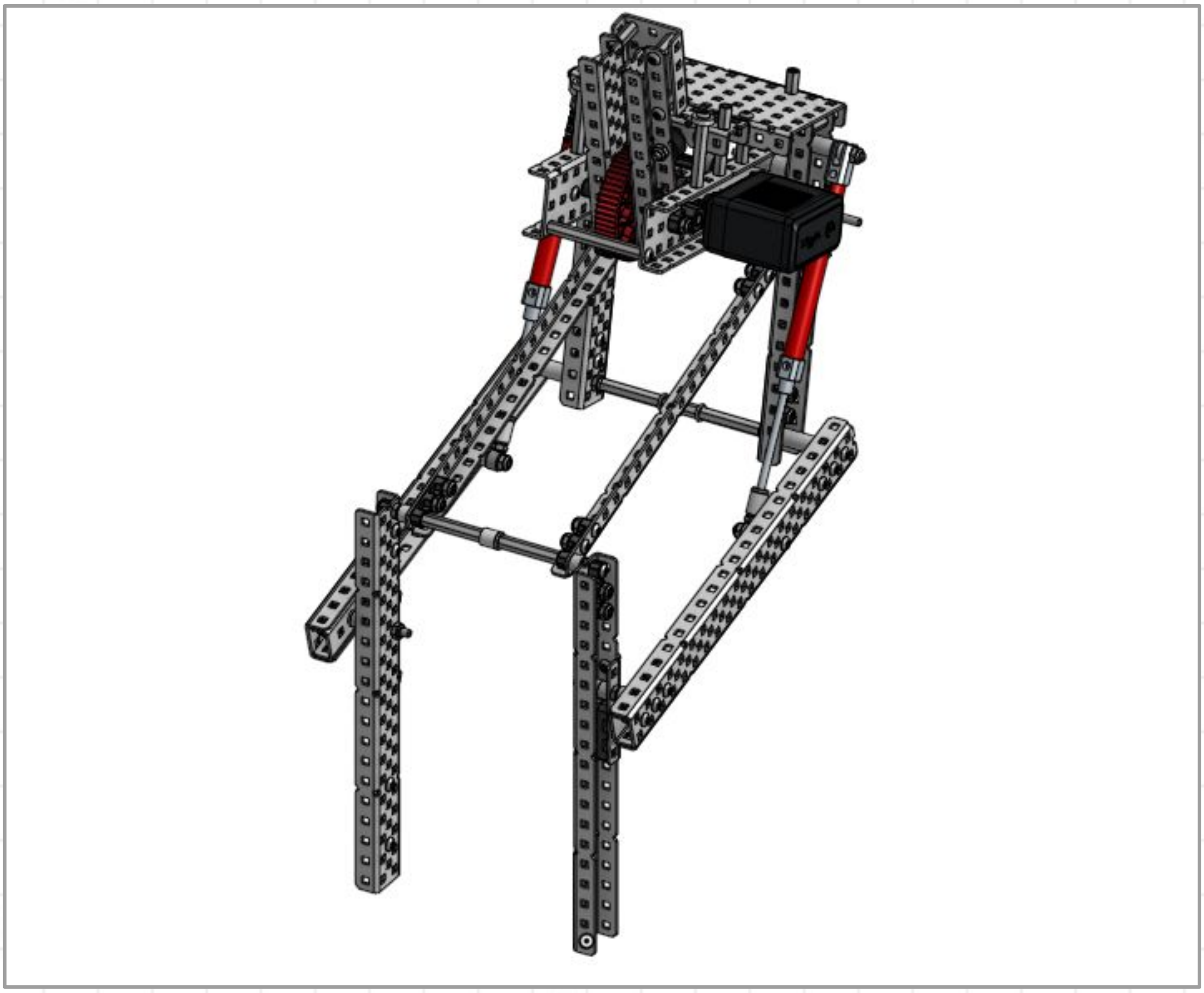
18)

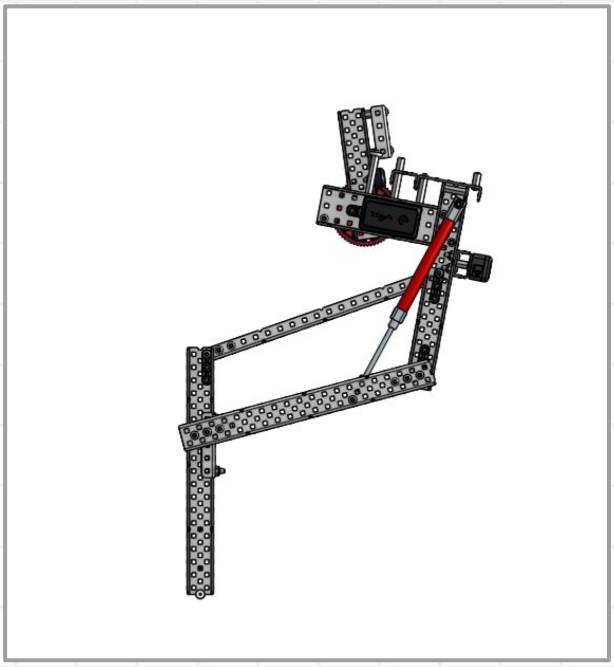
The final step of the elevated shooter is to attach the outer C-Channels to our mount. Look to mage on the right for spacing. After we make what is currently to the right, we attach that onto our mount.





Finished cad





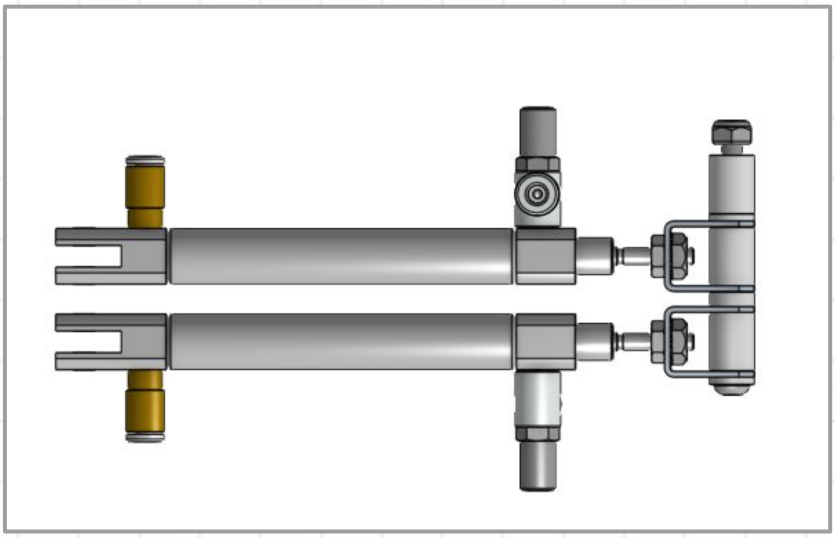
This is our elevated shooter, this mechanism took a while to design as this is our first time handling a lift. The image above is in isometric view and the one to the left is a side view of our mechanism.

We look forward to building this mechanism!

Now we will work on incorporating climb with our elevated shooter

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

CLIMB

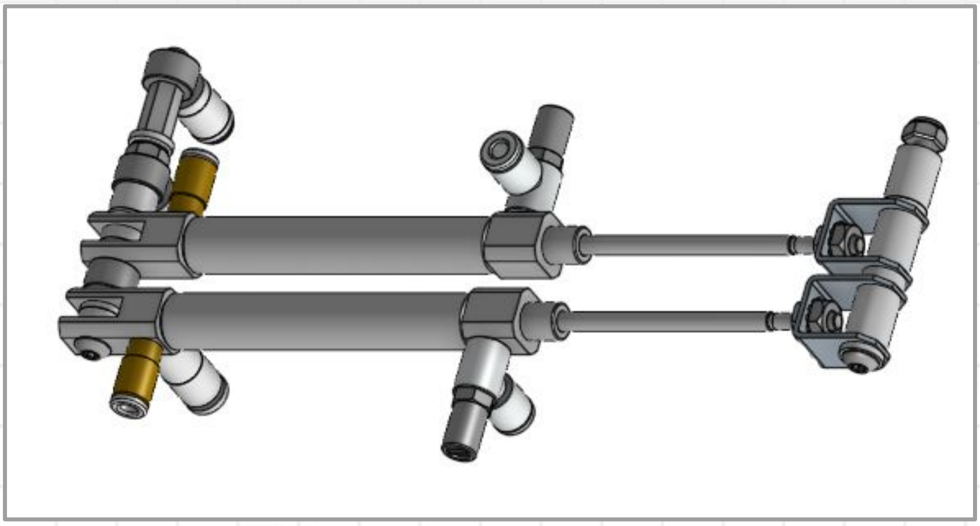


1)

We place 2 pistons side by side and we attach them together with one 2” screw with thin spacers. This allows us to how the two pistons together making sure that they both move at the same pace siniluaniousky, this give us the most power

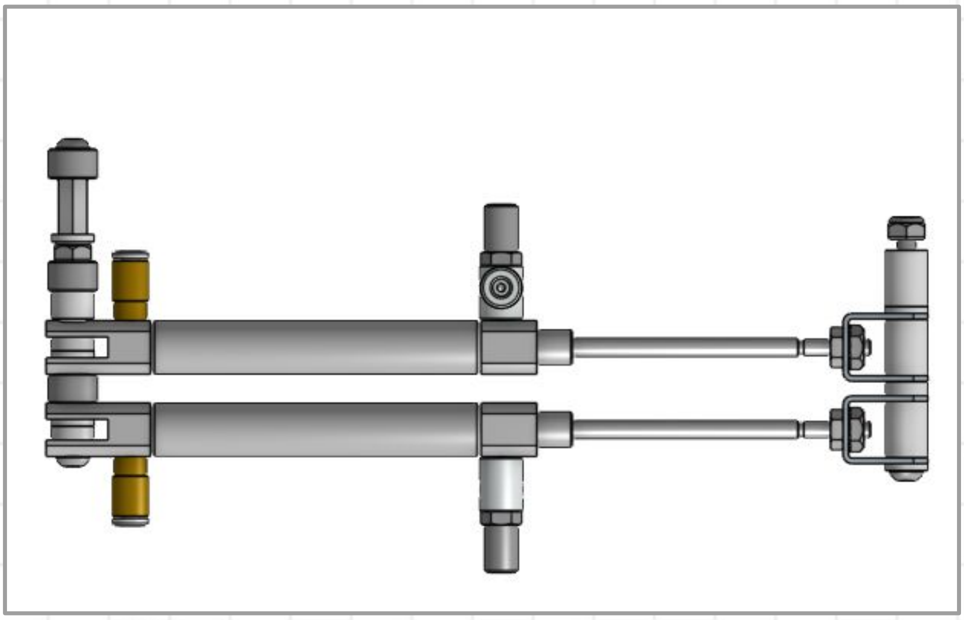
2a)

We add bracing on the bottom consisting of small standoffs, screws shaft collars and spacers. We must add a lot of support as in order to climb. The mechanism must be secure on the robot.

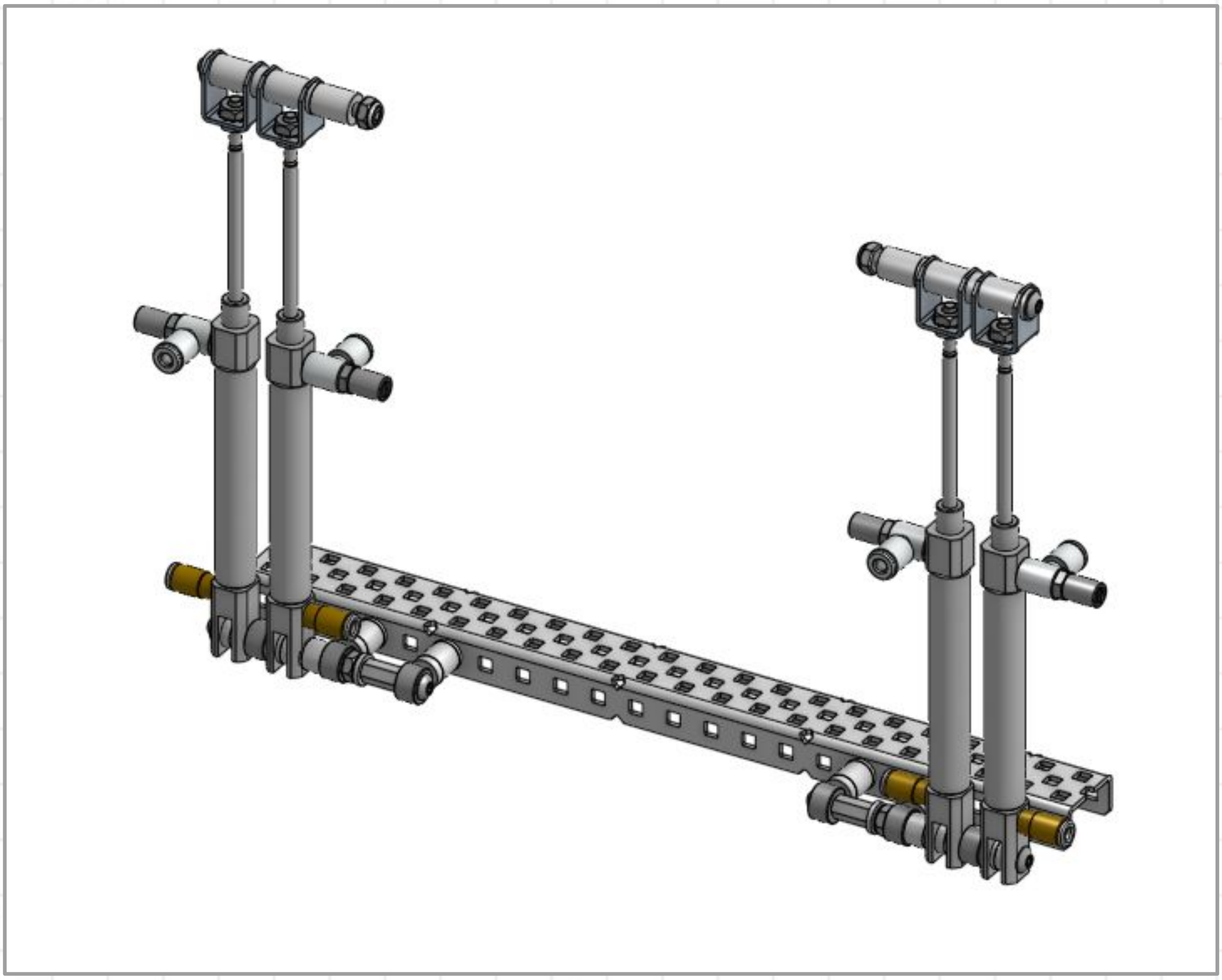


2b)

More detailed view of step 2. Design is mirrored.



DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC



This is our climbing mechanism. They will be mounted on the drivetrain. The pistons will pull down the C-Channels on the elevated shooter, clamping down on the elevation hang bar and effectively pulling the robot up. We will be adding something that secures them into the C-Channels, to keep it in place while also not using air. This will have to be done during the build section as we are unable to test our a majority of things in cad.

This will require a lot of tuning on placement so elevation tier is not confirmed

We look forward to experimenting with the climb

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

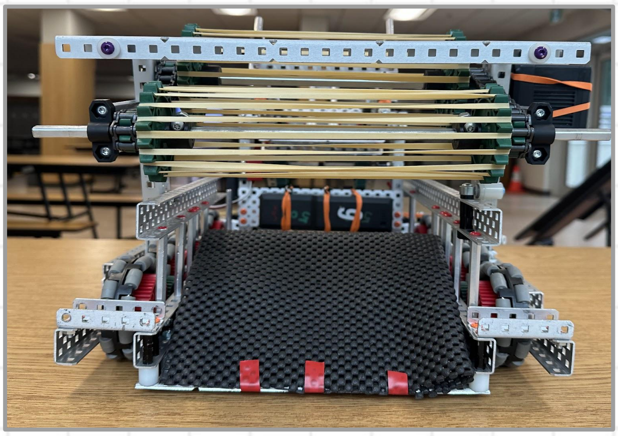
TESTING SOLUTION

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Making an optimal intake

What needs to be improved from our previous intake?



Our main issue with old intake was entanglement. We found that the elastic bands would get caught on other robots causing us to lose on time. The grip was also not optimal, although it was grippy we still took 2 tries on average to intake the triball during competitions and at high speeds.

We won't need to intake into the catapult as we find that we've never done that at all.

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Light in weight**
  - A lighter intake will allow us to intake the triball easier as well as scoring smoother
- **Grip**
  - The grippier the intake, the easier it is to take possession of a triball. We found that in the last 15-20 seconds using an intake is essential to scoring more points.
  - This will save allow us to maximize our time scoring triballs into the goal leading on to potentially letting us win a match]
- **No entanglement**
  - Entanglement wastes the most time and it can be avoided easily by not using elastic bands.
  - Hence we must change materials for an intake this time

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

CONSTRAINTS

RULE CONSTRAINTS:

Our drivetrain should fit within an 18” x 18” x 18” cube as stated in <R4>
Our drivetrain is currently around 16.5” x 10”. So this means that the intake should either be able to fold up in order to stay within size or to be out by an inch of less.

MATERIAL CONSTRAINTS:

None

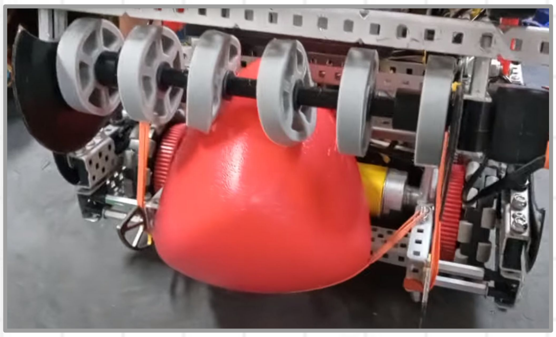
TIME CONSTRAINTS:

Drivetrain is to be completed on Tuesday, November 28th

Goal

Finding possible ways we can tick off these goals while still staying within the constraints

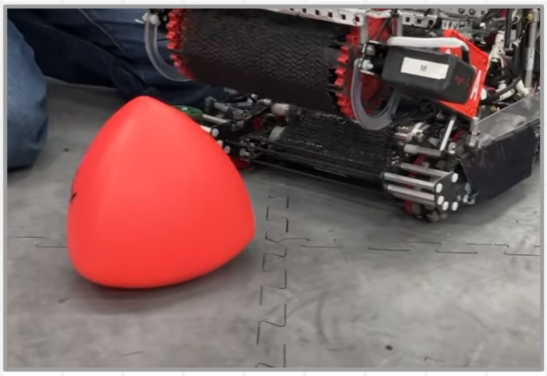
Below are possible solutions



Solution 1

Flex wheel intake. Flex wheels are grippy and proves to be very useful in the last season. There is no chance of entanglement and will be able to be flipped up.

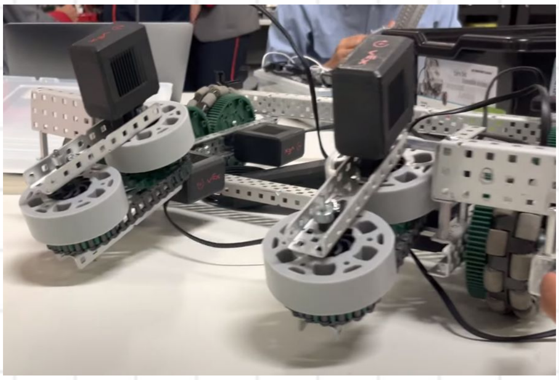
CONSIDERATIONS:
Will it be too light compared to our elevated shooter?



Solution 2

Elastic band intake covered by antislip mat. Will allow for more even grip on the triball. No risk of entanglement. Similarly to the flex wheel intake, it will be very light as well as being able to get flipped up

CONSIDERATIONS:
How will we attach the antislip mat?



Solution 3

Side intake. No risk of entanglement. Will be able to grip each individual triball very well and with precision as well as scoring them into the goal.

CONSIDERATIONS:
How will we attach the side intake on?

Image source:
https://youtube.com/watch?v=TWmtp-0rXiU

Summary of solutions

In total, we have 3 solutions that completely achieve our goal of no entanglement. Now we will try to narrow them down to one that fits all our requirements.

Initial observations and connections

Solution 1 - Flex wheel intake

Pros

- Conforms to irregular surfaces like that of a triball
- Simple to build, saves us the most time
- Low friction, less motor stress
- LOTS of grip
- Fits easily within constraints

Cons

- Prone to wear and tear

Solution 2 - Antislip mat intake

Pros

- Even grip
- Low friction
- Fits easily within constraints

Cons

- We have yet to test the effectiveness of the antislip mat’s grip on the triball
- Difficult attaching the antislip mat
- Will cost us time

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

Solution 3 - Side intake

Pros

- Even grip
- Precision
- Easy to score with

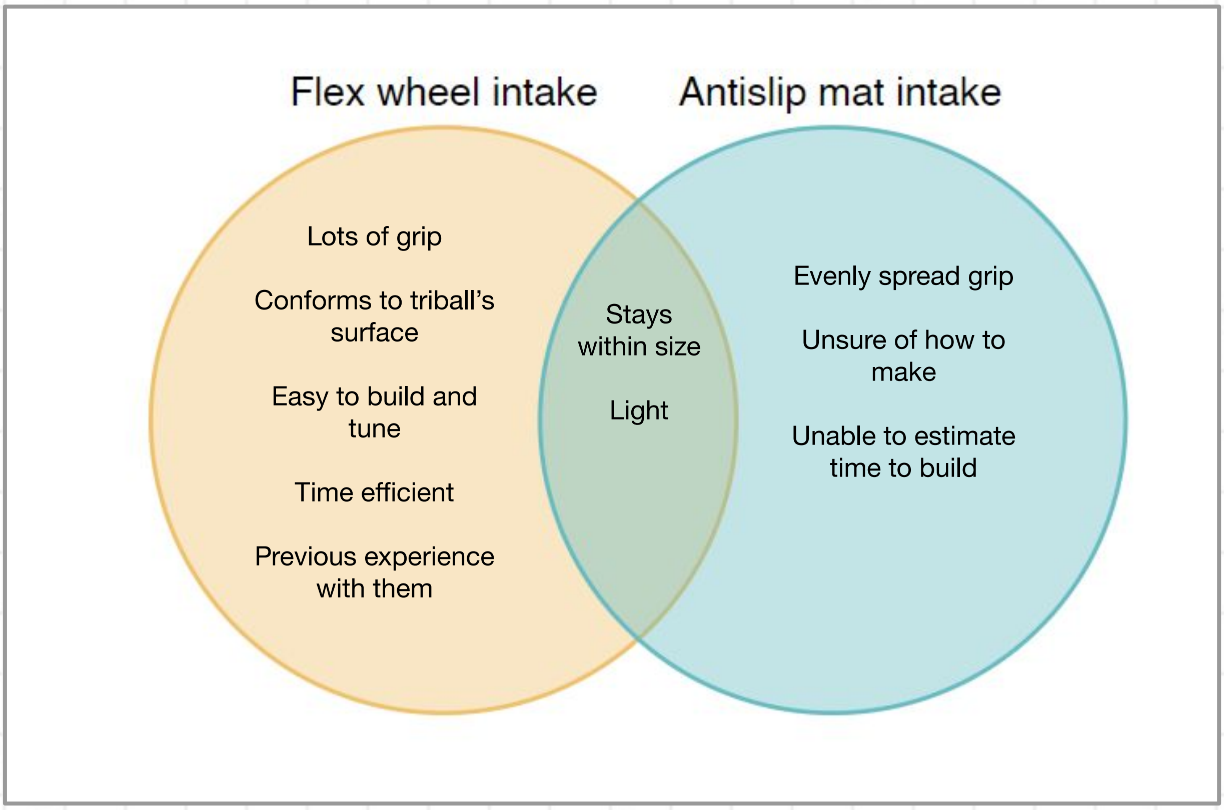
Cons

- Difficulty staying within size without making major changes.

DECISION MATRIX

Based on the pros and cons plus the added time constraints, we've decided to cut out the side intake and only compare the antislip mat intake and flex wheel intake

We will be doing do with a venn diagram



We will be building a flex wheel intake

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Designing the intake

ADDRESSING POSSIBLE ISSUES

Scoring smoothly

- We will be implementing sleds, so that we can easily slide over the goal
- This will allow us to smoothly score the triballs in the goal
- We've decided to go with delrin as our material again
- Delrin is very durable and that is why we've chosen to use delrin as our material instead of any other plastic

DESIGN SPECIFICATIONS

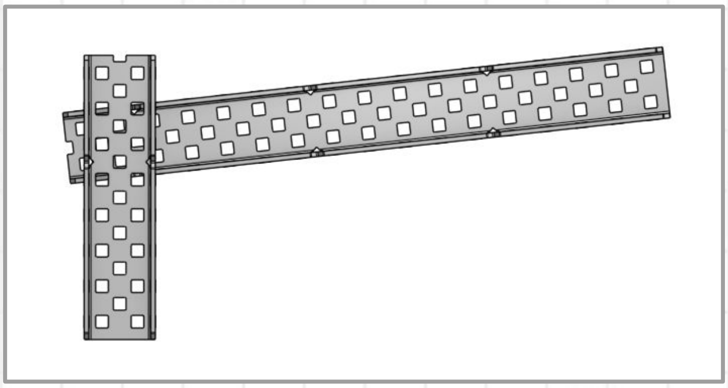
- 1x High Strength Shaft
- 1x Delrin Sheet (continued from our drivetrain sleds)
- 8x 2" flex wheels
- 2x 1x2x1x17 (17 hole) C-Channel
- 2x 1x2x1x8 (8 hole) C-Channel
- 2x 1x2x1x6 (6 hole) C-Channel
- 1x 600 RPM Motor
- 2x 6T Sprockets
- 1x Chain
- 1x 1x3x1x22 (22 hole) C-Channel
- As well as nylocks, standoffs and spacers that remain subject to change while designing.

DATE: 11/22/2023 11/22/2023

DESIGNED BY: RL

WITNESSED BY: TC

CAD - GUIDE

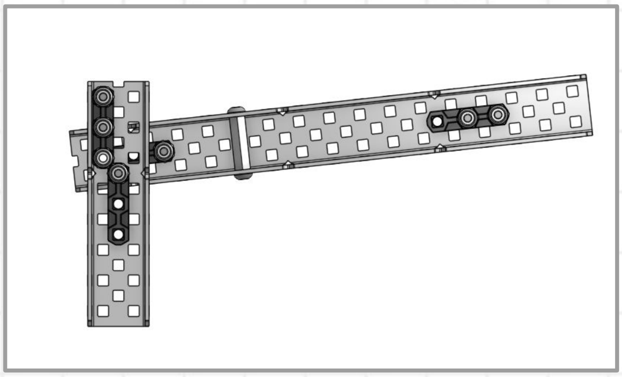


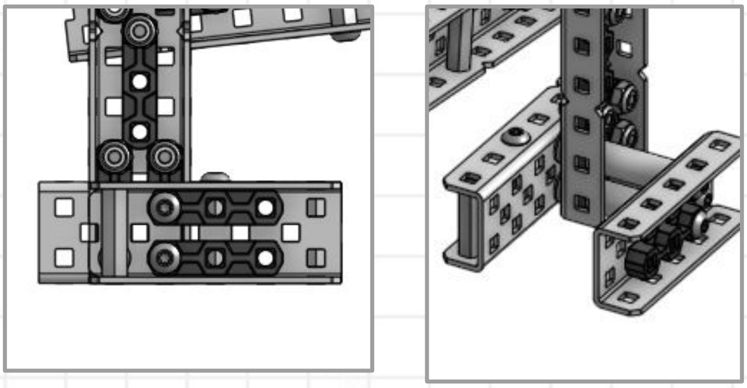
1)

We first line up our 8 hole C-Channel with a 1 hole C channel at an angle. 2 vertical holes on the 8 hole C-Channel should be aligned with the 2 horizontal holes of our longer C-Channel. We leave 1 hole away from the end of each C-Channel. Mirror this process for the other side.

2)

Adding bearings and bracing. We're using 4 bearings total, 2 on each C-Channel. We also have a 1" standoff to act as pressing for the longer C-Channel, the standoffs are located 6 holes away from the left of the 17 hole C-channel to brace it.



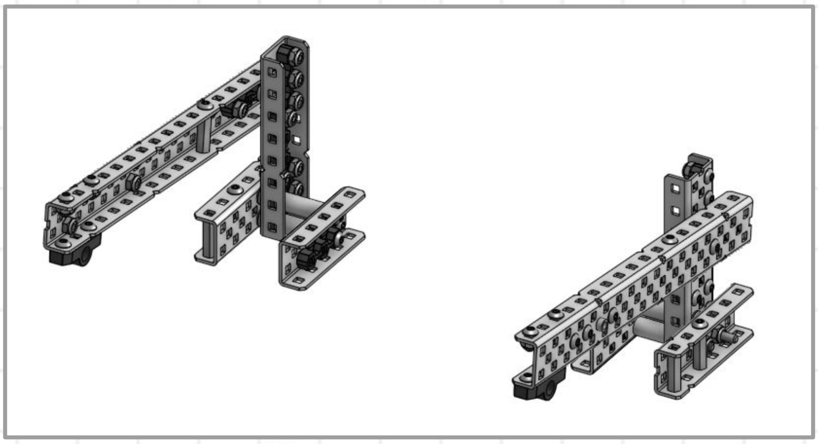


3)

Then we attach a two 6 hole C-Channel on the bottom 5 holes using screws and spacers with standoffs and bearings as bracing. This "sandwich" will allow us to attach the intake onto the the drivetrain.

4)

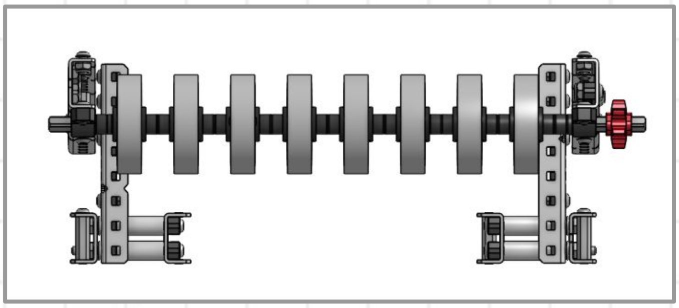
We mirror this process and line up the 2 sides together the insides of the C-Channels with one another. This will serve as a frame for our intake

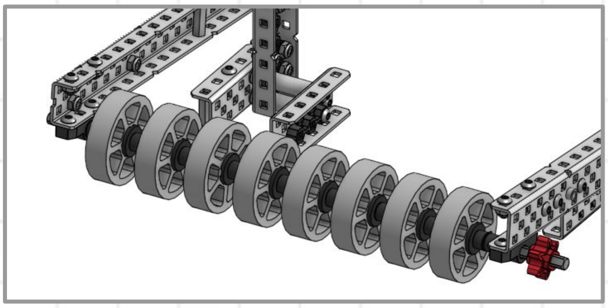


INTAKE

5)

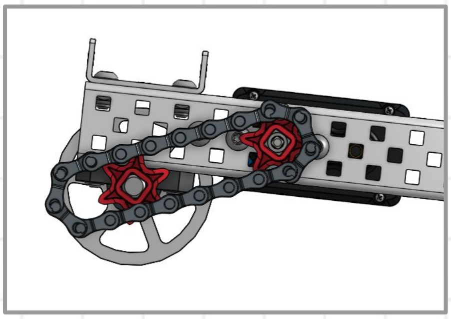
We now take a HS shaft and connect the 2 C-Channels with our 8 flexwheels and HS spacers spaced out to form our intake. On the right side we add a 6T sprocket on the end of the HS shaft which will allow us to connect to the middle. See images on the bottom for spacing.

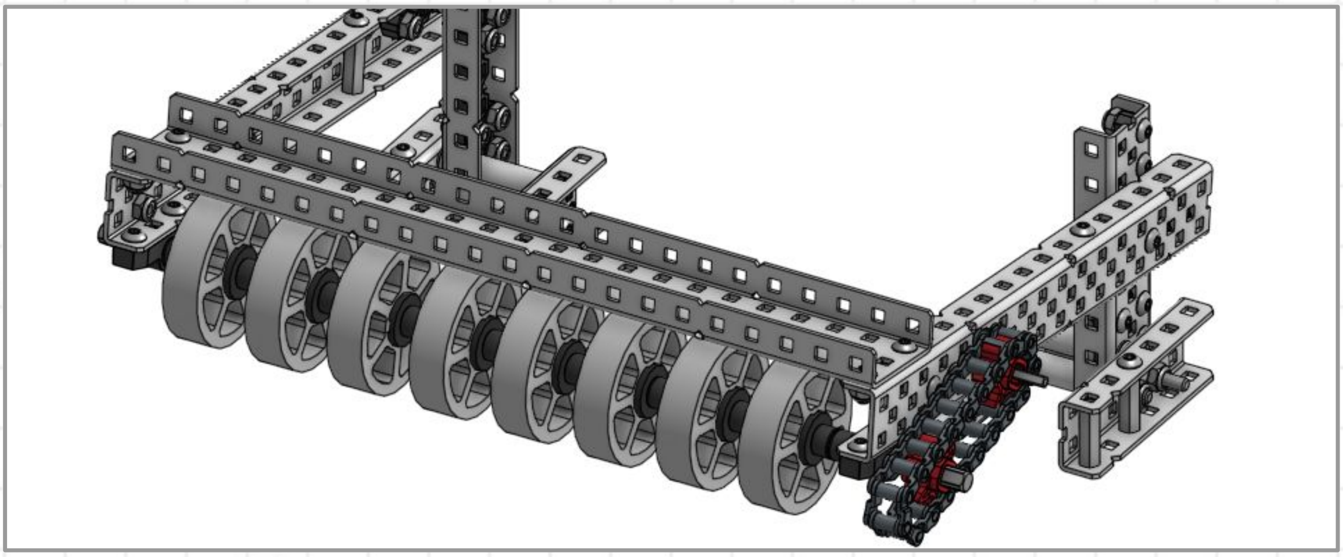




6)

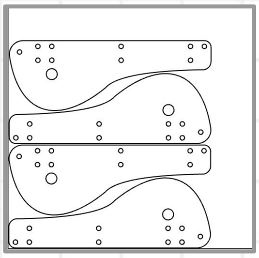
We now use another 17 hole, 3 wide C-Channel to brace the intake, holding it together and supporting the HS shaft at the same time. We add another sprocket on an LS shaft going through the bearing on the left side. We add a chain connecting the two sprockets.

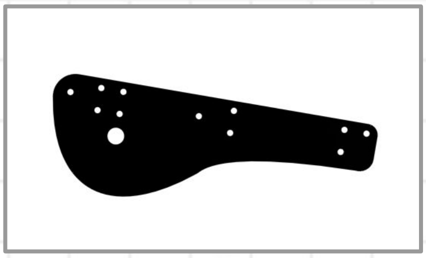




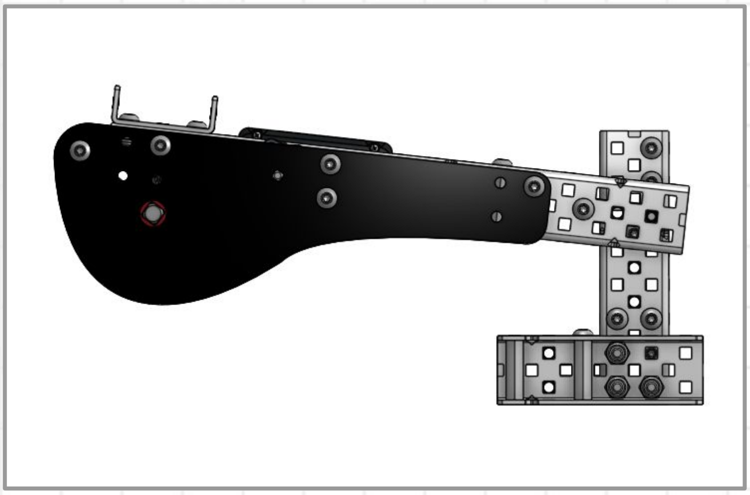
7)

We now laser cut the delrin for the intake sleds.
We've formatted the intake so that we waste the least plastic.

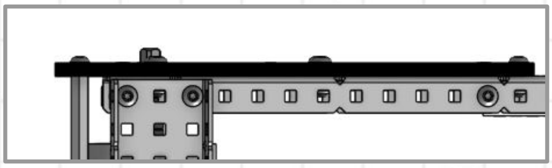




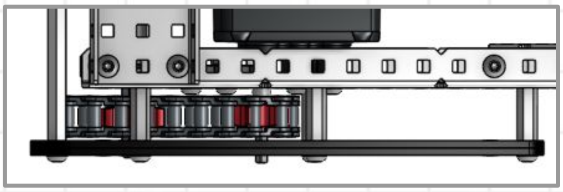
8) While we wait for the delrin to laser cut we can quickly attach the motor



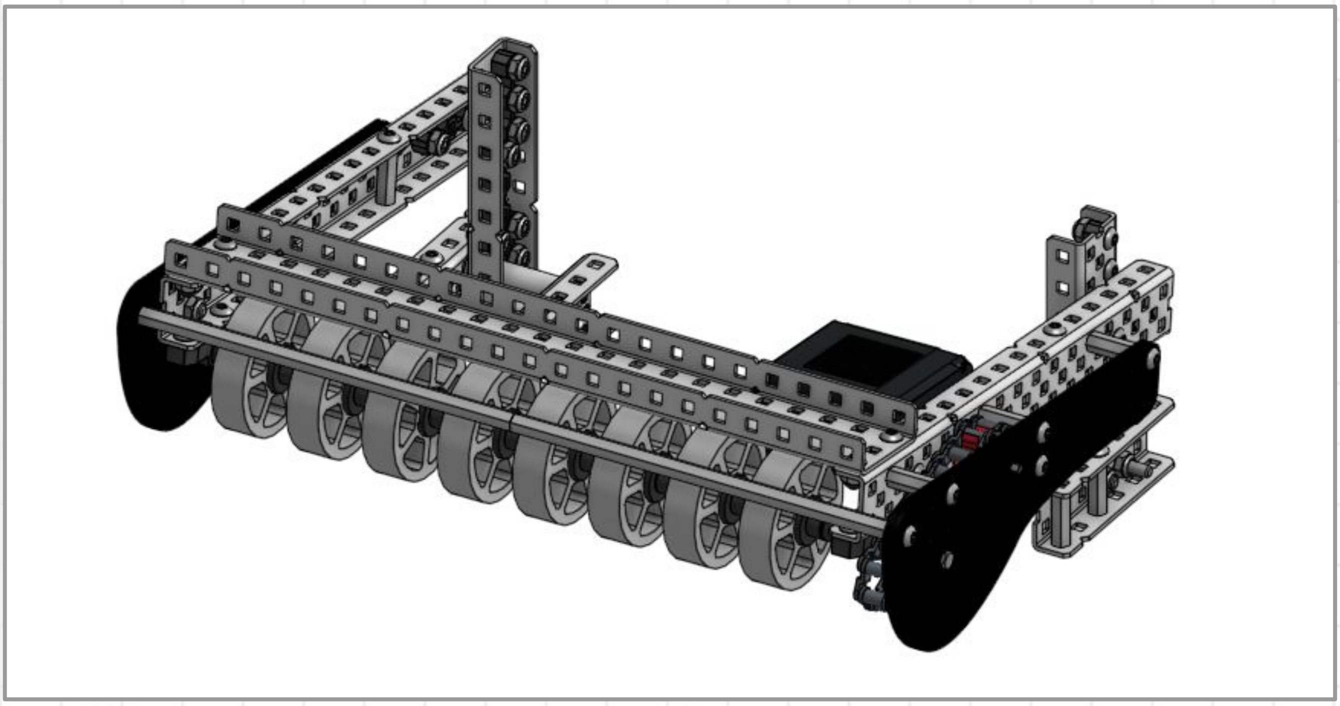
9a) We stack 2 sleds on each side so we have a stronger intake sled allowing us to slip up the goal to score.



9b) Note that we attach the intake sleds differently on each side. Top right image is for the side without the motor



10) Our final step is using standoffs to add extra bracing attaching the sleds together. This bar will help protect our intake



This is our completed intake!

We look forward to building the drivetrain the next week

DATE: 11/22/2023 DESIGNED BY: RL WITNESSED BY: TC

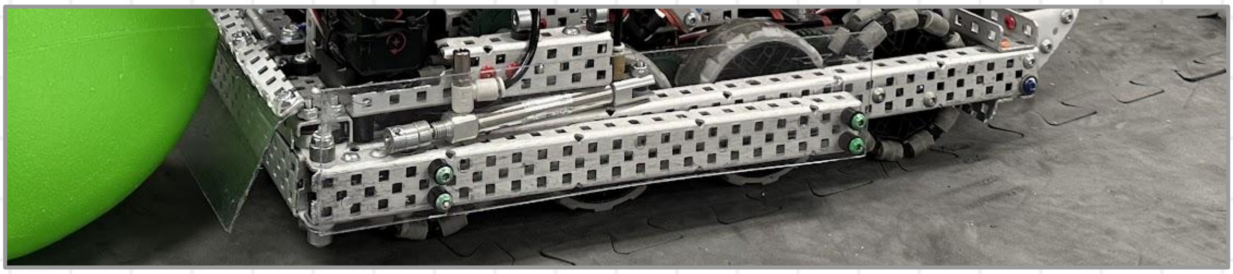
WINGS

Goal

Designing the wings

What needs to be improved from our previous design?

- We had no major issues with our wing design
- We will redesign them to fit with our current drivetrain.



Goal

Setting specific requirements to achieve

MAIN GOAL

- **Pushing Triballs into the goal**
  - This is the one of the only purposes of the wings, they allow us to score multiple triballs into the goal. These are beneficial in games and skills and maximized our use of time.
- **Pushing Triballs past the middle barrier**
  - This will allow us to quickly push another team's matchload onto our side making it easier for us to score

CONSTRAINTS

RULE CONSTRAINTS:

Wings cannot expand past 36" horizontally as stated in <SG2>

MATERIAL CONSTRAINTS:

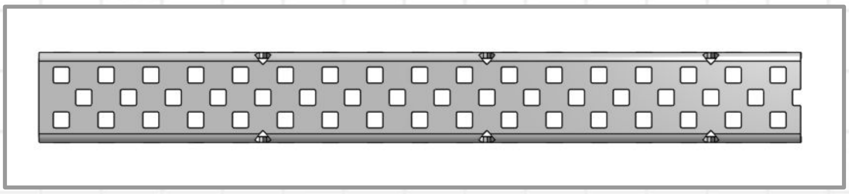
None

TIME CONSTRAINTS:

Drivetrain is to be completed on Friday, December 2nd

DATE: 11/23/2023 DESIGNED BY: RL WITNESSED BY: TC

CAD - GUIDE

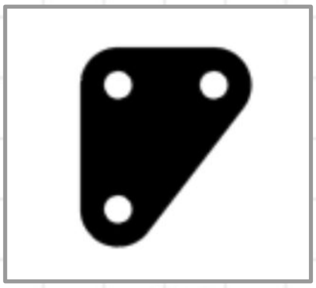


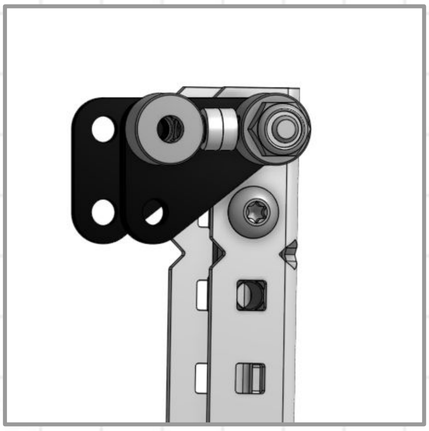
1)

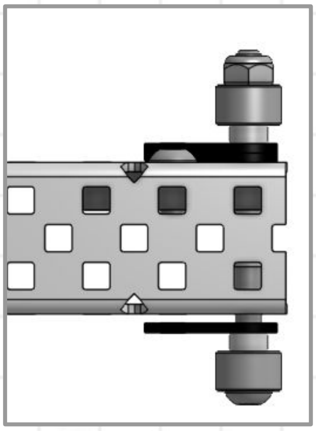
First we take our 17 hole C-Channel. This will be the main component of our wings

2)

We then print out 4 wing mounts with delrin
We will be using 2 on each side of the wings. This is a significant component in order for us to attach the wings onto the drivetrain. We've chosen to use delrin as it is more firm compared to other plastics





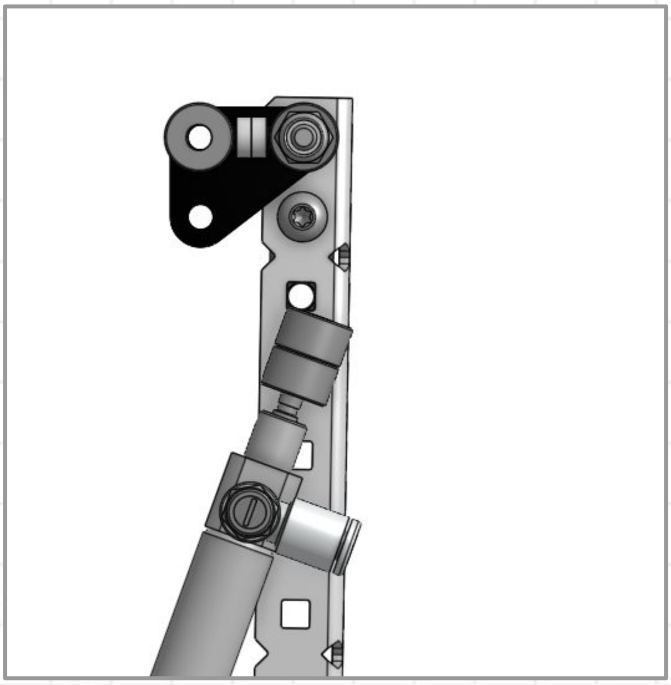


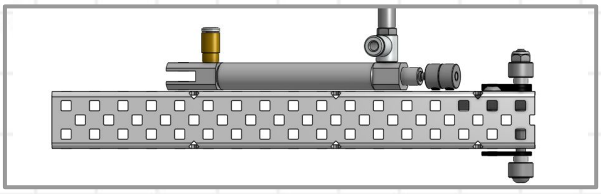
3)

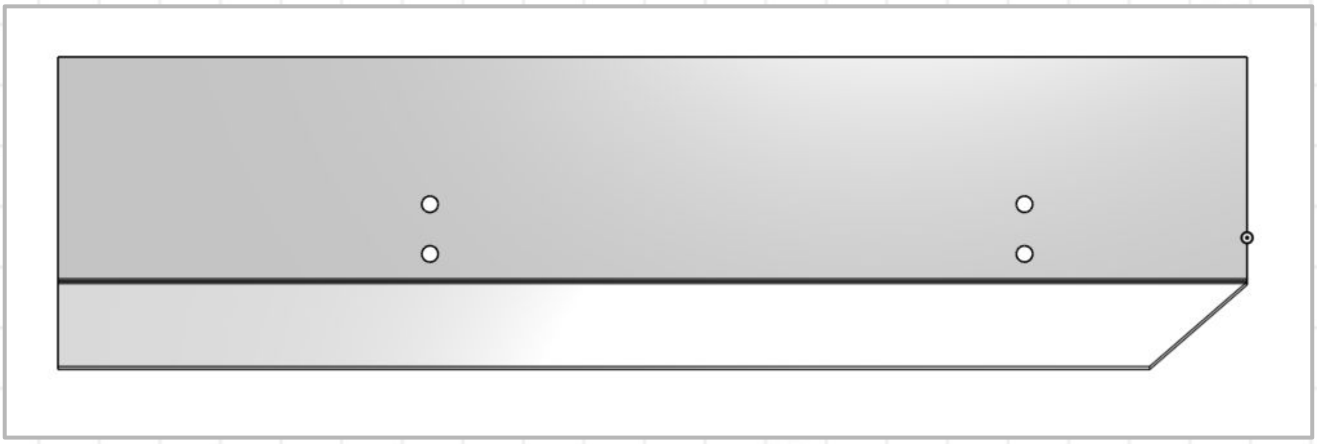
The wings are to pivot on a 2" screw. We place 2 wing mounts on each side of the C channel. And we space the screw out with shaft collars and 1/16" spacers. Look to image on the left for spacing

4)

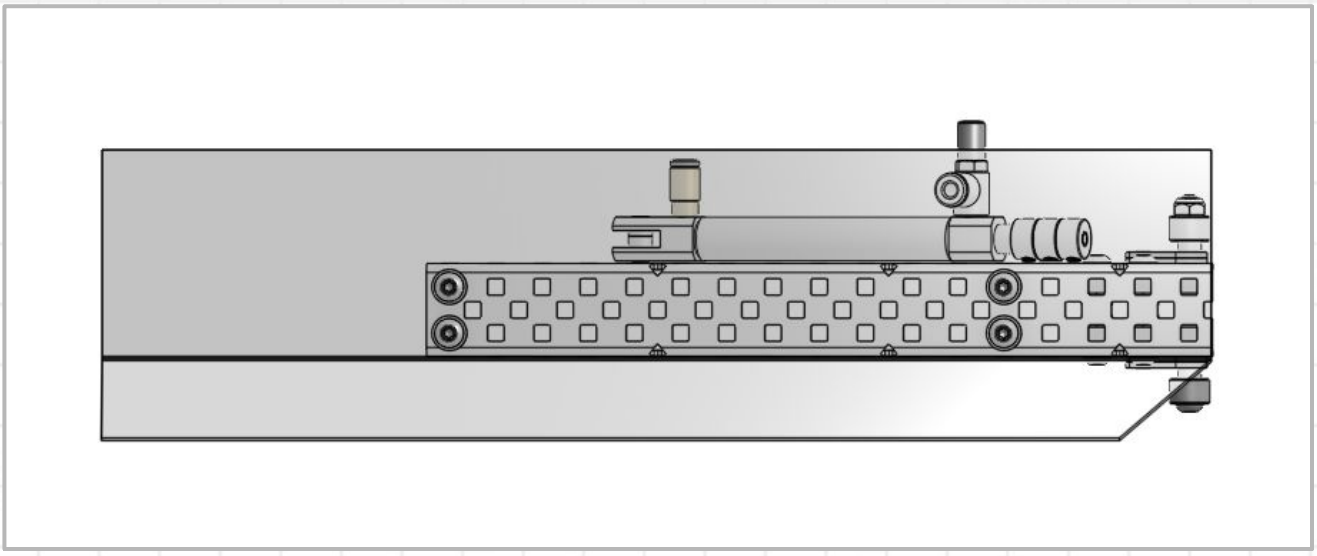
We now mount the piston. First we attach one ⅜" spacer on the piston, then on the end we attach shaft collars. We then attach the piston onto the wings via a screw attaching to the shaft collars.







5) We create our plastic surface with a polycarbonate sheet. We will bend the polycarbonate plastic around 10-20 degrees in order for it to be able to prop up the triballs in order for it to be pushed over the barrier. We will mark the holes in the plastic then drill it.



6)

The final step is to attach the polycarbonate onto the C-Channel allowing us to complete the wings. We secure the wings on the first and 13th columns of holes counting from the left.

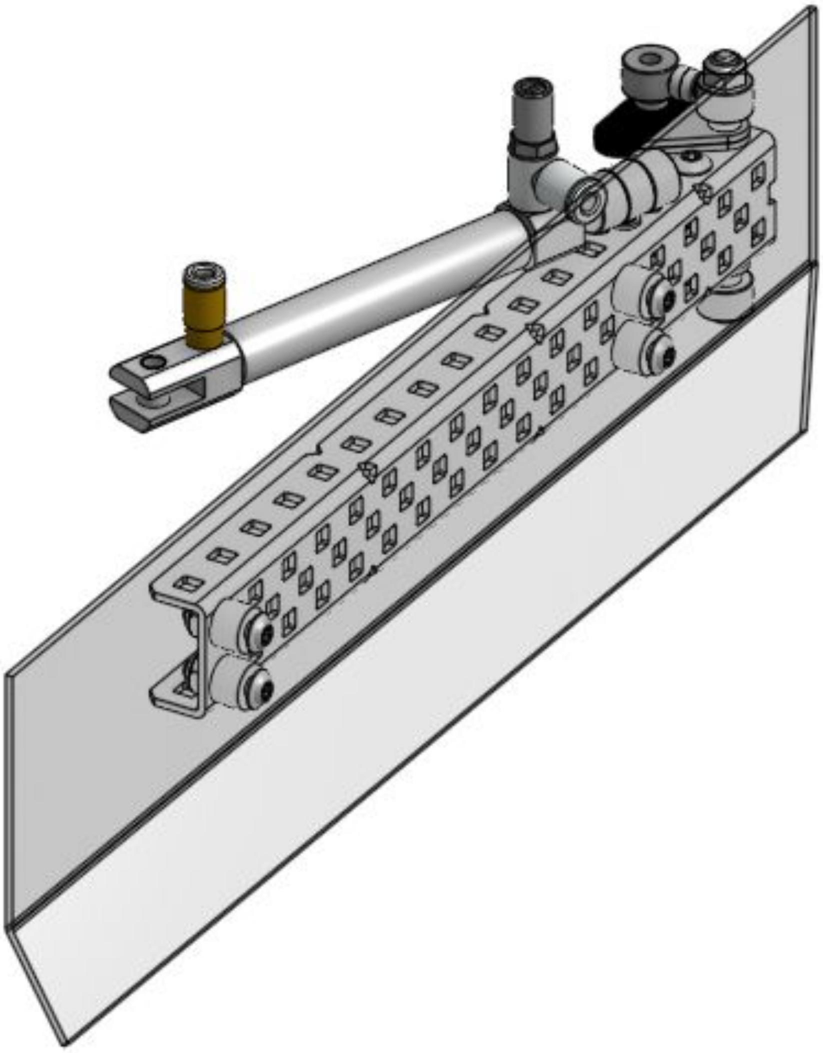
7)

We now mirror the process with the other side making the left wing!

WINGS

Finished cad

Here are our completed wings



REFLECTION

Does these wings match our requirements?

- **Pushing Triballs into the goal**
  - Yes as there is a greater surface area
- **Pushing Triballs past the middle barrier**
  - The wedge will allow us to quickly push multiple triballs over the middle barrier

We look forward to building the wings the next week

DATE: 11/23/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Designing the Blooper

<u>What needs to be improved from our previous design?</u>

- We had no major issues with our blooper design
- We will redesign them to fit with our current drivetrain.

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Getting triballs out of matchload zone**
  - Wins us awp, allowing us to stay in a high rank during qualifications

CONSTRAINTS

RULE CONSTRAINTS:

Wings cannot expand past 36” horizontally as stated in <SG2>

MATERIAL CONSTRAINTS:

None

TIME CONSTRAINTS:

Drivetrain is to be completed on Friday, December 2nd

SOLUTION

Due to said time constraints, we will not be explicitly showing our design process for the blooper. Please refer to page 177 of the first notebook

We will be skipping the background research and brainstorming solutions for this mechanism.

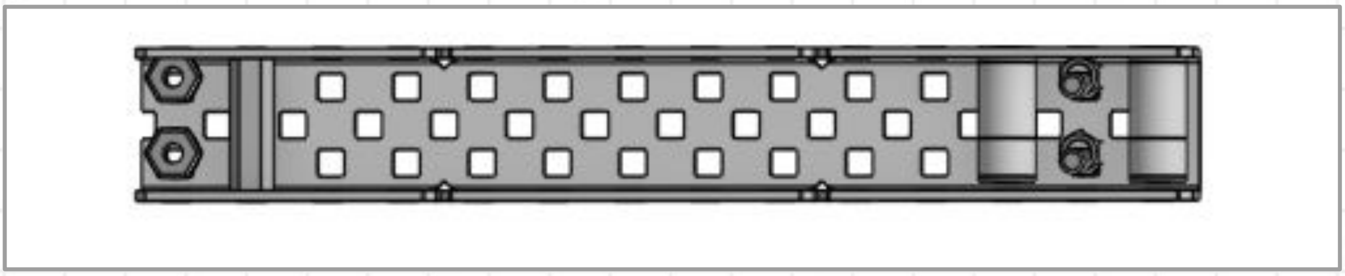
DESIGN SPECIFICATIONS

- 1x Polycarbonate sheet
- 1x Hinge
- 2x 1x2x1x15 (15 hole) C-Channel
- 1x 1” standoff
- 1x 2.5” screw
- 3x Shaft Collars
- Any other components that we decide to add

CAD - GUIDE

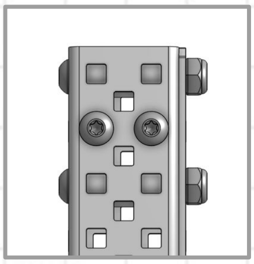
1)

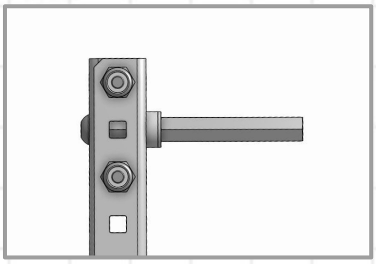
First we take one 15 hole C-Channel as the first component of our blooper. We then place 2 nylocks on the 2 holes of the left inside the C-Channel followed by a 1” standoff through both 2nd holes of the C-Channel. Then on the other side we first screw on our ⅛” standoffs on the 2nd holes. Then we place a ⅛” spacer along with a ¾” spacer on both sides of the standoffs. This will serve as the interior bracing so that the C-Channels do not bend.



2)

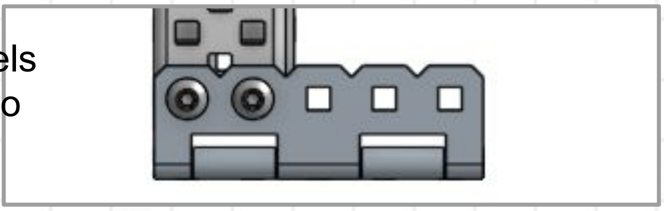
We then take our second 15 hole C-Channel and we place it on our first C-Channel. On the top, we put 1.5” screws through the standoffs and secured them with nylocks. We also add two 1.5” standoffs which will complete our “hook”





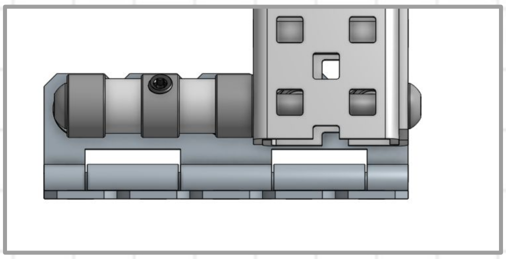
3)

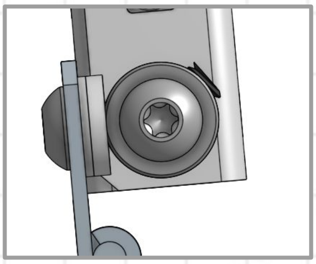
We attach the other end of the C-Channels to a hinge, putting screws through our two nylocks

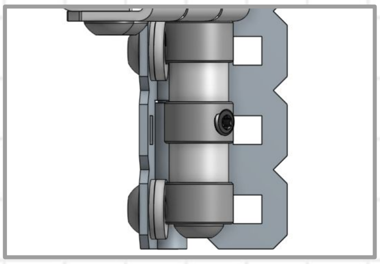


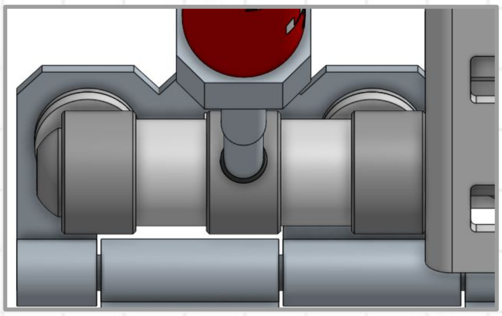
4)

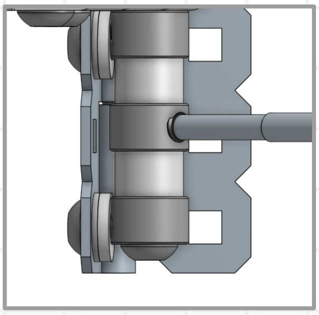
Now we take one ½”screw and another 1.5” scew and we put them though the C channels. On the longer screw we addeded shaft collars to better attach to the hinge.





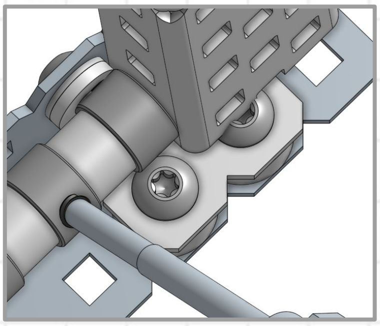






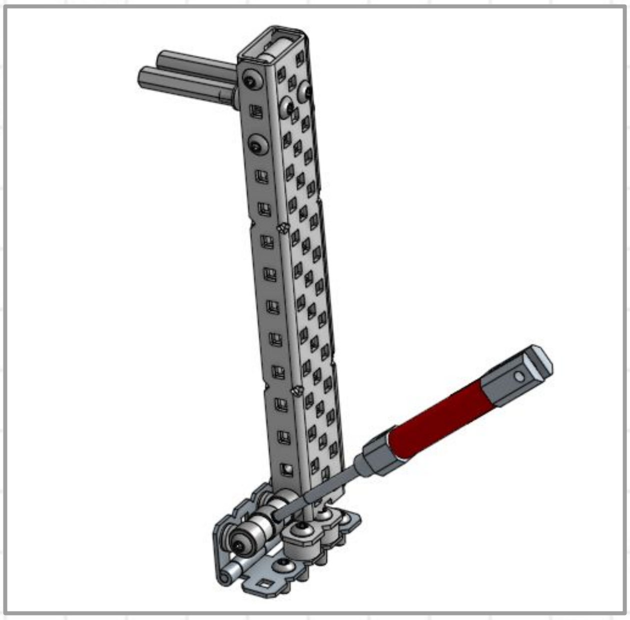
5)

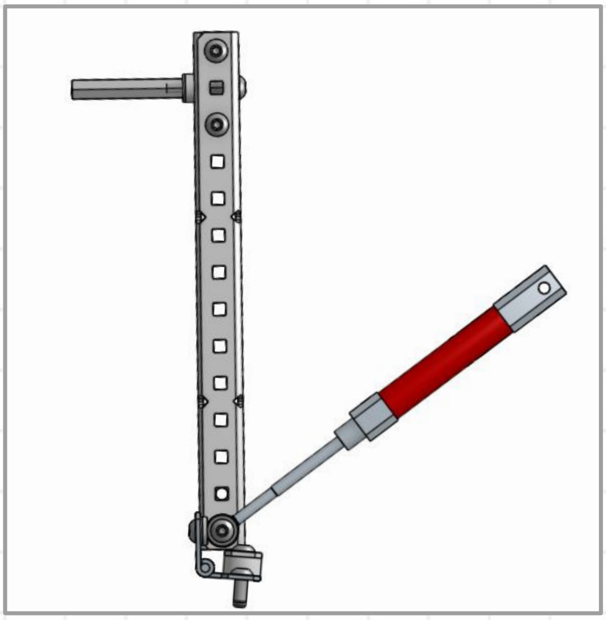
We attach the end of the piston to the middle shaft collar and we tighten it all the way



6)

Our final step is to screw a 2 hole plate onto two ⅜” spacers. This will make sure that the mechanism does not flip over, closing the hinge. It allows for our two C-Channels to stay in a 90 degree angle when mounted on our bot.



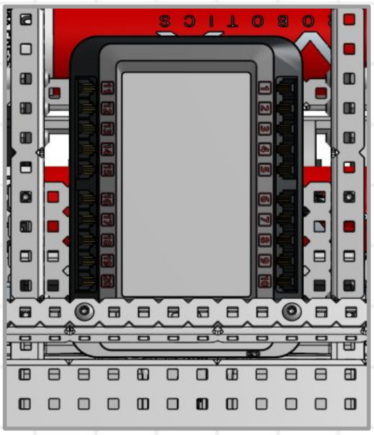


DATE: 11/24/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

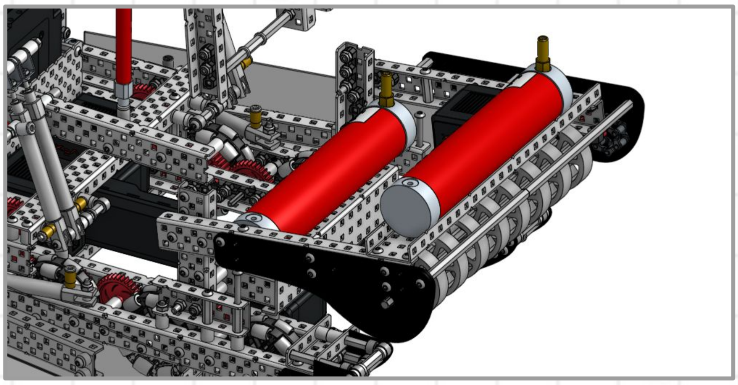
Putting together components

Brain placement



We've decided to place our brain at the very back of the robot under the lift. This way it's very accessible to access as well as being protected

On our previous robot we had placed it in the centre of the robot. Although it was visible, it was hard to access

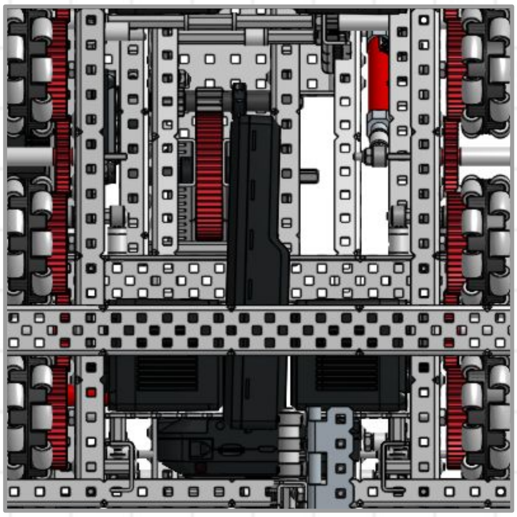


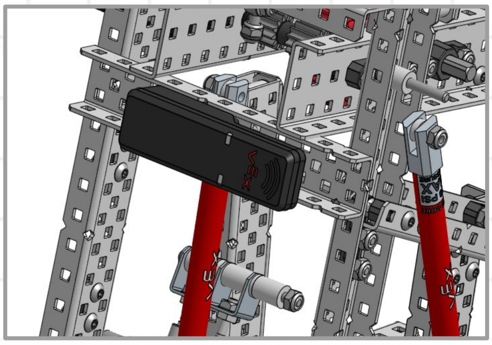
Tank placement

We've decided to place the tanks in 2 places, one on the intake to balance out the weight of our robot and the other inside the robot above the intake wall.

Battery placement

We've decided to place the battery in the interior of the robot, allowing for an easy switch when we raise the lift.





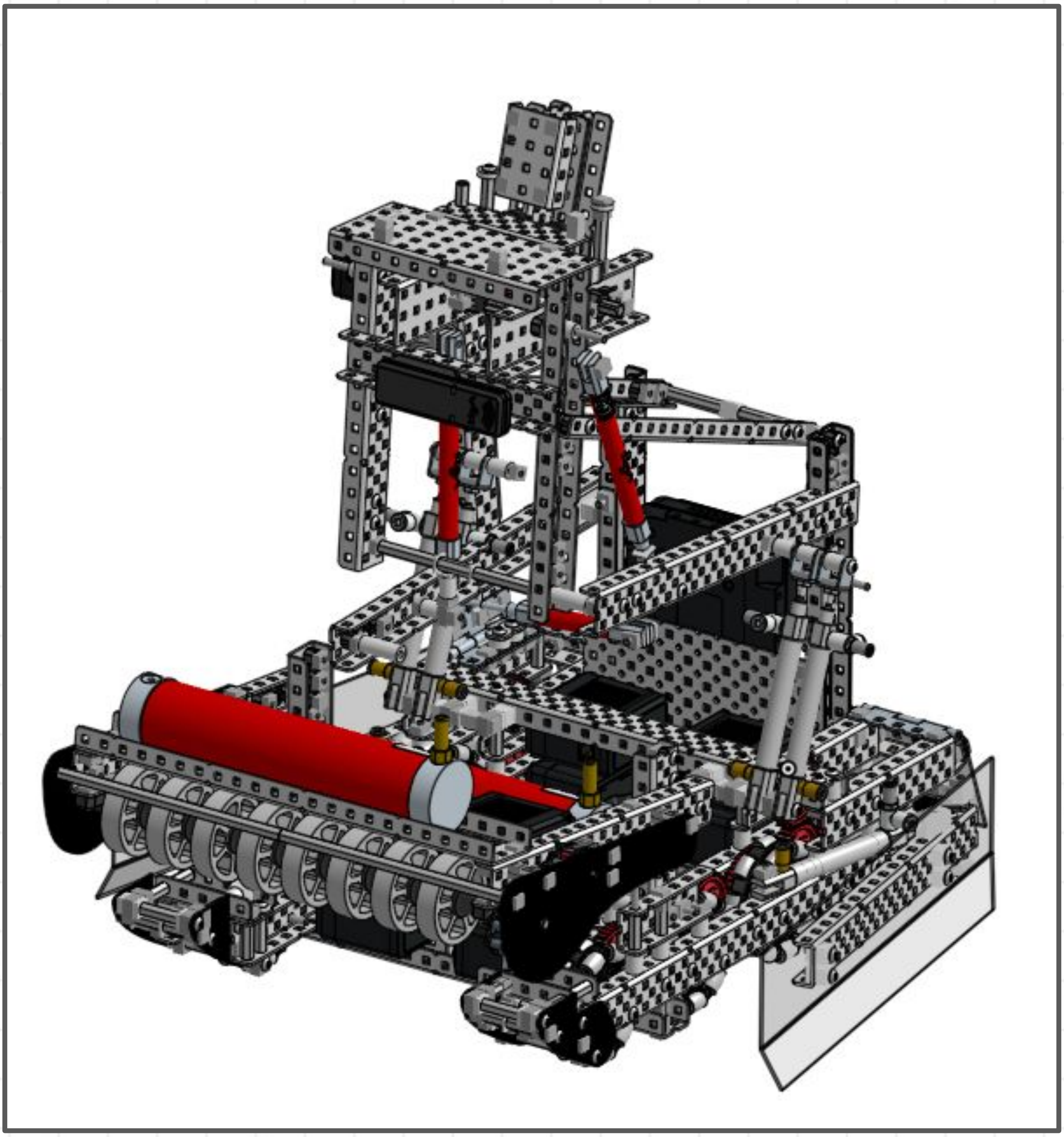
Radio Placement

We've decided to place the radio on the highest point of the robot (the slapper) this way we can keep it safe from potentially disconnecting

DATE: 11/24/2023 DESIGNED BY: RL WITNESSED BY: TC

ASSEMBLY

Here is an image of our entire robot



We've added a wedge and building process is very simple, so we won't be adding a guide for it.

We look forward to building the robot next week

DATE: 11/24/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

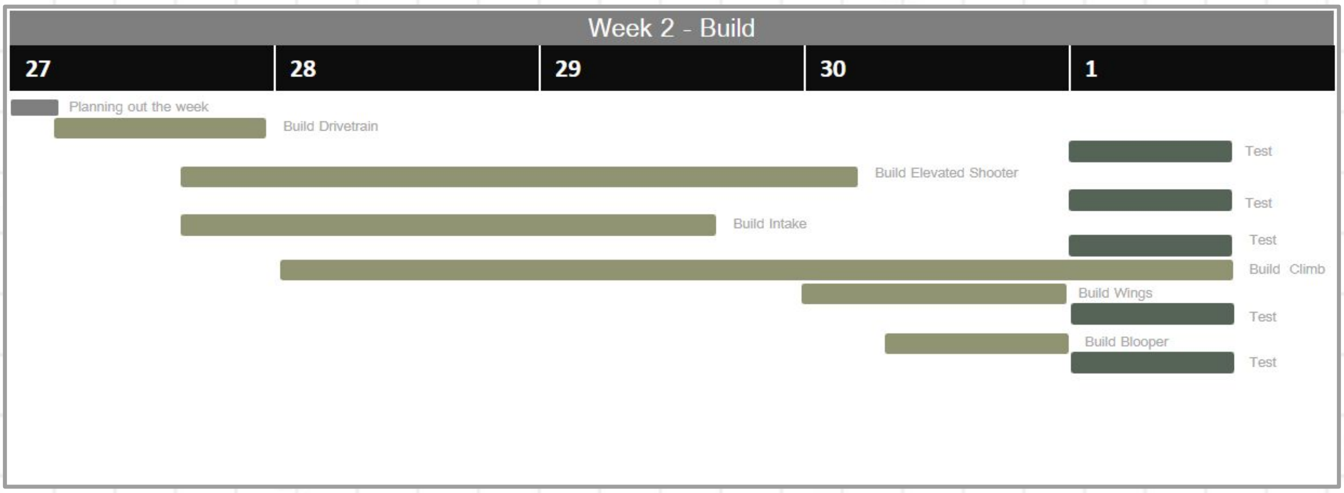
Organizing our time in order to efficiently make use of it and complete the rebuild

PLAN

One week has passed and we've successfully followed our plan:

- Week 1 → Design and Cad ✔
- Week 2 → Build
- Week 3 → Code and practice

Here is a Gantt chart showing a detailed plan of week 2



We've decided to color code the process we will follow with the design process of the mechanism, that also is shown on the sides of the notebook.

🟩 Develop solution

■ Testing solution

We will follow this schedule to our best. At the end of the week, we will confirm that all is done and create a new Gantt chart for week 3.

DATE: 11/27/2023 DESIGNED BY: RL WITNESSED BY: TC

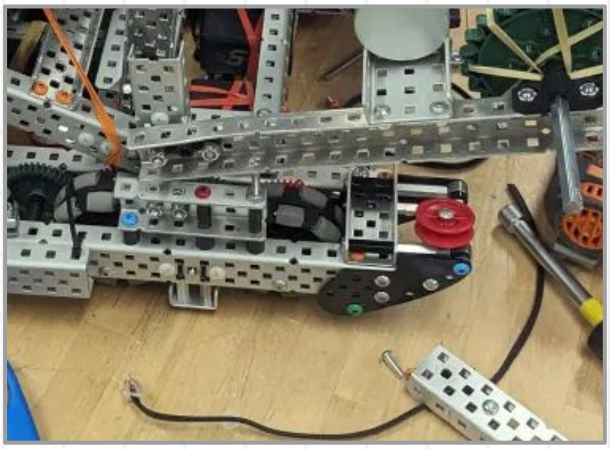
DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

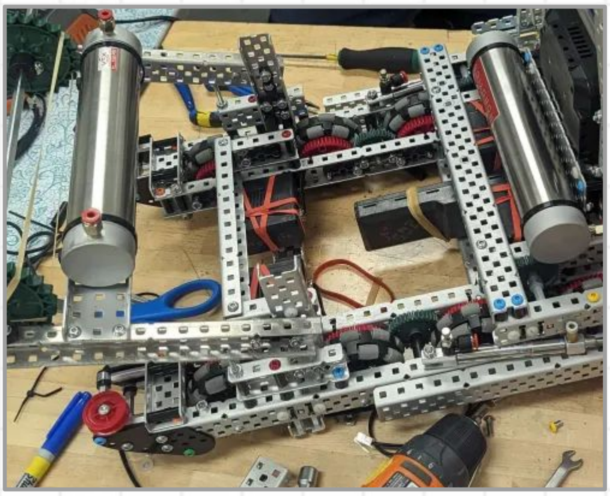
Goal

Making the drivetrain

This is the process of building the drivetrain. We picked 4:3 ratio and 600 rpm gear box.

We added a Plastic pulley which was meant to help us slide off the walls, preventing us from getting stuck.



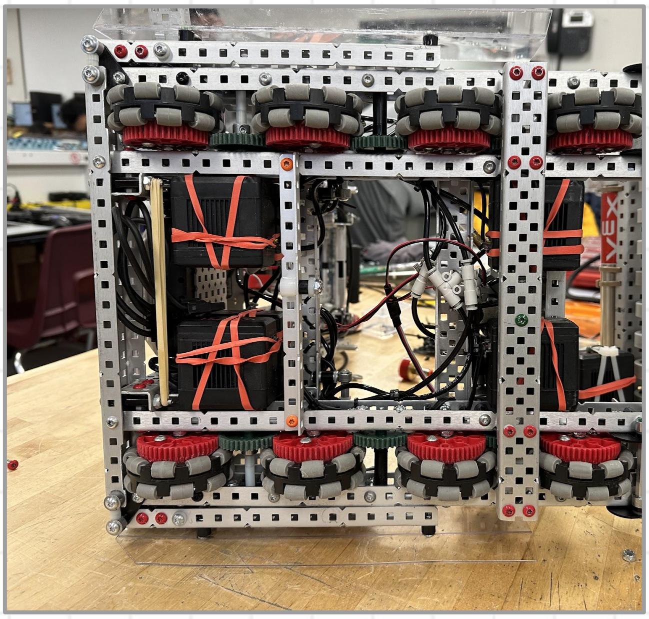


We decided to use 6 motor drive and omni wheels due to a few reasons

- More torque
  - This would help us push against opponent during games
- Smooth turns
  - Omni wheels allow us to drift, turn and control better

We connected both drivetrain with C channels to maximize supports and make sure it doesn't bend.

We decided to remove the plastic pulley as we realized that it didnt stay in place. There was no way to give it better bracing unless we decided to take apart the sleds. Due to the time constraints, we decided to take them off.

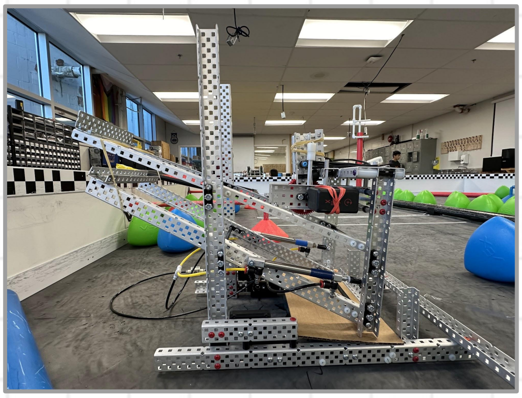


We look forward to testing our drivetrain

DATE: 11/29/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

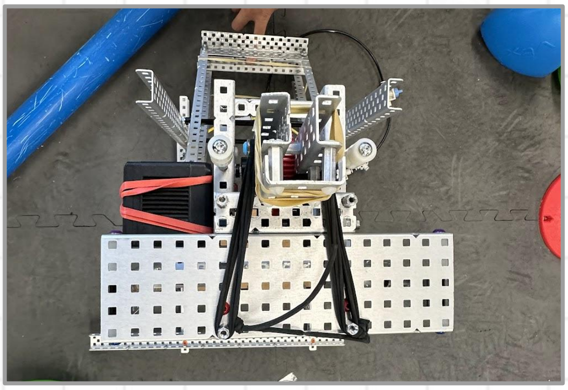
Making the elevated shooter

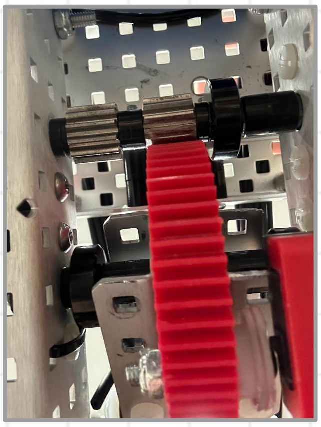


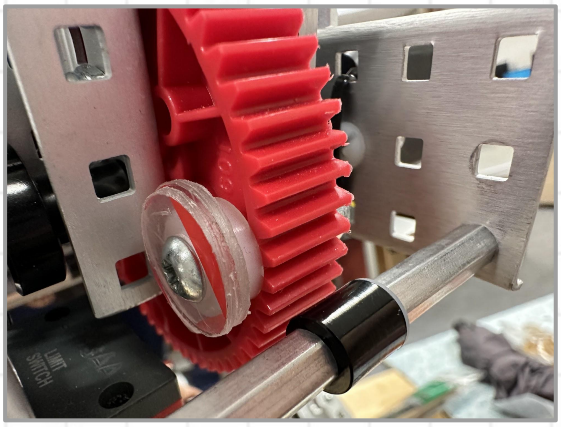
This is the process of building a lift. We wanted to double-check the length of C-Channels we wanted to cut. We decided to put a piece of cardboard under the lift to lessen damage on metal from dropping the lift.

We decided to use surgical tubing in place of elastic bands due to a few reasons

- Stronger
  - This survives through frequent use. We noted that elastic bands would quickly wear out over a relatively shorter period of time
- Customizable

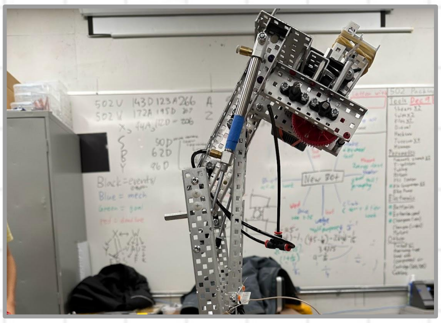






We've added custom polycarbonate spacers screwed onto the gear. We've placed a limit switch on the bottom of the slapper. The polycarb will be able to hit the limit switch, allowing us to shoot.

To the right is our completed mechanism. Mounting the pistons wasn't as difficult as we expected and we are very happy with the build.



We look forward to testing our mechanism!

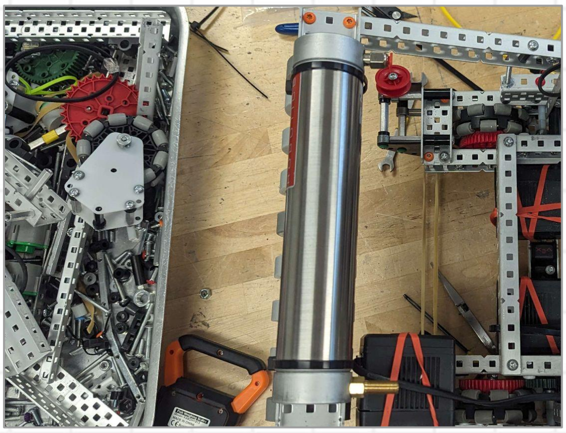
INTAKE

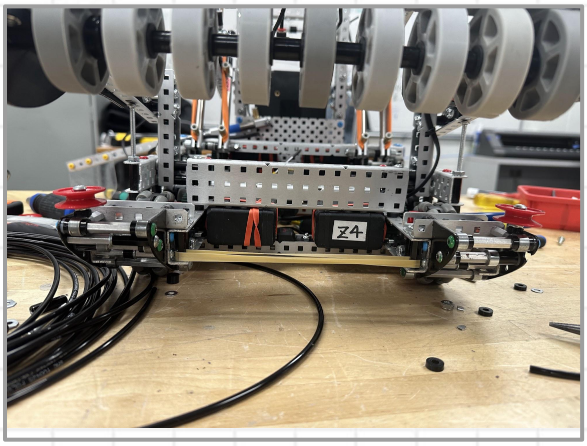
Goal

Making the intake

We decided to use flex wheels for intaking triballs due to a few reasons

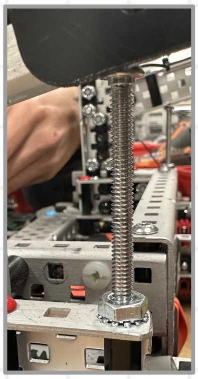
- Stronger
  - This survives through frequent use. We noted that elastic bands intake had high risk of entanglement with other bots and would break easily
- Ease to use/code

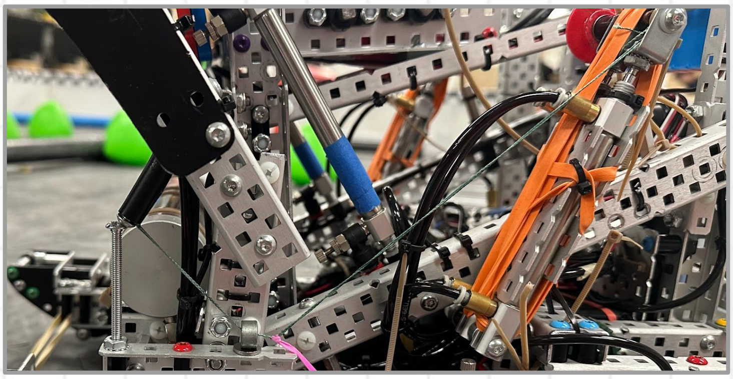




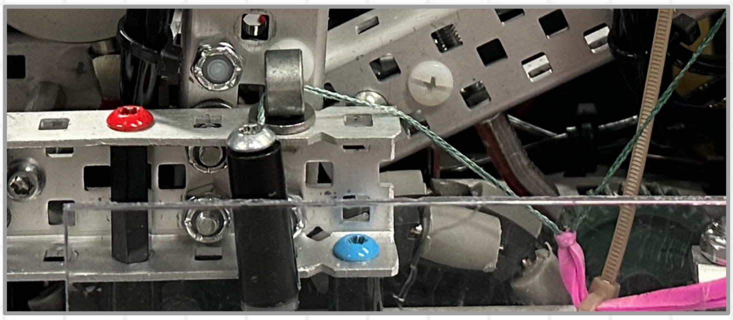
We decided to use one elastic band to serve as an intake ramp of sorts. This will allow the triball to rest on the elastic band while being held by the intake so that we can drive around while possessing a triball.

On the right we have a screw propping the intake up. This ensures that we will be able to intake triballs at all times.



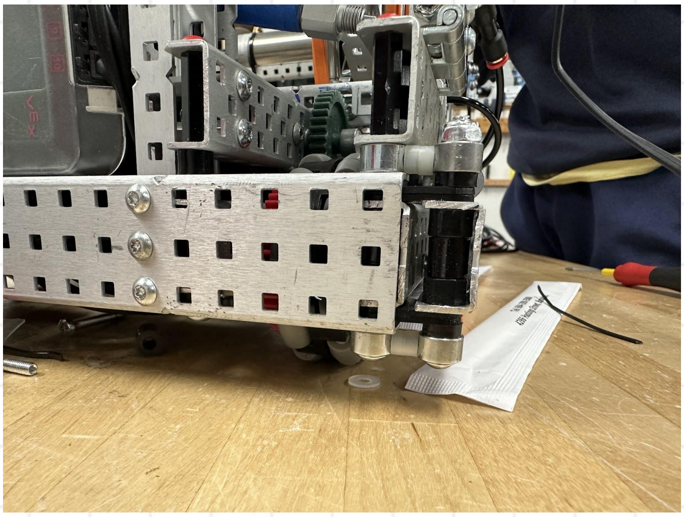


We've come up with a unique idea to make sure that we always start in size. We have a stopper that we made to prop the intake up. We used fishing wire to attach it to the climbing mechanism. The mech raises, dropping our intake



Goal

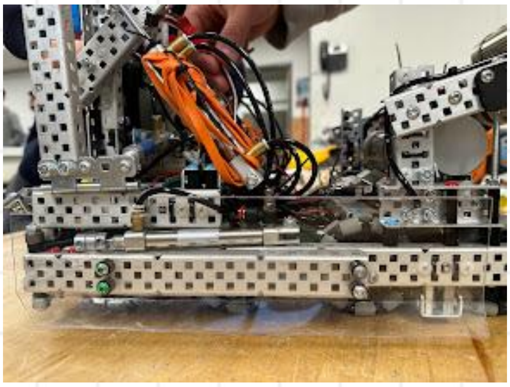
Making the wings

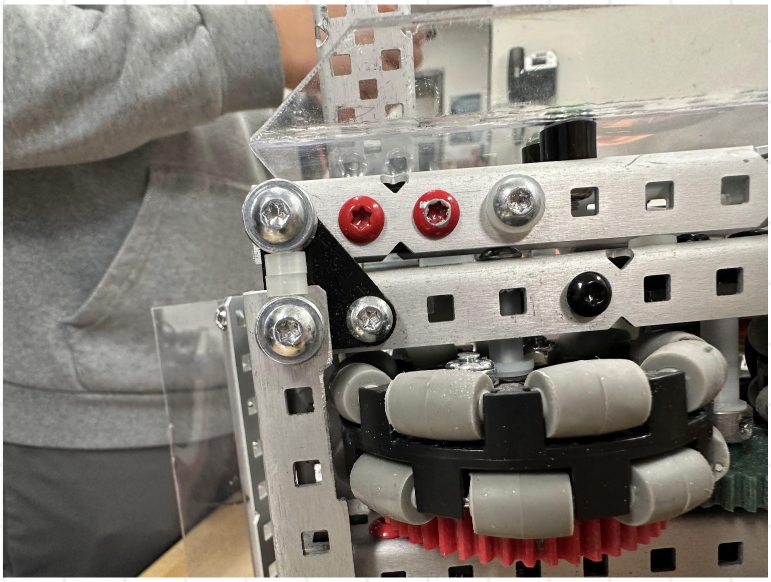


This is the process of building the wings. We wanted it to control it with numatics so we made it piston power. We decided to put the wings on the side of the bot connect it directly to the pistons.

We decided to add polycarbonate sheet to the wings due to a few reasons

- Bigger surface
  - This allow us to push more triballs and control them better
- Lift up triballs
  - The angled side allow us to lift up triballs against the middle bar and push them over offensive zone





The polycarbonate was bent using a bench press and we drilled holes into it to allow it to attach.

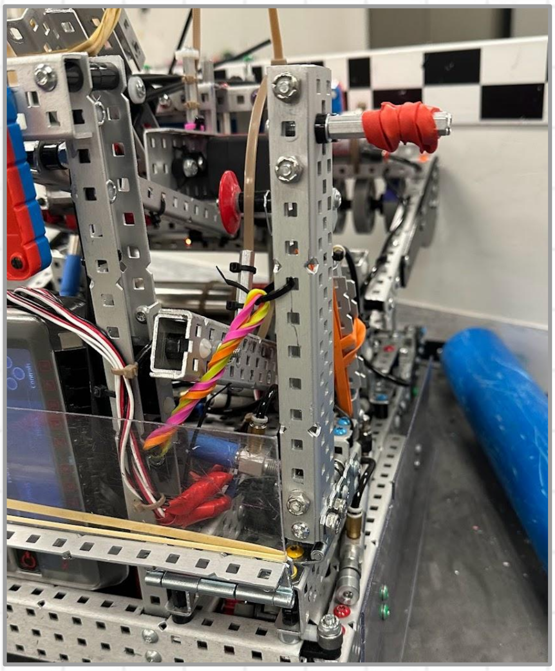
We designed a custom polycarbonate part to connect wings to our bot so we can control the distance between the bot and the wing.

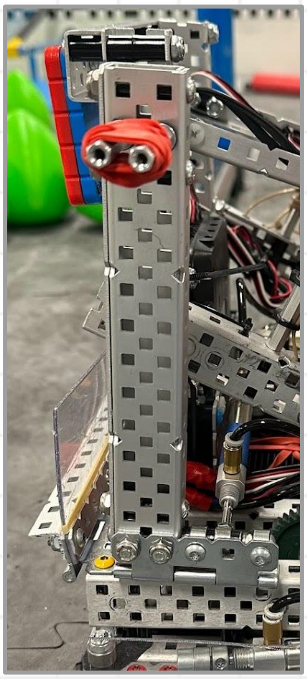
DATE: 11/30/2023 DESIGNED BY: RL WITNESSED BY: TC

BLOOPER

Goal

Making the blooper



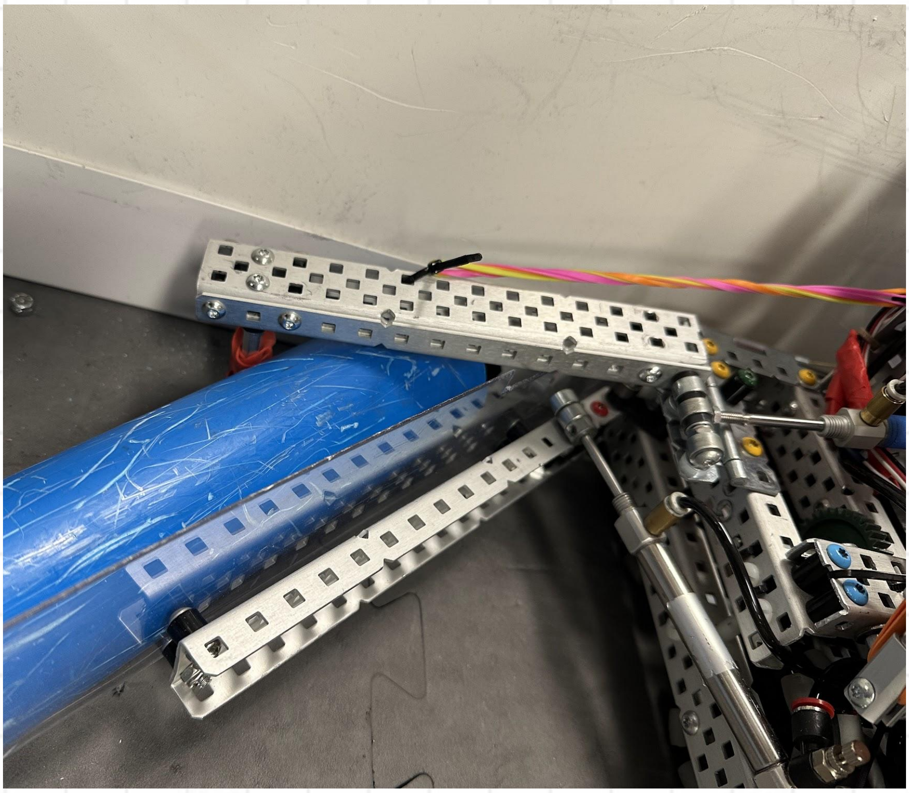


We decided to wrap an elastic band around the 2 standoffs as it adds more friction, preventing the standoffs to slip on the matchload bar.

This will be especially useful in cases where we are getting pushed while matchloading.

We initially wanted to build the blooper solely for AWP. but we realized that it could be used as a hook for when match loading. We've heavily reinforced it so that it will always remain reliable.

Our matchloading strategy in games is to hook ourselves to the corner with this mechanism.

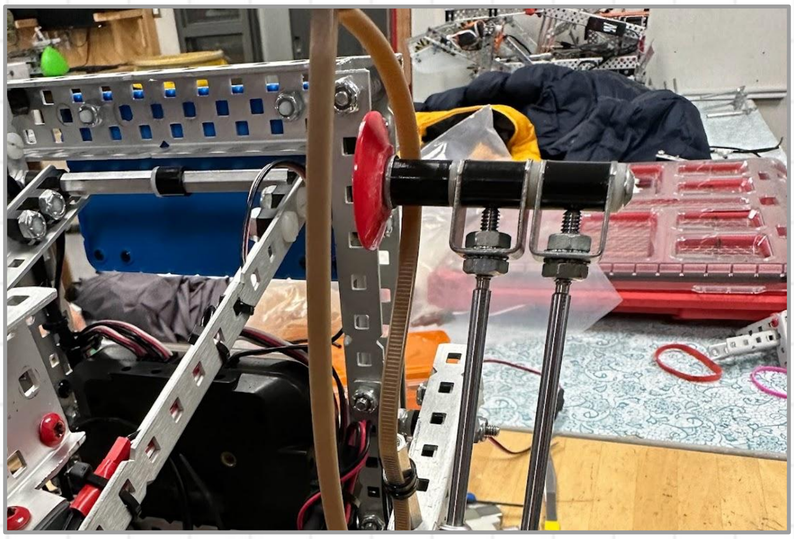


We look forward to using this mechanism in games!

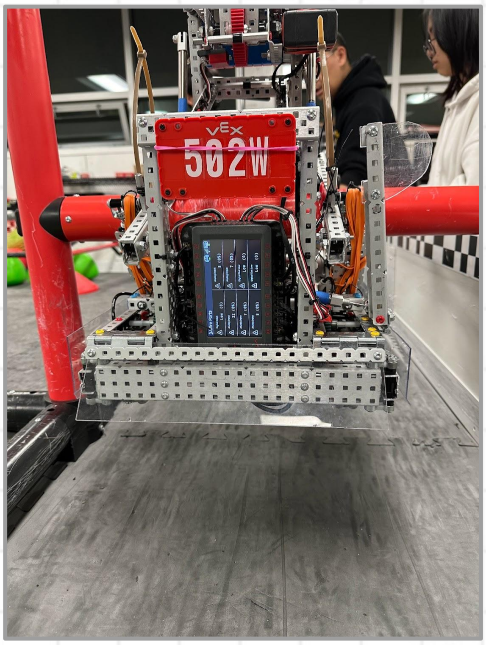
DATE: 12/01/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Making the climb

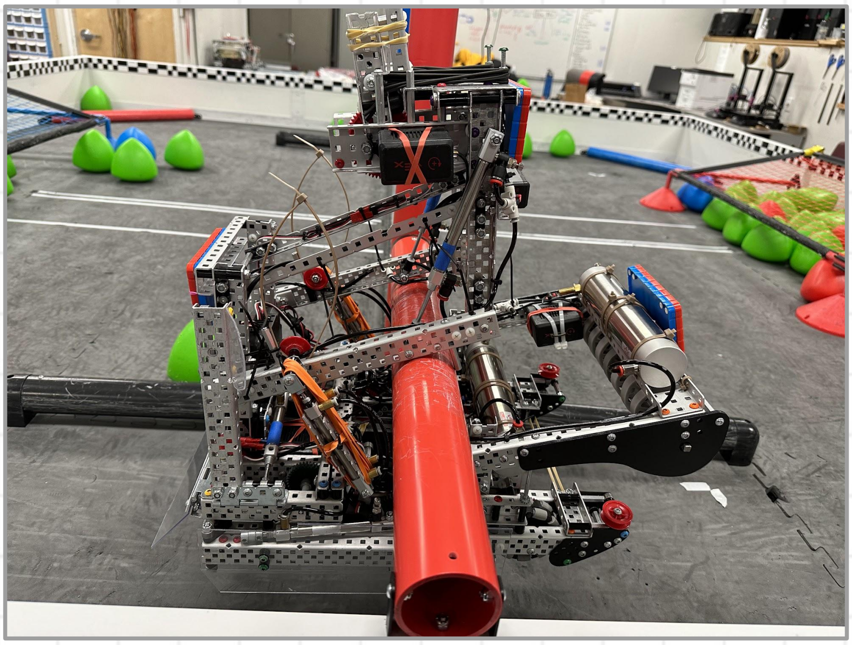


This is the process of building the climb.
We decided to cut apart the pulley to better slide against the C-Channel of the Elevated shooter



We decided to use four pistons due to a few reasons

- Fast
  - Using pistons allow us to climb at an instant
- More power
  - With more pistons we can climb with >70 psi



We added a stand off to the climbing C channel. This allows us to balance the bot more easily by moving the standoff to a different hole. The standoff also helps us to grab on the bar easier.

We look forward to improving this mechanism in the future

TESTING ROBOT

Goal

Testing all our mechanisms

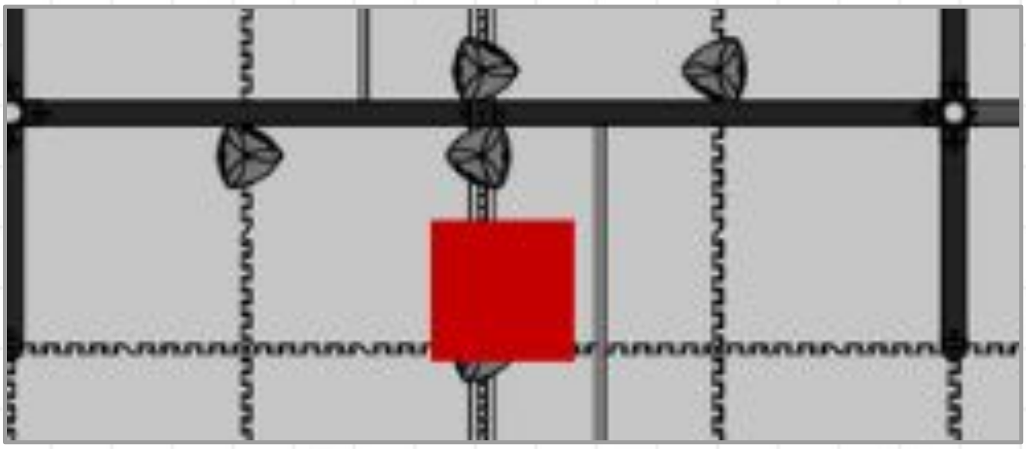
DRIVETRAIN - GOING OVER THE BARRIER

We want to be able to smoothly go over the barrier every round with efficiency and speed

Procedure

I. Place robot on field tile 2 tiles away from the middle barrier.
II. Drive forwards
III. Repeat 5 times
IV. Place robot 1 tile away from the middle barrier.
V. Repeat 5 times
VI. Place robot 1.5 tiles away from the middle barrier.
VII. Repeat 5 times

This will allow us to figure out how effectively we can climb over the barrier



Results

Each try was a success, this means that we can successfully drive over the barrier in no matter what instance. This will be able to significantly boost our defensive and offensive play.

TESTING ROBOT

ELEVATED SHOOTER - MATCHLOADING

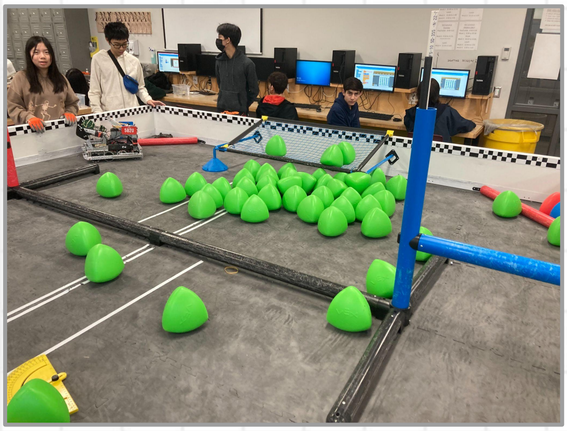
We want to be able to smoothly go over the barrier every round with efficiency and speed

Procedure

I. Place robot in matchloading position
II. Raise our old robot's blocker
III. Matchload to the other side

This allows us to see if we can actually shoot over a blocker, as well as testing our grouping.

Results



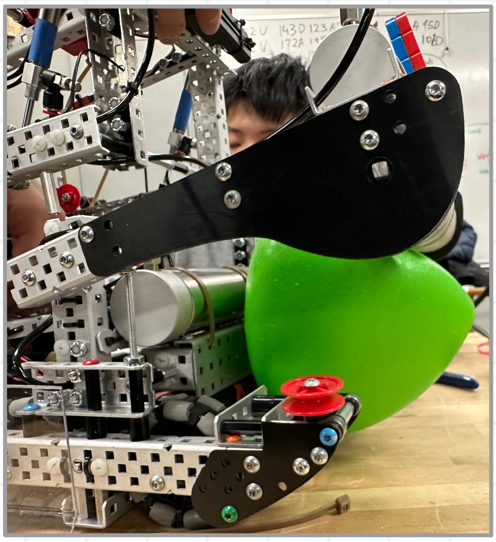
We found that even though we had little practice match loading we were able to match load over the blocker and achieve significantly better grouping

INTAKE

Procedure

I. Place robot on field
II. Place triball in the middle of the field
III. Drive robot forward and intake triball

This was a success and we found that we had way better grip than previously

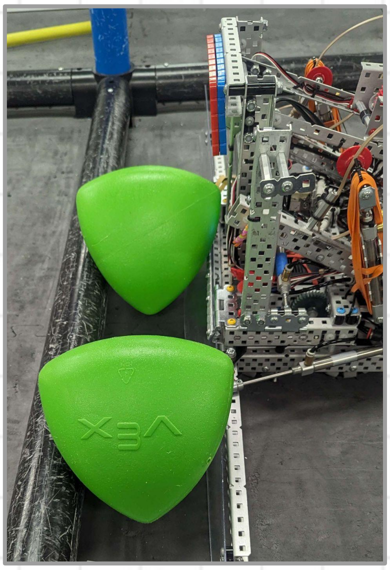


DATE: 12/01/2023 DESIGNED BY: RL WITNESSED BY: TC

WINGS AND WEDGE - PUSHING OVER BARRIER

Procedure

I. Place robot on field 1 tile away from middle barrier
II. Place triballs in front of the robot
III. Drive robot forward with open wings and intake triball

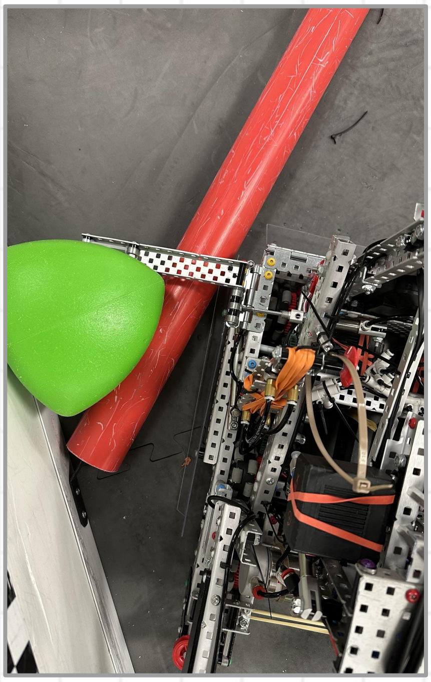


This was a success. Triballs easily went over the middle barrier

BLOOPER

Procedure

I. Place robot on with the blooper out
II. Drive forwards and turn



We will be checking if the triball gets out of the matchload zone. After 10 tries, we were able to get the triball out of the matchload zone successfully each time. This means that if we successfully code a close side auto, we will be abe to get AWP every time.

All our mechanisms match our initial goals and we look forward to coding the robot!

DATE: 12/01/2023 DESIGNED BY: RL WITNESSED BY: TC

Planning for Week 3

Goal

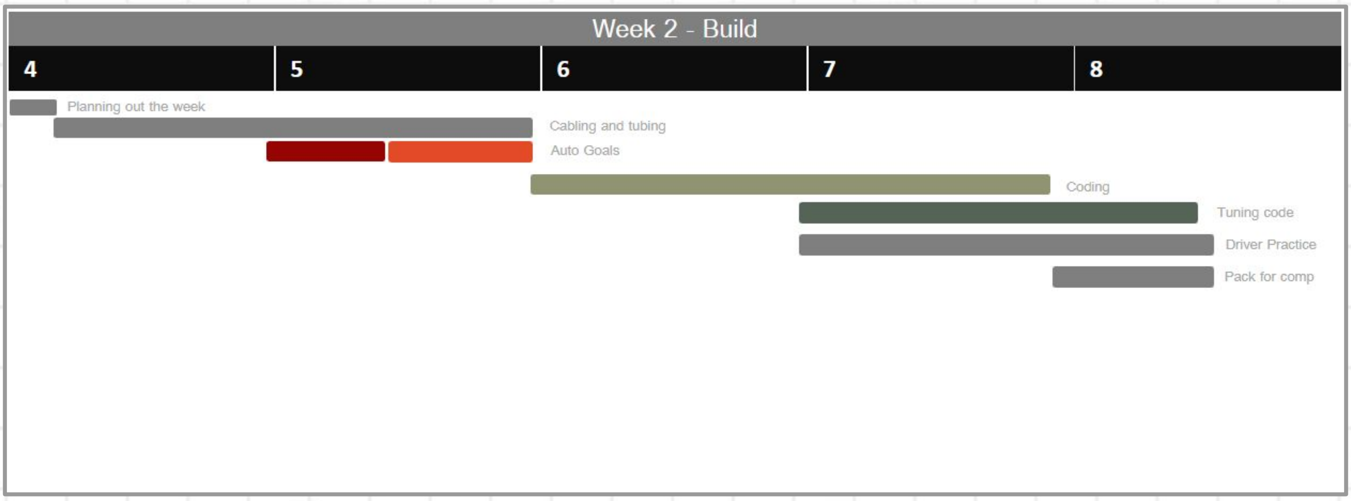
Organizing our time in order to efficiently make use of it and complete the rebuild

PLAN

Week 2 has passed and we've successfully followed our plan:

- Week 1 → Design and Cad ✔
- Week 2 → Build ✔
- Week 3 → Code and practice

Here is a Gantt chart showing a detailed plan of week 3



We've decided to color code the process we will follow with the design process of the mechanism, that also is shown on the sides of the notebook.

🟥 Identify Problem 🟥 Set Specific Reqs 🟧 Research 🟨 Select solution

🟩 Develop solution 🟩 Testing solution

We will follow this schedule to our best and achieve a complete tournament ready robot by the end of the week!

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

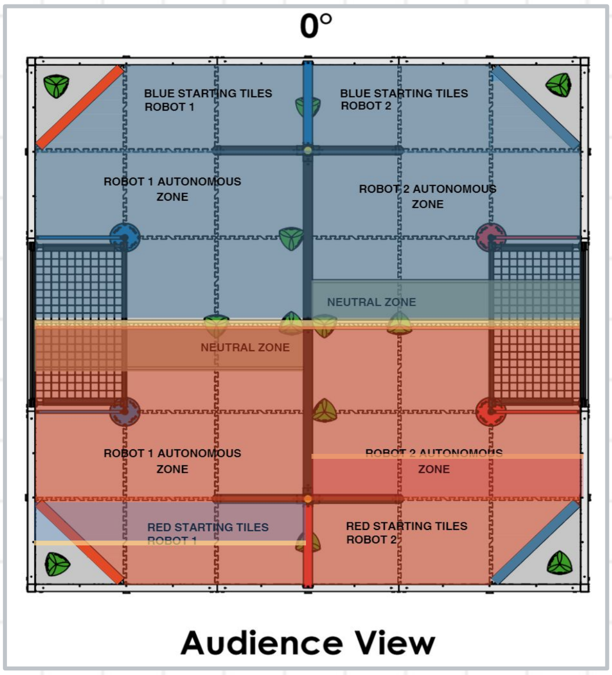
DATE: 12/04/2023 DESIGNED BY: RL WITNESSED BY: TC

GAME AUTO

Goal

Making game autos

Game Autonomous Period Review



KEY

- 🟨 Autonomous line
- 🟪 Neutral zone
- 🟦 Red alliance starting tiles and autonomous zones
- 🟥 Blue alliance starting tiles and autonomous zones

THERE ARE 3 MAIN GOALS WHEN CREATING A CLOSE SIDE AUTO:

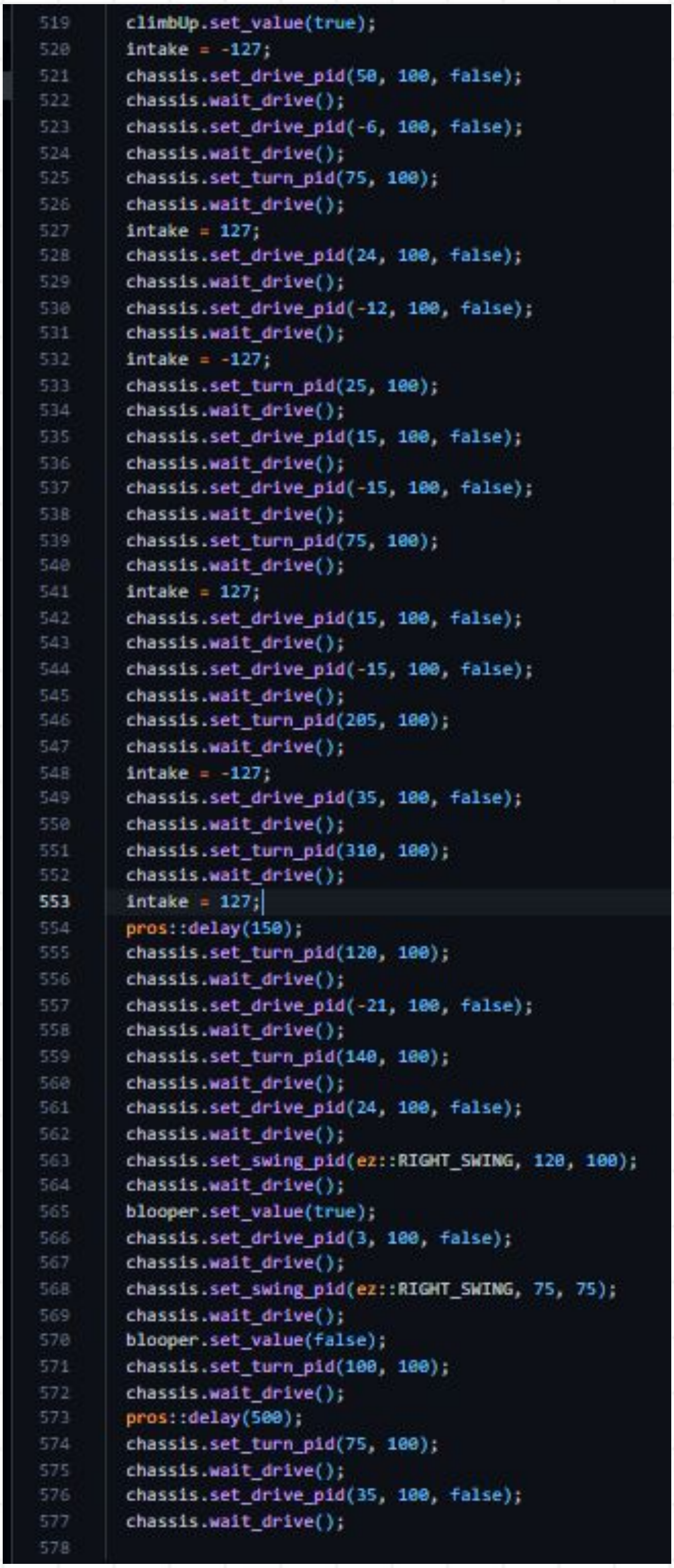
- Consistently remove triball from match load zone (vital for AWP)
- Score as many points as possible.
- Prevent the scoring of opponent triballs (useful for winning autos, but does not take priority over AWP)

THERE IS 1 GOAL FOR A FAR SIDE AUTO

- Score as many points as possible

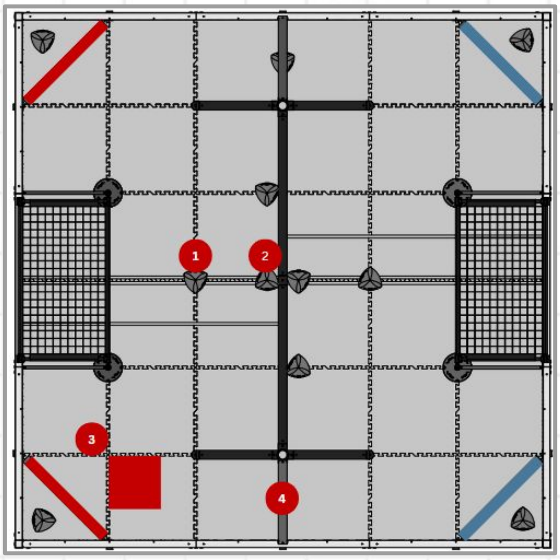
DATE: 12/05/2023 DESIGNED BY: RL WITNESSED BY: TC

CLOSE SIDE RUSH - AWP



```
climbUp.set_value(true);
intake = -127;
chassis.set_drive_pid(50, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-6, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(75, 100);
chassis.wait_drive();
intake = 127;
chassis.set_drive_pid(24, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-12, 100, false);
chassis.wait_drive();
intake = -127;
chassis.set_turn_pid(25, 100);
chassis.wait_drive();
chassis.set_drive_pid(15, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-15, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(75, 100);
chassis.wait_drive();
intake = 127;
chassis.set_drive_pid(15, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-15, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(205, 100);
chassis.wait_drive();
intake = -127;
chassis.set_drive_pid(35, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(310, 100);
chassis.wait_drive();
intake = 127;
pros::delay(150);
chassis.set_turn_pid(120, 100);
chassis.wait_drive();
chassis.set_drive_pid(-21, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(140, 100);
chassis.wait_drive();
chassis.set_drive_pid(24, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, 120, 100);
chassis.wait_drive();
blooper.set_value(true);
chassis.set_drive_pid(3, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, 75, 75);
chassis.wait_drive();
blooper.set_value(false);
chassis.set_turn_pid(100, 100);
chassis.wait_drive();
pros::delay(500);
chassis.set_turn_pid(75, 100);
chassis.wait_drive();
chassis.set_drive_pid(35, 100, false);
chassis.wait_drive();
```

It is essentially the same program but on the defensive side, with the added bonus of removing a match load triball for AWP. This is useful in qualification matches where we know the opponent will not go to for the middle (or else we risk interaction that may affect AWP), and is also useful for elimination matches where we WANT to interfere with offensive side.

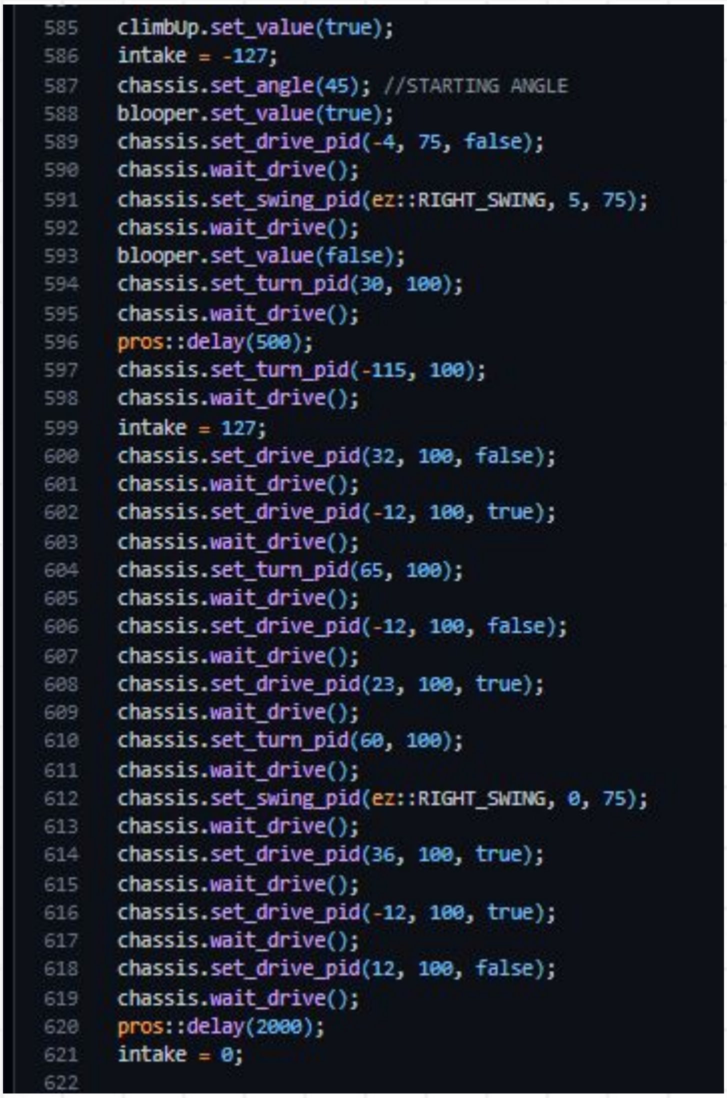


We rush to the middle and grab the closest triball and push it over to the far side(1). Then, it will grab the second ball and push it over as well(2).
After we secure the middle two balls, we will then go to score the preload(3). We ensure we push from the BACK in order to not go into the opponent net (violation that results in immediate autonomous loss + no AWP). Then, we remove the tribal from the match load zone, and go touch the barrier(4). There is also the bonus of scoring the neutral triballs.

Overall, this auto is good for 90% of qualification games where we know the opponent will not interfere with the autonomous routine.

DATE: 12/07/2023 DESIGNED BY: RL WITNESSED BY: TC

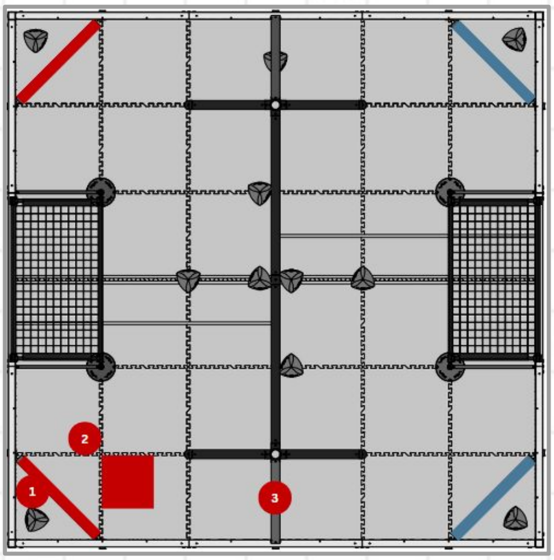
CLOSE SIDE SAFE - AWP



```
climbUp.set_value(true);
intake = -127;
chassis.set_angle(45); //STARTING ANGLE
blooper.set_value(true);
chassis.set_drive_pid(-4, 75, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, 5, 75);
chassis.wait_drive();
blooper.set_value(false);
chassis.set_turn_pid(30, 100);
chassis.wait_drive();
pros::delay(500);
chassis.set_turn_pid(-115, 100);
chassis.wait_drive();
intake = 127;
chassis.set_drive_pid(32, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(-12, 100, true);
chassis.wait_drive();
chassis.set_turn_pid(65, 100);
chassis.wait_drive();
chassis.set_drive_pid(-12, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(23, 100, true);
chassis.wait_drive();
chassis.set_turn_pid(60, 100);
chassis.wait_drive();
chassis.set_swing_pid(ez::RIGHT_SWING, 0, 75);
chassis.wait_drive();
chassis.set_drive_pid(36, 100, true);
chassis.wait_drive();
chassis.set_drive_pid(-12, 100, true);
chassis.wait_drive();
chassis.set_drive_pid(12, 100, false);
chassis.wait_drive();
pros::delay(2000);
intake = 0;

```

In this route, the robot does not stray away from safe zones, where we can dedicate all our time to playing it safe and ensuring the match load triball is removed. This program should be ran when we know there will be interference in a qualification match that has a probability of interfering with AWP triball removal

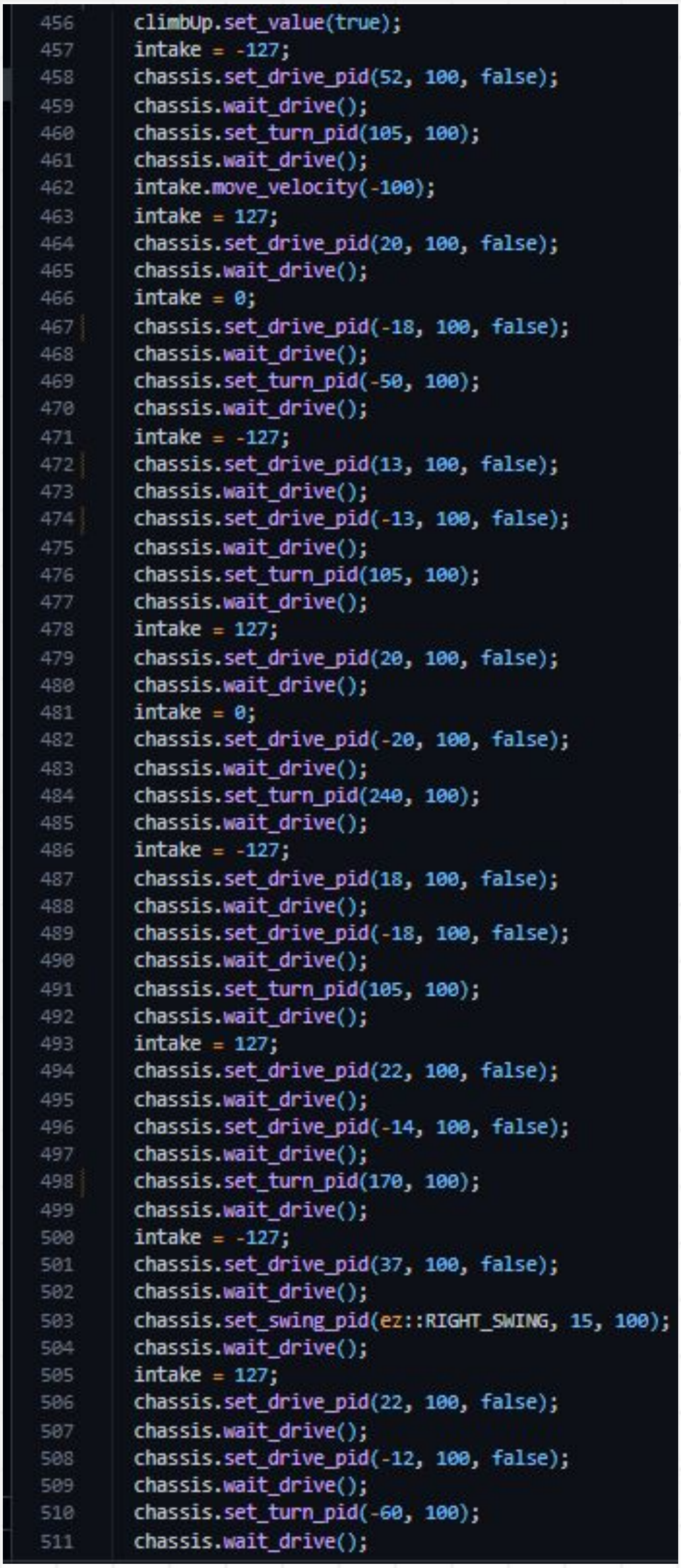


It is essentially the same program as the previous but on the defensive side, with the added bonus of removing a match load triball for AWP. This is useful in qualification matches where we know the opponent will not go to for the middle (or else we risk interaction that may affect AWP), and is also useful for elimination matches where we WANT to interfere with offensive side.

We first push the preload into the goal(1), then we turn and take the matchload our of the zone(2), getting us AWP. Finally we touch the bar(3).

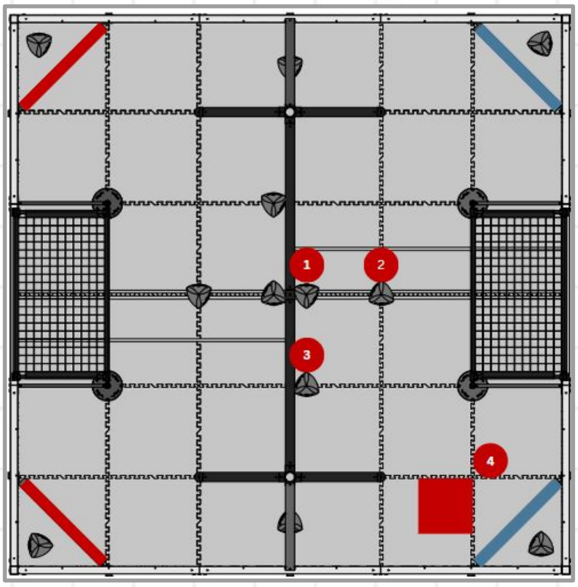
DATE: 12/07/2023 DESIGNED BY: RL WITNESSED BY: TC

FAR SIDE RUSH - AWP



```
    climbUp.set_value(true);
    intake = -127;
    chassis.set_drive_pid(52, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(105, 100);
    chassis.wait_drive();
    intake.move_velocity(-100);
    intake = 127;
    chassis.set_drive_pid(20, 100, false);
    chassis.wait_drive();
    intake = 0;
    chassis.set_drive_pid(-18, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(-50, 100);
    chassis.wait_drive();
    intake = -127;
    chassis.set_drive_pid(13, 100, false);
    chassis.wait_drive();
    chassis.set_drive_pid(-13, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(105, 100);
    chassis.wait_drive();
    intake = 127;
    chassis.set_drive_pid(20, 100, false);
    chassis.wait_drive();
    intake = 0;
    chassis.set_drive_pid(-20, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(240, 100);
    chassis.wait_drive();
    intake = -127;
    chassis.set_drive_pid(18, 100, false);
    chassis.wait_drive();
    chassis.set_drive_pid(-18, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(105, 100);
    chassis.wait_drive();
    intake = 127;
    chassis.set_drive_pid(22, 100, false);
    chassis.wait_drive();
    chassis.set_drive_pid(-14, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(170, 100);
    chassis.wait_drive();
    intake = -127;
    chassis.set_drive_pid(37, 100, false);
    chassis.wait_drive();
    chassis.set_swing_pid(ez::RIGHT_SWING, 15, 100);
    chassis.wait_drive();
    intake = 127;
    chassis.set_drive_pid(22, 100, false);
    chassis.wait_drive();
    chassis.set_drive_pid(-12, 100, false);
    chassis.wait_drive();
    chassis.set_turn_pid(-60, 100);
    chassis.wait_drive();
```

This is created with the primary goal of WINNING autonomous as well as removing matchload triball. It is useful for qualification matches where we know there will not be interference (so triball removal will work) as well as all elimination matches



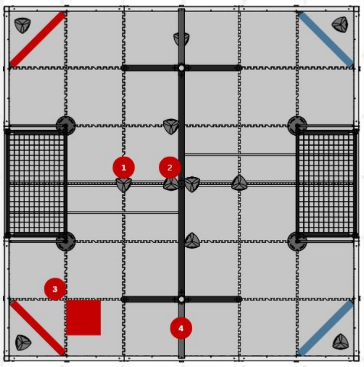
Far side rush immediate sprints to the middle of the field in order to grab the first triball to score (1). The two balls are essentially a race between red and blue, so it is vital that we snatch the balls up before the other team can grab them.

After grabbing the middle-most ball(1), the robot will score it in the net. Following this, it will go for the second ball to score it too(2). Then, it will go for the ball on offensive side that cannot be touched by opponents(3), then score it. Finally, it will score the preload(4). This autonomous is extremely consistent and effective in both elims and quals.

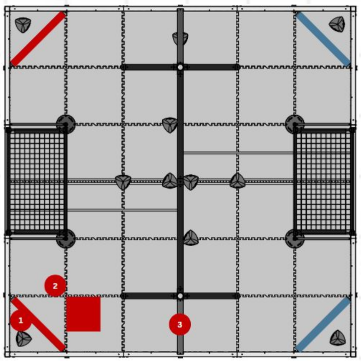
DATE: 12/07/2023 DESIGNED BY: RL WITNESSED BY: TC

OVERVIEW

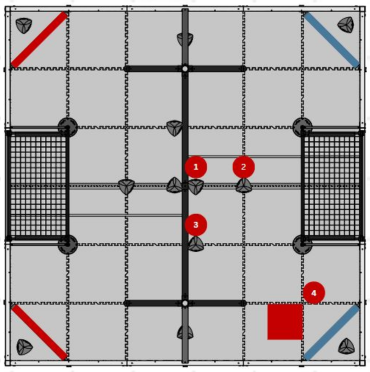
Close side rush



Close side safe



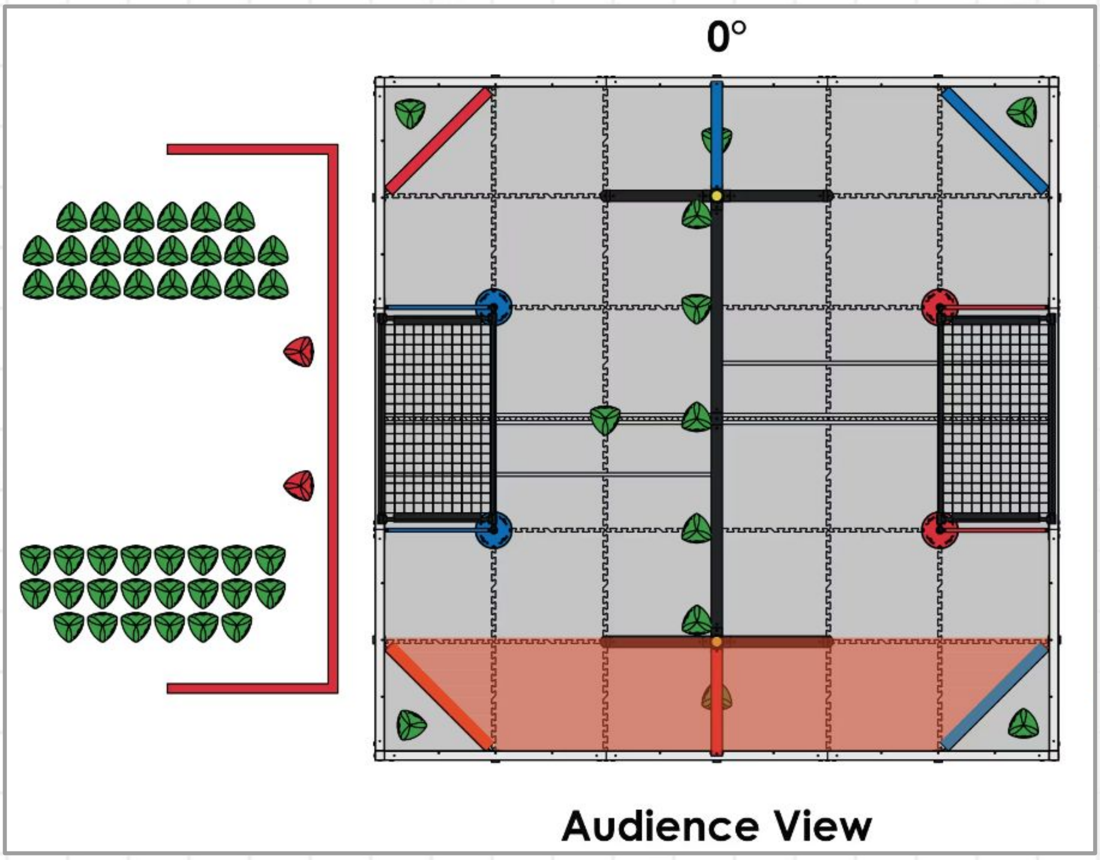
Far side rush



Goal

Making skills auto

SKILLS FIELD OVERVIEW



KEY

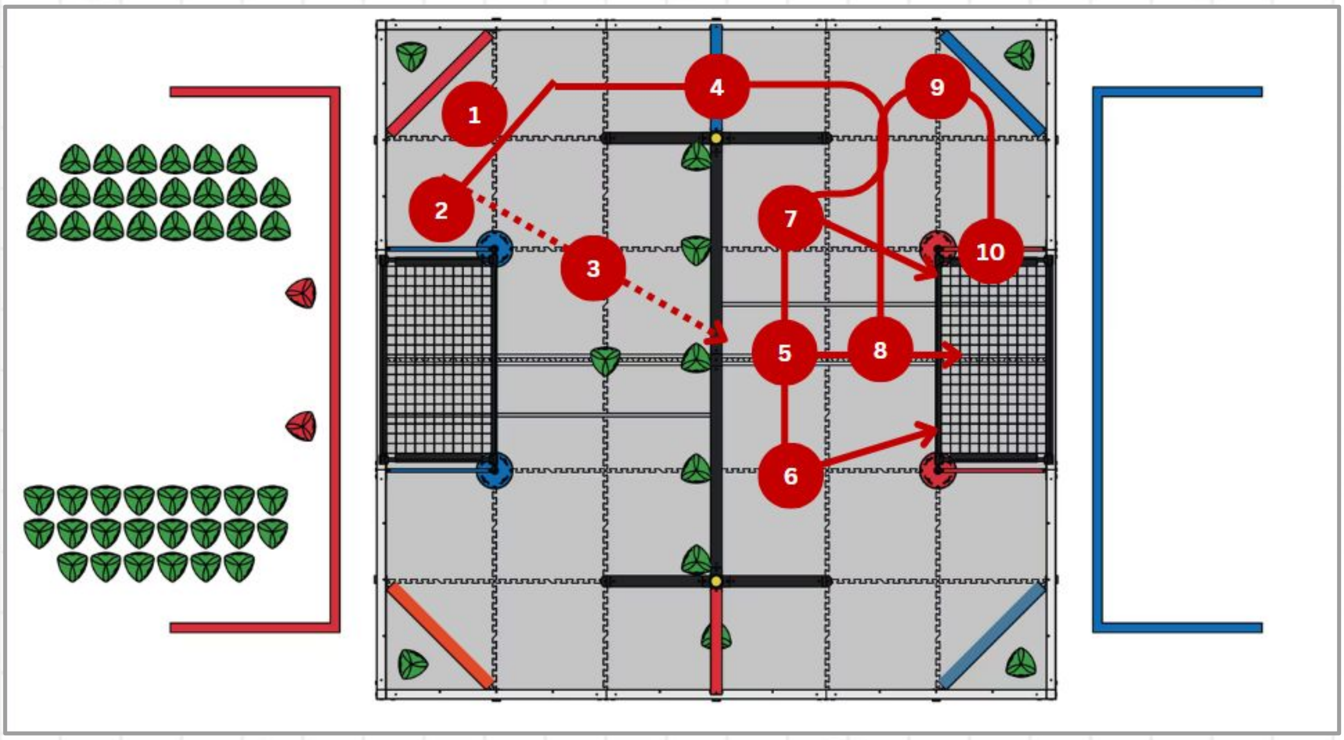
🟥 starting tiles

THERE IS ONE GOAL FOR SKILLS AUTO

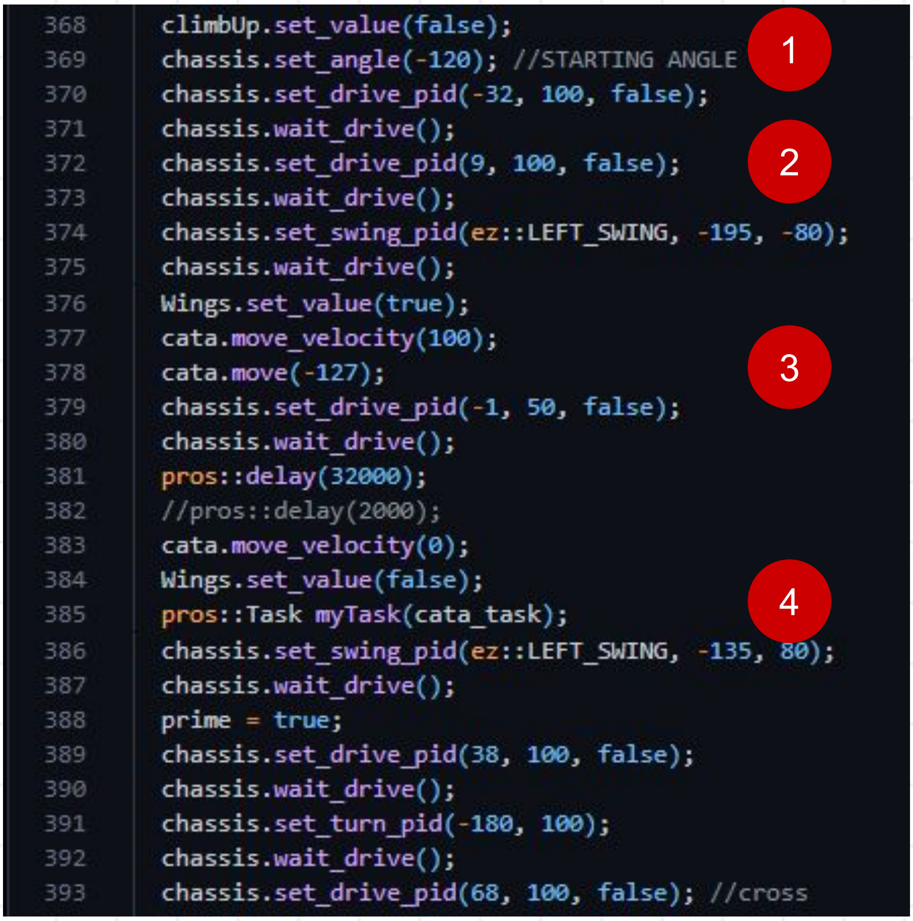
- Score as many points as possible

DATE: 12/07/2023 DESIGNED BY: RL WITNESSED BY: TC

SKILLS AUTO



This is a visual representation of our skills route.



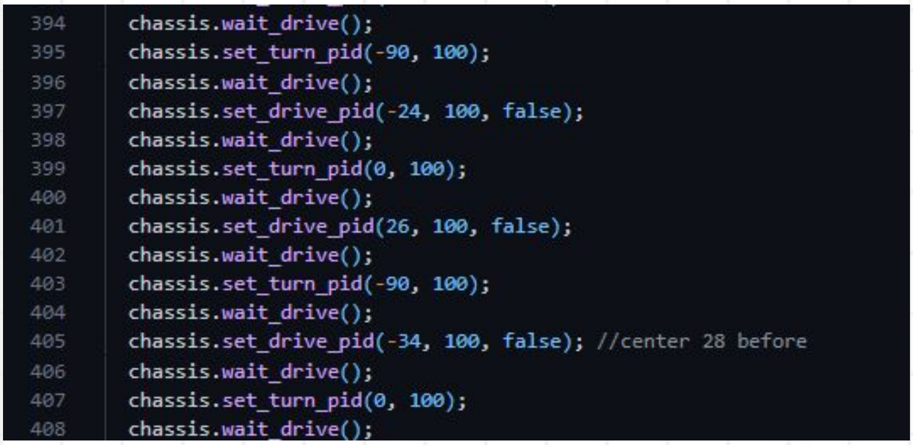
```
climbUp.set_value(false);
chassis.set_angle(-120); //STARTING ANGLE
chassis.set_drive_pid(-32, 100, false);
chassis.wait_drive();
chassis.set_drive_pid(9, 100, false);
chassis.wait_drive();
chassis.set_swing_pid(ez::LEFT_SWING, -195, -80);
chassis.wait_drive();
Wings.set_value(true);
cata.move_velocity(100);
cata.move(-127);
chassis.set_drive_pid(-1, 50, false);
chassis.wait_drive();
pros::delay(32000);
//pros::delay(2000);
cata.move_velocity(0);
Wings.set_value(false);
pros::Task myTask(cata_task);
chassis.set_swing_pid(ez::LEFT_SWING, -135, 80);
chassis.wait_drive();
prime = true;
chassis.set_drive_pid(38, 100, false);
chassis.wait_drive();
chassis.set_turn_pid(-180, 100);
chassis.wait_drive();
chassis.set_drive_pid(68, 100, false); //cross
```

We start by placing our robot in position (1) , the second the run commences we immidiately push our colored preload into the goal then set up for matchloading by angling ourselves and opening our wings to maintain contact with the match load bar (2).

Our next step is to matchload, here we cycle run our shooting mech for 30 seconds, this will allow us to matchload all our triblalls over the barrier, it will account for us missing around 2 triballs due to lack of practice(3).

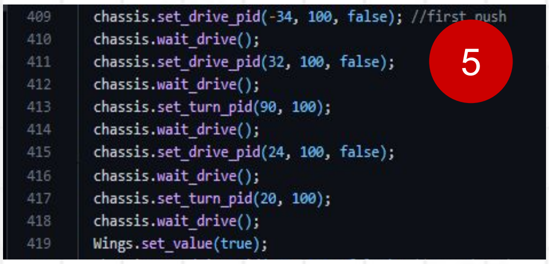
After matchloading is over we proceed cross into the offensive zone (4)

DATE: 12/08/2023 DESIGNED BY: RL WITNESSED BY: TC



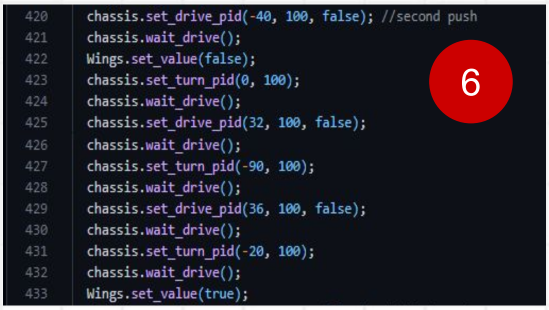
```
  chassis.wait_drive();
  chassis.set_turn_pid(-90, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(-24, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(0, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(26, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(-90, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(-34, 100, false); //center 28 before
  chassis.wait_drive();
  chassis.set_turn_pid(0, 100);
  chassis.wait_drive();
```

This is a continuation of (4). We then drive to the centre of the field, sticking close to the middle barrier. This allows us minimal interference with the matchloaded triballs, thus allowing us to score more of them into the goal



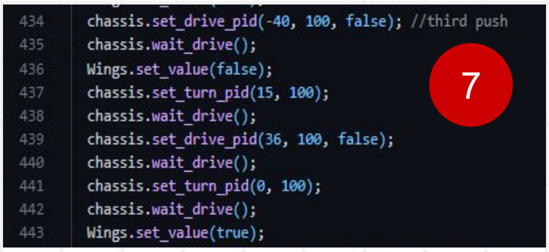
```
  chassis.set_drive_pid(-34, 100, false); //first push
  chassis.wait_drive();
  chassis.set_drive_pid(32, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(90, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(24, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(20, 100);
  chassis.wait_drive();
  Wings.set_value(true);
```

Push 1 (5)
Our first push is from the middle where we do not open our wings, this way we don't risk the chance of pushing triballs away from the net as we have a smaller area of contact.



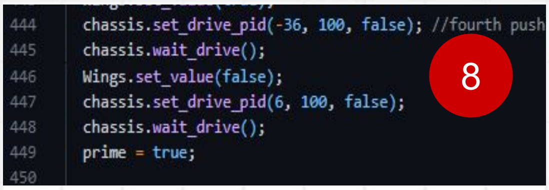
```
  chassis.set_drive_pid(-40, 100, false); //second push
  chassis.wait_drive();
  Wings.set_value(false);
  chassis.set_turn_pid(0, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(32, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(-90, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(36, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(-20, 100);
  chassis.wait_drive();
  Wings.set_value(true);
```

Push 2 (6)
Our second push is from the aide the furthest away from the red elevation bar. As we hope our matchloads to stay within this section. We Drive back to the initial position of the first push(5) drive onwards a tile, angle ourselves and then with open wings, we push the triballs into the goal.



```
  chassis.set_drive_pid(-40, 100, false); //third push
  chassis.wait_drive();
  Wings.set_value(false);
  chassis.set_turn_pid(15, 100);
  chassis.wait_drive();
  chassis.set_drive_pid(36, 100, false);
  chassis.wait_drive();
  chassis.set_turn_pid(0, 100);
  chassis.wait_drive();
  Wings.set_value(true);
```

Push 3 (7)
This push is essentially a mirrored version of push 2 (6). We drive back to the initial position of the first push(5) pass that point then we turn, angle and push with open wings. These 3 pushes should allow us to clear majority of the triballs located in the centre.



```
  chassis.set_drive_pid(-36, 100, false); //fourth push
  chassis.wait_drive();
  Wings.set_value(false);
  chassis.set_drive_pid(6, 100, false);
  chassis.wait_drive();
  prime = true;
```

Push 4 (8)
For one final assurance that all triballs located there are clear, we once again drive to to the initial position of the first push(5) and do one final push with wings open

Finally, we drive to the edge of the blue matchload bar and angle ourselves towards the side of the red goal(9). We then proceed to give one final push without wings, clearing the triballs stuck in the corner and scoring them into the goal(10)

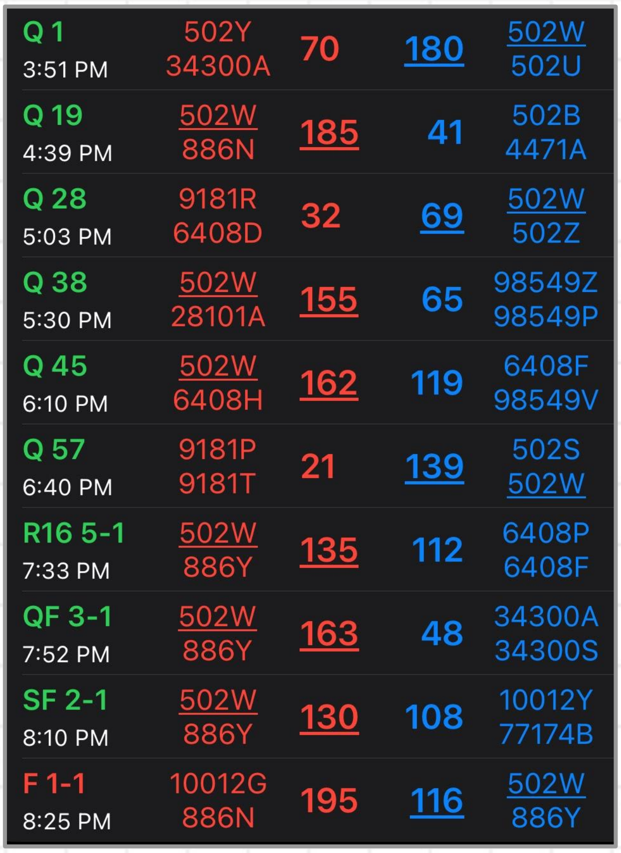
DATE: 12/08/2023 DESIGNED BY: RL WITNESSED BY: TC

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Goal

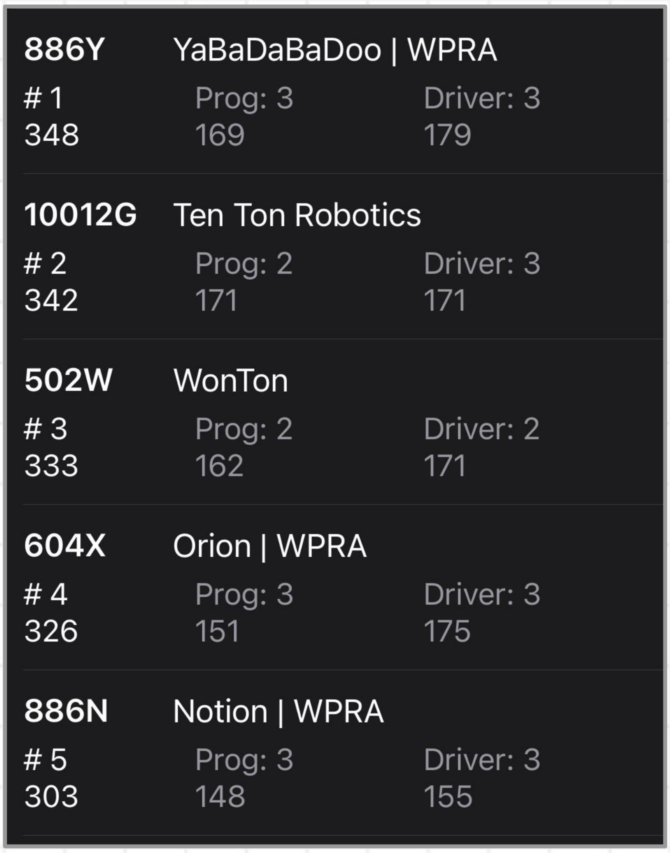
Going over our first comp with our new rebuilt robot

MATCHES



Q 1 3:51 PM	502Y 34300A	70	180	502W 502U
Q 19 4:39 PM	502W 886N	185	41	502B 4471A
Q 28 5:03 PM	9181R 6408D	32	69	502W 502Z
Q 38 5:30 PM	502W 28101A	155	65	98549Z 98549P
Q 45 6:10 PM	502W 6408H	162	119	6408F 98549V
Q 57 6:40 PM	9181P 9181T	21	139	502S 502W
R16 5-1 7:33 PM	502W 886Y	135	112	6408P 6408F
QF 3-1 7:52 PM	502W 886Y	163	48	34300A 34300S
SF 2-1 8:10 PM	502W 886Y	130	108	10012Y 77174B
F 1-1 8:25 PM	10012G 886N	195	116	502W 886Y

SKILLS



886Y	YaBaDaBaDoo | WPRA	
# 1 348	Prog: 3 169	Driver: 3 179
10012G	Ten Ton Robotics	
# 2 342	Prog: 2 171	Driver: 3 171
502W	WonTon	
# 3 333	Prog: 2 162	Driver: 2 171
604X	Orion | WPRA	
# 4 326	Prog: 3 151	Driver: 3 175
886N	Notion | WPRA	
# 5 303	Prog: 3 148	Driver: 3 155

Overall, we were quite successful in qualifications, winning all 6 matches, finishing in 2nd seed. We lost finals by 79 points.

Despite not practicing skills, we managed to do quite well, securing 3rd place.

RANKING

2	502W	WonTon	6-0-0	15 / 28 / 348

AWARDS

We won 2 awards this competition, the first being tournament finalists and the second being the design award

DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Going over our skills runs and matches

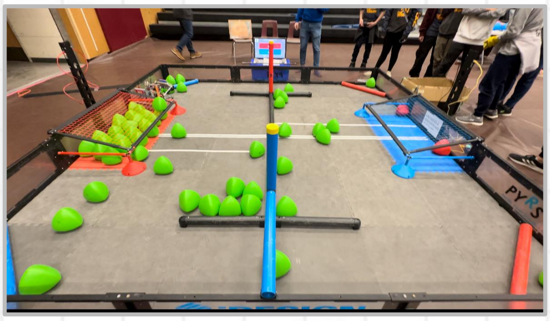
PROGRAMMING - I

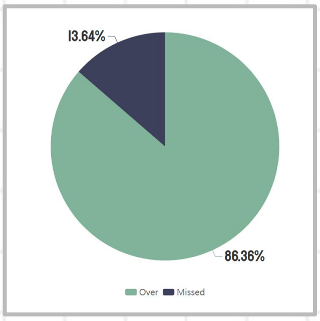
Total score: 155

Triballs in goal: 25

Triballs in offensive zone: 15

Elevation tier: none





We noted that the slapper was not strong enough, it seemed that its strength got worse than previously when testing. The strength got weaker the more we matchloaded. We missed 6 of our 44 matchloads(13.61%). We successfully scored the two preloads into the blue goal. Our first 3 pushes were successful, but when we tried to push the triballs from the top left corner of the image into the sides of the goal (4th push of the code, our robot completely missed them. It was found after this round that the surgical tubing on one side of the slapper slipped off, which potentially was a major contributing factor in causing the issue of low slapper strength.

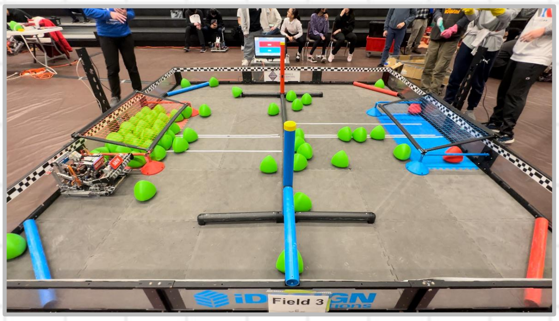
DRIVER - I

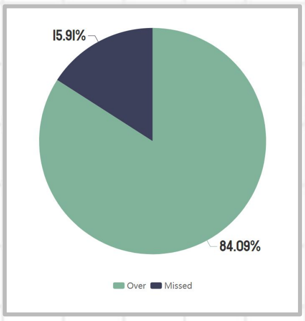
Total score: 171

Triballs in goal: 31

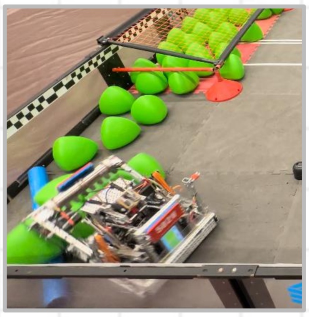
Triballs in offensive zone: 8

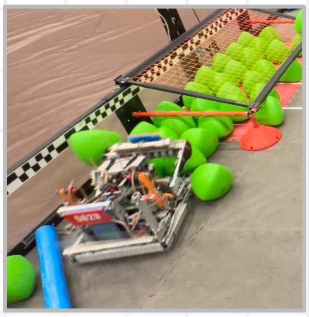
Elevation tier: none





The slapper was still not strong enough, even though we put the surgical tubing back on. We figured that we might just need to tighten the tubing after this driver skills run. Due to a combination of lack of slapper strength and human error, the triballs would bounce off the middle barrier. This caused us to miss 7 of our 44 matchloads(15.91%). Otherwise, we were successful in scoring the majority of triballs into the goal, successfully clearing the corner.





At 8 seconds remaining, we decided to push triballs into the sides of the goal (which took 3 tries total). An improvement to the efficiency was if we were to push from the back. This would allow us to have a greater surface area contacting the triballs. We could also push slower as there could be a possibility of preventing The triball from entering a matchload zone.

DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

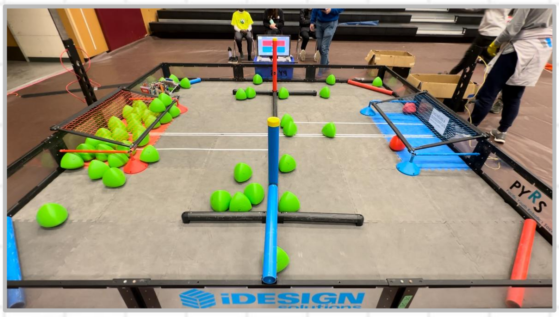
PROGRAMMING - 2

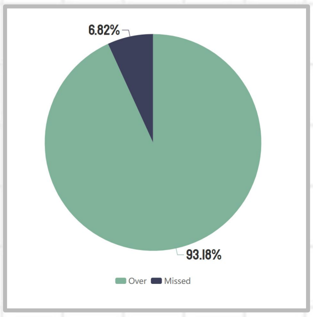
Total score: 162

Triballs in goal: 26

Triballs in offensive zone: 16

Elevation tier: none





After tightening the latex tubing, the strength got a lot better. The only misses were due to human error, which was 3 triballs (6.82%). This time, our pushes weren't nearly as good as the ones in our previous round. While pushing the triballs into the front of the goal, the robot knocked other triballs away, this is very hard to prevent as well as chance based. This time we managed to successfully clear the top left corner and score them into the goal. Overall, this significantly improved from our previous run.

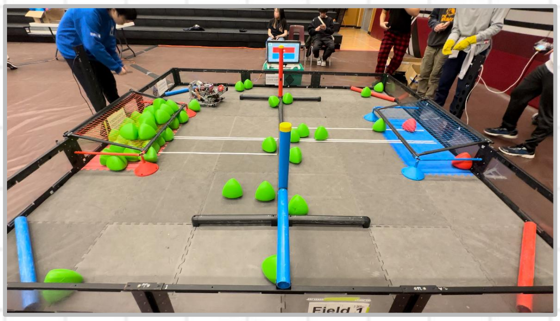
DRIVER - 2

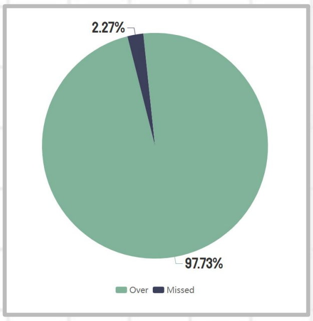
Total score: 171

Triballs in goal: 31

Triballs in offensive zone: 8

Elevation tier: none





Our second run of driver skills resulted in the exact same score as our previous. After tuning the slapper a bit more, its strength improved significantly. During this run, we only missed 1 triball when matchloading (2.2%). Though, 9 triballs landed on top of the goal, causing us to lose valuable points. We managed to score majority of our triballs into the goal. Overall this was a very successful driver run other than the fact that triballs were stuck on top of the goal.

SUMMARY

It's concluded that the shooter requires a lot of tuning in order for us to max out our skills score. We've gotten good driver runs despite the lack of practice as well as good matchloading. We've improves significantly through doing skills during this competition in both matchloading and driving. Furthermore, we also managed to achieve our highest combined skills score of 333 points.

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

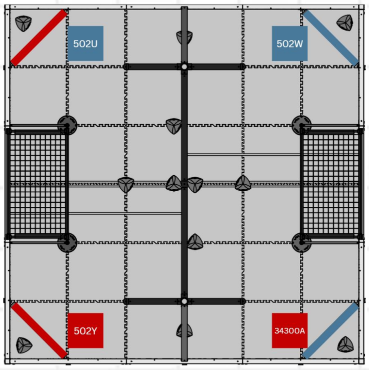
DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

QUALIFIER # 1: 502Y & 34300A VERSUS 502W & 502U

	Red	Blue
Total score	70	180
AWP		
Autonomous winner		
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	10	24
Triballs in offensive zone	3	3
Elevation tier	N/A	A, A

MATCH RESULT : WON 70 - 180 ; AWP

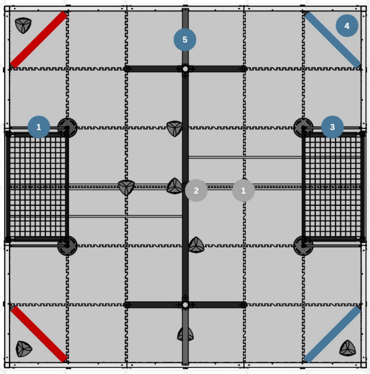
AUTONOMOUS PERIOD



We decided to start on the close side. This is because our alliance did not have a consistent AWP auto. We decided to run close side rush as we hoped to push triballs onto the other side, allowing us to successfully win the autonomous period as well as gain AWP. Our alliance's far side auto consisted of pushing the colored preload into the goal. This way we would take the triball out of our matchload zone as well as touch the bar while 502U scores a colored preload

AUTONOMOUS RESULTS

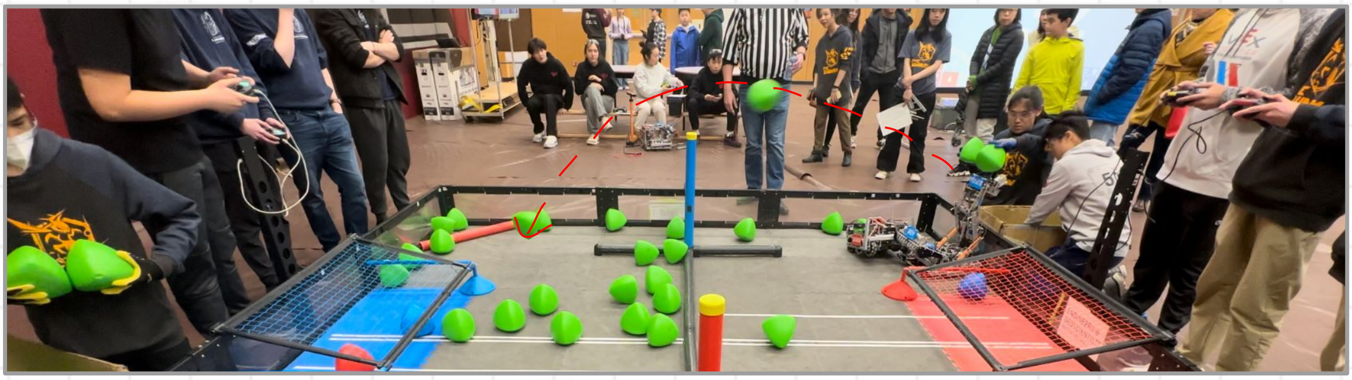
502U succeeded in pushing the preload into the goal, completing their portion of the AWP. During our autonomous, out robot missed the 2 triballs in the middle(1 and 2) which resulted in pushing them across the autonomous line. We managed to push in our preload as well as removing the triball from our match load zone and touching the elevation bar. We received an AWP but due to the 2 triballs not pushed over, we tied for autonomous. A possible reason as to why we missed the first 2 steps was sure to an error in setting up the robot, which resulted in the robot being half an inch too far.



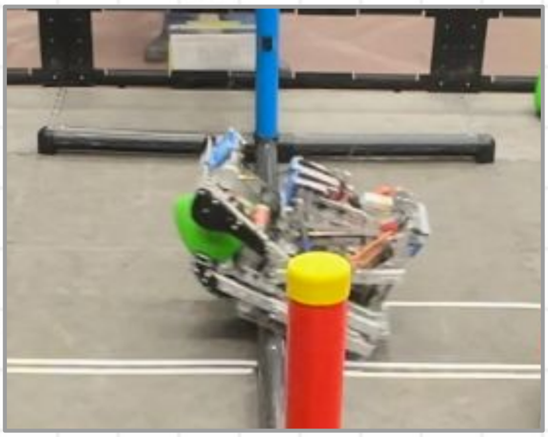
Overall, we did reach our goal of gaining an AWP which allows us to have a higher ranking during qualifications. Although we lost on the chance to be 8 points ahead we still won the match

DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

OBSERVATIONS



Matchloading was a success! We were able to get almost all of our matchloads over with little to no interference from other robots. The hook allowed us to stay stable despite getting pushes, and our height prevented a regular robot(without a blocker) from being able to block our shots. We had a good arc, being able to get our matchloads in the same zone.



SLEDS SUCCESSFUL

Our sleds were successful, allowing us to quickly go across the middle barrier to maximize our scoring efficiency. Along with us fixing our weight division, this allows us to score more triballs in a shorter period of time.

NEW DEFENCE STRATEGY?

While defending us from scoring into our goal, 502Y pushed 3 of our triballs into their matchload zone, preventing us from scoring them. This is a good strategy for us to use in instances when we don't want another team to score yet are unable to push the triballs back to our offensive zone.

DOUBLE CLIMB

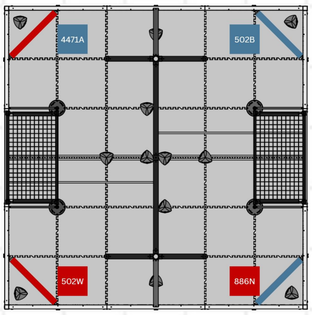
We finished our match with a double climb. Both A tier with us hanging on the elevation bar and 502U balancing on the middle barrier. This allowed us to gain 35 extra points as we were the only robots climbing. This further reiterates our statement that a double climb has the potential to win us a match.

QUALIFIER # 19: 502W & 886N VERSUS 502B & 4471A

	Red	Blue
Total score	185	41
AWP		
Autonomous winner	🟥	
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	29	5
Triballs in offensive zone	1	3
Elevation tier	A	N'A

MATCH RESULT : WON 185 - 41; NO AWP

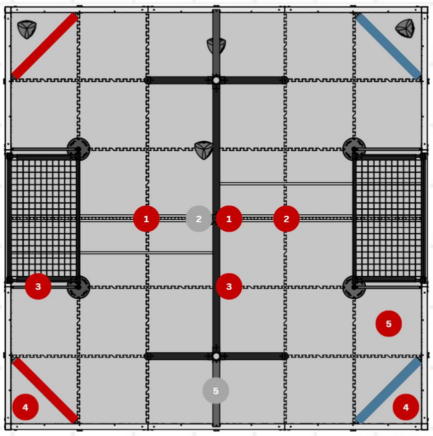
AUTONOMOUS PERIOD

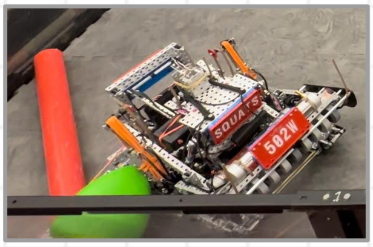


We decided to start on the close side with 886N on the far side. Previously, in the last competition, we allianced with them and won the tournament with the same starting positions as now shown. We ran our close side rush auto, and 886N ran their 5 ball auto. This combination easily would've allowed us to gain both AWP and to easily win the autonomous period.

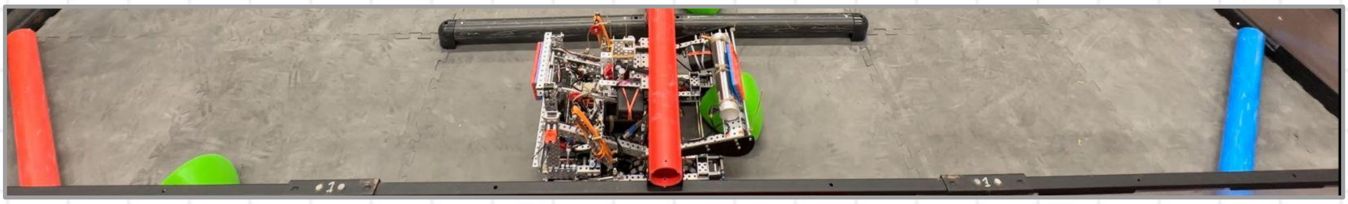
AUTONOMOUS RESULTS

886N'S autonomous program was successful. This match, we were unable to push the second triball to the other side due to the intake slipping on the triball as the triball was slightly too far away from it.



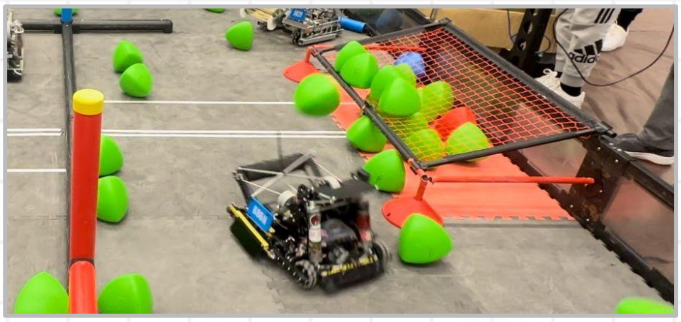


Another issue that occurred was that our hook got caught on the matchload zone displacing our robot which impacted our ability to touch the bar as our robot ended too far away. See image below.



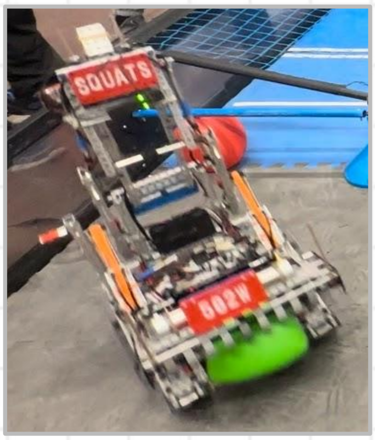
DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

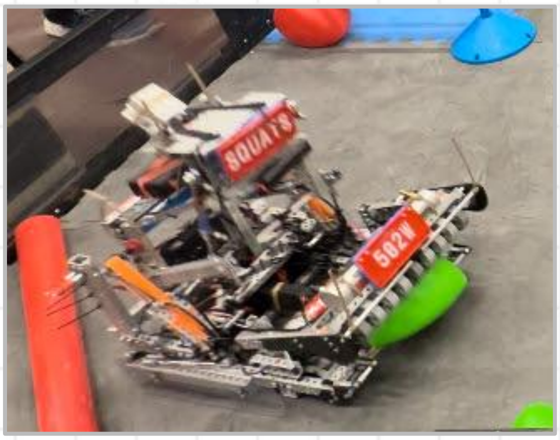
OBSERVATIONS

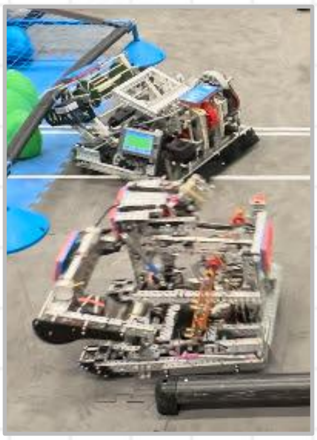


MATCHLOADING SUCCESS

Matchloading was mostly successful. Again, other robots defending us did not impact our matchloading at all. Although we did get 4 triballs on the goal which was also an issue during skills. This tells us that we need to spend more time tuning the mechanism. While we matchloaded, 886N scored the triballs in the goal.

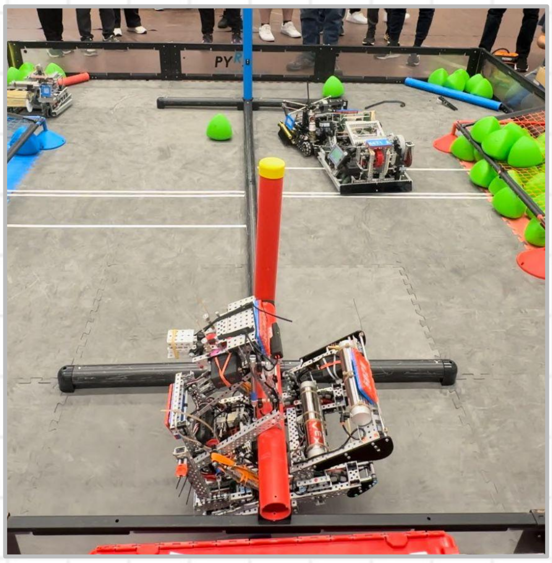


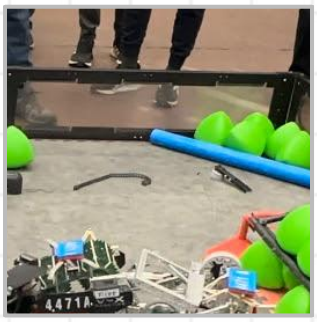




STUCK LIFT

An unusual occurrence happened during the match where we were unable to lower the lift. After matchloading it seemed to be caught and stuck, which hasn't ever happened previously. We attempted to drive back and forth before finally being able to lower it. A possible reason to why it occurred could either be a slight issue with connections or that the lift got stuck on the climb mechanism, preventing it from being lowered. Overall this issue costed us time to defend and score as we spent over 8 seconds trying to lower the mechanism.





DOUBLE CLIMB

We were not able to double climb as 886N's side climb fell off during the match. This was most likely due to rigorous defence where the mechanism made contact with the opposing robot.

We ended as the only robot climbing on the field. Our climb proved to be successful and consistent, allowing us to achieve a B tier climb.

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

TESTING SOLUTION

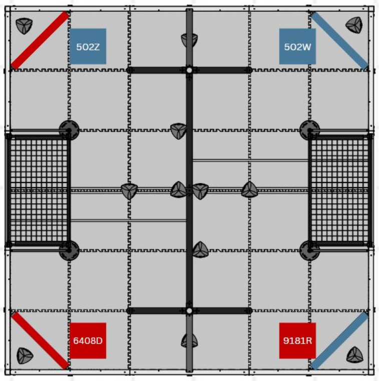
DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

QUALIFIER # 28: 9181R & 6408D VERSUS 502W & 502Z

	Red	Blue
Total score	32	69
AWP		
Autonomous winner	🟥	
Alliance triballs in either goal	1	1
Alliance triballs in either offensive zone	1	1
Triballs in goal	3	10
Triballs in offensive zone	1	6
Elevation tier	N'A	N'A

MATCH RESULT : WON 32 - 69; NO AWP

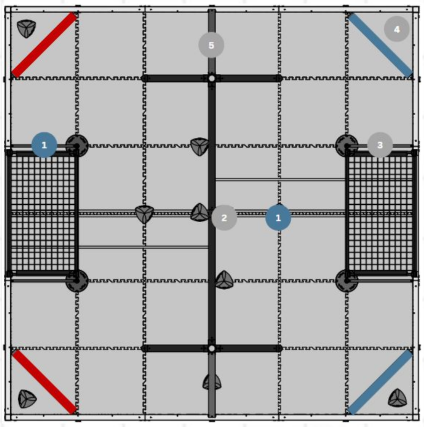
AUTONOMOUS PERIOD



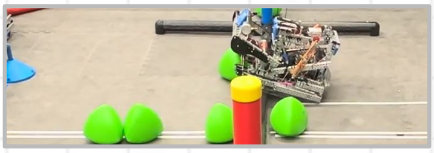
We decided to start on the close side with 502Z on the far side. We decided to run close side rush as we hoped to push triballs onto the other side, allowing us to successfully win the autonomous period as well as gain AWP. Our alliance's far side auto consisted of pushing the colored preload into the goal. This way we would take the triball out of our matchload zone as well as touch the bar while 502Z scores the preload into the goal.

AUTONOMOUS RESULTS

502Z completed their auto with no issue. We managed to push the first triball over the goal before our auto completely went off course due to no obvious reason. While pushing the first triball over the middle barrier, our robot stalled then proceeded to go forwards on top of the bar. Then after dislodging itself from the bar, our robot then missed all the designated steps preventing us from winning the autonomos period as well as gaining an AWP for this match. We ended up scoring 1 less triball than the opposing alliance.

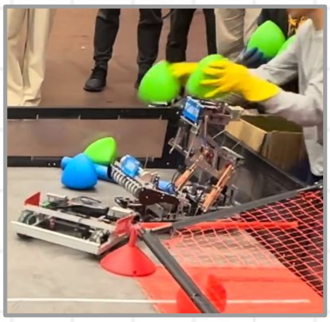


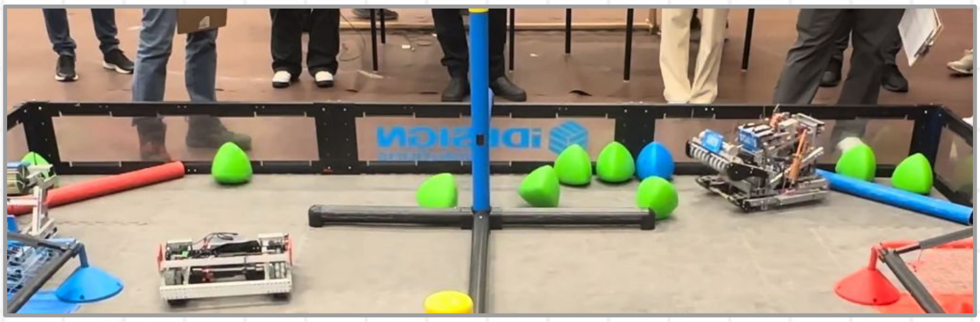
The image to the right shows the robot driving on the middle barrier. The most probable issue for the error is discussed on the next page.



DATE: 12/11/2023 DESIGNED BY: RL WITNESSED BY: TC

OBSERVATIONS

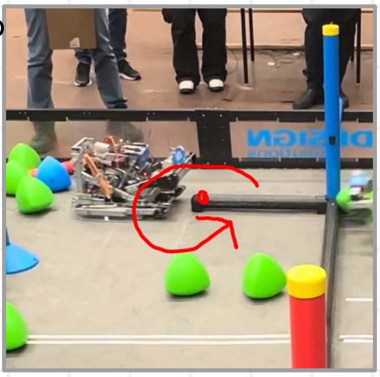




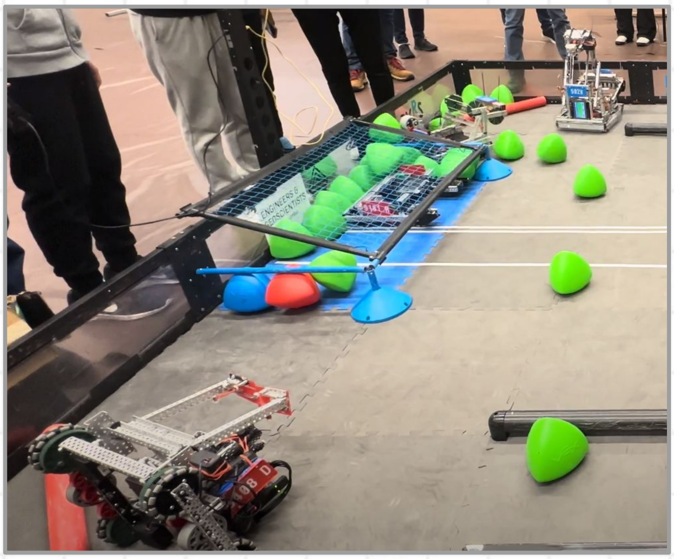
SLAPPER JAMMED

We noted as soon as we got ready to matchload that the slapper mechanism was jammed, this prevented us from matchloading via the elevated shooter at any instance during the match.

DRIVING DIFFICULTY



After realizing the first issue we decided to matchload via the side of the robot, then deciding to drive and score into our goal. As we drove forwards we found that the driving difficulty got increasingly high until the left side of the drivetrain stopped all functions, causing us to rotate around the red dot (as seen on the picture to the right). This prevented us from being any help to winning the match.

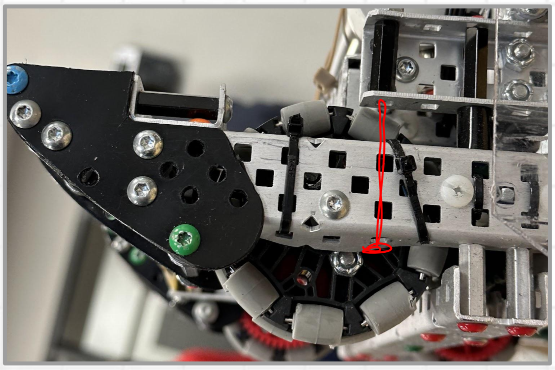


CHANGE IN STRATEGY

502Z had to matchload for themselves via the other matchload zone before scoring all the triballs. Due to the reason that we were stuck in the same zone as 502Z was scoring, this allowed 9181S to descore. The rest of the match consisted of a 1V1 between 9181S and 502Z, as 6408D had flipped over due to 502Z's defence. We had ended up rotating our robot as close to the elevation bar as possible in order to get out of the way. Overall, we won by 37 points thanks to 502Z's efforts.

CAUSE OF ISSUE

We found out that the screw that was boxing the gearbox came loose and fell off, leaving the spacers inside the C-Channel without anything securing them. This caused 2 spacers to be loose and free inside the drivetrain, eventually jamming the gears, causing the left side of the drivetrain to lock and lose function. They also caused the C-Channel to bend while they were jammed. We realized that there was no way to quickly fix the issue without taking apart the drivetrain. Hence, our solution was to zip tie them on.

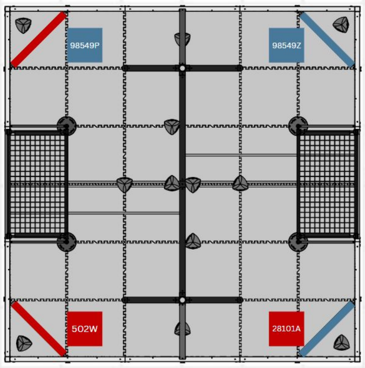


QUALIFIER # 38: 502W & 28101A VERSUS 98549Z &

	Red	Blue
Total score	155	65
AWP		
Autonomous winner		🟦
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	25	6
Triballs in offensive zone	0	1
Elevation tier	B	A

MATCH RESULT : WON 155 - 65; NO AWP

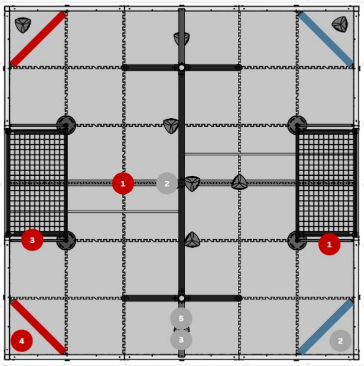
AUTONOMOUS PERIOD

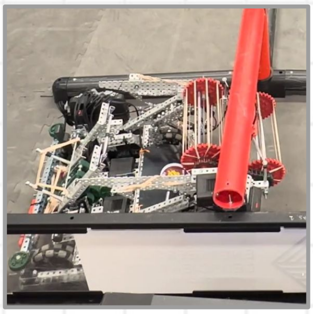


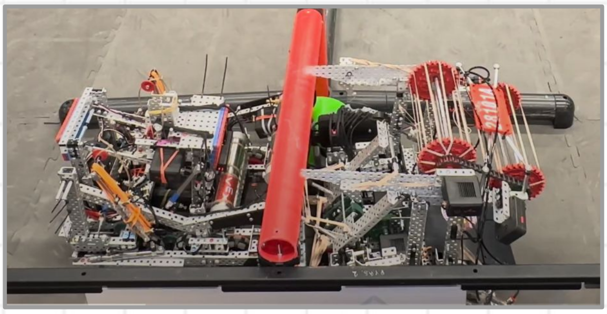
We decided to start on the close side with 28101A on the far side. We decided to run close side rush as we hoped to push triballs onto the other side, allowing us to successfully win the autonomous period as well as gain AWP. We decided to go with this as our auto was more consistent than 28101A's. Their auto consisted of pushing the preload into the goal (completing awp) as well as remove triballs from matchloads zones and finally touching the elevation bar.

AUTONOMOUS RESULTS

We had a bit of miscommunication occur as we were not aware that 28101A went completely under the bar to touch it. The result was being unable to receive an AWP as both of our robot's clashed, resulting in nothing making contact with the bar. This event will serve as a reminder to fully comprehend what our alliance's auto does. This will be especially useful in future matches to prevent this event from occurring

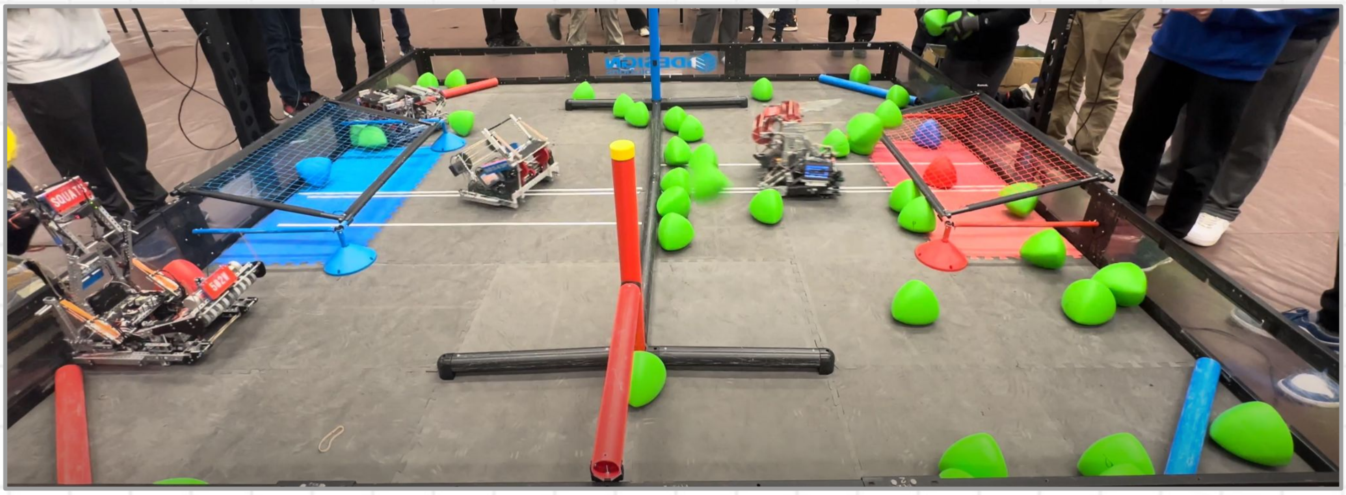






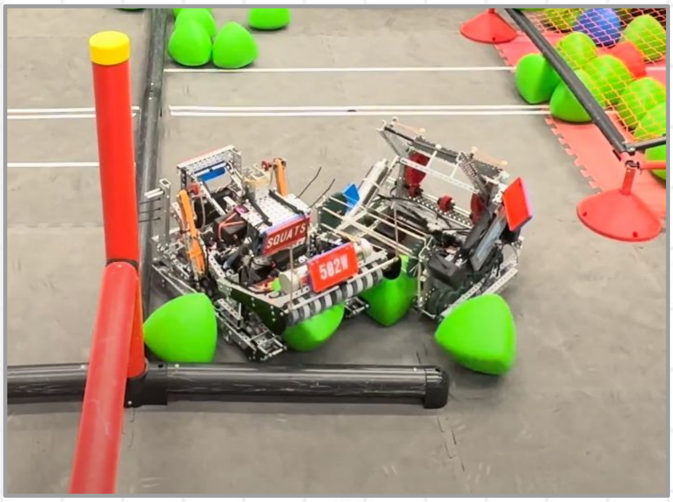
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

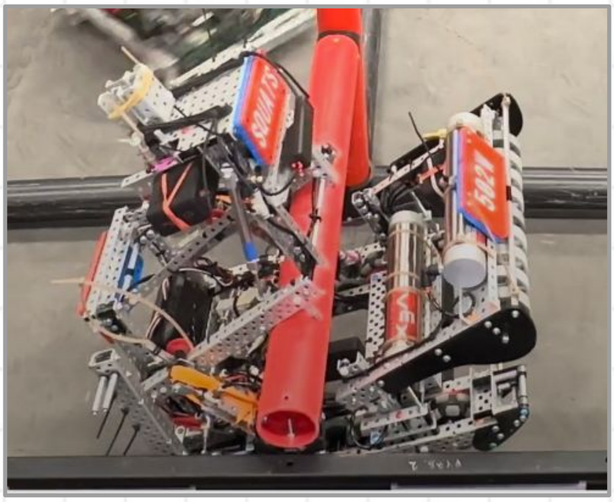
OBSERVATIONS



MATCHLOAD EFFICIENCY

Matchloading was a success and very efficient, We were able to get all of our matchloads over within minimal time. We can note in the image above that as we finished matchloading our opponent alliance barely had any triballs on their side. Due to our high arc and angle we did not miss any of our shots.





INTAKE GRIP

Unlike in previous matches, during this match we were the main scorer while 28101A defended. This is because no robots could descore, allowing us to double zone. As we vigorously scores we were being defended against, we found that the grip on the intake prevented the triballs from slipping out as well as preventing entanglement.

CLIMB

Again, during this match we successfully achieved a B tier climb. Although we weren't the only robot climbing we still had the highest tier, winning us 20 more points. We found that we only needed around 5 seconds to successfully climb.

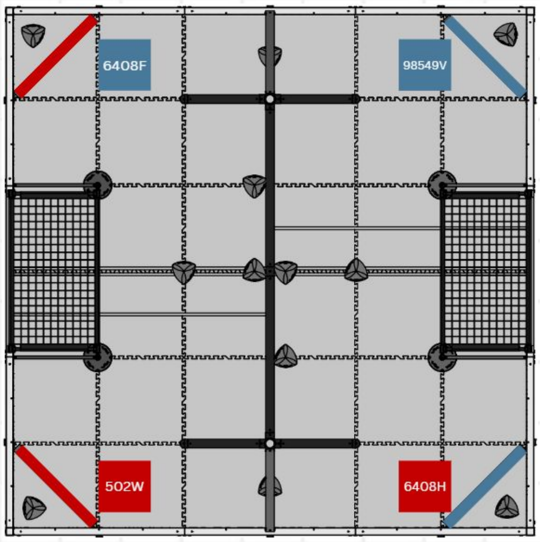
Other than the one miscommunication resulting in a loss of a potential AWP, the rest of the matches went really smoothly allowing us to win the match.

QUALIFIER # 45: 502W & 6408H VERSUS 98549V & 6408F

	Red	Blue
Total score	162	119
AWP	🟥	▨
Autonomous winner	🟥	▨
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	24	18
Triballs in offensive zone	2	2
Elevation tier	B	A

MATCH RESULT : WON 162 - 119 ; AWP

AUTONOMOUS PERIOD

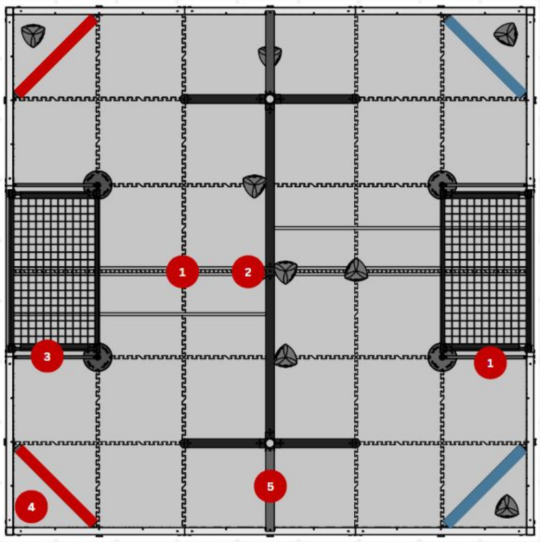


Just like with our previous matches, we ran close side rush with 6408H on the far side pushing 1 preload in the goal, this completes the AWP. We decided to run close side rush as we wish to successfully push triballs onto the other side (our offensive zone), allowing us to successfully win the autonomous period as well as gain AWP.

We had previously allianced before, so we're familiar with each other's autos as well as robot capabilities for game strategy.

AUTONOMOUS RESULTS

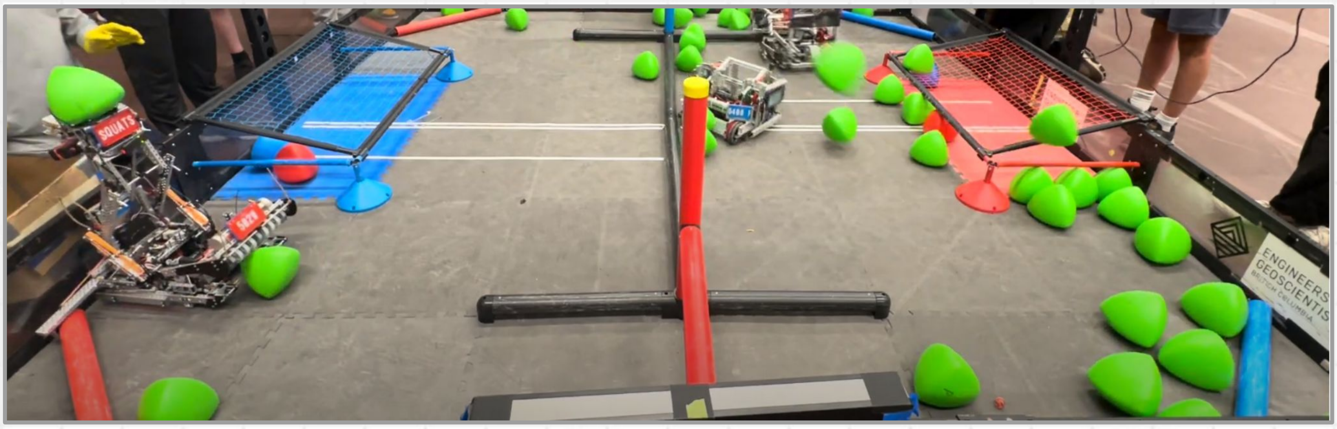
Autonomous was very successful, this was the first round where our autos worked perfectly, with out robot being able to complete all the coded steps. 6408H pushed the preload into the goal as well. This allowed us to gain an AWP, raising our ranking in qualifications as well as winning the autonomous period (8 points).



We were really happy with this autonomous period, being our most successful run of the tournament,

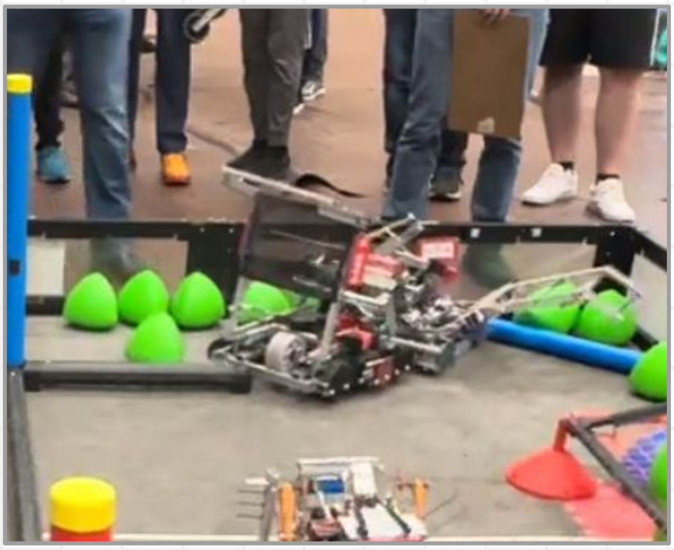
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

OBSERVATIONS



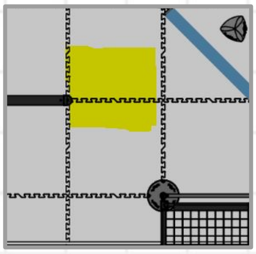
MATCHLOAD GROUPING

Matchloading resulted in very good grouping, we managed to get all our matchloads onto one side which allowed us to quickly score the triballs as our alliance defended.



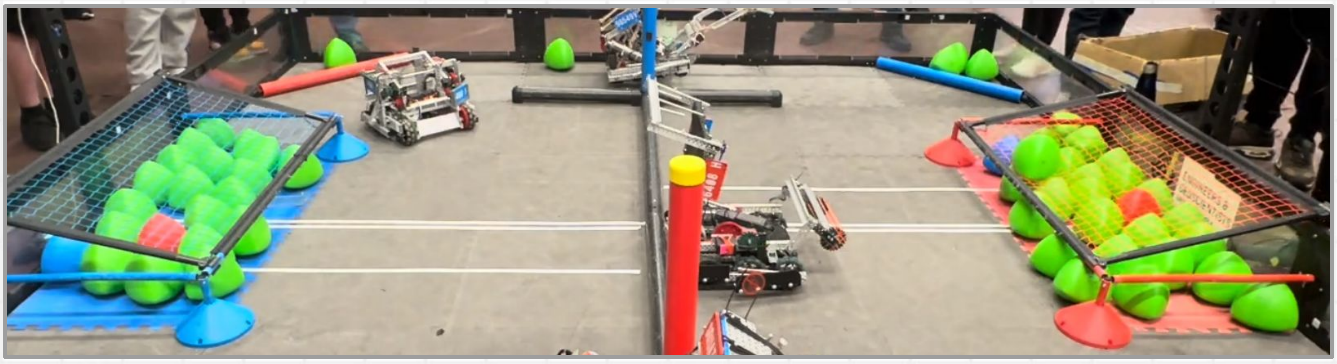
IDEAL BLOCKING POSITION

6408H defended the other robot from matchloading. After a few attempts, they managed to secure a very good spot. Located between the matchload zone and the end of the middle barrier (see bottom image for clarity)



This prevented the robot from pushing triballs to the other side as well as being able to matchload effectively trapping them.

Being able to maintain this position would've been the best way to defend the other robot.



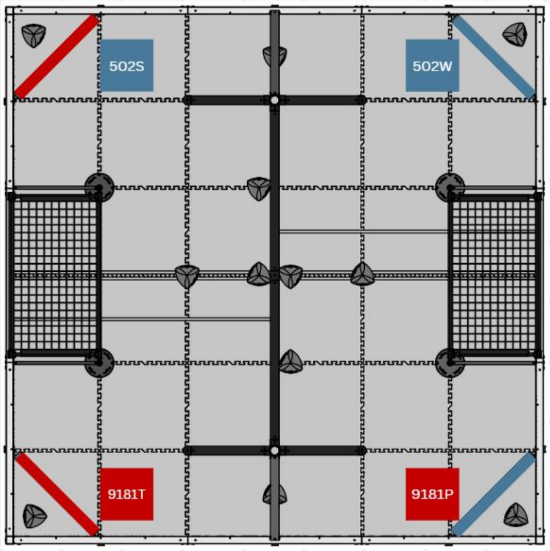
If we had managed to get to that blocking position sooner we would've been able to prevent the majority of the triballs in the blue goal. Overall we finished the match with yet another B tier climb which was higher compared to the other robot from the opposing alliance which had an A tier climb.

QUALIFIER # 57: 918IP & 918IT VERSUS 502S & 502W

	Red	Blue
Total score	21	139
AWP	▨	🟦
Autonomous winner	▨	🟦
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	1	19
Triballs in offensive zone	3	13
Elevation tier	N'A	N'A

MATCH RESULT : WON 21 - 139 ; AWP

AUTONOMOUS PERIOD

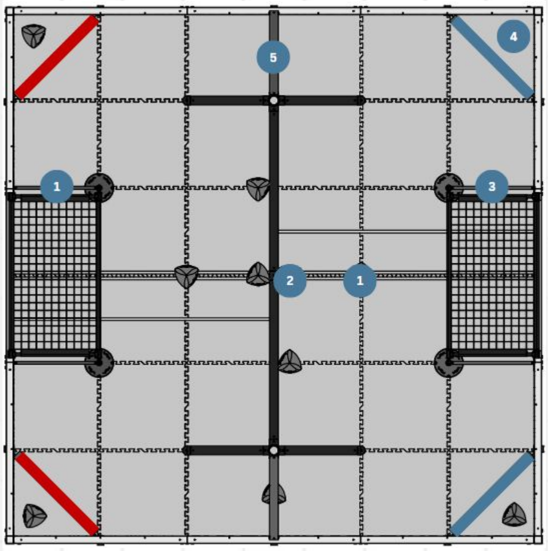


Just like with our previous matches yet again, we ran close side rush with 502S on the far side pushing 1 preload in the goal, this completes the AWP. We decided to run close side rush as we wish to successfully push triballs onto the other side (our offensive zone), allowing us to successfully win the autonomous period as well as gain AWP.

We had made sure that they had a consistent auto as previously they stated that their autos didn't work 100% of the time, so this time extra time was spent setting up their robot lining it up to the goal.

AUTONOMOUS RESULTS

Autonomous was very successful, this was the second round where our autos worked perfectly, with out robot being able to complete all the coded steps. 502W pushed the preload into the goal as well. This allowed us to gain an AWP, raising our ranking in qualifications as well as winning the autonomous period (8 points).



We were really happy with this autonomous period, as after the previous match we were starting to once again, achieve consistent autos

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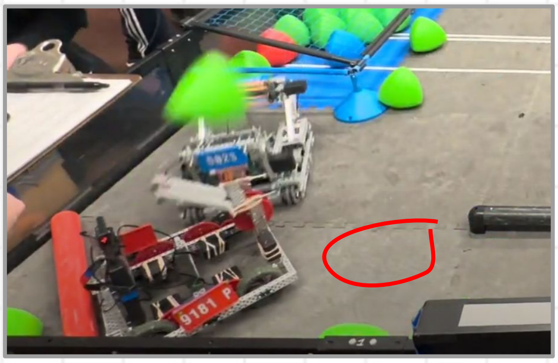
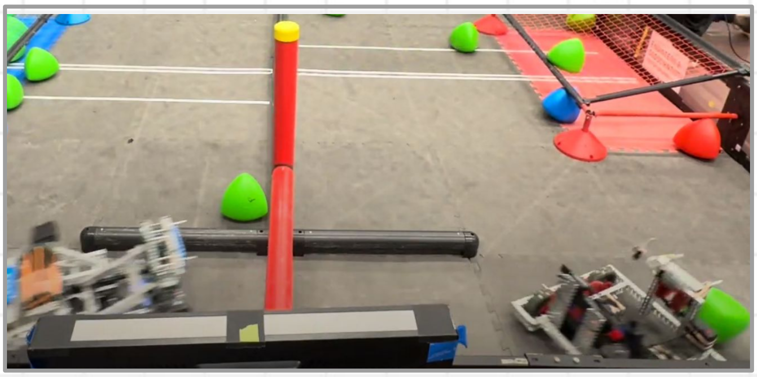
OBSERVATIONS

HOOK STRENGTH

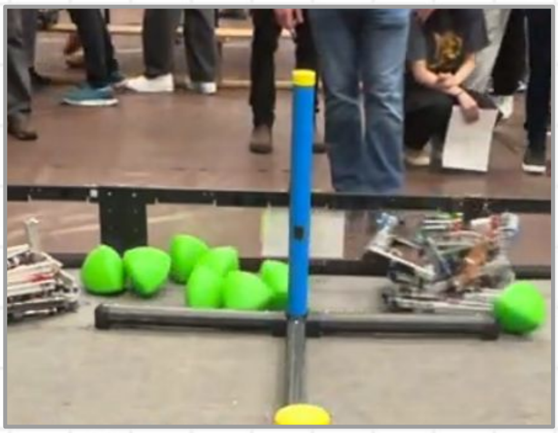
We were surprised to find that even a robot with wedges was unable to dislodge us from the matchloading position, even after they continuously rammed into our robot. They gave us little to no interference. Thus, this further reiterates the importance of the hook. It plays a crucial role in allowing us to maximize our matchloading quality and speed.

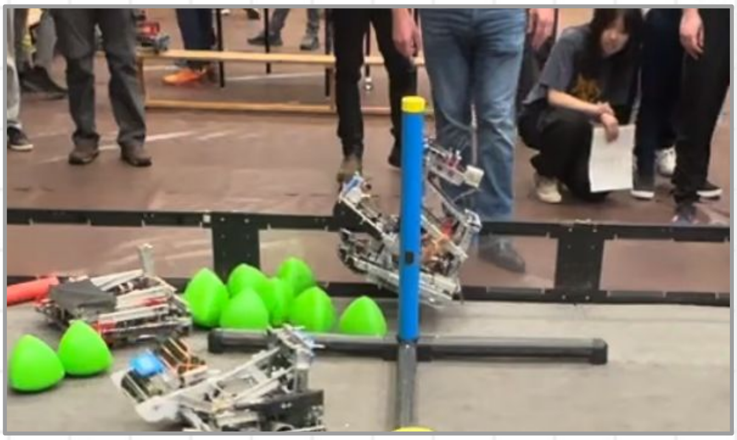




TIPS FOR DEFENDING

During the middle of the match, while 502S was defending 9181P from matchloading, they should have defended from the side closest to the elevation bar (red circle). This would prevent them from getting any triballs across. Due to the actual defence position, they were unable to stop 9181S from driving over to the other side of the field with triballs.





QUICK WAY TO SCORE POINTS?

A quick way to score points would be to matchload at the end of the game and go straight into the climb. This is a bit risky as there is always a chance that the triball touches the climbing robot, rendering the points null.

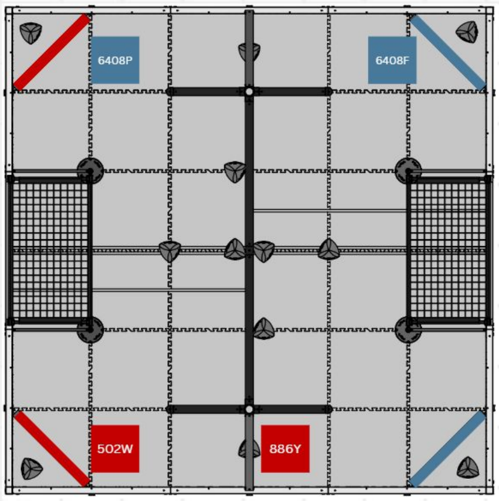
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

RI6: 502W & 886Y VERSUS 6408P & 6408F

	Red	Blue
Total score	135	112
Autonomous winner	🟥	▨
Alliance triballs in either goal	1	2
Alliance triballs in either offensive zone	1	0
Triballs in goal	20	16
Triballs in offensive zone	0	1
Elevation tier	A	A

MATCH RESULT : WON 135 - 112

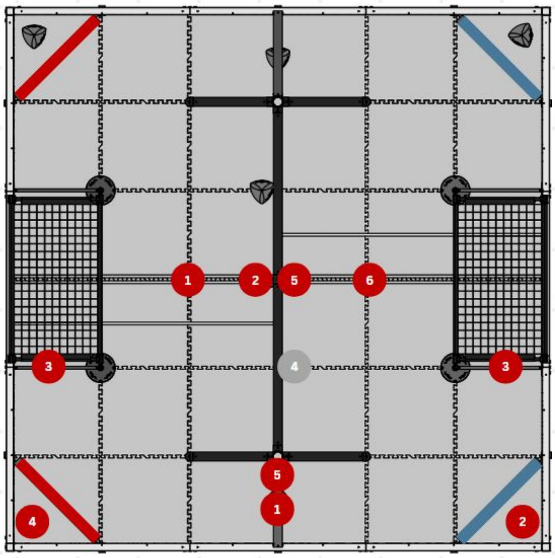
AUTONOMOUS PERIOD



For elims, we decided to stick to the close side rush auto for 3 reasons. The first being that 886Y's far side auto scored more triballs into the goal (6). The second reason was that our close side rush auto proved to be very consistent, as we'd used the same auto for the entire tournament. The last reason is that the close side is the side we would be matchloading from, this way we can efficiently use our time to get to that position as quick as possible, securing our position before any other robot tries to defend us.

AUTONOMOUS RESULTS

Overall, we won the autonomous period. Our close side auto worked perfectly and 886Y only missed a few triballs. We found that after pushing the triballs over to the other side, there's a chance that our alliance can score them as well. So there was a potential that 886Y would be able to score their 6 balls + plus an additional ball.

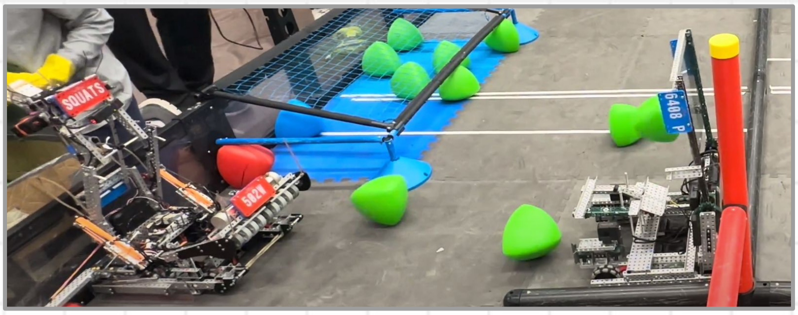


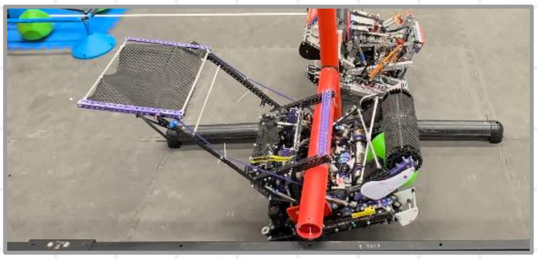
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

OBSERVATIONS

BLOCKED

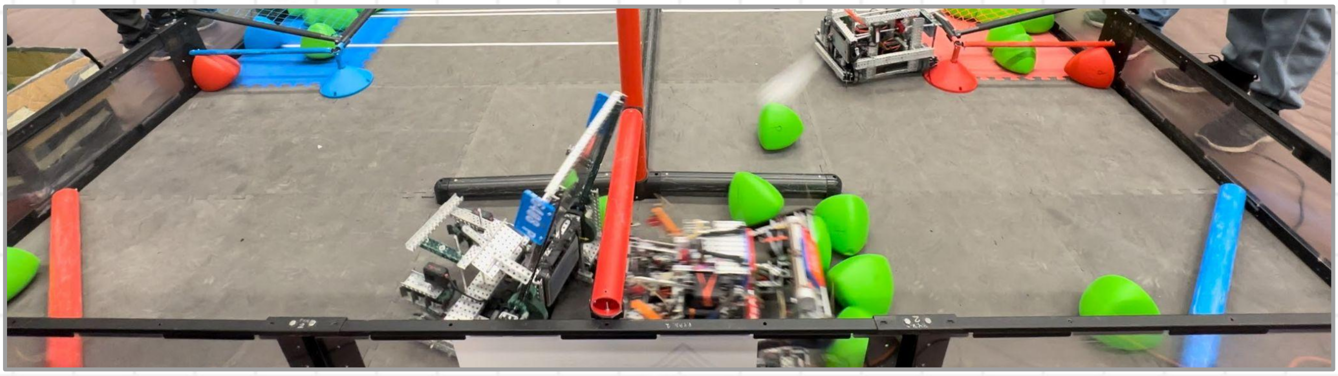
We found that if an opposing robot parked near the middle barrier, we could still be blocked. A total of 4 of our triballs were blocked.





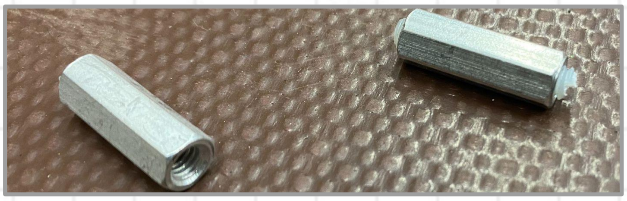
CLIMB

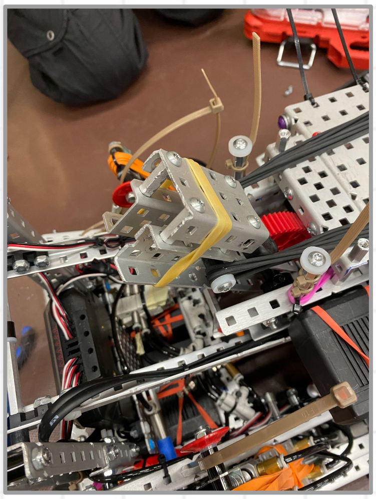
886Y finished the game with a B tier climb. Although our alliance wasn't the only alliance climbing during the match, we still had a higher elevation. Gaining 5 more points total than the opponent teams.



WARNING

Mid match the face of the slapper mechanism projected out of the field as we drove under the elevation bar. The reason of it flying out of the field was due to the elastics, as we went under the bar, the slapper is held down so when we passed the bar, the elastics effectively launched the piece of metal into the air. This resulted in a <G6> warning.





BROKEN NYLON SCREWS

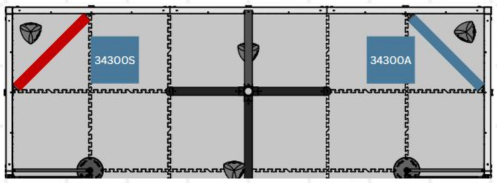
After the match, when assessing the metal, we found that the nylon screws had snapped. This taught us a valuable lesson to not use nylon screws on components using a lot of force. Our solution was to use metal screws instead of nylons ones on the mechanism from now on.

QUARTERFINALS: 502W & 886Y VERSUS 34300A &

	Red	Blue
Total score	163	48
Autonomous winner	🟥	▨
Alliance triballs in either goal	1	2
Alliance triballs in either offensive zone	1	0
Triballs in goal	20	6
Triballs in offensive zone	14	1
Elevation tier	B	N'A

MATCH RESULT : WON 163 - 48

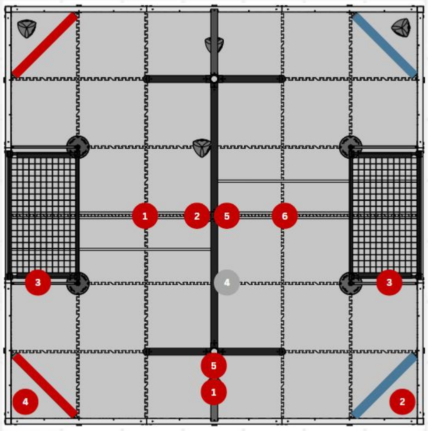
AUTONOMOUS PERIOD



Nothing changed from the previous match, we decided to stick to the same autos for the rest of elims. We run close side rush and 886Y runs 6 ball.

AUTONOMOUS RESULTS

We were still able to easily win the autonomous period. 886Y still missed #4, the triball located between the autonomous line and sides if the barrier. There was no interference from the other side (i.e. another team going for the same triballs in the neutral zone.) which was preferred as then no entanglement could occur and none of our autos were messed up.

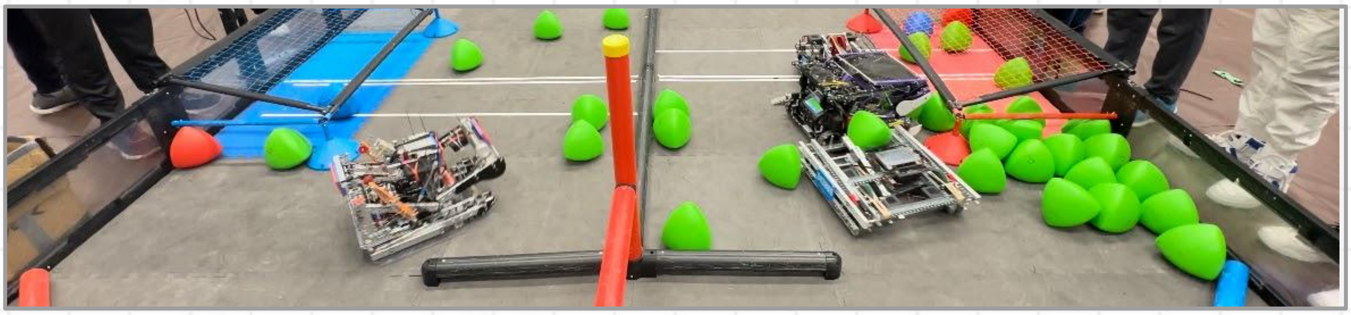


GAME STRATEGY

We decided to implement the most common game strategy for this match, where one robot matchloads and another robot defends and scores. Due to our elevated shooting mechanism, we were to matchload and 886Y was to defence since they had a blocker. This way we can quickly get our matchloads over to commence scoring, while our opposing alliance has yet to get many over (due to being defended against). This strategy is one that we are most familiar with, as we frequently used it in qualifications.

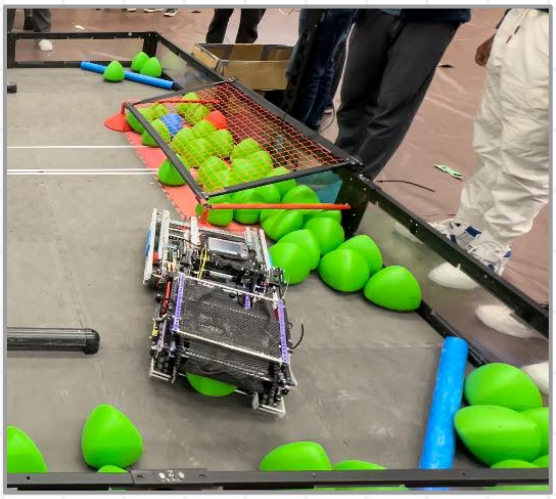
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

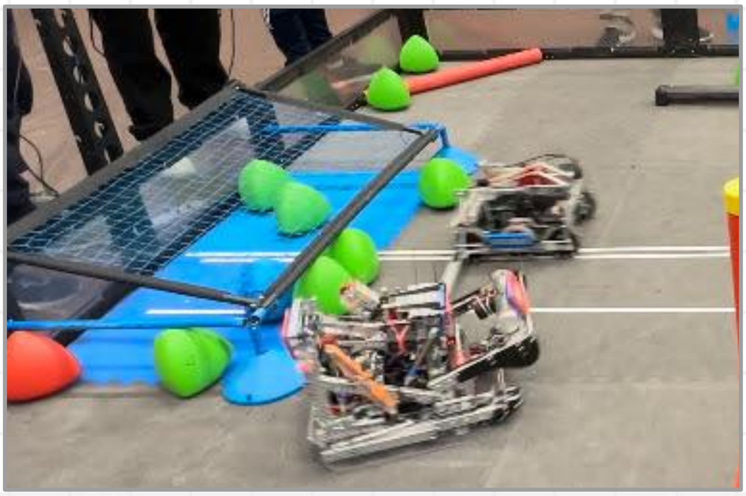
OBSERVATIONS



DEFENDED BY 2 BOTS

886Y was defended by 2 robots at the same time. The opposing alliance had bots which could all descore rendering us unable to double zone. As they were being defended against, we used our wedge and intake to push the triballs onto our side, clearing the alliance's offensive zone. Hence why we were unable to score the 11 triballs on the left side of the red goal, one of the opposing robots would go under the net and push the Triballs out again rendering our efforts useless.



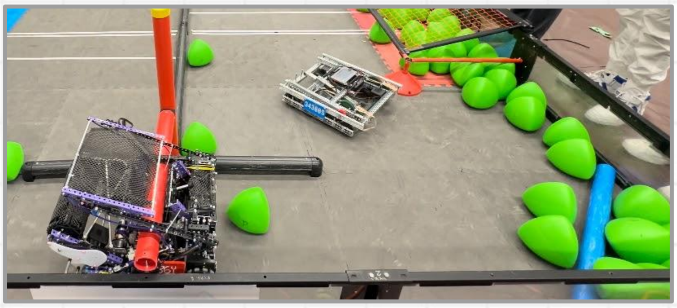


GUARDING THE CORNER

An opponent robot did a very good job in guarding the corner, preventing 886Y from scoring the triballs. 886Y could've tried to angle the robot in a way that they scored the triballs as they pushed against the other robot

BETTER DEFENCE NEEDED

We could've tried to keep the opposing alliance in their offensive zone by blocking them or pushing them when they decided to go through the alley or go over the middle barrier. Then 886Y would have an easier task of only dealing with 1 robot instead of 2. This way we'd be guaranteed to score more triballs, increasing the difference of points.



CLIMB

The match ended with 886Y's B tier climb. As our alliance was the only one that had elevated, we gained 20 more points than the opponents. This reiterates the importance of a climb during matches. Being the only robot who climbs, we gain the equivalence of 4 triballs scored into the goal (20 points).

DEFINE A PROBLEM

SET SPECIFIC REQUIREMENTS

BACKGROUND RESEARCH

BRAINSTORM, EVALUATE, CHOOSING SOLUTION

DEVELOP AND PROTOTYPE SOLUTION

TESTING SOLUTION

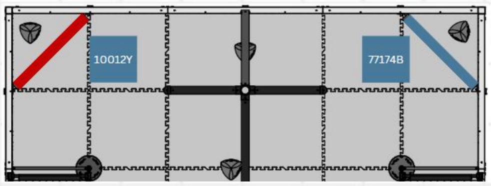
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

SEMIFINALS: 502W & 886Y VERSUS 10012Y & 77174B

	Red	Blue
Total score	163	48
Autonomous winner	🟥	
Alliance triballs in either goal	1	2
Alliance triballs in either offensive zone	1	0
Triballs in goal	20	6
Triballs in offensive zone	14	1
Elevation tier	B	N'A

MATCH RESULT : WON 130 - 108

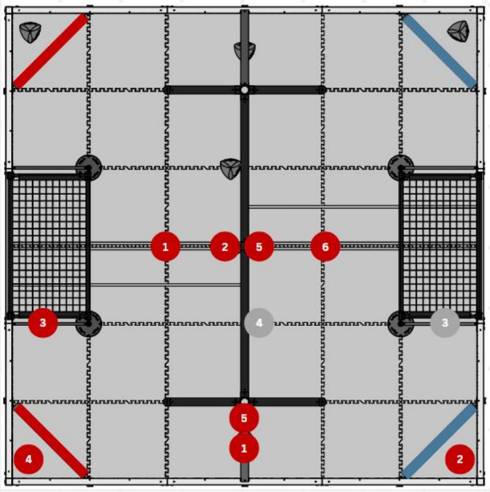
AUTONOMOUS PERIOD



Nothing changed from the previous match, we decided to stick to the same autos for the rest of elims. We run close side rush and 886Y runs 6 ball.

AUTONOMOUS RESULTS

We were still able to easily win the autonomous period. 886Y still missed #4, the triball located between the autonomous line and sides of the barrier. There was so interference from the opposing alliance as they decided to go for the middle triballs first (close side rush). Their intake slipped on the triballs rendering them unable to score them as well as 886Y would score the middle triballs last. Thus, no entanglement occurred.

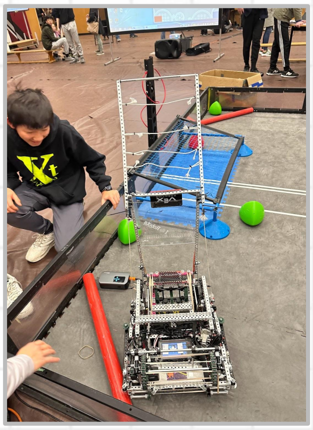


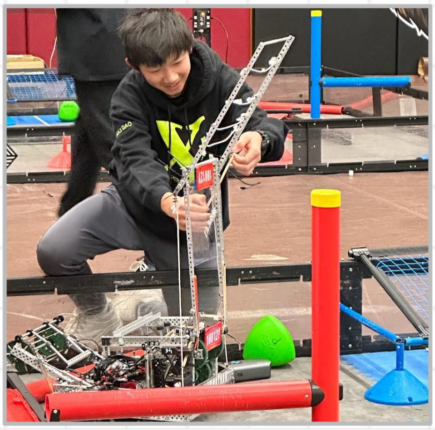
GAME STRATEGY

We decided to implement a new strategy, double bowling, in order to deal with 10012Y's large blocker. In this strategy, we split our 22 preloads in half and divided into the 2 matchload zones. This way we'd be able to match load from both sides, guaranteeing to score triballs since a robot cannot defend 2 robots across the field from one another. Although we've never practiced this strategy, it would be able to allow us to get past the blocker.

DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

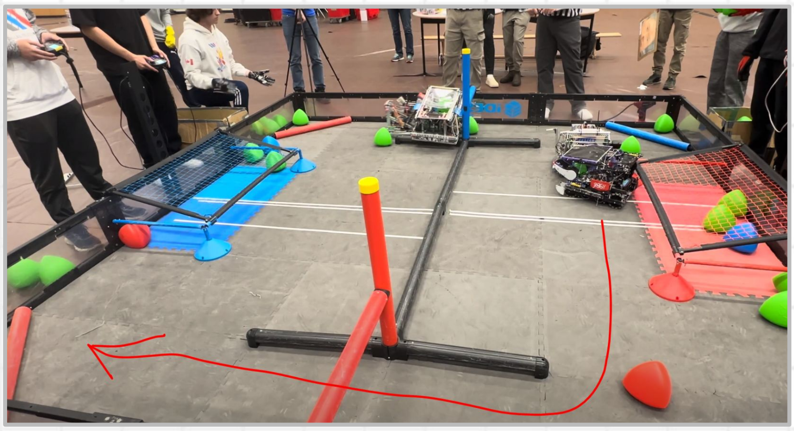
OBSERVATIONS

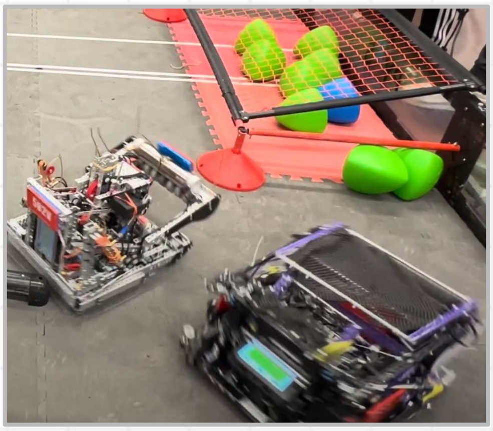




TALL BLOCKER

Note that 10012Y has a very tall blocker. This renders us incapable of matchloading as it's guaranteed that they manage to block all our matchloads. This is the reason we went with the double bowling strategy





MISSED OPPORTUNITIES

While being defended against, we failed to notice that 886Y had a clear path to matchload. If we had, then that would have been the best way to matchload. Here they could matchload via the puncher as 10012Y was defending us and the robot previously blocking them would be in the alley

BETTER DEFENCE NEEDED

We had been too preoccupied defending 77174B that we again were not able to defend 10012Y scoring by the time we had noticed. A better solution would be to always defend in between the 2 robots of the opposing alliance, this way we'd be able to switch from one robot to the other, preventing both of them from scoring.

The match ended with 10012Y and 886Y climbing. We had the higher climb, so we had gained 5 more points than the other alliance.

TIME WASTED

Around the middle of the match, there was a brief period of time when we both wanted to score the same triballs into the goal. Instead, one team should be matchloading at all times.

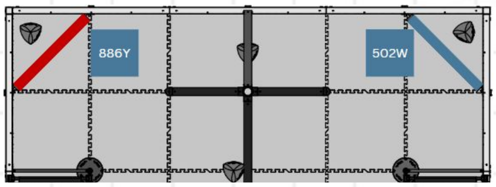
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

FINALS: 10012G & 886N VERSUS 502W & 886Y

	Red	Blue
Total score	195	116
Autonomous winner	🟥	
Alliance triballs in either goal	1	1
Alliance triballs in either offensive zone	1	1
Triballs in goal	29	16
Triballs in offensive zone	1	3
Elevation tier	A, A	B

MATCH RESULT : LOST 195 - 116

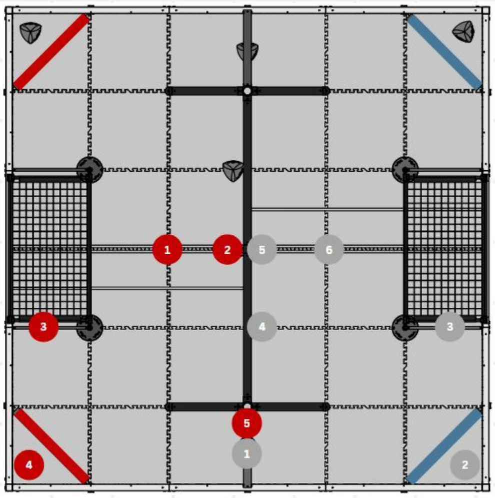
AUTONOMOUS PERIOD



Nothing changed from the previous match, we decided to stick to the same autos for the rest of elims. We run close side rush and 886Y runs 6 ball.

AUTONOMOUS RESULTS

We still won the autonomous period even though 886Y mistakenly ran the wrong auto, close side instead of the predetermined far side rush, preventing them from scoring any triballs. Thankfully our auto worked successfully. The 2 triballs pushed over allowed us to win the autonomous. It's noted that we should try to make a better auto for elims where we don't take out the triball from the matchload zone since it is in essence gifting the other alliance points as a Triball only counts for points if it is located in a opponents zone.

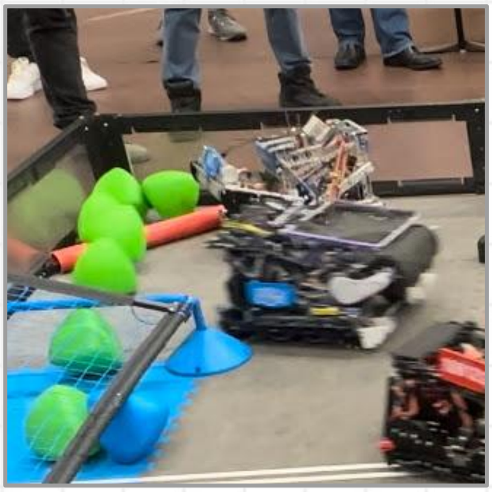


GAME STRATEGY

We decided to implement the same strategy, double bowling, as we thought 10012G would've overwhelmed us with matchloads. In this strategy, we split our 22 preloads in half and divided into the 2 matchload zones. This way we'd be able to match load from both sides, guaranteeing to score triballs since a robot cannot defend 2 robots across the field from one another.

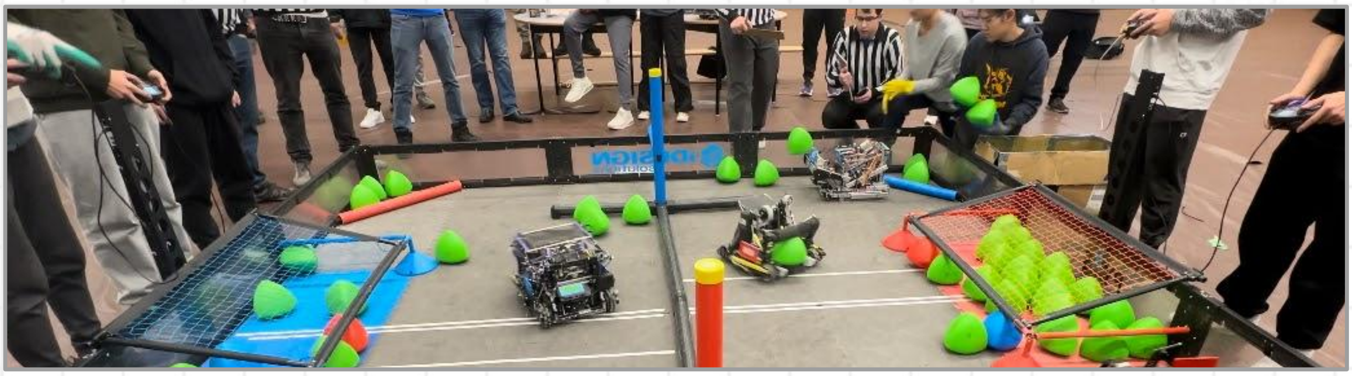
DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

OBSERVATIONS



PUSHING TOO FAST

Through the stress of finals, we pushed the triballs through the alley too fast, resulting in many triballs being stuck in the matchload zone, prevented from being scored. We note that no matter the situation, we should slow down pushing and not be rushed. In the situation on the left, as shown in the image. We should have taken our time scoring as 886Y was between us and 10012G which serves as a sort of barrier. Instead of rushed pushing if we had takedn our time, wwe'd have scored the 3 triballs in the goal and not push them into the matchload zone.

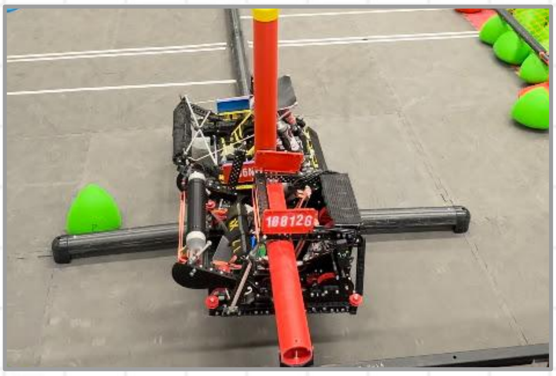


BAD GAME STRATEGY

We had chosen the wrong strategy for the match. We had little to no experience with the chosen strategy. Driving through the alley proved to be more time-consuming, with more triballs being stuck in the matchload zone. We could have matchloaded via the elevated shooter while 886Y scored them into the goal. We'd have little to no interference from the other team due to our hook. This way we'd be able to matchload quickly and effectively instead of spending an entire match struggling with scoring triballs. Thus, it's concluded that double bowling should only be used in cases where the opposing team has a large blocker. We've learned a lesson to clear our minds of the previous match and to reflect more on game strategy instead of rushing in.

DOUBLE CLIMB

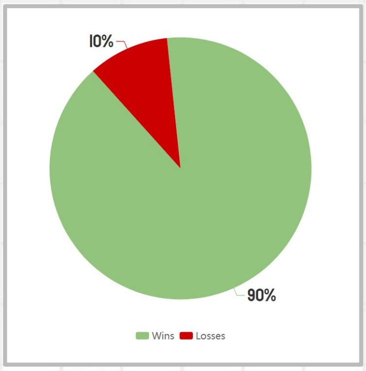
The match finished with our opposing alliance double climbing, instantly gaining many points. Our robot did not have a side climb, hence our alliance was not able to double climb. Double climb will either allow for a significant difference or will allow an alliance to win the match.



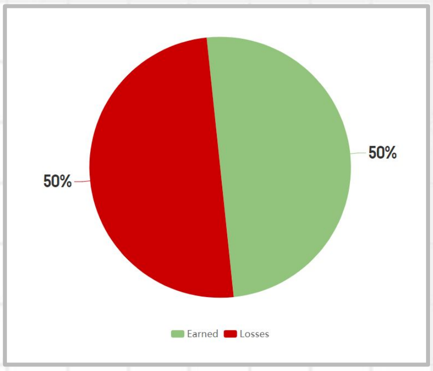
Summary

Overall, we were quite happy with the results of our very first tournament with this robot.

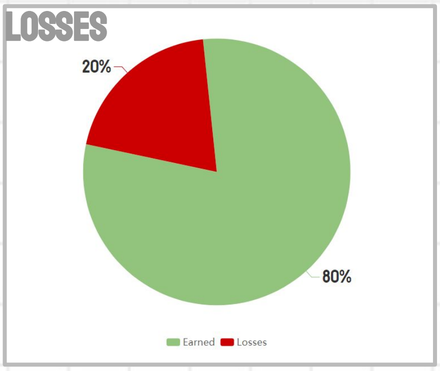
WINS VS LOSSES



AWP



AUTONOMOUS WINS VS LOSSES



WHAT WORKED WELL

- **Smooth grippy intake**
  - Allowed us to intake while being pushed
- **Matchloading via the elevated shooter**
  - During qualifications, we never got blocked
- **Hook/Blooper**
  - This kept us in place while matchloading
  - Able to remove the triball from the matchload zone consistently
- **Drivetrain**
  - Gave us pushing power and allowed us to travel fast
- **Sleds and weight balance**
  - We were able to achieve a B tier climb as well
  - Able to go over the middle barrier with ease

MAJOR ISSUES

- **Spacers in drivetrain**
  - Prevented the robot from driving
- **Matchloading via the alley**
  - We proved to be inefficient and inexperience
  - A lot of time was lost
- **Slapper strength**
  - During skills we had to tune it a lot with the result being either too strong or too weak
- **Game strategy**
  - The strategies we decided to implement proved to be inefficient
  - Practice is needed as well as watching more games

DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

Planning our time

Goal

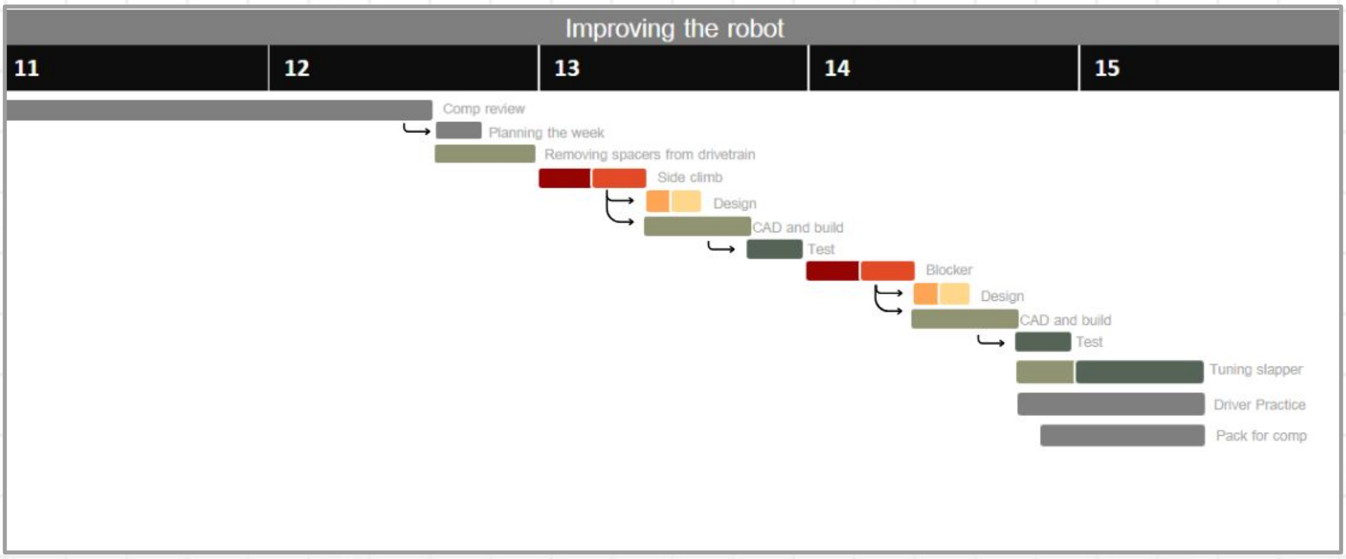
Organizing our time in order to efficiently make use of it and improve our robot

PLAN

We have an upcoming tournament this Sunday. We've decided to do 4 major things:

- **Fix the drivetrain**
  - Will save us in case the zip ties come off
- **Add a side climb**
  - A double climb will win us a match, so being able to climb both ways is ideal
- **Add a blocker**
  - We already have a strong offensive robot, so no we need to improve our defensive play.
- **Tune the puncher**
  - Allows for a higher skills score.

<u>Here is a Gantt chart showing a detailed plan of the week</u>



We've decided to color code the process we will follow with the design process, (also shown on the sides of the notebook)

🟥 Identify Problem 🟥 Set Specific Reqs 🟧 Research 🟨 Select solution

🟩 Develop solution 🟩 Testing solution

We will follow this schedule to our best and achieve an even better robot by the end of the week!

DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

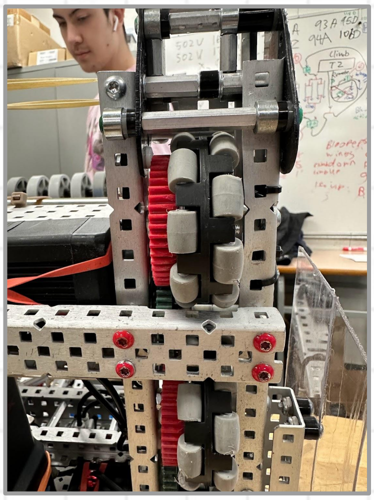
DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

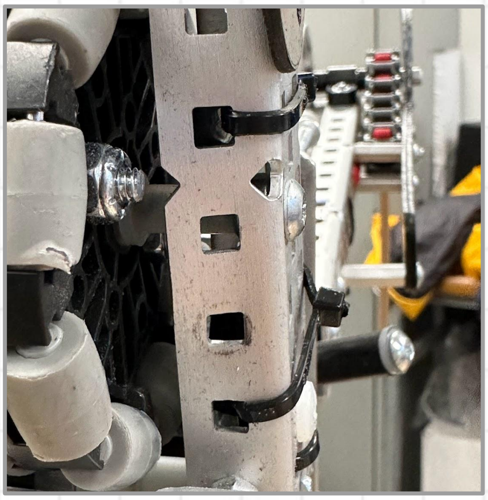
Goal

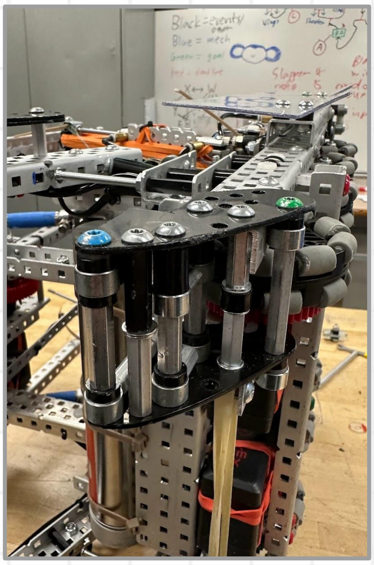
Removing the spacers from the drivetrain

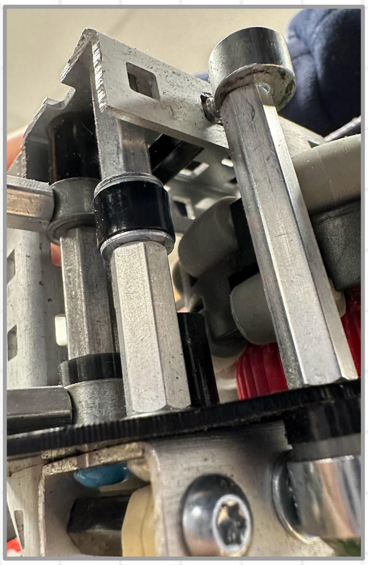
ISSUE

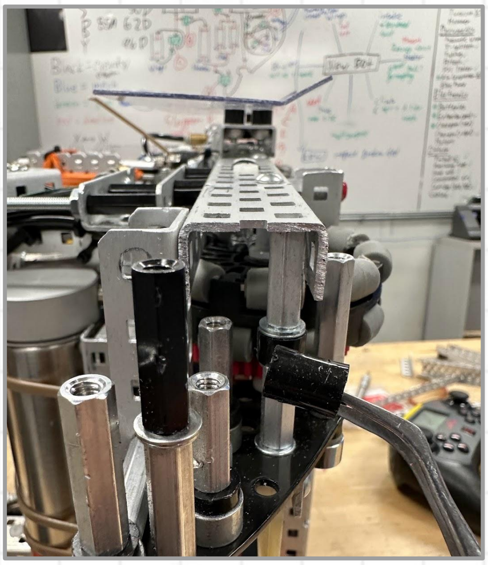
Our main fear is that the zip ties fall off, and the spacers are free once again. This will severely impact our robot performance as well as damage our drivetrain. This is a very important issue to fix











FINDING A SOLUTION

We initially thought that we had to take apart the entire half of the drivetrain in order to remove the spacers. This solution would cost us a lot of time, where we could have used to either tune or build other mechanisms

TAKING APART SLEDS

REMOVING SPACERS

A better solution would have been to take apart the sleds allowing us to reach the spacers. We noted that there was one black standoff boxing the C-Channel preventing the spacers from coming out. After removing them we managed to take out the spacers with tweezers.

DATE: 12/12/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Making a side climb

Why do we need a side climb?

- A double climb will win us a match
  - In cases where our alliance is the only team climbing when we automatically gain 35 points.
  - The range of extra points earned varies from 15-35
  - Will significantly raise our score

- More appealing alliance partner
  - A double climb is often a highly stressed requirement for an alliance, having one will increase our range of potential partners

Goal

Setting specific requirements to achieve

MAIN GOAL

- **A tier climb**
  - We can only achieve an A tier climb as a side climb consists of balancing on the middle barrier

- **Consistency**
  - We will need our side climb to be reliable
  - This means we need to have a good balance on the bar
  - We need to be able to get to that position in less than 5 seconds, since due to competitive matches the majority of time in the game will be spent on defending or scoring

- **Simplicity**
  - The more simple it is to build. The easier it is to tune.

CONSTRAINTS

RULE CONSTRAINTS:

Cannot expand past 36” horizontally, as stated in <SG2>

MATERIAL CONSTRAINTS:

None

TIME CONSTRAINTS:

Side climb is to be completed today, December 13th.

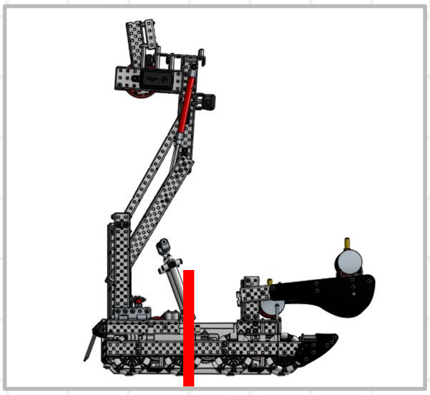
SIDE CLIMB

Goal

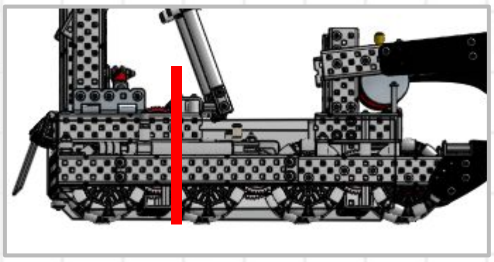
Finding possible ways we can tick off these goals while still staying within the constraints

WEIGHT DISTRIBUTION

Currently, the balancing point of our robot is shown in red. This means that the robot should sit on the bar with that point. The reason as to why the balancing point isn't the middle is due to the solenoids weighing the left side down.

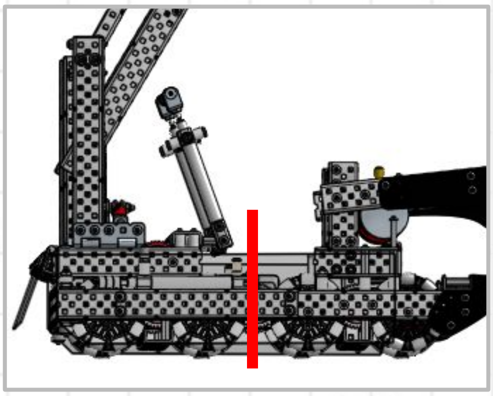


Below are possible solutions



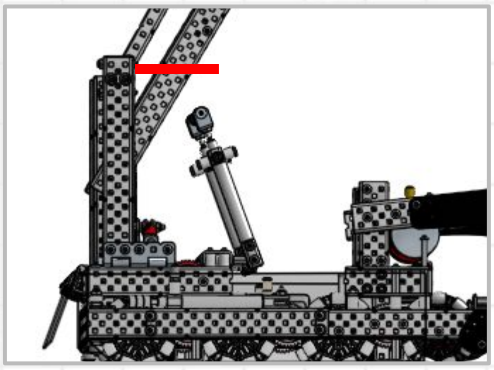
Solution 1
Building a new side climb mechanism located in the area of the red line. This would involve adding a new piston attached to another mechanism in the general space.

CONSIDERATIONS:
Will we have space to mount the mechanism?



Solution 2
Shuffling around solenoids, adding and taking away weights to that the centre of balance is directly in between the 2 centre wheels of each side of the drivetrain. This allows us to potentially drive onto the bar and balance without any other support

CONSIDERATIONS:
Very difficult to achieve along with lower success rate



Solution 3
Integrating a side climb mechanism onto the hook. This will be the simplest solution.

CONSIDERATIONS: Will this impact our ability to gain AWPS?
How large of an attachment would the added component be?

DATE: 12/13/2023 DESIGNED BY: RL WITNESSED BY: TC

Initial observations and connections

Solution 1 - Adding a new mechanism

Pros

- We will be able to customize the mechanism with few self set constraints
- Size and weight can vary
- Easier to tune

Cons

- Very hard to mount onto the robot, there is little to zero space

Solution 2 - Evening out weight distribution

Pros

- This will also allow us to have a better climb
- Being able to balance on the beam will also allow us to cross the middle barrier with even more ease

Cons

- Very hard to even out
- Time costin in both games and building

Solution 3 - Modifying hook/blooper

Pros

- Most simple solution
- Easy to tune, adjusting length
- Effective in games, little time needed to get onto the middle barrier

Cons

- We'll need to consider potential interference with AWP as well as hooking onto the matchload zone

DECISION MATRIX

We can first eliminate solution 2 as it will cost us too much time to achieve. The guarantee of a working balance is undetermined, and it's too risky to try since the upcoming competition is on Sunday. Solution 1 would have been the best option, except that we are unable to find another place on the robot without interfering with other mechanisms. So our only solution is to add an extension onto the side climb (Solution 3). Here are some requirements for our mechanism:

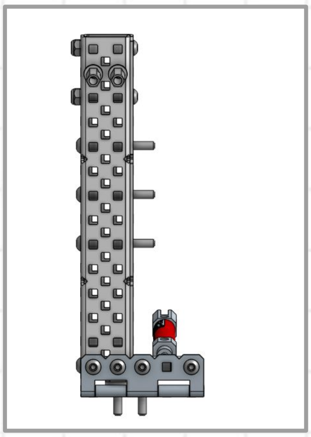
- **Easy attachment and removal**
  - This will be helpful in elims if we are to hang. This way we'd be able to remove some weight or other unnecessary components.
- **Simplicity and easy tuning**
  - This way we can quickly adjust components when needed, especially in the future.

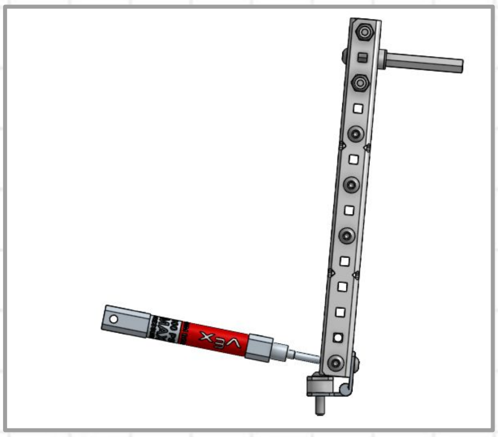
SIDE CLIMB

DESIGN SPECIFICATIONS

- 3x 2” Standoffs
- 3x 1.5” Screws
- 1x 1x1x7 (7 hole) angle
- 1x Adhesive foam

CAD - GUIDE



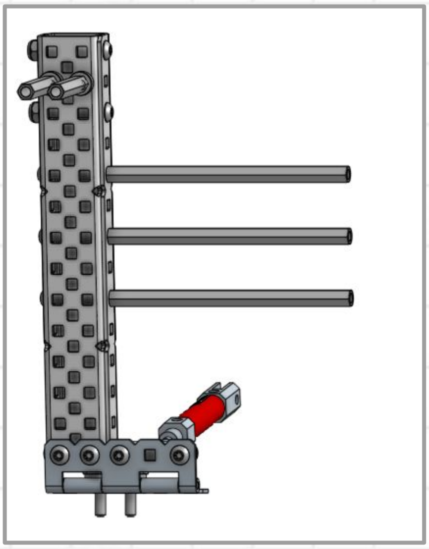


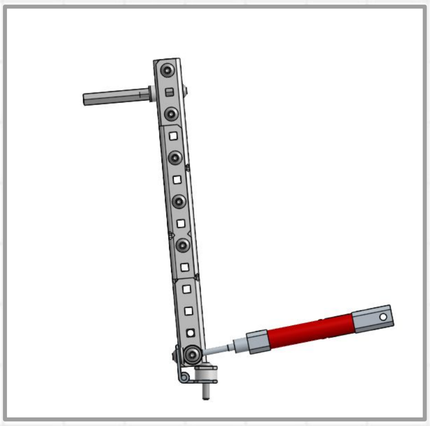
1)

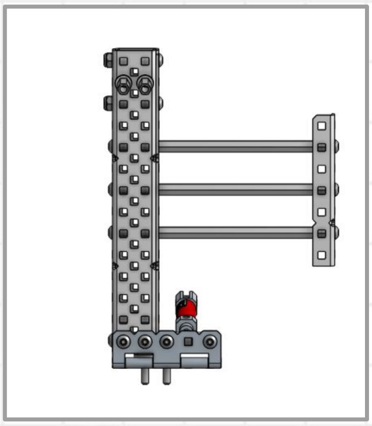
First, we put our three 1” screws through the climb mechanism located on every second hole starting from the 5th hole down. These screws will serve to hold the entire mechanism.

2)

Then we attach the 2” standoffs onto the screws. We want them secured as tight as possible, as this will be the structure supporting the robot’s weight when climbing. This will also be the section bracing the robot contacting the side of the elevation pole.







3)

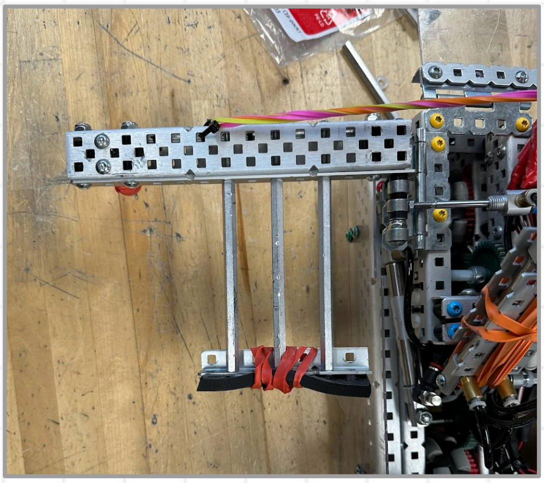
Finally, we place the angle onto the standoffs, with it lined up on the second hole of both ends to the standoffs. We then attach them with smaller screws.

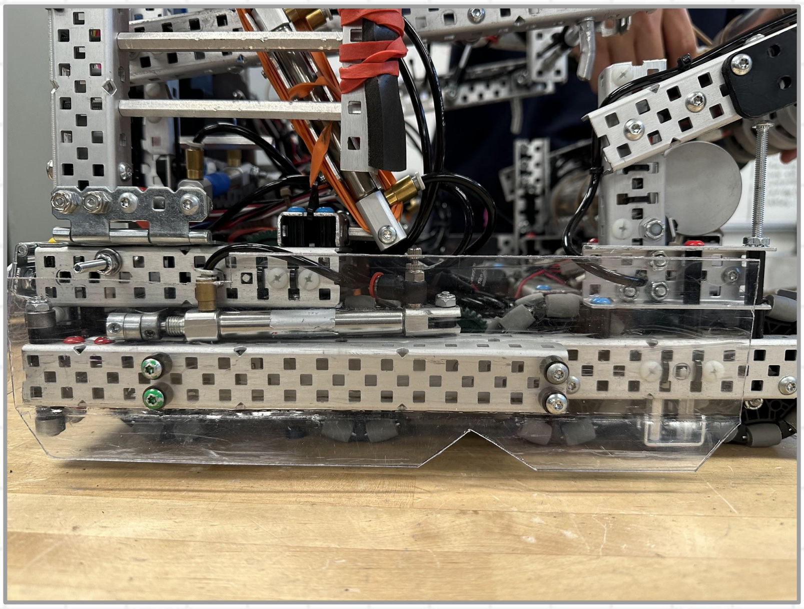
DATE: 12/13/2023 DESIGNED BY: RL WITNESSED BY: TC

BUILD

We take adhesive foam and cut 3.5" in length. This will be the component holding our robot onto the pole, it allows for more grip onto the bar as well as making our mechanism more effective in the long term.

We then stick the foam onto the L what is good about the adhesive foam is that it can stick to surfaces. Although it can stick, it may not last through wear and tear. This is why we placed an elastic band onto it as an additional way to keep the foam on. It also adds grip against the elevation pole, this way we can guarantee a climb.





We also decided to cut a triangle shape out of the polycarb of the wings. This could theoretically allow us to rest better on the barrier.

Again, this will ensure that we have a reliable side climb.

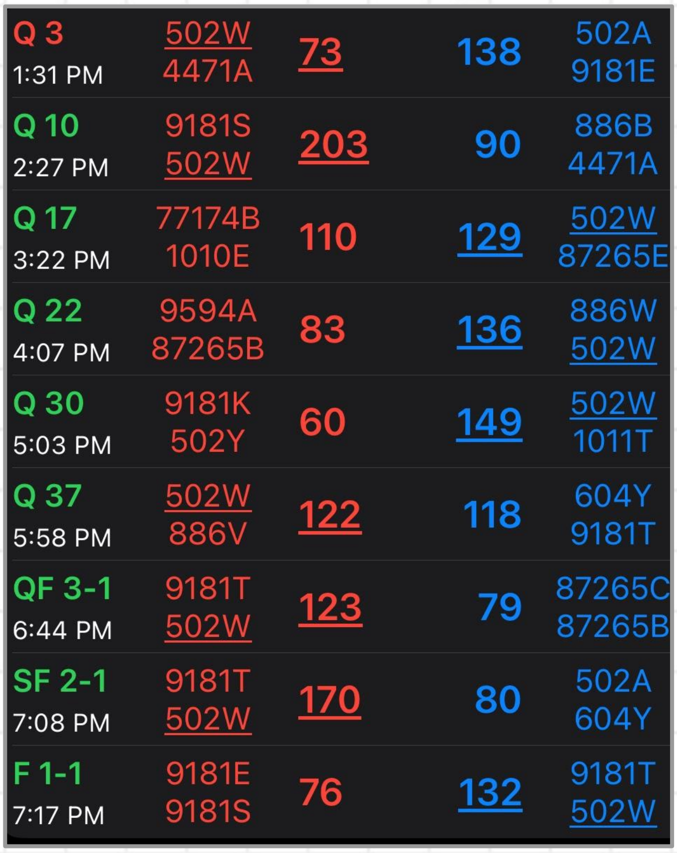
DATE: 12/13/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

Goal

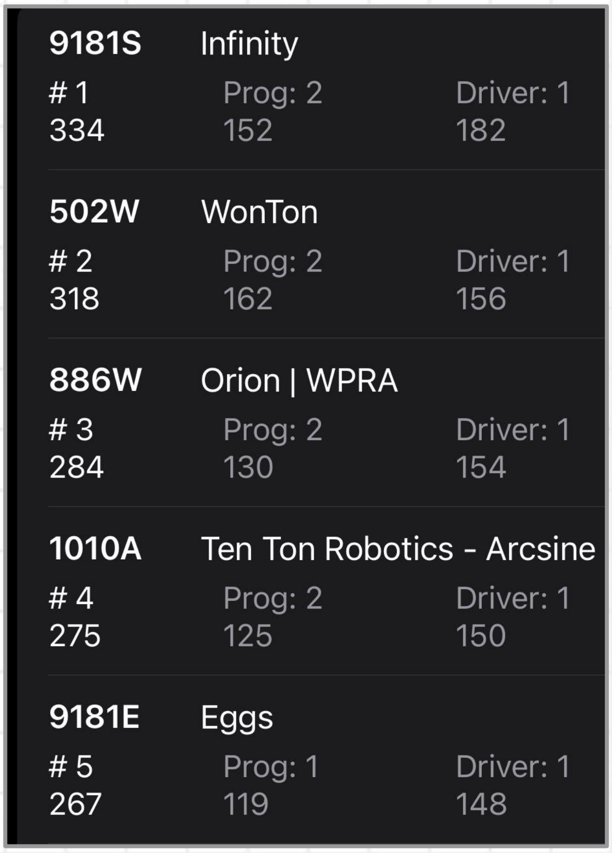
Going over our first comp with our new rebuilt robot

MATCHES



Q 3 1:31 PM	502W 4471A	73	138	502A 9181E
Q 10 2:27 PM	9181S 502W	203	90	886B 4471A
Q 17 3:22 PM	77174B 1010E	110	129	502W 87265E
Q 22 4:07 PM	9594A 87265B	83	136	886W 502W
Q 30 5:03 PM	9181K 502Y	60	149	502W 1011T
Q 37 5:58 PM	502W 886V	122	118	604Y 9181T
QF 3-1 6:44 PM	9181T 502W	123	79	87265C 87265B
SF 2-1 7:08 PM	9181T 502W	170	80	502A 604Y
F 1-1 7:17 PM	9181E 9181S	76	132	9181T 502W

SKILLS



9181S	Infinity	
# 1 334	Prog: 2 152	Driver: 1 182
502W	WonTon	
# 2 318	Prog: 2 162	Driver: 1 156
886W	Orion | WPRA	
# 3 284	Prog: 2 130	Driver: 1 154
1010A	Ten Ton Robotics - Arcsine	
# 4 275	Prog: 2 125	Driver: 1 150
9181E	Eggs	
# 5 267	Prog: 1 119	Driver: 1 148

Overall, we weren't the most successful in qualifications, winning all but one match and finishing on 7th seed. Eliminations were smooth, with our team managing to win finals.

Although we placed 2nd in skills, we were disappointed by our lackluster scores, as we had initially hoped to significantly increase our record score of 333.

RANKING

7	502W	WonTon	5-1-0	11 / 32 / 534

AWARDS

We won 2 awards this competition, the first being tournament champions and the second being the design award

DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

Skills Overview

Goal

Going over our skills runs and matches

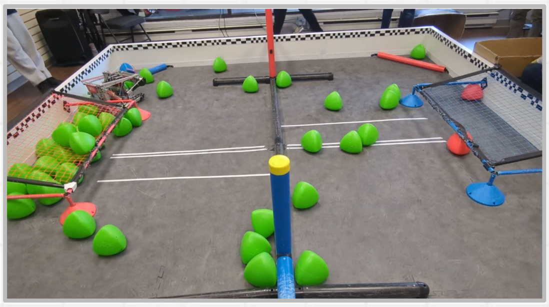
PROGRAMMING - I

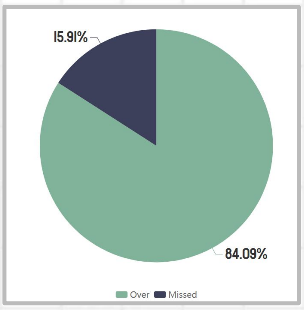
Total score: 124

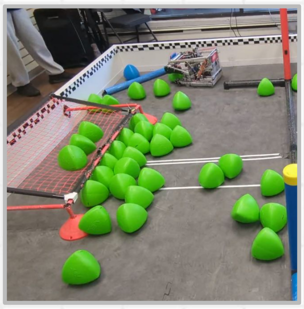
Triballs in goal: 20

Triballs in offensive zone: 12

Elevation tier: none







Contrary to the grouping we achieved during testing, the grouping during this match were not ideal. The reason was due to uncoordinated matchloading and misplacement of the Triballs, which also caused us to miss 7 of our 44 matchloads(15.91%) with an additional 3 Triballs stuck on top of the goal. The robot also missed the final push from the corner of the goal.

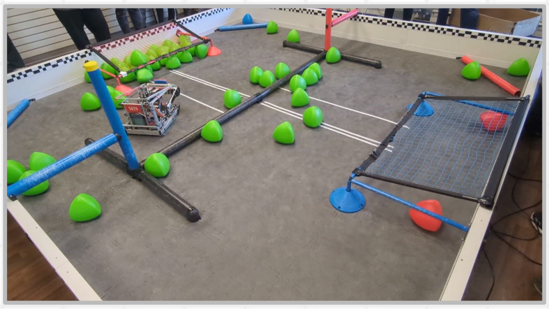
DRIVER - I

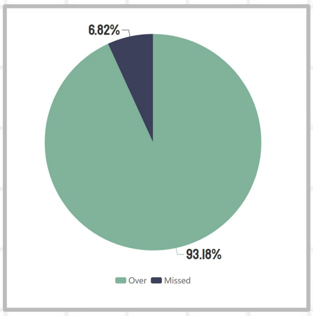
Total score: 156

Triballs in goal: 26

Triballs in offensive zone: 13

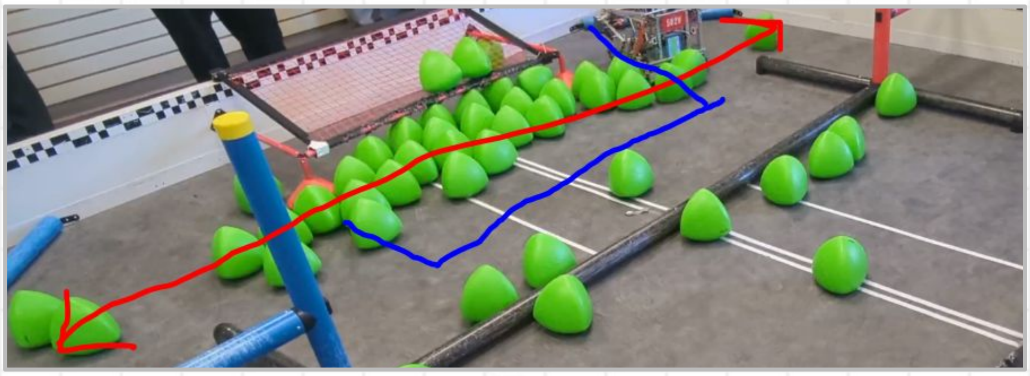
Elevation tier: none





Matchloading during driving was better than our first programming run with 3 of our 44 matchloads(8.82%) and 1 Triball on top of the goal. Grouping was spread out, horizontally, instead of being focused on the first two tiles.

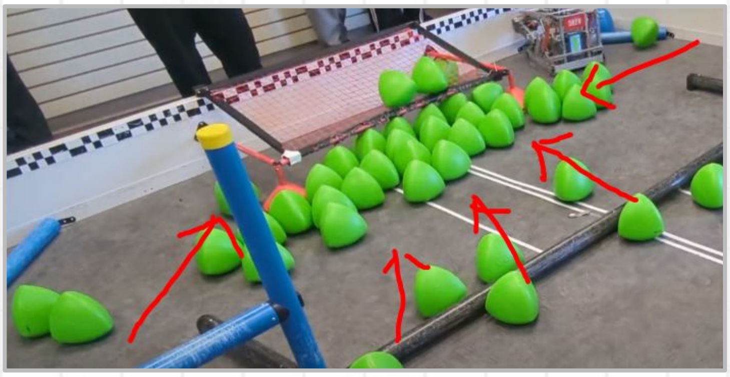
The blue region marks our expected grouping that we usually see occur as we test. The red line marks the end grouping of our matchloading for the current run.



DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

We first spent time pushing 1 Triball in from the corner. Upon reflection, more time should have been allocated to the center side than the corner. We then followed our programming skills strategy, which unfortunately resulted in Triballs getting pushed atop the goal.



A better strategy would have been if we started from one side (right side of the image) and moved to the other side with incrementing angles of where we push Triballs into the goal (pushing leftward). This way we would not have to go back and forth from side to side of the goal and maximize our efficiency and precision when scoring.

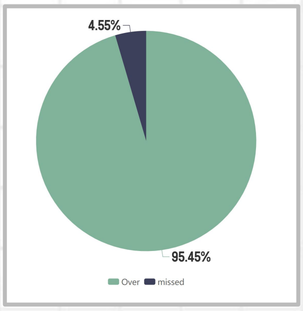
PROGRAMMING - 2

Total score: 162

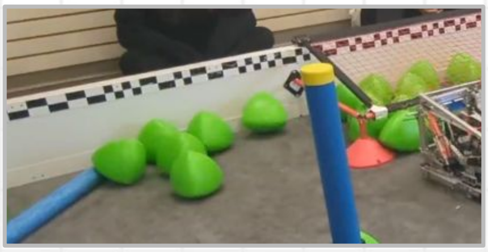
Triballs in goal: 26

Triballs in offensive zone: 16

Elevation tier: none



Although we improved from our first programming skills run, we still did not achieve our highest score. Matchloading improved as we only missed 2 Triballs (4.55%). We noted at this tournament that upon pushing Triballs into the goal, it appeared that we had gotten Triballs on top of the goal.



During our push from the left side of the goal, the robot inadvertently pushed 7 Triballs away (1 is not captured in the image as it is in the zone and was blocked). If those were able to be scored, we would have received a much higher score.

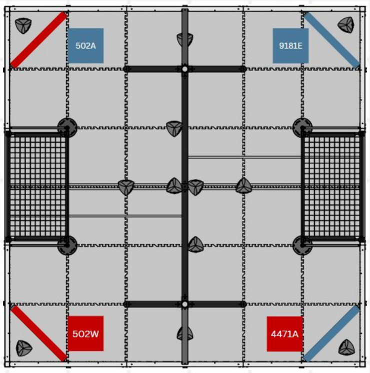
DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

QUALIFIER # 3: 502W & 4471A VERSUS 502A & 9181E

Q #3	Red	Blue
Total score	73	138
AWP		🟦
Autonomous winner	🟥	
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	7	9
Triballs in offensive zone	10	18
Elevation tier		A

MATCH RESULT : LOST 73 - 138

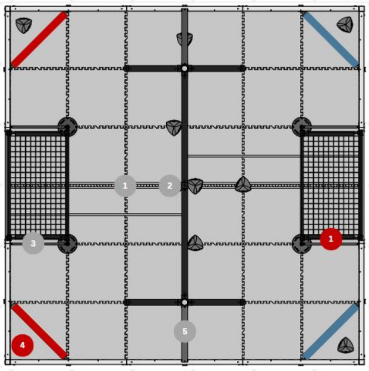
AUTONOMOUS PERIOD



We decided to start on the close side. This is because our alliance did not have a consistent AWP auto. We decided to run close side rush as we hoped to push Triballs onto the other side, allowing us to successfully win the autonomous period as well as gain AWP. Our alliance's far side auto consisted of pushing the colored preload into the goal. This way we would take the Triball out of our matchload zone as well as touch the bar while our alliance partner scores a colored preload

AUTONOMOUS RESULTS

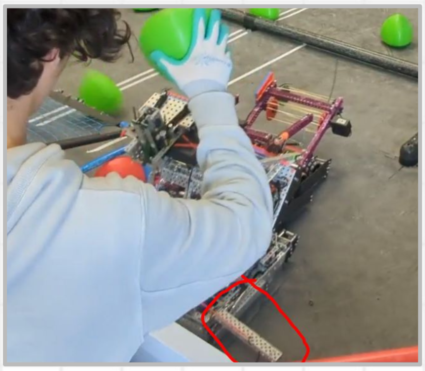
4471A succeeded in pushing the preload into the goal, completing their portion of the AWP. During our autonomous, our robot missed the 2 Triballs in the middle(1 and 2) as well as all other steps except for removing the Triball out of the matchload zone(4). We won autonomous but did not receive AWP. A possible reason as to why we missed all the steps, but one was most likely due to an error in setting up the robot, which resulted in the robot being an inch or so too far.

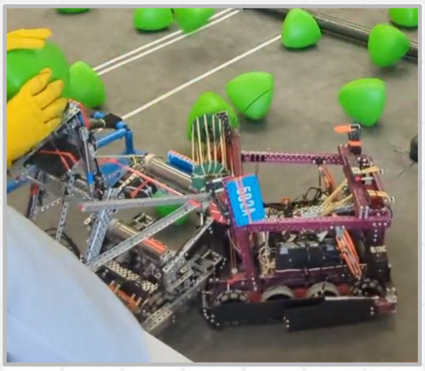


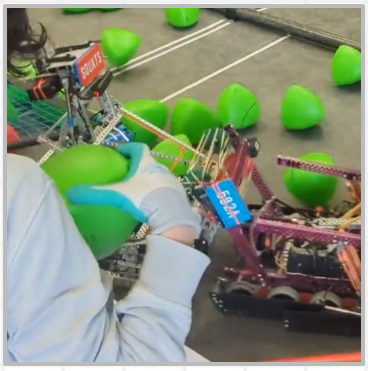
AWP is very important to get higher ranks in qualifications, a match with no AWP awarded and losing one will severely impact our rankings, thus impacting our alliance selections for eliminations.

DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

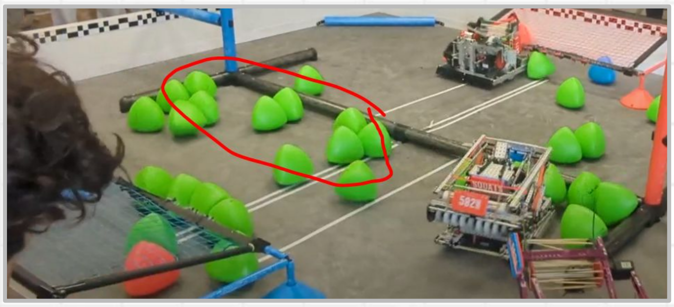
WPRA CHRISTMAS





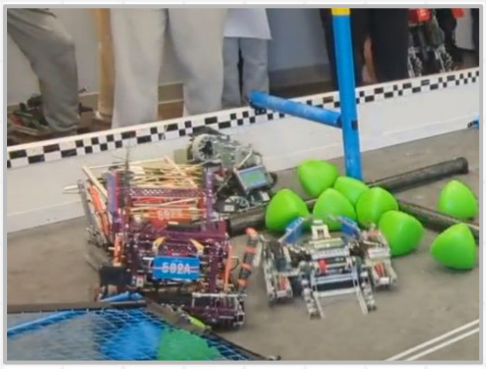


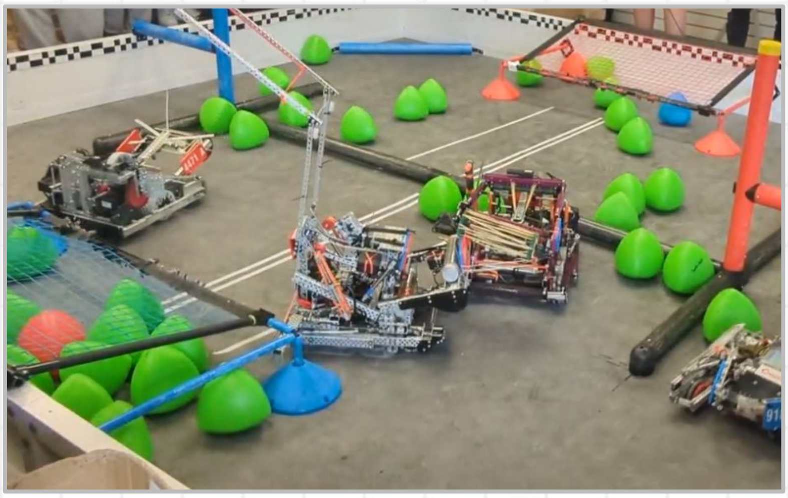
A series of mistakes and unfortunate circumstances caused us to lose the match. The first was when we failed to hook onto the matchload bar when matchloading which allowed 502A to push us, rendering us unable to launch Triballs to the other side.



The second mistake was that we didn't directly go to the Triballs in the center of the field, a possibility would have been to quickly open our wings and push the Triballs over the barrier with the wedges. This way, 502A would have taken longer to reach us.

Our alliance partner and 502A pinned us. We were unable to escape from the position. This was largely due to miscommunication between alliance partners.





ENTANGLEMENT

Another large factor was entanglement. During multiple times during the match, we were entangled with 502A. Each time they defended against us, their intake would get caught on a component of the robot. Overall, around 30 seconds of the game were spent entangled with them. We are unsure of what to do to combat this, other than potentially moving the plates.

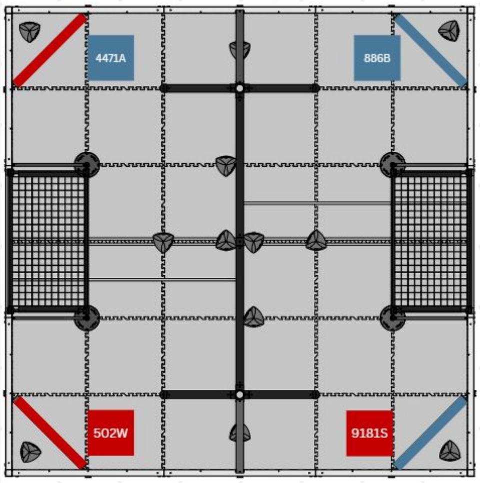
DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

QUALIFIER # 10: 502W & 9181S VERSUS 886B & 4471A

	Red	Blue
Total score	203	90
AWP		
Autonomous winner	🟥	
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	33	14
Triballs in offensive zone	0	0
Elevation tier	B	A

MATCH RESULT : WON 203 - 90

AUTONOMOUS PERIOD

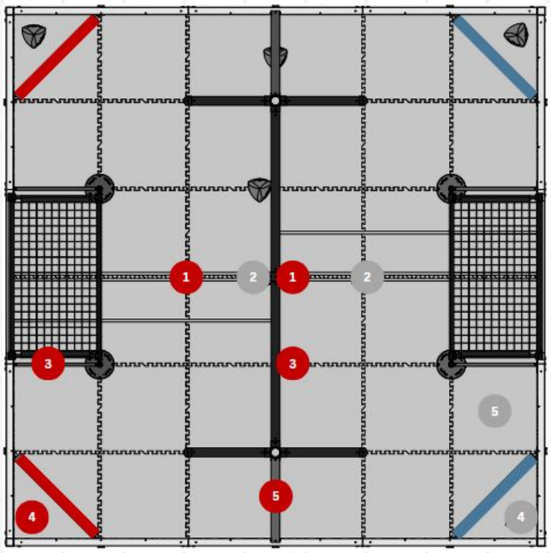


We decided to start on the close side as it was decided between us that we had the more consistent close side AWP. We decided to run close side rush as we hoped to push Triballs onto the other side, allowing us to successfully win the autonomous period as well as gain AWP.

9181S's far side auto consisted of scoring 5 Triballs (including the preload). This way, we'd be able for sure to win the Autonomous Bonus as well.

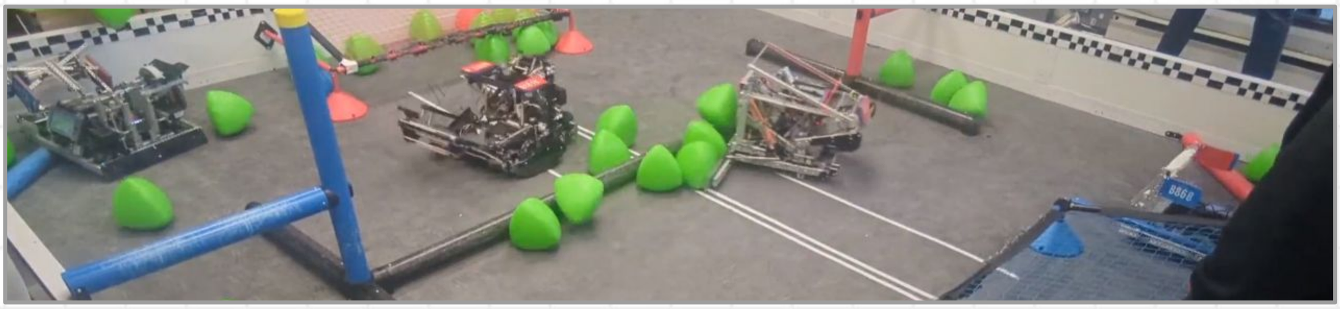
AUTONOMOUS RESULTS

This time around, we paid extra attention to setting the robot up. During our autonomous, our robot only missed a Triball in the middle(2). We managed to push in our preload into the goal, push one Triball over the long barrier, as well as removing the Triball from our match load zone and touching the elevation bar. We completed our side of the AWP, but unfortunately 9181S was not able to score the preload, hence preventing us from being awarded the AWP. Although we did win the autonomous bonus.



DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

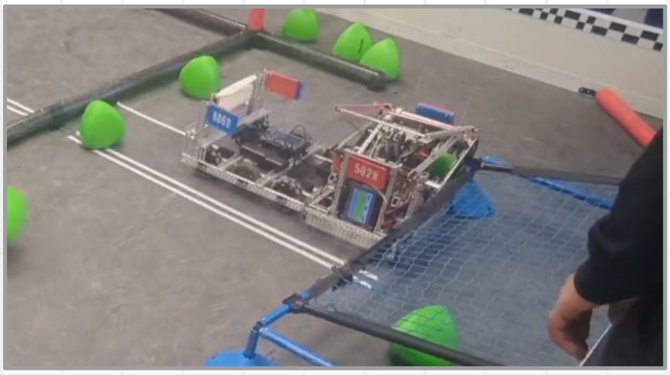


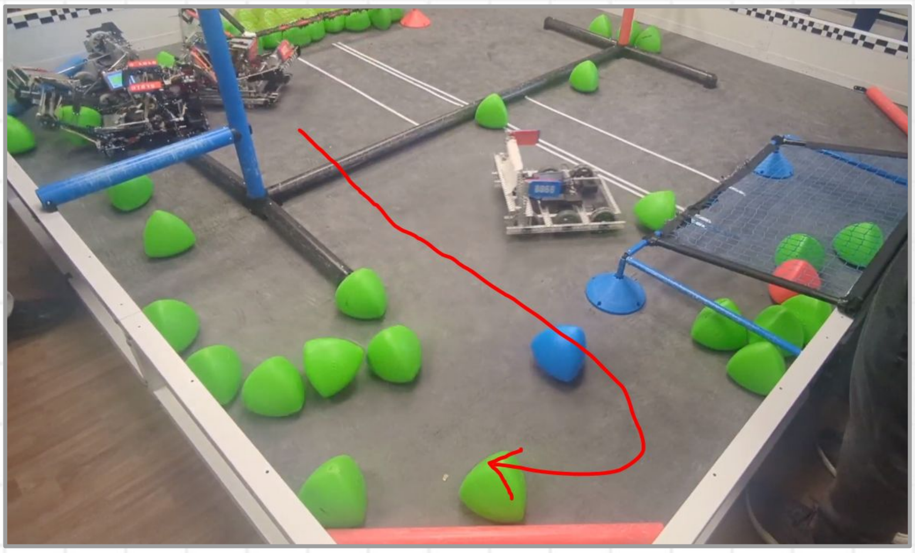
IMPLEMENTING IMPROVEMENTS

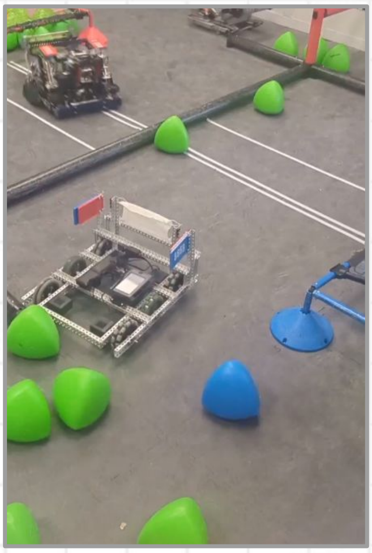
We decided to implement our observations from the previous match by opening our wings and pushing Triballs across the barrier. This served us well as we were able to quickly utilized our time to push Triballs across the middle barrier.

PINNING OBSERVATIONS

We took note that different game elements will be of aid when pinning. For instance, pinning in between the match load bar and goal. To the right, we were pinned against the goal, rendering us unable to escape it within a short amount of time.





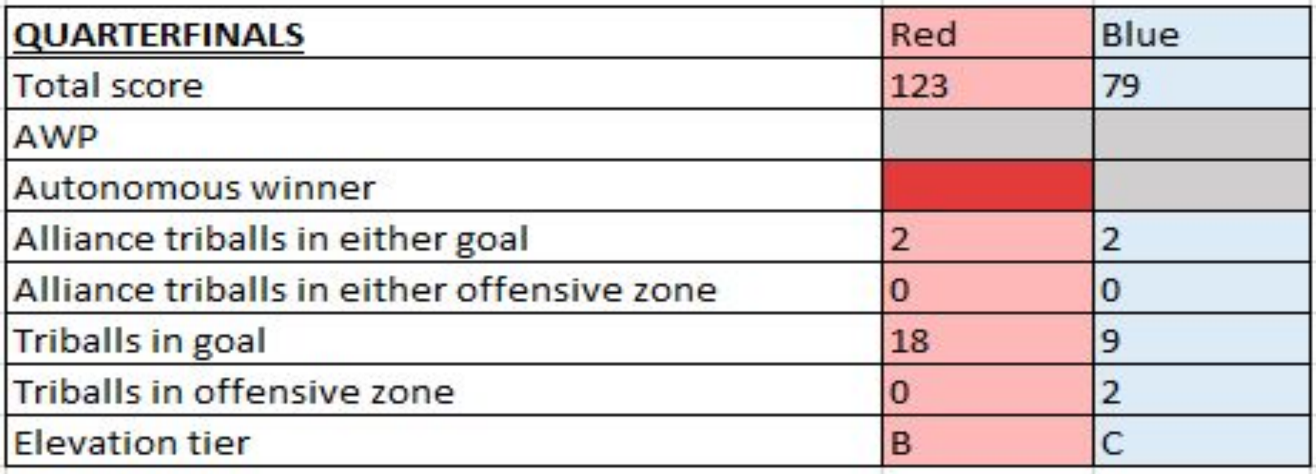


MISSED OPPORTUNITIES

There was one instance during the match where we both went to the same position. Instead, we could have made use of our sleds, gone across the barrier intercepting 886B instead of prioritizing the 3 unguarded Triballs (as seen on the upper right image.

DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

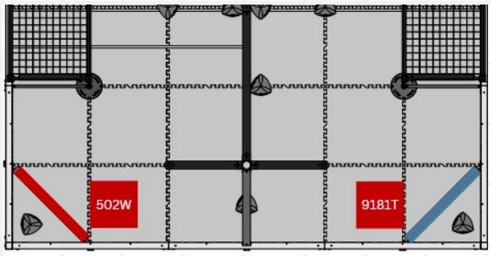
QUARTERFINALS: 502W & 9181T VERSUS 87265C &



QUARTERFINALS	Red	Blue
Total score	123	79
AWP		
Autonomous winner	🟥	
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	18	9
Triballs in offensive zone	0	2
Elevation tier	B	C

MATCH RESULT : WON 123 - 118

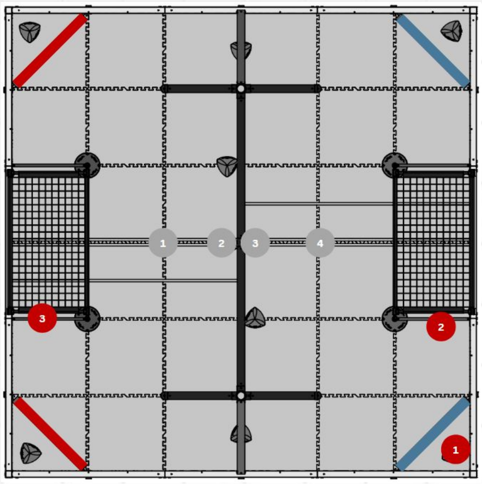
AUTONOMOUS PERIOD



We decided to run our close side auto for elims for easier matchloading. Unlike our AWP, instead of taking the Triball out of the matchload zone and touching the bar, we directly go to matchloading position so when the game starts no time will be wasted. 9181T's auto consists of scoring 3 Triballs including the Preload

AUTONOMOUS RESULTS

We won autonomous even though all we did was score the preloads. We missed the first step and after the second step the Triball slipped back into our side affter outtakking it. The same happened with 9181T where they only managed to score the preload and the Triball from the matchload zone and missed the other 2 Triballs.

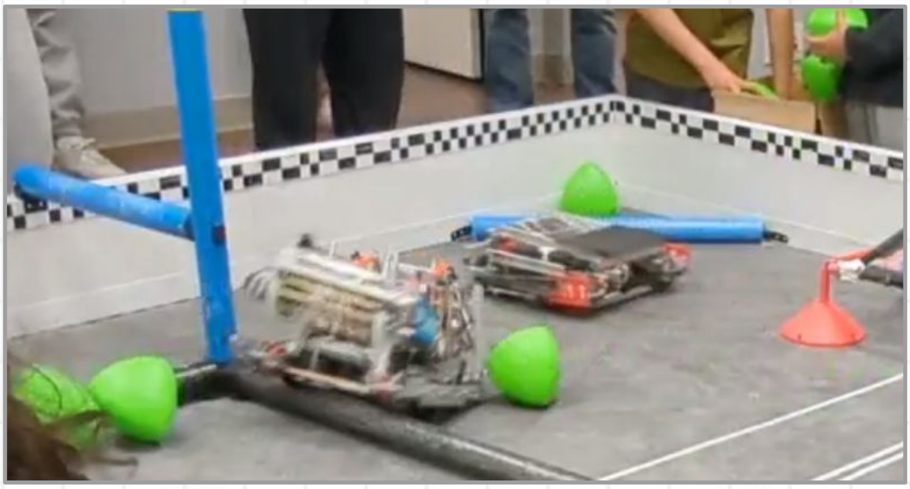


GAME STRATEGY

We decided to implement the same strategy we've used throughout, using our second iteration of the robot. We matchload Triballs over to the other side while 9181T guards the opponent matchload bars, preventing them from matchloading during the match. Both 9181T and we will try to score Triballs at any given moment but not at the cost of letting our opponent alliance score. As both the opponents cannot descore, we will be able to double zone anytime.

DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

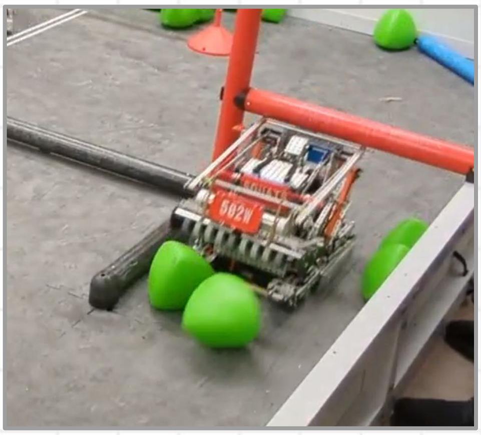


GOOD DEFENSE

9181T had great defense guarding the corner at all times. It's important to watch the matchloaders while defending to see which side they decided to matchload from. In this case, they did not switch sides. This way we can predict movements.

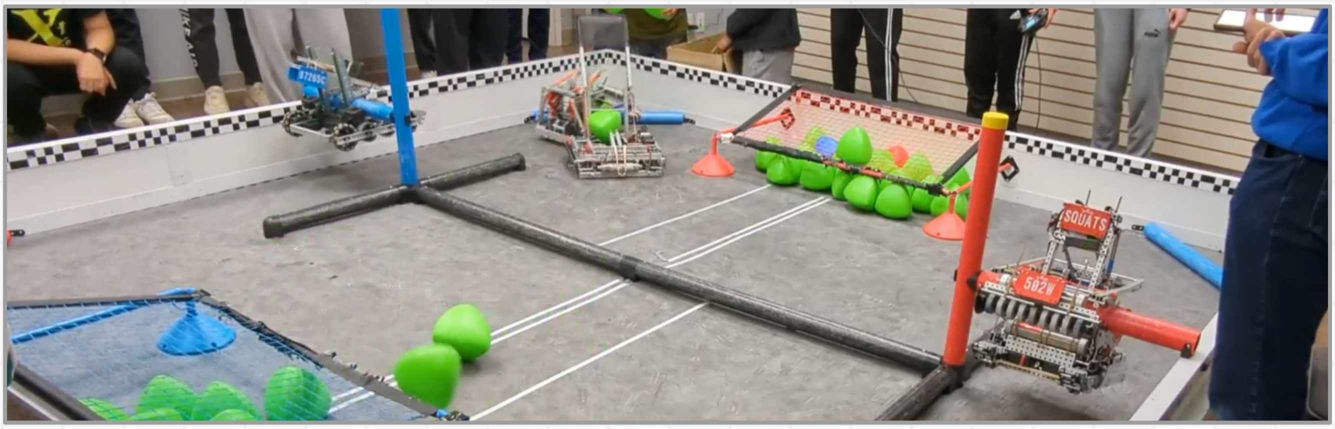
PINNED/STUCK IN POSITION

As stated in previously, we are only able to go under the elevation bar in one direction. While trying to push Triballs over to the other side an opponent robot pushed us from the other side effectively trapping us in the alley as we have limited maneuverability.



JAMMED SHOOTER

Our shooter tends to jam once in a while as we go under the elevation bar. Thankfully, it has yet to jam in crucial situations. So far in order to avoid it we've only mathloaded in the beginning of match via shooter.



ENDGAME

Game ended with a B tier climb from our alliance and a C tier from the other Alliance. We can note how much stronger PTO is compared to a piston climb.

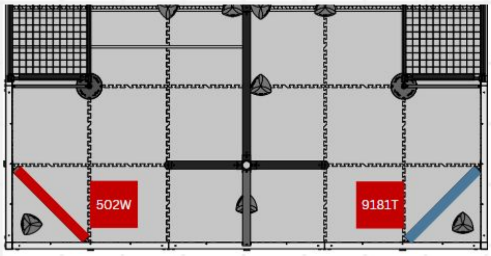
DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

SEMIFINALS: 502W & 9181T VERSUS 502A & 604Y

SEMIFINALS	Red	Blue
Total score	170	80
AWP		
Autonomous winner	🟥	
Alliance triballs in either goal	2	1
Alliance triballs in either offensive zone	0	1
Triballs in goal	26	12
Triballs in offensive zone	1	0
Elevation tier	B	B

MATCH RESULT : WON 170 - 80

AUTONOMOUS PERIOD

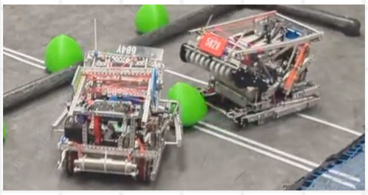


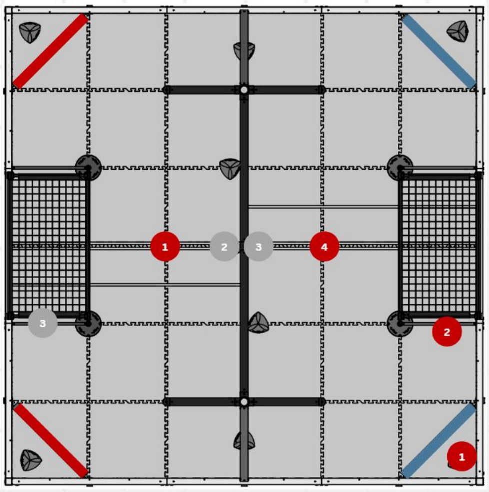
We decided to run our close side auto for elims for easier matchloading. Unlike our AWP, instead of taking the Triball out of the matchload zone and touching the bar, we directly go to matchloading position so when the game starts no time will be wasted. 9181T's auto consists of scoring 3 Triballs including the Preload

AUTONOMOUS RESULTS

We won autonomous. We missed all but the first step. 9181T had a partially successful auto run this time around where they only managed all but the 3rd step. Both our robot and 604Y implemented a rush into our programs except to different Triballs as seen on the image below.

The result of it was a crash and misdirection of our robots. Though, we all stayed within our respective zones.



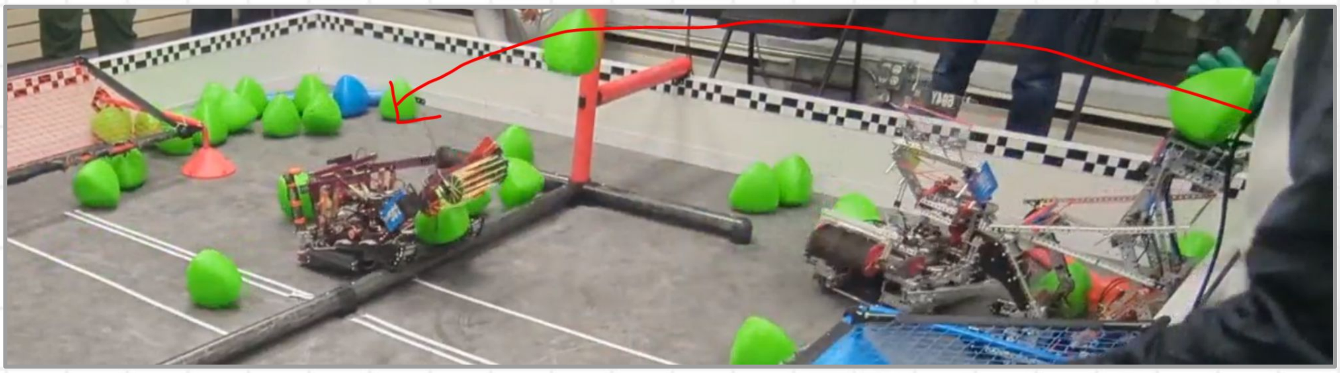


GAME STRATEGY

We decided to implement the same strategy we've used throughout, using our second iteration of the robot. We matchload Triballs over to the other side while 9181T guards the opponent matchload bars, preventing them from matchloading during the match. Both 9181T and we will try to score Triballs at any given moment but not at the cost of letting our opponent alliance score. As both the opponents cannot descore, we will be able to double zone anytime.

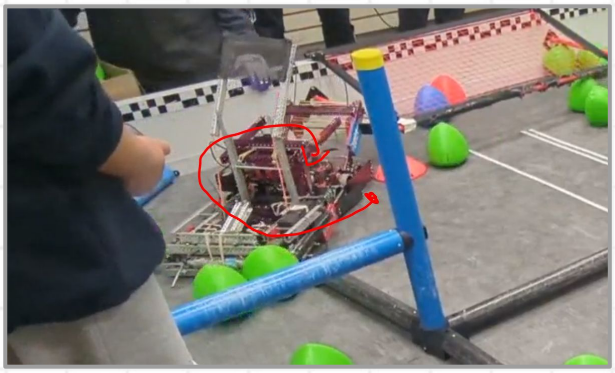
DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS



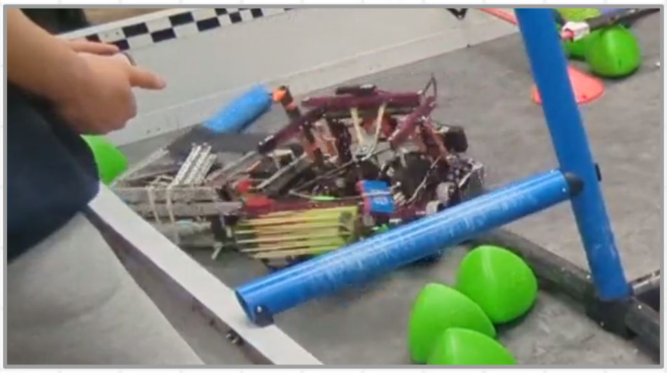
GOOD GROUPING

Grouping had been exceptionally well during the round. We managed to only land our Triballs in the corner which is beneficial in 2 ways, the first being it's easier for us to score, scoring via the side of the goal and the second being that it's much more difficult for opponent teams to manipulate the Triballs without them rolling into the match load zone or pushing them under the alley or over the barrier.



DEFENSE OBSERVATION NO. I

When 2 robots are both pushing one another, there is a possibility of rotation. In this scenario, 9181T took advantage of the rotation, successfully guarding the matchload bar. Note that they had initially started pushing at the red point

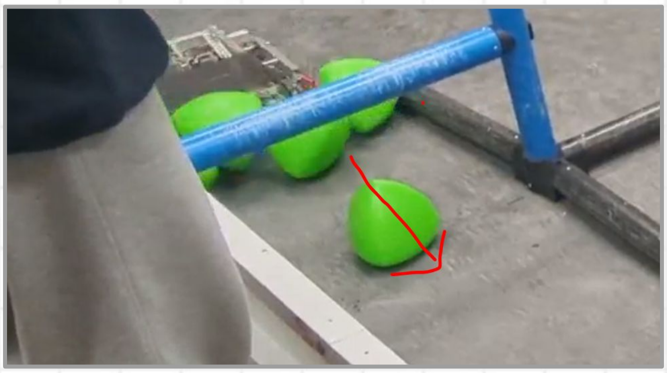


DEFENSE OBSERVATION NO. 2

As mentioned in previous match analysis, the ideal matchload position is when a robot is sandwiched in between the end of the barrier and the matchload bar. This blocks the other robots from going under the alley to score the Triball into the sides of the goal.

A SLIGHT ERROR

Our alliance partner made an error of accidentally pushing 5 Triballs to the opponent's side. We have to note that in competitions one should always be aware of their own position and color on a field lest we make similar errors in judgement.



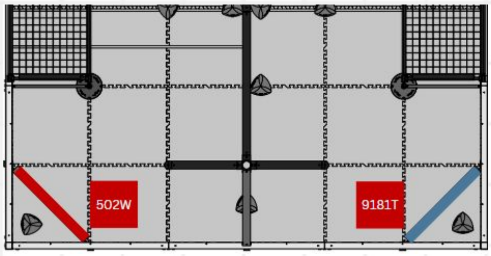
DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

FINALS: 9181E & 9181S VERSUS 502W & 9181T

FINALS	Red	Blue
Total score	76	132
AWP		
Autonomous winner		
Alliance triballs in either goal	2	2
Alliance triballs in either offensive zone	0	0
Triballs in goal	10	18
Triballs in offensive zone	8	2
Elevation tier	B	B

MATCH RESULT : WON 76 - 132

AUTONOMOUS PERIOD



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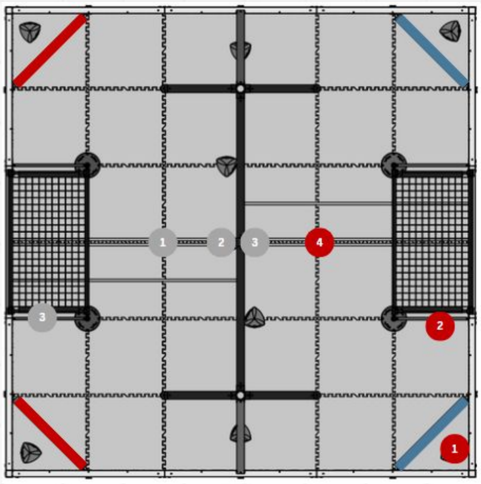
AUTONOMOUS RESULTS

Due to both teams from both alliances having rush we were again misdirected and did not manage to score any Triballs into the net. Thankfully, with the Triballs scored by our alliance partner we were abel to win the autonomous period.

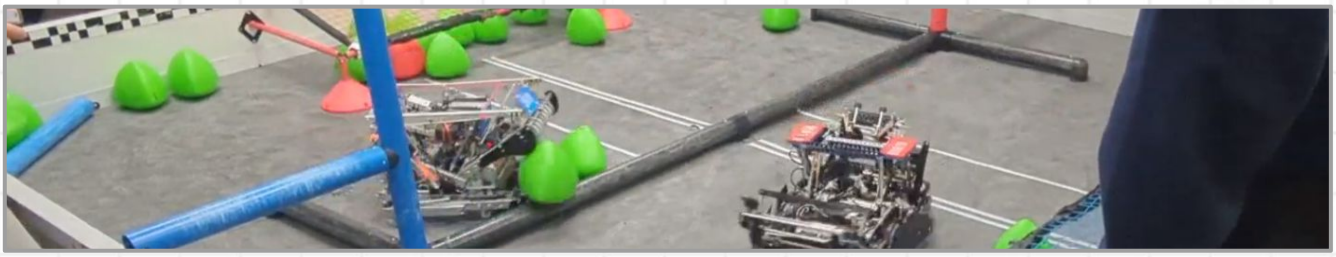


GAME STRATEGY

We decided to implement the same strategy we've used throughout, using our second iteration of the robot. We matchload Triballs over to the other side while 9181T guards the opponent matchload bars, preventing them from matchloading during the match. Both 9181T and we will try to score Triballs at any given moment but not at the cost of letting our opponent alliance score. As both the opponents cannot descore, we will be able to double zone anytime.

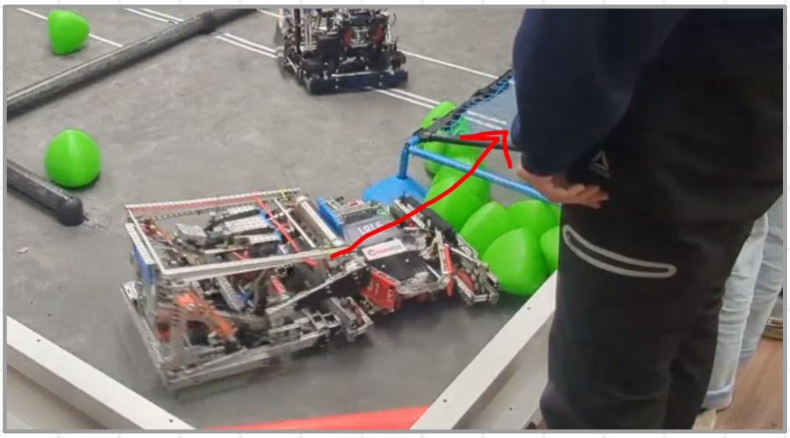
DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS



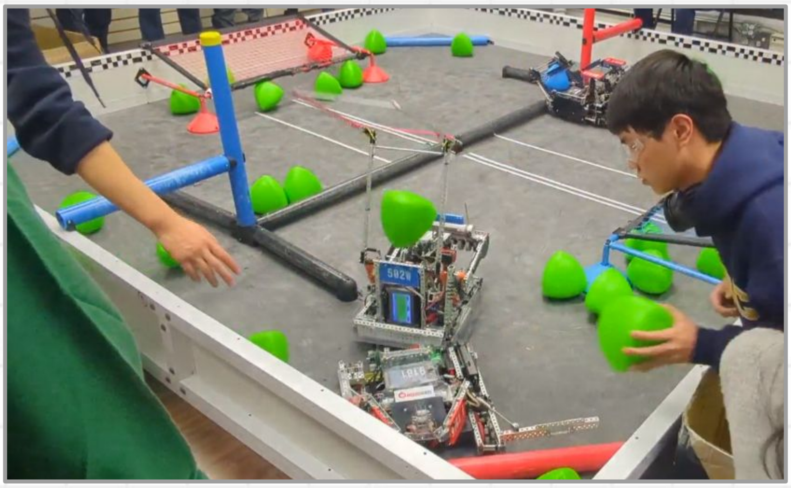
OBSERVATION ON PUSHING TRIBALLS OVER BARRIER

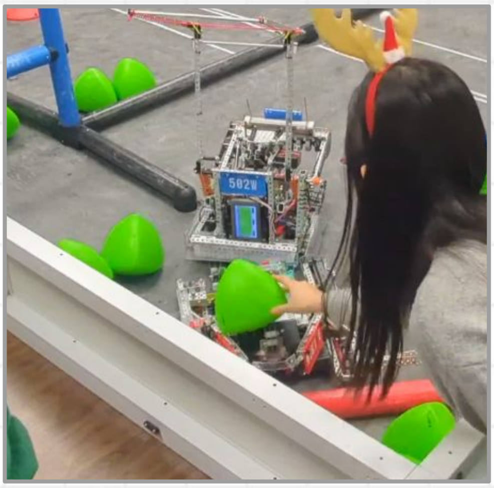
Something we noticed is that Aaron seems to be more comfortable pushing Triballs with the intake than the wedge. More driver practice will be needed in order to combat this.



TORQUE

More torque gives us a higher advantage in games. We are able to push other robots with much more ease. In the scenario on the right, 9181E was trying to block us from scoring. As we had more power we were able to push 9181E so that we scored the Triballs through them.





BLOCKER

We used our blocker to defend 9181E from matchloading. Here we came to a conclusion that a shorter robot is easier to block as most of the Triballs hit our plate and the lower ends of the blocker. Although we didn’t use our blocker that much during games and at times it seemed like more of an annoying component, it was still useful when blocking shots in specific situations.

DEFENSE

Again, this position is ideal to defend with. This way they are unable to move to the left, into the alley where they can cross and score Triballs into the goal.

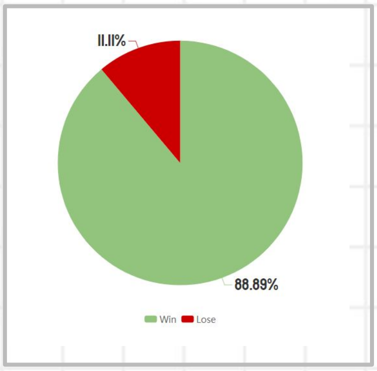
DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

WPRA CHRISTMAS

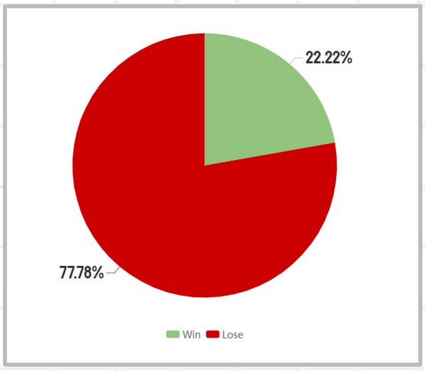
Summary

Overall, we were quite happy with the results of our very first tournament with this robot.

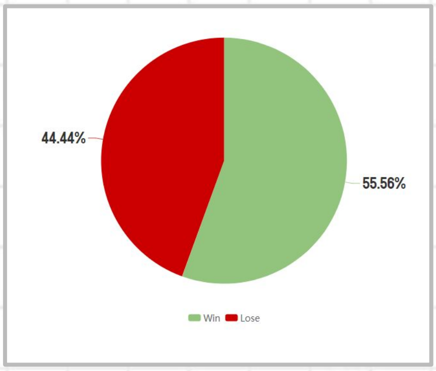
WINS VS LOSSES



AWP



AUTONOMOUS WINS VS



WHAT WORKED WELL

- **Smooth grippy intake**
  - Allowed us to intake while being pushed
- **Matchloading via the elevated shooter**
  - During qualifications, we never got blocked
- **Hook/Blooper**
  - This kept us in place while matchloading
  - Able to remove the triball from the matchload zone consistently
- **Drivetrain**
  - Gave us pushing power and allowed us to travel fast
- **Sleds and weight balance**
  - We were able to achieve a B tier climb as well
  - Able to go over the middle barrier with ease
- **Game strategy**
  - We were better in communicating with other teams allowing us to smoothly flow through eliminations.

MAJOR ISSUES

- **AWP inconsistency**
  - In many games, we were unable to gain an AWP which impacted our rankings in qualifications.
  - Reasons were due to colliding robots in the neutral zone.

- **Maneuverability**
  - Maneuvering under the elevation bar proved to be difficult when we were getting pushed from another side due to the reason that we are only able to go under the elevation bar from one direction.

DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

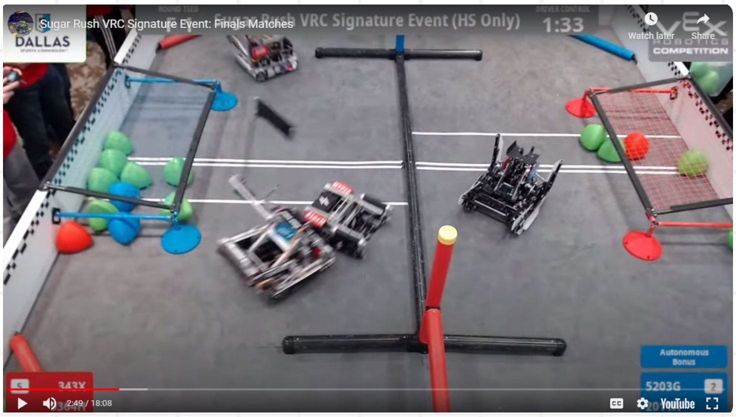
ROBOT REBUILD

Goal

Rebuilding our robot

Why rebuild our robot?

- Upon watching signature events to better improve our game strategies we noted that in BC our competition region, we are very launch centered where majority of teams match load via shooter every single match. Upon watching signature events, namely Sugar Rush the most common strategies used in eliminations were Starvation.



- Teams preferred to use their intakes to score Triballs individually into the goal. The times where majority of Triballs are scored seemed to be from the autonomous period. Then teams switch to all defense with occasional scoring.

- Rebuilding our bot will be the fastest way to ameliorate all aspects or components of our bot

- Trying out new strategies will improve our competitive edge, the larger the range of different strategies that we are comfortable with the better we are able to quickly make decisions in games

- A new robot will also increase our own skills and expose us to new mechanisms or variations of them

- We will also improve our efficiency and time management

Overall, rebuilding our robot will be a rewarding experience for us. As we only have 2 weeks we are excited to tackle a new challenge within this time frame. We look forward to bringing our new robot to the upcoming tournament at Southridge Secondary on January 20th

DATE: 01/08/2024 DESIGNED BY: RL WITNESSED BY: TC

TOP 3 MAJOR REQUIREMENTS

- **Light in weight**
    - Our old robots were 17 lbs and 19 lbs. Which was a major contributing factor to overheating and slower speeds.
    - A robot being too heavy will also impact our goal of going over the barrier smoothly. Being able to go over will allow us to use even better game strategies, as we can now manoeuvre with ease throughout the entire field.
- **Strong against defence**
    - Over under is heavily contact based, from our experience.
    - Especially for our new strategies, we hope to be strong in defence as starvation will rely on us being able to push other robots as well as being able to withstand other robots pushing us from different sides .
- **Fast**
    - Having an advantage of speed will highly impact our performance in games.
    - We will be able to quickly score and beat other robots to our own goal. We found that robots do chase to try and defend so we wish to out drive them.

OVERALL CONSTRAINTS

RULE CONSTRAINTS:

Our robot should fit within an 18” x 18” x 18” cube as stated in <R4>

MATERIAL CONSTRAINTS:

None

TIME CONSTRAINTS:

Drivetrain is to be completed on Monday, November 27th

DATE: 01/08/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

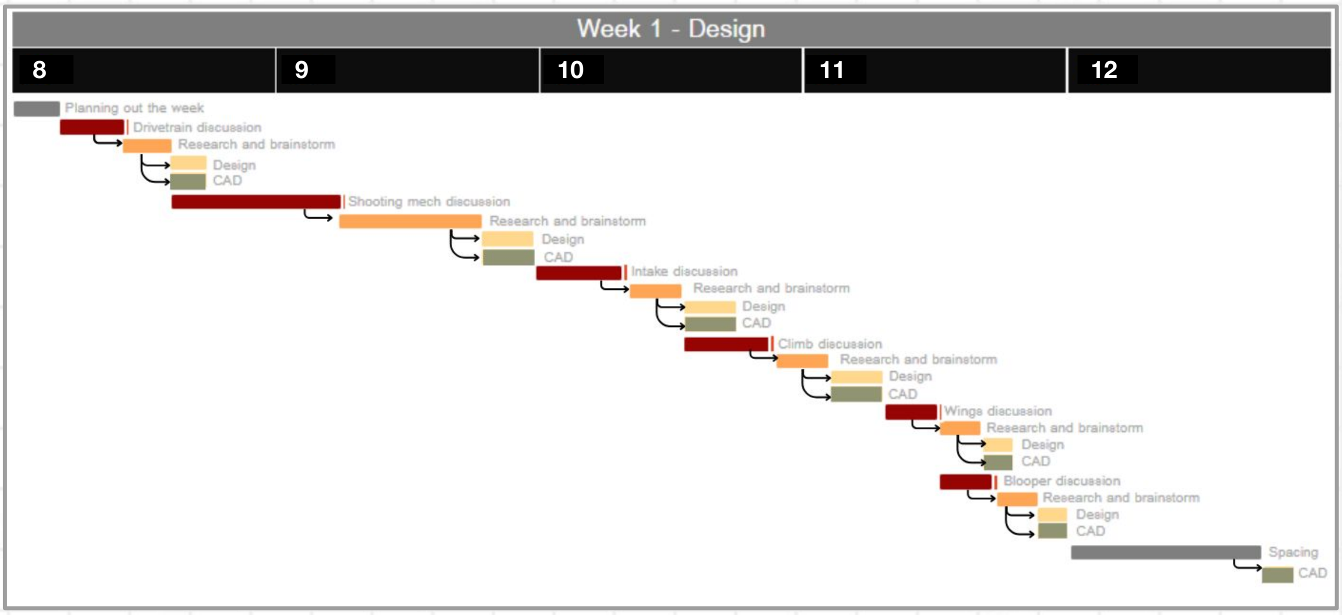
Organizing our time in order to efficiently make use of it and complete the rebuild

PLAN

We have 2 weeks to get a complete a robot, in order to efficiently maximize our use of time we've decided to split the weeks as the following:

- Week 1 → Design and Cad
- Week 2 → Build, Code, and practice

<u>Here is a Gantt chart showing a detailed plan of week 1</u>



We've decided to color code the process we will follow with the design process of the mechanism, that also is shown on the sides of the notebook.

🟥 Identify Problem 🟥 Set Specific Reqs 🟧 Research 🟨 Select solution 🟩 Develop solution

We will follow this schedule to our best, and we will also be checking in with the chart mid-week on January 10 to see if any changes need to be made. At the end of the week, we will confirm that all is done and create a new Gantt chart for week 2.

DATE: 01/09/2024 DESIGNED BY: RL WITNESSED BY: TC

Goal

Making a drivetrain

What needs to be improved from our previous drivetrain?

- Our old drivetrain gear ratio of 3:4 at 450 rpm paired with 2.75” wheels
- We will try to raise the speed of the drivetrain will allowing us to gain a competitive edge in games.
    - Previously our driver spent less time grappling with the speed in practice, therefore making it possible for us to allocate more time on skills, offence or defensive routes and strategies that we wanted to try.
    - Yet we found out that speed benefits us immensely in all the aspects we wanted to allocate more time to. Time must be spent for driver practice.

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Speed**
    - We want to raise our speed now but not so much that our driver cannot handle even with tons of practice. Having the confidence in our speed will do us well in skills and during games.
    - We won’t raise our speed exponentially, so we hope to not pass the 550 RPM range from our current range of 450 RPM.
- **Power**
    - Pushing power will greatly impact our odds of winning or losing a match. Defence is always important as well as offence, where we hope to withstand pushes and be able to stay our ground. This will be beneficial as we hope to match load a lot more with our new robot
- **Maneuverability**
    - We want to be more at ease navigating the elements. This will allow us to efficiently use time to travel around the field during matches. Giving us a more competitive edge.

CONSTRAINTS

RULE CONSTRAINTS:

Our drivetrain should fit within an 18” x 18” x 18” cube as stated in <R4>

MATERIAL CONSTRAINTS:

None

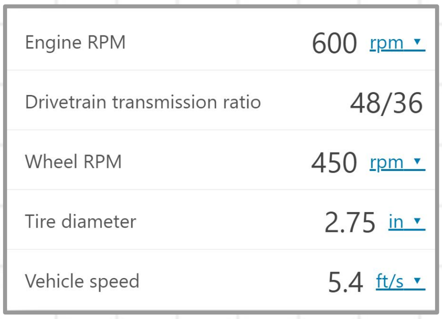
TIME CONSTRAINTS:

Drivetrain is to be completed on Monday, January 15th

Goal

Finding possible ways we can tick off these goals while still staying within the constraints. Our RPM calculations are used are done via the RPM calculator on the website omni calculator (https://www.omnicalculator.com/everyday-life/rpm)

SPEED

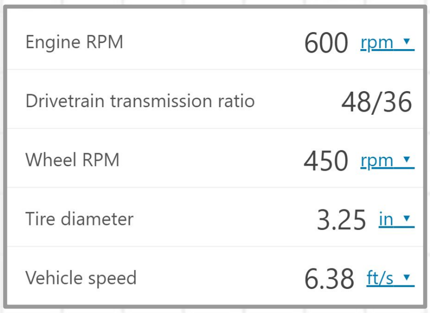


Engine RPM	600 rpm
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm
Tire diameter	2.75 in
Vehicle speed	5.4 ft/s

For reference, this was our original gear ratio and rpm (shown on the left) → 4:3 at 450rpm

Our goal is to raise the speed of the drivetrain by a little bit so that we gain a competitive advantage. We’ve decided to use ft/s for speed as our field is measured in feet (12’ x 12’)

Below are possible solutions



Engine RPM	600 rpm
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm
Tire diameter	3.25 in
Vehicle speed	6.38 ft/s

Solution 1

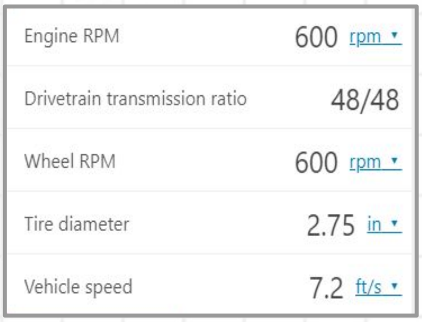
A possibility could be to revert to our old wheel size. Note that with this change, our drivetrain speed will increase 0.98 ft/s than originally.

CONSIDERATIONS:

We’ve had previous issues around the Drivetrain and handling this speed, then again we are familiar with this gearing and speed thus making practice easier

DATE: 01/09/2024 DESIGNED BY: RL WITNESSED BY: TC

DRIVETRAIN

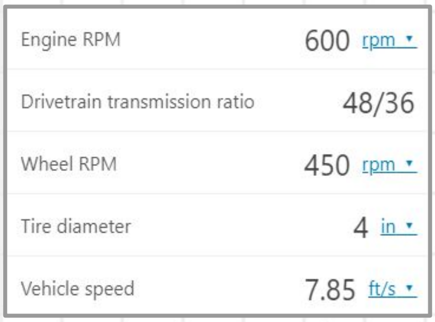


Engine RPM	600 rpm ▾
Drivetrain transmission ratio	48/48
Wheel RPM	600 rpm ▾
Tire diameter	2.75 in ▾
Vehicle speed	7.2 ft/s ▾

Solution 2

This will involve us changing a the gearing. The gear ratio will be changed to 1:1 with any choice of gear size, resulting in 600rpm. Wheel diameter will remain the same

CONSIDERATIONS:
This will most likely be too fast and sensitive for us to control. Although it is fast, it may prove to be an issue for us,



Engine RPM	600 rpm ▾
Drivetrain transmission ratio	48/36
Wheel RPM	450 rpm ▾
Tire diameter	4 in ▾
Vehicle speed	7.85 ft/s ▾

Solution 3

This will involve us changing the wheel size. RPM and gear ratios remain the same and we will be traveling at a speed faster than our second solution.

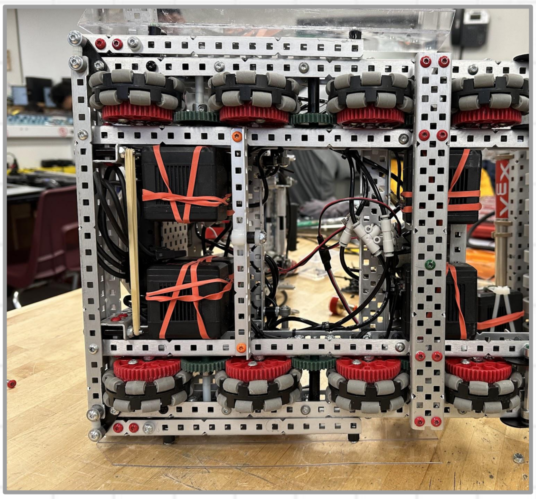
CONSIDERATIONS:
Again this speed may prove to be so difficult to control.

Summary of solutions

In total, we have 3 solutions which have a range of speeds. Going from 6.38 ft/s to 7.85 ft/s

POWER

On first bot, we had previously used 4 omnidirectional wheels on each of the drivetrain but ended up changing them to 2 omnidirectional wheels with 2 traction wheels. Then for our current robot we implemented 4 omnidirectional wheels. 2.75” in size. If we revert to 3.25 omnis, so long as we have an evenly distributed weight, we will be able to defend ourselves from getting flipped



We’ve decided to revert to our old combo IF we use 3.25 wheels, but we will keep this wheel combination if we use the same size wheels. This way we won't get tipped over in any way

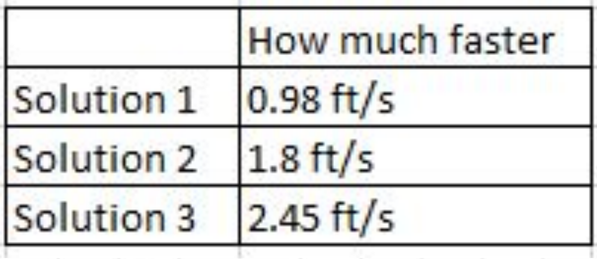
DATE: 01/09/2023 DESIGNED BY: RL WITNESSED BY: TC

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
BACKGROUND RESEARCH
BRAINSTORM, EVALUATE, CHOOSING SOLUTION
DEVELOP AND PROTOTYPE SOLUTION
TESTING SOLUTION

Goal

Selecting a design

DECISION MATRIX



	How much faster
Solution 1	0.98 ft/s
Solution 2	1.8 ft/s
Solution 3	2.45 ft/s

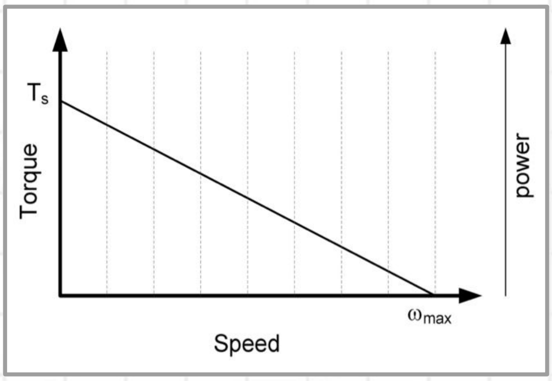
We can see that solution 3 is way faster than our first speed of 5.4 ft/s

Past considerations

We have to note that we found difficulty with Solution 1 previously with our first robot causing us to aim for a slower drivetrain. Using previous knowledge it seems that solution 3, an extremely fast gearing will appear to be too hard to handle.

Torque

Though we do want to increase speed we cannot neglect torque. The faster the robot the lower the torque.



As there is an inverse relationship between the two if we go for option 2 and 3, we fear that we won't be able to be strong in defense against other robots. Although speed is important it's not enough to sacrifice pushing power for, hence solution 1 is the only solution where there is a balance.

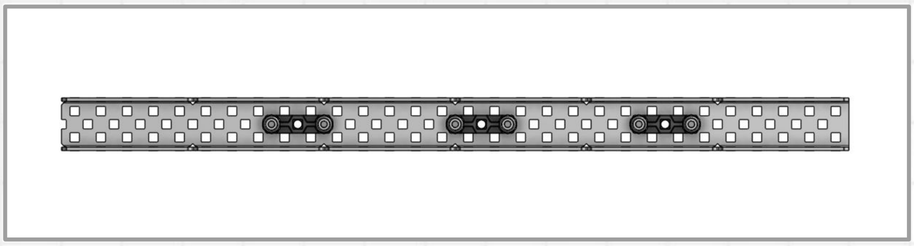
Conclusion

We will be going with solution 1, with the 8 omnidirectional 3.25” wheels as before, aiming to have a robot narrower in width compared to our previous robot.

DATE: 01/09/2024 DESIGNED BY: RL WITNESSED BY: TC

DESIGN SPECIFICATIONS

- 8x 3.2” Omni wheels
- 8x 36T Low Strength gears
- 8x 48T High Strength Gears
- 6x Low Strength Shafts cut to 3.5”
- 8x 2” Screws
- 1x Delrin Sheet
- 2x 1x2x1x30 (30 hole) C-Channel
- 2x 1x2x1x28 (28 hole) C-Channel
- 3x 1x2x1x20 (20 hole) C-Channel
- 4x 1x2x1x10 (10 hole) C-Channel
- 2x 1x3x1x22 (22 hole) C-Channel
- As well as spacers, standoffs, bearings and nylocks that remain subject to change

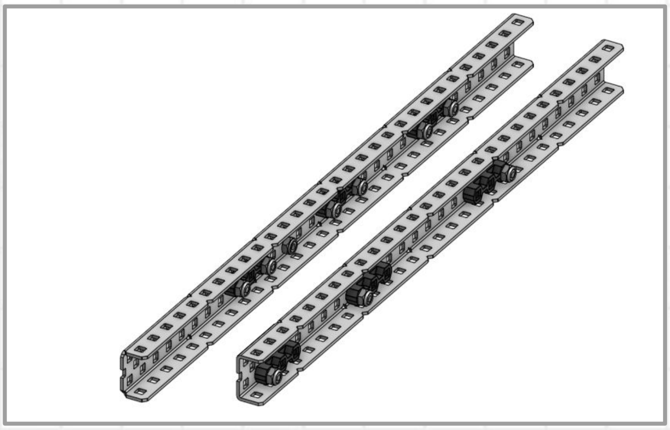


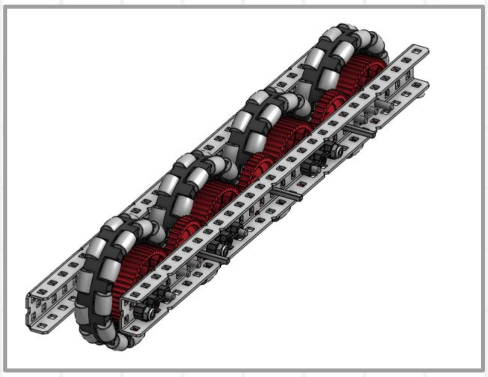
1)

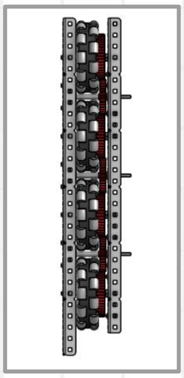
We first attach bearings onto the two 20 hole C channels on the holes shown on the left

2)

Then we attach them onto the 28 hole C-Channels. We take 2 C-Channels of both sizes and lines up their ends as shown on the image to the right. We should have 3 holes of a difference between the front of the two pieces







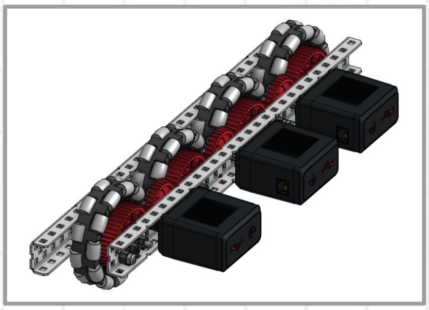
3)

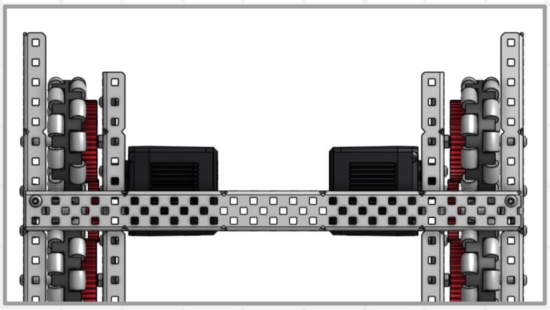
With the C-Channels lined up, we then put on the wheels and gears. We use screwjoingts for the wheels and 48T gears (attached together) and LS shafts for the 36T gears.

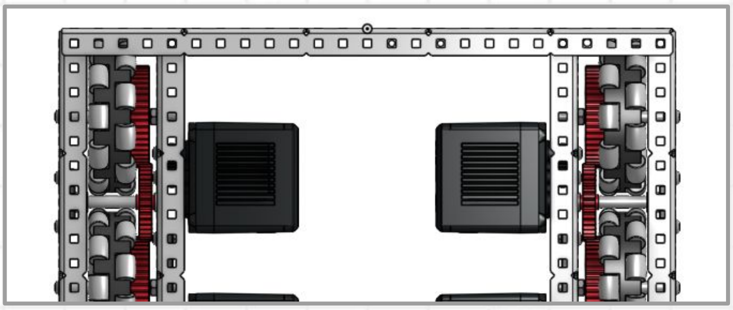
DRIVETRAIN

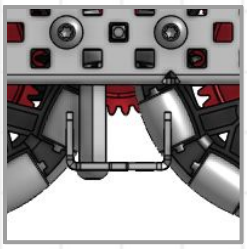
4)

After creating steps 1-3 over again, we attach the 200 rpm motors to the LS shafts. This time we decided to not make a gearbox as we can aim for a lower robot as well as needing less space for the intake.







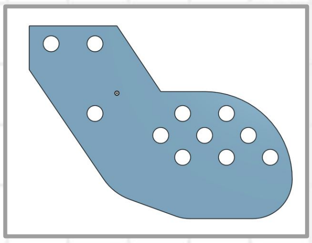


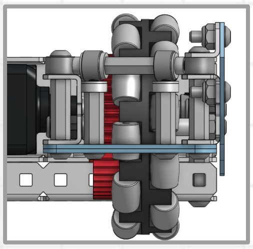
5)

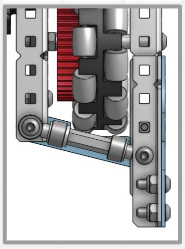
Next, we place the 2 components together and attach them with a 3x25 C-Channel at the end to form a back wall where we can push Triballs. Then with a 25 C-Channel we cross brace the middle with a 1-inch standoff each located on the 10th holes of the outer C-Channels and the 7th on the inner.

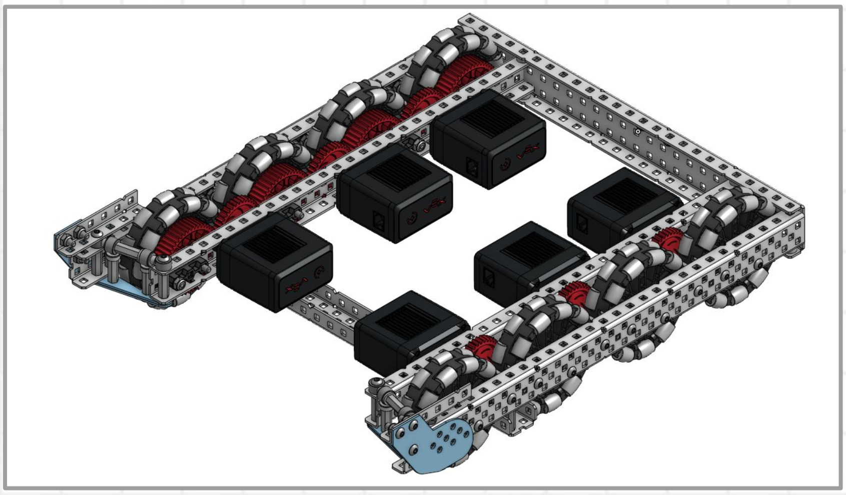
6)

Sleds serve to allow us to go over the middle barrier, allowing us to implement multiple game strategies. We heavily brace them to withstand wear.









This is our completed drivetrain and we look forward to creating it.

DATE: 01/09/2024 DESIGNED BY: RL WITNESSED BY: TC

Goal

Making a shooting mechanism

What needs to be improved from our previous shooter?

- Our previous version of a raised shooter served to be more harmful than beneficial in games, limiting movement.
- Previously we were only able to go under the horizontal elevation bar in one direction as our elevated shooter was too tall when folded down
    - This issue led us to become jammed against it while playing defense multiple times.
- Judging from the current game strategies, a shooter would be most beneficial in skills, while in games we hope to focus on bowling. Again, this is one of the major reasons why we decided to rebuild the robot in the first place.

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Speed**
    - We want a fast shooter as in skills we only have 1 minute to score as many Triballs as we can. We hope to have the shooter cycle for under 30 seconds, that way we can allocate more time into scoring them into the net
    - We hope to have a hence helping with accuracy as well and to ensuring Triballs land quickly and that they do not roll off to the sides

- **Accuracy**
    - We want the matchloaded Triballs to land directly in front of the goal
    - With more accuracy and consistency our robot would have much ease in pushing Triballs into the goal
    - More time will be saved as well as an overall higher skills score

DEFINE A PROBLEM
SET SPECIFIC REQUIREMENTS
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CONSTRAINTS

RULE CONSTRAINTS:

Our shooter should fit within an 18” x 18” x 18” cube as stated in <R4> when mounted on the drivetrain. Should also be under 11” vertically at all times (to go under the elevation bar.

MATERIAL CONSTRAINTS:

None

TIME CONSTRAINTS:

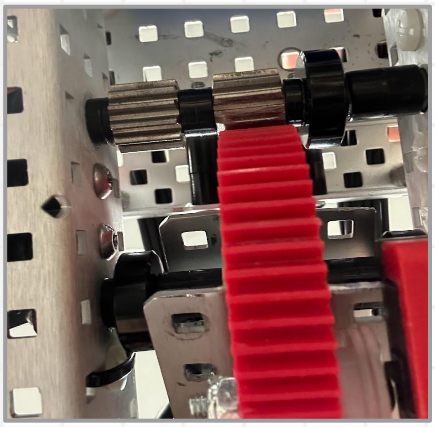
Drivetrain is to be completed on Monday, January 15th

Goal

Finding possible ways we can tick off these goals while still staying within the constraints and size.

We’ve decided to keep a puncher mechanism as it served us quite well on the previous robot.

SPEED



For reference, this was our original gearing for our shooter (shown on the left)

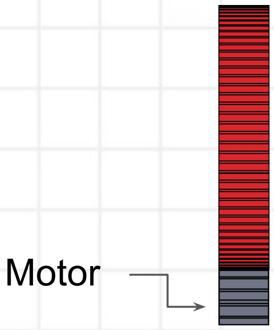
12T - 60T

Below are possible solutions

Solution 1

A possibility could be to use the fastest gear ratio, with a 12T gear and an 84T gear

CONSIDERATIONS:
Will our matchloading skills be on par with the speed of the shooter, previously we found it hard adjusting to the speed.

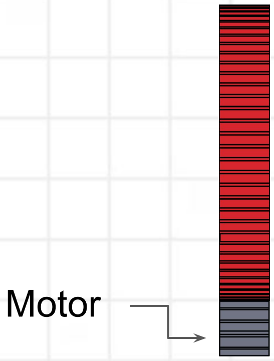


DATE: 01/15/2024 DESIGNED BY: RL WITNESSED BY: TC

Solution 2

Another possibility could be to use the a slightly slower gear ratio but still faster than our previous, with a 12T gear and an 72T gear

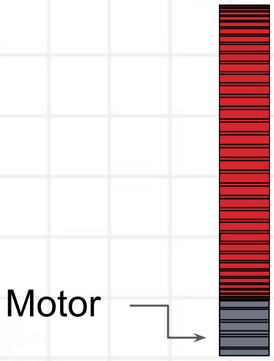
CONSIDERATIONS:
Will our matchloading skills be on par with the speed of the shooter, previously we found it hard adjusting to the speed.



Solution 3

The final solution would we to keep the same gearing for the mechanism.

CONSIDERATIONS:
We already matchloaded at max speed before and the shooting time is under 30 seconds. This wouldn't lead to much improvement at higher speeds.



Goal

Selecting a design

Initial observations and connections

While observing, we always keep our goal of good grouping in mind as well as the potential of improvement

Solution 1 - 12T driving 84T slip gear

Pros

- Fast
- Speed adjustable
- Would allow for the most Triballs across the field with minimum time
  - Increase in skills score
  - Last minute matchloading in games

Cons

- Less power due to speed
- Matchloading may need lots of practice and there might be difficulty adjusting.

Solution 2 - Flywheel on a stick

Pros

- Fast
- Easier to adjust to for matchloading than solution 1

Cons

- Less power due to speed
- Matchloading may still need lots of practice and there might be difficulty adjusting.

Solution 3 - 12T driving 60T slip gear

Pros

- Fast enough
- We already have experience with it
- Less time adjusting to matchloading

Cons

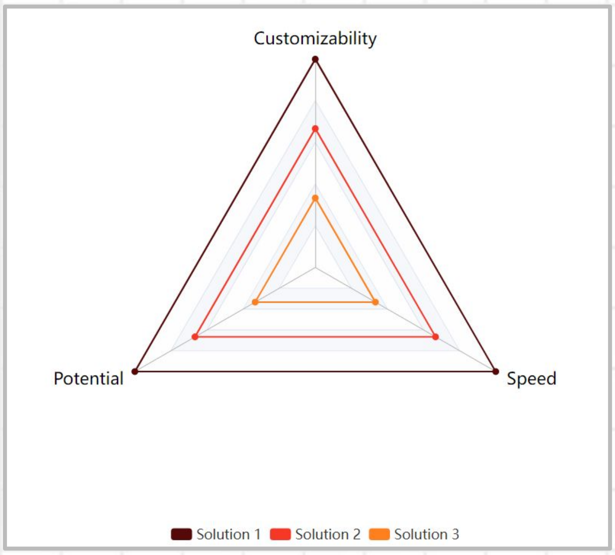
- No potential for improvement

DECISION MATRIX

We’ve decided to rank our solutions from 1 to 3, 3 being the best and 1 being the worst. Here are a list of ideal characteristics we’d look for when determining the final solution

- **Customizability**
  - Allows us to easily control variables allowing for a smoother gameplay and easier adjustments, maximizing our use of time and scores.
- **Speed**
  - This is our second goal to achieve as this will be the most important variable in skills.
- **Potential**
  - Potential for improvement

	Solution 1	Solution 2	Solution 3
Customizability	3	2	1
Speed	3	2	1
Potential	3	2	1



After ranking and graphing them out, it seems that Solution 3 is the obvious choice to match our requirement.

DATE: 01/16/2024 DESIGNED BY: RL WITNESSED BY: TC

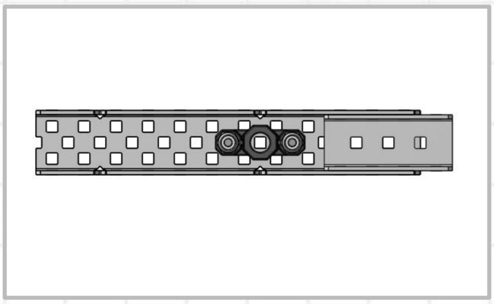
Goal

Designing the shooting mechanism

DESIGN SPECIFICATIONS

- 2x High Strength Shaft
- 1x 84T High Strength Gear
- 1x 12T High Strength Gear
- 2x 1x2x1x12 (12 hole) C-Channel
- 2x C-Channel couplers
- 1x 1x2x1x10 (10 hole) C-Channel
- 1x 1x2x1x17 (17 hole) C-Channel
- 1x 1x2x1x13 (13 hole) C-Channel
- As well as bearings, screws, nylocks and spacers that remain subject to change

CAD - GUIDE

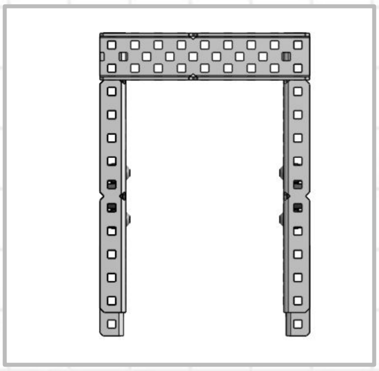


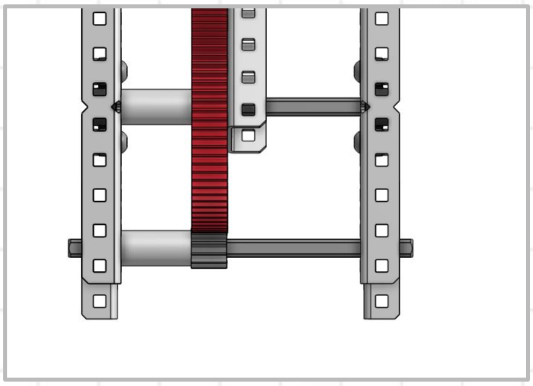
1)

We first take our two 12 hole c-channels and attach the couplers onto the end, lining up the last 2 holes. We then add a bearing onto the 3 holes starting from the 3rd hole. 1 hole after our couplers.

2)

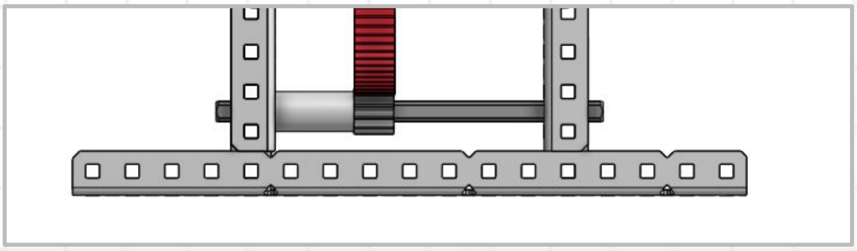
We then take the 10 hole c-channel and attach our two pieces onto the ends(non coupler end). This will serve as our frame for the shooter.





3)

Add two 6” HS shaft pieces in through the holes where the bearings are placed. On the top HS shaft, we attach a 1.5” spacer then our 8T gear and finally our 13 hole c-channel which will be making contact with the Triball. Then on the bottom, a 1.5” spacer and a 12T gear.



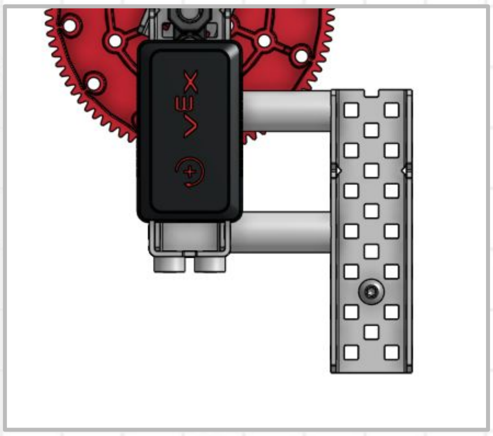
4)

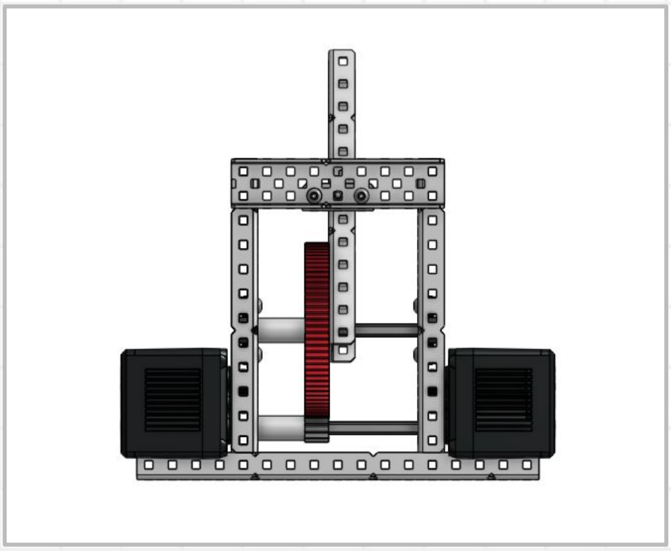
Attach a 12 hole c-channel on the bottom lining up the 5th holes of both ends to the couplers

5)

Take two 7 hole c-channels and attach them onto the frame via two 1.5” spacers.

This will serve as extra bracing for the force as well as a means to attach the mechanism onto the drivetrain.



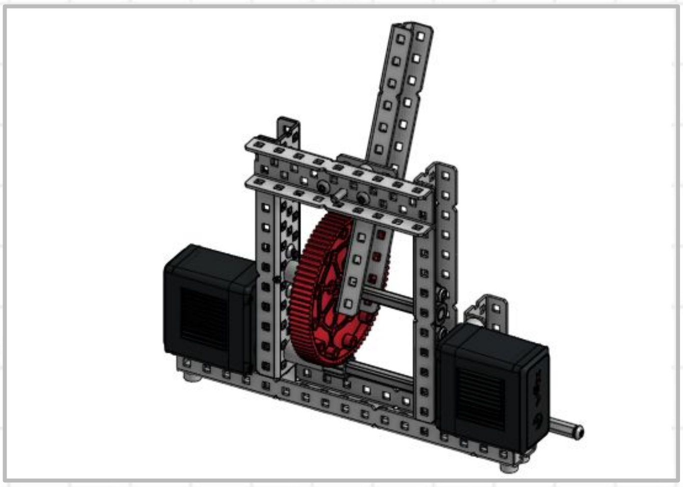


6)

We add 2 motors onto both ends of the lower HS shaft, this will aid us in getting more power and force when launching the Triballs across the field as well as allowing us to have higher accuracy.

This is our completed mechanism. As typically we allocate a single motor to the shooter, we now have no motors left.

We’ve decided to have no motor on the intake during skills, then adding the motor back onto the intake during games.



DATE: 01/17/2024 DESIGNED BY: RL WITNESSED BY: TC

INTAKE

Goal

Designing the intake

SAME DESIGN

WHY SAME DESIGN?

- We found the intake to be one of the best components of our previous robot
- Allowed us to smoothly score the triballs in the goal
- Grippy

ADDRESSING POSSIBLE ISSUES

Scoring smoothly

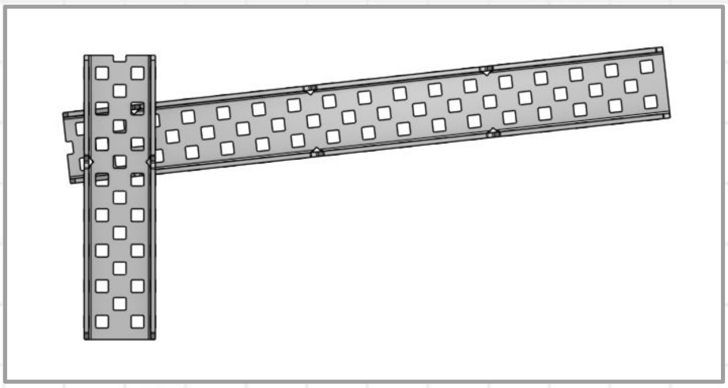
- We will be implementing sleds, so that we can easily slide over the goal
- This will allow us to smoothly score the triballs in the goal
- We've decided to go with delrin as our material again
- Delrin is very durable and that is why we've chosen to use delrin as our material instead of any other plastic

DESIGN SPECIFICATIONS

- 1x High Strength Shaft
- 1x Delrin Sheet (continued from our drivetrain sleds)
- 8x 2" flex wheels
- 2x 1x2x1x17 (17 hole) C-Channel
- 2x 1x2x1x8 (8 hole) C-Channel
- 2x 1x2x1x6 (6 hole) C-Channel
- 1x 600 RPM Motor
- 2x 6T Sprockets
- 1x Chain
- 1x 1x3x1x22 (22 hole) C-Channel
- As well as nylocks, standoffs and spacers that remain subject to change while designing.

DATE: 01/18/2023 DESIGNED BY: RL WITNESSED BY: TC

CAD - GUIDE

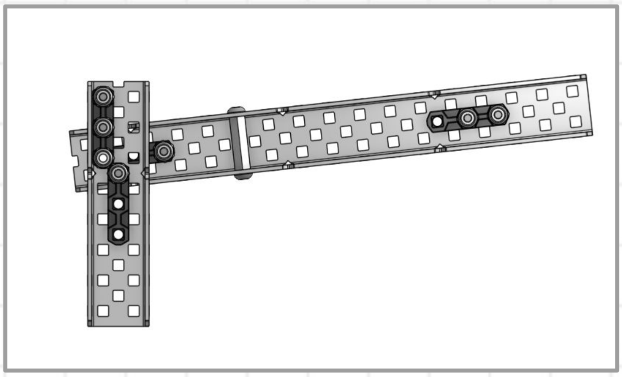


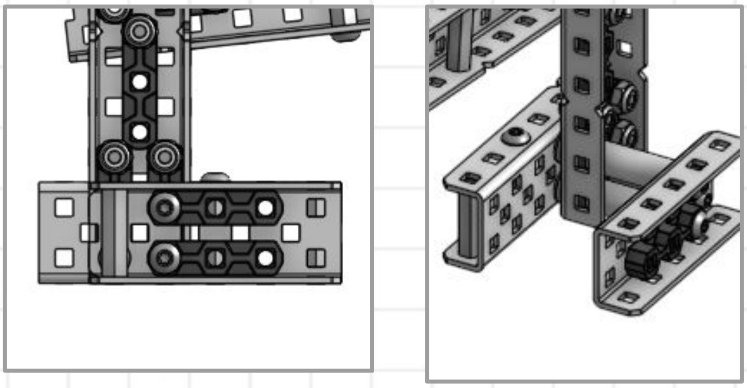
1)

We first line up our 8 hole C-Channel with a 1 hole C channel at an angle. 2 vertical holes on the 8 hole C-Channel should be aligned with the 2 horizontal holes of our longer C-Channel. We leave 1 hole away from the end of each C-Channel. Mirror this process for the other side.

2)

Adding bearings and bracing. We're using 4 bearings total, 2 on each C-Channel. We also have a 1" standoff to act as pressing for the longer C-Channel, the standoffs are located 6 holes away from the left of the 17 hole C-channel to brace it.



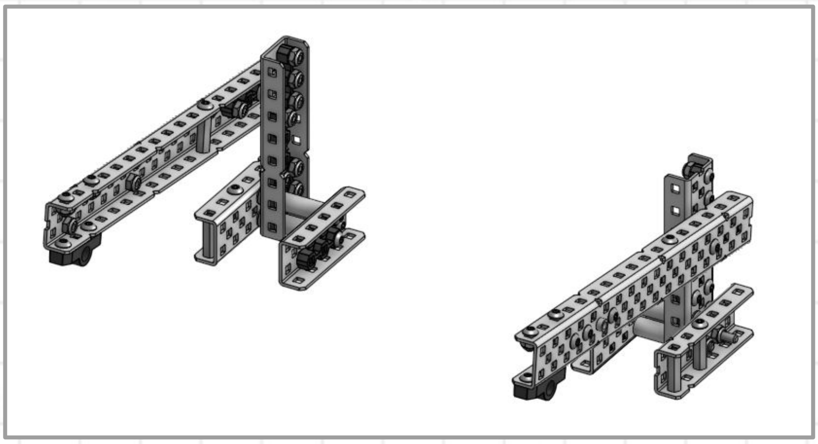


3)

Then we attach a two 6 hole C-Channel on the bottom 5 holes using screws and spacers with standoffs and bearings as bracing. This "sandwich" will allow us to attach the intake onto the the drivetrain.

4)

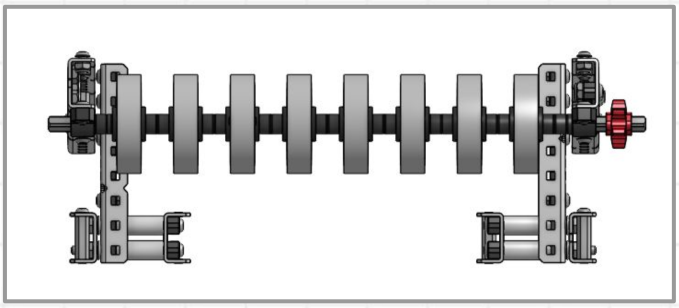
We mirror this process and line up the 2 sides together the insides of the C-Channels with one another. This will serve as a frame for our intake

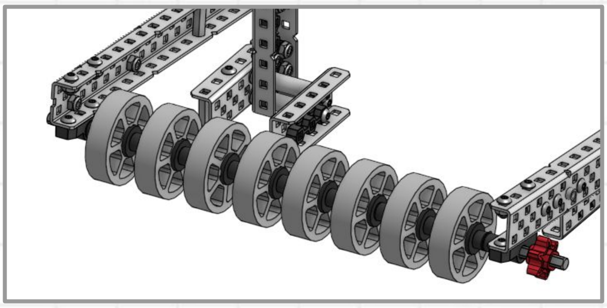


DATE: 01/18/2024 DESIGNED BY: RL WITNESSED BY: TC

5)

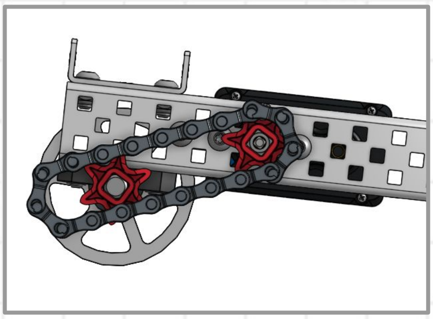
We now take a HS shaft and connect the 2 C-Channels with our 8 flexwheels and HS spacers spaced out to form our intake. On the right side we add a 6T sprocket on the end of the HS shaft which will allow us to connect to the middle. See images on the bottom for spacing.

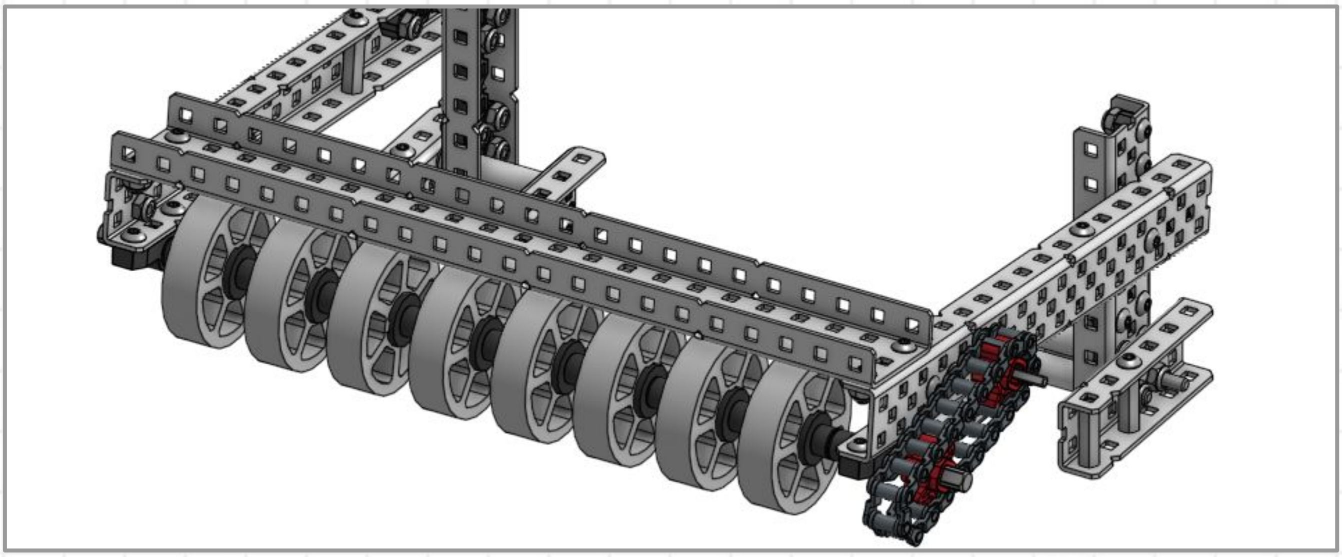


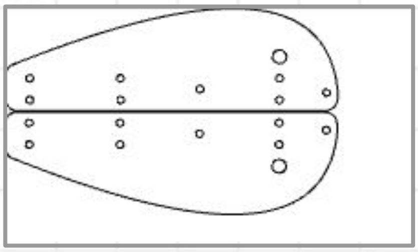


6)

We now use another 17 hole, 3 wide C-Channel to brace the intake, holding it together and supporting the HS shaft at the same time. We add another sprocket on an LS shaft going through the bearing on the left side. We add a chain connecting the two sprockets.





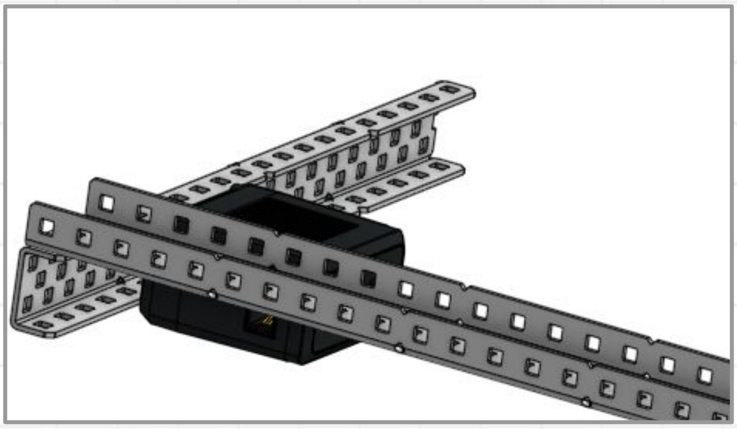


7)

We now laser cut the delrin for the intake sleds. We've formatted the intake so that we waste the least plastic.

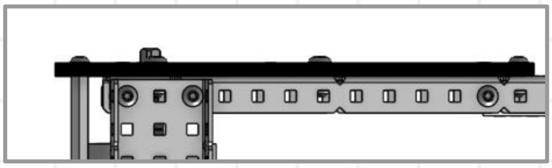
Intake

8) While we wait for the delrin to laser cut we can quickly attach the motor

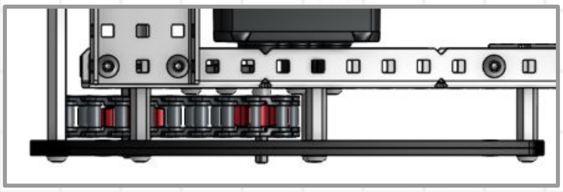


9a)

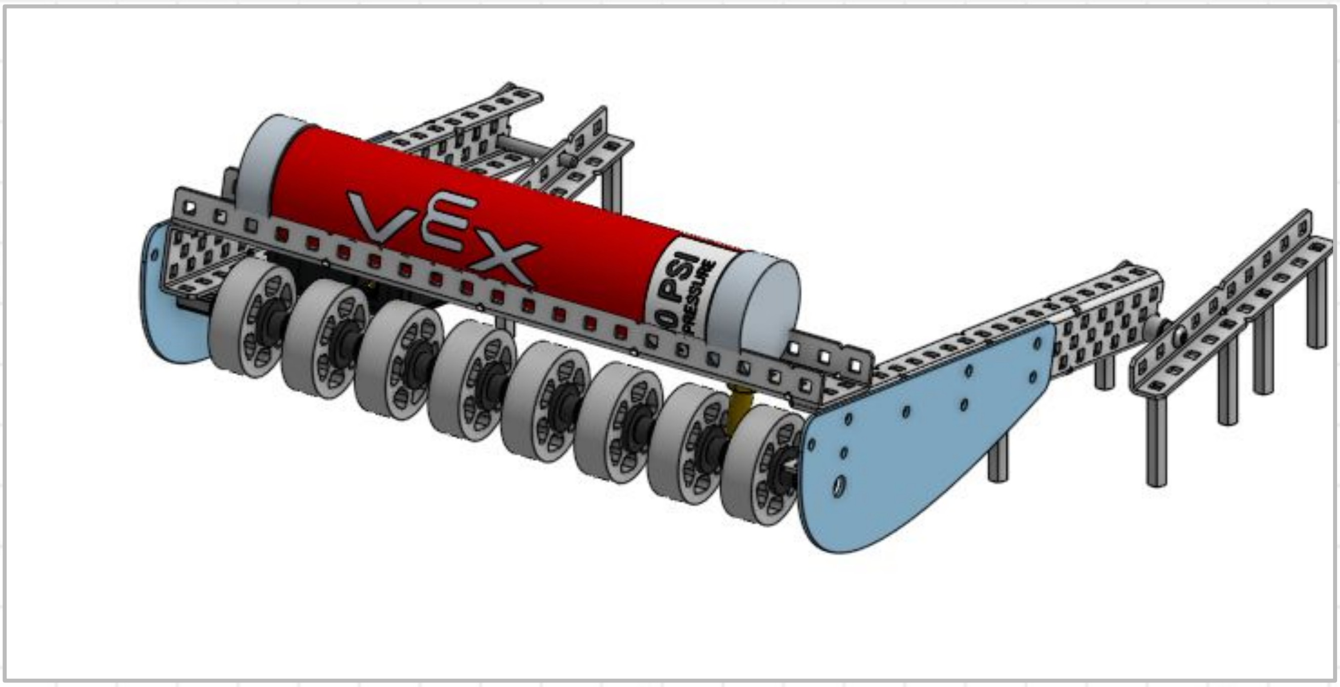
We stack 2 sleds on each side so we have a stronger intake sled allowing us to slip up the goal to score.



9b) Note that we attach the intake sleds differently on each side. Top right image is for the side without the motor



10) Our final step is using standoffs to add extra bracing attaching the sleds together. This bar will help protect our intake



This is our completed intake!

We look forward to building the drivetrain the next week

DATE: 01/18/2024 DESIGNED BY: RL WITNESSED BY: TC

Goal

Designing the wings

What needs to be improved from our previous design?

With our new game strategy, we hope to utilize the wings more during games. Previously we only used them in skills, but with the proper expertise in driving we could make advantage of our wings so that we can push a greater mass of Triballs into the goal.

Bowling will also be easier with wings as with a larger surface (wider) we will have more control over the directions off Triballs, as we initially found that when pushing 5 Triballs realistically we have 2 or 3 left scored into the goal.

Goal

Setting specific requirements to achieve

MAIN GOAL

- **Pushing Triballs into the goal**
  - This is the one of the only purposes of the wings, they allow us to score multiple triballs into the goal. These are beneficial in games and skills and maximized our use of time.
- **Pushing Triballs past the middle barrier**
  - This will allow us to quickly push another team's matchload onto our side making it easier for us to score

CONSTRAINTS

RULE CONSTRAINTS:

Wings cannot expand past 36" horizontally as stated in <SG2>

MATERIAL CONSTRAINTS:

None

TIME CONSTRAINTS:

Drivetrain is to be completed on Wednesday, January 10th

Solution 1

We could have all locking horizontal wings on one side of the robot so that we are able to push more Triballs into the goal. With our previous robot wings would flex backwards when we pushed a large quantity.

CONSIDERATIONS:
May break during games, does not flex so we are unable to use them when bowling

Solution 2

We could have Vertical wings

CONSIDERATIONS:
Unable to use them when bowling

Solution 3

We could have no locking wings like before

CONSIDERATIONS:
Would we be sacrificing a good skills score in order to improve game performance?

Goal

Selecting a design

Initial observations and connections

Solution 1 - Locking horizontal wings

Pros

- Higher skills score
- Strong and sturdy

Cons

- Risky to use in games
  - Bending piston is a possibility in games

Solution 2 - Vertical wings

Pros

- Saves on air when deploying as gravity
- Strong and sturdy
- Higher skills score

Cons

- Risky to use in games
- Unable to go through the alley with them open

DATE: 01/22/2024 DESIGNED BY: RL WITNESSED BY: TC

Wings

Solution 3 - Horizontal wings

Pros

- Allows us to use them while bowling
- Higher game performance

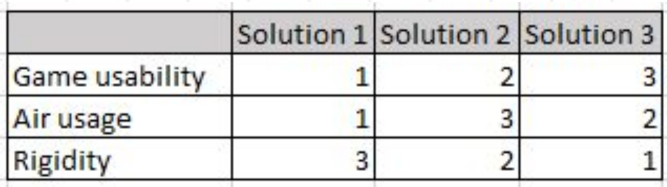
Cons

- Trade off for skills score

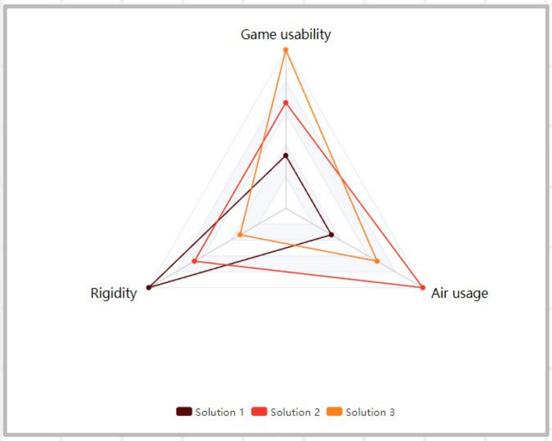
DECISION MATRIX

We've decided to rank our solutions from 1 to 3, 3 being the best and 1 being the worst. Here are a list of ideal characteristics we'd look for when determining the final solution

- **Usefulness in games**
  - Compatibility with other strategies (ex. bowling)
- **Air usage**
  - Less air the better as we can save more air for the climb
  - We've decided to use 1 tank for wings + climb this time to save on weight.
- **Rigidity**
  - The rigidness of the mechanism will allow us to obtain a higher skills score as they won't flex



	Solution 1	Solution 2	Solution 3
Game usability	1	2	3
Air usage	1	3	2
Rigidity	3	2	1



A robot is capable of having 2 pairs of wings hence we've come to a decision.

We've decided on Horizontal non-locking wings for one side of the robot while the other side of the robt has vertical wings. This way we'll maximise performance in both games and skills.

DATE: 01/22/2023 DESIGNED BY: RL WITNESSED BY: TC

Wings

Goal

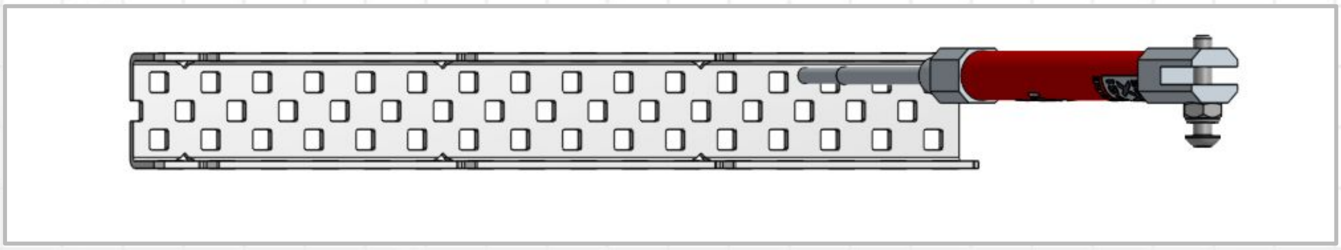
Designing the intake

HORIZONTAL WINGS

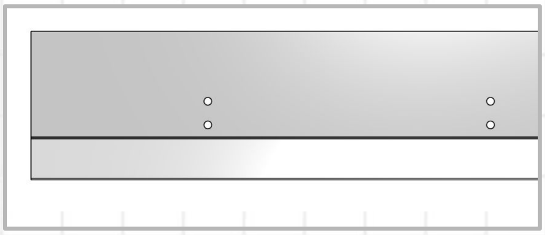
- 1x Delrin Sheet (for wing mounts)
- 2x 1x2x1x17 (17 hole) C-Channel
- 2x Pistons
- As well as bearings, screws, nylocks and spacers that remain subject to change

VERTICAL WINGS

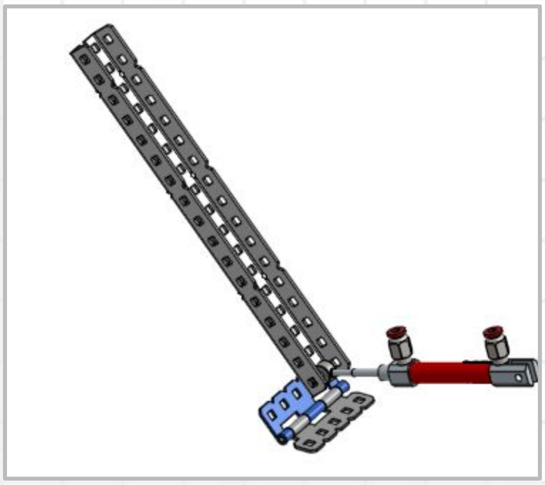
- 1x Delrin Sheet (for wing mounts)
- 2x 1x2x1x17 (17 hole) C-Channel
- 2x Pistons
- 2x hinges
- As well as bearings, screws, nylocks and spacers that remain subject to change



For horizontal wings, we take the same design as our previous wings and we line them up with the piston on the image above. The rest of the build process is the same.

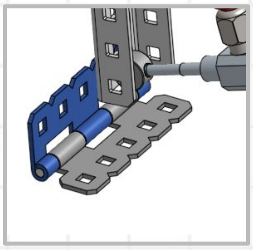


We create wedges with a polycarbonate sheet. We will bend the polycarbonate plastic around 10-20 degrees in order for it to be able to prop up the triballs in order for it to be pushed over the barrier. We will mark the holes in the plastic then drill it.



For our vertical wings, we line up the 17 hole c-channel with the end of the hinges

.



We attach our double acting pistons with a lock nut to the inner side of the C-Channel

DATE: 01/23/2024 DESIGNED BY: TC WITNESSED BY: RL

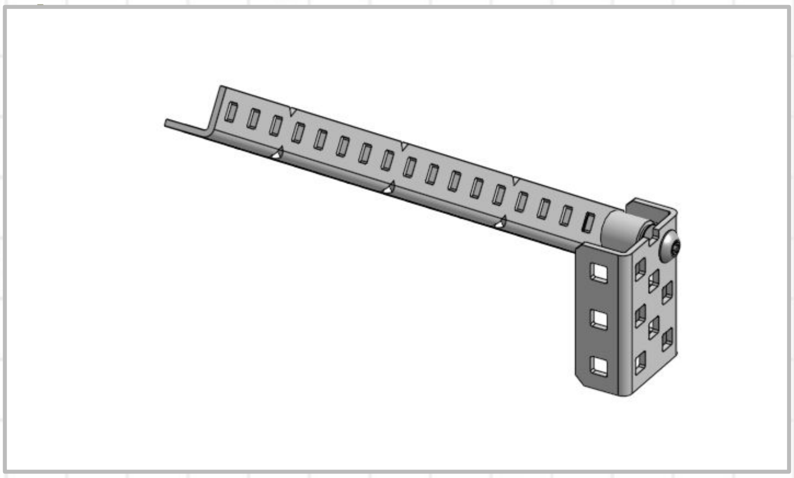
Goal

Making climb mechanism

DESIGN SPECIFICATIONS

- 1x Polycarbonate sheet
- 4x pistons
- 2x 1x1x15 (15 hole) L-Channel
- 1x 1” standoff
- 1x 2.5” screw
- 3x Shaft Collars
- Any other components that we decide to add

CAD - GUIDE



1)

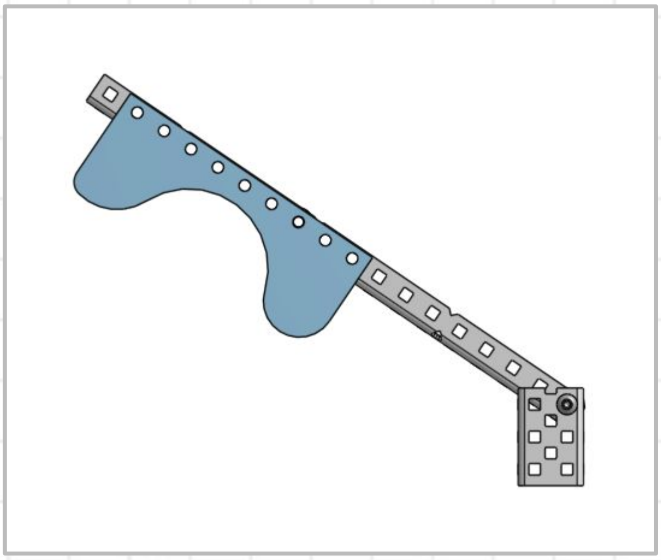
Connect 15 holes L-channel and 3 holes c-channel with 2.5” screw and ⅜ spacer between it.

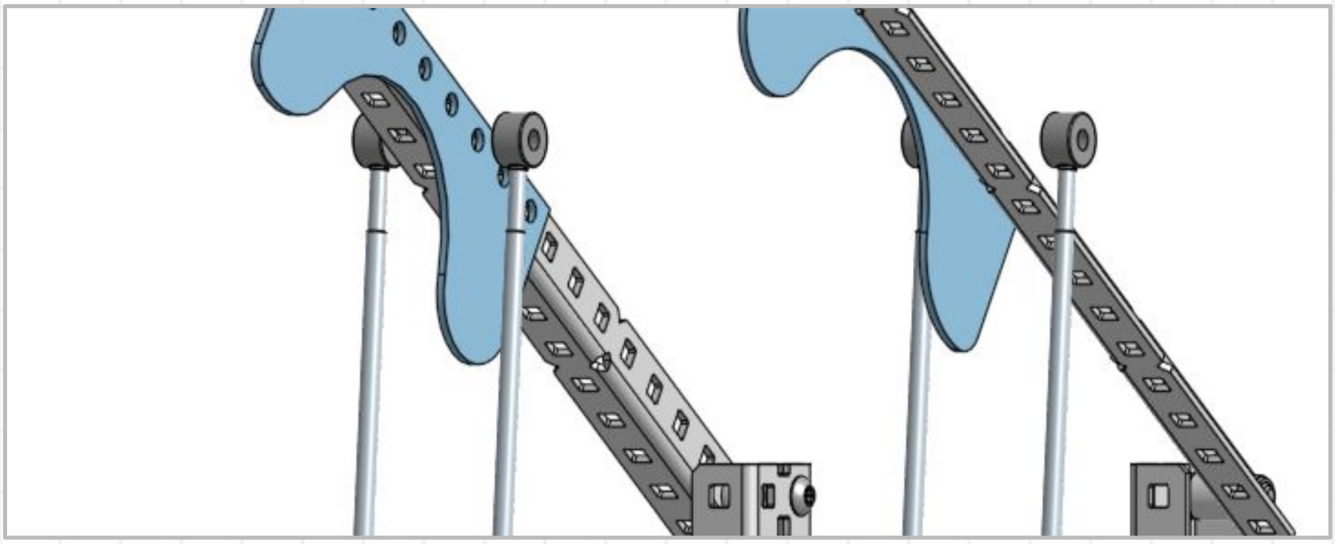
This will be the main climbing component which will support the robot’s weight.

2)

Create two pieces of custom delrin sheet shaped to the elevation bar. The sheet must be rounded to allow for sliding on the elevation bar.

Stack on one side of the L-channel and connect them with screw and nuts. We leave one hole from the top

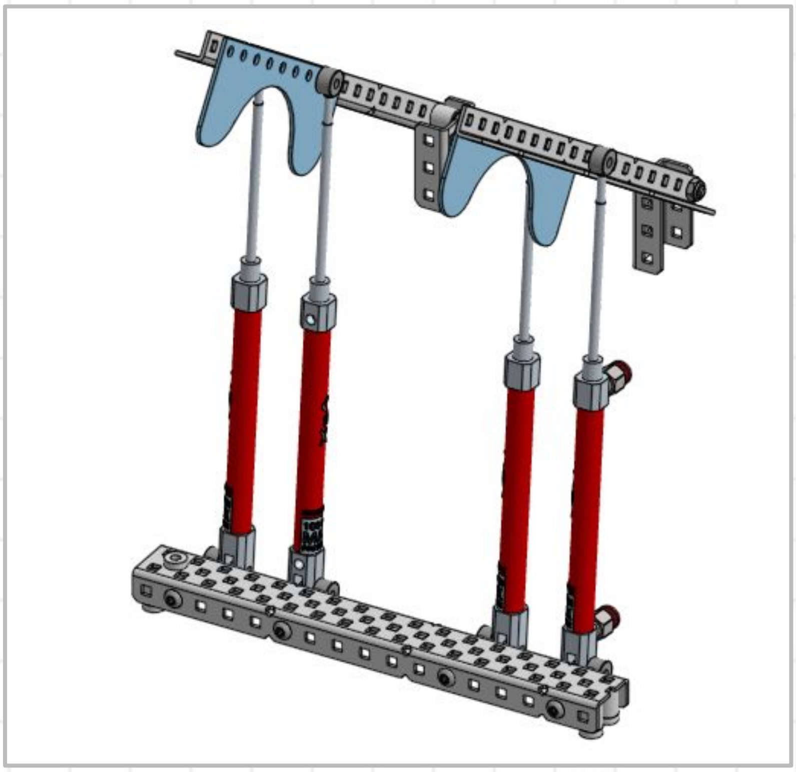




3)

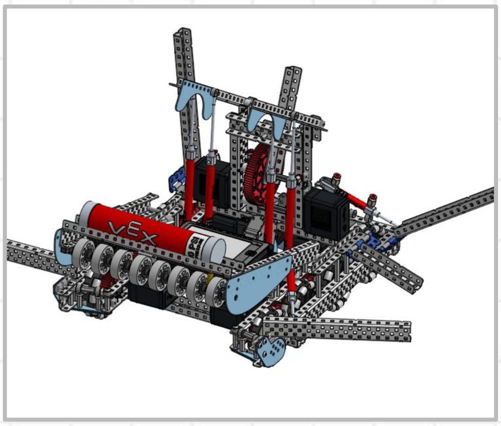
Connect a shaft collar to the end of piston and repeat four times, connect 2 shaft collar to the L-channel with a long screw and nut. Repeat the same for the other L-channel.

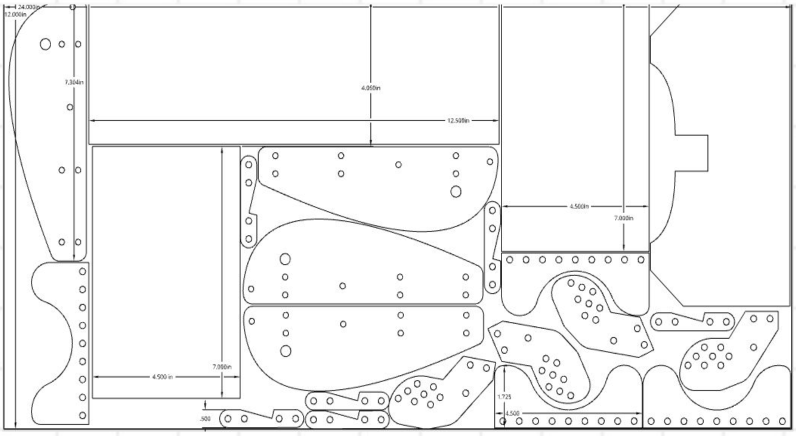
The shaft collar should be lined up to the 3rd hole on the custom polycarb from the right



4)

We then connect the pistons to a C-Channel and secure them on. We make sure to brace them a lot as the 4 pistons are responsible for lifting the entire robot up.

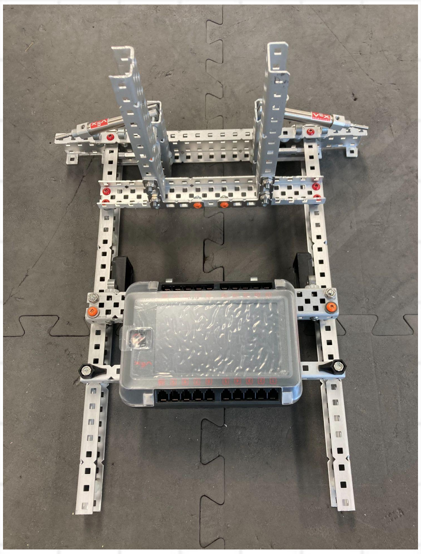




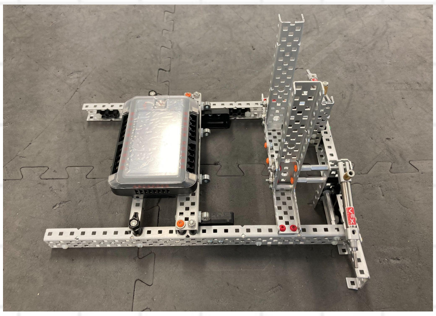
This is our completed robot as well as the drawing for the plastic. We will be printing all the custom plastic on delrin with a lasercutter.

BUILD

MOUNTING BRAIN



We first build the inner frame where we mount the brain to the centre. We get started on the supports of the shooter as well. We use multiple-channels to cross brace the drivetrain to be square.

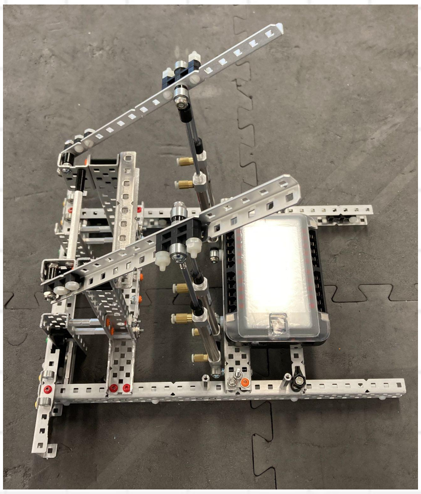


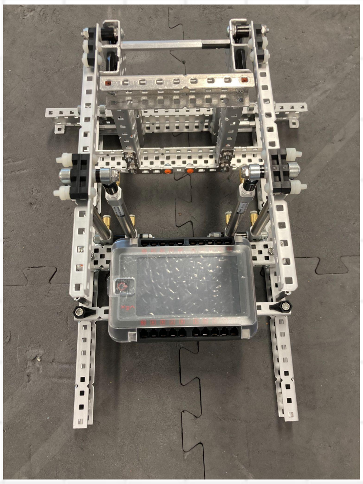
MOUNTING PISTON

We also mount the pistons for the vertical wings located on the back of the robot.

ADDING THE CLIMB

As the climb mechanism is located in the centre of the robot, we also add our climb mechanism on which will be heavily heavily braced.





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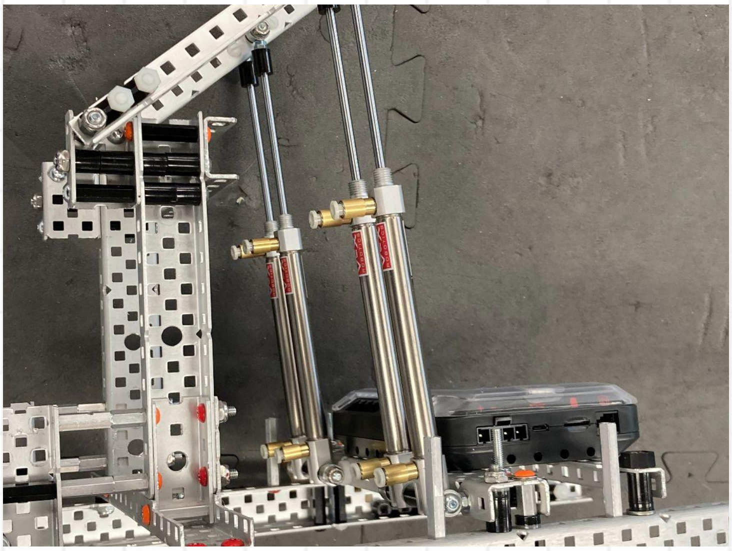
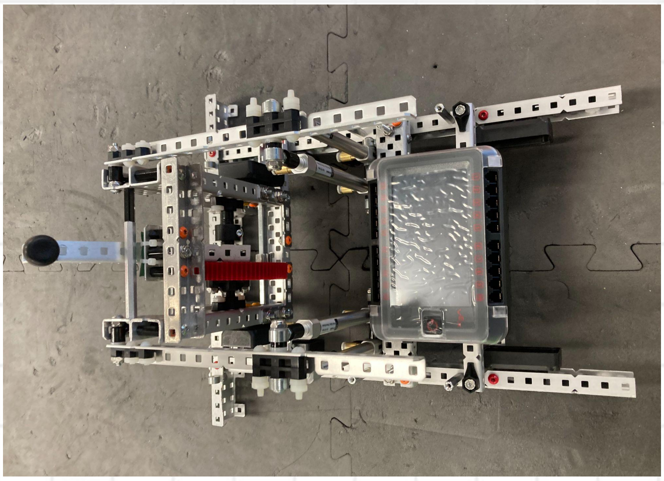


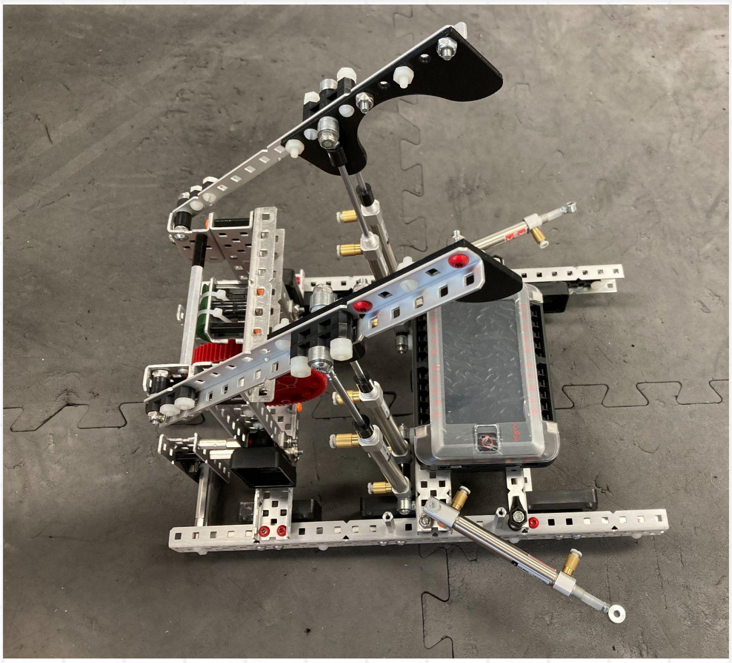
PISTON PLACEMENT

This is a closer look at the mounted pistons, note the bracing on the climb mechanism, this will serve to hold our entire robot up

SHOOTING MECHANISM

We then add our puncher onto the mechanism. We decided to use a rubber bumper to make contact the the Triball as previously they have been very reliable in accuracy and power transfer.

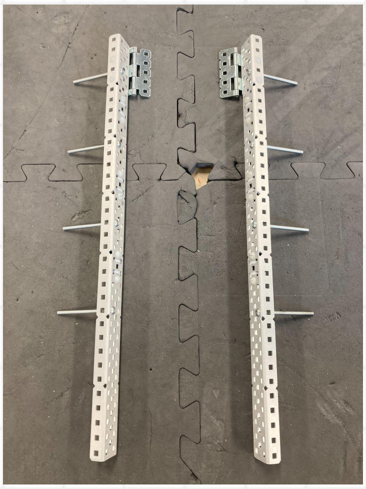


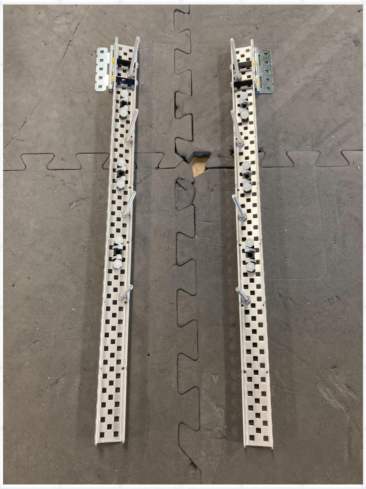


ADDING PLASTIC + PISTONS

We then add the custom printed plastic onto the climb mechanism. We use a combination of nylon screws and nuts as well as metal in order to save on weight. The lighter the robot the better as we will be able to go over the barrier easier as well as preventing overheating.

DATE: 01/25/2024 DESIGNED BY: RL WITNESSED BY: TC

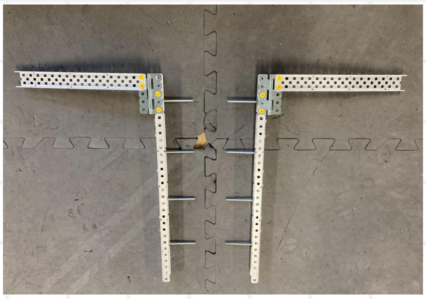


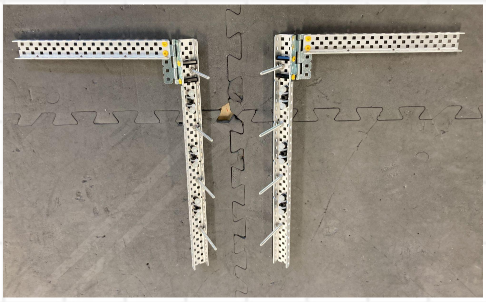


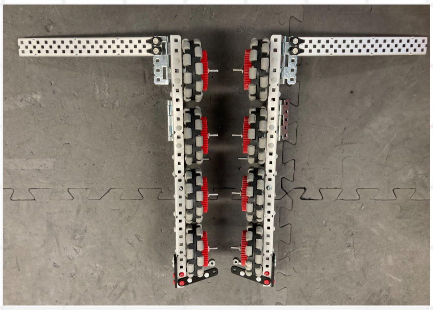
DRIVETRAIN COMPONENTS

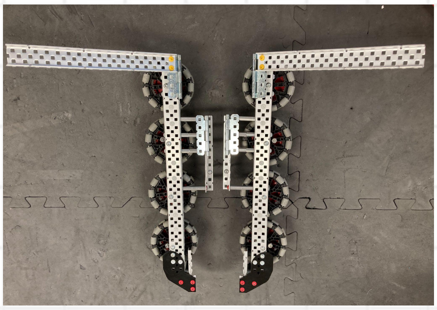
We get started on the sides of our drivetrains the images to the left show the front and back view of the side. Screwjoints are placed accordingly.

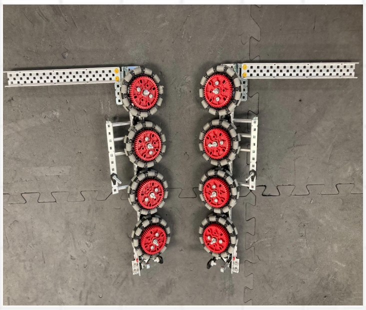
We attach the C-Channels onto the hinges to for wings



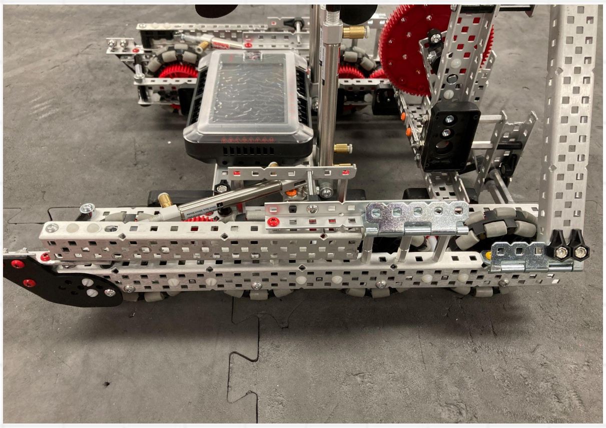








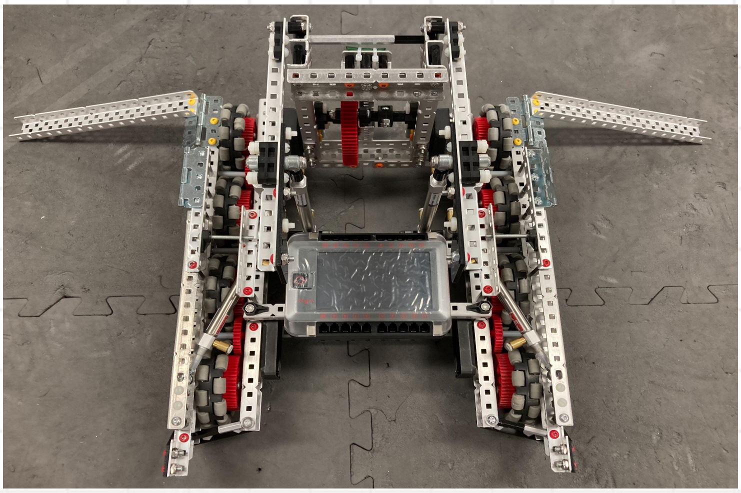
Then we add wheels and gearing. In the meantime we attach our sleds on while we have more working space.

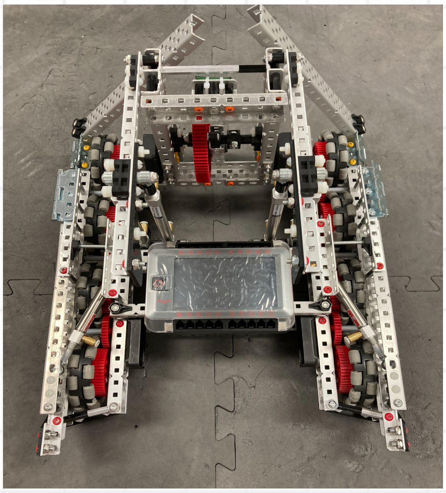


FINISHING BASE OF ROBOT

We attach the components built above onto the centre piece. Now our complete base has been assembled and built

DATE: 01/25/2023 DESIGNED BY: RL WITNESSED BY: TC

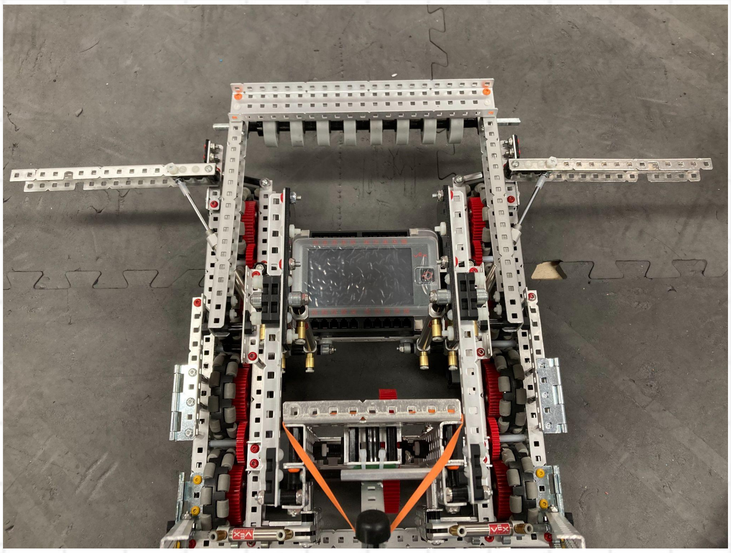


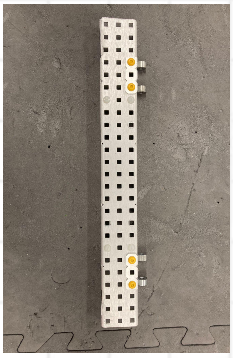


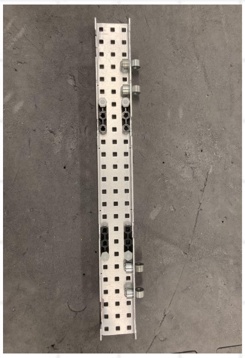
Above are some more images of the robot the one on the left has open vertical wings and the 2nd image has undeployed wings.
We then use standoffs and screws to further brace the drivetrain.

ADDING THE CLIMB

After finishing the intake we attach onto the drivetrain, as well as adding rubber band to temporarily hold the puncher while we're building.







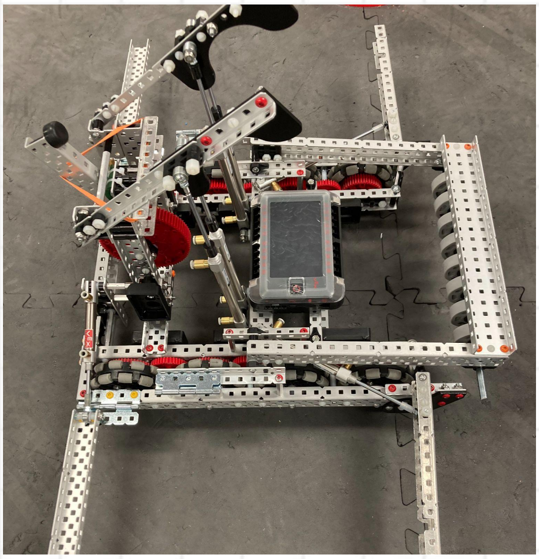
DRIVETRAIN COMPONENTS

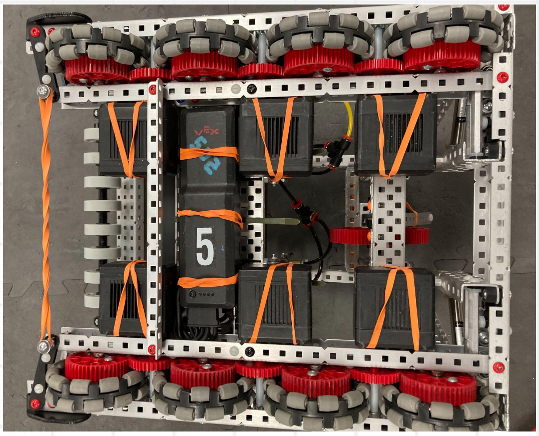
We take a larger C-Channel and create the back of the robot. We will attach wedges for the future.

DATE: 01/25/2024 DESIGNED BY: RL WITNESSED BY: TC

COMPLETED ROBOT

The robot is basically complete, all that is left is to properly add all our bands and to test our components. Cabling has not been done, but it will be done in accordance to testing,



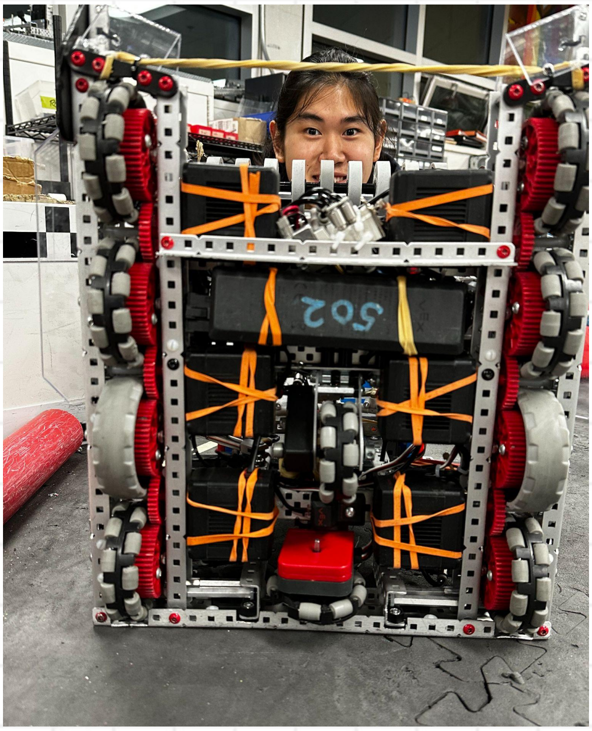


BOTTOM OF ROBOT

This is the robot after banding from the bottom. The battery is easily swappable as well as the motors. As we can see from the left where the intake is located, we have 1 robber band stretched across to help hold the Triball in place just like our previous intake.

INSTALLING ODOM PODS

In the empty space in between motors on the upper image we install 2 odom pods in order to use odometry while coding skills autonomous programs as well as game autos



DATE: 01/25/2023 DESIGNED BY: RL WITNESSED BY: TC

Goal

Testing our major mechanisms

SHOOTER TUNING

We want to figure out what to put on the slapper to make contact with the triball in order to accurately shoot them across the field in order to get better grouping.

Procedure

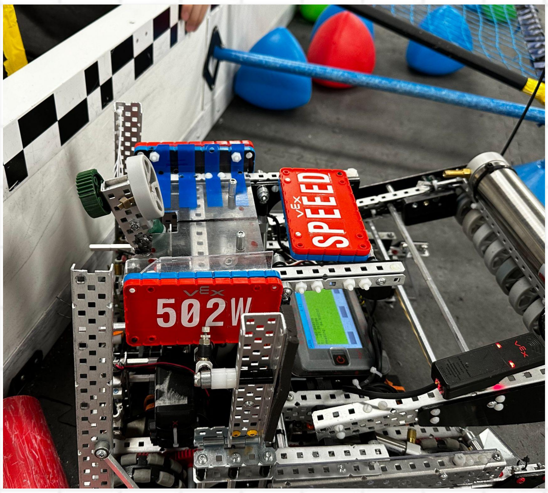
I. Place robot where it is contacting the matchload barrier
II. Place triballs onto shooter, shoot a total of 10 minimum over
III. Check for arc and grouping

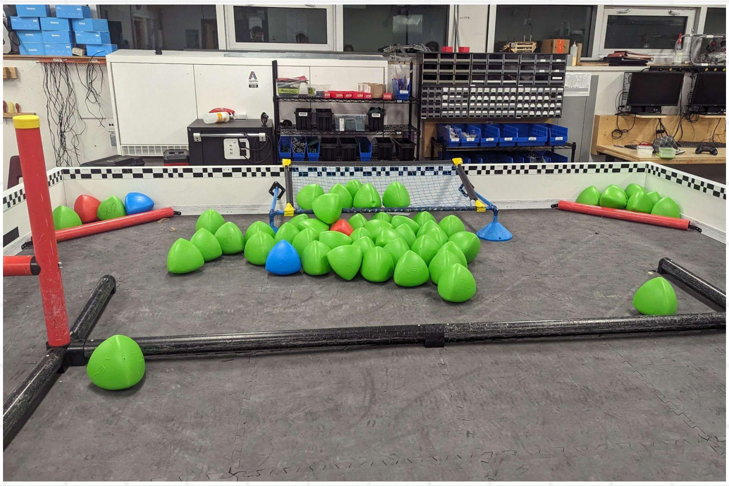
Results

Our original plan of using a rubber bumper did not work as the arc was too low as well as weak in power, a solution for this issue was to make the shooter arm taller to contact the triball more but then our robot would be too tall so we then tried the following slappers

- C-Channel on standoffs - arc still too low 5/10 went over the middle barrier
- Gear - too hard and arc was even worse only 3/10 went over
- Traction wheel - better results with 7/10 over
- Flexwheel - The best results with 9/10 over

We decided to stick with the flywheel, but we found that at times reults would be inconsistent. This was due to the weight of the mechanism, so we decided to add an extra gear which fixed all problems





DATE: 02/03/2024 DESIGNED BY: RL WITNESSED BY: TC

CLIMB TESTING

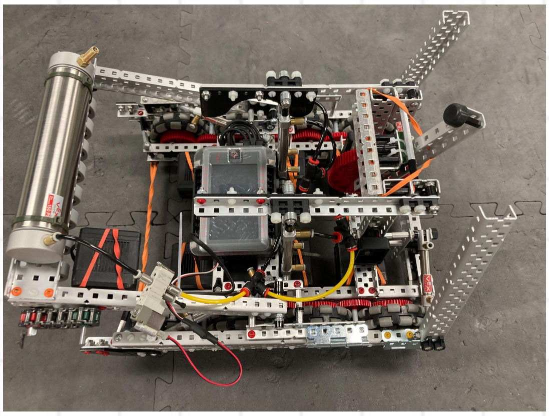
We want to figure out the minimum amount of air it takes to climb with one air tank, this way we'll be able to see if we really can use 1 air tank.

On our previous robot, we had used tanks with 1 tank dedicated to the climb where we'd climb with over 70 psi

Procedure

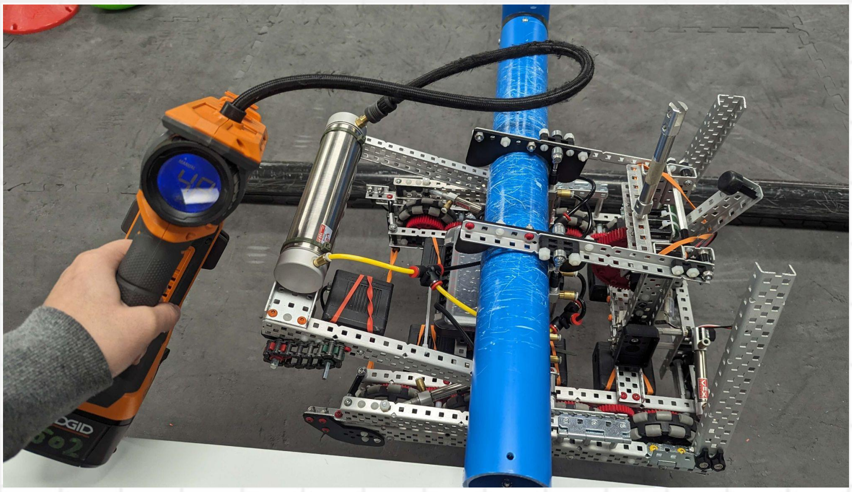
I. Place robot where it is contacting the elevation bar
II. Pump air at increments of 5 psi
III. See at what psi we need to climb

Image to the right shows the setup for the test, after thoroughly testing we will cable the Robot



Results

We learned that we were able to climb with merely 40 psi !
As wings don't require that much air to deploy this means we have tons of extra air to climb, where we achieved a B tier.
For a C tier climb, we would likely need another tank. In favor of game performance (lighter = faster) we chose to keep the climb the way it is.

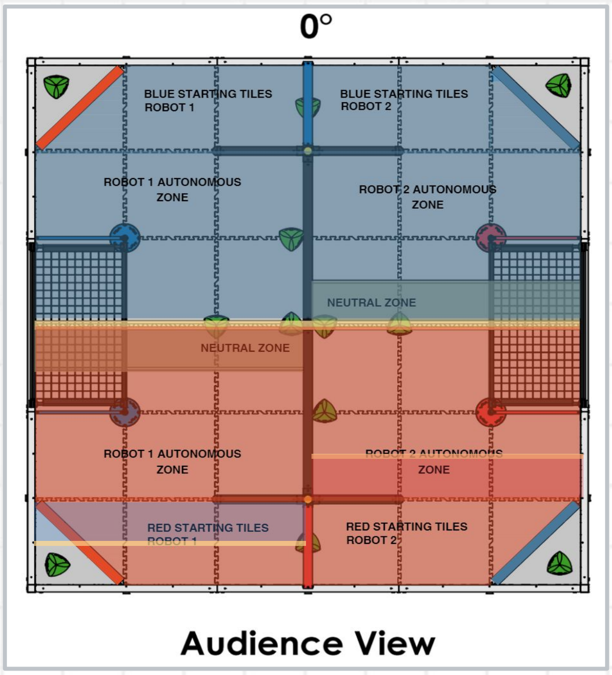


Nevertheless, we must account for all scenarios. If we have not enough air we are able to passively climb at A tier, this way double climbing at A would lead to higher points scored with our alliance.

Goal

Making game autos

Game Autonomous Period Review

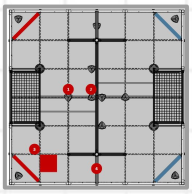


KEY

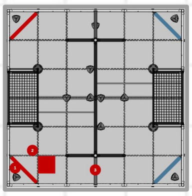
🟨	Autonomous line
🟪	Neutral zone
🟦	Red alliance starting tiles and autonomous zones
🟥	Blue alliance starting tiles and autonomous zones

THERE ARE 3 MAIN GOALS WHEN CREATING A CLOSE SIDE AUTO:

- Consistently remove triball from match load zone (vital for AWP)
- Score as many points as possible.
- Prevent the scoring of opponent triballs (useful for winning autos, but does not take priority over AWP)

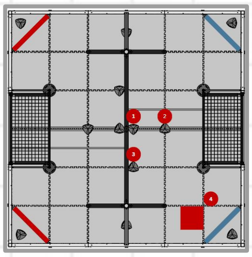


We hope to make consistent autos that work without a fail as we had issues with it previously



THERE IS 1 GOAL FOR A FAR SIDE AUTO

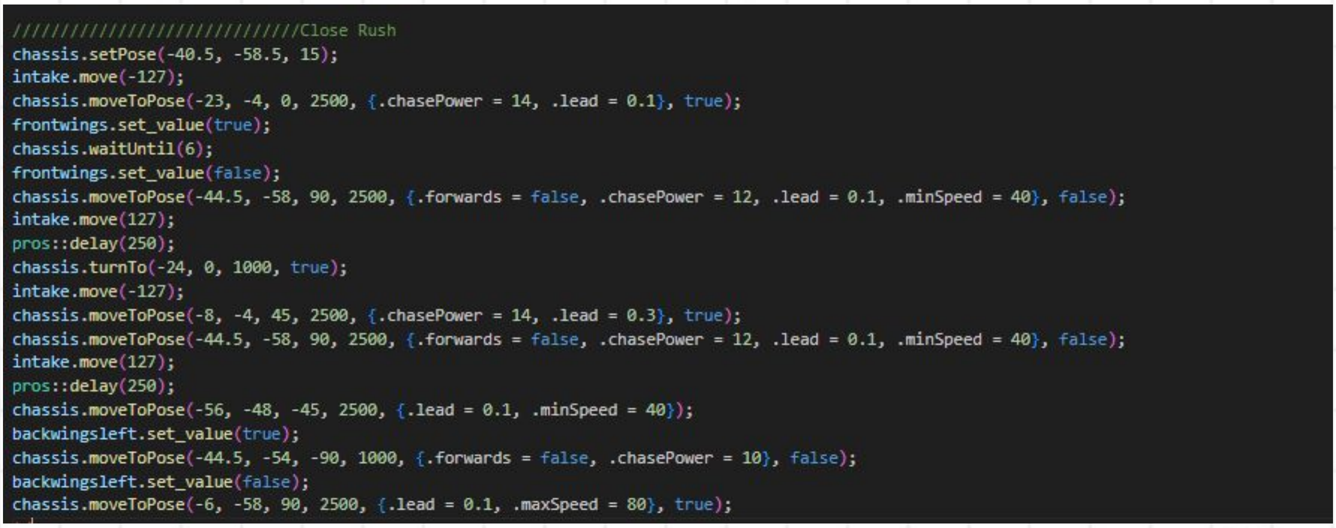
- Score as many points as possible



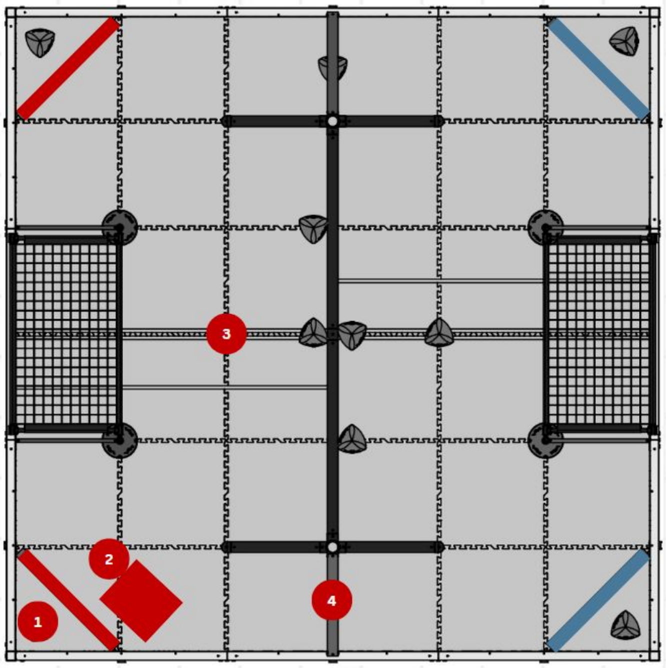
Previously our auto scored 4 Triballs so we hope to score more than 4 this time around

DATE: 02/05/2023 DESIGNED BY: RL WITNESSED BY: TC

CLOSE SIDE RUSH - AWP



```
////////////////////////////////Close Rush
chassis.setPose(-40.5, -58.5, 15);
intake.move(-127);
chassis.moveToPose(-23, -4, 0, 2500, {.chasePower = 14, .lead = 0.1}, true);
frontwings.set_value(true);
chassis.waitUntil(6);
frontwings.set_value(false);
chassis.moveToPose(-44.5, -58, 90, 2500, {.forwards = false, .chasePower = 12, .lead = 0.1, .minSpeed = 40}, false);
intake.move(127);
pros::delay(250);
chassis.turnTo(-24, 0, 1000, true);
intake.move(-127);
chassis.moveToPose(-8, -4, 45, 2500, {.chasePower = 14, .lead = 0.3}, true);
chassis.moveToPose(-44.5, -58, 90, 2500, {.forwards = false, .chasePower = 12, .lead = 0.1, .minSpeed = 40}, false);
intake.move(127);
pros::delay(250);
chassis.moveToPose(-56, -48, -45, 2500, {.lead = 0.1, .minSpeed = 40});
backwingsleft.set_value(true);
chassis.moveToPose(-44.5, -54, -90, 1000, {.forwards = false, .chasePower = 10}, false);
backwingsleft.set_value(false);
chassis.moveToPose(-6, -58, 90, 2500, {.lead = 0.1, .maxSpeed = 80}, true);
```



It is the most reliable auto for close side This is useful in qualification matches where we know the opponent will not go to for the middle (or else we risk interaction that may affect AWP), and is also useful for elimination matches where we WANT to interfere with offensive side.

Another scenario where we'd use this program is if we need to guarantee an auto win.

We first remove the Triball in the matchload zone completing the AWP goals for this side partially (1). Then score the preload into the goal(2).
After that, we immediately rush to the centre we grab the Triball (3). We take the middle Triball and drive to the elevation bar, where we push the Triball there and the Triball in our intake to the other side while simultaneously and going touch the bar(4). There is also the bonus of scoring 1 neutral Triball.

Overall, this auto is good for 90% of qualification games where we know the opponent will not interfere with the autonomous routine.

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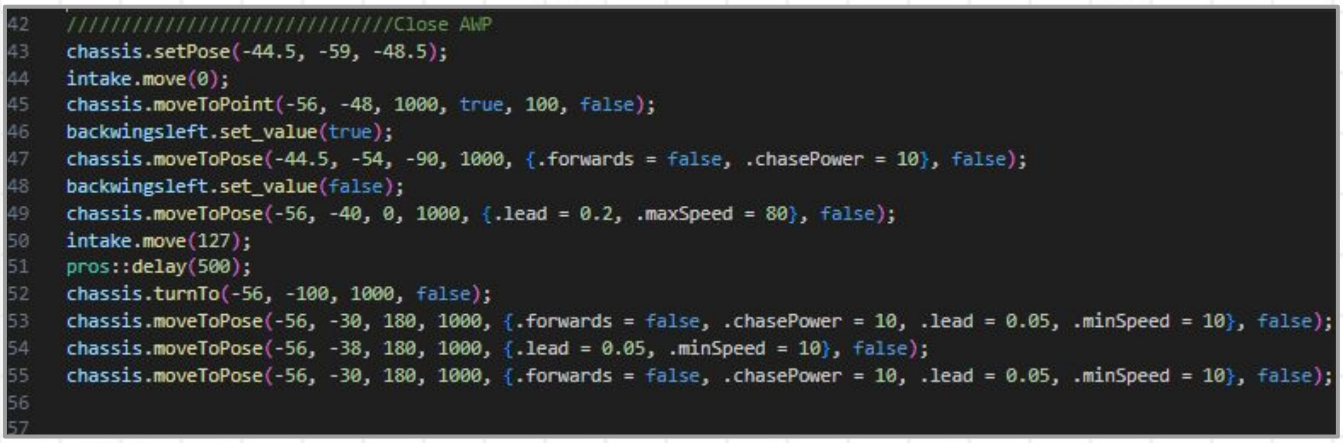
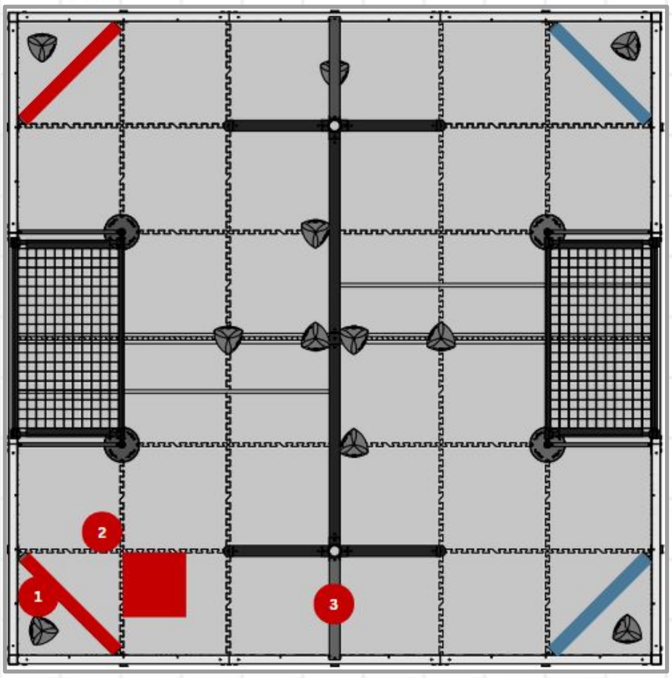
CLOSE SIDE SAFE - AWP



```
///////////////////////////////Close AWP
chassis.setPose(-44.5, -59, -48.5);
intake.move(0);
chassis.moveToPoint(-56, -48, 1000, true, 100, false);
backwingsleft.set_value(true);
chassis.moveToPose(-44.5, -54, -90, 1000, {.forwards = false, .chasePower = 10}, false);
backwingsleft.set_value(false);
chassis.moveToPose(-56, -40, 0, 1000, {.lead = 0.2, .maxSpeed = 80}, false);
intake.move(127);
pros::delay(500);
chassis.turnTo(-56, -100, 1000, false);
chassis.moveToPose(-56, -30, 180, 1000, {.forwards = false, .chasePower = 10, .lead = 0.05, .minSpeed = 10}, false);
chassis.moveToPose(-56, -38, 180, 1000, {.lead = 0.05, .minSpeed = 10}, false);
chassis.moveToPose(-56, -30, 180, 1000, {.forwards = false, .chasePower = 10, .lead = 0.05, .minSpeed = 10}, false);
```



In this route, just like our previous code, the robot does not stray away from safe zones, where we can dedicate all our time to playing it safe and ensuring the match load triball is removed. This program should be ran when we know there will be interference in a qualification match that has a probability of interfering with AWP Triball removal

It is essentially the same program as the previous but on the defensive side, with the added bonus of removing a match load triball for AWP. This is useful in qualification matches where we know the opponent will not go to for the middle (or else we risk interaction that may affect AWP), and is also useful for elimination matches where we WANT to interfere with offensive side.

We first push the preload into the goal(1), then we turn and take the matchload our of the zone(2), getting us AWP. Finally we touch the bar(3).

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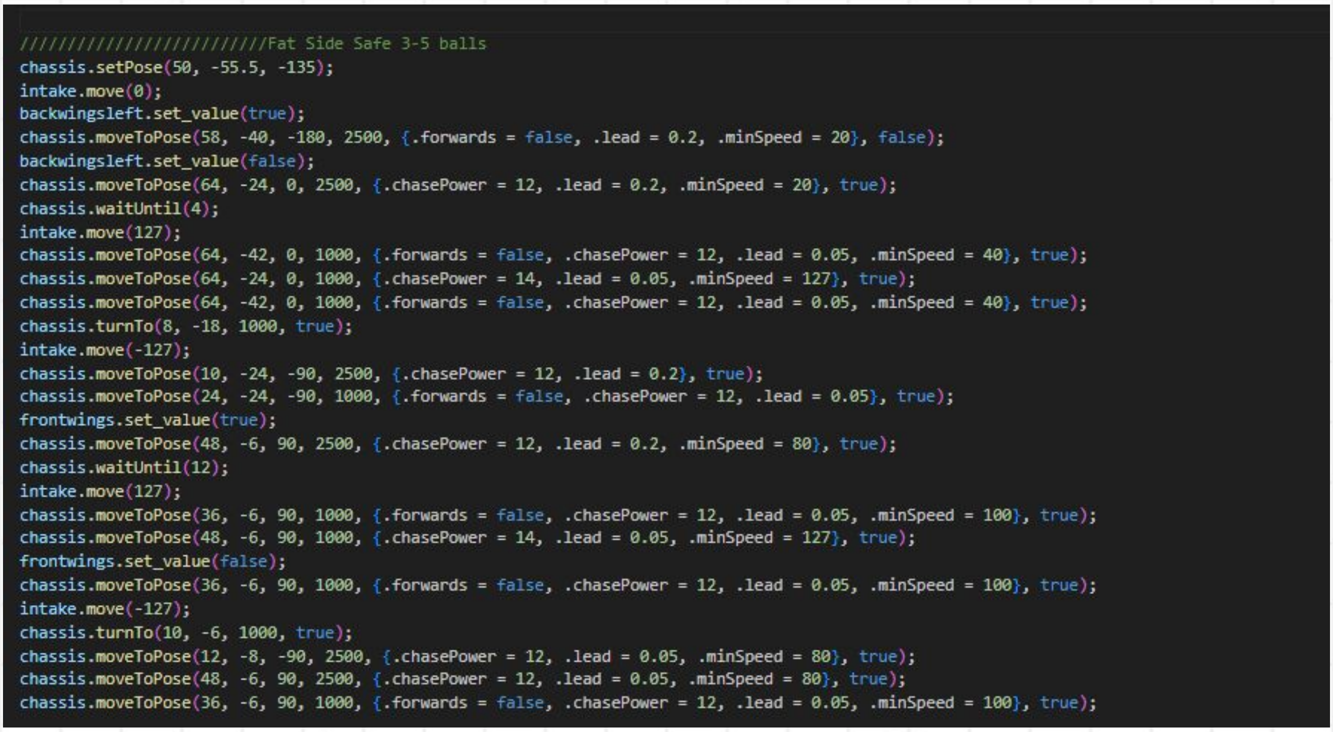
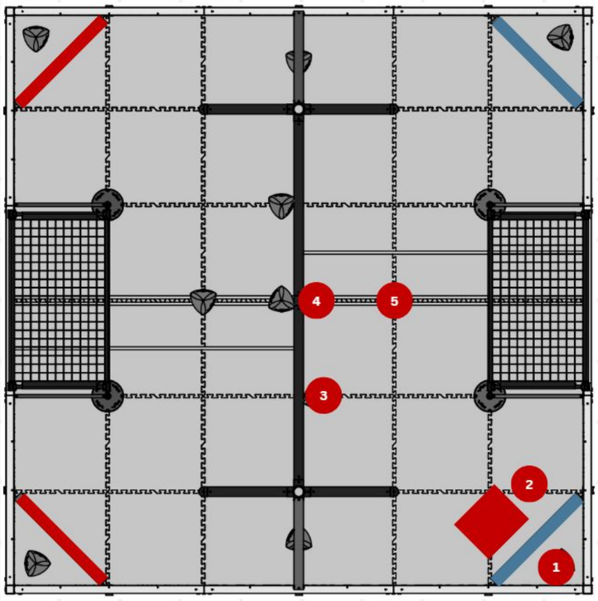
FAR SIDE - AWP



```
//////////////////////////Fat Side Safe 3-5 balls
chassis.setPose(50, -55.5, -135);
intake.move(0);
backwingsleft.set_value(true);
chassis.moveToPose(58, -40, -180, 2500, {.forwards = false, .lead = 0.2, .minSpeed = 20}, false);
backwingsleft.set_value(false);
chassis.moveToPose(64, -24, 0, 2500, {.chasePower = 12, .lead = 0.2, .minSpeed = 20}, true);
chassis.waitUntil(4);
intake.move(127);
chassis.moveToPose(64, -42, 0, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05, .minSpeed = 40}, true);
chassis.moveToPose(64, -24, 0, 1000, {.chasePower = 14, .lead = 0.05, .minSpeed = 127}, true);
chassis.moveToPose(64, -42, 0, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05, .minSpeed = 40}, true);
chassis.turnTo(8, -18, 1000, true);
intake.move(-127);
chassis.moveToPose(10, -24, -90, 2500, {.chasePower = 12, .lead = 0.2}, true);
chassis.moveToPose(24, -24, -90, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05}, true);
frontwings.set_value(true);
chassis.moveToPose(48, -6, 90, 2500, {.chasePower = 12, .lead = 0.2, .minSpeed = 80}, true);
chassis.waitUntil(12);
intake.move(127);
chassis.moveToPose(36, -6, 90, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05, .minSpeed = 100}, true);
chassis.moveToPose(48, -6, 90, 1000, {.chasePower = 14, .lead = 0.05, .minSpeed = 127}, true);
frontwings.set_value(false);
chassis.moveToPose(36, -6, 90, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05, .minSpeed = 100}, true);
intake.move(-127);
chassis.turnTo(10, -6, 1000, true);
chassis.moveToPose(12, -8, -90, 2500, {.chasePower = 12, .lead = 0.05, .minSpeed = 80}, true);
chassis.moveToPose(48, -6, 90, 2500, {.chasePower = 12, .lead = 0.05, .minSpeed = 80}, true);
chassis.moveToPose(36, -6, 90, 1000, {.forwards = false, .chasePower = 12, .lead = 0.05, .minSpeed = 100}, true);
```



This is created with the primary goal of WINNING autonomous as well as removing matchload triball. It is useful for qualification matches where we know there will not be interference (so triball removal will work) as well as all elimination matches

Far side first takes out the preload from the alliance goal (1) then scores it along with the preload.(2)

Then, it will go for the ball on offensive side that cannot be touched by opponents(3), grab it with the intake and score it into the goal. Finally, it will grab the Triball contacting the long barrier(4). Then push the Triballs into the goal along with the last one in the neutral zone(5).

This autonomous is extremely consistent and effective in both elims and quals. It scores around 3-5 depends on if the opponents take the 2 Triballs in the neutral zone

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