Entries By Date

Entries By Project

CAD Software Difficulties

Focus: **CAD Software**

By: **Mae Subramanian**

Date: **05/10/2024**

→ **Objective:** Identify issues with CAD software

After struggles with CAD software and collaboration, the team's design process needs to be reevaluated. In the past, the team relied on SolidWorks along with GrabCAD Workbench to expose the program's offline file storage to the cloud - also known as Product Data Management (PDM).

Unfortunately, **GrabCAD Workbench was shut down in 2023.** This caused the team to resort to Bild PDM as an alternative last season, during which members struggled to install the software. Only four students were able to successfully use Bild PDM throughout the season. Additionally, members were not able to collaborate at once due to the file needing to be checked out & in. During time constrained points in the year, members resorted to alternative CAD software to avoid this difficulty. However, this ultimately caused inconsistency

The team's diversion from Bild PDM is a call to action for the upcoming season.

Continued in **CAD Software Meeting** (Pg. 3)

CAD Software Meeting

Focus: **CAD Software**

By: **Mae Subramanian**

Date: **05/10/2024**

Continued from **CAD Software Difficulties** (Pg. 2)

→ **Objective:** Discuss CAD with the team.

The team met and discussed the state of CAD, addressing issues that stood out from our design process including:

- Difficulties with onboarding members
- An aim for the

→ **:** .

Initial Drivetrain Expectations

Focus: **Initial Drivetrain**

By: **Mae Subramanian** , **Zoe Rizzo**

Date: **06/20/2024**

→ **Objective:** Discuss starting the drivetrain for our first robot. **A drivetrain is the first and most important part of a robot.** If a robot can't drive straight, slips when it turns, or is easily pushed, it will not be easy to win matches. If the drivetrain is too complex, it will be difficult to repair or make changes. Without a good drivetrain, winning will be very difficult.

Returning members met to discuss our values for the drivetrain that will serve as our first robot's base. Reflecting on previous years' experiences, we came up with the three key needs that to satisfy with this first drivetrain:

Traction

During the 2023-2024 Over Under season, a lack of traction resulted in inaccurate positioning during the autonomous period. To prioritize accurate positioning during the autonomous period, the team agreed that **both robots should have an added a traction wheel in the center to avoid drifting or being pushed around.**

Modularity

Space requirements of the first robot's subsystems may change as time goes on during the prototyping process. The initial drivetrain should have movable components such as its cross-braces that can adapt around mechanisms such as the robot's intake or climbing mechanism.

Odometry

The initial drivetrain **MUST** be built around having space available for odometry pods. Based on our strategy meeting last week, winning autonomous is ranked as a high priority for the team. This means we need to give the software sub-team the necessary sensors to have a consistent autonomous. Especially in VEX U, since our autonomous period is longer, matches can be determined in autonomous, which means this needs to be a priority.

We will need to design our drivetrain around these three factors. Doing this will give us the best chance to have successful robots.

Continued in **Selecting a Drivetrain** (Pg. 16)

Software Drivetrain

Focus: **Software Drivetrain**

By: **Ellie Bancroft**

Date: **09/01/2024**

→ **Objective:** Discuss this entry's very important issue.

Software needs a drivetrain to test code on. We took apart our old software robot Nemo, so we need to develop a new drivetrain for Software to use.

Goals:

- Introduce new Hardware members to building
- Get Software a drivetrain to test on as soon as possible
    - Have sensors mounting locations for sensors
- Build a Drivetrain similar to a real competition robot

We also want to not hold any members back from building if they don't have experience with CAD, so we think it would be beneficial if this drivetrain was freebuilt instead of designed in CAD.

We are going to introduce new members to VEX hardware by building a new drivetrain for Software for them to test programs and train new members on.

Continued in **Odometry Pods** (Pg. 47)

Season Kickoff

Focus: **Season Kickoff**

By: **Mae Subramanian**

Date: **09/03/2024**

→ **Objective:** Prepare to onboard new members to the hardware sub-team at the upcoming Hardware meeting.

First year students are interested in joining our team. The four returning Hardware members met to discuss how to organize a onboarding the tens of interested students at the team's upcoming onboarding meeting on September 8th.

For the meeting, we began by preparing a presentation discussing basic build practices in VEX to bring help bring FTC or FRC alumni and those without robotics experience to the same page. During this meting, we will send out a form gauging incoming members' backgrounds and interests to further understand assess each member's individual needs.

The upcoming onboarding meeting will help us better understand incoming members' skillsets and backgrounds in preparation for the season.

%%

Kickoff team organization

- Get a drive done physically for software
  - for new members with little experience
  - give basic parameters
  - 15in drive
  - guide people to build that
  - 6 motor, 4 omni with center traction
- Get an optimal, general purpose drive for build
  - decently modular
  - ready for hardware to prototype on
  - 8 motor, 4 omni, center traction
  - CJ and

Two separate task forces going on at once:

keep candy on person and give it to contributing questions or points

things to talk about at meeting

- vex build system
  - square holes and that kind of stuff
- drivetrain concepts
  - drop center
  - screw joints

        - = idler
        - why that works on a smaller scale
- how odometry modules work
    - why we hate them
    - why software doesn't deserve them
- PTOs
- how pneumatics work/ways they're commonly used
- assimilate to tipping point build methods
    - overcenter locking mechs/locking claws
    - how people got rings on the goals/tilted goals
- fabrication processes

discussion topics:

- what we can do to make a good drive for hardware/proposals
    - things to keep in mind like modularity
- general thoughts about the game - %%

Continued in **Hardware Orientation Recap** (Pg. 8)

Hardware Orientation Recap

Focus: **Orientation & Onboarding**

By: **Ellie Bancroft**

Date: **09/12/2024**

→ **Objective:** Review Results of Orientation Meeting

The orientation meeting was very successful. The meeting had a lot of engagement, with almost 60 prospective members attending. The guided discussion groups had solid engagement, and we heard a lot of ideas for strategy. Overall people seemed interested and the meeting was a good sign for recruitment this season.

There were some issues that came up though, the meeting was almost 4 hours long so interest began to drop off. Another issue is that some of the changes in the VEXU section of the manual weren't clearly communicated. This might have affected what conclusions the strategy discussions came to. It would likely be beneficial to hold additional strategy meetings in the future.

Looking forward, a large influx of members may pose logistical challenges to us. With only 7 members with experience on campus, a lot of our bandwidth may be taken up by onboarding.

The orientation meeting went very well and is a strong sign for recruitment; there may be additional logistical challenges for onboarding and managing an influx of new members

Hardware Split Prep

Focus: **Season Kickoff**

By: **Mae Subramanian**

Date: **09/12/2024**

Continued from **Hardware Orientation Recap** (Pg. 8)

→ **Objective:** Figure out logistics in onboarding members

Now that members have been introduced to the Hardware Team, we need to split up into subteams.

We need to gauge interest before splitting members up. Members are affected by three factors: the meetings they can make, the experience they have, and what they're interested in working on.

Continued in **Initial Hardware Brainstorming** (Pg. 11)

Hardware Orientation Recap

Focus: **Season Kickoff**

By: **Ellie Bancroft**

Date: **09/12/2024**

Continued from **Season Kickoff** (Pg. 6)

→ **Objective:** Review results of the orientation meeting

The orientation meeting was very successful. The meeting had a lot of engagement, with almost 60 prospective members attending. The guided discussion groups had solid engagement, and we heard a lot of ideas for strategy. Overall people seemed interested and the meeting was a good sign for recruitment this season.

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- The meeting was almost 4 hours long, so interest began to drop off.
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The orientation meeting went very well and is a strong sign for recruitment; there may be additional logistical challenges for onboarding and managing an influx of new members.

Continued in **Hardware Split Prep** (Pg. 9)

Initial Hardware Brainstorming

Focus: **Season Kickoff**

By: **Mae Subramanian**

Date: **09/15/2024**

Continued from **Hardware Split Prep** (Pg. 9)

→ **Objective:** Brainstorm mechanisms in prep for the upcoming weeks of hardware.

We need to get prototyping. The team had its first hardware meeting today, thinking about specifics for each subsystem.

[!quote]+ Brainstorm notes from meeting Intake:

- Skewer/Plunger mechanism
  - Easy for stacks
  - Can only hold 2 rings, so we'd need to be able to do this quickly
- Two groups brought this up: Top roller intaking into the robot
  - Helps to pull the ring in regardless of the cross-sectional width
- Active **side rollers**
  - 2 silicone wheels/rubber band wheels that intake rings
  - We don't need to worry about sorting until afterwards
  - Wheels on the **side** instead of the top
  - Inspired by YNOT (see image below)

Grabbing the mobile stake:

- Group 1 - mobile stake grabber?
  - Mobile goal shaped cutout
  - Use the indent in the mobile stake
  - We need something for the base to lean against as as we pull the lip of the mobile stake
  - Research overcenter locking claw
- Group 2
  - Took inspiration from watching tiktok during hardware meeting!! :LiSparkles:
  - Same as others
- Group 3
  - Use a dr4b to raise to the neutral stake - this goes over to a future problem

```
We can also make a guard in front of the robot to knock the stacks down
```

YNOT inspiration

Keeping in mind that the mobile stake has some resistance on the rings, we can't just rely on gravity to score rings. We thought of the following ideas for end effector problems:

- How do we quickly pass rings onto the mobile stake?
  - Conveyor that traverses up through the robot, and then we can push it down onto the mobile stake
- How do we raise up to neutral goal
  - Continued idea of using the skewer/plunger idea
  - Raise the entire conveyor up
  - Use a basket on the intaking end of the robot and raise it up
  - All using 4bar/6bar to reach

Climb

- How do we climb?
  - Four hooks total that fold when they press up against the bottom of the rung, alternating so that
  - Use post as support
  - Passive climb
- Buddy climb?
  - One robot sits on top of the other
    - ❌ We have to design the robot frames around that a lot

- Really really high strength latch
- One robot holding mobile stake and can hold onto it and latch on and climb
- Other robot that can latch on similar to locking claws

%%**Bolded last sentence that concludes/summarizes observations/future plans.**%%

Continued in **Prioritizing Hardware Objectives For Skills** (Pg. 14)

Prioritizing Hardware Objectives For Skills

Focus: **Season Kickoff**

By: **Ellie Bancroft** Date: **09/22/2024**

Continued from **Initial Hardware Brainstorming** (Pg. 11)

→ **Objective:** Identify needs for our 15in to do well during Skills.

We need to determine our goals and objectives for Skills. Since one of our main goals this year is winning Excellence at Worlds, we need to be in the top 40% of Skills.

Why does Skills matter?

Skills is important as it is a very direct way to increase our chances of qualifying for worlds. A high rank in skills at competitions is necessary to be eligible for Excellence, so we will need strong performances in both driver and programming skills.

Skills can also directly qualify us for worlds, with the teams with the top 5 skills scores on December 31st 2024 being awarded qualification to the world championship. Qualifying that early in the season would allow us to plan more long term, and reduce the stress that comes from trying to get a worlds qualification.

How is Skills different from Head to Head?

For the purposes of design the primary differences between Skills and Head to Head Matches is:

- The robot doesn't need to contend with defense
- There are no stacks of four rings on the field
- There is no need to descore rings

What do our robots need to do?

We can apply most of the conclusions we've made about scoring from head to head matches, but need to place a greater priority on simplicity due to the shorter period of time we have to build these robots as well as some mechanisms just not being necessary for skills.

Because of this, more complicated mechanisms like a Buddy climb might make sense to not add despite the large amount of points they can get because of the time it would take to refine their design.

Ranked List of Robot Functions

1. Drive
2. Possess Mobile Stakes
3. Possess Rings
4. Score on Mobile Stakes
5. Sort Rings by Color
6. Score on Alliance Stakes
7. Score on Neutral Stakes
8. Low Climb

Selecting a Drivetrain

Focus: **Initial Drivetrain**

By: **Mae Subramanian**

Date: **09/23/2024**

Continued from **Initial Drivetrain Expectations** (Pg. 4)

→ **Objective:** Decide on a drivetrain design for the Initial Drivetrain **The team met to settle on a drive out of multiple proposed options.** After

Bolded summary sentence that concludes our decision and leads into future plans.

%%note: this usually involves a decision matrix! for big decisions like deciding on a drivetrain, this is best written after a hardware meeting :)%%

Continued in **Drivetrain Options** (Pg. 24)

Intake & Brainstorming

Focus: **15in Intake**

By: **Ellie Bancroft**

Date: **09/29/2024**

→ **Objective:** Identify possible mechanisms for a Ring intake.

Following season kickoff expectations, our robot will need some method of intaking Rings. In general, intakes can be divided into two types: active and passive. An active intake uses some sort of rotation to pull in game elements, while a passive intake is something like a claw where it needs to be lined up and then actuated.

Active Intake Styles

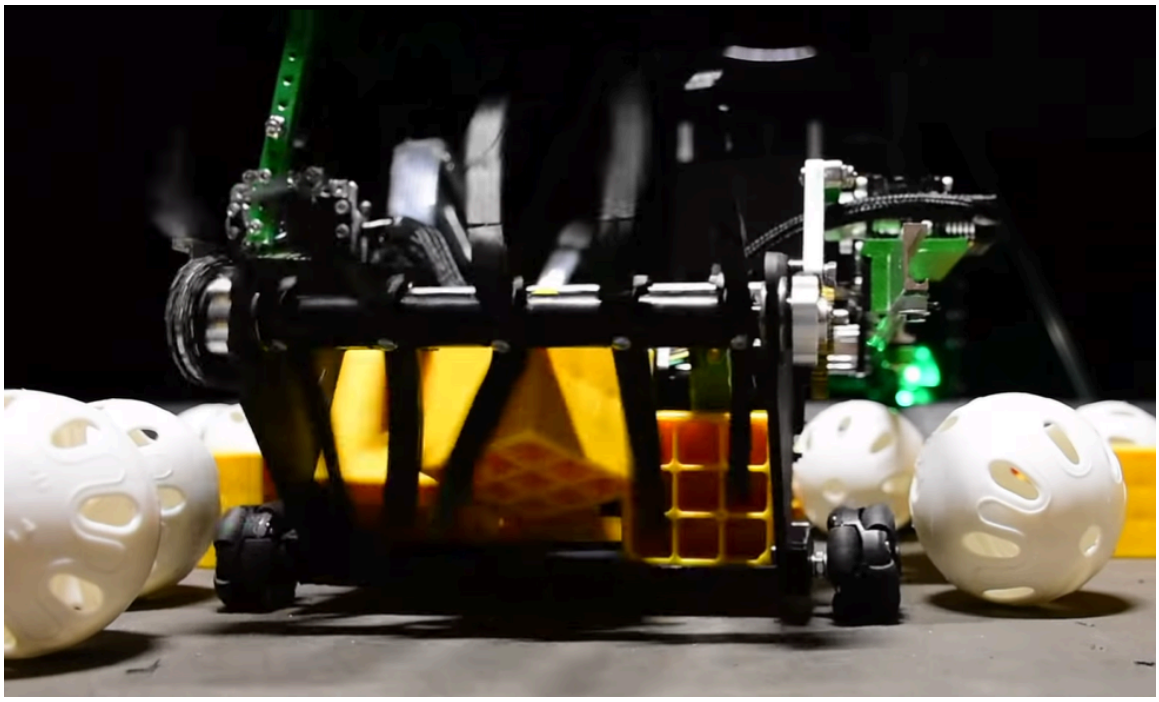
Top Roller Intake

Top roller intakes are frequently used for game elements with a flat top or that would otherwise be hard to grab from the sides. These intakes can allow robots to intake from a wide horizontal range.

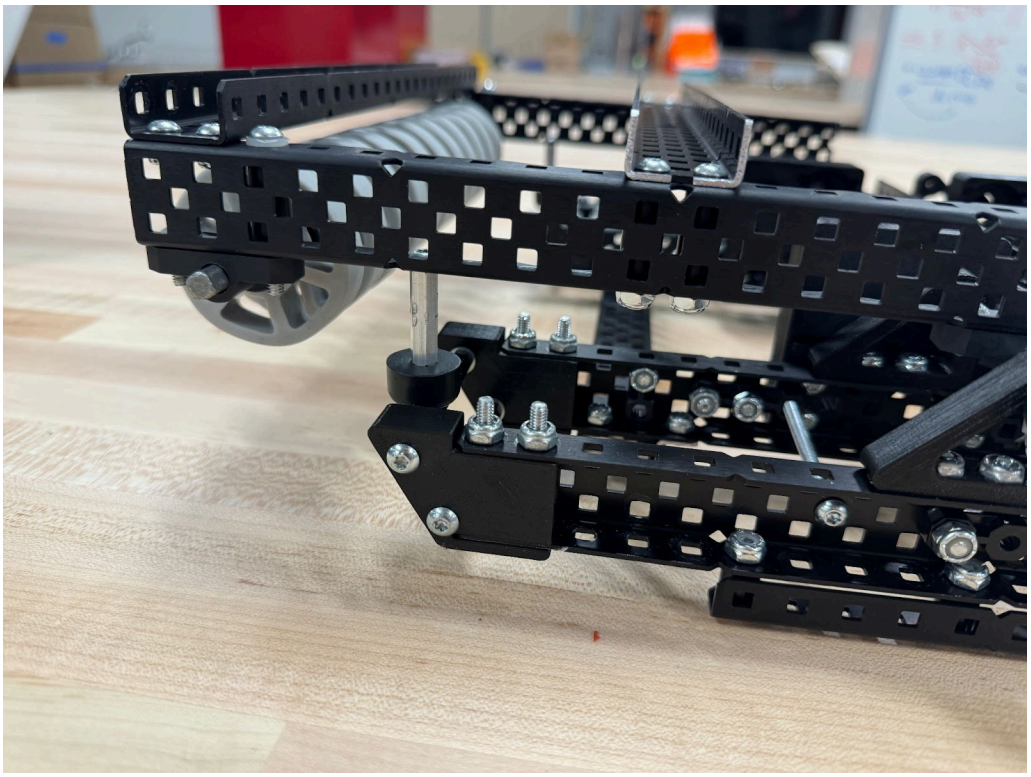
Relevant to this game, a pivoting top roller intake could be actuated up and down, which would allow us to better deal with the ring stacks that are on the field.

Surgical Tubing Intake

Use of surgical tubing on an intake is much more common in other competitive robotics programs such as FTC. Surgical tubing can be useful on an intake due to its high grip, and with these game elements the potential to act as hooks on the center of the ring that better pull in the rings into the robot.



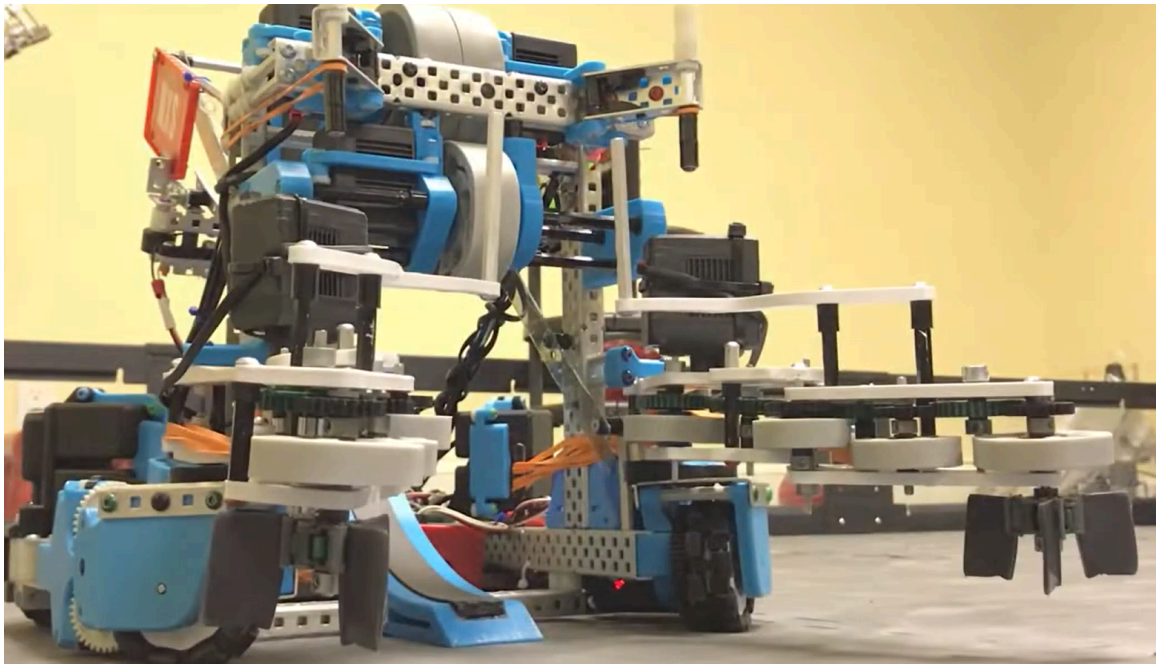
Since their release flex wheels have been widely used in intakes in V5RC. The compliance of the flex wheels allows them to get good traction on game elements, and we have used them in the past such as in Over Under. Potential downsides of using flex wheels are their weight and potentially having less grip than other options.



Side Roller Intake

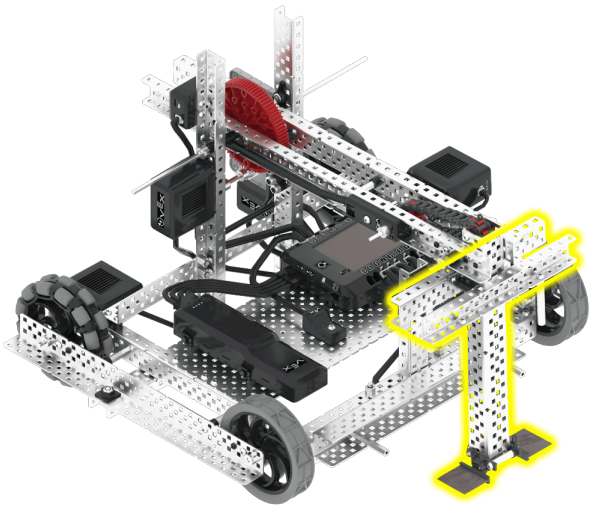
Side rollers are another common intake, being more commonly used when teams want to intake a game element such as a cube where it helps to contact the game element from multiple sides so it doesn't roll (such as in games with cubic game elements like Tower Takeover)

For this game, it would be less useful to have a side roller intake, due to the round shape of the rings it would be difficult to design an intake that can intake from a wide range and remain in contact with the ring as it goes in.



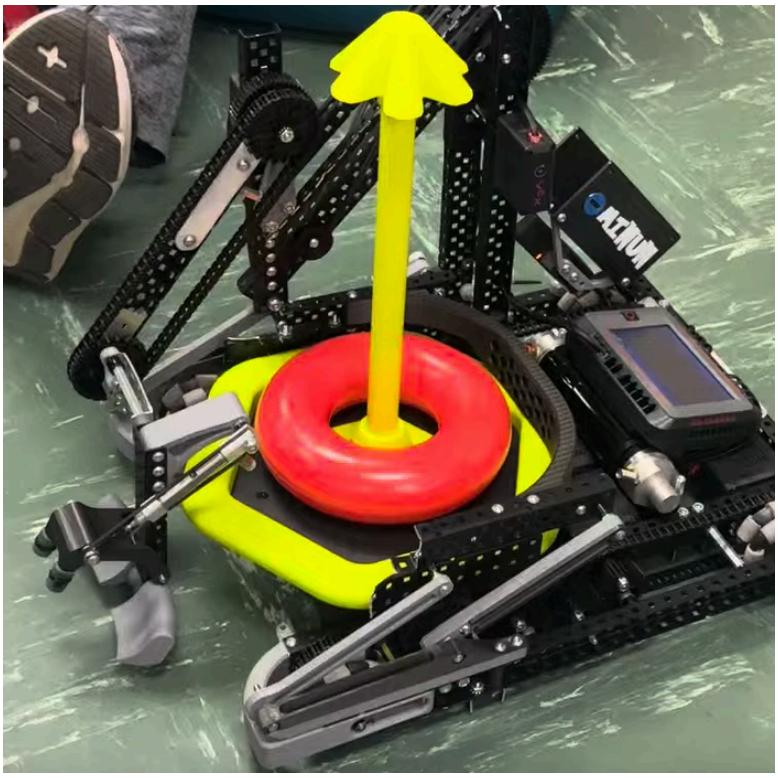
Possible advantages of this are that it allows us to have an intake also working as our scoring mechanism which removes the need for some kind of hand off. This also could allow for easier scoring on the neutral or high stakes as an intake like this could be on any kind of arm or lift that could reach up high.

This design does also come with a lot of disadvantages though. Having to grab through the center of the ring means we need to line up precisely to actually grab anything, and would in general be slower than any active intake.

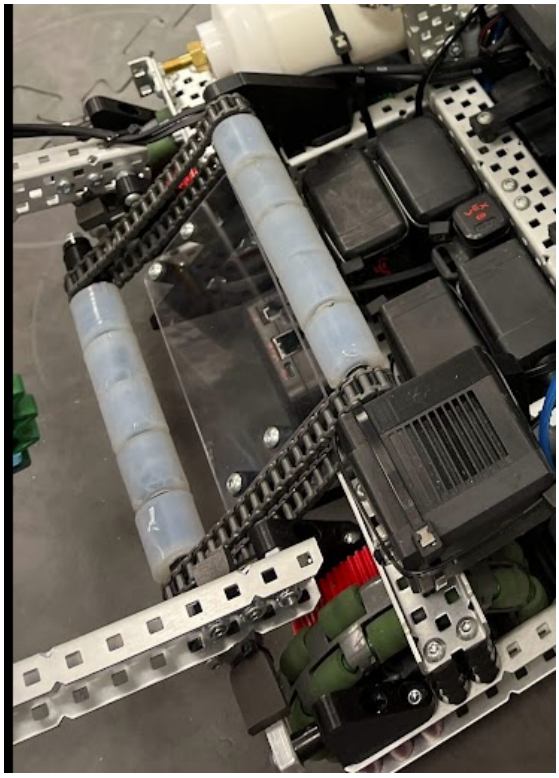


Claw Intake

Claw intakes are relatively common in V5RC, though are not frequently used at a high level in most games. These have the same advantages and disadvantages of the stick intakes for this game, potentially with worse alignment issues since they would either need to grab horizontally with a very wide grabber, or vertically which would only work when lined up in a narrow range.



Bbottom intake ramp roller** Bottom rollers In addition to a top roller help transition game objects from the ground into the bot, using small 1in silicon rollers to help the game element get off the floor and unto the ramp.



Continued in **Intake Selection** (Pg. 28)

Grabber Requirements

Focus: **15in Mobile Goal Grabber**

By: **Ellie Bancroft** Date: **09/30/2024**

→ **Objective:** Create requirements for a Mobile Stakes grabber.

To score effectively we need to have some way to grab and hold Mobile Stakes. Minimizing our movement around the field is going to allow us to score faster. Carrying around a mobile stake while being able to score on it allows us to have a consistent position to score and minimizes our movement around the field since we don't have to drive back and forth between rings and a mobile stake.

Goals and Requirements:

1. Minimize points of failure
    1. Reduce Complexity
    2. Fewer Moving Parts
2. Keep as much of the Mobile Stake in the robot as possible
    1. Prevent other teams from stealing it
3. Keep all of the Mobile Stake grabber inside the 15in sizing limit at all times
    1. Keep the robot within expansion limits
4. Get the top of the Mobile Stake as close to inside the 15in size limit as possible
    1. Make scoring on the Mobile Stake easier
    2. Lets the conveyor be able to score in its starting position

Continued in **Grabber Brainstorming** (Pg. 25)

Drivetrain Options

Focus: **Initial Drivetrain**

By: **Mae Subramanian**

Date: **09/30/2024**

Continued from **Selecting a Drivetrain** (Pg. 16)

→ **Objective:** Identify options to build/overcome something/solve a problem/etc. **Bolded thesis-like intro sentence.** Background knowledge. Talk about the problems. Yadda yadda yadda. **Bolded summary sentence that concludes our options and leads into future plans.**

Continued in **Gear Meshing Issues** (Pg. 33)

Grabber Brainstorming

Focus: **15in Mobile Goal Grabber**

By: **Ellie Bancroft**

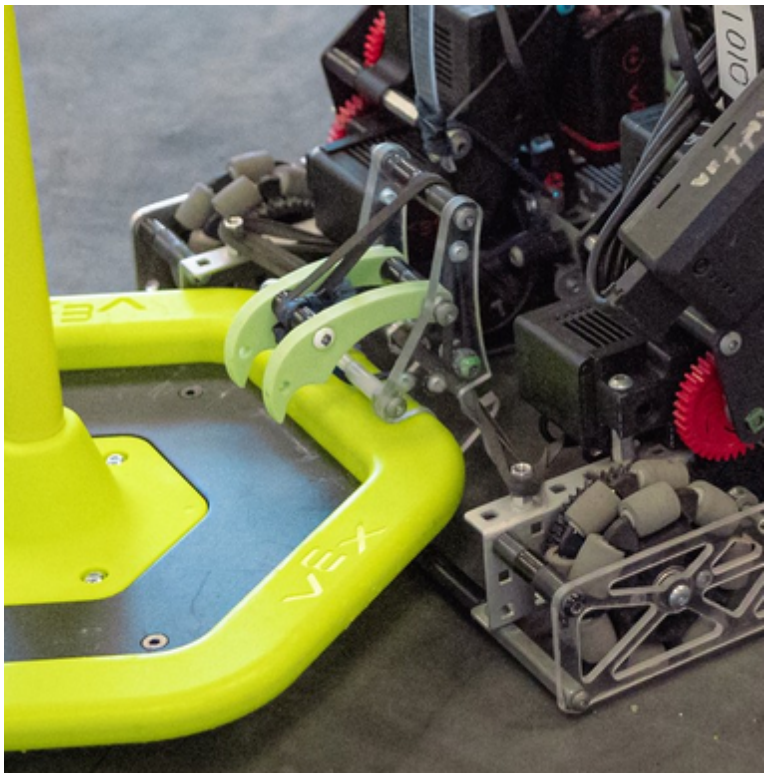
Date: **10/04/2024**

Continued from **Grabber Requirements** (Pg. 23)

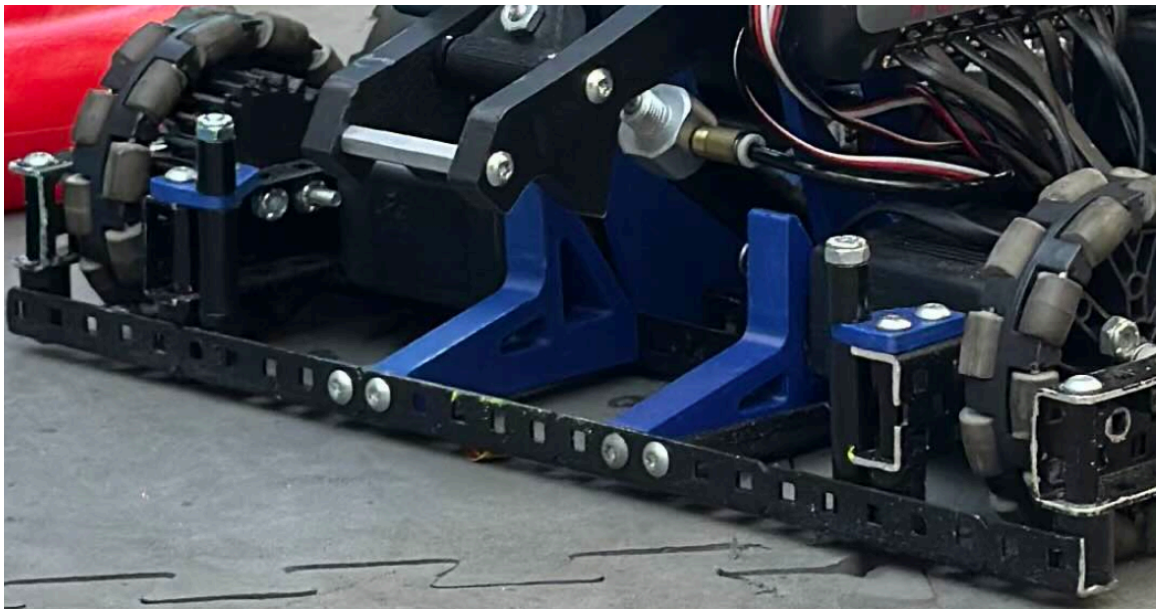
→ **Objective:** Identify possible Mobile Stake Grabber Designs.

We need some way of possessing and holding onto Mobile Stakes. Mobile Goals have been a mechanism used in many past VRC games, so we can look into past mechanisms to take inspiration.

In the Zone Style Mobile Grabber



Arm Grabber



There is a depth of knowledge of similar mechanisms to Mobile Stake grabbers that we can rely on. An arm or tilting style grabber seem most applicable to this game.

Continued in **Tilting Grabber Proof of Concept** (Pg. 42)

Intake Selection

Focus: **15in Intake**

By: **Ellie Bancroft** , **Mae Subramanian**

Date: **10/06/2024**

Continued from **Intake & Brainstorming** (Pg. 17)

→ **Objective:** Select the best intake options to prototype.

The team met to score potential intake options. Using a decision matrix, we listed scored the following criteria based on importance:

Criteria	Reason	Weight (1-5)
Range	A wider intaking range makes collecting rings easier for our drivers and autonomous period.	5
Speed	The faster we get a ring into the robot the sooner we can score it.	5
Grip	Allows the intake to be more consistent and gives us a competitive advantage against other teams.	3
Complexity	More complexity means more points of failure.	3
Multi-Purpose Manipulator	Reusing the intake for another mechanism reduces robot complexity, but the intake's quality should remain the priority.	1
Space Efficiency	Space efficiency is important, but the robot is already designed to leave space for the intake.	2

Surgical Tubing Top Roller

Analysis	Score	Weighted Score
Top roller allows for greater horizontal range but is limited by the robot's width and ring size.	5	25
This can run as fast as a motor can spin a wheel.	5	25
Has high grip and acts as a hook through the center of the ring.	5	15
Requires the use of custom parts to ensure that tubing stays attached - increased risk of failure.	3	9
Not useful for other mechanisms.	1	1
Occupies most of the front, but leaves some space for other mechanisms.	2	4
	Total	79

Flex Wheel Top Roller

Analysis	Score	Weighted Score
Top roller allows for greater horizontal range but is limited by the robot's width and ring size.	5	25
This can run as fast as a motor can spin a wheel.	5	25
Flex wheels offer various durometers and decent grip, but their smooth surface limits grip strength.	4	12
No custom parts but chain could break	4	12
Not useful for other mechanisms.	1	1
Uses majority of the front of the robot with some room for other mechanisms	2	4
	Total	79

Flex Wheel Side Roller

Analysis	Score	Weighted Score
Can only intake from slightly wider than the minimum distance between rollers	2	10
This can run as fast as a motor can spin a wheel.	5	25
Flex wheels offer various durometers and decent grip, but their smooth surface limits grip strength.	4	12
	3	9
Not useful for other mechanisms.	1	1
Uses too much horizontal space and front of the robot if folding is required.	1	2
	Total	59

Stick

Analysis	Score	Weighted Score
The ring's inner hole is small making it hard to position.	2	10
Can only go as fast as it takes to line up and actuate the mechanism	3	15
Ring could be pulled out from the side	4	12
Potential to be entirely passive, almost no points of failure.	5	15
Could be used for a scoring mechanism	5	5
Very small	5	10
	Total	67

Decision Summary

	Surgical Tubing Top Roller	Flex Wheel Top Roller	Flex Wheel Side Roller	Stick	Claw
Total Score	79	79	59	67	62
Comparing the total scores in our decision matrix, we decided that the **Surgical Tubing Top Roller** and **Flex Wheel Top Roller** were both worthy candidates to test out. As we prototype, we will examine the benefits and drawbacks of each.					

Our next step is to prototype surgical tubing and flex wheel intakes.

%% note: this usually involves a decision matrix! for big decisions like deciding on a drivetrain, this is best written after a hardware meeting :)%%

Continued in **Intake Proof of Concept** (Pg. 38)

Testing and Tuning Voron V0 Focus: **Manufacturing and 3D Printing**

By: **Aidan Kelley** Date: **10/06/2024**

%%proofreading note: please review RIT VEX U Notebook Standards#LiWholeWord Conventions & Wording and RIT VEX U Notebook Standards#LiUnlink No links.%% → **Objective:** Tune the Voron V0—a custom-built printer started last season—to full functionality for manufacturing custom parts.

The Voron V0 and existing manufacturing methods were re-evaluated with new members of Hardware Subteam. In previous years, various slicer programs have been used to turn 3D object files %%(OBJ, STL)%% to GCode. We used slicers like Cura, PrusaSlicer, and SuperSlicer. Through member recommendations, we decided to switch to OrcaSlicer. %%As there is no existing convention for slicing part files on the subteam, this transition was neither at a loss nor necessary gain.%% OrcaSlicer's ease of use and easy-to-understand UI makes it easier to train less-experienced members of the team, and its network connections will allow for direct printing from the slicer window.

Through cursory manual inspection of the 3D printer, immediate problems were identified. The transportation of the printer to and from the previous year's World Championship broke the printer's enclosure door off (which is constructed of printed parts and can be easily reprinted) and loosened the bolts holding the frame together. Most importantly, the linear rails were loose in their attachment to the frame. These loosened connections were tightened.

The printer's software was then inspected. We quickly realized that OrcaSlicer sets the (0,0) coordinate for the print bed at the "lower left" corner (when viewing the print bed from the enclosure door towards the back of the printer). The Voron's configuration set the (0,0) coordinate to the "upper left" corner. The motor connections for x and y motors were swapped to change the direction of motor travel, and axial direction was inverted in the `printer.cfg` configuration file to ensure that the positive x and y axes were consistent with the software. A homing test was performed and both axes homed in the correct direction, and set the correct corner as (0,0).

Note for future reference that the printer homes to coordinates (110,100); the software assumes a print bed of these dimensions, which is an underestimate. Underestimates are better than overestimates. %% We might not want to include notes to self about the details of technical parameter in the notebook. The judges are scanning for information on our process, so this might not be relevant to them.%%

Macros were added from https://ellis3dp.com/Print-Tuning-Guide/ to allow for easier homing, bed leveling, print start and end, print pause and resume, and heating and cooling the bed and hotend. %% See RIT VEX U Notebook Standards#💬 Addressing The Team %%

An extrusion test was next performed to identify why the printer had previous difficulties in extruding material at a consistent rate. A cold pull of the nozzle came out clean, indicating few or no obtrusions inside the nozzle or heat block. A problem was evident, though, as the melting temperature of the filament was ~55 degrees less than what the printer required to smoothly extrude. The printer.cfg file was inspected for problems, and it was identified the wrong thermistor name was called. The brand of thermistor was found, and input, and the printer's temperature began reading more accurate values (e.g. ambient temperature at 28 degrees and not 73).

An extrusion steps tuning was performed per https://ellis3dp.com/Print-Tuning-Guide/; 120mm of filament was measured and 100 mm was fed at 1mm/s. The remaining 20mm was measured for accuracy, and the rotations value was tuned to increase precision. Likewise, the gearing ratio was updated from 50:20 to 1:1 as the extruder motor was found to be wrongly listed in the software. %% See RIT VEX U Notebook Standards#💬 Addressing The Team %%

Following these tests a bed level test was performed.

Recalibrations to bed height, print temperature, and pressure need to be performed, but these updates to the Voron V0 have left it in a much improved state.

Continued in **Continuation of Voron V0 Tuning** (Pg. 49)

Gear Meshing Issues

Focus: **Initial Drivetrain**

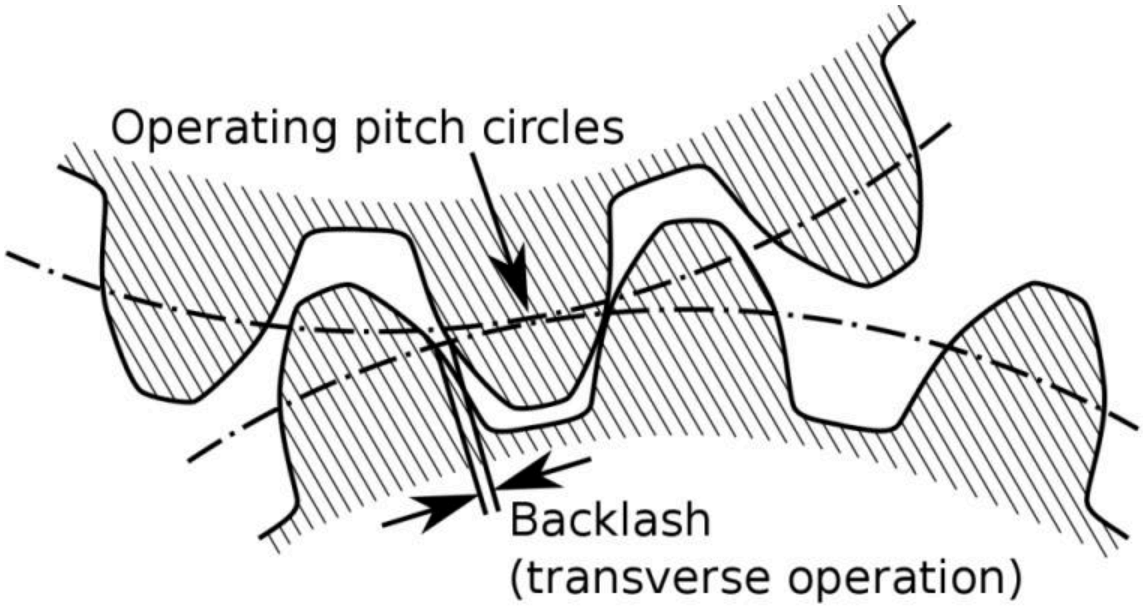
By: **Mae Subramanian**

Date: **10/06/2024**

Continued from **Drivetrain Options** (Pg. 24)

→ **Objective:** Tackle gear meshing issues in the initial drivetrain. **The initial drivetrain resists and crunches as it moves.** For the sake of compactness, 3D printed gears on the initial drivetrain serve as a space-saving measure in the width of each of its sides. With the first attempt at these gears installed, the drivetrain crunched.

Looking closer, we noticed that the walls of the 3D printed gears were slightly overextruded, causing the teeth to jam against each other as they moved. [pic?] This phenomenon is due to a lack of **backlash**: space added between the teeth of gears for them to mesh without pushing into each other.



Source: Plant Engineer's Handbook by R. Keith Mobley p.1038

We solved this issue by adding `0.007`in of backlash to our gear design, which closely match the VEX gears' tooth profile. This new geartrain of the initial drivetrain was reprinted and replaced. Additionally, we added dry-film lubricant to reduce

The initial drivetrain's sides now spin freely, making the drive ready for testing.

Continued in **Drivetrain Proof of Concept** (Pg. 34)

Drivetrain Proof of Concept

Focus: **Initial Drivetrain**

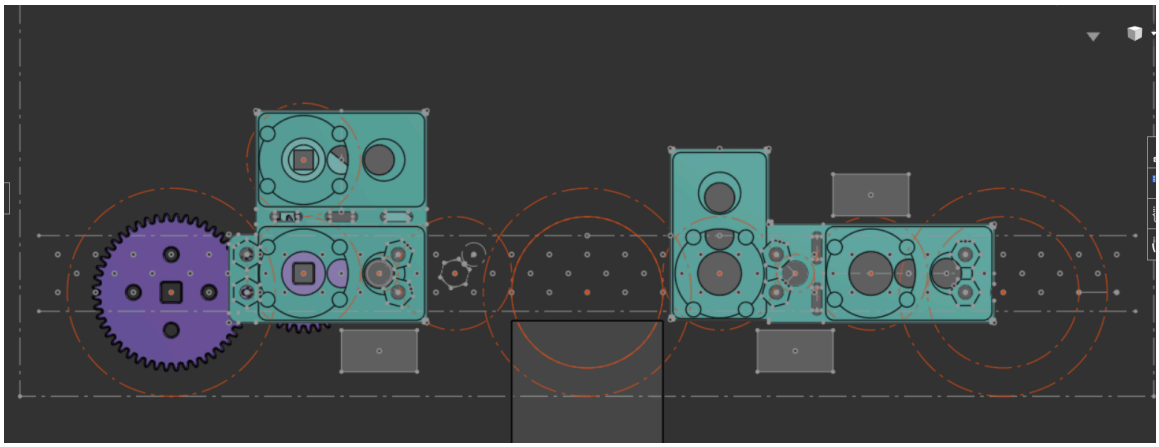
By: **Brayden**

Date: **10/08/2024**

Continued from **Gear Meshing Issues** (Pg. 33)

→ **Objective:** build and test the initial drivetrain.

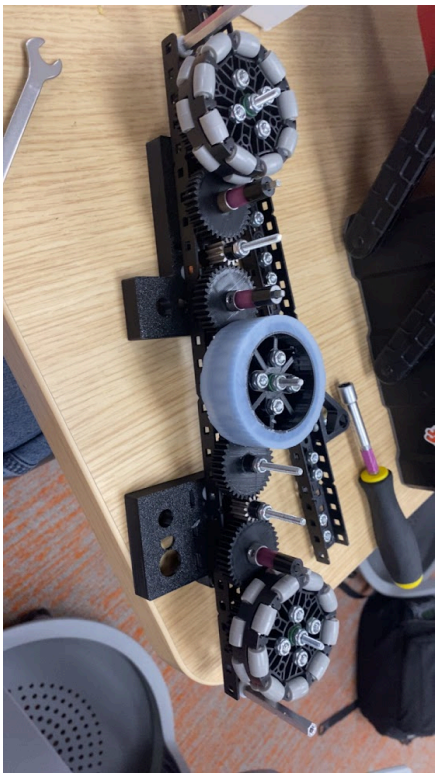
Creating motor mounts



By creating 2D Drawing of our wheel, gear, motor, and C channel, we can create a layout of where we want out motors to be. We created 3D printable mounts using OnShape and custom made feature scripts to make the face of the motor into a extrusion.

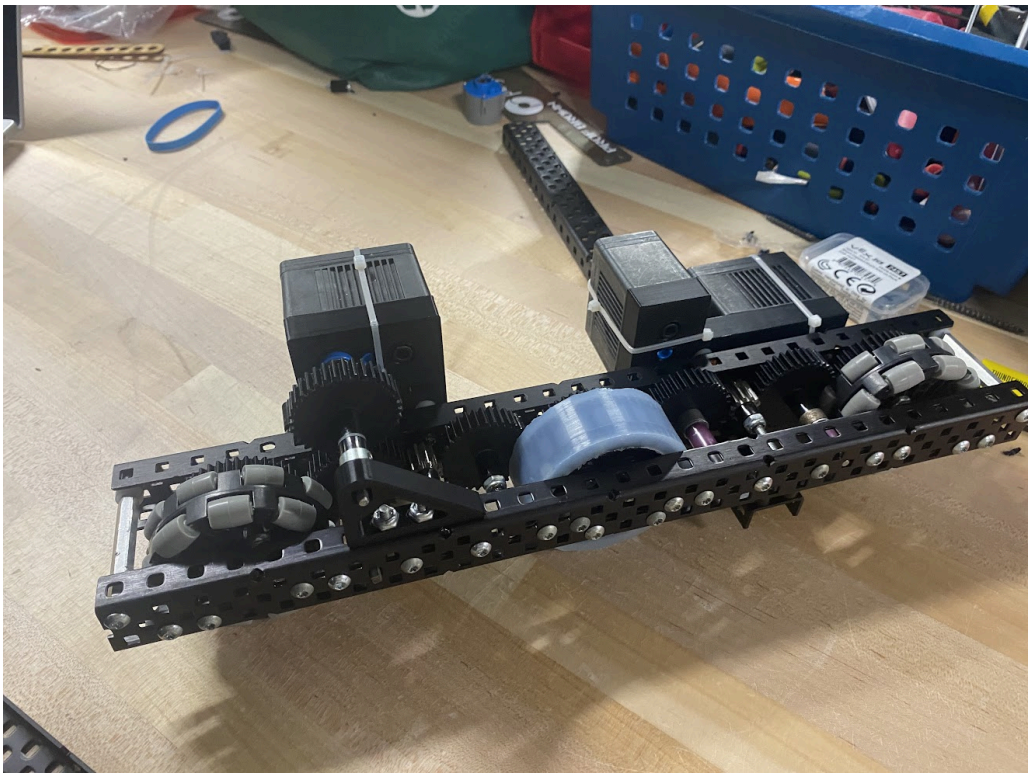
Implementing design

Having the full 3D CAD of our design implementing is fairly easy, copying from the mounter screen to parts. We created each side of the drivetrain at the same time, allowing multiple people to work on the bot simultaneously.

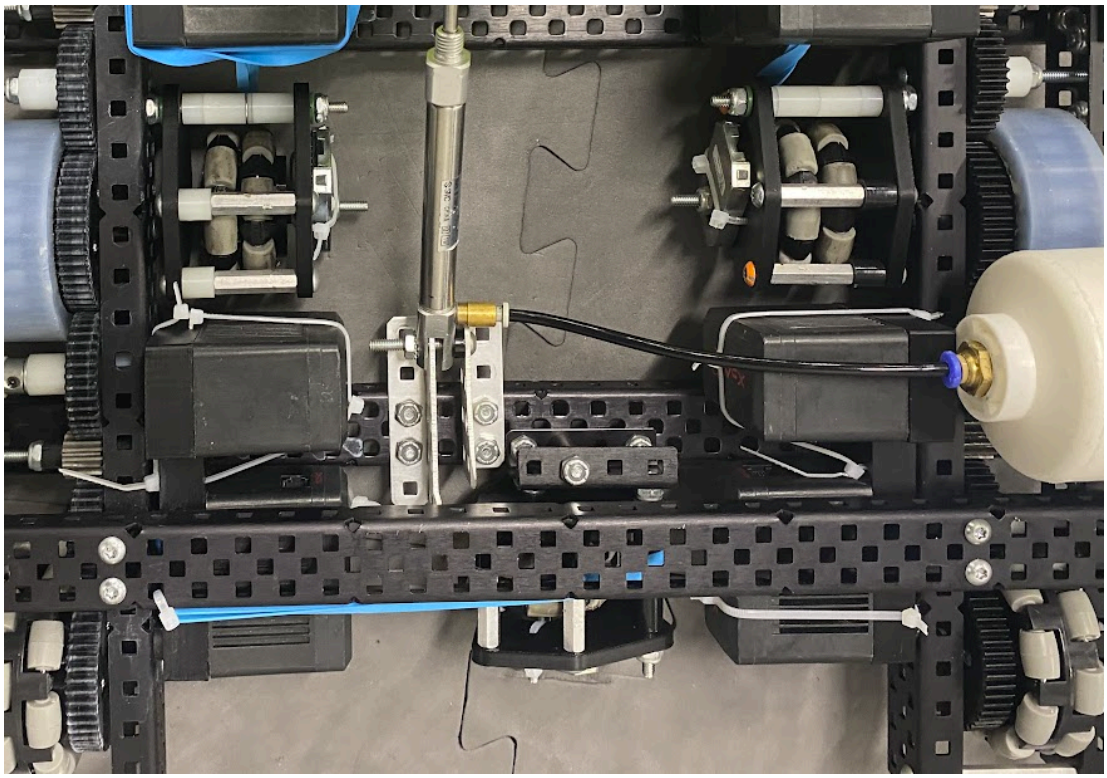


Gearing and Spacing of the Drivetrain

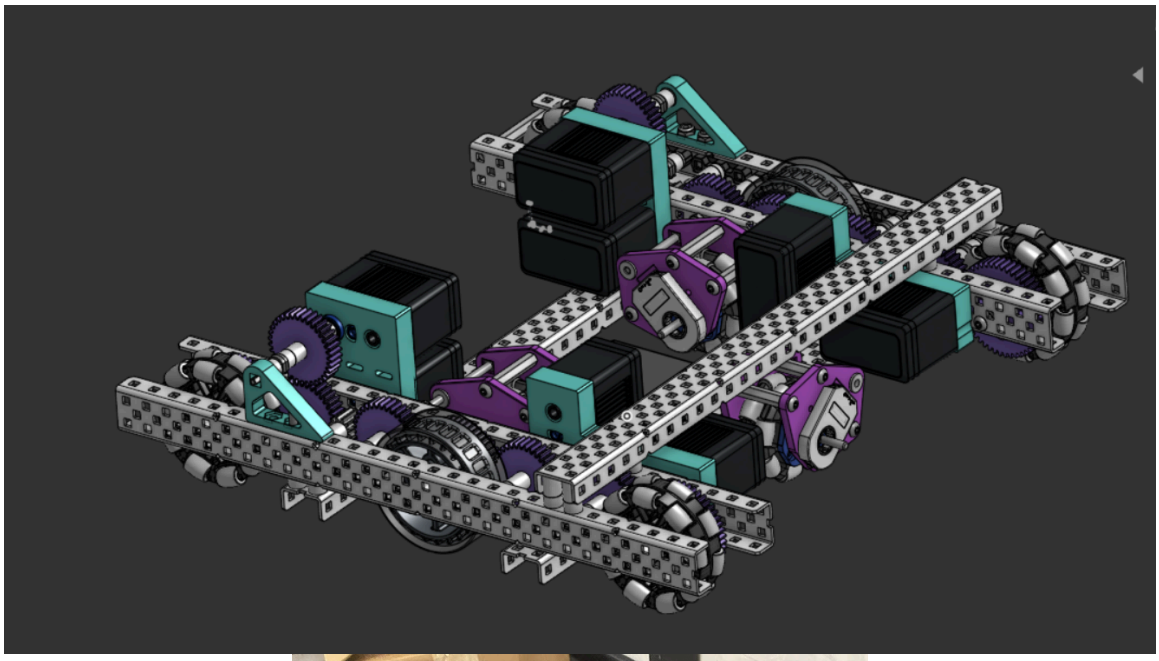
Our CAD model translated well into building it, as all the spacing and gearing is correct.

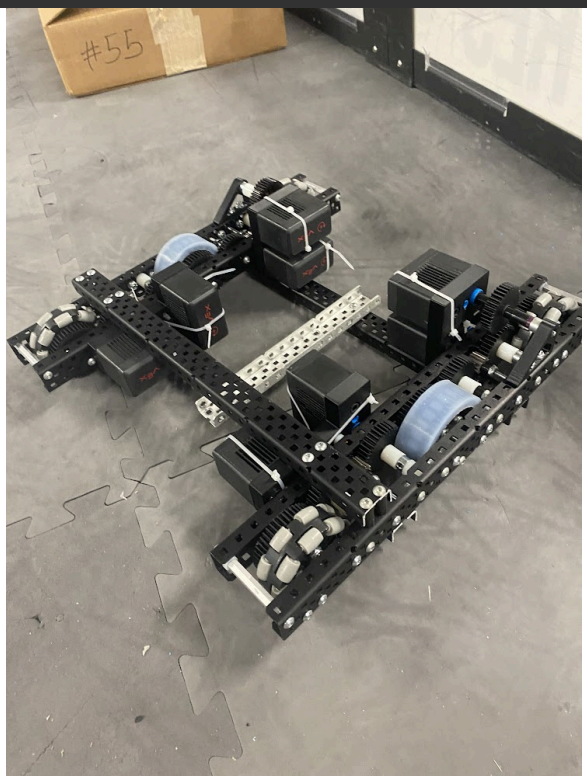


Odom:



Drivetrain Overview





Intake Proof of Concept

Focus: **15in Intake**

By: **Ellie Bancroft**

Date: **10/13/2024**

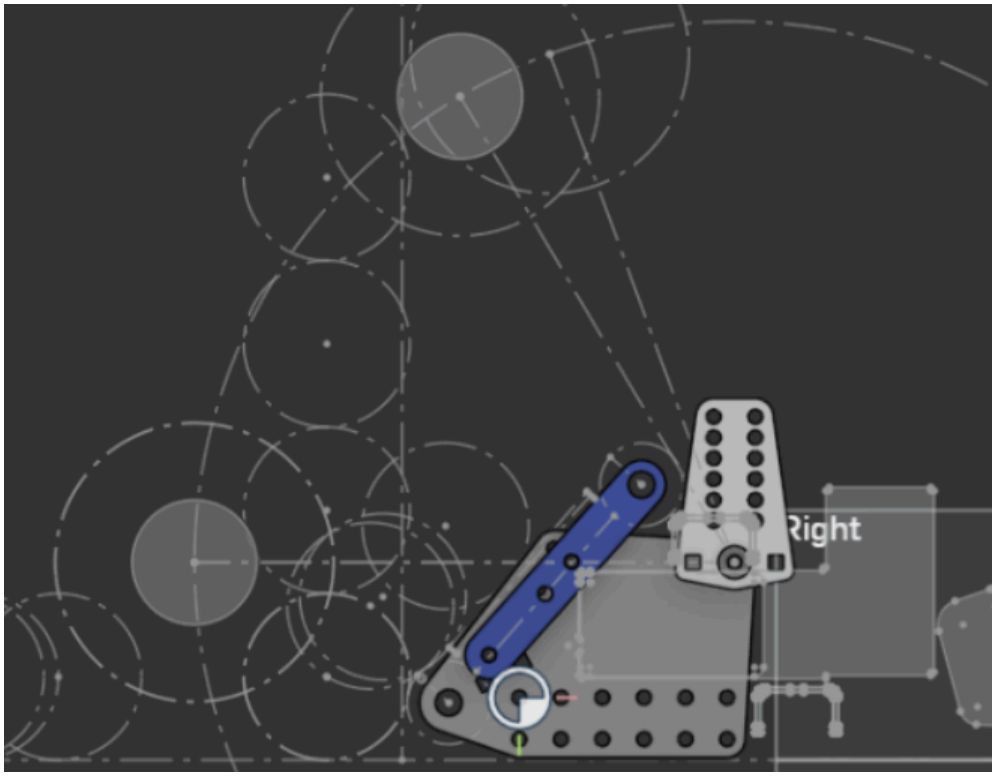
Continued from **Intake Selection** (Pg. 28)

→ **Objective:** Determine the most effective position and type of roller for our intake.

Prototype Design

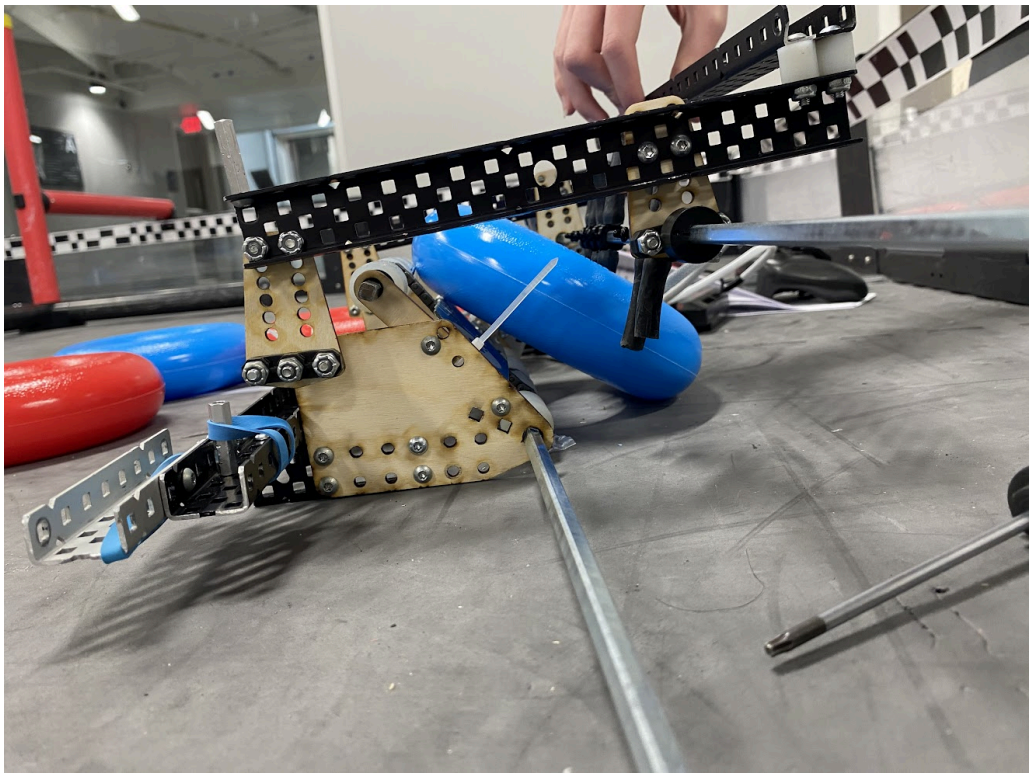
For this prototype we want to be able to adjust the position of the roller so we can find the best position for the intake for each type of roller.

CAD design drawing: using the 2D drawing from the drivetrain as reference and creating 2D drawings of the ring game element we created a drawing protype of a top roller and bottom ramp roller. in addition to testing making the prototypes out of MDF laser cut wood



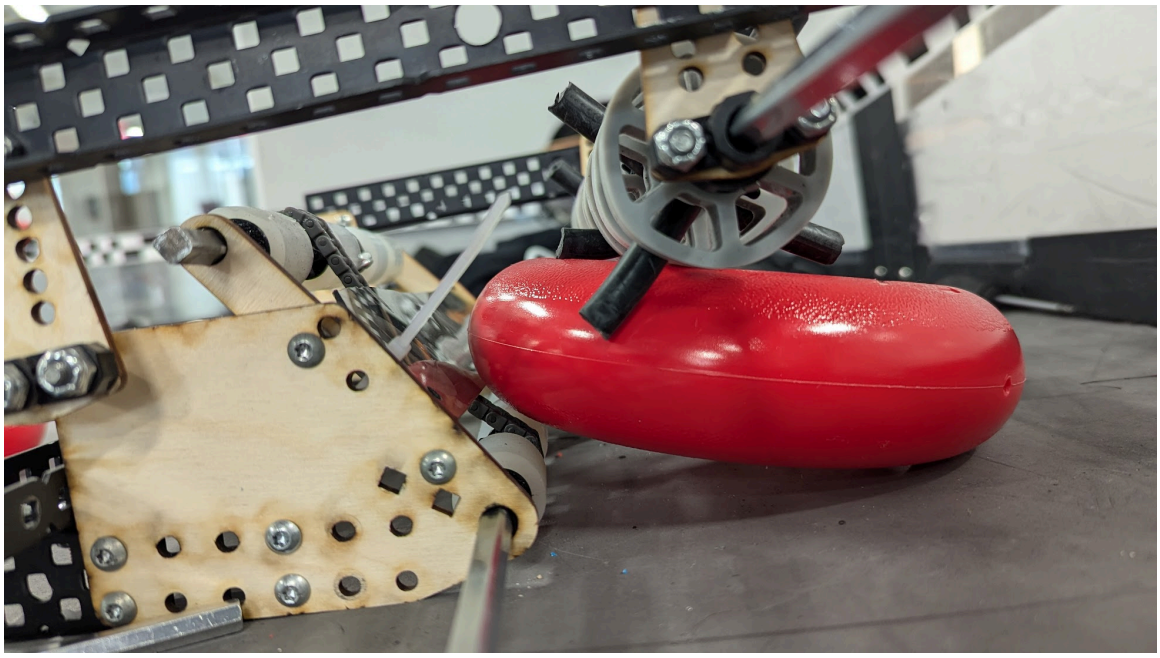
Implementation

Use the laser cut wood and C channel to create this prototype. Use 1in molded silicon rollers as bottom rollers, and top rollers.



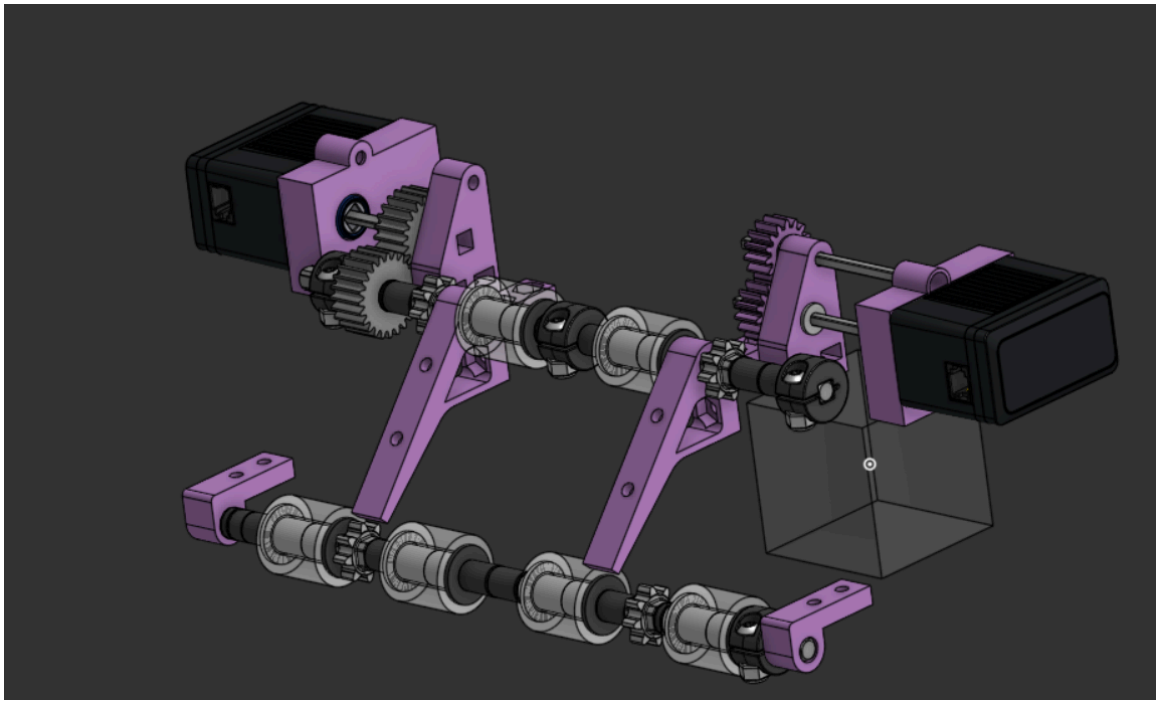
Desired Data

This prototype worked very well, using the surgical tubing it helps grab the ring if it is not perfectly aligned. The combination of the bottom and top roller creates a very smooth transition from the ground to the intake. **As this performance seems very promising, we are going to move forward with this design with incorporating onto the bot.**



Incorporate Design onto 15in Robot

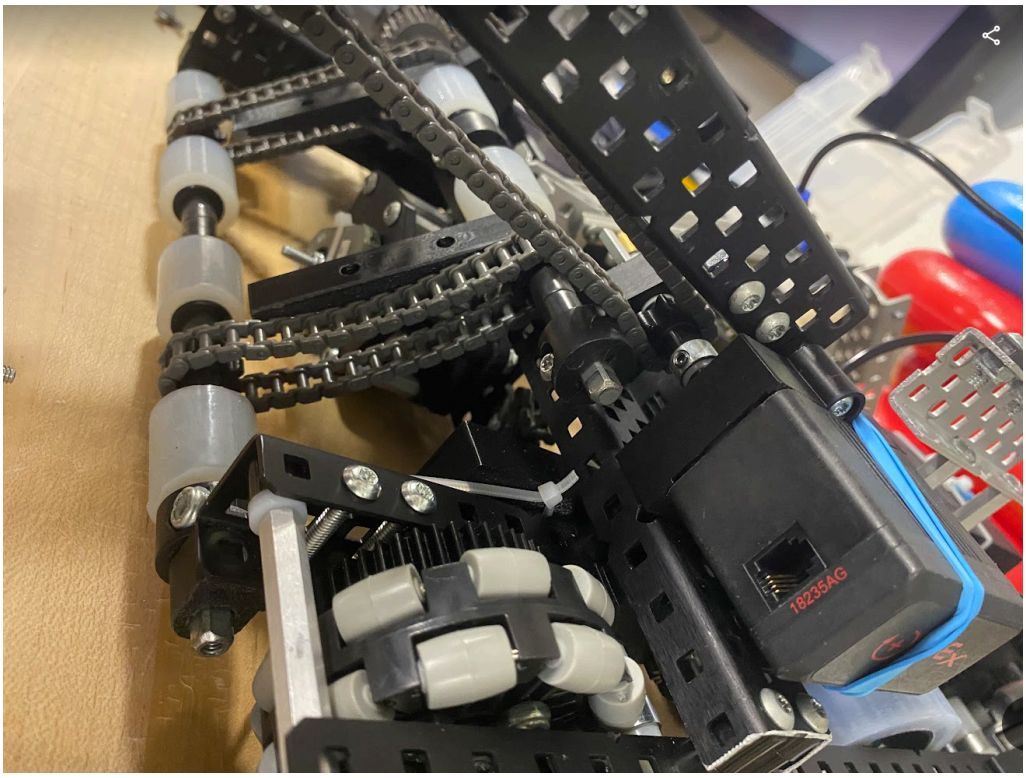
Our current design work well, but cannot fit onto the bot. **We need to redesign the mounts to attach to the bot.**



Using the same geometry as our previous prototype to create motor and axle mounts.

Top Roller Intake

While attaching the motor to the top roller we realized that chain is griding on the bottom roller shaft collar. To fix this issue, we are going to gear power to the pivot point of the intake and sprocket from the pivot point instead of the motor mount.



Tilting Grabber Proof of Concept Focus: **15in Mobile Goal Grabber**

By: **Ellie Bancroft** , **Brayden** Date: **10/16/2024**

Continued from **Grabber Brainstorming** (Pg. 25)

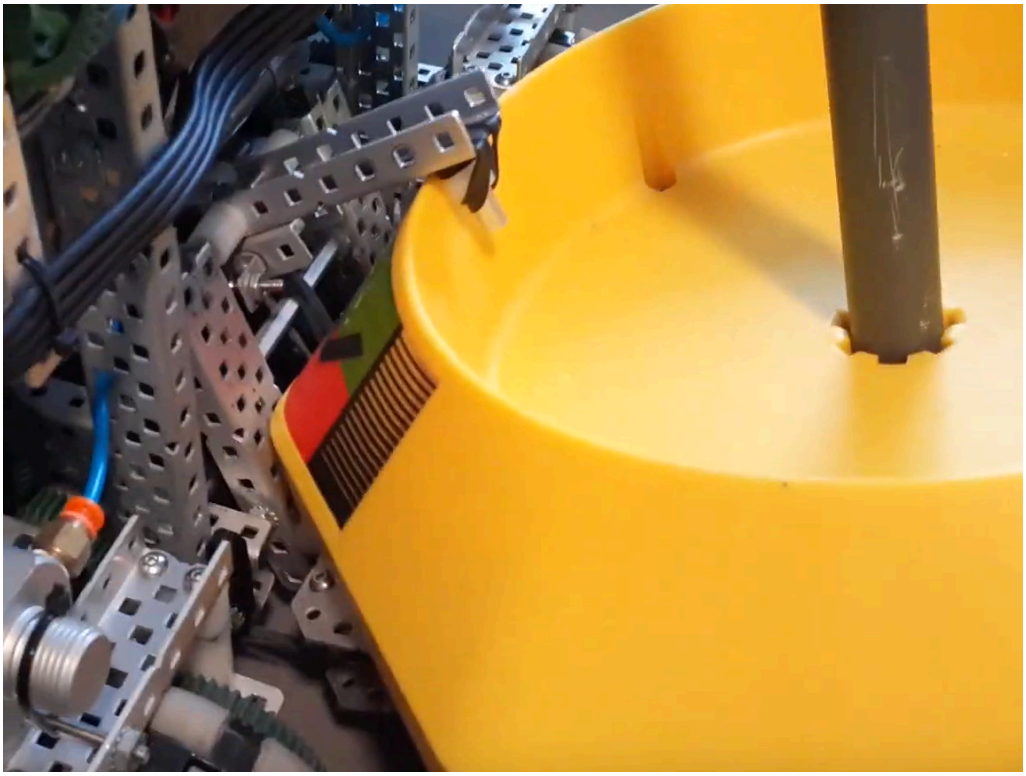
→ **Objective:** Build and test a tilting mobile stake grabber.

After deciding a tilting grabber is the most viable design, we need to design, prototype, and test one.

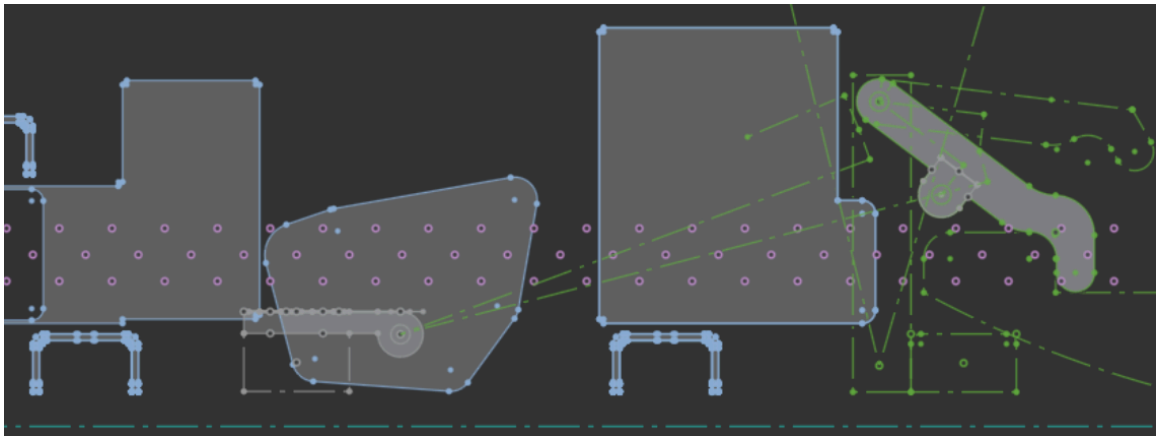
Testing Criteria:

- Design can effectively hold the mobile stake in place
- Design has the leverage to pull it when driving
- Design can grab it from any orientation
- The mobile stake cannot be easily pulled out from the grabber

We decided to base this design off of the two piston Mobile Goal grabber that 2775J ran in Tipping Point. We did this because its use of two pistons instead of two allows for easier mounting of pistons, and reduces the complexity of the prototype overall.



Design



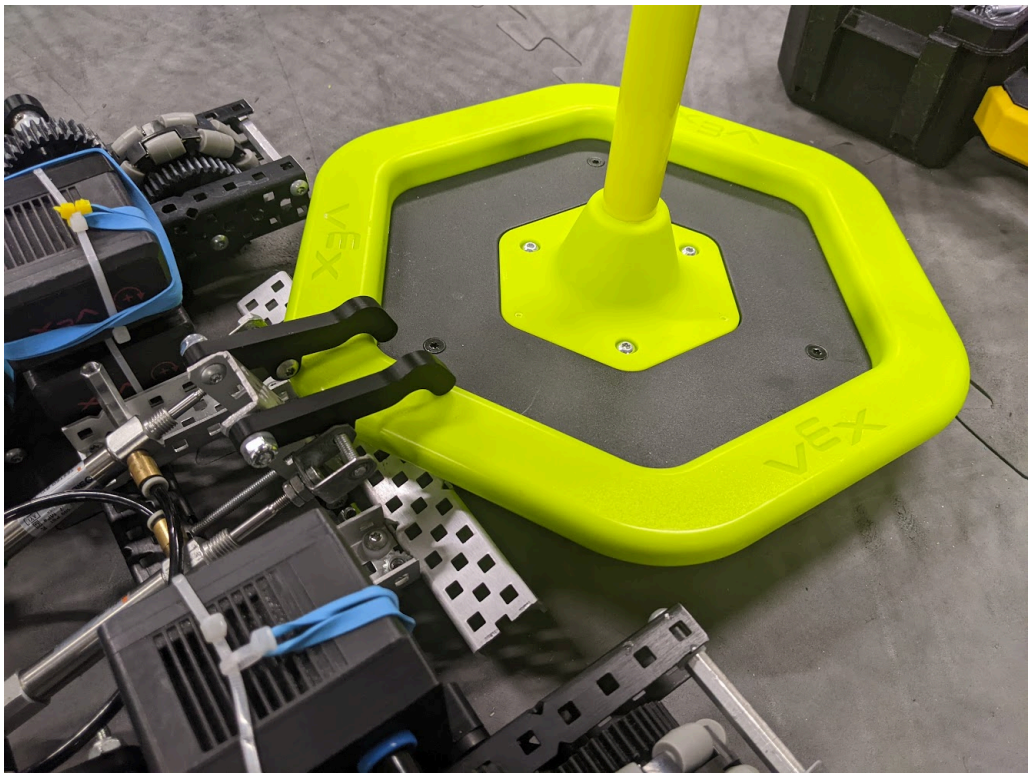
This design uses a short grabber arm that holds the Mobile Stake by clamping it between a c-channel and a 3d printed hook. This design works by having the 2 channels and grabber be pulled back by the pistons and using tension in rubber bands to force the pistons to pull the grabber backward when a mobile stake is in place.

Implementation

While the piston mount itself was designed to be on holeset, the overall mechanism was difficult to build. The positioning of the cross braces on the robot are not ideal for a mechanism being mounted far back on the robot, so we had to use pieces of c-channel and use shaft collars as bushings to build this mechanism. The result of this is that the grabber was limited in how far it could rotate backward by a piece of c-channel.

Testing

At 100 PSI the prototype was able to pull back the Mobile Stake somewhat, but have almost not resistance to being pulled out of the grasp of the claw.



Prototype did not work at all when attempting to grab the Mobile Stake at its corner.

Lessons from Testing

This design did not have nearly enough leverage to hold the Mobile Stake in place. The short arms of the grabbing mechanism meant that they just slipped away

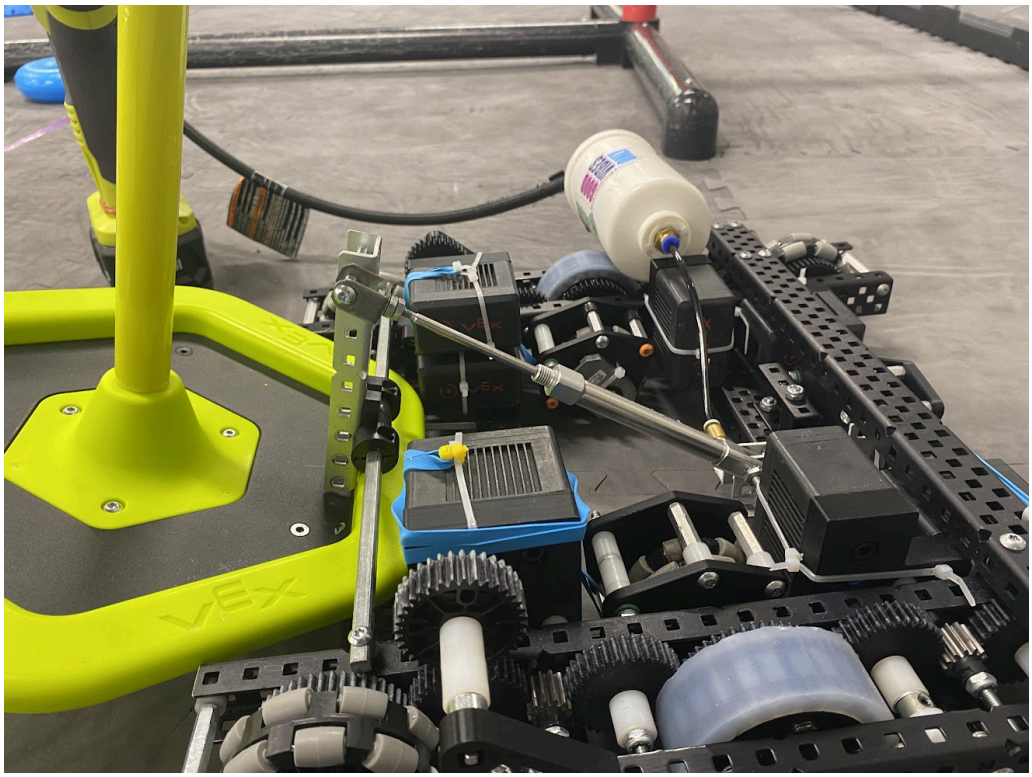
Another issue is that these hooks only contacted at a point and relied entirely on the force of the air, so in an actual match they would likely not be functioning towards the end of the match as our robot uses its air.

Finally this design shows that our grabber needs to be contacting at a smaller point to work for grabbing a mobile stake at the corner, or else it just will not function.

While this design did not work, we gathered useful data about what changed need to be made for future Mobile Stake Grabbers

New approach: Prototyping

Seeing that our previous design did not work, and the odd nature of the mobile goal, we think **it might be easier to prototype in person vs theorizing the physics of the mobile goal in CAD**.



Mounting:

The prototype we have created works, but the piston mounting is not effective for attaching 2 pistons to.

Odometry Pods

Focus: **Software Drivetrain**

By: **Samuel Radulski**

Date: **10/16/2024**

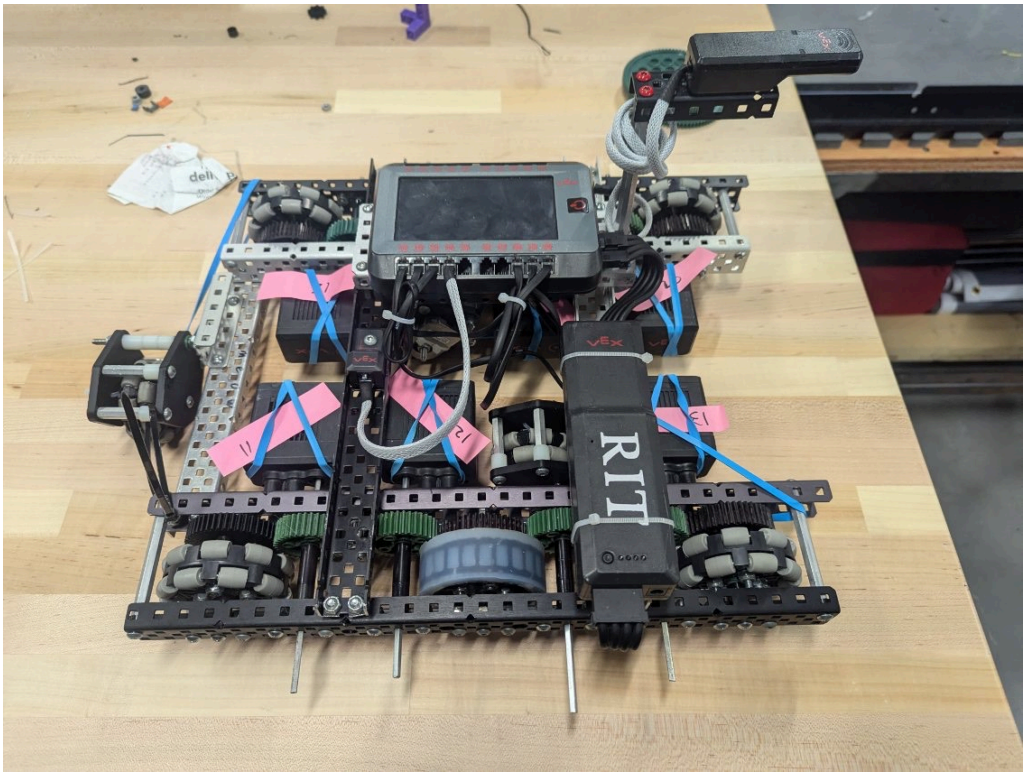
Continued from **Software Drivetrain** (Pg. 5)

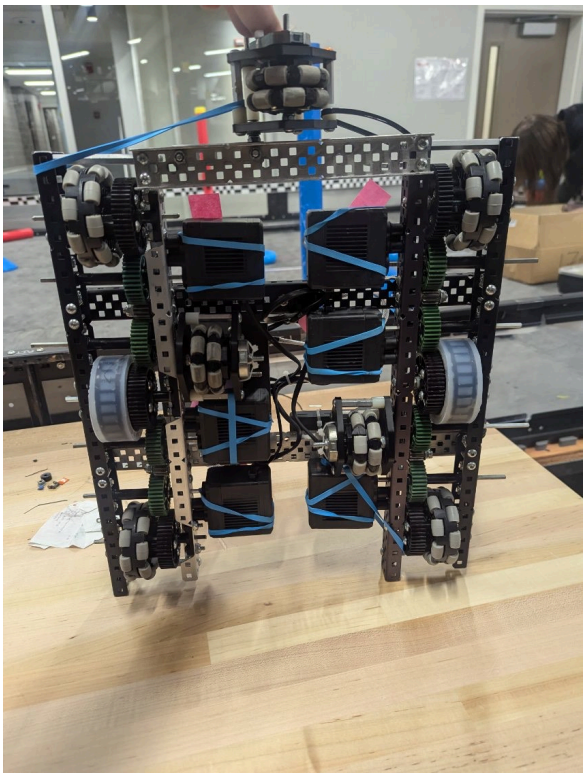
→ **Objective:** Implement the odometry pods for the software drivetrain

To keep the software drivetrain on track with the initial drivetrain, odometry pods were needed. The software team can now work on and test code while getting location information from the drivetrain. Mounted on pivots to account for field variance and to accurately represent the initial drivetrain while its under construction.

This drivetrain has posed a strong benefit to the software sub-team and has strongly helped new team members learn how to use the VEX build system on an accurate representation of a drivetrain used in competition.

The software drivetrain is finished and ready to be used by the software sub-team.





Odemetry Pod Placement

Continuation of Voron V0 Tuning

Focus: **Manufacturing and 3D Printing**

By: **Tyler Kennedy** Date: **10/17/2024**

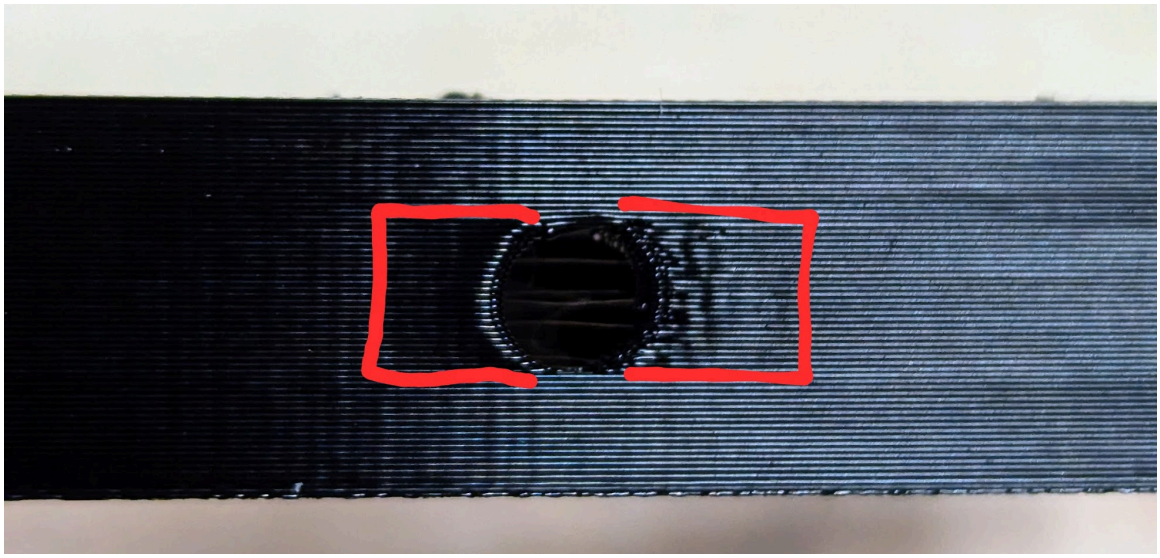
Continued from **Testing and Tuning Voron V0** (Pg. 31)

→ **Objective:** Tune the Voron V0 to reduce visual defects and improve tolerances.

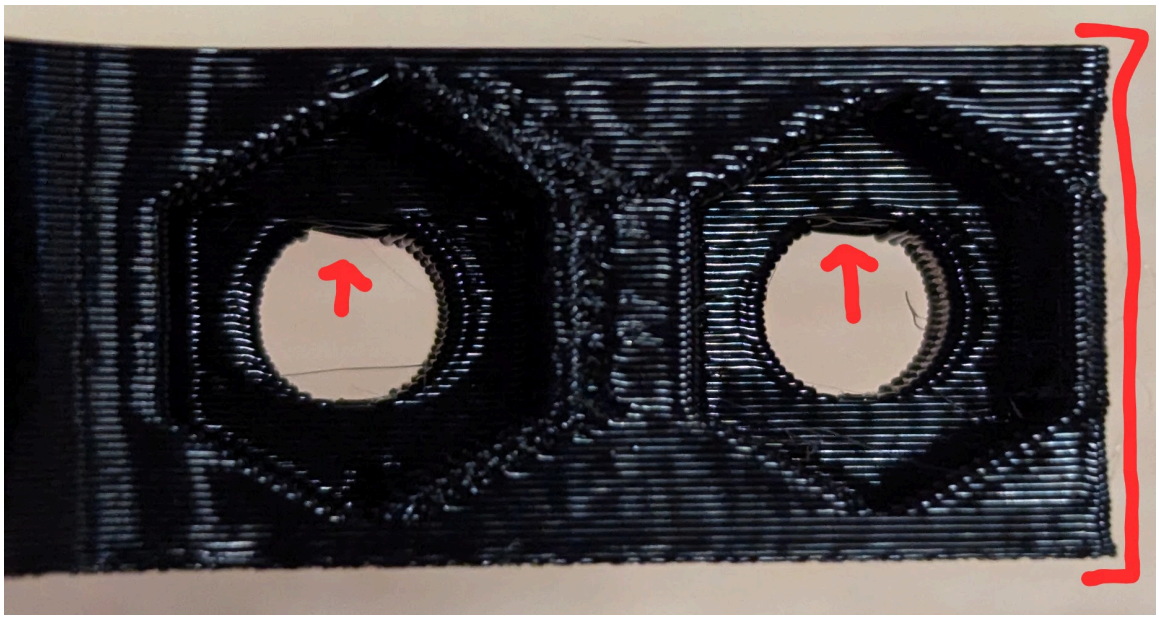
While the Voron V0 has been made much more functional, it still has far to go in terms of quality and tolerances of printed parts. The first test print after the rework of the firmware showed good progress, but there was still noticeable stringing, ringing, and cooling issues.

Definitions

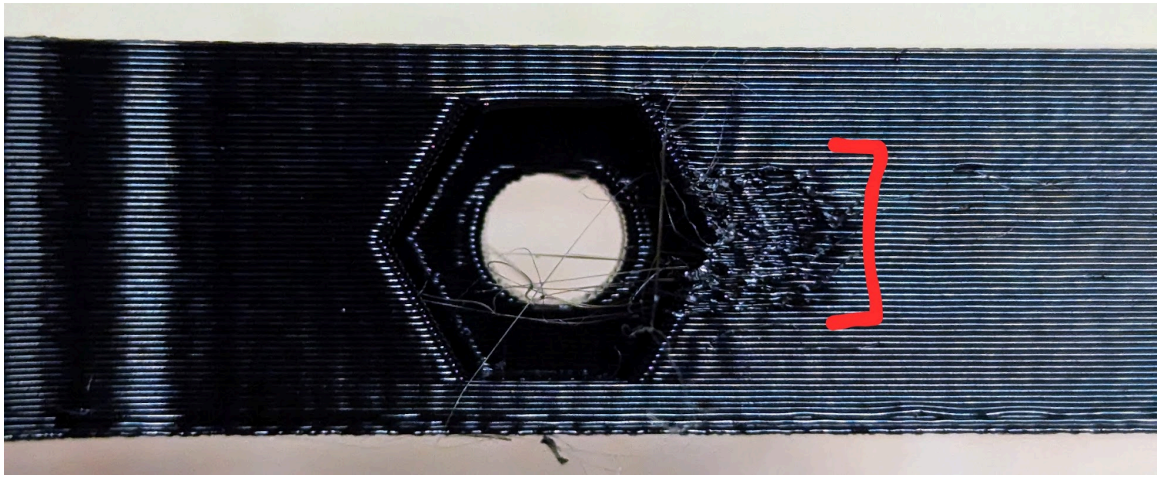
"Stringing": Thin strands of filament created on travel moves "Ringing": Also known as ghosting; ripples that show up on the surface of the print, typically near sharp corners or smaller details "Cooling Issues": Droop on overhangs showing that the plastic isn't being cooled quick enough.



The above image shows ringing around a hole through the part, Pressure advance tuning can help reduce it but to go further, we would need to slow down the speeds around sensitive areas.



An example of both ringing and drooping, with some stringing (though stringing is easily removed so it isn't as much of an issue). The drooping could be improved through better cooling, while the ringing is the same problem as above. Stringing just needs the retraction settings tuned further.



This under extrusion was most likely caused by the scarf joints setting which has since been disabled.

The retraction was tuned through a retraction test tower, showing that 2.5mm to 3mm was the optimal retraction distance. Firmware retraction was set up and enabled through the slicer to allow for smoother retraction while printing.

Pressure advance was recalibrated through a new pattern test, showing that a value of .5 worked best for pressure advance. This test involved printing a series of sharp corners while changing the pressure advance value at each, then choosing the value that yielded the sharpest, most accurate 90° corner.
We got SSH working for the raspberry pi and changed the login *(new login can be found*

on the Voron next to the rpi, still with username: pi) to protect against random attacks were we to connect the board to the internet *(as the previous username/password setup was the board default)*.

As a final change, the motor current was upped from .7A to .8A to accommodate for the skipped steps we noticed at higher speeds and ensure no skipped steps at lower speeds.

The Voron's performance is adequate for parts manufacturing but there are still many improvements that could be made to reduce printing time and increase print quality.

Continued in **Speed Testing Voron V0** (Pg. 53)

Hook Design

Focus: **15in Conveyor**

By: **Colt Franklin**

Date: **10/20/2024**

→ **Objective:** Update on conveyor progress for hooks. **Bolded thesis-like intro sentence.** Background knowledge. Talk about what was improved or updated and what tests we ran to see how it performed. Yadda yadda yadda. We developed the cad design

Bolded summary sentence that concludes and leads into what's next for this issue (a test, further modification, etc).

Continued in **Side Towers with Mounts** (Pg. 54)

Speed Testing Voron V0

Focus: **Manufacturing and 3D Printing**

By: **Tyler Kennedy**

Date: **10/20/2024**

Continued from **Continuation of Voron V0 Tuning** (Pg. 49)

→ **Objective:** Go Beyond

Side Towers with Mounts

Focus: **15in Conveyor**

By: **Samuel Radulski**

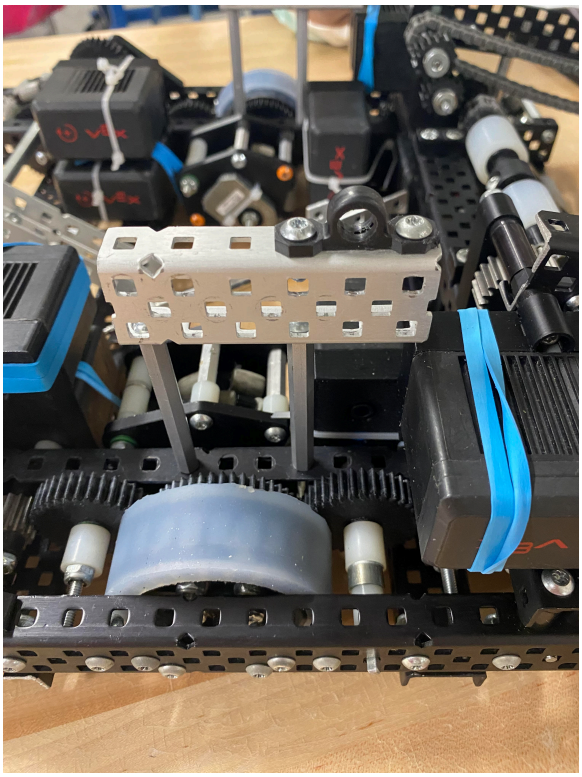
Date: **10/25/2024**

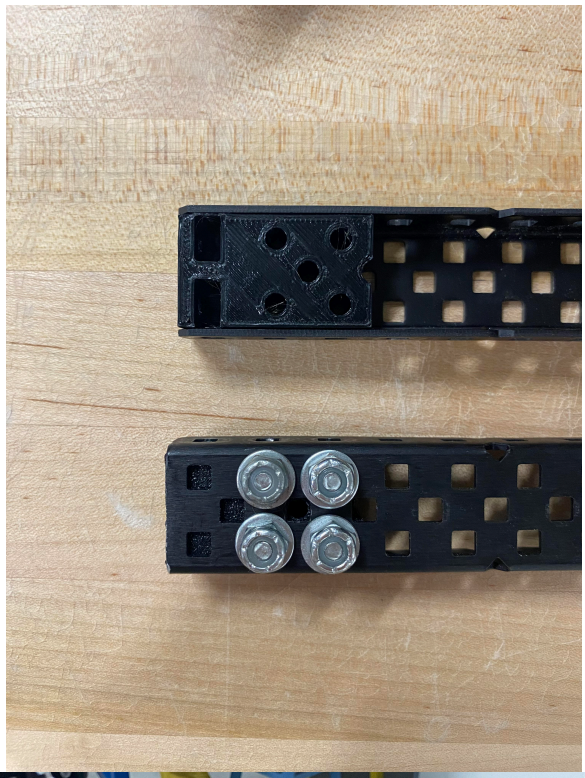
Continued from **Hook Design** (Pg. 52)

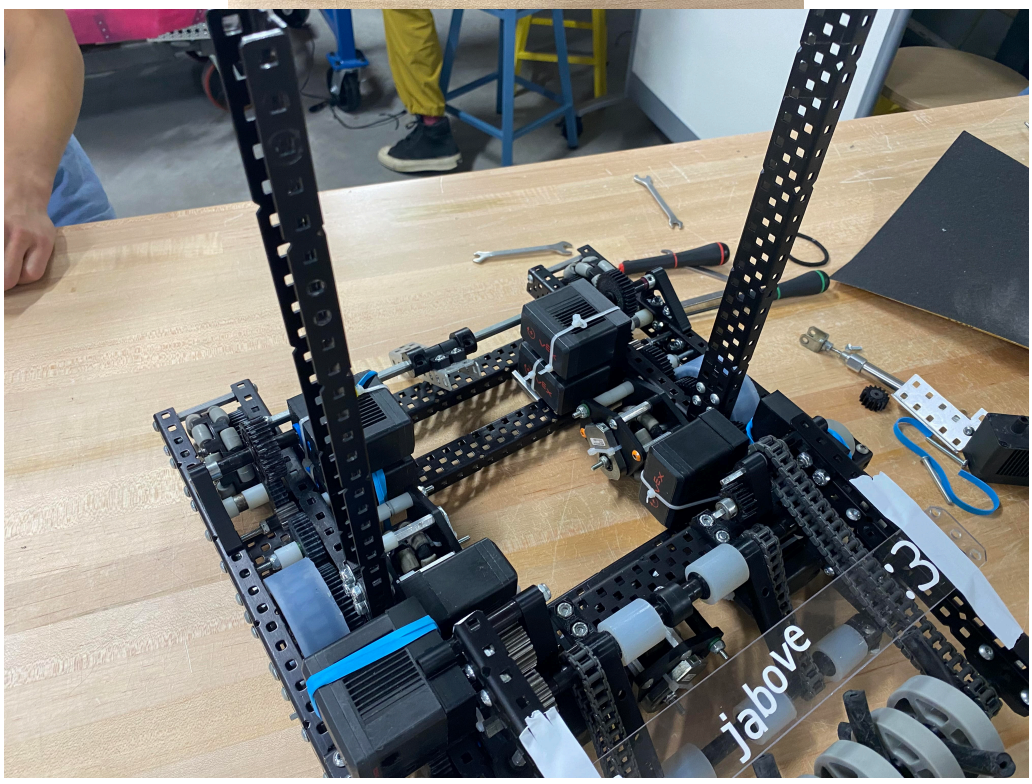
→ **Objective:** Mount side towers on bot for conveyor to be build upon.

The bottom conveyor can now be constructed. Using custom 3D-printed mounting joints, two towers were added mirroring each other on either side of the bot. We modified preexisting mounts for the bottom roller to be build upon these towers instead of their older tower, allowing for a significantly easier time creating/putting together the rest of the conveyor upon it.

With the towers in place, we can continue our progress and build the bottom conveyor on the bot.



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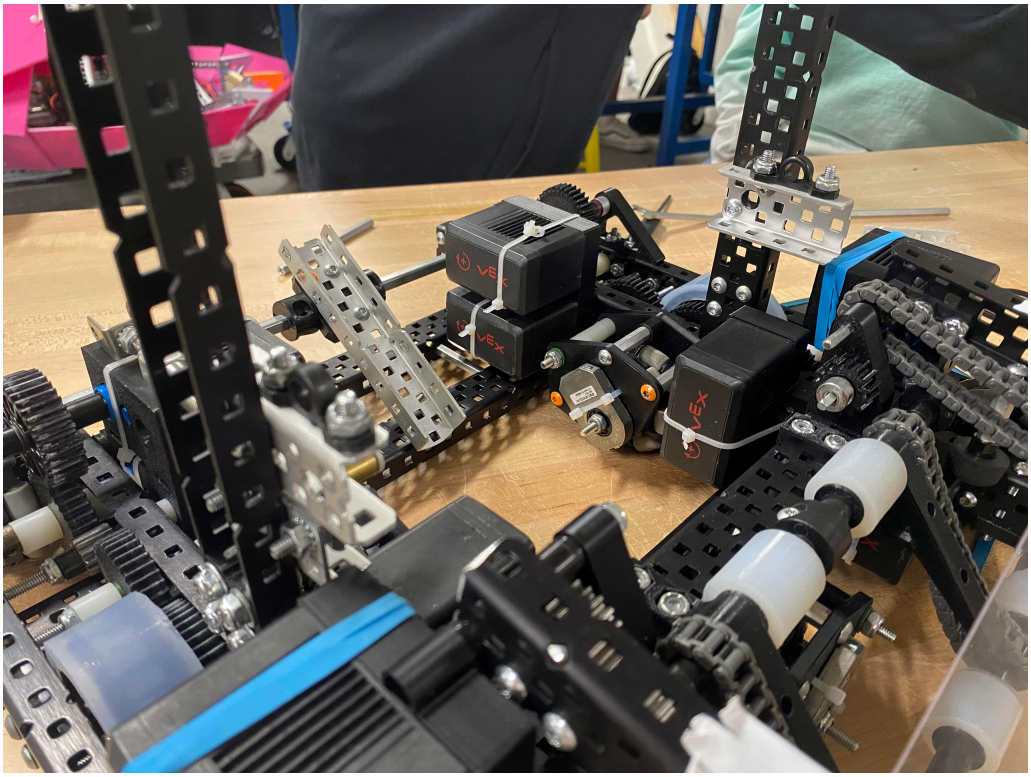
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