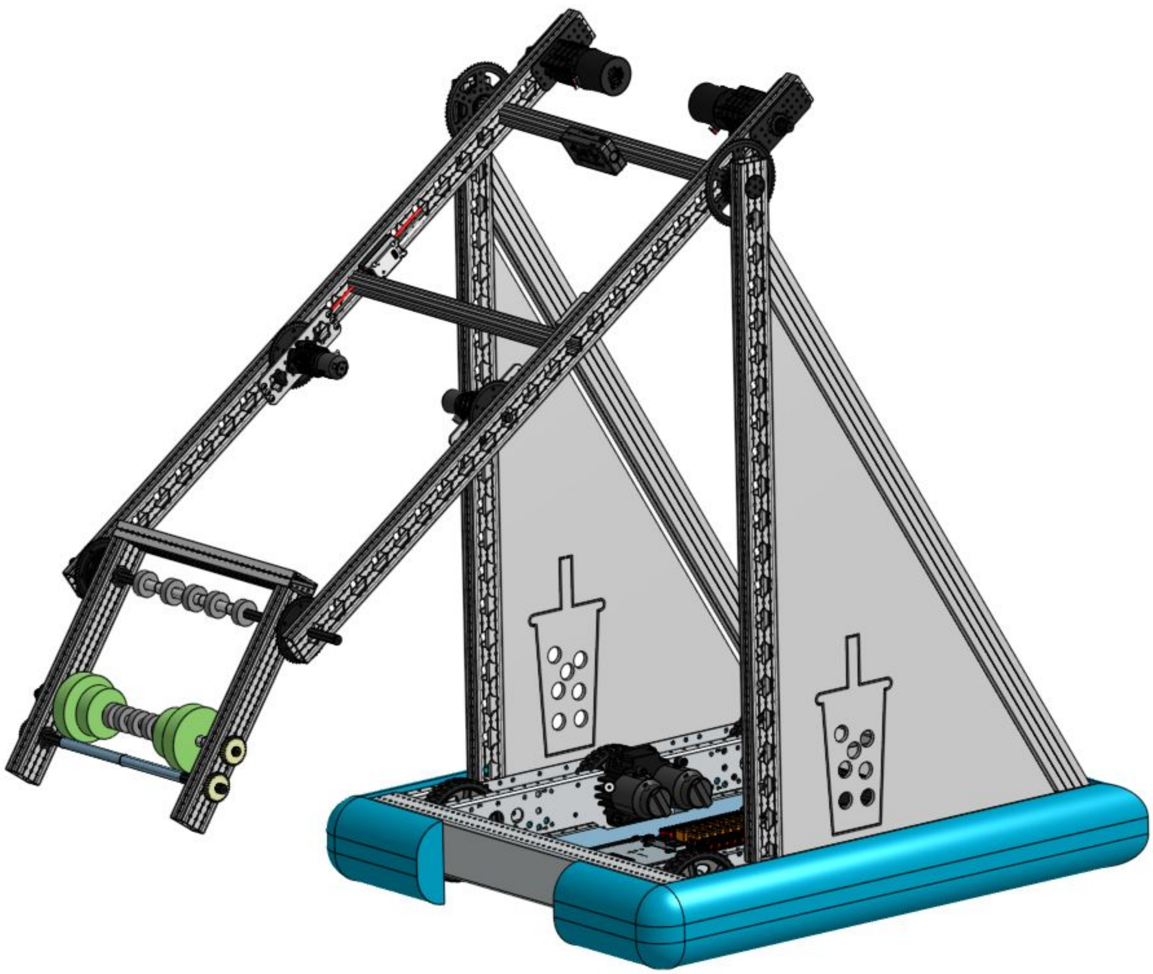
2023
Tech Binder

Boba Bots 253

Tea-Rex

Our robot: Tea-Rex



Summary:

Built for the FRC game Charged Up!, our robot, Tea-Rex, is composed of a custom drivetrain using a West Coast tank drivetrain as inspiration, KitBot tubing to construct the arm & intake, and aluminum tubing & dead axles to support our main system.

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Charged Up! 2023 Summary

Autonomous (Auto)

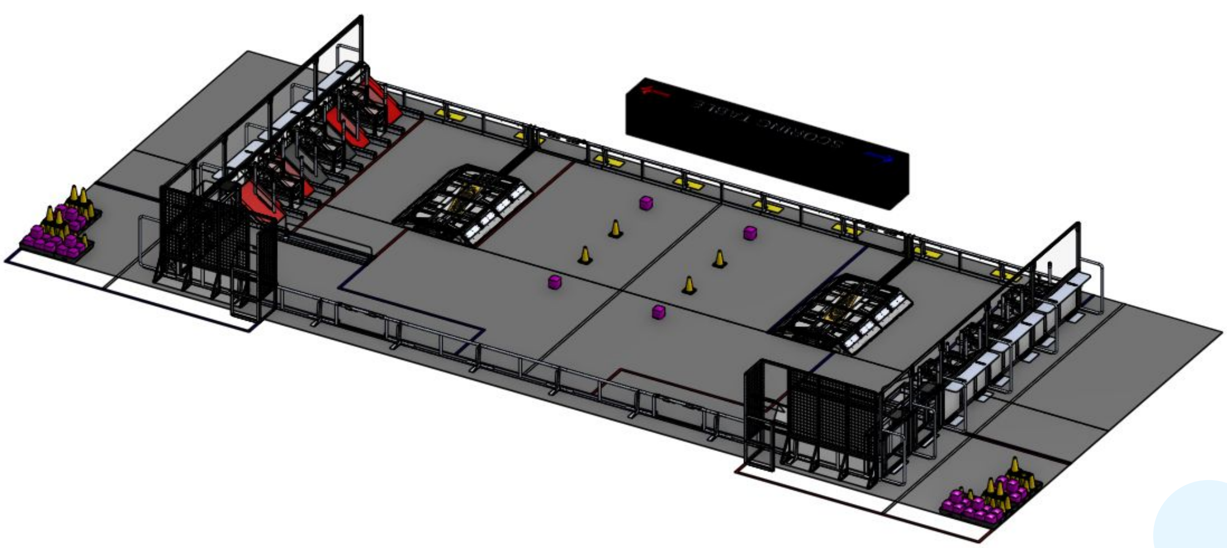
Auto is the phase where robots attempt to score points without driver control relying solely on code. Robots gain points for “taxi” from the community and scoring on their respective grids. During this 15 second phase, all points from scoring on grids or the charging station receive a slight boost in value.

Teleop

Teleop is the longest phase in the game, lasting for a total of 2 minutes and 15 seconds during which drivers control robots from the driver’s station to retrieve game pieces like cones and cubes to score on the grids. Drivers may also dock on the charging station in addition to retrieving game pieces for the grids. During this phase, points scored on the grids are of the original value.

Endgame

During this 30 second phase, drivers continue to score points on grids or park, dock, or engage on charging stations.

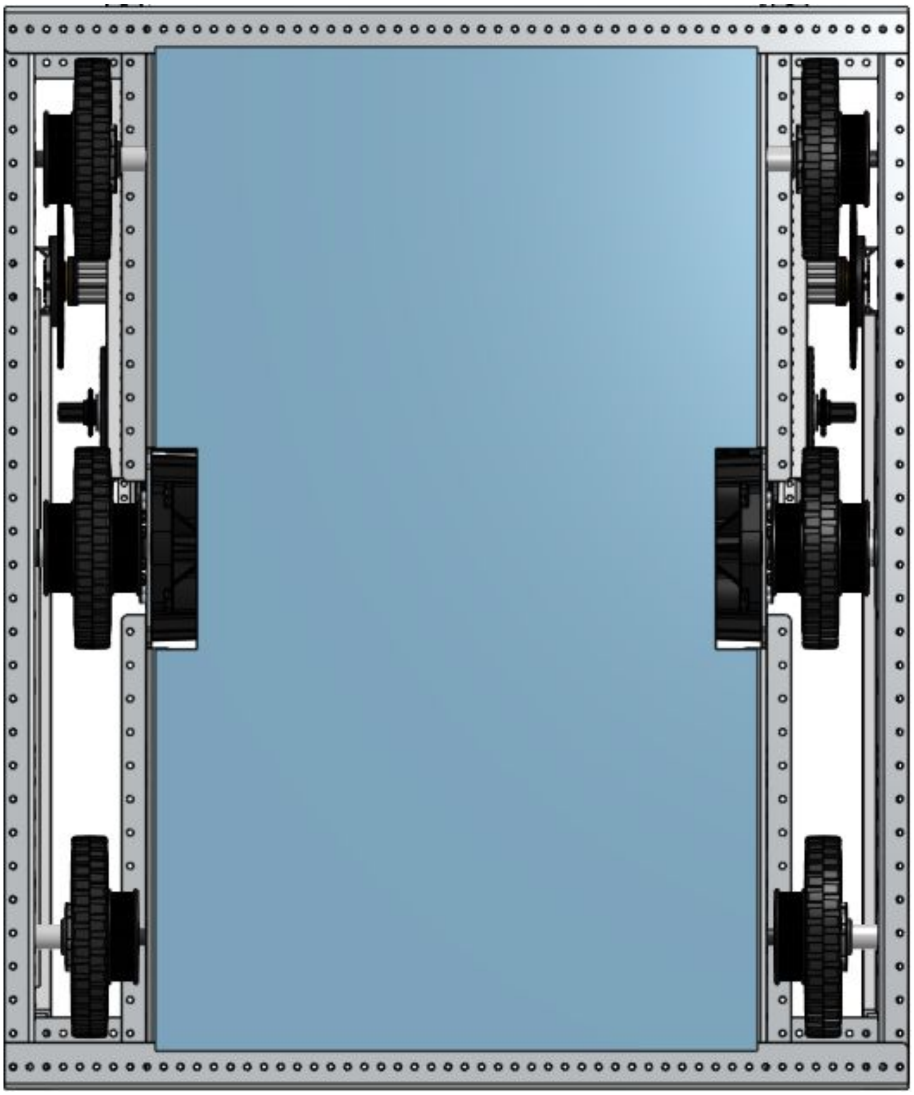


Drivetrain (Mechanical)

Summary:

Our robot has a 31.75” x 27” custom drive base made from KitBot materials.

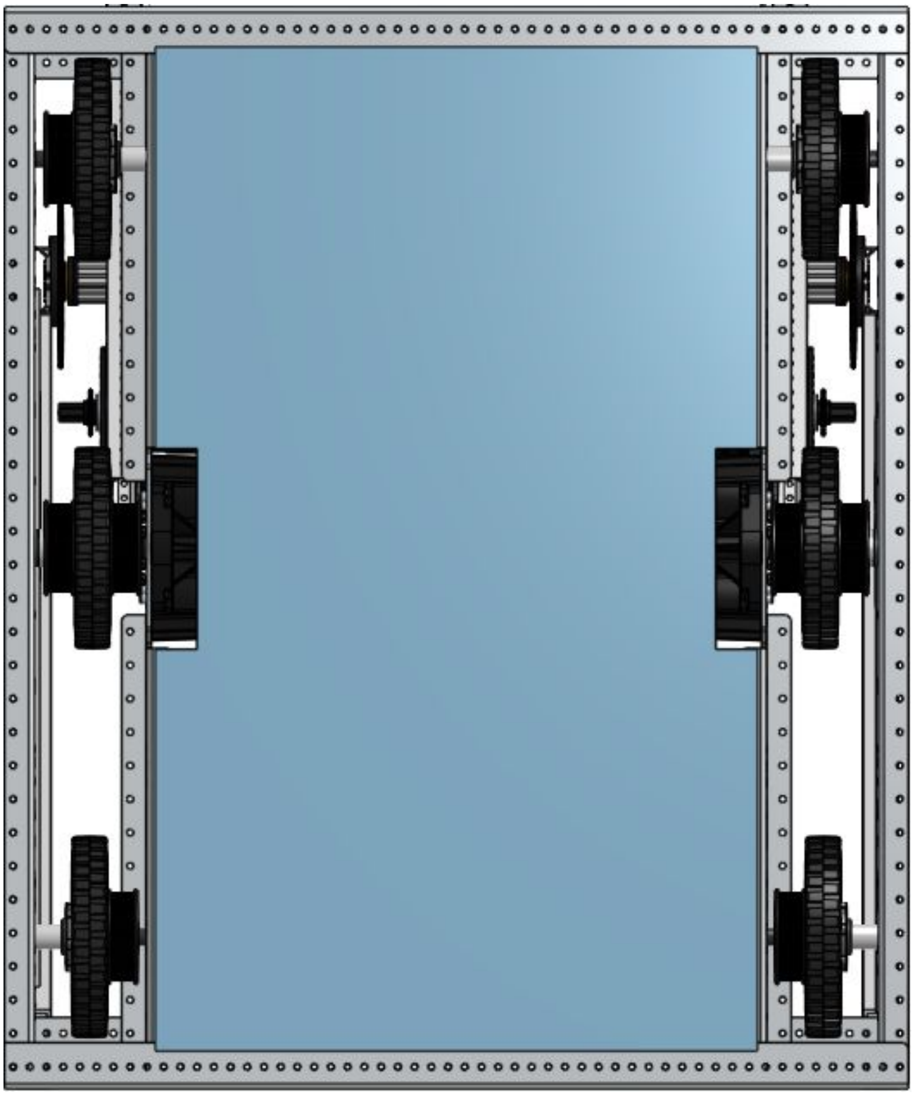
Our drivetrain uses six 6” traction wheels. The middle two have blue 50A durometer nitrile tread for extra traction, and the outer four have white 80A durometer HiGrip wheels to allow for smoother rotation.



Drivetrain (Electrical & Software)

Summary:

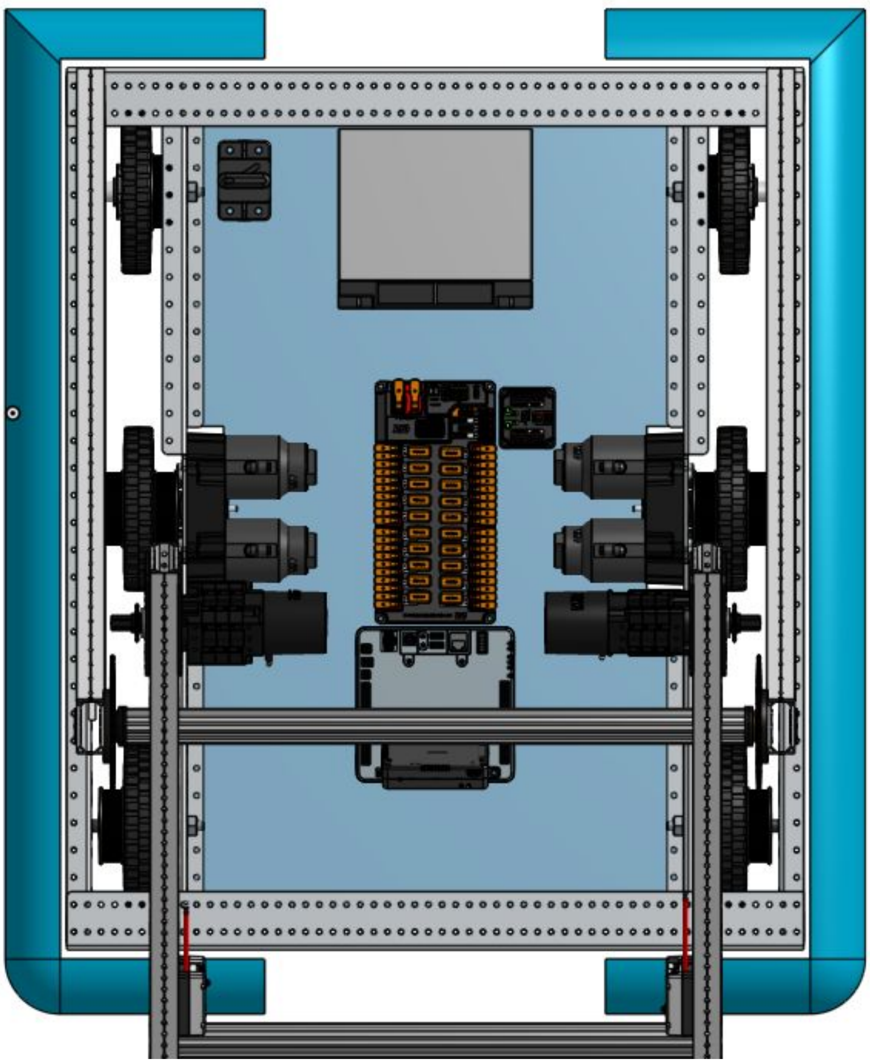
As mentioned in the previous page, the drivetrain is very similar to our 2022 Robot Ghost-Tea's drivetrain in software. It is a differential-drive based drivetrain, with 4 Falcon 500 motors (2 per side, one "lead" motor and one "follower" motor) all of which are controlled by an XBOX controller.



Bumpers (Mechanical)

Summary:

Our bumpers are 2-piece bumpers shaped like U's. Considering the height of our robot, it seemed extraneous to use box bumpers since it would require lifting the bumpers up and above the whole height of the robot which was a major problem for our team with an even shorter robot like our last year's robot: Ghost-TEA. By using C-Bumpers, our pit crew is able to swap alliance colors easily between matches, maximizing the time used for performing maintenance fixes on the robot.



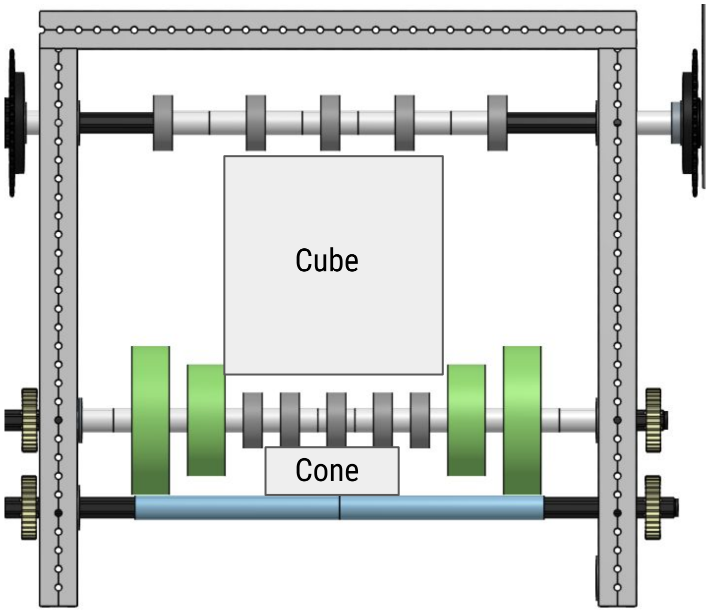
Intake (Mechanical)

Final Design:

Our technical departments decided on using a three-bar linkage type intake that works simultaneously with a “wrist” that allows an easy, more compact extension in opposed to a strictly-sized arm. It is driven by chains and 32-tooth sprockets Neo 550 motor at a 3:1 ratio. Our intake is designed to intake both cones and cubes in order to score on both cone nodes and cube nodes. The cone intake is between the middle bar containing large green compliant wheels and the bar containing the white flexible rollers. The cube intake is between the middle bar containing the large green compliant wheels and the bar containing only smaller gray compliant wheels. Our robot can intake in three different ways: floor-cube, floor-upright-cone, and floor-sideways-cone.

How it works:

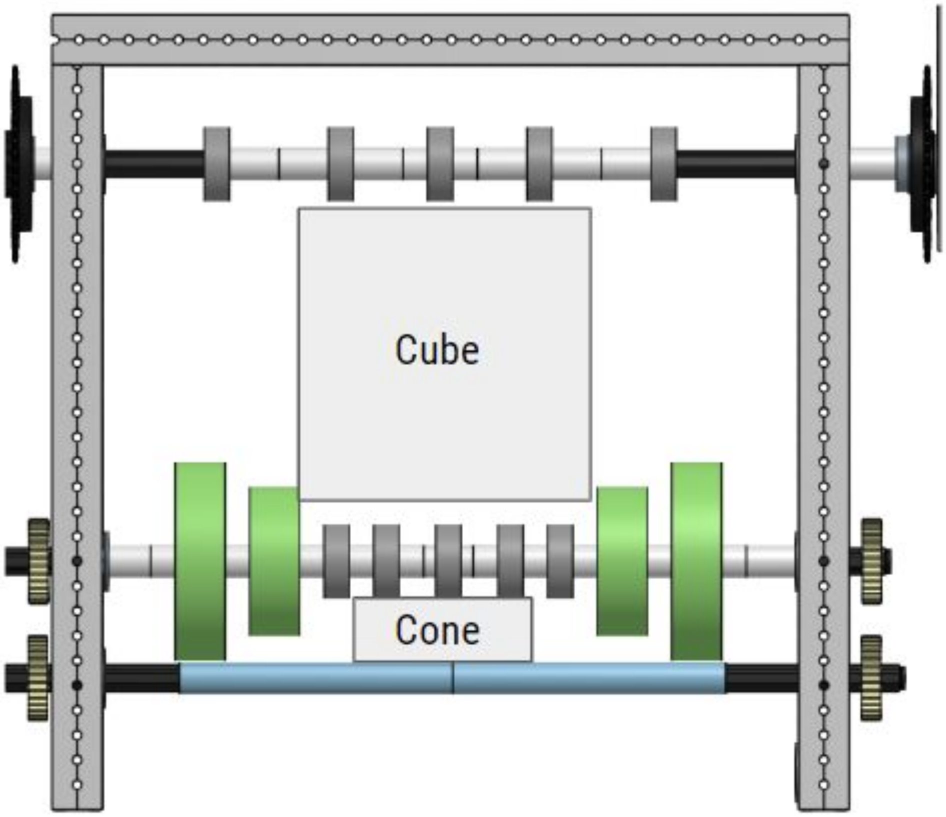
The wrist rotates to actuate the intake, and is able to do so 180 degrees to maximize positional efficiency. When the wrist extends the intake, the intake retracts, allowing a cone to be sucked in between the axles containing large green compliant wheels and white rollers or a cube between the axles containing the small gray compliant wheels and the large green compliant wheels.



Intake (Electrical & Software)

Summary:

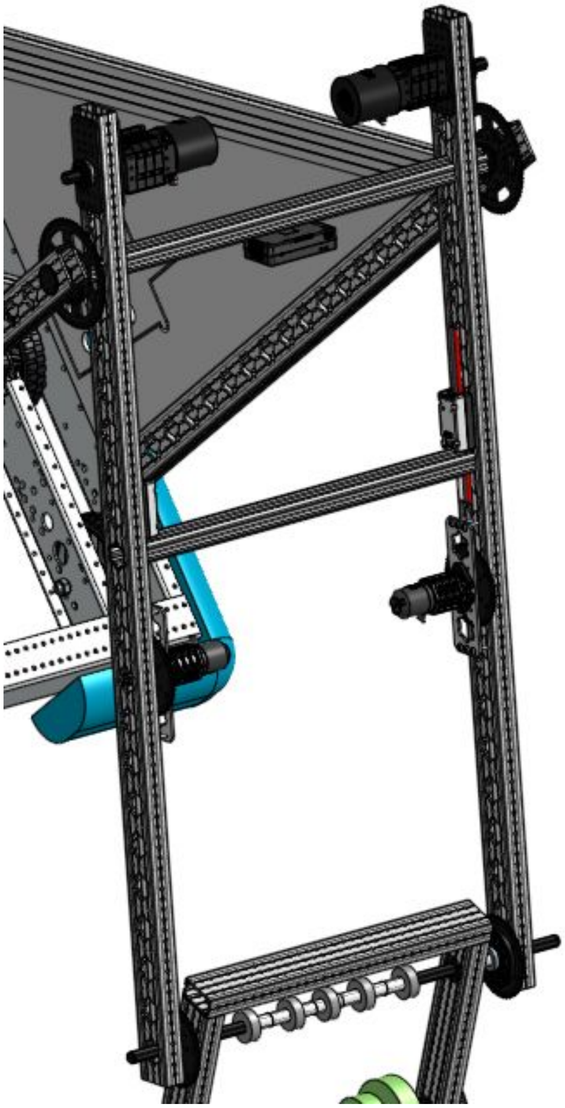
The intake is powered with a Neo 550 motor for actuating and spinning the three different bars. When the driver presses a button on the XBOX Controller, the Neo 550 motor uses motion profiling and positional feedback control to rotate in order to intake a game piece.



Arm (Mechanical)

Summary:

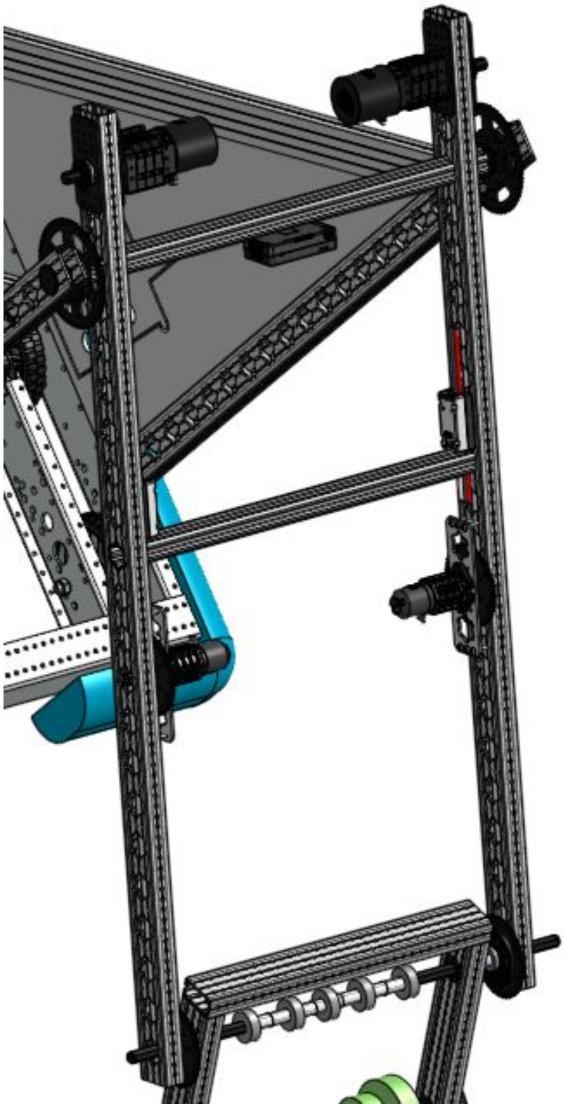
This year, our technical department decided on using KitBot 2” by 1” tubing in order to maximize our reach and height to score on the grids while also maintaining a rigidized and balanced robot. Our arm is powered using two Neo 550 motors mounted to the arm uprights via a MAX dead axle and bushings. The chain used to power arm rotation is the same chain used to power wrist rotation for our intake. In order to minimize slack in the chain, we used a sprocket that extends the chain to the very end of the arm. There are also 4 SparkMAX 500 motor controllers attached from the middle of the arm up to the top of the arm in order to smoothly operate intake and wrist rotation.



Arm (Electrical and Software)

Encoders:

Using an encoder on the Neo 550 motors, we are able to manipulate the motor's constants, such as it's power percentage and efficiency.



Support System (Mechanical)

Rigidizing the Arm Uprights:

The arm uprights which are attached to the robot arms are secured to the drivetrain using a cut-out piece of a C-Panel which is then bolted through the hollow section of the arm upright tubing to another cut-out piece of a C-Panel. Our team decided on making this small adjustment due to a minor issue in which only a quarter of the upright would be attached to the drivetrain. This meant that we would only be getting a quarter of the stability required for this robot to stay intact. Attaching this cut-out to the upright and the drivetrain allowed us to maintain rigidity without adding heavy material.

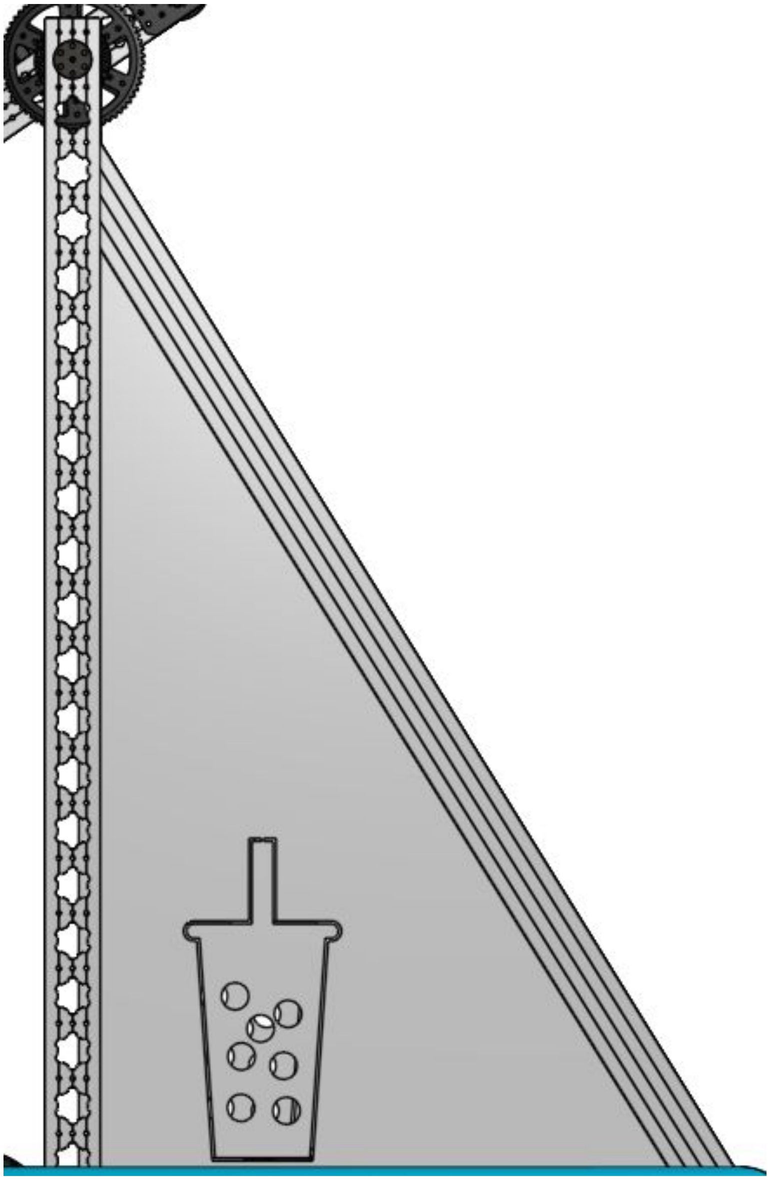
3D Printed Supports:

Our technical department decided on fitting in 3D printed parts between some of our tubing in order to prevent it from crushing. We also used 3D printed parts in order to prevent tube crushing which was an early-on issue in our robot's early stages. In response to this, we printed small blocks of 3D printed material in order to tubing crushing at its most vulnerable points. Some of these small features can be found supporting the arm uprights and the intake's surrounding tubing.

Support System (Mechanical) Cont.

Triangular-Support Reinforcements:

Adding the diagonal supports connecting the back of the drivetrain to the arm uprights was a simple decision for the team as it was necessary in order to prevent the upright tubing from bending backwards. Another reason for doing so was to add weight to the back of the robot in order to keep the weight balanced. The tubing used is cut at a 58.25 degree angle which attaches to the uprights and at a 31.75 degree angle which attaches to the back C-Panel of the robot.



Vision (Electrical & Software)

Summary:

This year, for our vision we are using 1 limelight: mainly for the webcam, not for it's sensory mechanisms. During autonomous, we implemented the drive and rotation commands at the start of the autonomous phase to score cones and cubes a well as try to dock and engage on the charging station. Then, we intake a game piece to get a head start for the teleop phase.

Issues We Faced

Prototyping/Designing:

During our prototyping phase, our mechanical department noticed that the aluminium tubing was crushing due to pressure after securing material to the tubing.

Drivetrain:

While calculating the maximum width and length to fit 3 robots of equal size onto the charging station, we failed to take into consideration the thickness of the bumpers when building our robot. This caused us to trim off around 0.5 inches off of all sides of the drivetrain, leaving us at a 31.75” by 27” base.

Support System:

Due to the excessive amounts of bolting and nutting, we had to implement a support system with dead axles and 3D printed parts that further prevents the aluminum tubing from crushing.

Use of Vision:

We struggled to find a place to mount the limelight and because we put the dead axle to support the aluminum tubing , but realized that the dead axle blocks the main purpose of the limelight which is for positional sensing.