"Gustavo"
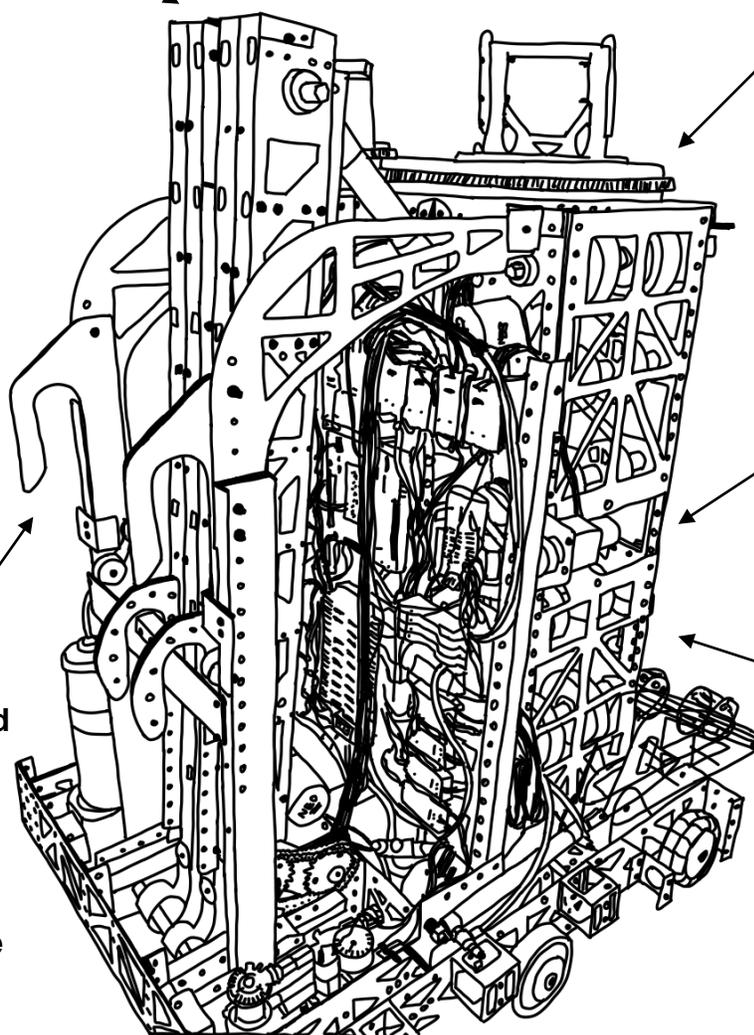## Metal Moose
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A 3 stage belt and piston elevator design allows for a quick ascent to the traversal bar. The piston not only helps traverse but also reduces swing by pulling the robot to a lower center of mass.

A Limelight camera powered through a slip ring tracks the hub and a gear set mounted to a rotating turntable allow for unlimited rotations of the shooter. This allows us to constantly track our target.

Thirty wheels within the indexer help collect and guide the cargo up to the four flywheels to shoot. Constantly watching the indexer are color sensors to tell the code and drivers what cargo we have in what position.

Precisely placed fixed and moving hooks allow for the robot to pull itself to the next rung with the robot tilting just the right amount. The fixed hooks latch on to the rung while the moving hooks reach for the next bar.

Color sensors within the robot allow for sorting of the cargo with enemy cargo being rejected and alliance balls being taken in.

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The continuous rotation turret is controlled by a Neo with a built-in encoder to always be able to turn to the correct angle. The Limelight controlled through a slip ring is able to consistently rotate with the turret as it has a gear ratio of one-to-one with the turret gear. The Limelight sends info on the angles of the retro-reflective tape on the hub relative to the Limelight to the RoboRIO where it is fed into various processes that automate our shooting. This information also determines the power with which the ball is shot up from the flywheels, before being deflected by the 3d-printed and CNC cut hood.
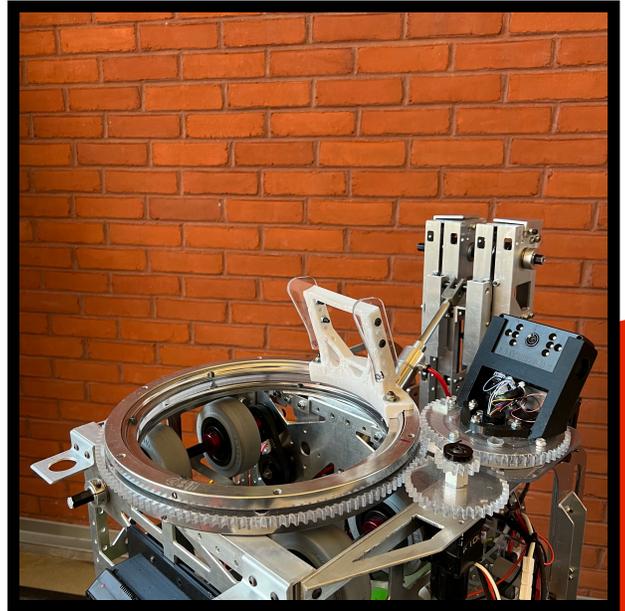
This image shows our color sensors that are attached to our robot's indexer. These color sensors allow us to keep track of the cargo stored inside the robot as well as filter what cargo we pick up. For example, while collecting cargo, if we accidentally collect an enemy cargo, the lower color sensor will tell the robot that we have the wrong ball, which inverts the gate to spit the enemy cargo back out over the collector. If we do happen to pick up an enemy cargo, the upper color sensor automatically tells our shooting command to lower the speed of the flywheels so that the cargo isn't scored.
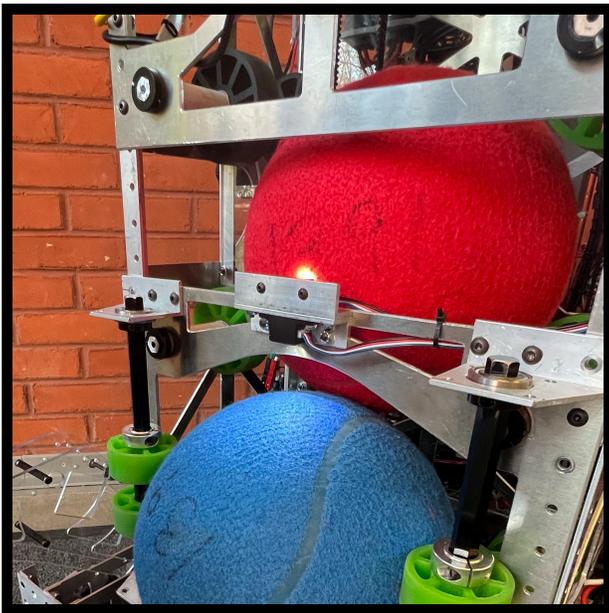
The elevator works with the first arm extending up to the bar, then the piston latches the arm onto the bar. Then the robot pulls up with the arm to put this bar underneath the fixed hooks which spring back to allow the bar to slide through. Once the fixed hook has the bar, the arm reaches out for the next bar. The moving arm uses the piston to stop swinging, fighting the robot's center of gravity. The arm uses aluminum channel, belts, bearings, springs and more to work. It was made with the CNC router, CNC mill, 3d printer and the lathe.
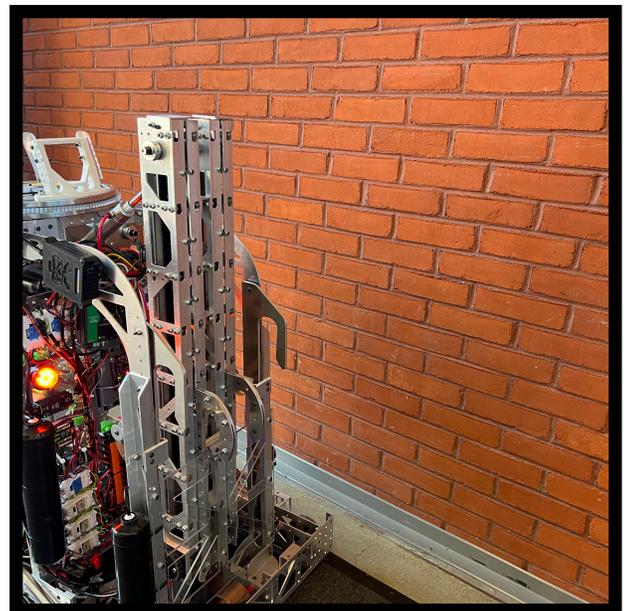
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The collector consists of two pneumatically controlled polycarbonate arms mounted on the frame of the robot with wheels on the front. This lower pivot point ensures that the collector can pivot out of the way if it collides with something in front of it. The polycarbonate arms are the perfect combination of compliant and strong to be able to flex if hit, but not have any issues operating.
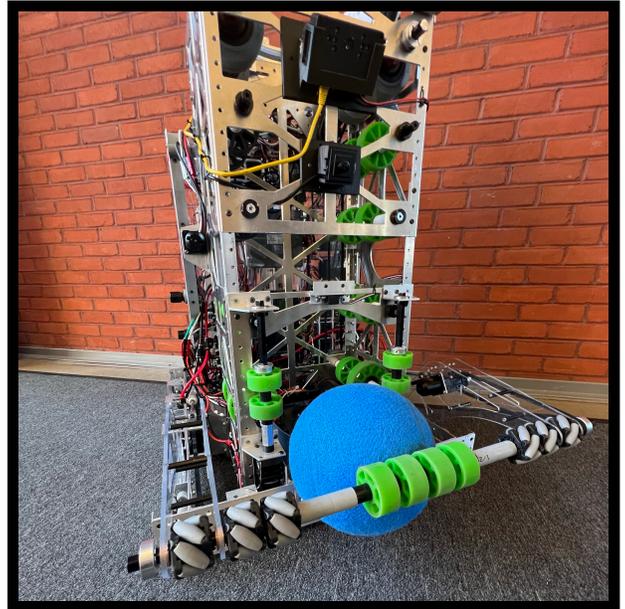
On the front of our robot, we have a second Limelight that has ball recognition for alliance cargo. Through this recognition, we can have the robot automatically turn the robot to face directly toward the closest alliance cargo. This allows our five-ball autonomous to function consistently, not relying on perfect alignment or precise turn angles. The collection of cargo during teleop is also made much easier with the help of a button that locks on to the closest ball while maintaining the control of the driver.
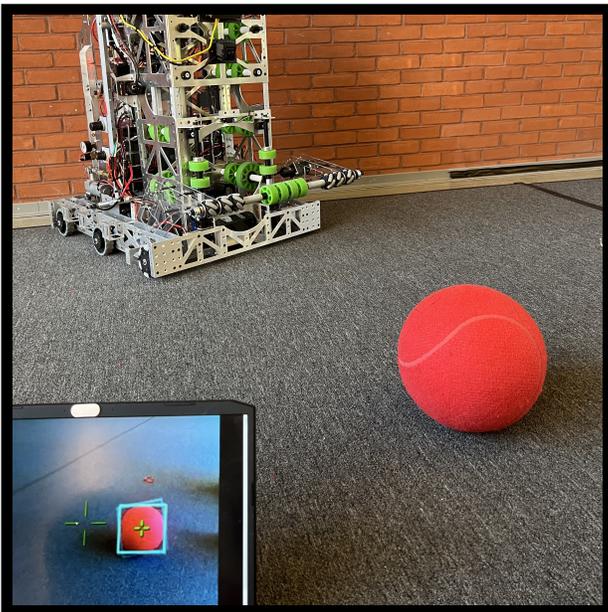
The drive base consists of 4 Versa Wheels and 2 Omni wheels. The Omni wheels in the front help ease turning while maintaining the same speed and consistency. The tank drive allows for simple but effective driving especially with the automatic ball recognition and turning. A single speed gearbox controls these 6 wheels, with one on either side. Additionally, 2 straight pieces of angle can be seen to hold the battery in place and to keep the robot structure rigid. To make the drive base, we used the CNC mill, CNC router and more.