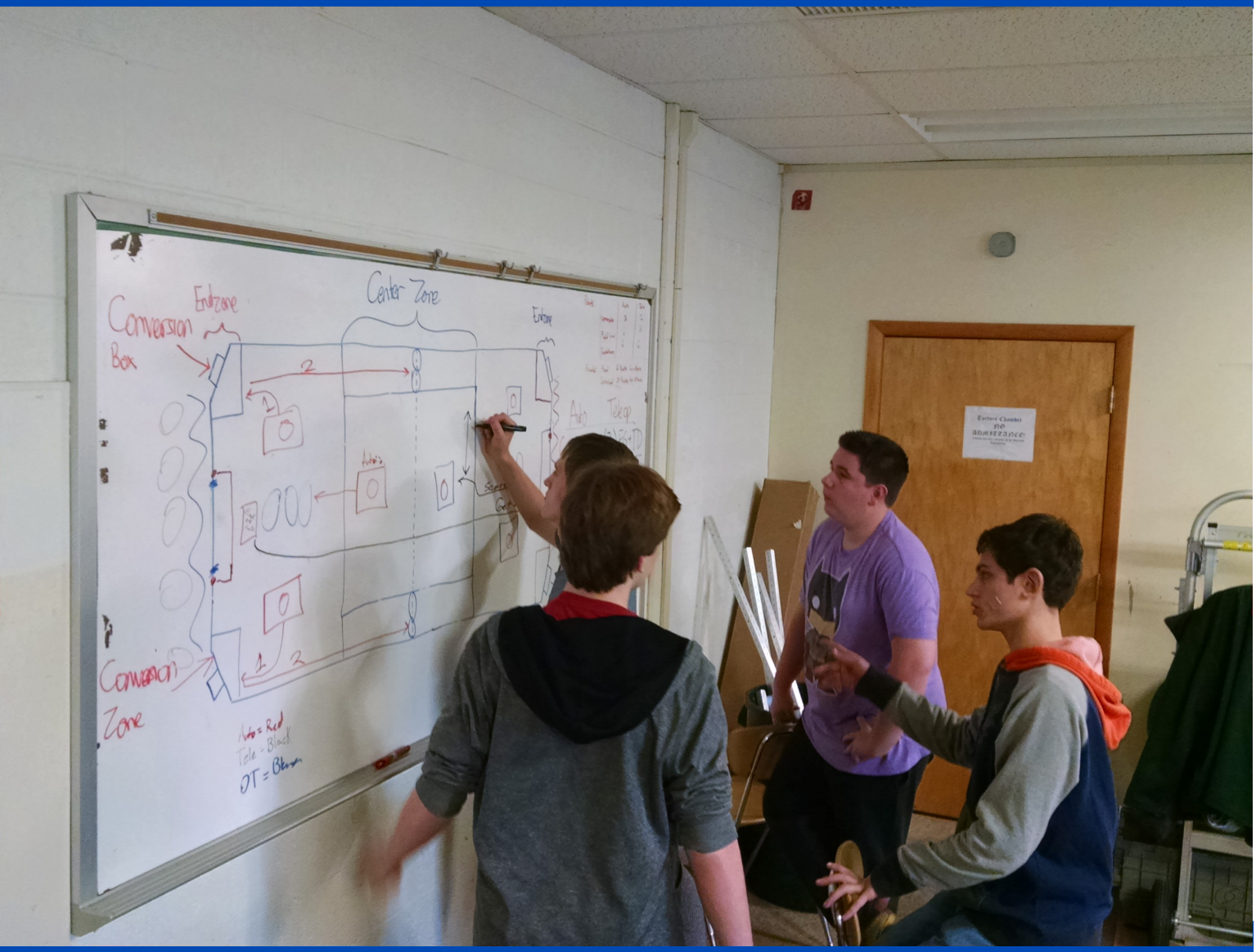
5254

2016
ENGINEERING NOTEBOOK

HELPING YOUTH PURSUE EXCELLENCE

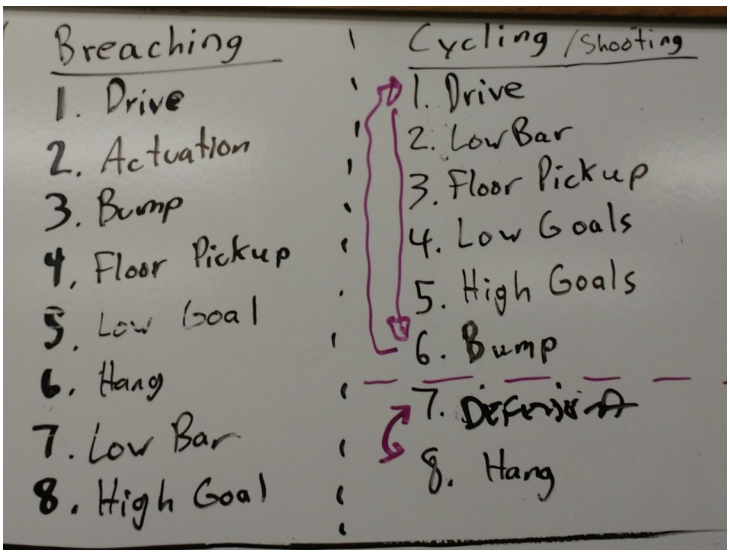
STRATEGY



- PRIORITY LIST
- PROTOTYPING
- 3D PRINTED PARTS

PRIORITY LIST

Our team came up with two main priority lists corresponding to different roles our robot would play. After discussion our team decided on a cycling robot for the higher score ceiling associated with scoring high goals as there is no limit to the amount of points you can gain from scoring boulders.



Final Priority List

1. Drive
2. Low Bar
3. Floor Pickup
4. Low Goals
5. High Goals
6. Bumps (Defense categories B & D)
7. Activation (Defense category A)
8. Hang
9. Doors (Defense category C)

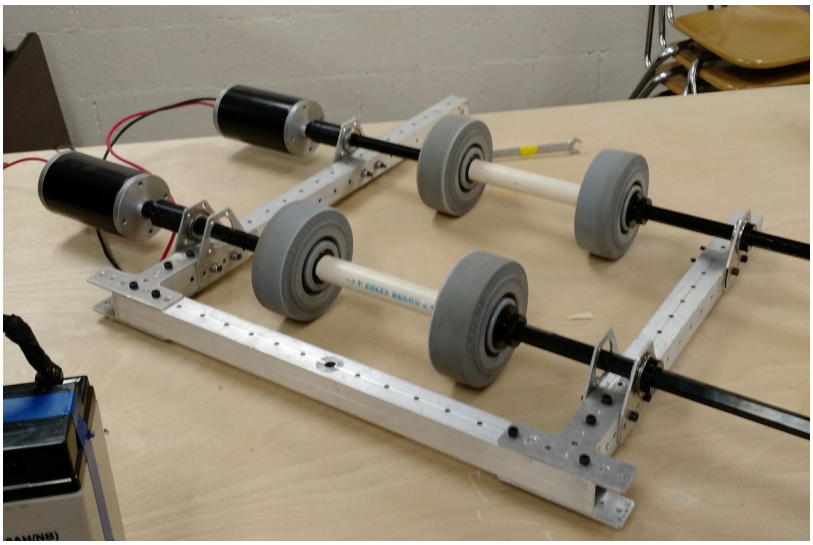
1. **Drive:** To be able to accomplish any of the other priorities you need to be able to drive. Because the drivetrain is the base for the whole robot we are sure to make it as strong and effective as possible.
2. **Low Bar:** We valued being able to do the low bar very highly as it's the only constant defense making it a great defense to cycle over and to use in auto.
3. **Floor Pickup:** Being able to effectively collect balls to transport them to your opponents courtyard to be scored.
4. **Low Goals:** The low goal is useful as it is easier to score in than the high goal and provides a quick way to gain points.
5. **Bumps:** Being able to cross both categories B & D means you can have other defense to be able to drive over quickly for fast cycling time.
6. **Activation:** Knowing the importance of gaining a ranking point through a breach we wanted to be able to breach 4 out of 5 defense categories on our own.

Our robot accomplishes everything up to this point as of the Tech Valley Regional

PROTOTYPES

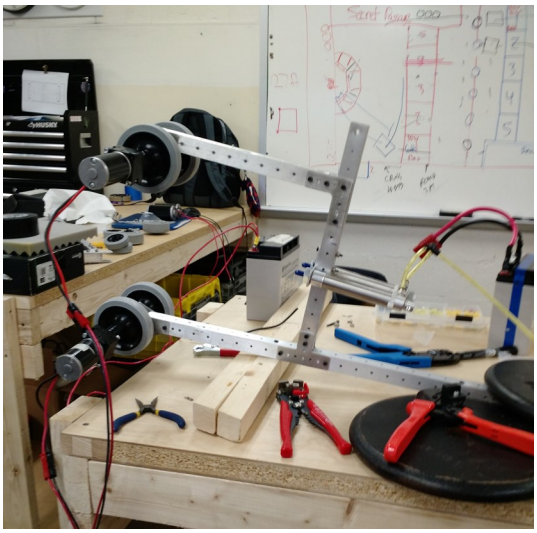
Our team jumped straight into prototyping this year by using the VersaFrame system to quickly iterate our ideas. This lead to us generating functional proof of concepts very quickly.

Day 1: Shooter



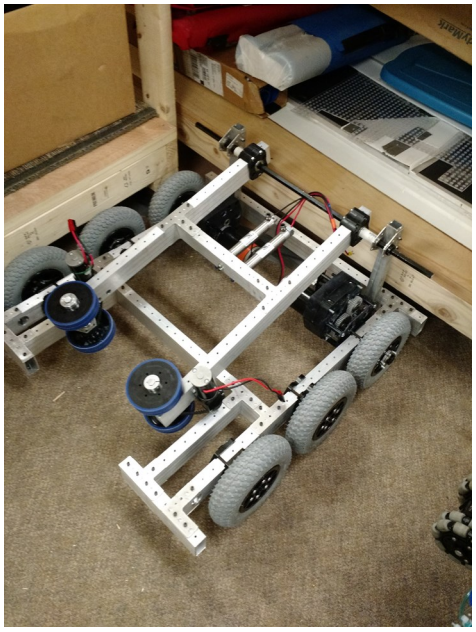
Proof of concept for a flywheel shooter. Easily adjustable compression rates and wheel spacing.

Day 2: Shooter V2

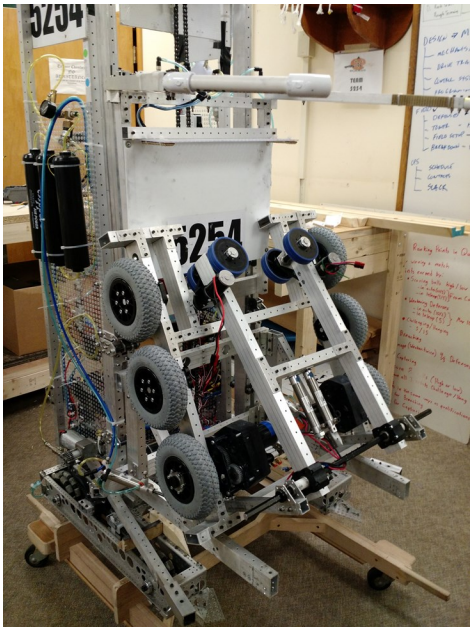


Initial iteration using compression learned from initial prototype. We added pneumatics to consistently push ball into wheels.

Day 5: Chassis + Shooter

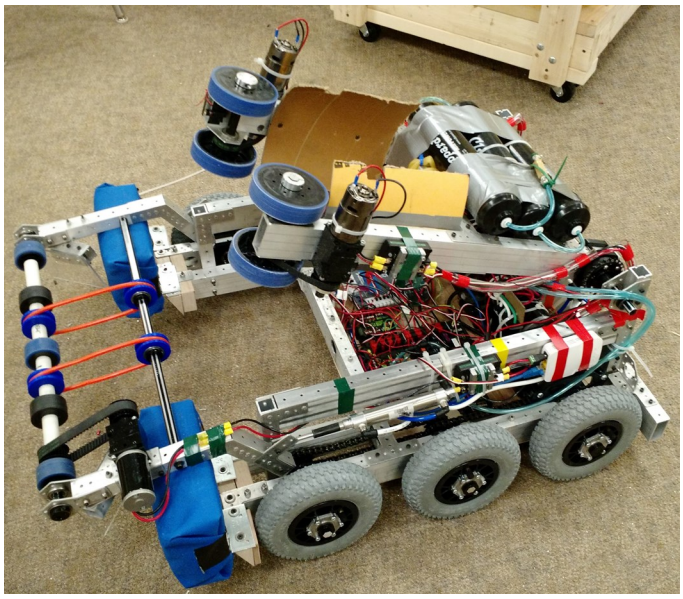


Our prototype shooter and drivetrain combined to serve as our prototype robot. Uses ballshifting transmissions and 8in pneumatic wheels to help us get over defenses. Shooter is powered by 2 bag motors in 1:1 Versaplanetary gearboxes.



PROTOTYPES

Day 12: Driving Robot



Our rapid progress allowed us to have a driving robot by the end of **week 2**.

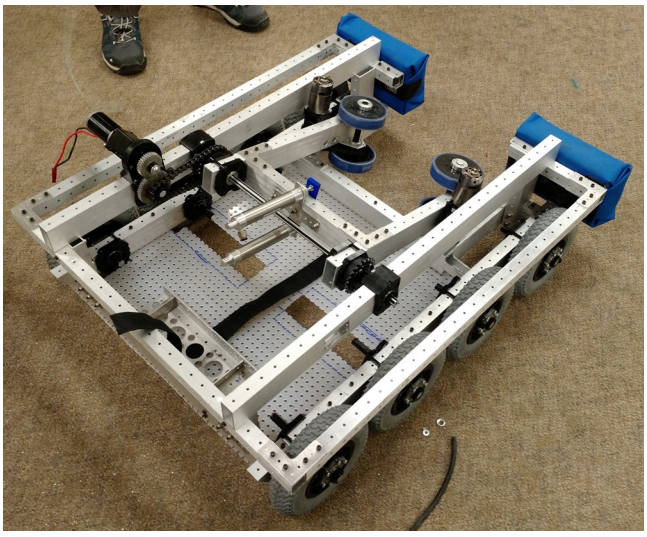
This robot was capable of:

- Going under the low bar
- Driving over category B & D defenses
- Intake boulders
- Shoot both high and low goals

This accomplishes up to priority item 6.

Day 18: Practice Robot

This entire robot prototype taught us a lot leading to many design revisions for our final robot. The major changes were changing to a 8 wheel drivetrain and making the shooter arm shorter. This practice bot was fabricated after practicing with the prototype and realizing what we should change moving to our final design.



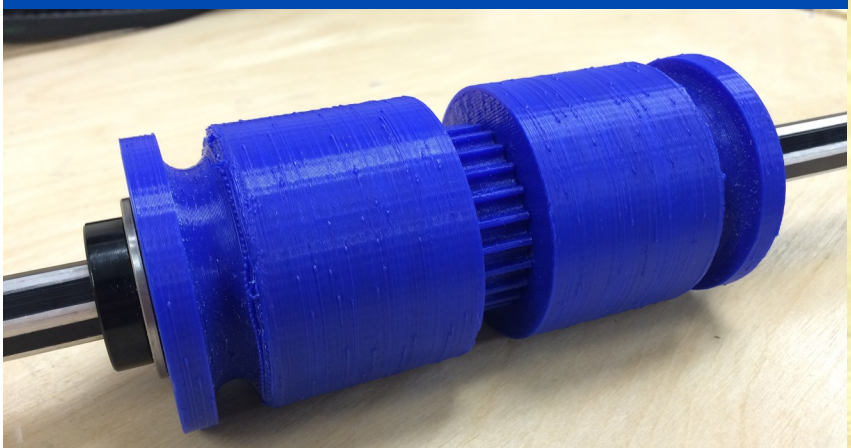
Because of our rapid progress we released a joke “reveal video” in week 3 of build season.

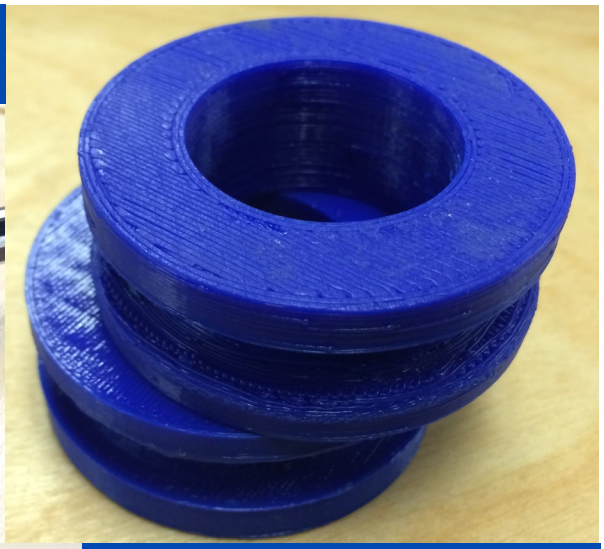
3D PRINTED PARTS

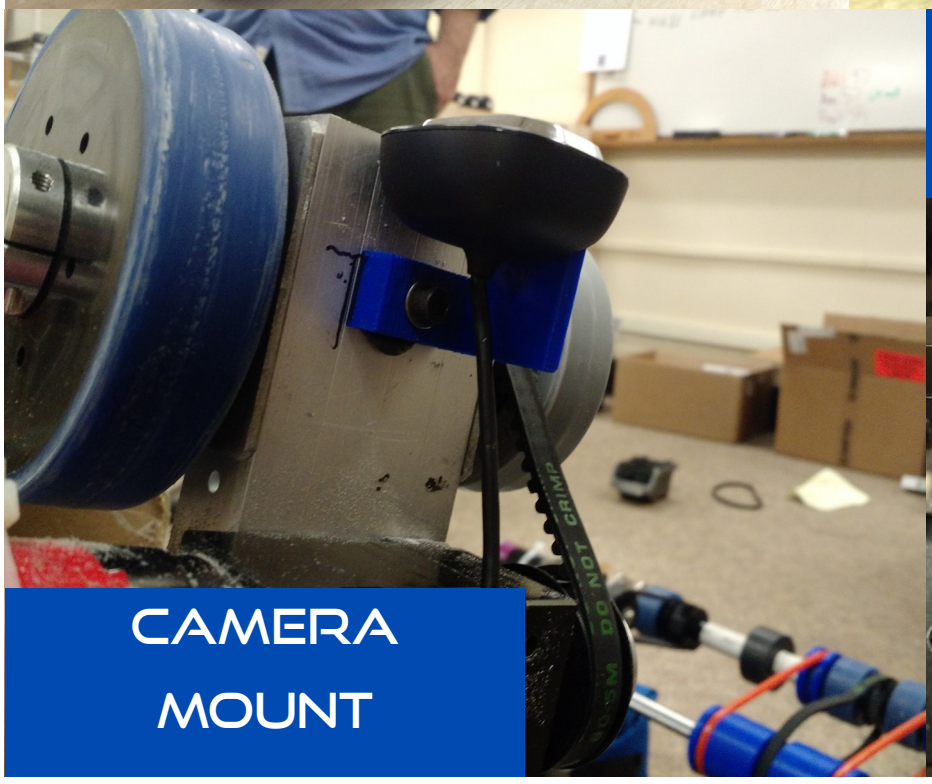
Our teams fabrication recourses are limited to a chop saw, drill press, hand tools and our schools wood shop. Because of this our team uses almost exclusively off the shelf parts. The one custom fabrication recourse we have access to is a 3D printer.

EXAMPLES OF 3D PRINTED PARTS:

INTAKE PULLEYS

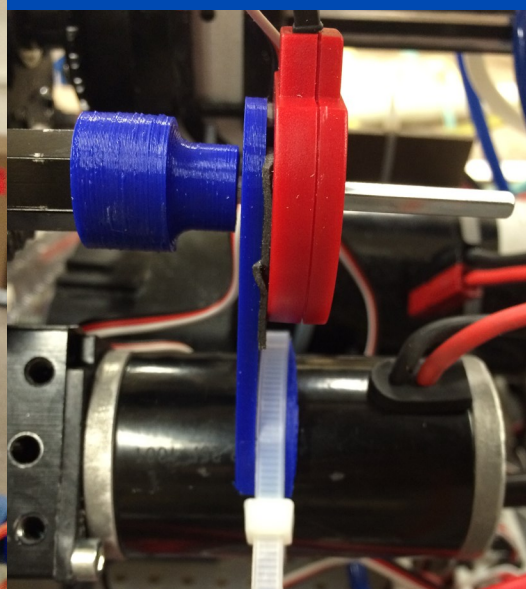






CAMERA MOUNT

POTENTIOMETER MOUNT

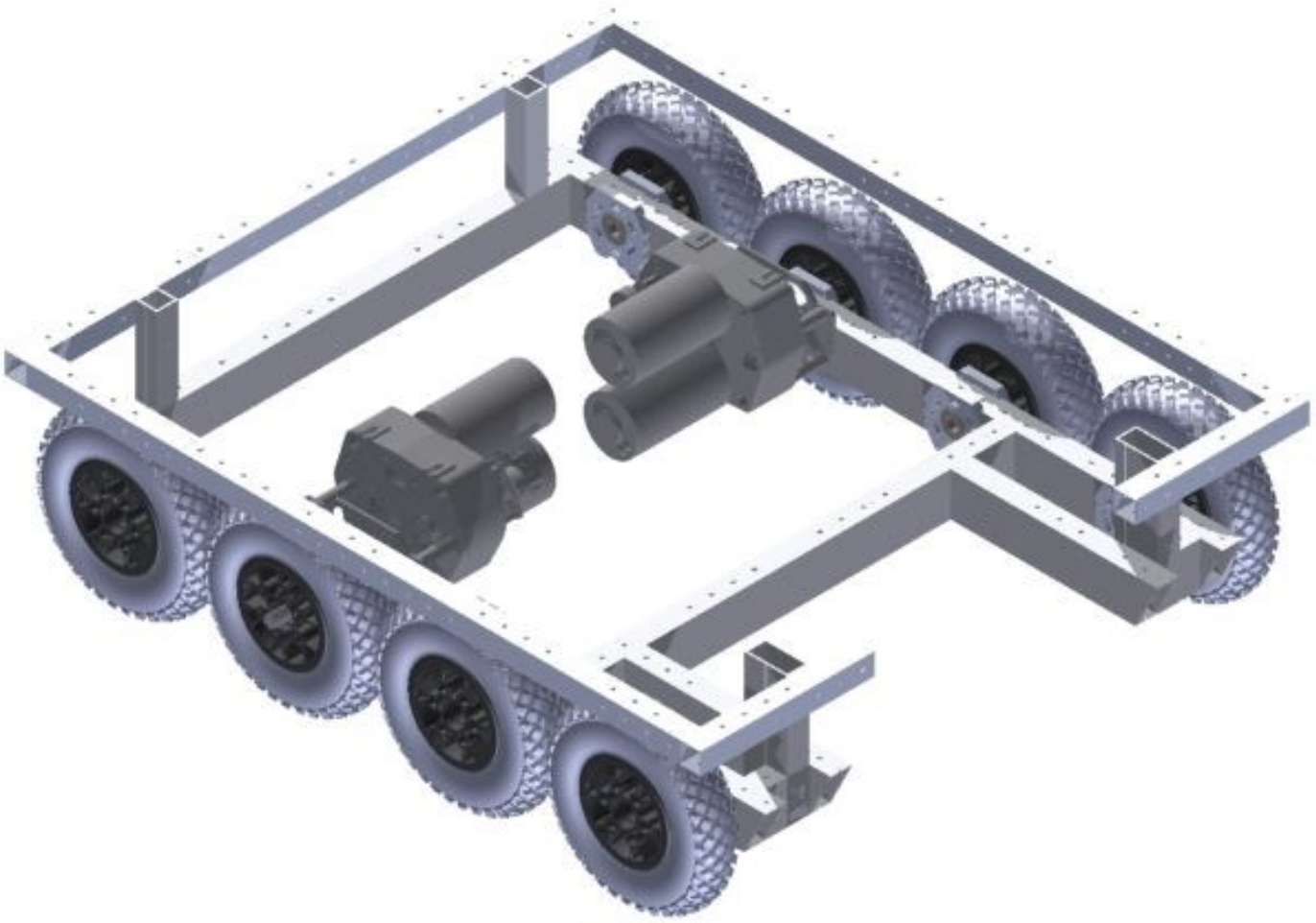


FINAL DESIGN

PATHFINDER

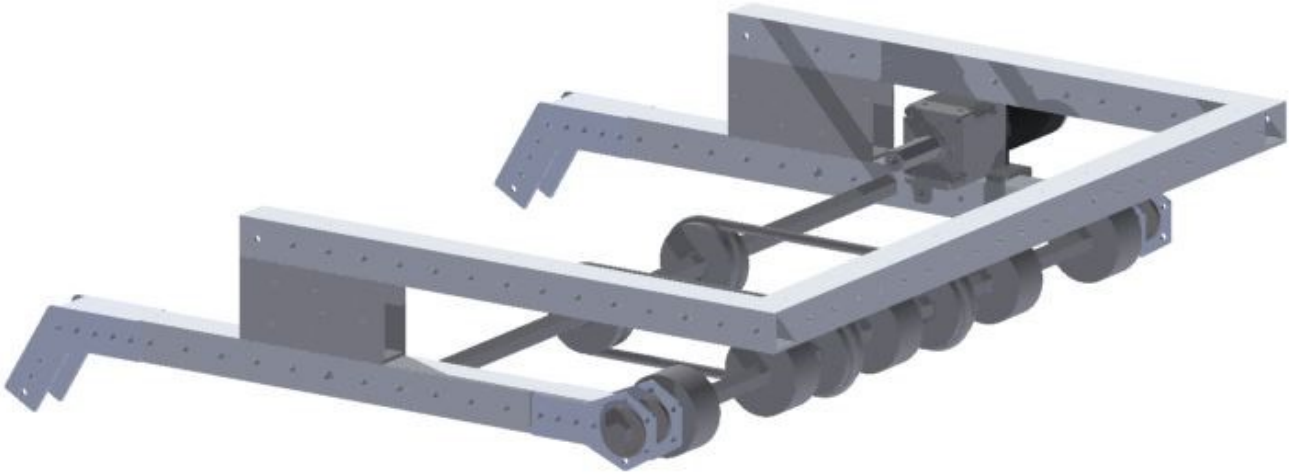
- DRIVETRAIN
- INTAKE
- SHOOTER
- TOMAHAWKS

DRIVETRAIN

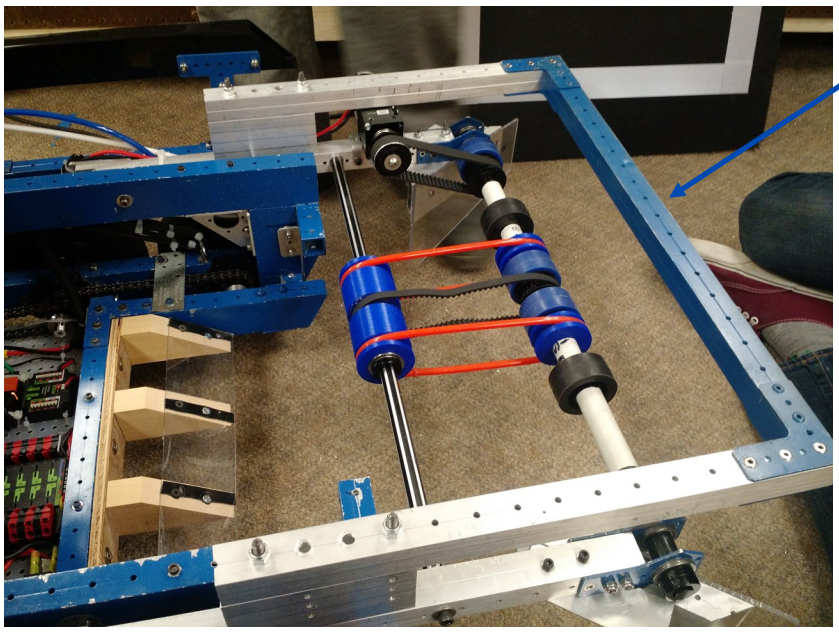


- 2-speed gearbox utilizing VEX Pro Ball Shifters with speeds of 5 and 15 FPS
- Eight 8 inch pneumatic Razor Dune Buggy wheels using AndyMark hubs
- #35 chain connecting all wheels
- Versablocks and WCP cams allow for tensioning of chains
- Upper superstructure for bumper mounting

INTAKE



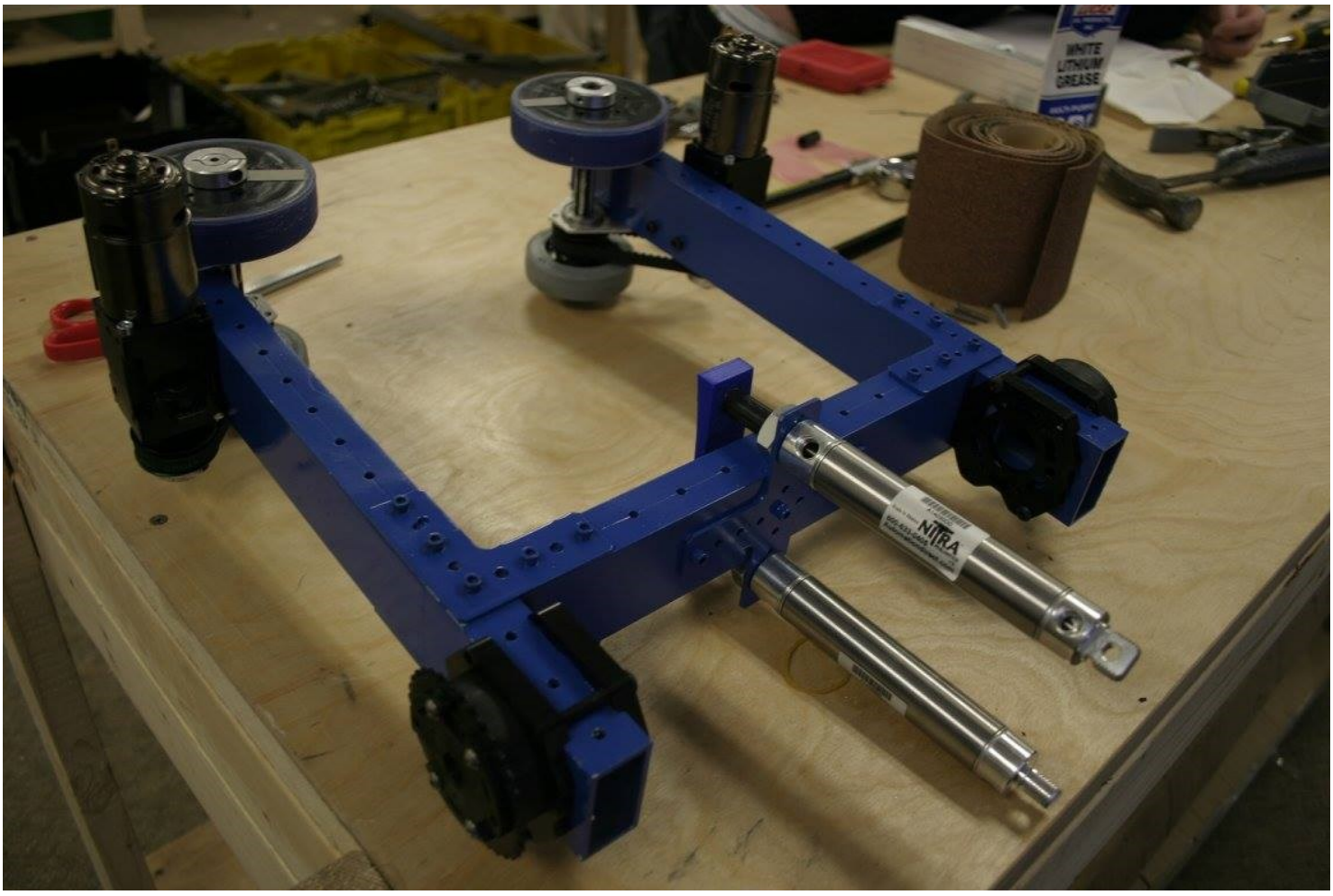
- Deflection panels to funnel ball into robot with a 24 in width
- Powered by a bag motor in a 10:1 VersaPlanetary Gear-box
- Polycord belts move ball from front wheels into shooter on custom 3D printed pulleys
- Integrated hard stop for lining up to shoot a high goal



Intake Hard Stop

This bar allows us to drive into the castle wall to insure we're always in the same location for a shot into the high goal greatly increasing our accuracy.

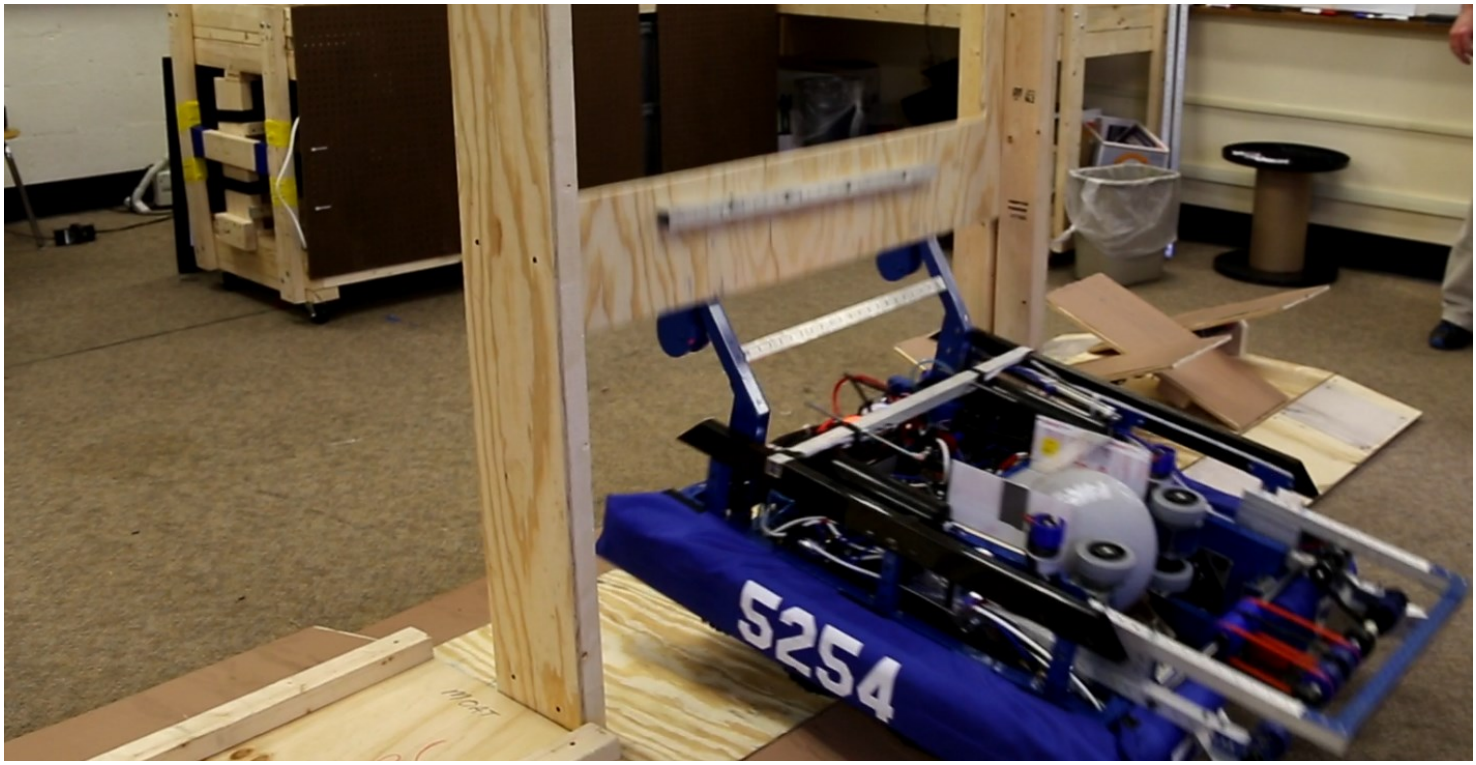
SHOOTER



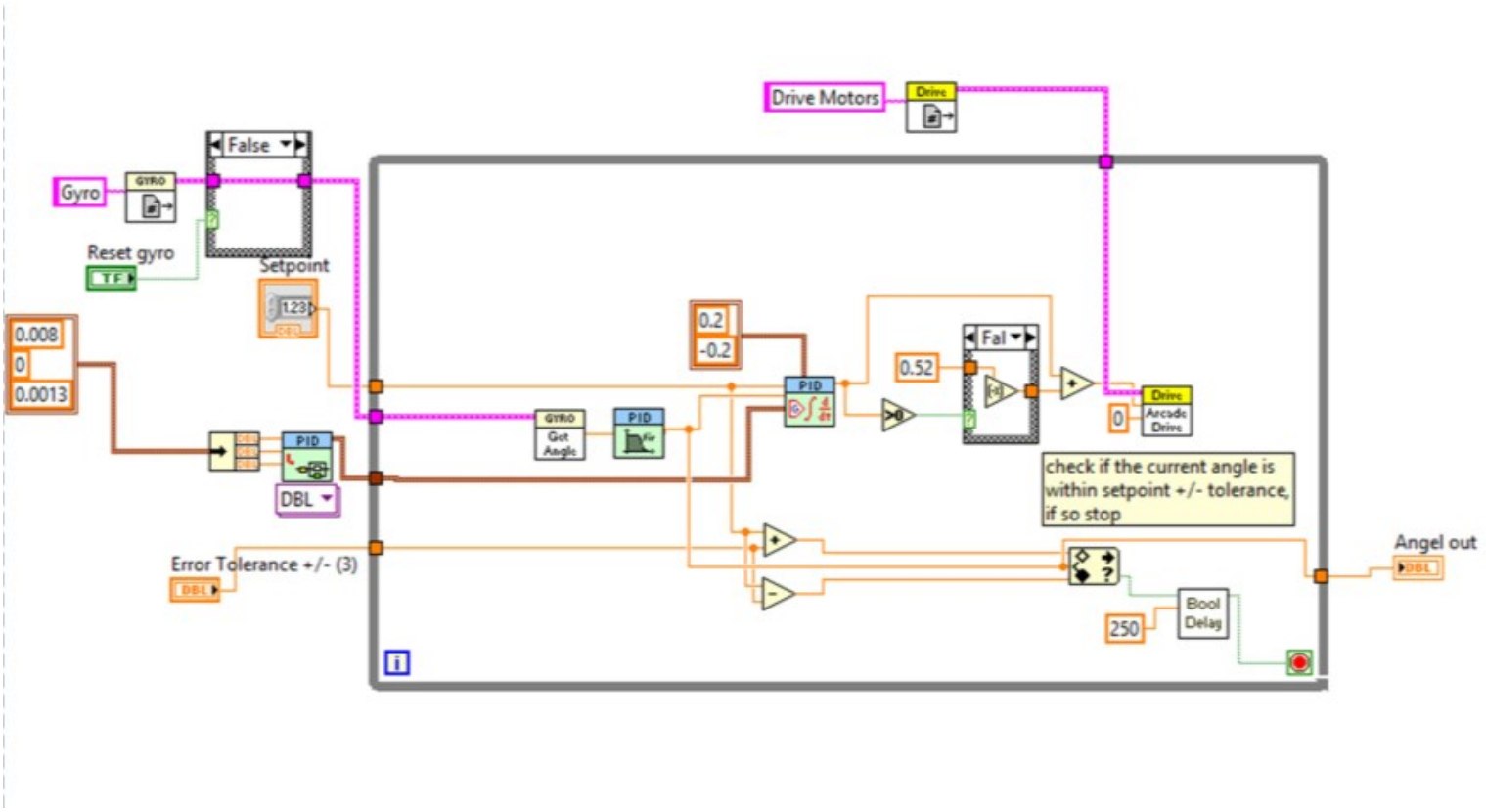
- Capable of scoring low and high from multiple locations
- Uses 4 wheels powered by 2x 775 Pro motors in a 2-stage VersaPlanetary Gearbox with a 3:1 reduction and an integrated encoder for wheel speed control
- Wheels are connected to gearbox with an HTD belt
- Ball is pushed into wheels using 2x 3 inch stroke pistons and a 3D printed connector
- Pivots using a bag motor with a series of reductions for a total gear ratio of 220:1

TOMAHAWKS

- Pneumatically actuated by 2x 7 inch stroke pistons
- Lowers on two panels of the Cheval de Frise
- Goes under then lifts the Portcullis
- Completes priority list number 7
- Actuates down to travel under the low bar



CONTROLS



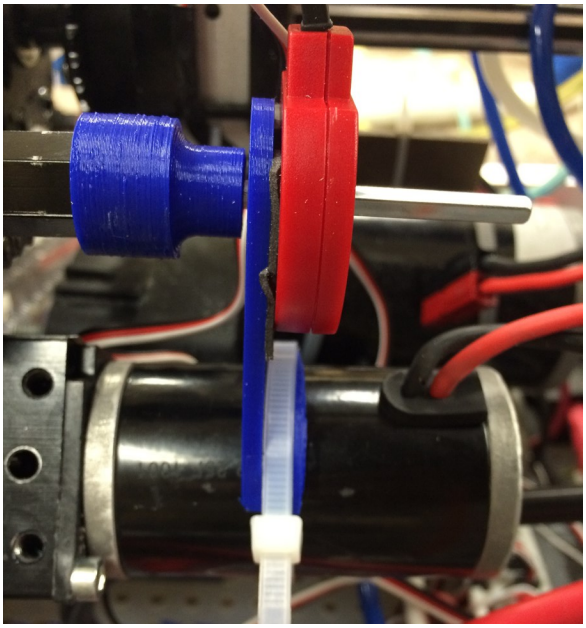
. SHOOTER

. AUTONOMOUS

. DRIVER ASSIST POLE

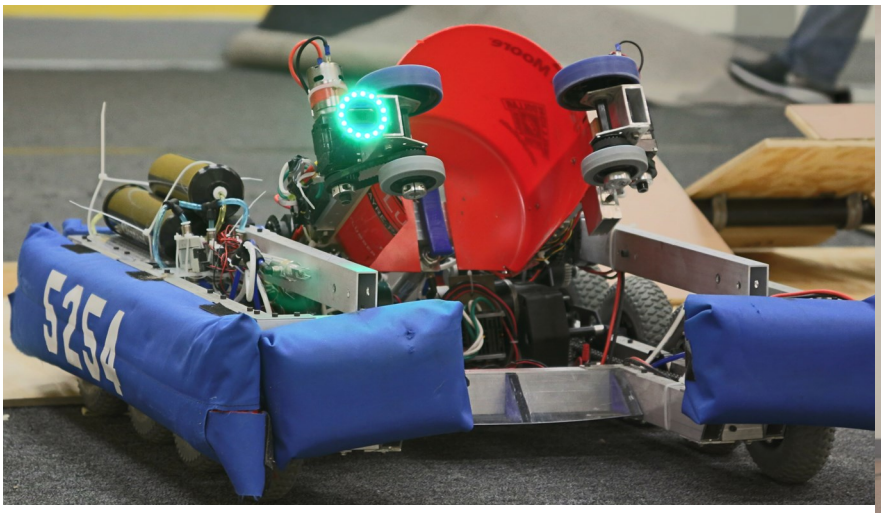
SHOOTER / AUTONOMOUS

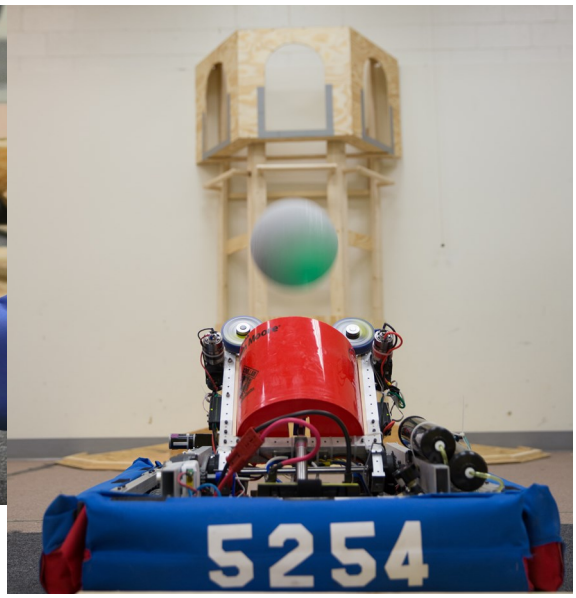
SHOOTER



- Arm angle set points controlled by a PID loop and an encoder mounted to the arm
- Preset heights for different shot locations on field

AUTONOMOUS





- Uses encoders and gyro to drive a specific distance and angle
- Vision tracking to detect reflective tape on the castle
- Robot is capable of crossing the low bar, bumps, and CDF then scoring in the high or low goal during auto.

DRIVER ASSIST POLE

From the beginning we knew that driver visibility would be an issue. After seeing some of the previous weeks of competition we decided to make a camera mounted to a telescoping pole to get an aerial view of the field.

CAPABILITIES:

- Go Pro mounted on a telescoping pole capable of going up to 11 ft. 8 in. off the ground
- HDMI cable runs to monitor to allow drivers and other teams to gain a better view of the field
- Useful for seeing our low robot from over the tall defenses and finding boulders hidden behind defenses