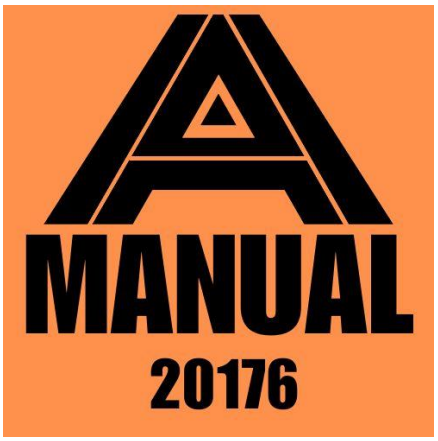
# ABERHART

# A-MANUAL

## FTC 20176

## ENGINEERING PORTFOLIO



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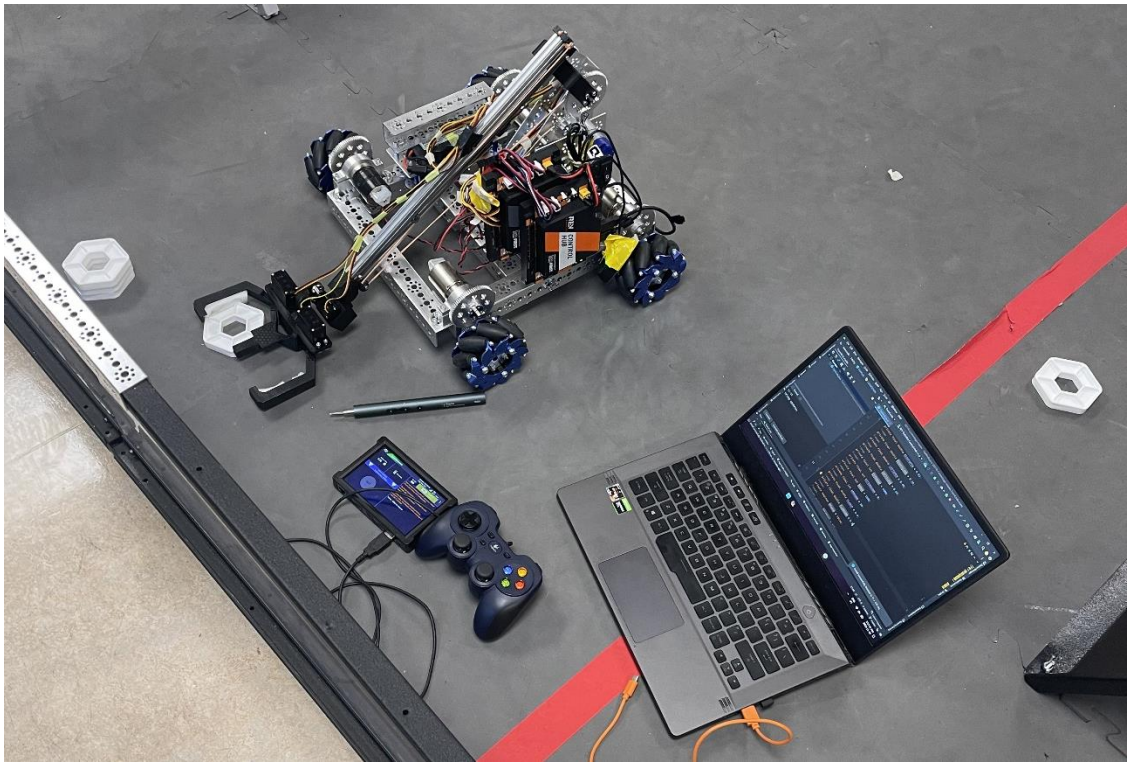
# TEAM SUMMARY

## Overview:

FTC 20176, “Aberhart A-Manual”, is a strong team of 10 capable and active members. Our team focuses on the use of 3D-designed and printed parts, and the technique of seamless integration between standards and customs. We have always strived to use our expertise in 3D printing to create personalized and effective parts that will strengthen our robot’s ability to swiftly navigate the field and precisely score game elements. In this year’s CenterStage season, 20176 aims to take its camera-assisted autonomous to the next level with the provided TensorFlow tool. Combining powerful detection algorithms with our extreme build quality, Aberhart A-Manual has high hopes for a top 10 finish in this year’s season.



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# Team Members:

Aberhart A-Manual is filled with dedicated and talented members. We meet twice a week on Monday and Wednesday afternoons, 2 hours per meeting. Every person on the team is valued and respected for their skills, and together, 20176 was able to establish a very open and friendly work environment.

- Yihe G12 Captain, Driver, Builder, Coder, 3D Designer
- Elliot G12 Builder
- Isaac G12 Coder
- Cole G11 Coder
- Matthew G11 Builder
- Kieran G11 Builder
- Owen G10 Field Assembly, Backup Driver
- Colin G10 Builder
- Jude G10 Team Mascot
- Harris G10 Website Designer

From left to Right:

Yihe, Kieran, Colin, Cole, Elliot, Jude, Owen (Matthew, Issac,

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# Team Mentors & Contact Info:

All teams at Aberhart have 3 mentors that act as our FTC representatives, Sponsor Teachers, and also share their expertise and skills to boost our progress. Our Mentors include Mr. Gustaaf Wehnes, Ms. Ng Luna and Mr. James.

- Mr. Wehnes: Gustaaf Wehnes is an instructor in Computer Science at Aberhart and a Robotics Mentor since 10 years. Throughout his role as a mentor, he has played a pivotal role in guiding numerous students, aiding in the cultivation of their interests and essential life skills.
- Ms. Luna: Ms. Ng Luna is a science teacher at William Aberhart High School, specializing in teaching Biology. Ms. Luna joined Robotics this year as a Mentor & Sponsor Teacher and has worked to provide expertise and support to every team in the school.
- Mr. James: Neil James, employed as a firmware developer at General Dynamics, held a pivotal role in securing sponsorship for various years through his affiliation with the company, but this year, he is back as a mentor and supporter for our teams.

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Main Contacts:

- Teacher in Charge - Gustaaf Wehnes
- Email - gjwehnes@cbe.ab.ca
- Phone - (403)-289-2551 Ext.7712
- Teacher in Charge - Ng Luna
- Email - lung@cbe.ab.ca
- Phone - (403)-289-2551
- Website: https://aberobotics.github.io/
- Instagram: https://www.instagram.com/aberhartroboticsrepublic/
- X: https://mobile.twitter.com/aberhartRR

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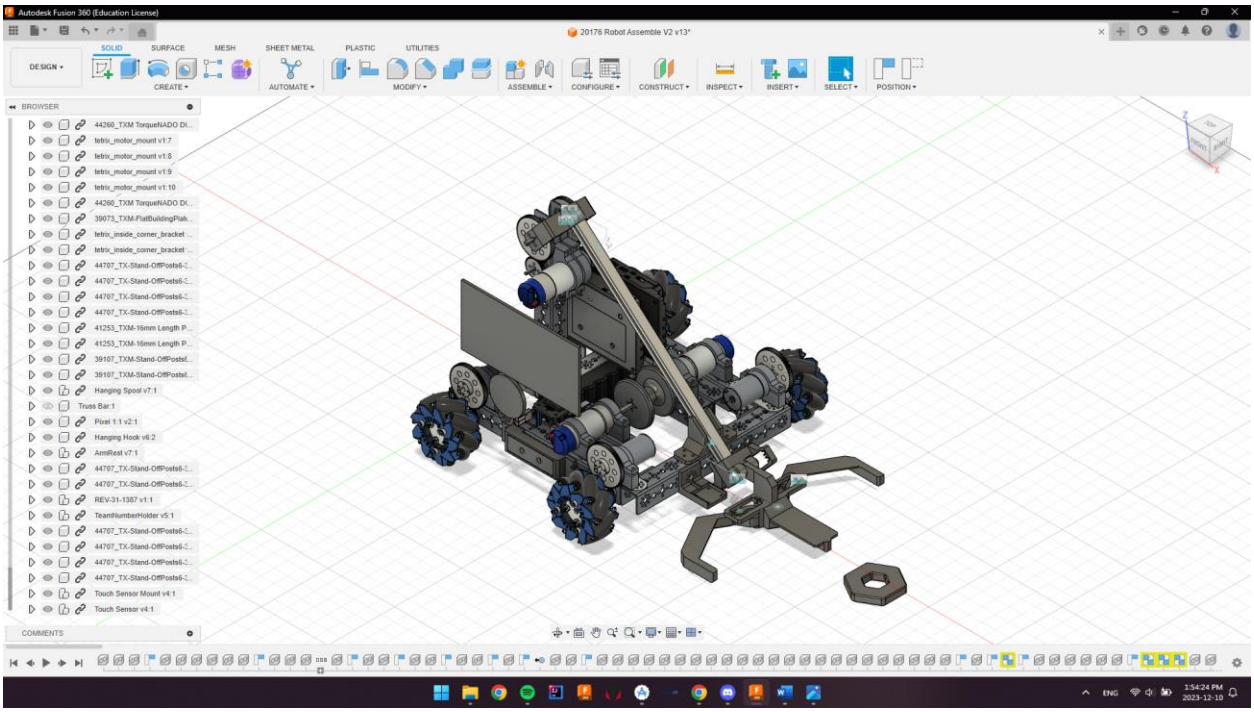
# BUILD PROCESS

## Robot Design:

In this year's CenterStage season, 20176's robot, Jeff, focuses on speed and precision. Below is a screenshot of our up-to-date CAD file of our current version of Jeff.




Below will be a brief summary of the past versions.

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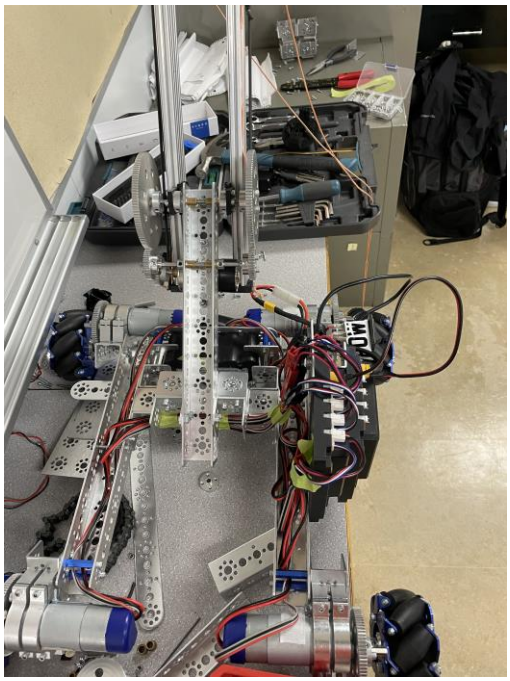
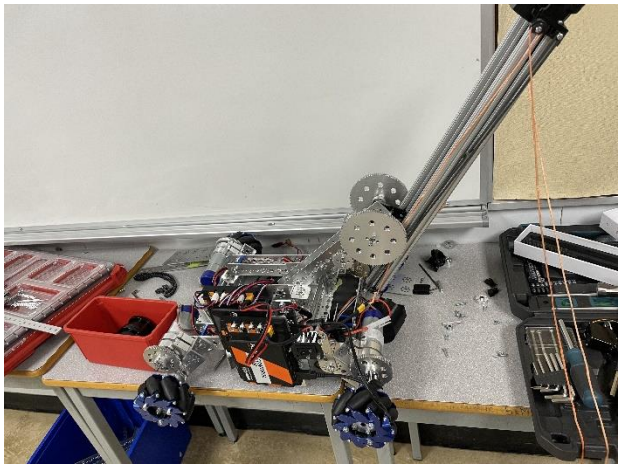
# V1:

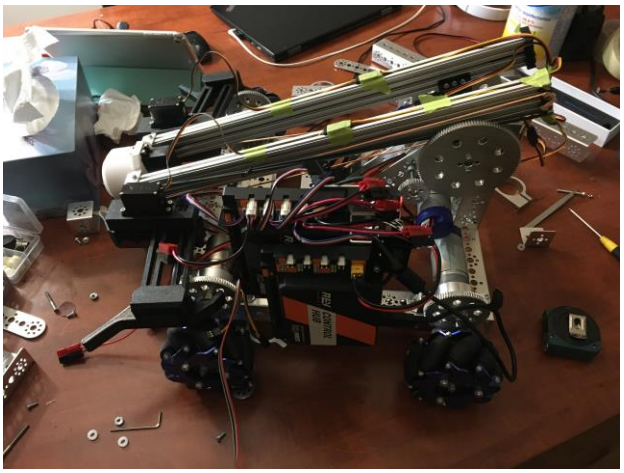


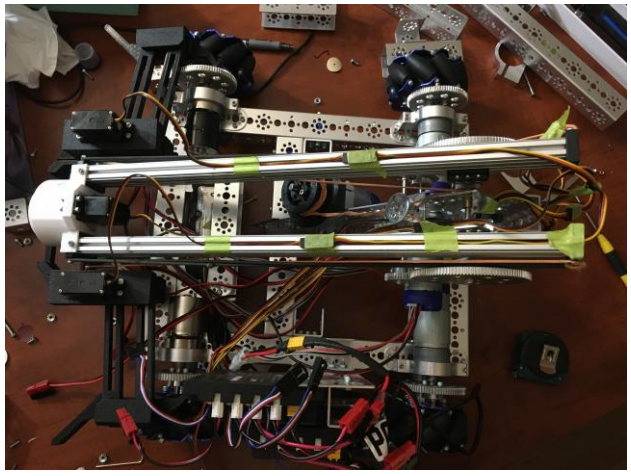


In V1, our robot had a raised base, with a 1:2 simple gearbox for speed increase. The arm was controlled by a DC Motor with a 3:1 gear reduction. The arm is constructed by 2 pairs of REV extrusion bars, which can extend to reach the top line on the backboard.

V1 is a proof-of-concept, with many immature designs that was replaced quickly in V1.5.

# V1.5:





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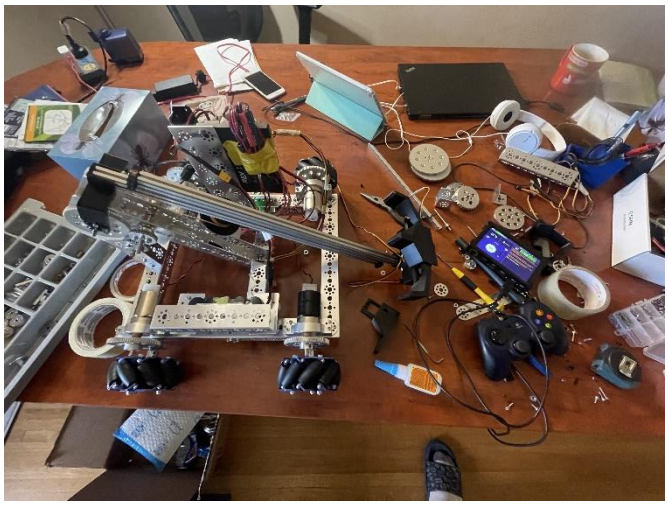
V1.5 had some important changes. The frame was entirely reconstructed, with better strength and more room. Instead of a raised platform, Jeff is now close to the ground, and can go under any bars on the field. The battery is shifted up front, to act as a counter weight for the arm. The front encoder motors has been swapped out with DC motors, which allowed the lifting and extending of the arm to be controlled more percisely

V1.5 was the first version we tested our TeleOp on. But it was still too heavy, especially the arm.

## V2:



V2 is a substantial change. All of the drive motors are now DC, and we redesigned the arm. Now, there is only 1 pair extrusion bar, and the gear ratio dropped to 2:1. The claw is entirely reworked.

V2 is around 30% lighter than V1.5, which allowed greater speed. The new claw is 60% lighter, with an entirely new design. The battery is now placed on the right, to counteract the control hub assembly on the left.

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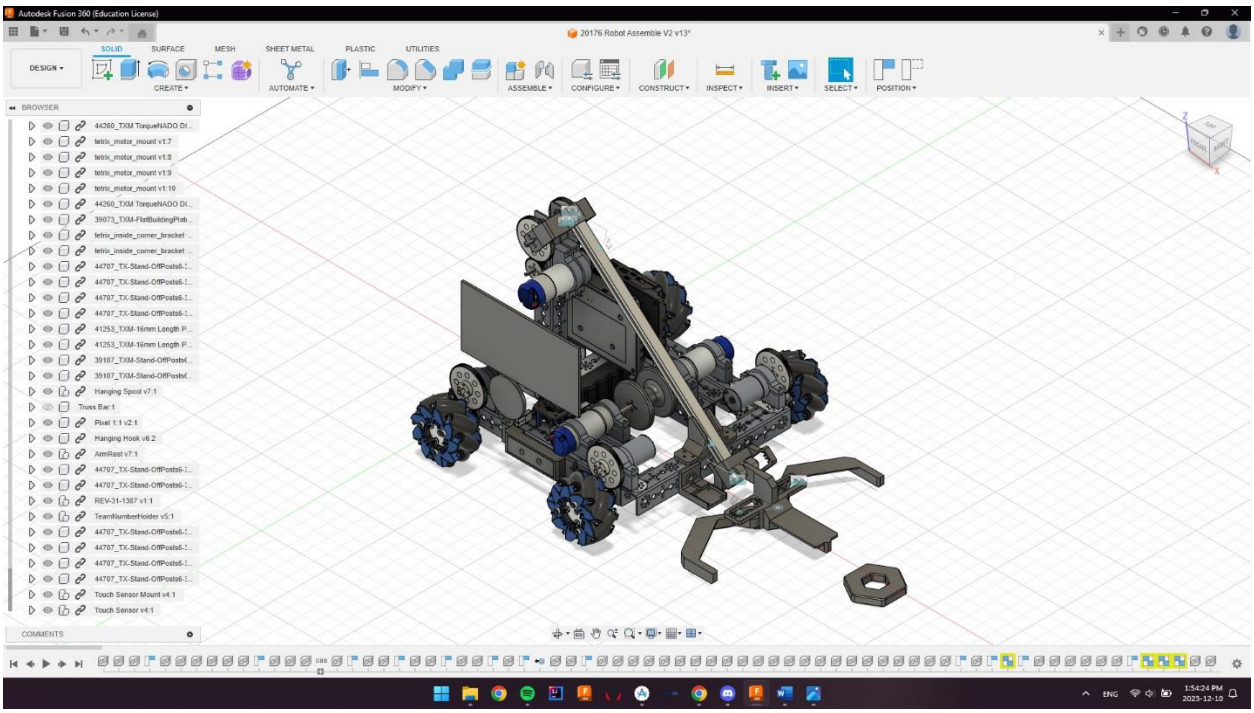
# V2.5:




V2.5 is the newest version, and probably the last major one. Another rework on the arm, this time we changed the mounting of the support. By moving it to the back, we created room for our new hanging mechanism. Also removed the extension ability of our arm, after realizing how little placing the pixels mattered compared to hanging and autonomous. Better space management allowed for easy mounting of team numbers, and an airplane launcher (not shown in this image; not modeled yet).

With V2.5, our robot can accomplish all of the “side-quests”: Hanging, Drone, and 2+0 Autonomous(work in progress). In some time, we can expect about 100+ points per game.

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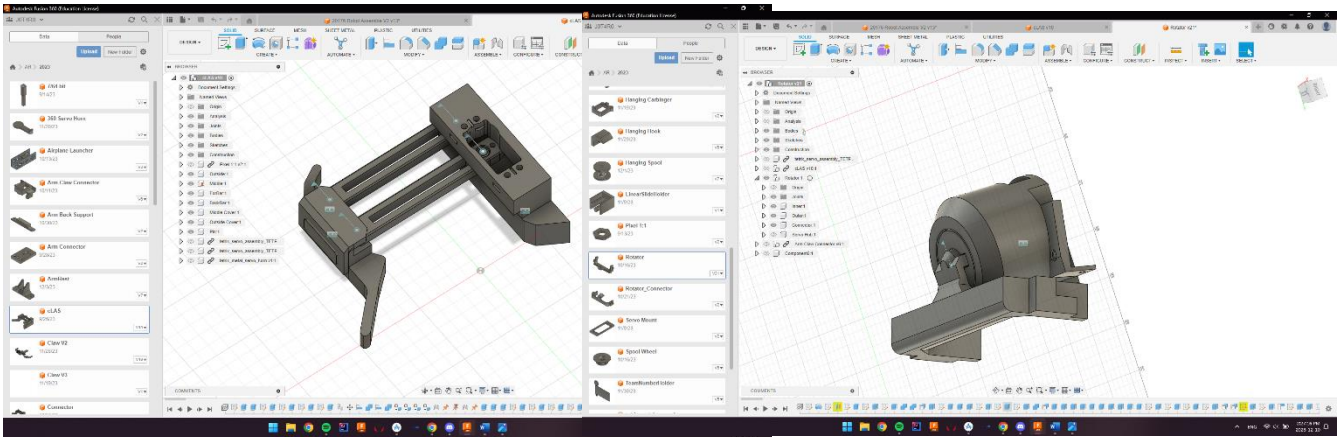
# Claw Design:

There were 2 major versions of our claw design.

In V1, we went with a four-bar linkage design. Our goal was to be able to pick up and release the pixels without flipping the claw.

The final claw can take in a pixel from the front, and slide it our the back.

The rotational bit is a print-in-place piece that can flip the claws.



V2 is much more conventional.

It has a flipping mechanism

Controlled by a servo, and 2

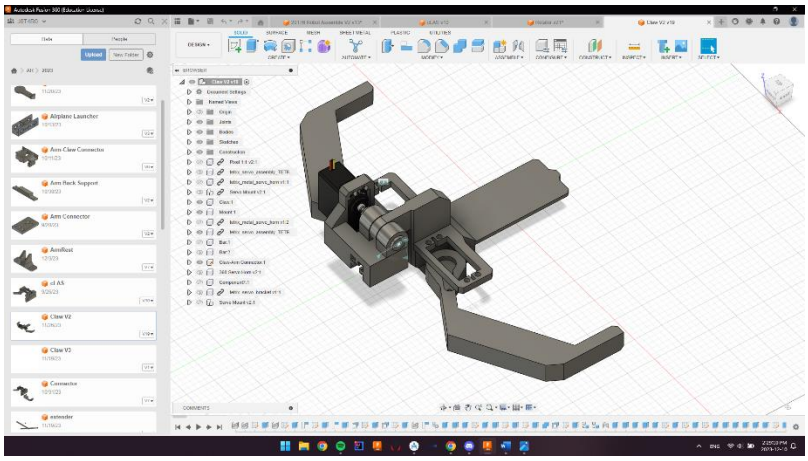
Other servos that control the

Catchers.

There is less moving parts, and

Much less weight. One major flaw

Is that it requires some aiming during pickup.



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# CODE

## TeleOp:

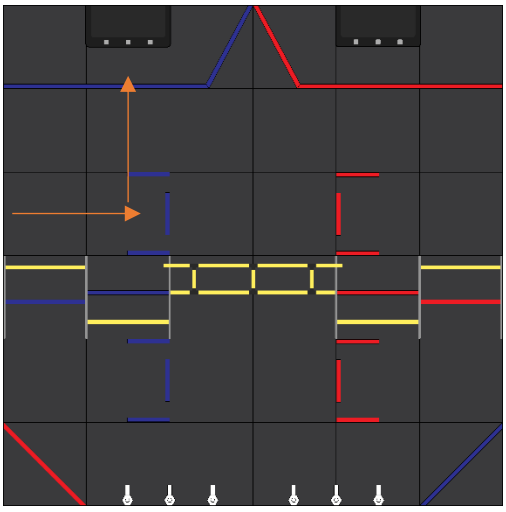
Jeff has a maccanum wheel drive train, so it can achieve movement in all directions. There is only one driver for Jeff, but the controller scheme is heavily simplified. We have one button for the arm to go all the way up, flip the claw, and release the pixels. Another button is responsible for doing the reverse. Hanging and airplane launching can also be done with a click. Overall, our TeleOp is a balance between features and ease of use.

During TeleOp, we opt to complete all of the “side quests”: Hanging + drone, for 50 pts. We will try to create as many mosaics as we can with the help of our human player.

## Autonomous:

Currently, we use the REV Color Sensor V3 for our team prop detection, and use timings to achieve a 2+0 autonomous. After round 3, we will replace the sensor with a camera, and use the TensorFlow tool to train our AI to recognize our team prop, along with reading April tags for more precise movement.

Our method of detecting team props is by Driving to the middle of the second square, and Turning to check for the team prop. After that, we Will use hard-coded timings to drive to the Backboard to place our second pixel.



# Additional Resources

- 3D CAD file link: https://a360.co/3Nl50xz
- TeleOp & Autonomous Code on Github: https://github.com/IsaacMattson/20176-Centerstage
- Engineering Notebook: https://docs.google.com/presentation/d/1iiNSKO10WcJNVy3Z3oJW9UBbTSbvsUpq34DAQYWH2Go/edit?usp=sharing
- Any other inquiries:

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