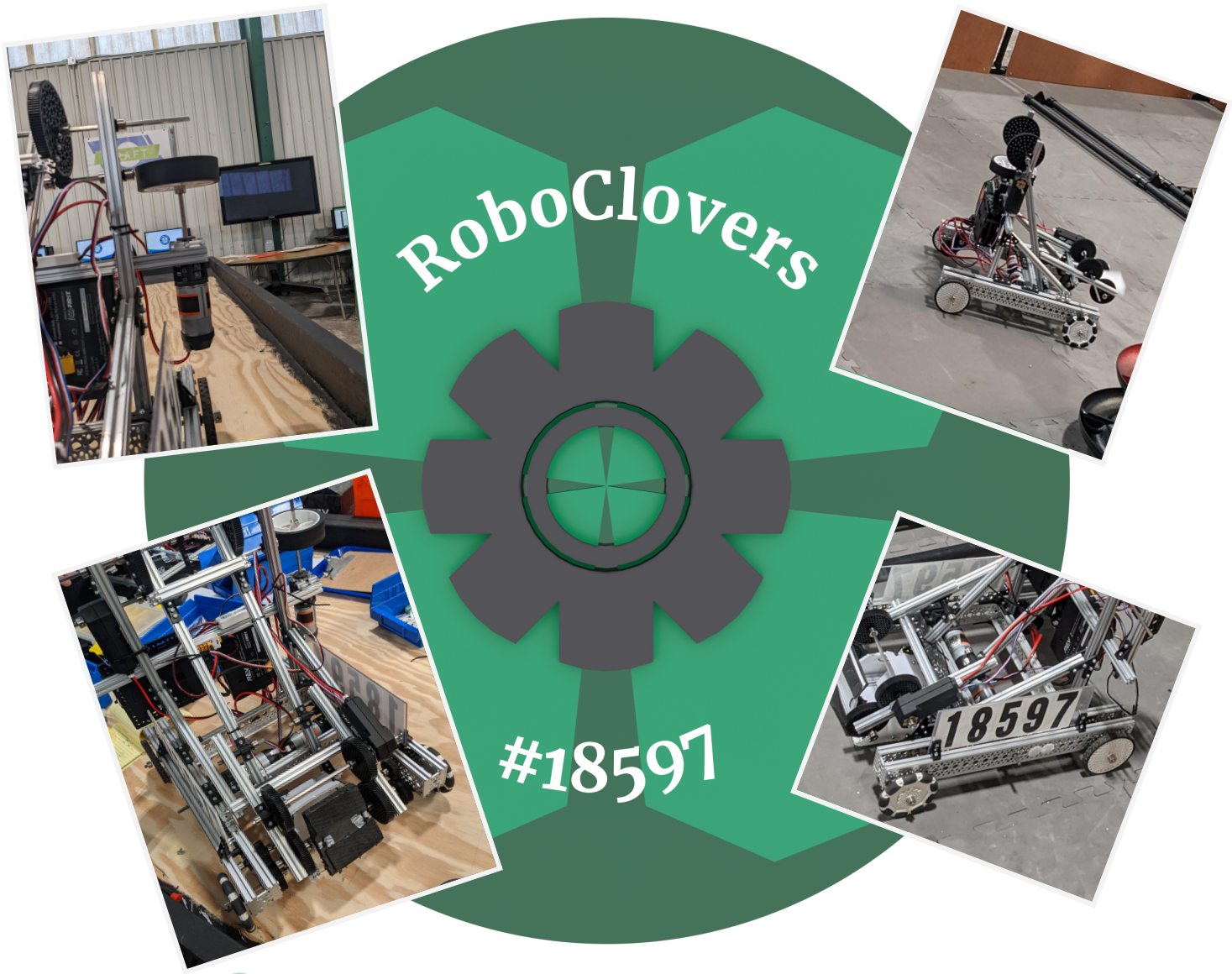
Engineering Portfolio



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Team Summary

We are the RoboClovers

Our team consists of 6 returning members from the 2020-2021 season and 6 rookie members.

Members:

President: Logan

VP of Building: Tristan

Members of Building: Kaylee, Landyn, Catherine, Jesse

VP of Programming: Sam

Members of Programming: Ryan, Corey, Logan

VP of Communications and Marketing: Nikolas

Members of Communications and Marketing: Kaitlyn, Shane

The Problem

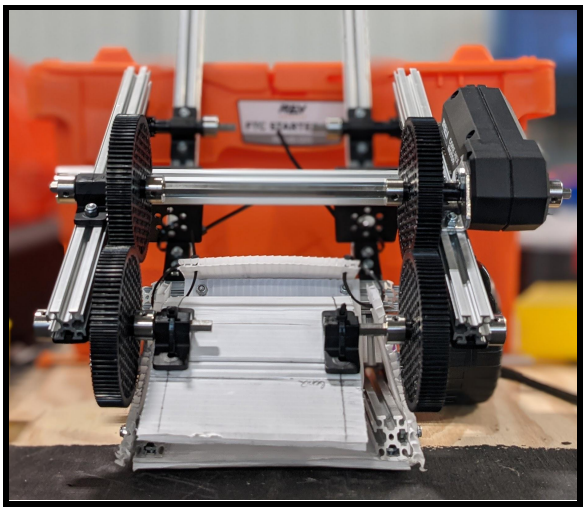
Within FTC's 2021 FIRST challenge, we have been given the problem of better transporting cargo from point A to point B accurately and efficiently. This too is a problem within the real world, which many of FTC's sponsors wish to see solved. Though this by itself is a simple problem definition, to go more into depth, we, the RoboClovers, have considered the following :

- What problems can the freight encounter when transporting the cargo and how seriously can it affect the ability of the freight?
    - In our terms, what elements on the field will be an obstacle to us and how seriously will it affect the robot's ability to transport cargo if encountered?
- What is the most effective way of getting hold of cargo and delivering it without seriously damaging the cargo?
    - In our terms, what is the best intake system for getting hold of cargo and what is the best outtake system which can be easily predicted without undesirable effects (IE. launching the cargo)?
- Which areas of the freight would be best to place parts which could assist in the delivery, transportation, and movement of the cargo while maximizing the ability of the freight itself?
    - In our terms, which areas on the robot would be best used to implement systems which would maximize the scoring of points while also not inhibiting the robot itself?

These are among many of the problems which many teams, including us, the RoboClovers, must solve with creative and innovative solutions. Of course, to produce such creative solutions, we must brainstorm, utilize, and repurpose many ideas already out there which assists in the same field.

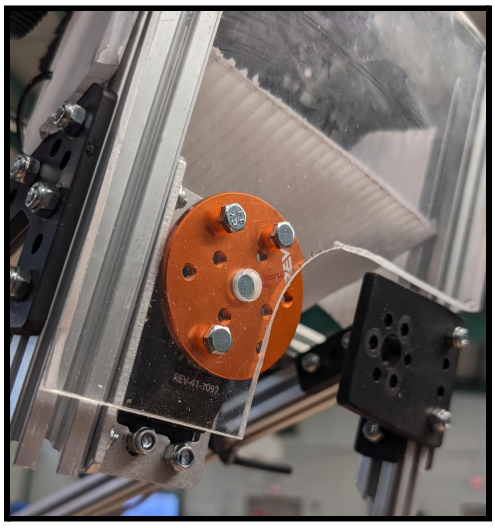
Our Obstacles

Throughout our time finding ways to best maximize our robots efficiency, we had come up with many creative solutions, which many were good, and others, not so much. For example, at the beginning we had created a simple intake box which worked by rotating a flap above the box to intake a piece of cargo, after that same flap would deliver the cargo wherever it desired. While this system was good, it could have been better.



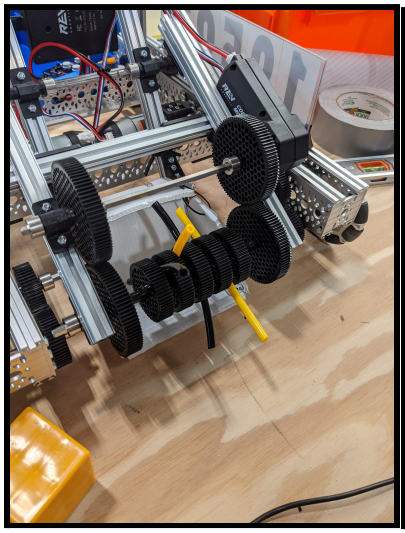
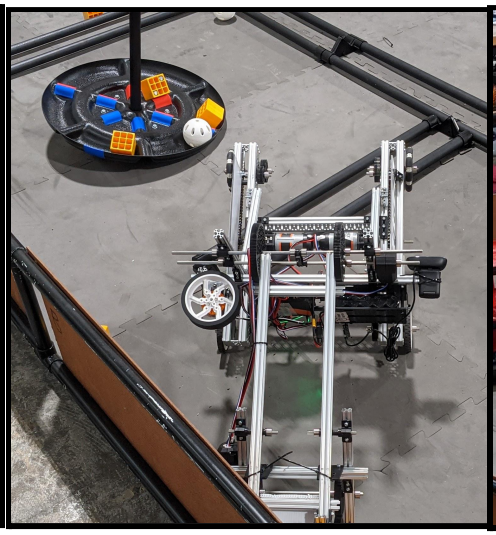
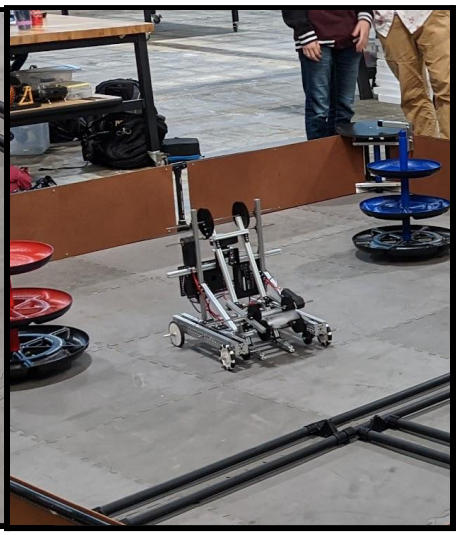
Our members got to brainstorming, and after a while, we came up with a new intake system. It was simple, only two gears being connected by surgical tubing in a pattern. The idea was that by spinning the intake device, the tubing would catch cargo in its path and hold it in between the two gears until delivery. Though, after testing, we had found out that this system was a total and complete failure. It would often not pick up anything at all, and if it did, it wasn't willing to eject the cargo afterwards.

We had come back to square one, and after an ingenious idea by our coach, we had created a scissor door like system which would simply move the bottom of the intake box, allowing the cargo to fall directly onto its destination. As of now, we still use this system, but we still know there is room for improvement within the intake and outtake process.

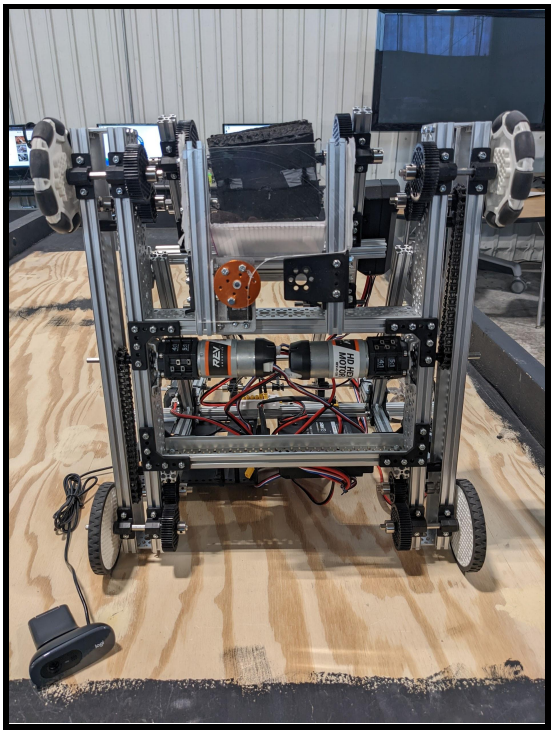


Robot Design

Throughout the entirety of the season, we have been constantly updating and improving our robot to better fit the conditions of the game. The design of our robot is based on the REV FREIGHT FRENZY STARTER BOT, but we've redesigned it to be our own. After many ideas, sketches, iterations, and prototypes, we have maximized the preferred proficiency of our robot. In this, we display vital parts of the robot which have been tested and revised many times.

The Drivetrain



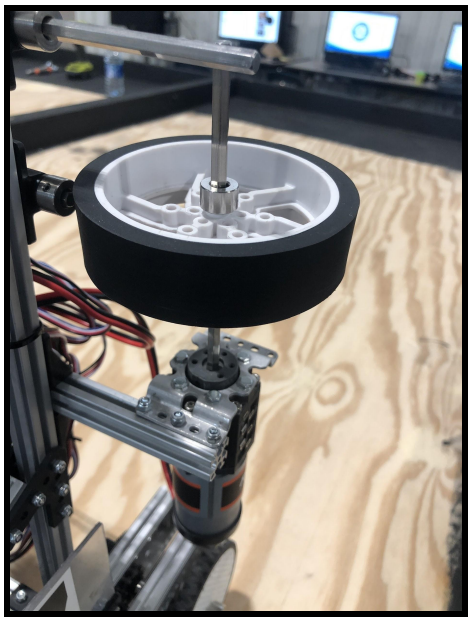
The bedrock of the robot, the drivetrain is what allows mobility to our robot and is one of the most essential pieces to the game.

It is a 4 wheel chain and gear drive system that has roughly 2 inches of ground clearance, which allows us to drive over the barriers with little issue.

The wheels consist of two REV omni wheels in the front for easy turns and two REV traction wheels in the back to improve traction on the barriers.

Prior to the season, we had constructed the REV Mecanum Drivetrain Kit, but upon seeing that we would have to cross barriers, we knew our current drive train wouldn't cut it with it's little ground clearance and ability to stick to surfaces. Lucky for us, however, the drivetrain we had was very similar to the REV FTC Starter bot, making it easy to convert it accordingly. Since then, it hasn't seen much change as our current design works quite well.

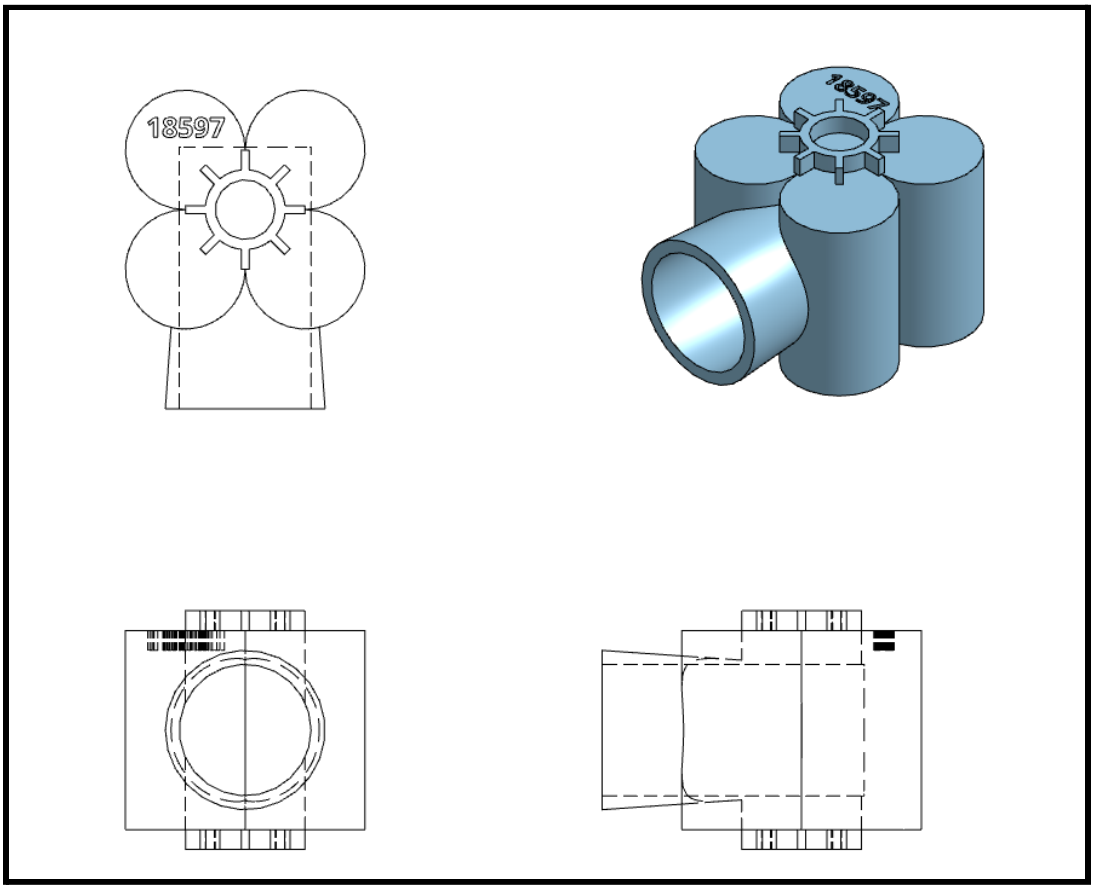
The Carousel Wheel



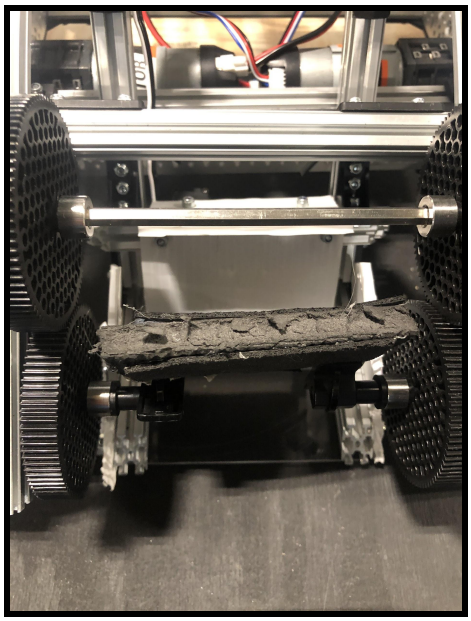
The carousel is turned by a REV HD hex motor with an UltraPlanetary gearbox attached to it. Previously, it had been turned by a REV core hex motor, but since the speed of the motor wasn't enough, we were constantly relying on our alliance team to turn the carousel. We eventually made it a priority to switch the motor out with a stronger HD hex motor, which gets the job done. We originally had it between the two arm extrusions but it was later moved to the ride edge of the robot. This modification allowed us to have enough time in autonomous to include a carousel as well as perfect parking in the storage unit. In fact it had given us plenty of time left, so later on we had the cargo box placed on the middle level of the alliance shipping hub, then a carousel, then a perfect parking. At the moment the detection of the duck has not been implemented into autonomous, therefore it will only be delivering the ducks on the middle level.

Team Shipping Element

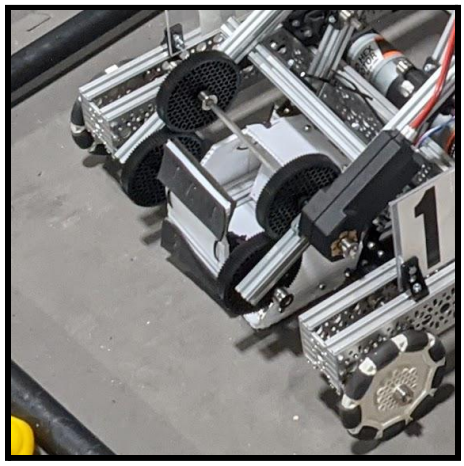
Our team shipping element has gone through three main iterations in design. The first one was smaller and featured a hole through the entire thing that was not sufficient enough to fit the top of the shipping hub. Although we have not had a method in capping the shipping hub yet, it is better to feature a design that makes that possible. The second design was improved in size and the bottom piece was expanded to allow for more space to cap. The current design features a hole that does not go through the top, because it has to rest only on the shipping hub pole



The Intake/Outtake System



The intake/outake system is made up of a moving flap to bring in cargo and an intake box to hold it in. The flap is a piece of [whatever the flap is made of] with neoprene tape on the tips to better bring in cargo. The intake box is made of corrugated plastic and has a horizontal moving flap at the bottom to drop cargo from the box.

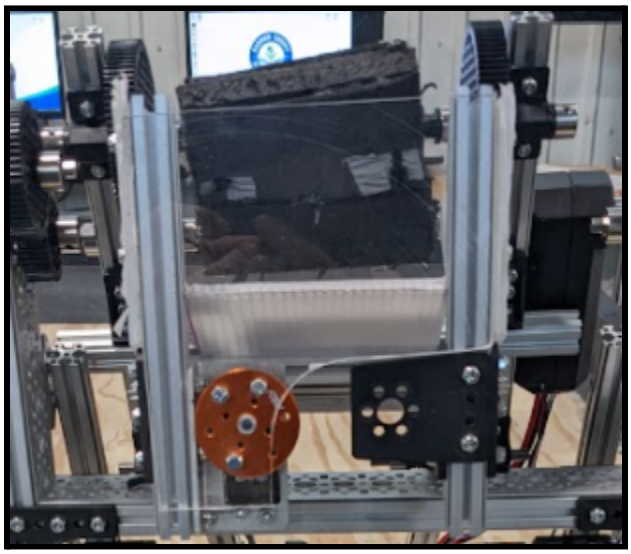


At first, it was just a flap of corrugated plastic and cardboard box, we quickly replaced the cardboard box with one of corrugated plastic due to the cardboard box being super low quality and ineffective.. This worked, but not very well. The flap would constantly need to be replaced and was very inefficient on its own. We marginally improved the flap by adding grip tape to the tips, but it didn't fix the constant need for replacement.

Eventually, we replaced the corrugated plastic entirely and used a piece of foam similar to the foam used for the field mats, alongside the grip tape. This greatly improved the durability of the flap, and due to it being more sturdy it led to more consistent intake/outtake results.

Still, however, the intake/outtake system was wildly inconsistent and clumsy, which lead to us having to brainstorm what ways we could improve it. We all agreed upon the idea of a dump truck, or having a way to release the cargo by opening the bottom of

the intake box. This idea would need to take a back seat, as we had to worry about upcoming league meets before we took apart our robot.



Once we had some breathing room, we were able to come up with the idea of moving a flap on the bottom of the intake box with a servo, and then promptly manifested the idea. The results were very good, as we no longer had to be at the whims of the flap to drop cargo, and saw much more consistent and reliable release.

Outreach Activities

On December 11th, 2021 we helped judge and referee the FLL tournament hosted at our facility. We had 6 of our members refereeing tables, 2 members being score runners, 2 members judging presentations, and 2 members making buttons.

We had other adult volunteers also help us judge presentations and sell concessions. We set up the game area on Friday, December 10th, 2021 from 3:30-6pm. We had four FLL kids from our barrow robotics team help set up concessions as well.

Future Team Plan

Our team is hoping to reach far within FTC as we push forward the next couple of years. This year the hope is to reach the state as we were unable to last year by a small margin, with next year's plan to perhaps reach nationals with the experience we will have had by then. Not only will we have more experience, but the plan is for new recruits to be invited in order to help with tasks such as documentation or business so we spend the majority of our time as efficiently as possible. Promoting the team can come through future fundraisers that will not only fund us for later years but also catch the interest of those who help or hold attention to our fundraising. If funding ends up successful enough it will open up an opportunity for the creation of an FRC team along with our FTC and two FLL teams as a part of Barrow robotics.