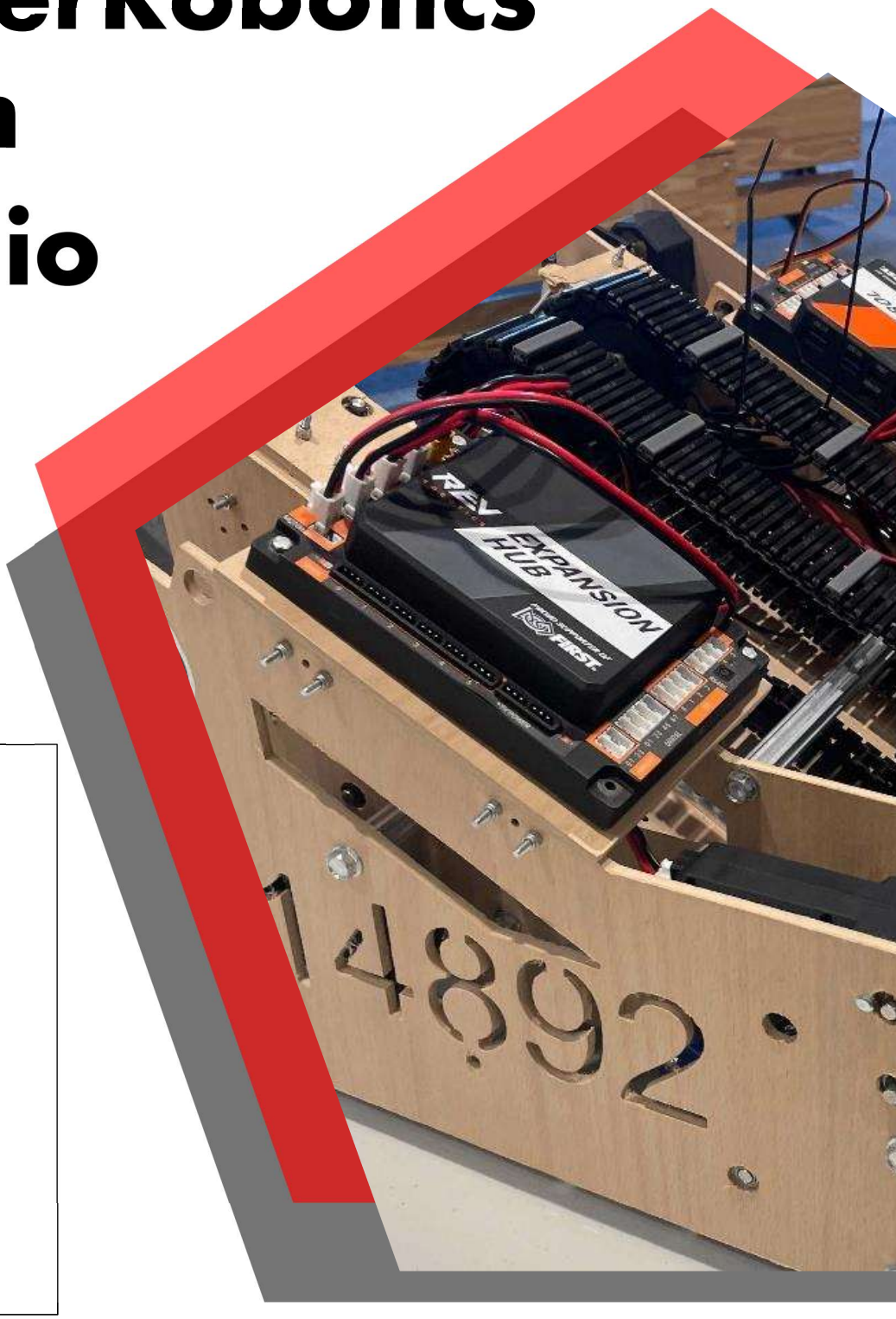
14892 AvengerRobotics Venom Portfolio



FTC 2020-2021

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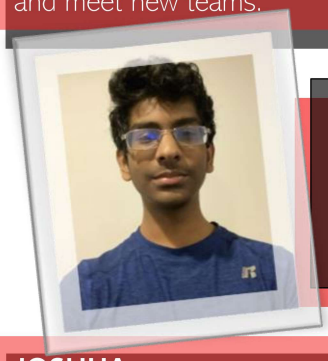
TEAM HISTORY

Who Are We?

14892 is an FTC team at the Alliance Academy for Innovation in the Northern Georgia FTC league. Alliance has the biggest FTC program in the state with fourteen teams. This will be 14892's third year as a number in FTC, but in those years, there have been multiple successes. In the first year of 14892, the team did not have many successes as a team. The second of our team's number was the most successful though because the team went to the State Championship, and they won the first award for Alliance at States. We were an all-freshman team who worked heavily on our notebook and won many awards at the regional tournament. We had won the Design Award, the Winning Alliance Award, and the Second Place Inspire Award. This meant that we had qualified for the State Competition. The state tournament was something none of us had seen before, and we finished in the middle with our rankings from the qualifying matches. Last year, we had done lots of outreach with our favorites being able to visit military service members in our county and write them handwritten letters saying thank you. We also got to show them our robots and tell them about first. Our other favorite was being able to host robotics competitions for middle school students in our county and around Georgia. These competitions had about fifty to sixty teams. Last year, we also had ten members, but this year we have eight members. Six of our members show up every day for practice, and one is fully online with one doing half online and half in-person. We had to limit the amount of people on our team due to Covid-19, so our team split into two different teams in our program. We are always helping each other out to get things done though. In our program, we have two mentors, Mr. Welsch and Mr. Mathis, and they help us through our problems along with giving us advice. Our seven members this year are Adam, Aniket, Greyson, Joshua, Nathan, Nick, Rahul, and Vishali, who are all sophomores. Six members on our team help with our design or building of our robot through drawing, CAD, or hands-on building. This allows us to be able to have more opportunities to build a better robot than last year. Two of our members are on the programming team, which will make us have an improved autonomous and scouting page. Everybody on our team will work on the notebook as we have lost most of our business team from last year. We are proud to say we have a new member named Nick. We are ready to get him prepared for this year, and he will be one of our drivers. Our team will also have four people inside of our interview. We will talk about Mechanical, Programming, CAD/Design, and Notebook/Portfolio. We are looking forward to a great season and are hoping to go all the way to the State Competition or Worlds!

ADAM

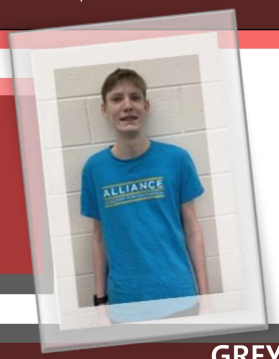
I am one of our team's mechanics and notebook authors. During competitions, I will be the main mechanic, a scouter, and an interviewer. This will be my fifth year of robotics. I started robotics in sixth grade because I wanted to experience real-world robotics. My favorite part of FIRST is being able to outreach to our community and meet new teams.



ANIKET

I am one of our team's main programmers and a notebook author. During competitions, I will be a coach and an interviewer. This will be my fourth year of robotics. I decided to do robotics because he wanted a fun experience. My favorite part about FIRST is being able to go to competitions and compete.

JOSHUA



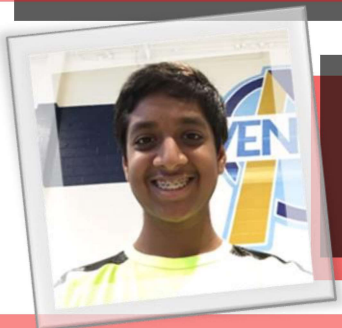
I am one of our team's mechanics and designers. At competitions, I will be our main driver. I enjoy getting to problem solve and challenging myself in robotics. I like FIRST because everybody acts professionally at competitions.

GREYSON

I am on the Design and Mechanical sub-team. I am a driver and scouter for our team at competitions. I am in my third year of robotics, and I am very excited. My favorite part of robotics is being able to have a new challenge. I like to be able to get to help build the robot and obtain new knowledge.

NATHAN

This is going to be my second year of robotics, and I am on the notebook and mechanical team. I will be a driver and interviewer at our competitions. I joined robotics to make new friends, and my favorite part of robotics is getting to obtain new knowledge and build structures.



RAHUL

I am one of our programmers and notebook authors. This will be my fourth year doing robotics, and I joined because I had an interest in programming. I will be a scouting director at competitions since I will be online this year. My favorite part about FIRST is getting to make new memories with my friends.

VISHALI

I am our team's main designer and a notebook author. I joined robotics three years ago because of my love for art and engineering. FIRST has allowed me to express my art, which is my favorite part about FIRST. At competitions, I will be a human player and interviewer.

Mr.Welsch

Our team has multiple mentors that help us with every aspect of robotics. Our two main mentors are Mr. Welsch and Mr. Mathis. They are at every practice and always checking in with us to make sure we are on the right track. Without Mr. Welsch and Mr. Mathis, our team would not be as successful as we are. Along with Mr. Welsch and Mr. Mathis, our parents are always willing to help us with their insight on our robot. Other teachers around our school are always encouraging our robotics team and program. We are very thankful for all the help and support we get from our mentor!

Mr.Mathis

BUSINESS PLAN

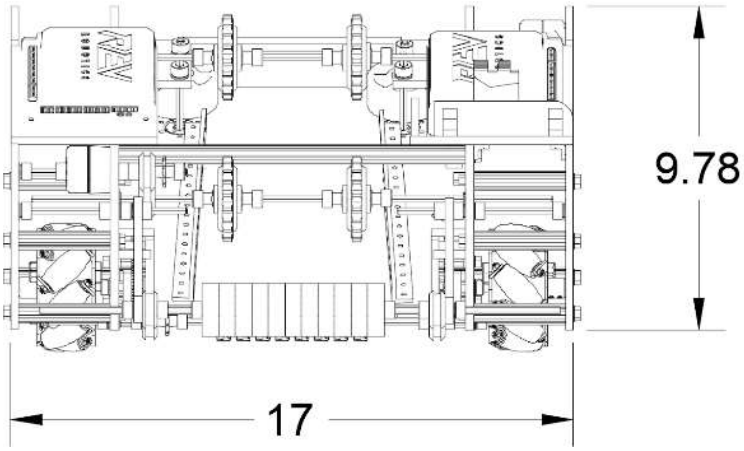
Throughout the entire season, our team has gotten the opportunity to learn and develop new skills. Some of these skills we wanted to learn and some we never knew we would develop. At the beginning of the season, nobody on our team had used a computer numerical controlled system before. However, with the help of our mentors, we were able to learn how to fully design our robot on a CAD design software and print out a custom-made chassis. We were able to complete this twice throughout the season with both our custom robot designs. We also were able to learn more about the design process compared to last year too. Last year, our robot was made from pre-made parts, and we never came up with a full design. This year, we made calculations for our shooter, designed the robot on CAD, and talked with our mentors before building one part of our robot. This helped us decrease the amount of time it took to do trial and error.

This year we were able to learn more about formatting with Adobe, Google Slides, and Microsoft Word. We made two Business plans with Google Slides to learn the basics about formatting, and we were able to try something more advanced in February of 2021 with our Portfolio. Our first design was made in Adobe, but it did not provide the look we wanted our portfolio to have, which let us to try formatting in Microsoft Word.

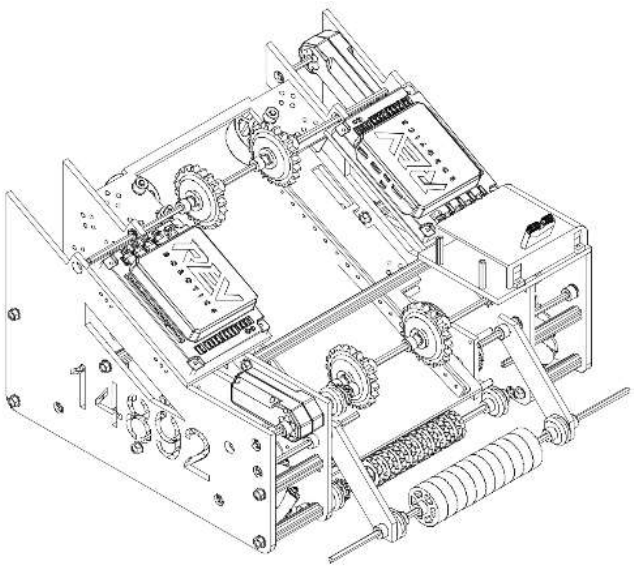
There are many other things our team learned throughout the season too. For instance, we learned how to use numerous amounts of power tools and machinery. With a custom robot, we were able to learn about new parts and mechanisms that we could use such as Mecanum Wheels. Our programmer was able to learn and program a gyro sensor, color sensor, and Vuforia. All in all, Covid-19 has impacted the FIRST FTC season this year, but our team was still able to learn about new aspects of robotics, which will help us in the future in robotics and adulthood.

ROBOT IN CAD

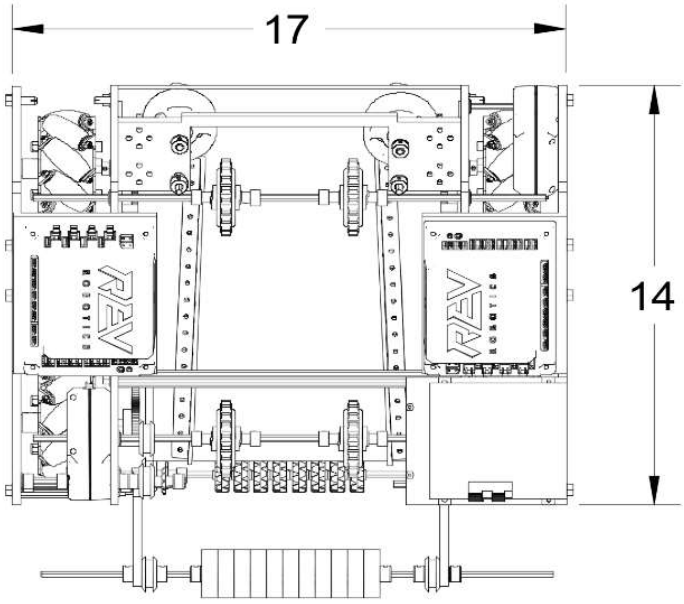
FRONT



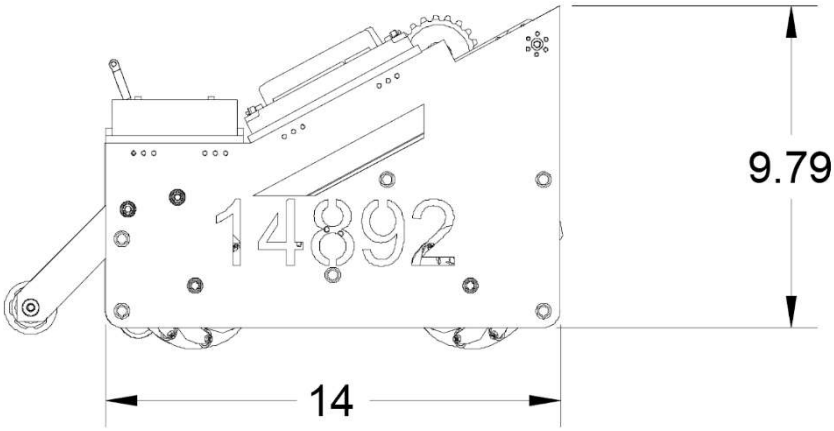
HOME



TOP

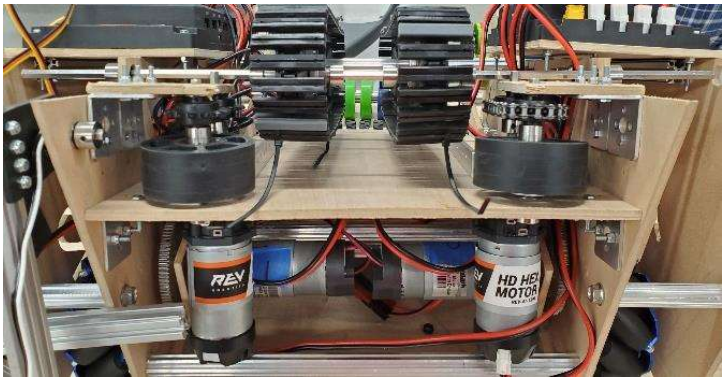


SIDE

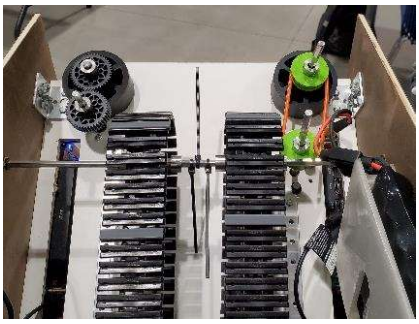


SHOOTER

Our shooter is one of the best, it has the most innovative design with two 5:1 built in gear boxes on our motors and 2.25 in compliant wheels for the tightest hold of the rings. The wheels are connected to the motors with chains on 15 teeth sprockets. This lets us shoot at a high speed in a small form factor. This will be one of the fastest shooters we ever had. We are using ultra planetary rev motors to have the highest performance with the fastest speed. The shooter is attached to the CNCed ramp, and there is a support piece on top that has shafts running through it.



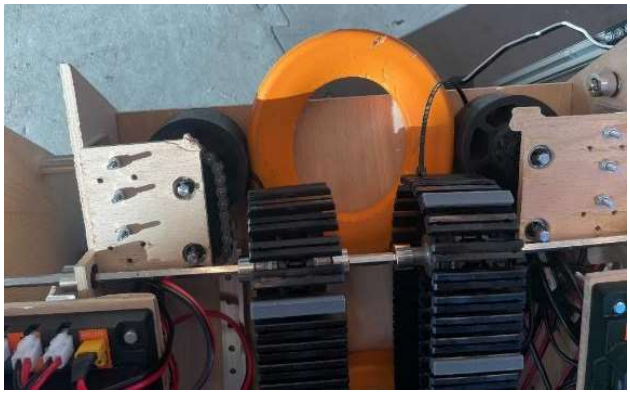
Old Shooter Design



Our old shooter design was similar to the current one, but it was a lot more complex. This made us want to simplify the design in the new robot. What made it complex was how we geared it. There were two sets of pulleys and one set of gears. This created lots of extra tension and force that made it where our shooter could only score into the low goal. We wanted to score into the mid-level goal.

Shooter in Action

The Shooter Takes the ring from the conveyor and shoots it to either the middle goal or the low goal. The shooter can also knock over the power shot targets.

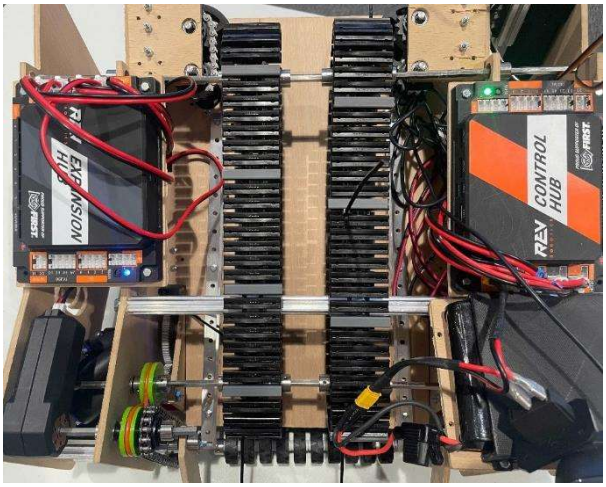


Special Part of the Shooter

The innovative design lets us shoot the rings at a higher speed then most robots, with the 5:1 Gearbox on the shooter our robot can shoot at approximately 1200rpm or 8mph.

CONVEYOR

The conveyor gets the rings from our intake and carries it to the shooter. We have two sides to our conveyor. Both help move the rings up into the conveyor. We put in a ramp underneath the robot, so we can move the rings more effectively up to the shooter. We power the conveyor with a Rev core hex motor. We use the same motor to power our intake.



Special Part of the Conveyor

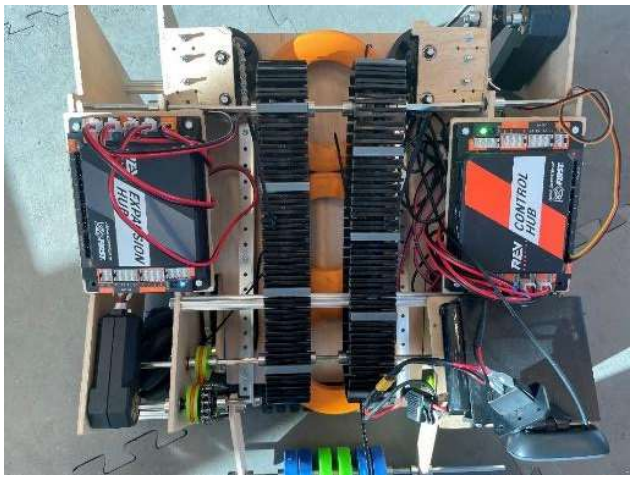
There are some things that are unique about our robot. With our robot we have two parts. Each are made with Tetrix tank treads. We also CNCed our ramp. We designed it so that it will have holes for all the screws and motors. We also put spaces for the wires to go into. We also use zip ties to help move the rings.

Old Conveyor Design

With our old design, both sides of the conveyor were made from Tetrix tank treads. At each end of the conveyor, it was attached to a 16in shaft. One of the shafts, was attached to a Rev core hex motor. That is how we were able to move the conveyor. We also had 3 zip ties on each end of the conveyor. This helped grab the rings from the intake and bring it to the shooter. It also helped push the rings into the shooter. One some of the tank treads we put grips so that the rings do not fall.

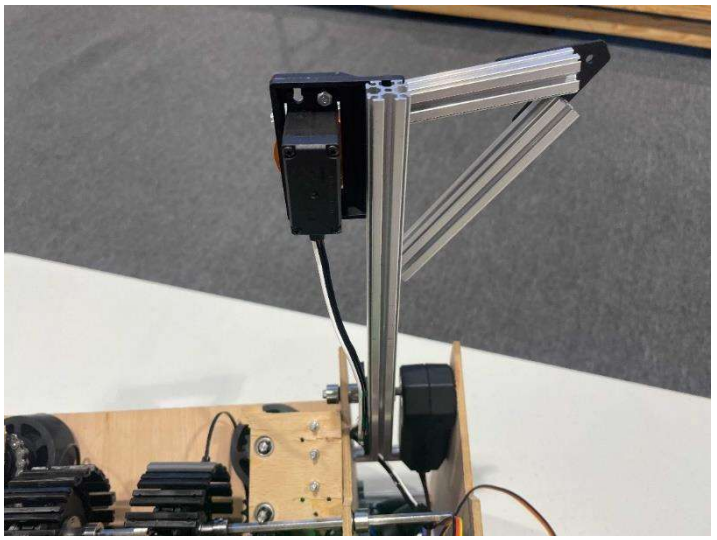
Conveyor in Action

The conveyor will grab the rings from the intake and move them into the shooter. We do this by having the zip ties push the rings up through the conveyor. The zip ties are evenly spaced, so the rings fit perfectly between them.



WOBBLE GOAL LIFT

Our wobble goal lift is a simple design made from REV robotics pieces. The wobble goal lift is powered by a REV core hex motor, which provides more torque than speed for our lift. We need more torque because the wobble goal and lift are heavy along with being farther away from the motor makes it require more torque. Connected to the shaft in the motor is an extrusion, and the extrusion has a servo attached at the end of it. This servo has a claw with more extrusions, so the wobble goal is locked in three points of contact.



Wobble Goal Lift in Action

Our wobble goal lift can drive up to a wobble goal and extend the arm out in a rotational direction. Our servo claw latches onto the stem of the wobble goal. The wobble goal is then lifted by the arm over the field wall, and we drop it outside of the field.

Old Wobble Goal Lift

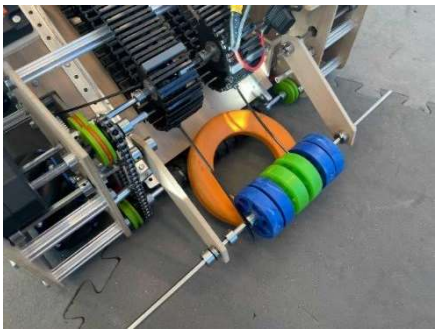
Our old robot design did not have a wobble goal lift because we had not planned on needing it at the beginning of the season. This proved to be completely wrong as we were not able to score many points with just rings. The wobble goal lift then became a priority for a new robot design.

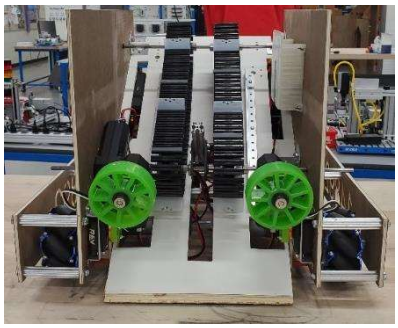
Special Part of the Wobble Goal Lift

What makes our wobble goal lift is the location of where it is on our robot. We put our wobble goal lift on the back left corner of our robot away from all the other mechanisms on our robot.

Intake in Action

To start off, our robot drives up to a ring, and our driver powers the intake. The intake wheels in the front bring in the rings towards the second set of wheels. The second set of wheels spin the opposite direction, so the rings go over the wheels onto our ramp which is elevated off the ground by an inch. Once the rings are on the ramp, the conveyor will start to bring the rings in from the intake.





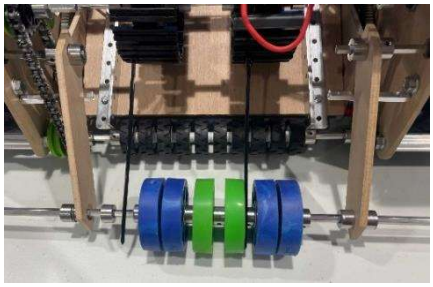
Old Intake

The intake on our old robot faced vertically with two AndyMark compliant wheels. These compliant wheels were 35A compression, which is easily compressed, and three inches in diameter. The compression allowed for us to bring rings into the robot more easily and up to the ramp. The reason we switched intake designs was because we had to drive up to a wall to bring the rings into the robot.

Special Part of Intake

The part of our intake that stands out is the set of two different shafts and wheels. The second set of intake wheels are 30mm traction wheels. Not many other teams have their rings go over something to get to their ramp or conveyor. However, through much deliberation, we chose to make our intake have small wheels, so the rings could go over the wheels onto our elevated ramp.

INTAKE



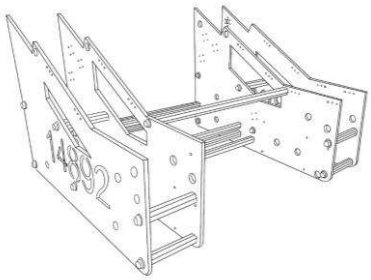
Our intake is made from complaint wheels and 30mm traction wheels. There are two sets of shafts with different types of wheels. The first shaft in the front has two-inch compliant wheels on it. They are meant to bring in the rings toward the center of the robot. The second set of wheels are on another shaft about three more inches into the robot. These 30mm traction wheels are meant to rotate inward to get the rings over the wheels and onto the ramp. Our intake is powered by the same motor as the conveyor, a REV core hex, and pulleys and sprockets are used to connect all the shafts in the mechanism.

CHASSIS

The new chassis has four custom side panels, four Pico Boxes and three mounting plates for the control hub, expansion hub, and battery. All four plates are 14 in long and have a peak height of 9.776in. The reason behind changing the length of the robot was to make it easier to mount the robot's intake and still have it on pivot to make it better at collecting rings.

Old Chassis Design

The old chassis has four custom side panels and four Pico Boxes. The inner side panels are 17.5in long and 13in high. The outer side panels are 17.5 in long and 3.5 in high. All 4 Pico Boxes are 4in long and 3 in high. The drive train motors are Neverest 40 motors powering an 80 to 40 gear ratio or a 2 to 1 speed ratio. The main problem with the chassis was that it was so close to the 18in by 18in that we struggled to get our intake to be efficient on a pivot so it can extend outside of the 18in sizing box.

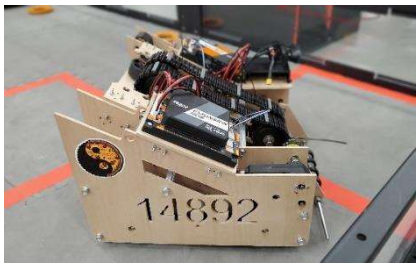


Special Part of the Chassis

One special thing about our robot is how we managed to mount our control hub, expansion hub, and battery. We have it so the depth of where the nut threads onto the bolt is lower than the flat surface that the control hub, expansion hub and battery lay flat on covering the top of the screw. Since it is mounted that way, we do not have to have standoffs to lift the expansion hub, control hub and battery since the head of the screw is not in the way of the pieces.

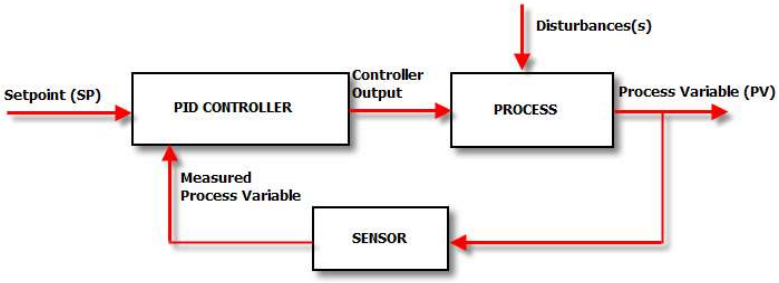
Chassis in Action

Since the chassis uses Mecanum wheels it can strafe. With the 2 to 1 speed gear ratio and the Neverest 40 motors it has a lot of speed and torque allowing it to reach all the rings in a shorter amount of time. If we were to obstruct the path of the other team on the field, we would be able to slow the other team with the high torque and not get any major or minor penalties due to the speed of the robot.



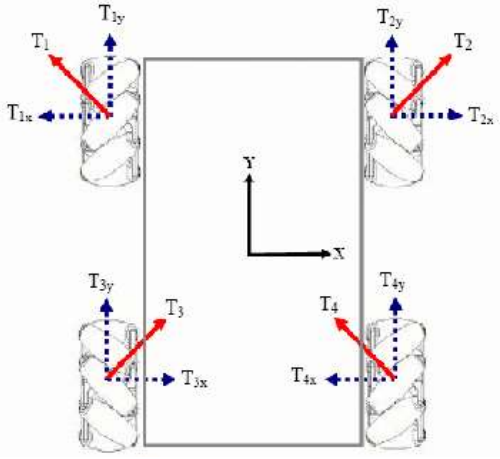
PROGRAMMING

The FTC programming environment is split into two distinct categories, TeleOP, used in the driver controlled period, and Autonomous, used in the aptly named autonomous period.



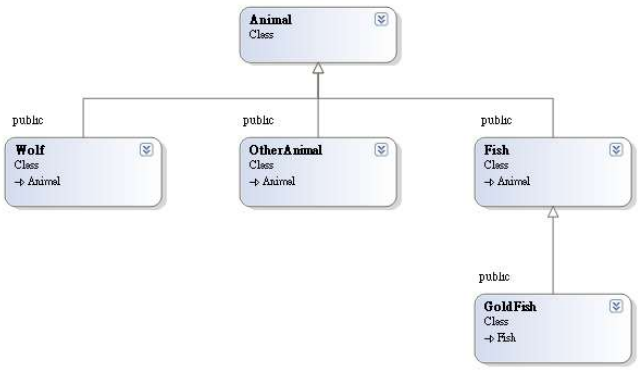
TeleOP

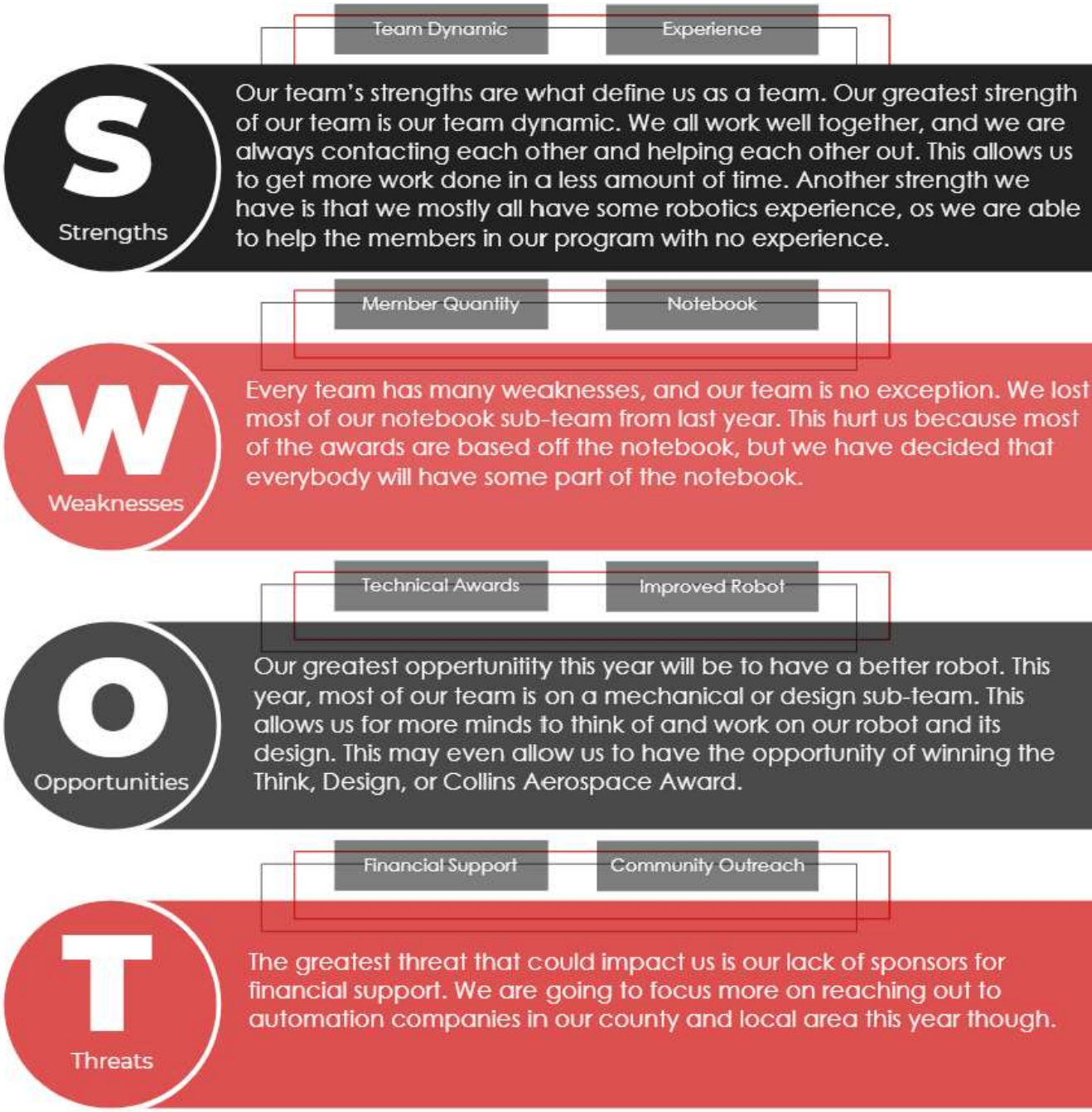
Our TeleOP integrates numerous innovations and optimizations to create an efficient, powerful, and easy-to-use driver structure. We use a Tank drive system to control our drivetrain, which allows the driver to control each side of the robot's wheels via a respective joystick. This is paired with smooth strafing integration using the joysticks' x-axis to create a driving experience that can easily be committed to muscle memory. Our manipulators are controlled in a way that minimizes the driver's fine motor movement by tying controls commonly used in conjunction with each other together. The most notable use of this physical optimization is the union of the shooter and conveyor. Although these two are bound to different motors, they can be controlled in conjunction with each other using a singular button.



Autonomous

In addition to our physical optimizations, our robot boasts a series of programmatic optimizations. To account for minute flaws and environmental changes that can occur on the field, our robot has a corrected drive system with a PID loop capable of moving the robot in its intended direction regardless of any kind of physical failures the robot endures. The drivetrain can lose anything from a single bolt to 2 wheels and still operate correctly during the autonomous period. Our program is also heavily abstracted, meaning it is simplified into its most elementary use cases with the use of functions. This allows everyone on the team to have a basic understanding of the robot's code and modify it if the programming team is absent from a meeting or competition. Furthermore, our code is uploaded and stored in a git repository that contains guides and directions for modifying the robot's configuration, the robot's code, and more.





Team Goals

- Make a custom chassis through CAD with mostly custom parts for our manipulators.
- Help our six new freshman teams with mechanical and notebook, so they have a chance to make it to the state competition.
- We want to prepare in advance for our interview, so we can show gracious professionalism.
- Thank First Responders and Medical Staff for working through the due course of the pandemic.
- Our main end goal is to make it to the state competition.

MENTORS

MENTORS	RELATION	OCCUPATION
Mr. Welsch	Mechatronics Teacher	Lead Robotics Coach
Mr. Mathis	Mechatronics Teacher	Robotics Coach
Mr. Ewers	Adam's Dad	Mechanical Engineer
Mrs. Ewers	Adam's Mom	Accountant
Mr. Balasubramaniam	Vishali's Dad	Software Engineer
Mrs. Chadalavada	Aniket's Mom	Software Engineer
Mr. Kline	Greyson's Dad	Highschool Math Teacher
Mr. Vanga	Rahul's Dad	Software Engineer
Mrs. Vanga	Rahul's Mom	Quality Analyst
Ms. Patrick	Joshua's Mom	Nurse

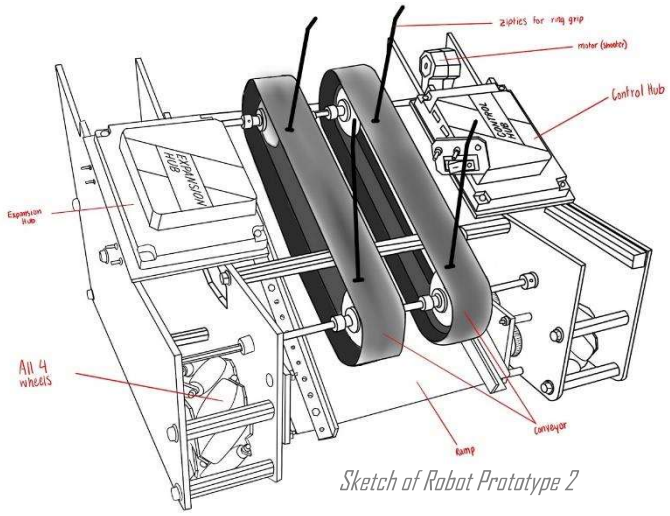
This table above is a list of mentors that have helped us so far this

OUR MENTORS

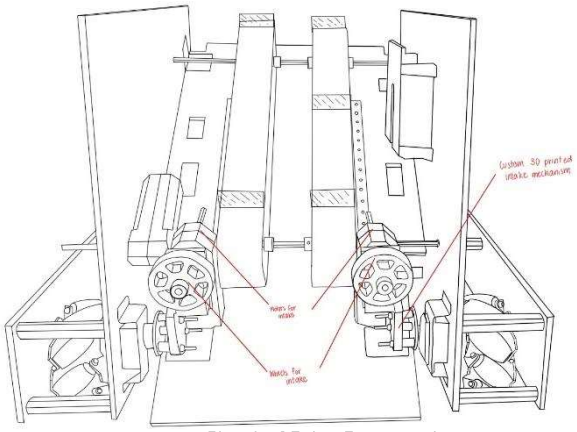
Everyday our team is connecting with our mentors in some aspect of robotics. Most of our interaction with mentors would be Mr. Welsch and Mr. Mathis since they are at every robotics practice. Both look out for the best interest of our team and help us get ready for competitions. Mr. Ewers has helped the team with the mechanical aspect of the robot when he suggested a change on the math for the shooter on the robot. Mrs. Ewers has helped the team look at the financials of the team, and she helped look over our team's business plan. Ms. Patrick has helped the team go over safety precautions when being around each other at practices. Mr. Kline did the same as Mr. Ewers in helping our team with calculations needed when 3D designing. He also helped Greyson 3D print some objects for our team such as a webcam mount and pulleys. Mr. Balasubramaniam, Mrs. Chadalavada, and Mr. Vanga helped our team in learning more about Java and different sensors such as a gyroscope. Finally, Mrs. Vanga helped our team with looking over what kind of structures our team should use on our robot. She helped us be convinced that polycarbonate would be better for us to use instead of ¼ inch plywood.

As seen above, our mentors help us in every part of robotics, and we would not be near as successful without their help. Many decisions would have been made that would have cost us time and money if we did not have their insight. For this, we make sure to thank our mentors every day for their help to us.

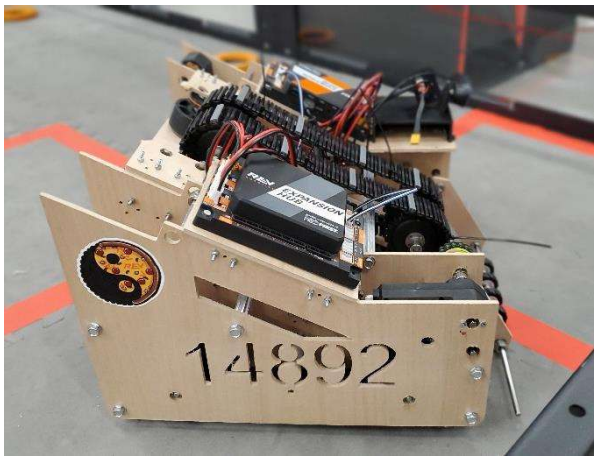
VISUAL DOCUMENTATIONS OF THE ROBOT



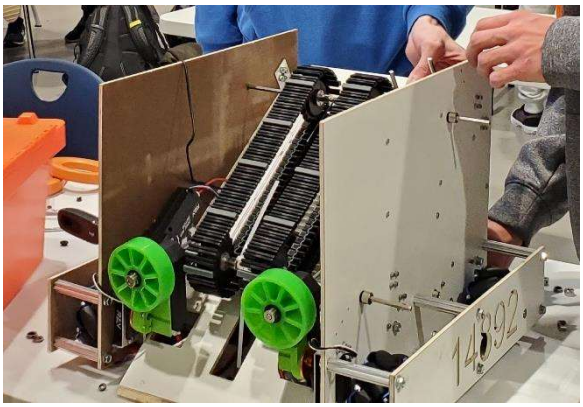
Sketch of Robot Prototype 2



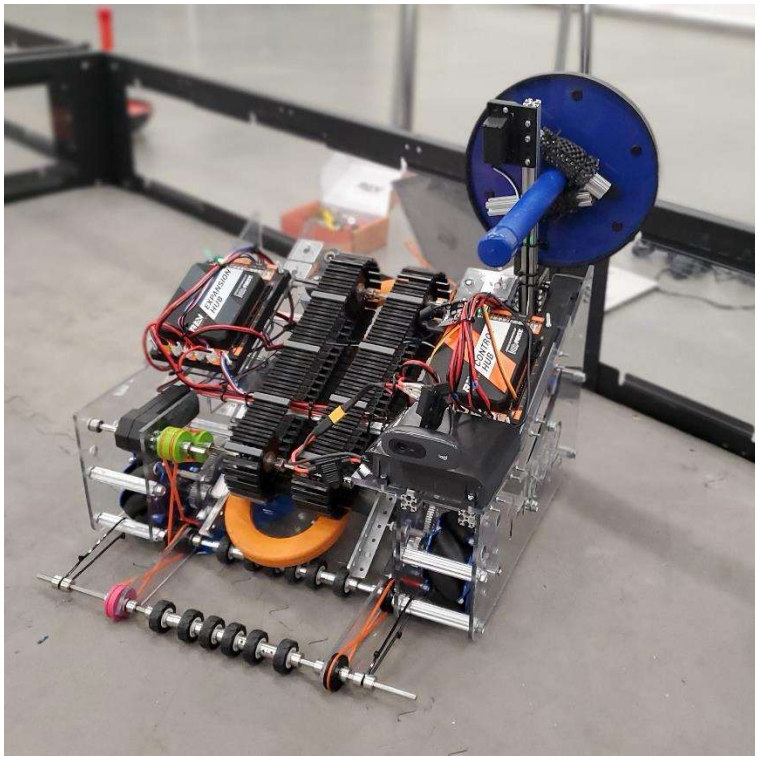
Sketch of Robot Prototype 1



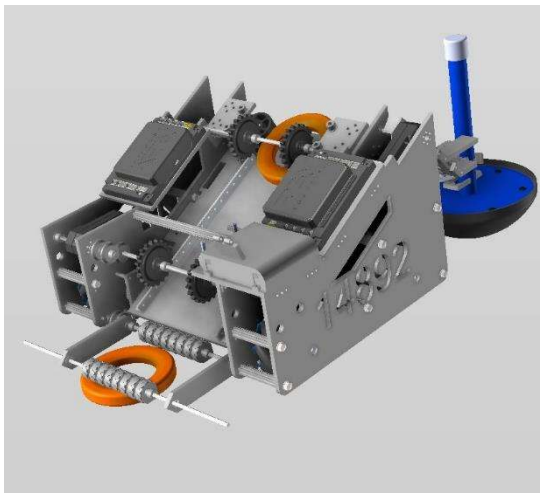
Robot Prototype 2



Robot Prototype 1



Robot Prototype 2 (current robot is the same design with different frame material)



CAD Design of Robot Prototype 2

OUTREACH

Outreach is a large part of who our team is. Our team enjoys being able to get together to help our community and other teams at our school. Covid-19 has made it very difficult for us to go do more outreach, but we still tried our hardest to find ways to connect with our community.

Card Outreach

Greyson, Adam, and Vishali all wrote outreach cards for first responders who have put their lives on the line to take care of people through the pandemic. We also wrote to sick children in the hospital over Christmas.

Marvel Academy (tutoring)

Vishali volunteers every Friday morning at our school to help other students at our school who need help in a specific subject. With being in honors classes, Vishali can help almost every person with their homework or studying for a test or quiz.

Helping Other Teams

Our entire team is in our second year of FTC, so we are always helping first year robotics teams or Freshman with their robot design, programming, or portfolio. Adam made multiple presentations at the beginning of the year for all the teams about robotics and how to succeed throughout the season. One of the presentations was about how to succeed in the interview process of the Regional Tournament.

The World of First

On April 1st, our team hosted an online meeting talking about FIRST robotics. We talked about our team as well as the main overview of FTC. The main purpose of this event was to get kids and adults involved in FIRST.

Media Outreach

Our main source of social media is our Instagram. We have gained over 200 followers this year from last year. We have a total of 865 followers on Instagram, and we reach out to other teams with helpful insight and outreach opportunities. An example of this is when we reached out to other teams through Instagram over the summer to make a video for First Responders saving people from Covid-19. There were over 100 teams involved in total for the video.

Middle school Vex IQ

Adam is a mentor to three middle school robotics teams at Vickery Creek Middle School. He went to a couple of their practices to help them prepare for their upcoming competitions. At the practices, he would help them with programming issues and robot designs.

Meals by Grace

Adam and Vishali have delivered and prepared meals to multiple families on a couple of occasions in the fall of 2020. During this hard time, multiple families need food for their families.

Video of FIRST

Our team worked with a bunch of other teams all over the nation to make a video as tribute to FIRST.

Automation Direct is a huge sponsor to both our school and the FIRST program. Our robot consists of multiple parts from Automation Direct.

Another huge sponsor is REV robotics. Multiple parts of our robot are made of REV parts including the expansion hub and the control hub.