



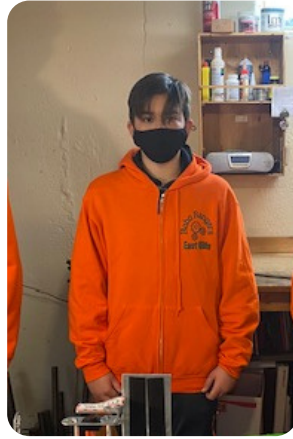
Engineering Portfolio



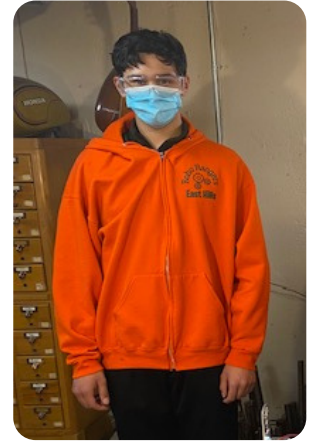
Meet the Robo Rangers



“ I'm Rohit Bhattiprolu. I'm 13 and in 8th grade. I work mostly on coding for the team. Outside of robotics I like to go on bike rides, play the guitar, and am interested in space industry. ”



“ I'm Naveen Pullukat. I'm 14 and in 8th grade. I've been a part of FIRST for 7 years. I am a Boy Scout and I also like to play baseball and video games. I'm on the build team and am the driver for Robo Rangers. ”



“ I'm Lucas Kissoondial and I'm 14 and in 8th grade. I'm on the build team and outside of Robotics I like to work on 3D printing and 3D modeling. I also play on my school's baseball team. ”



“ My name is Magdalena Leonard and I'm 13 years old. I spend most of my time on the build team for Robo Rangers. When I'm not at Robotics, I love doing crafts! ”



“ I'm 14 and in 8th grade. This is my first year in Robotics and I love it. Even when I'm not at Robotics, I love to program and use different computer software. ”



“ Hi, I'm Will Harber. I'm 14 and this is my first year participating in FIRST. I'm on the build team. I also play and referee soccer, play in the school band and also play piano. ”



A Robo Ranger in Brazil!

This season, we had a teammate who spent an extended time in Brazil. This posed a challenge for the team as well as allowed us to experience what it's like to work together as a team remotely, all while navigating time changes and communication issues!

Victor spent from October 25, 2020 to March 6, 2021 in his home country of Brazil and did school and robotics remotely. He enjoyed having 5 months with his extended family even though they couldn't see each other that much during COVID.

Sometimes Victor was able to Zoom with us during our Robotics meetings. He told us about the things he was doing in Brazil so we could catch up with him.

Victor used his time in Brazil to work on the Robo Rangers website as well as programming with Rohit.

The first time we tried to Zoom with Victor, we got confused with time zones and it didn't work. After that we were able to zoom with him just fine.

"When Victor and I were experiencing many technical difficulties with the phones we had one of us trying out new solutions, and the other testing those solutions out to prove that they worked." - Rohit



Overall, we realized it's much easier to be able to meet in person and it's difficult to participate in FTC virtually. We were thankful to be able to work with Victor while he was away and we think it was a good idea to allow him to work on the website as that was a task he is really good at and it can be done from anywhere!

"We communicated with him through Zoom and it was hard because there was a time change, and there were many times where we could not get in contact with him, and it was overall hard to do." - Magdalena



Understanding the Ultimate Goal Challenge

Once we understood the challenge, we came up with what components of the robot we had to build. We focused mainly on the donuts because they are reusable during the game and they could accumulate more points. We also focused on how to transport the ring from the floor to an angled launcher smoothly.

It helped to have last year's robot to start with because it saved us the time needed to build and program a chassis from scratch.

We knew we needed to have a shooter that shot out the rings. We used the chassis from last year because we knew the mecanum wheels would be useful for lining up shots. When the robot's wheels move in two different directions, the mecanum wheels will allow the robot to move side to side.

We decided the rings could be more important than the wobble goals. They can be reused and possibly scoring more points because there's more time to interact with the rings, so we chose to focus on those.



Goal of Team Meetings

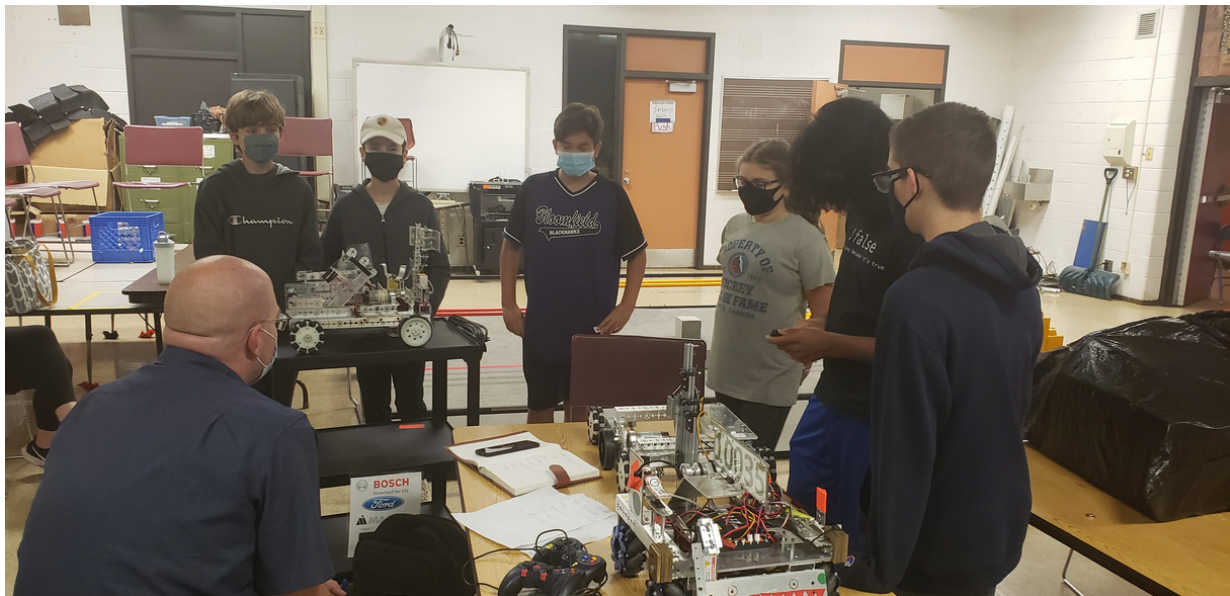
Every meeting we tried to accomplish as much as possible. We never knew if that was our last meeting for a while. At the beginning of the meeting we identified what we wanted to do, and we set about doing it. Each meeting, we had a goal of making progress on both building the robot and programming.

There were two main sub-teams, the programming team, and the build team. At the beginning of the season everybody was working on the robot, because there was not much to do programming wise. But later in the season we split into the two teams. The build team is responsible for building the robot, while the programming team is responsible for all the programming and wiring of the robot.

This team was pretty unique because 3 of our teammates had never participated in FTC. It was amazing how those members jumped right in, felt comfortable working on the robot and contributing ideas and solving problems.

Everyone worked together really nicely, we had 4 builders and 2 programmers. If we had a problem we would all try and solve it . We didn't have many disagreements because when we made a decision we all agreed on it.

Each meeting, we aimed to make a goal and plan for the day and reflect on our tasks and the outcome. **On the following page is a sample page from our engineering notebook.**



Entry from the Engineering Notebook



FTC #10035 Robo Rangers

Meeting Date: 10-03-20

Location: Lahser Shop

<input checked="" type="checkbox"/> Rohit Bhattiprolu	<input checked="" type="checkbox"/> Coach Leonard	<input type="checkbox"/> Mrs. Bhattiprolu
<input checked="" type="checkbox"/> Naveen Pullukat	<input checked="" type="checkbox"/> Mrs. Leonard	<input type="checkbox"/> Mr. Araujo
<input checked="" type="checkbox"/> Magdalena Leonard	<input checked="" type="checkbox"/> Mrs. Pullukat	<input type="checkbox"/> Mr. Pullukat
<input checked="" type="checkbox"/> William Harber	<input type="checkbox"/> Mr. Harber	<input type="checkbox"/> Lucas Kissoondial
<input checked="" type="checkbox"/> Ben Donnellon	<input type="checkbox"/> Mr. Donnellon	<input type="checkbox"/>
<input checked="" type="checkbox"/> Victor Araujo	<input type="checkbox"/> Mr. Bhattiprolu	<input type="checkbox"/>

Goals/Plan:

Take apart the old robot and start building the launcher system

Magdalena: Task

Took apart the old robot to leave just the chassis remaining and started to build the launcher system

Reflection

I think I did really well in building the launcher and taking apart the old robot

Rohit: Task

We took of all the modules on last years robot and the slapper on the demo bot. We also started to take apart the slapper.

Reflection

I feel like we completed a lot.

Ben: Task

I helped take apart the "elevator" and which picked up the stones last season. I also helped take apart the "guillatine" which was used to pull the platform last season. I also helped with the wheels and took them apart and then reassembled them.

Reflection

That I think I approved a lot when it comes to using tools and wrenches .

Victor: Task

We started taking off the old robot and did plannings for the slapper and we advanced on our concept of the launcher.

Reflection

We advanced our concept on the launcher for the rings, we started taking our old robot parts and reusing it on the new one.

Will: Task

I started to design the picker upper for the rings

Reflection

I think I could have done some things faster

Naveen: Task

I switched out a gear

Reflection

I did pretty ok

Lucas: Task

We designed a way to collect the rings.we packed away the old course.

Reflection

We failed to download fusion 360

Reviewed by:

Magdalena Leonard

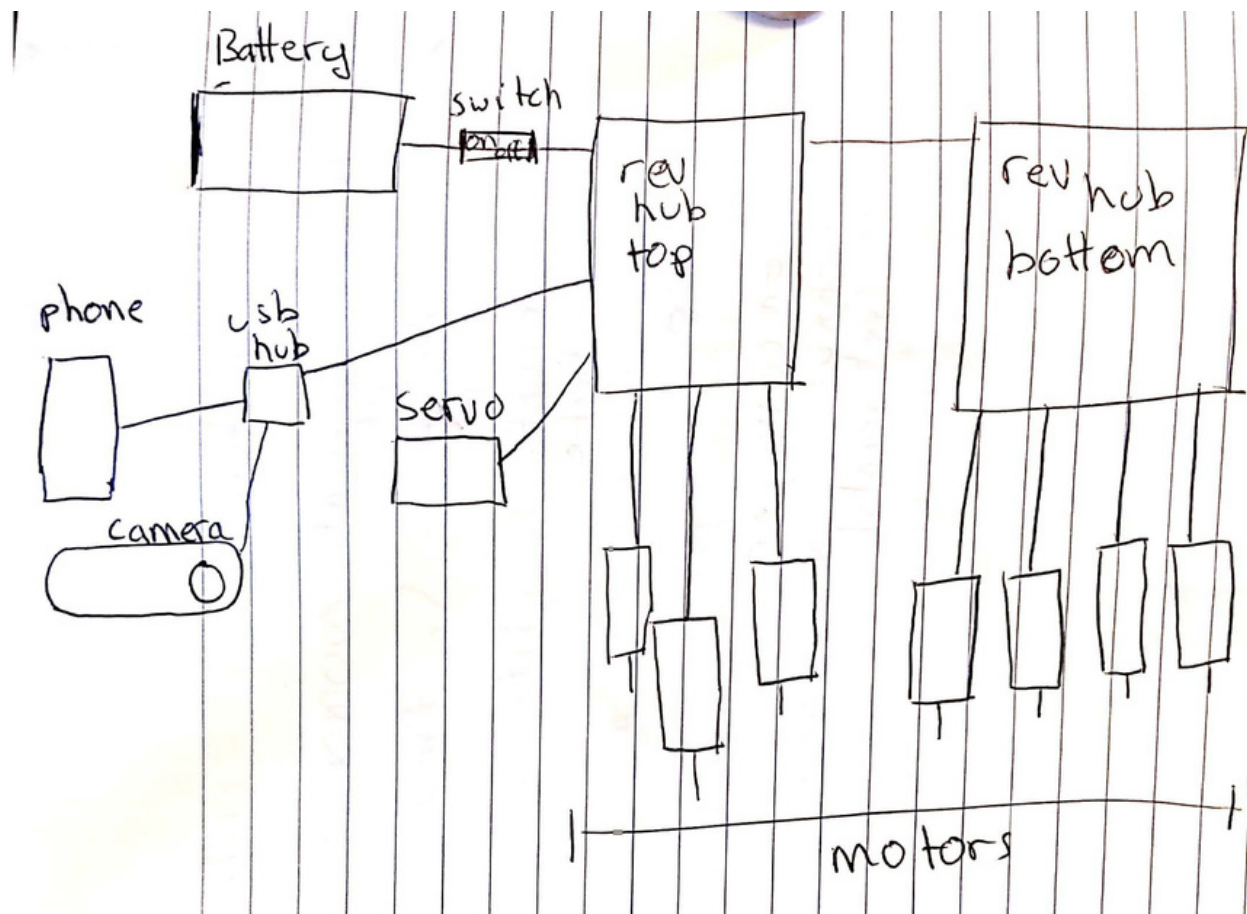
Design & Prototype

At the beginning of the season, we brainstormed many concepts for picking up rings and transporting them to a shooter and how a ring launcher would function.

The conveyer and launcher was a module that is separate from the chassis and mostly independent.

Our first prototype of our shooter was much different. It used 1 motor, 1 chain and 3 gears. One wheel would be spun in the inside of the chain and the other one was spun on the outside.

We made our prototype out of cardboard to give us a decent idea of what our robot would look like.



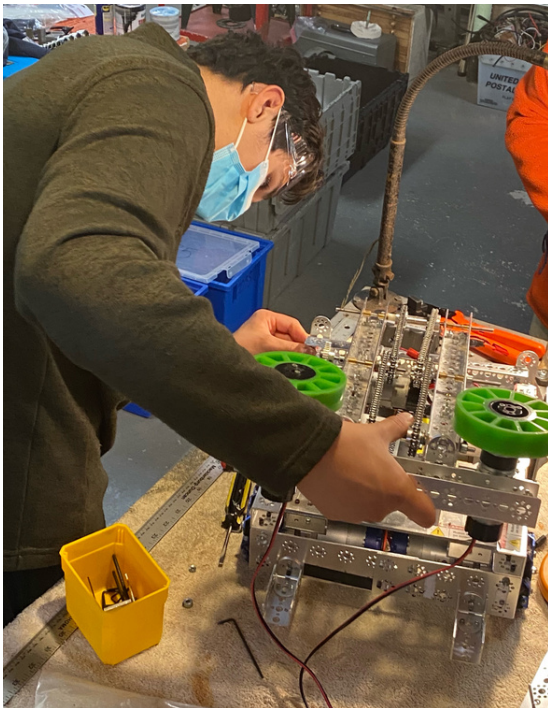
Robot Build

We first came up with concepts that would include essential parts of the robot and narrowed our options down before choosing the design we found best. In the middle of the season before we had a big 'break', we built and assembled the components. At the end we optimized our size and made our systems more efficient.

Our robot has special wheels called mecanum wheels. They allow the robot to strafe to the left and right. It has a conveyor belt that transports the rings from the picker-upper to the shooter. The picker-upper acts like a pancake flipper to pick up the rings and place them on the conveyor belt. The shooter is comprised of two motors that shoot the ring out.

Our robot has two motors and two wheels for the shooter. The two wheels spin to launch the rings. We started with our chassis and built separate parts like the conveyor belt and the shooter.

We drew out our ideas on the whiteboard so we had an idea of what we wanted to do for our robot, and we had people split into different groups so the build was more organized.



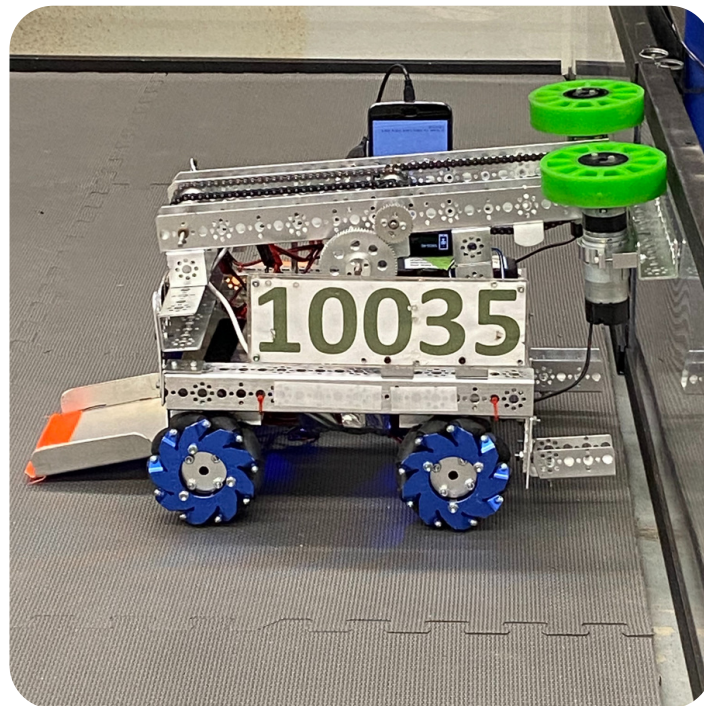
Introducing Our Robot!

Our robot uses a mecam-based chassis with 3 other major components:

- The first component is the scooper and flipper that scoops up and flips donuts onto our second component, the conveyer belt.
- The second component is conveyer belt, which uses 6 gears, 4 chains, 2 C-channels and one motor. It moves the donuts and feeds it into the shooter.
- Our shooter is the third component and that uses 2 wheels with each being powered by a DC motor. It shoots the donuts into the goals.

Our robot has a launch system that launches the rings high and far. To start the process that transports the rings, a 'pancake flipper' scoops the rings off the ground, then rotates via a servo, to flip 180. The rings lift and are brought onto a conveyer belt, comprised of 2 pairs of chains that feed the rings into the shooter. The shooter is made of 2 motors on either side of the conveyer belt that have wheels horizontally. They spin in a way that makes the discs launch out quickly.

The conveyer ring launcher are mostly separate from the chassis. They were built separately and are only connected at 2 points near the base because the launcher-conveyer system are at an angle.



Programming Team

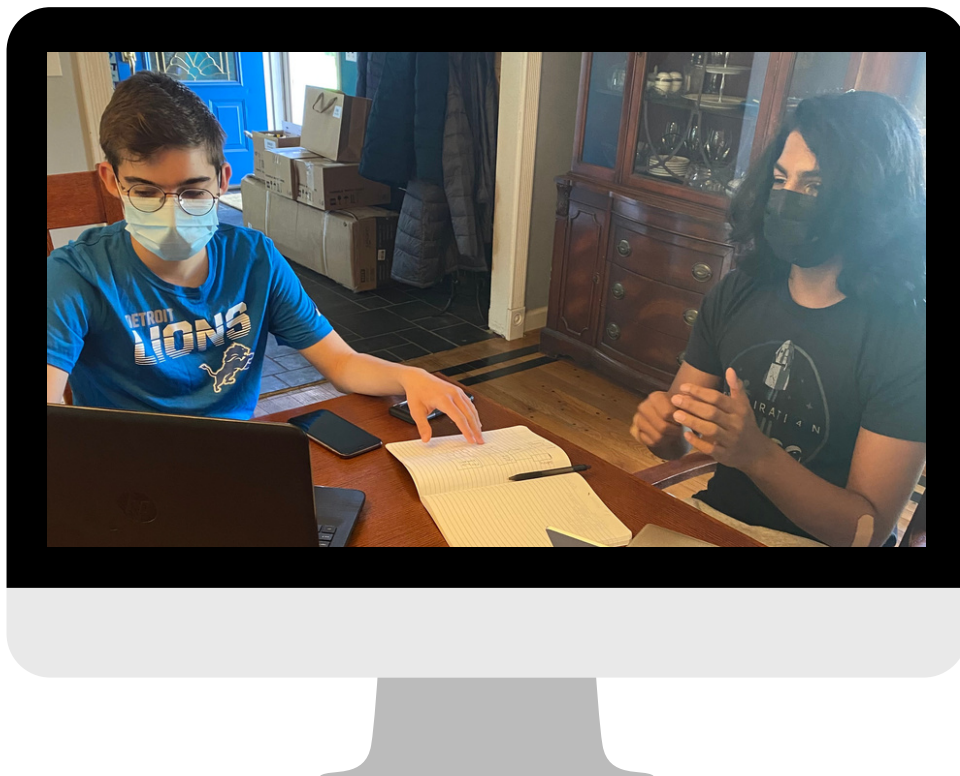
Because we had the code from last year, and the same chassis, we kept the same program for the basic movement of the robot.

We had a huge starting off point for programming. We then worked on the ring recognition. We took a sample program, and changed it to fit our specific needs, and got it to somewhat work, although there were still some bugs to work on.

Then we wrote all the programs necessary for the main components of the robot to work.

Next we had to work on the wiring of the robot. We had to make sure that everything has its own port, and that we connected our rev hubs properly, because we had two of them.

For the autonomous program, we took our code from last year and made an autonomous template program in order to help set up the basics of an efficient autonomous program.



Challenges Encountered

We never lose, we either win or learn

The Robo Rangers are always up for a challenge. Our goal is to learn. This season we encountered so many challenges. We accepted these challenges and persevered.

1. As we mentioned before, we had a teammate that worked with us from Brazil. We figured out how to communicate with him virtually and came up with an idea of how best he could contribute to the team while away.
2. Our school district relocated our team's meetings from a really nice workshop with tons of tools, to our middle school. So, most of the season, we didn't have access to tools we needed. So, instead of using the tools as we normally would, we had to find a new part to be able to do what we needed.
3. Of course COVID-19 was a huge obstacle for us. Our season was postponed in the middle and it was difficult to have meetings cancelled throughout the season. It was a challenge to plan the season when we didn't know when we could meet.
4. For us, the 18"x 18"x 18" rule was a bit of a challenge because we had to cut down on a lot of things to fit into the space limit.
5. When building the shooter, one of the motors made the robot exceed the 18"x 18"x 18" size limit. We had to move the motor that was exceeding the limit to another area on the robot.
6. We also encountered a challenge when we could not figure out how to attach our launching mechanism to our robot. We overcame that challenge by finding parts that we thought could work, and finally coming up with an idea to attach it.
7. A challenge, but also a favorite memory of this season was when Victor and Rohit got the ring recognition program working. This feat had felt so out of reach in the past, and finally being able to accomplish it felt great.
8. When we had an obstacle, we decided as a team what the best option was and then moved forward and began working on that option. This allowed us to keep moving with less friction amongst the team.



Robot Reflection

Will

“ I like that our robot is simple, functional and consistent. If I could change something, I would make the conveyor-launcher module's angle of elevation adjustable. ”

Naveen

“ If I could change something about the robot it would be the size. If it was smaller, it may have been faster. ”

Magdalena

“ I like the launching system that we have. If I could change anything, I would change how we pick up the rings. ”

Rohit

“ I would make the robot more compact, and have some other mechanism to pick up the rings. I don't think that that mechanism is the most efficient. I like the way we are shooting the robot, and the fact that we are using a webcam to recognize the rings. ”

Lucas

“ I like the robot so far. I like the design because it's different from other teams. One thing I would change is to make it pick up rings faster. ”

Victor

“ I really loved programming the robot. If I could change anything about it, I'd make it more of a wireless system with small batteries. I'd also reduce the size and weight of the robot. ”



Our New Skills

This season we learned how to use technology for remote meetings, and to be united as a team during all of the stuff that happened through this time, and to finish what we start.

This Ultimate Goal challenge allowed us to learn more about different parts such as chains for the launcher and the conveyer belt and about different tools like a chain breaker.

One new member said "I learned how to use basic, universal building blocks to build something with a specific purpose, made up of individual and interlocking functions".

COVID-19 forced us to learn how to build in a more efficient manner. We learned to appreciate the time you have, because it was very hard to build the robot with the limited time and resources that we had.

We learned to think outside the box when our meetings were relocated to the Middle School. We didn't have access to the tools we were accustomed to and that made it difficult, but we feel proud we could come up with alternative ideas.



Outreach

The Robo Rangers have a strong outreach history. The Robo Rangers mentor FLL Explore Team, Magnetic Eagles. We were able to teach the basics of programming in four half hour sessions. Watching them see what they did work was very rewarding.

Each year, we strive to spread the word about FIRST. In year's past, the Robo Rangers collected gently used Lego pieces to assemble kits for every first grader at a nearby school. The kits would come with information about how to join a FIRST team! The Robo Rangers deliver these kits themselves to amazed and grateful kids! Unfortunately, due to the COVID-19 pandemic, we had to pause the collection of Lego pieces and postpone the delivery of the kits. We look forward to completing this outreach project at the appropriate time.

This year, we continued our tradition of sponsoring a foster child's Christmas. We coordinated a fundraiser through Expedition Soap Company and raised funds through our friends and family. We then partnered with Operation Good Cheer to purchase a teen boy's entire wish list!

"I feel great about getting the teenager everything on his wish list, we talked about how we have so much, and others have so little." -Rohit

"I did talk about it with my friends. It made me feel very good that we were able to buy the teenager everything on his wish list in order to make Christmas a happier time for him." -Magdalena

"My mom and I wrapped up presents for him and it makes me feel good that he now has better things." -Naveen

Operation Good Cheer SM
"Making Christmas wishes come true"



Season Reflection

What we liked about this season:

- This season was more relaxed; it was not as stressful as previous seasons. This season felt like a break compared to other ones.
- We used our sessions wisely. At one point, we were able to finish the robot quickly in just two meetings.
- We were so thankful to be able to even have a Robotics season during this weird year!
- Even though some of us had participated in FIRST, only two of us had been on a team together before. It was great to meet new people!

What we didn't love about this season:

- This season was not as fun as in past seasons due to the COVID-19 pandemic.
- Having long pauses in between the season, it made it hard because we lost valuable time to work on our robot due to the COVID cases getting worse, which caused the pause to begin with.
- We had extra challenges of moving shop locations mid-season and that put extra stress on us as a team.

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