

Infinity Tech: Team #13684

Creating An Infinite Stream Of Technologists

Infinity Tech's 2023-2024
Engineering Notebook

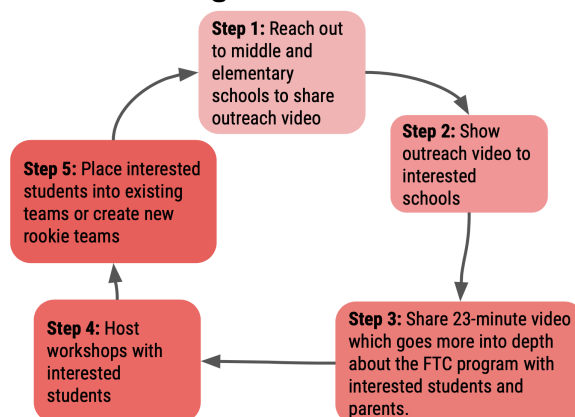
Hello, Namaste, C à o, Guten Tag, Hola, Shalom, Aloha, Zdravstvuyte, Konnichiwa, Salut, Ellohay, Kumusta and Nihao! We are Infinity Tech (Team #13684). Welcome to our Engineering Notebook!

We are a team of middle schoolers from the Plymouth-Canton community. The majority of us go to East Middle School, a school in Plymouth, MI, but some go to Liberty, Pioneer, and West Middle School. Our journey started in September 2017 when our founders went to a meeting where they watched a presentation about how FTC worked. Soon after that, our team was formed! **Currently, the team member count is 11 students and 8 mentors, plus our robot (robot name).** We are now on our sixth season of robotics and have been to ten competitions. In this notebook, you'll find brief biographies written by our team, our design process, our outreach and fundraising, and much more!

Exposing the world to FIRST

In 2017, we were the last middle school in the Plymouth-Canton School (PCCS) district to establish a team. One year after the COVID pandemic, we were the only team left out of the 10 teams that had been associated with Plymouth-Canton Community Schools! After the pandemic, we helped create 3 teams by sending informational videos to middle schools and 5th graders, hosting robotics workshops, and connecting them to the high school teams FIRST's coordinator. We are currently 1 of 7 FTC teams associated with the PCCS district who are competing this year. Our goal is to keep Infinity Tech going after we graduate from middle school as well as sustain robotics in PCCS and our community. We hope we help expose FIRST robotics at schools by mentoring at Galimore elementary school's robotics club, sending an informational video to elementary schools and middle schools across the district, and hosting and/or helping at community events like Robots in the Park.

Growing Robotic Process



How does our team solve design problems?

We try to face problems together. Infinity Tech brainstorms ideas to fix problems and prototypes before actually building them. New ideas bring our team together, and each member of team Infinity Tech is proud and happy to be working on building, programming, business, or design. We ensured everyone had something to do even if people had to share jobs.

Infinity Tech sets an agenda for most meetings. We also have a kanban board of the tasks and goals we need to finish by the end of the week, depending on our priorities. If we don't finish a task, a small group of people will complete the tasks during the next meeting or before we meet again. Issues are not anything to panic about; we always work on the problems calmly and carefully by writing on whiteboards, discussing, and testing our hypotheses. Every problem we face makes our team stronger.

Make a one pager of kids reached, teams created, service hours

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Part A

Introductions

In our introductions, you'll find the following:

1. Individual teammate biographies
2. Mentor Bios

Team Biographies



My name is Kabir and I am in 8th grade at East Middle School. My hobbies are playing video games, going outside, and coding. My favorite part of robotics is coding (I'm learning it right now)! I am a part of the programming and building teams. I joined robotics because we get to do fun things like building a robot and coding.



My name is Karthik and I am in 8th grade at East Middle school. My hobbies are video games, soccer, and playing trumpet. I am on the build team. My part of robotics is building the robot and learning about how to build. I joined robotics because I really enjoy robotics from years of FLL and FLL Jr.



My name is Edison and I'm in 7th grade at East Middle School. My hobbies are video games, cross country, reading, and golf. I'm on the business team and building team. My favorite part of robotics is seeing the robot go from design to reality. I joined robotics because I like to see how to youth of today can affect the future of technology



My name is Neha and I'm in 7th grade at East Middle School. My hobbies include reading, biking, and playing the piano. I am on the building team. My favorite part of robotics is: building because it helps you bring an idea to life. I joined robotics because I wanted to be part of a team that created a machine that could execute what was necessary.



My name is Himani, I am in 7th grade at Pioneer Middle School. My favorite things to do outside of school are playing sports like basketball and soccer. I also enjoy reading and going on walks. My favorite part of robotics is that you can build stuff and program it to do anything you want. I wanted to be a part of robotics because I like building stuff and wanted to do it with a team.



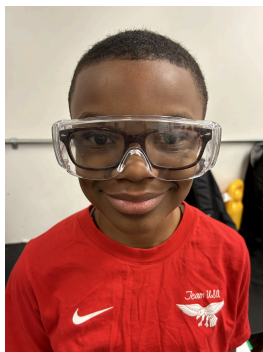
My name is Donovan and I am a 7th grade student at Pioneer Middle school. My favorite activities are playing basketball, soccer and looking at expensive new shoes to buy. My favorite part of robotics is building, improving the robot and doing the math to find what we need to do to improve our robots, such as finding the gear ratio to help our motor work better. I wanted to join this team because I want to enjoy the experience of working with a team building robots.



Hi, my name is Vasmitha and I'm an 8th grade student at Pioneer Middle School. My hobbies include swimming, public speaking, playing piano, and hanging out with my friends and family. My favorite part of robotics is being a part of the business team and learning new things at almost every robotics meeting. It's so fun! I wanted to join robotics because I wanted to learn something new and I am interested in working with robots.



Hi, my name is Bonnie! I am a 6th grader at East Middle School. I like to read, write, crochet, and listen to music. My favorite part of robotics is working with other people to get stuff done. I wanted to join robotics because I wanted to meet new people and learn new things!



Hi my name is Parker. I am a 6th grader at West Middle School. I like to play games and do fencing. My favorite part of robotics is building and driving. I wanted to join robotics because it looked fun. I am on the building team and I'm good with screws.



My name is Zane and I am an 8th grader at East Middle School. I have many activities such as swimming, piano, programming for myself, and robotics. My favorite subject is math and I am very good at it. I have a younger brother which I enjoy hanging out with. In my spare time I play soccer and basketball as well as hang out with friends and make my own games by coding. I enjoy

robotics and I program for my robotics team.

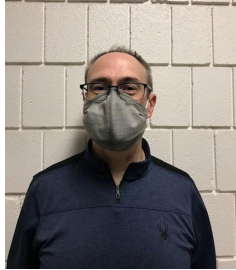


Hi, my name is Aarav and I'm an 8th grade student at East Middle School. My hobbies include swimming, listening to music and playing with my friends. My favorite part of robotics is helping in a way. I wanted to join robotics because I like coding and I wanted to code a robot again.

Mentor Biographies



I'm Eddie and I'm a Sr. Safety Regulatory Engineer working on automated vehicles, crash avoidance systems, and alcohol detection research and regulatory cooperation with the federal government. I enjoy spending time with my family, traveling, snowboarding, golfing, rock climbing, and Tae Kwon Do. I am a founding member of Infinity Tech, co-coach of the building team and the mentor for the business team. I have been coaching Infinity Tech for 5 years.



I'm Eric and I work for Ford Motor Company as the Competitive Benchmarking Manager. I have Bachelors and Masters Degrees in Mechanical Engineering. I enjoy spending time with my family, learning about technology, home improvement projects, and photography. This is my third year mentoring with Infinity Tech.



I'm Kanthan and I'm a Senior Engineer at Airflow Sciences Corporation, an engineering consulting company specializing in fluid dynamics. I have a Bachelor's degree from Malaysia and a Masters Degree in Aerospace Engineering from the University of Michigan. Go Blue! I enjoy soccer, reading, and traveling with my family. This is my second year with Infinity Tech, and I am the programming mentor.



I'm Angela and I'm an Attorney and fund developer for community organizations. I have a Bachelors in Business Administration Information Systems and a Masters Degree in Organizational Management. I love the fall for football, apple picking, and great soups. I enjoy reading, camping, traveling, and spending time with my family, but most of all coffee makes me happy! This is my first year with Infinity Tech as a business mentor.



I'm Hina. I work for ThermalFisher Scientific as a Clinical Trials Monitor. I have a Bachelors and Masters Degree in Medical Biotechnology and Clinical Research respectively. I enjoy cooking, traveling, and spending time with my girls. This is my first year with InfinityTech.

Part B

Outreach and Fundraising

In this section you will find:

- **Field Trips**
- **Mentoring**
- **Fundraising**
- **Recruiting**
- **Outreach**

Outreach Done in the Past

2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
• Demoed for the Dodson FLL team • 6th grade orientation presentation • Got our first sponsors	• Mentored Dodson and Gallimore elementary robotics teams and demonstrated with our robot • “Robots in the Park” booth	• Presentations at East’s feeder schools • “Robots in the Park” booth • Field trip to University of Michigan • Sponsor Visit	• We went to Caresoft in Livonia, MI • The pandemic made outreach difficult	• We went to Caresoft • Sent a video to the homerooms at Liberty Middle School to get people into robotics



What We Did/Plan This Year

Workshops

Growing Robotic Process

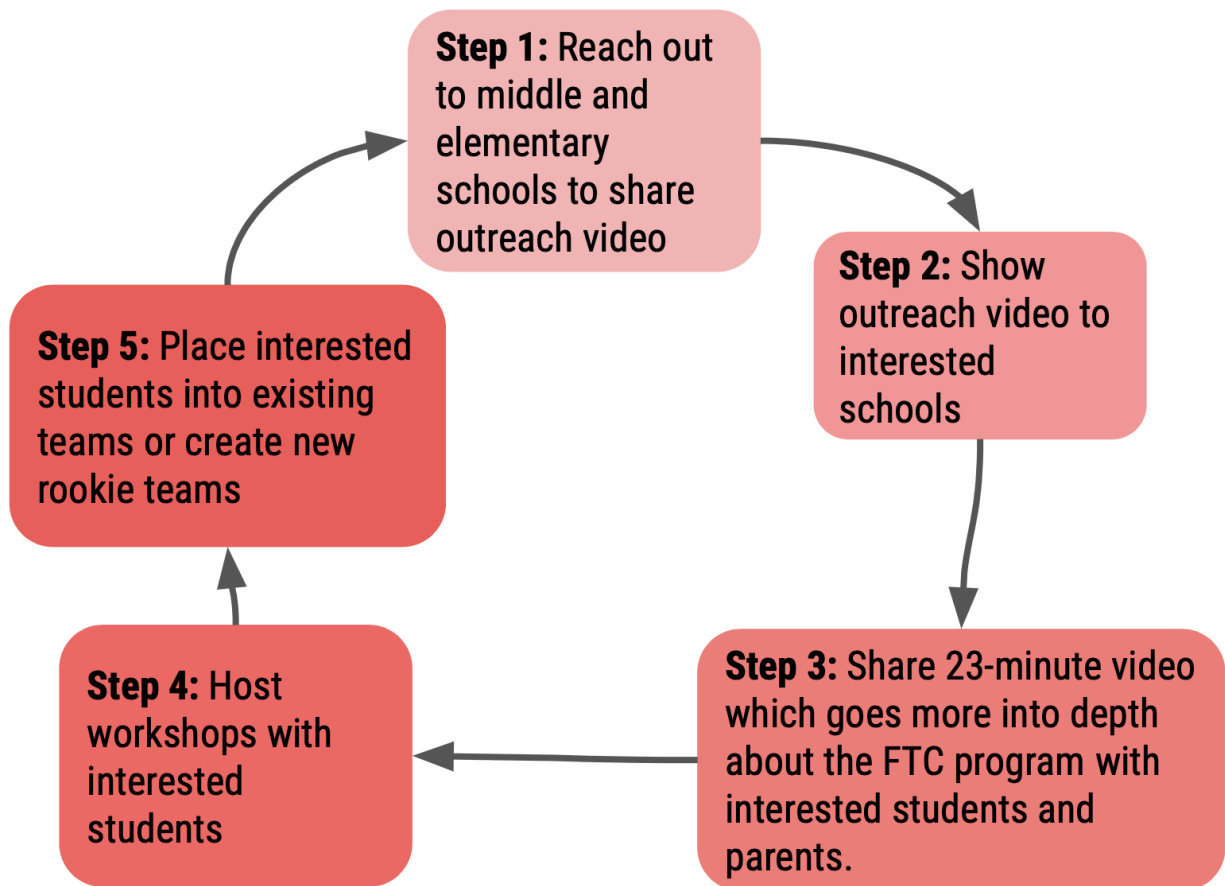


Figure A. Our process to grow robotics in PCCS

We hosted another workshop this year. In the past the mechanism (pincher-claw) the students built took too long and was too complex to build. So we made a mechanism that looks like a golf putter, which was much simpler and students could program it with a servo programmer. They also drove the robot and it was a very successful event! We are continuing to work and refine our workshops and plan to make them

short and hopefully host at least one more this year, maybe directed for elementary schools and use the EV3 robots we have.

Replace pictures

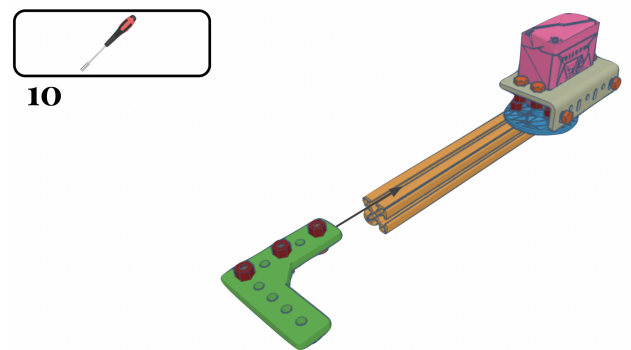


Figure B- Pincher Claw Instructions

Provide parts to teams

Some teams disbanded due to Covid. Some of the teams had extra parts, and supplies, so we picked up those parts from the schools and we split them up between rookie teams. This included tetrix parts, tools, and business supplies.

5th Grade Roundup Robotics

When we were sending out an interest video to middle and elementary schools we noticed that there were no interested 5th graders despite sharing a video with almost all of the elementary schools. However about half of the interested students were 6th graders that we missed last year. Therefore these students missed out on a year of robotics and we wanted to fix this. We collaborated with Lightning Robotics (our FRC team) to host an event for 5th graders to get them interested in joining middle school robotics. In total ~60 students participated in the event from 13 different elementary schools. We had four activities for them: paper rockets (inspired by NASA), human coding and marble run (provided by Lightning Robotics) and robot driver's license (inspired by Dark Matter). We also shared a less serious info video than our normal presentation and we liked it a lot more because it was more engaging and shorter. 34 students signed up for a team after this event (about half of all interested students who want to join a team).



FLL Explorer Festival

3 of our team members attended the FLL Explorer Festival hosted by Lightning Robotics. Lightning borrowed one of our activities we used during 5th grade robotics roundup for this event!

Insert pictures

Girl Scout Robotics Exploration Event

Lightning Robotics invited us to volunteer at their Girl Scout Robotics Exploration Event. This event was for “Daisy” girl scouts (grades kindergarten and 1st)

Mentored 12 Gallimore Teams / Volunteered at Gallimore's Robofest Competition

The head teacher for Gallimore reached out to our team, inviting us to mentor the Gallimore Robofest robotics teams which are comprised of 4th and 5th grade students. We assisted the teams in programming and building. We also volunteered at the Robofest competition as judges, photographers, and proctors. In total we mentored 12 teams of 4-5 students.

Replace photos



50 States Outreach

We are currently working on meeting and discussing with teams across the nation via email and zoom meetings. In addition, we have sent out polls and discussed our processes with teams from Nevada to Hawaii

FLL Explorer Dodson Demo

Our team went to Dodson Elementary School (a school in our district) and did a demo for all four teams and let them drive our robot. We explained the next level, FTC to them, and showed how we are different and alike with them. Each team included 5-6, and inspired about 20 kids.

Lightning Robotics #862 (FRC) Mentoring Our Team

Lighting Robotics (our high school team) allows us to meet at the school and use their rooms and tools. They also provide us student mentors during our entire season. They also let us volunteer at some of their events like the Girl Scout event and FLL Explorer Festival. Many thanks to our mentors and team members of Lightning Robotics!!!



Bottle/can return fundraiser

We raised about \$270 worth of bottles and cans from friends, family, and others who were returning cans at the same time as us. We set up a bottle drive through our local Busch's grocery store. Thank you to all donors! We are planning on completing another bottle/can return fundraiser this year.

(Add more photo variety)



Recruiting

From our workshops and marketing videos sent to Plymouth-Canton elementary and middle schools, we had 32 applicants to our team in total and recruited 7 new students this year. We had an application and interview process to find the best possible people for the team. This helped our team know how to interview and gives experience to the students we interview. We wanted to have a mix of all grades to help in sustaining the team in the future. Those who did not make it on our team, we helped place them on new/current teams.

Starting New Teams

Update numbers

Before the pandemic there were ~10 FTC teams affiliated with PCCS, after the pandemic we were the only FTC left associated with the district. The past two years we have helped to start to build up the middle school teams and now there are 10 teams!

We edited the video from last year to make it be able to be used every year without any changes. So far about 102 students have reached out about being interested in robotics for this season since the beginning of December.

In total 112 new students were interested in FTC robotics through reaching out over social media and to the school district. We edited the video from last year to make it be able to be used every year without any changes. Then sent out a video to the middle and elementary schools for them to place in their newsletters early to mid-December. To our knowledge 17 of our 19 middle and elementary schools have responded about the video and have shared information about FTC robotics at school. From this alone we got 40 new students interested in robotics. Towards the middle of February we started to plan for 5th grade robotics roundup, which continued to spread interest in robotics with another 62 students interested. When school started back up, one of the middle schools placed our interest form on their website which brought in even more students! Out of the 112 students, 76 signed up to actually join a team. This is more than doubled of what we did last year! So far we have started 1 team with other students on a waitlist until we can get more mentors. We also worked with other FTC teams in the community who needed more students to continue their team.

2023 Kickoff Event

This year we hosted a 2023 FTC official Kickoff and around 130-140 people came. We had presented the Centerstage Kickoff Video and it was a good way to start off the competition. (Talk about presentations, pit examples, co hosted with Lightning Robotics)



Caresoft Event

Like last year, we visited Caresoft in Livonia and learned about benchmarking cars. We invited 2 of the rookie teams we created, but unfortunately they were unable to attend. 11 people from our team were able to attend the event. We learned about how they benchmark cars and use virtual reality (VR) to look at cars. We also got a tour of their facility.



Operations Manual

We created an operational manual for future Infinity Tech members to help them recruit new members and grow robotics in the Plymouth-Canton community. It is a process with templates/videos and shows how to reach out to schools to share a video, host workshops, and start new teams. (see Appendix A)

Webinar with Saurabh Gupta, co-creator of Astro (an Amazon Robot) and Dash and Dot robots.

Infinity Tech hosted a webinar with Saurabh Gupta who shared his experience with robotics and robots he has worked to create. We invited about 15 robotics teams in our area and a total 21 people attended. It was very enlightening to see what type of robots are invented in our world! (Insert pictures)

FLL Expansion

We worked with Lightning Robotics to grow FLL Challenge (4th and 5th grade level robotics) in our community since only one of our 15 elementary schools currently has the program. We helped host a informational meeting for prospective mentors, fill in

Peer Awards

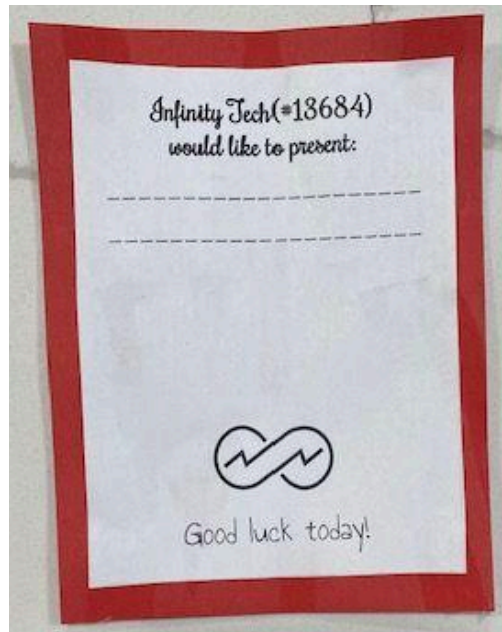
We give each team an award from our team, ranging from “Coolest Looking Grabber” or “Cleanest Looking Pit Area” to “Coolest Team Hats”. It’s one of our ways of showing Gracious Professionalism. We’ve brought

one along to our presentation.

In our rookie year, we got dead last in all our competition and no awards, but one team gave out awards. We got "Coolest Rear Wheels" and it meant the world to us that someone recognized our work. We wanted to spread that recognition, hence the making of these awards.

Examples of awards we are giving out this year:

- Best team name
- Team name with the Greatest pun
- Cleanest pit area
- Coolest swag
- Coolest rear wheels
- Coolest front wheels
- Greatest robot name
- Coolest rear wheels
- Funniest team name
- Coolest beacon
- Best giveaway
- Longest name
- Best shirts
- Coolest Intake Mechanisms
- Coolest looking robot
- Most complex robot
- The biggest robot
- The smallest robot
- Most decorated pit area
- Best team spirit
- Best looking cart



Bipedal UofM Robotics Lab

We visited the University of Michigan's bipedal robotics lab along with the Gallimore Elementary Battlebots (a FLL team in Plymouth-Canton). Our tour guide was Mehgna Menon and she gave a tour around the lab. We talked to Professor Ram Vasudevan, he showed us some of the robots that his class programmed and answered questions that we had. Afterwards, Mehgna showed us many robots in action and how one of their robots delivered a package. Overall, it was a really good and educational experience. (Insert pictures)

PCCS School Cleanups

We have been going to schools in our district and cleaning up litter. So far we have been to Liberty Middle School and collected two large bags. (Insert pictures)

Forgotten Harvest

7 of our members volunteered at Forgotten Harvest. We helped pack food into boxes and our shift packed a total of 7,648 pounds of food! (Insert pictures)

RoboRally

Infinity Tech hosted an event we call RoboRally. The purpose of this event was to host an Amazing Race/scavenger hunt that involved community/team building. We invited over 30 teams to the event, but due to many off-season competitions and it being summer time, many teams were unable to make it. We had a total of 16 participants, 4 teams, and 10 volunteers. This event took place on our high school campus and it was a lot of fun!! (Insert pictures)

Trinity Church Food Bank

44,355

Robots in the Park

Robots in the Park is an annual event hosted by Lightning Robotics every year. This day event takes place at Kellogg Park where kids can participate in STEAM event related activities and learn about the robotics program. This year they invited our 8th grade students to help plan the event as they transferred out of Infinity Tech to Lightning Robotics. On the event day, 11 of our members volunteered for both the morning and afternoon shifts. We let kids drive our chassis, had the robot on display, and gave kids robot driver's licenses.

Part C

Our Robot's Journey

In this section you will find

- Game Strategy
- Mechanisms
- Programming

Pre-Season

During the off season the build/business teams made LEGO-like building instructions for the wrist-hand grabber and the pincher claw. We used these instructions during workshops and trained new Infinity Tech members. These instructions were shared with FTC teams across the world.

Additionally, we have been building a catalog of mechanisms(Figure C) to both train and have ready depending on what our game strategy is for this year. We have built a GoBilda chassis with odometry wheels, wrist arm grabber, pincher claw, vertical intake, and 4-bar arm mechanisms.

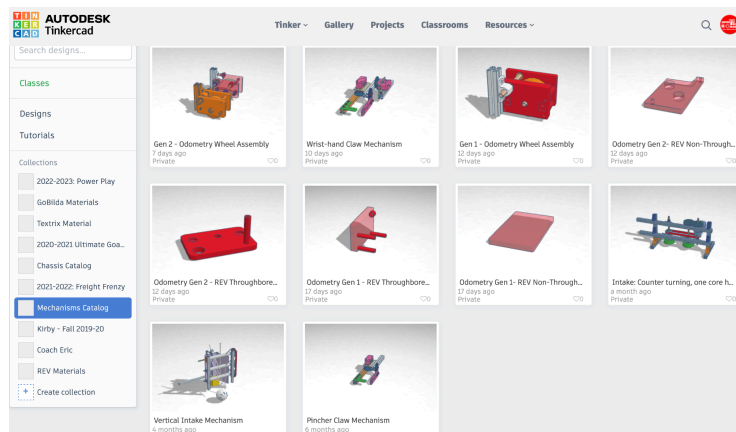
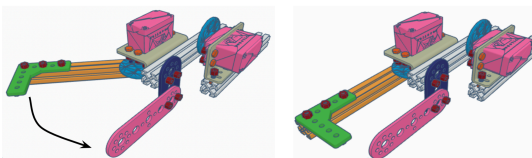


Figure C. Our mechanism catalog from over the years



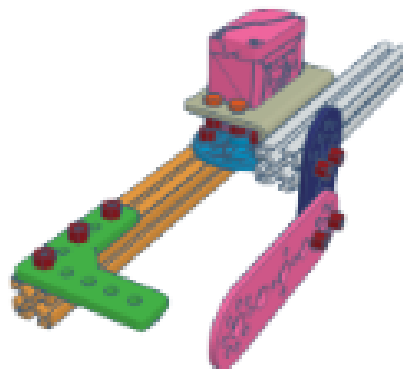
Wrist-Hand Grabber

Building Instructions



Pincher-Claw

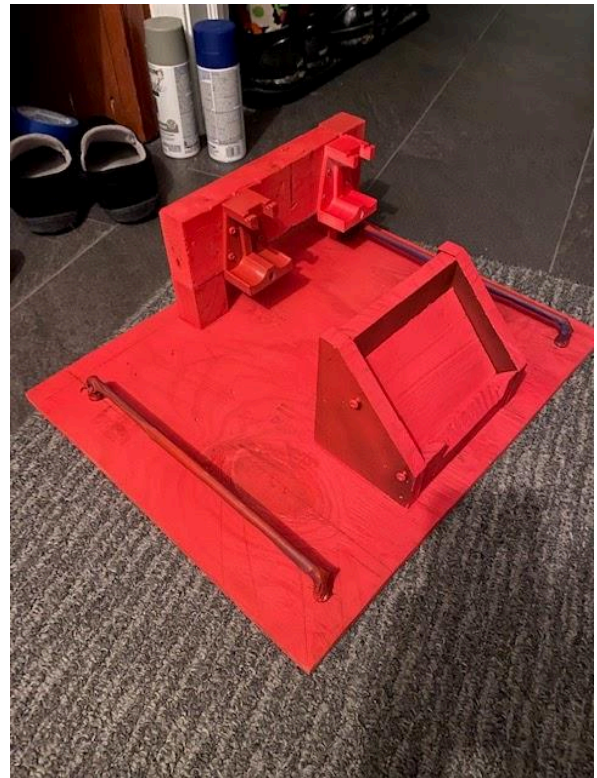
Building Instructions



Driver Station Tray

We designed a practical and soon to be team theme-related driver pad (Figure D) for easier movement between the pits to the driver stand during competitions. It will go with our space/rocket related theme by showing team spirit and out of the box thinking. It keeps the controllers, the driver hub, and the beacon from getting damaged when we are moving the equipment.

Figure D- Driver station tray



Game Strategy

The first meeting after the game came out, our team worked on game strategy and came out with the table [needs to be replaced]. Prioritizing the most important things to the least important.

Overall, we felt that with such an open field our top priority is our cycle time. In order to maximize our movement, we [hope] to create a robot under 12 inches so we can navigate under both the trusses and stage door. To maximize efficiency, we [hope] to move the least amount possible. To ensure stability, we made our robot the widest possible to compensate for its low height. By creating such a far reaching intake and outake, our strategy should maximize efficiency.

Scoring Achievement	Autonomous Points	Driver-Controlled Points	End Game Points	Comments	Priority (1=High, 3=L. low, one each per section)
Navigation: Robot Parked in Terminal or Substation	2	20	1	We plan to park based on the signal.	2
Signal: Robot Parked only on the Signal Zone that corresponds to the Signal Image	10			We've parked, but we want to try to make our own signal move because that is worth more.	3
Signal: Robot Parked only on the two Tiles that corresponds to the team supplied Signal Signal Image	20			A lot of points to park so this is one of the top priorities for the programming team.	13
Placement: Cone placed in a Terminal	1			Circles	4
Cone Secured on Ground Junction	2			Circles	7
Cone Secured on Low Junction	3	3	3	Place reason for low junction to circles.	6
Cone Secured on Medium Junction	4	4	4	Sec and highest points for junctions and may be easier to place cones on because it moves less.	8
Cone Secured on High Junction	5	5	5	The high junction is worth the most points and is a part of our circuit strategy.	9
Ownership: Junction Owned by Cone	20	10	3	We want to own as much junctions as we can because only one alliance can own each junction and helps us make a circuit or keep them from making a circuit.	10
Ownership: Junction Owned by Beacon			10	Competing with a beacon ensures that we own a junction and would be helpful if we are trying to make a circuit.	11
Circuit: Completed Circuit			20	We want to try getting a circuit or just prevent the other alliance from getting the circuit because it is worth a lot of points.	12
Navigation: Robot Parked in Terminal			2	We can score all four another cone instead of parking which is more points, so we plan to park only if we have 1 or 2 seconds left and don't have enough time to place another cone.	5

Building

Mechanisms

Chassis

By: the whole team

Quick facts and stats:

- **Motor count:** 4
- **Servo count:** 0
- **Sensor count:**

Hardest aspect of this specific part:

Why did we choose this design?

- We picked a goBilda chassis over the rev chassis we used last year because it is faster.

How does it work?

We have a goBilda strafing chassis this year.

Issues we encountered	How we fixed them

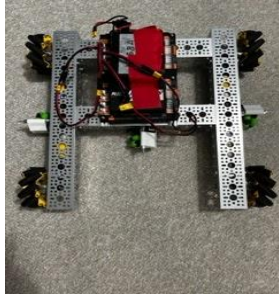


Figure G: Test chassis to learn how odometry pods work and work parallel with mechanical build team

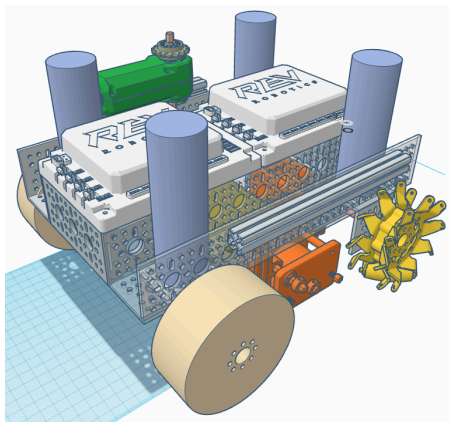


Figure H: Smaller 16" diagonal chassis with vertically mounted motors