Belen Jesuit Preparatory School

Wolverine Robotics
FTC Team 19442

2024-2025 SEASON

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Wolverine Robotics (19442)

Engineering Portfolio 2024-25

Team Introduction

Hello world! We are Wolverine Robotics, FTC Team 19442, from Belen Jesuit Preparatory School in Miami, Florida. Our team was established in 2021 as a group of eighth graders. As we have progressed, we have gained experience and practice in robotics and aim to continue shaping our team into the best version of itself. What sets Wolverine Robotics apart is our commitment to fostering a family-like environment where every member contributes their strengths, ensuring that success is a shared achievement.

Our Story

The Belen Robotics Club was founded in 2019. At the time we were a VEX Robotics Challenge team. When the class of 2021 graduated, the club faced a pivotal moment. With no leadership or mentors remaining, a new group of dedicated eighth and ninth graders stepped up to redefine the team, transitioning from VEX Robotics to FIRST Tech Challenge. We have organized the club to have an executive board, recruited new members to be in our club, gained significant experience in building robots, and even earned our club's first FIRST awards. As we progress, we aim to keep elevating the club to new heights and improve it for the future students who will join the club. As we continue to grow, we are driven by the belief that robotics can spark creativity, foster collaboration, and transform the world around us.

Team Goals

1. Gracious Professionalism: We strive to embody FIRST's core value of Gracious Professionalism by fostering respect, kindness, and teamwork both within our team and with others in the robotics community.
2. Learning Valuable Skills: Our goal is to continuously develop technical and non-technical skills, including engineering design, coding, collaboration, and leadership, to prepare for future challenges in robotics and beyond.
3. Mentoring Younger Team Members: We are committed to sharing our knowledge and experience with newer members, ensuring that they feel supported and confident as they grow within the team.
4. Outreach: We aim to inspire our local community by engaging in STEM outreach activities that promote robotics and FIRST's mission of innovation, collaboration and inclusivity.
5. Continuous Self-Improvement: As a team, we embrace a growth mindset, constantly seeking ways to improve our designs, strategies, and teamwork to achieve excellence on and off the field.

Team Awards

In our journey so far, we've been honored with several awards, including the 2023-2024 South Florida League Championship Design Award and the South Florida League Championship Finalist Alliance. These accolades not only recognize our technical excellence but also the collaborative spirit that defines Wolverine Robotics. Hopefully, in the future we can continue to excel and win more awards!

Team Roles

Our team operates as a cohesive unit, with each role contributing its unique expertise to create innovative solutions and achieve our goals.

Hardware Engineers: Santiago Felix-Padilla, Lucas V. Diaz, Oliver de Armas
Responsible for designing, building, and maintaining the robot. They use CAD software to create custom parts and ensure all systems are robust and competition-ready. Hardware engineers also collaborate with software engineers to integrate mechanisms seamlessly.

Software Engineers: Raul Gomez-Pina, Jose Zequeira
Responsible for developing and refining tele-op and autonomous code to maximize the robot's performance. They also test, debug, and adapt the software based on real-time competition conditions and team strategies.

Business Marketing: Pablo Castro, Alejandro Lurigados
Responsible for managing the team's public presence through the website and social media. They actively engage with sponsors, secure funding, and ensure the team is well-equipped for competitions.

Outreach Coordinator: Santiago Felix-Padilla, Jose Zequeira
Responsible for organizing and leading service initiatives that bring STEM opportunities to the community. They play a key role in mentoring younger students and fostering a love for robotics beyond the team.

Gracious Professionalism

Gracious professionalism is a guiding principle for Team 19442, Wolverine Robotics, shaping the way we work and interact with others. On our team, we incorporate gracious professionalism by fostering a supportive and inclusive environment where every member feels valued and encouraged to contribute their unique skills. During competitions, we prioritize helping other teams by sharing tools, troubleshooting technical issues, or providing advice to overcome challenges. Within our team, we emphasize collaboration over competition, resolving conflicts respectfully and ensuring that all voices are heard in decision-making. Additionally, we extend our commitment to gracious professionalism beyond robotics, engaging in outreach programs to mentor younger students, share STEM knowledge, and promote FIRST values in our community. By embodying these practices, Wolverine Robotics not only strengthens our own team but also contributes to the larger mission of creating a culture of innovation, kindness, and mutual respect.

Sustainability Plan

Since our rookie year in 2021, 19442 Wolverine Robotics has grown into a thriving team. Our mission is to ensure that the team's legacy extends well beyond the current members by creating a strong foundation of mentorship, recruitment, and knowledge-sharing. By fostering a culture of collaboration and innovation, we aim to inspire and equip the next generation of engineers.

Attracting New Members:

Club Fair:

Each year at the school's club fair, we showcase our robots and invite younger students to engage with them by driving or observing the technology up close. This hands-on experience sparks interest and helps us recruit enthusiastic new members.

Open House:

Recruitment begins even before students join the school, during Open House events. Rather than simply displaying our robot, we demonstrate how it is built and programmed. Prospective students and their families can see our teamwork in action and learn about FIRST's mission. We emphasize how the robotics club teaches not only technical skills but also collaboration, creativity, and problem-solving, making students more well-rounded individuals.

Mentoring Younger Students:

An essential part of our sustainability plan is mentoring our younger team, 20723. Through workshops, hands-on activities, and shadowing opportunities, we ensure they gain the skills and confidence needed to take on leadership roles. By transferring our knowledge and providing guidance, we empower them to carry forward the legacy of 19442 Wolverine Robotics after we graduate.

Through these efforts, we hope to inspire future generations.

Outreach

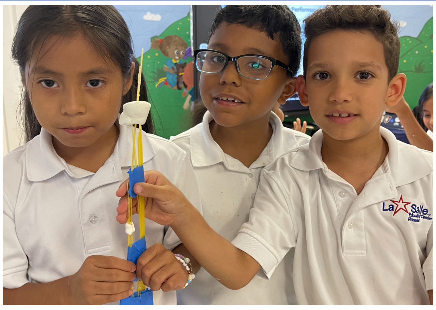
STEMQuest

STEM Quest, founded by team member Santiago Felix-Padilla in 2022, is a community service program that offers low income and agricultural children in our comunity the opportunity to explore science, technology, engineering, and math (STEM) through robotics. Since 2024, Team 19442 has actively participated by leading bi-weekly classes focused on robotics and science education.

The program aims to break down racial and social barriers by providing equal opportunities for all participants, fostering inclusivity and diversity. Through collaborative projects and shared learning, STEM Quest promotes mutual respect, teamwork, and camaraderie among children from various backgrounds. Students gain confidence in their abilities, develop leadership skills, and build a strong foundation in STEM disciplines. They learn to work as part of a team, make collaborative decisions, and adapt to new challenges—skills that are invaluable in any career.

Our team embodies FIRST's core values of teamwork, gracious professionalism, and continuous learning by offering hands-on workshops, interactive demonstrations, and STEM events. These include teaching stem related topics in easy and fun ways like building spaghetti towers, popsicle stick catapults, solar-powered robots, and teaching 3D design with TinkerCAD. We also invite STEM Quest students to FTC competitions at Belen Jesuit, where they can experience FIRST firsthand and engage with our robots. Additionally, we've donated STEM resources, including 3D printers, to LaSalle Educational Center, in Homestead FL, enhancing access to STEM learning.

STEM Quest is not just about building robots or coding programs; it is about building future leaders, innovators, and problem-solvers who will shape the world for the better. By fostering a love for STEM and teaching essential life skills, STEM Quest plays a crucial role in creating a brighter future for all. Changing one life at a time!



Spaghetti Tower

Our team organized a spaghetti tower activity in which the kids would team up into groups of 3-4, and build a tower made of spaghetti, tape, and marshmallows, competing to build the tallest tower. This activity taught trial and error, teamwork, and the principles behind a stable foundation.

Catapults

Our team organized a popsicle stick catapult in which the kids would individually build a catapult made of rubber bands and popsicle sticks, and compete to see who made the strongest catapult. This activity taught the kids about potential and kinetic energy, levers, and how mass affects how far projectiles fly.

3D Printer and STEM Toys Donations

Our team donated 3D printers and STEM toys to La Salle Educational Center. Since these donations, we've taught lessons about 3D printing using TinkerCAD and have taught the kids principles of 3D design and engineering.

FTC Competition Visits

Our team organized visits to FTC competitions hosted at Belen in 2024 and 2025, in which the kids got to see and learn from FTC matches, the different mechanisms in the robots, driving the robot themselves, and even a tour of our lab.

Interactive STEM Wall

Our team designed and installed an interactive STEM wall at La Salle Educational Center. This wall is used throughout school days and in our visits to keep the kids engaged with STEM. This wall is composed of a magnetic board where the kids can make marble tracks and a LEGO wall that the kdis can build on.

Solar Powered Robots

Our team built solar powered robots with the kids at La Salle Educational Center. This lesson not only showed the kids how to build a robot, but it taught them about different types of renewable energy.

Please visit **stemquest.org** for more information about our team's service to others through STEM Quest!

STEM Quest Video

FIRST TECH CHALLENGE

S.T.E.M. Quest

Create - Innovate - Learn - Have Fun!

La Salle Educational Center Homestead

Please visit **stemquest.org** for more information about our team's service to others through STEM Quest!

School Visits

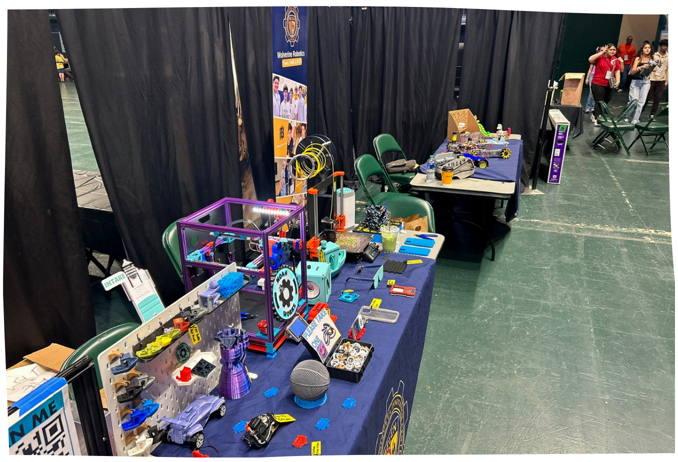
Earlier this year, the team leadership reached out to Belen's Community Director after seeing visiting schools touring the Innovation Center and wanting to include them in our engineering community. Team 19442 is now hosting STEM activities for the visiting female students from underrepresented elementary schools in the downtown Miami area.

In these visits, we set up LEGO engineering kits and teach them to build racing robots. We begin with a presentation about design principles and how to apply them to building the kits they have. Students are then split into teams, where they learn how to control these LEGO robots through block-based code and optimize their design to race against other teams.

Maker Faire Miami

The Maker Faire Miami is a STEM expo hosted at the Watsco Center in the bay area. The expo was set up to share innovation in engineering and design with kids from local underserved communities. In recent years, the Faire has hosted projects from Fairchild, Battlebots teams, and robots from Boston Dynamics.

Since 2023, team 19442 has set up a booth at the Maker Faire to showcase the team's accomplishments and skills. In our booth, we present our current year robot and functional systems from robots in previous years. We aim to educate people with passions in STEM in the local community about our robot and mission by showcasing our engineering portfolios and design process.



Robot

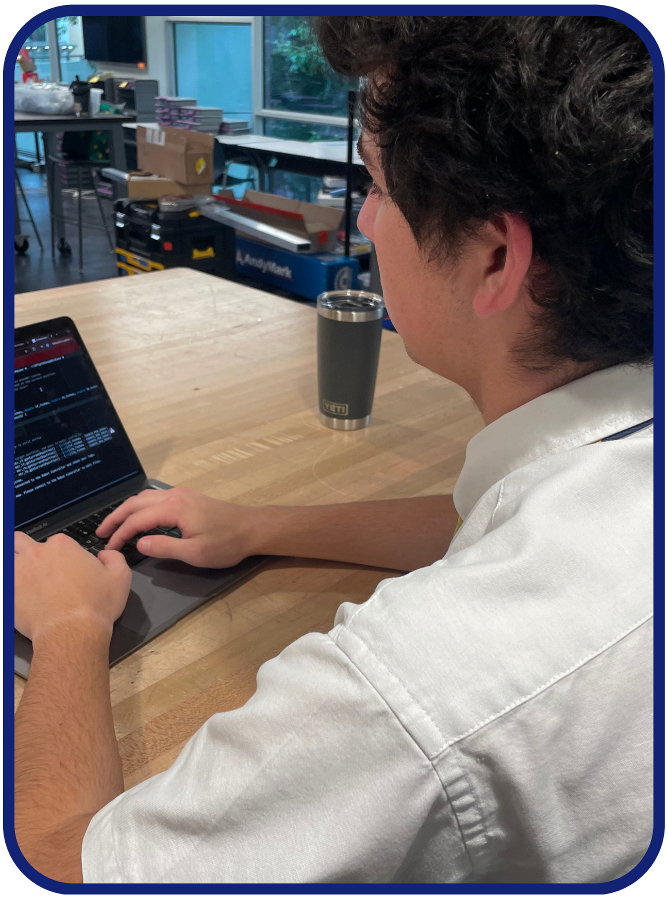
Strategy

As we tested that we had a higher cycle rate when scoring samples, we focused on sample scoring, so we operate without interfering with our teammates.

1. Autonomous: Upon start, we place a specimen on the high bar and park in the observation zone
2. Tele-op: Place samples into the upper basket so our alliance member can attach species onto the colored bar so the robots don't interfere with each other scoring points. We cycle through 4-6 specimens on average.
3. Endgame: We drop the final samples and perform a level two hang, scoring 15 additional points

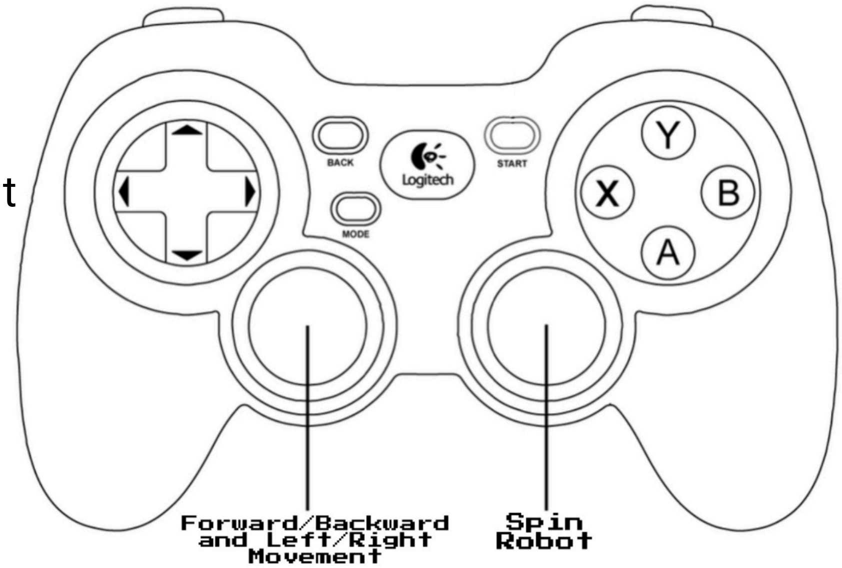
Software

1. Our initial plan for an autonomous stage was to use a camera with an object detection system. However, in the meantime, the robot is hard coded to follow a path in which it places the pre-loaded specimen in the high chamber and then park, scoring 13 points in the autonomous stage. This intermediate autonomous works around every two out of three times, as sometimes it experiences difficulties in hooking the specimen onto the chamber.
2. The future autonomous code will center around the use of a GoBilda Husky Lens. This Husky Lens camera comes with a preloaded April Tag and color detection system that will allow us to not only place the specimen in the high chamber but also pick up other samples and place them in the high basket, in addition to parking in the observation zone. In total, this new autonomous will allow us to score between 21 and 37 points per autonomous stage under ideal conditions.

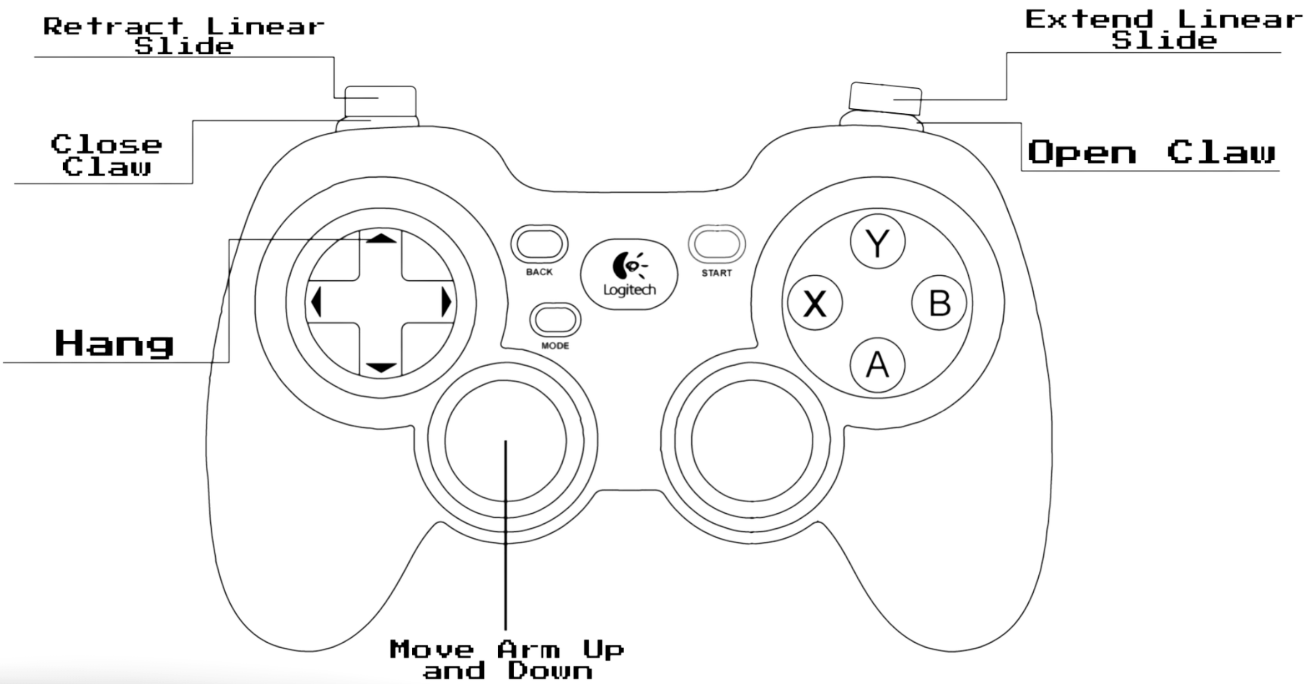


Tele-Op

1. Controller 1
    a. Left Stick - Vertical and Horizontal robot movement
    b. Right Stick - Spins robot



2. Controller 2
    a. Right Trigger - Extend Linear Slide
    b. Left Trigger - Retract Linear Slide
    c. Right Bumper - Open Claw
    d. Left Bumper - Close Claw
    e. Left Stick - Move Arm Up/Down

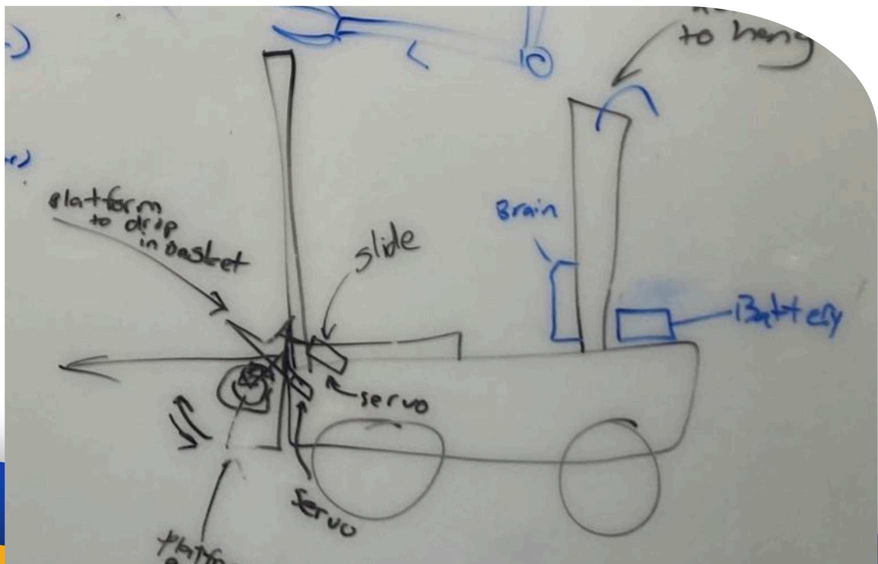


Mechanisms

Initial Design

Our approach to our robot's design at the beginning of the year was drastically different from our current one. The robot was more complicated, which led to more chances for errors and made it harder to use the robot successfully. We eventually switched to a simpler and more effective design, the evolution between the original design elements and the final design is described below.

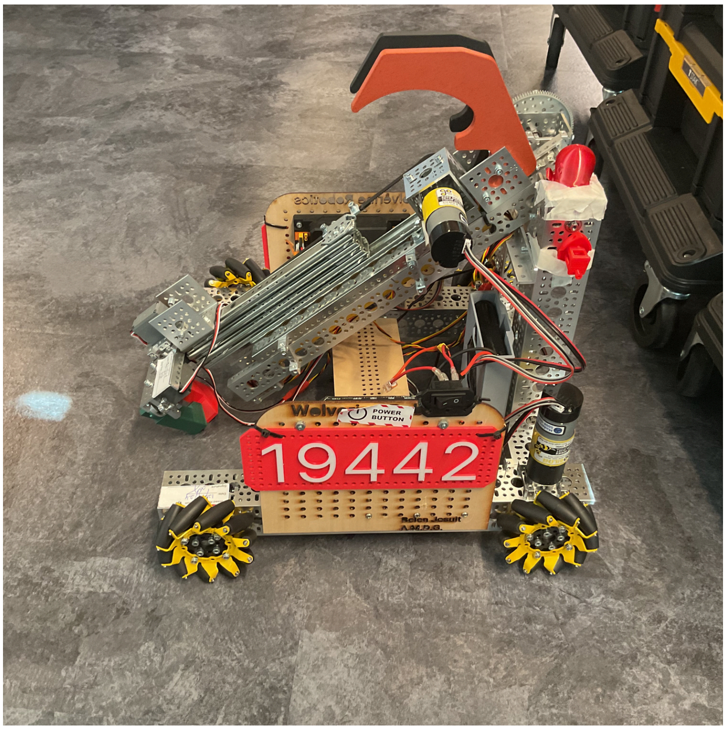
1. Chassis:
    a. The chassis of our robot was the only part that remained mostly unchanged through the original and final design as they were both built to optimize space for other components of the robot. The only change was the removal of the odometry wheels since we decided to no longer use them in the autonomous stage.
2. Intake:
    a. The intake of our robot initially consisted of a horizontal linear slide with a servo attached to the end. On the servo was a 3D modeled box with one end open, and the box contained a servo that would spin a set of silicon wheels to bring the samples into the box. The problem with this design was that the box was very heavy for the linear slide and the silicon wheels were inconsistent in collecting the samples.
3. Output:
    a. The output of our robot initially consisted of a vertical linear slide with a servo and a box at the bottom. The samples from the intake box would be deposited into the box on the vertical linear slide, and from there the slide would lift the samples to drop them in the top basket. The problem with this design was that it was dependent on the intake system and the transfer of samples between the two systems was inconsistent because of a slight misalignment and timing issue.
4. Hang:
    a. The hanging system of our robot was initially a a linear actuator with a u-shaped metal piece on top. This would have worked if we had angled the linear actuator, but since we had it pointed straight up the metal piece didn't actually hook onto the bar so this system didn't work at all.

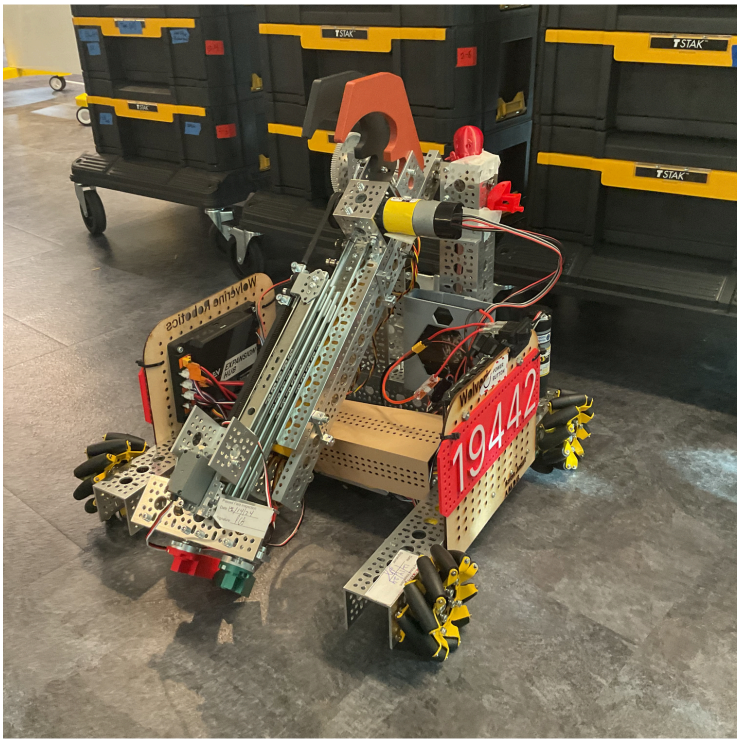


Final Design

Our final design was much more simple, with one arm on the robot that could do the hanging, intake, and output all on its own, meaning there was much less room for error in the robot.

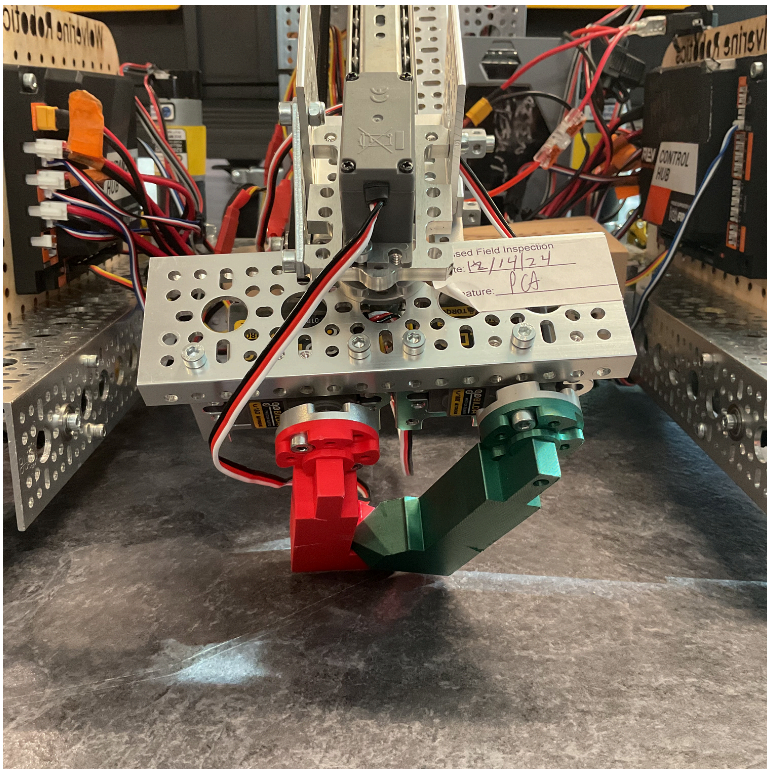
1. Chassis:
    a. The robot features a standard GoBilda chassis equipped with mecanum wheels, driven by four motors strategically positioned to optimize functionality and create space for additional mechanisms. The two rear motors are mounted upward, while the front motors are placed inside the robot's frame, maximizing the internal layout for future expansions. This design ensures ample room for integrating sophisticated components while maintaining maneuverability through the mecanum wheels.

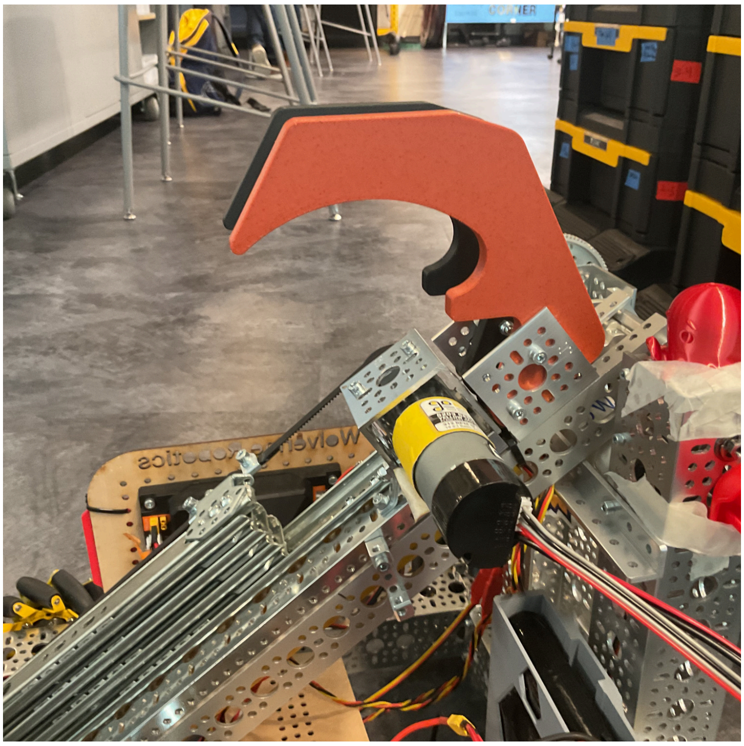




2. Arm:
    a. The robot's arm mechanism employs GoBilda linear slides that extend from the center of the robot to reach lengths of approximately 30 to 40 inches. This extension allows the arm to access the pit where samples are stored, enabling the claw to retrieve them efficiently. Serving a dual purpose, the arm also functions as the outtake mechanism by elevating samples to deposit them into a basket or to hang them on designated rods, showcasing its versatility in handling various tasks.

3. Claw:
    - At the end of the arm is a claw designed for precision and efficiency. The claw consists of pincers powered by two servos, carefully engineered for optimal performance. The pincers feature a custom 3D-printed triangular design that enhances their ability to securely grasp and manipulate samples. Recently, the claw mechanism was simplified by eliminating additional servos responsible for controlling the x-plane, reducing complexity and increasing efficiency without sacrificing functionality.





4. Hang:
    - For hanging tasks, the robot incorporates a torque motor connected to a bar, enabling it to lift itself off the ground with ease. This robust mechanism ensures the robot can successfully execute hanging challenges, a critical aspect of its performance. Together, these features demonstrate a balance of innovative engineering and practical design, making the robot a versatile and competitive machine.

Expenses

Part Name:	**Cost (USD):**	**Purpose:**
Strafer Chassis- 104mm Mecanum Wheel	479.99	Robot chassis and drivetrain with omni-directional movement
4- Stage Viper Slide (Belt Driven, 240mm slides)	157.49	Vertical lift system for extending the robot's arm
5203 Series Yellow Jacket Planetary Gear Motor	33.74	Motor for operating the robot's arm
Control Hub	350.00	Main controller for running the robot's software
Expansion Hub	250.00	To expand the input/output ports to connect motors and sensors
Materials	200.00	Wood, metal, 3D printer filament
Annual National Registration	295.00	
Annual League Registration	250.00	
Total	1816.22	

Income

Income:	**Amount (USD):**
Alumni Donations	1,300
Belen Jesuit Prep School	4,000
Total:	5,300