FRIAR INDUSTRIES

St. Anthony's High School

Team 23707

Engineering Portfolio

Cover designed by Karolina, our Art Department friend.

2024-2025

INTRODUCTION

Meet The Team

Building Team-6
Panayi N.K.
Aaron Roccanova
John Santi
Patrick Wang
Eddie Koo
Bella Cho

Coding Team-4
Logan Rembisz
Erlis Hoxha
Isabella Núñez
Brody Morgan

Outreach Team-5
James Bruno
Madyson Gavilanes
Mairead Hill-Hotz
Lorenzo D'Ambrosio
Kayla Halpin

Apprentices/Club members: (Next Year's Team...)
Zoe Schmocker **(Building)**
Aimee Yu **(Building)**
Hywan (**Building)**
Louise (**Building)**
Lynn **(Building)**
Joe Zerbo**(coding)**

Coaches:
Mr. Schildkneckt
Ms. Torresson

Mentor:
Mr. Santi

Our Story & 'KISS'

FRIAR Industries is growing in numbers, popularity and impact. In only our 2nd year, we imbedded gracious professionalism for everyone, **worked as an integrated team**, and developed leadership skills as we took on the responsibility of **apprenticeships.** We have had so much fun reaching out into the community to connect with and motivate others to get excited about STEM. Reflection, planning, and **getting kids with different skillsets to participate in the team's goals** has made us closer, stronger and more respectful of the work everyone does.

We have found ourselves regularly following the advice from our 1st mentor, Mr. Mike!

Keep It 'Super Simple'

especially as other mentors also recommended simple experimental changes and **iterative design** instead of overinflated ideas! As we practiced KISS, we realized how much it helped us stay with our plan and achieve our goals.

Index

Applying Saint Anthony's values to competition

Attending Saint Anthony's has instilled in each of us Franciscan core values including teamwork, respect, cooperation, and more that naturally aligns with the six core principles of FIRST. As a Franciscan team we love the opportunity to participate in such a competition that enforces the value of gracious professionalism like our school does. Not only can these core values be seen in the way we interact with one another on and off the field but during competition too. This year we formed friendships with other teams by hosting them in our innovation lab and even communicated with an international team. We are excited to come back again strong for the 2024-2025 FIRST season and network once again with our fellow coders, engineers, and outreachers.

Into the Deep

Since last year, our team dynamic has evolved. Many of us who were just learning the basics of FIRST, engineering, outreach, and coding are now in leadership roles, guiding eager underclassmen who want to learn and compete. We embraced this challenge by making our team more inclusive and fun, such as learning about our Korean teammates' culture by making seaweed soup. It was a great way to kick off the 2025 Into the Deep competition season!

Organization

We wanted to hit the ground running this year and begin setting goals for our team early on. The first thing we did was get organized and began to make plans for our outreach, building, and coding teams. This was very successful for our team as it allowed us to develop a great team dyanamic for the new year, improve our outreach massively from the previous year to this year, and allowed for the building and coding teams to work more efficiently on the robot.

Event_tasks1

Date	Team	Task
9/27/2024	All Members	All members set up for open house for 9/28
	Outreach	The Outreach Team worked on a new logo
	Builders	The Building Team put faster motors inside of the robot
9/28/2024	All Members	OPEN HOUSE WAS A SUCCESS!
10/5/2024	Coders	The Coding Team added controls to the intake and wheel
	Coders	The Coding Team is working on the intake controls with the wrist
	Builders	The Building Team is working on repairing the wrist

The picture to the left displays one of the ways in which we were able to organize ourselves. In utilizing different apps such as google sheets and calendar, we were able to plan meetings ahead of time and make an agenda so that we stayed on task.

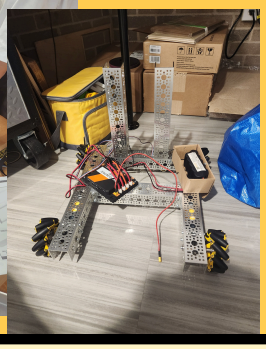
"We Create our own LUCK"

-Altin Hoxha (Team Mentor - Pg. 4)

We began our **PLANNING AND ORGANIZATIONAL PROCESS** in **AUGUST on ZOOM** as we knew how crucial it was to start **EARLY** to see ourselves succeed within our outreach, coding, and building goals.

By **MID-SEPTEMBER** we had already completed the following:

- Finished chassis design
- Devised outreach goals/events we hoped to accomplish/ plans to develop and grow team
- Successfully led Open House tour of Saint Anthony's Innovation Center, described our team, the First Tech Challenge, let interested students last year's drive robot, and hand out goodies to families.



Financial Sustainability

Reusing Parts: The school administration, **impressed with our success** not only as a team but with the Robotics Class has agreed to **buy new GoBilda parts** which will replace the REV ones used this year. For next year, our team plans to **reuse the parts** in advanced outreach experiences as to not waste precious materials and $$.

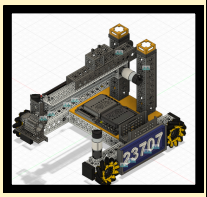
Don Corrao, Head of Development: **"You all are 'THE' reason we are the largest Catholic HS in the country."**

Donors: The image above shows the head of development, seeing our Roblox game for the first time, which extremely impressed him. He chose to invite **James**, one of the creators of the game, to the **Catholic High School Principal's Dinner** in which **every principal/top administrator** and **donors** of **every Catholic High School in Long Island** attended. This will allowed us to communicate directly to donors not only our love for our school but STEM in general, potentially leading to more funds.

SEEING DOUBLE - Risk Aversion

One of the **biggest lessons** learned by our team this year from both experience and mentors is **to be prepared and be ready to fail** (many times). That is why when experimenting with different designs, we worked on our robot **from the previous year** to **avoid risking damaging the robot too close to competition. 'Try new things, but be ready to fail'.**

V.S



Season Timeline Project Planning

As stated previously, our **brainstorming began in August** in which we began setting **goals** and predicting **potential challenges** we may face in the 2024-2025 season: Keep the NEXT team strong; build core teams that interlock and build the team up; and KISS so we don't overreach.

Throughout our engineering process we've kept our favorite motto in mind, **"KISS: Keep It Super Simple"** which allowed us to stay **simple, focused, keep the programmers in the loop while building**, and most importantly, keep the **user** in mind, making sure the robot functions well.

Finances

Control Hub = $350
Driver Hub = $250

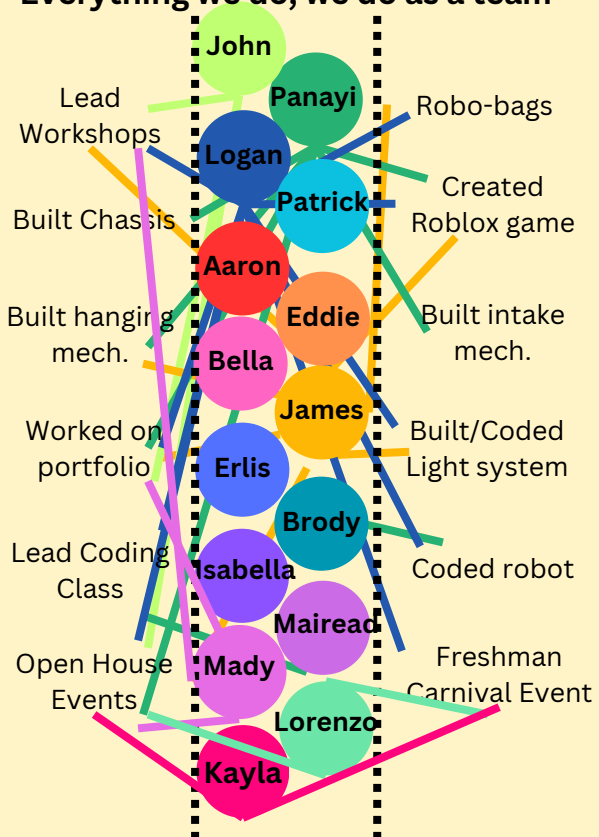
Total on Parts + First Registration = $5,600
Extra Parts - $1000 (yearly approx.)

Local Tournament Registration - $600 (yearly)

GRAND TOTAL = $7206

Rainbow of Contribution

"Everything we do, we do as a team"



Outreach & Service Plan

X-RobotX Kids STEM Summer Camp
John and Patrick combined their **passion for robotics and FIRST** competitions with their classroom experience, **inspiring the next generation to pursue STEM**.

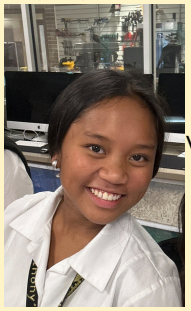
Annual Freshman Club Carnival
This event includes approx. **600+ freshman** who are looking to join clubs. This event is **key to find new members + spread FIRST message +** work with other **NONSTEM** clubs!

Goodie Bags for Teams + Open Houses
We created goodie bags with a Boston Dynamics puzzle kit, **because everyone should be able to build something**, and "Joe Cool" keychains with **"I <3 FTC" on his shirt to represent on the go**! These were handed out to **fellow teams (with their team colors)** and families at Open houses.

Sharing our love of SCIENCE and FIRST to Non-STEM Communities

Principal - Brother David
We sparked our principal's interest through Roblox which led to him wanting a part in our STEM initiatives.

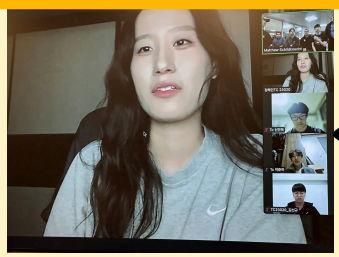
PR & Media - Geovanny
Geo, who normally does photos/videos for sporting events, helped us with photographing our outreach events, tying him into robotics!



Art Wizard - Karolina
Karolina, who enjoys art and is in Art Honor Society volunteered to help us design our team emblem and banner! The cover and banner we currently use is her design!

Lessons learned to improve future events

Virtual Meet with International Korean Team
This event was highly significant for the both teams as we were able share our love for robotics, improve our robot, and make new friends!



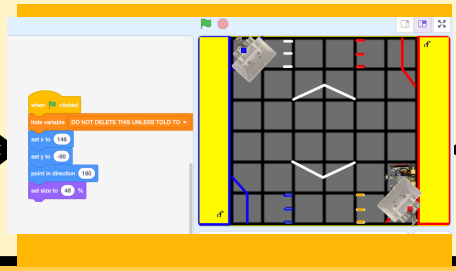
What was learned: Plan events early
Opportunity: Able to host Invicta + Vega + Wise
Since this event took a long time to come to fruition, we learned the importance of planning early, which is why we started planning our meet with Invicta + Vega very early.

Open House -1200 people- What!?
Throughout the year, SA holds open houses, each hosting 400-700 families. **We arrange with administration to be ON the Tour List and are able to connect with families about our club & FTC.** Additionally we represent the entire Innovation Center and its resources which services our school.

Prospective students + families

What was learned: It is important to practice our elevator pitches - so many visitors had STEM connections to share like out mentor said '**opportunity surprises you, be ready'.**
Because Open Houses require long speeches and demonstrations, this prepared us for our meet with Mr. Corrao, who invited us to attend the LI Catholic principal's dinner.

Friars First Ever Scratch Class 4 Kids
We teach elementary students Scratch on Zoom about every week, spreading STEM and FIRST robotics (we even created the FTC field in Scratch for these students and showed them our Roblox game)

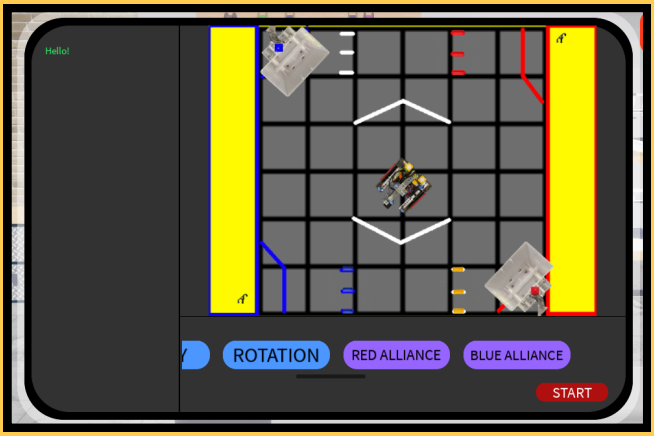


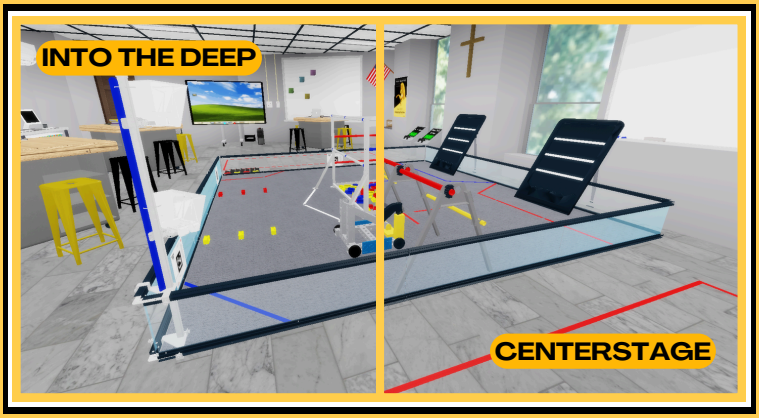
What was learned: Be Persistent
There were many timing and communication hurdles to overcome, but persistence worked! This helped us learn to develop other connections & and find another way!

A bit of FIRST fun turned into our biggest draw!

A few of our members (Panayi, James, and Logan) were only playing around on Roblox Studios before James shared that he thought they should **develop a game with an FTC theme**. After 3 months, they were full finished with ***"The Innovation Center", a 1:1 recreation of our Robotics room,*** and **showed it at one of our New Student Open house events**! The **Head of Development at Saint Anthony's High School** caught wind of it and came to take a peak. He was so impressed that he asked our team to present it at the **"Principal's Dinner", an event that gathers all K-12 Catholic school principals and administrators in the New York area into one room**. This event allowed us to **share our game with hundreds of people**. We also announced the game's release on Instagram where the Saint Anthony's Instagram page reposted it, **allowing us to market FIRST to over a whopping 1.4 MILLION people in the month of February alone**!

The Innovation Center Roblox game was **developed with the help of our code and build apprentices, teaching them LUA and refining their Fusion360 skills** along the way. As we used it and shared it, we even included our **Code 4 Kids students.** They influenced the game by recommending we add a computer for using Scratch - Logan made that real! **Now you can code Scratch inside of Roblox.**





The Innovation Center has numerous activities to explore. You can **play Into the Deep and Centerstage with friends** at the Game Field, activate our **3D printers to print a model in your chosen color and code in Scratch** in the Print Area, or **see our team's current awards and projects** in our Tool Room!

CONNECT: TEAM DEVELOPMENT

How we learn from EACH OTHER

Started Brainstorming AUGUST 2024 -> Met on Zoom to discuss team growth, development of skills, etc. & year2!

Challenges for 2024-2025 Season:

1. Team **predominately rising seniors** by the end of 2023-2024 season
2. Needed to **recruit new members** (particularly **underclassmen**)
3. Had to figure out a way to teach our new members **HARD + SOFT skills** so that they are **PREPARED** to lead club themselves one day
4. Needed to figure out a way to **properly integrate underclassmen** /building a **team dynamic** + making everyone **comfortable** with one another so everyone can contribute.

GOALS for development of skills:

- Teach HARD skills like Java, building process, CAD, 3D printing in **ongoing courses,** etc.
- Teach SOFT skills like how to lead outreach events, communicate with prospective students (pg. 3-Open Houses), develop the portfolio, etc.
- Build team dynamic (make Seaweed soup, Saturday breakfast & brownies!) + make students comfortable and utilized.

STEPS we have taken to reach goals:

- Divide into sub-teams to teach everyone different skills more effectively: prioritize & then share
- Host a series of workshops to teach students Fusion +Java
- Have apprentices work closely with upperclassman to better learn about process by shadowing a role model.
- Have apprentices work on the portfolio + lead outreach events & have everyone database the details to track our progress

NEW Apprenticeship Program + WORKSHOPS

Many enthusiastic underclassmen decided to join our team due to our recruitment efforts (Pgs. 3-4) and are being taught as small group or 1:1 **APPRENTICES** to continue the legacy of our team.

During meetings our team diverges into three sections to lead **WORKSHOPS** in **Outreach, Building, and Coding**. Many of our juniors became **LEADERS** of each section and would allow the underclassmen to **shadow**, **learn** to build, design, code the robot and even **find sponsors or connect** with other teams in the area. This helps them gain confidence and feel comfortable with leading the team for next year. At the end, we come together, converging into ONE TEAM and discuss our progress.

Fusion Workshop

Code Workshop

Apprentices' Experiences

"Meeting the Korean team helped get another perspective on our robots and our unique feature. They liked our arm design as well and said it was really efficient."
(Meeting w/ korean team)

Isabella (Apprentice)

"Explaining how the club works to interested 8th graders"
(Open House Event)

Brody (Apprentice)

Learning Skills in NEW Robotics Class

Due to our team's success, the administration created our school's **FIRST EVER robotics class.** Half of the class is **underclassmen**, some of whom are on the robotics team as well and have the opportunity to learn **HARD skills** such as **building**, **modeling** in Fusion, and more! We will also have a **mini competition**, so everyone gets a chance to learn about FIRST and compete even if they are not on the actual robotics team.


Triumph on the Tech Field: Robotics Team Shines at FIRST Tech Challenge

CONNECT: MENTORS & SPEAKERS

How we learn from experts, engineers, AND mentors: LISTEN, ASK, & TRY

<u>James O'Brien, PhD, Physics & Math</u>
Works with Asteroid Deflection
PLAN to FAIL! "Try new things you KNOW will fail - this is where the learning is."

<u>Altin Hoxha, CTO of Platonic</u>
200+ students invited to learn how blockchain & smart contracts will **finance emerging technologies & share FTC with NON STEM clubs.**

<u>Stefano Matussi, IBM executive and renowned aerospace engineer:</u> design satellites, AI neural networks & **engineering skills are highly marketable can lead to MANY career options.**

Returning Mentor & Innovation Inspiration

<u>Tyler Bershad, Mechanical Engineer, Amazon, Corning, NSF, & FTC alum</u>
He prompted us to focus on our engineering process. **"Train and Build *those* skills** - they will take you through MANY engineering problems.

<u>Mike Christ- mechanical engineer & design mentor:</u> impressed with our pivoting arm and light up cues, he then worked with Eddie's new lift design, **suggested a more workable version**, built a hook we could try, met with us virtually& in person and kept in contact with email and text. **He is our 'go to' robot design advisor who promotes our ideas and helps to 'make it work'.**

"Mike was a **great mentor** to help us today. We had initial disagreements and discussion on whether we should go for the second ascent" - John Santi, Team Cpt.

Second trip to Canon!

<u>Tina Huber, Senior Product Planning Specialist @ Canon:</u>
Onsite detailed demo of the "Whiz" a commercial grade floor cleaner used in hotels, nursing homes and many other types of businesses.
$32K robot!

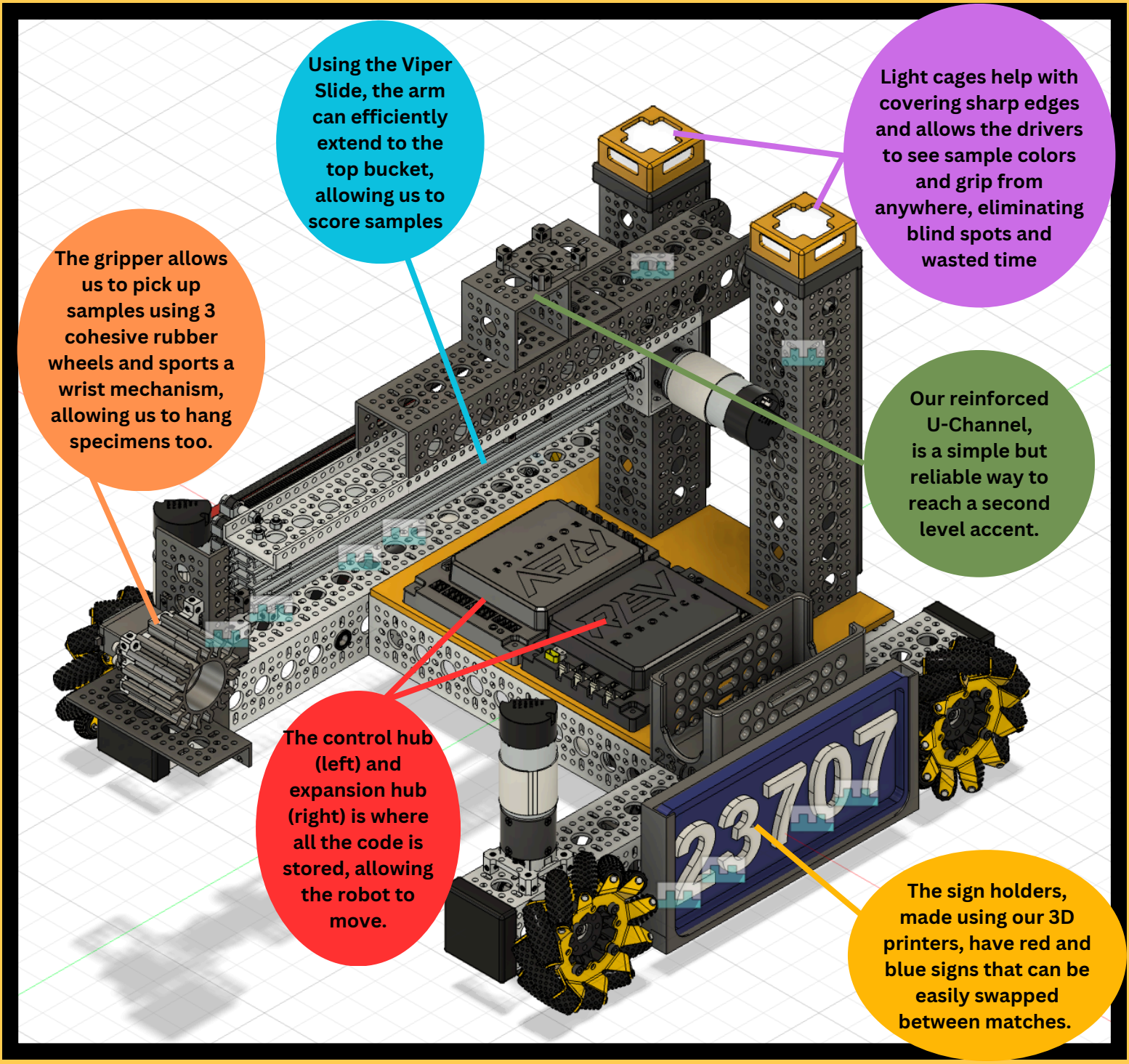
"Today we went to Canon USA to see their technology. They showed us Whiz, an automatic robot vacuum. **The robot shares similar features and items to what we use for our robot.**" - Isabella Nunez

<u>Captain Christopher Aliperti is an Instructor of Mechanical Engineering at USMA: West Point</u>

His inspiration: taking signals from the human body to rework and create a working prosthetic.
"Machine learning is the new fundamental skill."

"Always work on projects with people, not by yourself because you won't learn anything in that time"
-Kayla Halpin

COMPUTER AIDED DESIGN



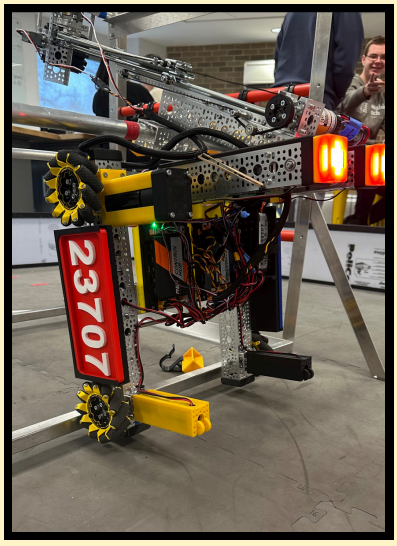
CLIMB DESIGNS: not as easy as 123...

#1 - Simple U Channel

This was our first/simplest design of the hanging mechanism (following our principle of KISS). The robot was able to lift itself off the ground.

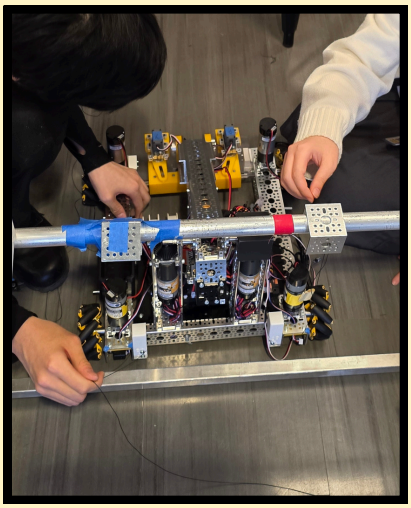
PROBLEMS

The U-Channel started to bend out of shape due to stress caused by the immense weight of the robot. We also learned that even touching the bottom bar meant this didn't count as a level 2 ascent



#2 - Winch Mechanism

This design was a winch that hidden under our chassis that utilized kevlar strings attached to U-Channels. This was essentially a grappling hook design meant to reach 2nd level ascent.



PROBLEMS

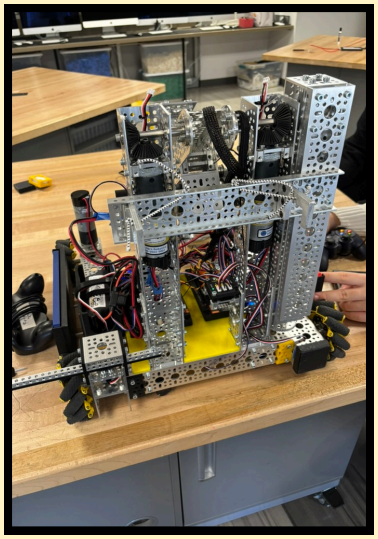
The motor wasn't strong enough to winch the robot up, there was no way to reach 3rd level ascent (U-Channels couldn't leave the bar), and too many moving pieces.

#3 - Linear Actuator

We were assisted in designing this iteration by one of mentors, Mr. Mike Christ. We used a linear slide attached to our base to easily slide up and grab the 2nd level ascent and quickly move up for a 3rd ascent.

PROBLEMS

The motor wasn't strong enough to pull the robot up, many of the pieces used for hanging were bending out of shape, weight was not evenly distributed.

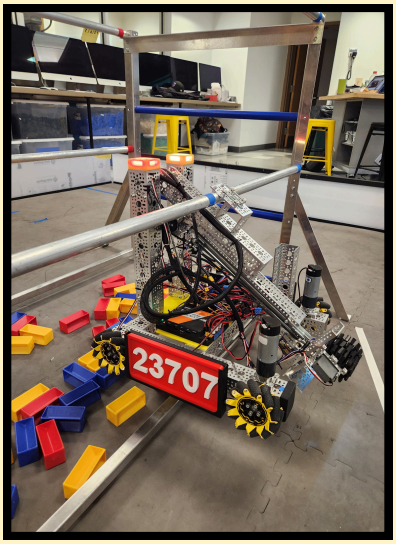


#4 - Reinforced U Channel

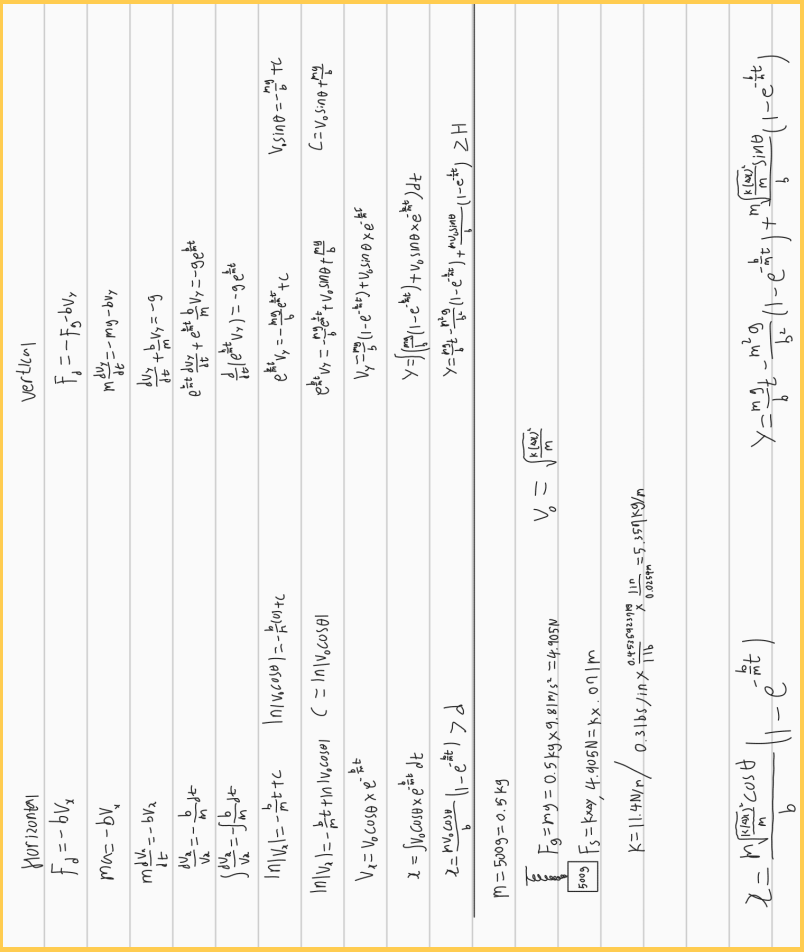
After our 3rd design failed, we decided to go back to the basics and keep our principle of KISS. We went back to the U-Channel design, but this time we tightly reinforced it to make sure it wouldn't bend.

(NO) PROBLEMS

This is our current design. It works very well and we aren't having any issues. The only foreseeable problem is that we aren't able to get to the 3rd ascent from here.



PHYSICS OF CLIMB DESIGN



Bot Measurements

Radius: 1.5 ft = 18 in = 46 cm

Arm weight: 4 pounds = 1.8 kg on Earth

Torque Calculation for Arm

Torque = perpendicular weight * radius

Torque = 1.8 kg * 46 cm = 83 kg cm

Motor Specs

GoBilda 5203 Yellow Series Motors

Gear Ration 19:1 312 RPM

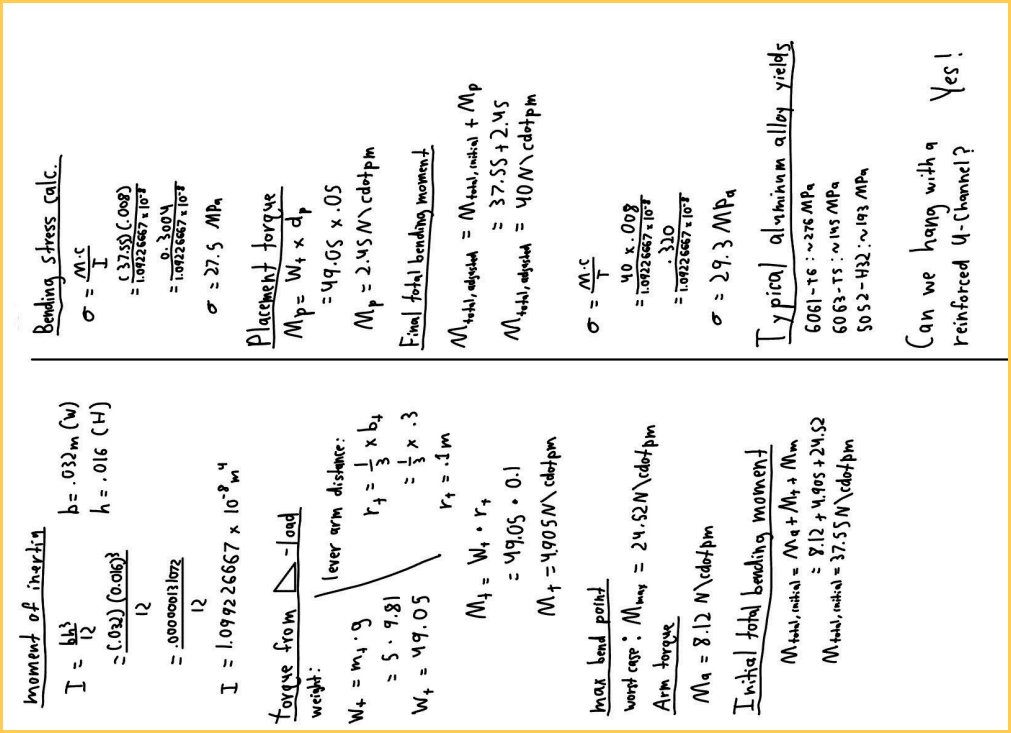
Torque = 24.3 kg cm

Motor Specs

GoBilda 5203 Yellow Series Motors

Gear ratio 188:1 30 RPM

Torque = 250 kg cm



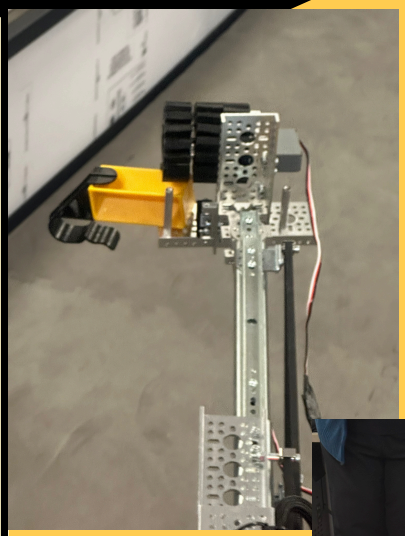
Why our hang just works! (Physics Edition)

The calculations above are to test the possibility of our reinforced U-Channel bending. We calculate stressors such as gravity and the placement of the U-Channel. With sudden movements and swaying motions, our regular U-Channel would bend due to unpredicted stressors but with our reinforced U-Channel, we plan for those stressors, now that we learned how detrimental they can be, by using a reinforced U-channel, tripling the original yield thanks to features like added surface area which spreads out the load.

GRIPPER & INTAKE ITERATIONS

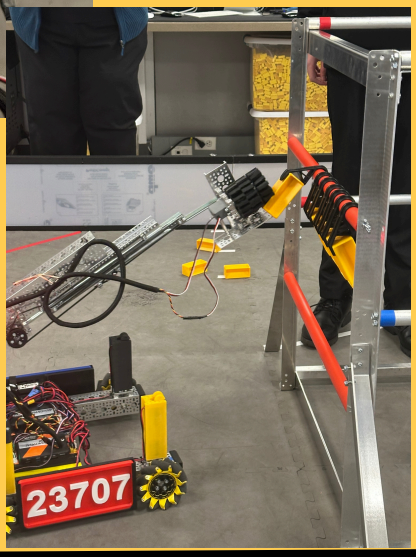
INTAKE SYSTEM

First iteration of Gripper: Originally the gripper utilized two rubber wheels to pull the block in. The picture shown to the right illustrates this. We **chose a wheel over a claw as it is efficient and does not depend on the starting positions of samples and specimens**. The wheel is also **much faster and reliable in both its intake and deposits**. We even utilize a **wrist-like mechanism** which **allows the gripper wheel to turn from side-to-side**, giving us the **option to hang specimens** as well.



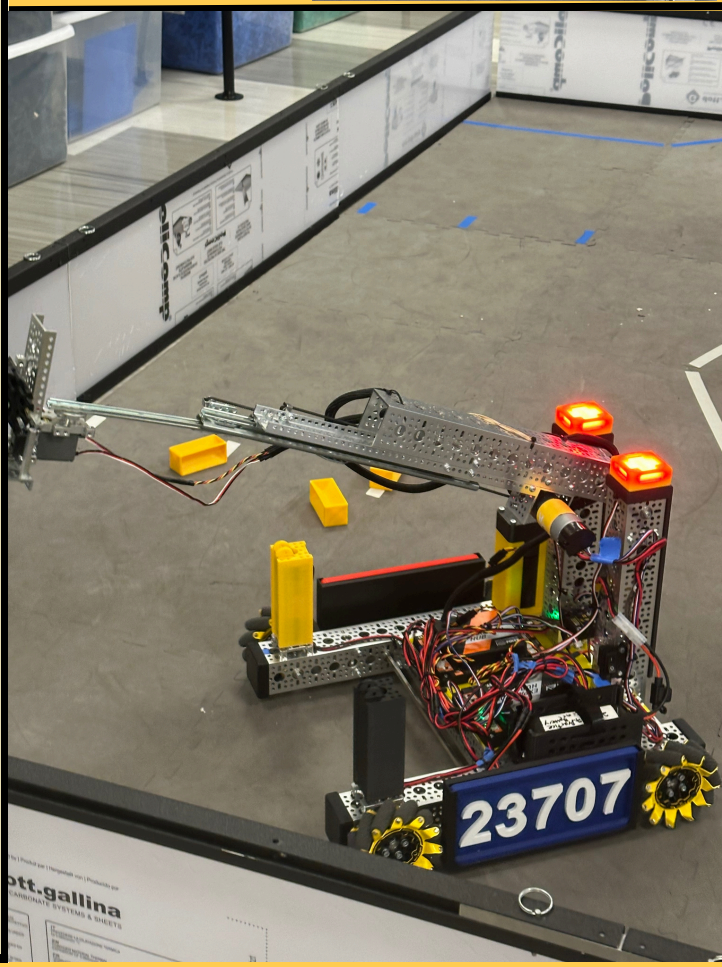
Testing and hypothesis: We encountered minor issues with this design: the two rubber wheels on the gripper lacked sufficient friction, resulting in inconsistent block pickups. Additionally, the overhanging ledge intended to secure the block upon retrieval, was not properly angled with the ground, preventing the block from being guided smoothly into the gripper.

Second Iteration: To address these design issues, we added these design issues, we **added an extra rubber wheel to the gripper, increasing surface area and friction**, which significantly improved the robot's ability to pick up blocks, Additionally we adjusted the overhanging ledge to **a 20-25 degree angle relative to the ground,** optimizing alignment and **ensuring a smoother, more reliable intake**



Testing and hypothesis: We faced challenges in determining whether the gripper was successfully picking up samples in the submersible. Additionally, our drivers struggled with visibility, not being able to see past the robot to identify the color of the blocks the drivers were grabbing.

Third Iteration: We **added our custom-coded sensor** determine whether a block has been picked up and measures its distance from the arm. These **sensors send signals to an indicator light on top of the robot**, which starts as **red and gradually turns green as the block moves closer**. Once the block is fully secured, the light turns completely green. Additionally, we **use the same sensor to detect the block's color and reflects it through a light on top of the robot**, providing real-time feedback to our drivers. If our robot **accidentally picks up another team's sample, the sensor will signal the robot to automatically spit the block out**. These enhancements **significantly improved our drivers' efficiency and overall performance**, creating a **zero risk system and saving precious time during Teleop**.



VIPERSLIDE ARM

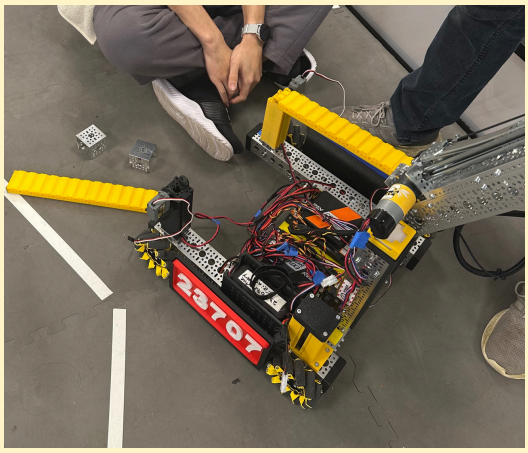
Our Principle Motto: KISS (Keep It Super Simple) -> The Viper slide has been through various trials. **Initially, it had been built incorrectly, with the screws that are supposed to hold the belt in place completely misaligned**, which had been realized after testing it, forcing us to take the entire slide apart to fix it. **Additionally, we had a difficult time initially threading the belt through its path while ensuring it had proper tension**. This was due to the slide's incorrect assembly which we resolved after reassembly.

After vast amounts of maintenance and experimentation, we have learned how this mechanism operates to the fullest. Now adjusted to our needs with proper tension and reinforced belt clips, we are able to attach specimens with the mechanism at both the top bar and drop at the high basket with ease, without the previous errors of the belt detaching and not reaching the proper distance.

Two high torque motors are used to lift the arm, and use bevel gears in order to ensure both that the weight of the arm can be lifted and lift the total weight of the robot while hanging. **We chose bevel gears after previous gears had failed to stay in one piece thanks to our high torque motors.**

WIRING

For the wiring of our robot arm, a rubber band was added so that the wire would recoil, preventing it from hanging on the ground and getting tangled up with robotics parts. A black sleeve was also used to protect the wiring.



Testing and hypothesis:

After realizing that the sensor wire was not long enough for the arm, we decide to solder a one meter-long wire into the connectors in order to fix this problem. Making your own can be faster than FedEx!

3D PRINTED ELEMENTS

Light holders: These are located on top of the robot's towers in order to hold the lights which display what color specimen/sample is being held by the gripper and if we have a full grip on it from anywhere on the field.

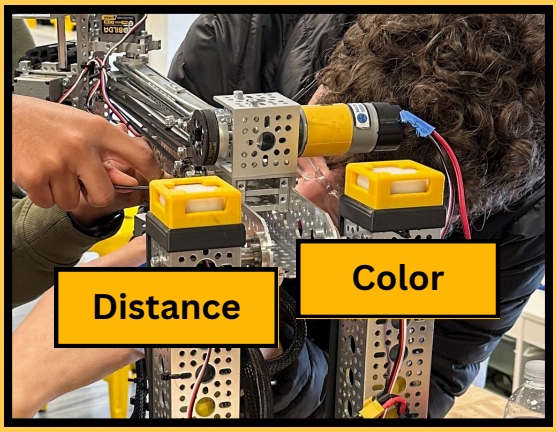
Sign: There are two sign holders on either side with signs that can be quickly and effortlessly replaced depending on our alliance color.

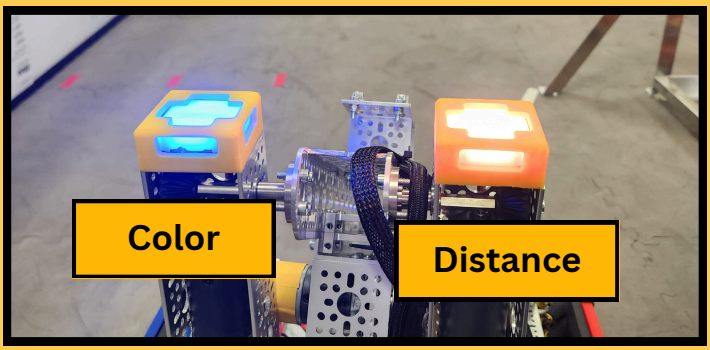
Backplates and safety caps: These caps were printed in order to protect from sharp edges on our robot both on and off the field.

Battery holder: This was custom modeled and printed in order to safely hold the battery of the robot while still being lightweight as to not throw off the robot's balance.

Color sensor and robot intake

In the FTC Into The Deep Game Manual one of the penalty rules is that **if you pick up a sample of the opposite color of your alliance then you are deducted 5 points**. As the arm is reaching into the submersible to pick up a sample, we might accidentally pick up a sample of the opposite color. So to fix this problem, **the intake wheel will use a sensor that will sense if the opposite team's sample is in the claw and it will start spinning backwards if it is**. When we are picking up our team's sample color the robot will intake the sample. When we intake the sample we have 2 sensor lights. The left light tells you what color the robot is intaking. The right light tells you from a far away distance if the sample is all the way in the intake system based on a red to green spectrum. **This is useful to the drivers on the field so that they can very easily see if the sample is fully in the wheel intake or not.** This feature also creates what we call a **"Zero Risk" system**, meaning **we don't have to worry about accidently gaining a penalty** and can take from the submersible without risk. **This feature also shaves off around 3 seconds of confirming grip and color per sample, allowing us to use that time to score more 2 more samples into the high basket**. **Talk about efficiency at it's finest!**





GAME STRATEGY

Basket

Picking up samples and putting them into the high basket is what we specialize in, **averaging around 8 samples per game in Teleop alone**. The **gripper is so accurate, we can get 4 specimens in autonomous!**

Specimen

Our gripper is not designed to pick up specimens with high efficiency, although it is **possible thanks to our wrist-like mechanism.** We traded off and prioritized on the speed of getting samples. For this reason, we can also prioritize taking samples from the submersible during Teleop.

Hang Time

When their are 15 seconds left in the game, we back our robot up to the submersible and **by pushing our arm backwards we lock onto the first bar, using a reinforced U-Channel**. Then, we simply pull it back and lift ourselves up to a **Level 2 ascent**.

EFFICIENCY

To **maximize our time** spent picking up samples. we installed the previously mentioned lights. **These reduce the sample pick up time** from **5 seconds to 2 seconds per sample**, greatly improving how many samples we can intake. They do this by quickly signaling the intake's status to the drivers.

SOFTWARE DEVELOPMENT

Roadrunner Code

We used a GoBilda odometry computer and two GoBilda spring loaded odometry pods to track our position on the field. After **attempting to make a custom module** for our first qualifiers to take this position and move we decided to scrap that module and use roadrunner. After our coders got some **assistance from members of the Unofficial FTC discord**, we were able to set up the roadrunner module and get reliable, consistent robot movement.

Field Coordinate System

```
final double sampleY = -34.75;
13 usages
final double[] bucketPos = {41, -9, Math.toRadians(45)};
```

The robot uses a field coordinate system to navigate the field. To make code easier to write, **our autonomous converts the field into a X and Y graph**. We have **preset positions for important locations** such as the basket, the samples Y position, and the submersible.

Autonomous Scoring

During autonomous we aim to score **32 points**. Our autonomous program does the following:

- Place a preloaded neutral sample into the high basket
- Collect and place all **3 yellow samples** from the spike marks **into the high basket**

Our testing had a relatively high success rate. These 32 points scored will also be counted at the end of Teleop, **for a total of 64 points**.

Rev Color Sensor CODE

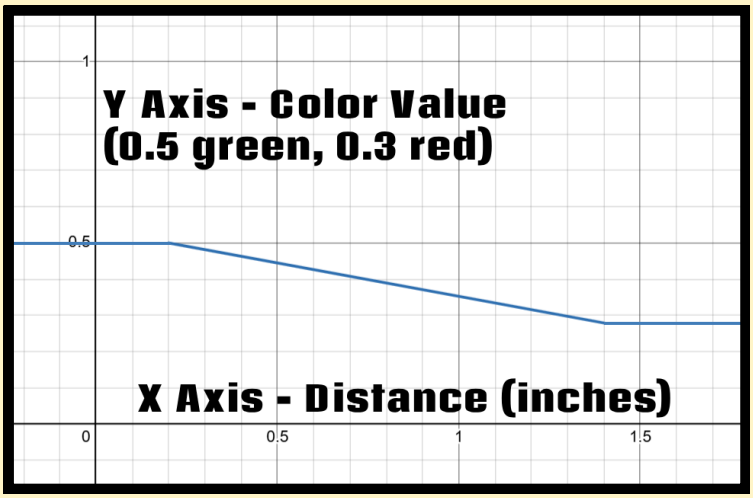
In order to properly calculate the color for the distance light the code it follows the following steps:

1. First it takes the distance in inches, from the sensor
2. Then it **plugs this value into a linear function**
    a. By plugging into this linear function it **allows us convert a distance value into its relative y value (light color)**
3. It then **caps the function at green and red to prevent random colors**

```
public double smoothMap(double input) {
    // Apply linear interpolation to get the result
    double output = slope * input + intercept;

    //Apply limits to the color range
    output = Math.min(output, 0.6);
    output = Math.max(output, 0.279);

    return output;
}
```



FUTURE PLANS

Impact from OUTREACH

Fundraising Money for Korean Team

Meeting with an international FTC team was one of the most **positive** events of the season, **allowing us to improve our robot, get ideas, and make new friends**! Our brilliant Korean friends made Worlds, and we are currently working with **Don Corrao (pg. 3) to gain sponsorships** and **direct funds to this team!**

Middle School Mentorship Program!

After James presented at the **New York Catholic School's Principal dinner** (Pg. 3), the **principal of St. Patrick's MS** said she wanted to **start an FTC team because of our game** and **wants us to help jumpstart it** as well as **include their students in our coding classes**, allowing us as a team to continue **spreading our love for FTC and STEM to others!**

Robotics is the Mama Hen to HUNDREDS of incoming Students!

Mr. Arrigo, Dean of Men, asked James at the **Catholic School's Principal's Dinner** to present to **the incoming freshmen** during iPad distribution in **JULY**, making us the **FIRST EXPOSURE** to these incoming students, allowing us not only to grow our team but continue to **spread our love for robotics to the soon-to-be school community!**