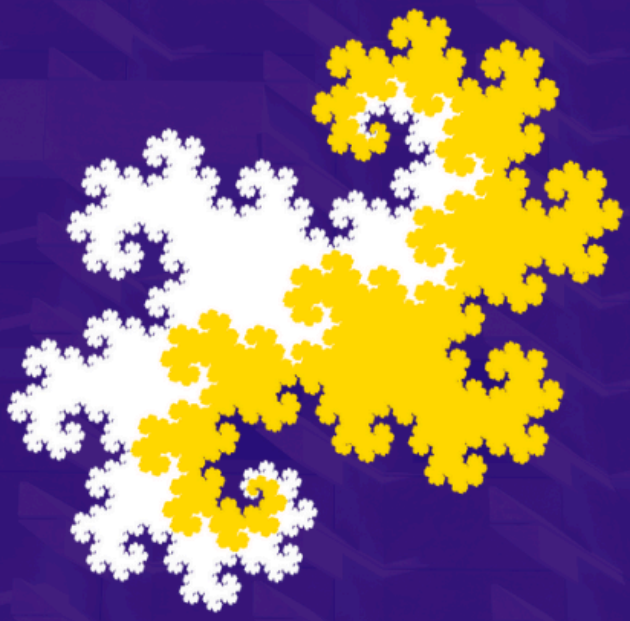


A Byte Irrational

FTC Team 15065

Engineering Portfolio 23-24

0x3AD9

CENTERSTAGE

PRESENTED BY RTX

FIRST

ORLANDO SCIENCE SCHOOLS

STEM Charter School

Team Information

Who We Are

We, A Byte Irrational, are a high school FTC team from Orlando Science Schools. We have proudly been Team 15065 since 2019, making it our **fifth season** competing in FTC. We started off with 5 members who were new to FTC and have since doubled our numbers. This season we welcomed three new members and have diversified our skills greatly as a team. We have two experienced engineering mentors to guide us on our design journey, Mr. Don Boughton and Mr. Stephen Whitfield, as well as highly supportive parents.

Like our signature twindragon, we aspire to innovate and create new from old when it comes to design. This season, we took on many challenges proposed by the new game field and created an original design suited for effortless maneuvering and securing pixels.

Our Members

Sarah- Co-founder, Captain, Mechanical; 5 yrs

Diyar- Co-founder, Mechanical, Electrical; 5 yrs

Joshua- Programming; 5 yrs

Shriya- Business, Finance; 2 yrs

Dilan- Mechanical, Finance; 5 yrs

Anant- Mechanical; 1 yr

Hamsika- Mechanical; 5 yrs

Nivedita- Marketing, Outreach Coordinator; 2 yrs

Team Goals

- [x] Sarah- Design a mechanism in CAD
- [x] Diyar- Help families connect their kids to FIRST
- [x] Joshua- Code a team website from scratch
- [x] Shriya- Reach out to 5 new companies for grants
- [x] Dilan- Learn how to draft emails to companies
- [x] Anant- Familiarize with basic mechanisms & tools
- [x] Hamsika- Learn how to build/design a viper slide
- [x] Nivedita- Coordinate 2 outreach events

Our Goals

> Expand FIRST in Central Florida

As seasonal demonstrators at Northlake Park Community School's STEM Night, the school had reached out to us in regards to **starting an FLL team** at the school. This season, we have plans to follow through and **coach a Lego League team** for all interested students. We have been working out the details and hope to finalize the project in the summer.

> Coordinate and Exhibit at The Museum of Arts and Sciences (MOAS)

During our robot demonstration at Maker Faire, our team was able to meet the **Education Manager at MOAS**, who invited us to attend the **International Day of Women and Girls in Science** event on February 10th. Our outreach coordinator, Nivedita, is currently in touch with the museum's curator of science and our team is **confirmed to exhibit** on that day. We have been reaching out to different FTC and FRC teams in the Daytona and Orlando area to **coordinate** a successful event showcasing all of what FIRST has to offer!

> Reach 150 Hours of Outreach

At a total of **250 hours**, our team **exceeded** our original goal of 150 volunteer/outreach hours set at the beginning of the year through demonstrating at local events, presenting at conferences, and giving back to the FIRST community!

Business and Sustainability Plan

Financial

For funding, we decided to focus more of our efforts on maintaining long-term sponsorships while reaching out to new ones. We are appreciative of Collins Aerospace, Publix Charities and Lockheed Martin for renewing their grants to support our team. This season we are proudly sponsored by **Collins Aerospace, Publix, NASA Exploration Ground Systems, Lockheed Martin, 3M Corporation, Raytheon Technologies & Orlando Science Middle & High School.**

Recruitment

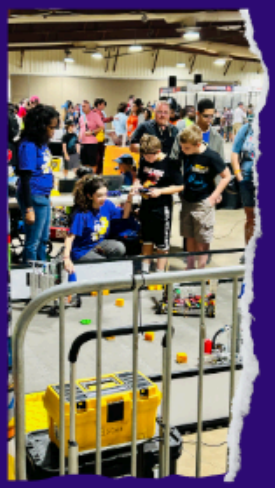
Our team was founded by and is composed mostly of high school juniors, which is why we have been exclusively recruiting freshmen and sophomores to continue our team's legacy after next season. We have also been sure to train our younger recruits, especially those who are founding members, to lead the team in the future. We are also looking into training parents of our younger members to become mentors in the future. This will include learning how to plan and organize meetings and guide through any obstacles in the engineering process.

Outreach Projects & Partnerships

Our Community

SPARK STEM Fest

- This annual event at the Orlando Science Center celebrates STEM for families
- **~30 families showed interest in FIRST for their child** and obtained our regional FIRST coordinator's contact info
- We showed kids how to manuever the robot through our field setup, and gave each kid a team sticker after, making them honorary team members!
- **We introduced around 100 parents and young children to FIRST**



Maker Faire

- Hosted by Maker Effect Foundation, a fiscal sponsor of FIRST
- We had team members going out and talking to families about FIRST
- About **15 families** we spoke to were interested in having their kids join a FIRST team
- A few of our team members showed kids how to operate our robot through our simulated game field
- We donated our field setup for all FTC teams to demo their robots on
- **The event was a huge success and we reached around 200 excited children, parents, and even fellow exhibitors from the engineering community!**

Boy Scouts Presentation

- Our team member and Scout, Dilan, organized a FIRST presentation at one of his Boy Scouts meetings
- Joined by our team captain, Sarah, they **created and presented a slide presentation introducing FIRST robotics**
- The slides went over different roles on the team, the engineering design process, and what the season looks like
- During the Q&A, there were a ton of questions about how to start a FIRST team and join a school/community FTC/FRC team
- **There were about 40 scouts in attendance**

The World

Coordinating APEC 2023

This season, we were able to **coordinate** our first FIRST exhibit as a team. The Applied Power Electronics Conference (APEC) is a focus group within the Institute of Electrical and Electronics Engineers (IEEE) and there were 3,000 attendees from all over the world during the week. Our team's outreach coordinator, Nivedita, was able to communicate with an event coordinator in regards to planning the set-up, area, participants, and registration. Once confirming our attendance, we invited FTC teams Super 7 and Zip Ties and FRC team Gra-V from the Central Florida area to join us in our demonstration. We donated our field set-up for all teams to use and each team got the opportunity to showcase their robot to the crowd of power electronics professionals. We reached around **100 STEM professionals** and gained **2 new contacts**! **Our exhibit was so successful the event's steering committee decided to contact FIRST national headquarters and continue it at the APEC 2024 conference in Long Beach, CA!**

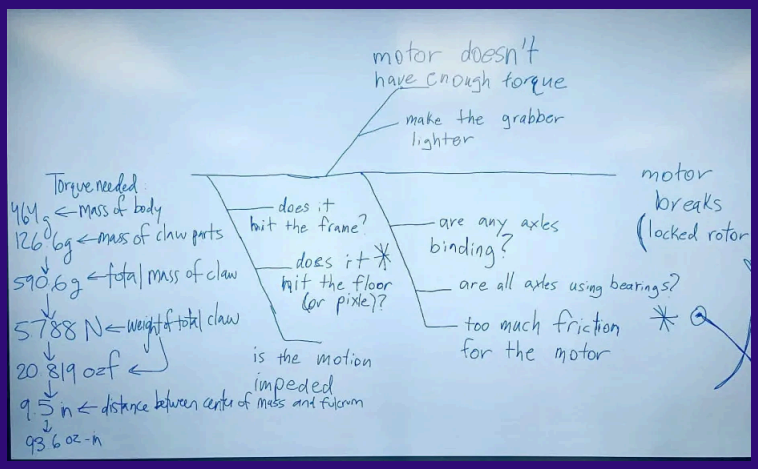
Presenting at I/ITSEC 2024

The Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) is organized and sponsored by the National Training & Simulation Association. It is the world's largest modeling, simulation and training event and it takes place annually here in Orlando. Our team was able to present at the FIRST exhibition on November 29, 2023 as an FTC league representative. We demonstrated our robot and held conversations with experienced engineers on its mechanics. **At I/ITSEC we were able to meet over 100 STEM professionals and leaders from all around the world**

Meeting General Maria Barrett, head of Air Force Cybersecurity, at our I/ITSEC booth!

Posing with the Mayor of Orange County, Jerry Demings!

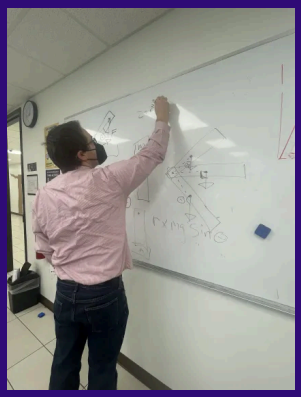
Our Connections



Mentored by Ms. Karen Oliver

Our long time mentor, Ms. Oliver, is a Systems Engineer at Lockheed Martin. With her many years of experience leading as a senior manager and **overseeing 1,200 design engineers** in the development of a system from beginning to end, Ms. Oliver's insight has greatly helped our team overcome obstacles faced. Using her methods of problem solving, we have been able to **identify root issues in our robot**. We used this process while determining why our servos suddenly kept locking, despite keeping the load weight constant.

Assisted by Dr. VonMoss



Our team reached out to Dr. Justin VonMoss for insight on how to apply physics to our robot this season. Dr. VonMoss has a **PhD in Nuclear Physics from Florida State University** and has years of experience as an educator and **Directorate of Global Security in Nuclear Science and Engineering** at the Oak Ridge National Lab. Dr. Vonmoss was able to help our team determine the correct amount of torque required for the servo in our hinging gripper mechanism. This insight was highly valuable in ensuring we used the correct type of servo. Dr. Vonmoss taught our team members valuable knowledge of how seemingly abstract physics formulas could be applied to real world situations, and was able to demonstrate how engineering is built upon principles of physics.

Mentored by Mr. Anthony Winiewicz

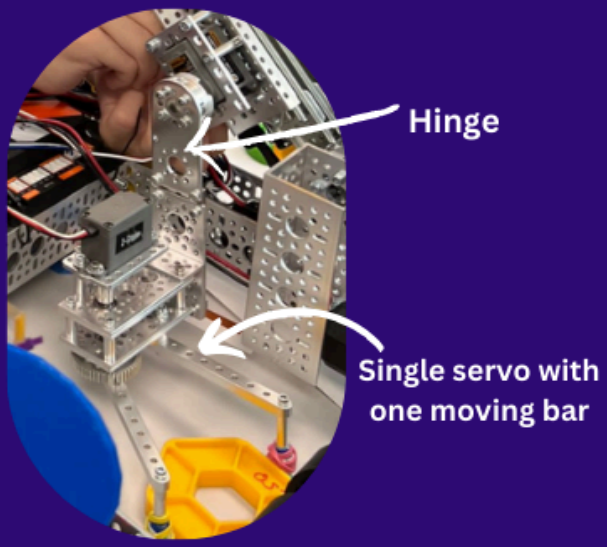
Throughout this season, our team has been mentored by Mr. Anthony Winiewicz, who is the current **President of Innovative Engineers & Constructors, LLC**. Mr. Tony has decades of experience in various fields of robotics ranging from medical to pipeline. His familiarity with the engineering design process was especially useful and helped us identify and overcome obstacles in our own process. Mr. Tony reviewed our overall design and provided insight on chassis designs that best balance the center of weight. He also played a fundamental role in helping us explore how to assemble Misumi SAR230 slides, and how to make them compatible with other hole patterns.

Gripper

The two main goals for the gripper are the ability to securely **hold on to two pixels and place them on the backdrop** at a specific angle.

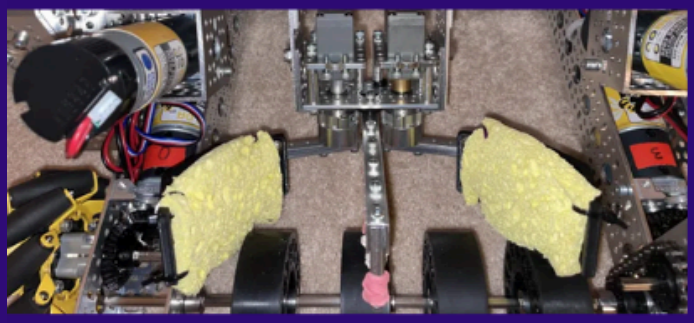
Initial Solution

Our first design had a **single servo** with a **hinge** attached to one side of the lifter.



Challenge #1

Could only pick up and place **one pixel** at a time.

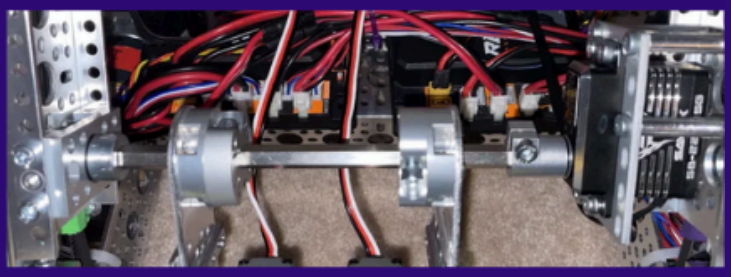


Solution

We designed a gripper with **2 servos** and an **immobile plate in the center** to hold the pixels.

Challenge #2

It was **too unstable** to precisely place pixels on the board.

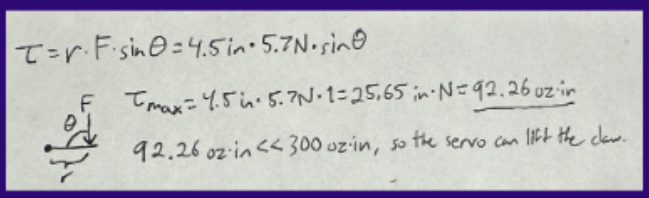


Solution #2

We added an **axle** going across the 2 linear slides, which was rotated by a servo. The gripper section connects to the axle with sonic hubs.

Challenge #3

The servo on the hinge kept **locking** and **did not have enough torque** to lift the gripper



Final Solution

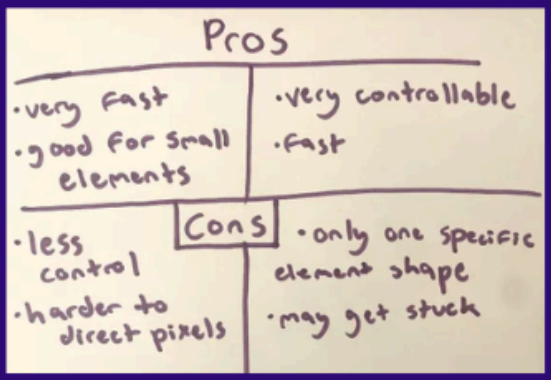
Physics was applied to calculate the required torque needed, and a servo with that level was used in place of the old one

Intake

The intake must be able to **efficiently intake pixels** and **direct them into the two chambers** of the gripper

Prototyping

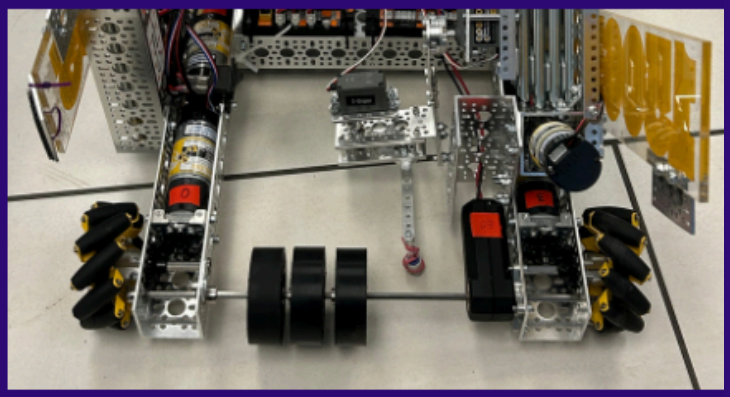
Surgical Tubing



Compliant Wheels

Initial Solution

Our first design used a rev motor directly connected to an axle, and compliant wheels to intake the pixels

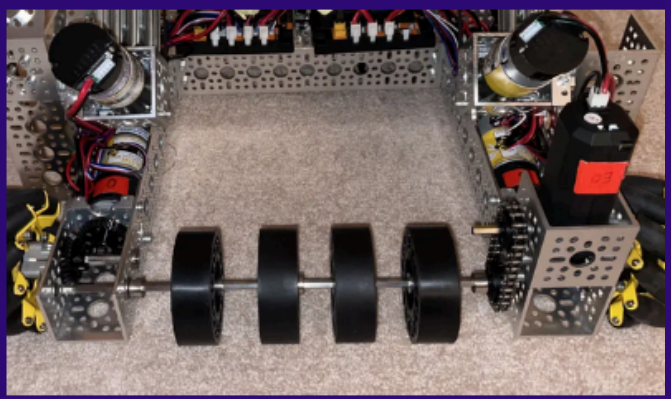


Challenge #1

The motor made the intake area **too small** to take in 2 pixels

Final Solution

We used **gears** to mount the motor on top of the chassis, clearing up the intake space to mount more compliant wheels

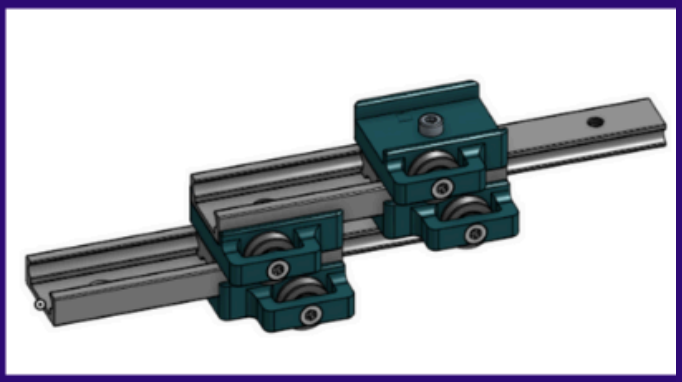


Lifter

The lifter must be able to **quickly extend out to the backdrop**, and be sturdy enough to **support the weight of the robot while hanging**.

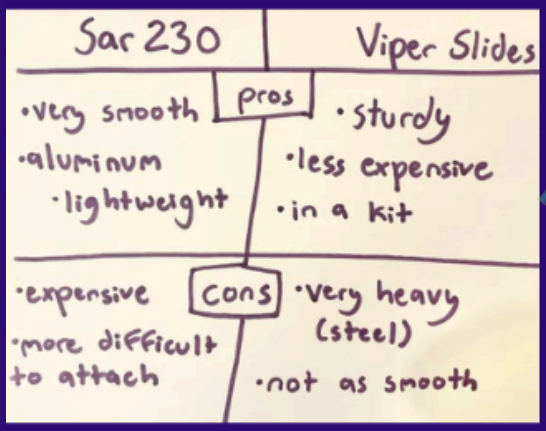
Initial Solution

Our first design utilized the **SAR230 Misumi slides,** however there were complications with the delivery and they were not able to arrive in time for this season



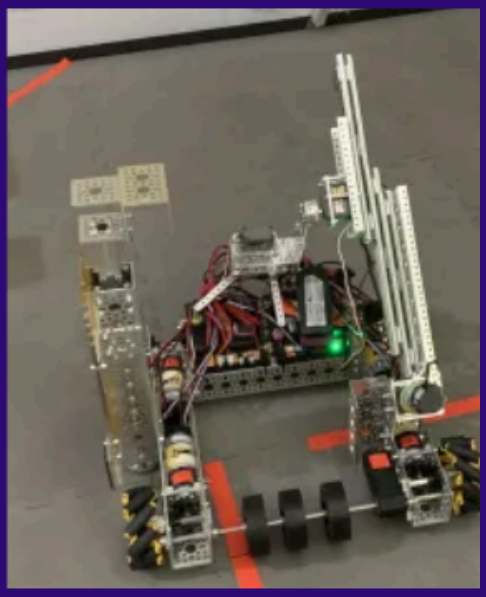
Revised Solution

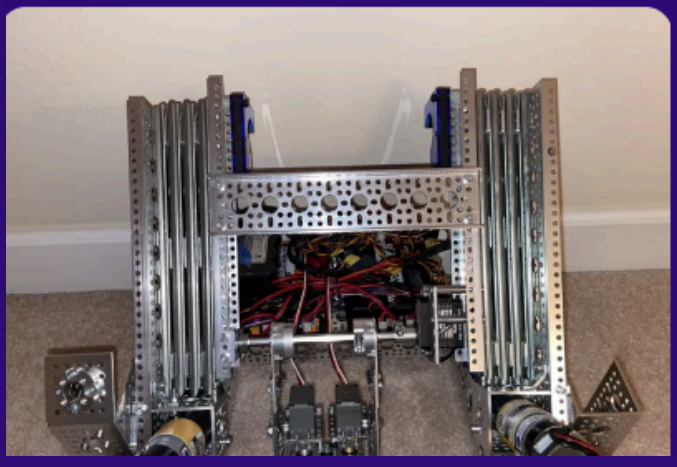
Instead of Misumi linear slides, we opted for the **goBILDA viper slides**.



Challenge #1

The single viper slide was **not strong enough** to lift the entire robot to hang onto the truss.





Final Solution

We added **two viper slides** on both sides of the chassis.

Hanger

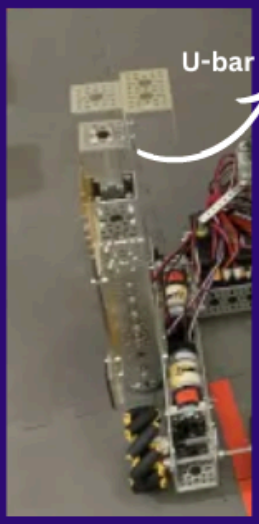
The hanger must be able to support the **entire weight** of the robot and **hang** on a overhead truss.

Initial Solution

Our first design used a **linear actuator** as our main lifting mechanism.

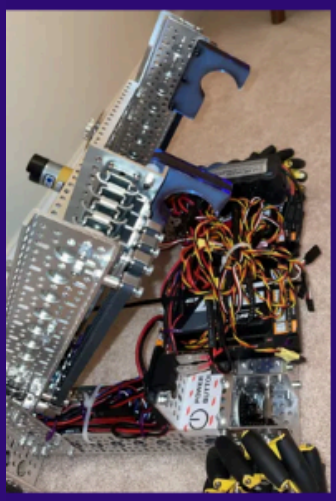
Challenge #1

The linear actuator added **unnecessary weight**, making the robot too bulky and inefficiently using space on the sides.



Solution

Instead of the linear actuator, we decided to attach **custom-made hooks** made of **wood** onto our viper slides.



Challenge #2

The hooks were **too small** to grip onto the bar.

Final Solution

We made the hole on the hanger larger, and used **acrylic** and wood.