Team 21936

SAMOTECH ROBOTICS

POWER PLAY

PRESENTED BY Raytheon Technologies

FIRST TECH CHALLENGE

ABOUT US

We are SaMoTech Robotics, **founded last fall by several 9th grade students** who, after a successful year with a middle school FTC team, graduated to a high school without a robotics program.

Rather than give up, we established SaMoTech as a community-based team, determined to build on last season's accomplishments competing in FIRST Tech Challenge.

Now 9-players strong with 8th & 9th grade students from 4 different schools, SaMoTech has overcome many challenges including limited resources and no dedicated practice space to finish regular season **ranked the #1 team in Los Angeles**.

MISSION

To design, build and program a world-class FTC robot while promoting FIRST and STEM in our community, all while developing our skills to become well-rounded science and technology leaders.

ROOKIE SEASON ACHIEVEMENTS - COMPETITION

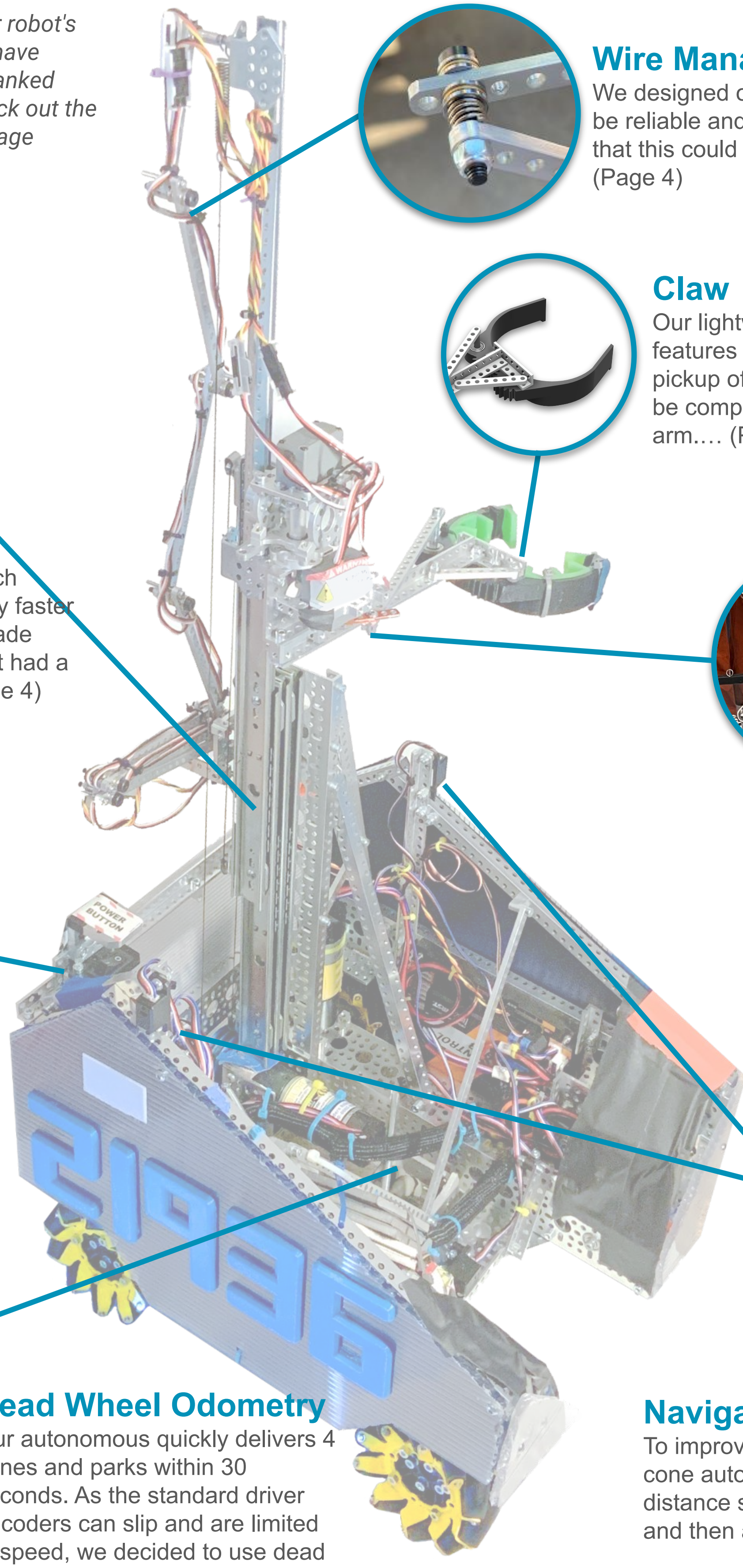
- ★ Ranked **#1 in Los Angeles** at the end of regular season
- ★ The only **undefeated** SoCal team with a record of 19-0-0 in qualifying matches
- ★ Currently the **#1 Autonomous program** in our region
- ★ **1st Place** Champions of League W
- ★ **ILT 2 Champions** -- Winning Alliance Captain
- ★ We set **4 of the current top 10 record scores** in the region

ROOKIE SEASON ACHIEVEMENTS - COMMUNITY

- ★ **Collaborated** multiple times with other FTC Teams to practice and share knowledge & experience
- ★ Secured **3 corporate donors / sponsors** new to the FIRST Community
- ★ **Volunteered** regularly to assist a local middle school FTC Team
- ★ **Talked with school district** to make FIRST part of the public school system
- ★ Interviewed for a **feature article** in our School District newsletter for our accomplishments and long-term goals of incorporating FIRST into the public school system
- ★ Featured in a **frontpage article** of our local newspaper, sharing our love of FIRST and our hopes to see robotics programs and teams in more public schools.

ROBOT DIAGRAM

Here is an overview of our robot's unique components that have made SaMoTech the #1 ranked team in Los Angeles. Check out the summaries and find the page numbers for more details!



Wire Management

We designed our wire management to be reliable and sturdy. We also realized that this could help stabilize the slide… (Page 4)

Claw

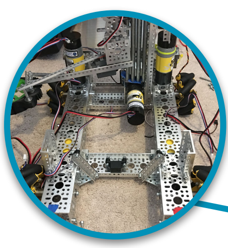
Our lightweight claw has automatic features such as sensor-driven pickup of cones. It was designed to be compact and to easily fit on our arm.… (Page 6)

Slide

We made our slide much faster by using a slightly faster motor and a custom-made pulley we designed that had a bigger diameter… (Page 4)

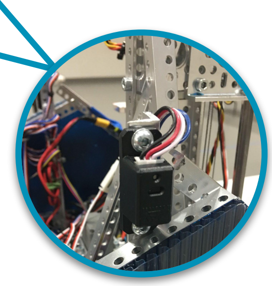
Arm

To deliver cones fast in autonomous and teleop we use an arm that rotates 180 degrees and allows us to deliver cones off the side of the robot never requiring us to turn… (Page 3)



Chassis

Our chassis is a modified goBILDA mecanum chassis that is small and easily navigates the field at a high speed. The entire chassis was designed around the arm … (Page 3)



Navigational Sensors

To improve our accuracy in our 4 cone autonomous, we used distance sensors to “see” the pole and then align… (Page 6)

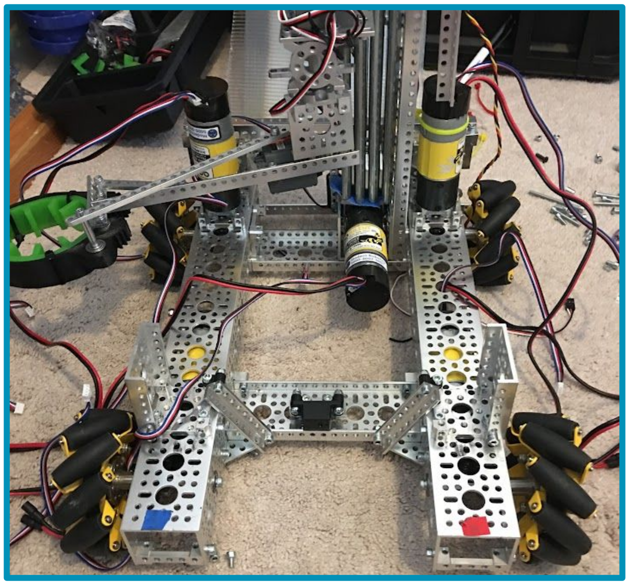
Dead Wheel Odometry

Our autonomous quickly delivers 4 cones and parks within 30 seconds. As the standard driver encoders can slip and are limited in speed, we decided to use dead wheel odometry to perform complex trajectories with extreme accuracy… (Page 7)

CHASSIS

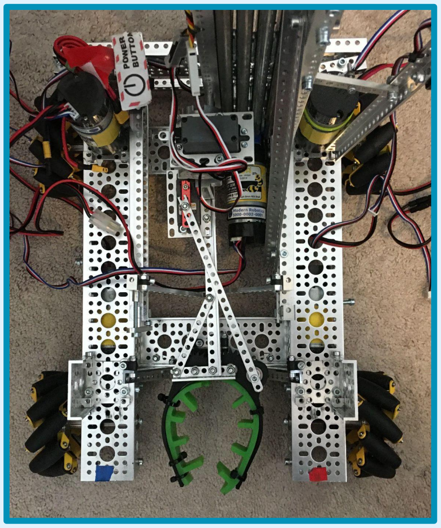
Our Secret Weapon: The Arm

Our robot's rotating arm is the **key to our winning streak** on the field. It can **reach over either side of the robot** so that the drivers can deliver cones quickly and efficiently, **without having to rotate the chassis**. The result is **rapid cone deliveries** and **quick returns** to the substation. Many teams have copied us since our first meet, but we're still making improvements, so we hope to stay a step ahead!



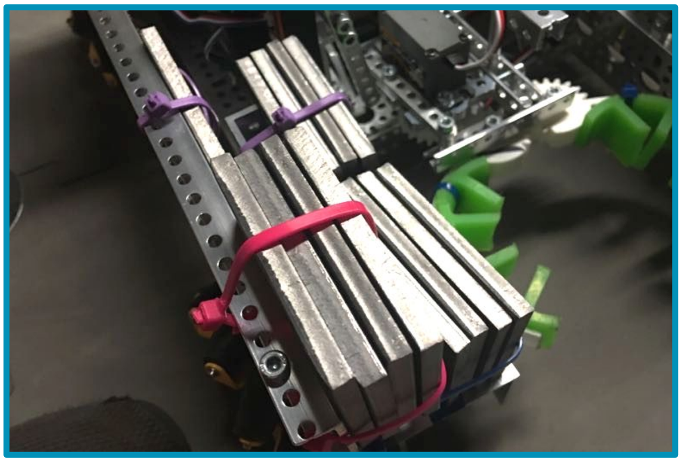
Tiny and Fast Chassis

We knew squeezing between all those poles would make driving tough if our robot was full width, and our rotating arm needed to be able to reach over the sides to deliver cones, so we made the chassis as **narrow as possible**. To ensure the **protection of the claw**, it was designed to be **recessed within the chassis**.



Problem Solving

One of our main challenges was that the **robot didn't drive straight** due to **chassis flex**. This **affected the gears and axles**, **causing friction** and preventing the robot from driving smoothly. To fix this, we added **chassis stiffeners** which helped stabilize the robot and allowed it to drive straight. However, we also encountered friction issues and had to make some adjustments to the gear train to **reduce friction and improve overall performance**.

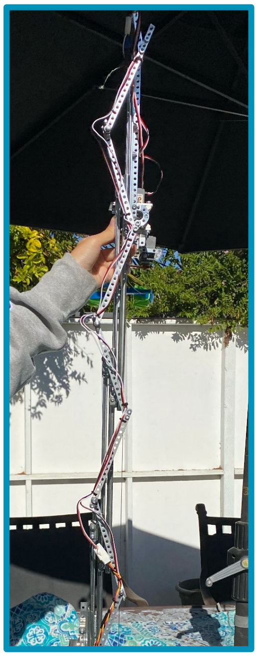


Tungsten Balances the Weight

One of the challenges faced during the design of our robot was tipping over since all the **weight is in the back** where the heavy slide is. This led to the robot **driving crooked** and lacking precision during driver controlled periods. To overcome this, we **measured the weight** at each corner and **added ballast weights** to distribute the weight as evenly as we could. Recently, **we got a tungsten company to donate 12 pounds of tungsten**, which is almost as heavy as lead but isn't toxic!

REACHING FOR THE HIGH POLE

Last year our former team used rotating arms to reach high. But this year's poles are so high that we realized we'd have to use slides. Through trial and error we found string that wouldn't break and made our slide faster and less floppy.

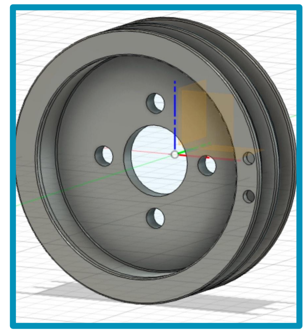


String Evolution

The string that came with our slides was weak, and it kept snapping. We experimented with four different types of string. We tried **Kevlar kite string**, and when that broke, we tried braiding the Kevlar. However, this also didn't work because it was **wide and too stretchy**. Finally, we found a **200-lb string** that was much stronger, and **it hasn't snapped once**.

3D Printing Custom Pulley

Once our robot was up and running, we realized that our **slide was way too slow**; the robot was fast, but our drivers would have to wait for the slide to raise. First we got a **faster motor,** which improved things slightly. Then, we designed a slightly **larger pulley** that made the string much faster. It allowed more string to be released or taken in per motor rotation, resulting in faster movement of the slide. To design the pulley, we used Fusion 360 and modeled it based on our current pulley from goBILDA. The larger pulley was a success and **significantly increased the speed of the linear slide** on our robot without sacrificing any torque.



Identifying Wiring Problem

We began by **researching** what cable management techniques other FTC teams had done in past years when using slides, and we tried a couple. Our first attempt was a curly piece of flexible wire that would stretch and shorten like a **phone cord**. We also tried a **plastic chain** to hold the wires, but it was floppy and you couldn't make it long enough to go all the way up to a high pole.

Fighting Friction and Swing

Eventually we saw that some teams with slides make a **skinny, jointed arm** next to the slides that carries the wires, so we decided to try that. It was difficult because our swinging arm design meant that our cable management had to be **VERY compact**, so that's why there are so many short sections of aluminum instead of longer ones. But it still had problems with friction and swinging, leading it to **stick out to one side of the robot** or the other. Someone suggested **ball bearings**, and we found these ones on Amazon that are called **thrust bearings**: they're a layer of balls sandwiched between two washers. They really made the **friction go away**!

Cable Management

Our robot is very narrow, so instead of using two slides side-by-side like most teams, we tried to get away with **only one slide**. However, one slide was very **unstable**, so it was wiggling a lot while our driver was trying to place cones on high junctions! When we added our **cable management**, it **reduced the wiggling** once we got the joints to just the right tightness. Especially in the highest position, when the cable management system is locked out, the arm is **much more stable**. We still wish we had a second slide, like many other teams (including the ones who have our swinging arm), but so far we're doing really well with our current design and plan on sticking to it.

3D MODELING

Claw

CONSTRAINTS

During the development of the claw, we had several constraints in mind. Our goal was to design a claw that could **grab onto the sides of the cone**, so we attached half a **rubber wheel** to both sides of the claw to **improve its grip** and prevent the cone from slipping out. We also wanted to minimize the weight on the arm to ensure it would not weigh down and slow down the slide, so we **only used one servo** on the claw.

PROBLEM SOLVING

During a test drive the night before a competition, the claw of our robot **caught on a pole and broke**. In response, we decided to create a new, **stronger claw**. We examined the point of breakage and made that part **thicker** on CAD. This new design has proven to be more durable, as we have been using it successfully for a while now.

FINAL CLAW

The "final" claw was made using filament with a **20% infill** for the claw, gears on the inside to allow the two claws to connect more effectively than our previous design, and **smooth arcs** on the inside to **prevent the gears from interacting with the cone**. All of these components were **extruded 12mm** in height, and the diameter of the gear was calculated to match the holes on a metal plate, allowing us to securely attach it using screws.

Beacon

Beacon V1

Our goal for the design of our beacon was to have a beacon that could be placed on top of a cone, enabling the robot to score both the cone and beacon at the same time. We needed a quick design before the first meet, so we designed a prototype, which was just a **plain hollow cylinder** that would be placed on top of the cone. However, we found many issues with this design; for example, it could **fall off the cone easily** if not placed on properly, and it was **extremely heavy**, making it **hard for the drivers to control**.

Beacon V2

After designing Beacon V1, we decided to make it even **thinner** and add large **triangle-shaped holes** to **reduce its weight**, as it was too heavy previously. We also made adjustments to the slope to ensure that it would **match that of the cone**, to reduce the chance that it might fall off. We added **internal support** to the beacon to make it more durable and **resistant to damage**, and we printed our team name and number on the outside of the beacon to give it a personal touch and make it easily identifiable.

Beacon V3

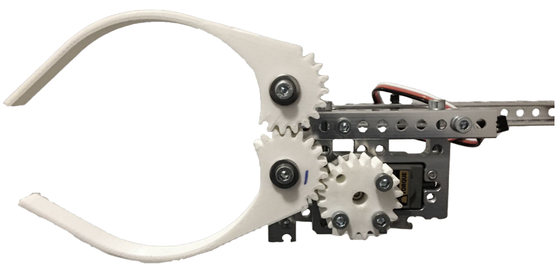
V2 wasn't always the most practical. Although lighter, it was still **heavy**, and still sometimes **fell off the cone**. We decided to make a **micro-beacon** instead. The first design was a floppy ring with a narrow column. However, the **ring and column were too thin**, and thus they broke. Instead, we made the ring and the column **thicker** for more support and embossed our team name and number onto them. We also used a **minty blue filament** for the blue micro-beacon instead of the usual dark blue so it could be **easily spotted**.

> *I really enjoy 3D modeling claw, because with every problem we encountered, there was a solution, and many more problem to fix.*
>
> \- Ari

CLAW ITERATIONS

Claw V1

For our first version of the claw, we designed a **lightweight mechanism** with a **stable grip** that reduced stress on the servo motor. We used a **scissor-like mechanism** that utilized **metal pushrods** and a **servo motor.** The servo motor was **at the base of the arm**, which took weight off the end of the arm and **ensure stability** when the arm rotated. The push-rods transferred the motion from the servo to the custom claws located at the end of the arm. We lined the claw with **green rubber wheels** cut in half to strengthen its grip on objects. The claw and arm were constructed from **aluminum beams**, with 3D-printed claws bolted onto the end of the arm. The nuts holding the custom claws were loosely tightened to allow for rotation.



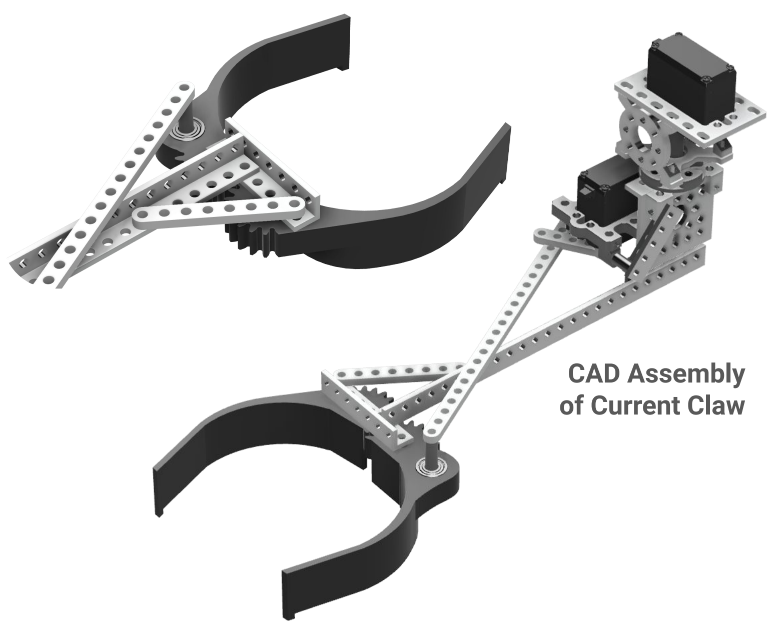
Claw V2

We **researched** online and found that some teams use **gear teeth** to make their claws operate. Ari was really interested in learning CAD, so he bravely took on the job of trying to make a **gear-driven design** that would stay straight. The holes in the claws were enlarged to accommodate standoffs instead of bolts, which allowed for **free rotation while tightening the nuts**. We especially wanted to make the **claw more compact** and not conflict as much with other mechanisms on the robot. This one worked pretty well, except our arm was even **more wobbly** as it rotated back and forth since **all of the weight of the servo was out at the end** of the arm.

Current Design

The third iteration aimed to combine the best factors of our previous designs to ideally create our current claw that is **undefeated for 23 matches** (including ILT). The servo was moved back to the **base of the arm**, with **a push rod** to control **one half of the claw**. Then **gear teeth** make the other side of the claw go too. The use of **ball bearings** aimed to **reduce friction** and **improve the stability** of the claw, resulting in a more reliable and effective gripping mechanism.

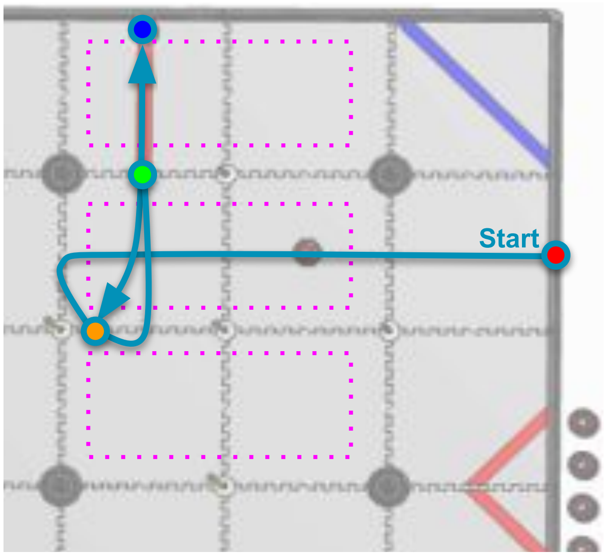
We also **inverted the servo** so that the am can center very low in our chassis without the servo crashing into the other internal parts of our robot. Overall, the final claw design demonstrated the power of **iterative design** and the importance of continually testing and refining prototypes to achieve the desired outcome.



CAD Assembly of Current Claw

> *I really enjoyed engineering the claw because I was able to come up with solutions to problems.*
>
> \- Griffin

AUTONOMOUS (4 CONES)



Our autonomous scores 4 cones and parks correctly:

1. First, our robot reads our custom signal sleeve with a camera, then shoots away from wall toward the high pole.

2. The robot deposits the preloaded cone on the high pole.

3. Uses the low pole to align with the center of the stack.

4. Drives forward and picks up the top cone off the stack.

5. Using odometry and sensors, delivers a cone to the close high pole. Repeat steps **3**-**5** three more times.

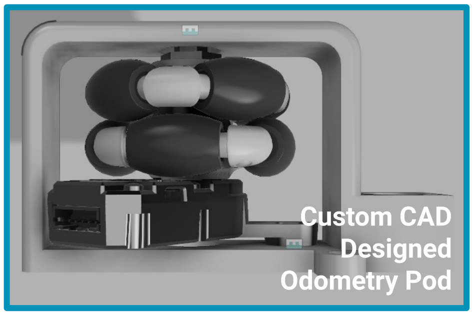
6. Finally, our robot parks in the spot corresponding to the signal sleeve we detected as we drove through it. Parking positions shown in diagram as pink boxes.

Consistent 4 Cone & Parking Autonomous

During the autonomous portion of the game, our robot **consistently** scores a total of 60 points. This includes 40 points for delivering 4 cones to the close high pole and 20 points for correctly parking in the designated position with the custom signal sleeve. Our high-scoring autonomous consistently starts us off with a **strong lead** for teleop which has contributed a lot to our current **23-game win streak in league and ILT play**.

Dead Wheel Odometry

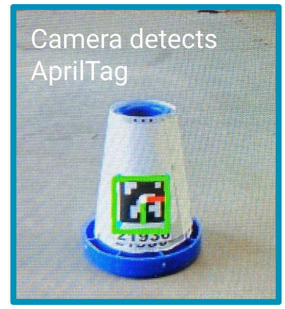
Our original autonomous was limited by slipping wheels when we used only encoders on the motors like most teams. For more accurate positioning during autonomous, we added **odometry using dead wheels with encoders**. Dead wheel odometry is the use of small wheels attached to encoders that track the wheels rotation and robots movement. However, finding a location for the wheels was a challenge since our chassis was small. We decided to make space for the **odometry wheels in the center of the robot**, which also helped it be **more accurate**, as the middle of the robot hardly lifts off the field. Most odometry uses three wheels but we only needed two since we didn't turn a lot in our autonomous, which saved space on our robot while still performing their function. The IMU in the expansion hub also provided accurate heading information, further eliminating the need for a third wheel. We **designed and printed custom pods** that were **robust with low friction**. We also added a small servo mechanism to **lift the pods up during teleop** to allow us to **drive over ground junctions**, to avoid getting caught on them when driving with the pods lowered. The dead wheels **sped up our autonomous** while still remaining accurate and consistent.



> *Programming the autonomous is fun… when it works.*
>
> \- Brandon

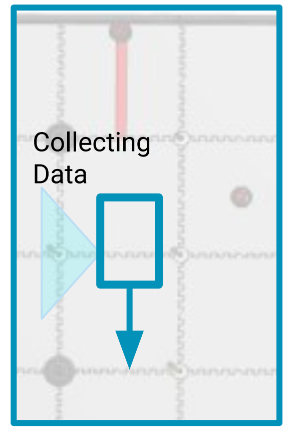
SENSOR ALIGNMENT ALGORITHM

Color Sensor vs Camera



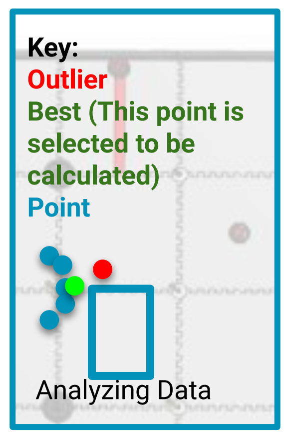
We recently upgraded our autonomous system by implementing a **new camera** system that **uses AprilTags**, similar to QR codes, to **identify our custom signal sleeve**. While previously relying on a color sensor to detect colors on the signal sleeve, we switched to the camera for **better accuracy** and the ability **to align the robot more precisely** to the side of the tile. With the camera scanning the area, there is **no longer a need to align the color sensor** with the signal sleeve cone in the center of the tile.

Data Collection



We first start the process collecting information, data, for our auto alignment algorithm. We collect data to **pick the best sensor distances** to use as the sensor can be inaccurate when "barely seeing" the pole. The robot starts off driving backwards until first "seeing" the pole with sensors. Once the robot has seen the pole, it **begins the data collection process**. This process has the robot slowly crawl backwards which synchronously **scanning with the sensors**. In this time it **collects a dataset of normally 8-15**. The dataset includes multiple classes **storing information** of the **robot's estimated position, rotation, and the measured distance** to the pole at that current time. After the robot completely loses the pole or detects the numbers getting smaller, it stops the data collection and moves on to the next stage.

Analyzing & Sorting Data



After the robot collects all the data and passes the pole, it employs a **highly optimized and complex algorithm** to **analyze and sort the data set**. First, the data set is sorted in **ascending order** using an efficient sorting algorithm such as quicksort or mergesort, which allows for faster processing and easier analysis. Sorting the data by distance from least to greatest ensures that the **closest distance**, which is the most accurate distance, **is selected to locate the pole**.

ex: [8.24, 7.75, 6.24, 5.8, 5.7, 6.1, 7.2, 2.3] -> [2.3, 5.7, 5.8, 6.1, 6.24, 7.2, 7.75, 8.24]

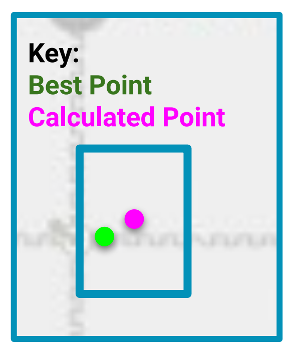
To **identify outliers** in the data set, we use an algorithm that **compares each data point** with the next least valued point and if the point is different compared to the next points by a certain factor we calculated then it is considered an outlier and **removed from the dataset**.

ex: [**2.3**, 5.7, 5.8, 6.1, 6.24, 7.2, 7.75, 8.24] -> [5.7, 5.8, 6.1, 6.24, 7.2, 7.75, 8.24]

Once the data set is processed and outliers are removed, the robot **selects the first index of the resulting array**, [0], which corresponds to the **closest distance to the pole** and the position where the robot collected the data.

dataset[0] = (x, y, rotation, sensor value)

Calculating Delivery Position



Now that the robot has analyzed the **best possible data** in the dataset, we **calculate the exact location** for the robot to deliver to cone. Using the **sensor value** and the **distance** between the robot and the pole, we calculate the distance that the robot needs to move to **align itself with the pole.** The calculation takes into account the **direction of the alignment** and the **forward offset** of the robot. We then use **trigonometry** to transform the robot's pose by the **calculated distance** and heading offset, ensuring that it is properly aligned with the pole. Finally, the robot is able to move to its desired location and deliver with **precision** and **accuracy**.

> *"I've learned that in FTC, to do well in the competition is to have the most reliable robot on the field."*
>
> \- Brandon

DRIVER-FRIENDLY CONTROLS

Slide & Arm Presets

We also made a number of improvements to the slide, claw, and rotating arm mechanisms. The slide has **preset heights** that can be easily accessed by the operator with the press of a button, allowing for more precise control and flexibility in movement. We decided to add this because it was very difficult to manually raise the height to the perfect level. This feature is particularly useful when the robot is performing tasks that require a specific height, such as reaching the top of a pole or delivering a cone to a designated location. In addition to the preset heights, we also added buttons to **control the movement of the rotating arm**, enabling it to be moved left, right, or centered quickly in **preset positions**. This allows the operator to easily position the arm for tasks such as cone delivery or retrieval, without having to manually move it perfectly. It also allows for **consistency**, as it always turns the same amount each time, leaving all the fine tuning to the chassis driver.

Automatic Safety Control

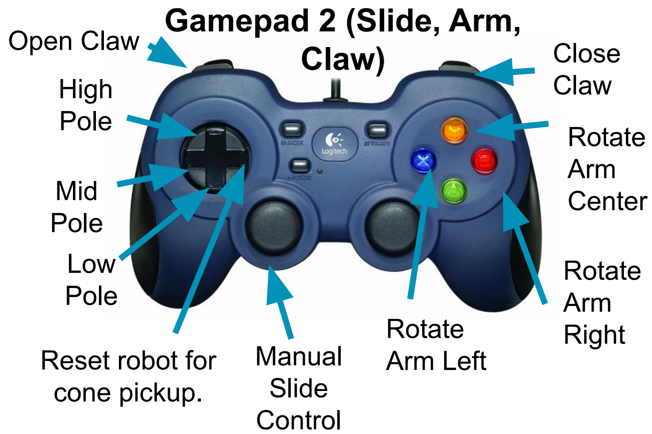
To address the problem of the arm not being aligned with the slide as it lowers, we have added **safety features** that track the slide's position and **automatically center the arm** to **prevent any potential collisions and damage to the arm and claw**. Furthermore, we have implemented **automatic control** of the arm and claw at specific slide heights to reduce the likelihood of driver error and to ensure the safety of all the robot's mechanisms. These upgrades significantly improve the efficiency and safety of our robot.

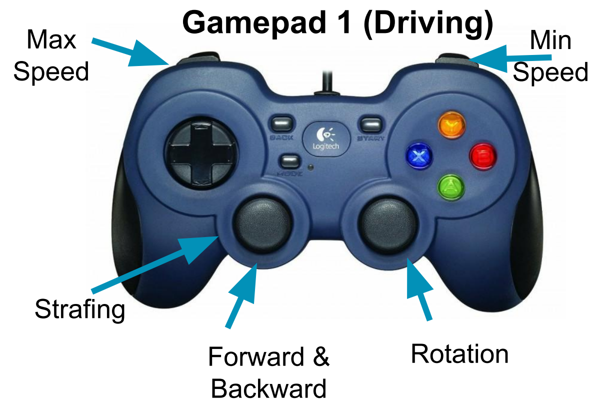
Automatic Claw

We also implemented the use of **sensors on the claw.** In addition to simple open and close presets, we included an **automatic grab function utilizing a distance sensor** at the base of the robot. This sensor is used to **detect cones** within the designated pick-up area and **trigger the automatic grab function** when the distance falls within a certain range. We originally wanted to put a sensor inside the claw itself, but we realized that putting it on the robot itself has several advantages, including the ability to utilize a sensor with a higher profile and a reduction in the number of wires required to reach the slide at its maximum height. In addition, our claw would often catch on objects or the slide would descend while the arm was still open, so we added an automatic close as the slide reached its lowest height and then an automatic open once the slide reached the ground.

Chassis Speeds

To further improve the efficiency and success of our teleop, we implemented two driving modes: **slow and fast speed**. These modes enable the chassis driver to **tailor the speed of the robot to the specific task at hand**, providing greater control and precision for tasks such as cone delivery. In addition to these driving modes, we also made several enhancements to the claw and slide mechanisms. By implementing these improvements, we were able to significantly **increase the speed and accuracy of cone delivery**, resulting in a more efficient and successful teleop. It also allowed us to **expand more on our coding knowledge**.





WINNING THE GAME

Autonomous Advantage

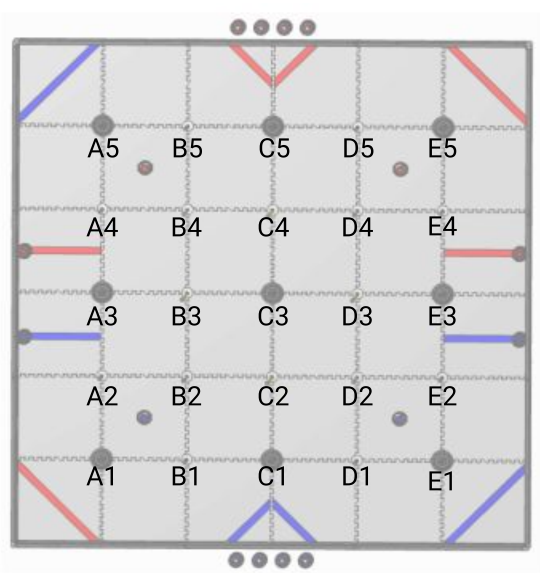
Our autonomous **consistently delivers 4 cones on the high pole** giving us a **solid lead** when teleop starts. With this lead, we work with our alliance partners to maintain it throughout the rest of the match.

Alliance Strategy

Effective teamwork is crucial for success in robotics competition, and communication during meets is especially important. Prior to a match, our team members approach our alliance partners to discuss strengths, weaknesses, and strategies, and **collaborate on a plan**. However, after the first meet we noticed that our note-taking during these conversations was very inefficient and instead created a **multiple-choice form**, including a field diagram, to streamline the communication with alliances.

Game Strategy

A significant portion of our team meetings are dedicated to developing and refining our strategy. We **designed our robot around this strategy**, which focuses on taking cones from the substation during teleop and moving backwards while rotating the arm to **reach all of the junctions and claiming as many of them as possible**. We also prioritize lateral and forward/backward movements to **minimize turning**. This allows us to be flexible in our strategy in the match itself— **owning as many poles** as possible is extremely helpful for making circuits, or alternatively, we could own as many poles as possible. Overall, our robot can place a total of **16 or more cones, 4 cones in autonomous, 2 from the side stack, and 10 or more from the substation**. It's been incredibly fun to see how our strategy has evolved over the season as everyone's robots have improved so much!



Naming the Poles

Our robot has become extremely fast, and thus we needed to create more efficient communication, as it took too long to identify what junction to score on in a symmetrical field. We implemented a **grid system** that **labels each junction** with a unique combination of a letter and number after Meet 0. This grid system has been helpful in **clarifying communication** during practices and **improving efficiency**. We also established a process to clearly communicate our goals to the entire team. The coach will specify the desired junction, the **position of the slide**, and the necessary **arm rotation**. The arm rotation is **detonated by red for left and blue for right**, as left and right are relative. The chassis driver will either confirm the plan with the same junction number or suggest an alternative by saying "no" and stating the new junction letter-number combination. This ensures that everyone is aware of the plan and **avoids confusion** about the intended scoring junction. It worked very successfully, and we were also able to **assist CyberDragons create their own version of our grid system**.

OUTREACH

Outreach is a vital part of our FTC journey. By sharing knowledge and experience with other teams, we have seen how cooperation benefits everyone. And by seeking opportunities to share with our community, our team benefits from more supporters while promoting STEM in the entire school district.

Legacy Building

We were devastated when our local high school decided against having an FTC team this year, which is why **we founded SaMoTech as a community-based team**. However, our desire to see **FIRST programs incorporated into the public school system remains a major long-term goal** for our team.

Our members are actively **communicating with Santa Monica School Board officials**, principals, and administrators in an effort to **develop FIRST robotics programs and teams in the middle schools and high school**. And we are pleased to share that although progress has been slow, **enthusiasm is growing**.

We now have tentative dates in March and April to **present FIRST to the communities at Grant Elementary, Lincoln Middle School, and Santa Monica High School**. We are hopeful that our persistence, enthusiasm, and success will result in someday seeing **our entire public school system become part of the FIRST community**.

Front Page News

Our team was recently featured in a front-page article of our city's only daily newspaper, ***The Santa Monica Daily** Press*. In the article, we **share our gratitude** to FIRST while **sharing their mission** and **promoting STEM**. This incredible opportunity came about after we emailed the publication with updates on our team's storybook rookie season, then invited a **reporter to attend one of our weekly meetings**.

SaMoTech Robotics team to compete in Southern California Championship

GRACE INEZ ADAMS
SMDP Staff Writer

On a recent Thursday afternoon, a robot named Sam zipped around inside a Santa Monica garage. Controlled by several teens gathered around it, the robot used an extendable claw to pick up blue cones and deliver them to various posts.

Sam is the creation of nine local middle and high school students who formed the SaMoTech Robotics team last year.

The team is currently participating in the FIRST (For Inspiration and Recognition of

School Board Attention

Several of our team members have been **interviewed for an article** coming out in the March 2023 edition of *The Wave*, **our school district's monthly newsletter**. Again, we have used this opportunity to **promote FIRST** and share our hopes to see engineering and **robotics teams become part of our city's public school** system.

Social Media & Website

Our team uses its **Instagram account** (@samotechrobotics) and **YouTube channel** (@samotechrobotics) to engage with the online community and **share our experiences** in FTC. These channels provide us with the opportunity to share information, and **collaborate with other teams**, as well as **gain more sponsors**. In addition, we have a website, (https://samotechrobotics.com/) serves as a platform for us to **showcase our progress and connect with the FTC community**. We designed and built a website that is both aesthetically pleasing and user-friendly. Our ultimate goal is to establish ourselves as a respected and competitive presence in the FTC community.

> *I really love this community because everyone is so friendly and supportive.*
>
> \- Camille

OUTREACH

Assisting CyberDragons

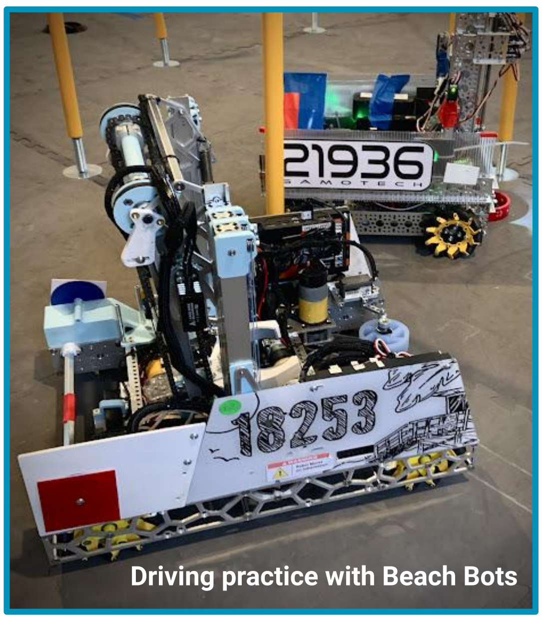
As a team, we are passionate about **helping others and sharing our knowledge** and experience with those who are just starting out in FTC. That's why **we volunteer twice a week to assist the local CyberDragons team**. Many members of our team were on CyberDragons last year.

The CyberDragon teams are mostly made up of **younger students who are new to the competition**, and although we have little experience ourselves, we do our best to **guide and assist them as they learn the ropes**. This has not only been a rewarding way for us to **give back to our community**, but it has also allowed us to develop our **leadership and teaching skills**.

Helping with CyberDragons also helps us with our team's **sustainability**. Since SaMoTech members are primarily in high school, this connection to our local middle school level team will **allow us to recruit new members each year**, as graduating eighth graders from the CyberDragons can join us as freshmen at SaMoTech.

Assisting CyberDragons

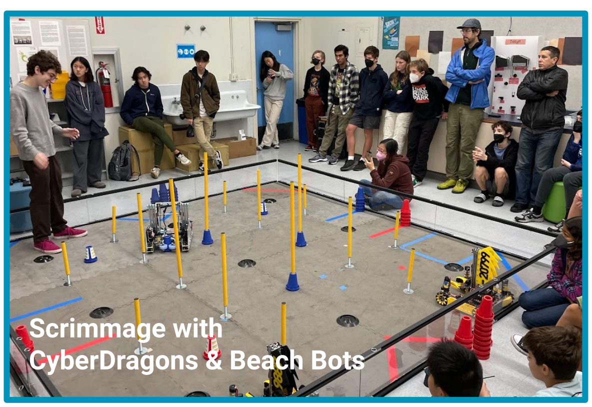
Driving with CyberDragons



Driving practice with Beach Bots

Exchanging ideas with Beach Bots

Driving with X-Drive



Scrimmage with CyberDragons & Beach Bots

Networking With Other Teams

Our team reached out to X-Drive (16321) and Crossroads Inc (22533) to exchange ideas and get more practice driving. During a meeting at Crossroads, we discussed our **driving strategies** and how we used them in real match situations. We also learned from more experienced teams like Beach Bots (18253), who **provided valuable feedback** on improving our robot, including **addressing weight distribution issues**. Collaborating and exchanging ideas with these teams has been a productive and beneficial journey for us, especially as a relatively new team in our first year of competition.

BUSINESS PLAN

As a new robotics team, we need a secure business plan to **manage our resources** and make sure we have what we need to succeed because we have to **start from scratch**. We have gotten **sponsors through outreach and fundraising** and use a **system to track our budget**. This way, we can make sure we have the resources we need to reach our goals.

Sponsors

We are thankful to **Ziprecruiter**, a job recruiting service, and **goBILDA**, a well-known company within FIRST, for their help and guidance. The support of **RNI** and **Panasonic**, an organization that invests in new ideas and innovation, were also so helpful for our team. We are so thankful to have the support of such amazing sponsors. Without their generosity the SaMoTech team would not be possible.

Fundraising

In addition to our sponsors, we also used outreach as a means of supporting our finances. On our **Instagram account**, we shared our **GoFundMe page** and encouraged our parents to reach out to their networks for support. Through our GoFundMe campaign, we were able to raise funds that greatly helped us get our team off the ground. We are extremely grateful to our generous donors as they have been instrumental in enabling us to establish the SaMoTech robotics team.

Budget Tracking

To ensure that we are using our funds efficiently, we created a **budget tracking sheet** that lists all of our purchases and all the money we have received. This has been very helpful in helping us make **informed decisions** about where and when to spend our money, as well as how much we need to achieve our goals. By keeping track of our finances using this budget sheet, we are able to **manage our resources effectively** and ensure that we are using our funds wisely.

Expenses

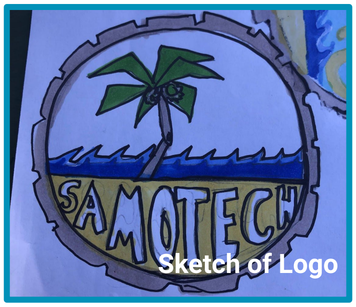
ITEMS	COST
FTC Season & League Registration	$595.00
Hubs & Electronic Set (control)	$1,070.00
Robot starter kits, batteries, parts	$2,036.00
Practice Field & Scoring Elements	$819.00
Custom fabrication	$350.00
Administrative costs / banking fees	$135.00
Craft Services / Meals	$300.00
Safety gear & Expendables	$140.00
Tools & 3D Printer	$950.00
Marketing / Promotion (shirts, displays, etc)	$400.00
TOTAL EXPENSES:	$6,795.00

INCOME

SOURCE	FUNDING TYPE	AMOUNT
ZipRecruiter	Sponsor	$2,000.00
Rowe Neurology Institute	Sponsor	$1,000.00
First Inspires (Rookie Grant)	Grant	$750.00
The Panasonic Foundation	Grant	$300.00
Family Contributions	Donations	$1,700.00
GoFundMe	Donations	$1,500.00
	TOTAL INCOME TO DATE:	$7,250.00

Our Budget Tracking Sheet is shown above with our expenses as well as our income from our wonderful sponsors!

VISUAL DESIGN


Sketch of Logo

Early Digital Logo

Logo Design

As a rookie team joining FTC this year, we were starting from scratch and didn't have many of the simple things most teams start with, such as a team name or logo. We selected 'SaMoTech' as our team name and set about **designing a logo**. Our logo features a beach and palm trees, symbols of Santa Monica, in a mechanical style. We used Adobe Illustrator, which we chose over Photoshop due to its ability to scale graphics without loss of quality. During the design process, we **learned a lot about the software**, and in the end, we were able to produce a logo that we feel effectively represents our team.

Robot Aesthetics

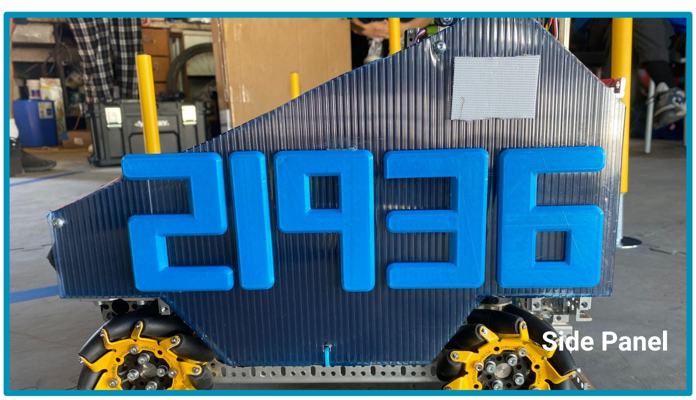
We used corrugated plastic to cut two panels in the shape of the robot and colored the inside with navy blue spray paint, with light blue 3D-printed numbers on the opposite side. The colored back provides a clean look and hides the robot's internal components, **protecting the crucial parts of the robot**. The panel's slope also improves the performance of our turning arm, as it **guides it to center itself in the middle of our chassis**. We also added a personalized license plate to the back of the robot to give it a unique character.

Final Logo Design

T-Shirt Design

After designing our logo and font, **we entered the designs into Printful, a t-shirt printing website**. We ordered two prototypes to confirm that the text placement was correct. Upon receiving the prototypes, we identified a few issues that needed to be addressed; for example, the logo was a little too high on the shirt.

In order to resolve these issues, we decided to work with a local print shop, as they could make the necessary changes without increasing the price. They offered more flexibility in terms of design, allowing us to add our sponsors to the back of the shirt and a small design to the sleeve. Additionally, the local print shop had a lower bulk printing price.



I loved working on the design of the t-shirt because I liked brainstorming the ideas.

\- Georgia