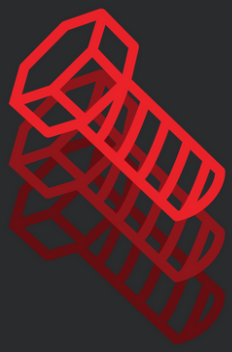

BOLT.M3

Engineering Notebook

Part 2

#22801

Power Play

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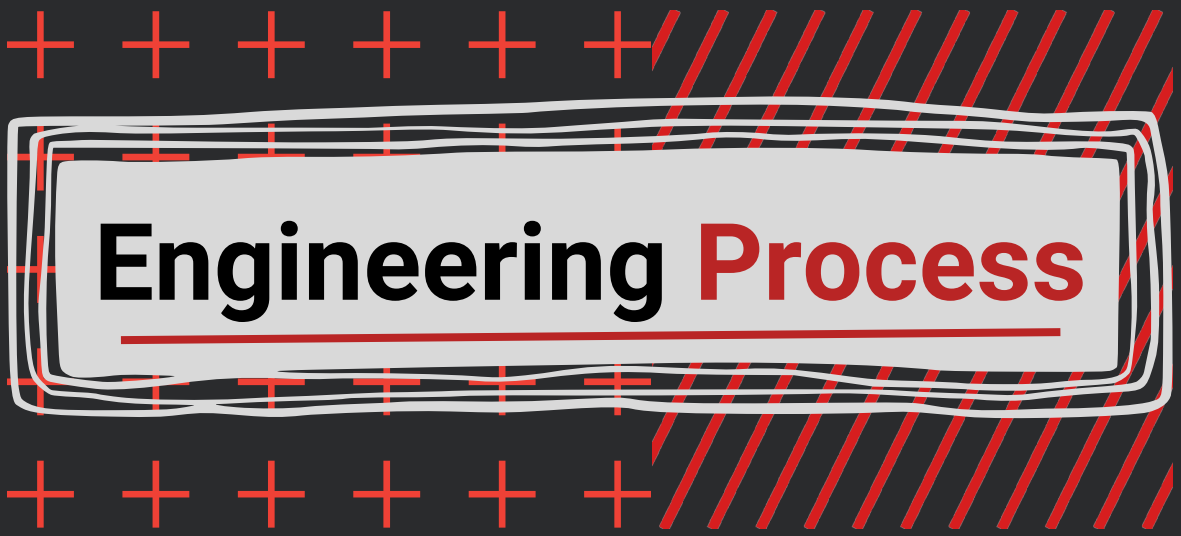

Engineering Process

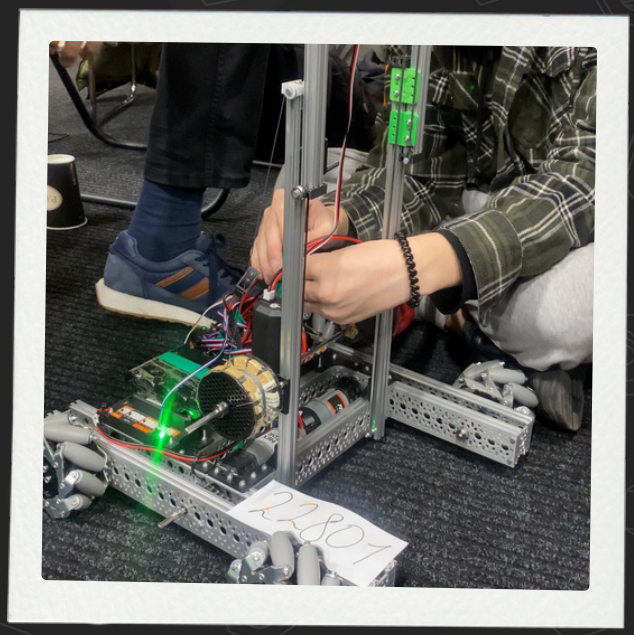
THE BEGINNING OF THE SEASON

The renewed version of Bolt.m3 team was created right after the First Global Challenge's end, around the 14-15th of September. The first two months were almost entirely dedicated to making a good portfolio and completing the outreach challenge.

We visited different schools in Almaty and spread information about the First Championships and the world of robotics. This significantly contributed to our progress in various awards, such as Connect or Inspire.

Although we spent most of our time presenting First in front of students, we were still heavily involved in the practical part of the new Energize season.

Our team was developing ideas and a general plan for the future robot. At some point, we decided to recreate the lift construction from the recent FGC season. The concept seemed easy at first.



We aimed to design a lift using strings and pulleys and enjoy the easy win. Hence, that became our master plan.

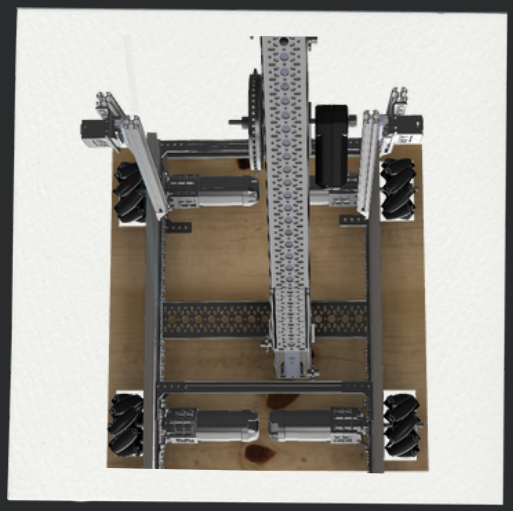
We spent an entire month building what was already done in the past. Everything was going excellent until the Haileybury Championship occurred on November 19-20.

That experience showed us how unstable the entire construction was since our robot broke down in the middle of a game. As a result, we realized that the string lift would only work with additional help.

We adopted a different approach by implementing our lift with sliders taken from drawers. The illustration is below.

The sudden switch in our plan was when we got a package from the US containing some extremely crucial resources for the robot.
We received the long-awaited expansion hub along with four mecanum wheels. These two things were a must-have for a winning team.

How we planned the lift as a CAD model



top view

side view

Next couple of weeks, we balanced the pressure through the entire perimeter of the robot. Finally, we created a balance resulting in a more incredible lift speed.

In December, we spent the entire month writing and testing the code. During the process, we identified that motors became the most significant obstacle for our team since their capacity and the frequency of rotation differed. So we tried fixing the issue manually with the help of efficient code.

```
motorBackLeft.setPower(0.93 * motorPower);
motorBackRight.setPower(motorPower);
motorFrontLeft.setPower(motorPower);
motorFrontRight.setPower(0.97 * motorPower);
```

Later, we discovered that all of the cables in the lab were mysteriously cut. Therefore, the entire December was dedicated to fixing and soldering our cables. We also tried 3D printing some of the details needed for a better connection of wires.

Detailed Processes

Team activity in September-November

The renewed version of Bolt.m3 team was created right after the end of the First Global Challenge somewhere around the 14-15th of September. The first two months were almost entirely dedicated to making a good portfolio and completing the outreach challenge. We were visiting different schools in Almaty and spread information about First Championships and the world of robotics in general. This was a huge contribution to our progress in different awards such as Connect or Inspire awards. Although we were spending most of our time presenting First in front of scholars, we still were heavily involved in the practical part of the new Energize season. Our team was actively coming up with ideas and a general plan regarding the future robot. At some point, we decided to recreate the lift construction from the recent FGC season. The concept seemed pretty easy at first. Design a lift using strings and pulleys and enjoy the easy win. Hence, that became our master plan. We spent an entire month building what was already done in the past. Everything was going perfectly fine up until the Haileybury Championship which took place on November 19-20.

Team activity in September-November

That experience showed us how unstable the entire construction was since our robot broke down right in the middle of a game. We came to a realization that the string lift will not work without additional help. That is why we decided to adopt a different approach by implementing our lift with sliders taken from drawers (we will link the illustration below). The sudden switch in our plan was the time when we got a package delivered from the US which contained some extremely crucial resources for the robot. We received the long-awaited expansion hub along with 4 mecanum wheels. These two things were a must-have for a winning team. In the following weeks, we were testing a new base with a renewed lift. Next couple of weeks we were balancing out the pressure through the entire perimeter of the robot. Creating a balance resulted in a greater speed of the lift. In December we spent the entire month writing and testing the code. During the process, we identified that motors became the greatest obstacle for our team since their capacity and the frequency of rotation differed. We tried fixing the issue manually and with the help of efficient code. Later on, we found out that several cables in our lab were cut by a mysterious sequence of events. Therefore, December was also dedicated to fixing and soldering our cables. We also tried 3D printing some of the details needed for a better connection of cables.

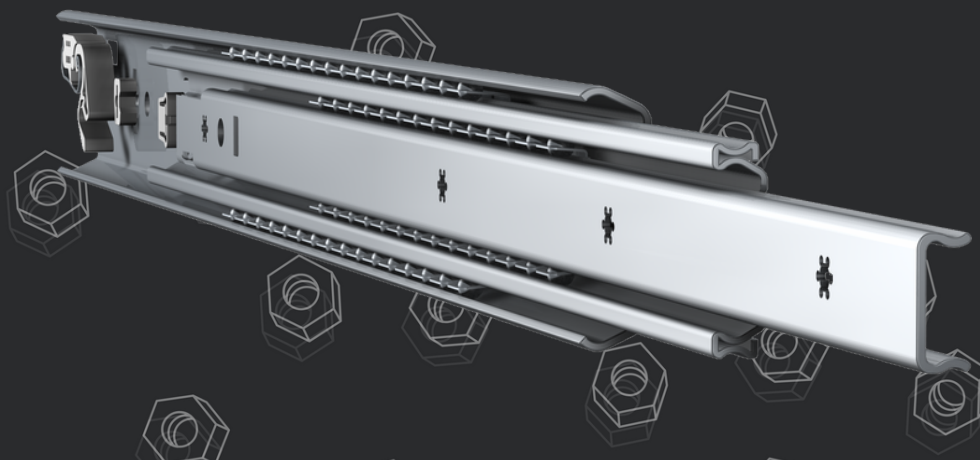
*us during the Haileybury Championship

5.12.2022

Alikhan and Kadylbek went out in the cold to buy telescopic sliders for the lift. They returned to the lab with a couple of new sliders and much motivation to work. That is why they made two parallel lifts and tried testing them.

6.12.2022

Alikhan, one of the engineers on the team, has changed the construction of the lift by combining two parallel charges of 80 cm in length and making a single 120 cm one.



13.12.2022

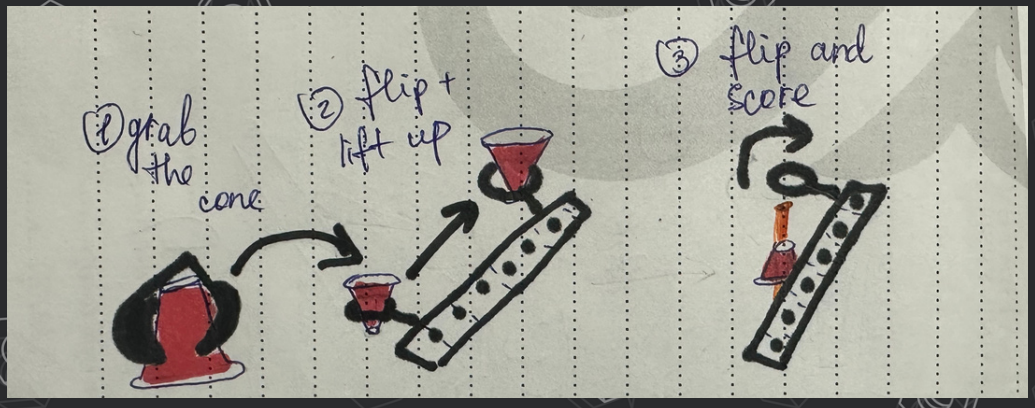
We tested the base and found that our control hub was behaving oddly due to a broken encoder port. Later, we replaced it with another port, and everything worked well. As for the lift, we constructed it by attaching 3 C-Channels and two telescopic sliders to each other.

We also set an aim for the following day. We all agreed on pursuing the same goal: changing the construction of the claw intake and finding the most efficient way of attaching it to the robot per se.

the broken port

14.12.2022

We came up with a new system of cone-scoring. At first, the robot would take the cone, flip it into a basket that will be attached to the lift, and after the charge reaches the height of the junction, the basket will make a 180-degree rotation again and put the cone of the intersection.



At the same time, Vlad and Sat worked on the design for our Instagram posts. During that, Sanzhar was trying to figure out how to connect the intake with the front of our robot.

Despite a massive leap in progress, we still needed some clarification about the robot. For example, our engineers debated the angle at which the lift would be tilted. However, it did not stop us from testing the robot.

We also figured that the lift did not have enough capacity and hence, was making one of the motors overheat.

Therefore we decided to read the documentation that came with the motor, and we found out that its' maximal torque was 3.2 N*m which was not enough for the lift to go up with the wanted speed.

We got some of the equipment from our school's physics lab. Then, using a newton-meter, we estimated the force needed to make the lift go up faster. After doing some calculations, we concluded that the ride needs a second motor for a higher speed and better performance.

Specifications

- Output Shaft: 5mm Female Hex
- Weight: 7 oz
- Voltage: 12V DC
- Free Speed: 125 RPM
- Stall Torque: 3.2 N-m
- Stall Current: 4.4 A
- Gear Ratio: 72:1
- Encoder Counts per Revolution
  - At the motor - 4 counts/revolution
  - At the output - 288 counts/revolution

15.12.2022

That day, we attached the lift to the robot. We faced some problems with chains and the charge position per se. In addition, we experienced significant difficulties connecting everything to the base so the construction would work and be stable simultaneously.

As a result, we secured two extra extrusions, one placed in front of the lift to give it better support.

And the other one was placed right below the charge to balance the pressure created by the lift construction's heavyweight. However, the second extrusion was a source of a new problem that we failed to calculate. Unfortunately, it gave the robot a hard time navigating the field.

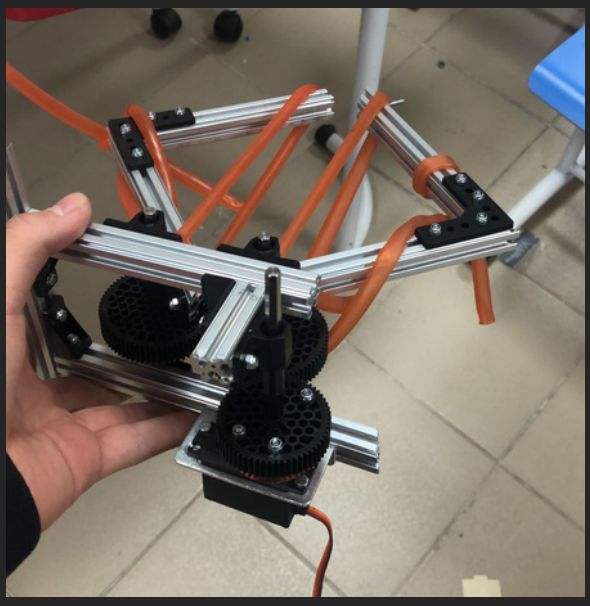
This decision was thoroughly calculated through physics equations.

* The gravitational force exerted on the supporting c-channel is equal to the mass of the lift times a gravitational constant (9.8 m/s2) multiplied by the cosine of the angle to which it is tilted

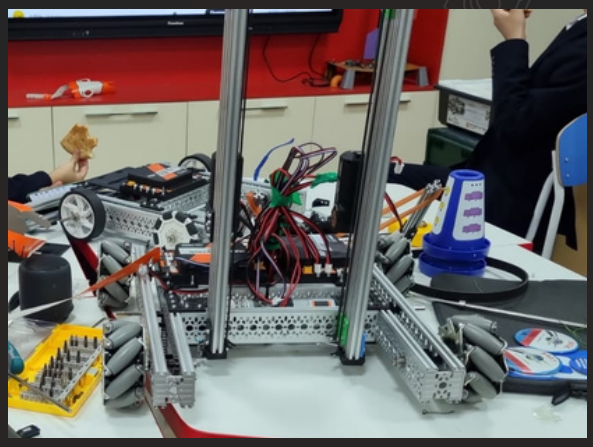
23.12.2022

We decided not to attach the intake to the lift construction. Instead, although there were many options for the possible placement of the information, we agreed on connecting it to a C-Channel right in front of the two motors at the back.

In the process, we thought it would be more efficient if we displaced the third servo, so we moved it a little and renewed the sponges used in the intake.



* the sponges are used alongside rubber bands to tighten the grip of the intake. That way, the intake could be sharp, but because of the soft nature of sponges, the claws would still be able to bring the cone up.



24.12.2022

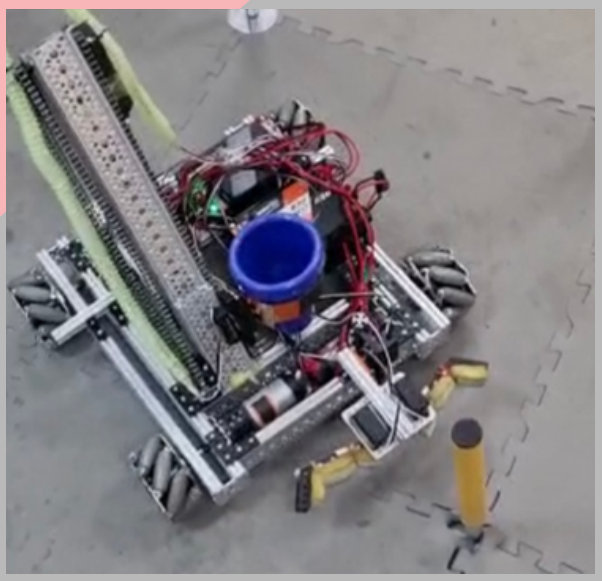
We dedicated the entire day to testing our robot and how accurately it puts cones into junctions. In the process, we found that completing one cycle takes about 5.2 seconds.

Later we found out that the lift construction outweighed our base, and the robot was on the verge of falling whenever it made the slightest movements. That is why we had to change the angle with which the lift was inclined. So instead of a 30-degree bracket, we used the 60-degree angle bracket,, which balanced the weight.

The cycle includes taking the cone with a claw, then flipping it into a basket-like construction which is then lifted up by a lift, and again, is flipped on the junction. However, cones do not always land properly.

26.12.2022

I spent the day fixing the base and making it move more efficiently. We also created a 3D model of the possible basket. We have tried a couple of designs but could not find anything that would top our last basket- a cutout from a left-over pizza box. However, by the end of the day, we had finished designing it and decided to print it out the following day.



27.12.2022

That day was dedicated to helping out another FTC team who needed help accessing their lab due to their long Christmas holidays. Some of the team members are former Fizmat students, which added colour to our day since we had a lovely time catching up with each other. Generally, the day was dedicated to making our guests feel welcome in our lab🤗

28.12.2022

We were renovating the lift construction since it had difficulty going up and back down. So we had to shorten the chains and fix the entire lift. We also printed out a 3D model of a basket that was supposed to be used as the alternative to our previous one, but unfortunately, our 3D printer broke down mid-process, and the basket turned out to be half done.

We also worked alongside the Invicta team from Haileybury, using our lab as a shelter. Later, we tested the base and how it moves around the field. We discovered some problems with the movement of the wheels, and the whole floor was moving weirdly. Hence, our programmer Sanzhar was trying to solve the problem.

Moving on to the creative part of our work, we filmed a couple of TikToks for the first part of the Social Media Challenge and recorded a new year's congratulation for the entire First community.

29.12.2022

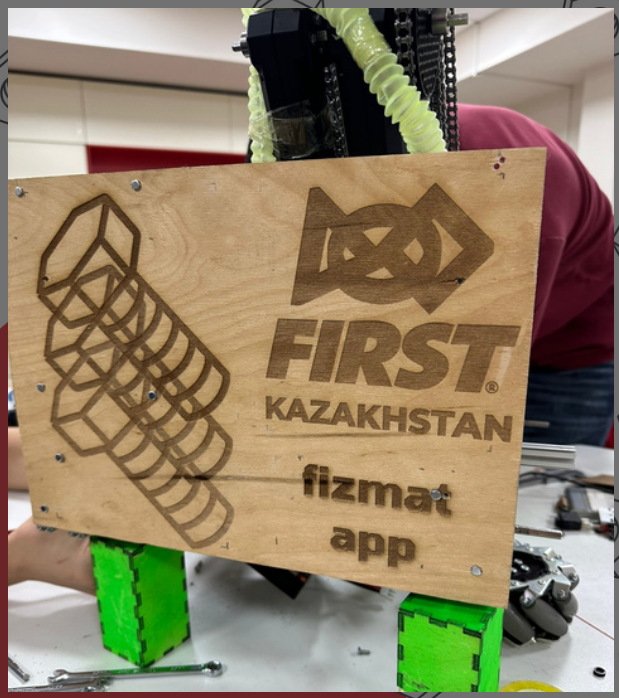
We were trying to solve the chain issue because some chains needed to be longer or longer. That is why Sanzhar and Zaki spent much time fixing the chains. Later, during the robot testing, one of the bolts connecting some chains flew off. Hence, we decided to replace it with a bigger one. And when we did, the problem was solved.

*here is a visual representation of them praying to the god of chains

5.01.2023

This day we got to work with a wood-cutting laser to make wooden pieces as a part of our robot's design. The team captain, Tair, was accompanied by one of the interns of Bolt.m3 team while carving wood using the laser above the beam. By the end of the day, two out of three walls were already installed on the robot's sides.

The primary purpose of this exact design approach was based on more than just its looks. Our genius engineers created the perfect placement for two of our robot's brains (control and expansion hubs). We decided to hide them on the inner side of the wooden wall. It was done with the help of numerous bolts and a drill. In the end, we successfully made our ideas come true, as it is seen in the picture below ;)



Later that day we organized a little get-together with a team from the United States via Discord. There, we discussed the current state of our robot, and they shared some advice regarding the capacity of our motors.

After completing the formal part of our meeting we moved on to a friendly chess match among the engineers of both of our teams. We got to learn a little bit more about one another's cultures and our ways of playing chess.

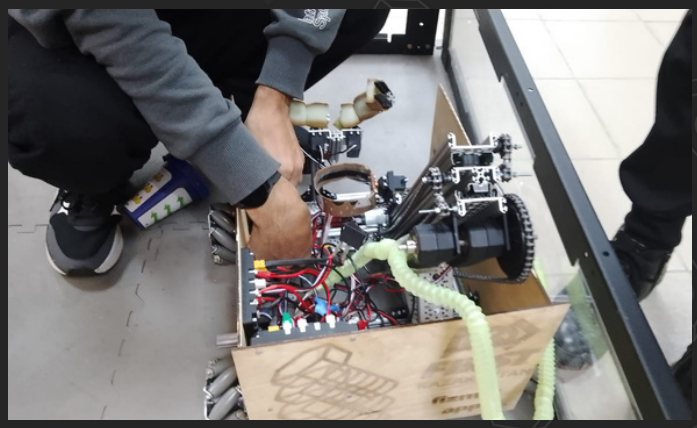
6.01.2023

One of the best students of Purdue University and a graduate of RPhMS, Sardar, came to the lab and gave us a couple of great pieces of advice. He also provided his personal opinion on the technical abilities of the robot. By spilling his thoughts, he confirmed our previous suspicions.

First, the length of our intake needs to be improved in reaching for the cone while completing the task. Initially, we wanted to create a station that continuously places cones on junctions without moving. However, it turns out that the intake needs to be longer for the robot to remain in one place while completing the task.
Secondly, the centre of mass is a little displaced, which makes the entire robot shake when the lift construction starts working, which indicates that we should look into the structure of the base.

Meanwhile, the other two team members, Sanzhar and Zaki, were finishing up writing the code for the autonomous period of the game. During the process, they discovered a couple of problems with the capacity of motors used for spinning wheels. As a result, slow engines have a lower frequency when spinning the mecanum wheels, affecting how the robot moves on the field. However, they still managed to fix the problem.

After fixing the problems above, they tried testing the robot on the field. By the end, they detected that the accuracy of the construction could have been better than we expected. For example, only 1 in 7 cones gets in the hole of the junction. This leads us to conclude that we must put more effort into making the process as accurate as possible.



7.01.2023

Since our lab is closed on weekends, we had a small amount of time to prepare for the upcoming Daryn First Championship. Therefore, we spent an entire day printing out posters, candy wrappings, and stickers for the pit.

10.01.2023
First Daryn Championship

The day started with final tests of the robot and autonomous program. After that, we began training both drivers to get used to controlling the robot quickly. Later, we played test games and identified some issues facing the robot. We found out that the chain was falling off. Hence, we decided to fix it. At around 5-6 pm, we had our first qualifier. We were in an alliance with our labmates, the AENTA team. Not surprisingly, we won that game with a score of 100:96. By the end of the day; we were ranked 3rd out of all 12 teams.

*almost broke the world record here

Here is a quick recap of the day by the team captain, Tair

” The day was very productive. All of us were tired, yet satisfied. To be honest, the most stressful part of the day was the end of the championship when we had to submit the assigned documentation.

Unfortunately, we missed the submission deadline for both the engineering notebook and portfolio. The reason for that is a minor misunderstanding between us and the people conducting the event. As a result, we managed to convince the hosts to accept our last-minute documentation. After that, we headed back to our beloved place - the lab.”

cap

Honestly, we were extremely relieved that we could submit our portfolio and notebook. That day ended successfully because we won both of the qualifier games. After the first day of the championship, we had an hour-long drive home.

Due to the lack of space in our school bus, some of the people had to stand for the entire time of ride. But even the deficiency of comfortable seats did not stop us from having fun. The ride was accompanied by old pop songs and a whole lot of singing.

Despite the fact that the day was deriving, most of the team members stayed in the lab working alongside teams from NIS up until midnight.

11.01.2023

The second day of the Daryn First Championship. Once again, the day began with testing if the robot was functioning well. The next step was preparing for the playoff games planned for lunch. By then, we were already cherry-picking teams, making notes, and discussing their robots for future collaborations.

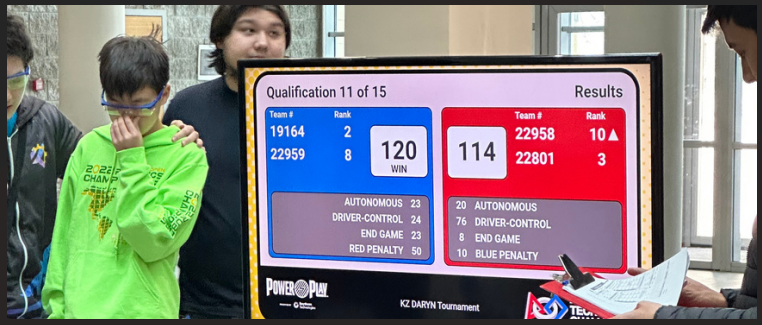
In the semifinals, we had to play two games against an alliance formed by Adelab and Infinity teams.
Since our alliance had two pretty strong cycle bot robots, we did not come up with a strategy, although we knew that cycling would be enough to win the semifinals. Therefore, that was what we did. We landed ourselves a place in the finals against an alliance formed by NIS students.

this is us right before the final game

Despite losing in the finals, we still had the status of Finalist Alliance Captain Award.

Another good thing is that we got the Inspire award and an orange flag that goes with it. Now, it is one of our lab's main attractions.

Receiving this award was a huge motivation for us to work harder, and become the best versions of ourselves.



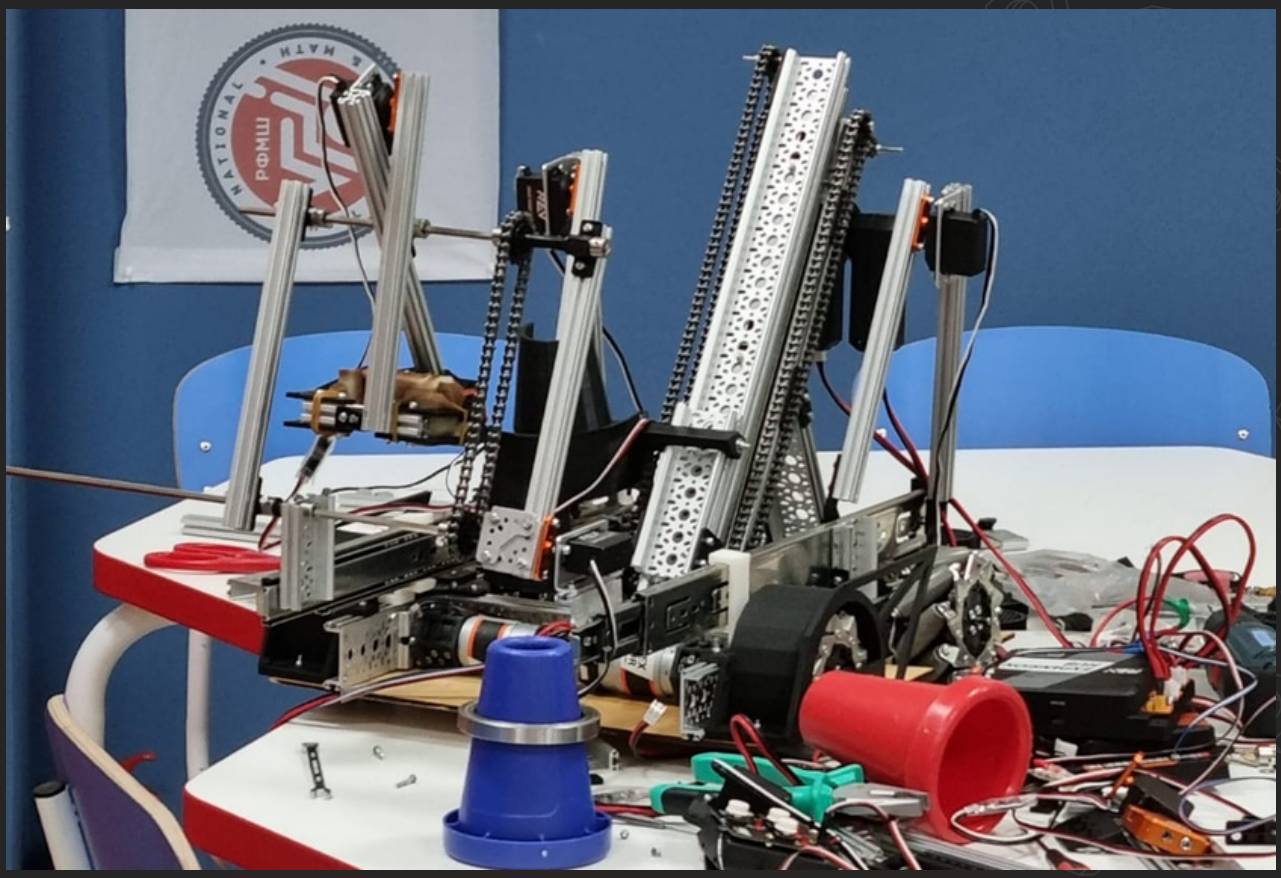
As the handbook engineer, I will be forever grateful for meeting my teammates and for having this amazing opportunity to work with all of them. Now, I would like to share a little bit of love and appreciation that my teammates have shown to the entire Handbook Engineering department after winning the Inspire Award.

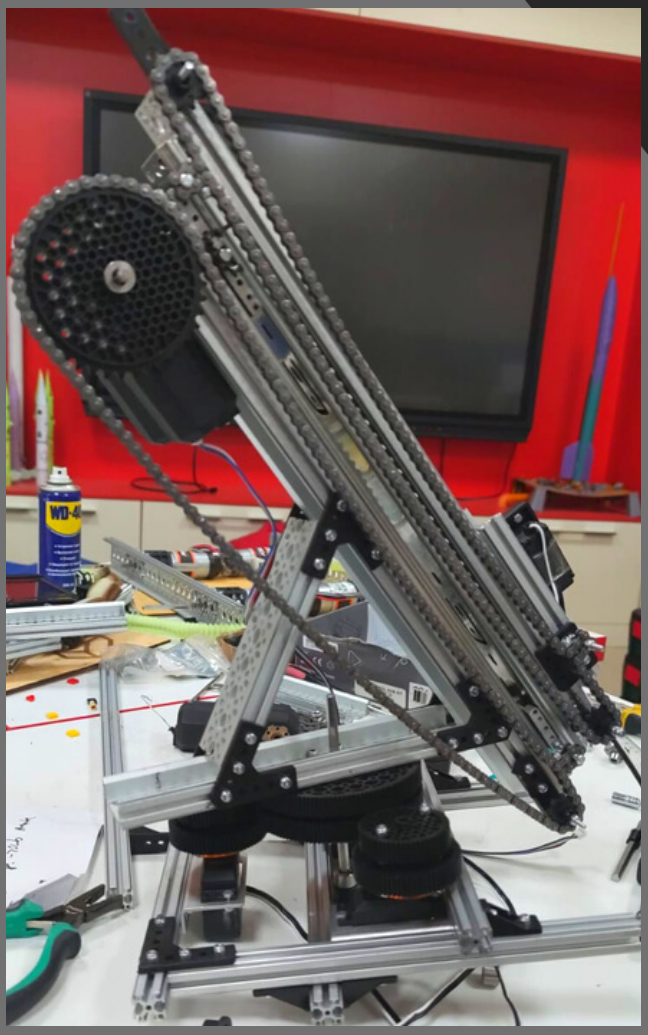
16.01.2023

After taking a long and refreshing break from robotics, we gathered all of our strength once again and dived right into work. After the Daryn Championship, we decided to customize our robot, and fully change its design. That day was spent mainly on discussing our future plans and ambitions. As a result, we got a whole bunch of crazy notions and no idea of how to bring them to life.

17.01.2023

That day all of the engineers were busy working with the lift. We decided to make the lift lighter by removing a C-Channel which was between two sliders. We have also changed the chains and made them tighter.

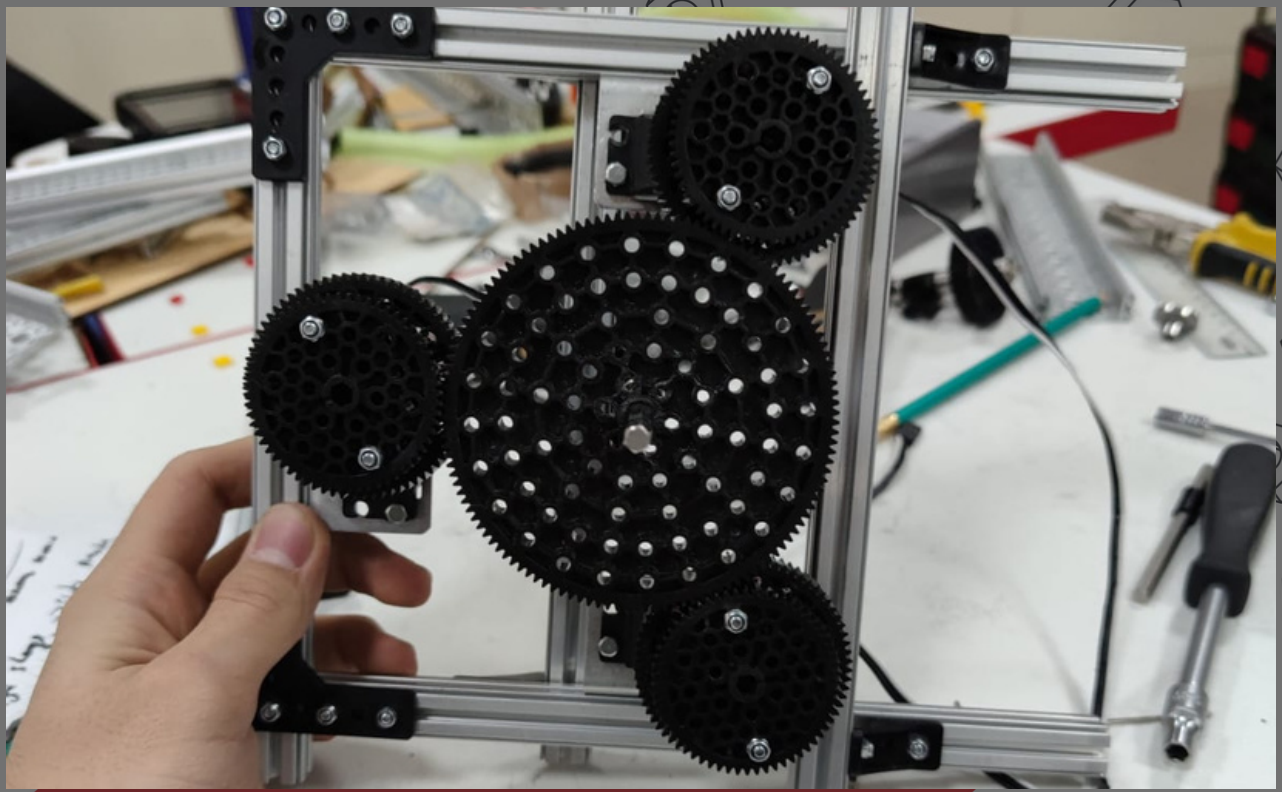




18.01.2023

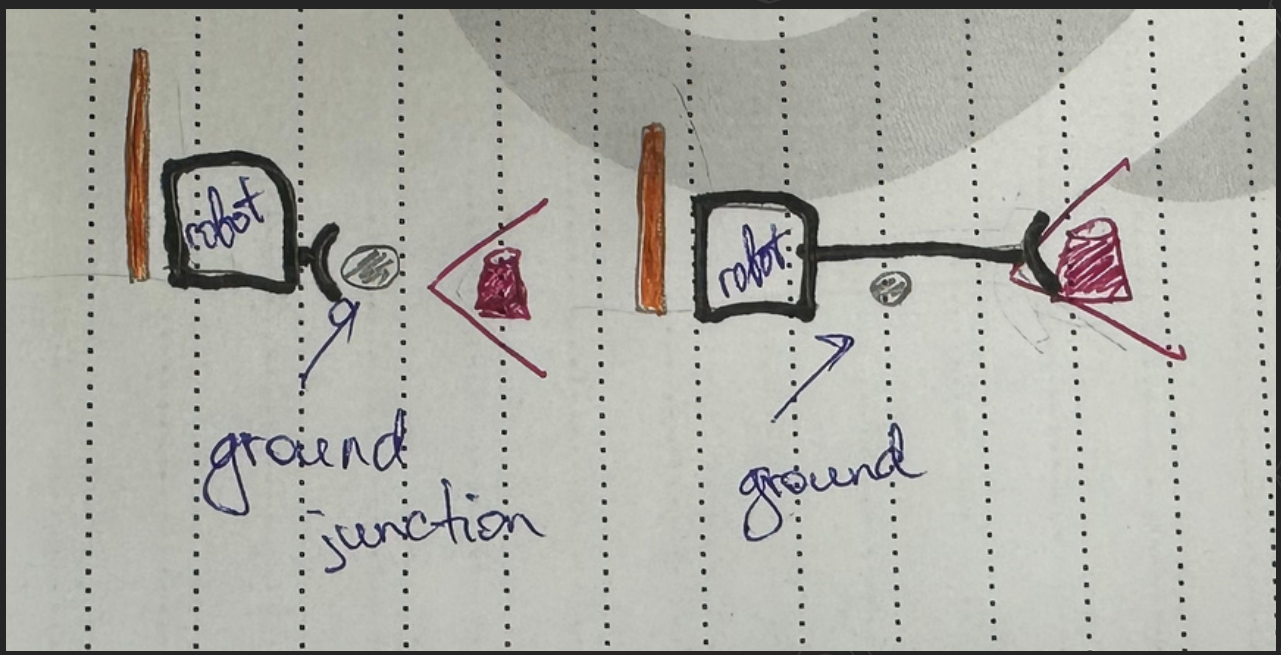
Made a prototype of a rotating base for the lift and continued renovating it.

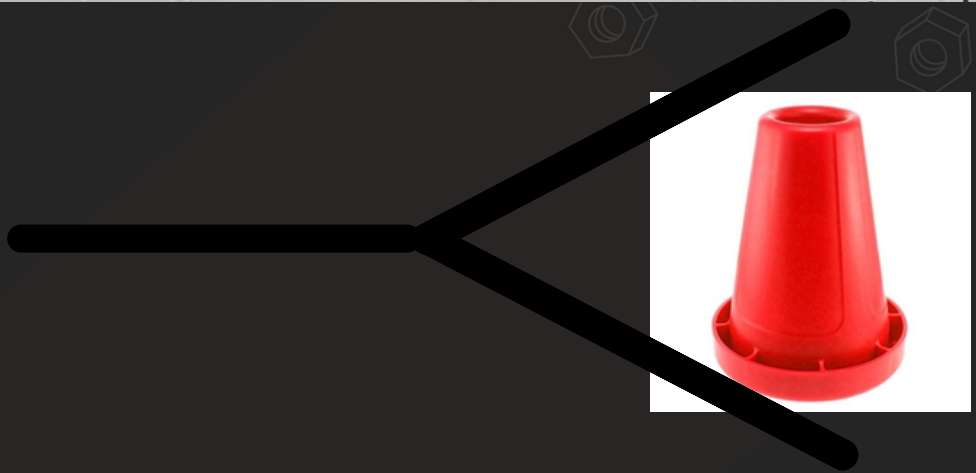
We decided to use chains because strings were unreliable and would be slipping instead of rotating. The strings also could have broken. Generally, using chains is more efficient since they move faster and smoother due to the lack of friction.

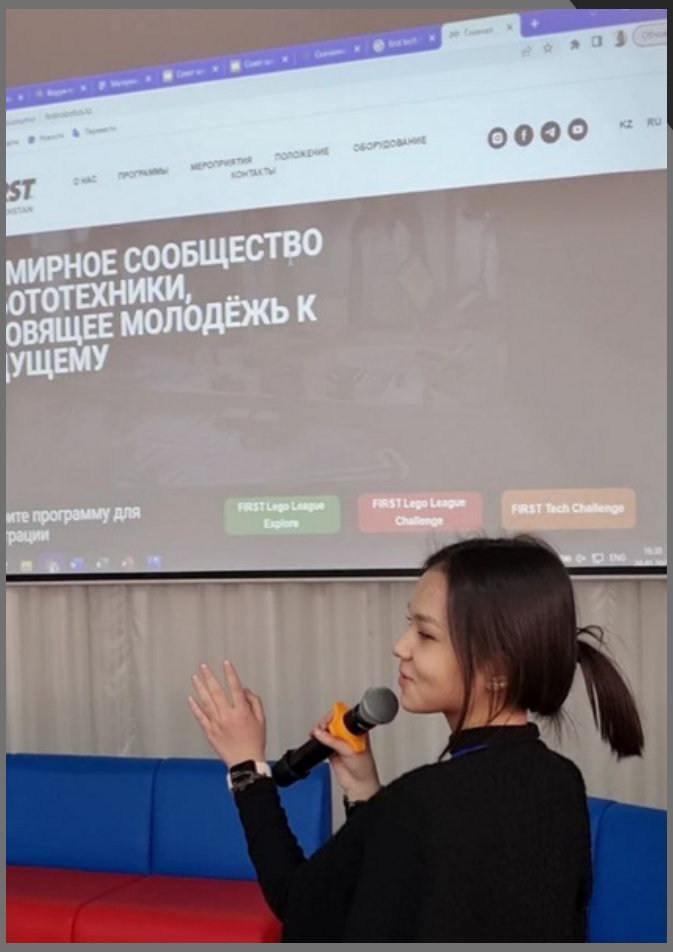


19.01.2023

The past two days were spent on a discussion of a possible strategy for a lift on a rotating base. Although the idea could have been recreated with three servos, we decided it was just a waste of resources since we devised another strategy. However, there were no doubts that the system would work because we debated the topic for a long time. So the new idea was that the robot would have a static tilted lift and an extended intake. As it was discovered, our past tactic could have been easily outplayed at the beginning of the match with only one cone on a ground junction. However, our new approach guaranteed a better reach and an unbeatable tactic.







20.01.2023

Our team's captain and SM Manager have been to a formal gathering of different schools' student councils where they made great connections with various student body presidents. They have also presented FIRST and it's principles in front of the crowd.

That day has made a huge contribution to the development of our future outreach

*Zhanel is somewhere in the crowd

24.01.23

Started developing the retractable intake after a few days of planning. We settled on using servos to move furniture rails on which our intake would be built upon. We successfully installed both sides of the intake on the robot and it works smoothly. We also finished assembling the drivetrain and started printing out the 3D details needed for the robot. Thankfully, we have two amazing mentors, Aidos and Dauren, who make sure that the process goes as smoothly as possible while creating a safe working environment for us.

We also helped two rookie teams: Zertte and Rebels. Zertte is now our mentee team which we help with different aspects of robot-building. May it be writing an autonomous code or helping with engineering decisions.

Moving on to a team from Zhanaozen called the Rebels, we established a friendly connection right away. Our team members had a fruitful discussion about the PowerPlay season and the robot's main duties. Another wonderful thing about newbies teams is that they are always curious and have interesting questions (and we gladly answered all of them). We also made a deal with both teams that they will occasionally be coming to the lab. We also figured that they had difficulties understanding the game and its rules. This realization has given motivation to our team to work faster on Russian and Kazakh translations of REV documentation.

26.01.2023

Today we formed a new robotics team of 9th and 10th graders to make them show them the world of robotics and FIRST competitions. We had an interview with each applicant and chose 7 of them. Choosing people suitable was relatively easy, but picking a name for the team was way harder. After a long discussion, we agreed on naming a newly-formed team after a legendary NSPhM team from the previous season of FTC. Ever since then, that group of 7 was known as the 5x1 team.

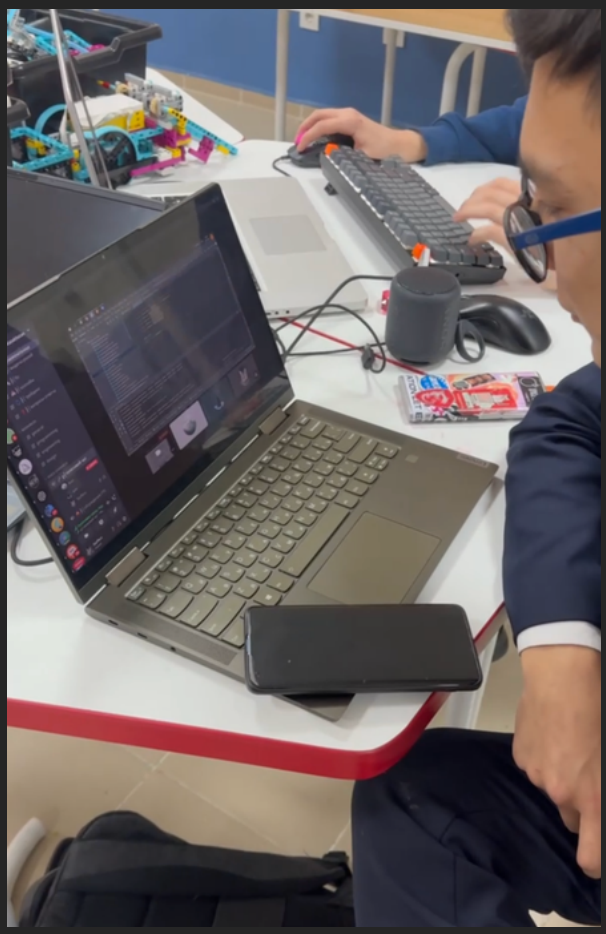
27.01.2023

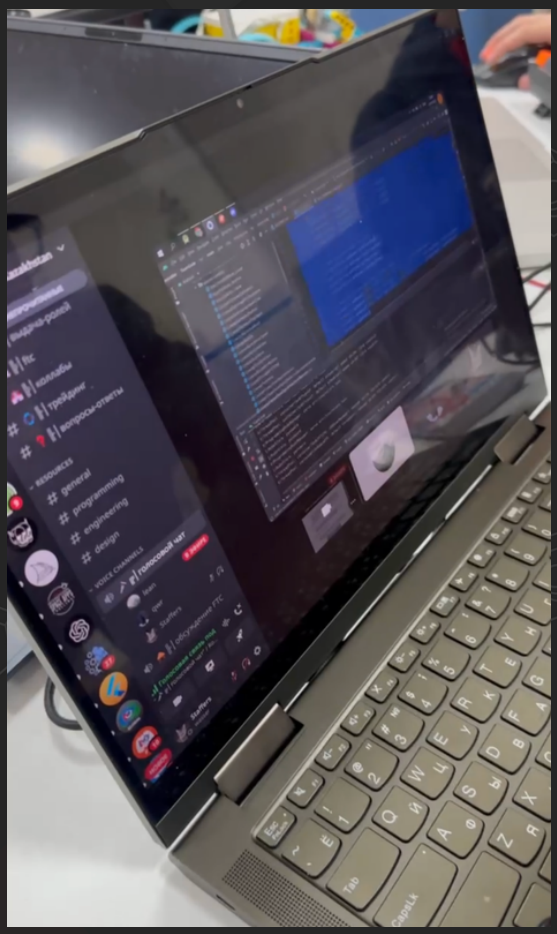
Sanzhar, Zaki, Shapagat, Andrey gave a presentation about robotics in BIL. All of our members actively and thoroughly participated in the presentation and successfully piqued the interests of the students there, we exchanged contacts and showed them the way.

After that, we headed back to the lab and continued to work. Some of our members worked on translating the website while others worked on a prototype concept for the intake. The intake was built, and thankfully it works both hypothetically and mechanically. Although we didn't have enough time to program the intake and simulate the process, we still did a great amount of job. Our plan for tomorrow is to finish writing a code for the intake.

28.01.2023

Our main programmer, Vlad, has helped the asapcevision the FTC team by explaining how to configure the Driver Hub. He also explained the structure of the LinearOpMode program and taught them how to launch it. After all of this, allowed them to turn the motor on, which made all of us extremely happy.





Sanzhar finished programming and began to adjust the servos. During the configuration process, it became clear that turning a few servos by 180 degrees was necessary for a proper adjustment. Hence, we asked Kadyl to turn them 180 degrees, but the rotation did not resolve the problem for some reason. This made us realize that the mechanical part was missing something, and asked Sat to figure it out.

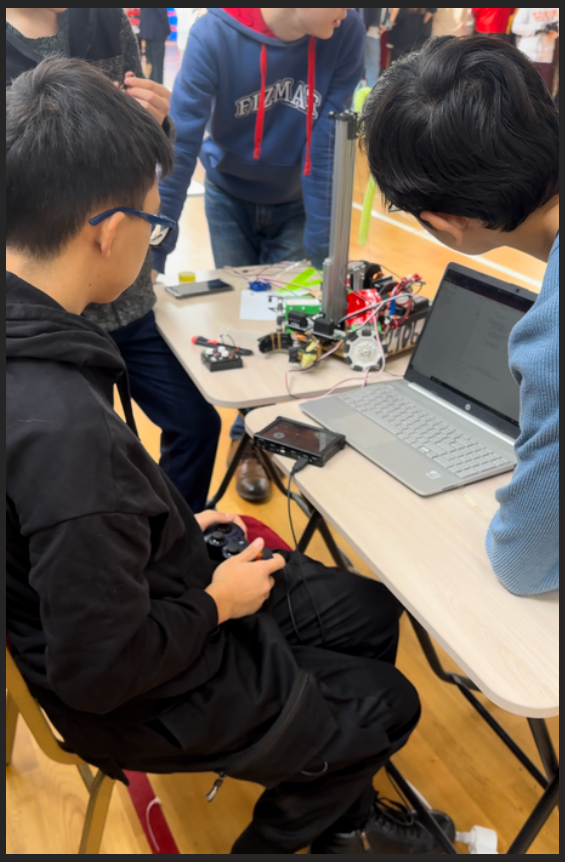
29.01.2023

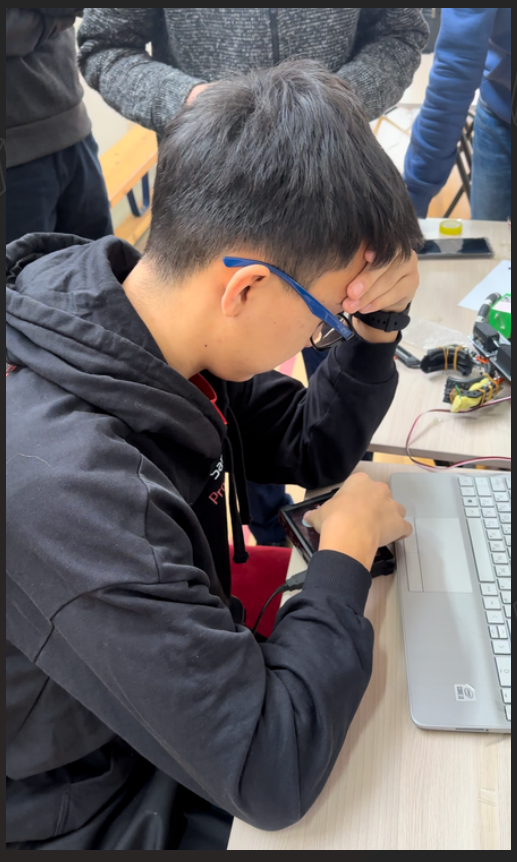
This was a day before the Fizmat First Championship, and as the hosting team, we had to arrive at school at 8 am and help with the organization issues. According to the plan, all the teams who participate were supposed to go through an inspection and team interviews. Hence, since early in the morning, we were busy setting up fields for the upcoming game. Later on, at around 1 pm, other teams started actively filling in the lab, and it got a little bit stuffy. That is why we had to ask the teams to leave 2 of their members in the lab and go into the neighboring classroom, where our team captain was entertaining the rest of the people. Meanwhile, our Handbook Engineer Nurai was monitoring the process of interview-giving. The rest of the team was busy assembling pits for both FLL and FTC. In a nutshell, most of the people stayed helping until 1 am. However, that was a justified risk since the championship went great and was well organized.

30.01.2023

The day of the Fizmat First Championship. Fortunately, we did not have to come to school extra early that day. Therefore we arrived a little bit before the beginning of the qualifiers. Although half of the team stayed in the lab to finish working on the intake and look after the lab, the other half was watching the games and getting to know other teams better.

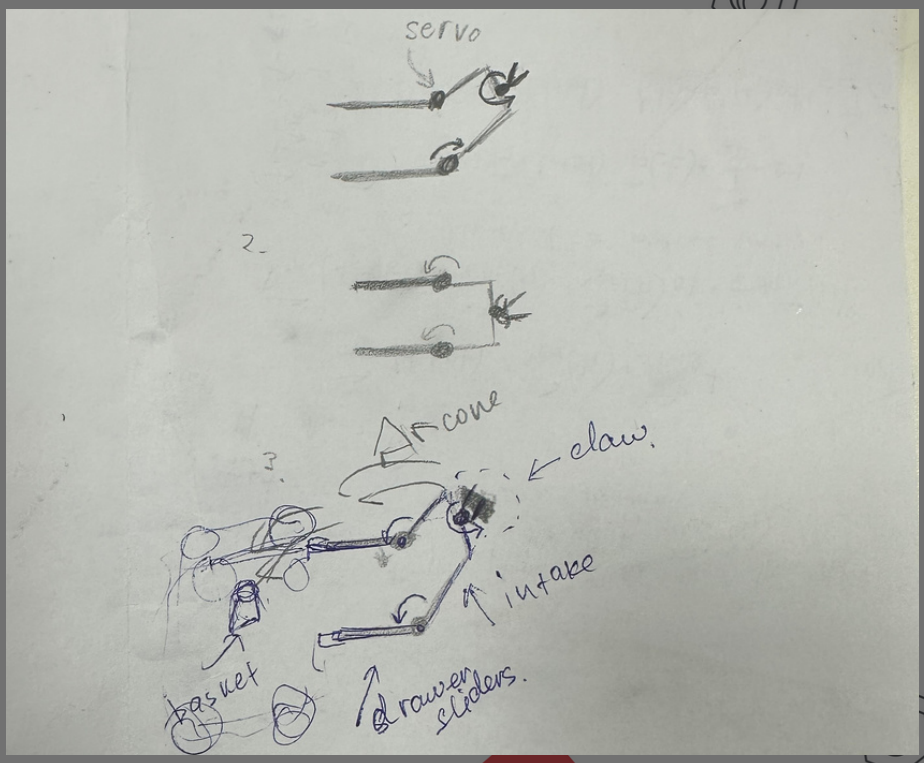
At some point, we noticed that our new team 5x1 was in fussing around their robot. So we walked up to them offering our help. It turns out that their code was bugging and something was not working right. That is why our head programmer, Sanzhar, looked through the code and found some minor mistakes which were not letting the robot function well.





31.01.2023

We tested the intake which was built by Kadyl, Tair, and Zaki on Sunday, and it turned out that even after changing the gear ratio the servo did not have enough torque to lift the intake up. After several tries to make the intake work, we gave up and blamed it all on its technical abilities. After taking the intake off, we started thinking of ways to attach the claw. Alibi suggested rotating it perpendicular to the floor axis instead of parallel.

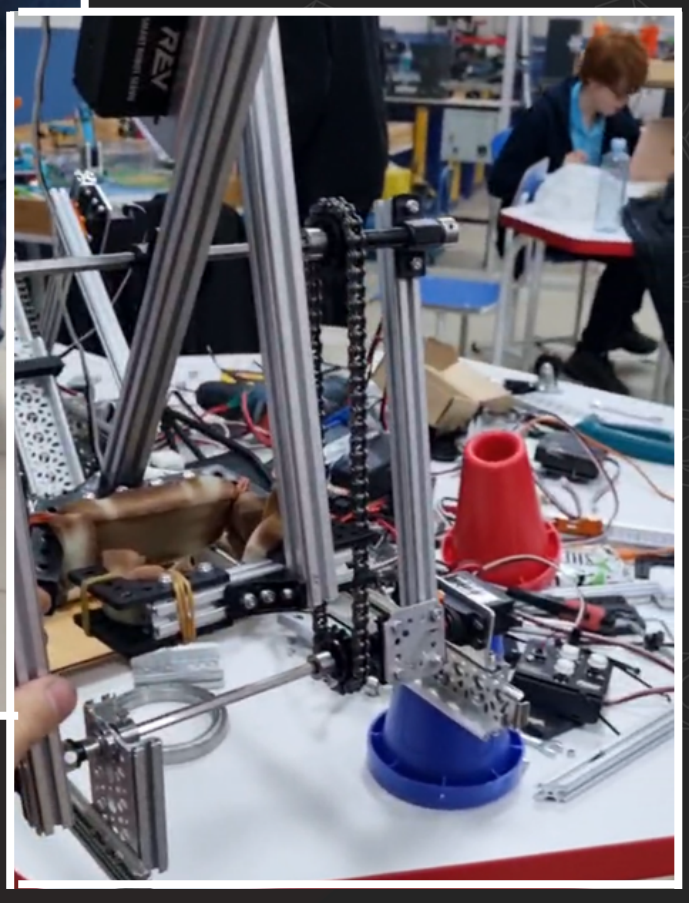


We started building a new intake right away and were done in the course of two hours. Then, Sanzhar programmed all servos to manual control. Due to that, the intake successfully completed its job, but the claw did not have enough reach, and hence, was not putting the cone right into the basket.

Our goal for the future is to time the cycle and automate cone picking with a single button

1.02.2023

We greeted our friends from our previous outreach activities at BIL high school. They came to Zertte Studio to find out more about the world of robotics and the FIRST Championships. We gladly showed them the way around the lab and explained how to register for tournaments. Unfortunately, they said that currently their school is short on money and cannot afford to buy a REV kit. We tried finding sponsors but the guys decided to put off robotics for now, and participate in FGC instead.
We also finished renovating our intake and were testing until the rest of the day.

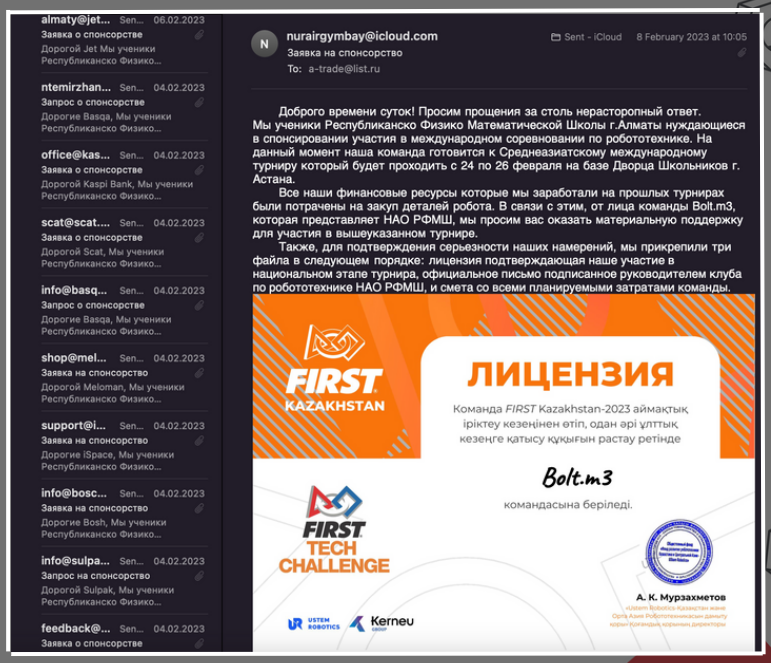


2.02.2023

After testing our latest intake, we realized that it has to be way longer than it is currently. However, all of us agreed that there is a better way to approach this problem and create a brand-new intake with better reach, grip, and functionality. Plans for the future include replacing a servo with a motor that will be attached to a toothed gear.

4.02.2023

Our handbook engineer, Nurai, arranged 4 meetings with FTC teams from the US to bring people together. She also was emailing huge local companies asking for sponsorship.



almaty@jet... Sen... 06.02.2023
Заявка о спонсорстве
Дорогой Jet Мы ученики Республиканско Физико...

ntemirzhan... Sen... 04.02.2023
Запрос о спонсорстве
Дорогие Basqa, Мы ученики Республиканско Физико...

office@kas... Sen... 04.02.2023
Заявка о спонсорстве
Дорогой Kaspi Bank, Мы ученики Республиканско Физико...

scat@scat.... Sen... 04.02.2023
Заявка о спонсорстве
Дорогой Scat, Мы ученики Республиканско Физико...

info@basq... Sen... 04.02.2023
Запрос о спонсорстве
Дорогие Basqa, Мы ученики Республиканско Физико...

shop@mel... Sen... 04.02.2023
Заявка на спонсорство
Дорогой Meloman, Мы ученики Республиканско Физико...

support@i... Sen... 04.02.2023
Заявка на спонсорство
Дорогие iSpace, Мы ученики Республиканско Физико...

info@bosc... Sen... 04.02.2023
Заявка на спонсорство
Дорогие Bosh, Мы ученики Республиканско Физико...

info@sulpa... Sen... 04.02.2023
Запрос на спонсорство
Дорогой Sulpak, Мы ученики Республиканско Физико...

feedback@... Sen... 04.02.2023
Заявка о спонсорстве

nurairgymbay@icloud.com
Sent - iCloud 8 February 2023 at 10:05
Заявка на спонсорство
To: a-trade@list.ru

Доброго времени суток! Просим прощения за столь нерасторопный ответ.
Мы ученики Республиканско Физико Математической Школы г.Алматы нуждающиеся в спонсировании участия в международном соревновании по робототехнике. На данный момент наша команда готовится к Среднеазиатскому международному турниру который будет проходить с 24 по 26 февраля на базе Дворца Школьников г. Астана.
Все наши финансовые ресурсы которые мы заработали на прошлых турнирах были потрачены на закуп деталей робота. В связи с этим, от лица команды Bolt.m3, которая представляет НАО РФМШ, мы просим вас оказать материальную поддержку для участия в вышеуказанном турнире.
Также, для подтверждения серьезности наших намерений, мы прикрепили три файла в следующем порядке: лицензия подтверждающая наше участие в национальном этапе турнира, официальное письмо подписанное руководителем клуба по робототехнике НАО РФМШ, и смета со всеми планируемыми затратами команды.

FIRST KAZAKHSTAN

ЛИЦЕНЗИЯ

Команда *FIRST* Kazakhstan-2023 аймақтық іріктеу кезеңінен өтіп, одан әрі ұлттық кезеңге қатысу құқығын растау ретінде

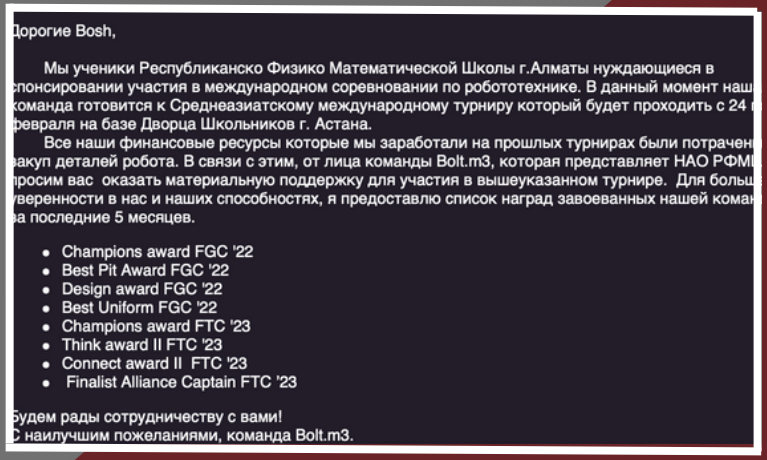
Bolt.m3

командасына беріледі.

FIRST TECH CHALLENGE

USTEM ROBOTICS Kerneu

А. К. Мурзахметов



Дорогие Bosh,

Мы ученики Республиканско Физико Математической Школы г.Алматы нуждающиеся в спонсировании участия в международном соревновании по робототехнике. В данный момент наша команда готовится к Среднеазиатскому международному турниру который будет проходить с 24 февраля на базе Дворца Школьников г. Астана.
Все наши финансовые ресурсы которые мы заработали на прошлых турнирах были потрачены на закуп деталей робота. В связи с этим, от лица команды Bolt.m3, которая представляет НАО РФМШ, просим вас оказать материальную поддержку для участия в вышеуказанном турнире. Для большей уверенности в нас и наших способностях, я предоставлю список наград завоеванных нашей командой за последние 5 месяцев.

- Champions award FGC '22
- Best Pit Award FGC '22
- Design award FGC '22
- Best Uniform FGC '22
- Champions award FTC '23
- Think award II FTC '23
- Connect award II FTC '23
- Finalist Alliance Captain FTC '23

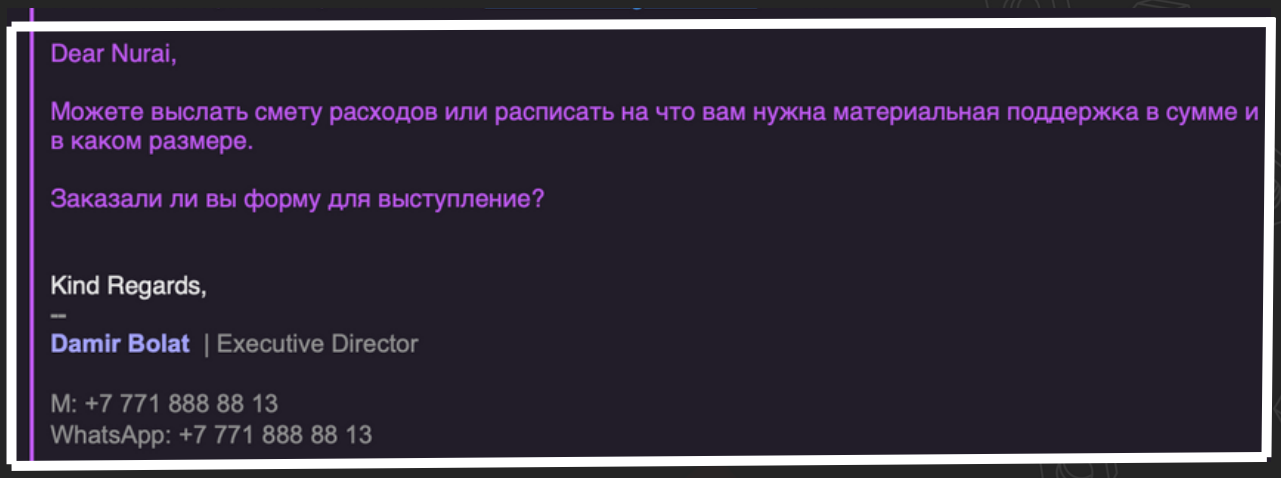
Будем рады сотрудничеству с вами!
С наилучшим пожеланиями, команда Bolt.m3.

We emailed the following companies asking for sponsorship:

GSC Study
Basqa Wear
Kaspi Bank
Scat Airlines
Meloman
iSpace
Bosch
Sulpak
Dodo Pizza
KazakhMys
Rakhat
Tele 2
Jet

5.01.2023

We got an answer from a couple of companies such as GSC, Magnum, Tele2, and Dodo Pizza. However, only two of them were interested in sponsoring our team. Those were GSC and Magnum. Both of them asked for an official letter with a business plan and a list of expenses. Despite finding possible sponsors, we started thinking of different methods to raise more money for our team. Nurai suggested hosting a math olympiad for children and raising money off of that. Another idea was using Valentine's day as a target and selling valentines for a low cost. Another valentines day inspired idea was hosting a dance in our school for additional payment. Regardless, all of these ideas were not good enough, so we decided to focus on finding sponsors instead.



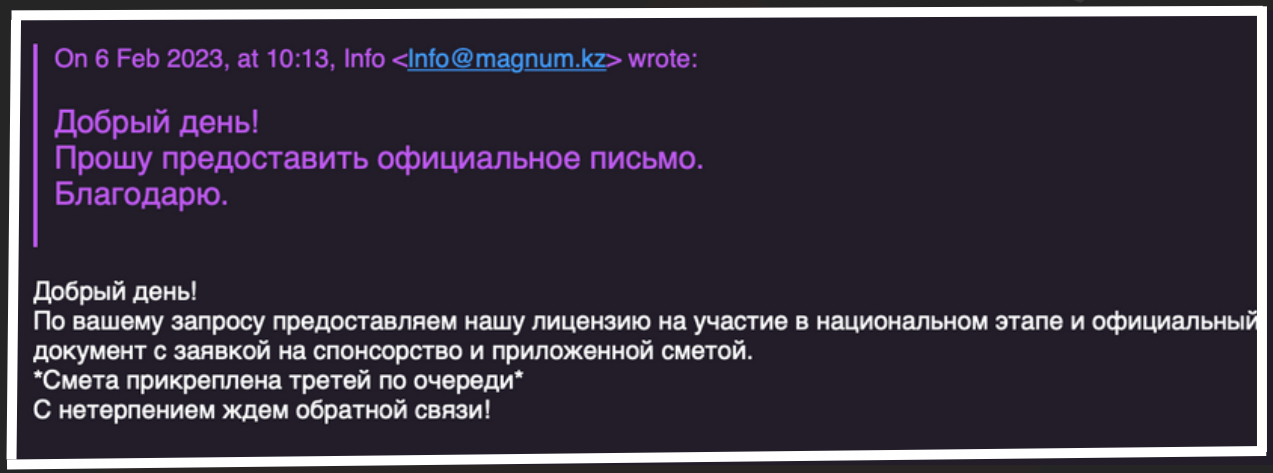
Dear Nurai,

Можете выслать смету расходов или расписать на что вам нужна материальная поддержка в сумме и в каком размере.

Заказали ли вы форму для выступление?

Kind Regards,
–
Damir Bolat | Executive Director

M: +7 771 888 88 13
WhatsApp: +7 771 888 88 13



On 6 Feb 2023, at 10:13, Info <Info@magnum.kz> wrote:

Добрый день!
Прошу предоставить официальное письмо.
Благодарю.

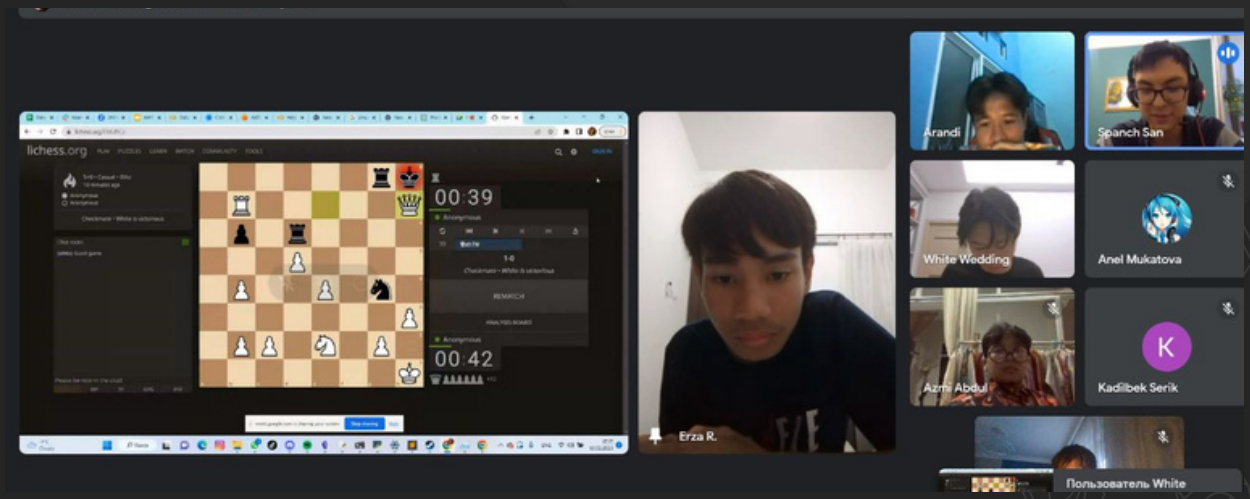
Добрый день!
По вашему запросу предоставляем нашу лицензию на участие в национальном этапе и официальный документ с заявкой на спонсорство и приложенной сметой.
Смета прикреплена третей по очереди
С нетерпением ждем обратной связи!

Another thing was that we went to support our lab-mates on their first big event. Nurai and Tair were there the entire time and will now share their thoughts on the STEM with AENTA forum.

"As a former member of AENTA, I was extremely proud to see my friends gather this number of people to see their presentation. It takes an act of great courage to present in front of people, which is why I was stunned at how calmly members of AENTA handled the crowd. I could see the genuine interest in each of the guest's eyes when they were talking about the world of robotics and FIRST. Generally, the forum went great, and all the hard work that AENTA has done was justified."
 - Nurai

"It was great!" - Tair

"The best expirience in communicate with bolt.m3.
Really like it!" - Shakir



Right after the forum we had a meeting with a team from Indonesia called the JavaTroopers. It turns out that the team consists of 8th graders only. All of them were very passionate about FTC and robotics, so we gave them some general advice on code, engineering processes, and how to keep up the team spirit among the people. We embraced our cultures and talked about the norms of each country. Another thing is that we agreed on helping each other out whenever we needed it.

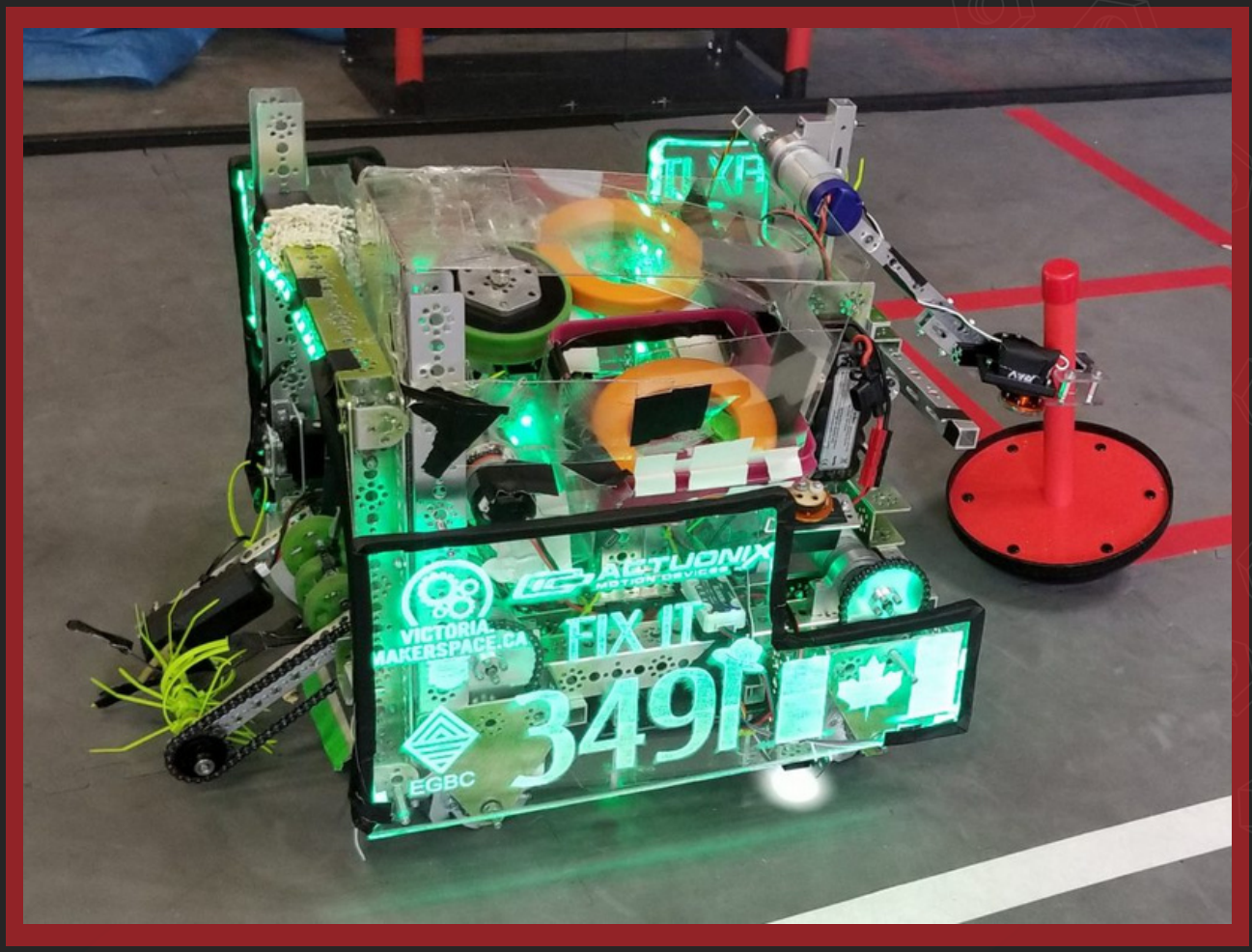
Considering that JavaTroopers is a rookie team, we offered our help with all sorts of things, may it be sharing our past experiences or helping to build a robot. At the end of the meeting, we played offered them to play a game of chess. Concluding, the meeting was fun, and all of us enjoyed it!

6.01.2023

We created a business plan and an estimate for our future sponsors. We also had two meetings with FTC teams from different parts of the world. The Green Machine #15458 from New Jersey, and BCS Vikings #21905 from Norway. Concerning the sponsorships, we signed an official letter for Magnum and were left waiting for their reply. We also got a call back from our CrowdFunding application. A huge company from Kazakhstan called Enactus was interested in our robots and contacted us asking for details concerning the work culture of Bolt.m3. We sent them our achievements and past presentations to let them know that we are seriously aiming for a win.

Moving on to the technical part of our work, we built an intake and had some cable management done. We also had some troubles with our base which made us dismantle the top of the robot and explore the mecanum base to find the source of the problem.

It turns out that one of the motors was loose due to a weakly tightened stopper inside of the motor. We quickly tightened it up and got rid of the problem.
We also gave an extra set of mecanum wheels to our mentee rookie team zertte.
Similarly, we lent a PDP panel, and two Spark Mini extenders to a team from ASMS called the aspacevision.
Furthermore, we cut some plywood to create brand-new walls with a new design for the robot. While cutting it we came up with a great way to style the outside of the robot. We are now planning to glue acrylic glass to the inside of the wooden inscription and light it up with two LED tapes.



*here is a reference picture

Later that day, the establishers of FIRST in Kazakhstan, Nurdaulet and Asylbek, brought some guests to our lab. One of them was an engineer of a specialized enterprise that produces a full range of works and services for the overhaul and modernization of armored vehicles and the second one is currently working for Elon Musk and a number of projects such as SpaceX, Hyperloop, and Tesla. We guided them through our lab and told them about FIRST, its principles, and its' championships. Both of them were highly interested in the creation of our amazing robots, therefore, we told them everything about it. By the end of our guide through the lab, they invited us to a factory of the aforementioned Kazakhstan Engineering company to show us how real professionals work.

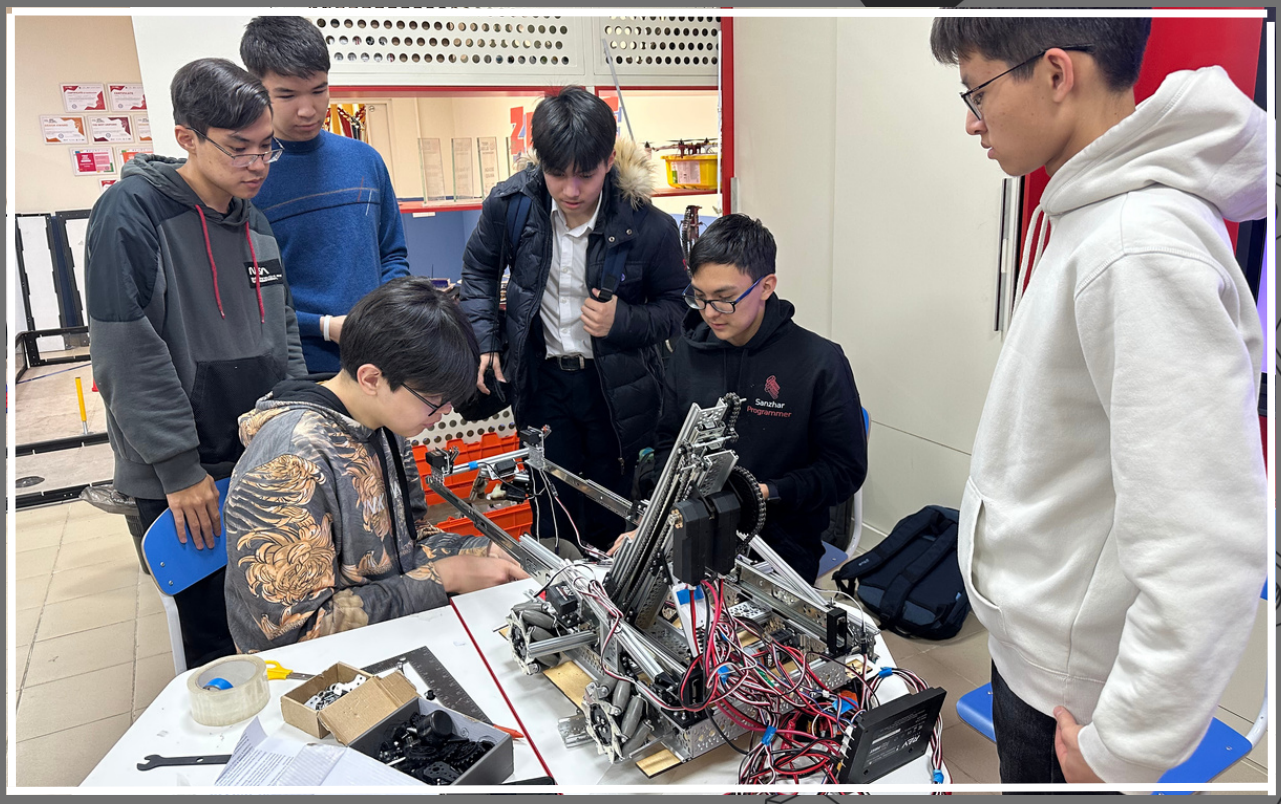
Sanzhar Taizhan

7.01.2023

The day started with signing letters to companies i.e Enactus, asking for sponsorship and partnership. Then we proceeded with the work on the notebook. Since at that time, we were desperate about finding sponsors, we were looking for different ways to raise money and found another Crowdfunding website. However, in order to apply for a sponsorship, we had to open up a Youtube channel and record a short video explaining why we need the money. Hence, Anel and Nurai recorded two Youtube videos, one explaining the history of our teams, and why we desperately need money, and the second one showing our viewers the way around the lab. In addition, we finished reassembling the base and were now working on automizing the intake to make it work with a single button. Also, our 3D designer Anel almost finished the CAD model of the robot, and our mentor put some details on print. All in all, the day was productive, thanks to our motivation to work.

8.01.2023

The day was mainly dedicated to the engineering notebook and portfolio. In terms of the robot, we did not make much progress, instead, we gather all of our engineers for an occasional checkup and tried finding mistakes in the robot. It seemed like everything was going great so far, so we proceeded to work on the current design of the robot.



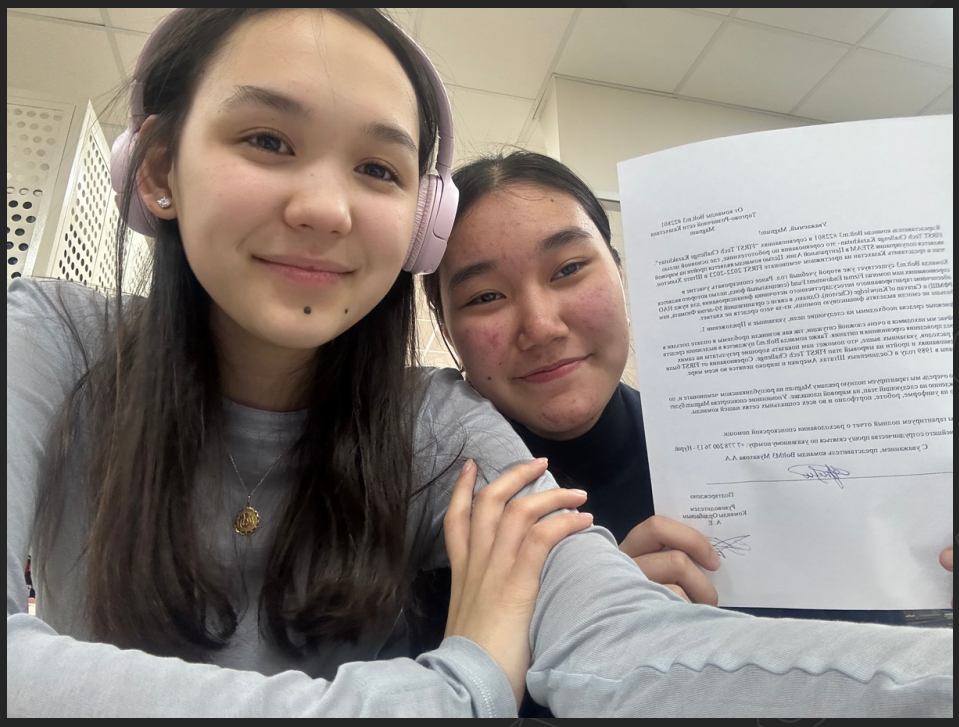
We cut up the glass for our original idea for the walls of the robot. Big thanks to our mentor Dauren for helping us measure and cut the glass.

The day started with a meeting with a soon-to-be team from the Turkistan region. They had seen FIRST competitions on TV and got really interested in robotics in general. Therefore, they contacted us asking about all kinds of things starting from needed materials to the participation fee. Our team members were kind enough to offer the team the Kazakh translation of the REV documentation and shortly introduce them to FIRST. The team got excited and asked us for further partnership. We also gave them the contacts of REV kits sellers, so they would not have to search the endless web for a little piece of information. In addition, we told them about the financial reward that our country would provide for the winners of FTC. To conclude, the meeting definitely cleared the air for the rookie team and we were glad that robotics once again united people form different parts of the country.

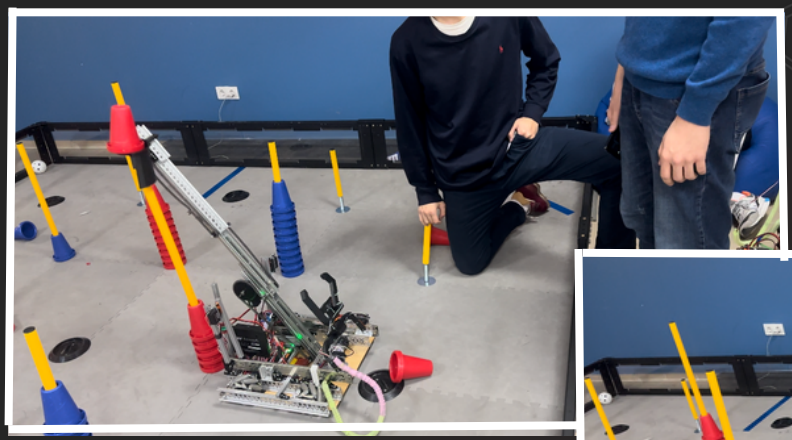
Later that day, a representative from both Bolt.m3 and AENTA met up with one of the members of the QSTEM team to arrange a meeting at Tamos High School. All three of them arrived at Tamos and had a talk with the principal. Fortunately, she was interested in spreading STEAM among students, so she gladly accepted our offer. Hence, we scheduled the meeting for February 16th.
They also met up with some teachers who gave positive feedback about robotics and said that they wished that Tamos would have a team of its own. Then, we talked to some of the students of that school and found out that a vast majority were interested in robotics. Therefore, we decided to open up an FTC team at Tamos for the next season.

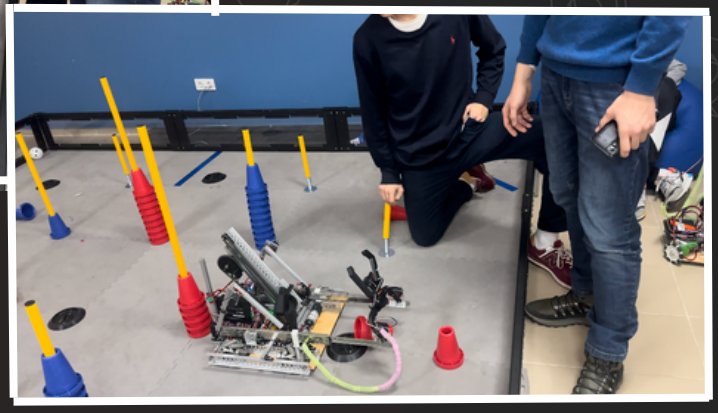
10.01.2023

That day we spent the first two hours writing the engineering notebook. We also made a deal with GSC study that they will be sponsoring our pit for this FTC season



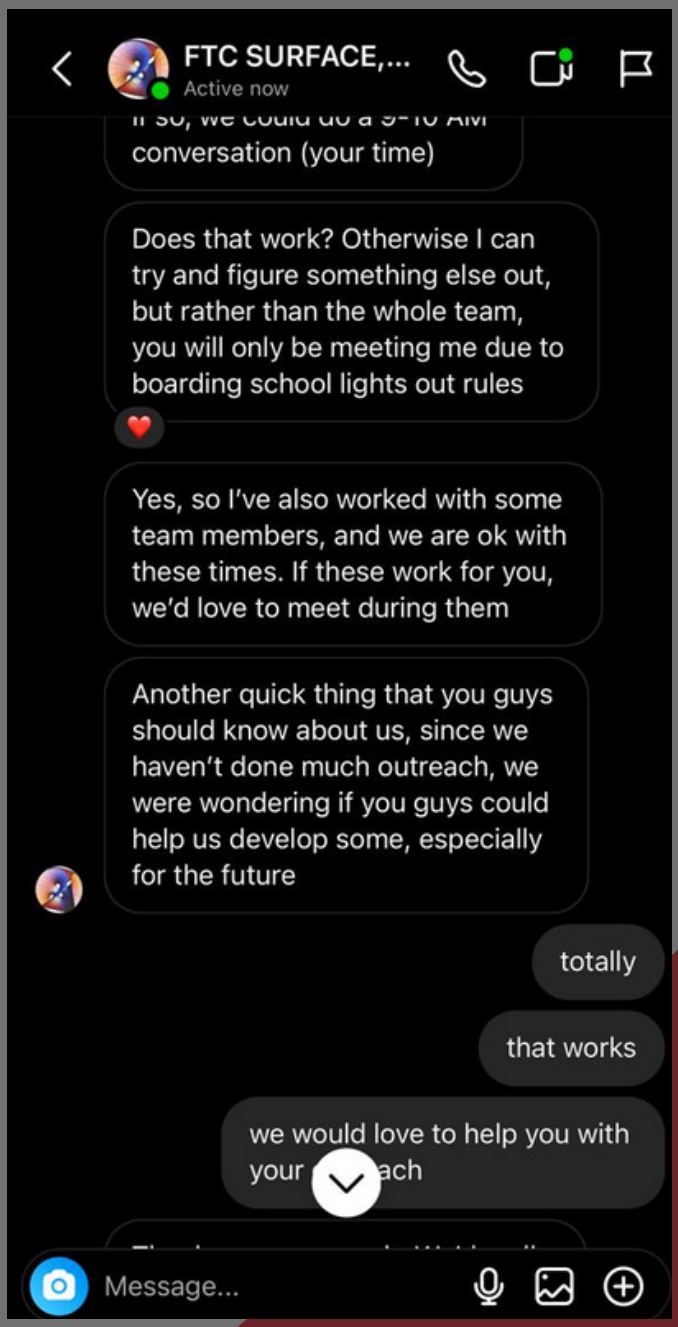
We spent the rest of the day testing the robot and modifying the walls for the design award.

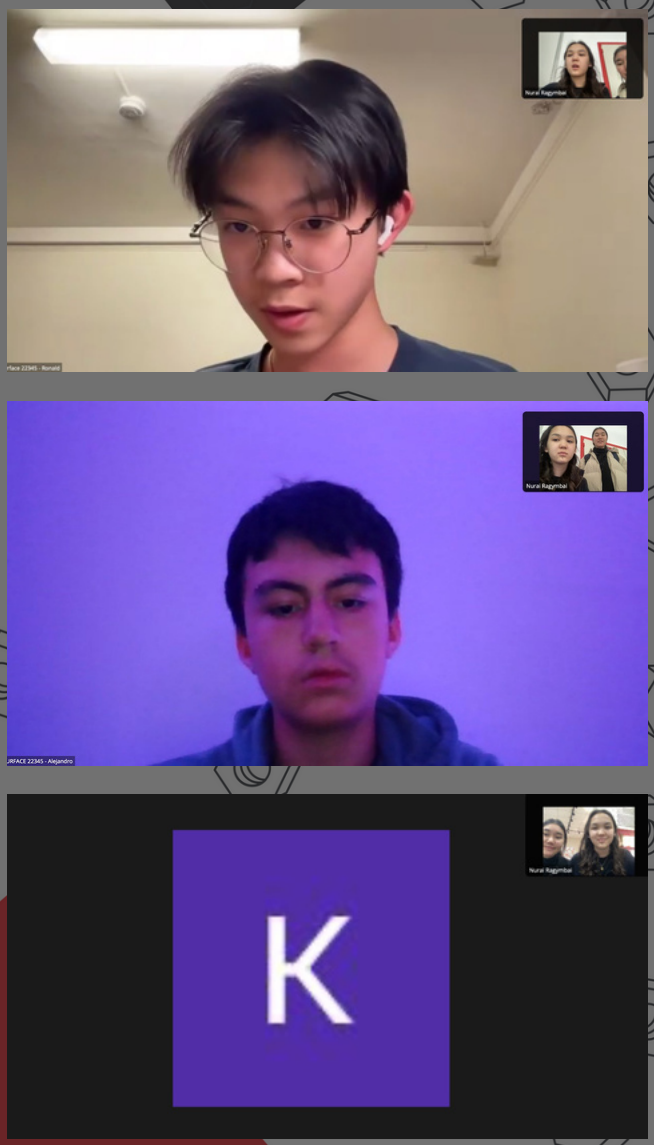




11.01.2023

That Saturday was almost fully dedicated to meetings with other teams. At the beginning of the day, we met up with Surface team #22345 from the United States. They are fairly new to FTC, and they asked us to help with their outreach activities.

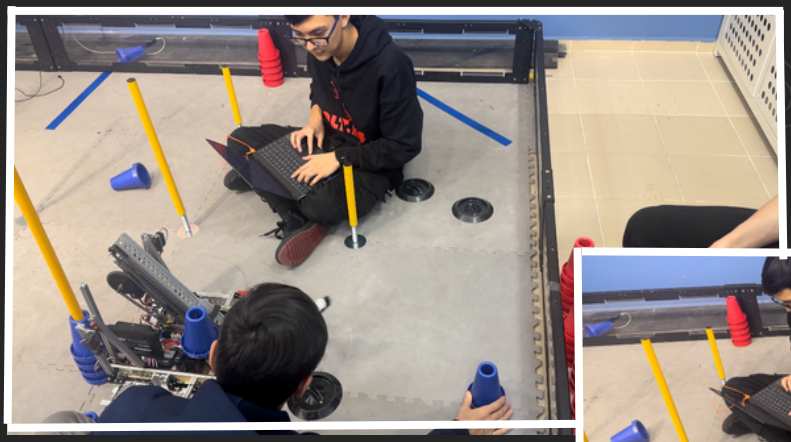


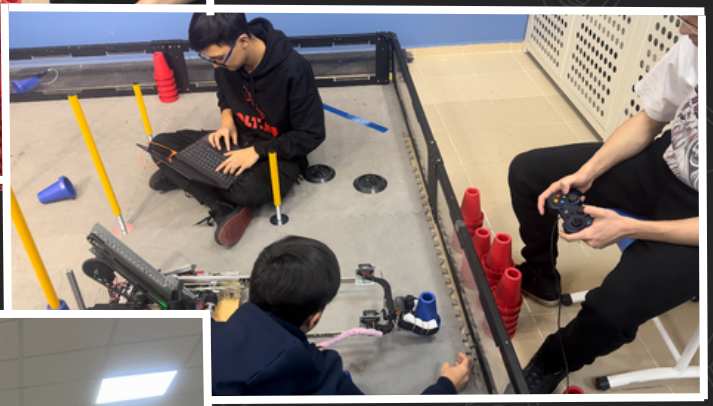


we had a fun time discussing regionals and our progress.

We also met up with another team from the US called Enigma #13835 which consists of only 3 people. We discussed our robots and efficient way of finding sponsors. There is more information available on page 36.

The rest of the day was spent training our drivers, and building up a strategy for our games. We decided to cycle the robot for the first minute of the match and make connections until the end of the game.





13.01.2023

The day started off with preparation for the upcoming presentation in the #1 orphanage of Almaty. We made a presentation that introduces viewers to FIRST. After being fully ready, we headed out to the orphanage. The ride did not take that long, although we made a stop to buy some candies for the children. After arriving there, some of the kids immediately recognized us from past presentations. they walked us to the principal's office where we made a deal that we will be coming to teach how to build and program robots every Monday and Wednesday at 11 am. Then, we headed out to the presentation per se. There we have met the most talented children that we ever worked with. They were interested in every single thing we were saying. After the formal part of our presentation we organized a practical part where they could drive the robot themselves They had a fun time controlling the robot.

14.02.2023 - 31.06.2023

You can see the rest of the subsequent dates in the first part of the engineering notebook. You can also see some of the engineering in the following pages of the notebook. We have done a tremendous amount of work during this time and are proud of it. We've also collected a lot of accomplishments including at international games. Thanks for reading this page

01-03.07.2023

On the exciting first day of the final phase, our team conducted a detailed inspection of the 3D model of our robot. We pored over every nuance, focusing especially on areas that showed any potential disadvantages. The diversity of perspectives within our team proved invaluable as each member brought their unique expertise to the fore. Some scrutinized the model from an engineering perspective, while others were on the lookout for any operational inefficiencies that might have been overlooked.

We paid particular attention to the form, fit, and function of the robot. Every detail mattered to us, and we knew that even the smallest improvements could potentially have a significant impact on the overall performance of our robot.

Having identified areas that required adjustment, we worked together to correct these issues, harnessing the latest 3D design software. The team atmosphere was both intense and electrifying as we tackled the challenges head-on. Our focus on teamwork and collaboration played a crucial role in this stage, and each member's contribution was acknowledged and respected.

After finalizing the corrections to our 3D model, we moved to the production phase, where we began printing the 3D parts necessary for our robot. Each part was printed with utmost precision and inspected rigorously for quality assurance. The whir of the 3D printer served as a motivating backdrop to the tireless work of our team.

A significant portion of our efforts was dedicated to the Basket Analysis. This detail was especially important as it was a complex yet crucial component of our robot. The team poured its collective energy into ensuring that every aspect of this analysis was accurate and efficiently designed. We are proud of our collective efforts and the resulting improvements, which you can see in the detailed report at the end of this section.

We have indeed worked relentlessly over the past week, but we are inspired and energized by the progress we've made. Looking at the finished product of our robot, we couldn't be more proud of the hard work, creativity, and innovation our team has put in. As we move forward, we remain committed to continuous improvement, always seeking to make our robot even better.

04-06.07.2023

The dawn of the subsequent days heralded a new stage in our journey: rebuilding our robot using the Gobilda system. Embracing a sense of unity and shared purpose, we meticulously embarked on this process, buoyed by the vision of our finished robot.

We pooled our efforts to assemble not one but two robots from the available parts. This decision to build a second robot wasn't just to push our boundaries or test our efficiency, but rather, it served as a crucial part of our competitive strategy.

With two robots at our disposal, we were able to simulate realistic competitive scenarios. We set the robots against each other in a series of tasks and challenges, carefully observing how they performed. The firsthand insight we gained into the robots' performance proved invaluable. We didn't just learn about the strengths of our design – we also identified the weaknesses that needed to be addressed.

Our dedicated team put in countless hours of work. Every day, from dawn till late into the night, we toiled tirelessly. Sleep was a luxury few of us could afford, but we were driven by the belief that our efforts would lead to a great result. The aroma of brewed coffee often filled our workspace, providing a comforting respite from our rigorous schedules.

We kept a keen eye on the performance of our robots, carefully noting down any flaws or potential areas of improvement. We discussed and debated these points, refining our design and strategy based on our observations. As we continued this cycle of build, compete, analyze, and refine, we began to see the fruit of our labors.

Our commitment to our project was unwavering, and we were willing to put in whatever hours were necessary to ensure our robot was the best it could be. Though the work was challenging and the hours long, seeing our robot compete and improve with each passing day filled us with a sense of accomplishment and pride. We look forward to continuing our work, always pushing the boundaries of what we can achieve.

06-09.07.2023

Over the past three days, we've embarked on an intense journey of refining the driving capabilities of our robots. We understand the paramount importance of flawless maneuverability in robotics competitions, and thus, we dedicated our energy and resources to optimize our robots' performance.

In the hum of our workspace, team members huddled around our creations, their eyes filled with unwavering focus and determination. Using a blend of cutting-edge technology and our collective skill set, we tested, tweaked, and fine-tuned our robots' movements and responses. We ran drills, emulated competition scenarios, and rigorously assessed our robots' agility, speed, and precision. In every motion of our robots, we strived for the epitome of perfection, knowing that each turn, each pivot, and each stride would count in the competition.

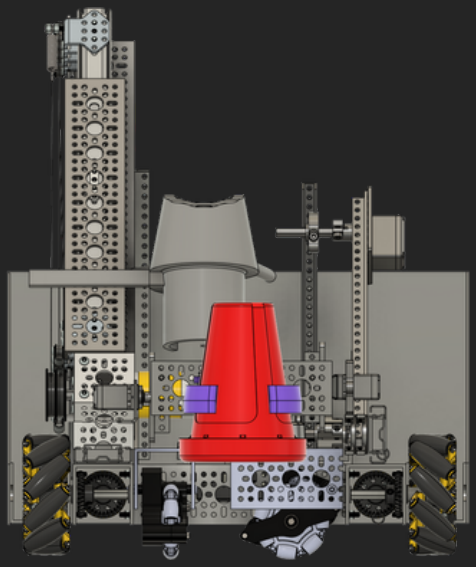
As part of our deep-dive analysis, we paid specific attention to our robots' autonomous functioning. Autonomy in a robot is its ability to operate and navigate independently, which is a cornerstone for any successful competitive robot. This is why we treated any flaw in our autonomy systems not merely as a disadvantage, but rather as a critical area for immediate correction.

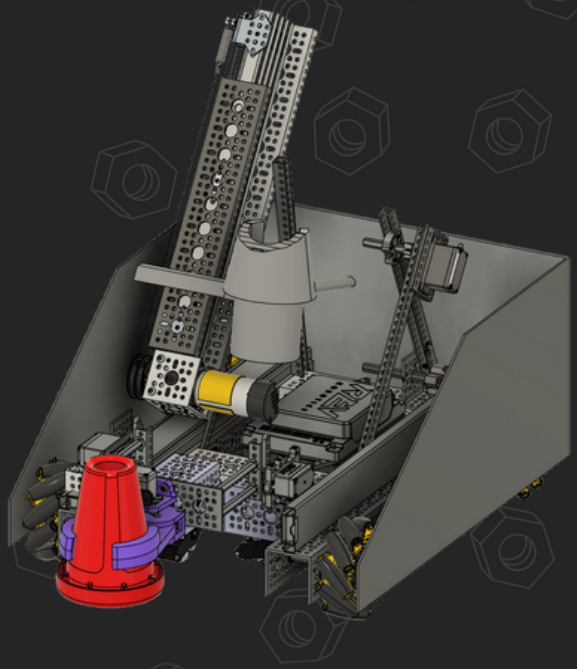
As our robots moved through various tasks, we meticulously identified bottlenecks in the autonomous operation. Every observed misstep was an opportunity for improvement. We studied the patterns, hypothesized improvements, and put these hypotheses to the test. It was a relentless cycle of scrutinizing, learning, adapting, and refining. But it was also an exhilarating experience, as we witnessed our robots becoming increasingly adept and responsive.

Through sleepless nights and continuous trials, our team didn't just work on the robots; we became a part of their evolution. We shared in their journey, rejoiced in their successes, and learned from their missteps. We believe in our robots and their potential to shine in the upcoming competition. After all, they aren't just machines - they are the tangible manifestation of our team's dedication, expertise, and unwavering
resolve.

3D CAD Process

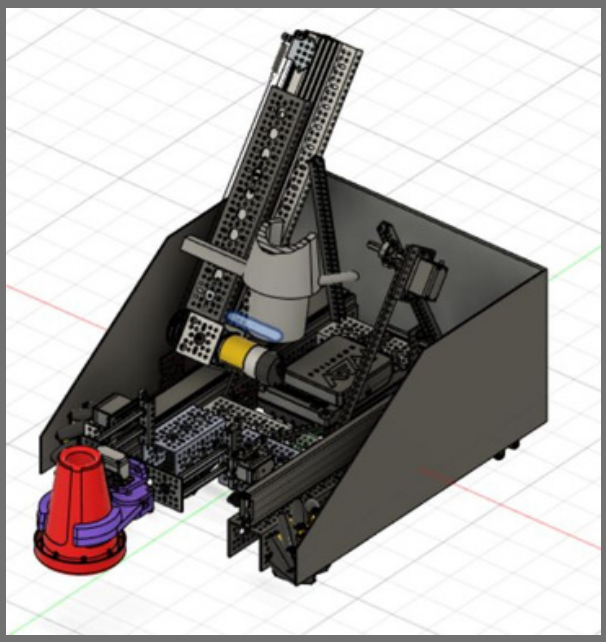
Exploring CAD for the first time brought us a refreshing perspective on robotics, as we were able to acquire new skills encompassing modeling, texturing, and utilizing various features within different 3D applications such as Fusion 360 and SketchUp. Moreover, delving into these tools enabled us to deepen our understanding of the intricate processes involved in designing and visualizing robotic systems.

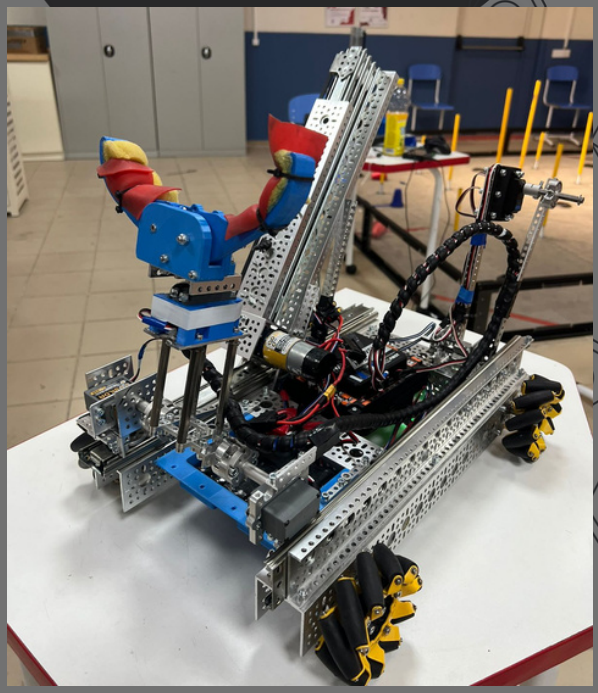


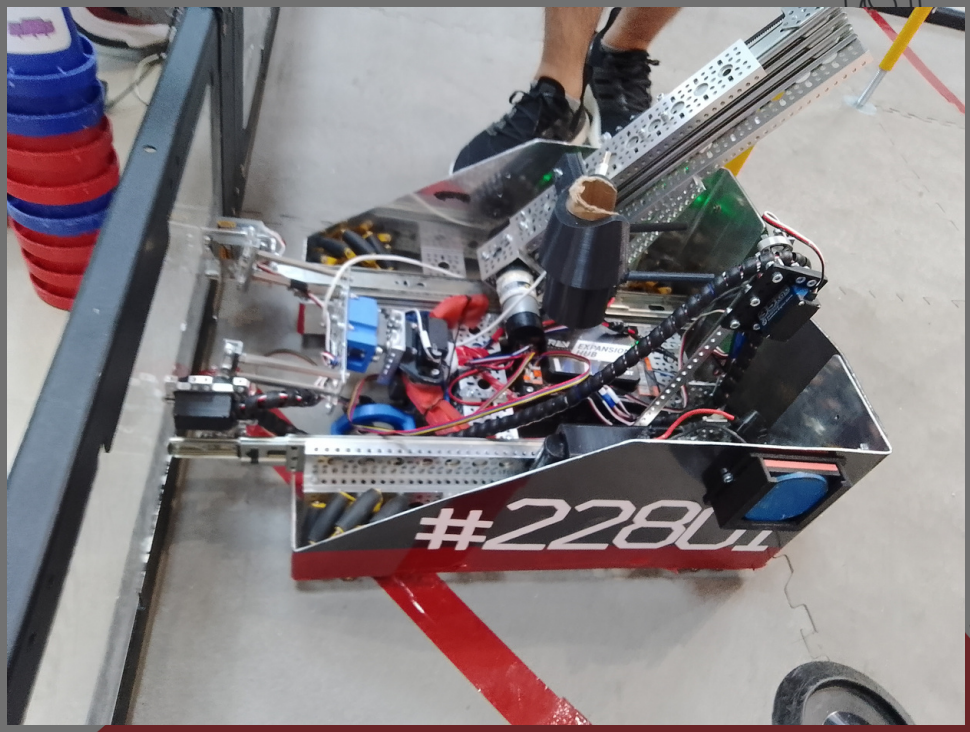


By immersing ourselves in the world of CAD, we broadened our knowledge and expanded our abilities to create intricate and detailed representations of robotic components. This hands-on experience opened up a realm of possibilities, propelling us to further explore the realm of robotics and its integration with CAD technology.

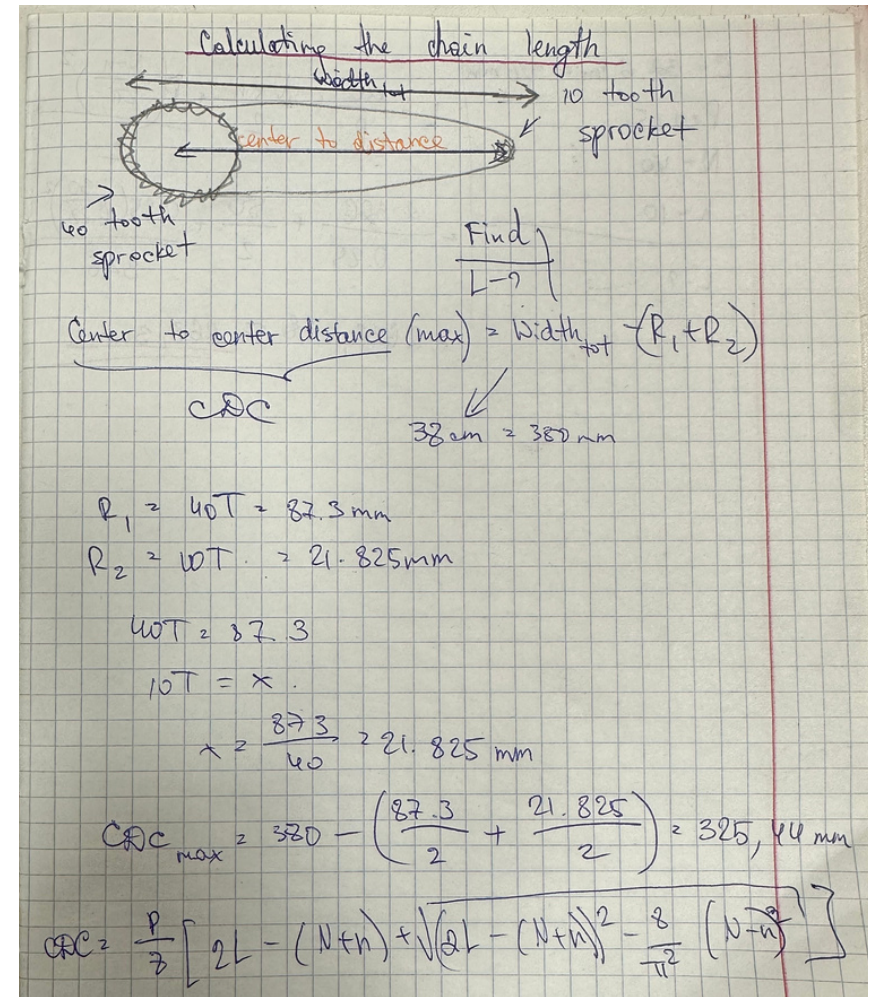
Robot photo gallery





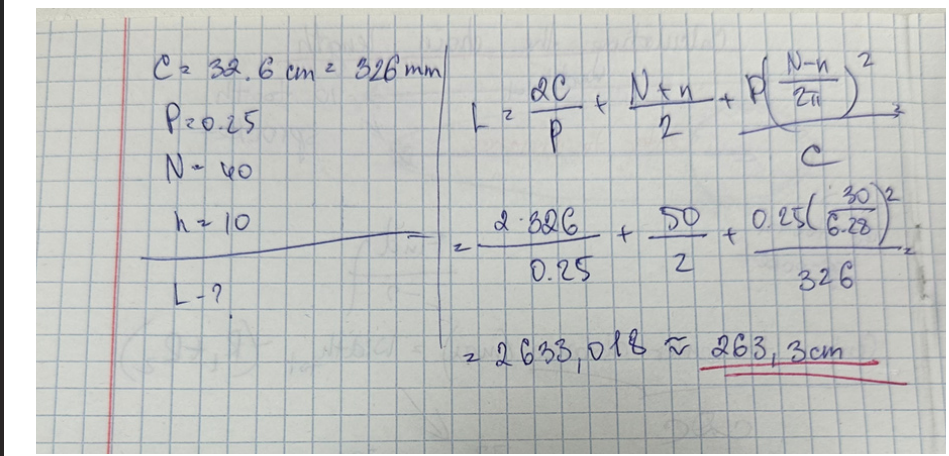


Lift Construction



Before constructing the robot, we made thorough calculations in order to make our work more efficient and spend less time on rebuilding minor mistakes

*Here is an estimation of the length of the chain used on the left side of the lift.



A prototype of the first lift

Pros

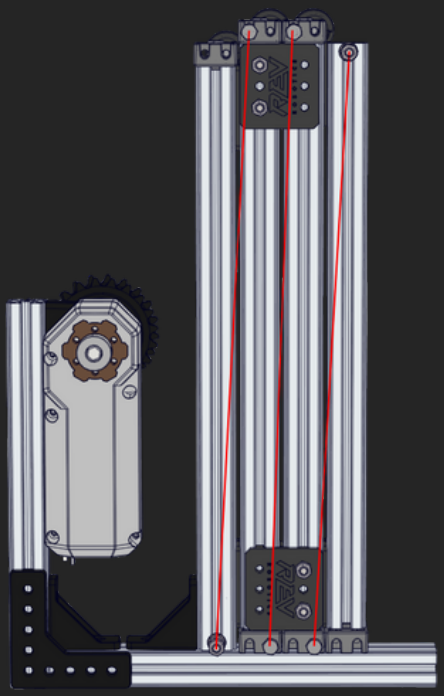
Looked cool
Could handle more weight
Consisted of two string lifts
Was relatively light due to the usage of extrusions (which are less heavier than C-Channels)

Cons

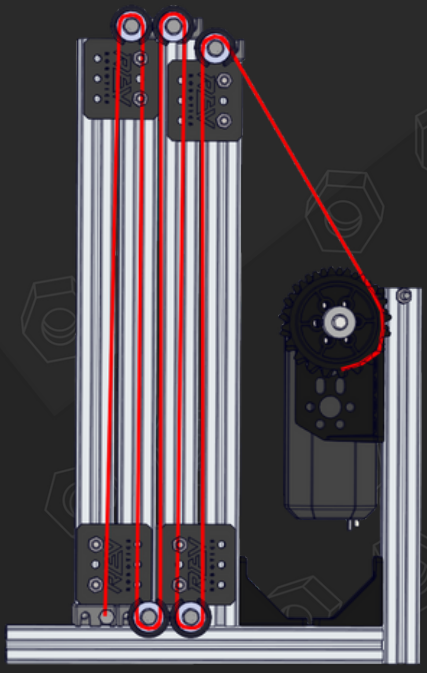
Had a complicated mechanism
Was going up at different speeds and at different times
It made it a bit challenging to program
The string kept ripping apart

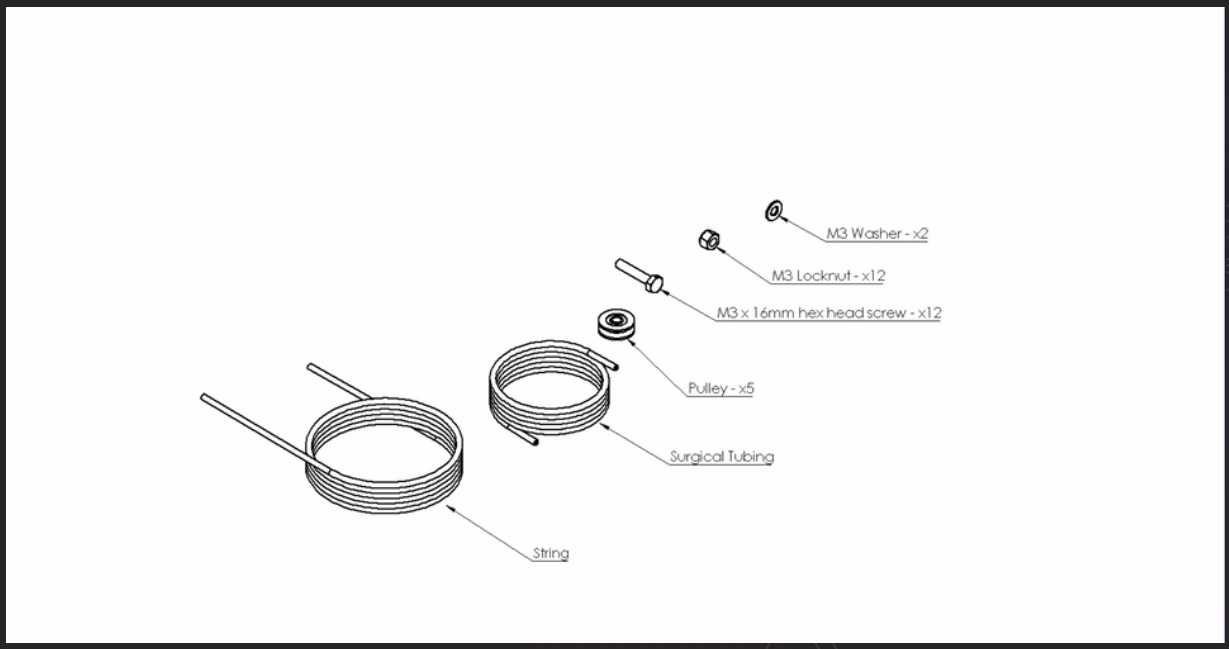
However, we realized that our brilliant team is capable of creating something new an innovative.

Another thing is that during Haileybury Championship the given lift showed how inefficient it is. As aforementioned, the string lift's main drawback is its constant need in fixation. This by itself is already a huge downside

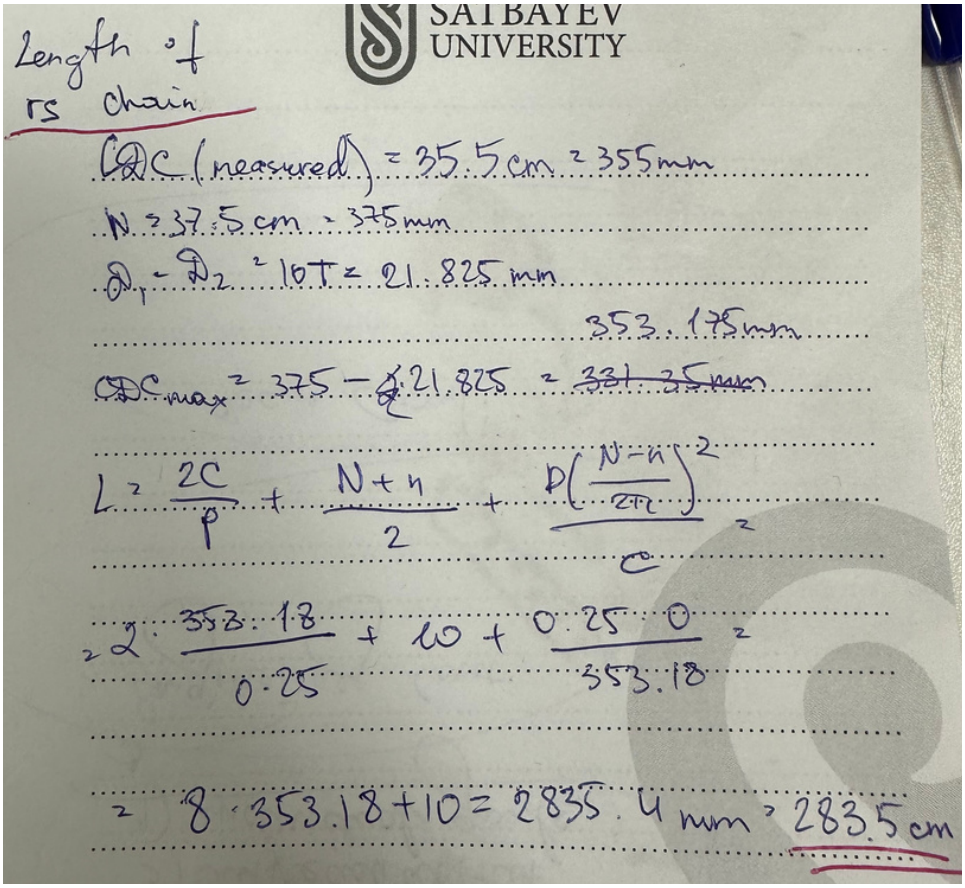


This is a default lift that was previously used during the FGC Carbon capture season. It is made of 4 42mm extrusions, pulleys, and a string.





The mechanism is known to everyone since it is now used by most teams. A single motor pulls a string on a sprocket, and the rest of the construction lifts up. Despite the simplicity of this mechanism, it did not work for us since the string was either too thin or too thick. Therefore,it was either ripping or not going up.



Length of rs chain

SATBAYEV UNIVERSITY

OC (measured) = 35.5 cm = 355 mm

N = 37.5 cm = 375 mm

$D_1 - D_2 = 10T = 21.825$ mm

353.175 mm

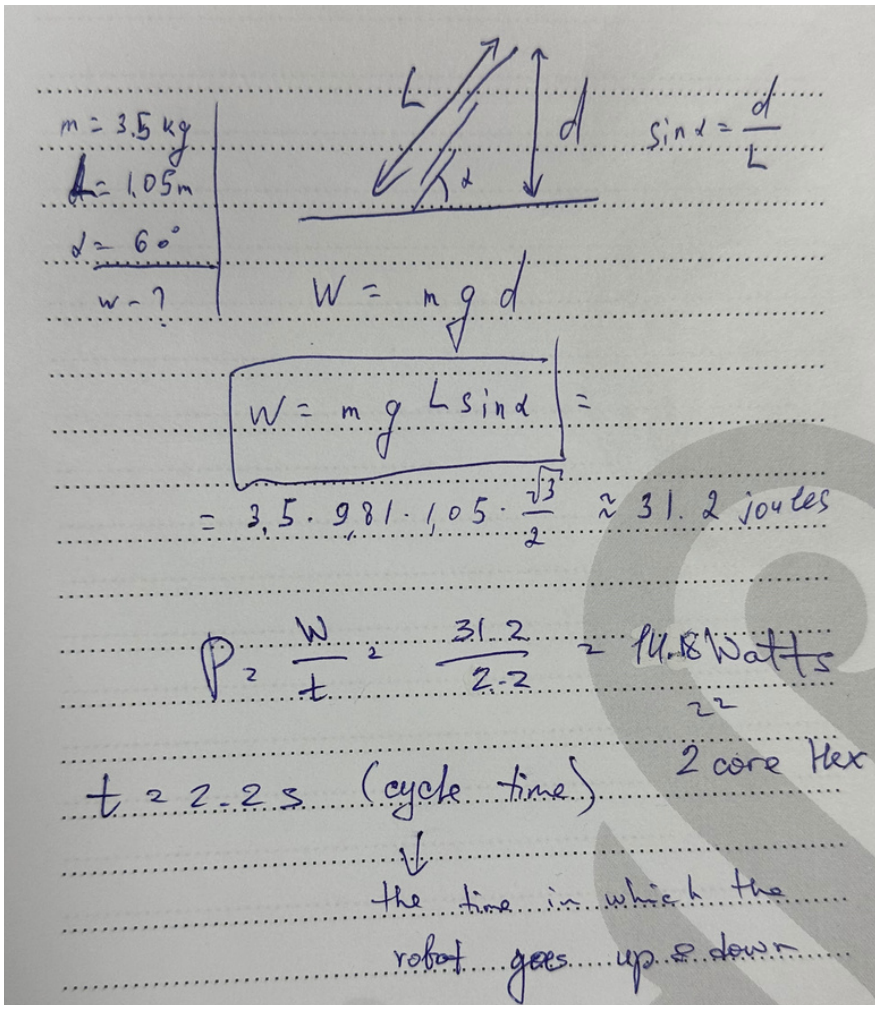
$OC_{max} = 375 - 21.825 = 331.35$ mm

$L = \frac{2C}{P} + \frac{N+n}{2} + \frac{P\left(\frac{N-n}{2\pi}\right)^2}{C} =$

$= 2 \cdot \frac{353.18}{0.25} + 10 + \frac{0.25 \cdot 0}{353.18} =$

$= 8 \cdot 353.18 + 10 = 2835.4$ mm = 283.5 cm

Here are left side chain length calculations



m = 3.5 kg

L = 1.05 m

$\alpha = 60°$

w - ?

$\sin\alpha = \frac{d}{L}$

$W = mgd$

$W = mgL\sin\alpha =$

$= 3.5 \cdot 9.81 \cdot 1.05 \cdot \frac{\sqrt{3}}{2} \approx 31.2$ joules

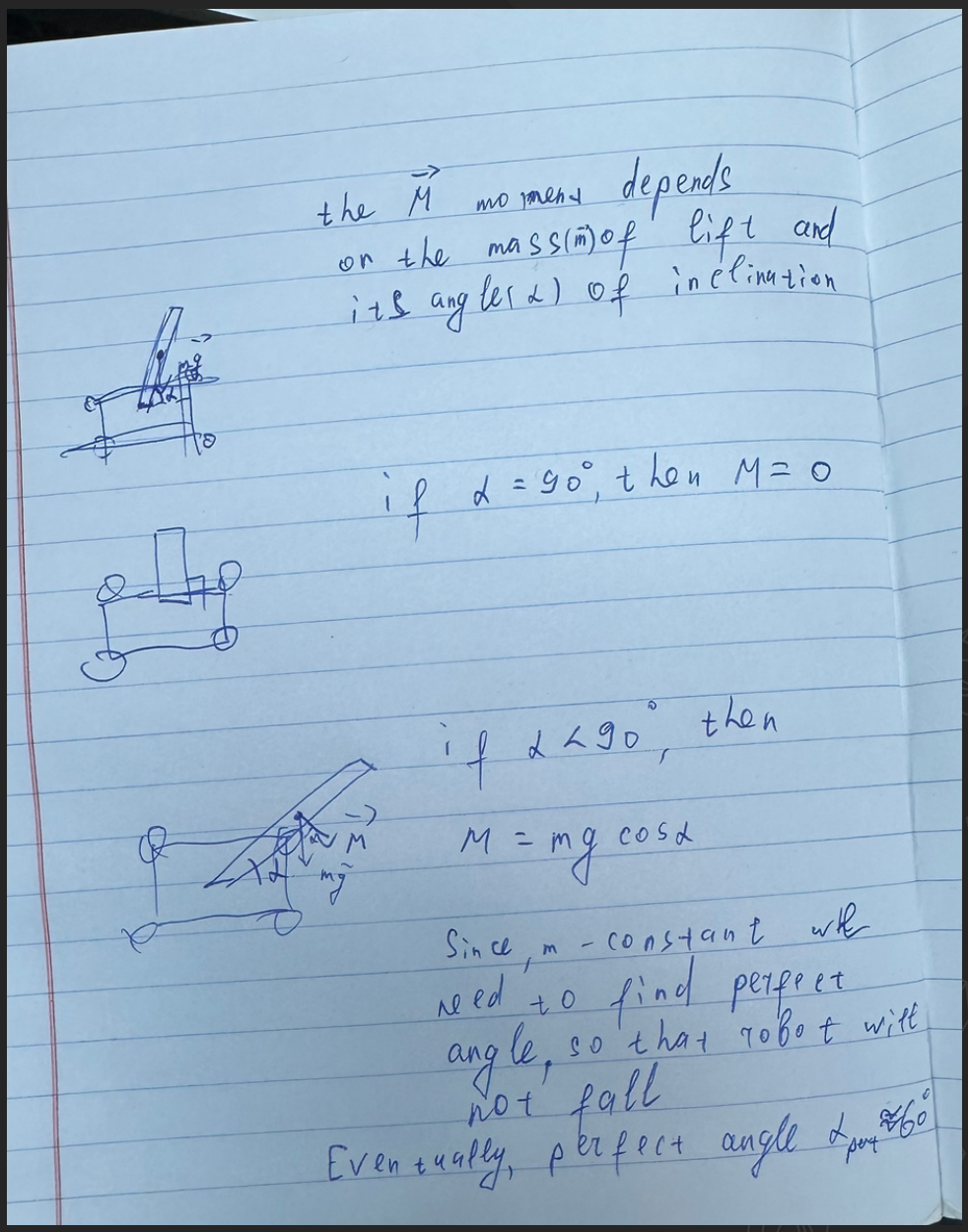
$P = \frac{W}{t} = \frac{31.2}{2.2} = 14.18$ Watts

2 core Hex

t = 2.2 s (cycle time)

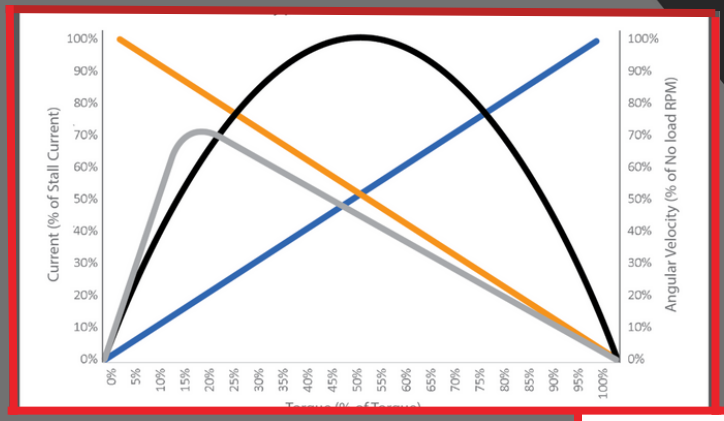
the time in which the robot goes up & down

In this extract, we calculated the number of Hex Motors needed to make the lift go up fast



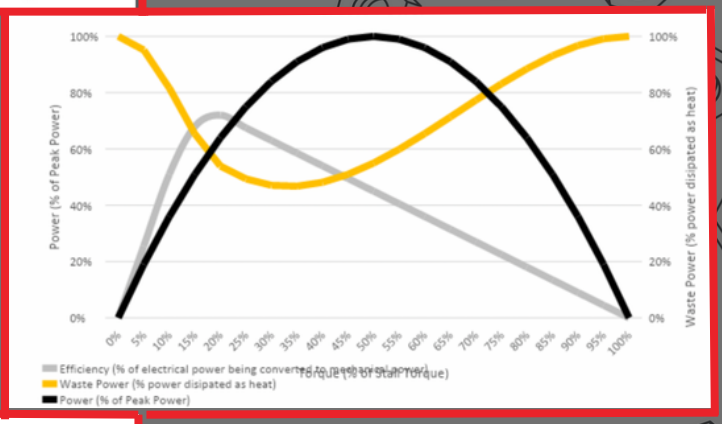
Here are some important calculations made by one of our engineers who assumed that the bigger the angle, the less weight.

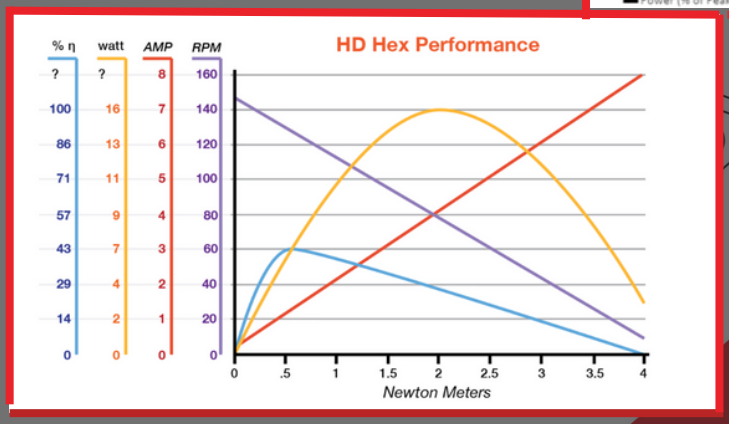
It could be explained with simple laws of Physics. Since the lift is inclined, its gravitational force would be equal to the mass of the lift times gravity multiplied by the cosinus of the angle to which it is tilted.
Consequently, bigger angle results in a bigger value of the cosinus of the angle to which it is inclined



Prototypical Brushed DC Motor

Waste power

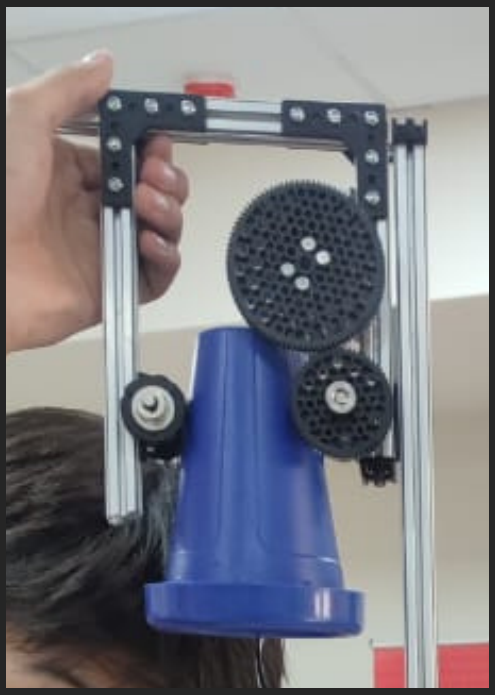


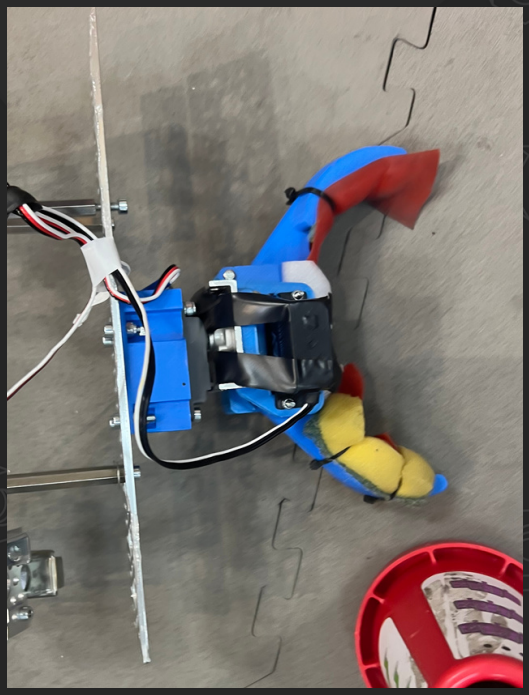


HD Hex Performance

We have used these three graphs to estimate the performance of our motors. We found out that a single Hex Motor is able to work continuously for 3.71 hours. The calculations were done by comparing maximum torque and Hex's usual torque, measured when the motor's RPM is zero and the motor is drawing its full Stall Current. This value is the maximum torque the motor is ever capable of outputting.

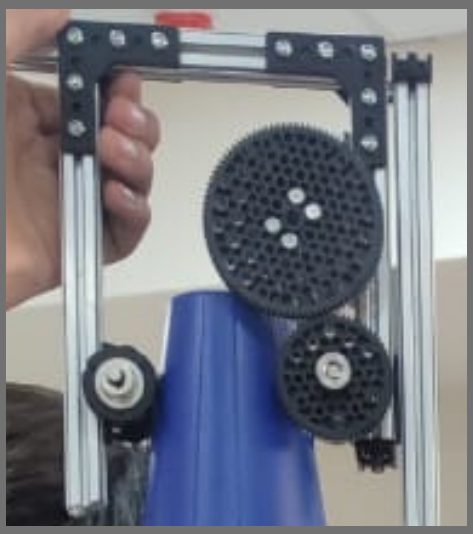
Intake Construction



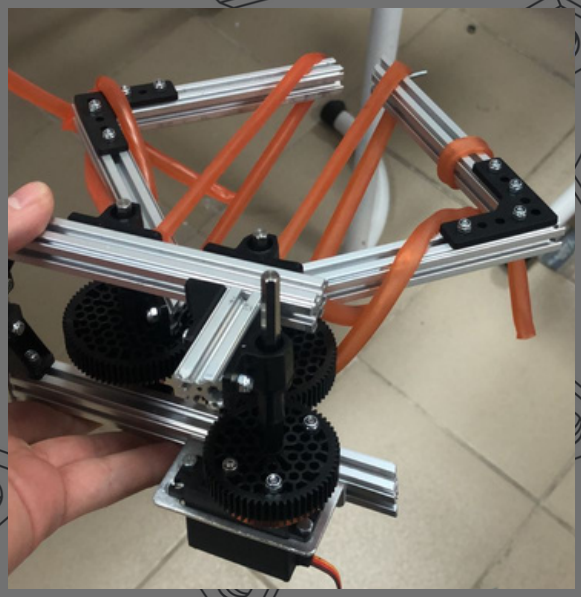


At that time this intake seemed like a great option since it was mentioned in the manual (kickoff concepts), and generally, the grip was great, and the idea seemed cool. Regardless, it was not as flexible as we wished it to be

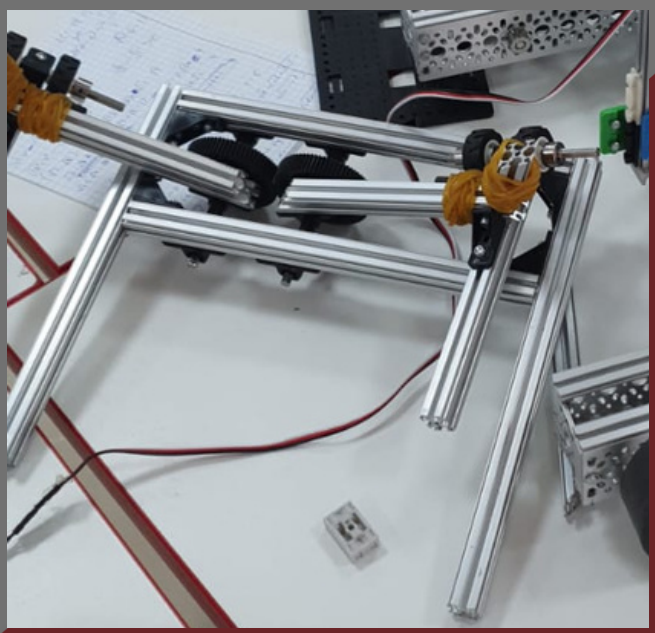
After doing some research we found out that using loofah would be both efficient and eco-friendly. We examined the stiffness, strength, and energy absorption characteristics of the luffa sponge material and it turns out that it has an ideal energy absorption feature.



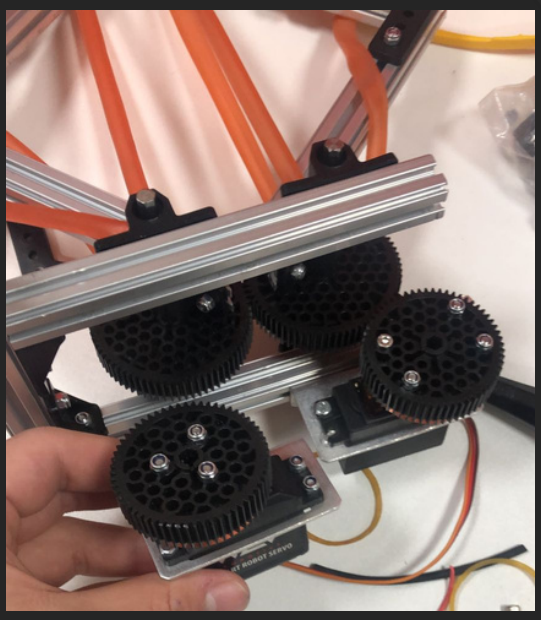
1. Roller Intake
Was good at taking the cones in, but could easily drop them if the robot was shaking.



2. Surgical tubing Intake
Definitely had better coverage, worked on 1 servo, and used 3 tooth gears. However, it was bad at holding cones, and therefore we tried using rubber bands.



Although this intake used rubber bands, it was too huge and short at the same time. That is why we decided to use sponges instead of rubber bands.

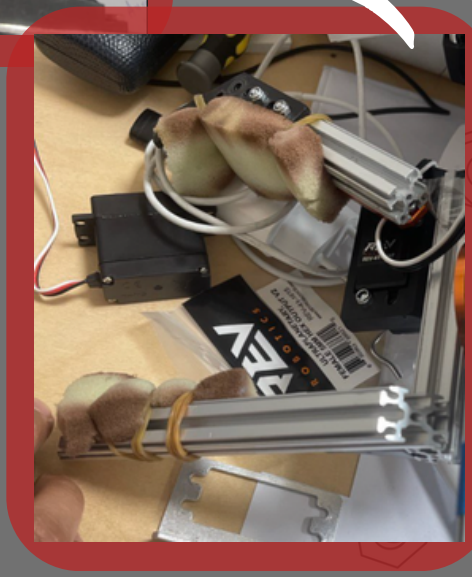


We tried experimenting with surgical tubing once again, but the construction was too complicated It now used 2 servos and 4 tooth gears. In short, this intake was a complete failure.

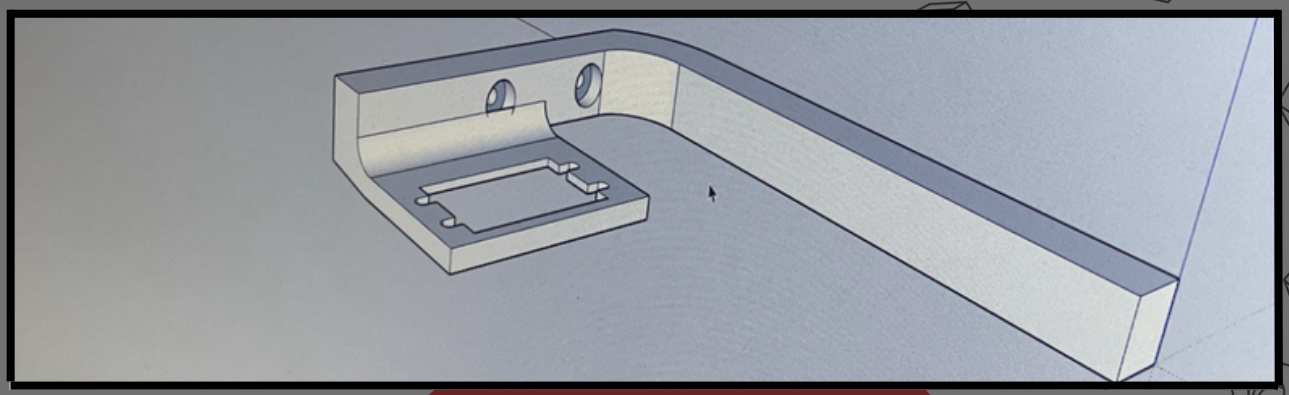
This intake was hands down the most creative one. However, we had a hard time figuring out the way to attach it to the robot. Thus, we changed the sponges and the construction per se.

This is a default intake that works like a claw. This was when we made up our minds on the construction of the intake. The only drawback was the bad quality of the 3D printed details since they kept breaking.

We made a prototype of the perfect intake, and here is what it looks like. Later on, we recreated a 3D model of it. The main idea is that one of the claws will not be moving while the other one will actively move from side to side collecting the cones.



Prototype



This 3D model includes the non-moving part of the robot as well as a holder for the servo motor. Unfortunately, the 3D printer that we used had low-quality filling, and hence, the printed detail kept breaking. But despite that, the construction is great and works really well.

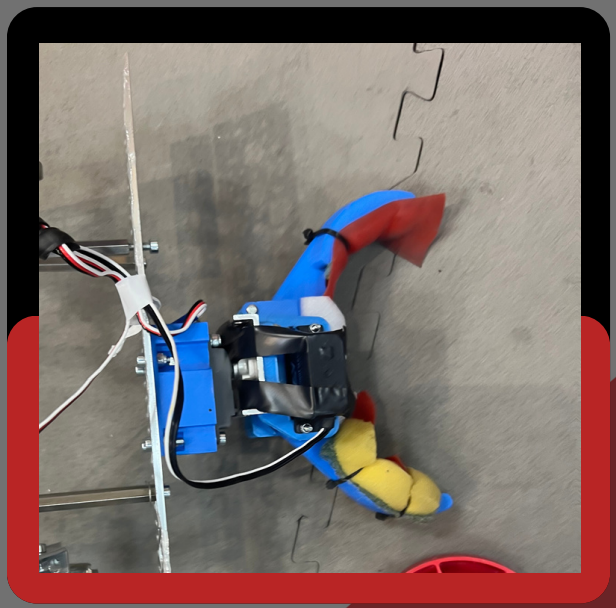
Design #1

Issue

The idea came to us based on the tentacles of a crab. But after we changed the lift mechanism, we didn't have enough encoders for a third servo motor. So then we came up with another idea for the stack.

Claw - the most challenging part because we have long thought about the second design idea. Correct claw design plays a role in how many cones we can take in a short period of time.

Final Design



We sketched the claw which consists of two servo motors (one that converts the cone, the second that grips the cone resting on a static 3d part). It fulfilled our functional goal and we came to this final design.

4. Telescopic Slide Intake

We design a telescopic slider Intake that should take cones from multiple directions and has steadfast construction in frequent slider extensions.

Design

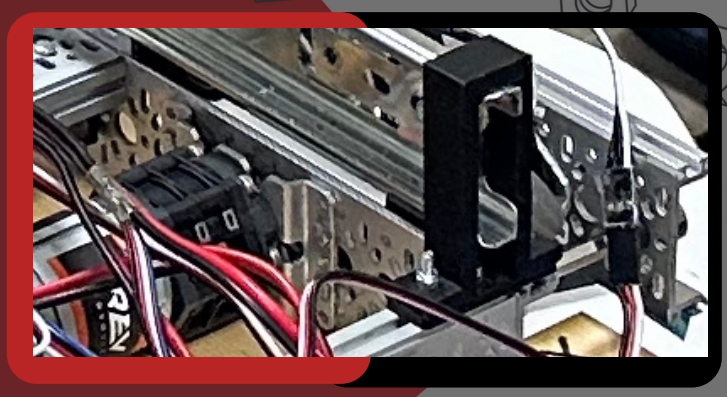
3D detail

Issue

The problem that arase with the telescope slides was there attachment. We installed a servo to move them, so sometimes the movement might be different.

Final Design

To fix this, we created 3-D parts so that they would fix the slides reliably. It held them firmly in the drivetrain, and when you turn on the servo motors the sliders didn't wobble,

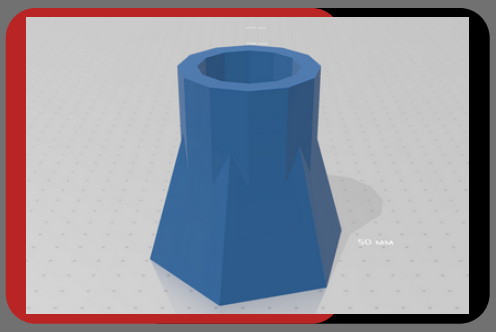


5. Beacon

The custom beacon gives us more points for the robot game, which is a nice bonus.

Design #1

Design #2



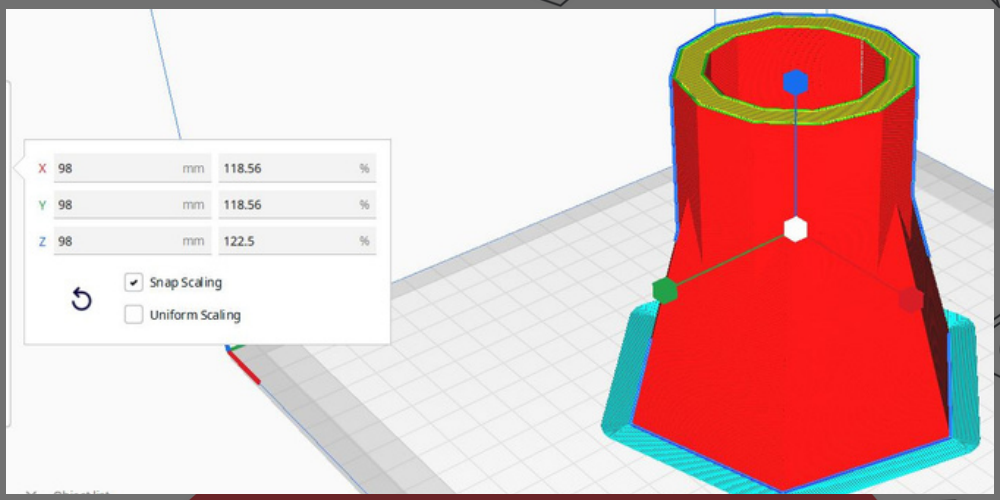
Issue #1

Our first Beacon was made during the competition out of ordinary glass. Red and blue sleeves could be swapped on it, and it also had stops on the ends, which gave the tumbler weight.

Issue #2

When we made the 3D Detail Icon, it turned out to be relatively small because the claw held it loosely.

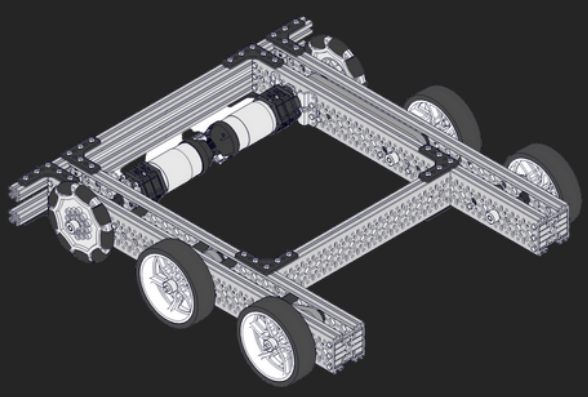
Final Design

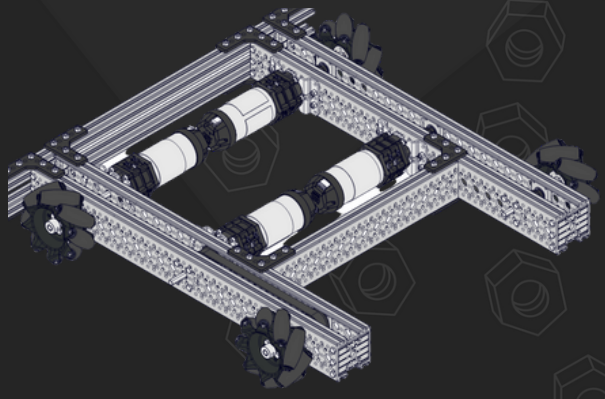


We changed the beacon con to full occupancy and created the markings precisely according to the rules of 3 inches in - 4 inches max.

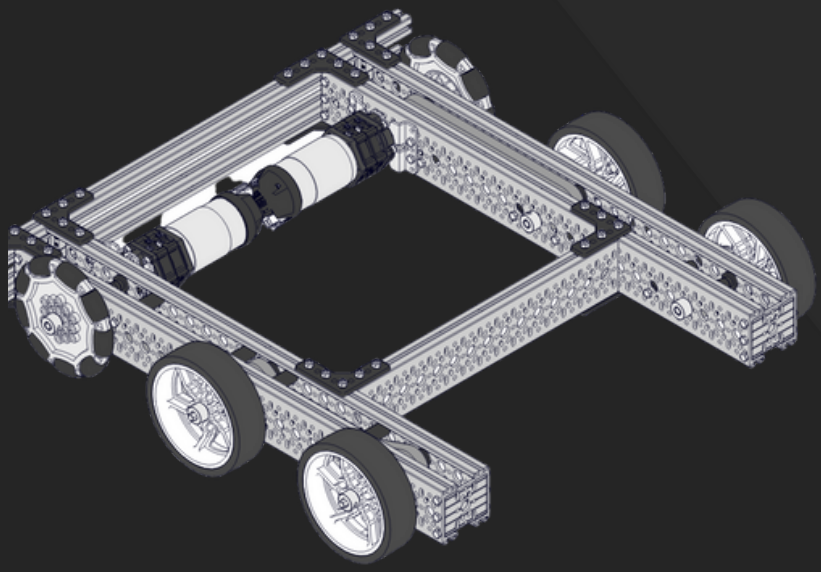
Drivetrain Construction

Our Inspiration





Now, consider our transmission.
Our transmission has been changed 3+ times throughout the season. We have come a very long way to arrive at the current, ideal transmission in our opinion. Next, we will tell you more about our path to the final transmission



Our First Drivetrain

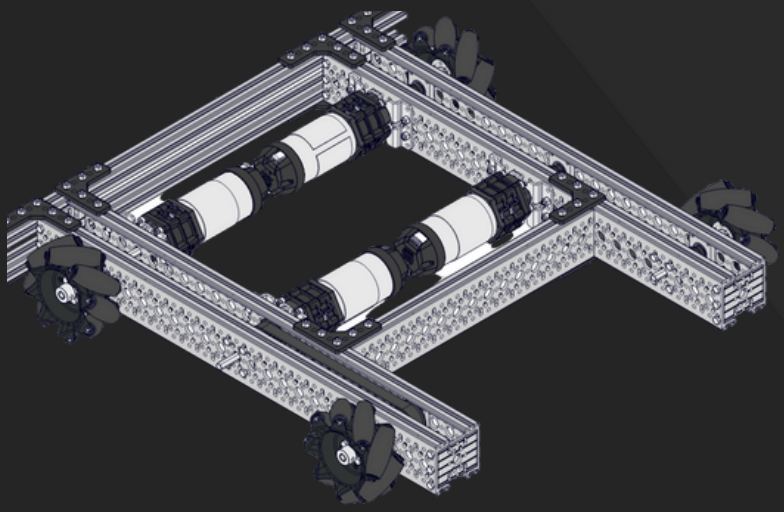
In the picture on the left, you can see an example of our very first and standard drivetrain, we built it in the first few weeks from the start of the FIRST season.

Why did we change this drivetrain?

The biggest reason why we replaced our transmission with wheels. We changed the wheels to mecanum. Since these wheels are much better than omni, below you can see a comparison of the types. You can see an example of omni wheels in the picture on the right

Compare

Omni wheels are another type of omnidirectional wheel that can move in any direction without changing orientation. Unlike mecanum wheels, which have an angled tread pattern, omni wheels have multiple small rollers arranged in a circular pattern around the wheel. This allows the wheel to move in any direction, including diagonally.



Our Second Drivetrain

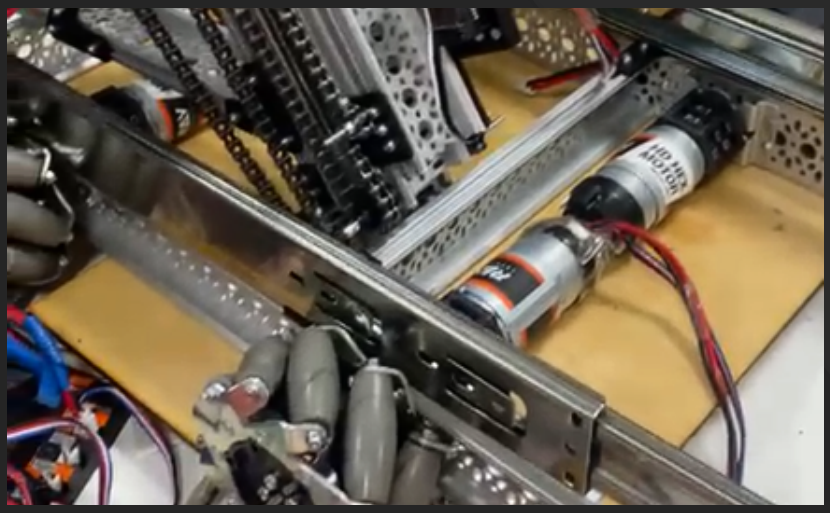
In the picture on the left, you can see an example of our second, standard drivetrain, we built it in the first few weeks from the build of first drivetrain.

Why did we change this drivetrain?

This transmission had too much weight and an inconvenient arrangement of motors for us. It was also a regular standard transmission, which was also the reason for its replacement. We solved this problem by rearranging the motors and changing the design itself

Compare

While chains can be a useful component in some types of drivetrains, there may be better alternatives for mecanum wheel drivetrains that prioritize weight, simplicity, and efficiency. Directdrive or belt-driven systems may be better choices that can provide similar or better performance without the added complexity and wear that chains can introduce.



Our third Drivetrain

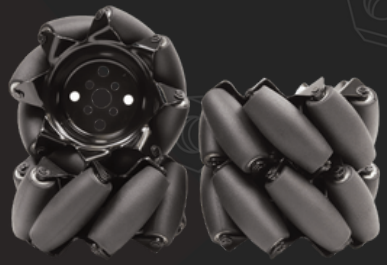
In the picture on the left, you can see an example of our last drivetrain, we built it in the last few weeks from the games in the SDU.

Why did we choose this drivetrain?

the drivetrain was chosen because it is efficient, comfortable, aesthetically pleasing, and lightweight. These are all desirable qualities for a drivetrain, as efficiency and low weight can improve the overall performance and maneuverability of the robot, while comfort and aesthetics can make it more appealing to users.

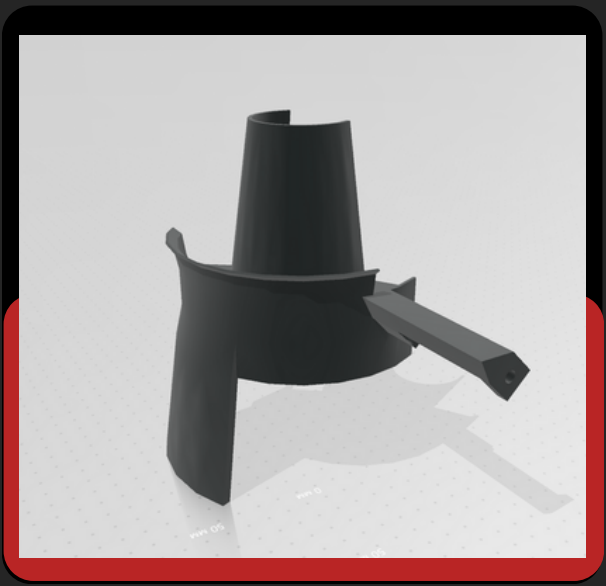
What do we think about this drivetrain?

Now we think that this is one of the best transmissions that we could build, it is as close as possible to our ideal and fulfills almost all our requirements. It is efficient, comfortable, beautiful, and weighs little, unlike previous transmissions



Basket

Design #1

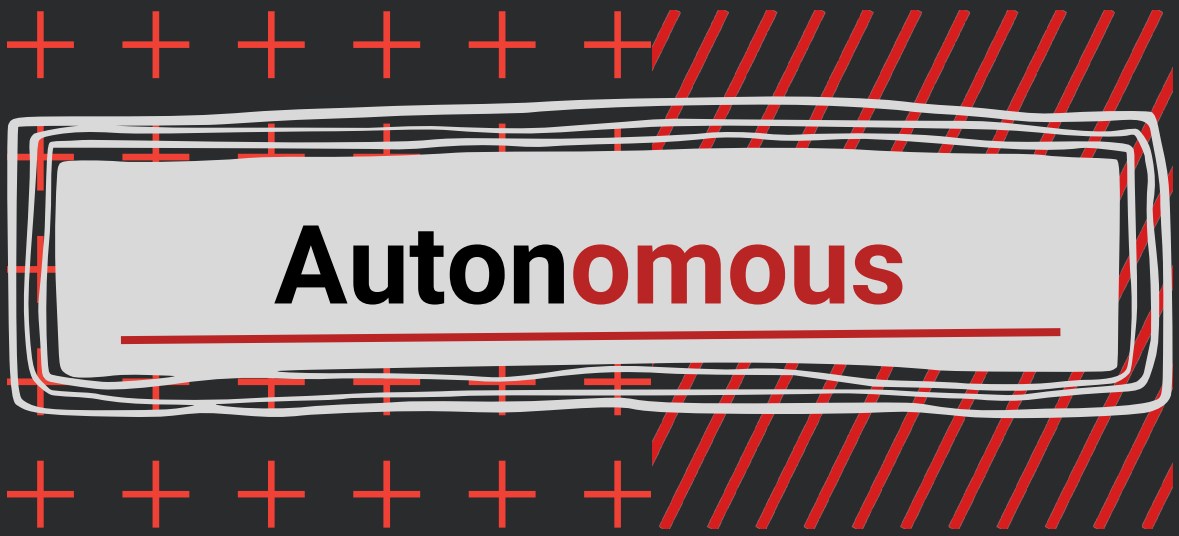


Issue

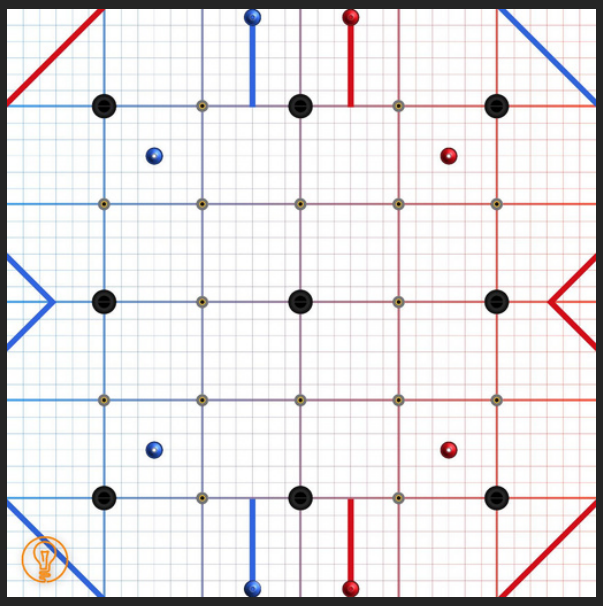
The first model of the basket was too short for the cone which made it fall out every time the lift went up.

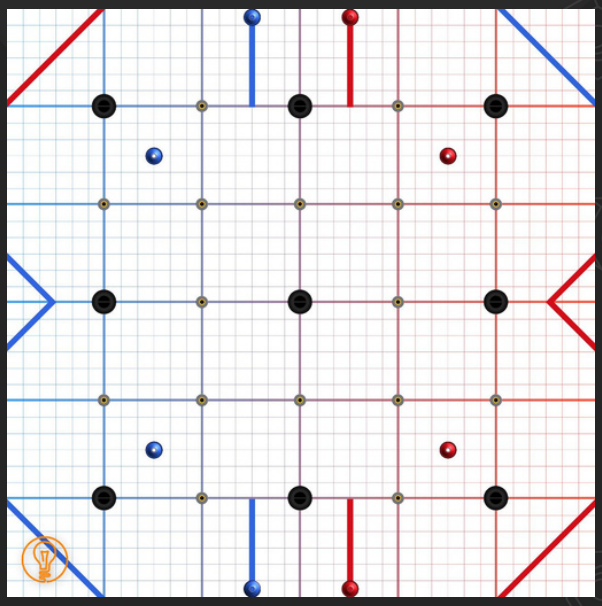
Final Design

As a solution, we removed the borders. So now it was the entire intake without anything else. There are also sticks to make scoring cones to the junction easier.


Autonomous

Our Strategy





During the autonomy, we will score 5 cones. And later cycle 10 cones in a minute, and for the rest of the time, we drive around the field and make the cones. We are also going to negotiate with the teams from our alliance.

1) If our alliance does not have autonomy, we will do in 40 seconds 10 cones on the middle junction and their 5 side junctions.

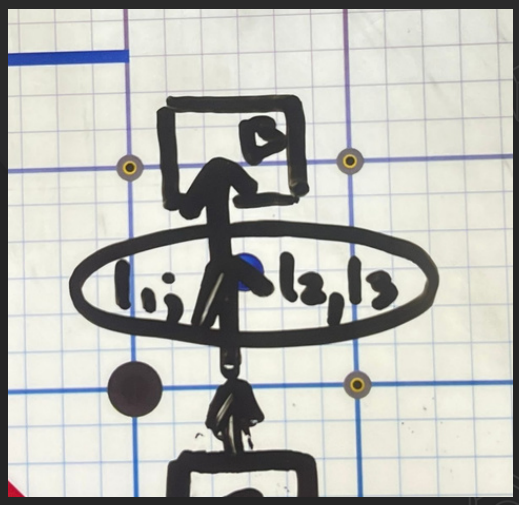
2) If the bottom junction is blocked in the middle, we will also score junctions on the sides.

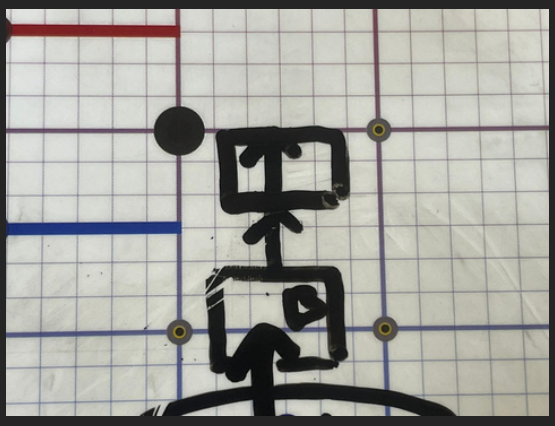
Overall, we will score junctions in the middle while our alliance team is on the sides (the low and middle).

Finally, in the last seconds: We will score junctions near the triangles when the last minutes are up. All of this will be done by side-junking.

Autonomous Steps

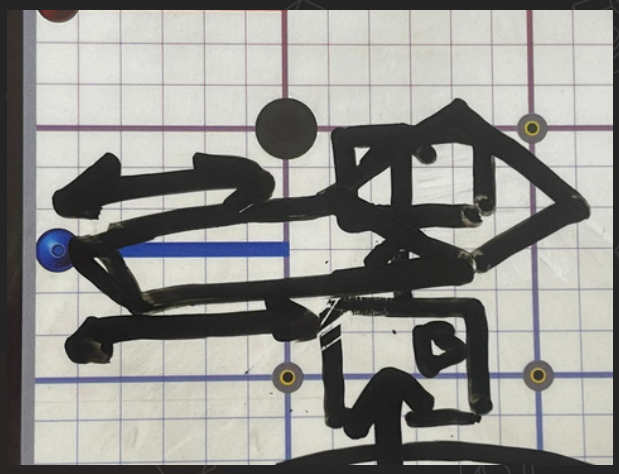
Before the robot starts moving, the camera on the robot reads from the cone what its position is. There are three positions in total: 1, 2, 3 and the camera reads I1, I2, I3 respectively.

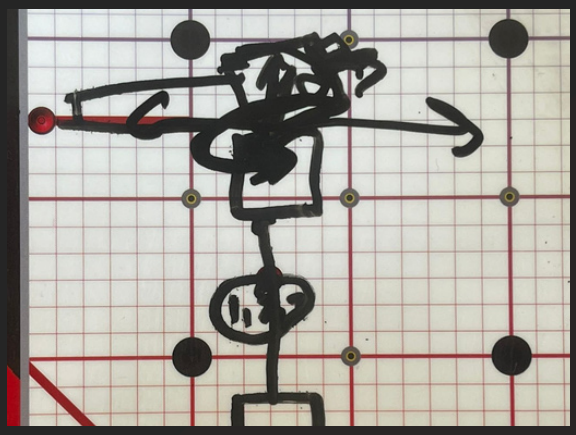




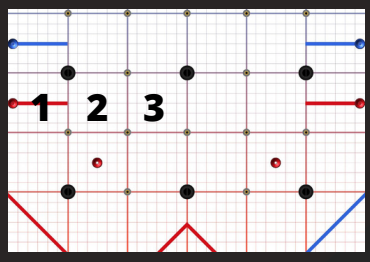
Later it reaches a certain point as shown in the picture. From this point it goes straight to the end, turns around.

Intake sprawls and takes the cone, putting it on the basket and hooking up the lift.

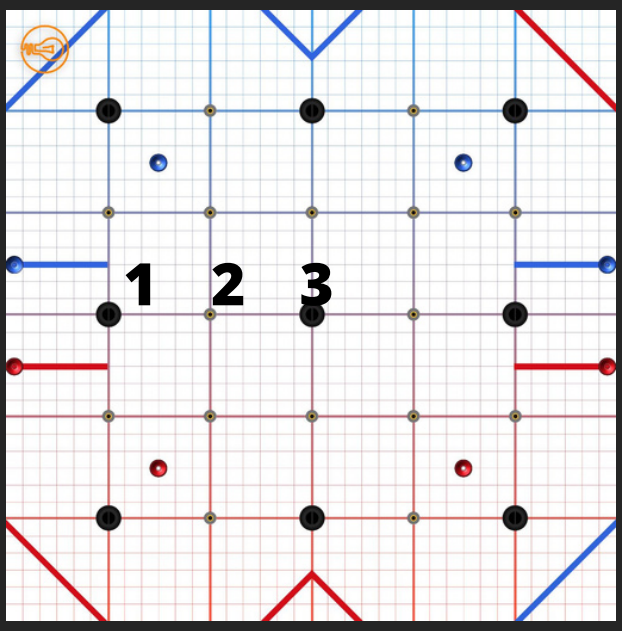


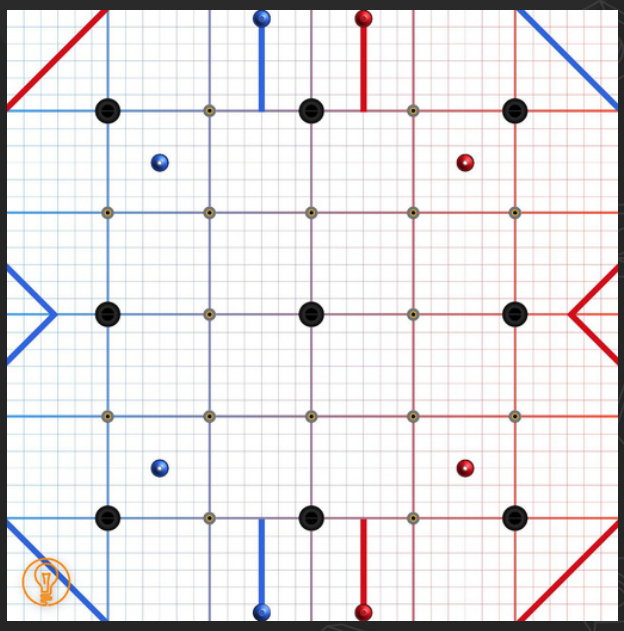


put everything we need, we get to our positions (1, 2 or 3)



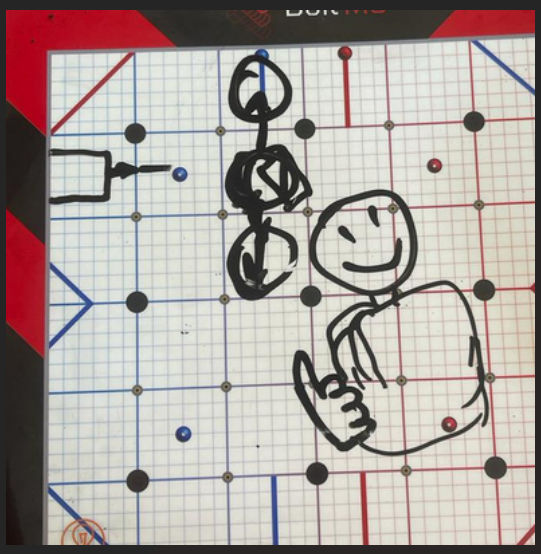
Autonomous Summary

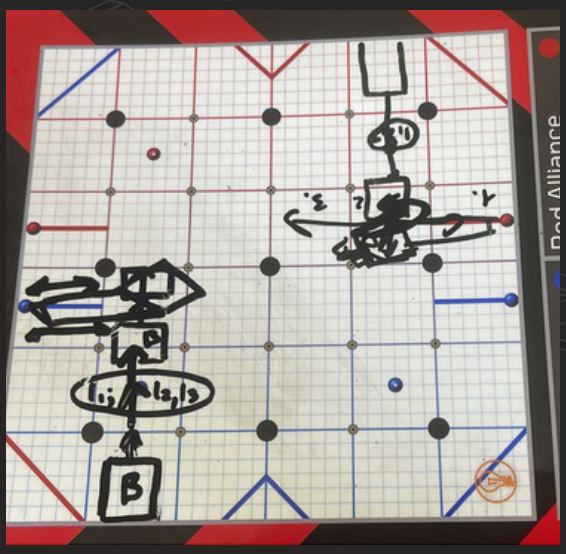




In general, the most important thing in our autonomous work is to score 5 cones (50 points) + parking (20 points).

During autonomous operation we have 5 positions (for each parking lot separately) change.





Software Development

Software strategy - to create a simple yet adaptable program for drivers on the top part of the game and to make the highest scoring and efficient program on the autonomous region of the game.

Intelligent controls - our main goal was to create an efficient and simple program for our drivers. So, our programs contain automated cone intake, an automatic cycle algorithm combined with button shortcuts to fully extend or fold intake, set intake to lowest or idle up/down position, and also precisely move the extension and raising of the information with the speed that driver wants

Dual control - to fully satisfy and even the workload for the drivers, we use two controllers and two drivers to control our robot. The first driver's task is to maintain based on full speed, lift fully, and cycle algorithm. The second driver's mission is to entirely prevent the intake part of the robot combined with a low-speed control of the base to aim for junctions and cones.

Driver compatibility - our program is programmed to fit the driver's style and satisfy his desires. For example, the movement for the base for our drivers is projected on the sqrt(x) graph to create a smoothness effect on the drivetrain control. Also, our cycle and putting cone algorithms contain little delays between extending and grabbing cones to allow our drivers to correct little errors and grab cones correctly.

Tele-Op Goals

To score ten cones on the high junction at the cycling stage and cut the maximum amount of cones while conquering the effective junctions to create a circuit.

The goal for the teleop stage: is 80 points solo.

High junction: 13

Middle junction: 5

Ground junction: 2

Key Algorithms:

Autonomous:

Detector.getTag() - to identify the QR code id and then identify the signal parking zone.

GRABIntakePosition - to grab the cone with the given position of the intake and extension

PUTCONEIntakePosition - to put the cone on the basket

ThrowCone - to score the cone on the junction using the time method explained above

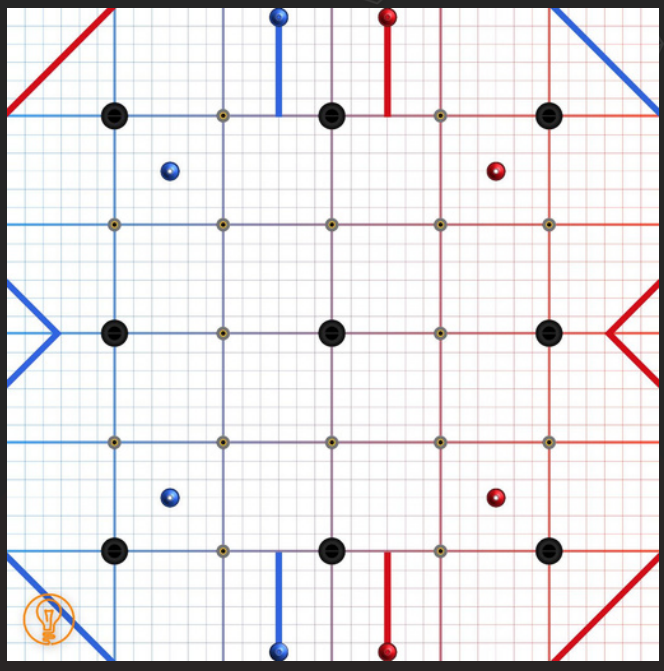
Teleop:

GRABIntakePosition - to grab the cone with the given position of the intake and extension

PUTCONEIntakePosition - to put the cone on the basket

threadFULLExtend - use another thread to use the cycle algorithm of extending, picking the cone and putting on the basket. Another line is used not to interfere with the movement of the robot and driver. 1st driver mainly uses it.

threadPUTCONE - use another thread to grab and put the cone on the basket(the shorter version of the full extend algorithm without extension2nd driver mainly uses it, driver.



THE ENDING OF PREPARATION

Lastly, we would like to express our gratitude in the path we had traveled together. Every step we took was always of a new nature, beyond our expectations. During these last few weeks, we gained a lot of valuable lessons, broadened the horizons of our minds, had the opportunity to exchange cultures with people from other side of the globe . We appreciate and respect FIRST principles, as they line with our views. We believe that FIRST principles are more than a set of rules. We are all something more than just participants of a robotics competition. We are the ones who will shape the future. We are the ones that will reach incredible heights. Preparing for the competition graciously provided us with the necessary skill sets and a wave of different emotional experience that we will remember for as long as possible.