

# Engineering Notebook #19117 | R0016



# ROBO SAPIENS



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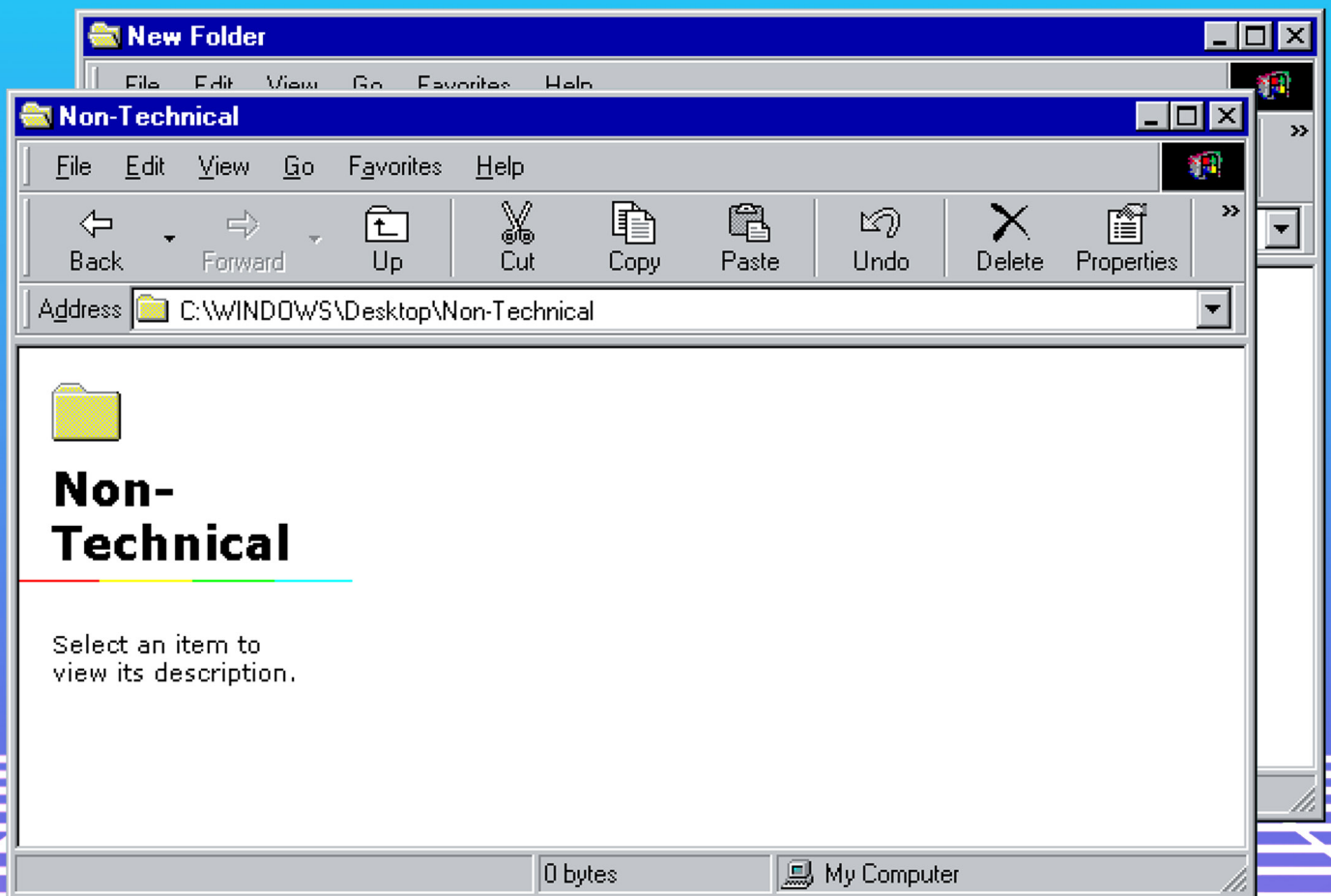
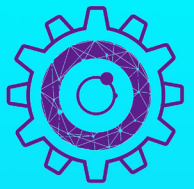
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9 September -  
"Kick Off"  
1 object(s) selected



Program Files  
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recruiting  
1 object(s) selected



Program Files  
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Program Files  
7 December - finishing up  
our last prototype of the  
Mecanum wheels  
1 object(s) selected



Program Files  
File Edit View Help  
Program Files  
5 November -  
"Robofest"  
1 object(s) selected



Program Files  
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Program Files  
11 December -  
"BraveBots"  
(Hypercube, Ploiești)  
1 object(s) selected



Program Files  
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Program Files  
19-20 December -  
"Santa's Spiriduși"  
1 object(s) selected



Program Files  
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Program Files  
21 January - Izr  
"Robotics fest"  
1 object(s) selected



Program Files  
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14 January -  
demo Qube  
(our first won demo)  
1 object(s) selected



Program Files  
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Program Files  
24 January - "Unirea Roboților"  
(Ploiești, Ercast, Phantom,  
Underconstruction)  
1 object(s) selected



Program Files  
File Edit View Help  
Program Files  
26 January -  
visiting the children  
from the "Sfanta Sofia"  
Center  
1 object(s) selected



Program Files  
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Program Files  
6 February -  
Assembling the robot  
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## 1. TEAM HISTORY AND PROGRESS

RoboSapiens was founded in 2016, when the FTC community was very small and wasn't very popular. Luckily for us, our mentors helped us significantly along the way and we embarked on this journey together. Our performance in the first season was pretty good considering we were at the beginning and we finished up on the 14th place out of 44 teams.

The second time around, right from the beginning we participated in many more activities, all of which were extremely eye-opening for us. Some highlights include our participation in numerous demonstrative matches, the regional championship and the visit to Saint Sofia center for children. Moreover, the second season marked the start of the "Robo Sapiens Junior" FLL team, which we mentor. We also managed to get organised, despite our biggest problem, which was time management. In the end, after many days and nights' work, we ended up in 9th place out of 94 teams and we won the 3rd place of the "Motivate" award and the "Finalist Alliance Award".

The "Rover Ruckus" season started off pretty well as we participated in even more events than in the previous year. Some examples include various demonstrative matches, hackathons, camps and different interviews. Moreover, we organised "All the STEM Ladies", an event meant to inspire young girls to follow a career in any technical domain. However, our time management was a bit off and we finished the robot with little time before the competition, this thing affecting our further performance. We managed to finish 46th out of 218 teams.

The SkyStone season was a really good one regarding our robot performance, but we weren't able to participate in the regional phase because the pandemic came and unfortunately it was cancelled. Even though the competition didn't take place, we still participated in a few demos in order to test our robots.

The Ultimate goal season started pretty good, with our prototype working but with time we created too many prototypes and ended up having quite a few issues with the final robot. Despite those issues, the competition went really well. We had a lot of fun, even though we didn't perform as we wanted to or win any prizes.

The Freight Frenzy season was more of a learning and testing out of our robot's new features, rather than trying to win anything. We tried a new form of organisation that worked out pretty well in our workshop. We also tried out new robot prototypes and odometry functions.

This season the robot's system works very well, as well as the odometry and the autonomy. We were very organised during this season and we were able to achieve everything we wanted. We constantly went to other team's demos to test the prototype and the robot itself. We hope to achieve our goal to reach the national phase of the competition.

## 2. MEMBERS

‘I have always wanted to be part of something significant and make a difference. This team allowed me to channel my passions and further expand my field of knowledge. For me, teamwork is crucial and I believe this project is influencing our personality positively.’ ~ Victor Hasieganu (Team Leader)

‘Along this team, I’ve managed to channel my passion for science and technology into something positive. I’m grateful for being part of such a project and for having the opportunity of putting my skills and knowledge to use.’ ~ Marinaș Mihai (Head of the CAD Department)

‘They said that curiosity killed the cat yet I’m still standing, despite continuing to express it, especially in the FTC World’ ~ Gaspar Isabela (Head of the Marketing Department)

‘Hello!! My name is Bianca, I’m 16 yrs and I’m a junior. I take care of the image of the team as I’m part of the marketing department. I am an ambitious and disciplined person who is easy to motivate. I like details and that’s why I emphasize the presentation of the team, so that I can show everyone how good we are.’ ~ Ilie Bianca (Marketing Department)

‘Hello! My name is Alexia, I’m in the 10th grade and I am part of the marketing department. I consider myself a sociable, energetic and inventive person, willing to interact with other people. Since elementary school, I have wanted to be part of a robotics team, being passionate about this field.’ ~ Ene Alexia (Marketing Department)

‘My name is Hami and I am in the 10th grade. I consider myself a creative person, the reason why I joined this team and along with that I developed my abilities in multiple fields.’ ~ Arslan Hamide (CAD Department)

‘Hi, my name is Thea, I am in the 11th grade and I am part of the CAD design department of the robotics team. I am passionate about computer science and drawing and I consider robotics a field of the future that has always aroused curiosity. I joined the team because I wanted to accumulate as much knowledge as possible in this field.’ ~ Bojan Thea (CAD Department)

‘My name is Calin and I’m in 10th grade. I like getting to know new things and playing on the PC. I’m passionate about programming, that’s why I chose the robotics club, it arouses my curiosity and develops my skills to write code.’ ~ Murariu Călin (Programming Department)

‘My name is George, I’m in the 10th grade and I’m passionate about all things technology. I joined this team to learn new things and test my knowledge in this field.’ ~ Herășteanu George (Programming Department)

‘Hey, there! I am Irina, I am 17 years old, I am in the 11th grade and I am part of the CAD department. I love to read and have always had a passion for science. I joined the team to learn as much as possible about this vast field of robotics.’ ~ Lecea Irina (CAD Department)

‘Robotics arouses my curiosity and that’s why I decided to join the club to learn more about what it means to be in a well-organized team.’ ~ Matei Andrei (CAD Department)



‘I’m passionate about everything that means technology, hardware and software. I joined the robotics club to pursue my passion and put my creativity and attention to detail to contribution. ‘  
~ Pop Cristian (Building Department)

‘My name is Rares and I’m in 10th grade. I consider myself an introvert, but direct in thinking. I like to read, play the guitar and play on the computer. I’m passionate about old things, especially technology considered “antique”. I chose to join this club to learn more about building and programming a robot, and to discover my limits.’ ~ Saulea Rareş (Building Department)

‘Hi. My name is Anemona. I’m in the 11th grade and I am a member of the CAD design department within the robotics team. I am passionate about literature as well as exact sciences. I thought robotics could provide me with the desired information and the necessary experience in a field I’m passionate about, so I joined the team.’ ~ Stan Anemona (CAD Department)

‘Hi, my name is Mihnea and I’m in the 12th grade. This is my 4th year of FTC. I’m part of the CAD design team, but I always try to help the assembly team as well. I’m fond of all that is STEAM, and for the future I’d like a career in software engineering. The team and robotics in general helped me discover this technical side of me, as up until I joined, I was more inclined to the non-technical side.’  
~ Velcea Mihnea (Volunteer)

‘I am Pomeran Ioana, I’ve been part of the Robosapiens team since 9th grade and I contribute to the CAD and assembly part. Working in a team and facing the challenges of the competition together helped me develop as a person and gained useful skills in life.’ ~ Pomeran Ioana (Volunteer)

‘I am Andrew from 12th grade and I’m a member of the building department. I have been passionate about the technical field since I was a child. My hobby is photography and I also like the non-technical side. This robotics club has taught me to work effectively with other members.’ ~ Stan Andrei (Peer Mentor)

### **3. MENTORS**

Our main mentor is our Physics teacher, Mrs. Petronia Dumitrescu, who helps us with everything from team organization to logistics. Moreover, this year, an old member, Teodor Curiman, got in touch with us and offered his help during this season, for which we are very grateful.

### **4. FRESHMEN RECRUITMENT**

Every year, we look for new pupils at our highschool, preferably in the 9th grade, to join us in our pursuit for excellence in the FTC competition.

#### **a. Signing Up Process:**

Gathering feedback from our past seasons, we have decided to start recruiting from before the official Kick-Off. This year, for instance, signing-up started in the first week of September. We talked between senior members and decided to hold the workshops during the following month.

## **b. Learning Process:**

Our tutorials were created to teach the freshmen relevant lessons about programming, designing, building and marketing that we judge will aid them to become knowledgeable FTC members. Our lessons included some homework that helped in the final selection at the end of the learning phase.

## **c. Selection Process:**

Mainly, for this task, we used the homework they completed in the last phase of the recruiting to see who is most passionate and worthy to join our team. Most Freshmen decided for themselves that they don't want to get in the team and gave up along the way. Finally, we were surprised by how good the final tasks we gave them turned out so we recruited most of those who finished them.

## **d. Integration Process:**

To make everyone get used to one another, we invited the freshmen to work with us. Our goal is for us to get to know them and vice versa. This mostly happens after the competition, in spring; that is mostly when we have enough time to spend doing other activities than working on our robot so that is a good period to show our new colleagues around our workshop.

## **5. WORKFLOW**

This year, once again, we use the Agile Method.

Agile is centered around the idea of iterative development, where requirements and solutions evolve through collaboration between self-organizing cross-functional teams. Through Agile, we have a greater aptitude to respond to change and manage our time, as well as much more effective communication skills. We operate according to the Scrum methodology. This relies on breaking work into goals that can be completed within time-boxed iterations, called sprints, which in our case last 2 weeks.

During the sprint we have held the following meetings:

- **Sprint Planning:** a meeting in which we lay out our goals and specific tasks for the sprint
- **Daily Standups:** 2 weekly gatherings, usually around 20 minutes, in which we discuss the progress made so far, as well as add or remove tasks according to our needs
- **Sprint Review:** a short summary of the goals achieved in a sprint, held before the Retrospective
- **Sprint Retrospective:** a meeting, lasting around 1-2 hours, in which the team reflects on the sprint and finds solutions to overcome the problems encountered during it

To keep track of things we use Miro, an online platform which allows us to keep everything organized. We split the board into four sections so that we would know the status of the task (to do, in progress, on hold or done).

Though from a glance it looks the same as the past agile method used by us, this season, we elected a Team Leader and Heads for every department, in order to facilitate mobility within departments.

## 6. OUTREACH

### a. Demo GearManiacs Off-Season

We had the pleasure of signing up for a demonstration held by the robotics team Gearmaniacs in their hometown of Sibiu in April.

During the tournament, we connected with the other teams and shared our previous season's experiences. This was our first traditional event since we joined the team shortly after the COVID-19 pandemic began.

During the qualifications, we learned how to collaborate with an ally and create a viable strategy by getting the best out of each team's abilities. Even though our robot was malfunctioning, we were glad to hear that a qualified team had chosen us to be their ally for the semi-finals. We definitely have a different perspective now that we've had the opportunity to collaborate with other teams that share our goals and attend a traditional event.

### b. Codecamp Festival Off-Season

We were given the opportunity to be one of the three robotics teams attending Code-Camp Festival, an off-season event in which we were able to showcase our last year's hard work.

One of the main centers of attraction was a small robotic arm, dubbed "Wilhelm", made by one of our senior members in their past-time and which you could control using a special mobile app. The challenge was to try and control the moving arm and carry a tiny cube from one platform to another. Apart from that we held several demonstration matches with the two other teams present, Titans and Robo-Titans. The nature of this event, which focused on bringing together some of the best speakers, leading software development companies, and creating the ideal learning environment, allowed for future sponsorships and partnerships, which were a great addition to the overall event.



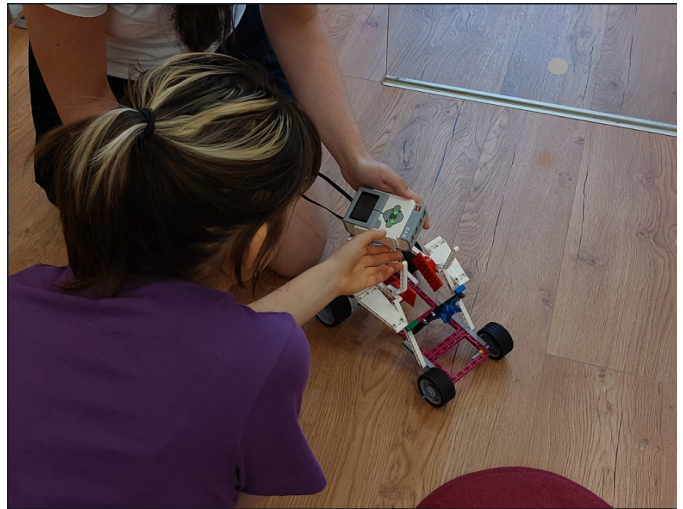
### c. Demo Punk Off-Season

In June, we attended a demo hosted by Cyberpunk, a robotics team from Turda. This was our second traditional demo, and we gained valuable insight on how to improve our game strategy in comparison with other teams' own strategies.. After the competition, we had the opportunity to bond with a team we had befriended, discovering our shared interests and exploring the beautiful city of Turda. Our experience provided us with a greater appreciation of robotics competitions and the people involved in them.

### d. "Zi de bine" community Center Off-Season

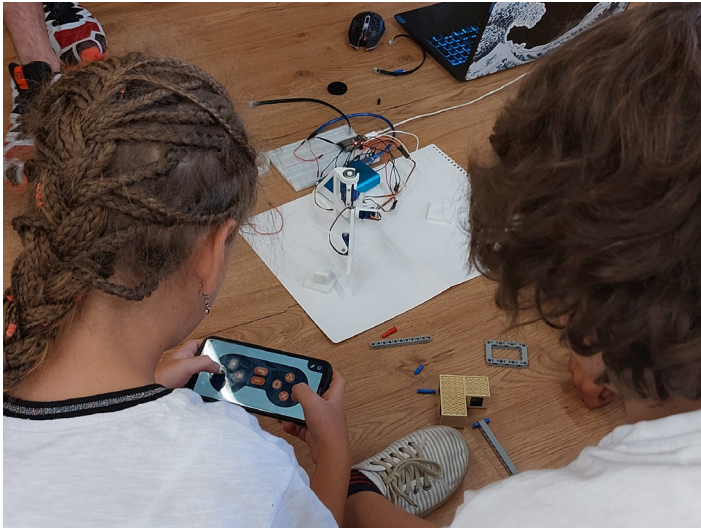
The summer of 2022 was educational, firstly for us because we were invited to teach children from Ukraine in partnership with the "Zi de Bine" Community Center, and secondly for them because they got to see what being on a robotics team really takes. Because the ages of the children varied from 4 to 11 years, we tried to make the sessions as entertaining as possible by turning to our knowledge of the FIRST LEGO League. We taught them the basic concepts of robotics and helped them build their own robot using LEGO pieces.

After those introductory courses, we dove straight into coding, and with the help of two online platforms: Blockly and CodeCombat, we showed them how to program a robot. At one of the last sessions, we brought “Wilhem,” the tiny robotic arm, with us and let the children play with it. They were so taken with it that they began building cube towers and refused to leave its side.



**e. Esentza summer camp Off-Season**

During the summer of 2022, we were invited to participate in the Esentza Summer Camp. We started off by attending a demo, which helped in getting familiar with the other teams and their robots, but also adjusting to the camp’s atmosphere.



The next day, we got the chance to visit the Technical University of Cluj-Napoca. In the evenings we had some chats with an aerospace engineer that made us more aware of our impact on the environment as a robotics team. For our last meeting we had to prepare a project from which we learned how to work being time pressured. This experience brought us together and tested our abilities to collaborate and work as a team.

In the meantime, the members of the hosting team divided all the participants into three groups, which would later attend classes for each department. Thus, we managed to deepen our knowledge and contribute to the creation of the robot.

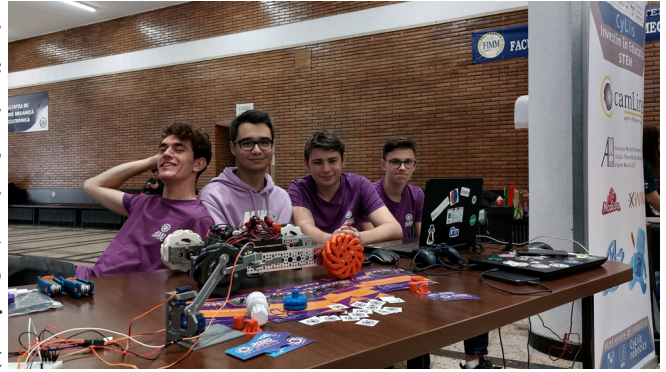
By the end of the camp, we were given a challenge that was going to take place on the last day of our trip. The task was to adapt our robot or build a new one so that it would lift and turn on a vacuum cleaner. In order to achieve our goal, we got to work with the ‘Ercast’ team, sharing and organizing our tasks as best as we could. This event led to late nights of work but we felt that it was well worth it. In the end, our robots managed to complete the challenge and we are also glad to mention that we made lots of friends with whom we still keep in touch.



### f. Robofest

We were honored to be invited to Robofest, a gathering that resembles a DEMO and aims to promote FTC robotics, which was held at the Politehnica University of Bucharest to commemorate the university's 200th anniversary. Given that this university focuses on technical aspects of work, there were several festivals taking place at the same time that we got to visit. Seeing other teams' robots and talking about our journey is refreshing and often brings up a different perspective on how things work. On top of that, we were ecstatic, to say the least, at what the other festivals and exhibitors had to offer.

Furthermore, two presentations were held to reacquaint us with the competition after the break; one in which we were given organizational details about this year's competition and one in which we were provided information about judging and engineering notebooks.



### g. Xeo Talks

In late October we were invited to attend a weekend full of conferences in Alba-Iulia, "Xeotalks", hosted by Team Xeo.

The first day started with a tour of the city by the volunteer assigned to our team, Anda. This tour helped us later that day when we participated in a treasure hunt. In the evening, the conferences started with Xeo Alumni. The topic was problems that FTC teams have (sponsors, working space, differences of opinion with their school etc.).

On the second day, we went to "1 Decembrie 1918" University's amphitheater and had the chance to talk to many amazing people including:

Andreea Bogdan, journalist and radio announcer, that talked to us about public speaking

Ana Popescu, an FTC program director, who answered via Zoom what questions we had about this year's season

The rockstar of Romanian science, Cristian Presura (physicist, author, researcher) that talked to us about the applications of physics in robotics and with who we had a Q&A session

Alex Cazacu, an FTC Romanian referee, who presented us another CAD software, Onshape

Cristiana Cazacu who gave us a brief presentation of Politehnica University of Bucharest, that helped us get a sense of what the Faculty of Industrial Engineering and Robotics has to offer

Crina Gilia Hutanu, a therapist from Sibiu, that helped us see life in a different way by talking about unlearning

On the last day Alex Cazacu, as a referee, who answered our questions about this year's game strategy

Xeo Alumni who told us the story of team Xeo, its origins, and how it changed the lives of so many students.

After a wonderful dinner with some members of team Xeo, we went to the train station. We said our heartwarming goodbyes and got onto our train.



### **h. Demo Bravebots X Hypercube**

On the 11th of December, we had the pleasure of signing up for the BraveBots X HyperCube demo that was held at the Ploiești Palace of Culture.

We competed with one of the first robot prototypes and managed to get all the way to the semi-finals. This was our first demo this year, thus our goal was to get our new members more accustomed to the competition and train this year's drivers.

Like always, it was a pleasure to compete against teams from all over the country and also meet new people. Even though we weren't in first place, we fought until the end and got a satisfying result.

### **i. Qube and Ignite demo**

On 14th January 2023 we had the pleasure to be invited to the Qube Ignite Demo that was held at Bucharest's 2nd District's Hall.

Our main goal for this demo was to find different tactics for the game and for the competition.

After the qualifying matches, we were surprised to see we ranked 2nd on the leaderboard. For the Semi-finals and finals, we chose Qube to complete our alliance because our robots were complementary and very efficient together. By working together and focusing on the games, we managed to win the finals and secure our first significant result after the pandemic. In the end we were very happy because not only did we leave with a physical reward for the endeavor we showed in the last years, but we also gained knowledge on how to improve our robot for the competition and completed our goals for this demo.

### **j. Lzr Robotics Fest - Titans demo**

On the 21st of January, we had the pleasure to be invited to the LZR Robotics Fest that was held in the Politehnica University of Bucharest. We attended with the same prototype as before (refer to "Bravebot" and "Qube and ignite" demo), our main goal being to test its system and to gain more experience. During this demo, we played various matches, which allowed us to gain valuable insights on how to modify the final concept of the robot. Even though the matches weren't our best, we still learned a lot from them.

### **k. "Unirea Roboților"**

On January 24, 2023, we were happy to take part in "Unirea Roboților", organized by Ercast, Phantom Robotics, and Under Construction, that was held in Ploiești at "Elie Radu" Technological High School.

As the event was held in honor of the unification of our country, at the very beginning of the demo, a traditional dance occurred, in which all the present participants gladly participated.

This time, we also brought a small drone and recorded some short videos of the events we witnessed. It is safe to say that everyone was overjoyed by the appearance of this little fella.

It was a great opportunity to test our prototypes, and, as we always do, we were able to learn a lot more about how to improve our robot by learning from all the mistakes that were made.



## I. “Roboți la cuțite”

Right at the end of this season, when the most stressful times began, we had the opportunity to blow off some steam by participating in the “Roboți la Cuțite” competition, organized by InfoRobotics.

The challenge was to make a cake and send a picture of the finished product and a short video from behind the scenes of making it. Our team participated with a tiramisu, made from scratch by our team’s newest members. For them, it was an amazing opportunity to get to learn how to work together, and, for us, we created new memories.

Besides eating a delicious cake, we also learned more about our colleagues and how to cooperate with each other, so it is safe to say that we all enjoyed ourselves even if this wasn’t a robotics related event.



## 7. OUR EVENTS

### a. Santa’s Spiriduși

On the 19th and 20th of December our team organized a Christmas fair with the purpose of raising a sum of money for St Sofia’s Community Center, an organization supporting young children. With the help from one of our sponsors Cornico, we were able to entertain our school’s students with popcorn and sweets. Afterwards, we made a deal with St. Sofia Community Center, where we would show the children how a robot works and help them with their schoolwork.

#### Lessons learned:

Making and selling popcorn is not as easy as it seems.

Organizing a fair in our school was tiring at first; we had to move desks and chairs for the booths, prepare the products that we would sell and be down-to-earth throughout the busy and chaotic school breaks when everyone would come out of their classes and buy our merchandise. But we adapted and overcame it by. Keep in mind that you are going to need more manpower in order to move a significant amount of furniture around.



Expectations	Outcomes
Raise at least 1000 ron for charity	We raised over 1600 ron for charity that were used to buy school supplies for the children.
Having at least 6 stalls besides ours	There were over 20 stalls that were selling throughout the days the fair went on.
Catching the students’ attention with events	The students from our school prepared a concert for our event, where everyone could listen to lovely Christmas Carols (and a theater play as well.)
Buy school supplies for the children at St. Sofia	Besides the school supplies, we’ve gathered some books that were also given to the children from St. Sofia.

## **b. Open Doors**

We were glad to hear that our school wants to host an ‘open high school day’ in which students from various middle schools would come. They wanted us to present the workshop and tell them more about our team.

We were looking forward to being able to share even a glimpse into the FTC world with the outsiders; after all, what’s better than having a taste test before submerging into it?

## **Planning**

Given that the event would take the form of guided tours throughout the highschool and all it has to offer, we made a schedule so that we could be sure the presentations would be optimal. This way, we ensured that the students would grasp the fundamentals behind our team and its purpose.

## **Following through with the plan**

Because this was a new topic for the majority of the people, we decided that we should present them the FIRST values and offer them a bit of background not only about the competition, but about its goal as well. We explained this year’s theme and showed them what a remote match looked like.

We then went on to talk about the organization of our team and explained to them our design process. We used this year’s prototypes and final mechanisms to help them understand the process better. We also told them about our personal experiences in the community and how it influenced our daily lives. At the end we encouraged and helped a bunch of more daring people to drive the robot, making this

## **“Hominidae” Magazine**

During the last few sprints, we thought about creating an off-season magazine. The objective of this publication is to raise awareness on various topics related to contemporary society, such as pollution, space, and more, that would appeal to both the younger and older generations. So far, we agreed on the name “Hominidae” which means hominid (family of primates including man and his fossil precursors from the Quaternary period) in latin. The name itself was chosen to represent the journey that humanity took to reach where we are today.

We want to include multiple articles, such as:

Interviews with important personalities from the FTC or STEAM community on the subjects that we choose;

How are humans actually related to the subjects and how do those topics influence our day-to-day lifestyles;

If possible, an article related to robotics and the subject chosen, for example, if one edition of the magazine is about pollution, we can talk about the CO2 emissions in our working space.

Our decision is to create an interactive magazine which will include various amusing jokes and intriguing facts. This approach is intended to ensure that the publication remains engaging for all audiences. The plan is to publish the magazine twice a year, and initially distribute it within the FTC Community. Later, the goal is to expand the distribution to reach a broader audience.



## 8. FLL COMMUNITY

In our high school, there is one FLL team at the moment, which was re-established this year after 2 years of inactivity. The name of the team is RoboSapiens Jr., named after us. In the past years, there used to be 2 teams, the other one named ZeBots. The two teams used to be coached by FTC members that graduated high school now. This year’s team is coached by past FLL members, who were part of RoboSapiens Jr., and some are also members of the FTC team right now.

The training field of the little team is in our robotics workshop, so that if they have any questions or need help, we are right there to support them.

After 2 years of inactivity, RoboSapiens Jr. is re-established with pupils from 5th to 6th grade. This year’s theme is called SUPERPOWERED, concentrating on saving and storing energy in sustainable ways, not only by the robot on the field, but also by the innovation project they are making.

They put a lot of effort in what they do and we hope that they will have fun working, learn something new every day, and best of luck in this season!

## 9. BUSINESS PLAN

### a. Team goal

### DESIGN AWARD

1. Team shows respect and Gracious Professionalism® to everyone they meet at a FIRST Tech Challenge event.	X
2. Team must submit an Engineering Notebook with an Engineering section that includes detailed Robot design drawings.	X
3. Team demonstrates industrial design principles, striking a balance between form, function, and aesthetics.	X
4. Robot distinguishes itself from others by its aesthetic and functional design.	X
5. Basis for the design is well considered (that is inspiration, function, etc.).	X

1. During the competition, we have done our best to always display Gracious Professionalism®, within every outreach and FIRST activities we have participated in, by making sure to treat any people we meet respectfully. Not only that, but we also managed to form bonds with some of the teams which later helped us.

2. Our Engineering Section contains detailed robot design drawings.

3. We consider that we have managed to achieve the task of creating a well balanced robot in terms of design, function and aesthetics.

4. We think our robot is quite unique in terms of creating a balance between form and function. It is well built and it shows the importance that we accorded to its appearance.

5. We prioritized its function, but when it comes to the robot’s form, we strived for something unique. We wanted to make it look as well put together as possible.

## ROCKWELL COLLINS INNOVATE AWARD

Bringing great ideas from concept to reality.

The Rockwell Collins Innovate Award could be won by the Team that thinks outside the box, and has the ingenuity and inventiveness to make their designs come to life. This judged award is given to the Team that has the most innovative and creative robot design solution to any specific components in the FIRST Tech Challenge game. Elements of this award include elegant design, robustness, and ‘out of the box’ thinking related to design. This award addresses both the design of the whole robot and a sub-assembly attached to the robot. The Team’s Engineering Notebook must include journal entries to show the design of the component or components and the team’s robot to be eligible for this award. Entries must describe how the team ended up choosing this solution.

<b>1. Team shows respect and Gracious Professionalism® to everyone they meet at a FIRST Tech Challenge event.</b>	<b>X</b>
<b>2. Team must submit an Engineering Notebook. The Engineering Notebook must include an Engineering section that documents the design process and how the Team arrived at their design solution.</b>	<b>X</b>
<b>3. Robot or Robot sub-assembly must be elegant and unique in its design.</b>	<b>X</b>
<b>4. Creative components must be stable, robust, and work reliably.</b>	<b>X</b>
<b>5. Robot design is efficient and consistent with Team plan and strategy.</b>	<b>X</b>

1. During the competition, we have done our best to always display Gracious Professionalism®, within every outreach and activities we have participated in, by making sure to treat any people we meet both with respect and kindness. We were willing to help everyone in need and interacted with many teams.
2. Our Engineering Section documents our design process and how we arrived at the design solutions.
3. We think some of our design elements are unique and combine both innovativeness and functionality.
4. Our unique design elements work reliably, as we prioritize an element function and later work on its innovative part.
5. Our robot design works very well with our chosen Game Strategy and we have rarely encountered problems when we modified the old version of an element with a more innovative one.

## CONTROL AWARD

Mastering Robot intelligence.

The Control Award is acquired by a team that uses sensors and software to increase the Robot’s functionality on the field. This award is given to the team that demonstrates innovative thinking in the control system to solve game challenges such as autonomous operation, improving mechanical systems with intelligent control, or using sensors to achieve better results on the field. The control component should work consistently on the field. The Team’s Engineering Notebook must contain details about the implementation of the software, sensors, and mechanical control.

1. Team shows respect and Gracious Professionalism® to everyone they meet at a FIRST Tech Challenge event.	X
2. Team must apply for the Control Award by filling out the Control Award Content Sheet, located in Appendix D of the Game Manual Part 1.	X
3. The Team must submit an Engineering Notebook. The Engineering Notebook must include an Engineering section that documents the control components.	X
4. Control Components must enhance the functionality of the Robot on the Playing Field	X
5. Advanced software techniques and algorithms are encouraged.	X
6. Control Components should work reliably	X

1. During the competition, we have done our best to always display Gracious Professionalism®, within every outreach and activities we have participated in, by making sure to treat any people we meet both with respect and kindness. We were willing to help everyone in need and interacted with many teams.
2. We filled out the Controlled Award Content Sheet.
3. We have documented the control components in the Engineering Section of the Engineering Notebook.
4. Our control components enhance the functionality of our robot in the Playing Field almost every time.
5. Our control components work quite reliably and we came up with modern solutions to the old problems that we have faced during this season.

## **b. Sponsors**

We have received help from various companies this season, like Cornico, ESSA and Thoughtworks. We are grateful for their support and thanks to them, our team succeeded in going this far. Most of their help consisted of money, but some of them managed to help us even more, for example:

i. Cornico is a snack company which offers products and services related to gastronomy. They not only work in Romania, but also in most countries around Europe. Even though this company is relatively new in Romania, they still agreed to sponsor us. Moreover, during the Christmas event “ Santa’s Spiridusi”, they offered us a popcorn machine, popcorn and all the ingredients needed for our stand. With their help, our stand was one of the most popular during the whole event.

ii. ESSA is a company that works in merchandise, leasing and BTL. They work not only in the urban areas, but they also cover small cities and rural areas.

iii. Thoughtworks is one of the most important sponsors for us. They focus on the relationship between the company and the client and on the quality of their services. Why we are saying that this company is one of the most important to us is not only because of their monetary help, but also due to the involvement they had in our team’s management, by accompanying us during certain meetings and giving us pieces of advice that we have been following ever since.

### c. Future plans

As we require regular funding for purchasing robot parts and organizing events, sponsors play a vital role in raising our budget. One potential avenue is to partner with companies that produce robotics-related products or services, such as software, hardware, or sensors. Additionally, we could seek out partnerships with organizations that have a strong interest in advancing STEM education or supporting innovation and technology. Another possibility is to explore funding opportunities through government grants or crowdfunding campaigns. By actively seeking out partnerships and funding sources, our robotics team can continue to innovate and achieve our goals, while also building lasting relationships with sponsors and supporters.

### d. SWOT analysis

SWOT analysis is a strategic planning tool used to identify and evaluate a team's internal strengths and weaknesses, as well as external opportunities and threats. It involves assessing the team's resources, capabilities, and competitive position to help formulate strategies for evolution and success. We use it in order to assess our skills and understand in what aspects we should try to rectify our mistakes or make progress.

<p><b>STRENGTHS</b>  <b>Potential:</b> lots of passion and motivation, high adaptability to different situations  <b>Culture:</b> friendship, great teamwork abilities  <b>Partnership:</b> good relationships with other teams, high exposure to different events</p>	<p><b>WEAKNESSES</b>  <b>Skills:</b> Lack of trained mentors to provide critical skills training for our team members and rookies  <b>Organization:</b> Time management skills( even though it evolved from last season, it still is a problem)  <b>Support:</b> Parents involvement and support</p>
<p><b>OPPORTUNITIES</b>  <b>Recruiting:</b> We have a large base for students recruitment in our school  <b>Funding:</b> Finding future sponsorships from companies in this field</p>	<p><b>THREATS</b>  <b>Impact within the FTC community:</b> not being able to organize a demo ourselves  <b>Readiness for competition:</b> we worry that we might not be able to finish the notebook in time  <b>Support:</b> not having a stable budget throughout the season</p>

## 10. FINANCIAL PLAN

This year we managed to get a couple of sponsorships that raised our revenue by 16,200 RON (approximately 3,264 euros). The majority of this money was invested back into the team, thus totaling 13,453 RON (around 2,744 euros). In the end, we saved up 2,747 RON (560 euros). (for more detailed information about our earnings and spendings go to Technical Appendix)

### a. Fundraising strategies

As sponsorships represent our primary financial resource, it is crucial to continually seek out potential business partners who may be in a position to offer us support. Some of our main strategies that we already use or some that we should implement are:

- Define more valuable and attractive sponsorship packages
- Research for companies interested in sponsoring STEM activities and find out their contacts
- Contact as many companies as we can through email or directly speaking

Another financial source are public fund-raisers, in which we can mainly raise our budget from organizing events associated with the public holidays (Halloween, Christmas, St. Valentine, Easter, etc) in our high school.

## **b. Sustainability plan**

These days there are already a lot of environmental issues, especially regarding the most popular topics at this moment- pollution and climate change. With this in mind, we as a robotics team, try our best to protect the environment through different ways which we believe everyone should try and apply in their own lives.

First of all, building a robot requires a lot of materials and resources, which, if thrown into nature, could negatively contribute to the already existing issues. This is why we make a point to reuse as many pieces from last year as possible. When this is not possible due to design improvements for the 3D printed pieces, we try to save the old pieces and store them in boxes so that we can recycle them later by turning the plastic used into filament.

This season, we conducted a number of 3D printing studies, ranging from attempting to perfect our 3D Mecanum wheels to 3D designing our two intake claws. We also experimented with different filaments, such as Nylon and PETG, to improve the quality of our printed pieces, one of which was the transmission, which we printed out of Nylon instead of PLA like last year. As a result, we needed to upgrade our 3D printer to meet the printing requirements of each material.

Doing so, we encountered a lot of problems, and we were, yet again, reminded why we like to refer to our 3D printer as “the Devil’s spawn” or “the Devil”. Regardless of the ups and downs of upgrading it ourselves, we ventured out of our comfort zone and decided on fixing it rather than buying a new printer and throwing the one that we had away. This decision worked wonders. Custom fit electronics, a new hotend and extruder combo paired with a powerful cooling setup designed by us, tied together with Klipper, the best firmware at the moment, increased the maximum speed of the printer by 6x. This allowed us to print any material we wanted at very high speeds and we are proud to say that we are able to print a Benchy in about 15 minutes, the world record being roughly 5 minutes (the model takes around an hour on most other printers).

## **11. MARKETING**

Every aspect of our team’s image is under the control of the marketing department, which advertises us using various promotional materials and social media apps. Moreover, the media department is also in charge of overseeing our external bonds. They have a number of individuals organizing future activities that involve the community, as well as those who specialize in public resources (PR), who support us in maintaining our ties with the public and securing sponsorships so that we can continue working as a team.

### **Learning Process:**

In the learning process of our freshmen, we start by introducing them to the fundamentals and principles of marketing. After that, our new aspirants are divided into teams of 3-4 people and are assigned a task to create promotional materials for a mock-up event, such as posters, captions, videos and emails. Finally, the entire group of freshmen is given one last task before they can start doing real marketing work - managing and promoting a mock-up demo. This task will help them gain a better understanding of the marketing process and how to effectively promote an event.

## a. Event planning

Planning an event requires a lot of thought, so how do we organize ourselves?

- We have a quick brainstorming session where we share our ideas before deciding what events we will plan this year.
- After selecting our preferred concepts, we then come up with a plan:
  - First, we ask ourselves:
    - What requirements must be fulfilled for this event? (Do we need sponsors, speakers or are there any other requirements?)
    - What preparation procedures must we abide by?
    - Do we have enough personnel to carry out this event?
    - Who is our 'customer persona' or target audience?
  - Once those inquiries are resolved, we move forward with:
    - Finding a suitable location that meets our needs
    - Choosing the ideal date(s) and developing a timeline as well as the event script
  - Lastly, we divide the work amongst ourselves by assigning each person their tasks
- After the event, we hold a brief retrospective to see what went well, what didn't work and how can we improve

To ensure that our events are a great success, we take the following factors into great consideration:

- The first thing the general public encounters is the event's name. Given this, it is crucial for the name to be catchy while also reflecting our intentions and providing only a vague hint as to what the theme will be.
  - 'If it isn't appealing to us, why bother?'- Over the years, we've learned that if we aren't enthusiastic about an event we're planning, neither will the public, and the outcome won't be good—or at the very least, satisfactory. We must select the themes for an event based on our personal preferences and what we would be excited to work on in order for it to succeed. Working with passion and sincerity can keep you inspired throughout the entire period of time spent planning the event and drastically increase the quality of work.
  - How do the events benefit the attendees and how is our event different from similar ones?

## b. Social media

Social media apps are the best way to communicate with the other teams and share our work. Platforms such as Instagram, TikTok, Facebook allow us to showcase our work and provide updates on our progress. Sharing photos and videos from our workshop or the events we've been to/ we organized allows other teams to learn from our experiences and collaborate with one another. Social media also provides an opportunity to connect with each other and engage in discussions, ask for different things such as robot parts, take part in challenges or minigames. By sharing our work on social media, we can increase our visibility and reach a wider audience, which can lead to new opportunities for partnerships and collaborations. The apps we use to connect with the FTC community are Instagram and TikTok:

- Our team extensively relied on Instagram to connect with other teams and share our content with the community. Through this platform, we could effectively promote both upcoming and past events, as well as the ones we've been to. It proved to be an excellent way to communicate with other teams, whether we needed to request specific robot parts or spread awareness about future events. Many other teams also use Instagram to conduct interactive games among themselves through their stories, which are images or videos available for a limited time of 24 hours.

## **c. Tools used**

To manage and distribute our tasks, to have all our files ready for whenever we need them, to be able to talk, hold our meetings and working sessions anywhere at any time, we use a lot of digital tools. The combination of these apps help us save time and constantly be as organized as possible.

### **DISCORD:**

Discord is a social platform where users have the ability to communicate through voice calls, video calls, text messaging, media and files in private chats called “servers”. This is our most used app for meetings, as our server is very well organized into smaller branches, one for each department, one for the whole team, and the others for the type of meeting we are holding. Some of the things Discord can do are: text, voice, video chat, screen share etc. We use this app almost daily for the working sessions and meetings that can be held online, for texts or files that are important and the whole team needs to see.

### **GOOGLE DRIVE:**

Google Drive is a file storage and synchronization service. It allows users to store files and photos on folders, share files with other persons, and collaborative editing of documents, spreadsheets, presentations, drawings, forms and more. The key attributes that this app has for us are:

- File sharing
- Real-time multi-editing
- File organization
- Version control

We keep all of our team’s documents and photos on Google Drive in order to access them easily across multiple devices and to keep them updated.

### **MIRO:**

Miro is an online whiteboard used for team collaboration, visualizing team concepts and ideas, real-time multi-editing, and remote working. We use the app as a support for meetings where we do brainstorming sessions or task distribution. Some of the app’s features that help us are:

- Brainstorm new ideas and designs
- Edit, annotate, mark-up documents
- Take notes from the meetings
- Distribute tasks, due dates etc.
- Plan and manage work sessions

### **TIMETREE:**

TimeTree is a calendar app in which the members of the same team can view all the shared events, the date of it and the hour it starts. We use this app to schedule our meetings, working sessions and other events in which we participate. Based on the event, not every member of the team is supposed to participate, for example the working session for the marketing department is made only for the marketing members, and in this app you can create, invite or join an event based on your availability or if it is related to your job in the team.

### **TRELLO:**

Apart from the other tools, we discovered this app during this season and it proved really useful for managing and viewing all of our tasks, due dates and the stage the task is in( to do, in progress, done). Trello helps us keep being organized and work in a very productive way, so that we don’t waste a lot of time on task management and distribution. It has a board-like look in which all the invited members can edit, join a task or event, add due dates and mark a task as finished. We also have a color code so that we can organize our events even better and be more intuitive.

## **INSTAGRAM:**

Instagram was our most used app for socializing with other teams and sharing our content with the community. Throughout this app we were able to announce our upcoming events and also the ones we participated in. It's a really good way of communicating with the other teams, for example in terms of borrowing specific robot parts or for announcing future events. Lots of teams use this app to create small minigames between each other through stories( photos or videos that are available for 24 hours only).

## **TIKTOK:**

This is the newest app we started using. Tiktok is an app in which people make small videos, usually for entertainment. We use it to be able to come closer with the other teams, do challenges with each other and spend our time in a fun way, allowing viewers to see us not only working, but also having fun.

## **GOOGLE DOCS:**

Google Docs is an app in which we can write our documents and be able to do collaborative editing. We use it in order to keep being organized with our writing and have everything on the same platform, so we can easily edit or move what we write from one document to another. We also use this app to keep track of what we discuss during our meetings or to distribute and manage our tasks.

## **WHATSAPP:**

WhatsApp is our most used app for communication between each other. We have multiple group chats, one with all the team members, where we discuss through text messages things everyone should know, and one group for each department, where only the members of the specific department discuss. It is also a really easy and fast method of asking questions to each other, sending pictures regarding the robot, events we would like to participate in, asking for permission or opinion on doing something, sending updates and asking for help.

## **CANVA:**

Canva is an editing app in which we create everything that needs a design, including Instagram posts, posters, banners, and flags. It is really intuitive and easy to use, it has a wide range of editing tools which helped us create beautiful designs. It also has a real time multi-editing feature which helps us work from home and use our time as beneficial as possible.

## **ANDROID STUDIO:**

Android Studio, which is the official Integrated Development Environment (IDE) for Android app development, is built on IntelliJ IDEA's robust code editor and developer tools. By using the REV Hardware Client, it can connect to our REV Control Hub, making it easy to push and run code. Additionally, the IDE provides advanced code completion and intuitive syntax highlighting features, which help to speed up code writing.

## **GITHUB:**

GitHub is an online hosting service that utilizes Git for software development and version control. It offers Git's distributed version control along with access control, software feature requests, bug tracking, task management, wikis, and continuous integration for every project.

We use GitHub to track all changes to our primary project and also to clone the code for remote use at home and work.

Fusion 360 is a professional-grade product design and manufacturing platform that utilizes cloud-based 3D modeling and computer-aided design (CAD) software.

Apart from designing custom parts for our robot before 3D printing them, we also used Fusion360 to model the whole chassis.



## d. Working sessions

### SPRINT 1 (05.09.2022-24.09.2022)

Session 1

Date: 05.09.2022

Attendance: Isa, Andrei, Maria, Victor

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Instagram post "Recruiting freshmen"</li> </ul>		x	
<ul style="list-style-type: none"> <li>Poster for recruiting freshmen students</li> </ul>		x	

As the school year starts, we started to prepare for welcoming freshmen into the team. We started by thinking of a poster structure that could captivate the students. Also, the poster will have to be posted on our instagram account so more people can see it.

Session 2

Date: 07.09.2022

Attendance: Isa, Bianca, Victor, Maria, Andrei

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Instagram post "Recruiting freshmens"</li> </ul>			x
<ul style="list-style-type: none"> <li>Poster for recruiting freshmen students</li> </ul>			x
<ul style="list-style-type: none"> <li>Registration form for freshmen</li> </ul>			x
<ul style="list-style-type: none"> <li>Post on our website the recruiting announcement</li> </ul>			x

We finished working for our recruiting announcement. We divided our jobs so we could work faster and more organized. We posted on the website and on instagram the form and freshmen already started to apply.

### SPRINT 2 (25.09.2022-08.10.2022)

Session 1

Date: 30.09.2022

Attendance: Bianca, Isa, Alexia, Lara

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Instagram post " Zi de Bine "</li> </ul>			x

We prepared the caption, chose and edited the pictures for the post.

Session 2

Date: 7.10.2022

Attendance: Bianca, Isa, Alexia, Lara

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Posting instagram stories with the prototype</li> </ul>	x		
<ul style="list-style-type: none"> <li>Rearranging the story highlights on instagram</li> </ul>			x
<ul style="list-style-type: none"> <li>Sending emails to sponsors</li> </ul>		x	
<ul style="list-style-type: none"> <li>Archive old posts to maintain the instagram feed</li> </ul>		x	

We decided on the structure of our Instagram account and for that, we have to archive a few posts. Apart from that, we reorganized our instagram highlights. Some of the old stories had no context anymore so we chose to remove them.

We wanted to be more active on the account with stories of the prototype we are currently working on and we tried to prepare a few stories for the following days.

We searched for new sponsors to contact and now we have to send the emails to them.

**SPRINT 3 (09.10.2022-23.10.2022)**

Session 1

Date: 16.10.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Adding new stories from events in which we participated in highlights on instagram</li> </ul>			x
<ul style="list-style-type: none"> <li>Choosing new story highlights covers</li> </ul>			x

We wanted to make our instagram feed look more aesthetically pleasing. In order for that to happen, we rearranged our highlights and chose to use symbolic and minimalist pictures, that had our team's colours, as their cover.

Session 2

Date: 21.10.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Posting instagram stories at XeoTalks</li> </ul>			x
<ul style="list-style-type: none"> <li>Making an instagram post featuring our team members and their personality.</li> </ul>	x		
<ul style="list-style-type: none"> <li>Posting an instagram story to gather questions about the team members</li> </ul>			x

After a brief brainstorming regarding our instagram posts and how to match the style we used for the recruitment visual in our following posts, we came up with a new idea. Because the majority of time spent on the app is us trying to show and tell what we've been up to, we decided that it's time to finally show the faces behind the screen and a little bit of insight on their personality. Given that it's hard to open up to strangers on the internet, we tried to make them as easy-going as possible and only share small, almost insignificant, but still interesting details about the ones who were willing to participate. One of those pieces of information was their Myers & Briggs 16 personality test results or even their favorite songs! As some of the members went to XeoTalks, an event organised by another team in Alba lulia, we asked them to make a lot of stories so our instagram account could have some more activity.

**SPRINT 4(24.10.2022-06.11.2022)**

Session 1

Date: 30.10.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Making an instagram post featuring our team members and their personality.</li> </ul>	x		

We decided that we should postpone the post with the team member's personality for January, when we will receive more answers from the members and we will come up with more ideas for this kind of post.

Session 2

Date: 6.11.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Design promotional materials</li> </ul>	x		
<ul style="list-style-type: none"> <li>Start writing the journal's</li> </ul>		x	

As we made an inventory of our promotional materials, we thought it would be great if we started on brainstorming a few designs for our new promotional materials. Also, the journal being a great part of the competition, we thought about starting to write its contents. We divided the chapters and each of us took a few that sounded good for ourselves.

**SPRINT 5(07.11.2022-20.11.2022)**

## Session 1

Date: 19.11.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Making an instagram post featuring our team members and their personality.</li> </ul>			x
<ul style="list-style-type: none"> <li>Making an instagram post from RoboFest</li> </ul>		x	
<ul style="list-style-type: none"> <li>Reassigning the writing parts of the journal</li> </ul>			x
<ul style="list-style-type: none"> <li>Brainstorm for a Christmas event</li> </ul>			x

The post with the team members' personality is prepared and waiting to be posted. We also managed to prepare the instagram post from Robofest, an event organised at POLITEHNICA University of Bucharest in which our team participated.

Apart from that, some modifications had to be made to the way we split the journal's content to each other.

Lastly, we had a brainstorming on what event we should organise for Christmas and we decided on a fundraising event for an association called " St. Sofia " near our highschool. The event will be held in the main hall on the first floor and it will include different stands for each highschool-commercial.

**SPRINT 6 (21.11.2022-04.12.2022)**

## Session 1

Date: 21.11.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Making an instagram post from RoboFest</li> </ul>			x
<ul style="list-style-type: none"> <li>Explaining the final project to the freshmen that applied for the marketing department</li> </ul>			x

We finished up and shared the post featuring Robofest, which took place at POLITEHNICA University of Bucharest, on Instagram. Furthermore, we explained to the freshmen who applied to join the marketing department their final project, its requirements, and the deadline for submission.

## Session 2

Date: 24.11.2022

Attendance: Andrei,

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Re-designing our business cards</li> </ul>		x	

After seeing different business cards at Robofest and exchanging outside resources, such as where to make transparent business cards, with other teams, we decided to make a new, more professional design for ours

## Session 3

Date: 25.11.2022

Attendance: Alexia, Bianca, Isa

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Assigning tasks for the Christmas event and deadlines</li> </ul>			x
<ul style="list-style-type: none"> <li>Introducing Trello</li> </ul>			x

We held a brief meeting in which we divided the tasks for the Christmas event among ourselves and chose a deadline for each one. Furthermore, we decided to try Trello, a task manager for teams, to get a better view of our progress and to keep us more focused on the tasks that we had.

Session 4  
Date: 27.11.2022  
Attendance: Bianca, Isa

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Designing the Christmas event poster</li></ul>			x
<ul style="list-style-type: none"><li>Coming up with a name for the event</li></ul>		x	

Every event must be well-advertised, and in order to do so and reach as many people as possible, we decided to design some posters and place them around our highschool's perimeter. Following that, we still hadn't decided on a name for our event and couldn't keep calling it the "Christmas event" so we came up with not one, but three names. Because we couldn't agree on one, we created a POLL and let the majority speak.

Session 5  
Date: 28.11.2022  
Attendance: Isa

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Designing a new roll-up to thank our sponsors</li></ul>		x	
<ul style="list-style-type: none"><li>Sending an email to inkspired</li></ul>			x

Since this year we managed to get more sponsors, we wanted to design a Roll-up to thank them for their contribution. Following the same line of thought, we also sent an email to inkspired, a Romanian business that specializes in imprinting t-shirts and jackets, to see if they would be willing to sponsor us this season.

## SPRINT 7(3.12.2022-17.12.2022)

Session 1  
Date: 03.12.2022  
Attendance: Isa, Bianca, Alexia

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Coming up with a name for the Christmas event</li></ul>			x
<ul style="list-style-type: none"><li>Design Instagram post for the event</li></ul>		x	
<ul style="list-style-type: none"><li>Create a registration form for the event</li></ul>			x

After voting which of the three name options is the best, we chose the Christmas event to be named "Santa's Spiriduși". With the name chosen, we started working on a design for the Instagram post and came up with two versions: one to match the poster and a totally different one. We voted on the one matching the poster.

Apart from that, we created a registration form on Google Forms to keep track of everyone that wanted to participate in the Christmas fair.

Session 2  
Date: 05.12.2022  
Attendance: Isa, Bianca, Alexia,

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Design Instagram post for "Santa's Spiridusi"</li></ul>			x
<ul style="list-style-type: none"><li>Post on Instagram about the event</li></ul>			x
<ul style="list-style-type: none"><li>Write the caption for the post</li></ul>			x

We completed the design for the Instagram post, almost ready to launch it, but before that we had to write the caption for it which included details about the event and how to participate.

**SPRINT 8 (18.12.2022-1.01.2023)**

Session 1

Date: 21.12.2022

Attendance: Bianca, Isa, Alexia

Tasks:	Postponed	In Progress	Completed
• The Christmas event "Santa's Spiridusi"			x
• Officially introducing the freshmen in our team			x
• Working on a design for the team's t-shirts		x	

The Christmas event, "Santa's Spiridusi" was a complete success and our booth gained the most popularity by selling popcorn to the students. Everyone came to order and we accepted both cash and card payments using BT Pay.

Moreover, we finally introduced the freshmen that managed to complete the task that we have assigned to them. We are really happy because they are all invested and willing to help.

We have also started to work on a design for our new team's t-shirts and hoodies and also search for a company to help us make them. The team really liked it and most of us wanted to order both the hoodie and the t-shirt.

Session 2

Date: 23.12.2022

Attendance: Bianca

Tasks:	Postponed	In Progress	Completed
• Making progress regarding the non-technical part of the journal		x	

We are making a lot of progress with the non-technical part of the journal and we managed to complete more than half of the tasks related to it. Now we only have to write a few more sections and have the final check.

**SPRINT 9 (2.01.2023-16.01.2023)**

Session 1

Date: 11.01.2023

Attendance: Bianca, Isa, Alexia, Deni, Mara, Miruna, Diana, Oana

Tasks:	Postponed	In Progress	Completed
• Introducing the freshmen into our way of working			x
• Research flag printing info			x
• Start designing the flag		x	

After finally welcoming the freshmen into our team, we hosted a meeting to show them how we divide our tasks, how we work and how to keep being organized.

We thought it would be a good idea to have a flag which we could use for decoration purposes at the competition stand. We started doing some research about the flags material, dimension, how many we want and what is the budget for it. After doing a little brainstorming, we decided who to start making the design and even came up with a few ideas.

**SPRINT 10 (17.01.2023-31.01.2023)**

Session 1

Date: 18.01.2023

Attendance: Bianca, Isa, Alexia, Deni, Mara, Miruna, Diana, Oana

Tasks:	Postponed	In Progress	Completed
• Make Instagram posts for the demos		x	
• Brainstorm magazine ideas		x	
• Design roll-ups to thank our sponsors			x
• Design t-shirt logo (front and back)		x	

We hosted a meeting in which we first talked about the demo posts we should make, then we assigned to each other different tasks regarding the visuals and captions. We also set due dates for each post in order to keep our Instagram profile on a well balanced schedule.

We came up with an idea to create an off-season magazine which would include different topics regarding not only the practical side of robotics, but also its relation to the environment and other domains. We brainstormed a few ideas regarding the name and how we want to design it, we also talked about how we want to print and advertise it.

## Session 2

Date: 26.01.2023

Attendance: Bianca, Isa, Alexia, Deni, Mara, Miruna, Diana, Oana

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Make Instagram posts for the demos</li> </ul>			x
<ul style="list-style-type: none"> <li>Make a 2022 recap reel (60 photos)</li> </ul>		x	
<ul style="list-style-type: none"> <li>Re-design t-shirt logo (front and back)</li> </ul>			x

We finished the designs for the demo posts and we added them on our Instagram profile.

We finally finished designing the roll-up, remaining only to go print it.

A good way to see our progress and how we evolved as a team was to make an Instagram reel with 60 photos from the last year. We talked about who should choose the photos, make the video itself and write the caption.

As the competition gets closer, we started re-designing the t-shirt front logo( we voted from a few options) and then the back in which we had RoboSapiens written.

**SPRINT 11 (01.02.2023-15.02.2023)**

## Session 1

Date: 03.02.2023

Attendance: Bianca, Isa, Alexia, Deni, Mara, Miruna, Diana, Oana

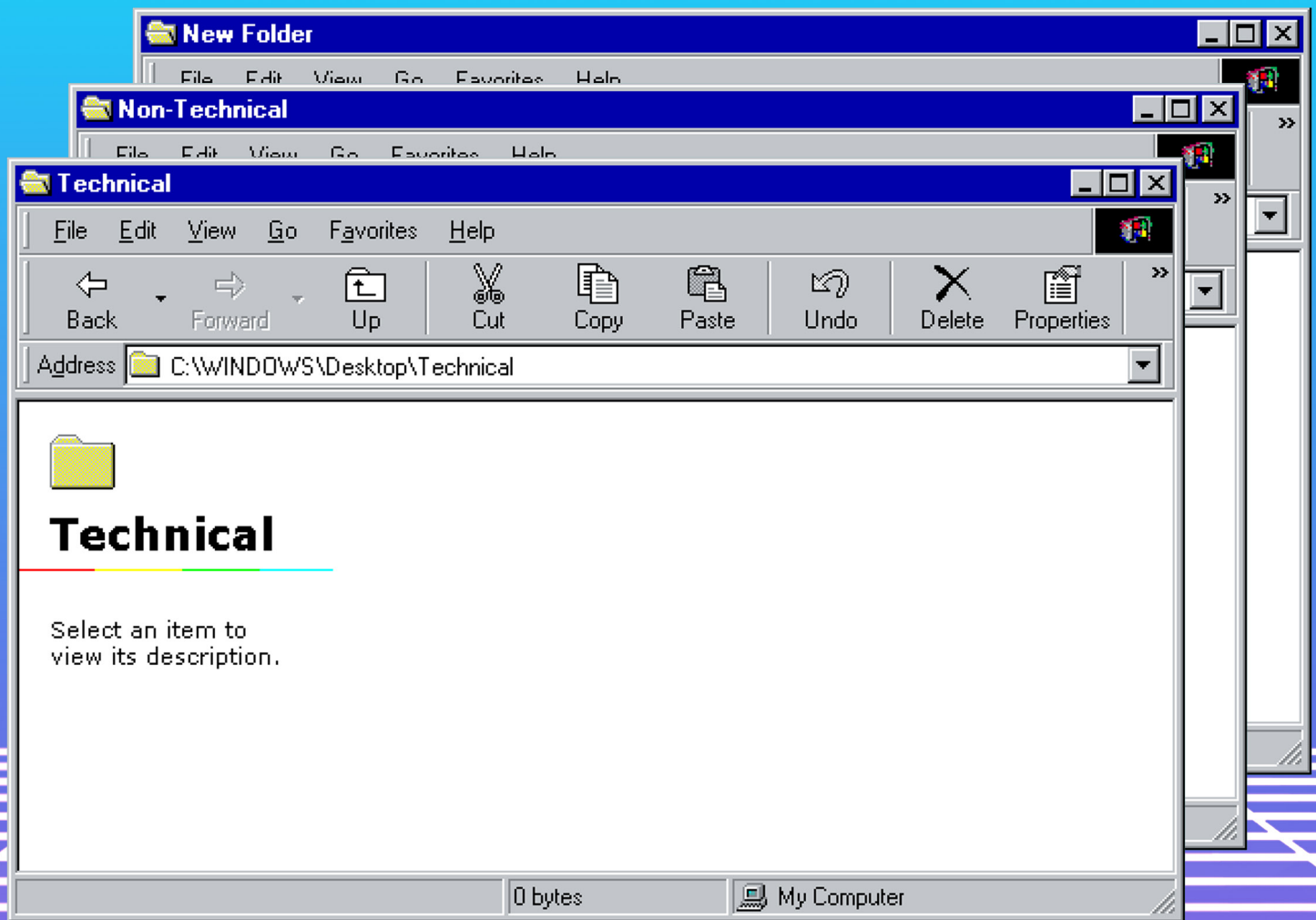
Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Make Instagram posts for Roboti la cutite</li> </ul>			x
<ul style="list-style-type: none"> <li>Finish the 2022 recap reel (60 photos)</li> </ul>			x
<ul style="list-style-type: none"> <li>Complete the flag design</li> </ul>			x
<ul style="list-style-type: none"> <li>Create a TikTok account</li> </ul>			x

We participated in the "Roboți la cuțite" contest hosted by Info(1)Robotics where we had to bake a cake and decorate it to represent our team. After we were done with baking and decorating it, we made some photos and posted them on Instagram, along with the caption.

After a lot of work with making the reel with our 2022 recap, we finally finished it and posted it on Instagram.

We had a few options for the roll-up design, but we managed to vote one using the WhatsApp POLL feature. Now that the design is ready, we went to print them.

After having a small discussion about how we could come closer with the other teams, we thought of creating a TikTok account in which we could do challenges with the teams and spend our time in a fun way, allowing viewers to see us not only working, but also having fun.



# 1. DEPARTMENT OVERVIEW

## a. Building

### i. Overview

The team responsible for building the machinery assembles the chassis and subsystems while ensuring that everything is functioning properly. They carefully follow the design created by the CAD team to ensure that the machinery is constructed according to the intended design specifications. It's worth noting that not all members are exclusively part of the building team, as some also work with the CAD and software teams. This cross-functional team structure is highly beneficial since it allows team members to have a more comprehensive understanding of all the systems. By having team members work across departments, they can more fully understand the design intent and how the different systems work together. This helps to ensure that the final product is not only constructed properly but also meets the intended design specifications.

### ii. NASA thinking process

NASA, the National Aeronautics and Space Administration, is known for its rigorous thinking process when it comes to designing and executing missions. NASA employs a multidisciplinary approach that involves experts from various fields such as engineering, science, mathematics, and technology. The agency takes on a systematic problem-solving approach, starting with defining the problem and then generating a list of potential solutions. Each solution is then analyzed and evaluated based on its feasibility, cost, and potential impact. NASA also considers risks and potential problems that may arise during the execution of the mission. This process is repeated until the best solution is identified and a plan is developed to implement it. The goal of this thinking process is to ensure that NASA missions are executed safely, efficiently, and with the maximum scientific and technological impact.

When we encounter a problem we always think of multiple ways to solve it and weigh the pros and cons of each solution before making a final decision. This allows us to see various perspectives and choose the best approach to solve the issue at hand. By approaching problems in this way, we can ensure that we are making informed decisions and taking a well-rounded approach to solving challenges.

### iii. Working Sessions

#### SPRINT 1 (05.09.2022-24.09.2022)

Session 1

Date: 19.09.2022

Attendance: Ivan, George, Rareș, Victor, Thea, Mihai, Irina, Calin, Pop, Andrei

Tasks:	Postponed	In Progress	Completed
• Slide		x	
• Field		x	

The sliders have been ordered and the field has been put in place.

Session 2

Date: 21.09.2022

Attendance: Rareș, Victor, Calin, Hami, Pop, George, Andrei

Tasks:	Postponed	In Progress	Completed
• Field		x	

We have added walls on the field.



**SPRINT 2 (25.09.2022-08.10.2022)**

Session 1

Date: 28.09.2022

Attendance: Rareș, Ivan

Tasks:	Postponed	In Progress	Completed
• Slide		x	

We have purchased the sliders and the building department is merging them together.

**SPRINT 3 (09.10.2022-23.10.2022)**

Session 1

Date 12.10.2022

Attendance: Rareș, Ivan

Tasks:	Postponed	In Progress	Completed
• Horizontal slide			x
• Chassis	x		

We have assembled the horizontal slides and we reinforced the main slider. We also disassembled the chassis for maintenance.

Session 2

Date 13.10.2022

Attendance: Rareș, George

Tasks:	Postponed	In Progress	Completed
• Chassis			x

We reassembled the chassis.

Session 3

Date 14.10.2022

Attendance: Rareș, Ivan

Tasks:	Postponed	In Progress	Completed
• Mounted motors			x

We mounted the motors for the mecanum wheels on the chassis.

## Session 4

Date 14.10.2022

Attendance: Rareș, Ivan, Pop

Tasks:	Postponed	In Progress	Completed
• Chassis			x

## SPRINT 4 (24.10.2022-06.11.2022)

## Session 1

Date: 1.11.2022

Attendance: Rares, Ivan, Mihai, George, Pop

Tasks:	Postponed	In Progress	Completed
• Chassis		x	

We mounted the motors on the chassis.

## Session 2

Date: 4.11.2022

Attendance: Rares, Ivan, Mihai, George, Pop, Andrei

Tasks:	Postponed	In Progress	Completed
• Chassis			x

We added the mecanum wheels on the chassis and we are finished with the chassis.

## SPRINT 6 (21.11.2022-04.12.2022)

## Session 1

Date: 23.11.2022

Attendance: Rareș, George

Tasks:	Postponed	In Progress	Completed
• Vertical Slide		x	

The vertical sliders have arrived and we tested their performance and we wait for a few pieces to be projected and printed by the CAD department in order to advance with the building of the arm.

### SPRINT 7 (05.12.2022-18.12.2022)

#### Session 1

Date: 06.12.2022

Attendance: Rareş, George

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Vertical slide</li> </ul>			x
<ul style="list-style-type: none"> <li>odometry</li> </ul>			x

We have made enhancements on the vertical slider and we are finished with the arm for the demo this week. The odometry is assembled and put on the chassis.

#### Session 2

Date: 12.12.2022

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Vertical Slide</li> </ul>			x
<ul style="list-style-type: none"> <li>Mecanum Wheels</li> </ul>			x

We replaced the braided 0.3 mm fishing line with a 3 mm braided line which is far more stress resistant. We also replaced the 3D printed ~~mecanum~~ wheels with some AndyMark wheels found in the workshop.

#### Session 3

Date: 14.12.2022

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Vertical Slide</li> </ul>			x
<ul style="list-style-type: none"> <li>Mecanum Wheels</li> </ul>			x

We did maintenance work and used sandpaper to smoothen the surface and we added chamfer on each wheel.

## SPRINT 9 (02.01.2023-16.01.2023)

Session 1

Date: 02.01.2023

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Vertical Slide</li></ul>			x
<ul style="list-style-type: none"><li>Horizontal Slides</li></ul>		x	

We started assembling the horizontal slide, meant for taking the cones which are distant from the robot. A new, printed arm has been put on the vertical slider.

Session 2

Date: 13.01.2023

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Vertical Slide</li></ul>		x	

Because gravity doesn't retract the horizontal slide, unlike the vertical one, we had to come up with a system which consists of a line that pulls the slide back to its initial position, in a spool next to the initial one (we called this project "Return Line").

## SPRINT 10 (17.01.2023-31.01.2023)

Session 1

Date: 24.01.2023

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Return line of the horizontal slide</li></ul>		x	

We have tested our idea, and it was successful. We wait for the CAD team to print an arm that will work on this case.

## SPRINT 11 (01.02.2023-15.02.2023)

Session 1

Date: 07.02.2023

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Horizontal Slider</li></ul>		x	

The print is ready for testing. Frankly, we couldn't test it, but it will be done in a few days.

Session 2

Date: 09.02.2023

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Horizontal Slider</li></ul>			x

We have put 2 servos for the horizontal slider: one is attached to the slider and the other one to the arm (in order to function the arm as an omnidirectional one). After we pieced it together, the arm has been tested with a successful outcome. The robot is done, and we are preparing it for testing the motors and maintenance.

## b. Computer Aided Design (CAD)

### i. Overview

The CAD department analyzes the way the robot and the subsystems are supposed to work and how they can be assembled. This department is in charge of designing all the parts that are going to be used in showcasing the final product while also designing custom parts that would fit out needs and aren't commercialized. The CAD department works hand-in-hand with the building department so they make our robot and subsystems practical, durable, and innovative.

### ii. Learning process

The learning process of our freshmen starts with a simple introduction to what CAD (Computer-Aided Design) is and some fundamental concepts and principles, including the user interface, tools and basic drawing techniques. From there, the freshmen learn how to create and edit 2D drawings, meaning lines, arcs, circles and polygons. Then, at last, they learn how to manipulate 3D objects and shapes. We also teach them how to export the custom parts and prepare them for 3D printing.

### iii. Working Sessions

#### SPRINT 1 (05.09.2022-24.09.2022)

Session 1

Date: 07.09.2022

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>• Odometry</li> </ul>		x	

We started to work on the suspension and design. We try to follow the print in-place principles to make a manufacturable design with little to no assembly.

#### SPRINT 2 (25.09.2022-08.10.2022)

Session 1

Date: 7.10.2022

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>• Fixing the 3D printer</li> </ul>		x	

We worked on repairing and improving our 3D printer. We wanted to make a change in the printing time and fix the current issues.

#### SPRINT 3 (09.10.2022-23.10.2022)

Session 1

Date: 9.10.2022

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>• Spindles for the Mecanum wheels</li> </ul>			x

We tested the spindles and decided to print more to have some extra in case we needed them. 48 spindles were printed to be put on the Mecanum omnidirectional wheels.

Session 2  
Date: 10.10.2022  
Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Fixing the 3D printer</li> </ul>			x

We added some changes to the 3D printer, such as:  
 -automatic leveling;  
 -custom cooling system ;  
 -we cut the printing time to a third of the original time;  
 -added an extruder heating cartridge which is more powerful by 10W;

#### SPRINT 4(24.10.2022-06.11.2022)

Session 1  
Date: 27.10.2022  
Attendance: Hami, Irina

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Prototype for gripper</li> </ul>		x	

We started the process of designing the gripper. After some research, we decided to use the four bar linkage method.

#### SPRINT 5(07.11.2022-20.11.2022)

Session 1  
Date: 07.11.2022  
Attendance: Hami, Irina

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Gripper Prototype</li> </ul>		x	

We worked on multiple claw prototypes at the same time. We took everyone's opinion into consideration and came up with a few ideas.

## Session 2

Date: 09.11.2022  
Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Rendering the chassis</li></ul>			x

We rendered the chassis in Fusion360 along with the mecanum wheels.

## Session 3

Date: 28.11.2022  
Attendance: Irina, Thea, Hami, Mihai, Anemona

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Gripper</li></ul>		x	

After using the four bar linkage method, we found its inefficiencies and we decided to use jaws. This improved the process of gripping the cone.

## SPRINT 6 (21.11.2022-03.12.2022)

### Session 1

Date: 15.11.2022  
Attendance: Irina, Hami

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Gripper</li></ul>			x

We chose one of the claws designed and refined it, by changing the design, density and other small problems that we had on our previous versions.

### Session 2

Date: 24.11.2022  
Attendance: Irina, Hami

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Spacer drawer slides</li></ul>			x

We designed a spacer for the drawer slides to let the bearings spin. We used a net of empty triangles to use as little material as possible.

## SPRINT 7(05.12.2022-18.12.2022)

### Session 1

Date: 07.12.2022  
Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"><li>Odometry</li></ul>			x
<ul style="list-style-type: none"><li>Check the printer</li></ul>			x

We refined the odometry, which made printing the parts possible. We also checked the efficiency of the printer.

## Session 2

Date: 09.12.2022

Attendance: Mihai, Matei Andrei

Tasks:	Postponed	In Progress	Completed
• Spindles			x
• Guards for the rope			s

We started working on the guards for the rope, making a compact and steady design. We printed again 48 spindles for the mecanum wheels. The wheels are entirely 3D printed.

## Session 3

Date: 14.12.2022

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
• Adding the slide's 3D design In Fusion360		x	

We added the slide's design in Fusion360 and [making](#) the 3D design of the Final Robot.

## SPRINT 8 (18.12.2022-1.01.2023)

## Session 1

Date: 21.12.2022

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
• Adding the slide's 3D design In Fusion360		x	

We made a little bit of progress in Fusion360 and continued to work on the final design of the robot.

## SPRINT 9 (2.01.2023-16.01.2023)

## Session 1

Date: 11.01.2023

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
• Rendering the slide			x

We worked some more on the slide system, testing different positions for the motors powering the slides, while taking into account the center of gravity and the length of tubing needed.

## SPRINT 10 (17.01.2023-31.01.2023)

## Session 1

Date: 17.01.2023

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
• Printing the spacer drawer slides			x
• Designing a reel			x
• Printing the reel			x

We printed the spacer drawer slides which were designed specifically for our needs. We also engineered 3 components that merged into a reel. We mixed the components to make custom reels for each of the motors activating the two slides.



## Session 2

Date: 20.01.2023

Attendance: Hami

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Designing a camera mount</li> </ul>		x	

After the original mount from our camera broke, we decided to engineer a camera mount with adjustable angles, which could then be placed anywhere on the chassis and also to maneuver it easier.

## Session 3

Date: 27.01.2023

Attendance: Mihai, Hami

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Designing a camera mount</li> </ul>			x
<ul style="list-style-type: none"> <li>Printing a camera mount</li> </ul>			x

We finished designing the camera mount, made the case a little heavier to be more tough. We also printed it and did a few endurance tests.

**SPRINT 11 (01.02.2023-15.02.2023)**

## Session 1

Date: 01.02.2023

Attendance: Mihai

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Rendering the claw</li> </ul>			x

We added the new claw mechanism to the digital version of the chassis.

## Session 2

Date: 06.02.2023

Attendance: Matei Andrei

Tasks:	Postponed	In Progress	Completed
<ul style="list-style-type: none"> <li>Lateral wall</li> </ul>		x	

The wall was designed and modified. We thought about how to improve it. After taking the team's opinions into consideration, we added their suggestions.

Session 3  
Date: 07.02.2023  
Attendance: Matei Andrei

Tasks:	Postponed	In Progress	Completed
• Lateral wall			x

We added all the sponsors and the logo in the middle of the wall. We changed the size of the wall, making it more compact and stronger. And we also put it in the digital version of the chassis.

## c. Programming

### i. Overview

Our robot's code is written by the programming department, starting from the basic mechanisms to more advanced stages in the game such as the Autonomous Period and the Tele-Op Period.

We use the Java programming language. As colleagues of the same group, we can combine our coding knowledge, making the team more effective in writing the best code for our robot, which is then refined after thorough testing.

The software we use is Android Studio, which, with the help of the REV Hardware Client, makes it really easy and intuitive to push our Java code on the REV Control Hub.

### ii. This Year's Code

We wrote our code in Java, using the FtcRobotController github repository and later forking Roadrunner. The project is structured using object oriented programming principles, there is a robot class that includes all the subsystems, which all have their own classes and methods.

The constructor class is called Robot. In this class we initialize three other objects: MecanumDriveCh, which is the class responsible for the movement of our chassis with mecanum wheels, the Intake class, which is the class responsible for the operation of our horizontal slider and claw and lastly the Outtake, which moves the vertical slider and the claw attached to it.

In the Intake, all the Servos and the DcMotor are placed on the Hardware Map. We initialize the DcMotor, set its ZeroPowerBehavior, Mode and Direction, set the three Servos directions and also initialize the distance sensor. There also are several methods for the multidirectional claw and the horizontal slider. The most important method here is the autoExtend which uses the distance sensor to see how much it needs to extend the slider so the claw can grip the cone and transfer it to the Outtake system.

In the Outtake class one DcMotor and one Servo are placed on the Hardware Map, and initialize them the same as in the Intake class. There also are several methods for the claw and the slider's operation for all the junctions.

In the Tele-op, we gather all these classes and their methods and bind them to intuitive buttons on our gamepads.

In the Autonomous, we start with the initialization of the camera and the AprilTag detection pipeline. Depending on which one of the Apriltags is shown, the robot follows different trajectories built using Roadrunner. In these trajectories we combine every class and method in our project so the Robot can move and score on its own. After this, the robot parks on the position the AprilTag indicated earlier.

### iii. Freshmen learning

In the education process for our freshmen, we begin with the fundamentals of Java, which includes syntax, variables, functions, and control structures. After ensuring that the students have a strong understanding of these basic concepts, we then move on to more advanced topics such as object-oriented programming, data structures, and algorithms. After the basics of Java have been covered, we move on to the core component of our code, the FtcRobotController repository. We aim to cover as many features as possible before tackling the most challenging topic, Roadrunner. Roadrunner provides precise and consistent autonomous navigation, which can be learned through the resources available on their official website, [learnroadrunner.com](http://learnroadrunner.com). It contains highly documented information about this trajectory follower and it is beginner friendly, so setting it up was a matter of time and focus.

### iv. Working sessions

#### SPRINT 1 (12.09.2022-25.09.2022)

Session 1

Date: 14.9.2022

Attendance: Rareş, George, Calin, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags	x		
Tensorflow	x		
Tele-op		x	
EasyOpenCV	x		

We began by forking the FtcRobotController repository from Github and moved on to making the robot move on the field.

#### SPRINT 2 (26.09.2022-9.10.2022)

Session 1

Date: 7.10.2022

Attendance: Rareş, George, Calin, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags		x	
Tensorflow	x		
Teleop		x	
EasyOpenCV	x		

After ensuring the robot was moving properly, we then started researching how to program the image recognition for the start of the autonomous phase.

#### SPRINT 3 (10.10.2022-23.10.2022)

Session 1

Date: 14.10.2022

Attendance: Rareş, George, Calin, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Tensorflow	x		
Teleop		x	
EasyOpenCV	x		

The OpenCV pipeline was working perfectly for the AprilTags but we had yet to implement tensorflow and train the A.I. model.

Session 2

Date: 17.10.2022

Attendance: Rareş, George, Calin

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Tensorflow	x		
Teleop		x	
EasyOpenCV	x		

We found a website where we could train the A.I. model but still struggle with implementing and actually using it.

**SPRINT 4 (24.10.2022-6.11.2022)**

Session 1

Date: 6.11.2022

Attendance: Rareş, George

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Vuforia		x	
Tensorflow		x	
Teleop		x	
EasyOpenCV		x	

Although we are still working on the implementation of Tensorflow, we want to see if we can use EasyOpenCV instead for cone recognition. We also researched Vuforia in an attempt to use the Navigation Images

Session 2

Date: 9.11.2022

Attendance: Rareş, George, Calin

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Vuforia			x
Tensorflow		x	
Teleop		x	
EasyOpenCV		x	

Tensorflow is still not working but we managed to make EasyOpenCV detect the color of the cones and if they exist. We tuned Teleop by using a throttling system based on an exponential equation. Vuforia was working fine but we had to see how we could use it.

**SPRINT 6 (21.11.2022-4.12.2022)**

Session 1

Date: 27.11.2022

Attendance: Calin, George, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Vuforia	x		
Tensorflow		x	
Teleop		x	
EasyOpenCV		x	
Roadrunner		x	

We started researching and learning how to do Roadrunner and started doing the necessary tests and calibrations. Vuforia didn't seem to do a good enough job so we chose not to use it.

## Session 2

Date: 29.11.2022

Attendance: Calin, Ivan, Victor

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Tensorflow		x	
Teleop		x	
EasyOpenCV		x	
Roadrunner		x	

We finished doing the tests and calibrations for the chassis we have at the moment but there is still room for improvement. We'll be redoing all these tests once we have the final version of the chassis.

**SPRINT 8 (18.12.2022-1.01.2023)**

## Session 1

Date: 21.12.2022

Attendance: Calin, George, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Teleop		x	
Roadrunner		x	

We decided to give up trying to implement Vuforia, Tensorflow and EasyOpenCV because it wasn't what we needed and focused mainly on making Roadrunner accurate. Detecting the cone using EOpenCV for more precise collecting was a good idea but it just wasn't reliable enough.

## Session 2

Date: 28.12.2022

Attendance: Calin, George, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Teleop		x	
Roadrunner		x	
Intake + Outtake Sequence			

We upgraded our robot so we have to program a new tele-op. We have a new intake system and an outtake system. We decided to write a code sequence that makes the intake take a cone and it gets transferred to the outtake.

**SPRINT 9 (1.01.2023-15.01.2023)**

Session 1

Date: 5.01.2023

Attendance: Calin, George, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Teleop			x
Roadrunner		x	
Intake + Outtake Sequence		x	

As soon as the building team finished mounting all the subsystems we started to calibrate and get the final version of roadrunner. We struggled with the weight balance of the robot but our building team helped us and managed to get a somewhat more accurate Roadrunner. We also wrote part of the Intake + Outtake sequence that is really consistent.

Session 2

Date: 10.01.2023

Attendance: Calin, George, Ivan

Tasks:	Postponed	In Progress	Completed
EasyOpenCV with AprilTags			x
Teleop			x
Roadrunner		x	
Intake + Outtake Sequence			x

We finished the Intake + Outtake sequence. We are also very close to getting an excellent Roadrunner navigation.

**2. GAME STRATEGY****a. Initial game strategy**

The Final Game Strategy is crucial, because we should get the most of our robot capabilities.

For the autonomous period our aim is to be consistent in following trajectories using the Roadrunner library and also in scoring. Our goals are:

- Place the preload on a tall or medium junction;
- Place the 5 cones from our sidewall on a tall or medium junction;
- Recognising the randomized position of our custom signal sleeve and parking in the indicated zone

During the first 1.5 minutes of the Driver Period, our main tasks are:

- Controlling junctions;
- Stacking cones on a tall junction as fast as possible if practicable;

Controlling the field is one of the most important attributes for an alliance, so capturing as many junctions in as little time as possible is very important for the final result of a game. Hence, our priorities include:

- Consolidating junction ownership;
- Complete the Circuit;
- Capping a strategically important junction (up to judgement while in a match);
- Stacking cones on a tall junction if practicable;

## b. Final game strategy

Since we participated in multiple demos until we finished our robot, we had to use a prototype and also adapt our Game Strategy in order to have a good result.

For the Autonomous period, having not managed to follow trajectories consistently, we selected simple tasks to get some good points right off the bat:

- Parking according to the reading it gets from the Signal Sleeve;
- Turning to a heading that will facilitate an efficient start to Tele-Op;

Our main purpose is to control the field as much as possible by using the sidewall cone stacks, thus, attempting to:

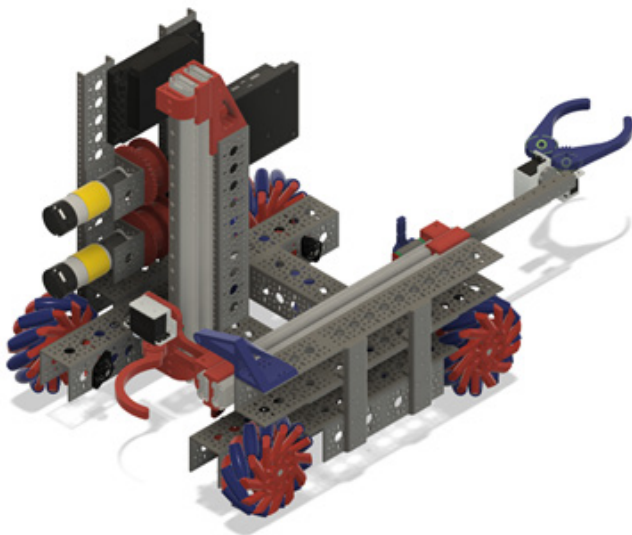
- Owning as many junctions;
- Clearing our sidewall cone stack;
- Moving to the other sidewall stack if practicable;

In the Endgame we will keep capturing junctions in order to assert field dominance, our goals being to:

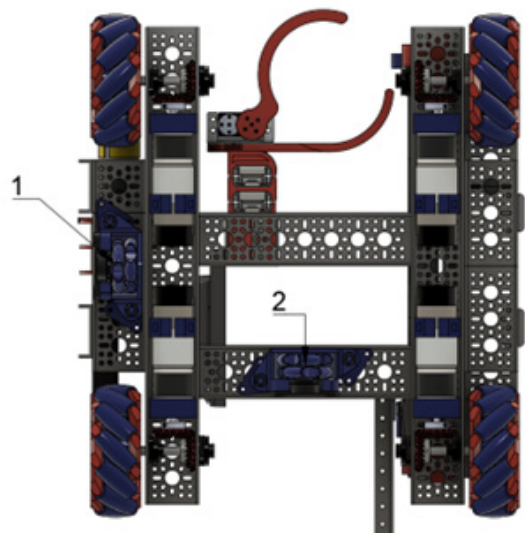
- Capture and recapture junctions;
- Complete the Circuit;
- Cap a key junction on the field (up to judgment on the spot);

## 3. THE ROBOT

The mechanisms we opted for, in the end, are the basic Strafer Chassis with smaller U-Channels in the middle that aid in moving between obstacles, the Odometry System, the Scoring Slide, the Retrieving Slide and the Power Train. You can find out more about our thought and design process in the following chapters.



Final Robot CAD design



Final Robot CAD design

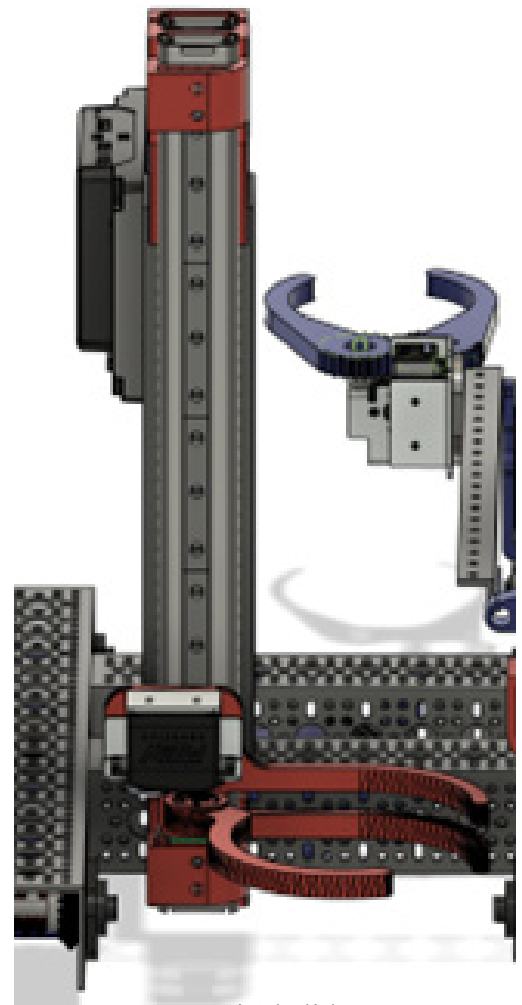
## a. Evolution: From prototypes to final systems

### i. SCORING SYSTEM

#### 1. The scoring slide

We chose to use a continuous slides system, even though it's not the fastest, this mechanism puts less strain on the motors and is mechanically simpler. Not only this, but the system itself was very easy to build. Since we already had a prototype that we could test—a slide and 3D-printed claw that we had previously used in Ultimate Goal—we had more than enough reasons to stick with this system. Testing the old slide mechanism, we noticed that in order to reach the high junction, we would need new slides because the ones that we had were only reaching the medium one and had a tendency to get stuck every now and then. We chose to use two 406 mm Misumi medium load telescopic three step slides (SRX3616) to ensure they remained undamaged in the event of a collision with other robots. Those two are secured with 3-D printed spacers (as seen in the picture). Furthermore we printed another support that connects the slides to the Gobilda U-Channel for increased resistance. Unfortunately, the mass of those slides exceeded the capacity of the AndyMark motors we planned on using, thus we had to switch to motors with higher torque, such as the GoBilda yellow jacket series

Additionally, so that the claw could be lifted at the full capacity of the slides we attached it to a linear bearing that moved upwards on the linear axis, on the slides. The claw itself was 3D designed in favor of having a bigger grasping range. Therefore, the wingspan of the claw equals the distance between the two 432 mm Gobilda U-Channels that make up the chassis.



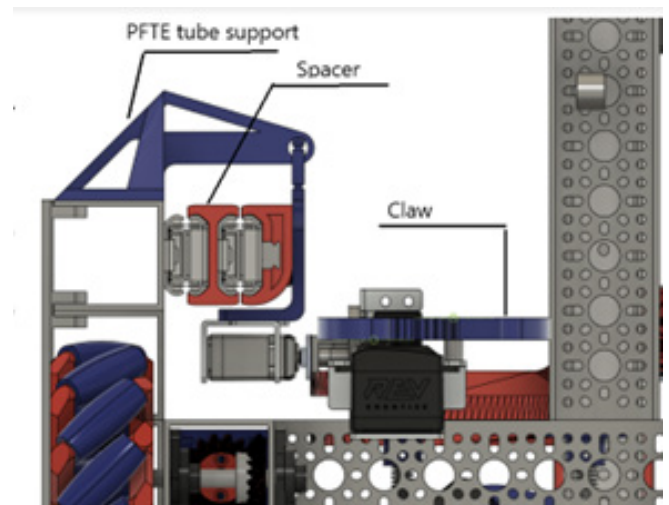
Vertical slide

Because the area we had to work with was a little tight due to the other half of the Scoring System, the Retrieving slides, we moved the motors and the spools onto which the fishing line for the mechanisms is wound further away from the slides. We also added PTFE tubes and pneumatic fittings, to guide the 1,2 mm braided fishing line that we used, without interfering with any other parts and reducing the likelihood of it deteriorating faster.

#### 2. The “golden” retrieving slide

The idea for the system came to us in a brainstorming session when we looked back at some robots from Rover Ruckus and realized we could use a design very similar to the intakes they had back then.

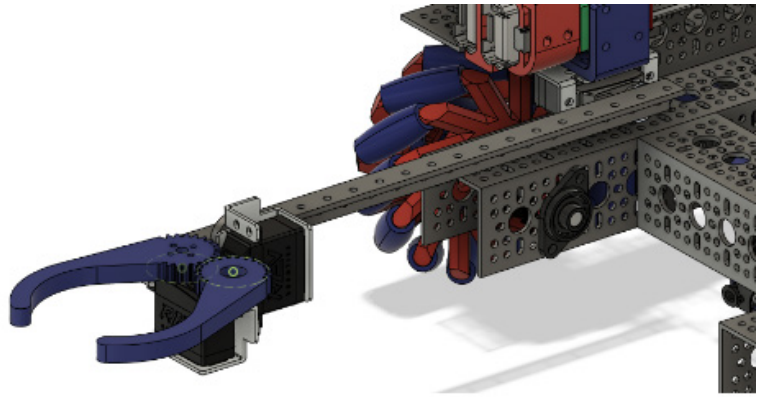
We used the same basic slide and spool setup as the scoring slide with a few modifications to fit the lack of a force to bring them back after extension, like gravity in the case of the scoring system. A return line was added with the purpose of pulling the linear bearing back, running on the same spool as the extension line, in the opposite direction. Initially, we wanted to make a rack and pinion system to adjust the claw's height. After attending to multiple demos, however, another idea arose and we changed the final concept to what it is now.





We used a REV Smart Servo with a 300mm long arm and a rotating claw at the end to extend the reach even further and make sure we can place down a cone in the upright position directly inside the scoring system's claw. The math showed that the servo had just enough torque to lift it all and the real life testing was on par.

We had to leave a corridor for the cone as it passed through the chassis in order to make the idea work, so mounting the spool directly behind the the slide was not an option,

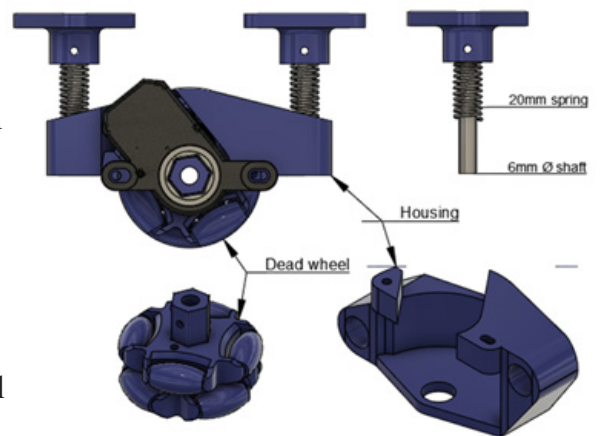


thus we came up with the idea to use a system similar to the Bowden tubes on 3D printers to pass the lines through the chassis and connect the PTFE tubing with pneumatic fittings on both ends, mounting the spool and the goBILDA Yellow Jacket motor on the other side of the robot. This proved to work wonders, as the system had very little friction and did its job with sufficiently high accuracy.

## ii. ODOMETRY SYSTEM

For keeping track of our robot's position during the autonomous period and the driver controlled period in order to adjust our position of the field; we are using a 2-wheel twin odometry setup designed by us and placed as seen above.

Like the housing and the supports for the 6mm shaft, the dead wheel itself is 3D printed using PETG, following print-in-place principles to place the individual rollers inside the body, making them move freely while also allowing for a design that requires no assembly, only the removal of some support material. Once printed it cannot be taken apart without breaking it.



Odometry System

Two LM6UU linear bearings are press-fit into the housing, rolling smoothly on the 6mm shaft, allowing for about 1 cm of travel. To ensure contact with the playing field at all times we added 20mm spring pushing on the linear bearings.

Using the REV Robotics Through Bore Encoder to track the position of the dead wheels allows for a very small margin of error of around  $\pm 1\%$  tested on the official playing field.

We use this 2-wheel odometry setup for implementing Roadrunner. As we don't have a 3-wheel setup, we have to use a gyroscope sensor on our REV Control Hub, which isn't as accurate but it is much easier to use.

## iii. THE POWER TRAIN

This is our fifth and hopefully final version of our 3d printed power train. The idea for it arose last season when, due to a non standard motor and wheel setup, we had to improvise and use hypoid gears which were really hard to manufacture out of metal. Fortunately, 3D printing them was surprisingly easy!

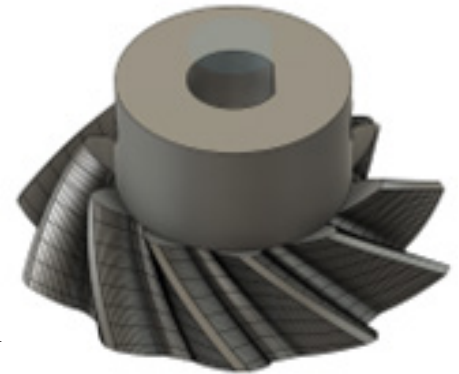
Our calculations showed that the assembly could withstand 1.3x the amount of load at stall current on the motor, provided the right material is used in the recommended conditions. We used PLA at the time, as it was the easiest material to print and test that we had on hand. We soon found out that the real world conditions were a lot harsher on the gears, due to the unpredictable nature of the load jumping over the warehouse bars. We unfortunately could not find a way to fix the problem and it soon became the downfall of our robot.

This year things were a lot different, as we switched from the NeveRest Classic series to NeveRest Orbital, which allowed for simpler setups that could withstand more load, like the one seen above, or the ones offered by goBILDA. We were so close to succeeding that we challenged ourselves to keep the 3d printed gears into this season.

Changing the gears from hypoid to herringbone bevel gears helped a lot, as the self centering properties kept the gears aligned and less prone to breaking if a shock exceeded the normal load.

Due to some issues where the gears wore out over time we started experimenting with different materials and optimizations:

- We increased the wall count and infill percentage in the slicer and decreased the cooling so the layers fused together better
- We tried PETG as it was only a little harder to print, a lot softer than PLA and less prone to cracking; this worked to an extent but they still wore out pretty quickly. We had metal hubs machined and narrowed the time in which we could swap out any broken gear down, to 5 minutes, so that we would be able to do it in between matches, if necessary.



Hypoid Gears

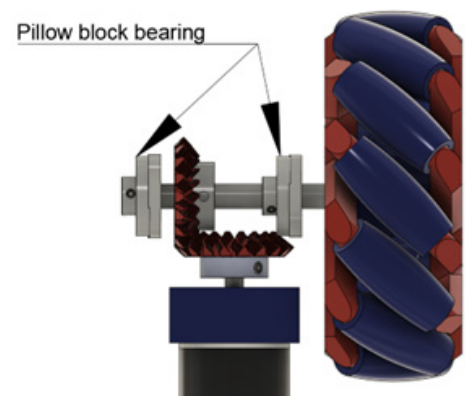


Herringbone Gears

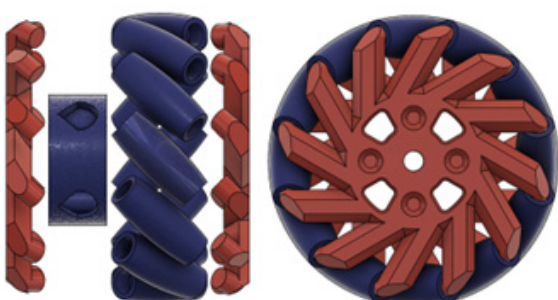
-Nylon seemed like the best material, but it is also close to impossible to print on standard machines. Luckily we took care of most of the preparations for printing in between seasons by heavily upgrading our printer (see more on page (unde e satana)), or so we thought; we had very little luck in getting the first layer of the print to stick to the printer's bed. It took an accidental discovery, while trying to print the gears out of an alloy of plastics, to find out that we could use a PETG raft to interface between the bed and the first layer of the nylon gear while cranking up the heating of the bed and enclosing the printer while also having an active dryer taking care of the moisture in the filament whilst it is printing. After finding the magic formula we ended up with the current design, which was by far the strongest.

#### iv. THE MECANUM WHEELS

Like the majority of teams in our competition we chose to run mecanum wheels on our robot. Their level of mobility and relative lack of complexity is unmatched by any other solutions. Last season we chose to download a pre-existing design from the web and scale it up to fit our chassis. After we had them printed out of PLA we noticed some unwanted vibration from the spaces between the rollers being too big. This did not cause any major problems, but it gave us the idea to change some aspects about the wheel, or even better, make our own!



The Power Train



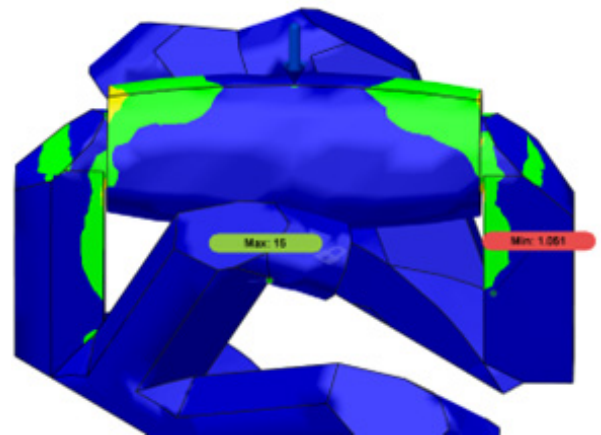
3D Printed Mecanum Wheels

This was the first successful design we all agreed is worth printing. The wheels dimensions were 120x45mm and it had 12 rollers, an upgrade from the 10 that caused the vibrations.

It could also withstand a force of 300N, although just barely.

After printing them out of PETG the first tests went surprisingly well, the vibrations were gone but the lack of grip was apparent when the strafing motion of the robot became jittery and followed a circle instead of a straight trajectory.

Using sleeves made out of TPU, a printable rubber, we expected to have as much grip as the commercial wheels from goBILDA or Andymark.



Stress Simulation

This turned out to not be the case as the hygroscopic nature of TPU caused little steam bubbles in the filament while printing and making the final product have a coefficient of friction way higher than any of us expected. In the end the wheels gripped the surface so well it left little tracks while the robot was turning, thus making them illegal to use in competition.

As we were running low on time we ended up using the old Andymark wheels we had lying around, with plans to fix the design and make it open source in the future so other teams or hobbyists could use and modify them freely.



3D Printed Mecanum Wheel with TPU Rollers



AndyMark Mecanum Wheel

## 4. TECHNICAL APPENDIX

## RECORD

## OF RECEIPTS AND PAYMENTS FOR THE YEAR 2022-2023

Nr. crt	Data	The issuing company	Type of operations (explanations)	REVENUE		SPENDINGS
				Cash	Deposit	
1	mar. 2022	Cabinet Individual avocatură	sponsorship		300,00	
2	apr. 2022	Cabinet Individual avocatură	sponsorship		300,00	
3	apr. 2022	Firma comercianta de piese de lucru	order of work materials			-58,10
4	apr. 2022	Firma comercianta de piese de lucru	order of work materials			-38,84
5	apr. 2022	Firma comercianta de piese de lucru	order of work materials			-29,99
6	mai 2022	Cabinet Individual avocatură	sponsorship		300,00	
7	mai 2022		purchase of promotional materials			-31,02
8	mai 2022		purchase of promotional materials			-484,93
9	mai 2022		purchase of promotional materials			-532,53
10	iun. 2022	Cabinet Individual avocatură	sponsorship		300,00	
11	iun. 2022		order of work materials			-20,91
12	iun. 2022		order of work materials			-153,88
13	iul. 2022	Cabinet Individual avocatură	sponsorship		300,00	
14	iul. 2022	NATIE PRIN EDUCATIE	order of work materials			-3542,99
15	iul. 2022	NATIE PRIN EDUCATIE	order of work materials			-403,00
16	iul. 2022	NATIE PRIN EDUCATIE	order of work materials			-119,00
17	aug. 2022	S.C. ESSA SALES & DISTRIBUTION SA.	sponsorship		2 500,00	
18	aug. 2022	Cabinet Individual avocatură	sponsorship		300,00	
19	sept. 2022	Cabinet Individual avocatură	sponsorship		300,00	
20	sept. 2022		order of work materials			-22,80
21	sept. 2022		order of work materials			-25,99
22	sept. 2022		order of work materials			-42,63
23	sept. 2022		order of work materials			-49,91
24	sept. 2022		order of work materials			-23,20
25	sept. 2022		order of 3D materials			-579,00
26	sept. 2022	THOUGHTWORKS ROMANIA S R L.	sponsorship		8 000,00	
27	oct. 2022	Cabinet Individual avocatură	sponsorship		300,00	
28	nov. 2022	Cabinet Individual avocatură	sponsorship		300,00	
29	nov. 2022		order of work materials			-61,50
30	nov. 2022		order of work materials			-67,00
31	nov. 2022		order of work materials			-275,00
32	nov. 2022		order of work materials			-53,66
33	nov. 2022		order of work materials			-109,00
34	nov. 2022		order of work materials			-380,00
35	nov. 2022		order of work materials			-248,96
36	nov. 2022		order of work materials			-43,93
37	nov. 2022		order of work materials			-64,00
38	nov. 2022		order of work materials			-579,98
39	nov. 2022		order of work materials			-199,00
40	nov. 2022		order of work materials			-804,41
41	dec. 2022	Cabinet Individual avocatură	sponsorship		300,00	
42	dec. 2022	CORNICO FOOD AND SERVICE SRL	sponsorship	2 100,00		-1 538,37
43	dec. 2022		order of work materials			-192,00
44	dec. 2022		order of work materials			-380,00
45	ian. 2023	Cabinet Individual avocatură	sponsorship		300,00	
46	ian. 2023	PIESE ROBOTICĂ	order of work materials			-1 043,02
47	ian. 2023		order of work materials			-81,99
48	ian. 2023		order of work materials			-37,46
49	ian. 2023		order of work materials			-329,70
50	ian. 2023		order of work materials			-89,50
51	ian. 2023		order of work materials			-50,00
52	feb. 2023	Cabinet Individual avocatură	sponsorship		300,00	
53	feb. 2023		purchase of promotional materials			-615,48
54	feb. 2023		order of work materials			-50,00
<b>TO REPORT</b>				<b>2.100,00</b>	<b>14.100,00</b>	<b>-13.452,68</b>
<b>SAVINGS FROM THIS SEASON</b>				<b>2.747,32</b>		

Material	PROS	CONS
Stainless Steel	Very strong, doesn't rust, hard to bend out of shape	Heavy, hard to work with
Aluminum	Lightweight, Good tensile strength compared to its weight, easy to work with	Easy to bend and break
Nylon	Impact resistant, holds up very well to high loads, Ideal for printing gears	Hygroscopic, Very hard to print, porous
PETG	Good mix between flexibility and resistance	Harder to print
Plexiglass	Transparent	Brittle
PTFE	Very low friction coefficient	Soft, easy to cut
Rubber	Good grip, strain resistant, can stretch	Low resistance to abrasion



