FIRST TECH CHALLENGE ROMANIA

INTO THE DEEP presented by RTX

2024 SEASON #9 2025

ORGANIZATOR NAȚIE PRIN EDUCAȚIE

PARTENER FONDATOR BRD GROUPE SOCIETE GENERALE

HF

High Five
19049

Engineering Notebook

2024-2025

OUR TEAM

APRIL 2024 - JUNE 2025

Members & Volunteers:

Teodor Ene
Team Leader

Age: 17 yo
11th grade
Personality: INFJ-T
About: *Team Work makes the dream work*, I'm passionate about rock music, and my friends are always front and center in my life.

David Șerban
Technical Lead

Age: 16 yo
9th grade
Personality: ENFP-A
About: I love spending time outdoors with my friends, and I'm really into sports.

Maya Soare
Technical Lead

Age: 16 yo
9th grade
Personality: ENTJ-A
About: Hi! I love trying new things and challenging myself by stepping out of my comfort zone.

Evelina Manda
Non-Technical Lead

Age: 16 yo
10th grade
Personality: ISFP-T
About: *I may not build the robots, but I help build the team that makes it all possible*. I'm passionate about science, music and art.

Maria Trandafir
Programming

Age: 16 yo
9th grade
Personality: INTP-A
About: I'm analytical, curious, and fascinated by problem-solving. I'm always striving to find a balance between logic and emotion.

Andrada Bălan
CAD

Age: 16 yo
10th grade
Personality: INTJ-T
About: I'm passionate about art, rock music, and puzzle games.

David Iordache
CAD & Mechanical

Age: 14 yo
7th grade
Personality: ISFJ-A
About: I'm interested in STEM activities, passionate about sports, and I enjoy spending time with my friends.

Andra Băncescu
Digital Design & Marketing

Age: 18 yo
11th grade
Personality: ENFJ-A
About: I enjoy learning about science, and in my free time, I like to paint.

Yannis Udrea
Programming

Age: 15 yo
9th grade
Personality: INFP-T
About: Howdy! I'm passionate about anything tech-related, I love the energy and community of *FIRST®*, and I want to help more people experience and enjoy it.

Matei Dumitrică
Mechanical

Age: 15 yo
9th grade
Personality: ESTP-A
About: I enjoy spending time with my friends and meeting new people.

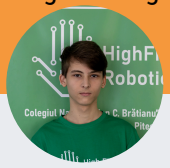
Andrei Nedelea
Mechanical

Age: 17 yo
10th grade
Personality: ISTJ-A
About: I'm open-minded and always ready to take on new challenges. I enjoy football, volleyball, card games, and table tennis.

Cristina Teodose
Marketing

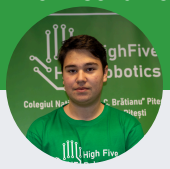
Age: 18 yo
11th grade
Personality: ENFJ-A
About: Hi! I love wearing accessories and spending most of my free time rewatching my favorite movies, especially romcoms.

Teodor Pană
Programming



Age: 15 yo
9th grade
Personality: ENTJ-A
About: Hello! I enjoy spending time with my friends and family. Trying new things and experiences is one of my passions.

Cristian Perja
CAD & Mechanical



Age: 17 yo
10th grade
Personality: ESTP-T
About: I enjoy learning new things, sharing my experiences with others, and embracing new challenges to step out of my comfort zone.

Raluca Marinescu
Marketing

Age: 17 yo
11th grade
Personality: ENTJ-A
About: I adore watching movies and TV shows, especially horror, action, and dystopian genres. I also love rock music and extreme sports.

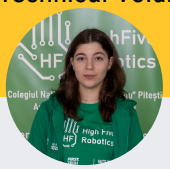
Alexia Manea
Non-Technical Volunteer

Age: 18 yo
11th grade
Personality: INFJ-T
About: Besides robotics, I'm involved in theatre, volunteering and I enjoy reading.

Luca Creață
Mechanical Volunteer

Age: 17 yo
11th grade
Personality: ENFJ-A
About: Hi! I enjoy all kinds of sports, I love working in teams and my passion is coding.

Elena Stancu
Non-Technical Volunteer



Age: 17 yo
10th grade
Personality: ENTJ-T
About: Hi! I'm passionate about science, and I enjoy thriller books and sci-fi movies.

Recruitment:

Introduction:

The entire continuity of our team is based on training, educating and involving as many generations of children as possible in the ***FIRST®*** phenomenom.

Volunteers and members are essential both for the vitality of the team and for the program itself, for the scale and complexity it has reached. Of course, like any other team, annually and sometimes even several times in a single season, we carry out **recruitment sessions,** in which we try to attract interested young people, eager for knowledge and a unique experience to join us. We offer them an optimal framework in which they can cultivate their passions together with other children, learn and, most importantly, make mistakes without any fear.

11 children after recruitments a total of 8 new members and 3 active volunteers

Through the organized recruitment sessions, we managed to have 33 volunteers from 9 high schools in the city, from 9th up to 11th grade.

Overview:

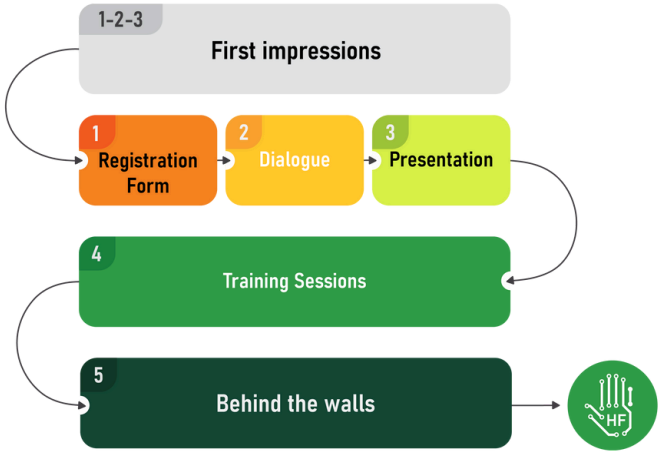
As our recruitment approach proved to be beneficial last year, we decided to keep the same **recruitment strategy** in this season as well. This allows us to get to know volunteers both individually and within a group and to provide them with more options for activities, tasks and time to adapt, discover and orient themselves to a specific department.
The first recruitment session began on **April 2024**, ending on **June 2024**, followed by 2 more sessions, **July-August** and **November-January**, and last, but not at least, one more session which started in **April 2025** and it's still going.

Stages 1-2-3

The first sub-step is, as in the last years, that of filling out the form, which contains personal information, a **CV** and a **letter.** Through these, we manage to make a first general impression of the person behind the answer, being able to get an idea of what topics we approach in our first conversations.

The letter also shows us a provisional role assignment desired by our new volunteer.

Slowly, through repeated visits to the hub and many conversations, we introduced them, initially, to our methods of organization and hierarchy, through weekly discussions with each group of volunteers and a presentation (members, mentors).



Stage 4

Additional training sessions, which have been implemented since last year, **involve volunteers** in the actual work of each department.
We held several sessions where volunteers could learn details about their department, whether it was tutorials in OnShape, the basics of object-oriented programming, or ways to communicate openly with the people around us.

Stage 5

We believe that the optimum way to learn and evolve is experience, followed by mistakes (**principle *Fail fast, learn fast***).

Thus, organizing the **Off Season** (events, algorithm and mechanism testing) in such a way that we can involve our volunteers as much as possible.

Depending on the chosen department and the practical skills observed, the volunteers implement the information taken from us in the different projects we assigned them.

Conclusion:

Up to this moment, we have managed to have over **30 volunteers actively involved** in the learning process, of which **11** are still with us.
Of these, **8** later became **members of our team** (3 in mechanical, 2 in non-technical, 3 in programming), and **3 volunteers** were officially registered, becoming part of our community.

Risk Management:

Our team is going through a period of transition, with the integration of a new generation of members. To provide them with a more accessible and efficient learning process, we have optimized working methods and introduced more intuitive solutions.

One of the most significant changes was the transition from **InDesign to Canva** for creating the Engineering Notebooks. Choosing this more user-friendly tool allowed new members to quickly adapt to the design principles, eliminating the steep learning curve and giving them more confidence in the creative process. Similarly, for illustrating the team mascots, we migrated from **Procreate to Krita**, an open-source software that gives us more flexibility and expanded creative possibilities.

In addition to the technical changes, we also focused on developing the recruits' social and professional skills. We organized **training sessions**, including **mock interviews**, **presentations to sponsors**, and **visits to high schools**, giving them the opportunity to better understand the *FIRST®* phenomenon. These experiences helped them **build their confidence**, improve their **communication skills**, and become familiar with team dynamics.

Through these initiatives, we not only ease the transition for new members, but we also ensure that we maintain a high standard of professionalism, creativity and team performance. **Adaptability** and **innovation** remain **key elements** that will help us grow and **evolve together**.

Mentors & Assistents:

Emanuel Șerban
Mentor

Age: 45 yo
Mostly Technical
IT Specialist

Tiberiu Ionescu
Mentor

Age: 21 yo
Mostly
Non-technical
Student

Bogdan Ionescu
Mentor

Age: 41 yo
Mostly
Non-technical
Teacher

Alexandru Iordache
Peer Mentor

Age: 19 yo
Mostly Technical
Student

During this season, **INTO THE DEEP**, we received continuous support from our **4 mentors**. But let's not forget the support we received from our **2 assistants**, Ms. Augustina Ene and Ms. Monica Iordache and also from our **alumnus**, Teodor Voiculescu.

We would like to thank these people for all their effort and unconditional support.

With their help, we were able to develop on many levels, having multiple **training sessions**.

We learned **how to manage our emotions** in stressful moments. Also, through these sessions, we were able to evolve **our technical knowledge**, developing our 3D design skills, but also learning about the importance of the materials we use.

Assistance from 1 university professor and 1 psychologist!

Augustina Ene
Asistent

Age: 55 yo
Mostly
Non-technical
Psychologist

Monica Iordache
Asistent

Age: 48 yo
Mostly Technical
University professor

Teodor Voiculescu
Alumnus

Age: 18 yo
Mostly Technical
Student

Support from 1 Alumnus

We would also like to sincerely thank our **alumnus** for the dedication, passion, and time he invested in our team. Your continued support and presence in our community mean the world to us. You helped shape who we are, and we're proud to still have you with us on this journey.

Objectives:

During this season, in order **to be aware of the goals we set for ourselves**, **the resources we have** (temporal, human, financial), **the responsible distribution of roles** and **how we relate to the current season**, **INTO THE DEEP**, each member filled out a form in which they were asked to freely, realistically and honestly express their opinion regarding their personal goals, the contribution they will have and the goals of the season from the point of view of the team itself.

Later that day, during the weekly meeting, we analyzed together, the members and mentors, the proposed targets, the degree of possible materialization and what each one entails, as well as individual development for the future.

Following the **OKR method** (Objective Key Results - this involves establishing a significant, specific and well-defined objective, followed by several smaller results, through which the degree of achievement can be measured), we set ourselves certain milestones, combining it with smaller **SMART** (Specific, Measurable, Achievable, Relevant, Time-based) **targets**, for example:

Some of the objectives we've managed to achieve:

- **Having over 20 events & projects** - we managed to have over 40 events in the span of 15 months, doubling the number we initially set as an objective, impacting over 7000 people from our community
- **Obtaining revenues of at least €35 000 for the European Premier Event** - we managed to reach revenues of around €51 000 - enough to cover our expenses for this journey
- **Rebuilding our robot with more complex pieces, reducing its weight** - through the year we've evolved and learnt new things, now having a total of 108 custom pieces (73 pcs. of PLA, 12 polycarbonate pcs., 23 Aluminium plates). From the 19kg we had at Nationals, the robot for the European Premier Event has 18kg

***Work in progress* objectives**

- **Strengthening relationships with teams from *FIRST*® programs** - we want to interact with as many teams from the *FIRST*® programs as we can. Though our International Hub project, we've met with over 50 teams from 17 countries, carried out over the last 8 months and still going
- **Continuity of our team** - every year we organise different Recruitment Sessions so that we are in a continuous learning process, with new members and volunteers coming every year. This season we've had 33 volunteers (a record for our team), of which 8 became members and 3 are active volunteers

Responses to the INTO THE DEEP Objectives form from members of our team:

Nume Prenume	Obiective Personale In Acest Sezon	Contributie Personala	Obiective Ale Echipei
Maya	-Sa contribui la mentinerea unor bune relatii in echipa. Sa invat sa comunic mai bine si sa cer mai des ajutorul celorlalti. Sa ma implic atat pe partea de software cat si pe hardware. Sa ma implic la caiet, atat la scrierea textelor cat si la design. Sa invat sa imi stapanesc emotiile ca driver.	Driver 2, strategii, comunicarea cu sponsorii, tinerea prezentarilor si a cursurilor, International Hub, software, hardware (glisiere), organizare echipa, dtp, scrierea textelor la caiet atat tehnice cat si non tehnice	Sa ne imbunatatim comunicarea si relatiile dintre membrii, sa obtinem un rezultat cat mai bun, proportional cu munca, sa avem o organizare mai buna, sa ajungem cat mai departe in competiție, sa ne gestionam mai bine emotiile
Teo E.	- Să îmi dezvolt abilitățile de leadership, organizare și management de echipa. - De asemenea aș vrea să îmi dezvolt abilități pe partea de mecanică și să îmi continui prgresul pe software.	- Organizare de echipă - Experiență pe software, organizare de evenimente - UI/UX Design și Web development - Predarea Cunoștințelor mai departe membrilor noi. - 3D Design & Mecanică	- Să dezvoltăm un colectiv cât mai strâns ca echipă. - Fiind un an de început pentru o mare parte din echipă doresc să se dozvolte cât mai mult pentru a le asigura progresul în anii următori.

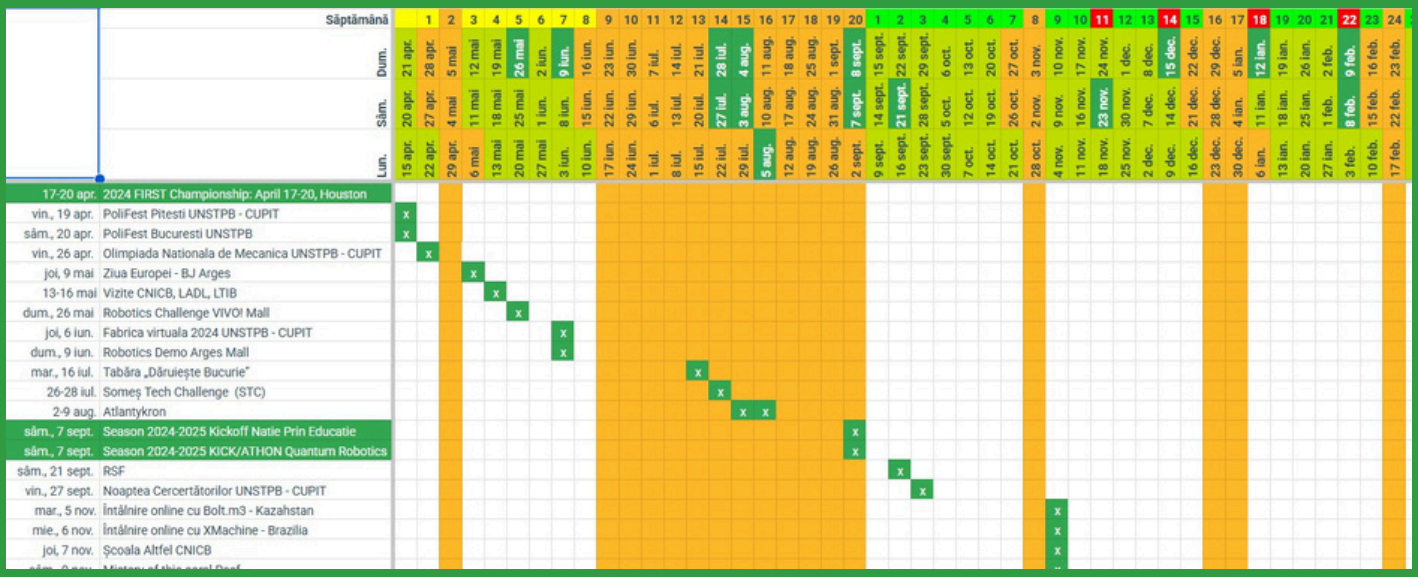
Eve M.	- Să îmi dezvolt abilitățile de coordonare a unei echipe și de lucru în echipă - Respectarea timeline-urilor și a deadline-urilor - Îmbunătățirea aspectului design-urilor - Îmbunătățirea skill-urilor de Public Speaking - Să creez un mediu prietenos și încurajator în cadrul echipei	- Crearea materialelor de design - Coordonarea departamentului Non-Tehnic - Predarea cunoștințelor obținute de-a lungul timpului noilor membrii și voluntari - Redactarea și punerea în pagină a Engineering Notebook și Portofolio - Foto & Video – social media - Identitatea vizuală a echipei - Prezentări și vizite în diverse locații (atât materialul vizual, cât și prezentarea acestuia) - Interacțiunea cu membrii comunității atât tehnice, cât și non-tehnice în cadrul diverselor evenimente	- Crearea și menținerea unui colectiv unit, bazat pe încredere și comunicare - Gestionarea mai bună a situațiilor tensionate
Cristina	-să continui îmbunătățirea abilităților de public speaking prin acceptarea provocărilor de acest tip; -să învăț și alte programe de design în afară de Canva; -să învăț mai bine HTML și CSS; -să îmi gestionez timpul mai bine	-design și programare site; -realizarea descrierilor pentru postările de pe Instagram -realizarea textelor pentru caietul tehnic	-dezvoltarea spiritului de echipă; -o mai bună gestionare a situațiilor tensionate; -să ne calificăm la Națională
David I.	-Să continui dezvoltarea pe departamentul de mecanică și proiectare 3D -Să îmi dezvolt abilitățile de lucru în echipă	-Proiectare 3D -Scouting -Realizarea textelor pentru caietul tehnic	-Să continuăm dezvoltarea acestui colectiv -Să ne descurcăm la fel de bine în situațile tensionate
David Ș.	- Să mențin relația echipei - Să ajut pe partea Tehnică cât mai mult pot(software + hardware) - Îmbunătățirea abilităților de proiectare 3D - Să lucrez în echipă cât mai eficient - Realizarea a strategii eficiente - Să cunosc cât mai multe persoane și să îmi fac prieteni din cât mai multe echipe - Să organizez echipa eficient	- 3D Design - Mecanică - Programare - Redactare Caiete - Scouting - Strategii - Driver - Interacțiunii cu membrii celorlalte echipe - Organizare de echipă - Editare de videoclipuri - Predarea cunoștiințelor mai departe noilor membrii	- Să ne dezvoltăm cât mai bine ca o echipă - Să creăm un colectiv cât mai unit în care vom comunica eficient - Să creăm cât mai multe relații între echipe - Obținerea unui rezultat cât mai bun - Să ne mișcăm cât mai bine în teren ca echipă - Să fim o echipă cât mai organizată
Alex I.	• Dezvoltarea abilităților de programare în Java; • Dezvoltarea abilităților de programare orientată spre obiect; • Învățare InDesgn pentru caietul tehnic; • Învățare Html, Css și JavaScript; • Dezvoltarea abilităților de editare foto/video.	• Programare; • Caiet Tehnic; • Site; • Învățarea noilor recruți; • Editare Video Înscriere.	• Maximizarea punctelor obținute de robot în perioada de autonomie.

Organization:

In order **to be consistent**, **to objectively and realistically evaluate the activities** already carried out and their results, and **to outline future goals and approaches**, we must have **optimal organization**, **well-defined internal rules of conduct**, and **coherence in vision and actions**: from the way tasks are assigned and assumed, how they are planned over time to how they are incorporated into the team's next tasks, everything must be done with a sense of responsibility. Thus, this season, too, we have adopted various organizational methods such as using: **Season Timeline, Google Workspace, MeisterTask, Main Role & Support, Meetings, Action Lists**, and **Programs**-whether for weekends or holidays.

Season Timeline

One method we have continued to use and which has become an important component of our organization is the **Season Timeline**. This way, we manage to keep a compact record of the objective itself, without burdening ourselves with additional information.



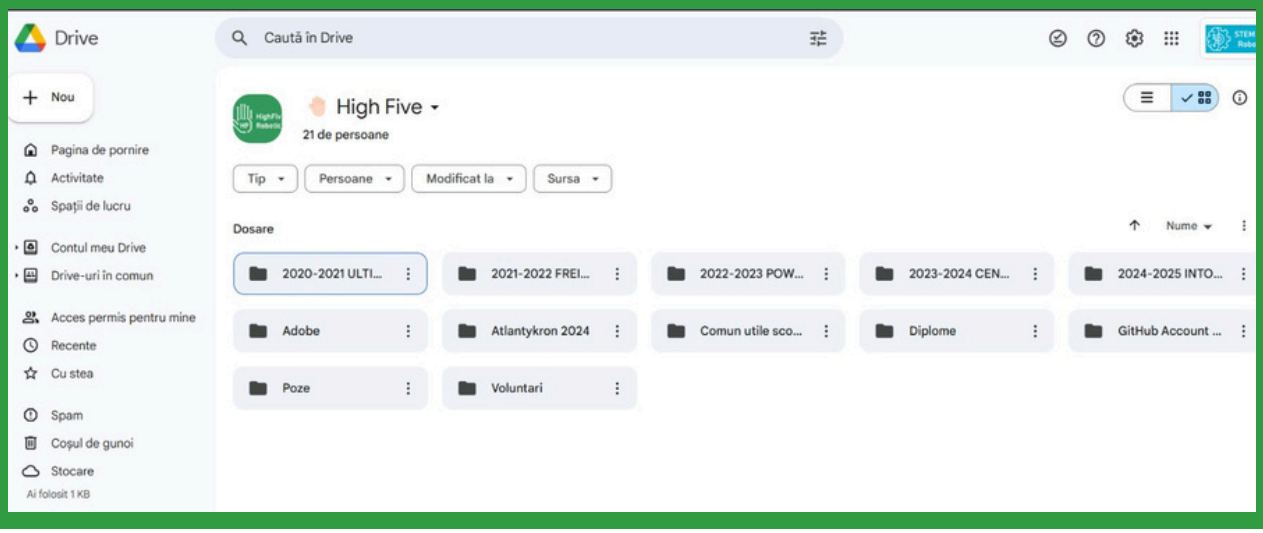
17-20 apr.	2024 FIRST Championship: April 17-20, Houston
vin., 19 apr.	PoliFest Pitesti UNSTPB - CUPIT
sâm., 20 apr.	PoliFest Bucuresti UNSTPB
vin., 26 apr.	Olimpiada Nationala de Mecanica UNSTPB - CUPIT
joi, 9 mai	Ziua Europei - BJ Arges
13-16 mai	Vizite CNICB, LADL, LTIB
dum., 26 mai	Robotics Challenge VIVO! Mall
joi, 6 iun.	Fabrica virtuala 2024 UNSTPB - CUPIT
dum., 9 iun.	Robotics Demo Arges Mall
mar., 16 iul.	Tabăra „Dăruiește Bucurie"
26-28 iul.	Someș Tech Challenge (STC)
2-9 aug.	Atlantykron
sâm., 7 sept.	Season 2024-2025 Kickoff Natie Prin Educatie
sâm., 7 sept.	Season 2024-2025 KICK/ATHON Quantum Robotics
sâm., 21 sept.	RSF
vin., 27 sept.	Noaptea Cercertătorilor UNSTPB - CUPIT
mar., 5 nov.	Întâlnire online cu Bolt.m3 - Kazahstan
mie., 6 nov.	Întâlnire online cu XMachine - Brazilia
joi, 7 nov.	Școala Altfel CNICB

Google Workspace

For us, transparency is key, so **Google Workspace** is an optimal working environment. The suite of apps such as **Google Drive, Google Meet, Google Docs, Google Sheets, Google Forms and Gmail** help us stay connected to the activities of other members, **all 18 members constantly using these online tools**, as well as the mentors. It gives us mobility, efficiency and an optimal infrastructure, for the long term.

Thus, as in **OnShape** (the application we use for 3D design), **multiple members can work simultaneously** on a project, benefiting from real-time updates, while also managing each previous version of it.

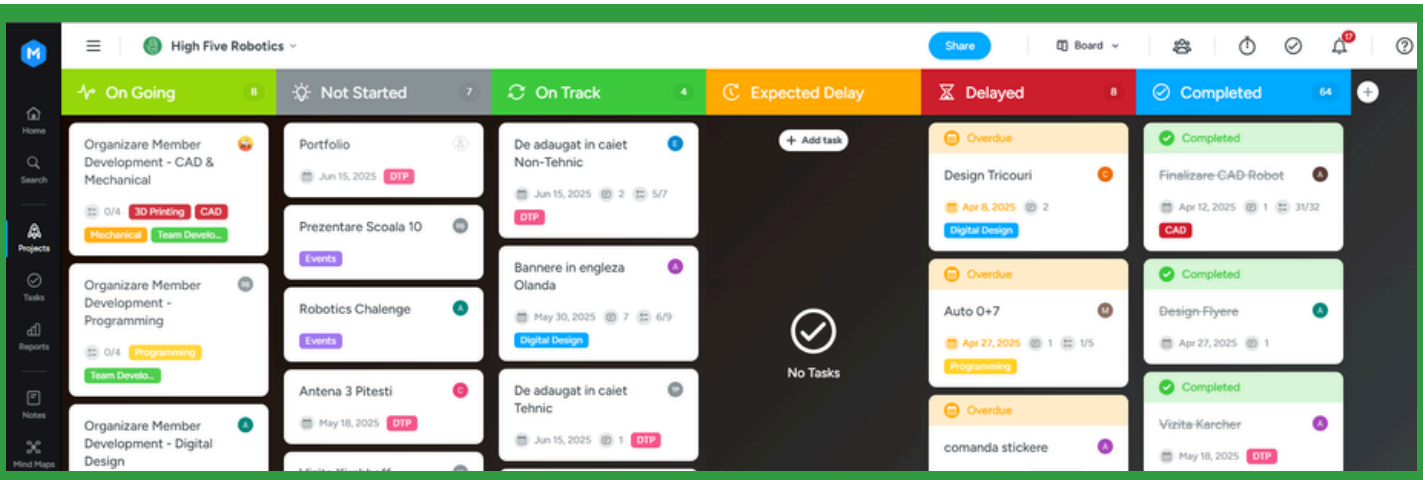
Later, in the High Five team's shared **Drive**, the entire internally created community can access **the archive of all seasons**, as we have implemented this method since the team was founded, and each of us stores most of the necessary files (from technical notebooks, graphic content for the visual identity, resources for volunteers, videos, photos, budget and other documents) in well-organized folders.



Google Workspace
Shared Google Drive

Meistertask

One method of organisation we have adopted recently is **MeisterTask**. It allows us to keep our planning clear, focusing on what needs to be done without overwhelming ourselves with unnecessary details. Through its visual task boards, we're able to maintain a shared overview of progress, responsibilities, and deadlines—making collaboration more efficient and goal-oriented.



Screenshot from MeisterTask

Main role & support — Shadowing & Role transfer

For a team to function as a whole, each **member** must carry out their own, specific tasks (for example, people in the Software department ensure the programming of the robot, with its related tasks) with full involvement, but also organize themselves in such a way that everyone has someone to be their **backup**.

Role distribution

	3D Design / Mechanics	Programming	Marketing / Social Media / Events	Design	Poze / Video / Editare	DTP
	6	4	6	5	5	5
1 Teo E.	x		x		x	x
2 Maya		x	x	x		x
3 David Ș.	x	x			x	o
4 Eve			x	x	x	x
5 Matei	x					o
6 David I.	x					o
7 Maria		x	x			o
8 Andrada	x			x		o
9 Andra			x	x	x	x
10 Cristina			x	x	x	x
11 Yannis		x				o
12 Andrei	x					o
13 Alex I.		o				o
14 Teo V.	o				o	o
15 Alex C.	o					o
16 Raluca			o	o	o	o
17 Crsti	o		o	o		o
18 Teo P.		o				o
19 Luca	o					o
20 Elena			o	o	o	o

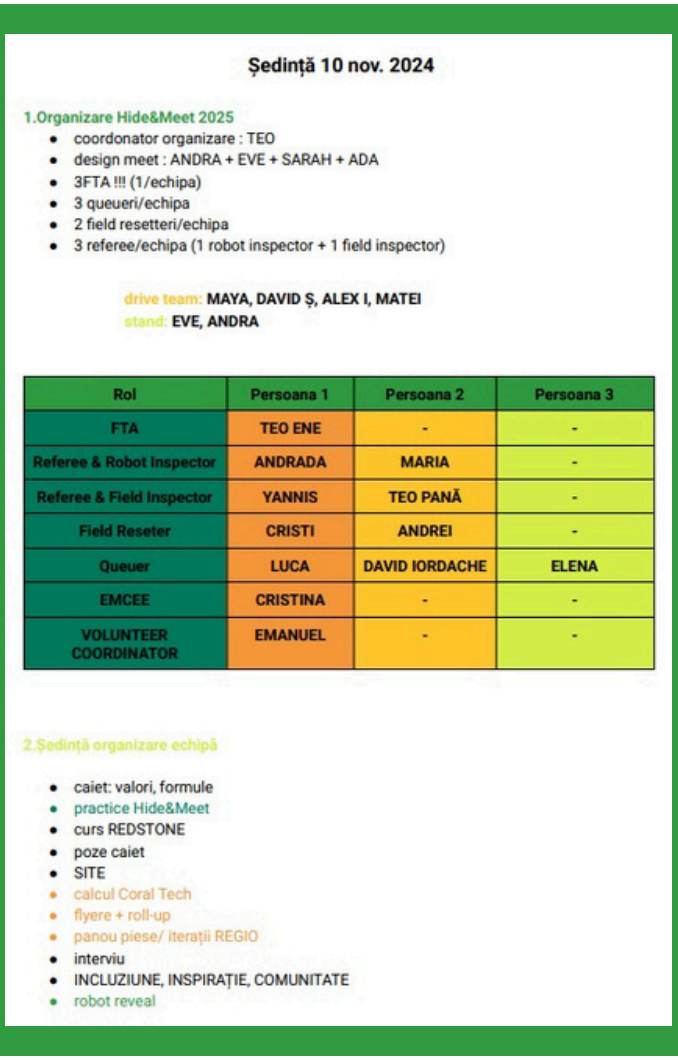
Thus, because this year we are going through **a transition stage** from mostly veterans to mostly new members/volunteers, through this **Support process**, which we correlate for the new ones with **Shadowing**, we achieve the transfer of tasks, skills and experiences, in the smoothest, easiest way possible. It also helps us to have a fluidity in thinking, which allows us to objectively evaluate the results of previous generations, in order to progress.

Meetings

Although they may not seem so important for the proper functioning of the team, all the **weekly and extra meetings** (either specific to each department or general), which are scheduled according to the dynamics of our activities and the parameters along the way, are actually **the foundation of our planning and organization**, as these are the first steps in communication, analysis and resolution or in the formation of the other documents we use (Season Timeline, Action List, etc.).

In order to be able **to constantly improve**, **minimize waiting times**, or **find solutions as quickly as possible** for problems that arise along the way, we have **weekly meetings** (on Sundays) with the **entire team** (mentors, members, volunteers), which are held based on a list of discussion topics prepared in advance during the week.

We use it as an **organizational guide** and, at the same time, it outlines the minute, which we carry out without exception and with a sense of responsibility, precisely because it contains all the problems, ideas and updates from the last seven days, subsequently used by the rest.



Ședință 10 nov. 2024

1.Organizare Hide&Meet 2025

- coordonator organizare : TEO
- design meet : ANDRA + EVE + SARAH + ADA
- 3FTA !!! (1/echipa)
- 3 queueri/echipa
- 2 field resetteri/echipa
- 3 referee/echipa (1 robot inspector + 1 field inspector)

drive team: MAYA, DAVID Ș, ALEX I, MATEI
stand: EVE, ANDRA

Rol	Persoana 1	Persoana 2	Persoana 3
FTA	TEO ENE	-	-
Referee & Robot Inspector	ANDRADA	MARIA	-
Referee & Field Inspector	YANNIS	TEO PANĂ	-
Field Reseter	CRISTI	ANDREI	-
Queuer	LUCA	DAVID IORDACHE	ELENA
EMCEE	CRISTINA	-	-
VOLUNTEER COORDINATOR	EMANUEL	-	-

2.Ședință organizare echipă

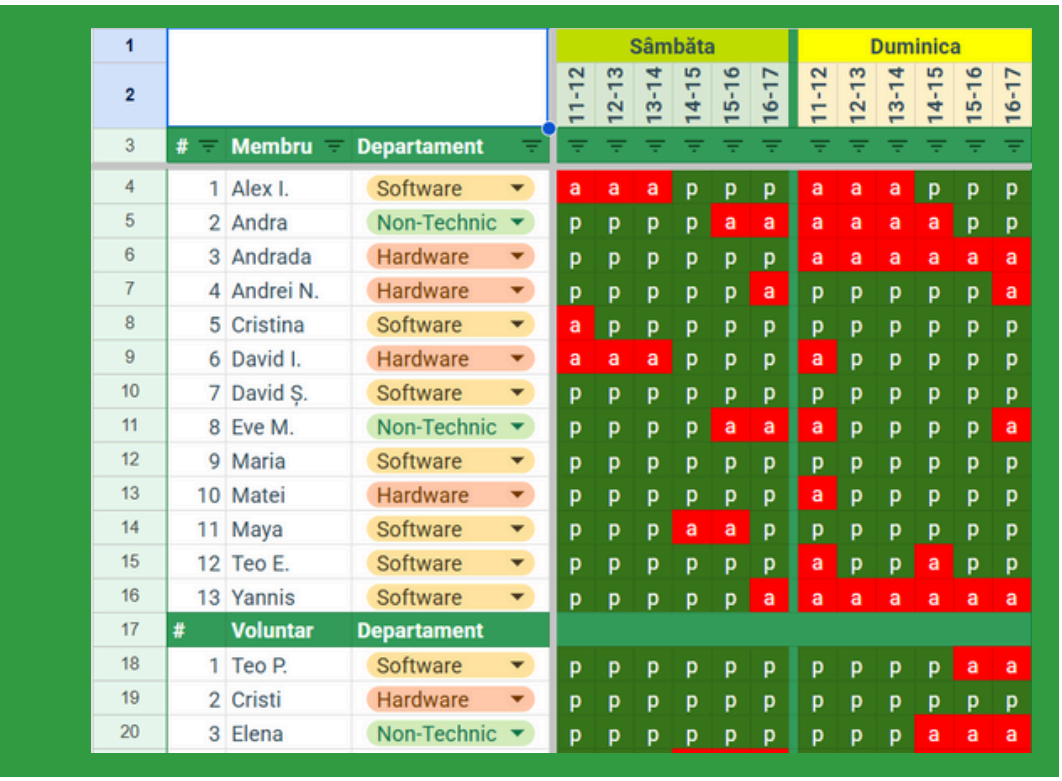
- caiet: valori, formule
- practice Hide&Meet
- curs REDSTONE
- poze caiet
- SITE
- calcul Coral Tech
- flyere + roll-up
- panou piese/ iterații REGIO
- interviu
- INCLUZIUNE, INSPIRAȚIE, COMUNITATE
- robot reveal

Action List

An **Action List** is an organized list of specific tasks assigned to team members, with **clear deadlines** and **precise objectives**. It includes all the **activities necessary to complete** the project and provides an overview of **each member's responsibilities**, thus becoming the key to our success in task management. It is an organization and progress monitoring tool that helps us stay focused and work efficiently.

Each task in the Action List has a **due date** and a **responsible member**, ensuring transparency and accountability. It also includes a **prioritization system** to ensure deadlines are met.

ID	Action	Priority	Department	Owner	Assigned Date	Due Date	Status	Completion Date
1	Participare Kickoff & KICK/ATHON 7-8 sept.	High	Hardware	Teo V.	1 sept.	6 sept.	Completed	6 sept.
2	Participare Kickoff & KICK/ATHON 7-8 sept.	High	Software	Alex I.	1 sept.	6 sept.	Completed	6 sept.
3	Participare KICK/ATHON 8 sept.	Medium	Non-Tehnic	Teo E.	1 sept.	6 sept.	Completed	6 sept.
4	Filmare Video Înscriere NPE	High	Non-Tehnic	Eve	1 sept.	15 sept.	Completed	15 sept.
5	Editare Video Înscriere NPE	High	Non-Tehnic	David Ș.	1 sept.	22 sept.	Completed	19 sept.
6	Participare RSF 21 sept.	Medium	Team	Teo E.	1 sept.	20 sept.	Completed	20 sept.
7	Declarații Înscriere NPE	High	Team	Everyone	9 sept.	15 sept.	Completed	15 sept.
8	Participare Noaptea Cercertătorilor UNSTPB - CUPIT 27 sept.	Medium	Team	Alex P.	16 sept.	26 sept.	Completed	26 sept.
9	Design Tricouri / Hanorace	Medium	Non-Tehnic	Andra	19 sept.	20 oct.	Completed	20 oct.
10	Roll-up / Pop-up / Spider	Medium	Non-Tehnic	Eve	19 sept.	20 oct.	Completed	18 oct.
11	Postare Video Valori High Five (Reel, Tik Tok, Public YT), luni, ora 20	High	Non-Tehnic	Eve	22 sept.	23 sept.	Completed	23 sept.
12	Prototip funcțional Intake activ pentru SAMPLES	High	Hardware	Matei	22 sept.	6 oct.	Completed	20 oct.
13	Prototip funcțional Intake pasiv pentru SPECIMENS	High	Hardware	David Ș.	22 sept.	6 oct.	Completed	8 oct.
14	Șabloane Email-uri Sponsori (existenți, prezenți la evenimente, noi)	Medium	Non-Tehnic	Maya	22 sept.	6 oct.	Completed	27 sept.
15	Inventar goBILDA	High	Hardware	David I.	29 sept.	6 oct.	Completed	20 oct.



			Sâmbăta						Duminica					
			11-12	12-13	13-14	14-15	15-16	16-17	11-12	12-13	13-14	14-15	15-16	16-17
#	Membru	Departament												
1	Alex I.	Software	a	a	a	p	p	p	a	a	a	p	p	p
2	Andra	Non-Technic	p	p	p	p	a	a	a	a	a	a	p	p
3	Andrada	Hardware	p	p	p	p	p	p	a	a	a	a	a	a
4	Andrei N.	Hardware	p	p	p	p	p	a	p	p	p	p	p	a
5	Cristina	Software	a	p	p	p	p	p	p	p	p	p	p	p
6	David I.	Hardware	a	a	a	p	p	p	a	p	p	p	p	p
7	David Ș.	Software	p	p	p	p	p	p	p	p	p	p	p	p
8	Eve M.	Non-Technic	p	p	p	p	a	a	a	p	p	p	p	a
9	Maria	Software	p	p	p	p	p	p	p	p	p	p	p	p
10	Matei	Hardware	p	p	p	p	p	p	a	p	p	p	p	p
11	Maya	Software	p	p	p	a	a	p	p	p	p	p	p	p
12	Teo E.	Software	p	p	p	p	p	p	a	p	p	a	p	p
13	Yannis	Software	p	p	p	p	p	a	a	a	a	a	a	a
#	Voluntar	Departament												
1	Teo P.	Software	p	p	p	p	p	p	p	p	p	p	a	a
2	Cristi	Hardware	p	p	p	p	p	p	p	p	p	p	p	p
3	Elena	Non-Technic	p	p	p	p	p	p	p	p	p	a	a	a

Schedule during Weekends and Holidays

Both weekends and holidays are valuable time for any **robotics** team, providing the opportunity to work on projects at a more focused pace and develop skills essential for success.
The program conducted during this interval plays a key role in preparing the team for competitions and in creating a solid foundation of technical knowledge and **collaboration**.

A key reason why our team chose to implement a weekend program is to understand who we can rely on on specific days or times. Events and **competitions** require careful planning, and success depends on the constant availability and involvement of team members and volunteers.

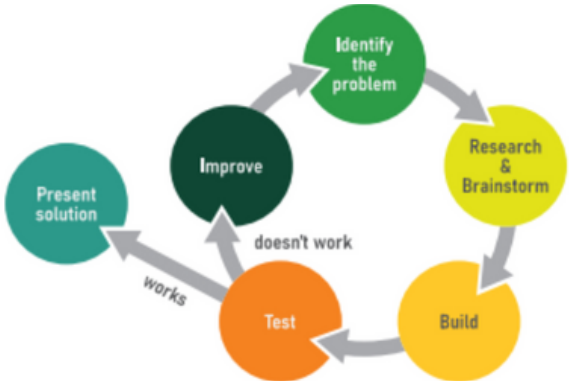
HARDWARE

APRIL 2024 - JUNE 2025

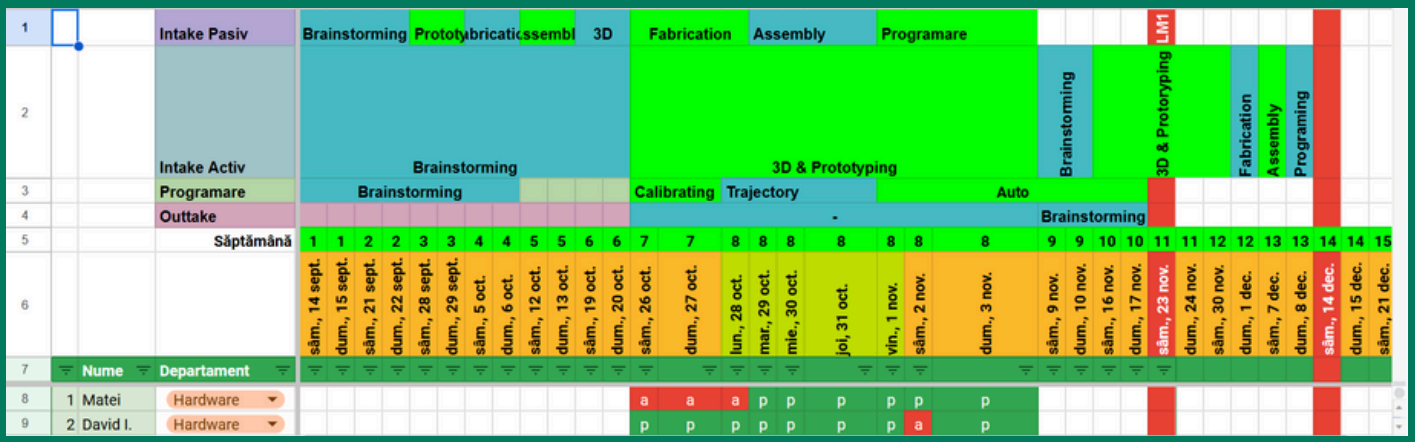
Engineering Design Process:

This process represents a concept through which we can overcome any challenge in an organized and efficient way, creating an algorithm, a precise series of steps to follow after the creation of each new prototype.

The first step is identifying the problem. After we determine what it is, we do a lot of **research**, either through **scouting**, talking with other teams or seeing different implementations from the **engineering industry**.
After we decide what we want to implement, we start **brainstorming** which helps us find as many solutions and **innovative ideas** as possible.
We **present** each concept, together, we **evaluate** it in an objective manner and afterwards we decide what prototypes are most likely to be **successful**. We **build** and **test** them. This process gets repeated as many times as necessary, following each and every step until we are satisfied with the final result.



Timeline based on our Engineering Design Process:

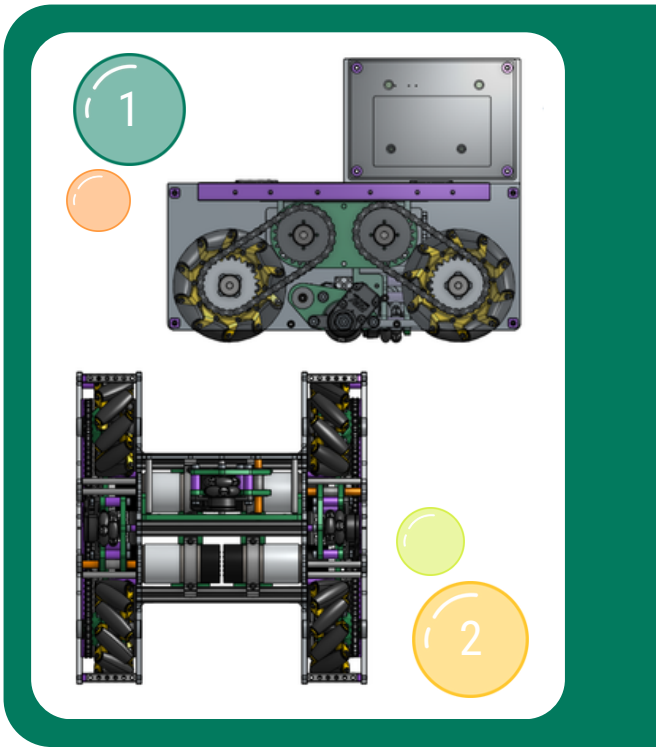


Off-Season Chassis:

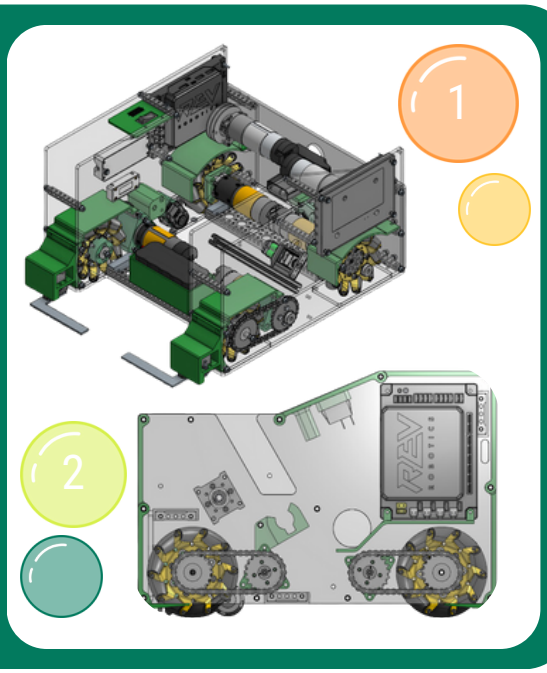
From the start of summer we started designing and building a **chassis** made to be as versatile as possible and to be used for the next season and allow us to implement any mechanism. Thus making the first steps in preparing for the next season.
We started by **brainstorming** and analyzing in detail each chassis we built the previous season, **CENTERSTAGE**, finding advantages and disadvantages for each one.

Kickoff Chassis 2023:

Advantages:	Disadvantages:
• the chassis is really small • easier cable management • the battery is low to the ground and the center of gravity is lowered • easier maintenance • versatile • integrated alliance marker holder • H type structure is really robust • chain transmission for lowered vibrations • the control and expansion hubs have air access for cooling	• the camera is left exposed • the cable motors are inaccessible • there are a lot of spacers used for the parallel plates • the motors are too high up • the 3 odometry wheels should be more spaced out



League Tournament Chassis 2024:

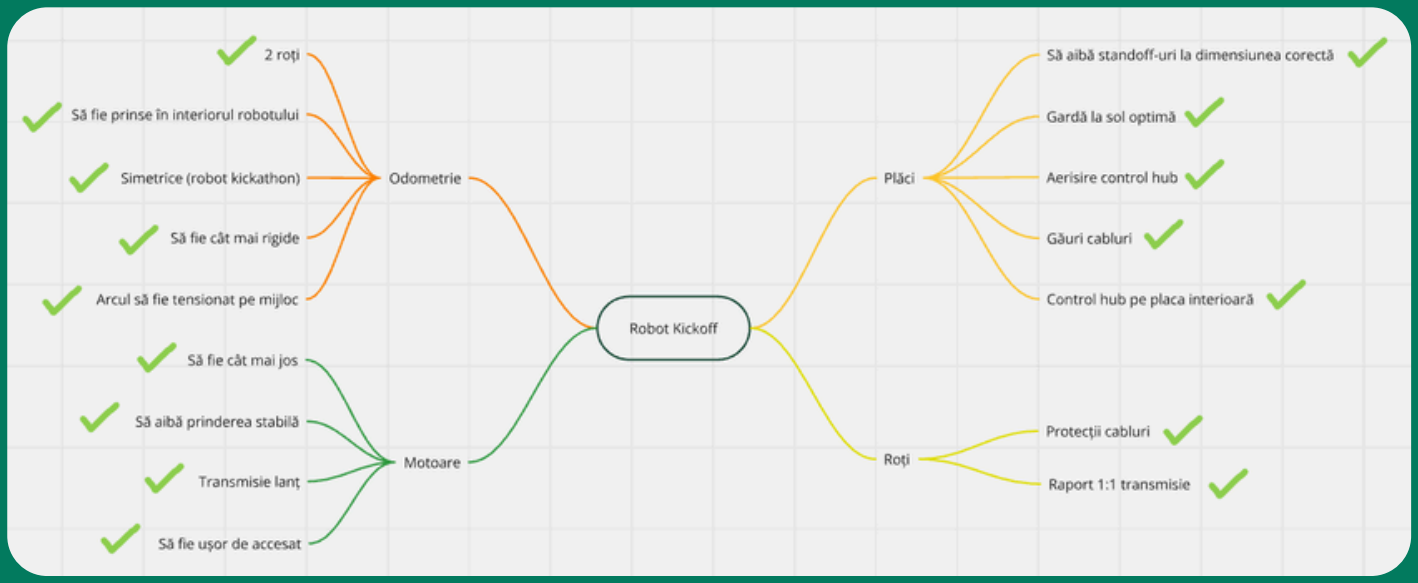


Advantages:	Disadvantages:
• wheel protectors • the bottom plate makes the robot more rigid and stops the slides from touching the ground • the camera is centered and protected • U type chassis creates more space in front of the robot	• the control and expansion hubs are placed on the exterior plate • the screws from the bottom plate are really low and can scratch the tiles • the odopods are not well designed • two of the motors are direct-drive • off-centered center of mass • it is not as sturdy as the Kickoff chassis • the **odometry** is between parallel plates

National Championship Chassis 2024:

Advantages:	Disadvantages:
• the **odometry** is more reliable • the **odometry** is inside the chassis not between parallel plates • Control and expansion hubs are placed on the interior plate and have air cooling vents	• the odometry wheels should be more spaced out • the chains are not well enough tensioned • the motor mounts are unreliable

Thus, we arrived at the next design criteria for the **Kickoff** chassis, we organized them in **a mind map in Miro**.



After finishing the **brainstorming** period we started with **prototyping and 3d design** in which we realized the CAD for it in Onshape between the 13th and 25th of july
Between the 29th of July and the 1st of August, we started fabricating and printing the parts for the chassis.
We assembled it between the 2nd and 18th of August
The chassis is 38.4cm x 36.4 cm and is driven by goBILDA Yellow JAcket 5203 Series 435 RMP and the localization si done with 2 custom odometry pods

SWOT Analysis:

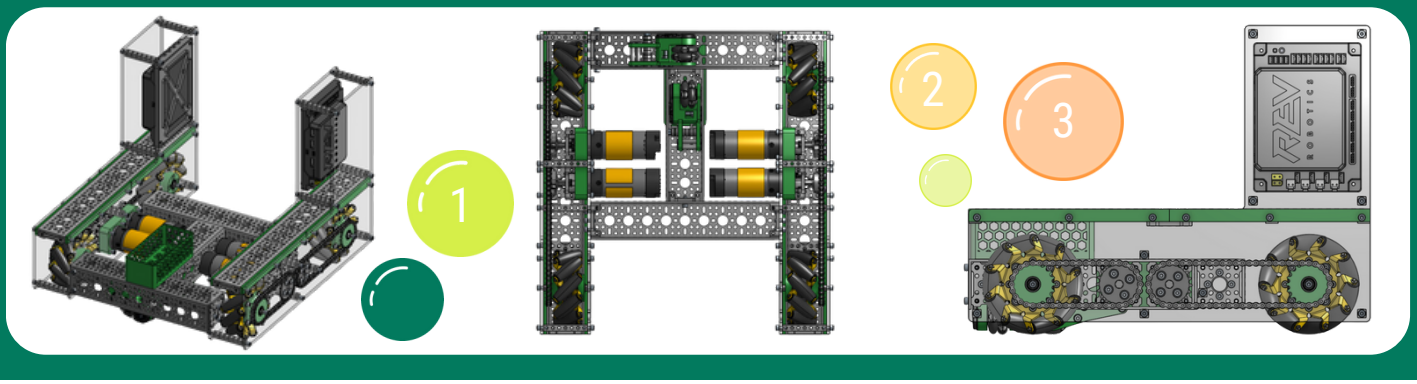
The good	The not so good
Strengths: • small, sturdy, modular and reliable • more stable odopods from previous designed and better placed at the center of rotation of the robot • it is very precise	**Weaknesses:** • it is heavy
Opportunities: • we can use it trought the season until we arrive at a final design	**Threats**: • the game seasons field and elements were unknown at the moment so we might have needed a higher/lower ground clearance

Conclusions:

After finishing this **chassis**, we understood how important is versatility and modularity to be able to tackle any game mission.

Also, we found out that goBILDA Kit Parts are very efficient for prototyping, but also very sturdy. We learned that before assembling any part we need to thoroughly review the cad file for any problems.
Points of improvement

- printing the **mecanum wheel** rollers from **TPU**
- using topical optimization with aluminium parts to reduce weight



Odometry:

While designing the chaise we realized that the previous design was unable to fit inside a goBILDA U-Channel so we decided to design a new Odopod based on the goBILDA SwingArm design.
During the brainstorming period(28th-29th of July) we analized our previous design:

Advantages:	Disadvantages:
• Higher reliability	• It wasn't really sturdy being mounted on a single side • It was to large for our needs

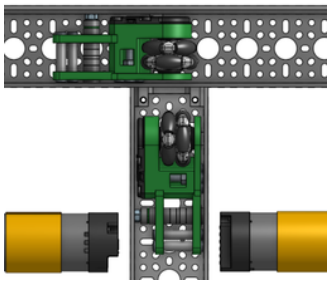
Subsequently, from July 29th to July 30th followed the prototyping and 3D design period in which we worked in **Onshape** trying several variants. After the prototyping and 3D design period came the manufacturing period in which we printed all the necessary parts for the Odopods, which lasted from July 30th to July 31st. Once we finished manufacturing the parts, we assembled them and obtained the Odopod on August 1st, the assembly period. To create the **Odopod** we used 18 parts (7 screws, 3 nuts, 3 bearings, 2 plates, 1 encoder, 2 standoffs), thus reducing the number of parts by 10% compared to the old **Odopod**.

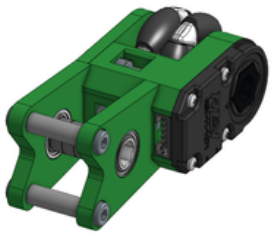
SWOT Analysis:

The good	The not so good
Strengths: • Reliable and more stable • Less parts • Well tensioned and we have a string that prevents overextension	**Weaknesses:** • Hefty length
Opportunities: • Being used for a longer period of time	**Threats**: • Can get stuck in the field

Conclusions:

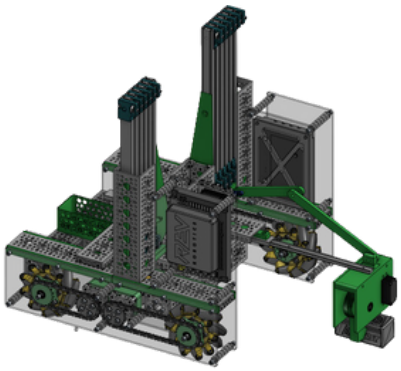
- Symmetry is key
- well centered tension is really important
- overextension can be a big problem

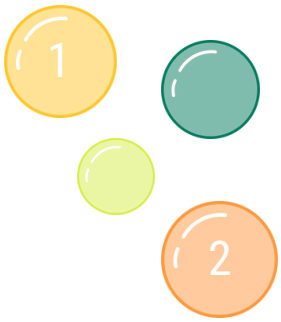


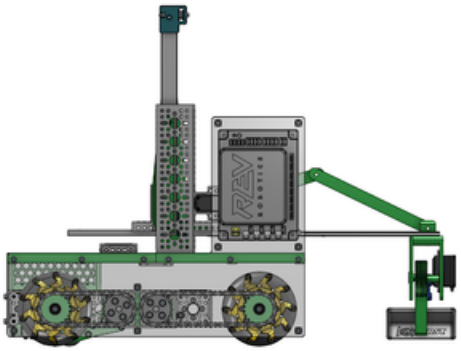


Robot V1 - KickAthon:

After the start of the new season, INTO THE DEEP, we participated at the annual competition organized by **Quantum Robotics #14270 KickAthon**, where we had to build a first version of a robot in **16 hours**, managing available resources with **innovative** ideas and **strategies**.

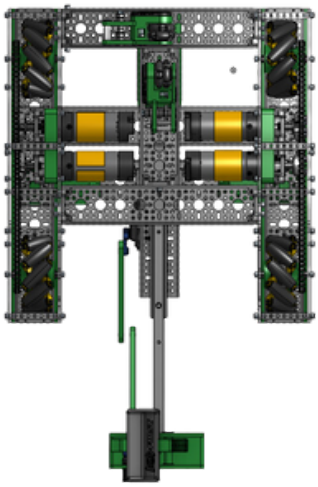






Chassis:

To manage our time and focus on the theme specific mechanism we used the previously designed chassis from the O**ff-Season** Period.



Pasive Intake:

After analyzing this year's mission we decided to focus on scoring in the **High Basket** to maximize our score.

Thus we thought of a passive intake to be able to collect both from the spike marks and from the **Submersible**.

Isometric Capture from **OnShape** with the Chassis

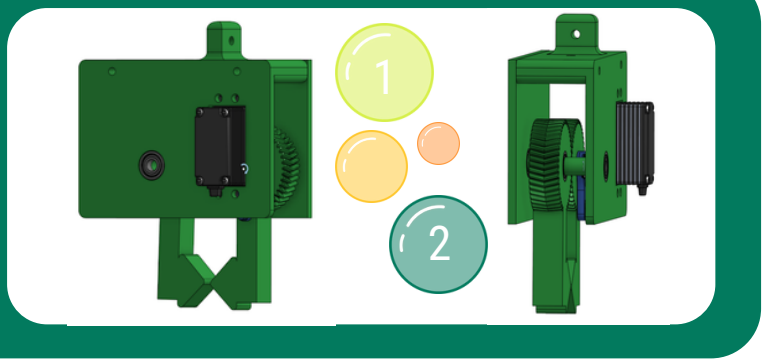
Max speed:

$$\frac{RPM}{60} \times WheelDiameter \times \pi = \frac{2{,}19m}{s}$$

Advantages:	Disadvantages:
• we could score in the **High Basket**	• it wasn't reliable or consistent • it was mounted in a single screw from the Linear Slide.

Points of improvement:

- stabilizing the **claws** (maintaining the same constant distance from the sidewalls)
- more robust parts
- increasing the gear modulus

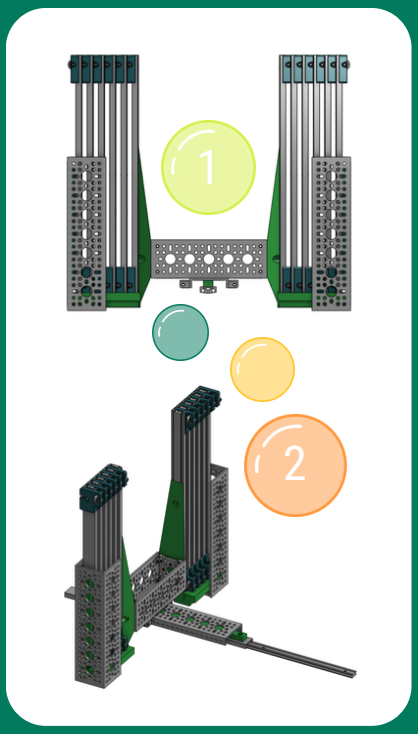


Since we wanted to reach the **High Basket** we used 6 sets of MISUMI SAR 230 slides activonated by 2 goBILDA Yellow Jacket 223 RPM, we used 4 spools 2 for the retraction and 2 for the extension.

Necessary Torque Slides

$$m * g * r = 2{,}5kg \times \frac{9{,}81N}{kg} \times \times 0{,}0195m = 0{,}48Nm$$

Isometric Capture from **OnShape** with the Lift



Advantages:	Disadvantages:
• we could score in the **High Basket**	• The stringing could tangle on the spool and could also unravel • it was unreliable • because of these problems we might not reach the **High Basket**

Linkage:

In order to collect from the **Submersible**, we needed to have a way to extend horizontally. So we used a linear slide, which was driven by a Linkage.

Advantages:	Disadvantages:
• Could collect from the **Submersible**	• Wrong dimensions • Protrudes outward so in turn it was hard to drive • Difficult to opperate

Points of improvement:

- Increasing the thickness of the two parts from the scissor linkage principle
- Calculating the necessary dimensions
- Making the printed parts more robust
- Saving space in the robot (no longer protruding outside it)

Conclusions:

Following the matches played within the **Kickathon** competition, we conducted the following analysis of the entire robot, its performance, and the impediments found:

SWOT Analysis:

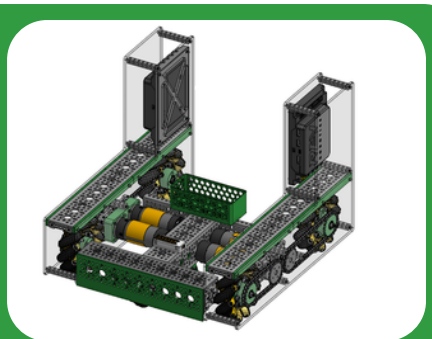
The good	The not so good
Strengths: • Relatively fast scoring • Could collect from the **Submersible**	Weaknesses: • It is heavy • Instable • Unreliable
Opportunities: • We can reuse some of our improving them in the process	Threats: • The robot could break really easily between matches

Robot V2 - League Meet #1:

The first League Meet we attended was the very first League Meet organized in Romania. It was held by teams **Ro2D2 #17962** and **infO(1)Robotics #15993**, in Ploiești, on November 23rd.

Chassis:

For the chassis, we kept the same model we used at Kickathon, only changing the wheels with the new goBILDA Mecanum wheels.



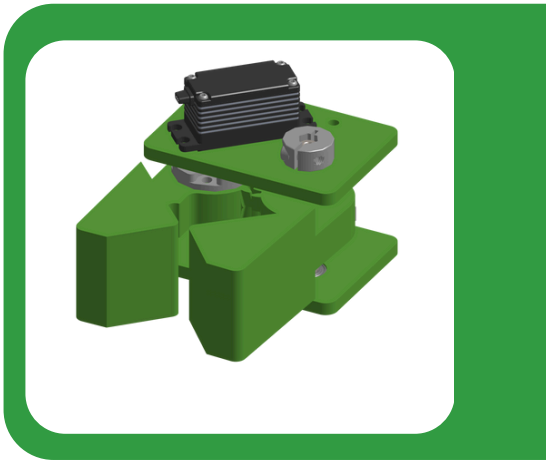
$$v = \frac{RPM}{60} \times wheelDiameter \times \pi = 2{,}37 m/s$$

Passive Intake:

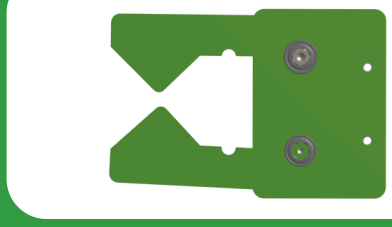
After several brainstorming sessions (September 14-22) we realized that we needed a claw that would collect **Specimens** from the Field Perimeter and score them on the **Chamber**.
Thus, we arrived at the following concepts:

- We will use Herringbone gears
- We will use an exact number of teeth (6 and 7 teeth)

- The claw will have a triangular shape (triangle with an angle of 91 degrees)
- The bottom of the housing will be connected to the top with a Quad Block Mount



After the brainstorming period, a time of prototyping and 3D design followed, starting on September 23rd and ending on October 4th, during which we created a version of the Intake in **CAD**. Subsequently, a manufacturing interval followed from October 5th to October 11th, during which we 3D printed all the designed parts.



Isometric Capture from **OnShape** with the Passive Intake

Next came the assembly and testing period from October 7th to October 13th, in which we joined all the previously designed parts and began to verify their functionality in the field.

SWOT Analysis:

The good	The not so good
Strengths: • Easy to use • Easy to program • Versatile	Weaknesses: • Relatively unstable • The parallel plates aren't parallel • We don't have any sensor to know when the collection was successful
Opportunities: • Integrating a **Color Sensor** • Having 2 points of support for the parallel plates • 3 points of contact for the **Specimens**	Threats: • Having a fixed number of teeth means it could surpass its range of motions not working anymore

Points of improvement:

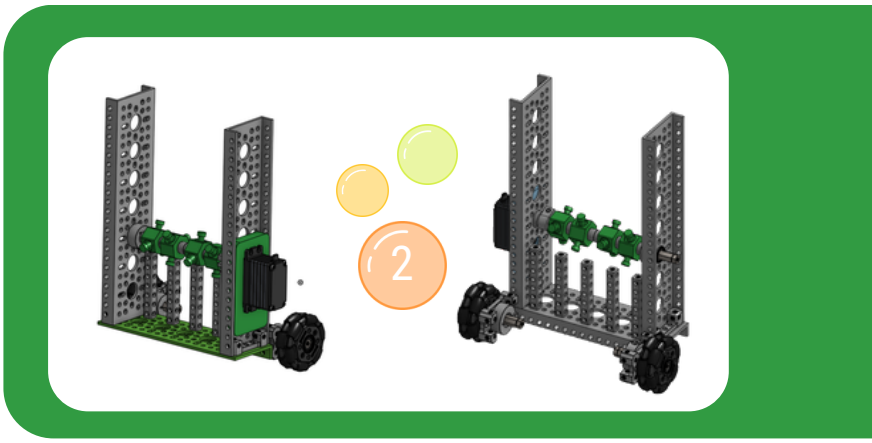
- Adding a **Color Sensor**
- Holding the plates at 2 points
- Holding the **Specimens** at 3 points

Active Intake:

After several brainstorming sessions (14 Sep - 20 Oct), we decided to collect the **Samples** through an **Active Intake**, being a versatile and easy to improve mechanism.
Thus, we arrived at the following concepts:

- We will use surgical tubes
- The Intake will be operated by an Axon Mini
- 3 points of contact for the **Specimens**

We continued by prototyping such an Intake, starting on October 26th, using 2 Low Side U-Channels from goBILDA, attached to the arm via a shaft and 4 Hyper Hubs. We opted for the Channels from goBILDA, because they are very easy to use and help us in the subsequent creation of a more stable and high-performance 3D printed Intake.



Isometric Capture from **OnShape** with the Active Intake

The **Samples** are collected by 12 surgical tubes, attached to a shaft driven by an Axon Mini. Thus, the **Samples** are locked inside the Intake, and the reverse rotation of the servo will lead to their placement in the **Baskets**.
At the same time, we used 2 Omni Wheels with a diameter of 48mm to always have the Intake at the perfect angle, when it is left on the ground, completing the Intake on November 3rd.

SWOT Analysis:

The good	The not so good
Strengths: • Easy and fast collection, from any position of a **Sample** • Easy to program and use	Weaknesses: • Cannot collect from **Submersible** • Unstable and inconsistent • Too big
Opportunities: • Most parts can be used for other iterations • We can easily improve the mechanism	Threats: • When placing **Samples** in the **High Basket** the robot has a very high center of gravity, making it very unstable

Points of improvement:

We can continue to prototype a similar intake, to collect from the **Submersible.**

Lift:

To reach the **High Chamber** and **High Basket** we used two MISUMI SAR230 slide systems placed in parallel with 6 stages each.
We started with a brainstorming period that started on October 10th and ended on October 12th, after which we drew the following conclusions:

- We will use 6 stages
- To attach other mechanisms between them we will put a Low-Side U-Channel on each side
- The mechanism will be operated by some 3D printed pulleys to prevent the thread from getting tangled

Then, there was a 3D prototyping period where we laid everything out in CAD to see the possible problems with this mechanism. This lasted from October 12th to October 20th.

Then, there was the manufacturing period which lasted from October 26th to October 27th where we 3D printed all the parts needed for assembly.

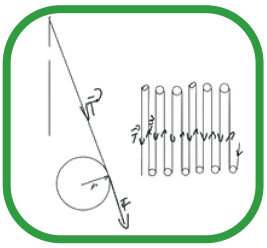
After we got all the parts we started assembling, this part lasting from October 29th to October 31st.

Necessary Torque Arm

$$m \times g \times l = 0.85kg \times \frac{9.81N}{Kg} \times 0{,}34m = 2{,}84Nm$$

Necessary Torque for Slides:

$$\tau = m \times g \times SpoolRadius \times GearRatio = 2kg \times \frac{9.81N}{kg} \times 0.018m \times \frac{1}{2} = 0{,}175Nm$$

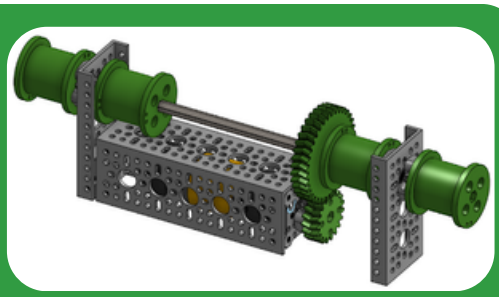


Isometric Capture from **OnShape** with the Lift

Advantages:	Disadvantages:
• The thread does not tangle • The system is versatile and reliable	• Cables can go under the slides • 6 stages are too many, 2 of them are useless

Spools:

To operate the slides, we must use a pulley system to retract and extend the strings, but also to keep them constantly under tension.



After a brainstorming session on October 12, we reached the following conclusions:

- We will use 2 3D printed pulleys on each side, one to retract the string and one to extend it.
- All 4 pulleys will be connected to a long shaft.
- To drive the shaft, we will use 2 Herringbone gears, with a ratio of 1:2, the smaller one being driven by a 13:7:1 motor with 435 RPM, thus having 217 RPM in the shaft.

Isometric Capture from **OnShape** with the Spools

Then, we continued by making a 3D prototype in **Onshape**, starting on October 19th, and finishing on October 26th.

SWOT Analysis:

The good	The not so good
Strengths: • We use a single motor • All 4 pulleys are attached to a single shaft • The rope no longer tangles	Weaknesses: • Weight • Instability • Unreliability
Opportunities: • Using the same system for future iterations	Threats: • Cutting the thread on the edge of the pulleys

Conclusions:

- We have created a simple and efficient pulley system.
- The idea used can be reused for future iterations.

Arm:

Necessary Torque Arm

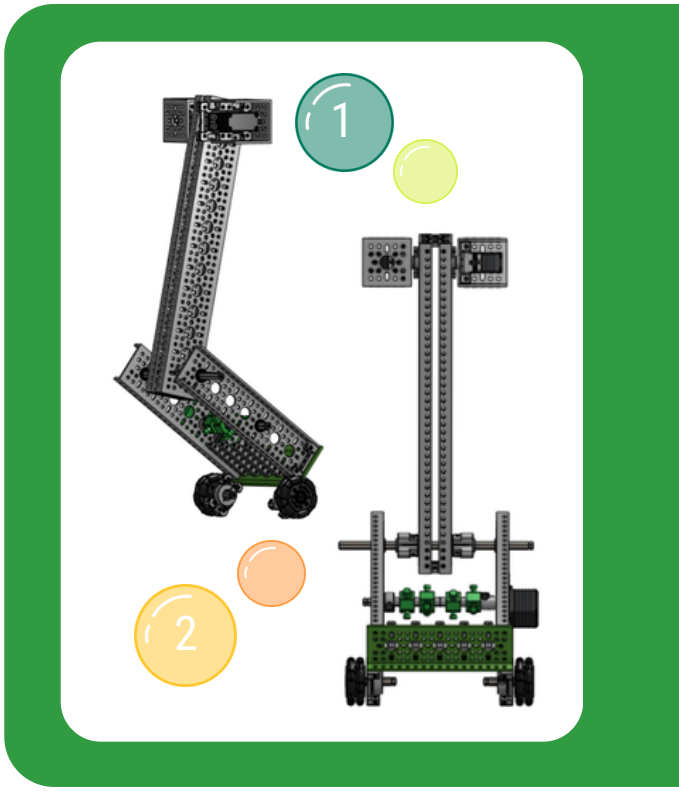
$$m \times g \times l = 0.85kg \times \frac{9.81N}{Kg} \times 0{,}34m = 2{,}84Nm$$

Since the period between **Kick-Off** and the first **League Meet** did not give us enough time to achieve our goals, we decided to adapt the ideas to the working time we have available and create an arm with which we can collect the **Samples** positioned on the **Spike Marks**.

After a brainstorming session, we arrived at a simple arm that resembles the Intake of the national team robot from the 2023-2024 season. Our strategy was designed to use all the available elements outside the **Submersible** to replace the lost score.

Like any other mechanism, the arm was created after a discussion with the team, followed by **CAD** (computer-aided design) design and physical verification of the concept.

Isometric Capture from **OnShape** with the Arm



In addition to the advantages of this **arm**, there are, of course, risks that we tried to mitigate as much as possible. Among these risks was the lack of stability of the robot when the arm was raised to the **High Basket** level (a problem solved with the addition of the **Ascent system**) and the force with which it hit the ground when it was brought to its initial position, which could lead to its damage (solved by connecting the arm with an elastic tube for counter-springing that allows it to touch the ground only when necessary).

SWOT Analysis:

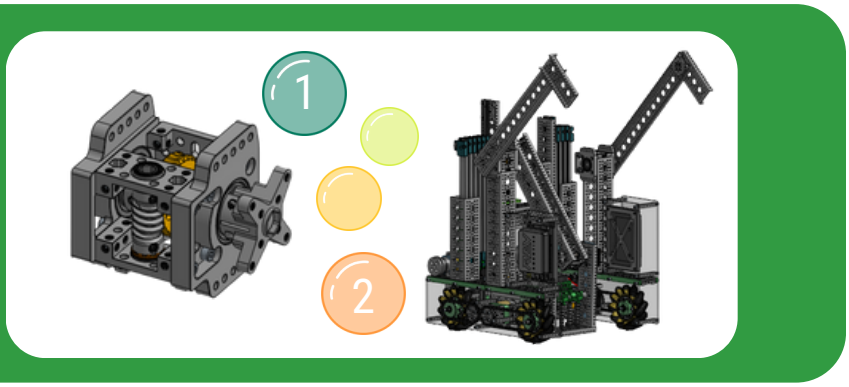
The good	The not so good
Strengths: • Easily reaches the **High Basket** • Efficient • Stable • Reliable	Weaknesses: • Weight • Returned to initial position there was a possibility of getting stuck in tile • Impossible to collect from **Submersible**
Opportunities: • Can be used for an **Outtake** system	Threats: • It destabilizes the robot when it is lifted

Conclusions:

Although the mechanism is not too complex, it can still be considered a good start that leaves a lot of room for improvement, based on which we can analyze and create one that will be more effective for the next **League Meets**.

Ascent System:

Considering that we have a very heavy robot, we decided to use a Worm Gear from goBILDA to climb, which is quite strong and can easily support 91 kilograms. We use a 223 RPM motor, with a 50.9:1 ratio. Through it, the mechanism makes 4 rotations per minute, thus climbing quite slowly but steadily. First, we prototyped on the spare chassis (November 6), while the robot was used for Autonomy, and after we concluded that it works, we assembled it on the main robot according to the **Engineering Design Process.**



We used 2 10-hole U-Channels to attach both mechanisms to the chassis, and two 15-hole Low Side U-Channels with two 4-hole ones following them to be able to hang the robot on the **Low Rung.**

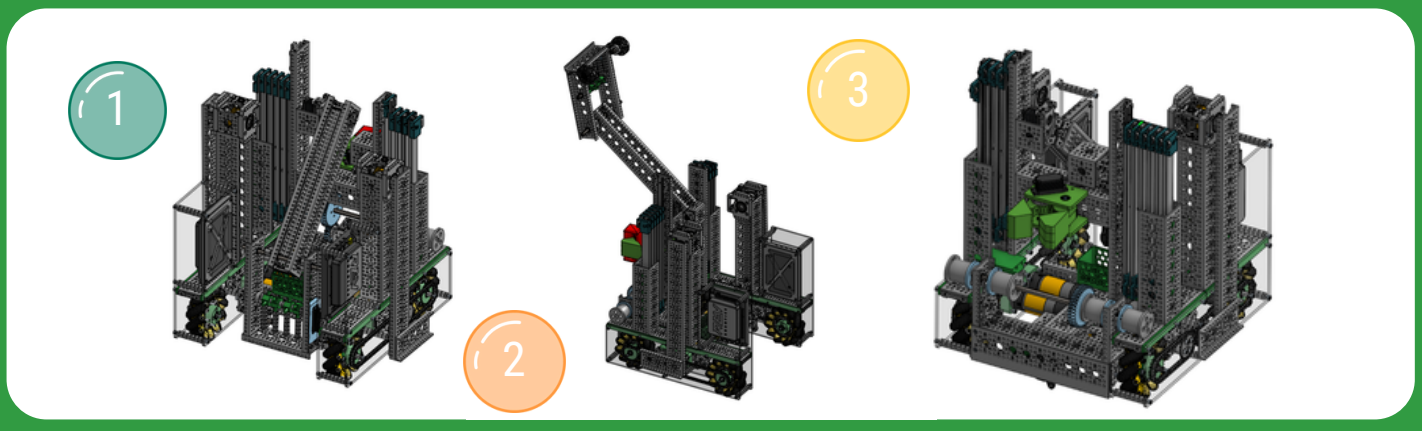
Thus, we managed to finish building the hanging system on November 8, after two days.

SWOT Analysis:

The good	The not so good
Strengths: • Efficient • Consistent • Functional	Weaknesses: • We climb very slowly • Both mechanisms are very heavy
Opportunities: • Prototyping a mechanism for **Ascent Level 3** • The Worm Gear can also be used for other iterations	Threats: • Running out of climbing time

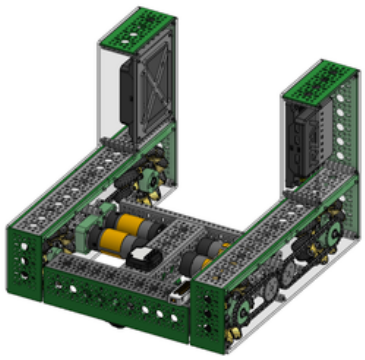
Conclusions:

The material from which the Linkage is made forms the basis of the entire transfer, representing its sustainability. Starting with the next iterations, we decided to make it much more stable, as the risk of breaking the PLA filament is quite high.



Robot V3 - League Meet #2 + #3:

The second League Meet we attended was held by the **Quantum Robotics** team **#14270** in Bucharest, on December 15th. The Robot, Lift, Pulleys and Hanging System remained the same, being satisfied with the performance of the systems. The third League Meet we attended was organized by us, in collaboration with the teams, **4D-Robotics #18160**, **LightBulb Robotics #23203** and **ARRA #25538**, in Pitești, on January 12. The robot, chassis, Passive Intake, Pulleys and Hanging System remained the same, being satisfied with the performance of the systems.



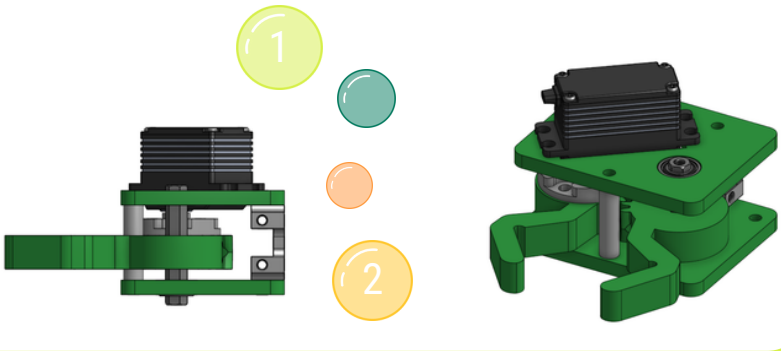
Chassis:

Looking at the chassis, it remained unchanged from the first League Meet, trying to focus on collecting and scoring, up until that point the chassis had not been a problem, being constant and sustainable.

Isometric Capture from **OnShape** with the Chassis

Passive Intake

After several brainstorming sessions (November 25-26) we realized that the claw we had at the first League Meet could be improved in several ways.



Thus, we reached the following conclusions:

- Let's reduce the weight as much as possible
- We will increase the number of teeth
- The claw will grab the Specimen by its corners
- The bottom of the case will be connected to the top with a 27 mm Quad Block Mount

Isometric Capture from **OnShape** with the Passive Intake

After the **brainstorming** period, a period of prototyping and 3D design followed (November 25-28) during which we created a version of the Intake in **CAD**.

Subsequently, a manufacturing interval followed from November 29 to December 1, during which we 3D printed all the designed parts.

Next came the assembly and testing period from December 2 to December 8, in which we combined all the previously designed parts and began to verify their functionality in the field.

SWOT Analysis:

The good	The not so good
Strengths: • Easy to use • Easy to program • Very versatile	Weaknesses: • Does not use **Color Sensor**
Opportunities: • We can improve the mechanism very easily and it is also cheap	Threats: • Having a fixed number, the teeth of the wheels can de-mesh off the wheel

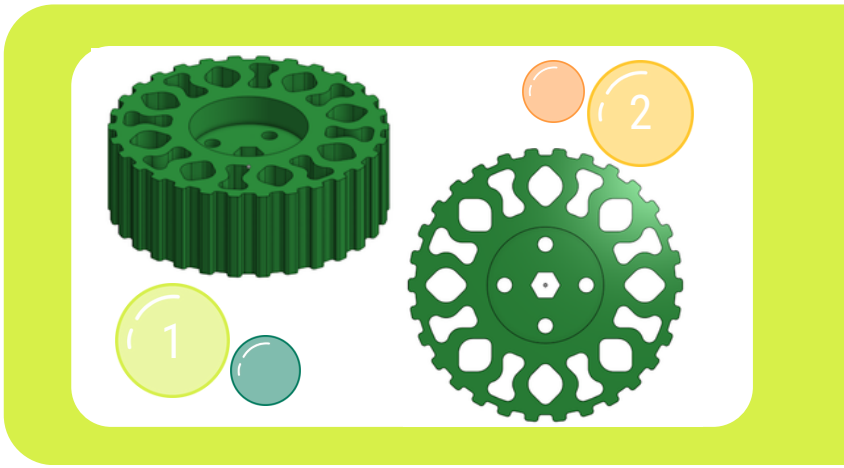
Conclusions:

We have made something simple and effective that is very easy to improve, being:

- Adding a **Color Sensor**

Active Intake Prototype:

Since we had an impediment regarding the order of parts for the second **League Meet**, we decided to try printing some kind of goBilda Gecko™ Wheels out of TPU. To avoid the grip problem brought by the difference in material (TPU, in our case - Rubber, goBilda) we added some grooves to our design.



Isometric Capture from **OnShape** with the Active Intake Prototype

Unfortunately, we were unable to use them because, during testing, we realized that we could not collect in a consistent manner, assembly being difficult, as the distance between the 2 wheels had to be exact, measured perfectly in order to apply pressure on the collected **Sample**.

Active Intake:

Following the experience in the first **League Meet** that we had with the previous Active Intake, we noticed the following issues:

- Unstable
- Too big
- Collection is not constant (especially when coming perpendicular to the **Sample**)
- We risk collecting more than one **Sample**

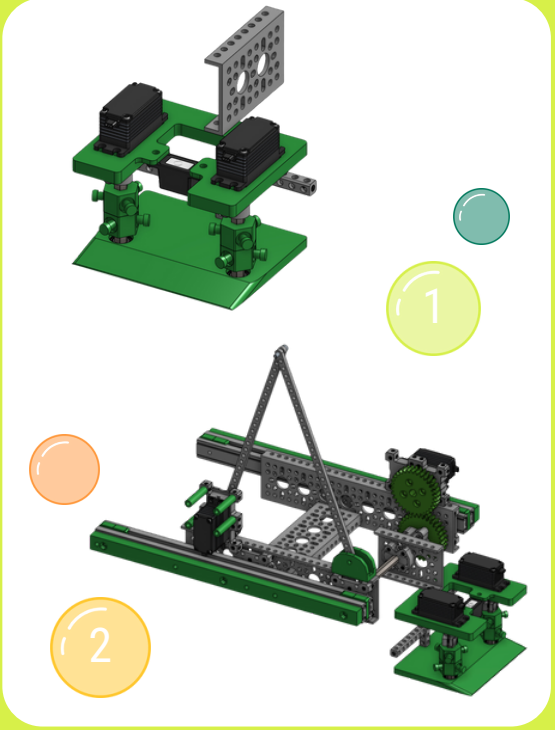
These issues became even more prominent when we tried to collect from the **Submersible**. So for the next iteration we wanted to collect with a left-right system to solve the problem with multiple collection. We also noticed that by using surgical tubes with sufficient adhesion, we were able to rotate the **Samples**, solving the problem of consistent collection at an angle.

The first prototype was made from a 4 Low Side U-Channel from goBILDA, 2 REX 8mm axles, 2 REX 8mm flange bearings, a transmission made from an elastic band and two pulleys, and tube clamps.

With this one we realized that it would be very difficult to use a **color sensor** while using a transfer, so we decided to use 2 separate servos to actuate the **Intake** and a **color sensor** to help us with both **Autonomy** and **TeleOp**.

We decided to print the prototype in 4 separate parts to avoid the potential problems that come from printing a part with so many supports and to make it easy to change and modify. The hole behind the Intake acts as a funnel for the robot transfer.

Isometric Capture from **OnShape** with the Active Intake



We use 12 high-adhesion, less rigid tubes to maximize collection speed. At the same time, we manage to maintain the ability to rotate **Samples** that are not perpendicular to the Intake.

For the next iterations, we should try to make an Intake without a Bottom Plate to eliminate the problem of the Intake getting stuck in the **Submersible.**

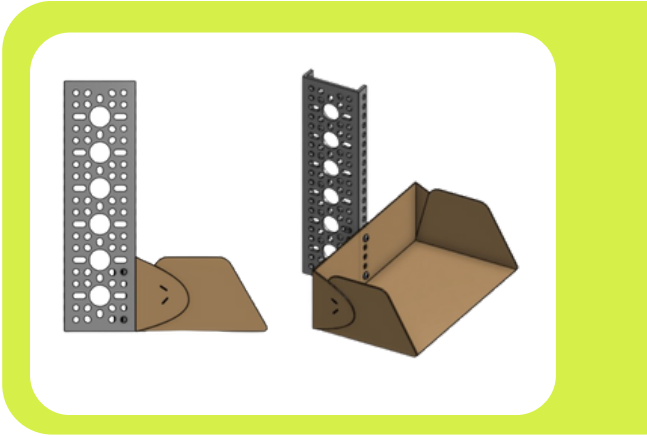
SWOT Analysis:

The good	The not so good
Strengths: • Easy and fast collection, from any position • Easy to use • The **color sensor** provides a lot of useful information	Weaknesses: • Too big • Hard to collect from outside the **Submersible**
Opportunities: • Easy to modify	Threats: • When collecting from the **Submersible** there is a risk that the Bottom Plate will hit a **Sample** and we will not be able to collect

Transfer Prototype:

During the brainstorming sessions for the **Intake**, we also discussed finding a suitable **Outtake**, something simple but reliable that would be attached to the slides to reach the **High Basket**, the mechanism designed to be in the shape of a swing.

To ensure that the idea was functional and to see the dimensions and position as precisely as possible, we used the lid of a cardboard box, working in parallel in **CAD** to design a version that could be used on the robot. Using cardboard was beneficial not only from the perspectives listed above but also regarding its reuse and saving of filament.



Conclusions:

In conclusion, although the cardboard transfer did not make it onto the robot, it was a good way to test the idea and it positively influenced the outcome, emphasizing the benefits but also the problems to solve.

Linkage Max/Min force:

$$F_{fy} = \frac{\tau}{l} \times \cos(|90° - \theta|) \times cos\theta_2 =>$$

Linkage Prototype:

During brainstorming sessions with the team, we decided that for the next iteration of the **Active Intake**, we would use a set of two sliders driven by an Axon MAX using two printed Linkage bars.

Due to its mechanical simplicity, we decided that this mechanism would be the most suitable for our robot. It coordinates perfectly with our strategy, being fast and consistent, allowing for easy collection from the **Submersible**.
Like any other mechanism, the Linkage began with its prototyping in **CAD** where we could test ideas and modify until we reached a satisfactory result.

Isometric Capture from **OnShape** with the Linkage Prototype

While the idea was a good one, there were some risks that we eliminated in subsequent iterations. Among the risks is the breakage of the printed bars, as the filament is more elastic and fragile than other materials.

SWOT Analysis:

The good	The not so good
Strengths: • fast • steady • easy	Weaknesses: • fragile
Opportunities: • making it from a sustainable material	Threats: • it easily breaks

Linkage:

Considering that the horizontal slides had to be operated by a fairly rigid and compact system, we decided that the most efficient idea would be a Linkage. This had the task of making the slides more efficient in the shortest possible time.

The first step was prototyping, being essential for the result of the final piece. For this assembly, the following were used:

- Axon MAX+; having enough torque to be able to move a slide loaded with 45 kg (kgf is a unit of force equal to that required to resist the acceleration of a one kg table in a gravitational field of 9.8 m/s^2).
- Servo Hub (25 Tooth Spline, 32mm Diameter);
- Flat Beam (23 Hole, 184 mm Length)x2; due to the delay in the placed order, we had to cut the designed piece on a CNC, similar to those from goBILDA. The size is 5/2 of the total size of the slide.
- A printed part to facilitate the precise clamping of the Flat Beam on a Low-Side U-Channel, which helped to make the extension system move more smoothly and efficiently.
- Spacers to fix the Axon in the designed position.

Based on extensive testing, we deduced that this Linkage system will remain on the robot, as only the Flat Beams have been stiffened and improved, and its placement on the chassis indicates a well-designed design.

Isometric Capture from **OnShape** with the Linkage

Advantages:	Disadvantages:
• The thread does not tangle • The system is versatile and reliable	• Cables can go under the slides • 6 stages are too many, 2 of them are useless

Conclusions:

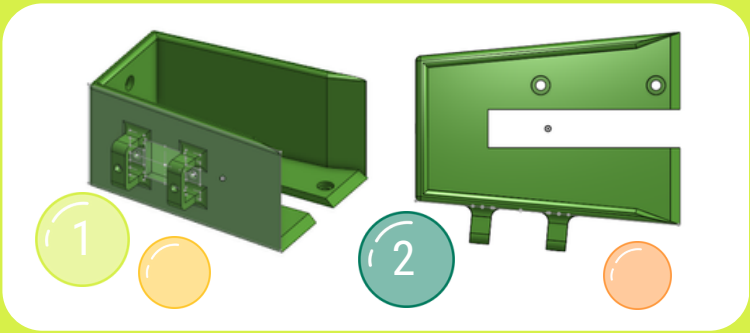
The linkage is very well positioned on the robot, protecting it from impact and significantly reducing the occurrence of a possible failure. It is also shock resistant, being made of hard-aluminum and is quite fast [MAX speed; 0.085sec/60° at 8.4V voltage], which improves our performance both during the **Autonomy** period and in **TeleOp**.

Bucket:

After a few brainstorming sessions, we came to the conclusion that in order to score as efficiently and consistently as possible in **Baskets**, we needed a 3D printed piece that would support the **Sample** both during transport and transfer. We named it **Bucket**, inspired by its shape.

We decided that it would have a U shape. Instead of 90 degree angles, the walls would be positioned at 95 degree angles, as we found through testing that this way the transfer is more efficient.

Also, to check if we have a **Sample** in the Bucket, we created a crack for a **Color Sensor** and for a clamp that ensures the **Sample** is supported when the **Bucket** is turned upside down.



Based on the **Engineering-Design-Process**, we started with a 3D design period that lasted from November 30th to December 1st.

This was followed by the manufacturing period that started on December 2nd and was completed on December 3rd, thus reaching a final version for the **Bucket**.

Isometric Capture from **OnShape** with the **Bucket**

Max torque Arm: $m \times g \times l = 1{,}17Nm$

SWOT Analysis:

The good	The not so good
Strengths: • Easy to make • Reliable • Accurate on scoring	Weaknesses: • Sometimes the **Sample** doesn't reach the **bucket**
Opportunities: • Can also be used in future iterations	Threats: • **Samples** may fall and get stuck in the robot

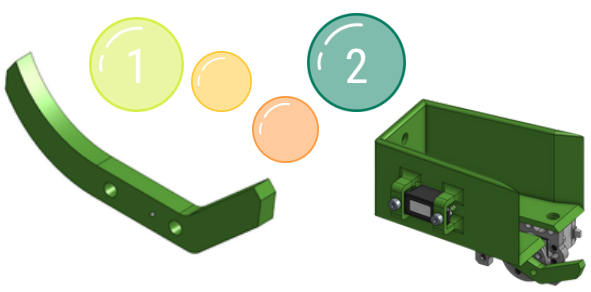
Conclusions:

With the help of this piece we were able to score easily in **Baskets**.
Although it is not the best option for transfer from a technical point of view, it worked very well throughout the competition, proving to be consistent and accurate.

Chopstick:

Looking at the robot design for the second **League Meet**, we held a brainstorming session where we decided to change the **Outtake** system. This helped improve the robot through its simplicity, accuracy, and reliability throughout the matches played during the second **League Meet.**

This assembly is composed of a bucket and a chopstick, with the role of retaining the **Sample** inside the bucket, with the ultimate goal of being able to score the **Sample** in the **High Basket** or the **Low Basket**.
The chopstick was designed simultaneously with the rocker, bringing a significant impact and an exceptional improvement to this mechanism.



Isometric capture from **OnShape** with the **Chopstick**

Advantages:	Disadvantages:
• Simple • Precise • Reliable	• If it's under too much stress it can break

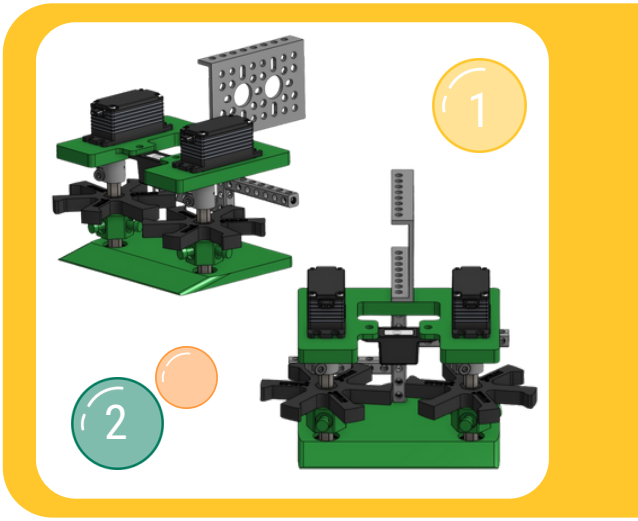
Robot V3.1 - League Meet #4 + League Tournament:

The fourth **League Meet**, we participated in, the **Eastern Arena**, organized by the **Eastern Foxes team #19098**, in **Ploiești**, on February 1. The robot, Chassis, Passive Intake and Hanging System remained the same, being satisfied with the performance of the systems.

Active Intake Prototype:

Although there were not many problems with the Intake used at the previous **League Meets**, we decided that for the League Tournament stage we would try to make it as efficient as possible, the main problem being the collection time.

The modification we made was to add a 72mm Boot-Wheel from goBILDA between two rows of tubes, which easily catches the **Sample** due to its star shape and the material it is made of.
The way it works is to straighten the **Sample** using the tubes, and then the Boot-Wheel will collect it.



Isometric capture from **OnShape** with the **Active Intake Prototype**

SWOT Analysis:

The good	The not so good
Strengths: • Faster collection speed	Weaknesses: • Sometimes it pushes the **Sample** out of range before collecting it
Opportunities: • Easy to iterate	Threats: • The transfer succes rate has dropped quite a bit

Conclusions:

We conclude that this active prototype version improved the speed of collecting game elements and modifying the piece for any iteration, but at the same time the **Sample** collection rate was a disadvantage, the decision of this version remaining strictly at the prototype state given the harder collection of game pieces.

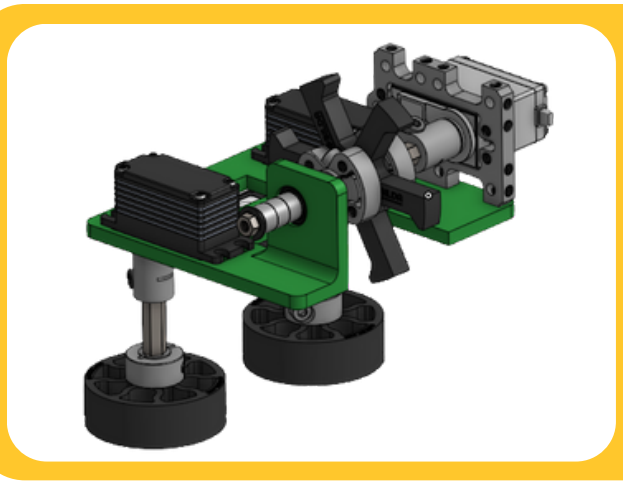
Active Intake Prototype- Gecko Wheels:

After making the first prototype of the Intake with Gecko Wheels, we realized that the main problem with it was the size of the Gecko wheels, which were very small. Because of this, the collection was very inconsistent. So, we continued by prototyping a second Intake with 2 Gecko wheels, also 48mm in size, driven by an axle coupled to a Axon Mini.

However, to solve the collection problem, we added a 72mm Boot Wheel, mounted vertically on a shaft driven by a GoBILDA Speed Servo. This is used to pull the **Samples**, especially in the **Submersible**, so that they can be collected later by the Gecko wheels.

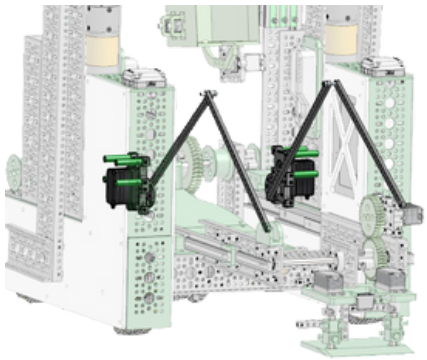
This prototype of Intake proved better than its first iteration, but not very consistent.

Isometric capture from **OnShape** with the **Active Intake**



Linkage:

Following previous competitions, we found that the Linkage could not handle the weight of the entire assembly on the horizontal slides. After a **Brainstorming session**, we decided that the best solution would be to add another Axon Max+. This increased our Torque by two times, being essential for the speed and stability of the robot in the process of collecting game elements. This decision made our robot heavier, but through the added power of the Linkage it is a plus and a significant improvement to it, compensating for the added weight.



Advantages:	Disadvatanges:
• Torque • Speed • Stability/Stiffness	• Added weight • Power consumption

In conclusion, these improvements have had a significant impact on making the game more efficient on the field, increasing the number of cycles we can do in a minute and maximizing our scoring.

Isometric capture from **OnShape** with the **Linkage**

New Max/Min force LK:

$$F_{Min2} = 2 \times F_{Min} = 7{,}22N \quad F_{Max2} = 2 \times F_{Max} = 18{,}88N$$

Lift:

For the League Tournament competition we decided to analyze all the subsystems and see what simple but significant improvements could be made in the remaining time.

Thus, to improve the Lift we reduced the weight by 200g by changing the C-Channels (where possible we put Mini C-Channels and shortened them to the minimum size). Based on these changes we recalculated the required torque delivered by the motor.

Thus we realized that we could use a 5203 Series Yellow Jacket Planetary Gear Motor 3.7:1 Ratio with a Gear Ratio of 2:1 which is imposed on us by the space we have.

Necesarry torque Slides:

$$m \times g \times SpoolRadius \times GearRatio = \frac{1{,}5kg \times 9.81 \times 1{,}8cm}{2} = 0{,}13Nm$$

$$(0{,}21Nm + 60\%\ Marjă\ de\ eroare\ rocomandată\ pentru\ Motoare\ Brushed)$$

$$\tau_{GoBilda} = 0.53Nm$$

New Lift Speed:

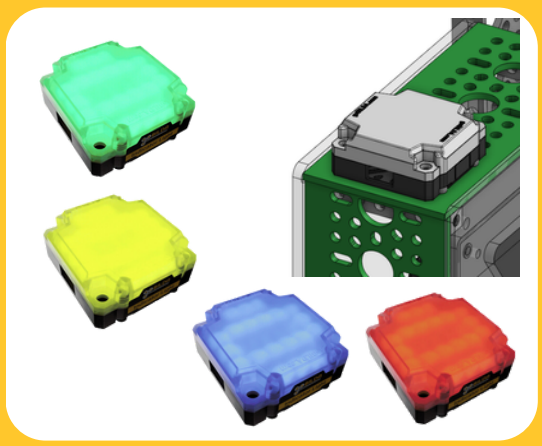
$$v = \frac{RPM}{60} \times SpoolRadius \times \pi = \frac{305{,}4cm}{s}\ (0{,}2s/h_{max})$$

Conclusions:

Just like with Linkage, we made a minor change that had a huge impact on the game strategy, the number of cycles made, and the efficiency of the entire subsystem.

Driver Assist:

After a brief analysis of the transfer we discovered ways to save time and help the two drivers to move faster. With the help of LEDs we can determine the exact moment when the transfer was completed, when we collected **Samples** and their color (green representing the transfer and yellow, red and blue the color of the **Samples**)



To reduce the stress caused by the lack of visibility at certain angles, we decided to use the **RGB** Indicator Light from **goBILDA**. We decided to use them because they fit perfectly with our game strategy based on collecting in **Submersible**.

To be as visible as possible, we positioned them on the sides of the robot, above the Control and Expansion Hubs, being the highest point of the chassis and the most difficult to block by another robot.

Isometric capture from OnShape with the **Driver Assist**

Advantages:	Disadvantages:
• Helps drivers during the match • Easy to program	

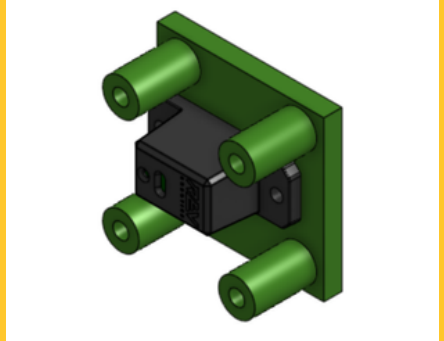
Distance recalibration sensor:

Following the experiences from testing at the Hub and at competitions (League Meet #2 and League Meet #3), we encountered quite a few problems stemming from the robot's sensitivity to external factors that vary, not ensuring constancy (e.g. initial position, odometry slippage, etc.).
Thus, in order to try to increase the robot's consistency during the **Autonomous Period**, we decided to test the use of a **Distance Sensor**.

We positioned this sensor inside the U-channel in front of the robot, at the center, on a 3D printed mount, to ensure that the sensor's alignment is optimal considering its position relative to the rest of the field and the game elements.

Usage:

We use it strictly during the **Autonomous Period** to ensure that all errors are resolved. We consider the distance from the **Submersible/Perimeter** as landmarks, these contribute to the recalculation of the desired position in order to maintain a constant set of coordinates throughout the cycles, at the time of scoring.



Isometric capture from **OnShape**:

Robot V4 - National Championship:

The Chassis and Suspension System remained the same, being satisfied with the performance of the systems.

Active Intake Prototype:

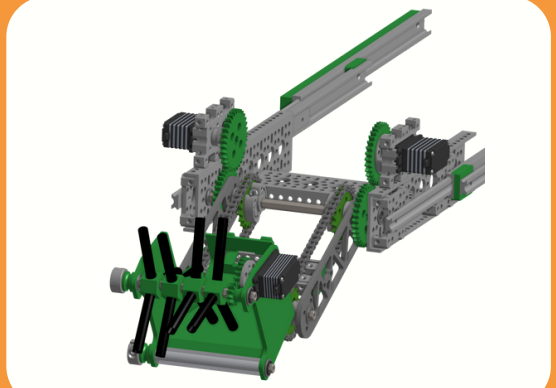
After the League Tournament stage, we analyzed the performance of the **Active Intake** throughout the matches and came to a few conclusions:

- the transfer needs to be done differently, as it is the biggest problem during the matches, and there are chances that it won't work.
- we need a more efficient intake that can **collect selectively** when we need to play with **Specimens** .
- the Intake will need to be able to collect from a greater distance, because a lot of time during the **TeleOp** period was wasted trying to collect **Samples** from the **Submersible** that we couldn't reach.

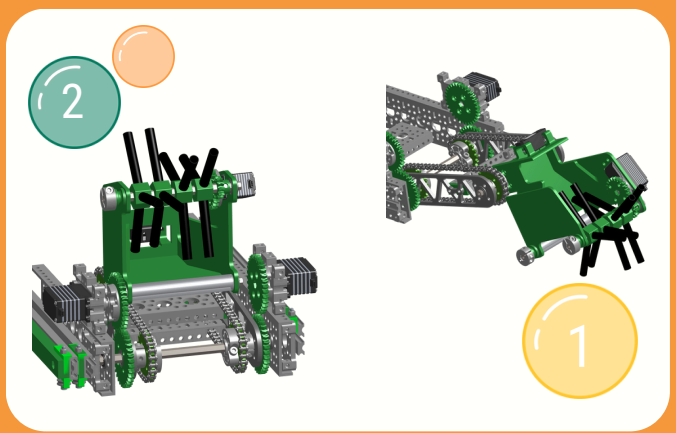
After trying the prototype with the fixed bowl, we had multiple **Brainstorming Sessions**, from February 10-12, and we came to the conclusion that instead of having the bowl on the Low Side U-Channel on the horizontal slides, we will put it directly in the Intake. The bowl, being part of the intake, solves most of the problems we had previously, especially with the transfer. It will have 2 holes on the side at the end, to have access to the **Sample** Arm Claw in the Outtake.

We continued by prototyping in **CAD**, starting on Feb 12th and finishing the first iteration on Feb 14th. After testing it, we realized that the design was not optimal, as the **Samples** were often stuck at the entrance to the tank. Thus, we continued by starting prototyping the next iteration, reducing the distance between the side walls, where the **Samples** enter. The Intake was completed on Feb 17th.

The Intake was designed as a bucket, with a tube system, as in previous versions, with a 1:2 transmission through an Axon mini. We also added a bottle rolling with a heat-sealed belt transmission. In addition, it was adapted with a REV Color V3 Color Sensor which makes the collection and scoring much more efficient. For the Arm and Wrist we used 2 Axon MAX, using a chain transmission, to allow us to collect the **Samples** by holding the **Intake perpendicular/passive**, but also **horizontal/active** and to put it in the optimal transfer position.



The perpendicular/passive position helps us when **selectively collecting Samples**, especially when playing **Specimens** , as more **precision** is needed.



The horizontal/active position helps us more when **cycling to the Basket**, as it is much faster and more efficient and allows us to collect further into the **Submersible**.

The strength improvement was increased by cutting 2 aluminum plates that are part of the Intake, making it stiffer and lighter.

Isometric capture from **OnShape** with the **Active Intake Prototype:**

SWOT Analysis:

The good	The not so good
Strengths: • Much more efficient collection from Submersible • 2 collection positions	Weaknesses: • Selective collection can be quite difficult for drivers during **TeleOp**
Opportunities: • 10 **Specimens** / 15 **Samples** in **TeleOp**	Threats: • **Sample** not detected by **Color Sensor**

Conclusions:

In conclusion, the new Intake is much more efficient and practical, solving most of the problems encountered previously. Although there are still risks in the transfer and the mechanical complexity can lead to failures, this Intake represents a significant improvement over the previous version and will contribute to better performance in competitions.

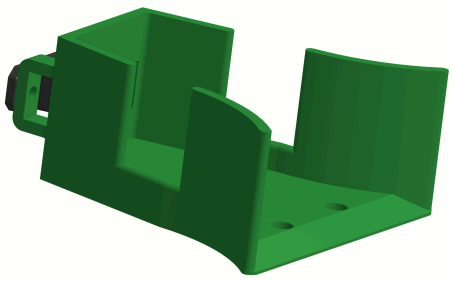
Fixed Bucket prototype:

After brainstorming sessions after the League Tournament round, we decided to make a small and safe improvement to the current robot, before we started prototyping another intake.
On February 10th, we started prototyping **a system with a fixed bucket** on the Low Side U-Channel on the horizontal Slides. This system allows for transfer from the Intake while the horizontal slide is retracting, thus reducing cycle time.

We decided to make the Bowl wider at the entrance, because a big problem we had in almost all the matches in the League Tournament was the transfer from the Intake to the Bowl. We also implemented two holes in the side walls to allow the **Claw** in the **Outtake** to grab the **Sample**, to score it.

We used a **REV Color V3** at the end of it to detect the color of the **Sample**. This way, we know exactly when the transfer from the Intake has been made, and the **Sample** is in the right position.

Isometric capture from **OnShape** with the **Fixed Bucket Prototype**:



SWOT Analysis:

The good	The not so good
Strengths: • Efficient • Improved collection efficiency	Weaknesses: • Increased complexity • Requires precise integration • Requires recalibration and testing
Opportunities: • Achieve consistent 6 second **cycles** • Increase range • Improve mechanical reliability	Threats: • Requires precise integration

Conclusions:

In conclusion, the fixed tank prototype brings significant improvements in transfer efficiency, **reducing cycle time**. This mechanism represents a reliable solution that we can fall back on if alternative variants do not provide optimal results.

Arm:

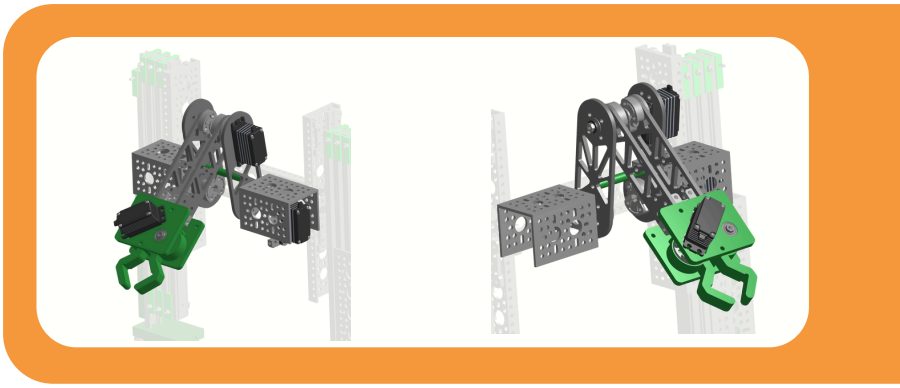
After the League Tournament stage, we analyzed the robot's performance throughout the matches and came to the conclusion that the most time in a cycle was lost due to the slow transfer. So, we started by doing a **Brainstorming Session**, which helped us find many ideas that could significantly improve the transfer. We realized that we could use the **Pendulum Arm** idea, which we prototyped during the winter break, adapting it to the new transfer idea.

We thought that the best option was a **Pendulum Arm**, because it allows us to **cycle Specimens without rotating the robot 180 degrees**, but also to make the transfer from the vat to the new Intake much more efficient.

Then we started designing it in CAD by February 10th and finished building it on February 11th. Testing took place between February 14th and 16th. As a result, we concluded that the new Arm is efficient and easy to implement, making the transfer from the Intake much faster and the **Specimen** cycles more efficient.

At the same time, we decided that the best improvement to the Arm would be its strength, with its parts being printed in PLA. On February 26th, we CNC-cut the 4mm thick aluminum plates, which was crucial in defining the Arm, and in achieving a better, lighter and stronger transfer and Outtake.

Isometric capture from **OnShape** with the **Arm**:



SWOT Analysis:

The good	The not so good
Strengths: • Much more efficient transfer • **Specimen** cycles are more efficient	Weaknesses: • Possibility of **Samples** being blocked during transfer
Opportunities: • Much faster and more efficient **Specimen** Cycles	Threats: • Limited appointment time • High maintenance

Conclusions:

In conclusion, this change was a significant improvement in the robot's transfer and Outtake, significantly reducing cycle times, especially for **Specimens** .

Robot V5 - European Premier Event:

When prepairing for the European Championship we decided to keep our V4 Robot version intact while also creating a totally new version, V5, keeping the same base concepts.

Main Robot Changes:

Immediately after **the Nationals Championship**, from the 16th of March until the 18th, we had multiple **Brainstorming Sessions** where we analysed our robot's flaws and how we could overcome them. Structuring our timeline, we realised we had 5-7 weeks until the robot had to be finished, so that we had enough time to program it.

Our initial thought was that we needed to make as few big changes as possible, only making slight adjustments to our mechanisms, and change what truly had to be changed, like the Outtake System.

1.Reducing weight:

The biggest flaw for our robot was that we were using too much GoBILDA, which made it very heavy. This did not only affect the movement speed around the field, but also the lift, the outtake and the horizontal extension.
So, we decided to use **3mm aluminium plates**, while using **Topological optimization**, so called **Pocketing**, replacing the old 4mm polycarbonate we used, **reducing around 0,5kg - 1kg** all around.

2.Changing the Outtake:

After playing **Specimens** in 3 matches at the **National Championship**, we noticed some weaknesses when collecting and scoring the **Specimens** , because the angles were not optimal, and we lost **1-2s per cycle**.
In conclusion, we changed the Outtake System entirely, so we could score the **Specimens** directly on the trajectory, without having to stop each time in front of the **Chambers**.

3.Doubling Lift speed:

By adding another 1150 RPM motor we doubled out Lift extension speed, from 3s to 1.5s, while still having the same torque. This was a simple, yet very effective improvement, that we could add, without taking any risks. Also, moving the motors more centrally, while using Bevel Gears, improved the centre of gravity.

4.Accelerating the Ascend:

Another mechanism we saw we could improve was the **level 2 Ascend**. In our **Nationals Championship**, Ascends after the buzzer were not counted, so a lot of points were wasted, due to poor time management. Essentially, we needed to reduce the time of the Climb, **from 5 seconds to 2-3 seconds.**

5.Moving the Linkage Servos:

The last problem we identified was that when collecting **Samples** from the short side of the **Submersible**, our Linkage System for the Horizontal Extension would hit the **Low Chamber**, thus preventing it from retracting.
The solution was moving the two Servos as back as we could, and now we can score **Specimens** on **High Chamber,** while collecting **Samples** from the **Submersible**.

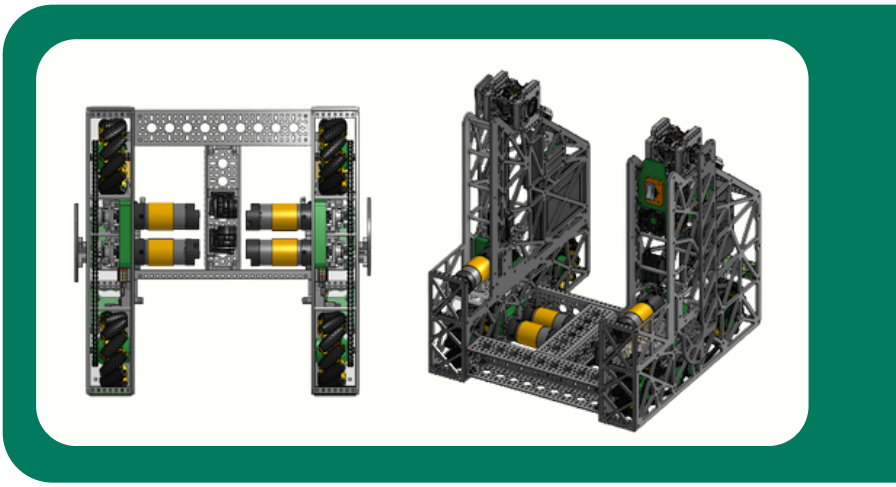
Chassis:

As for the Chassis we made a lot of changes after the **National Championship** with the help of a **Brainstorming Session** that lasted from 16th March to 18th March. First of all we decided to make the parallel Plates from pocketed 3mm Aluminum because it is less heavier and stronger than the 4 mm Polycarbonate that we had before.

We also positioned the Worm Gear and the motor for the **Ascent Mechanism** between the Plates as close to the ground as possible to lower the center of mass. Also we put the Slides on the inner plates because we wanted to get rid of the goBILDA channel to make it lighter.

After that we started the 3D Design period that started on the 20th March and ended on 24th of March where we met all the requirements from the Brainstorming.

Isometric capture from **OnShape** with the **Chassis**:



Then we started the fabrication of the pieces on the 20th April and it lasted until 30th April when we got all the pieces that we needed for this Chassis.

After that started the assembly period that lasted since 1st may until 5th may where we assembled all the pieces that we had.

SWOT Analysis:

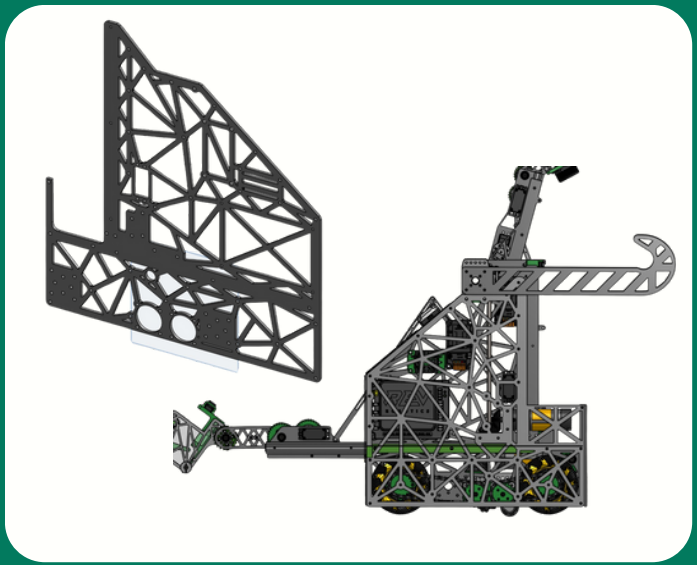
The good	The not so good
Strengths: • It is less heavy than the last Chassis that we had • The center of mass is way lower	Weaknesses: • It needs a lot of maintenance
Opportunities: • We can use it for the **European Premier Event** and also after it	Threats: • The Plates could be cut with wrong holes and that will result in problems of putting things on them

Conclusions:

By doing this we made **our first custom chassis** and it was really interesting and challenging.

Topological optimization (Pocketing):

For the **European Premier Event**, we decided to use the technique of topological optimization, more exactly **Pocketing**, to make the robot as light as possible, without losing its strength. We used this method on important parts like the Chassis Plates and the Intake and Outtake mechanisms.



Isometric capture from **OnShape** with the **Pocketing**

Our game strategy is based on speed, mobility, and consistency, and a lighter robot helps in all of these areas. A light robot moves faster, is easier to control, and puts less stress on the motors, which makes it more stable and efficient during matches.

We looked at the original design and found areas where we could remove material without affecting performance. We used Pocketing, which means cutting holes or spaces in areas where the material is not needed.

We designed these parts in CAD and tested them using **FEA (finite element analysis)** to make sure they are still strong enough.
With this process, we reduced the weight by up to **30%** on some parts, while keeping the functionality and strength. Also, the design looks better and is easier to make with our tools (CNC* and 3D printing).

This idea helped us learn more about engineering thinking and gave us a real advantage in the competition. We plan to use this method on other parts too, to keep our robot fast, strong, and reliable during the season.

Avantages:	Disadvantages:
• Weight • Speed • Efficiency	• Complexity • Time • Manufacturing

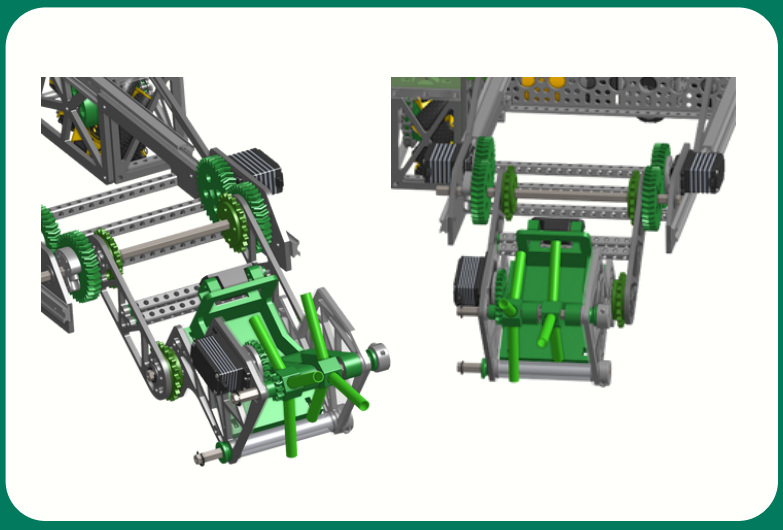
Conclusions:

As it proved efficient and a pivot point in our robot design we implemented all of the topological improvements, with regard to the original concepts, as the previous iterations, or the testing phase, proved their worth , stability and maintainability. Straying from the original design was minimized and in doing so we fused Pocketing into our existing design without actually sacrificing all that we built throughout the season, just improving one of the biggest downsides of our robot, it's weight, thus leaving us with a blend of improvement and predictability when it comes to the handling and structural integrity of the robot

Active Intake:

For the **European Premier Event**, we analyzed the performance of the Passive Intake and identified some key areas for improvement. Specifically, we noticed issues with mechanical strength and game piece collection during matches. As a team, we decided to make the necessary changes for the next step.

We replaced the side walls of the Intake with 3 mm Aluminum Plates, processed through Pocketing. This significantly increased the rigidity of the mechanism, without adding unnecessary weight. This modification made the Intake more stable and reliable during intense competitions.



Isometric capture from **OnShape** with the **Active Intake**:

We also modified the shape of the bucket so that the game pieces would enter more easily and not get stuck.

We adjusted the angles and contours of the entry curves, resulting in smoother and faster collection, reducing the time wasted during cycles. Another important improvement was the addition of **a Clamp above the Bucket**.

It helps hold the pieces inside the Bucket after collection, **preventing them from bouncing out during rapid movements or sudden robot shifts**.

The Clamp only opens when the piece is transferred to the outtake, improving safety and control over the whole process. Our strategy remains: constant, reliability, efficiency, and speed are essential elements for our success.

After implementing the new improvements, the intake became safer, faster, and more efficient. We significantly reduced incidents of pieces being lost and improved the collection time, giving us better control over the game.

Avantages:	Disadvantages:
• Efficient collection from **Submersible**. • Collects from two angles • Faster and more reliable	• Selective collection is hard in **TeleOp** • Needs frequent maintenance

Conclusions:

In conclusion, the improvements made to the intake have made it more efficient and reliable. These changes help us collect game pieces faster and more safely, improving the robot's performance in competitions. We are confident these changes will contribute to a better performance in future stages of the competition.

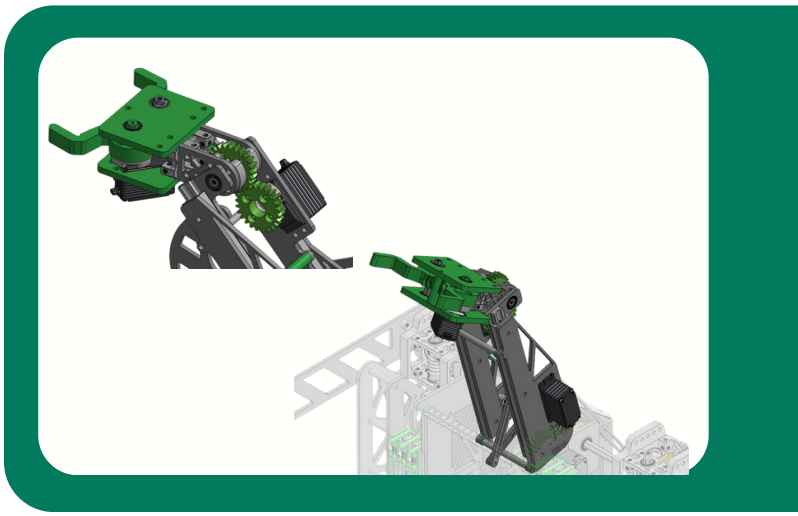
Outtake:

While prototyping the Outtake system we had in mind two main things: to minimize the time it took to score **Specimens** and to score them using the Chassis.

The mechanism contains a Passive Claw that we have also used in the past due to its reliability, with a wrist driven by a AXON MAX servo with a 1:1 ratio, placed on two MISUMI sar220 slides.

One factor that changed the speed we placed the **Specimens** with was not having to lift the whole assembly in order to reach the **High Chamber**.

The Slides made it easy to reach the bar while the Wrist helped place them at an angle.



Isometric capture from **OnShape** with the **Outtake**:

By using the Chassis we reduced the stress we would have to put on the Servos, relying on the Motors to score.

Lift:

After the **National Championship**, we realized we needed a faster lift, especially while scoring **Samples** on the **High Basket,** as our slow scoring was one of the biggest liabilities in-game.

The biggest problem that we could solve with our Lift was the weight, as we used too many GoBILDA U and C channels. Replacing them with custom 3mm Aluminium Plates and goBILDA Square Beams reduced the lift weight considerably.

This change not only helped speed up the Lift Extension speed, but also to have a better center of gravity while scoring on **High Basket**.

We decided to add another 1150 RPM motor to our lift, doubling the speed while having the same torque. This reduced every extension **from around 1.5 sec to less than 0.5 sec.**

For our **Pulley syste**m, we use 2 separate Pulleys for each set of string, one for extending and one for retracting. This helps to not get the string tangled.

More changes:

- we placed the motors more centrally and horizontally, by using goBILDA Bevel Gears
- we lowered the Shaft with the Pulleys

Isometric capture from **OnShape** with the **Lift**

SWOT Analysis:

The good	The not so good
Strengths: • x2 faster lift than V4 • Very reliable • Great center of gravity	Weaknesses: • While doing transfers, **Samples** don't have enough space to pass through the middle, so they have to go over the top
Opportunities: • Reducing **Sample** and **Specimen** cycles by almost 1 seconds each.	Threats: • String, being on the outside, can get cut by other robots

Linkage:

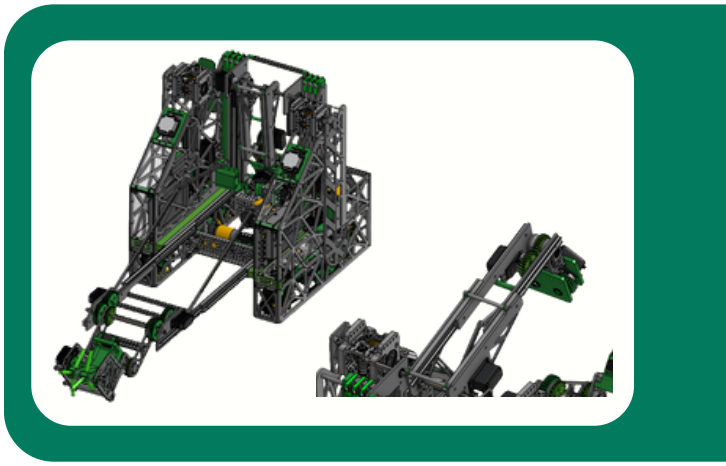
After a period of **Brainstorming** we decided for our Horizontal Slides and the Outtake Slides we decided to use a Linkage. As for the Horizontal Slides, firstly we decided to use four bars made from 3 mm Aluminum Pocketed and they were actioned by two Servos.Two bars were 220 mm and the other two bars were 300 .

For the Outtake we used only two bars actioned by a Servo. One bar was 85 mm and the other was 100 mm.

Then we started designing them in **OnShape** and that took from 24th march until 26th march.

After that we fabricated them from 24th April to 30th April. This time we cut them at a CNC

After that we assembled them on the robot. That took from 1st of May until 3rd May.



Isometric capture from **OnShape** with the **Linkage**

Advantages:	Disadvantages:
• They were custom and we could make them the perfect dimensions • They were pocketed and they weren't heavy	• The bars were to long and could easily deform.

Conclusions:

By doing this mechanism we learnt that we can't make the bars custom if they are very long because they could deforme.

Ascent Mechanism:

For the **European Premier Event** we decided to make some big changes to our robot. As for the Ascent Mechanism we decided to keep the same concept but at the same time lower the center of gravity and make it less heavy.

To do that we changed the motors from 223 RPM to 312 RPM to make it faster but also we positioned them lower to the ground, above the wheels and near the linear slides, using bevel gears from goBILDA with a 216mm REX shafting.

To do the **Ascent** we grab the **Rung** with two 3D designed hooks made out of 3mm Aluminum with Pocketing to reduce material in low stress areas.

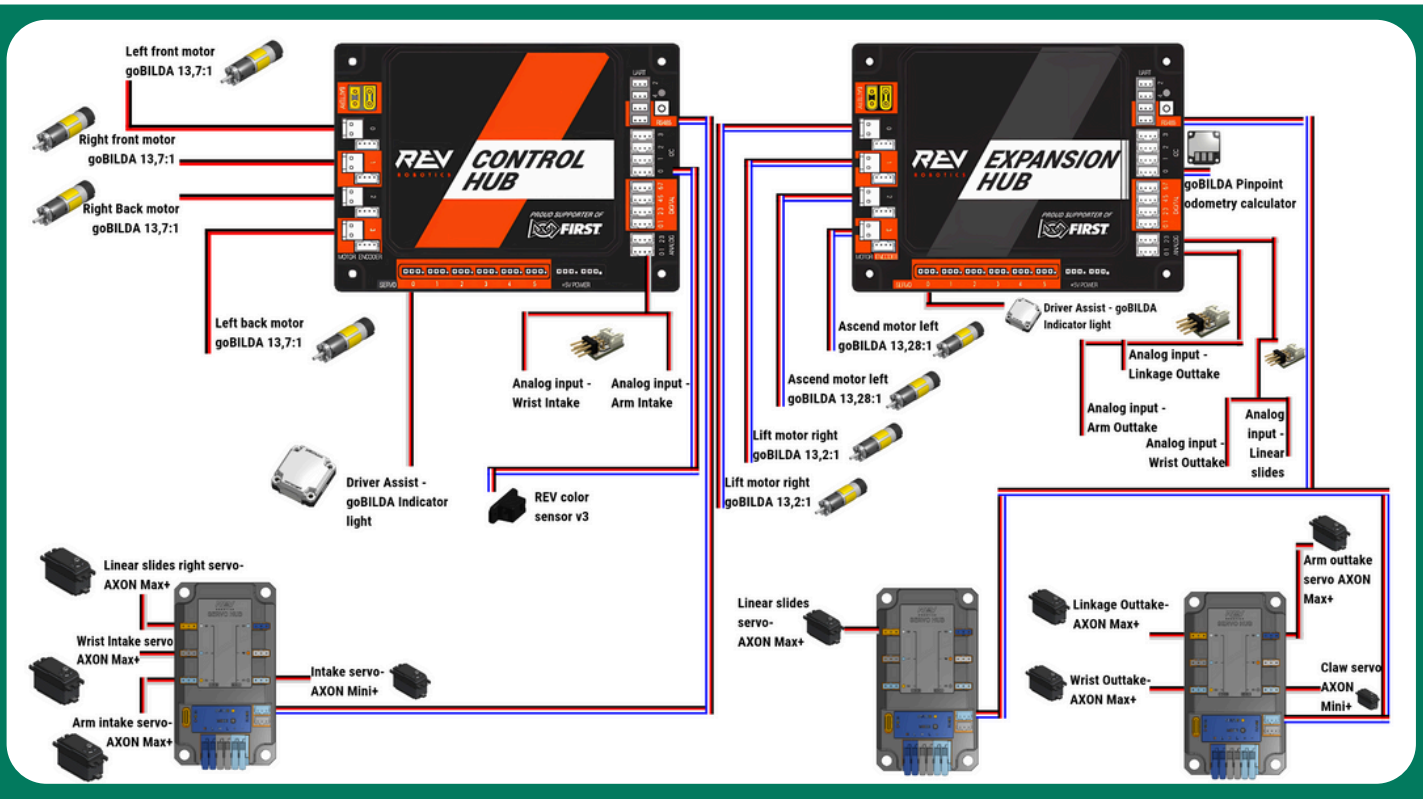
Capture from **Stress Analysis** for the **Ascent Mechanism**

Avantages:	Disadvantages:
• it is a lot lighter	• at first we thought the hooks may bend, but until now, in testing, it didn't occured to us.

Cable Managment:

For the V5 Robot we decided to put a little bit more emphasis on the cable managemenrt and so we made the next changes to the way we think about a certain design and its implementation:

- We created designated cable paths, especially for the main power line and motor cable paths running along the chassis, leaving space between moving parts and places to secure the cables to the plates.
- After the Nationals where we tasted some Polycarbonate Servo Cable Clips made by Plex Robotics (a local FTC Part manufacturer and reseller) we made the final switch to them, fixing and securing them with a piece of tape just to be extra sure that the cables are properly connected.
- We made the switch to REV Servo Hubs from REV Servo Power Distribution Modules and tired to place one on the lift and one on the horizontal slides, because it would have made cable routing much easier, needing to manage only an RS45 Data cable and a Power Cable and the analog encoder outputs, reducing the number of cables on the slides from 12 to 9. Unfortunately we realized that we don't have enough space to place one on the horizontal extendo.

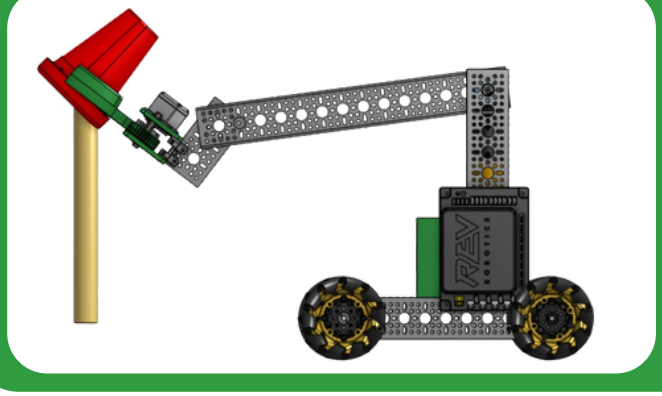


- For the lift we made the switch from retractable key rings that were clunky and needed to pull the cables outside of the robot chassis to work to routing them on special 3D Designed cable adaptors for Misumi Slides.

- And we decided to try out the GoBilda Cable sleeve, because it is stronger and easier to use than the plastic coil cable sleeves we used to use.

It wasn't a straightforward process and we still made a few mistakes until arriving at the final design, but all these changes minimized out chances of having cable management problems during a competition

Volunteers Robot:



With the beginning of the **OffSeason** period, we decided to give our volunteers the opportunity to build their first robot that we are going to use for the presentations with kids.

We wanted this robot to be as simple as possible in order to be easily controlled by anyone, and to be able to score the cones from **POWERPLAY** season on the **Low Junctions**.

This robot consists of an H-shape chassis made from standard goBILDA U channels, with Mecanum Wheels actioned by four AndyMark NeveRest Orbital Gearmotors with 20:1 gear ratio and 344 RPM.

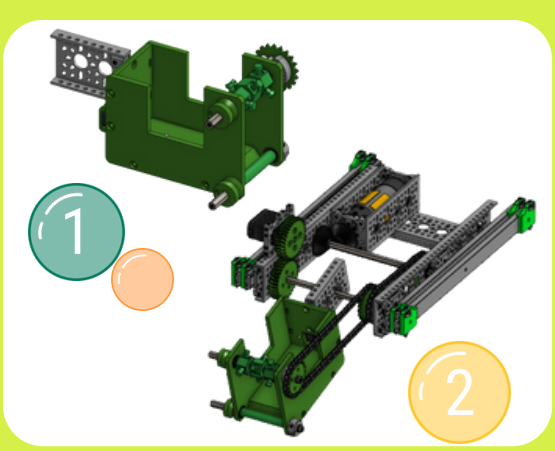
For the scoring system, we use a Passive Claw mounted on a 13 hole GoBILDA Low-Side U Channel that is actioned by a motor with Bevel Gears mounted on a 10 hole goBILDA U Channel placed vertically on the Chassis.

Prototypes:

Motor driven Intake:

To collect **Samples** from the **Submersible** and from the field more quickly, we decided to make an iteration of the Intake driven by a motor.
We started with a **Brainstorming** period in which we decided the following things:

- We will use a Counter Roller that will touch the ground to collect very well from all over the field, and this will be connected to the tube shaft by a heat-weldable belt
- The transmission from the motor to the tube shaft will be done by two Bevel Gears, one placed on the motor, one placed on the shaft parallel to the other on which the Intake is located. On this shaft we placed a pinion that was connected by a chain with a double pinion that rotated freely on the shaft with the Intake. The second sprocket is connected by chain to the tube shaft on the Intake so that when the motor rotates the Intake shaft will not rotate allowing us to put a wrist on that shaft
- We use a 435 rpm motor because if we put one with more rpm, it would not have enough torque



- The Intake must have a place for the arm claw to catch the **Sample**
- The Intake must have a Distance Sensor so that after collecting the tubes it is stopped and does not throw it away

Then followed by a 3D design period in which we made a first prototype. This lasted from December 21st to December 23rd. Then comes a fabrication period that lasted from December 24th to December 26th in which we printed all the parts we needed.

Isometric capture from **OnShape** with the **Motor driven Intake**

Then came an assembly period that lasted from December 27th to 28th in which we put all the pieces together. Finally, we tested it from December 28th to January 2nd.

Advantages:	Disadvantages:
• Collects very well and quickly	• Chain can get de-meshed • Very heavy • Has Bottom Plate

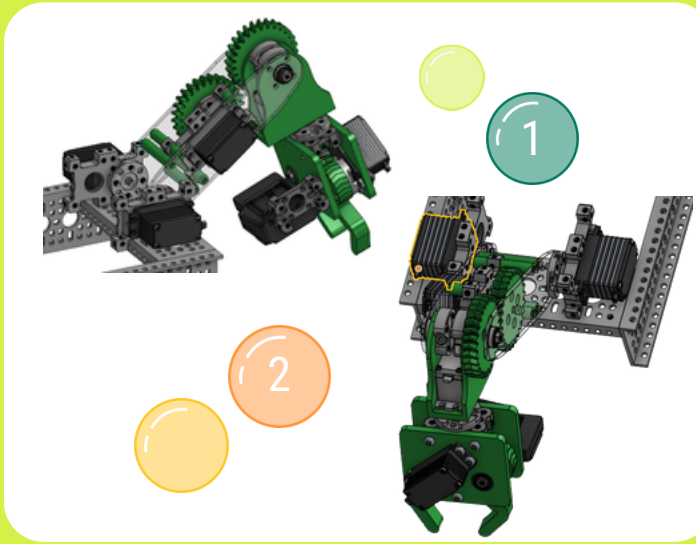
Conclusions:

By creating this mechanism, we tested a new way of collecting and, even though we don't use it, we learned a lot.

Claw Intake:

During **Brainstorming Sessions** during the winter break, we decided to prototype a Passive Claw Intake. This was intended to be used in all game strategies, namely collecting **Samples** from the **Submersible** as well as collecting **Specimens** from the **Perimeter** in the shortest possible time, but also accurately.
The prototype was designed to be substantially improved compared to other similar Intakes seen on most teams where we found this Intake.

The prototype started from the idea of being as mobile as possible and having as few restrictions on its movement anywhere in the **Submersible**, even on the field during the game, in order to collect from as many positions as possible. The idea that we developed in building this Intake Claw Prototype was to use a video camera to locate the **Sample** and collect it, wherever it was, thus improving its use by the driver, but also a better collection precision.
It has 2 pivots, 2 wrists, 3 MAX Axons and 2 goBILDA Speed Servos, for mobility, but also a very large **Sample** coverage area, not exceeding the allowed dimensions.



Isometric capture from **OnShape** with the **Claw Intake**:

Advantages:	Disadvantages:
• Collection speed • Collection area • Collection Automation	• Sturdiness • Wiring

Possible improvements:

- Rigidifying the walls using polycarbonate
- At the pivots and the first wrist, let's put Axon Mini

Conclusions:

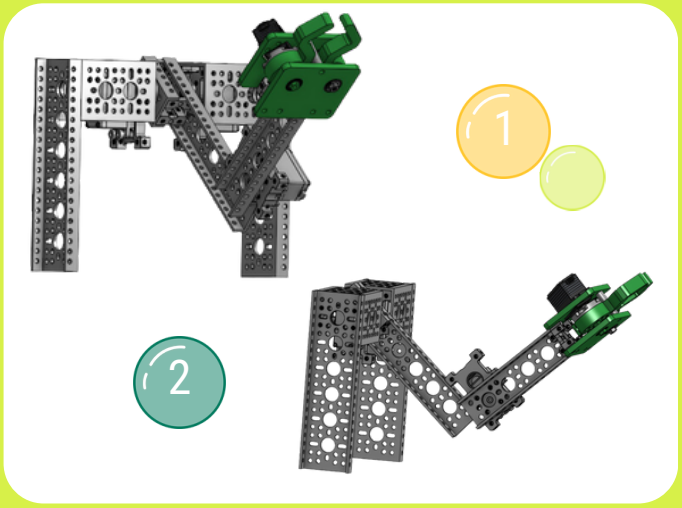
In conclusion, this prototype was a success, having favorable results during the testing period, being a very accessible option for use in future competitions.

Claw Transfer:

For the Active Intake with Motor and Passive Intake iterations we decided to also prototype a transfer using Passive Claw. Both prototypes had two points of movement (Arm & Wrist) to be easy and for collecting and placing the **Specimens** .

- **Motor driven Intake**

For this variant we needed a much longer arm but a short wrist to be able to make much smoother movements to make the transfer inside the intake as easy as possible, but also to have the necessary length to take the **Specimens** from the wall on one side and transfer them through the robot to reduce the cycle time.



- **Claw Intake**

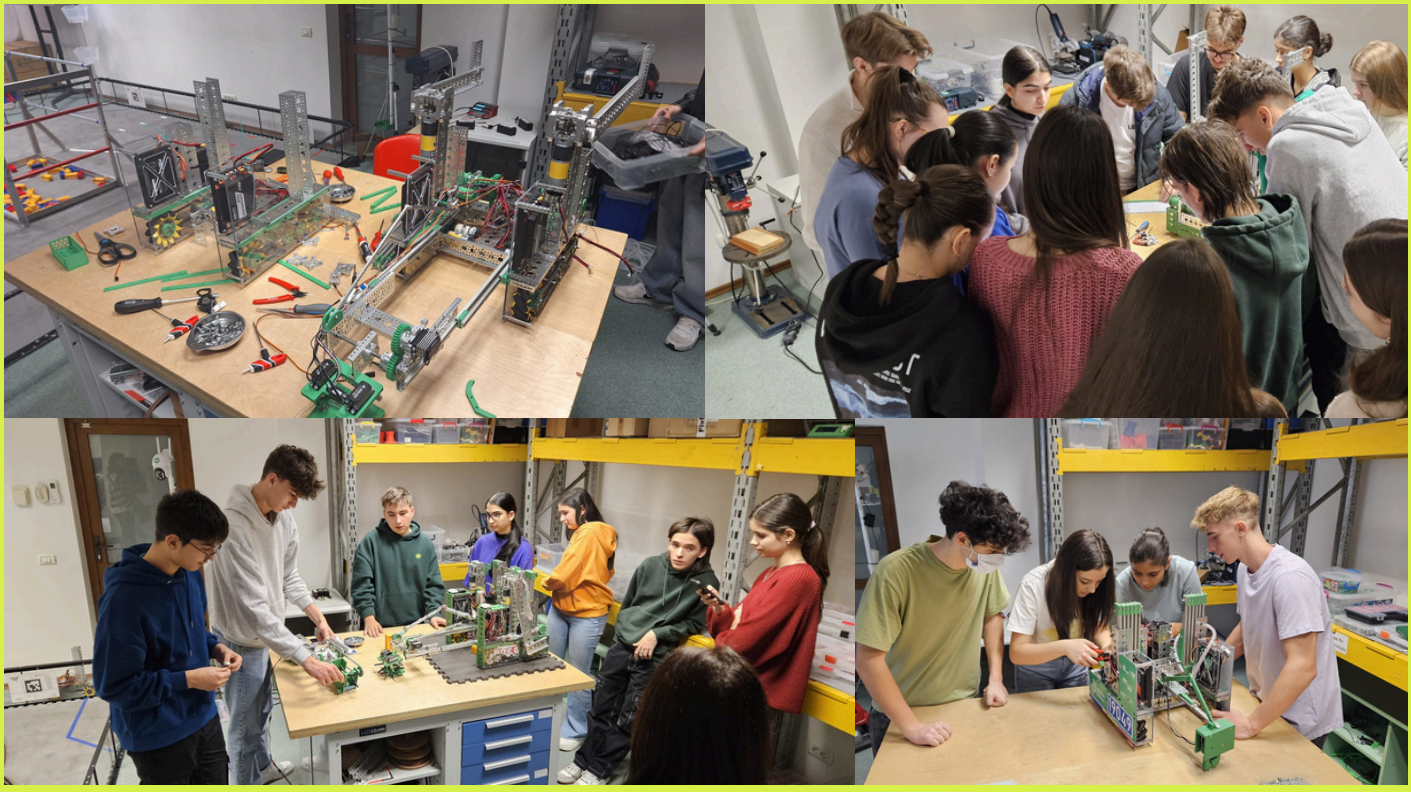
For this one we wanted to keep as many transfer and play options as possible, with the drivers field testing them to choose which one they prefer.

1. We kept the idea of using the Arm to collect from the wall and placing them on the **Chamber** with the same **Arm** from the previous iteration.
2. We have the option to do the transfer "Face to Face" with the Intake Claw at the same level as the transfer to be sure the transfer is done.

Isometric capture from **OnShape** with the **Claw Transfer**

3. The "From Above" Transfer, this requires the highest level of precision, but we considered it the easiest for the opportunity to collect the **Specimens** from the wall with the extension and to be able to make the transfer. Using the previous method we could not have done this, because the **Clip** would be oriented towards the inside of the Claw, so we can no longer place the **Specimen** on the **Chamber**.

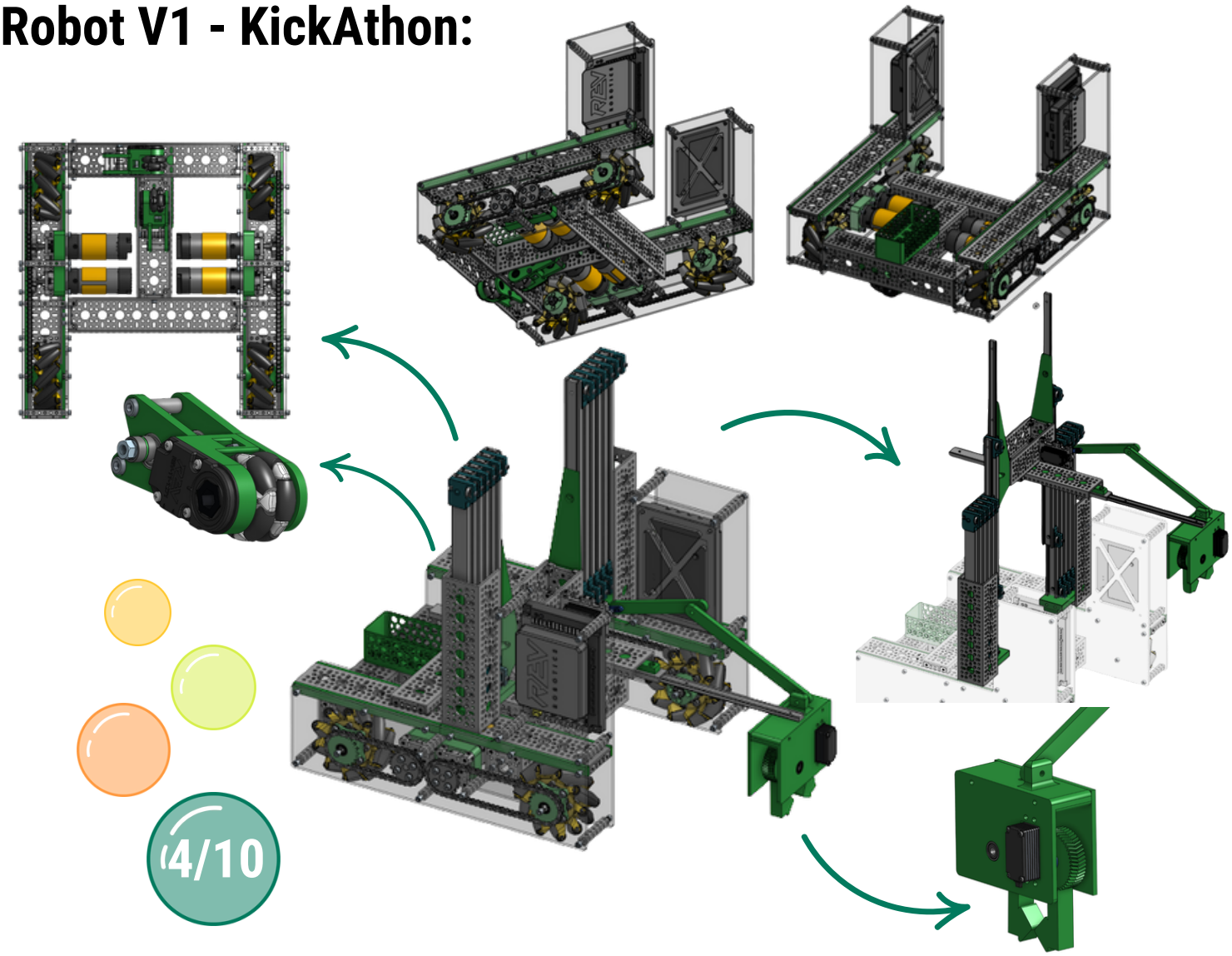
Thus we have two segments of equal length to perform all these movements and we translated its position towards the center to shorten these segments as much as possible.

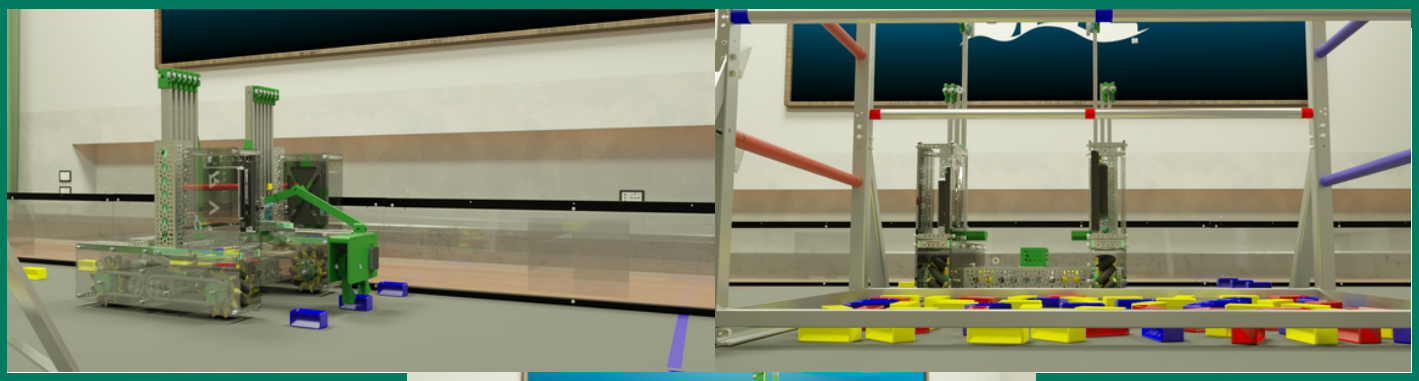


ROBOT EVOLUTION

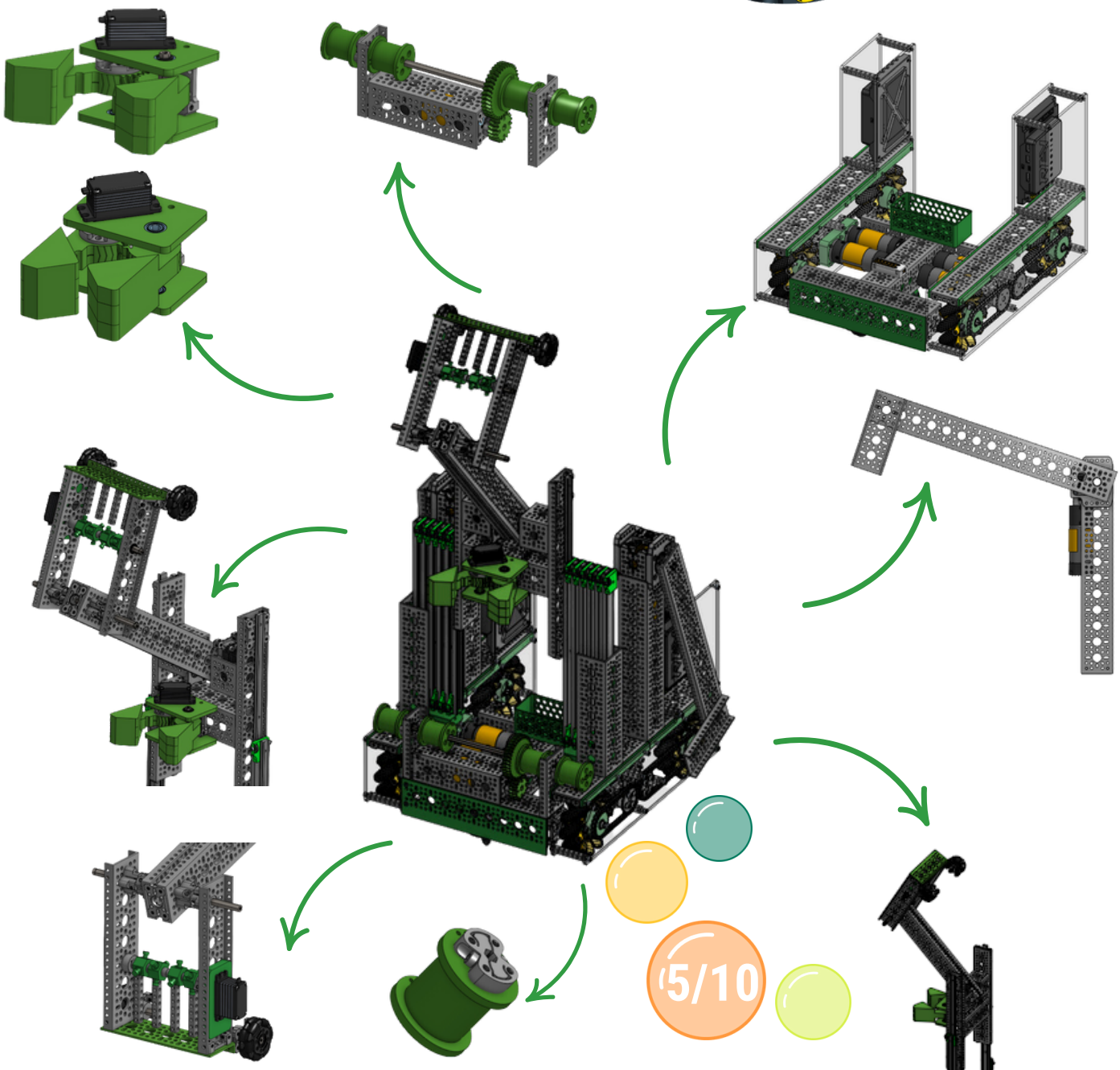
SEPTEMBER 2024 - JUNE 2025

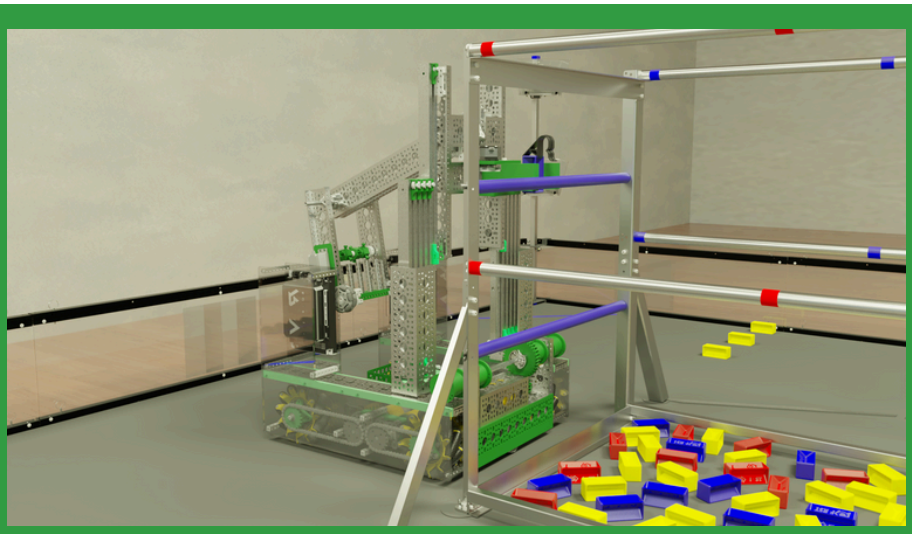
Robot V1 - KickAthon:



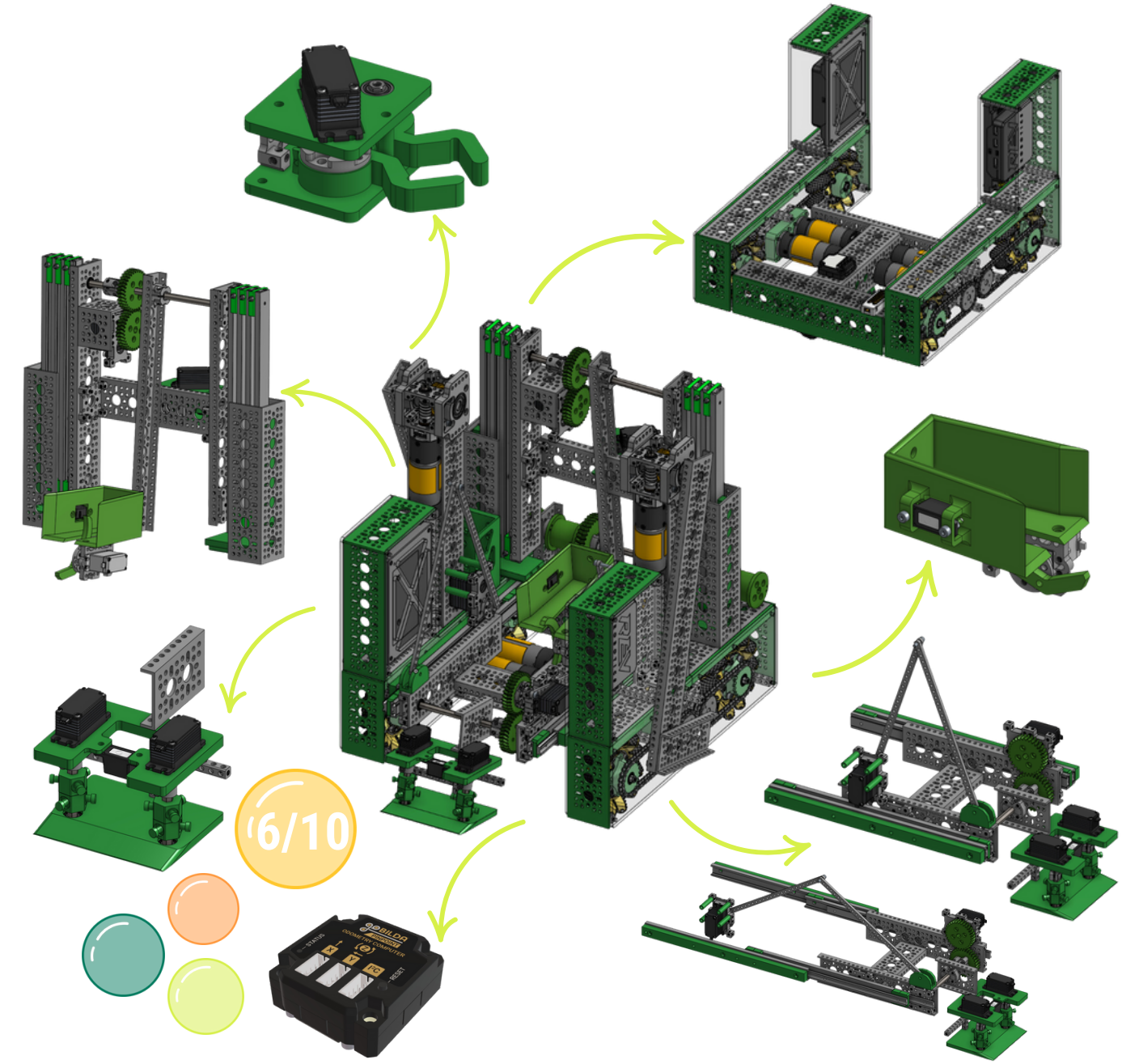


Robot V2 - League Meet #1/ Batman:

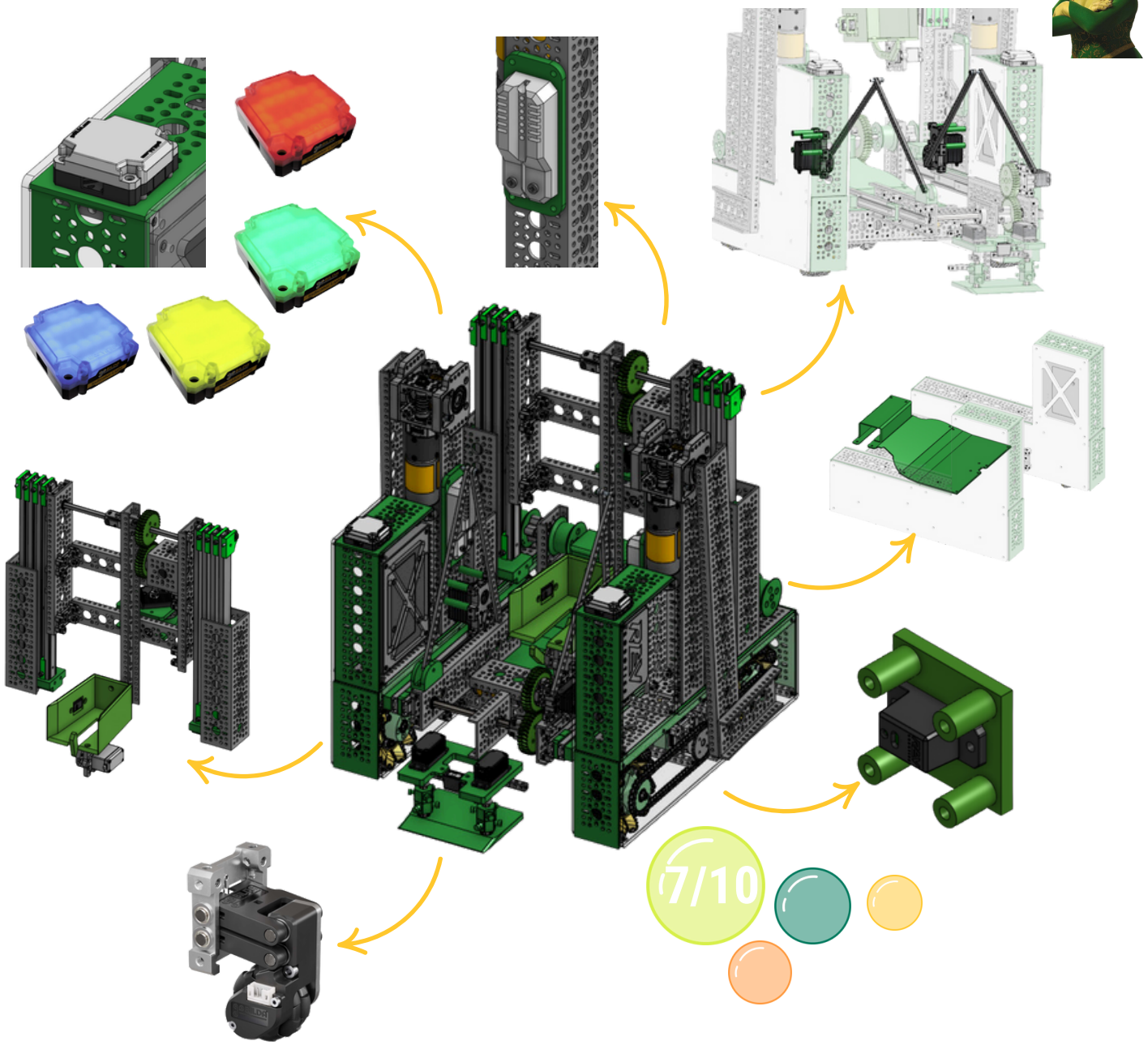


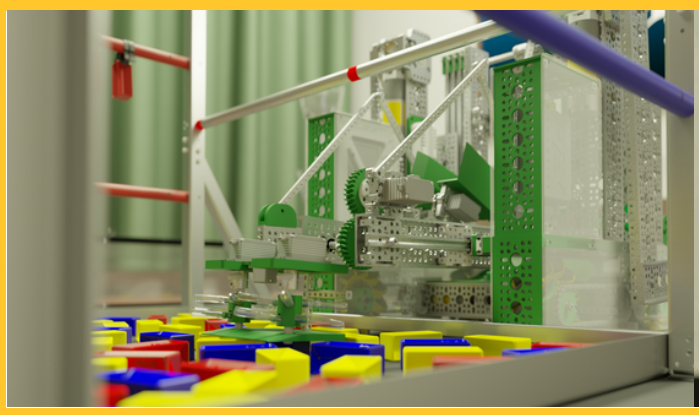


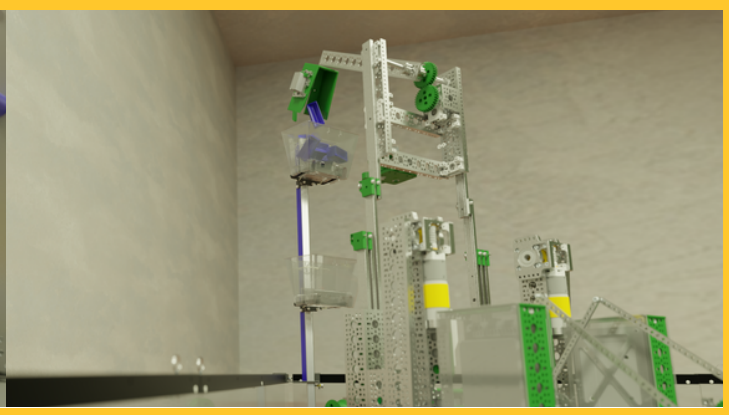
Robot V3 - League Meet #2 + #3/ Batmobile:



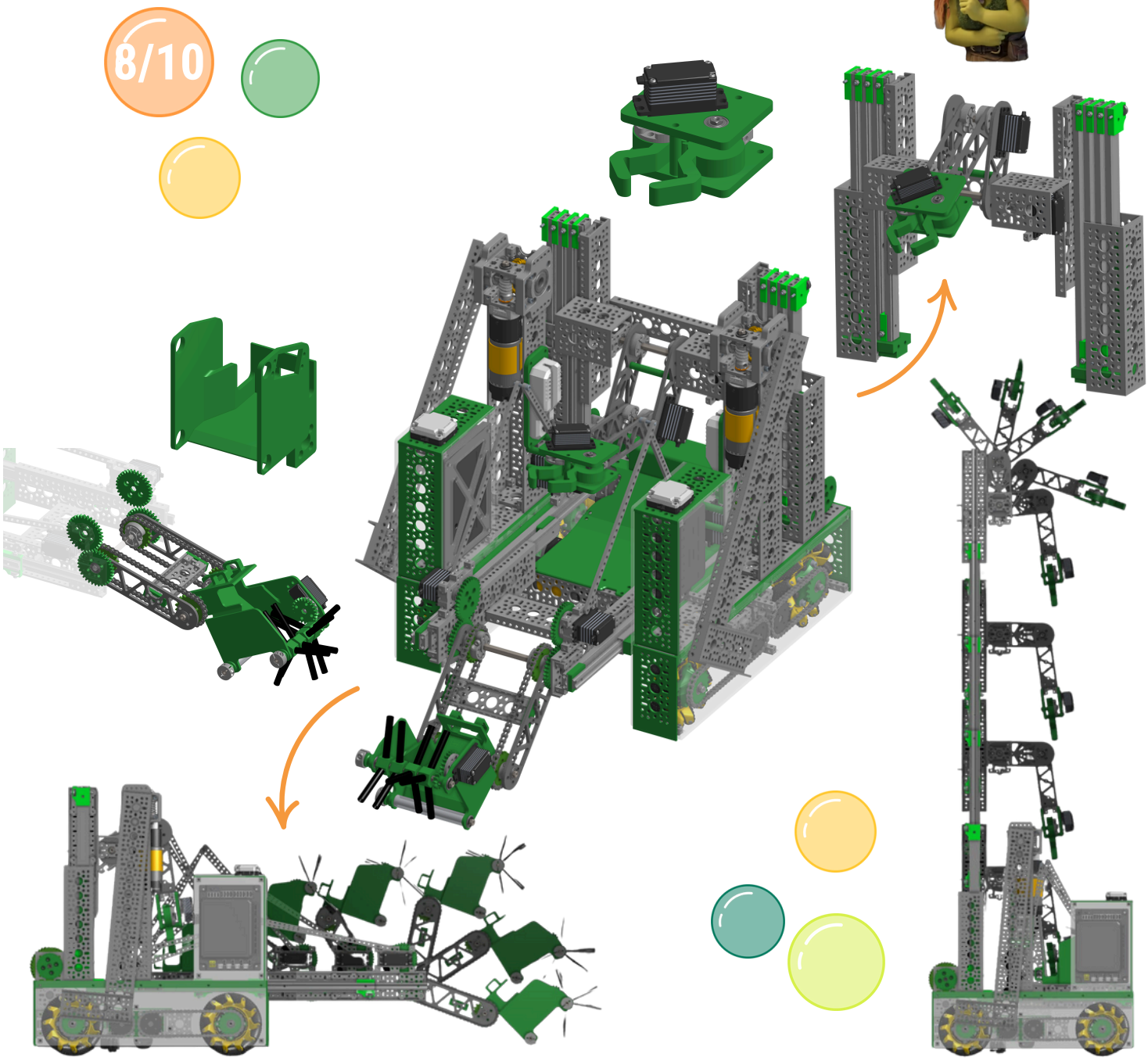
Robot V3.1 - League Meet #4 + League Tournament/ Fiona:

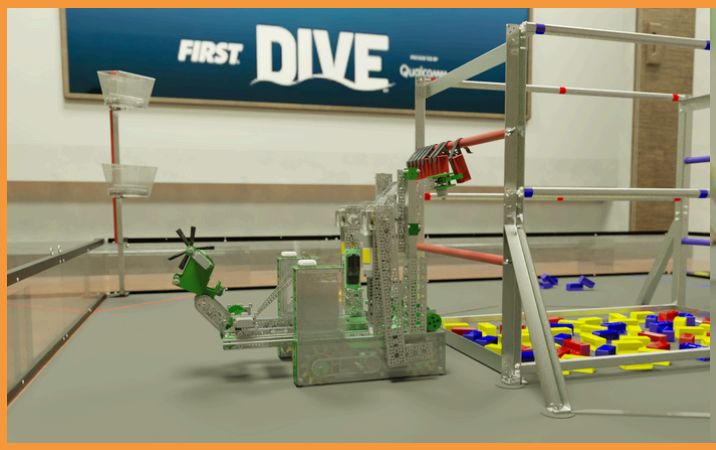


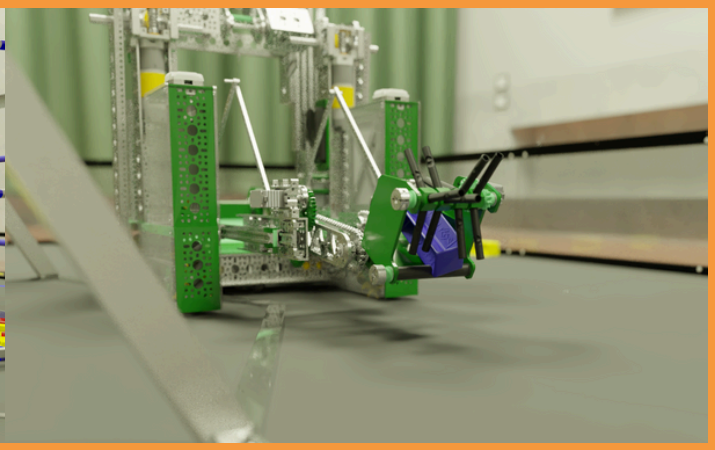




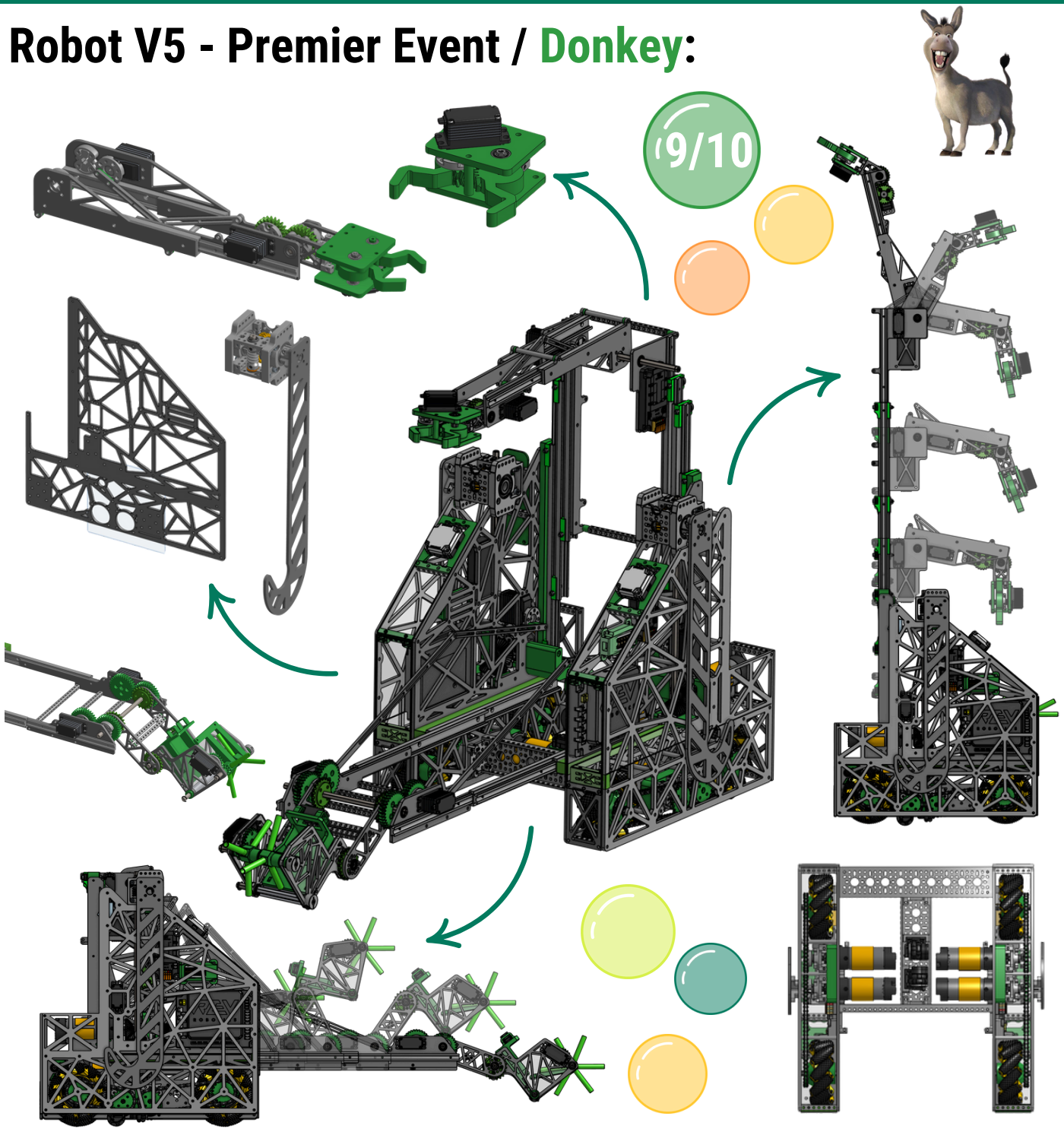
Robot V4 - National Championship/ Felicia:

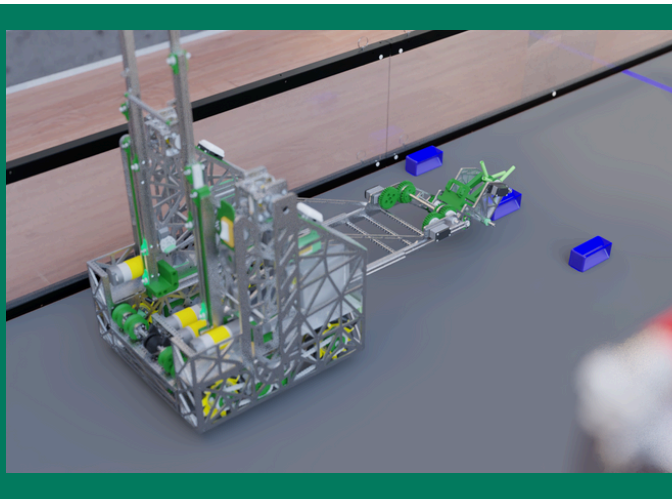


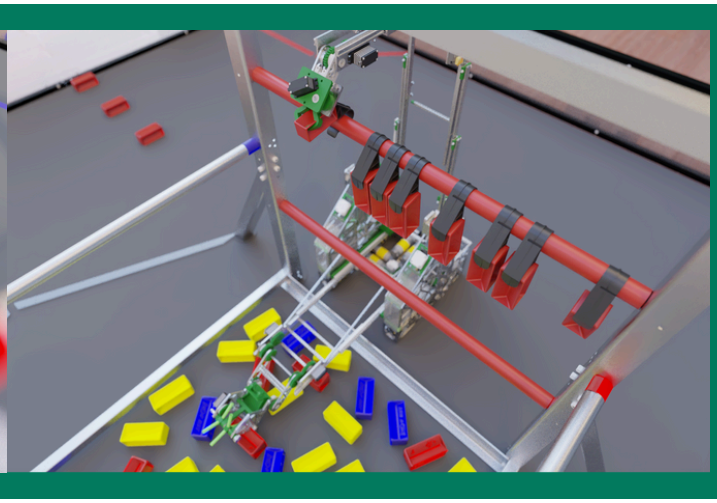




Robot V5 - Premier Event / Donkey:







SOFTWARE

APRIL 2024 - JUNE 2025

Robot V1 - KickAthon:

After the launch of the **new season INTO THE DEEP**, we participated in the annual **KickAthon** organized by **Quantum Robotics team #14270**, where, over the course **of 16 hours**, participants must adapt as efficiently as possible to the resources they have at their disposal and to the unique game rules, through innovative ideas and appropriate strategy. Thus, the challenge involved both the mechanical design of the **robot and the development** of a functional program, with **Autonomy** providing a real advantage to the teams.

During a brainstorming session, we established that we would address parking in the **Observation Zone** and placing **Samples** in the **High Basket Autonomously;** However, due to time constraints and the challenges encountered in the robot's mechanical components, we were unable to conduct enough tests. Thus, we focused strictly on achieving consistent parking in the **Observation Zone**, managing to place **Samples** only during the **TeleOp** period.

Conclusions:

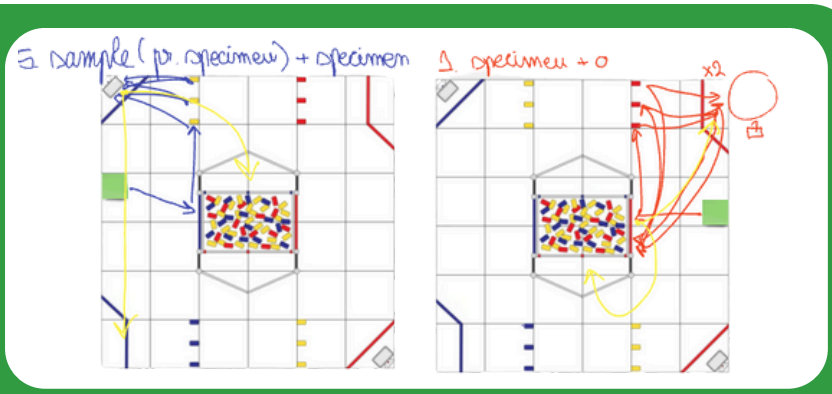
In the absence of time, we managed to form an initial strategy regarding **Autonomy** and the controlled period, which we also managed to test and validate during the demonstration matches.

Subsequently, the software program was developed, significantly increasing both the **Autonomy** score and the **TeleOp** score.

Robot V2 - League Meet #1:

Auto:

Shortly after the **KickAthon** Competition we realized that the **Auto period** is quite simple this year and offers quite few opportunities to score points. With that being said, our goal for the first League Meet (ROBOTICS DAYS #3, organized on November 23 by the **InfO(1)Robotics #15993** and **Ro2D2 #17962** teams) was a **43 points Autonomous** period, including the placement of the **Specimen preload** and three more **Specimens** that were obtained by pushing **Samples** on **Spike Marks + parking**.



Strategy:

Unfortunately, due to the lack of time, out of the 24 cases we thought for the **Autonomous** period, we had to prioritize the most important ones, which matched our game strategy. Thus, we managed to have **2 Autos for the first League Meet:**

- **Samples**, in which we had a **Specimen preload**, we collect all **3 Samples** and could park in the **Observation Zone** or in the **Ascend Zone**
- **Specimens**, in which we have a **Specimen preload**, we push 2 **Samples** into the **Observation Zone** and then score them, finally parking in the **Observation Zone**

Programming:

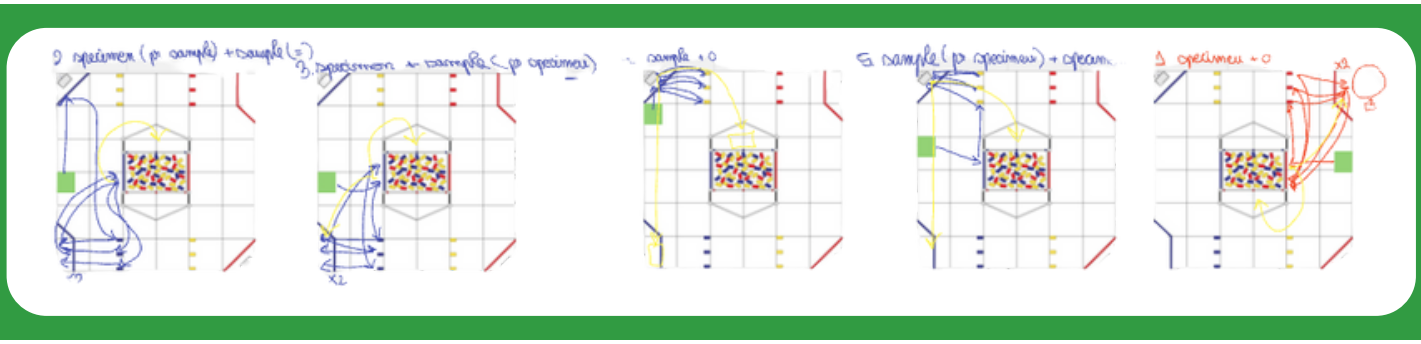
The entire **Autonomous** period was programmed using **Roadrunner 1.0** motion planning library. We preferred to use a wide variety of trajectories, to ensure that the **Auto** would be constant and to minimize error.

Results:

The results obtained in the competition provided us with validation regarding our concepts, obtaining the following scores:
Match 1: **37 points** (1 preload **Specimen** + 3 **Samples** + **parking**)
Match 2: **29 points** (1 preload **Specimen** + 2 **Samples** + **parking**)
Match 3: **37 points** (1 preload **Specimen** + 2 **Samples**)
Match 4: **37 points** (1 preload **Specimen** + 3 **Samples** + **parking**)
Match 5: **23 points** (1 preload **Specimen** + 1 **Sample** + **parking**)
Match 6: **37 points** (1 preload **Specimen** + 3 **Samples** + **parking**)

Conclusions:

We preferred to use the **Sample Auto**, because it complemented our game strategy (scoring the yellow **Samples**, in the **High Basket**) + having the highest score of both.



TeleOp:

This season we decided to have a slightly different approach than last year, dividing the controls between the two according to the actions of the chassis and the rest of the subsystems. Thus, Driver 1 is in charge of the **robot's navigation on the field** and the **level 2 Ascend** at the end of the match, and **Driver 2** has the role of controlling the **intake system and the outtake system.**

Driver 1:

Driver 1 controls the **chassis movements** via the **joysticks**.
Right joystick - **rotates the chassis**, controlling its **angle**
Left joystick - controls the **chassis movements** in the field, **front-back, left-right**
Right bumper - controls the climbers to do **Ascend Level 2**
Right + left trigger - controls the climbers, moving them in the **opposite direction** of rotation for **Ascend Level 2**
Right + left trigger + Right + left bumper - **resets** the **field centric**

Driver 2:

Since there are a lot of actions that must be performed individually, we decided to divide the controls, programming them in **2 cases**, one for **Specimens** and one for **Samples**. The cases are differentiated by the state of the Active Intake. If the Active Intake is on (collecting or in reverse motion) we have the **Sample state**, and if the Active Intake is off, we have the **Specimens state**. Also, some actions required in **both states are arranged in common.**

Common:

Right trigger - on the **first press**, the **Sample** intake **collects**, and on the **second**, the intake **scores** (**reverse movement**)
Left trigger - **stops** the rotation **movement** of the **active intake**
Right bumper - the **Specimen** intake **collects**
Left bumper - the **Specimen** intake **scores**
B - brings the **Lift** to the **collection position**
dpad_up - The **Lift** goes **up** segmentally
dpad_down - The **Lift** goes **down** segmentally
Right + left joystick - resets the **Lift** position

Sample:

A - Both the **Lift and the arm go up** to the preset scoring position in the **High Basket**
X - Both the **Lift and the arm go up** to the preset scoring position in the **Low Basket**

Specimen :

A - on the **first press**, the **Lift reaches** the preset **scoring position** on the **High Chamber**, and on the **second press**, it **scores** on the **High Chamber**, with an **Automation** that **opens the claw**
X - on the **first press**, the **Lift reaches** the preset scoring **position** on **Low Chamber**, and on the **second**, it **scores** on **Low Chamber**, with an **Automation** that **opens the claw**

Notes:

As in the case of **the second driver**, the controls are numerous, taking into account the possible human errors caused by emotions during matches, we decided to facilitate the control of the **subsystems** by **implementing** a variety of **Automations**. The most useful of them is used on the **X and A buttons** and is **described above**.

Robot V3 - League Meet #2:

Auto:

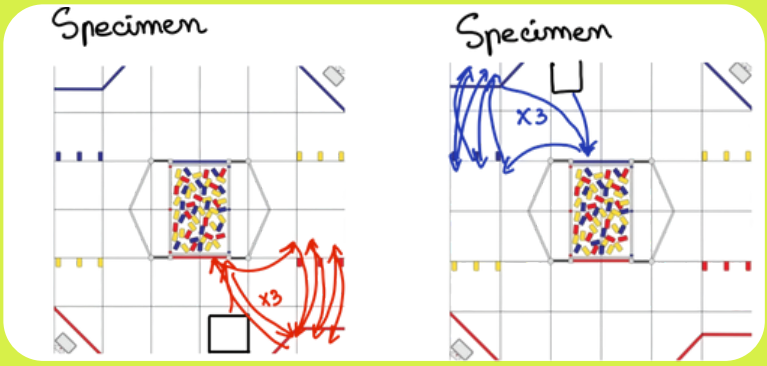
From the **first League Meet** to **the second**, the robot has been in a **continuous mechanical change**, showing some considerable **improvements**. Thereby, the **Autonomy** was much more **promising**, allowing us to **change the strategy** and **maximize the score**.
The entire **Autonomy** was programmed with the help of the **custom navigation algorithm**, called **Speedi**, made by us during the **OffSeason**. We preferred to use a wide variety of trajectories, to ensure that the range would be constant and to minimize error.

Strategy:

For the first **League Mee**t, we had an Auto for **both Specimens and Samples**, with **parking** in both the **Ascend Zone** and the **Observation Zone**, always taking **preload Specimens** , aspects that gave us an impressive adaptation regarding **teamwork with** our **alliance**. Thereby, for the second **League Meet**, we wanted to keep our strengths and we worked to **maximize** our **score**, managing to do:

1. an **Auto** of **3 Specimens + 1 Specimen preload + parking** (total: 43 points)
2. an **Auto** of **3 Samples + 1 Specimen preload + parking** (total: 37 points)

During the testing at our hub we realized that the most important aspect is the constancy of our **Autonomous** period and programming, which led us not to try to place **5 Specimens** or collect from the **Submersible** yet, since the result may vary in different circumstances.

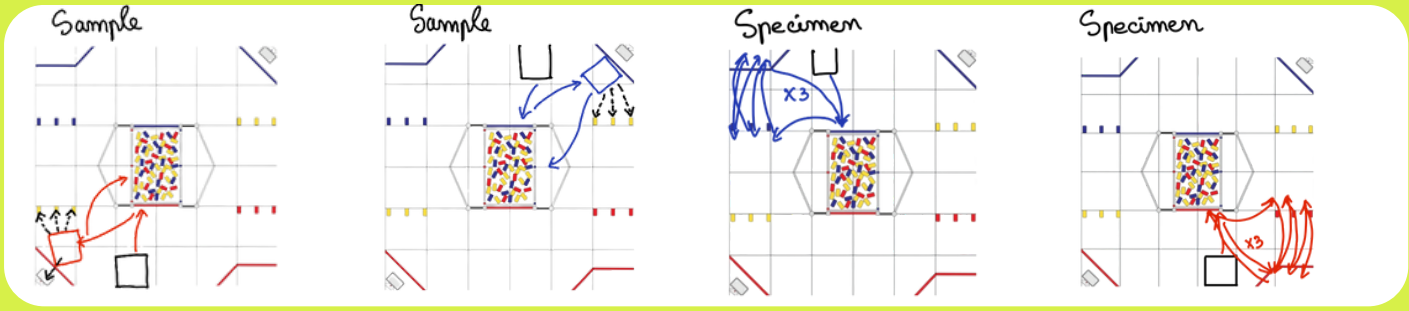


Results:

The results obtained in the competition gave us a validation, obtaining the following scores:
Match 1 : 33 points (**1 Specimen preload + 2 Specimens + parking**)
Match 2 : 43 points (**1 Specimen preload + 3 Specimens + parking**)
Match 3 : 26 points (**1 Specimen preload + 2 Samples**)
Match 4 : 43 points (**1 Specimen preload + 3 Specimens + parking**)
Match 5 : 10 points (**1 Specimen preload**)
Match 6: 43 points (**1 Specimen preload + 3 Specimens + parking**)

Conclusions:

Even though it depends entirely on the **Human Player**, with human error caused by emotions being able to intervene, the **Specimens Auto** brought us the most points and proved to be constant and adaptable, with the initial position of the robot being easily modified in the code, allowing us to collaborate perfectly with our alliance. The **Samples Auto** needs to be perfected, as this depends entirely on the position of the neutral **Samples** on the **Spike Marks**.



TeleOp:

Keeping the **same division** of **controls** between the **2 drivers** as in the **previous League Meet**, **Driver 1** takes care of the **chassis movements**, while **Driver 2** has the role of **ensuring the functioning** of the **subsystems** (**Intake**, **Outtake**, **transfer**). Regarding the **chassis**, there were **no changes** between the two **League Meets**, but from the perspective of the subsystems, the **Active Intake**, the **Passive Intake** underwent changes and we also implemented a transfer, the Intake system differing from the Outtake one. Thereby, the controls of **Driver** 1 remained almost identical, while those of **Driver 2** changed, increasing in number.

Driver 1:

Driver 1 controls the chassis movements via the **joysticks**.
Right joystick - rotates the **chassis**, controlling its **angle**
Left joystick - controls the **chassis movements** on the field, front-back, left-right
Right bumper - controls the **climbers** to do **Ascend Level 2**
Left bumper - controls the **Lift** system segmentally up
Right + Left trigger - controls the **climbers**, moving them in the opposite direction of rotation for **Ascend Level 2**
Right + Left trigger + Right + Left bumper - resets the **field centric**
dpad_left - controls the **Lift** system segmentally down
dpad_right - resets the **Lift** encoder

Driver 2:

Similar to the first **League Meet**, we divided the controls into 2 cases, one for **Samples** and one for **Specimens** . The cases vary by the state of the Active Intake. If the Active Intake is on (collecting or in reverse motion) we have the **Sample** state, and if the Active Intake is off, we have the **Specimens s**tate. Also, some actions required in both states are arranged in common.

Common:

dpad_down - **wrist** reaches the **collecting** position
dpad_left - **wrist** reaches the **intermediate** position, made for the moments when the **chassis** moves
dpad_up - **wrist** reaches the **transfer** position
Right trigger - on the first press, the **Sample** Intake collects, and on the second, the Intake scores (reverse movement)
Left trigger - stops the **rotation movement** of the **Active Intake**
B - brings the **Lift** to the collecting position

Specimen :

A - on the first press, the **Lift** reaches the preset scoring position on the **High Chamber**, and on the second, it scores on the **High Chamber**, having an automation that opens the **claw**
X - on the first press, the **Lift** reaches the preset scoring position on the **Low Chamber**, and on the second, it scores on the **Low Chamber**, having an automation that opens the **claw**
Right bumper - the **Specimen** Intake collects
Bumper left_- the **Specimen** Intake scores

Sample:

A - Both the Lift and the Arm go to the **preset scoring** position to the **High Basket**
X - Both the Lift and the Arm go to the **preset scoring** position to the **Low Basket**
Right Joystick Button - **Horizontal Sliders** extend to **the collecting position**,the **Active Intake** reaching the **collecting position** at the same time
Left Joystick Button - **Horizontal Sliders** retract to the scoring position. If the Color Sensor detect a neutral **Sample**, the Active Intake reaches the transfer position, and if it detects a **Sample** of the alliance color, the Active Intake reaches the intermediate position, to be taken to the **Observation Zone** or manually transferred to the Bucket
Right Joystick - **Horizontal Sliders** extend proportionally with the intensity with which the Joystick is being controlled
Left Joystick - **Horizontal Sliders** retract proportionally with the intensity with which the Joystick is being controlled

Notes:

As with the **second driver**, the controls are numerous, taking into account the possible human errors caused by emotions during matches, we decided to facilitate the control of the **subsystems** by **implementing a variety** of **Automations**. The most useful one of them is used on the **X and A buttons** and is described previously.

Robot V3 - League Meet #3:

Auto:

From the second **League Meet** to the third, the **robot** did not have any significant changes from a mechanical point of view. Thereby, the **Auto period** was put in the foreground, this being the easiest to improve between competitions, bringing us at least 20 additional points. We used **Speedi** again, because we noticed that it is much more efficient and faster, comparing it to what we tested during the winter break (**PedroPathing** and **RoadRunner**), the **Auto** being very constant and fast.

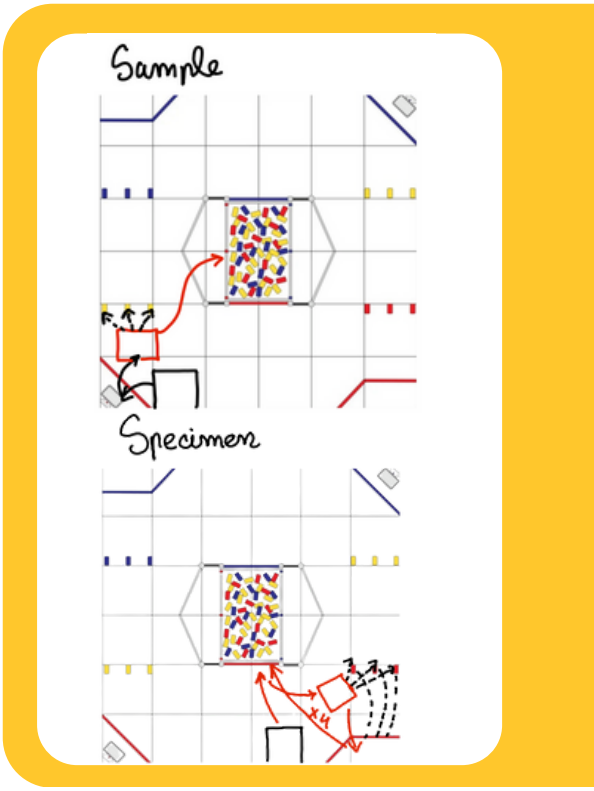
Strategy:

For the second **League Meet**, we had **Auto** for both **Specimens** and **Samples**, with parking in both the **Ascend Zone** and the **Observation Zone**, always taking **Specimen preloads**, aspects that offered us an adaptation that was not optimal, regarding teamwork alongside our alliance. Therefore, for the third **League Meet**, we wanted to keep our strengths, we worked to maximize the score and we thought that in order to be able to adapt in any instance with the alliance partner, it would be better to work on an **Auto** of **Samples** only, with the preload being a **Sample**.

We managed to do:

1. an **Auto** of **4 Specimens** + **1 Specimen preload** + **parking** in the **Observation Zone** (total: 53 points)
2. an **Auto** of **3 Samples** + **1 Sample preload** + **Ascend level 2** (total: 35 points)

During the tests, we realized that the most important aspect is the consistency of the **Autonomous** period, thus managing to achieve the **Auto** of **5+0**, through an original method, which was to push the **Samples** into the **Observation Zone** using our Intake, instead of pushing them with the robot, as we did at **League Meet** 2, saving enough time to be able to place **5 Specimens** , and if the battery was charged enough, we also had time to park in the **Observation Zone**.



Also, for the **Samples Auto**, we have several **Fail Safes**, a total of **5**, which are the following:

1. If we do not collect the first **Sample** after 2.5 seconds, the robot will go further back, and then go further forward to collect it, if it has not gotten close enough to the **Sample**.
2. If after 12 seconds after the program started, the robot fails to collect the first **Sample**, it continues its **Auto** trajectory, going to the second **Sample**.
3. If we do not collect the second **Sample** after 2 and a half seconds, proceed in the same way as for the first **Fail Safe**.
4. If after 23.5 seconds after the program started, the robot fails to collect the second **Sample**, it continues its **Auto** trajectory, going to the **third Sample**.
5. If after 28.5 seconds after the program started, the robot fails to collect the third **Sample**, it goes and parks, achieving a **Level 1 Ascend**

Results:

The results obtained in the competition provided us with validation, obtaining the following scores:
Match 1: 53 points (**1 Specimen preload** + **4 Specimens** + **parking** in the **Observation Zone**)
Match 2: 40 points (**1 Specimen preload** + **3 Specimens** + **parking** in the **Observation Zone**), as the robot oscillated too much around the position to collect the first **Specimen** .
Match 3: 43 points (**1 Specimen preload** + **3 Specimens** + **parking**)
Match 3: 33 points (**1 Specimen preload** + **2 Specimens** + **parking** in the **Observation Zone**), because the **PinPoint** gave us an error.
Match 5: 50 points (**1 Specimen preload** + **4 Specimens**)
Match 6: 35 points (**1 Sample preload** + **3 Samples** + **Ascend level 1**)

Conclusions:

Even though it depends on the **Human Player** and the position of the tubes before starting **Autonomy**, because we push **Samples** with the tubes from the Intake into the **Observation Zone**, the **Specimens Auto** brought us the most points and proved to be constant and adaptable, allowing us to collaborate perfectly with our alliance. The **Samples Auto** was perfected, having nothing left to improve so that we could make more points, due to the mechanical limitation.

TeleOp:

In terms of the controls of the two **Drivers** during the **TeleOp League Meets**, keeping the same division of controls between the 2 **drivers** as in the previous meet, **Driver** 1 takes care of the chassis movements, while **Driver** 2 has the role of ensuring the functioning of the subsystems (**Intake**, **Outtake**, **transfer**).

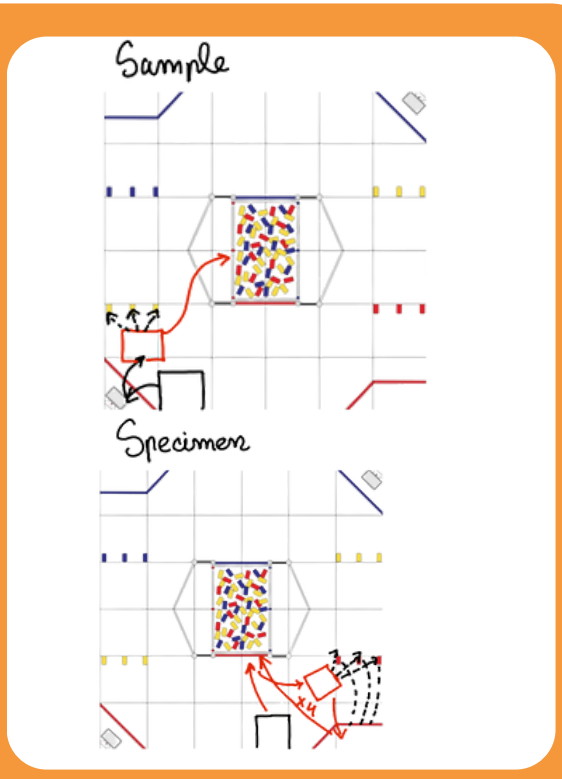
Robot V3.1 - League Meet #4 + League Tournament:

Introduction:

From the third **League Meet** to the fourth, the robot from a mechanical point of view had quite a few minor changes, which greatly increased our scoring potential. Thus, the **Auto** had to be modified, as we changed the odometry wheels of the robot. Even though we did not have much time available, we managed to make significant changes to the **Autonomies**, managing to improve them. We continued to use **Speedi**, as during the competitions in which we used it, it did not disappoint, the **Autonomous** period proving to be very constant and fast.

Strategy:

For the third **League Meet**, we had **Auto** for both **Specimens** and **Samples**, with parking in both the **Ascend Zone** and the **Observation Zone**, having an **Autonomy** of 5 **Specimens** and parking, and for the **Sample Auto**, we managed to place **4 Samples** and do **Ascend level 1**. Thus, for the fourth **League Meet**, we wanted to keep our strengths, we worked to maximize the score, working the most on the **Sample Auto**, managing to collect another **Sample** from the **Submersible**. Therefore, we managed to do:



1. an **Auto** of **4 Specimens** + **1 Specimen preload** + **Observation Zone** (total: **53** points)
2. an **Auto** of **4 Samples + 1 Sample preload + Ascend level 2** (total: **43** points)

The Specimens Auto did **not** have **significant improvements**, no longer having time to manage to score more points, managing to make it work the same as in the third **League Meet**.

Regarding the **Samples Auto**, we had to think of an **efficient method** to **collect** a **Sample** from the **Submersible**, regardless of the randomization, also taking into account the disadvantage of our robot, which is the **Wrist**, since if you lower it over a **Sample**, it gets **stuck** and you have to struggle to collect it. To solve this, we thought that we should **make space in the Submersible**, having a series of **trajectories** in which the robot enters the **Submersible**, **rotates** to the **right**, then to **the left** and finally **collects** a **Sample somewhere** in the **middle** of the **Submersible**, where the robot does not push the **Samples**.

We also have several **Fail Safes**, a total of **7**, which are as follows:

1. If we do not collect the first **Sample** after **2 seconds**, the robot will go **further back**, and then go **further forward** to collect it, if it has not gotten close enough to the **Sample**.
2. If after **12 seconds** after the program starts, the robot **fails** to **collect** the **first Sample**, it **continues** its trajectory, going to the **second Sample**.
3. If we do not collect the second **Sample** after **2** and a **half seconds**, it proceeds in the **same** way **as** the **first Fail Safe**.
4. If after **18 seconds** after the program starts, the robot fails to collect the **second Sample**, it **continues** its path, going to the **third Sample**.
5. If after **2** and a half seconds, the robot **fails** to collect the **third Sample**, it **changes position** and tries to collect it again.
6. If **23** seconds after the program starts, the robot **fails** to collect the **third Sample**, it **continues** its trajectory, going to **collect from the Submersible**.

7.If **25 seconds** after the program started, the robot **fails** to collect the **fourth Sample** and go to the **Basket**, it **achieves** an **Ascend Level 1**.

Results:

The results obtained in the competition provided us with validation, obtaining the following scores:
Match 1: **24** points (**1 Sample preload** + **2 Samples**)
Match 2: **43** points (**1 Specimen preload** + **3 Specimens** + **parking** in the **Observation Zone**), as the **Specimen** was not well placed on the perimeter.
Match 3: **43** points (**1 Specimen preload** + **2 Specimens** + **parking** in the **Observation Zone**), as the **Specimen** was not well placed on the perimeter.
Match 4: **40** points (**1 Specimen preload** + **3 Specimens**)
Match 5: **40** points (**1 Specimen preload** + **3 Specimens**)
Match 6: **30** points (**1 Specimen preload** + **2 Specimens**), as the robot was not well placed in his starting position.

Conclusions:

Even though it depends on the **Human Player**, the position of the surgical tubes before starting the **Autonomous** period, how charged the battery of the robot is, the **Samples Auto** brought us the most points and proved to be constant and adaptable, allowing us to collaborate perfectly with our alliance. The **Samples Auto** has been perfected, and definitely needs to be tested more for the next competition.

Robot V4 - National Championship :

Auto:

After the **League Tournament**, we changed the robot, having a different Intake and Outtake system. Thus, the **Auto period** had to be **modified** and even though we didn't have much time, we managed to redo it.

Programming :

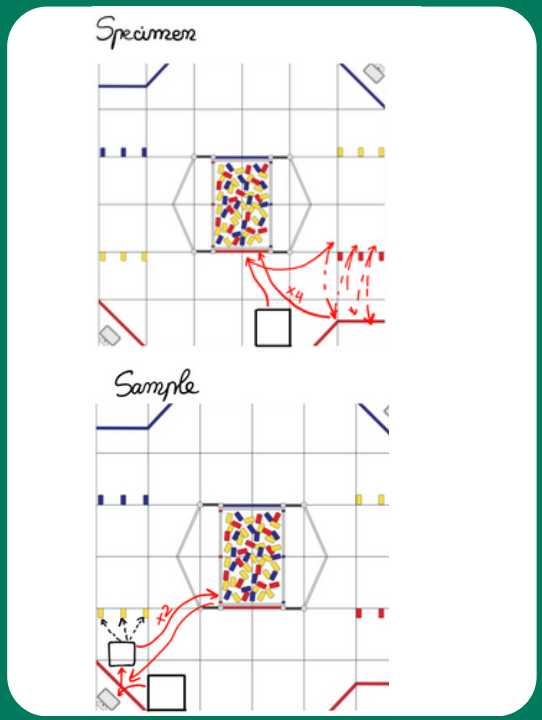
We continued to use **Speedi**, as during the competitions in which we previously **tested** it, it **did not disappoint**, the **Auto** proving to be **very constant** and **fast**.

For the **League Tournament**, we had an **Auto** for both **Specimens** and **Samples**, with **parking** in the **Ascend Zone** and in the **Observation Zone**, having an **Auto** of **5 Specimens** and **parking**, and for the **Sample** one, we managed to put **6 Samples** and do an **Ascend level 1**.

In the meantime, for the **National Championship**, we managed to do a **Specimens Auto**, but also a new **Sample** one.

- an **Auto** of **4 Specimens** + **1 Specimens preload** + **parking** in the **Observation Zone** (total: **53** points), which was much more constant, because we push the **Samples** with the **chassis**, not with the Intake tubes.
- an **Auto** of **5 Samples** + **1 Sample preload** + **Ascend level 1** (total: **51** points)

The Auto of **Specimens** did **not** have **significant** improvements, no longer having enough time to manage to score more points, making only the change of pushing the **Samples** with the chassis.



Regarding the **Samples Auto**, we had to think of an efficient method to collect a **Sample** from the **Submersible**, regardless of the randomization, also taking into account the disadvantage of our robot, which is that if you lower the **Wrist** over a **Sample**, it gets stuck and you struggle to collect it. We thought that we could constantly extend and retract the Linear Extension, to push the **Samples** through the **Submersible**, while the robot slowly takes it to the left.
We also have several **Fail Safes**, totaling **7**, which are as follows:

1. If we do not collect the first **Sample** after **2 seconds**, the robot will move back, and then move forward more to collect it, if it has not gotten close enough to the **Sample**.
2. If after another **2.5 seconds**, the robot fails to collect the first **Sample**, it continues its **Autonomy**, going to the **second Sample**.
3. If we do not collect the second **Sample** after **2 seconds**, it proceeds the same way as the first **Fail Safe**.
4. If after another **2.5 seconds**, the robot fails to collect the **second Sample**, it continues its **Autonomy**, going to the **third Sample**.
5. If after **2 seconds**, the robot fails to collect the **third Sample**, it changes its position and tries to collect it again.
6. If after another **2.5 seconds**, the robot fails to collect the **third Sample**, it continues its **Autonomy**, going to collect from the **Submersible**.

Conclusions:

Even though it depends on the **Human Player**, the **Specimens Auto** brought us the most points and proved to be constant and adaptable, allowing us to collaborate perfectly with our alliance. The **Sample Auto** needs to be improved, and it definitely needs to be tested more.

TeleOp:

Regarding the **organization** of the **controls**, the only change compared to the **League Tournament** is represented by moving the action through which we score the **Specimens** from **Driver 2** to **Driver 1**. This decision was made based on the number of **free buttons** on **each controller**. Apart from this change, the **controls remained** the **same**, **Driver 1** takes care of the **chassis movements**, while **Driver 2** has the role of ensuring the functioning of the **subsystems** (**Intake, Outtake, transfer**). Regarding the **chassis**, there were no changes between the **League Tournament** and **National Championships**, but regarding the **subsystems**, the **Intake**, **transfer** and **Outtake** are totally different. Thus, we had to rethink the functionality of their **Automations** and the control mode.

Driver 1:

Driver 1 controls the **chassis movements** via **joysticks**.
Right joystick - rotates the **chassis**, controlling its **angle**
Left joystick - controls the **chassis** movements in the field, front-back, left-right
Right bumper - controls the **climbers** to do **Ascend Level 2**
Left bumper - opens the **claw**
Right + left trigger - controls the **climbers**, moving them in the opposite direction of rotation for **Ascend Level 2**
dpad_left - controls the **Lift** segment down
dpad_right - resets the **Lift** encoder
dpad_up - resets the **field centric**
A - on the first press collects the **Specimen** on the **Field Perimeter**, and on the second it scores it on the **High Chamber**

Driver 2:
Left Bumper - opens the **claw**
Right Bumper - closes the **claw**
Left Trigger - stops the collecting state of the **Intake**
Right Trigger - on the first press, the **Intake** starts collecting, and on the second, it reverses its direction
A - on the first press, both the **Lift** and the **Arm** go up to the preset scoring position in the **High Basket**, and on the second, the systems go down to the scoring position in the **Low Basket**
B - brings the **Outtake** (**arm** + **claw**) to the transfer position
X - brings the **Intake** to the transfer position
dpad_left - does **not extend** the horizontal sliders and lowers the **Intake** to the sensor-based collecting position (Specific Collecting)
dpad_up - does not extend the horizontal sliders and lowers the **Intake** to the simple collecting position, starting to collect
dpad_down - **retracts** the horizontal sliders
Right Joystick - horizontal **sliders extend/retract** in proportion to the **intensity** with which the joystick is controlled
Joystick button right - **extends** the **sliders** and **lowers** the **Intake** to the simple collecting position, turning it on
Joystick left - extends the horizontal sliders and lowers the **Intake** to the sensor-based collecting position (Specific Collecting)

Types of collection:

- **Simple collection** - the Intake collects **Samples** based on the surgical tubes
- **Specific collection** - First, with the help of the **Color Sensor** inside the **Intake** we detect a suitable **Sample**, at which point the **Intake** is placed above it, without collecting. On the second press, the **Intake** reaches the ground position, collecting the **Sample**. This type helps us a lot in **Submersible**, being designed both for matches in which we need to score **Specimens** , and for those in which there is no space in the **Submersible** and we need more accuracy.

Notes:

As in the case of **Driver 2** , the controls are numerous, taking into account the possible human errors caused by emotions during matches, we decided to facilitate the control of the subsystems by implementing a variety of **automations**.

- When the Intake collects a **Sample** of the color of the opposite alliance, we have a preset automation that **reverses** the meaning of the Intake.
- We use a **Driver Assist** system based on **GoBILDA Indicator Lights** that display the color of the **Sample** we have collected.
- When we have collected a suitable **Sample**, the horizontal slides automatically retract, bringing the **Scoring Element** to the position required for transfer.
- Both the **Lift** and the **Arm** simultaneously rise to the preset scoring position in the **High Basket**.
- When scoring the **Specimens** , the **claw** automatically opens after the horizontal slides have reached the desired position.

Robot V5 - Preparation for Premier Event:

Introduction:

After the **National Championship**, we wanted to test our robot limits and do a little better on the **Specimen Auto**, because at that moment it was a simple 5 + 0 **Auto**.

Strategy:

So after the **National Championship** we really wanted to have a **5 + 1 Auto** and a **6 + 0 Auto** in case the rebuild for the **Premier Event** wouldn't really work out.

- For the **5 + 1 Auto** (58 points) we would start with the **preload Specimen** and instead of pushing the **Samples** with the robot, we would swipe them with the Intake, similar with what we had at **League Meet #3** and **#4** and at the **League Tournament**, but now the Intake is bigger so it will be more constant. With the additional time we have time to collect a **Sample** from the **Observation Zone** from the **Perimeter**, without clipping it into a **Specimen** and to put it into the **High Basket**.

- For the **6 + 0 Auto** (60 points) we would start with the **preload Specimen** and instead of pushing the **Samples** with the robot, we would do the same as the **5 + 1**. But before we push the **Samples** we have a really big problem, we don't have 6 colored specific **Samples** in the **Observation Zone** and neither a Camera on the **Robot**. So we created an XoY + Angle coordinates System in which we move the lateral movement of our robot, the Intake Extension and the angle. After collecting the **Sample**, we would give it to the Human Player and continue normally, but we didn't have enough time. We tried to change the trajectories to the **Submersible** and back to the **Observation Zone**, we saved 2 more seconds and still we didn't have enough time. Even though we would change a lot of other things, we needed 4 more seconds, because a cycle in **Auto** to place a **Specimen** takes 4.5 seconds. We score the **preload** in 1 second and that means that we have to push 3 **Samples** + the one we collected + collect it in 6.5 seconds which is impossible.

After we had finished the **Auto** we were trying to figure out why we had time to place one more **Sample** in the **High Basket**, but not one more **Specimen** on the **High Chamber**. We realized that the robot has enough time to reach its maximum velocity on that trajectory and that is why we can score one more **Sample**, but not one **Specimen** .

Also the **5 + 1** was **more safe**, because it didn't need to be manually selected in the Init, like the 6 + 0 **Auto**, because we didn't collect any **Samples** from the **Submersible**.

Conclusions:

Even though it depends on the **Human Player**, the **Specimens Auto** brought us the most points and proved to be constant and adaptable and even though we didn't really implement everything on the **National Championship** robot, we learned a lot of new things that we will use on the current robot.



Robot V5 - Premier Event:

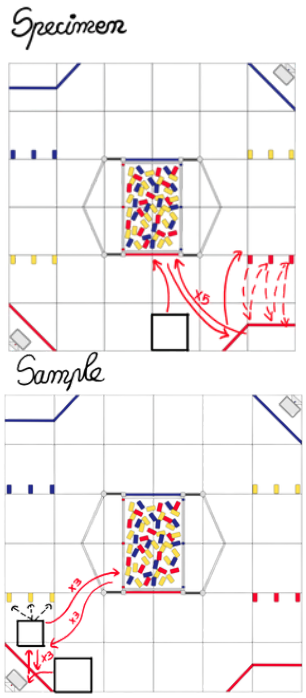
Auto:

After the **National Championship**, we changed the robot and we wanted to implement the ideas and improve the **Autos** that we had made on the V4 robot after the competition.

Programming :

We continued to use **Speedi**, as during the competitions in which we previously **tested** it, it **did not disappoint**, the **Auto** proving to be **very constant** and fast.

For the **National Championship**, we had an **Auto** for both **Specimens** and **Samples**, with parking in the **Ascend Zone** and in the **Observation Zone**, having an **Auto** of **6 Specimens** and parking, and for the **Sample** one, we managed to put **6 Samples** and do an **Ascend level 1**.



In the meantime, for the **Premier Event**, we managed to have more **Autos** than we thought so we can 100% complement our teammates.

- an **Auto** of **6 Specimens** + **parking in the Observation Zone** (total: **63** points)
- an **Auto** of **5 Specimens** + **1 Sample** + **parking in the Observation Zone**(total: **61** points)
- an **Auto** of **7 Samples** + **Ascend level 1**(total: **59** points)

The **Auto** of **Specimens** had the same ideas with the one on the old robot, but we had the time to push the **Samples** with the robot and do **6 Specimens** / **5 Specimens** + a **Sample**, because of our new **Outtake**.

The **Sample Auto** has an **unique idea**, of dividing the **Submersible** into **9 Zones** and collecting a **Sample** from a zone that you sellect, having more time to score more, because of the **new Outtake** + the **faster Lift**.

Conclusions:

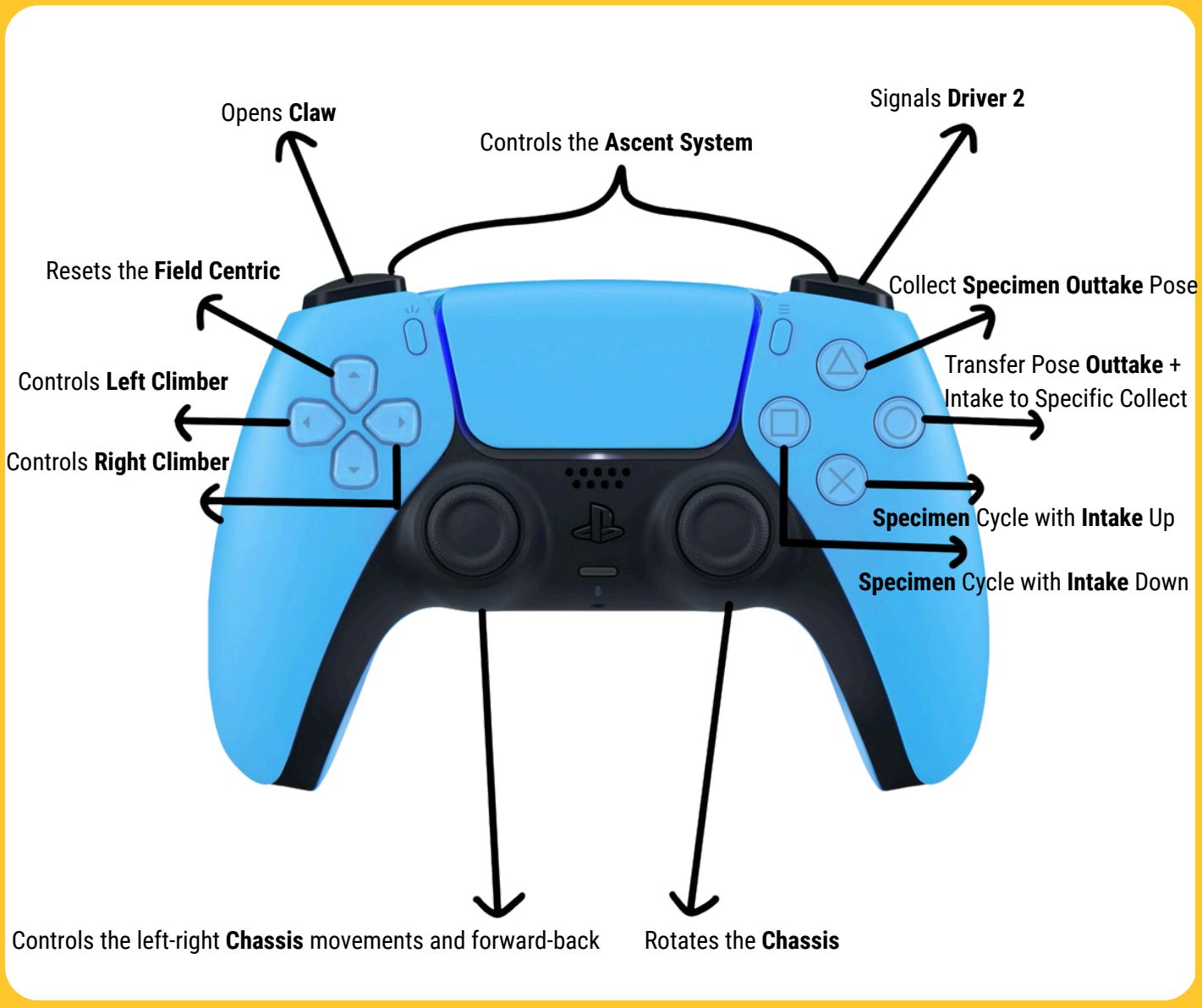
Even though it depends on the **Human Player**, the **Specimens Auto** brought us the most points and proved to be constant and adaptable, allowing us to collaborate perfectly with our alliance. The **Sample Auto** was improved and we finally have found a solution with the collection of **Samples** from the **Submersible**.

TeleOp:

Regarding the **organization** of the **controls**, there were little to no changes, just some **optimizations** of the sequences that we had and a few more. Apart from this change, the **controls remained** the **same**, **Driver 1** takes care of the **chassis movements** and the **scoring of Specimens** , while **Driver 2** has the role of ensuring the functioning of the **subsystems** (**Intake**, **Outtake**, **transfer**). Regarding the **Chassis**, there were some changes regarding the chassis speed when the **Intake** is extended, having a multiplier, but regarding the subsystems, the **Intake**, transfer and **Outtake** have been changed.

Driver 1:
Driver 1 controls the **chassis movements** via **joysticks**.
Right joystick - rotates the chassis, controlling its angle

Left joystick - controls the **chassis** movements in the field, front-back, left-right
Right bumper - gives a signal to **Driver 2**
Left bumper - opens the **Claw**
Right + left trigger - controls the **climbers**, moving them in the opposite direction or in the direction of climbing
dpad_left - moves the **left climber** in the opposite direction of climbing
dpad_right - moves the **right climber** in the opposite direction of climbing
dpad_up - resets the **Field Centric**
A - Controls the **Specimen** part with the **Intake** up
X - Controls the **Specimen** part with the **Intake** down
B - Sets the **Outtake** to transfer and extends the intake to specific collection
Y - Sets the **Outtake** to collect **Specimens**



Driver 2:
Left Bumper - opens the **Claw**
Right Bumper - closes the **Claw**
Left Trigger - the **Intake** starts collecting
Right Trigger - the **Intake** starts spitting
Left Trigger + Right Trigger - stops the **Intake**
A - the **Sample** Transfer is made

B - brings the **Outtake** to the transfer position
X - brings the **Intake** to the transfer position
Y - the **Specimen** Transfer is made
dpad_left - retracts the linear **slides**
dpad_up - raises the lifts by a little
dpad_down - lowers the **lifts** by a little
dpad_right - lowers the **lift** to score the **Samples** in **Low Basket**
Right Joystick - **horizontal sliders** extend/retract in **proportion** to the **intensity** with which the joystick is controlled
Joystick button right - starts collecting the way you chose
Joystick left - it allows you to choose the way you collect,based by the direction you press it:
- **left**: Simple collection
- **right**: Specific collection
- **up**: Collection with Extension
- **down**: Collection with Wait

Types of collection:

- **Simple collection** - the Intake collects **Samples** based on the surgical tubes
- **Specific collection** - First, with the help of the Color Sensor inside the **Intake** we detect a suitable **Sample**, at which point the **Intake** is placed above it, without collecting. On the second press, the Intake reaches the ground position, collecting the **Sample**. This type helps us a lot in **Submersible**, being designed both for matches in which we need to score **Specimens** , and for those in which there is no space in the **Submersible** and we need more **accuracy**.
- **Collection with Wait** - First, the **Intake** is extended like the simple collection with the A**rm** into a wait position and on the second press the **Intake** collects the **Sample**
- **Collection with Extension** - First, the **Intake** is extended to half on its maximum position and on the second press the **Intake** acts like on a simple collection, the **Wrist** and **Arm** go down and then the **linear slides** extend to the maximum position

Notes:

As in the case of **Driver 2**, the controls are numerous, taking into account the possible **human errors** caused by emotions during matches, we decided to facilitate the control of the subsystems by implementing a **variety of automations**.

- When the **Intake** collects a **Sample** of the color of the opposite alliance, we have a preset **Automation** that reverses the meaning of the **Intake**.
- We use a **Driver Assist** system based on **GoBILDA Indicator Lights** that display the color of the **Sample** we have collected.
- When we have collected a suitable **Sample**, the horizontal slides automatically retract, bringing the **Scoring Element** to the position required for transfer.
- Both the **Lift** and the **Arm** simultaneously raise to the preset scoring position in the **High Basket**.

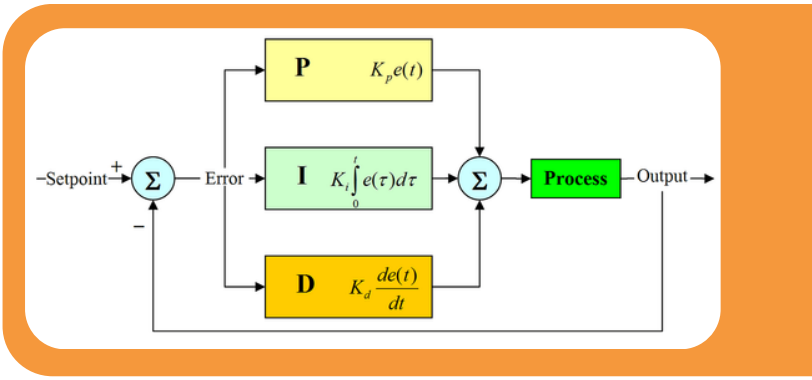
General Aspects:

Movement:

PID Controller:

A **PID Controller** (Proportional, Integral, Derivative) is a **feedback** loop that controls a system solely based on the error. **PID** is a form of a control loop based on the values provided by the system, which continuously contribute to controlling and stabilizing variables. An additional term is often added, generally **Feedforward**, corresponding to each system. In short, it applies a precise correction corresponding to the determined error.

Parameters



KP – Proportional coefficient

This is the simplest and easiest to implement of all the values, but also the most important. It is essential because it assigns a constant that is proportional to the error, transforming it into a correction value—whether it is for a motor, speed, or position. How will the **P** term respond? If the error is large, the correction will clearly be large as well; if the error is small, the correction will be accordingly small.

Ideally, over time, the system will almost always reach its final destination.

KD – Derivative coefficient

This term aims to "calm down" the effect caused by the rapid change of error. In other words, it tries to maintain the error value constant. Generally, during calibration, we strictly use the proportional and derivative **coefficients**, considering the issues caused by the integral **coefficient**. Usually, systems with a lot of friction do not require this **coefficient** or only need a very small value, relying more on the integral term, while systems with low friction are the opposite.

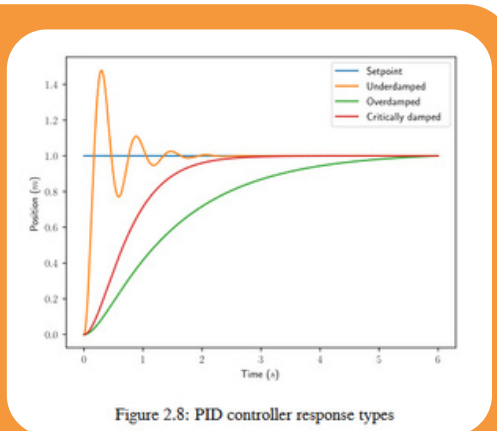


Figure 2.8: PID controller response types

KI – Integral coefficient

In systems used in the **FIRST® Tech Challenge** competition, the integral coefficient is the least used. Its purpose is to correct small errors that appear over time. When the system considers that it has reached the destination, it will stop, even if the error value is not yet zero. Over time, the integral term will increase the output, resulting in a closer approach to the final destination and a reduction in error. However, summing the error in this way has a harmful side effect: the longer the loop runs, the slower the sum increases—an aspect that obviously has a huge negative impact, since we do not want to introduce latency. To compensate, before being added to the sum, the value is multiplied by Δt, slowly scaling the entire sum.

Tuning:

The most important aspect to consider when tuning such a **Control oop** is how each coefficient affects the output. For example, if the system has not reached the final destination and it starts oscillating around the target, it means we need to increase the derivative coefficient. If the desired position is reached but inefficiently slowly, it means the proportional term is too small or the derivative term is too large.

TABLE 1 **Effects of independent P, I, and D tuning on closed-loop response.**
For example, while K_I and K_D are fixed, increasing K_P alone can decrease rise time, increase overshoot, slightly increase settling time, decrease the steady-state error, and decrease stability margins.

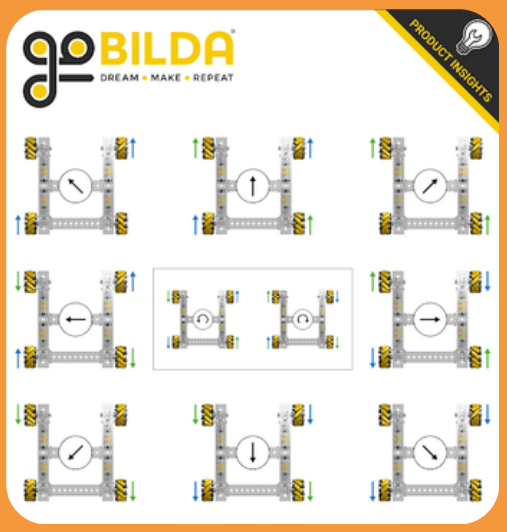
	Rise Time	Overshoot	Settling Time	Steady-State Error	Stability
Increasing K_P	Decrease	Increase	Small Increase	Decrease	Degrade
Increasing K_I	Small Decrease	Increase	Increase	Large Decrease	Degrade
Increasing K_D	Small Decrease	Decrease	Decrease	Minor Change	Improve

Robot Centric:

Robot Centric Drive movement keeps the robot moving within its relative coordinate system.

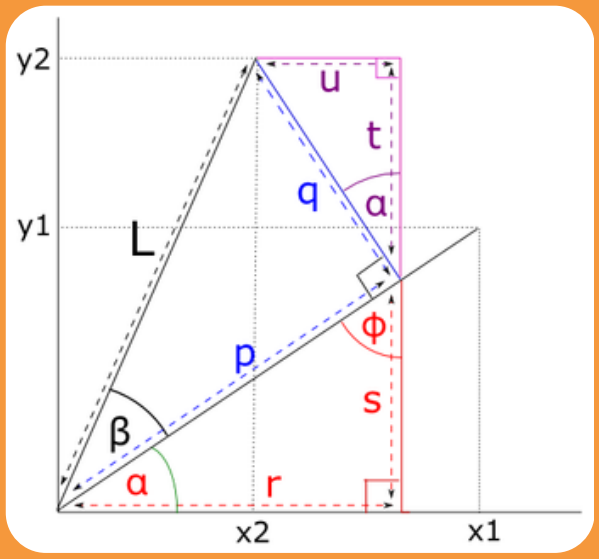
axial = -1 (left gamepad Oy movement)
strafe = left gamepad Ox movement
turn = gamepad Ox movement

power_left_back=axial-strafe+turn
power_left_front=axial+strafe+turn
power_right_back=axial+strafe-turn
power_right_front=axial-strafe-turn



Field Centric:

With a **field-centric** driving system, the joystick controls the direction of the robot relative to the terrain. This is preferred by some drivers because it can be rotated more easily while moving in a given direction. To achieve this, the x and y components of the joysticks are rotated in a trigonometric sense, provided by the **PinPoint's** internal **IMU**.
To make this motion, we need to read the angle given by the robot's **PinPoint**, to move the robot's coordinate system into the terrain coordinate system.
Formulas for determining the powers to be distributed to the wheels in **field-centric** motion:



x1=Lcos
y1=Lsin
x2=Lcos(+)
y2=Lsin(+)

power_left_back=rotY-rotX+turn
power_left_front=rotY+rotX+turn

power_rightt_back=rotY+rotX-turn
power_right_front=rotY-rotX-turn

cos(+)=coscos-sinsin
sin(+)=sinsin+coscos

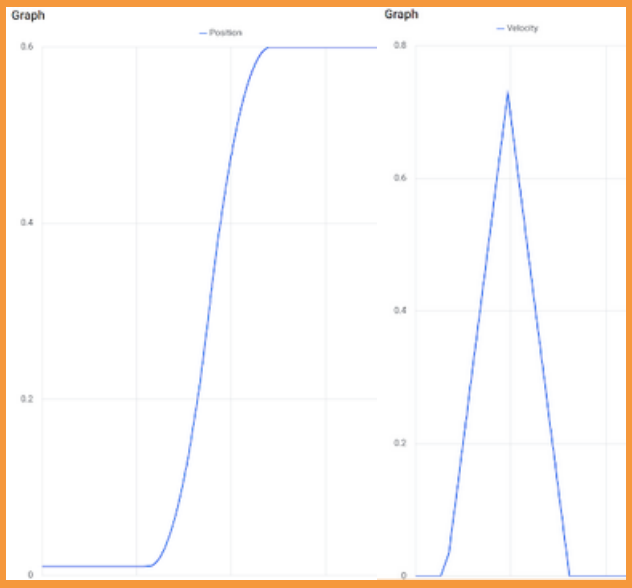
Lcos(+)=Lcoscos-Lsinsin
Lsin(+)=Lsinsin+Lcoscos

Lcos(+)=x1cos-y1sinx2=x1cos+y1sin
Lsin(+)=y1sin+x1siny2=y1sin+x1cos

Assymetric Motion Profile:

A **Motion Profile** is a function used to gradually change the speed of a system, in a controlled and consistent way, by gradually increasing or decreasing it until it reaches the desired speed. For example, if we want the robot, which is standing still, to move forward at maximum speed, in general, if we give maximum power to all the motors, there is a very high chance that the robot will make unwanted and uncontrollable movements because, although we give power to all the motors simultaneously, the robot will not instantly reach that speed. **Motion Profiling** solves this problem, making this process much more constant, helping to achieve a desired and predictable result.

Another example could be changing the position of an arm, to turn it upside down. We use this algorithm to gradually change the position of the arm, without forcing the servo or motor that drives it too hard to avoid any unfortunate incident.
This season we chose to use a **trapezoidal motion profile**, because it allows optimal control over the movements in exchange for a little more time to reach the desired final value, compared to the **S-Curve** and it is easier to implement.
To calculate the desired position, first we need to know the initial position, the final position to calculate the distance between the two, given by the formulas:



$$distance = x_{final} - x_0 . x_0 = initial\ position$$
$$x_{final} = final\ position$$
$$v_{max\ used} = min(v_{max\ given}, \sqrt{\frac{distance \times a * dec}{a + dec}})$$

This formula being proved by:
Calculating **vmax** used, if limits wouldn't exist:

$$distance = \frac{v_{max\ used}^{2}}{2a} + \frac{v_{max\ used}^{2}}{2dec}$$

from where:

$$v_{max\ used} = \sqrt{\frac{distance \times a * dec}{a + dec}}$$

Notes:
a = acceleration
dec = deccelaration

Value which we compare with vmax given

Because distance = d1+d2+d3. Judging by the grafic:

$$t_1 = \frac{v_{max\ used}}{a}$$
$$t_2 = max(\frac{distance}{v_{max\ used}} - \frac{(t1 + t3)}{2}$$

$$d_1 = \frac{v_0 + v_{max\ used}}{2} \times t_1$$
$$d_2 = v_{max\ used} \times t_2$$
$$d_3 = \frac{v_0 + v_{max\ used}}{2} \times t_3$$

$$distance = \frac{v_0 + v_{max\ used}}{2} \times t_1 + v_{max\ used} \times t_2 + \frac{v_0 + v_{max\ used}}{2} \times t_3$$

$$\frac{distance}{v_{max\ used}} = \frac{t_1}{2} + \frac{t_3}{2} + t_2$$

where the minimum is 0.

$$t_3 = \frac{v_{max\ used}}{dec}$$

For the period of time:

$$t \in [0, t_1]:$$

$$position = initial\ position + \frac{a * t^2}{2}$$

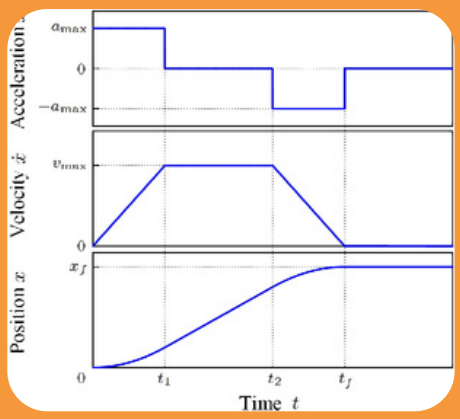
$$t \in (t_1, t_1 + t_2]:$$

$$position = initial\ position + \frac{a \times t_1^{\ 2}}{2} + v_{max\ used} \times (t - t_1)$$

and

$$t \in (t_1 + t_2, t_1 + t_2 + t_3]:$$

$$position = initial\ position + \frac{a \times t_1^{\ 2}}{2} + v_{max\ used} \times (t - t_1) + \frac{dec \times (t - t_1 - t_2)}{2}$$



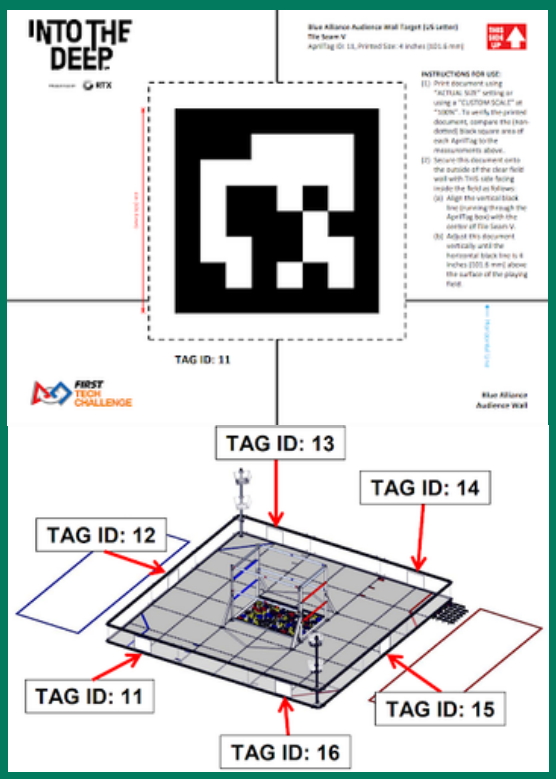
Localization:

AprilTag Relocalization:

There are many ways to relocate the robot in the **field**, one of them being based on **AprilTags**, **2D** barcodes made up of black and white squares, unique and easily identifiable by cameras. These are used when a potential error occurs due to odometry, acting as a failsafe for more accurate relocation of the robot.

Implementation:

These are of great help and since 2023 the robot is able to detect the angle and position it is in relation to the **AprilTag** and also the exact location of the **AprilTag** on the **field**, relative to the rest of the **game elements**.



Therefore, as long as we are in possession of both these values and the coordinates provided by the **odometry**, we can relocate the robot on the **field**, increasing accuracy, a fundamental aspect during the Autonomous period. Also, an important external factor in determining the most accurate location of the robot on the field is represented by the position of the camera on the robot. Both the height at which it is placed and the angle have an impact on the efficiency of reading and processing **AprilTags**.
This season, we used **AprilTags** strictly for our first competition, the **Kikcathon**, an event organized immediately after **KickOff**.

Thus, in Autonomy, if the position resulting from the **odometry** has an error, we calculate the robot's position based on the coordinates read from the **AprilTag** (where exactly it is on the field) and on the place where we were in relation to the **AprilTag**. Of course, the entire action is carried out in order not to take risks, being unable to detect whether the **odometry** really gives errors or not

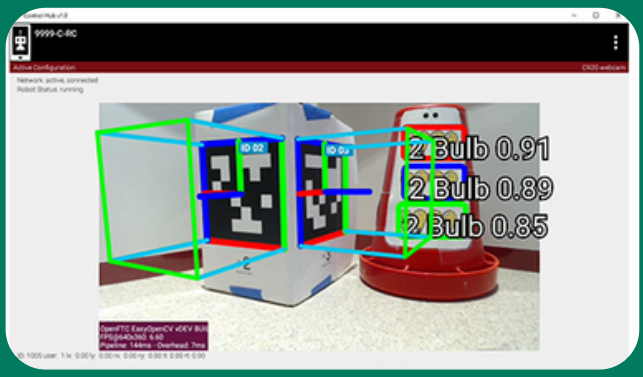
Camera Vison:

Computer Vision is the method by which the computer can process Images/Frames, giving the user the information sought. At the moment there are 3 methods often used in **FTC TensorFlow Lite**, **AprilTags** and **OpenCV** (via VisionPortal/EasyOpenCV).

We mainly used **OpenCV** this year, for the **passive intake** prototype, because it makes it very easy for us to use the 4 degrees of movement to Automatically align ourselves with the **Sample**.

Vison Portal:

Through this API we can add multiple **VisionProcessors** for a single camera, these are **OpenCV** Pipelines that allow the manipulation and processing of the image for the desired result (**AprilTag** Detection, **color** detection, **ColorBlob** Detection, etc.). These have a high difficulty of use, but provide a multitude of information.



Color Blobs:

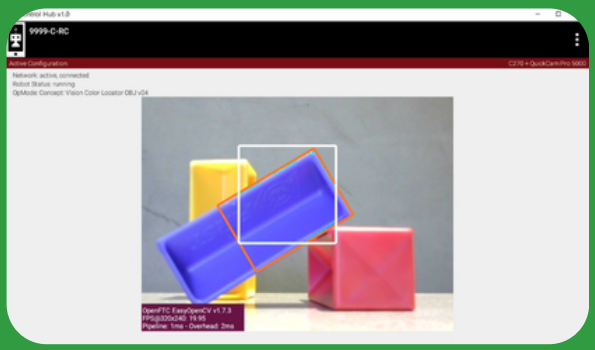
This is the processor in the **FTC SDK** that we use to isolate groups of pixels with similar colors according to **user-defined** tolerances.
Examples of such tolerances are:

- **Pre-Processing the image** (Part of the core **OpenCV** processing)
  - Blurring, creates a more gradual transition for the color
  - Erosion, removes camera artifacts and only important objects remain
  - Dilation, fills the gaps in the object to take it as a whole (the opposite of Erosion)
  - Camera Resolution
  - Region of interest, the portion of the image that this processor should process
  - Target Color, the color range of pixels to group
  - Choice of Contours, to exclude contours inside contours or other similar overlapping situations
- **PostProcessing:**
  - filter based on the blob area, to consider only objects with an area between the set parameters
  - pixel density filter, to ignore regions with potential detection problems
  - Aspect Ratio filter, to consider only elements with a certain shape (rectangle, square, etc.)

This Processor returns two objects, Blob (a cluster of pixels of the same color) and BoxFit (a rectangle tangent to the corners of the Blob)

Locating Objects using the processor:

If we have an object with a certain preset color, we can use **BoxFit** to determine its location on the camera, also if we know its Aspect Ratio in neutral position, using trigonometry formulas we can derive the **angle**.



"In projective geometry, a **homography** is an isomorphism of projective spaces, induced by an isomorphism of the vector spaces from which the projective spaces are derived."

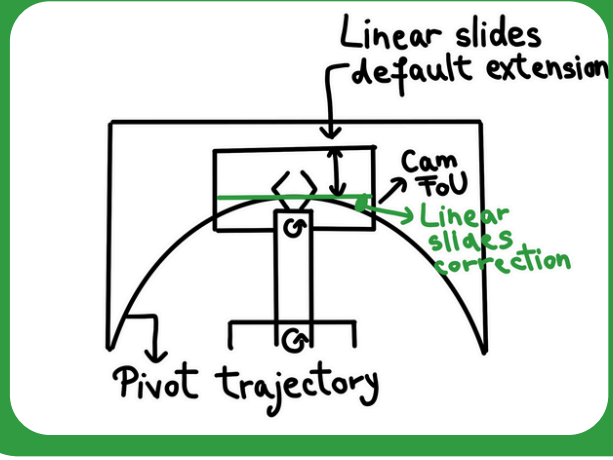
For our use we can use **homography** both to transform the space on the camera into the real space on the ground, but also to determine the location and orientation of the **Sample**.

This method is very useful for a camera that is not parallel to the ground to take into account an affine transformation of the space, which would distort the sample and the space into a trapezoid, detection being almost impossible without it.

We decided against using this method, preferring to solve potential problems mechanically, thus having only transpositions and scalings of the object that can be taken into account with simple mathematical formulas.

Alignment with a Sample:

For this we started by representing the mechanism as a system with 3 Degrees of Freedom (**Horizontal Extension**, **Arm Pivot** and **GH Pivot**) and determining several cases depending on the position of the **Sample** on the **Vision Camera**.
We reached the following conclusions:



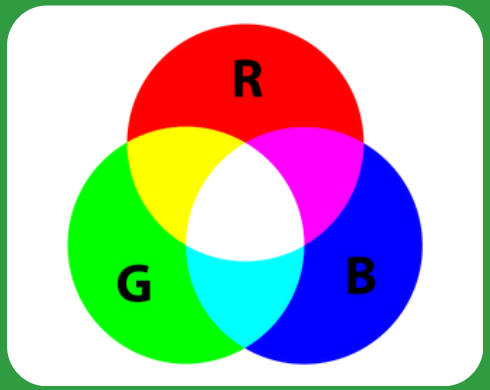
- we need to establish an alignment point that takes into account the movement of the arm on the Oy axis when collecting and the distance from the center of the camera to the **claw** (on the Ox Axis we keep the center as the alignment point, because the camera is located on the center of the arm).
- if we have the sliders retracted and the sample is behind the alignment point we need to move the **chassis**
- if the sample is to the left or right of the alignment point we need to extend the sliders more to take into account the loss of movement of the arm, which has a circular section trajectory.
- we can determine the angle at which the game element is using the tangent of the sides of the **BoxFit**
- the Range of Motion required for the pivot on the claw is 90 degrees
- **Sample Center Pos Y** = Pos.y/resolution.y*w(SCy)
- **Sample Center Pos X** = Pos.x/resolution.x*h(SCx)
- **Sweet Spot Point Y** = center.y/resolution.y*h -x.camoffset + armlength(a.l)(1-sqrt(1-sqrt(1-d/a.l))(SSPy)
- **Sweet Spot Point X** = center.x/resolution.x*w(SSPx)
- **Linear Slides Target** (Ticks)= prev pos +a.l(1-sin(arccos((SSPx-SCx)/a.l))+SCy-SSPy)*ticks/CM
- **Armpos** = arccos((SSPx-SCx)/a.l)/180
- **Pivot Angle** = SAngle(W<L)|90(L<W)+90- acos((SSPx-SCx)/a.l)(if(acos((SSPx-SCx)/a.l)>=90))
- **Pivot Angle** = SAngle(W<L)|90(L<W)-90+ acos((SSPx-SCx)/a.l)(if(acos((SSPx-SCx)/a.l)<=90))
- **Pivot Pos** = Pivot Angle/180

Impediments:

1. The detection on the **camera** turned out to be less optimal than expected, being slightly influenced by the ambient light and how the game elements are positioned
2. The detection and image processing time is longer than desired
3. The **Box-Fit** does not return the Width and Height values consistently, for the same object in the same orientation these can be inverted and thus have a 90 degree offset at the pivot.

Color Spaces:

To process **images**, they must be interpreted numerically. Typically, color is represented using 3 matrices. Each one expresses a characteristic of the color. Such representations are called **color models** and include:



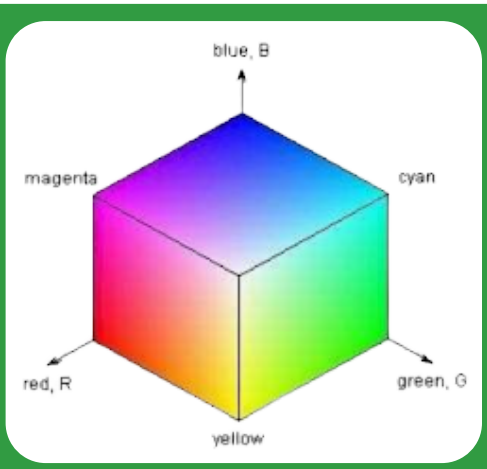
1. **RGB**

The standard model for a webcam, which has 3 types of color receptors: red, green and blue.
The recorded values signify the intensity of light captured by each receptor.

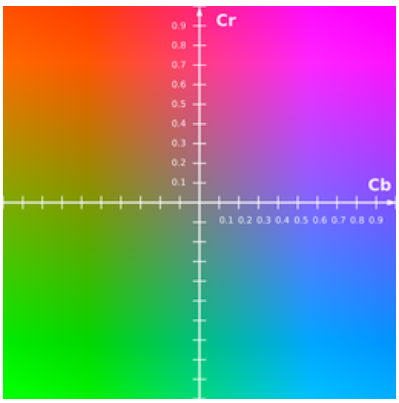
The ranges in which the colors are found are:

- **Red** (0-255). Pure Red has values of Red 255, Green 0, Blue 0
- **Green** (0-255). Pure Green has values of Red 0, Green 255, Blue 0
- **Blue** (0-255). Blue has values of Red 0, Green 0, Blue 255

A very good example to better understand how values are assigned is represented by the **Cubic Graph**:
The maximum value for each component is represented by the external face closest to the edges. Each shade on one of the faces is based on the color in the external corner. For example, all the shades on the right face of the cube are based on green.



The closest corner in the image is white, with the values Red 255, Green 255, Blue 255, and the opposite corner is black, with the values Red 0, Green 0, and Blue 0.



2.YCrCb / YUV

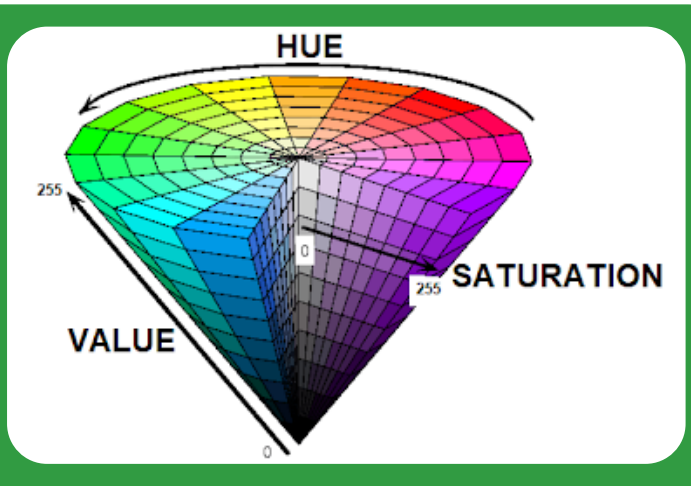
YCrCb is a color space used for color image pipeline.
The components of this color space are represented by:

- **Y** (luminance) is the luminance of the achromatic equivalent (grayscale) of the color
- **Cr/V(R - Y)** represents the chromatic component represented by the difference between red and achromatic luminance
- **Cb/U(A - Y)** represents the chromatic component represented by the difference between blue and achromatic luminance

The major difference between this color space and **RGB** is represented by brightness, **RGB** not using such a component in assigning values.

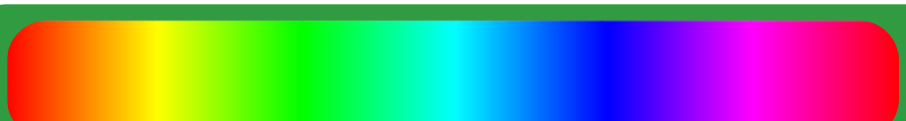
3. HSV/HSB

The **HSV/HSB** color space is the closest to the way we humans perceive colors. The components of this color space are represented by:



- **Hue** represents the color on a spectrum that starts at red and ends at red. From the perspective of a cone graph, **Hue** also represents the angle at which the color lies on the edge of the cone.
- **Saturation** represents the percentage of that color that must be added to obtain the desired shade. For example, if we had a **saturation** of 100%, this would represent pure color, without other additions. A color without saturation or with a small percentage would be white or a shade of gray.

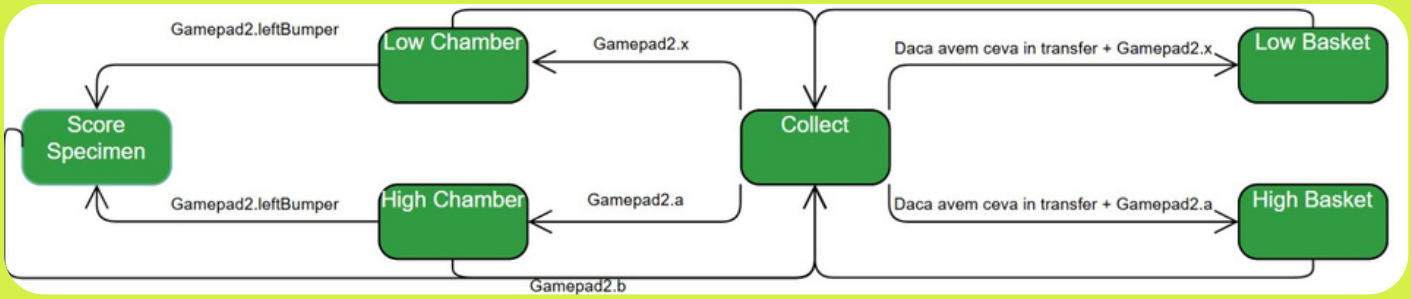
- **Value** represents brightness and depends on saturation. Value 0 represents black, and 100 is pure white, with maximum brightness.



Code structure:

Finite State Machine (FSM):

Finite State Machines are usually used to program more complex systems in a more organized and efficient way. They are also very useful when a system has to perform several actions simultaneously, especially when they depend on each other in a non-linear way.
The name **Finite State Machine** is quite suggestive, it is a **State Machine**, with a finite number of states. It can be in only one state at a time and can change its **state** when it performs a certain action.



Implementation and utilities:

In addition to the huge advantage of organizing the code and making bug detection more efficient, **Finite State Machines** have a real impact on the **Automations** created during **TeleOp**.

```
switch (state) {
    case Specimens:

        //Lift
        if (gamepad2.a && timerSpecimenHigh.milliseconds() >= 500) {
            robot.setAction(Robot.Actions.ScoreSpecimenHigh);
            timerSpecimenHigh.reset();
        }
        if (gamepad2.x && timerSpecimenLow.milliseconds() >= 500) {
            robot.setAction(Robot.Actions.ScoreSpecimenLow);
            timerSpecimenLow.reset();
        }
        //Intake Specimen
        if (gamepad2.left_bumper) {
            robot.intakeSpecimen.open();
        }
        if (gamepad2.right_bumper) {
            robot.intakeSpecimen.close();
        }
        break;
    case Samples:

        //Bucket
        if (gamepad2.right_bumper && timerBumper.milliseconds() >= 500) {
            if (Bucket.state == Bucket.States.Hold) {
                robot.bucket.setState(Bucket.States.Wait);
```

As we implemented a wide variety of **Automations** throughout the **Driver Controlled period** this year, **Finite State Machine** was a great help to us, one of the most common situations during matches being the moment when the **color sensor** in the active **Intake** detects that a **Sample** of the opposite **alliance's** color has been collected and it Automatically "spits" it out, activating the reverse movement. Of course, we also have a failsafe, in case something unexpected happens during the **Automation**, we can control the direction of the **intake** from the **driver 2** controller.

Analog Input Programming:

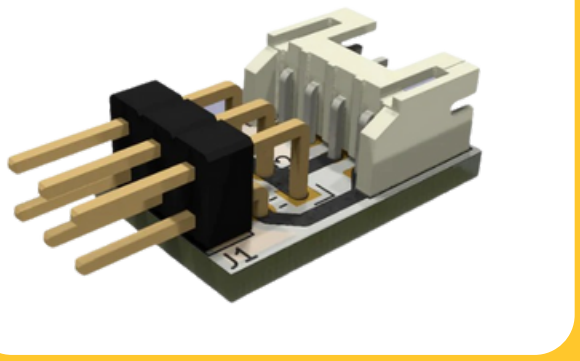
Introduction:

An **analog input** actually measures the voltage of something.It measures a single voltage, assigns a number to it, and then repeats. It can do this very quickly, which is one of the strengths of using an analog input instead of one of the **I2C** devices (which update much more slowly).

Usage:

On our current robot we use multiple analog inputs for measuring voltages from our **Linkage**, **Outtake Arm**, **Intake Arm** and **Intake Wrist**. Such a setup helps us calculate and see the real time position of any of our **servo**. This helps by giving near real time insights about the position of the **servo**. Although non-linear, after calibration the analog inputs can help at the following:

- **Automations** based on the current positions which offer faster results compared to timers.
- Precision is another very important factor as knowing the position removes much of the unexpected factor from the equation. Other methods of measuring such positions or making this kind of **Automations** are much more error prone than the **analog input**.



Of course the analog input also presents downsides just like any other form of digital data monitor. Some of them can be a deal breaker and include:

- The analog inputs may present some comparability issues depending on the servo type or the type of **adapter** used.
- They might sometime give bad or unreliable results based on the situation or configuration it is in.

Conclusions:

The **analog** input is versatile, precise and useful but it requires tinkering and setting up in the right configuration so it does not interfere with any of the other used mechanisms. If these **challenges** are overcome than the **analog input** can be a versatile tool with multiple uses.

Speedi:

Introduction:

Speedi is a navigation algorithm that can be used to create complex trajectories using **Cubic Bezier Curves** or simple lines. It is composed of 5 main parts:

1. Localization
2. Trajectory creator
3. Motor power calculation
4. Motor power distribution
5. Tuning programs

Advantages of using the algorithm we developed:

- tuning is very fast, most of the tests are **Semi Automatic** and the only part that requires increased attention is finding the right values for the 4 position correction **PIDs**.
- you have complete control over the movements made by the robot during the trajectory through our **Multipliers** system.
- creating an **Auto** is very flexible, because the programmer can use a **CommandBase** type system or a simple but efficient **Finite State Machine**.
- the simplicity of creating complex and long trajectories by simply declaring them chained and viewing them on the Dashboard.
- very smooth and almost instant transition from one trajectory to another.

Localizer:

Localizer with Two Wheel + IMU Localizer:

The **localizer** is one of the 3 essential parts that define **Speedi**. This is how the Trajectory Follower knows where the robot is along the trajectory. We have found two methods of localization using 2 perpendicular **encoders** (One for OX and one for OY) and an **IMU** (Inertial Measurement Unit), these are called:

1. Forward Euler Integration

Advantages:

- Much easier to extract formulas;
- Requires less processing time due to the simplicity of calculations.

Disadvantage:

- The localization errors are greater because this method assumes that the robot only moves in straight paths.

In the XoY coordinate system, the robot's motion on a straight path is described by the following differential equations, based on the linear velocity v and the orientation θ:

$$\frac{dx}{dt} = v_x * cos(\theta)$$

$$\frac{dy}{dt} = v_y * sin(\theta)$$

$$\frac{d\theta}{dt} = \omega$$

→ To solve differential equations, we use the **Forward Euler** integration method. This approximate method tells us that, for a function f(t) we have :

$$f(t + T) \approx f(t) + \frac{df}{dt} * T$$

We apply this method to our functions and get:

$$x(t + T) \approx x(t) + v(t) * cos(\theta(t)) * T$$

$$y(t + T) \approx y(t) + v(t) * sin(\theta(t)) * T$$

→

We represent this in discrete notation, where tk = kT, and so:

$$x_{k+1} = x_k + v_{x_k} * cos(\theta_k) * T$$

$$y_{k+1} = y_k + v_{y_k} * sin(\theta_k) * T$$

For the angle change we will use the reading directly from the **IMU**.

1. **Pose exponentials**

We learned about this method this year through the book: Controls Engineering in the **FIRST® Robotics Competition** by **Tyler Veness** and we adapted it to integrate it into our competition.

Advantages:

- Is one of the most popular and efficient ways to approximate the current position based on a global XoY coordinate system using the sensors specified above;
- Provides a more accurate model for a robot's position than **Forward Euler** Integration, especially for curved **trajectories**;

- After several tests and observations we found that the error produced at 10 m is approximately 4 cm.

Disadvantage:

- Errors are reduced using this method, but it requires more processing time due to matrix calculations.
- This method uses the assumption that the acceleration is 0 and this is where the small localization errors occur.

Objective:

Locating the robot as efficiently as possible during the **Autonomous** period.

Exponential pose is based on the simple idea that velocity is the first derivative of position with respect to time. Thus, in the robot's local system, linear **velocities** (vx, vy) and **angular velocity** (ω) are used to determine its **motion**.

We note:R the local coordinate system of the robot and G the global coordinate system. Everything with v refers to velocity and everything with d to position. We have:

$$R_{dx} = R_{v_x}\,dt$$
$$R_{dy} = R_{v_y}\,dt$$
$$R_{d\theta} = R_{v_\theta}\,dt$$

which we will note by Rdt, where x, y respectively denote the values on the axes OX, OY respectively the angle at which the robot is rotated.

We can write it in matrix form like this:

$$R\begin{bmatrix} dx \\ dy \\ d\theta \end{bmatrix} = R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix} dt$$

However, we need global **coordinates**, so we multiply both sides by the trigonometric rotation matrix as a function of time:

$$\begin{bmatrix} \cos\theta(t) & -\sin\theta(t) & 0 \\ \sin\theta(t) & \cos\theta(t) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

We obtain:

$$G\begin{bmatrix} dx \\ dy \\ d\theta \end{bmatrix} = \begin{bmatrix} \cos\theta(t) & -\sin\theta(t) & 0 \\ \sin\theta(t) & \cos\theta(t) & 0 \\ 0 & 0 & 1 \end{bmatrix} R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix} dt$$

$$\Leftrightarrow$$

$$G\begin{bmatrix} dx \\ dy \\ d\theta \end{bmatrix} = \begin{bmatrix} \cos\omega t & -\sin\omega t & 0 \\ \sin\omega t & \cos\omega t & 0 \\ 0 & 0 & 1 \end{bmatrix} R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix} dt$$

Now we apply $\int_0^t dt$ over the matrix equation to get rid of the derivative and it will result:

$$G\begin{bmatrix} \Delta x \\ \Delta y \\ \Delta\theta \end{bmatrix} = \begin{bmatrix} \frac{\sin\omega t}{\omega} & \frac{\cos\omega t}{\omega} & 0 \\ -\frac{\cos\omega t}{\omega} & \frac{\sin\omega t}{\omega} & 0 \\ 0 & 0 & t \end{bmatrix} R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix}\Bigg|_0^t$$

$$\Leftrightarrow$$

$$G\begin{bmatrix} \Delta x \\ \Delta y \\ \Delta\theta \end{bmatrix} = \begin{bmatrix} \frac{\sin\omega t}{\omega} & \frac{\cos\omega t - 1}{\omega} & 0 \\ \frac{1-\cos\omega t}{\omega} & \frac{\sin\omega t}{\omega} & 0 \\ 0 & 0 & t \end{bmatrix} R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix}$$

However, we need to measure these coordinates for another orientation besides θ = 0, so we multiply once more by the trigonometric rotation matrix, however we no longer need it as a function of time. Finally we obtain:

$$G\begin{bmatrix} \Delta x \\ \Delta y \\ \Delta\theta \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \frac{\sin\omega t}{\omega} & \frac{\cos\omega t - 1}{\omega} & 0 \\ \frac{1-\cos\omega t}{\omega} & \frac{\sin\omega t}{\omega} & 0 \\ 0 & 0 & t \end{bmatrix} R\begin{bmatrix} Vx \\ Vy \\ \omega \end{bmatrix}$$

We can take out the forced common factor t in the second matrix to get the position difference between updates instead of **velocities**:

$$G\begin{bmatrix}\Delta x\\ \Delta y\\ \Delta\theta\end{bmatrix} = \begin{bmatrix}\cos\theta & -\sin\theta & 0\\ \sin\theta & \cos\theta & 0\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}\frac{\sin\omega t}{\omega} & \frac{\cos\omega t-1}{\omega} & 0\\ \frac{1-\cos\omega t}{\omega} & \frac{\sin\omega t}{\omega} & 0\\ 0 & 0 & t\end{bmatrix}R\begin{bmatrix}v_x\\ v_y\\ \omega\end{bmatrix}t$$

$$G\begin{bmatrix}\Delta x\\ \Delta y\\ \Delta\theta\end{bmatrix} = \begin{bmatrix}\cos\theta & -\sin\theta & 0\\ \sin\theta & \cos\theta & 0\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}\frac{\sin\omega t}{\omega t} & \frac{\cos\omega t-1}{\omega t} & 0\\ \frac{1-\cos\omega t}{\omega t} & \frac{\sin\omega t}{\omega t} & 0\\ 0 & 0 & t\end{bmatrix}R\begin{bmatrix}v_x t\\ v_y t\\ \omega t\end{bmatrix}$$

$$G\begin{bmatrix}\Delta x\\ \Delta y\\ \Delta\theta\end{bmatrix} = \begin{bmatrix}\cos\theta & -\sin\theta & 0\\ \sin\theta & \cos\theta & 0\\ 0 & 0 & 1\end{bmatrix}\begin{bmatrix}\frac{\sin\Delta\theta}{\Delta\theta} & \frac{\cos\Delta\theta-1}{\Delta\theta} & 0\\ \frac{1-\cos\Delta\theta}{\Delta\theta} & \frac{\sin\Delta\theta}{\Delta\theta} & 0\\ 0 & 0 & 1\end{bmatrix}R\begin{bmatrix}\Delta x\\ \Delta y\\ \Delta\theta\end{bmatrix}$$

However, we can have 0(if the robot only went forward or only strafed) and we would have multiple divisions by 0 which would result in indeterminacy (**NaN** in **Java**). We decided that the best solution is to approximate the 2 terms using **Taylor Series** (2 are equal and 2 are opposite), since the functions are indefinitely differentiable:

$$\frac{\sin\Delta\theta}{\Delta\theta} = 1 - \frac{\Delta\theta^2}{6} + \ldots \approx 1 - \frac{\Delta\theta^2}{6}$$

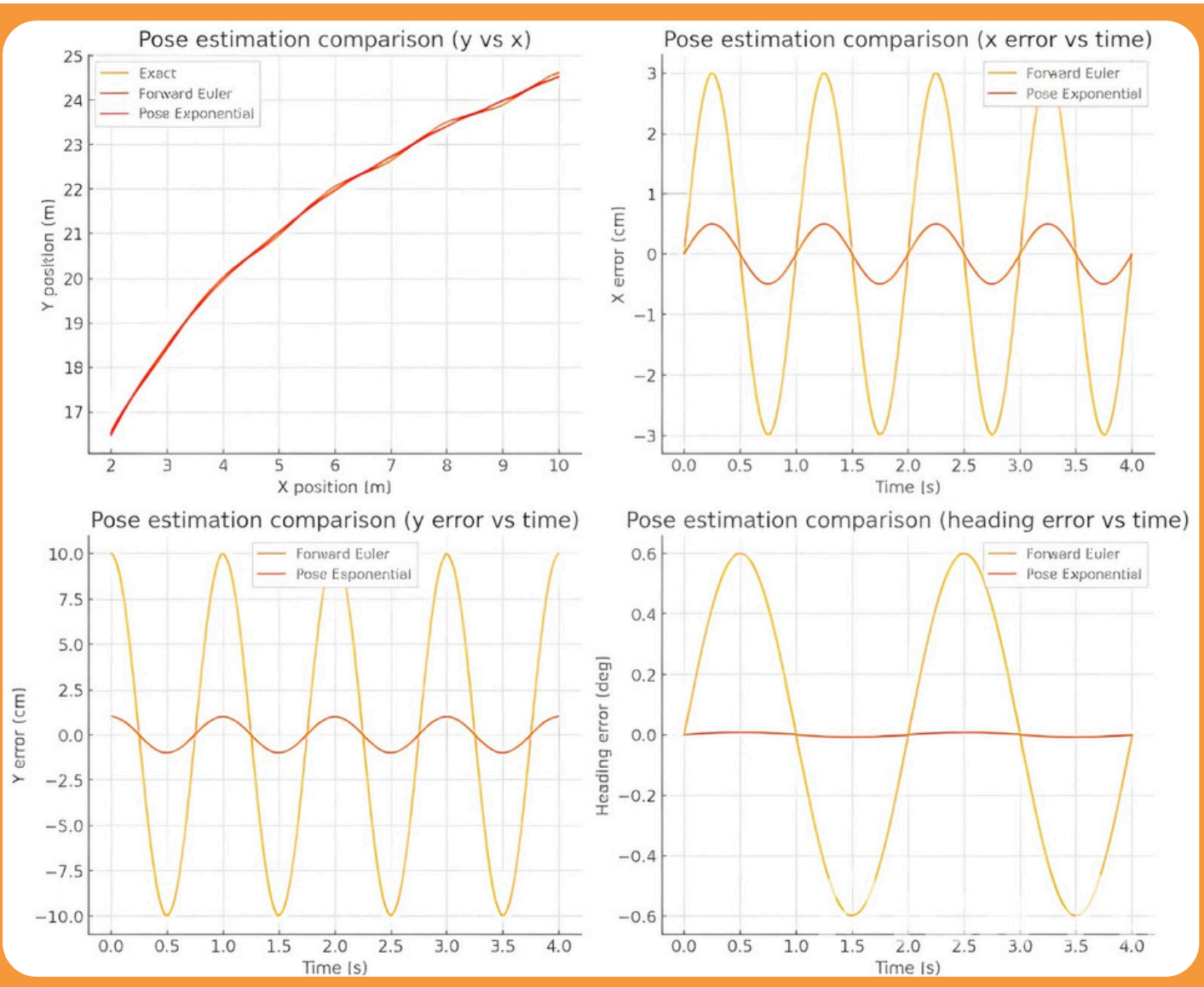
$$\frac{\cos\Delta\theta - 1}{\Delta\theta} = -\frac{\Delta\theta}{2} + \frac{\Delta\theta^3}{24} - \ldots \approx -\frac{\Delta\theta}{2}$$

Important idea:

Instead of representing the above calculation in the form in which we did it, in matrices, we realized that it would significantly improve the efficiency of our program if we did the matrix multiplication first, and then use the resulting numerical equation in the code.

Finally, to obtain the robot's current position on the ground, we add the three calculated deltas to the previously determined position.

Comparison between the 2 methods:



PinPoint localizer:

Although the method we developed worked very well and the error was relatively small, we discovered that **PinPoint**, an **odometry** calculator, uses a very similar method to **Pose** exponentials, except that it makes internal position updates at much shorter intervals: the control hub completes a loop once every 0.01-0.03 seconds, in other words it updates the robot's position every 10-30 ms, while **PinPoint** updates the position once every 0.00065 seconds, instead of every 0.65 ms, which means that the position is modified over 15 times more often.

Advantages:

- as **PinPoint** takes readings from **odometry** encoders and uses the internal **IMU**, it reduces the need for the control hub to take 3 I2C reads, which are the slowest, to a single I2C read directly from the computer;
- the position is updated over 15 times more frequently

Disadvantages:

- Consumes more current;
- The product is still in development and I had some problems with it.

After we solved the problems, **PinPoint** proved to be a more effective method of localization and we continued to use it.

Problems:	Solutions:
• **PinPoint** sometimes returns **NaN** values	• Before we go ahead and put the wrong values in the important variables, we update the values until they are no longer **NaN** (usually a single additional read is enough)
• Sometimes **PinPoint** returns a random speed instead of giving us the actual speed of the robot.	• We calculate the difference between the current position and the past position and divide it by how much time has passed between updates, because: $v = \frac{\Delta d}{\Delta t}$

Predetermine the stopping point based on the current speed:

We realized that if we calculate how fast the robot decelerates (we find the maximum speed of the robot on each axis and divide by how long it takes for the robot, which is moving at maximum speed, to stop completely) we can see the exact position at which the robot stops if we give 0 power to the motors at that moment. The formula for calculating the additional distance traveled:

$$x_{predicted} = x_{current} + \frac{sgn(v_x) * v_x * v_x}{2 * xDeceleration}$$

$$y_{predicted} = y_{current} + \frac{sgn(v_y) * v_y * v_y}{2 * yDeceleration}$$

- **pair(xpredicted,ypredicted)** represents the stopping position of the robot if the power from the motors becomes 0 at this moment
- vx and vy are the robot speeds on the 2 axes
- **xDeceleration**, **yDeceleration** represents the 2 values calculated previously
- **sgn()** represents the signature function (sign)

Trajectory creator:

Now that we have the robot's position continuously, the next step is to determine the ideal position of the robot at each moment. For this we used 2 types of trajectories:

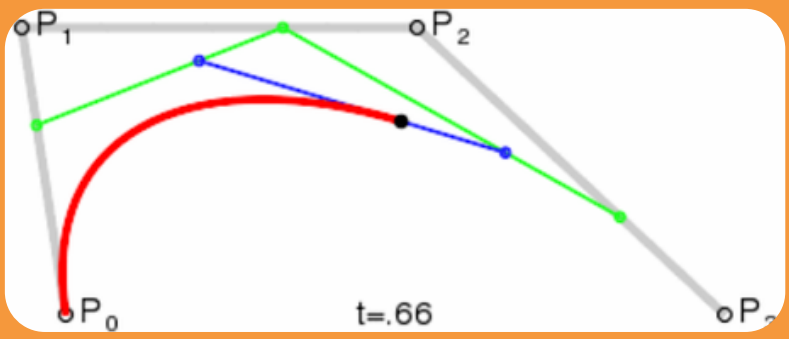
1. **Lines**

For this type of trajectory the robot receives a set of 3 values that we have called Pose: an x, a y and a heading, and it will calculate the fastest route between these 2 points.

This is done by finding the difference between the 2 positions (on each axis, respectively heading) and giving the correct power to the motors so that it reaches the desired position.

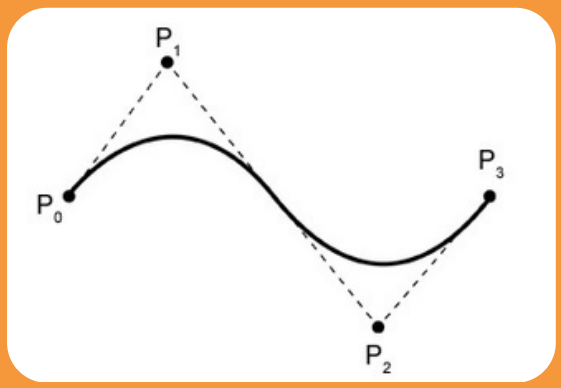
2. **Cubic Bézier curves**

A Bézier curve is defined by a set of control points P0 to Pn, where n is called the order of the curve. The first and last control points are always the endpoints of the curve; however, intermediate control points are generally not on the curve. Depending on the order of the curve, there are several types of **Bézier curves**.



We decided to use **Cubic Bezier** curves for several reasons:

1. Simplicity: **Cubic Bézier** curves are relatively simple to understand and use. They are defined by only a few **control points**, making them accessible in any situation.
2. Precise control: **Cubic Bézier** curves provide precise control over the path. The position and tangencies of the control points can be easily adjusted to achieve the exact path you want.
3. Easy joining: **Bézier curves** are easy to join and form **Bézier splines** which are complex, longer and easy to shape trajectories.



Four points P0, P1, P2 and P3in the plane or in higher-dimensional space define a **Cubic Bézier Curve**. The curve starts from P0 going towards P1 and reaches P3 coming from the direction of P2. Usually, it will not pass through P1 and P2 ;these points are there only to provide directional information.The distance between P1 and P2 determines "how far" and "how fast" the curve moves towards P1 before turning to P2.The equations for a point P(X,Y) on the **Cubic Curve** are of the form:

$$X_t = (1-t)^3 P_{x_0} + 3(1-t)^2 t P_{x_1} + 3(1-t)\, t^2 P_{x_2} + t^3 P_{x_3}, 0 \le t \le 1$$

$$Y_t = (1-t)^3 P_{y_0} + 3(1-t)^2 t P_{y_1} + 3(1-t)\, t^2 P_{y_2} + t^3 P_{y_3}, 0 \le t \le 1$$

Observation:
Calculating the first derivative of the function will result in:

$$X' = 3(1-t)^2 (P_{x_1} - P_{x_0}) + 6(1-t)\, t (P_{x_2} - P_{x_1}) + 3t^2 (P_{x_3} - P_{x_2}), 0 \le t \le 1$$

$$Y' = 3(1-t)^2 (P_{y_1} - P_{y_0}) + 6(1-t)\, t (P_{y_2} - P_{y_1}) + 3t^2 (P_{y_3} - P_{y_2}), 0 \le t \le 1$$

With these, by calculating atan(Y',X') we obtain the heading that the robot should have at this point so that it is tangent to the trajectory.

To achieve these trajectories,we realized that the best solution is to use 2 separate classes and an interface:

1. **Bézier Curve**:

This class was used with the aim of creating a **Bézier Curve** through the equation described previously and using the various properties of such a function, thus we have the following essential methods:

- **CubicBezierCurve(Vector p0, Vector p1, Vector p2, Vector p3)** or **CubicBezierCurve(Vector p0, Vector p1, Vector p2, Vector p3, double targetAngle)** - These 2 methods are the constructors and are used to create a **Bézier** curve based on the 4 given points:

```
public CubicBezierCurve(Vector p0, Vector p1, Vector p2, Vector p3) {
    this.p0 = p0;
    this.p1 = p1;
    this.p2 = p2;
    this.p3 = p3;
    computeLength();
  }
 public CubicBezierCurve(Vector p0, Vector p1, Vector p2, Vector p3, double
targetAngle) {
    this.targetAngle = targetAngle;
    this.p0 = p0;
    this.p1 = p1;
    this.p2 = p2;
    this.p3 = p3;
    computeLength();
  }
```

```
{
double w = 1 - t;
Vector firstTerm = p0.scalarMultiply(w * w * w);
Vector secondTerm = p1.scalarMultiply(3 * t * w * w);
Vector thirdTerm = p2.scalarMultiply(3 * t * t * w);
Vector fourthTerm = p3.scalarMultiply(t * t * t);
return firstTerm.add(secondTerm).add(thirdTerm).add(fourthTerm);
}
```

- **Vector calculate(double t) -** this function calculates the current position based on a given t.

```
 public Vector firstDerivative(double t)
{
double w = 1 - t;
Vector firstTerm = p1.subtract(p0).scalarMultiply(3 * w * w);
Vector secondTerm = p2.subtract(p1).scalarMultiply(6 * w * t);
Vector thirdTerm = p3.subtract(p2).scalarMultiply(3 * t * t);
return firstTerm.add(secondTerm).add(thirdTerm);
}
```

- **Vector firstDerivative(double t) -** calculates the first derivative (using the derivation rules for that polynomial function) of the function and returns the point on its graph that corresponds to a given t.

```
 public Vector secondDerivative(double t)
{
double w = 1 - t;
Vector doubP2 = p2.scalarMultiply(2);
Vector doubP1 = p1.scalarMultiply(2);
Vector firstTerm = p2.subtract(doubP1).add(p0).scalarMultiply(6*w);
Vector secondTerm = p3.subtract(doubP2).add(p1).scalarMultiply(6*t);
return firstTerm.add(secondTerm);
}
```

- **Vector secondDerivative(double t) -** calculates the second derivative of the function and returns the point on its graph that corresponds to a given t.

```
public double slope(double t)
{
Vector dt = firstDerivative(t);
return dt.getY() / dt.getX();
}
```

- **double slope(double t)** - calculate the slope of the line for that t (use the function **firstDerivative** to find the line)

- **double curvatureOfThePath(double t)** - calculates the curvature of the trajectory at a given t.

```
public double curvatureOfThePath(double t)
{
Vector derivative = firstDerivative(t);
Vector secondDerivative = secondDerivative(t);
if (derivative.getMagnitude() == 0) return 0;
return (Vector.crossProduct(derivative, secondDerivative)) / Math.pow(derivative.getMagnitude(), 3);
}
```

double findClosestPoint(Vector Point, double lastT) - finds the closest point on the trajectory to the position given in vector form (we don't care about the angle), the passed t and returns the t for that position.

```
public double findClosestPoint(Vector point, double lastT)
{
    double minT = -1;
    double minDist = Double.POSITIVE_INFINITY;//valoarea maximă pt double
    for (double i = lastT * resolution; i <= resolution; i++) {
        double t = (i / (double) resolution);
        double dist = calculateMinimizationFunction(t, point);
        if (dist < minDist) {
            minDist = dist;
            minT = t;
        }
    }
    if (calculateMinimizationFunction(lastT - (double) 1 / resolution, point) <= minDist) {
        double N = (lastT - (double) 1 / resolution) * resolution;
        for (double i = 0; i <= N; i++) {
            double t = (i / (double) resolution);
            double dist = calculateMinimizationFunction(t, point);
            if (dist < minDist) {
                minDist = dist;
                minT = t;
            }
        }
    }
    if (minT == -1)
        minT = 1;
    return minT;
}
```

Resolution - is the frequency of the points on the trajectory, it basically represents how many points the function graph is made up of (if it is too small the path will cut off the trajectory and will not follow it exactly, but if it is too large the time to travel through all the points is too long and it is not necessary to have very close points)

```
private double calculateMinimizationFunction(double t, Vector point)
 {
      return calculate(t).subtract(point).getMagnitude();
}
```

- **calculateMinimizationFunction(double t, Vector point)** - calculates the **Euclidean distance** between the point located at time t on the path and point which is a position (in this case it is the current position of the robot on the **field**)

- **void computeLength()** - calculate the total length of the trajectory by adding the **Euclidean distance** between each point (2 by 2) and since we already calculate the coordinates of the points, we will retain them in a matrix to draw them on the **Dashboard**, so we don't waste time with this representation and it can help us with calibration.

```
 private void computeLength()
{
      double dt = 1.0 / (double) resolution;
      for (double d = 0; d <= 1; d += dt) {
         Vector currentPoint = calculate(d);
         dashboardDrawingPoints[1][(int) (d * resolution)] = -currentPoint.getX() / 2.54;
         dashboardDrawingPoints[0][(int) (d * resolution)] = currentPoint.getY() / 2.54;

         lengthArray.add(length);
         length += calculate(d).getMagnitude() * dt;
      }
}
```

2.**BézierSpline:**

This class has exactly the same functions, the difference is that a bezier spline is made up of multiple curves and we cannot use the given t directly, because we do not know on which of the spline segments this t is located. To determine this, we proceed as follows:

```
int segmentCount = curves.size();
      double segmentLength = 1.0 / segmentCount;
int segmentIndex = Math.min((int) (t/segmentLength),segmentCount-1);
double localT = (t - segmentIndex * segmentLength) / segmentLength;
```

And after we have the segmentIndex and localT we can directly call the function we are interested in from the previous class. For example, for the function Vector calculate(double t):

```
public Vector calculate(double t)
{
      int segmentCount = curves.size();
      double segmentLength = 1.0 / segmentCount;
      int segmentIndex = Math.min((int) (t / segmentLength), segmentCount - 1);
      double localT = (t - segmentIndex * segmentLength) / segmentLength;

      return curves.get(segmentIndex).calculate(localT);
   }
```

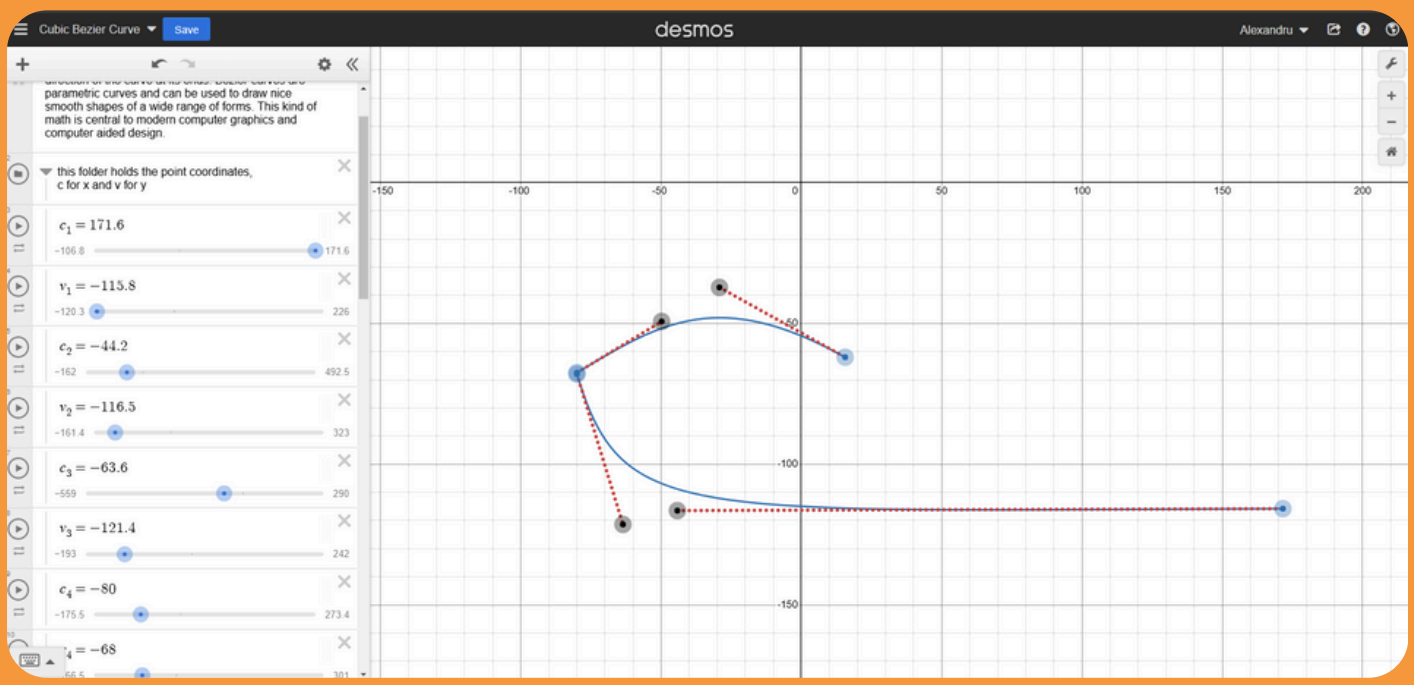
where curves is a list of each curve that makes up the spline and we do it in the constructor like this:

```
public BezierSpline(CubicBezierCurve... curves) {
      for (CubicBezierCurve curve : curves)
         addCurve(curve);
      computeLength();
   }

   public BezierSpline(double targetAngle, CubicBezierCurve... curves) {
      this.targetAngle = targetAngle;
      for (CubicBezierCurve curve : curves)
         addCurve(curve);
      computeLength();
   }
```

If we decide to use the first one, the angle the robot must reach is given by the first derivative of the curve and therefore it will remain continuously on the trajectory, and if we use the second constructor, we will specify what angle we want it to reach and maintain.

3.**Spline**:
We used this interface that combines the 2 classes because the functions are very similar and thus it makes our work much easier when calling the functions and initializing the trajectory.

Additionally, we realized that the easiest way to create our trajectories for the Autonomous period is through a graphing calculator like Desmos. So we made our own application to plot them:



Motor power calculation:

We were primarily interested in finding the power that should be given as a Vector, and then leaving the transformation to individual powers for each motor from the chassis in the other side of the algorithm. To be able to calculate this according to the trajectory, we used 2 different methods:

1. **GoToPoint**

This system works through **TargetPositions**, which represent positions (**Pose**) given directly by the programmer during the **Autonomy** to which the robot goes through a linear trajectory. However, we can also choose to use a Queue<Pose> in which we store all the positions we want the robot to reach, and the algorithm will take them in order and go through each one without stopping along the way.

After the program receives a new **TargetPosition**, the following sequence of actions occurs:

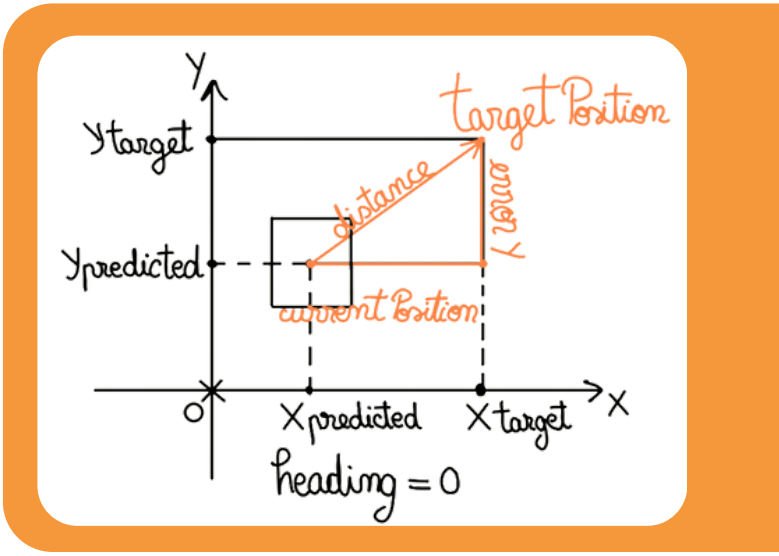
- the predicted position is calculated:

$$currentPosition = new\ Pose(x_{predicted}, y_{predicted}, heading)$$

- the error between is calculated targetPosition and currentPosition:

$$err = targetPosition.subtract(currentPosition)$$

- we check if the error is "small" or "large" and depending on that we decide whether to use the final or normal adjustment coefficients:




```
if(err.getMagnitude()<=15&&angleWrapper(err.getHeading())<=
Math.toRadians(15) && useFinalAdj) {
motors.resetMinPowersToOvercomeFriction();
resetMultipliers();
tPid.setPID(tPIDCoeff_finalAdj.p, tPIDCoeff_finalAdj.i, tPIDCoeff_finalAdj.d);
hPid.setPID(hPIDCoeff_finalAdj.p, hPIDCoeff_finalAdj.i, hPIDCoeff_finalAdj.d);
}
else {
motors.setMinPowersToOvercomeFriction();
tPid.setPID(tPIDCoeff_GoToPoint.p, tPIDCoeff_GoToPoint.i,
tPIDCoeff_GoToPoint.d);
hPid.setPID(hPIDCoeff.p, hPIDCoeff.i, hPIDCoeff.d);
}
```

- the distance to the target is calculated:

$$distance = Math.hypot(err.getX(), err.getY());$$

- we calculate the sine and cosine of the angle:

$$cos = err.getX() / distance;$$
$$sin = err.getY() / distance;$$

- we calculate the translational power that must be given to the motors as a function of distance using a PID:

$$translationalPower = tPid.calculate(-distance, 0);$$

- we decompose the power into vector components:

$$powerVector = new\ Vector(translationalPower * cos, translationalPower * sin);$$

- we rotate the power vector according to the robot orientation to make sure we don't confuse the oX coordinate with the oY coordinate, when the robot is rotated at an angle other than 0:

```
powerVector = powerVector.rotate(currentPose.getHeading());
```

- we recalculate the angle error to determine in which direction we rotate so that we reach the target the fastest (as the imu goes in the range [-180,180], if we are at -179 and we want to reach 180, instead of rotating -359 degrees as the error is, we rotate one degree in the opposite direction). For this we use the angleWrapper function:

```
private double angleWrapper(double angle) {
    angle %= (2.0 * Math.PI);
    if (angle > Math.PI) angle -= 2.0 * Math.PI;
    if (angle < -Math.PI) angle += 2.0 * Math.PI;
    return angle;
}
```

```
headingDiff = angleWrapper(err.getHeading());
```

- we calculate the angular power using another heading PID and add it to our power vector:

```
headingPower = hPid.calculate(- headingDiff, 0);
```

- we check if the sum of the elements in the modulo of our vector exceeds 1, and if so, we scale it to 1 (because the motors don't accept a power greater than 1 anyway, we need to make sure it is scaled appropriately between them):

```
if (Math.abs(powerVector.getX()) + Math.abs(powerVector.getY()) +
Math.abs(powerVector.getHeading()) > 1)
powerVector = powerVector.scaleToMagnitude_AngularAsWell(1);
```

- we apply multiplication to prioritize the move we are interested in to be made first:

```
powerVector = new Vector(powerVector.getX() * lateralMultiplier, powerVector.getY() *
forwardMultiplier, headingPower * headignMultiplier);
```

We can dynamically change these multiplications throughout the Autonomy, and after the position error associated with that multiplier is small enough, it returns to the value determined during calibration.

- Finally, we write the power in vector form for the left and right sides of the chassis and send it to the motors to make the necessary calculations before application:

```
motors.setMotorPower(new Vector[]{new Vector(powerVector.getX(), powerVector.getY() -
powerVector.getHeading()), new Vector(powerVector.getX(), powerVector.getY() + powerVector.getHeading())});
```

2.SplineFollower

This system works based on Splines, which are explained in the Trajectory Creator chapter. The algorithm takes the following steps in order at each loop to calculate the power vector:

- the current position in the locator is calculated:

```
currentPosition = new Pose(x, y, heading);
```

OBS: We cannot use the predicted position because here the trajectory is not linear and the formula only applies in those cases.

- we calculate the current t based on this position and remember it for the next cycle:

```
currentT = trajectory.findClosestPoint(robotPose.toVec(), lastT);
lastT = currentT;
```

- we calculate the following point of interest:

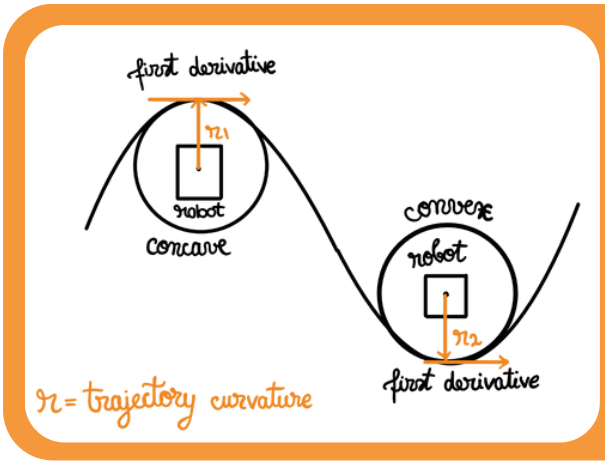
```
Vector currentTargetPoint = trajectory.calculate(currentT + 1.0 / resolution);
Pose targetPose = new Pose(currentTargetPoint, trajectory.heading(currentT + 1.0 / resolution));
```

- We check if the trajectory is at the end, and if so, we do a **GoToPoint** on the last part of the trajectory to make sure we don't miss the end point.
- now the algorithm makes 4 calculations for correction or trajectory advancement in the following order of importance:
  - path position correction with **PID**;
  - centrifugal force correction;
  - correction of the heading;
  - continue on the path
- We chose this order because we are interested in the robot staying on the trajectory, after the heading is correct and finally for it to continue on the trajectory.

The correction of the position on the trajectory and the heading works very similarly to that of **GoToPoint**, but here we have 2 **translational PIDs**: one for x and one for y because we need slightly more precise control, and one for heading.

Centrifugal force correction: to calculate this vector we use the curvature of the trajectory and the second derivative of the function which tells us what its graph looks like (if it is convex or concave), but also the first derivative which tells us how the velocity vector should be oriented. Thus, we obtain the following formula:

```
double curvature = trajectory.curvatureOfThePath(currentT);
```



$$correctionVector = Vector.polar(CentripetalScalingFactor * TotalMassOfRobot * Math.pow(trajectory.firstDerivative(currentT).scaleToMagnitude(1).getMagnitude(), 2) * curvature), trajectory.firstDerivative(currentT).getRelativeHeading() + Math.PI/2 * Math.signum(trajectory.secondDerivative(currentT).getRelativeHeading()))$$

This formula is based on the physics formula: $F_{centripetal} = m\frac{v^2}{r}$, where $F_{centripetal}$ -centripetal force (opposite and equal in magnitude to the centrifugal force)

m-TotalMassOfTheRobot

v-trajectory.firstDerivative(currentT).scaleToMagnitude(1).getMagnitude()(scaling is only done if the magnitude is greater than 1)

r-curvature

CentripetalScalingFactor is a **kP** type term, as in a **PID**, to apply this correction proportionally.

Now that we know the magnitude of the vector, we still need to find the orientation. We know that this force is perpendicular to the tangent to the graph (the first derivative), so it is enough to add or subtract 90 degrees from this orientation. To decide this sign, we look at the sign of the second derivative (which represents whether the graph is convex or concave).

$$trajectory.\,firstDerivative(currentT).\,getRelativeHeading() + Math.\,PI/2*$$

Continuation on the trajectory is done only when the other vectors have a fairly small magnitude (i.e. we are, first of all, on the trajectory) and is represented as length: by the magnitude of the first derivative scaled to 1 and as orientation by the direction of the tangent to the trajectory (the first derivative). This has the formula:

$$pathingPower = trajectory.\,firstDerivative(currentT).\,scaleToMagnitude(1);$$

After calculating the necessary vectors, we start adding them, taking into account the magnitude of the vector after each addition. If we add 2 vectors, and the result has magnitude above 1, then we look for a scalar by which we multiply the "less important" one, add them and return the final vector.
For example:

```
Vector unscaledCorrectionVector=pidVector.add(correctionVector);
if (unscaledCorrectionVector.getMagnitude() >= 1)
{
double norm = Vector.findScaleFactor(pidVector,correctionVector);
return pidVector.add(correctionVector.scalarMultiply(norm));
}
```

This is how we add the vector with **PID** position correction and the one with centrifugal force correction.

Motor power distribution:

Once the power vector has been calculated we need to see how to decompose it, in order to correctly distribute the power to the motors. Initially we tried to directly use the formulas described in the **Robot Centric** chapter. However with this approach we noticed a few problems:

1. the friction force with the tile is constantly slowing us down;
2. battery voltage influences the motor's rotation speed, so it must be compensated somehow;
3. In the formulas presented in the **Robot Centric** chapter, we use the assumption that their rollers are oriented at exactly 45 degrees, which is almost never true (it is a very small difference of maximum 1-2 degrees).

Compensation for friction force:

1. **Static friction**:

- is the frictional force that opposes the initiation of motion of an object at rest on a surface;
- occurs when an object is at rest and a force tries to set it in motion;
- is always greater than kinetic friction.

2. **Kinetic friction**

- is the frictional force acting on an object already in motion relative to a surface.
- only appears when the object is moving.
- is constant and less than the maximum static friction.

Based on these definitions we calculate 2 constants: one for the minimum power that must be given to the motor to overcome static friction and one for kinetic friction. We decide which one to apply as follows: we remember when the power was last 0 to the motors and based on that we apply the correction coefficient for static friction that we noted **minPowerToOvercomeKineticFriction**, while the robot is static and until it starts moving (we have a test that calculates this time and it is marked **SwitchFromStaticToKineticFriction**), and until it stops again we apply the other power marked **minimumPowerToOvercomeKineticFriction**. This is the sequence in the code:

$$(System.\,currentTimeMillis() > SWITCH\_FROM\_STATIC\_TO\_KINETIC\_FRICTION + lastZeroTime\,?$$

$$minPowerToOvercomeKineticFriction : minPowerToOvercomeStaticFriction)$$

Voltage compensation:

We decided to approach this inversely, because if the battery voltage is higher, we need less compensation, and if the voltage is lower, more compensation is needed. We chose to do this at a voltage of 13.0 V, considering that this is the ideal value, so that we do not compensate too much or too little. The formula we used was: (13.0 / voltage).

To apply these 2 compensations we decided to do it in a proportional way so we created an auxiliary variable to include them:

```
aux = (System.currentTimeMillis() > SWITCH FROM STATIC TO KINETIC FRICTION +
lastZeroTime ? minPowerToOvercomeKineticFriction : minPowerToOvercomeStaticFriction)
* (13.0 / voltage)
```

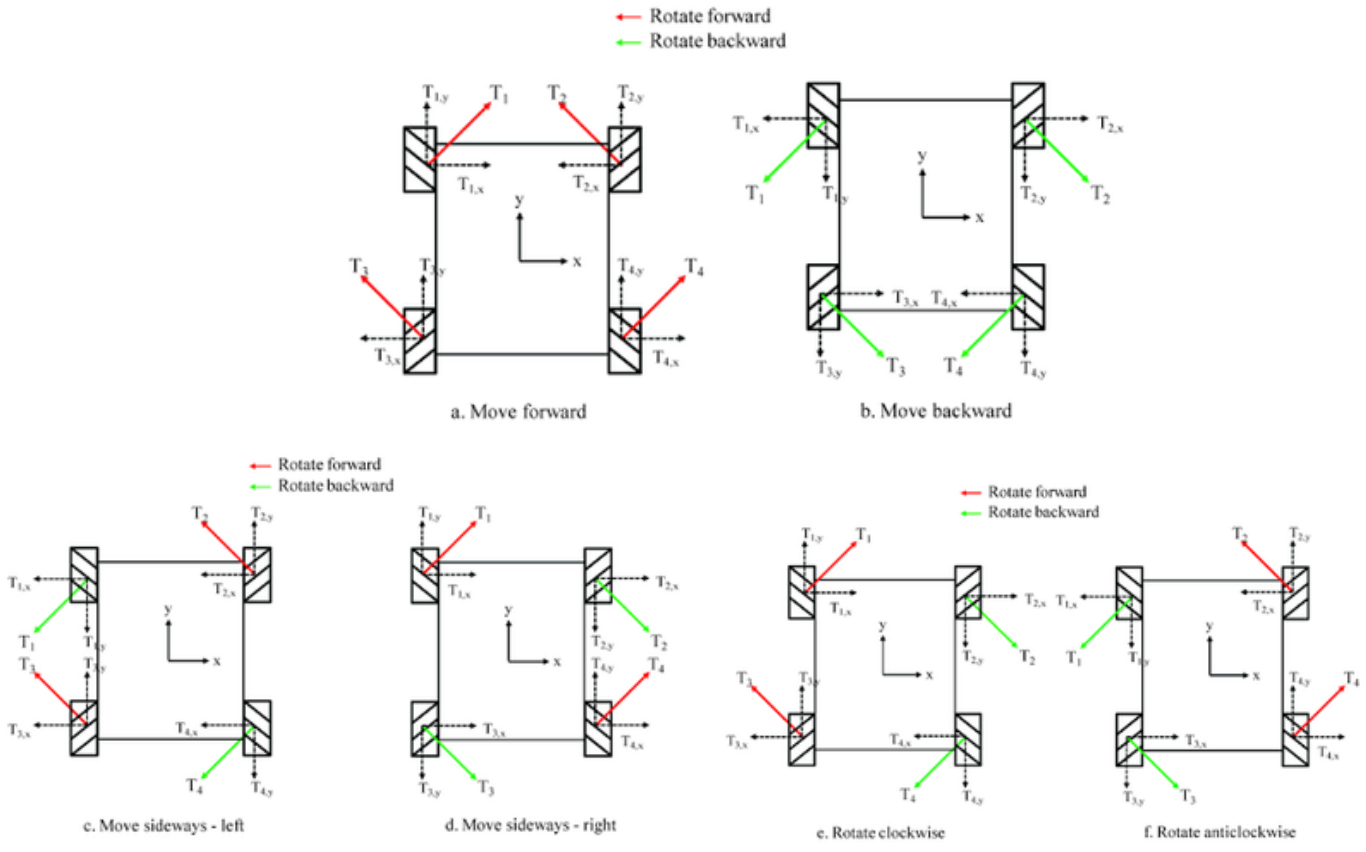
Now to apply the correction to the engine power in a correct way we will do this:

```
power = power * (1 − aux);

power = power + aux * Math.signum(power)
```

It is necessary to apply the correction in this way because if we add it directly we risk that the resulting power will be greater than 1 and then the correction would be useless, because the maximum power that can be given to the motor is 1 anyway and this would not be scaled properly.

Compensation for strafe imperfections:

In the ideal case, where the mecanum wheels are oriented at exactly 45°, then the force vectors of each wheel should behave as in the figure below for each movement:



It is obvious that if even one of the 4 vectors, which describe the movement, is not oriented at exactly 45°, then the vector components no longer cancel out perfectly and this is felt most when walking sideways, because the robot, depending on how big the difference is between the angle of the rollers and 45°, will start to drift slowly forward or backward.
To solve these imperfections, we calculate the x and y components of the maximum speed vector for the wheels and depending on how each one should be oriented, we calculate them as follows:

```
public static final double xMaxVelocity;//Calculat în MaxLateralVelocity
public static final double yMaxVelocity; //Calculat în MaxForwardVelocity
public static Vector frontLeftVector = new Vector(-xMaxVelocity, yMaxVelocity).scaleToMagnitude(1);
```

OBS: We scale the vectors to 1 so as not to make the power larger when we use it.

```
final Vector[] mecanumVectors = new Vector[]{
 Vector.polar(frontLeftVector.getMagnitude(), copiedFrontLeftVector.getOrientation()),
 Vector.polar(frontLeftVector.getMagnitude(), 2 * Math.PI - copiedFrontLeftVector.getOrientation()),
 Vector.polar(frontLeftVector.getMagnitude(), 2 * Math.PI - copiedFrontLeftVector.getOrientation()),
 Vector.polar(frontLeftVector.getMagnitude(), copiedFrontLeftVector.getOrientation())
   };
```

where:

```
public static Vector polar(double r, double t) {
 return new Vector(r * Math.cos(t), r * Math.sin(t));
}
public double getOrientation() {
return Math.atan2(y, x);
}
```

Using the calculated vectors, we apply the following formulas to calculate the power of each wheel:

```
Vector[] truePathingVectors = new Vector[]{new Vector(powerVector.getX(), powerVector.getY() +
powerVector.getHeading()), new Vector(powerVector.getX(), powerVector.getY() - powerVector.getHeading())};

truePathingVectors[0] = truePathingVectors[0].scalarMultiply(2.0);

truePathingVectors[1] = truePathingVectors[1].scalarMultiply(2.0);

wheelSpeeds[0] = (-mecanumVectors[1].getY() * truePathingVectors[0].getY() - truePathingVectors[0].getX() *
mecanumVectors[1].getX()) / (mecanumVectors[1].getY() * mecanumVectors[0].getX() - mecanumVectors[0].getY() *
mecanumVectors[1].getX());

wheelSpeeds[1] = (-mecanumVectors[0].getY() * truePathingVectors[0].getY() - truePathingVectors[0].getX() *
mecanumVectors[0].getX()) / (mecanumVectors[0].getY() * mecanumVectors[1].getX() - mecanumVectors[1].getY() *
mecanumVectors[0].getX());
```

```
wheelSpeeds[2] = (-mecanumVectors[3].getY() * truePathingVectors[1].getY() - truePathingVectors[1].getX() * mecanumVectors[3].getX()) / (mecanumVectors[3].getY() * mecanumVectors[2].getX() - mecanumVectors[2].getY() * mecanumVectors[3].getX());

wheelSpeeds[3] = (-mecanumVectors[2].getY() * truePathingVectors[1].getY() - truePathingVectors[1].getX() * mecanumVectors[2].getX()) / (mecanumVectors[2].getY() * mecanumVectors[3].getX() - mecanumVectors[3].getY() * mecanumVectors[2].getX());
```

These formulas are very similar to those used by the **Pedro Pathing library** (the difference is given by our coordinate system and theirs), and show the influence of each wheel on the movement, and **truePathingVectors** holds the power of the motors on the left side at position 0, and those on the right side at position 1.
With the help of these formulas, the power given to each wheel is correctly distributed according to the true orientation of its rollers.

Tuning:

In order to use the **path-following** algorithm to the full capacity of the robot, it must be properly calibrated.
Thus, we designed a series of tests, 7 of which are **semiAutomated** and 4 of which are manual.

The order of the tests is as follows:

1. cmTickPerCalculus
2. MaxForwardVelocity
3. MaxLateralVelocity
4. DecelerationTunerLateral
5. DecelerationTunerForward
6. KineticStaticTuner
7. MinimumPowerToOvercomeFrictionDrivetrainTuner
8. SwitchFromStaticToKineticFriction
9. ChassisPIDTuner
10. SplinePIDTuner
11. CentripalForceTuner

1. The first test is **cmTickPerCalculus**, which displays the encoder values read by PinPoint, so you can calculate values such as tick/mm.
2. The second test is **MaxForwardVelocity**, a test in which the robot will move forward at maximum power for 1500 milliseconds, which is approximately 360 cm forward (an entire field), this test displaying the constant on the telemetry at the end: **yMaxVelocity**.
3. The third test is **MaxLateralVelocity**, a test very similar to the second, in which the robot will move sideways at maximum power for 2000 milliseconds, approximately 360 cm to the right (a whole field), this test displaying the constant on the telemetry at the end: **xMaxVelocity**.
4. The fourth test is **DecelerationTunerLateral**, a test in which the robot will go forward at maximum power and begin to decelerate for 1000 milliseconds, approximately 360 cm laterally (a whole field), this test finally displaying the constant on the telemetry: **xDeceleration**.
5. The fifth test is **DecelerationTunerForward**, a test in which the robot will go with maximum power to the right and begin to decelerate for 1000 milliseconds, i.e. approximately 360 cm forward (a whole field), this test displaying at the end on constant telemetry: yDeceleration.
6. The sixth test is **KineticStaticTuner**, a test in which the robot moves forward at a constant, fairly low speed (15cm/s). It calculates the power (from 0 to 1) with which the robot moves, depending on the kinetic energy, this test displaying the constant on the telemetry: **minPowerToOvercomeKineticFriction**.

7. The seventh test is **MinimumPowerToOvercomeFrictionDrivetrainTuner**, a test in which the robot starts the power of a motor from 0 until it detects a movement in position, thus managing to overcome the static friction force. This test finally displays on the telemetry the array of constants: **minPowerToOvercomeStaticFriction**, containing 4 values for each motor.

8. The eighth test is **SwitchFromStaticToKineticFriction**, a test in which the robot walks forward with a minimum power of 15 cm. This test calculates the time in which the robot changes from static friction force to kinetic friction force (in milliseconds), finally displaying on the telemetry the constant: **switchFromStaticToKineticFriction**.

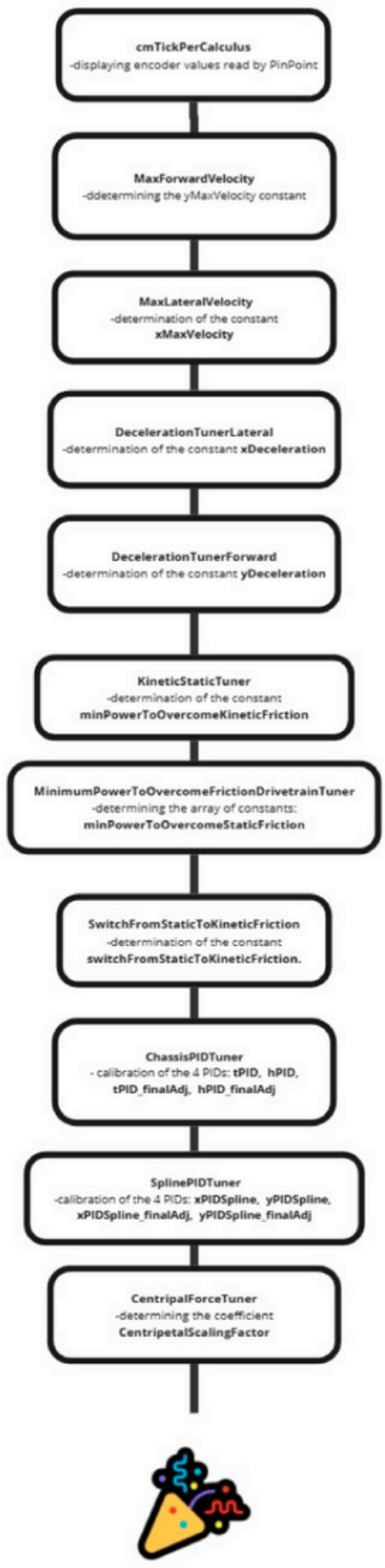
9. The ninth test is **ChassisPIDTuner**, a test in which you give the robot a point you want it to reach, this test being one of the 4 manual tests, having to calibrate 4 different PIDs:

- **tPID** (translational PID, which determines the movement on both Ox and Oy at **GoToPoints**, for large distances)
- **hPID** (which determines the change of the robot's heading, for large distances)
- **tPID_finalAdj** (**translational PID**, which determines the movement on both Ox and Oy at GoToPoints, for small distances)
- **hPID_finalAdj** (which determines the change of the

10. The tenth test is **SplinePIDTuner**, a test in which you give the robot the spline you want it to do, this test being one of the 4 **manual tests**, having to calibrate 4 different **PIDs**:

- **xPIDSpline**(which determines the movement on Ox in Splines, for large distances)
- **yPIDSpline**(which determines the movement on Oy in Splines, for large distances)
- **xPIDSpline_finalAdj**(which determines the movement on Ox in **Splines**, for small distances)
- **yPIDSpline_finalAdj**(which determines the movement on Oy in **Splines**, for small distances)

11. The eleventh test is **CentripalForceTuner**, a test in which you calculate the correction coefficient for centrifugal force, the coefficient you change in the code being: **CentripetalScalingFactor**.



2D Vector Class:

This class was created with the aim of simulating vectors in physics and to improve the ease of calculations with them.

This function converts a vector with polar coordinates into a vector with **Cartesian coordinates**.

```
public static Vector polar(double r, double t) {
  return new Vector(r * Math.cos(t), r * Math.sin(t));
}
```

In this function, the multiplication of two vectors is calculated.

```
public static double crossProduct(Vector a, Vector b) {
    return a.x * b.y - a.y * b.x;
}
```

To multiply 2 vectors that have magnitudes below 1, this function tries to find a scalar vector, to give the magnitude exactly 1, or as close to 1 as possible.

```
public static double findScaleFactor(Vector staticVector, Vector variableVector) {
    double a = Math.pow(variableVector.getX(), 2) + Math.pow(variableVector.getY(), 2);
    double b = staticVector.getX() * variableVector.getX() + staticVector.getY() * variableVector.getY();
    double c = Math.pow(staticVector.getX(), 2) + Math.pow(staticVector.getY(), 2) - 1.0;
    return (-b + Math.sqrt(Math.pow(b, 2) - a * c)) / (a);
}
```

This method returns the x of a vector.

```
public double getX() {
    return x;
}
```

In this method, you set the vector x coordinate.

```
public void setX(double x) {
    this.x = x;
    magnitude = Math.hypot(x, y);
}
```

This method returns the y of a vector.

```
public double getY() {
    return y;
}
```

In this method, you set the vector y coordinate.

```
public void setY(double y) {
    this.y = y;
    magnitude = Math.hypot(x, y);
}
```

In these 2 methods, you can set the robot's heading, or request the robot's heading.

```
public void setHeading(double heading) {
    this.heading = heading;
}

public double getHeading() {
    return heading;
}
```

In this function, the orientation of the vector is returned to you.

```
public double getRelativeHeading() {
    return Math.atan2(y, x);
}
```

In these 2 methods, they return the magnitude of the vector, respectively the magnitude of the vector calculated with the robot's heading.

```
public double getMagnitude() {
    return magnitude;
}

public double getMagnitude_AngularAsWell() { //magnitudinea cu tot cu unghiul
    return Math.sqrt(x * x + y * y + heading * heading);
}
```

These functions represent the addition, subtraction, multiplication, and division of 2 vectors, respectively.

```
public static Vector add(Vector a, Vector b) {
    return new Vector(a.x + b.x, a.y + b.y, a.heading + b.heading);
}

public static Vector subtract(Vector a, Vector b) {
    return new Vector(a.x - b.x, a.y - b.y, a.heading - b.heading);
}

public static Vector scalarMultiply(Vector vec, double scalar) {
    return new Vector(vec.x * scalar, vec.y * scalar, vec.heading * scalar);
}

public static Vector scalarDivide(Vector vec, double scalar) {
    return new Vector(vec.x / scalar, vec.y / scalar, vec.heading / scalar);
}
```

This method rotates your vector by a certain angle

```
public Vector rotate(double angle) {
    return new Vector(
        Math.cos(angle) * x + Math.sin(angle) * y,
        Math.cos(angle) * y - Math.sin(angle) * x,
        heading);
 }
```

In these functions, you scale the magnitude of the vector to a target.

```
public Vector scaleToMagnitude(double targetMagnitude) {    double currentMagnitude = getMagnitude();
    scaleBy(1.0 / currentMagnitude);
    scaleBy(targetMagnitude);
    return this;
 }

 public Vector scaleToMagnitude_AngularAsWell(double targetMagnitude) {
    double currentMagnitude = getMagnitude_AngularAsWell();
    scaleBy_AngularAsWell(1.00 / currentMagnitude);
    scaleBy_AngularAsWell(targetMagnitude);
    return this;
 }
```

In these functions, you scale the vector with a certain value.

```
public void scaleBy(double a) {
    x = x * a;
    y = y * a;
    magnitude = Math.hypot(x, y);
 }

 public void scaleBy_AngularAsWell(double a) {
    x = x * a;
    y = y * a;
    heading = heading * a;
    magnitude = Math.hypot(x, y);
 }
```

This function puts the coordinates of a vector into a string, to display them.

```
public String toString() {
    return "\n(" + x + "; " + y + "; " + heading + ")";
 }
```

This function turns a vector into a Pose.

```
public Pose toPose() {
    return new Pose(x, y, heading);
}
```

This method compares 2 vectors and tells you if they are equal.

```
public boolean equals(Vector vector) {
    return vector.getX() == x && vector.getY() == y && vector.getHeading() == heading;
}
```

This method gives you a boolean value, which represents whether one of the components of the vector is NaN.

```
public boolean isNaN() {
    return Double.isNaN(x) || Double.isNaN(y) || Double.isNaN(heading);
}
```

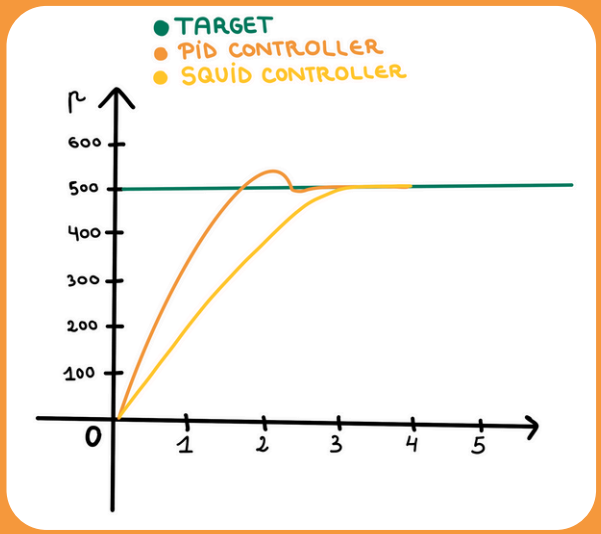
SQUID VS PID Controller

During the **Autonomous period** at the **League Tournament** we noticed that our robot oscillated a lot around the target and thus lost a lot of time. To solve this problem we implemented 2 **SQUIDs** for **translational** control.
The **SQUID** works similarly to a **PID**, the only difference being that the **kP** is applied like this:

- e - error
- P =e*sgn(e)*kP

This simple difference brings the following advantages and disadvantages:

Advantages:	Disadvantages:
• More stable to large errors due to radical function • Much more accurate, due to the lack of overshoot • More precise control in cases where the error is very small	• Slower in initial responses (this is where compensation for static friction force comes into play, which practically cancels out this disadvantage)



Fun fact:

Even though **SQUID** is an advanced technique, in reality, it is used to make the robot's movements smoother and more precise, a kind of '**SQUID** movement' - meaning extremely adaptable movements, like those of a **SQUID**!

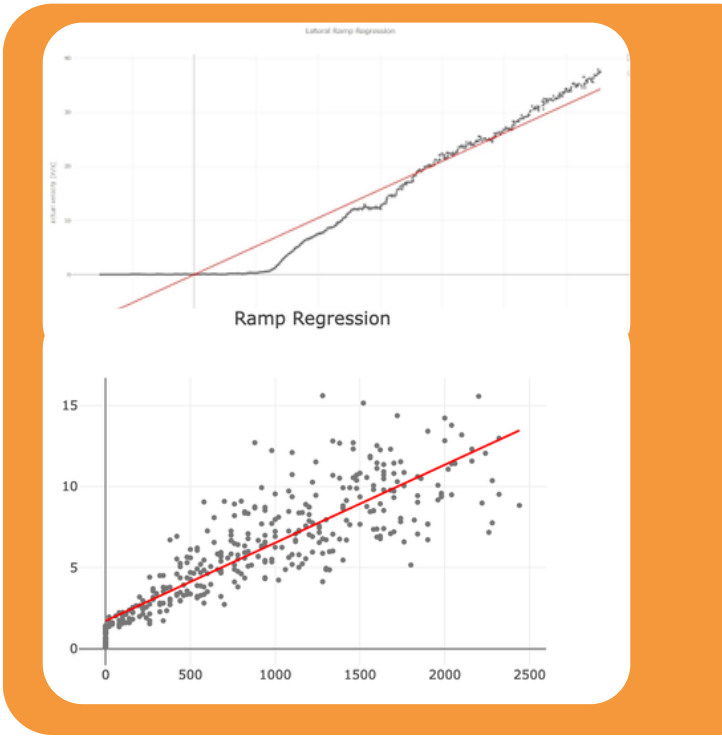
RoadRunner 1.0:

Road Runner is a motion planning library. It is designed primarily for **Autonomous** movement, allowing tracking and generating complex trajectories. With its help, we manage to think of the most efficient **Autonomies** in terms of movement on the ground.

Calibration:

Each robot is different, and the Road Runner must be calibrated individually. The process consists of running several tests provided (9 tests in total) and adjusting the parameters manually according to the response or **Automatically** adapting them based on the data collected.

Manual calibrations have been replaced with readings that can be interpreted in the form of a graph. This helps us to notice erroneous readings more easily, reaching a value closer to the real one.



Note:

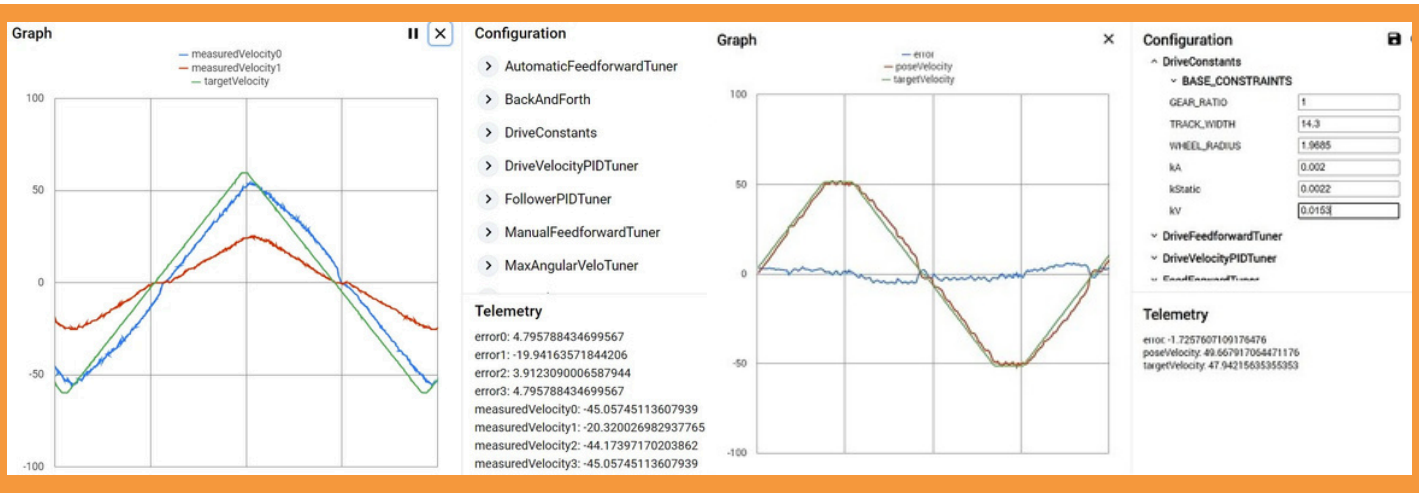
Calibration should be repeated periodically and especially when there are significant mechanical changes to the robot, so that there is certainty that the data is up-to-date and relevant.

Actions:

Actions help us define less complex movements, easy to combine. By delimiting programs, we make them easier to understand and modify. Actions can be reused in new **Autonomies**, so we never start from scratch, already having a base to start from.

Custom Actions:

Basically, actions are code segments that run in many small steps. This property allows us to run two actions A and B in parallel, without using multiple execution threads.



By executing “Step A”, “Step B”, “Step A”, ... in an alternating manner, actions A and B appear to progress simultaneously. But the illusion can be easily destroyed if “Step A” takes a long time and prevents B from running.
To create a custom action, we create a class that implements the Action interface:

- **public boolean run (TelemetryPacket packet)**: The code runs repeatedly while the method returns true.
- Calls to **run**() should complete quickly. Delays longer than 100ms will start to significantly affect other actions.

Paths and Trajectories:

Road Runner has two types of data structures that help build routes: paths and trajectories. Paths build the road using reference points that we define. These can be straight lines or splines. Trajectories are like paths, but they have motion profiling. This means that it also calculates what speed the robot should be at along the entire route in order to reach the desired position. This allows us to control the acceleration and speed of the robot.

Vectors and Positions:

Vector 2D: represents a 2d vector: is defined by 2 coordinates X and Y

Pose 2D: represents a 2d robot position: is defined by 2 coordinates X and Y and an angle. In general, these represent the robot position and the direction it is going. The angle increases in a counterclockwise direction. Also, any representation of an angle should be in radians. This is why we use the **Math.toRadians()** function if we want to work in degrees.

```
// defining a vector with (X,Y)coordinates
Vector2d myVector = new Vector2d(X, Y);
```

```
// defining a position with (X, Y) coordinates with a 90 degree angle
Pose2d myPose = new Pose2d(10, -5, Math.toRadians(90));
```

Markers:

RoadRunner provides 3 types of markers:

1) Time markers
2) Space markers
3) Movement markers

During **Autonomy** we use time markers, because they allow us to create an action based on the remaining time.

waitSeconds() - function that is useful for running actions between trajectories. Markers can run during waiting segments.

Pedro Pathing:

Pedro Pathing, or **Pedro** for short, is a tracking library that dynamically calculates its motor power along the advanced trajectory, created by the **FTC** Bay-Mechs 10158 team. With the help of this library, complex trajectories can be achieved using **Cubic Bezier Curves** or **Bezier lines**.

Pedro has a total of 6 localizers, these are:

1. Drive Encoder
2. Two-Wheel
3. Three-Wheel
4. Three-Wheel + IMU
5. OTOS Localizer
6. Pinpoint

In the short time we tested **Pedro**, we used the **Pinpoint localizer**, which had several problems, which is why we decided not to use the **Autonomies** achieved in **Pedro** in an official competition.

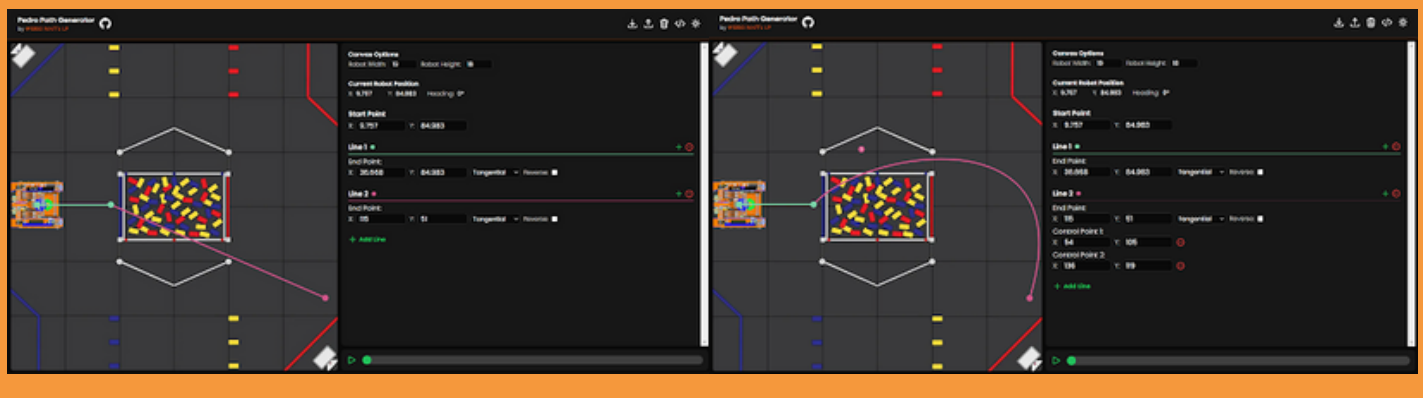
Tuning:

The first thing you need to do before starting the actual calibration is to choose the **localizer** and change the constants such as: unit of measurement, encoder Resolution and **odometry** wheel directions. After you finish changing the constants in the **localizer**, it is recommended to do the test: Localization Test, in which it constantly displays the encoder positions.

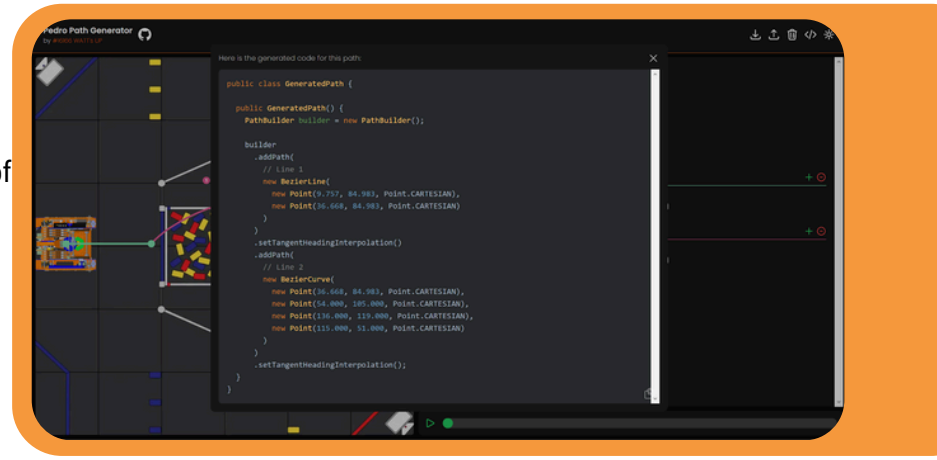
After you finish with the **localizer**, you need to do a total of 6 tests, of which the first 4 are Automatic, and in the other 2 tests you need to calibrate a total of 7 **PIDs**.
The order of the tests is:

1. **ForwardVelocityTuner**, a test where the robot moves forward 40 inches, to calculate the constant **xConstant**, which represents the maximum speed at which the robot moves forward.
2. **StrafeVelocityTuner**, a test where the robot moves right 40 inches, to calculate the constant **yConstant**, which represents the maximum speed at which the robot moves sideways.
3. **ForwardZeroPowerAccelerationTuner**, a test where the robot stops forward 30 inches/second, to calculate the constant **forwardZeroPowerAcceleration**, which represents the deceleration at which the robot stops forward.
4. **LateralZeroPowerAccelerationTuner**, a test where the robot stops sideways 30 inches/second, to calculate the constant lateralZeroPowerAcceleration, which represents the deceleration at which the robot stops sideways.
5. **StraightBackAndForth** is a test that you have to run 3 times, each time activating only certain PIDs to calibrate. The first time you run it, you have to calibrate the **Translational PID**, that is, the one that makes sure the robot stays on the trajectory. The second time you run the test, you have to correct the Heading **PID**, activating only the Heading PID. The third time you run the test, you will have to activate the Drive **PID**, the Heading **PID** and the Translational **PID** and you will have to calibrate the Drive PID, which makes sure the robot reaches the desired point.
6. **CurvedBackAndForth** is the last test in which you have to calibrate the **centripalScaling** coefficient, for the Centrifugal force correction.

We didn't use **Pedro** much, as we encountered a problem where the **PinPoint** gave an error in each **Autonomy**, on different trajectories and at different points, the robot stopping in place and getting stuck.
Pedro is very user friendly: there is also a discord server, where there will always be at least one person to help you in case you have any problems.



In addition, there is even a website (**https://pedro-path-generator.vercel.app/**) where you can create your trajectories, visualize how the robot follows them and modify them using coordinates or using the mouse.
The site interface shows a whole terrain. The coordinate system originates in the blue **Observation Zone** which has coordinates (0,0).



The top-right point has **coordinates** (144,144), the unit of measurement being inches.
If you want the robot to move forward, it means that you have to change the X coordinate value of a point, so that it moves to the right of the reference point.
To create a new trajectory, click on the "+ Add Line" button and then you have the option to leave the trajectory as a **Bezier Line** or convert it to a **Bezier Curve**, by clicking on the + next to Line 2.

To see how the robot follows the created trajectories, press the big green play button at the bottom, and it will start following the trajectories you created.
After you finish the trajectories, you also have an option to convert all the trajectories into code, namely the button in the upper right "</>".

Trajectories:

These can be, as I specified above, **Bezier Curves** or **Bezier Lines**, in which the robot has 3 different options to change its angle during the trajectory:

- Linear: It gradually changes its angle during the trajectory.
- Constant: It keeps its angle on the trajectory.
- Tangential: It maintains its angle with the direction of the trajectory.

Example of creating positions in **Pedro**:

```
private final Pose startPose = new Pose(9, 111, Math.toRadians(270));
private final Pose scorePose = new Pose(14, 129, Math.toRadians(315));

private final Pose pickup1Pose = new Pose(37, 121, Math.toRadians(0));
private final Pose pickup2Pose = new Pose(43, 130, Math.toRadians(0));
private final Pose pickup3Pose = new Pose(49, 135, Math.toRadians(0));

private final Pose parkPose = new Pose(60, 98, Math.toRadians(90));
private final Pose parkControlPose = new Pose(60, 98, Math.toRadians(90));
```

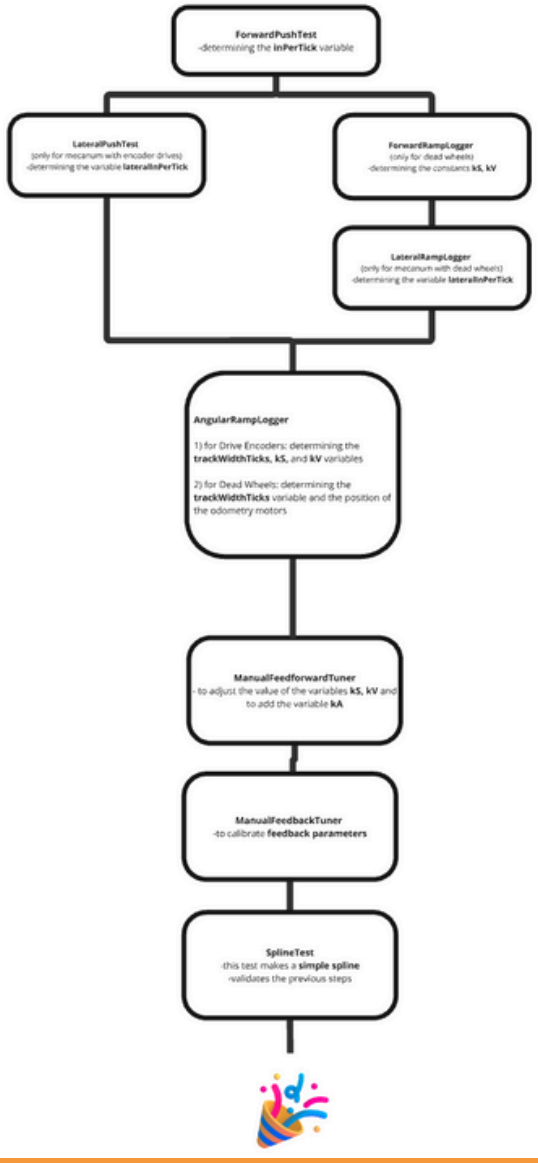
Example of creating trajectories:

```
grabPickup1 = follower.pathBuilder()
        .addPath(new BezierLine(new Point(scorePose), new Point(pickup1Pose)))
        .setLinearHeadingInterpolation(scorePose.getHeading(), pickup1Pose.getHeading())
        .build();

scorePickup1 = follower.pathBuilder()
        .addPath(new BezierLine(new Point(pickup1Pose), new Point(scorePose)))
        .setLinearHeadingInterpolation(pickup1Pose.getHeading(), scorePose.getHeading())
        .build();

grabPickup2 = follower.pathBuilder()
        .addPath(new BezierLine(new Point(scorePose), new Point(pickup2Pose)))
        .setLinearHeadingInterpolation(scorePose.getHeading(), pickup2Pose.getHeading())
        .build();

scorePickup2 = follower.pathBuilder()
        .addPath(new BezierLine(new Point(pickup2Pose), new Point(scorePose)))
        .setLinearHeadingInterpolation(pickup2Pose.getHeading(), scorePose.getHeading())
        .build();
```

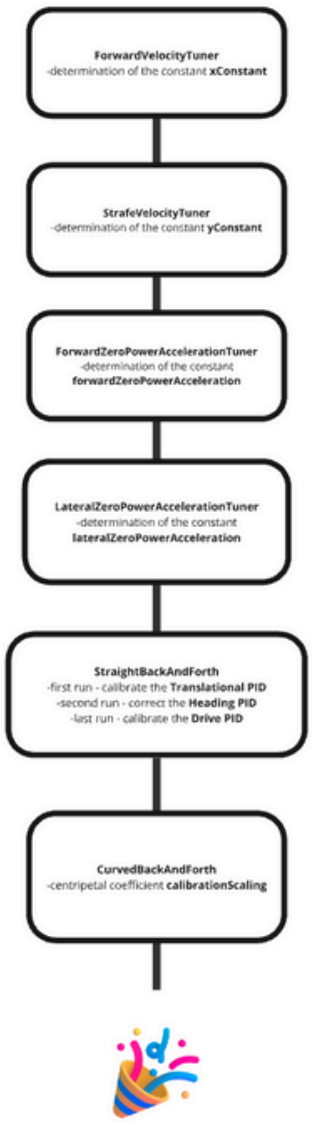
Example of Autonomy:

```
public void autonomousPathUpdate() {
    switch (pathState) {
        case 0:
            follower.followPath(scorePreload);
            setPathState(1);
            break;

        case 1:
            if (!follower.isBusy()) {
                follower.followPath(grabPickup1, true);
                setPathState(2);
            }
            break;

        case 2:
            if (!follower.isBusy()) {
                follower.followPath(scorePickup1, true);
                setPathState(3);
            }
            break;
```

RoadRunner Calibration:



Pedro Pathing Calibration:



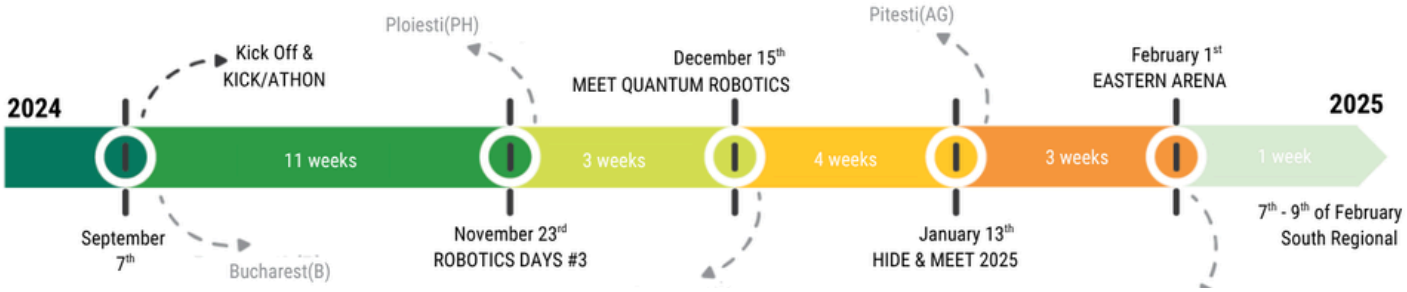
STRATEGY

SEPTEMBER 2024 - JUNE 2025

League Meet Participation Strategy:

As this year the season allows us to participate in a minimum of 3, maximum of 5 **League Meets**, we considered it quite important how many **League Meets** we decide to participate in and how we choose them.

League Meets represent a real opportunity to test and validate our concepts and iterations, so from the beginning of the season we realized that when we make a major change to the robot, both regarding the hardware components and the code developed for **Autonomous** and **TeleOp**, it would be ideal to participate in such a competition.



Thus, we chose our **League Meets** quite early, wanting to create an organized Timeline that would help both individual team members (visualizing their own tasks) and the entire team (visualizing progress). Since we needed to make changes to the robot constantly, we decided to choose **League Meets** equidistantly, so that we would have enough time between them to implement ideas.
We also considered the locations where they were held, new locations representing opportunities to meet new people, both from the STEM field and outside, to communicate and expand our outreach to as many areas as possible.

Season/Organization Strategy

Immediately after the theme was launched, we outlined the best, simplest, and most achievable game strategy. According to the tie-breaking criteria in the **League Ranking**, **Autonomous** is indispensable (as it also doubles our score), followed by the last 30 seconds in which we can climb, so that the **TeleOp** period remains a constant resource of points, but less valuable for the ranking.

Taking these aspects into account, we created a strategy for the evolution of the bots throughout the season that would focus on consistently obtaining the highest possible score in the first 30 seconds of the match, then on fulfilling the Ascend mission, ultimately exploiting the controlled period. We set ourselves detailed targets for each competition, respecting the organization.
We aimed to maintain an **OPR** as high as possible. **OPR** stands for **Offensive Power Rating**, which is a system that tries to deduce the average point contribution of a team in an alliance. Before and after each competition, we conducted an analysis of the proposed objectives and our achievements, an aspect that had a real impact on the evolution.

League Meet #1					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	1 specimen + 3 samples + ascend	1 specimens + 2,8 samples + ascend	37	35,4	95,68%
Auto Specimen	3 specimens + park	2 specimens + park	33	23	69,70%
TeleOp	5 specimens + 6 samples	4,66 specimens + 4,66 samples	98	83,33	85,03%
Ascend	Ascend level 2	5/6	15	12,5	83,33%

League Meet #2					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	1 specimen + 3 samples + ascend	1 specimens + 2 samples	37	26	70,27%
Auto Specimen	4 specimens + park	3,6 specimens + 5 / 6 park	43	34,4	80,00%
TeleOp Samples	4 specimens + 8 samples	3,5 specimens + 7,5 samples	104	95	91,35%
TeleOp Specimen	9 specimens	8 specimens + 1 sample	100	88	88,00%
Ascend	Ascend level 2	5/6	15	12,5	83,33%

League Meet #3					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	4 samples + ascend	4 samples + ascend	37	37	100,00%
Auto Specimen	5 specimens + park	4,2 specimens + 3 / 5 park	53	43,2	81,51%
TeleOp Samples	5 specimens + 10 samples	3 specimens + 9,5 samples(High Basket) + 0,25 samples (Low Basket) + 0,25 samples(Net Zone)	130	107,5	82,69%
TeleOp Specimen	11 specimens + 1 sample	9,5 specimens + 1 sample	118	103	87,29%
Ascend	Ascend level 2	6/6	15	15	100,00%

League Meet #4					
	Individual objective	Individual Average Outcome	Individual Score Objecti	Individual Average Sc	Completion
Auto Samples	4 samples + ascend	3 samples	37	24	64,86%
Auto Specimen	5 specimens + park	3,8 specimens + 2 / 5 Park	53	39,2	73,96%
TeleOp Samples	5 specimens + 14 samples	3,2 specimens +10,6 samples	162	117,2	72,35%
TeleOp Specimen	12 specimens + 1 sample	8 specimens + 1 sample	128	88	68,75%
Ascend	Ascend level 2	6 / 6	15	15	100,00%

KickAthon Strategy:

At **KickAthon**, even though we had very little time to think about a concrete strategy, we relied on scoring **Samples** in the **High Basket**, generally collecting **Samples** from **Spike Marks**, but also **Samples** from the **Observation Zone**.

Even though we didn't have a system for making any ascendancy, we took into account the fact that scoring a **Sample** in the **High Basket** brings you more points than parking in the **Observation Zone**.

Nr Crt	Period	Action	Points	Difficulty	Points/Dif
1	Auto	Sample Net Zone	2	2	1
2	Auto	Sample Low Basket	4	3	1,333333333
3	Auto	Sample High Basket	8	4	2
4	Auto	Specimen Low Chamber	6	4,5	1,333333333
5	Auto	Specimen High Chamber	10	5	2
6	Auto	Ascent Level 1	3	1	3
7	Auto	Park Observation Zone	3	1	3
8	TeleOp	Sample Net Zone	2	1	2
9	TeleOp	Sample Low Basket	4	2	2
10	TeleOp	Sample High Basket	8	3	2,666666667
11	TeleOp	Specimen Low Chanber	6	2,5	2,4
12	TeleOp	Specimen High Chamber	10	3,5	2,857142857
13	End Game	Park Observation Zone	3	0,5	6
14	End Game	Ascent Level 1	3	1	3
15	End Game	Ascent Level 2	15	3,5	4,285714286
16	End Game	Ascent Level 3	30	5	6

League Meet Strategy #1

After finishing the robot for the first **League Meet**, we started analyzing the missions we had during a match, creating a table in which we wrote how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we have a ratio between points and difficulty.

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	2	1,5
Sample in Netzone	2	1,5	1,3
Sample in low Basket	4	2,5	1,6
Sample in high Basket	8	3,5	2,3
Specimen on low Chamber	6	4	1,5
Specimen on high Chamber	10	5	2
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	0,5	6
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	3	2,7
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

After we finished filling out the table, we started to devise a strategy to score as many points as possible in the 2 and a half minutes, taking into account the fact that we couldn't collect from the **Submersible**. So we said that our priority would be to collect as many yellow **Samples** as possible and put them in the **Observation Zone** / score them, since they can be used on both alliances to score. So we thought that the **Autonomous** we would use most often would be **1 Specimen Preload** + **3 Samples** + **Ascend** (37 points), because this would get us the 3 yellow **Samples** in addition to the **Basket**, but if our teammates had **Sample Autonomous** , we would use the **Specimen** one, **3 Specimens** + **0 Samples** + **park**.

After that, at the beginning of the **TeleOp period**, we would go and try to take as many yellow **Samples** as possible from the **Spike Marks** of the opposing alliance and take them to the **Observation Zone** so that the other teams would not be able to take them, after that we would score the **5 Specimens** and then score as many **Samples** as possible (our target being 6, including those from **Autonomous**), and at the end of the match we would climb.

League Meet #1					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	1 specimen + 3 samples + ascend	1 specimens + 2,8 samples + ascend	37	35,4	95,68%
Auto Specimen	3 specimens + park	2 specimens + park	33	23	69,70%
TeleOp	5 specimens + 6 samples	4,66 specimens + 4,66 samples	98	83,33	85,03%
Ascend	Ascend level 2	5/6	15	12,5	83,33%

League Meet Strategy #2:

After finishing the robot for the second **League Meet**, we created a table in which we wrote how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we have a ratio between points and difficulty.

For the second League Meet we had Autonomy on both the Specimens ide (**4 Specimen + 0 Samples + park**) and the **Sample** side (**1 Specimen Preload + 3 Samples + Ascend**). Compared to the first **League Meet**, we also introduced an Intake that allows us to collect from the **Submersible**.
We tried to get along with our teammates not only on the **Autonomous** side, but also during the **TeleOp** period. For example, if they could only score **Samples**, we would have scored **Specimens** , and if our teammates could play **Specimens** , we would have preferred to score **Samples**, because we brought more points scoring **Samples** than **Specimens** .

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	2	1,5
Sample in Netzone	2	1,5	1,3
Sample in low Basket	4	3,5	1,1
Sample in high Basket	8	4,5	1,8
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	0,5	6
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	2,5	3,2
Specimen on low Chamber	6	3	2
Specimen on high Chamber	10	3,5	2,9
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

If we play:

- **Samples** in **TeleOp**, we didn't have such a complex strategy, we collected **Samples** from the **Submersible**, and then scored them in the **High Basket**.
- **Specimens** in **TeleOp**, we had a rather complex strategy, we collected as many **Samples** of the alliance color as possible in the first minute of the match, and then in the last 60 seconds we started scoring all the **Specimens** on the **High Chamber**, thus managing to do the same moves for a minute. Also, if we collected **Samples** and then scored them as **Specimens** , we would have lost a lot of time, since our robot has no way of scoring and collecting from the **Submersible** at the same time.

League Meet #2					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	1 specimen + 3 samples + ascend	1 specimens + 2 samples	37	26	70,27%
Auto Specimen	4 specimens + park	3,6 specimens + 5 / 6 park	43	34,4	80,00%
TeleOp Samples	4 specimens + 8 samples	3,5 specimens + 7,5 samples	104	95	91,35%
TeleOp Specimen	9 specimens	8 specimens + 1 sample	100	88	88,00%
Ascend	Ascend level 2	5/6	15	12,5	83,33%

League Meet Strategy #3

After finishing the robot for the third **League Meet**, we made a table in which we wrote how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we had a ratio between points and difficulty.

League Meet #3					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	4 samples + ascend	4 samples + ascend	37	37	100,00%
Auto Specimen	5 specimens + park	4,2 specimens + 3 / 5 park	53	43,2	81,51%
TeleOp Samples	5 specimens + 10 samples	3 specimens + 9,5 samples(High Basket) + 0,25 samples (Low Basket) + 0,25 samples(Net Zone)	130	107,5	82,69%
TeleOp Specimen	11 specimens + 1 sample	9,5 specimens + 1 sample	118	103	87,29%
Ascend	Ascend level 2	6/6	15	15	100,00%

For the third **League Meet**, we had **Autonomous** on both the **Specimens side** (5 **Specimens** + 0 **Samples** + **park**) and the **Sample** side (0 **Specimens** + 4 **Samples** + **Ascend**). Compared to the second League Meet, we changed the **Autonomous** strategy as well as the **TeleOp** strategy. We tried to get along with our teammates not only on the **Autonomous** side, but also during the **TeleOp** period. For example, if they could only score **Samples**, we would have scored **Specimens** , and if our teammates could place **Specimens** , we would have preferred to score **Samples**, because we brought more points scoring **Samples** than **Specimens** .

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	2	1,5
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	3	2,7
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	0,5	6
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	2,5	3,2
Specimen on low Chamber	6	3	2
Specimen on high Chamber	10	3,5	2,9
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

If we play:

- **Samples** in **TeleOp**, we didn't have such a complex strategy, we collect **Samples** from the **Submersible**, then score them in the **High Basket**.
- **Specimens** in **Teleop**, we had a rather complex strategy, starting with collecting a **Sample** from the **Observation Zone**, scoring it in the **High Basket**, then we start collecting as many **Samples** of the alliance color as possible in the first minute of the match, and after collecting 5 / 6 **Samples**, we start scoring all the **Specimens** on the **High Chamber**, so we manage to make the same repeated moves. Also, if we collect **Samples**, then score them as **Specimens** , we would have lost a lot of time, since our robot has no way to score and collect from the **Submersible** at the same time.

League Meet Strategy #4

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	2	1,5
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	3	2,7
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	0,5	6
Sample in Netzone	2	1	2
Sample in low Basket	4	1,5	2,7
Sample in high Basket	8	2	4
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

After we finished making the small changes to the robot for the fourth League Meet, we created a table in which we wrote how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we have a ratio between points and difficulty.

For the fourth **League Meet** we had **Autonomous** on both the **Specimens** ide (5 **Specimens** + 0 **Samples** + **park**) and the **Sample** side (0 **Specimens** + 4 **Samples** + **Ascend**). Compared to the second **League Meet**, we changed the **Autonomous** strategy as well as the **TeleOp** strategy. We thought the strategy we applied for the third **League Meet** was quite good, as we managed to coordinate with all our alliance partners without any problems, having a fairly high individual performance.

League Meet #4					
	Individual objective	Individual Average Outcome	Individual Score Objecti	Individual Average Sc	Completion
Auto Samples	4 samples + ascend	3 samples	37	24	64,86%
Auto Specimen	5 specimens + park	3,8 specimens + 2 / 5 Park	53	39,2	73,96%
TeleOp Samples	5 specimens + 14 samples	3,2 specimens +10,6 samples	162	117,2	72,35%
TeleOp Specimen	12 specimens + 1 sample	8 specimens + 1 sample	128	88	68,75%
Ascend	Ascend level 2	6 / 6	15	15	100,00%

League Tournament Strategy:

League Tournament					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	4 samples + ascend	3 samples + ascend	37	27	72,97%
Auto Specimen	5 specimens + park	3,66 specimens + 3 / 6 Park	53	38,66	72,94%
TeleOp	5 specimens + 14 samples	3,44 specimens + 10,33 samples	162	117,11	72,29%
Ascend	Ascend level 2	7 / 9	15	11,66	77,73%

For the **League Tournament**, we created a table in which we entered how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we have a ratio between points and difficulty.

For the League Tournament, we kept the same strategies that we had for the fourth League Meet, as we no longer had time to improve anything.

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	2	1,5
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	3	2,7
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	0,5	6
Sample in Netzone	2	1	2
Sample in low Basket	4	1,5	2,7
Sample in high Basket	8	2	4
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	3	3,3
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

Robot Game - Human Player:

For the **Human Player** strategy, we decided that in **Autonomous** the first **Specimen** it places will be from **Preload**, then the robot brings the 3 **Samples** from the **Spike Marks** on which the **Human Player** places one clip each, forming **Specimens** . After that, taking as a reference the two screws inside the perimeter in the left corner of the **Observation Zone**, it places the **Specimens** one by one between the screws.

If the robot has managed to place all 5 **Specimens** and has time to park, it places a yellow **Sample** in the left corner of the **Observation Zone** for easier collection at the start of the **TeleOp** period.

When we talk to our allied teams about the strategy for the match, usually the **Human Player** will be from the team that gives **Autonomous** of **Specimens** . However, if the **Human Player** of the alliance team does not have enough experience or has not given enough practice, our team's **Human Player** will enter the match.

National Championship Strategy:

For the national we created another table in which we entered how many points a certain task gives us, its difficulty (ranging from 0 to 5), and a column in which we have a ratio between points and difficulty, just like the one from the League Tournament.

National Championship					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	6 samples + ascend	3,57 samples High Basket + 0,28 samples Net Zone 3/7 ascend	51	30,42	59,65%
Auto Specimen	5 specimens + park	5 specimens	53	50	94,34%
TeleOp Samples	20 samples	14 samples High Basket + 0,57 samples Net Zone	160	113,14	70,71%
TeleOp Specimen	15 specimens	13 specimens + 0,5 samples	150	139	92,67%
Ascend	Ascend level 2	Ascend level 2	15	15	100,00%

The strategies remained mostly unchanged and so we kept the same table that we used during the fourth **League Meet** and the **League Tournament.**

Robot Game - Human Player:

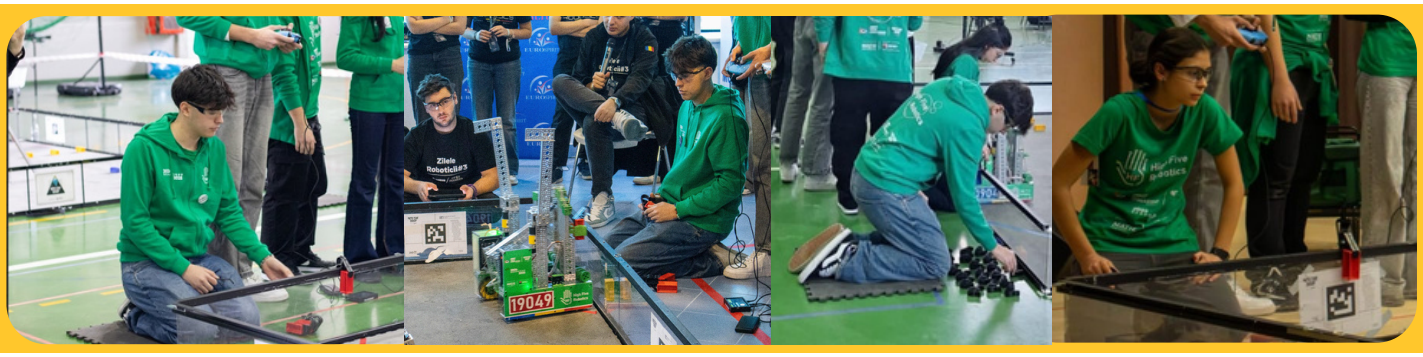
For the **Human Player** strategy, we decided to maintain the same approach as in the League Tournament, focusing on setting up an easier start for the **TeleOp** period while also focusing on maximizing the Auto performance. Again, the human player which will enter the match will be the one whose experience is more vast. Usually the one picked is from the team
that has a superior **Specimen Auto**. Such an approach limits the human error factor leaving this crucial decision to pure strategic thinking , therefore not really giving us the chance to mess up.

Another deciding factor we improved upon was the communication with the **Human Player** , and obviously with the whole team, as in a match, the synergy between all of the members of the drive team is crucial, especially in crucial situations where tensions and stakes are higher that a person is able to withstand all on its own, so being able to rely on other **Drive Team** members was our stepping stone to getting better.

Thus we maintained most of the strategy developed all throughout the season while improving it by making the social bounds between the members stronger, a very important factor when it comes to the overall performance of the team.

Auto			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Ascend Level 1	3	1	3
Sample in Netzone	2	1	2
Sample in low Basket	4	2	2
Sample in high Basket	8	2,5	3,2
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	2,5	4
TeleOp			
Task	Points	Difficulty	Pts./Diff.
Observation Zone Park	3	1	3
Sample in Netzone	2	1	2
Sample in low Basket	4	1,5	2,7
Sample in high Basket	8	2	4
Specimen on low Chamber	6	2	3
Specimen on high Chamber	10	2,5	4
Ascend Level 1	3	1	3
Ascend Level 2	15	3	5
Ascend Level 3	30	-	-

Also even tho we tried to be proeficient in both **Samples** and **Specimens** our focus was slightly shifted towards improving and optimizing our robot for a more **Sample** inclined play-style. We also tried to maximize the speed and consistency of our robot above the level it was at during the **League Tournament**. The combination of all those changes led us to the creation of a more optimized strategy that we used all throughout the **Romanian National Championship**.



European Premier Event Strategy:

As we did before, we gave every task a difficulty from 1-5 and we have made a table to get the Pts./Diff. value so we would know what we should try to score more.
In the **Auto** period, we have seen that **Specimens** are easier to do and give more points than **Sample** so we have tried to prioritise, but not excluding the **Sample Auto** so we could coordinate with our alliance partner even if they have or not an **Auto**.

For the **TeleOp** period, we have seen that for us scoring **Samples** and **Specimens** has the same difficulty so we tried to do more **Specimens** , because for other teams they are harder to do, but if we have the chance we would like to play **Samples**, because they are more valuable.

For playing **Specimens** we have a new strategy than before, that is to collect the farthest alliance specific **Samples** at the start of the **TeleOp** period and than starting scoring **Specimens** and collecting at the sametime, so we could score more this way.

With the new **robot** , we wanted to modify aspects like the weight ,stability and speed of the robot while maintaining the same base. This meant that core concepts like the active intake , chassis or the hanging system were kept the same , just optimized with pocketing, allowing us to make our strategy more reliant on our maneuverability around the field , due to our lower center of mass and all around lighter **robot**.

	A	B	C	D
1	Auto			
2	Task	Points	Difficulty	Pts./Diff.
3	Observation Zone Park	3	1	3
4	Ascend Level 1	3	1	3
5	Sample in Netzone	2	1	2
6	Sample in low Basket	4	2	2
7	Sample in high Basket	8	2,5	3,2
8	Specimen on low Chamber	6	2	3
9	Specimen on high Chamber	10	2,5	4
10	TeleOp			
11	Task	Points	Difficulty	Pts./Diff.
12	Observation Zone Park	3	1	3
13	Sample in Netzone	2	1	2
14	Sample in low Basket	4	1,5	2,7
15	Sample in high Basket	8	2	4
16	Specimen on low Chamber	6	2	3
17	Specimen on high Chamber	10	2,5	4
18	Ascend Level 1	3	1	3
19	Ascend Level 2	15	3	5
20	Ascend Level 3	30	-	

National Championship					
	Individual objective	Individual Average Outcome	Individual Score Objective	Individual Average Score	Completion
Auto Samples	6 samples + ascend	3,57 samples High Basket + 0,28 samples Net Zone 3/7 ascend	51	30,42	59,65%
Auto Specimen	5 specimens + park	5 specimens	53	50	94,34%
TeleOp Samples	20 samples	14 samples High Basket + 0,57 samples Net Zone	160	113,14	70,71%
TeleOp Specimen	15 specimens	13 specimens + 0,5 samples	150	139	92,67%
Ascend	Ascend level 2	Ascend level 2	15	15	100,00%

SCOUTING

APRIL 2024 - JUNE 2025

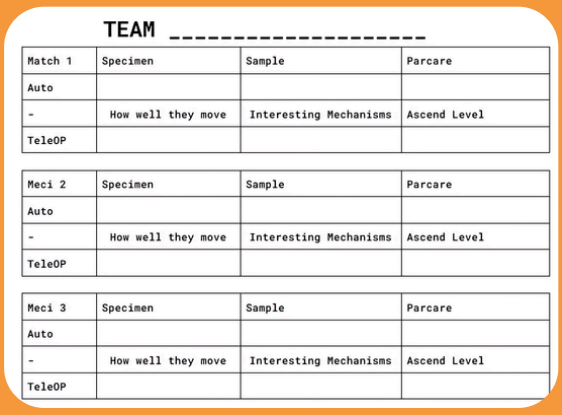
Introduction:

In the 9th season of ***FIRST®*** **Tech Challenge** in Romania, **INTO THE DEEP** , choosing to ground our information through the use of scouting turned out to be a good choice for the team as it was crucial in the development of our strategy and the teams overall progress.

We implemented a mixed approach, combining two main methods of scouting:

Paper Scouting: The direct observation during the whole duration of the matches allowed us
to collect relevant data quickly. Team members tracked indicators such as accuracy and speed of task execution, reliability of mechanics and tactics applied by the analyzed teams. The information was noted manually for further discussion and processing.

Digital Scouting: Observational data were organized into digital tables and graphs, using software tools to centralize the information. This method facilitated more in-depth analysis, helping to identify trends and compare performance between teams.



TEAM _____

Match 1	Specimen	Sample	Parcare
Auto			
-	How well they move	Interesting Mechanisms	Ascend Level
TeleOP			

Meci 2	Specimen	Sample	Parcare
Auto			
-	How well they move	Interesting Mechanisms	Ascend Level
TeleOP			

Meci 3	Specimen	Sample	Parcare
Auto			
-	How well they move	Interesting Mechanisms	Ascend Level
TeleOP			

Scouting was a fully integrated activity in our preparation, actively involving every member of the team.
This process stimulated collaboration and communication, with each person contributing with observations and ideas. As a result, not only did we gain valuable insights about the other teams, but we were able to identify our weaknesses and actively work to optimize them.The **FIRST®** values, especially **Gracious Professionalism**, were central to the way we approached **scouting**. Although our primary goal was to analyze other teams, we did so with respect for their work, recognizing their efforts and seeking to learn from their innovations and strategies. This attitude helped us to stay focused on our progress, without neglecting the importance of collaboration and
Fair-Play, always aiming higher.

League Meet #1 Robotics Days

Introduction

Participation in **Robotics Days #3**, our first **League Meet** of this season, held on November 24, 2024, represented an important reference point in the evolution of our team, bringing us back into the spirit of the ***FIRST®*** **Tech Challenge** competition. We stepped into this new season with an immense desire to learn, adapt, and exceed our limits. This competition was not just a technical challenge, testing our robot's performance, but also an opportunity to get to know ourselves better as a team, to identify our strengths, and to understand how we can function optimally together to maximize our performance as a whole.

Evolution and Learning as a Team

Robotics Days #3 was an excellent framework to evaluate our team's progress from many points of view. We observed that we managed to adapt more quickly to the new rules and challenges of the season, thanks to the collaboration of team members, which is continually evolving. Additionally, we learned to better manage our resources, both material and time. This ability to organize and efficiently allocate resources allowed us to fully benefit from the beauty of the competition, and through scouting activities, we managed to promote this feeling of joy, as we were able to create very good collaboration with alliance teams.

Scouting, Collaboration, and Mutual Help

The entire ***FIRST*® Tech Challenge** competition aims to promote collaboration and success through it, and scouting, although it may not seem so, plays a vital role in this promotion. **Scouting** activities allow team members to learn and observe not just technical aspects, but also vital information about interpersonal relationships, how other teams manage to combine everyone's perspectives, and perhaps even flaws that exist in our own team. It allows us to improve as a team, but also to adapt to others in order to provide those in our **alliance** with a pleasant, much less tense atmosphere, allowing both ourselves and others to focus on the beautiful parts of the competition. When it comes to the technical side, scouting has proven, obviously, very useful, not necessarily in giving us ideas to implement in our specific robot, but in helping us understand our level of performance compared to others, which results, of course, in a perpetual adaptation reaction through which we can maximize our own performance, as well as that of our alliance partner, regardless of the team, thus benefiting the community itself as a whole.

The Purpose of Scouting Activities

Scouting had from the beginning a purpose beneficial to all, being meant to help us in personal adaptation according to the abilities of other teams, due to strategic and technical differences between us. Besides this, we managed to observe the creative and innovative spirit of other teams, both from a technical and non-technical point of view. Collaboration is the main objective that our team wanted to follow through **Scouting**, an objective achieved quite easily through constant adaptation to teammates.

Conclusion

Our team's first **League Meet** had a good result, both due to the efforts of the **Drive Team** and the collaboration between teams in our alliance. This collaboration is partly due to our attempt to transform our playing style to accommodate everyone, respecting and considering the equal importance of all.

League Meet #1				
Team Number	**Team Name**	Auto Specimen	Auto Sample	Parking
15593	infO(1)Robotics	1+0	-	Obs. Zone
17869	ERcast2020	-	-	Asc. lvl. 1
17962	Ro2D2	-	-	Obs. Zone
18160	4D-Robotics	-	0 + 3 + ascend	Obs. Zone
19075	Clockworks	-	-	Asc. lvl. 1
19090	TEHROCUZ RO 087	-	-	Obs. Zone
19112	UNDEFINED	-	-	Asc. lvl. 2
19141	BraveBots	1 + 0 + park	-	Asc. lvl. 1
20925	HYPERCUBE	-	-	Obs. Zone
22226	Renaissance Robotics	-	-	-
24909	StarLight	-	1 + 3 + ascend	Asc. lvl. 2
24964	AstraDymaniX	-	-	Obs. Zone
25352	Schwefel Robotics	park	-	Obs. Zone

League Meet #2 Meet South

Event Organization and General Observations

Throughout **Meet Quantum**, our team members carefully observed the matches, focusing on a number of key aspects during both the **Autonomous** and **teleoperated** periods. In the Autonomous period, we accurately noted the score each team achieved, the accuracy of the placement of game elements and the consistency of the robot's movement without human intervention. We noted the frequent use of certain types of mechanisms, such **as a passive intake system** , often a claw, but with fundamentally different implementations:

- Some teams preferring to use this mechanism alone, improving it as much as possible by added versatility;
- Combining it with other mechanisms (Specimen collection tank, etc.).

During the **teleoperated** period, we carefully analyzed the number of complete cycles performed by each team, the speed and efficiency of the collection and scoring mechanisms, as well as the overall strategies used. We were impressed by the performance of teams that managed to optimize these aspects, maximizing the number of points obtained during the qualification. For example, we found ingenious ideas, such as the use of a passive claw-type **intake** mechanism with extended mobility, which helped us ourselves to see the pluses and minuses of such a system and to strategically orient ourselves according to their capabilities, thus realizing a very good symbiosis between the teams. This was a mutually enhancing relationship, where the team could observe the work of others, redirecting their inspiration back to the community in the form of spontaneous adaptation and, in particular, **Gracious** actions.

Analysis of the Mechanisms and Technical Solutions

One aspect of major interest for us was the analysis of the various technical solutions adopted by the participating teams, in particular in terms of intake and scoring mechanisms. We observed a variety of intake mechanisms, ranging from claw-type ones, which excel in simplicity, to active ones, which offer better control of the collected items, but can be more prone to jamming.

In this technical research:

- We observed the effectiveness of the mechanisms;
- We interacted with the respective teams to learn more about the creative thinking process;
- We strategically transformed ourselves to be able to support our alliance team as well, giving them the chance to make the most of their mechanisms and ingenuity.

League Meet #2				
Team Number	**Team Name**	Auto Specimen	Auto Sample	Parking
15593	infO(1)Robotics	3 + 0	-	Obs. Zone
17962	Ro2D2	5 + 0 + park	0 + 3 + ascend	Obs. Zone
18160	4D-Robotics	-	0 + 3 + ascend	Obs. Zone
19054	NeuroBotix	-	0 + 1	Asc. lvl. 2
19055	TITANS	-	-	Asc. lvl. 2
19099	H-tech	4 + 0 + park	-	Obs. Zone
19112	UNDEFINED	-	0 + 4	Asc. lvl. 2
19117	Robo-Sapiens	1 + 0 + park	-	Obs. Zone
19141	BraveBots	1 + 0 + park	0 + 4 + ascend	Asc. lvl. 1
19176	Broboți	-	-	Asc. lvl. 1
23203	Light Bulb Robotics	-	0 + 4 + ascend	Obs. Zone
24345	SPARKTECH	-	-	Obs. Zone
24637	Black Phantoms	2 + 0 + park	1 + 2 + ascend	Asc. lvl. 2
24909	StarLight	2 + 0 + park	1 + 0 + ascend	Asc. lvl. 2
25145	ILC Robotix	-	-	Obs. Zone
25352	Schwefel Robotics	park	-	Obs. Zone
25538	ARRA	4 + 0 + park	-	Asc. lvl. 2
27247	Poladroid	-	-	Obs. Zone

Harnessing *FIRST®* Values and Cooperation

In addition to the technical aspects, we placed particular weight on how the teams applied and furthered the ***FIRST®* values** throughout the competition. We were pleased to note that the spirit of **Gracious Professionalism** was present in most interactions, with teams demonstrating mutual respect, fair play and a welcoming attitude, even in stressful moments, by lending each other a helping hand. We also observed clear examples of **Coopertition** in where teams worked together and supported each other even though they were essentially competitors. This demonstrates that ***FIRST®* values** are not just theoretical concepts but principles actively applied in the community. Our team has focused on promoting these values in every interaction, aspiring towards a common evolution that includes all teams, not just ourselves.

Cooperation through Adaptation

Another important aspect we looked at was the ability of the teams to adapt to different alliance partners. We tried to exhibit flexibility and good communication with our alliance partners, managing to coordinate our efforts and adapt our strategies to maximize the overall alliance score, even though this **League Meet** was one where the tension was tremendous. This ability to adapt and collaborate is critical in ***FIRST®* Tech Challenge** events, where success is highly dependent on the synergy between alliance teams.

We, as a team, tried to adapt as best we could to our alliance partners, communicating with them and trying to establish the most effective strategy.

Conclusions

Participating in **Meet Quantum** was an extremely valuable experience for our team. We had the opportunity to closely observe a variety of technical and game strategies, analyze the performance of other teams, and identify areas where we had to improve our own robot. The insights we have gathered, especially the technical ones, but also those related to the interactions with other teams, will be essential in the team's development process. And Scouting has allowed us to connect with this incredible community, enabling us to receive, but also to offer each other advice and ideas, taking us leaps and bounds towards improvement.

League Meet #3 Hide & Meet

Introduction

On January 12, 2025, our team organized the **Hide&Meet** League Meet, an event in which we also participated. Naturally, this event required scouting, which, although conducted differently, was both necessary and beneficial not only for us, but for others as well.

Scouting Overview

Obviously, scouting in this event had the purpose of helping us accommodate all teams with our strategy, exposing the strengths of our strategy, as well as those of our alliance teammates, to be able to learn from each other and evolve together.

The actions taken by members who assumed the duty of scouting managed, through this, to promote positive values, to find technical information and use it, not just for our own purpose of improving our own technical part, but especially with the aim of learning from the inspirational thinking of others and to accommodate alliance partners, reducing tense moments during the competition. Technical information helped especially in establishing improved communication with all teammates, and through this we managed, despite any differences between teams, to form alliances focused on performance and collaboration. We understood that, beyond individual performance, close collaboration and a well thought out strategy are essential for success. This event provided us with the perfect context to test and refine this approach. Moreover, we focused on understanding everyone's perspectives, ensuring authentic synergy within alliances. We, as a team, tried to adapt as best as possible to alliance partners, communicating with them and trying to establish the most efficient strategy.

Technical details of scouting

The scouting team also aimed at visualizing interesting mechanisms to stimulate our own creativity, to observe our current mistakes, and to compare our performance, thus understanding how we can improve, how we can work better together, and what facts we should focus on. With the rapid approach of the League Tournament competition, the team dedicated much time to continuous improvement and made many efforts to achieve a better own performance. The scouting activity helped by:

- Revealing our own defects
- Providing a much vaster creative spirit
- Inspiration for the future
- Superior coordination with all teammates in the alliance
- Offering a very good method of self-evaluation

We carefully observed the strategies of other teams, especially how they manage the time and available resources, noting aspects that we can adapt to our own way of working. The detailed analysis of technical details allowed us to discover ingenious solutions, and each match was a lesson, in which we better understood the dynamics of the competition and the importance of adaptability.

League Meet #3				
Team Number	**Team Name**	Auto Specimen	Auto Sample	Parking
14277	QUBE.	-	1 + 0	Asc. lvl. 2
15976	TehnoZ	5 + 0 + park	-	Asc. lvl. 2
15593	infO(1)Robotics	1 + 0	-	Obs. Zone
17962	Ro2D2	5 + 1 + park	0 + 6 + ascend	Obs. Zone
18160	4D-Robotics	-	0 + 4 + ascend	Obs. Zone
19062	Phantom Robotics	4 + 0 + park	0 + 3 + ascend	Asc. lvl. 2
19067	Bionic Royals	1 + 0 + park	0 + 3 + ascend	Asc. lvl. 1
19088	BroBots	0 + 0 + park	0 + 1	Obs. Zone
19099	H-tech	3 + 0 + park	0 + 4 + ascend	Asc. lvl. 1
21030	MasterBots	park	-	Asc. lvl. 1
23203	Light Bulb Robotics	-	0 + 4 + ascend	Obs. Zone
24037	Start Code	-	-	Obs. Zone
24530	ElectroB0tics	-	-	Obs. Zone
24637	Black Phantoms	4 + 0 + park	0 + 3 + ascend	Asc. lvl. 2
24909	StarLight	5 + 0 + park	0 + 4 + ascend	Asc. lvl. 2
25538	ARRA	5 + 0	-	Asc. lvl. 2
26075	Vampire Robotics	park	0 + 1	Obs. Zone
27247	Poladroid	0 + 0 + park	-	Asc. lvl. 1
28260	Coral Tech	0 + 0 + park	-	Obs. Zone

Conclusion for League Meet #3

Scouting was an essential activity in our development as a team, in community development, and in improving all teams by unifying all the strengths present in each team, giving us the chance to compensate for our shortcomings reciprocally, through teamwork and by relating to the abilities of the other. This event showed us, once again, the power of collaboration and the importance of creating a united and motivated community. We learned that success is not just about competing, but also about growing together. Through scouting, we not only gathered information but created connections and encouraged an exchange of knowledge that will certainly have a positive impact on our future competitions. The ultimate goal is to actively contribute to a culture in which evolution is not just individual, but collective.

League Meet #4 Eastern Arena

Introduction:

Following participation in **Meet Eastern Arena**, our team's fourth League Meet, held on February 1 at the Petroleum and Gas University in Ploiești, we evolved as a team on all levels, both technically and socio-morally. The main purpose of participating in this event was to test and verify the latest technical details of the robot, as well as to study the latest changes that other teams' robots had before the League Tournament. We considered this event as perfect for final adjustments and testing.

Event Development and General Observations:
During this meet, our team members carefully observed how the matches unfolded, focusing on both the **Autonomous** and **teleoperated** periods. In the **Autonomous** period, we precisely noted the score obtained by each team, the accuracy of placing game elements, and the consistency of robot movement, keeping a kind of consistency with the previous scouting methods so that we can observe the linear progression of teams when at the same time with the seasons advancements.

We noted the frequent use of certain types of mechanisms, such as a **Passive Intake** system, often a claw, but with fundamentally different implementations, and **Active Intake** systems used the same type of claw attached to a very efficient system of slides with which they scored between 4 and 6 **Samples**. In the **teleoperated** period, we carefully analyzed the number of complete cycles performed by each team, the speed and efficiency of collection and scoring mechanisms, and the general strategies used. What we certainly observed is that all teams have evolved a lot since the first League Meet, drivers being much more focused and skillful regarding robot control through the controller, scoring more consistently than before both when it comes to **Samples** and also **Specimens** .

Regarding our team, we can say that we have overcome certain challenges that brought the team closer and homogenized it and showed us that in this competition nobody is alone and that there is always someone who jumps to help. The biggest technical challenge encountered by the team was when during a practice moment a screw from the slide system broke, remaining stuck in the slide, causing the slide to jam, subsequently coming loose. At that moment the first thing we did as a team was to bring the robot to the workbench and try together to solve the problem encountered. After a few unsuccessful attempts we had to ask for help from meet colleagues from another team, as the first match was about to start in a few minutes.

Following these moments of stress, with the help of teamwork and a piece from another team, we overcame the challenge, even managing to win the first match. So this competition means more than the technical part or the competition itself; it's about the relationships between people and how in any situations they are willing to help each other and within the team to create a real family.

League Meet #4				
Team Number	**Team Name**	Auto Specimen	Auto Sample	Parking
14270	Quantum Robotics	4 + 1	1 + 4	Ascend lvl 2
15989	RoboTitans	3 + 0	0 + 3	-
15991	Gamma	3 + 0	0 + 3	Observation Zone
16166	Watt'S Up	5 + 0	0 + 5	-
19064	Dragonic Force	1 + 2 + Park	2 + 1	Observation Zone
19098	Eastern Foxes	5 + 0 + Park	0 + 5	Observation Zone
19099	H-tech	2 + 0 + Park	0 + 2	Observation Zone
19112	UNDEFINED	-	0 + 1 + Ascend	Observation Zone
19116	VV Robots	-	-	-
19128	RoboDac Dacia	-	-	-
19131	Evolution	-	-	Observation Zone
19141	Bravebots	-	4 + 0 + Ascend	Ascend lvl 2
19176	Broboți	0 + 2	2 + 0	Ascend lvl 2
20691	Andromeda	-	-	Observation Zone
22226	Renaissance Robotics	-	-	Observation Zone
24530	ElectroB0tics	-	-	Observation Zone
24909	Starlight	4 + 0	0 + 4	Ascend lvl 2
25538	ARRA	4 + 0 + Park	0 + 2	Ascend lvl 3
28260	Coral Tech	0 + 4 + Park	4(Low Basket) + 0	Observation Zone

Robot Scouting - Before League Tournament #1

To plan our strategy regarding League Tournament alliances, we compiled a table containing necessary information about both the functionality of robots and the build system and the number of meets in which the targeted teams participated, which allows us to identify the strengths of each team in order to establish a configuration beneficial and efficient for both teams in terms of obtaining a better result within the alliance.

# Team Number	Team Name	# No. of Meets	Drivetrain	Intake	Outtake	Climb	Build System
14270	Quantum Robotics	5	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom
14277	QUBE	2	Mecanum	Claw	Claw	-	Custom + goBilda
15972	TehnoZ	5	Mecanum	Claw	Claw	Linear Slides	Custom
15989	RoboTitans	4	Mecanum	Claw	Claw	-	Custom + goBilda
15991	Gamma	4	Mecanum	Claw	Same claw intake OutTake	-	Custom
15993	infO(1)Robotics	4	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom + goBilda
16166	Watt'S Up	5	Mecanum	Claw	Claw	-	Custom
17624	IGNITE	1					
17869	ERcast2020	3	Mecanum	Claw	Tipper	Linear Slides	goBilda
17962	Ro2D2	5	Mecanum	Vertical Tubes	Claw	-	Custom
18160	4D-Robotics	4	Mecanum	Claw	Claw	-	Custom + goBilda
19049	High Five	4	Mecanum	Horizontal Tubes	Tipper	WormGear	Custom + goBilda
19054	NeuroBotix	5	Mecanum	Claw	Claw	-	Custom
19055	TITANS	4	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom
19059	ArtRobotix	3	Mecanum	Claw	Claw	-	goBilda
19062	Phantom Robotics	3	Mecanum	Claw	Claw	Linear Slides	Custom
19063	Under Constructions	0					
19064	Dragonic Force	4	Mecanum	Claw	Claw	-	Custom + goBilda
19067	BIONIC ROYALS	5	Mecanum	Gecko	Claw	-	Custom
19075	Clockworks	4	Mecanum	Claw	Claw	-	goBilda
19084	Zenith	4	Mecanum	Claw	Claw	Linear Slides	goBilda
19088	BROBOTS	5	Mecanum	Gecko	Gecko	-	goBilda
19090	TEHROCUZ RO 087	3	Mecanum	Claw	Same claw intake OutTake	-	goBilda
19096	DanubeRobotics	0					
19098	Eastern Foxes	4	Mecanum	Claw	Same claw intake OutTake	-	Custom + goBilda
19099	H-tech	5	Mecanum	Claw	Claw	-	Custom
19112	UNDEFINED	5	Mecanum	Gecko	Same claw intake OutTake	-	Custom
19116	VV Robots	4	Mecanum	Claw	Claw	-	Custom
19117	Robo-Sapiens	3	Mecanum	Claw	Claw	-	Custom + goBilda
19128	RoboDac Dacia	4	Tank	Claw	Same claw intake OutTake	-	Rev
19131	Evolution	3	Mecanum	Gecko	Gecko	Linear Slides	Rev + goBilda
19141	BraveBots	5	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom
19151	TECHNO-MAISTER	3	Mecanum	Claw	Claw	-	Custom + goBilda
19176	Broboți	5	Mecanum	Vertical Tubes	Claw	-	Custom
20131	The Inventors	0					
20691	Andromeda	3	Mecanum	Claw	Same claw intake OutTake	-	Custom + goBilda
20925	HYPERCUBE	4	Mecanum	Claw	Tipper	-	Rev
21030	MasterBots	4	Mecanum	Gecko	Same claw intake OutTake	-	goBilda
21050	MasterMinds	2	Mecanum	Gecko	Same claw intake OutTake	-	goBilda
21071	SkyLine	3	Mecanum	Claw	Same claw intake OutTake	-	Custom + goBilda
21169	CyberLions	2	Mecanum	Claw	Same claw intake OutTake	-	Rev
21476	ViCyber	2	Mecanum	Claw	Claw	Linear Slides	Custom + goBilda
22226	Renaissance Robotics	5	Mecanum	Claw	Claw	-	goBilda
22552	ToTheStars Robotics	0					
23203	Light Bulb Robotics	4	Mecanum	Claw	Claw	-	Custom + goBilda
23473	Helios Robotics	0					Custom + goBilda
24037	Start Code	3	Mecanum	Claw	Same claw intake OutTake	-	Custom + goBilda
24155	BlueSpace	3	Mecanum	Claw	Same claw intake OutTake	-	goBilda
24345	SPARKTECH	4	Mecanum	Gecko	Claw	-	Custom + goBilda
24399	ToastedMinds	3	Mecanum	Claw	Same claw intake OutTake	-	Rev
24530	ElectroB0tics	4	Mecanum	Vertical Tubes	Same claw intake OutTake	-	goBilda
24637	Black Phantoms	5	Mecanum	Claw	Claw	Linear Slides	Custom
24909	StarLight	5	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom
24964	AstraDymaniX	2	Mecanum	Claw	Same claw intake OutTake	-	Custom + goBilda
25145	ILC Robotix	5	Mecanum	Claw	Claw	Linear Slides	Custom + goBilda
25352	Schwefel Robotics	4	Tank	Claw	Claw	-	Rev
25538	ARRA	5	Mecanum	Claw	Same claw intake OutTake	Linear Slides	Custom
25841	Hansei Junior	0					

League Tournament :

Introduction:
During the three days of the **League Tournament Stage**, four team members performed scouting for each participating team, providing us with a solid base of information. This process helped us adapt our strategy based on the strengths and play styles of others, facilitating better collaboration in alliances. To collect relevant data, we used clear criteria, aligned with the strategies of the analyzed teams.

In-depth analysis:
The synthesis of all scouting methods: **paper scouting**, **mechanism observation**, **game strategy** tracking, led to the constitution of a complex **Scouting** sheet and, finally, the formation of a complex table.
We analyzed the game strategies of other teams to improve and better adapt in alliances. We considered tactical choices, such as preferences between **Specimen** and **Sample**, and the performance of each team. This classification helped us collaborate more efficiently.
We focused on both individual and alliance performance to better understand the adaptability of teams in competition. We also compared previous scores and results to evaluate the consistency and reliability of our team.
In addition, we provided information to other teams about their future teammates or opponents, making our detailed table available.

Benefits of Scouting:
The **Scouting** activity, as observed throughout the entire season, managed to stand out through the exceptionally high yield it offered, helping us technically.

Advantages:	Disadvantages:
• It gives us diverse perspectives on how other teams approach creative thinking and problem solutions, inspiring us technically, strategically, or design-wise • It helps us form effective alliances, based on good collaboration between teams. A well-planned strategy is essential for success, and through scouting, our team members can better understand the play style of partners, adapting for optimal coordination. • It provides the team with a synthesis of the efforts made by all other teams, which is important for personal reflection on the parts we ourselves could have improved.	• Errors can creep among correct data due to the intensity or pressure from certain matches, which, transmitted further to the entire team, can cause erroneous decisions. Therefore, scouting requires attention and time, intense verification, and patience. • Data can become outdated, causing possession of incorrect information due to variations/terms applied in a real match. Therefore, scouting is an activity complementary to individual communication with teams.

Conclusion:
Scouting was a key element in our strategy, helping us make more informed decisions and optimize our performance. Communication remains essential, but scouting gives us an additional advantage in competition, allowing us to build stronger alliances and evolve as a team. Despite challenges, its benefits have had a significant impact on our results and on the competition as a whole.

Robot Scouting - Before National

To efficiently plan our strategy regarding the formation of alliances at the National Stage, we created **a table with essential information** about robots, **build system**, and **preferred game element**. This data gives us a clear picture of the strengths and consistency level of each team, allowing us to identify the most suitable configurations for forming balanced, efficient, and competitive alliances, with the aim of obtaining the best possible results in the national competition.
In the **scouting process**, we track essential technical aspects such as: efficiency in the **Autonomous** period, **performance in TeleOp** (speed and accuracy), parking in **Endgame**, but also **adaptability in matches** and the team's **ability to strategically collaborate in an alliance**.

Team Number	Team Name	Drivetrain	What are they scoring effectively	Intake	Transfer	Outtake	Climb	Build System
12560	Soft Hoarders	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 3	Custom
14270	Quantum Robotics	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
14278	Xeo	Mecanum	Specimen	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
15972	TehnoZ	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
15991	Gamma	Mecanum	Specimen	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
15993	infO(1)Robotics	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
17713	Delta Force	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
17844	RUBIX	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
17860	Helix	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
17861	CSH	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	Ascend lvl 1	Custom + goBILDA
17871	Thobor RO 068	Mecanum	Specimen	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
17875	Code Warriors	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
17962	Ro2D2	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 3	Custom
17965	BOLTS AND GEARS	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom + goBILDA
18160	4D-Robotics	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	-	Custom
18338	StarTech	Mecanum	Samples & Specimens	Claw	Collects and places on the same side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19043	CyLiis	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19044	Peppers	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 3	Custom
19047	RavenTech_HD	Mecanum	Specimen	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom
19049	High Five	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom + goBILDA
19056	PrimeTech	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom
19061	Boogeybots	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19062	Phantom Robotics	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19064	Dragonic Force	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom + goBILDA
19066	AiCitizens	Mecanum	Specimen	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19068	ABSO-TECH	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19071	SmartCluster	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19074	Extropy	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom + goBILDA
19075	Clockworks	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	-	Custom
19082	RoboAs	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 3	Custom
19086	Robocorns RO004	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom
19091	The Resistance	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19093	Infinity Bolts	Mecanum	Specimen	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom
19098	Eastern Foxes	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19099	H-tech	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	-	Custom
19104	CyberPunk Robotics	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19105	DecebalTech	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 1	Custom
19109	RaSky	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19115	B-Robo	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19116	VV Robots	Mecanum	Specimen	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19120	AlphaBit	Mecanum	Sample	Gecko	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19121	Tea Borgs	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19141	BraveBots	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom
19176	Broboți	Mecanum	Samples & Specimens	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19234	ByteForce	Mecanum	Specimen	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
19242	RO169 RoboPeda	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 2	Custom + goBILDA
19256	CyberMoon	Mecanum	Specimen	Gecko	Collects and places on the opposite side	Claw	Ascend lvl 1	Custom
20265	Heart of RoBots	Mecanum	Specimen	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
20912	Harambe Cartel	Mecanum	Sample	Gheară	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
20936	Royal Engineers	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	-	Custom
20965	BIT-MO	Mecanum	Sample	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 1	Custom
21455	RoSophia	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	-	Custom
22017	Eu codez	Mecanum	Samples & Specimens	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
23203	Light Bulb Robotics	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	-	Custom
23161	CyberLIS76	Mecanum	Sample	Claw	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
23486	Seramitae	Mecanum	Specimen	Claw	Collects and places on the same side	Claw	-	Custom
24033	Alphatronic	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 2	Custom
24478	EngiNeerds	Mecanum	Sample	Active Intake	Collects and places on the opposite side	Claw	Ascend lvl 1	Custom
25145	ILC Robotix	Mecanum	Sample	Claw	Collects and places on the opposite side	Tipper	-	Custom + goBILDA
25538	ARRA	Mecanum	Specimen	Claw	Collects and places on the opposite side	The same claw Intake and OutTake	Ascend lvl 3	Custom

National Championship

Introduction:
During the Romanian National Championship we wanted to be sure that we do our best and to do that we applied one of the most crucial **values of *FIRST®*** , **Coopertition**. We tried to optimize our play style based on our alliance partner, therefore the same strategy as the one used at the **League Tournament** was applied:

A team consisting of 3 to 5 people would go and check every match of the event in detail, for potential downsides to some mechanisms, not only to know what we are up against but also to self measure the things we ourselves managed to integrate throughout the season. Besides the technical details as the wow factors present in the mechanisms on the robot we observed other important aspects as their consistency, capabilities under pressure, abilities as a team to surpass trouble, things we learned from.

Our team took advantage of the nights after the competition as well, using them to plan in advance and create solid strategies. As we try to always stick to the phrase "**Communication is key**" we decided to take matters into our own hand and try to find some common ground that we could build up on during the competition or playoffs. The **playoffs** represented a great opportunity for the scout team to not only continue their technical observations but also see the people's response to stress and the competition atmosphere. The technical analysis based on the data gathered by the scout team **turned out to pay-off** in the playoff by leading us to choosing the best alliance partners in those circumstances.

European Premier Event:

Robot Scouting -Before The Premier Event

After the news of our qualification came we went through a transformation because the teams we were about to face were untouchable and unreachable before. Here comes into play our project called **"International Hub"**, where we met with teams that want either answers or just to ask questions, traits very important for the team as it does not grow without the desire for it to do so.

From the meetings with all of the teams we learned a ton of **important values** besides which there exists kindness as those kind of meets went from confidential and formal to expressive and helpful. Throughout all of the countries we encountered we had no problem communicating and always aimed to give back information as a form of respect.

Besides communications we also relied on members from the team to research the background of the teams so we could be sure which is the perfect candidate for our needs.The **scouting table** , even tho it remained almost unchanged was still the pivot point in doing scouting effectively, as with the following structure it provided us with the most important information in a format easily readable and understandable even in high stress situation. The structure of the table was:

- A brief **identification** section where data like the team name , number and location is easily accessible
- Stats about the in **game performance** like the preferred game element and the proficiency in it
- Technical details like the type of **Drive-train**, **Intake** , **Outtake** or transfer they possess

Team Number	Team Name	Country of origin	Prefered Game Element	Climb	Intake	Outtake	Transfer	Drivetrain	Build System
641	Tater Scots	Boca Raton FL USA	Sample	Ascend Level 1	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	Custom + goBILDA
724	RedNek Robotics Wun	Sun River MT USA	Sample	Ascend Level 2	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom + goBILDA
8393	The Giant Diencephalic BrainSTEM Robotics Team	Baden PA USA	Specimen	Ascend Level 1	Claw	Claw	Collects and scores on the sam...	Mecanum	Custom
9473	Crocobots	Center ND USA	Sample	Ascend Level 2	NO FOOTAGE!	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE
9662	Apollo	misgav Z Israel	Sample	Ascend Level 3	NO FOOTAGE	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE
9963	Comets	Alexander ND USA	Specimen	Ascend Level 1	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	Custom + goBILDA
10111	Herberger Javelinas	Glendale AZ USA	Specimen	Ascend Level 2	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	goBILDA
10183	F.R.O.G. Frog Robots Of Germany	Stuttgart BW Germany	Sample	Ascend Level 1	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom + goBILDA
10941	SHAPE Robotics	APO AE USA	Sample	Ascend Level 2	Claw	Same Claw As Inta...	Collects and scores on the sam...	Mecanum	Custom + goBILDA
12560	Soft Hoarders	Craiova DJ Romania	Sample + Specimen	Ascend Level 3	Active Intake	Claw	Collects and scores on opposite...	Mecanum	Custom
14438	Noosphere Robotics	Kyiv 30 Ukraine	Specimen	Ascend Level 2	NO FOOTAGE	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE
16031	PARABELLUM	Port Coquitlam BC Canada	Sample + Specimen	Ascend Level 1	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	Custom
16055	Starbots FTC	Betim MG Brazil	Sample	Ascend Level 3	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom
16382	Casimir Tech	Eindhoven NB Netherlands	Sample + Specimen	Ascend Level 1	Claw	Same Claw As Inta...	Collects and scores on the sam...	Mecanum	goBILDA
16409	Team Orange	Breda NB Netherlands	Sample + Specimen	Ascend Level 2	Claw	Tipper	Collects and scores on the sam...	Mecanum	Custom
16417	ROC	Richmond Hill ON Canada	Sample	Ascend Level 2	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom + goBILDA
16785	Team ProBotiX	Bladel NB Netherlands	Specimen	Ascend Level 1	Claw	Claw	Collects and scores on the sam...	Mecanum	Custom + goBILDA
17742	SESI BAT TECH	São Gonçalo do Amarante RN Brazil	Specimen	Ascend Level 1	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom + goBILDA
18264	TheElectronovas	Fairfax VA USA	Sample	Ascend Level 1	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom
18306	STEM Cells	Austral NSW Australia	Sample	Ascend Level 1	Active Intake	Tipper	Collects and scores on opposite...	Mecanum	Custom
18833	Megiddo Lions	Regional Council of Megiddo Z Israel	Sample	Ascend Level 2	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom
18917	thE Agent Group	Oberkochen BW Germany	Sample	-	NO FOOTAGE	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE
19013	G-Force	Mumbai MH India	Sample + Specimen	Ascend Level 2	Active Intake	Claw	Collects and scores on opposite...	Mecanum	Custom
19043	CyLiis	Iasi IS Romania	Specimen	Ascend Level 2	Active Intake	Claw	Collects and scores on opposite...	Mecanum	Custom
19049	High Five	Pitesti AG Romania	Sample + Specimen	Ascend Level 2	Active Intake	Claw	Collects and scores on opposite...	Mecanum	Custom + goBILDA
19082	RoboAS	Brasov BV Romania	Sample + Specimen	Ascend Level 3	Active Intake	Claw	Collects and scores on opposite...	Mecanum	Custom
19099	H-tech	Bucuresti Sector 4 B Romania	Sample + Specimen	-	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom
19141	BraveBots	Ploiesti PH Romania	Sample + Specimen	Ascend Level 2	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	Custom
19163	MLP	Almaty ALA Kazakhstan	Sample	Ascend Level 3	Claw	Same Claw As Inta...	Collects and scores on opposite...	Mecanum	Custom
19234	ByteForce	Galați GL Romania	Specimen	Ascend Level 2	Claw	Claw	Collects and scores on opposite...	Mecanum	Custom
19280	UK 235 - Phoenix	London ENG United Kingdom	Specimen	Ascend Level 1	NO FOOTAGE	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE
19341	Crobotics	Sydney NSW Australia	Sample	Ascend Level 2	Claw	Same Claw As Inta...	Collects and scores on the sam...	Mecanum	goBILDA
19660	Sigma	Shanghai SH China	Specimen	Ascend Level 2	NO FOOTAGE	NO FOOTAGE	-	NO FOOTAGE	NO FOOTAGE

EVENTS

APRIL 2024 - JUNE 2025

Outreach Strategy

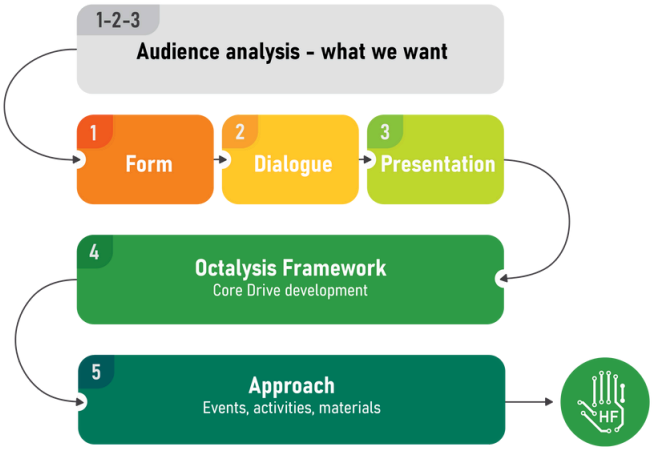
Introduction

In order to create a valuable **impact within the community**, both in terms of quality and scale, it is essential to adapt the information we aim to convey to the type of audience, their learning pace and level of comprehension, as well as to the field with which they are most familiar. This applies to everything from the way basic theoretical and practical concepts are presented, to how processes, tasks, and their integration within departments—behind the team, the entire competition, and the ***FIRST®*** phenomenon—are structured, and ultimately to the ideas and skills we seek to introduce to the public.

Development

This season, we implemented the **Octalysis Framework**, a method adopted following our participation in the Gamification Workshop at **the 2023 Atlantykron Summer Camp**. **The Octalysis Framework** is a **complex process** composed of various essential and rigorous stages, designed to produce a clear and adaptable outreach strategy. It significantly enhances the organization and definition of optimal methods for audience engagement. The framework **considers a wide array of crucial parameters** for both **technical events** and the **non-technical activities** carried out by the team. These include the target audience's perspective, their feedback, our proposed outcomes, applicability, and long-term development.

The first step involves identifying the categories of individuals with whom we aim to build active, lasting connections, as well as understanding the expectations and needs upon which we will base and refine our approach. To achieve this, we used a **coordinate system with two axes** to define **four key audience archetypes,** each located in one of the **quadrants**. Each axis represents a pair of opposing traits: **children vs. adults**, and **technical vs. non-technical individuals**. The resulting typologies include **sponsors** and young people who might attend our events or potentially **become volunteers** within our team.



For each archetype, we then evaluate the corresponding user persona by answering a series of targeted questions. For instance, technical children are typically motivated to participate in **STEM** activities, learn at a rapid pace, retain information in the long term, show preference for hardware and software departments, and are curious and eager to ask questions.

Based on these insights, we then apply the eight **Core Drives** of the **Octalysis Framework**.

Core Drive 2 - Development & Accomplishment

- The ability to feel responsible for their own actions and their consequences;
- Recognition and appreciation for their achievements, no matter how small;
- Confidence in their abilities and the desire to succeed in different activities.

Core Drive 1 - Epic Meaning & Calling

- Active participation of children in volunteer projects.

Core Drive 3 - Empowerment of Creativity & FeedBack

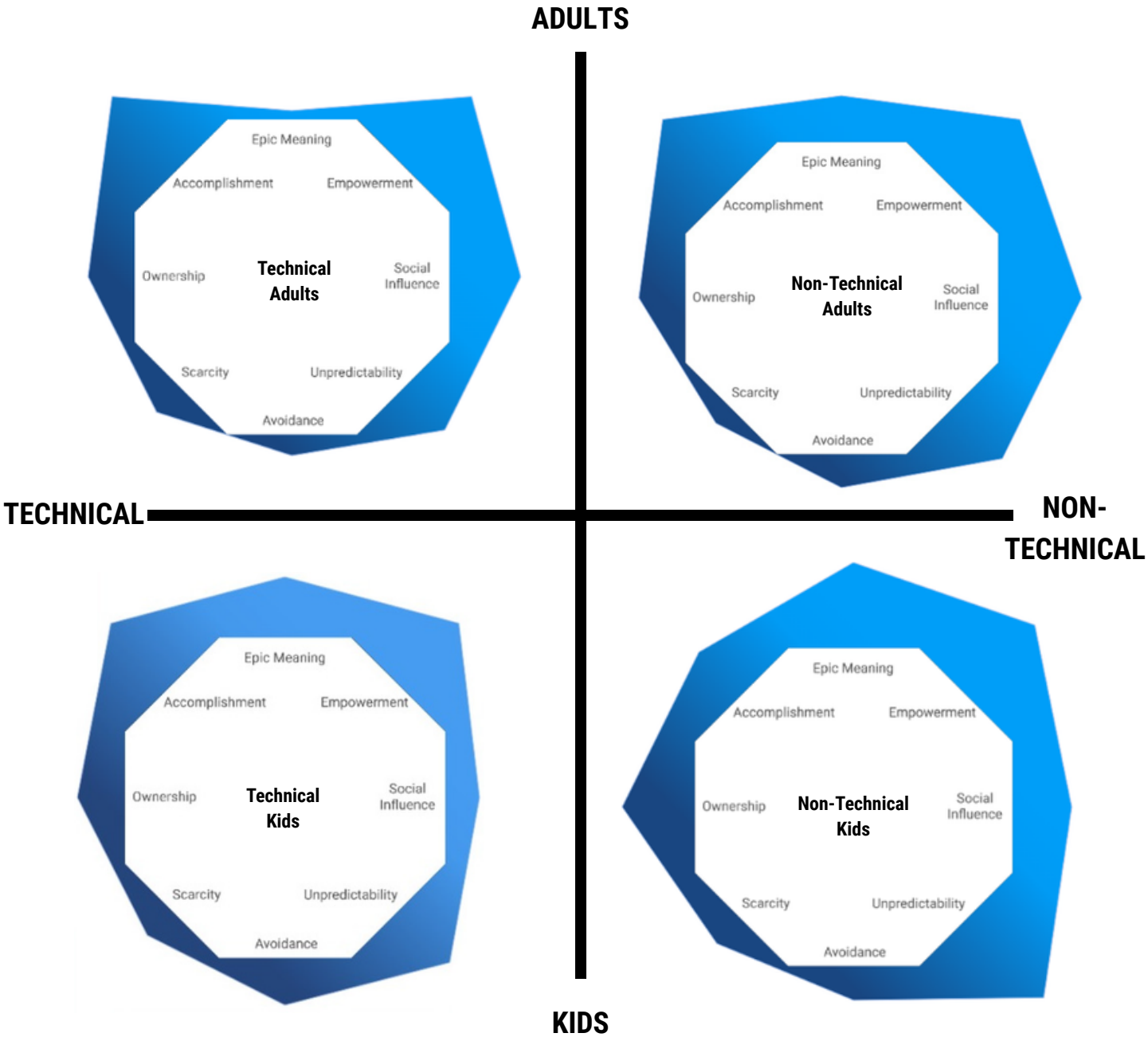
- Desire to express feelings and ideas through artistic activities;
- Creativity in finding solutions to problems or creating new things.

Core Drive 7 - Unpredictability & Curiosity

- Enthusiasm for special events
- Curiosity to understand how things around them work;
- Courage to explore the environment and experience new things;
- Ability to learn through play and interactive activities.

Each identified trait is rated on a scale from 1 to 10 according to its relevance within the context of the **Core Drives**. This process results in the development of an irregular octagon—its shape determined by the extent to which each **Core Drive** is represented. This visual representation enables us to identify and assess areas of high interest, which can be leveraged to attract and engage the audience, as well as areas of lower interest, which indicate opportunities to organize targeted events that address specific community needs.

Moreover, for the **two primary categories**—sponsors and potential new members—we have established a series of objectives and desired actions. These have enabled us to develop several effective methods for approaching our target audience in a professional and strategic manner.



PoliFest

April 18th –20th 2024

Introduction

PoliFest—the largest educational fair in the fields of science and engineering—was held last year between **April 18th and 20th 2024**, in two locations: **Pitești and Bucharest**. At that time at its **13th edition**, the event has further strengthened its reputation as a key platform for all those interested in **STEM**. **PoliFest** fosters interaction and collaboration, bringing together a wide range of participants—from high school and university students to educators, researchers, and representatives from leading companies.

Overview

The **primary goal of the event** was to facilitate **collaboration between academia and industry**, thus contributing to the development of stronger connections between education and the professional world. **PoliFest** aims to build a bridge between young people aspiring to **STEM** careers and industry experts, providing a space for the exchange of knowledge and experience.

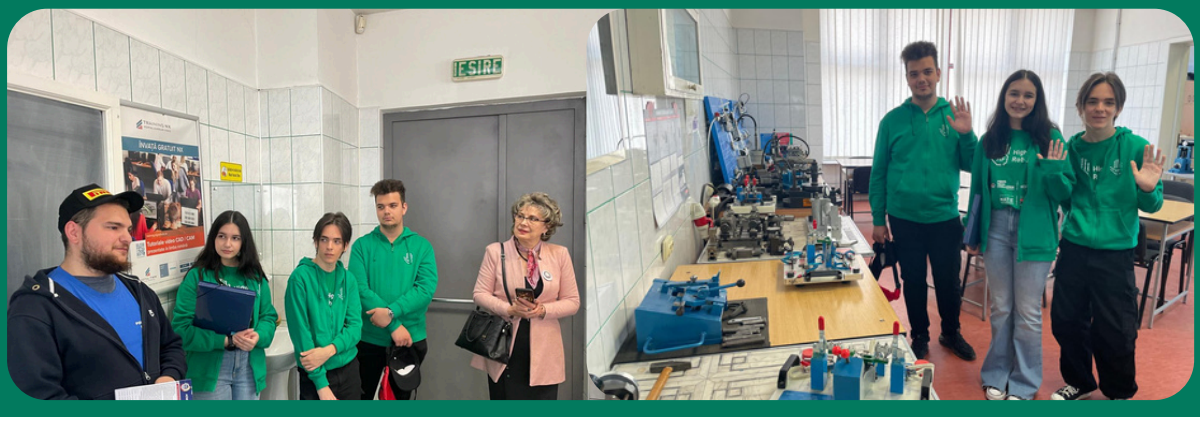
Over the course of the three-day event, our team had the opportunity to attend activities at both locations—**Pitești and Bucharest**.

The program included guided tours of university laboratories, offering us a first-hand look at state-of-the-art equipment and the chance to engage in meaningful conversations with professors and other experts. Through these discussions, we not only expanded our technical knowledge and developed new questions about equipment, physical processes, and methods of analysis and interpretation but also promoted the **values and mission** of the ***FIRST®*** community.

More than 70 top-tier companies were present, along with **300 experts and professors** from **STEM** fields, creating a dynamic environment for networking and dialogue on shared interests. The **2,000 students and graduates** in attendance had the opportunity to deepen their understanding and explore potential career paths.

Conclusion

Participating in **PoliFest** was—and continues to be—a valuable experience for our team, offering both inspiration and new perspectives.
The conferences, workshops, guided tours, and conversations with industry professionals enhanced our awareness of the technical field and, ultimately, helped us fulfill our ongoing mission: to **contribute to the growth of this collective, youthful voice shaping the future of STEM**.



PoliFest

April 3rd - 4th 2025

Introduction

Between **April 3rd and 4th, 2025,** we had the pleasure of participating in **PoliFest**, the largest educational fair dedicated to science and engineering. Now at its **14th edition**, the event took place simultaneously in **Pitești and Bucharest**, bringing together **students, teachers, researchers**, and **representatives** from top companies. It was a great opportunity to exchange ideas and **connect** with people passionate about **STEM**.

Main Content

PoliFest aimed to bring the academic and economic environments closer together, creating a bridge between young people and professionals. We attended the event held in **Pitești**, at the **University Center of the Politehnica University of Bucharest (UNSTPB)**.

We had the chance to engage with both university representatives and company delegates. Through open discussions, we learned new things that helped us grow, while also promoting the **STEM** movement and the values of ***FIRST®***.

Conclusion

PoliFest was a **valuable experience** for our team. We felt inspired, gained new knowledge, and left with even more motivation to continue advocating for **STEM** education. Every conference, workshop, or simple conversation brought us closer to the professional world and reminded us how important it is to stay curious and involved.

National Olympiad – Curriculum Area "Technologies" – Mechanics Field

April 26th 2024

Introduction

This competition represents an opportunity for young people passionate about mechanics from across the country, giving them the chance to demonstrate their skills and knowledge in a **competitive** and **stimulating environment**.

Participants will be tested in a variety of disciplines in the field of mechanics, from design and construction to efficiency and innovation. On **April 26 2024**, we had the pleasure of attending the opening ceremony of the **National Olympiad** – Curriculum Area "Technologies" – **Mechanics Field**, held at **Politehnica Bucharest** – **Pitești University Center**. Alongside four other robotics teams from Pitești, we had the honor of presenting the ***FIRST®*** phenomenon and **STEM values**, demonstrating the ability of young people to combine theoretical knowledge with practical applications in the field of **mechanics and robotics**.

Main Content

The event's main goal was **to highlight the skills** and knowledge of young people in the field of mechanical technologies and robotics. Among the specific objectives were promoting **teamwork**, encouraging **innovation** and **creativity**, and facilitating the exchange of ideas between participants. It also aimed to underline the importance of technological education in training future specialists in the field.

The event was opened by the **dean of the Faculty of Mechanics**, who emphasized the importance of youth involvement in such competitions, highlighting that they represent a launching pad for future engineers and innovators. His speech was followed by representatives of the **County School Inspectorate (ISJ)**, who stressed their continuous support for technological education and innovation in schools.

Each participating robotics team had the opportunity to present the ***FIRST®*** phenomenon, thus showing that there are multiple solutions to technical problems and that innovation has no limits when backed by solid knowledge and passion.

Together with us were three ***FIRST®* Tech Challenge** teams – **4D Robotics #18160**, **Broboți #19176**, **TehnoZ #15972** – and one ***FIRST®* Lego League** team, **TehnoZ Lightning Bolts**.

Our team's presentation was a moment of pride and emotion. We spoke about our team, how it was formed, and our journey over the years. Our robot was the centerpiece of the presentation, serving as a visual example. By explaining the thought process, design, and programming, we highlighted the **collaboration** and **teamwork** necessary to reach a high level of performance.

Conclusion

Participating in this event was a valuable experience both for us as a team and for everyone involved, giving us the opportunity to **learn** from one another and to **inspire** each other.

Creative and Connected

May 9th 2024

Introduction

On the occasion of **Europe Day**, celebrated on **May 9th**, the **Europe Direct Argeș Association**, in partnership with the **"Dinicu Golescu" Argeș County Library**, organized the fair of ideas, projects, and initiatives titled "**Creative and Connected**," in which we had the opportunity to participate.

Main Content

We set out to share and promote the **STEM** phenomenon and the **values of *FIRST*®** within the **local community**. Our main goal was to show young people the **positive impact** that robotics can have on their personal development and to encourage their involvement in this field.

The event's **primary aim** was to highlight extracurricular **European projects** by facilitating conversations between visitors and participants.

At the opening of the event, moderated by Mrs. Mihaela Voinicu, manager of the **"Dinicu Golescu" Argeș County Library**, Mr. Adrian Bughiu, Vice President of the **Argeș County Council**, and Mrs. Roxana Stoenescu, Executive Director of the Department of Culture, Tourism, and Youth within the **Argeș County Council**, were present. They congratulated the attendees for the projects they had accomplished.

Together with **four other *FIRST*® Tech Challenge teams from Argeș – 4D Robotics #18160, Broboți #19176, ARRA #25538 and TehnoZ #15972** – we organized demonstration matches to showcase, on a smaller scale, the atmosphere of official competitions. The room where our booths were located featured only programs from the **STEM** ecosystem, such as robotics teams from the ***FIRST*® programs (*FIRST*® Tech Challenge and *FIRST*® Lego League – TehnoZ Lightning Bolts)**.

Throughout the event, we engaged in conversations with curious young visitors, which allowed us to offer detailed information and encourage them to join the continuously growing robotics community.

Conclusion

We are glad that, through **one-on-one discussions at our booths** and the demonstration matches, we managed to **share the STEM phenomenon and the values of *FIRST*® within our community.**

Creative and Connected

May 9th 2025

Introduction

On **May 9th**, our team participated in the **Creative and Connected educational fair**, organized by the **"Dinicu Golescu" County Library** and **Europe Direct Argeș**, in celebration of **Europe Day**.

The event was held in the public pedestrian area in front of the library and brought together universities, educational institutions, and student-led initiatives, offering high school students **valuable insights** into academic and professional development opportunities.

Overview:

Our team was invited to present our **robotics activities and share our journey** to qualifying for the ***FIRST*® Tech Challenge European Premier Event** in the **Netherlands**.

We set up an interactive stand where visitors could explore our **engineering process**, **see our robot** in action, and **learn** about the structure of the ***FIRST*® Tech Challenge** competition. Team members engaged directly with **students, teachers, and representatives** from various institutions, answering questions, offering technical explanations, and demonstrating the robot's capabilities.

The event provided an excellent platform to promote **STEM** education and to **inspire younger students** to explore robotics and **teamwork**. Many visitors were curious about the design, programming, and strategic elements involved in building a competition-ready robot, and we were excited to **share our experience and lessons learned**.

Conclusion:

Participating in the **Creative and Connected fair** was a rewarding opportunity for **outreach and community engagement**. It allowed us to represent both our team and the **values of *FIRST*®**, while encouraging others to pursue innovative and hands-on learning. We are grateful to the organizers for including us in this initiative and look forward to more opportunities to share our passion for robotics.

High School STEM Outreach – Introduction to FTC

May 13th/14th /16th 2024 & April 11th/15th/16th/29th 2025

Introduction

Given the growing emphasis on unconventional education methods in **Romanian schools**, we saw an **opportunity to promote robotics** – a relatively new field for many students – as a way to broaden their horizons and expand their future aspirations.

Overview

Through our discussions with students, our **goal** was to highlight how **teamwork** simplifies progress, how seemingly difficult challenges can be overcome through continuous **learning**, and how the vast ***FIRST*® community** we are part of plays a powerful role in shaping us into well-rounded individuals.

Encouraged by the **feedback** we received during previous seasons, we set out to organize a series of events aimed at **spreading awareness of STEM** and **making it more accessible to high schoolers**. These sessions offered a safe, engaging environment where students could put theoretical knowledge into practice while also boosting their creativity.

May 13th 2024 – "Ion C. Brătianu" National College, Pitești

We kicked off the outreach series at our own school, **"Ion C. Brătianu" National College**. Welcomed warmly in the school's amphitheater, we held an interactive presentation for **two ninth-grade classes**. The robot demonstrations and fresh insights into robotics sparked their curiosity and showed them how they could get involved in exciting extracurricular activities.

May 14th 2024 – "Dinu Lipatti" Arts High School, Pitești

Given the strong connection between the **CENTERSTAGE season** and the arts, we felt it was essential to include "**Dinu Lipatti" Arts High School**. Through our presentation and hands-on robot demo, we introduced **three ninth-grade classes** to both the technical and non-technical sides of robotics. We were thrilled to see their enthusiasm and interest in joining this journey.

May 16th 2024 – "Ion Barbu" Theoretical High School, Pitești

For our **third visit**, we chose **"Ion Barbu" Theoretical High School**, a school with no existing FTC team. Together with **two ninth-grade** classes, we spent time talking about our shared passion for robotics — from **hardware** and **software** to outreach and branding. The students listened with great curiosity, asked thoughtful questions, and were eager to learn more.
Following our visit, the school made the exciting decision to start **their own *FIRST*® Tech Challenge team: RoboBarbu #27835**. Our community continues to grow!

April 11th 2025 - "Dinu Lipatti" Arts High School, Pitești

On April 11th, our team gave an interactive presentation at the **High School of Arts "Dinu Lipatti"**. We connected with students by sharing our robot, journey, and values, showing that robotics is not just about technology, but also creativity and freedom. Through a Q&A session, they learned more about the competition, and we were happy to **introduce them to the *FIRST*® community** in a safe and inspiring environment.

April 15th 2025 - "Nicolae Iorga" Secondary School Pitești

On April 15th, we visited **"Nicolae Iorga" Secondary School** to present how students can join a robotics team and get involved in the ***FIRST*® community**. We shared videos of our robot and matches, which sparked their interest, and explained how our robot works during a Q&A session. At the end, kids got to control the robot themselves, enjoying the hands-on experience. The visit introduced them to the **creative and supportive world of the *FIRST*® Tech Challenge**.

April 16th 2025 - "Alexandru Davila" Middle School Pitești

On April 16th, we visited **"Alexandru Davila" Middle School** for an interactive presentation **with 6th to 8th grade** students. We introduced them to the opportunities offered by robotics and the **impact of the *FIRST*® Competition** on **personal growth**. Through stories and a Q&A session, they learned about mechanics, programming, and the importance of non-technical roles. Many experienced their first hands-on interaction with a robot by taking on roles like driver or coach. It was more than a presentation—it was a connection with future innovators, and possibly future teammates.

April 29th 2025 - Ion C. Brătianu National College, Pitești

We had the opportunity to give a presentation to **9th grade students** from our high school, **"Ion C. Bratianu" National College**. We wanted to show them the many advantages of being part of a robotics team. For that we focused on both the creative part of the technical process, showing them our most unique mechanisms, and on the digital design needed to form a visual identity for your team. We explained the importance of brainstorming sessions and the way we come up with ideas for the actual construction, our programming and testing in order to reach high performance.
The students were curious, engaged and eager to learn more about our journey, facts that show through our Q&A session, which was full of open communication. We presented our robot and, by letting them control it, we challenged them to discover for themselves the effort and work behind a ***FIRST*® team**.

Conclusion

We were genuinely delighted to see how open and curious the students we interacted with were — **180 students in 2024 and 380 in 2025**. Curiosity was the driving force behind all our conversations. We left each visit with the hope that, for some of them, we've opened the door to the world of robotics — inspiring them to grow, aim for excellence, and thrive within a team that supports their passions and goals.

We interacted with 560 students from 3 high schools and 2 middle schools.

Events in Shopping Centers – VIVO! Mall & Argeș Mall

May 26th & June 9th 2024

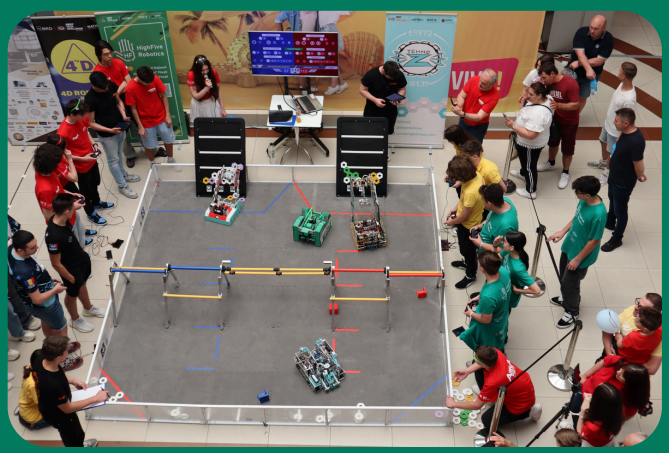
Introduction

Believing that robotics—and, by extension, its integration within the broader community—deserves **greater visibility**, we organized two events with the support of representatives from VIVO! Mall Pitești and Argeș Mall. This type of exposure encourages people to **explore, learn, and engage**, making such events **highly impactful**, given the large number of individuals who initially come to these venues for leisure.

Main Body

Through a wide range of activities both within and beyond the competition framework, we aim to **introduce more people to the world of STEM and *FIRST*® Tech Challenge**—its people, values, goals, and, most importantly, robotics itself. With this in mind, we designed our initiative to showcase the essence of the competition, offering a small-scale simulation of its official stages.
At the same time, our growing openness towards the community significantly contributes to the personal and collective growth of our team members. It pushes us to develop organizational skills, step outside our comfort zones, and work together as a well-defined unit.

- **VIVO! Mall – May 26th 2024**



Now in its **fourth edition**, the Robotics Challenge has become a local tradition. We were pleasantly surprised to see an increasing number of people eager to deepen their understanding and explore the fascinating world of robotics through these interactions.

Together with the **three other invited teams** from Pitești—**4D Robotics #18160, TehnoZ #15972, and ARRA #25538**—we successfully captured the public's attention through demo matches that offered a glimpse into the excitement of official competitions, as well as through booth discussions that allowed for meaningful exchanges with attendees.

To our delight, the audience, including both children and adults, showed great interest, gathering in large numbers around the playing field and booths. We enthusiastically answered their questions, explaining the robot-building process, offering live demonstrations of 3D printing, and sharing insights into the **STEM & *FIRST*® Tech Challenge** ecosystem. **The inclusiveness** and **values promoted** by our team resonated with the younger audience, many of whom expressed a desire to join us on this journey.

- **Argeș Mall – June 9th 2024**

Although held in a different location, the structure of the event remained similar—however, the atmosphere brought its own unique energy.

Once again, alongside **4D Robotics #18160, TehnoZ #15972, and ARRA #25538**, we managed to immerse the public in our field of expertise: **educational robotics**. Through engaging matches and open discussions at our booths, we **promoted STEM in the local community**. Attendees were impressed not only by the robot demonstrations but also by our accomplishments, which we shared throughout the event. These conversations gave us the opportunity to present the values that define our team and **the broader STEM movement**, fulfilling our goal of **spreading the *FIRST*® spirit within our community**.

Conclusion

These events provided an excellent opportunity to strengthen our bonds with other teams, reinforce the connection between new recruits and veterans, and bridge the gap between the ***FIRST*® community** and the general public. Once again, we were reminded that **"Everything is easier together—even robotics!"**

Events hosted in public spaces like shopping malls **primarily target young people aged 5 to 20**, as this age group shows the highest potential for being inspired and motivated to engage with **STEM** fields. Even so, an objective assessment revealed that throughout both events, **over 300 individuals**—from all age groups—took one more step toward discovering robotics.

VIVO! Mall is a modern shopping center, offering a variety of stores, restaurants, and entertainment spaces, all within a contemporary design.

Argeș Mall is a shopping center that combines retail, entertainment, and relaxation, offering a variety of stores, dining areas, and leisure options, all within an accessible and welcoming space.

Over 300 people impacted

"Everything is easier together – even robotics!"

Robotics Challenge

May 18th 2025

Introduction

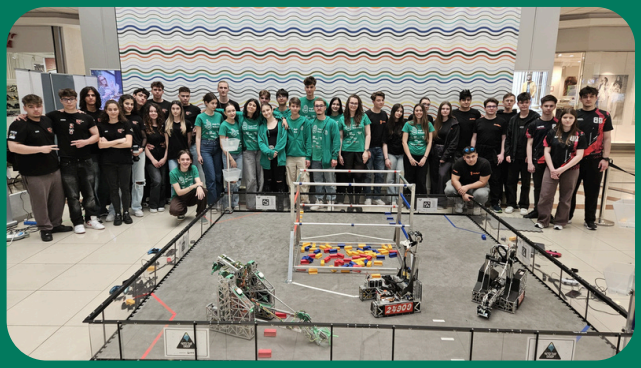
On May 18th, our team had the joy of organizing a robotics demonstration event in partnership with **VIVO! Mall** Pitești. Our goal was **to bring the fascinating world of the *FIRST*® Tech Challenge competition closer to the general public** – especially to young people and children – and to showcase the true meaning of **hard work, creativity** and **collaboration** behind each robot we build.

Main Body

For this initiative, we invited the teams **Starlight Robotics #24909**, **Broboti #19176**, and **RoboBarbu #27835** to join us, forming together a community united by shared values: **innovation, education** and **a passion for technology**. Our pits were carefully prepared, and each team presented high-performance robots designed for FTC competitions.

The event attracted a large number of visitors and the mall corridors were filled with enthusiasm and curiosity. Children were fascinated by the **dynamic robot demonstrations**, **asked lots of questions**, **watched friendly matches** and **discovered what it means to be part of a robotics team**.

For us, it was an extremely valuable experience to interact directly with the public and to see how our passion sparked interest in the eyes of the younger generation – perhaps even the future innovators or programmers of Romania.



Conclusion

Organizing this event gave us not only the opportunity to showcase our work but also to contribute to the promotion of STEM education in an accessible and interactive way.

We sincerely **thank our hosts** at **VIVO! Mall Pitești** for their support, the invited teams for their collaboration, and everyone who stood by us. It was a day in which we demonstrated that technology can connect people, inspire dreams, and help build a better future.

Virtual Factory

June 6th 2024

Introduction

Both globally and within the ***FIRST®*** phenomenon, **artificial intelligence** has become an increasingly prominent topic of discussion. Wishing to take part in its expansion, we participated in the **9th edition** of the Virtual Factory event organized by **UNSTPB-CUPIT** and presented the usefulness of **Computer Vision in educational robotics programs.**

Main Body

On **June 6th 2024**, at the **Faculty of Mechanics and Technology** within **UNSTPB-CUPIT**, the **9th edition** of the Virtual Factory event took place. Members of our team had the opportunity to present t**he applications of Computer Vision within the *FIRST®* Tech Challenge competition** to over **60 university professors and students**, as well as to other participants (**Goldplast, Leoni, Röchling, Dräxlmaier, Prelli, Forvia Argeș, Delta Invest, Kärcher, Piroux, Beko, Triumf, Lear Corporation, UiPath, EuroAPS**).

The event was organized with the purpose of promoting close collaboration between academia, industry, and innovation. Our presentation focused on **incorporating AI-based video processing into industry**. We also explained how we used this concept in the **FTC competition**, highlighting the importance of its applicability. Among the topics addressed were: **Computer Vision, TensorFlow, AprilTag detection processors** and positioning based on them, and the application of these concepts in industry (such as Automating product quality inspection, precise object manipulation, and monitoring production processes).

Through this presentation, we were able to further promote the **FIRST® Core Values**, demonstrating how this program has helped us grow and what we are capable of as a high school robotics team.

Conclusion

We thank our long-time partners, **UNSTPB-CUPIT**, for offering us yet another opportunity to connect and share the innovations created by the ***FIRST®* phenomenon** with the industrial and academic environment, and to learn from specialists in the field.

Virtual Factory

May 16th 2025

Introduction

On May 16th, our team had the pleasure of participating in the educational workshop The Virtual Factory, organized by the **Faculty of Mechanics and Technology within the National University of Science and Technology Politehnica Bucharest** – Pitești University Center. It was a truly valuable event for us, offering the opportunity to engage directly with representatives from both the academic and industrial sectors, in a context dedicated to **innovation, technical education, and interdisciplinary collaboration.**

Main Body

The event brought together numerous guests from the **fields of engineering and technology**, both from academia and from technical and industrial companies.

Through presentations delivered by **professors, researchers, and industry professionals**, we discovered new perspectives on how technology is applied in real-world settings, as well as on current challenges in the industrial landscape.

During the workshop, our team had the honor of presenting to the audience the robot we built for the ***FIRST*® Tech Challenge**, along with an overview of our team structure, competition track record, and our qualification for the **European Premier Event**.

We were excited to share our experiences so far, explain the processes behind designing and programming the robot, and highlight how we collaborate to achieve outstanding results.

Our presence was met with interest, and the conversations we had with professionals in the field brought us both encouragement and valuable advice that will guide our future development. It was also a great opportunity to make ourselves known in the academic environment and to better understand how our knowledge in robotics can be applied in practical, real-world contexts.

Conclusion

Participating in the Virtual Factory workshop was an important step for us in strengthening the connection between technological education, academia, and the industrial sector. We are sincerely grateful to **the Faculty of Mechanics and Technology** for the invitation, the warm welcome, and for organizing an event that supports the professional development of young people passionate about technology. We are thankful for the opportunity to contribute with our own experience – and for the chance to both inspire and be inspired.

Camp “Share the Joy”

July 16th 2024

Introduction

On July 16, 2024, we had the pleasure of participating,alongside team **ARRA #25538**, in the camp organized by **Rotary Club Pitești**, titled **“Dăruiește Bucurie” - Share the Joy**. The event took place in the village of Sătic, Argeș County, and one of our main responsibilities was to encourage **creative thinking** among the participating children through the use of **LEGO** building elements.

Main Body

Our primary goal was to introduce the world of **STEM** to children from underprivileged backgrounds. To achieve this, we organized a **workshop** using **LEGO Education SPIKE sets**. The children joined with great enthusiasm, and by the end, they were pleasantly surprised by the imaginative creations they had brought to life.

We also wanted them to leave with a positive memory of the experience, so we spent the entire day outdoors. After a lunch break, we provided additional **LEGO** pieces, allowing the children to bring their own ideas to life through hands-on building. At the end of the day, they were able to take their **LEGO** creations home as a keepsake.

Throughout the event, we engaged with around **15 children aged between 9 and 14**. For all participants, this was their very first interaction with the values and spirit of the ***FIRST*® community**. We made it a priority to reflect our united way of working and our enthusiasm for finding creative solutions.

Conclusion

The “**Share the Joy” camp** served as a grounding experience for our team—a reminder to be grateful for the opportunities our environment provides, and a motivation to actively work toward creating similar opportunities for those in underserved communities.

Someș Tech Challenge

July 26th-28th 2024

Introduction

Someș Tech Challenge is an **Off-Season** event, now in its **third edition**, held annually in Dej and organized by team **VECTRON #17873**. The event features matches based on the most recently completed season's game **CENTERSTAGE** and offers teams the chance to evaluate their strategies, test different Drive Team configurations for the upcoming season, and build meaningful connections with other robotics teams from across the country.

Main Body

Our **main goal** was to **help our new Drive Team** become accustomed to the competitive atmosphere, and the friendly, low-pressure environment of the demonstration matches created the perfect setting, full of the authentic ***FIRST®* spirit**.

This **annual event** is also supported and recognized by the **Technical University of Cluj-Napoca – Faculty of Industrial Engineering, Robotics, and Production Management**.

Over the course of the three-day event, the organizers facilitated **team-building activities** through which we were able to s**hare the core values of FIRST** not only with the participating teams and their supporters but also within our own team, focusing on strengthening our internal dynamics and relationships.

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA ROMANIA

Founded in 1948, the Technical University of Cluj-Napoca is one of the most prestigious higher education institutions in Romania. Actively involved in numerous international projects across Europe, it contributes to the technical education of top students in various fields.

Conclusion

Following a series of **well-coordinated and collaborative matches** with our alliances, we successfully advanced to the semifinals, forming Alliance 2 alongside **4D Robotics #18160** and **Titans #19055.**
At the end of the event, we secured **second place out of 26 participating teams**—an achievement that boosted our confidence and optimism as we prepared for the new season ahead.

Atlantykron - The Summer Academy

August 2nd - 9th 2024

Introduction

Between August 2nd and 9th, we had the pleasure of participating in **the 35th anniversary edition** of the **Atlantykron Summer Camp**. It took place on **Capidava Island**, a beautiful, wild island in the middle of the Danube, about the size of a football stadium. The island is inhabited only during this time of the year and exclusively by the camp's participants and special guests.

Main Body

Inspired by the wealth of knowledge we had gained the previous year, we wanted to share what we had learned over time with curious, eager-to-learn youth—this became our main goal during the camp. On August 5th, 6th, and 7th, we held **two workshops**: one about **3D design and printing**, and the other on **sensors and an introduction to programming complex elements.**

To ensure that our participants fully understood the topics covered, we chose to keep the number of attendees low—**6 per workshop, with a minimum age of 12.**

In total, we managed to engage **20 kids** and introduce them to the world of robotics.
For both workshops, we started with a well-defined plan and a variety of objectives. Our main goal was to give young people the opportunity to develop their skills in the field of robotics and to share with them the values that tie a team together. We also wanted to enhance their creative spirit by providing them with a large part of our resources, which they could use throughout the workshop.

During the **"First Steps in 3D Design and Printing" workshop**, we began by presenting the usefulness of 3D-printed parts in everyday life. The participants quickly picked up the skills needed to work in **Onshape**, the 3D design program, became familiar with it, and began their own projects. Of course, at the end of the course, each participant got to take home their personalized object as a souvenir, the result of their hard work throughout the class and a small memory from our workshop.
In the **"Programming and Sensors – Methods for Use and Reading Parameters" workshop**, the first step involved presenting various types of sensors, starting with the theory to ensure that all students fully understood.

The fact that they absorbed a lot of new information was proven by **their successful programming of a chassis, both in controlled and Autonomous modes**, which they accomplished by **working together as a team**. By also implementing some more advanced concepts, **they learned how to detect an AprilTag** and interpret the useful data it provided—putting it all into practice.

The only problems we encountered during the entire camp, which affected our efficiency, were internet instability—essential for both 3D design and robot programming—and the large amount of dust that settled on our devices, requiring constant maintenance. Of course, we managed to overcome these minor setbacks without much difficulty, using the offline moments to provide additional explanations and answer questions.

In addition to leading our own workshops, **our team members also took part in other workshops held throughout the camp**, which consistently impressed us with their value. Among them were: **First Aid & CPR Training F.A.C.T. – Radu Berca, Survival Techniques – Relu Nica, Sci Art – Heather, Carol and Donna Anderson, Yoga – Heather Anderson, and Bird Study – Agigea Bird Observatory.**

Outside of the workshops, we also attended conferences held by distinguished guests such as Prof. Alexandru Mironov, Dr. Eng. Florin Munteanu, Prof. Dr. Radu Dop, and representatives from NUCLEARELECTRICA. They tackled diverse topics that captivated our attention from the very first minutes: **"Politique Fiction – The New Silk Road," "Humanity in the Age of Artificial Intelligence," "Neuralink – The Technological Revolution and Neuroplasticity," and "The Energy of the Future. The Future of Energy."**

Founded in 1989, the Atlantykron Academy brings together lovers of beauty, culture, and technology from around the world on an island near Cernavodă. A unique project globally, it connects generations, interests, ideas, and perspectives through its activities, aiming to shape a better future for all.

Through the two workshops, we managed to make an impact on 20 children and young people aged between 12 and 18.

We are also very excited and equally grateful to have had the opportunity to meet and get to know the camp's guests of honor, including **Ravi Prakash – Systems Engineer for Entry, Descent, and Landing (EDL) at NASA Jet Propulsion Laboratory (JPL), Dumitru Dorin Prunariu – Romania's only cosmonaut and a renowned aerospace engineer, and Guy P. Djoken – President of the UNESCO Center for Peace**. In speaking with them, we presented the ***FIRST*® phenomenon** and managed to share the work we've done over the seasons and the values that define our team.

Dumitru Dorin Prunariu
Gen.-Loc. Dr. Ing.
The only romanian cosmonaut, who, in the year 1981, flew into space

Alexandru Mironov
Prof.
Writer, journalist and political figure, former Minister of Youth and Sports;

Florin Munteanu
Dr. Ing.
Doctor of Science, expert in Industrial Engineering and applications of Complexity Science.

Radu Dop
Prof. Dr.
Critical care medicine specialist, trained through "Eisenhower Fellowships" in the USA.

Ravi Prakash
Dr. Ing.
System engineer for the Curiosity rover from NASA Jet Propulsion Laboratory

Guy P. Djoken
President of the UNESCO Center for Peace, National Commission for UNESCO of the United States of America

In total: 8 days, 30 workshops, 16 conferences and participants from over 10 countries!

Also, for the team's internal mechanism, the Atlantykron experience acted as an intergenerational bond, as **three Alumni from the first season (the founders of the High Five team)** joined us and shared situations and knowledge from student life that helped us catalyze certain stages.

This island is open to the public only once a year, exclusively for this project, in a completely natural setting, with very limited access to the internet and electricity—only for the workshops. It is a camping-style place where hundreds of people live together and enthusiastically participate in fascinating courses. The **8 days** spent there **had a solidifying effect for us**—members, volunteers, and mentors alike—especially considering the newly formed team composition due to recent recruitments.

Conclusion

The **Atlantykron Summer Camp** was a wonderful experience that gave us the opportunity not only to learn new things and grow, but also to share, in turn, information about the passion that brings our team together.

Romanian Science Festival

September 21th 2024

Introduction

As time goes on, the **STEM community** continues to grow, with more and more children and young people joining the movement. **The Romanian Science Festival Caravan**, now in its **6th edition**, aims to promote science through non-formal educational methods designed for the general public.

Main Body

On **September 21**, in **Pitești's City Hall Square**, t**he 6th edition of the RSF Caravan** took place. Members of our team had the opportunity to become **hands-on experimenters**.

Alongside seven other robotics teams from the ***FIRST®*** programs — ***FIRST®* Tech Challenge** (**4D Robotics #18160, TehnoZ #15972, Broboți #19176, Arra #25538, Starlight #24909, Clockworks #19075**) and ***FIRST®* Lego League (TehnoZ Lightning Bolts)** — we helped promote ***FIRST®* values** and **STEM fields** within the local community.

ROMANIAN SCIENCE FESTIVAL

The mission of this project is to inspire, encourage, and challenge people of all ages and backgrounds to explore and understand the world around them.

Throughout the day, we engaged both children and adults in our area of expertise through live demonstrations and meaningful conversations sparked by curious questions. These interactions allowed us to provide in-depth information and encourage others to **join the growing robotics community**.

Thanks to its unconventional and engaging approach, the **RSF Caravan** continues to draw increasing attention to the importance of **STEM**. Student-led workshops — carefully guided by teachers and volunteers — successfully fulfilled the mission of the event

This year, the Romanian Science Festival brought together **over 30 scientists and 1,000 volunteers**, who conducted more than **200 interactive experiments**. The **11 themed workshop areas** — Art, Astronomy, Biology, Chemistry, Ecology & Sustainability, Physics, Genetics, Geography, Computer Science, Mathematics, and Medicine — offered more than **2,000 participants** (from toddlers and teens to parents, grandparents, teachers, and students) the chance to explore, learn, and enjoy science.

Conclusion

We sincerely thank the organizers, coordinators, and volunteers whose passion and dedication make this event possible year after year. We're truly glad that, through these kinds of interactions, we can confidently say that **STEM** and the community it fosters represent a vibrant environment for growth — one where more and more young people are discovering their passions.

European Researchers' Night

September 27th 2024

Introduction

On September 27, we took part in **the 6th edition** of **European Researchers' Night** at **the National University of Science and Technology POLITEHNICA Bucharest – Pitești University Center**. The main audience of the event was composed of university professors, students, and fellow high schoolers passionate about science, technology, engineering, and mathematics.

Main Body

Throughout the event, our booth attracted a large number of curious visitors eager to learn more about the program we are involved in, as well as how we manage our time and resources within the team.

Our participation in **European Researchers' Night** offered a valuable opportunity to connect with the academic world and promote **STEM** (Science, Technology, Engineering, and Mathematics) education. We also had the chance to explore several of the university's laboratories, where we observed a wide variety of **interactive experiments from diverse scientific fields.**

By attending this event, our goal was not only to showcase our achievements, but also to **inspire future generations** to get involved in **science and technology**. We aimed to demonstrate how a passion for knowledge can actively and consistently contribute to transforming the world we live in.

We also engaged with **other teams** and **research-oriented organizations**. The conversations we had opened up exciting new perspectives and potential opportunities for future collaboration.

Conclusion

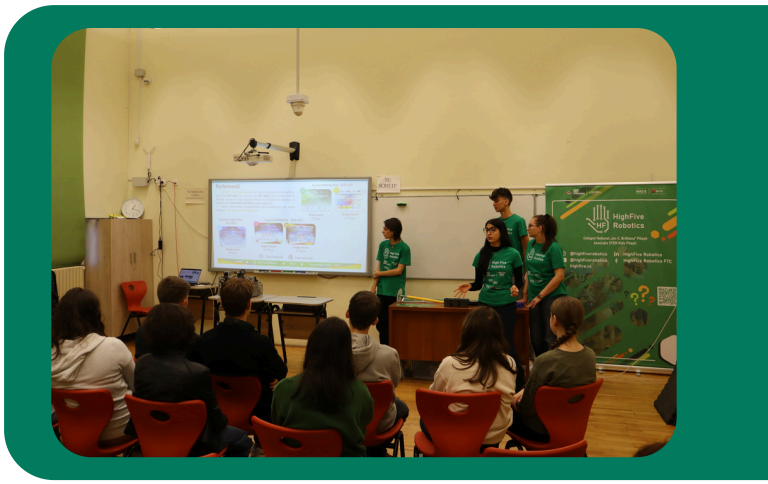
In conclusion, participating in European Researchers' Night was a valuable experience that allowed us to **share our enthusiasm for science and technology** with a diverse and enthusiastic audience. It provided us with the chance to interact with professionals from various fields and to encourage younger generations to embrace **STEM education** and its values.

The event served not only as a platform for promotion, but also as a great learning opportunity and a space to build meaningful connections for future partnerships.

Learning circuit

November 7th 2024

Introduction



During the **Alternative Education Week** that happens once per school year in Romania and has the purpose of enhancing students' knowledge through unconventional activities, team **Broboți #19176** and our team organized an engaging presentation at **"Ion C. Brătianu" National College** aimed at **introducing students to the world of robotics and technology competitions.**

Main Body

The session began with an introduction to the **FTC competition**, explaining its **concept and purpose**. Team members enthusiastically shared how **FTC** challenges them to design, build, and program robots to perform specific tasks in a

competitive setting, while also encouraging **logical thinking**, **teamwork**, and **creativity**. They also emphasized the long-term value of the skills gained, which help prepare them for future careers in science and engineering.

Throughout the event, we kept in mind to provide a detailed overview of our journey, to promote **Gracious Professionalism**, and to reinforce the **core values** of ***FIRST®***.

We then explained the different roles within a robotics team — from **3D design**, **mechanics**, and **programming** to **PR**, **marketing**, and **digital design** — highlighting that success in robotics isn't based solely on technical expertise, but also on strong, well-coordinated collaboration.

The most engaging part of the event was, without a doubt, the **live demonstration** of the competition robot. During the demo, the robot performed several programmed tasks and movements, impressing the students with its precision and complexity. Attendees were even invited to try operating the robot themselves, under the guidance of the team — an experience that sparked even more excitement and curiosity.

Toward the end, we **discussed the challenges encountered** during the building process and shared moments where we had to come up with **creative solutions to unexpected problems.**

We emphasized the **importance of perseverance and teamwork**, leaving the audience with a motivational message. The presentation concluded with a **Q&A session** and **an open invitation to join our team**, explaining the application process. Many students left inspired, with several **expressing interest in becoming part of a robotics team** in the future.

Conclusion

It was an interactive and educational experience through which the team succeeded in creating a dynamic atmosphere, sparking a genuine interest in technology and robotics among the students.

Mistery of the Coral Reef

November 9th 2024

Introduction

On November 9, our team had the opportunity to take part in **"Mystery of the Coral Reef"** event, an exciting treasure hunt organized by team **Tehno Z #15972** in the city of Pitești.

Main Body

The event kicked off in the school courtyard of **Zinca Golescu National College**, where we were warmly welcomed by the organizers. After a brief introduction, the game rules were explained, and we received our first mission.

The atmosphere was filled with anticipation and curiosity, and the adrenaline kicked in right from the start.
The theme of the event was seamlessly integrated into the challenges, with all tasks closely related to **water and marine life**. Each mission tested our **teamwork, communication, and quick-thinking skills**, pushing us to collaborate efficiently under pressure.

The riddles and clues led us through various parts of the city, giving us the chance to enjoy beautiful scenery along the way. After hours of intense effort and fun, we proudly **secured 3rd place**.
This result reflected the **strong teamwork** and values that guided us throughout the day. Although the game was challenging at times, that was exactly the type of **fun** our team was looking for.

Conclusion

Participating in the “Mystery of the Coral Reef” event was an extraordinary experience, filled with thrilling missions and unforgettable moments. We learned new things, pushed our limits, and most importantly, had a lot of fun.

Parents’ Kick-Off

November 17th 2024

Introduction

Behind every journey marked by success, there are always people who support us unconditionally — those who help us grow, overcome uncertainty, and face challenges along the way. On November 17, **we hosted our second “behind the scenes” event** at our hub, this time dedicated to the **parents of our team members**.

Main Body

This internal event managed to strengthen the connection between our visible efforts during the **Off Season** and the beginning of the **Into The Deep season**, highlighting all the behind-the-scenes work that made it possible — **from robot and algorithm iterations to event planning and fundraising.**

The event aimed to bring **parents and family members** closer to the competition experience, offering insight into the tasks and responsibilities, skills, and capabilities developed through involvement in such a program.During the meeting, we **shared our vision for the season**, the **team’s objectives**, and how each of us actively contributes to reaching them. We presented the **team structure**, upcoming competition plans, and the vital roles played by every member.

We are sincerely grateful to all the parents for standing by us every step of the way and for being the very first to empower us and believe in our vision.

From our history, values, and mission, to our technical (hardware and software) evolution and community engagement through both official and friendly events, we took the time to present our journey so far. We also outlined the next steps and goals set for the **INTO THE DEEP season**, sharing all of these openly with our parents.

Conclusion

This event offered us an opportunity to receive **valuable, constructive feedback** from an external but deeply trusted source. It helped us **reflect, improve, and grow** — both individually and as a team — while also considering how we share our message about STEM, ***FIRST*® Tech Challenge**, and our team within the wider community. It served as a reminder of the importance of communication and the impact we strive to make.

Speechless

November 24th 2024

Introduction

On November 24, 2024, we had the pleasure of attending the Speechless conference, organized by teams **Homosapiens #19053** and **NeuroBotix #19054**. Bringing together members of robotics teams from across the country, the event—hosted at **the Faculty of Industrial Engineering and Robotics of the University Politehnica of Bucharest**—offered a unique opportunity to explore and reflect on future careers in the field of technology.

Main Body

Thanks to the diverse professional backgrounds of the speakers, we were able to gain a wide range of perspectives, helping us form a more complete picture of the paths available within the tech industry.
The guest speakers included:

- **Liviu Bouruc** – former student at the University of Bucharest
- **George Popescu** – current UNIBUC student and member of the university's robotics team
- **Vlad Dieaconu** – employee at Adobe
- **Marian Bănică** – NASA collaborator
- **Ștefan Petriceanu** – university professor at UPB

From the students, we learnt about **the academic programs** offered by their universities, meanwhile from the professionals, we heard firsthand accounts of their experiences working in startups and large corporations.

Moreover, the conference highlighted how science and technology can bring about real change in the world by helping solve pressing problems. For instance, **Professor Ștefan Petriceanu** shared the story of an innovative project created by a few students from the UPB Faculty of Medical Engineering. Still in its testing phase, the project involves a smart glove designed to assist in the proper execution of cardiac massage, with the goal of increasing its success rate.

We interacted with over 100 people!

Conclusion

Speechless was a truly inspiring event. We left feeling motivated by the stories we heard and with a clearer understanding of the educational opportunities offered by some of the most prestigious technical universities in the country.

GALADE- UNItour

December 7th 2024

Introduction

On December 7, we had the opportunity to take part in the second edition of **GALADE - UNItour**, organized by the **Acționăm.Dăruim.Educăm. Association**. The event was dedicated to young people looking to make informed educational choices and explore their future career paths.

Main body

The **main goal** of the event was to inform students about the most popular universities in the country. Seven speakers from various fields — including **Science and Technology, Medicine, Social Sciences, and the Arts** — shared their personal experiences from university, highlighting both the challenges and the rewarding moments.

Our team's mission was to **promote STEM** and the **values of *FIRST*® within the local community**. We wanted to show young people how robotics can positively impact their personal and professional growth and to encourage them to get involved in this field.

Together with two other robotics teams from Pitești — **Broboti #19176** and **Arra #25538** — we set up booths in the venue's foyer and had the chance to talk with students attending the workshops. Through these conversations, **we engaged with over 50 curious** kids and teenagers. In addition to introducing them to the ***FIRST*® community**, we also discussed the importance of its **core values**, how we apply them in our day-to-day lives, and the benefits of teamwork.

Conclusion

We're grateful to **Acționăm.Dăruim.Educăm.** Association for the invitation and for giving us the chance to take part in this project and share the spirit of **STEM** and ***FIRST*®** within our local community.

ADE

The association "Act. Give. Educate." is dedicated to organizing charitable and community events, led by young volunteers from the city of Pitești.

Visit to the Vidraru Hydroelectric Power Plant

December 23th 2024

Introduction:

On December 23, we had the opportunity to visit the **Vidraru Hydroelectric Power Plant**, an experience that gave us a practical **perspective on this season's theme**.

Main Body:

The **main purpose** of this visit was to introduce the season's theme in an applicable and interactive way.
The visit began with **a short presentation about the energy importance of the plant**, followed by a film about its construction, which revealed the project's complexity and the challenges encountered throughout the building process.
We were given **technical details** about the construction and the prototyping stage of the project, emphasizing the innovative solutions adopted to overcome obstacles.

In the second part of the visit, we were taken **underground**, where we had the chance to **see the turbines** and study the complex diagrams behind the plant's operation.

Conclusion:

The visit to the **Vidraru Hydroelectric Power Plant** was **more than a hands-on lesson** – it was **a source of inspiration**, showing how engineering, perseverance, and creativity can turn an idea into reality.
We thank **Hidroelectrica** for making this visit possible, as well as the staff at the Vidraru Hydroelectric Power Plant for their detailed presentation of the project's history and complexity.

Hide & Meet

January 13th 2025

Introduction:

Building on the solid experience gained throughout previous seasons, this year **we organized the third edition of Hide & Meet,** held in Pitești, within the SUD region. **The League Meet** was hosted **by our team in collaboration with ARRA #25538, 4D Robotics #18160, and Lightbulb Robotics #23203**, and took place on January 12, 2025, in the sports hall of **"Mircea cel Bătrân" Middle School** in Pitești. Being one of the largest events planned by our team this season, brainstorming sessions began as early as October, while the month of December was dedicated entirely to preparing for Hide & Meet.

Overview

Thanks to the **support of Mr. Principal Dragoș Dinculescu, our volunteers, and our partners**, we managed to create an optimal competitive environment that fostered both preparation and performance.
Within just two weeks, all available spots were filled, and several teams were placed on a waiting list in case additional space became available.
The **20 participating teams,** hailing from **six cities** recognized as major robotics hubs—Pitești, Bucharest, Ploiești, Târgoviște, Râmnicu Vâlcea, and Curtea de Argeș—immersed the audience in an atmosphere reminiscent of high-energy sports events, marked by adrenaline, suspense, and curiosity. In recognition of every team's effort and involvement, we awarded participation certificates as well as diplomas for the top three placements.

First place was awarded to **Ro2D2 #17962**, second place to **Phantom Robotics #19062**, and third place to **StarLight Robotics #29409.**
In total, we interacted with **over 2,500 individuals** and collaborated directly with **19 teams**. The event was streamed live and reached more than **2,200 views** within just nine days.

Conclusion:

This experience had a positive impact on **collaboration between teams,** while also allowing us to discover, through practical involvement, how to use resources responsibly and how to build a healthy and constructive competitive environment.

20 participating teams

36 volunteers involved

Interacted with over 2500 people

Career day

February 22th 2025

Introduction

On February 22, we had the opportunity to participate in **Career Day**, an event organized by **Interact Pitești Association at the "Dinicu Golescu" County Library, Argeș**. This event was dedicated to career orientation and the discovery of personal passions.

Main Content

The **main purpose** of the event was to present various professions through the perspectives of experts from fields such as **medicine, engineering, aviation, law, public speaking, and psychology**. Each participant had the chance to learn something new about every career path discussed.

Our team aimed to share and **promote the STEM phenomenon** and the ***FIRST®* values** within **the local community**. Our **primary goal** was to show young people **the positive impact** that **robotics can have** on their personal development and to encourage them to get involved in this exciting and ever-growing field.

Together with the robotics team **ARRA #25538**, we even had our own pits in one of the rooms at the venue, where we had the opportunity to introduce STEM to people of various ages. Through these interactions, we managed to reach and inspire **over 50 curious children and teenagers**, as well as more than **20 adults** interested in the field. During our discussions, we not only introduced them to STEM but also explained the importance of ***FIRST®* values** and how we integrate them into our daily lives. Furthermore, we shared our team's progress throughout the season, using our engineering notebooks, and showcased our robot design in OnShape (CAD).

Conclusion

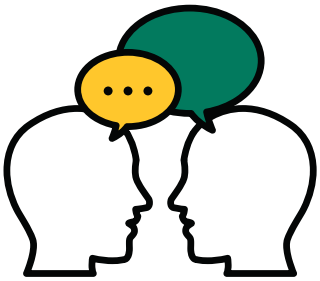
We are glad that we were able to **introduce so many young people to this field** and open up new possibilities for their future careers.

Workshop Verbal and Nonverbal Intelligence – Emotional Intelligence in Quality Communication

February 28th 2025

Introduction

On February 28th, we had the opportunity to attend a workshop focused on **developing both verbal and nonverbal intelligence** – essential components of effective communication. The event took place at **National University of Science and Technology Politehnica Bucharest, Pitești University Center**, and was led by **Cătălin Stoica**, a specialist in coaching, profiling, and neuroleadership.



Overview

Following our performance at the League Tournament Stage, we identified several areas for improvement and decided to participate in this workshop in order t**o grow emotionally** and **strengthen our communication skills** as a team.The experience proved to be extremely valuable, offering fresh perspectives on the importance of quality communication and empathy within a group.

We learned about the impact each type of language has on how we are perceived: **only 7%** of a message is **communicated verbally**, **38% through tone** and voice (paraverbal), and a **significant 55% through nonverbal cues** such as posture, gestures, and facial expressions.

Through real-life case studies and scenario analysis, we explored how different types of language can significantly influence interactions. We also deepened our understanding of emotional intelligence — a key factor in both effective communication and everyday life.

Conclusion

This workshop helped us become **more aware** of how profoundly communication affects team dynamics. It provided us with **practical tools and techniques** that **will support us** in strengthening interpersonal relationships and improving collaboration among team members. With this knowledge, we are now better equipped to create a more harmonious and productive working environment.

BROBOȚI FEST

March 1st 2025

Introduction:

On Saturday, **March 1st, 2025**, our team participated in **BROBOȚI FEST** at the **"Dinicu Golescu" Argeș County Library**, alongside **Broboți #19176**, the organizers of this event, as well as **Zenith #23307**, **TITANS #19055**, **Light Bulb Robotics #23203**, and **4D-Robotics #18160**.

Main Body:

BROBOȚI FEST is a fair dedicated to the **curious and creative**, eager to **learn, experiment, and discover** new opportunities in th field of technology. The event featured **science experiment booths, an area with FTC robotics demonstrations, LEGO workshops**, and exhibitors such as **Kärcher, ROSPIN, and Europe Direct**, who brought engaging activities and information for visitors.

Participating in this festival dedicated to promoting **STEAM** was the perfect opportunity to **interact** with other **FTC** teams present at the event, as well as to have **one-on-one discussions** with visitors.

At **BROBOȚI FEST**, we **shared our knowledge and inspired** young people to get involved in **the tech field**. We also learned a lot from our interactions with visitors, and their energy and curiosity gave us a huge boost.
This event was a true meeting point for young people, professionals, and enthusiasts in science and technology, who had the chance to grow actively in an atmosphere full of energy and innovation.

Conclusion:

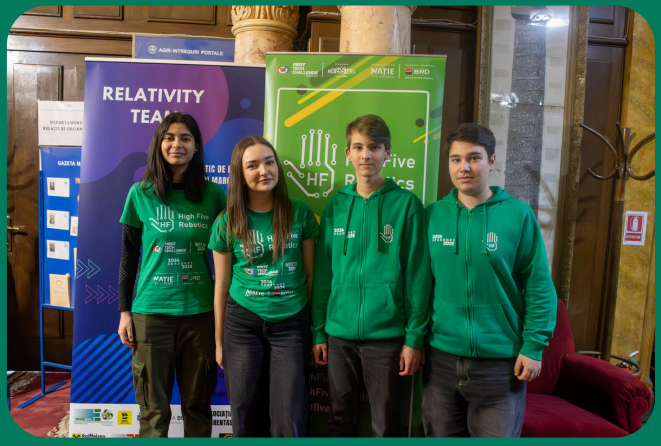
It was a wonderful experience and a great opportunity to promote ***FIRST®* values** in an interactive and engaging way. We were happy to see so many passionate young people who got involved actively, asking questions, exploring the field of robotics, and forming new connections.

Inspiring The Engineering Youth

March 2nd 2025

Introduction:

On **March 2, 2025**, we had the pleasure of attending the **"Inspiring The Engineering Youth"** conference, a remarkable event organized by team **Boogiebots #19053**. This conference brought together members of robotics teams from various cities, offering them the opportunity to learn and be inspired by the experiences of professionals in the STEM and engineering fields.



The event took place at the **AGIR Central Headquarters** in Bucharest and included f**our captivating talks** delivered by **engineers and specialists** with extensive experience. Each presentation offered valuable perspectives on the challenges and innovations in the tech field, contributing to the participants' **knowledge and passion** for **science** and **engineering**.

Among the topics discussed were: a presentation of a platform focused on **cybersecurity**, **robotics**, and innovation competitions; study areas within the **FIIR** faculty; and the use of robots in the construction sector.

The event also served as the perfect place for **networking**, and our team had the opportunity to collaborate and interact with other robotics teams.

Conclusion:

In the end, the event was a tremendous success, both for us and for everyone present, who left with a wealth of new ideas, valuable connections, and a heightened enthusiasm for what **STEAM** education represents. The experience once again highlighted the importance of collaboration between **science, technology, engineering, arts,** and **mathematics**, and inspired the new generations to tackle the challenges of the future in an innovative, creative and passionate manner.

Robotics demonstrations at Arges Mall

March 9th 2025

Introduction:

On **March 9,** at **Argeș Mall Pitești**, we organized a special event dedicated to robotics, together with the teams **ARRA #25538**, **Broboți #19176**, **Tehnoz #15972**, and **Starlight #24909**.
Through live demonstrations and interactive discussions, our aim was to bring the world of the ***FIRST®* Tech Challenge** (**FTC**) closer to the public and to show visitors what it truly means to be part of a robotics team.

Overview:

The event featured match simulations, where our robots were tested in a competitive environment similar to that of an actual **FTC** competition. **Spectators** had the opportunity to observe how the robots operate, how they are controlled, and what strategies we implement during matches.

The **main objective** was to **promote education in science, technology, engineering, and mathematics**, while encouraging young people to engage with this dynamic and innovative field.

Through hands-on demonstrations and dialogue, we intended to show that the world of robotics is both accessible and **captivating**—built step by step through **teamwork** and **creativity**.

In addition, at our booths, we engaged in conversations with visitors about the construction and programming processes, and the vital role of collaboration. This provided them with a realistic perspective on robotics and the challenges we face along the way.

Conclusion:

The event at **Argeș Mall Pitești** was an excellent opportunity to **bring the world of robotics closer** to the wider public. We successfully introduced **FTC** in an engaging and interactive format, demonstrated how our robots work, and sparked interest in the field of technology.
It was a valuable experience for both our team and the visitors, and we hope we managed to inspire as many young people as possible to explore and become involved in this exciting domain.

League Tournament

February 6-9th 2025

Introduction:

As in every season, we eagerly awaited the arrival of the **League Tournament** stage of the competition. The announcement that it would take place in **Pitești**, our hometown, brought us even greater excitement. The location presented a valuable opportunity for us to offer support, become more involved, and build meaningful relationships with other teams. We entered the competition with **confidence**, **optimism**, and a deep sense of curiosity.

Development:

Wishing to **prioritize involvement and contribute** as much as possible to the smooth organization of the event, we joined the **Nație Prin Educație** volunteering team from the very first day to help set up the venue. A total of eight of our team members actively volunteered, accumulating **88 hours** of service.

Given that the competition was held in a large sports hall, there was a significant amount of assembly required, but thanks to the collaboration of several teams, we were able to complete everything according to the planned schedule. Moreover, through our early interactions with other participants, we managed to ease the initial emotions and approached the first day of the competition fully prepared.

The following competition days unfolded wonderfully, filled with adrenaline, commitment, emotion, teamwork, and, of course, a strong spirit of **Gracious Professionalism**. At the end of the six **Ranking Matches**, we **secured the sixth position** and earned our place as **alliance captains** in the **Playoffs**. Advancing to this stage and reaching such a milestone represented the fulfillment of an important objective and brought us great joy, especially as this was the first season for our current **Drive Team** configuration.

Conclusion:

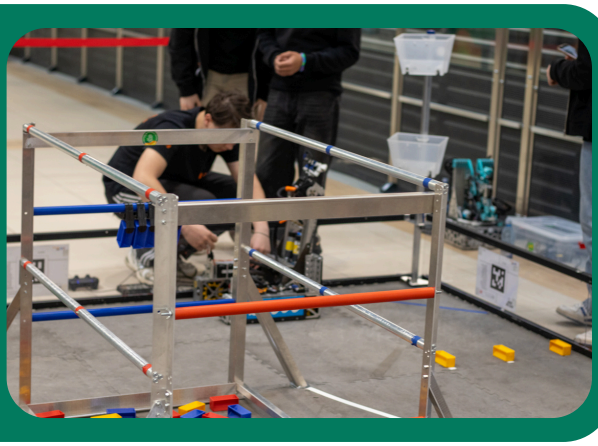
The entire competition left a powerful emotional impact on us as a robotics team and on the city as a whole. The fact that the event was open to the public significantly increased the number of people we could engage with. It offered us the chance to present the ***FIRST®*** **phenomenon** to a wider audience and allowed the community to witness the scale and energy of the event firsthand.

Pitești Retail Park

22-23th March 2025

Introduction:

On **March 22nd and 23rd, Pitești Retail Park** hosted an event dedicated to robotics enthusiasts, where we participated alongside **Tehno Z #15972**, **4D Robotics #18160, Arra #25538, Light Bulb Robotics #23203, Star Light Robotics #24909** and **Coral Tech #28260.** The goal was to show the public how our robots work and what it means to be part of a ***FIRST*® Tech Challenge** team.



Main Body:

The event featured several robotics demonstrations, where visitors could see the robots in action on the field. We also talked to curious guests about the building process, **3D** part design, and the components we typically use. We explained different types of **drivetrains**, efficient mechanical solutions, and how we adapt our robot based on the challenges of the season.

The audience exceeded our expectations: many kids and parents stopped by our booths, asked questions, and showed **genuine interest.**

We were happy to explain **how a robot works, how we collaborate as a team**, and why we're so **passionate** about **STEM** and technology.

Conclusion

The event was a great opportunity to promote what we do and to show how exciting and valuable technology can be. We hope we managed to inspire a few future programmers or **engineers** and we're glad we got the chance to be there.

PITEȘTI RETAIL PARK

Pitești Retail Park reinvents the shopping and entertainment experience, being the destination for an urban and fresh lifestyle audience.

IPAD Visit

March 25th 2025

Introduction:

On **March 25th 2025**, we had the honor of welcoming representatives from **IPAD**, a company specialized in industrial design and product solutions, to our workshop. The visit was **a valuable opportunity** to build a bridge between the world of technology and that of design, laying the foundation for a future collaboration that blends robotics with industrial design.

Overview:

We began by introducing our guests to our workspace and team — 20 kids passionate about technology. We first introduced them in the ***FIRST®* phenomenon**, presenting the ***FIRST®* Tech Challenge** program and its values.

Then we also showcased the robot we competed with, explaining the stages of design, **construction** and **programming**. The discussions were open and dynamic, touching on both technical aspects and ideas about how industrial design can enhance the functionality of robots.

In the second part of the meeting, we discussed the possibility of a joint project, where our team and **IPAD's** design specialists could collaborate to create a prototype that meets a real-world need—a product that combines the precision of robotics with a **user-friendly**, **ergonomic**, and **efficient** design.

Conclusion:

The meeting with the **IPAD** representatives was a motivating experience that encouraged us to see robotics not only as a technical challenge but also as a field where form and function must harmoniously coexist. We're excited to begin developing the next steps of this partnership together!

Kirchhoff Visit

March 27th 2025

Introduction

On **March 27th**, our team had the privilege of visiting the headquarters of **Kirchhoff Automotive**, one of the most respected companies in the **Automotive** components industry. This visit was **a valuable opportunity to engage** with **professionals in the field of engineering** and to share the journey of our current competition season.

Main Content

The **main goal** of the meeting was to **present our recent activities, highlighting our technical progress, key moments** that shaped our evolution, and the **important lessons** we've learned over time. We delivered a comprehensive presentation to the **Kirchhoff** specialists, sharing the **history of our team**, the **projects** we've been involved in, and the notable results we've achieved in previous competitions.

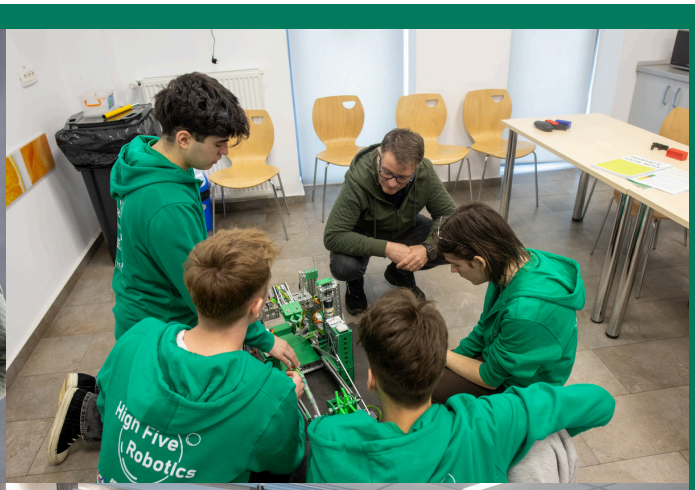
A significant part of the meeting was the demonstration of our team's robot in action, which showcased our technical expertise and innovation capabilities.

We also discussed the mission and values that guide us – **a passion for technology, teamwork, and a commitment** to making a positive impact in the **STEM** community.

Additionally, we outlined our future plans, including our upcoming participation in the **European Premier Event** this summer, as well as our ongoing dedication to team development and increased involvement in educational and community initiatives.

Conclusion

The visit to **Kirchhoff Automotive** was both an **inspirational and educational experience** for our entire team. It gave us the opportunity to **learn from experienced professionals, validate** our efforts, and **strengthen our motivation** for future projects. We are truly grateful for this opportunity and remain committed to continuous **growth** – both as a technical team and as ambassadors of **STEM** education in our community.



Award Ceremony at the Local Council of Pitești Municipality

March 31st 2025

Introduction

On **March 31, the Local Council of Pitesti Municipality** organized an **Award Ceremony** with the purpose of recognizing the achievements of the **FTC** teams that took part in the **National Championship**, but also the achievements of a **FLL** team, **ARRA #25538**.

Overview

We truly appreciated this initiative spearheaded by the Mayor himself, as it enhanced the visibility of the ***FIRST®*** phenomenon among the **local community** and may well have **inspired young people** to get involved in such programs.

We have been offered **merit diplomas** and agendas **as a reward**, but the most fulfilling part was certainly the rousing round of applause we have received from the audience, fostering the feeling of being part of **a bigger community** that is, at the same time, our support system.

We have held a brief presentation about our activity over the years, enthusiastically mentioning our participation in the **European Premier Event** this summer and have publicly expressed our gratitude towards our mentors that have guided us throughout the season.

We were also interviewed by reporters and the material has later been broadcast on a local TV channel. During the interview, we proudly showcased our achievements of the **INTO THE DEEP season** and have responded to questions about our robot and team.

Moreover, we have tried our best to **highlight the importance of teamwork, Gracious Professionalism** and **Coopertition**, the **core values** that define ***FIRST®***.

Conclusion:

We are extremely grateful for this opportunity and would like to **thank the Mayor and the Local Council of Pitesti Municipality** for their openness about the **world of robotics** and **STEM** and for making us feel seen and supported by our city.

Visit at Mrs. Ana Stan notarial office

2nd April 2025

Introduction

Our **robotics** team had the opportunity to visit t**he notary office of Mrs. Ana Stan** for an official meeting. The purpose of this visit was to present our team's activities within the ***FIRST*® Tech Challenge** program and to explore possibilities for partnership and support in our upcoming international endeavors.

Overview

During the meeting, we introduced the ***FIRST*® Tech Challenge**, an international robotics competition that promotes **STEM** education and challenges students to **develop skills in engineering, programming, and teamwork**. We outlined the core elements of our project, including **robot design**, **coding**, **strategic planning**, and our **outreach efforts within the community.**

We also highlighted our achievements in the current season, most notably our recent qualification for the **European Premier Event**, which will take place in the **Netherlands**. While this opportunity represents a major step forward for our team, it also comes with significant **logistical and financial demands**.

In this context, we were pleased to formalize **a partnership** with **the notary office of Ana Stan** through the signing of **a sponsorship contract.** This agreement will play a key role in supporting our travel and competition costs, allowing us to represent **Romania** at one of the highest levels of **international robotics competition**.

Conclusion

We are grateful for the warm reception and professional engagement shown by Mrs. Ana Stan during our visit. Her support reflects a strong commitment to **youth development and technological education**. We look forward to making the most of this partnership as we continue **our mission to grow as a team and inspire others** through our passion for robotics.

Kärcher Visit

April 9th 2025

Introduction

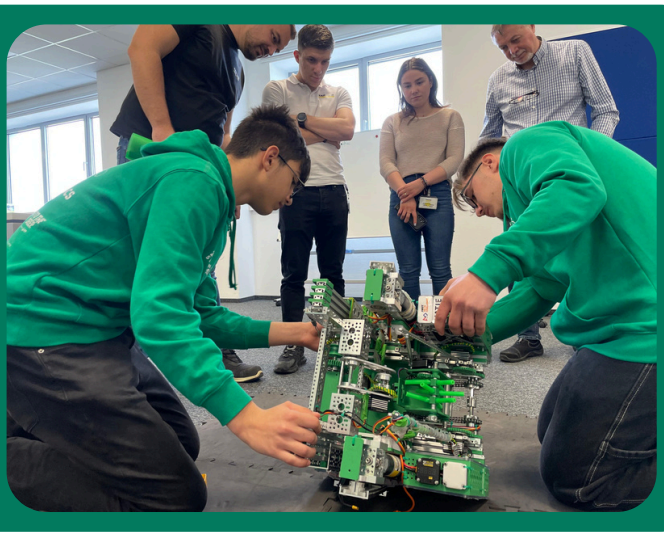
On **April 9th**, our team had the honor of visiting the **Kärcher** company headquarters in **Curtea de Argeș**, where we were warmly welcomed with openness, interest, and professionalism.
This meeting was a valuable opportunity for us to share with **Kärcher** representatives our journey within the **FIRST Tech Challenge** competition, as well as the values that motivate and define us as a team: passion for technology, innovation, and a strong spirit of collaboration.

Main Body

During the visit, we conducted a technical demonstration of our robot, explaining how it was designed and built to meet the specific challenges of this season's theme. We discussed our design, programming, and testing processes, offering a detailed insight into how we work and organize ourselves as a team.

In return, the **Kärcher** representatives offered us a captivating tour of their company. We had the chance to see the production hall, where components and parts for their products are manufactured, and to attend a detailed presentation of the various professional cleaning equipment developed by the company. This tour gave us a practical perspective on modern industrial processes and the high quality standards that **Kärcher** adheres to.

We also shared our plans to participate in the **European Premier Event**, an international-level competition where we aim to proudly represent Romania. In this context, we discussed the essential material and financial resources required to make this participation possible, highlighting our strong desire to continue growing and advancing what we have built so far.

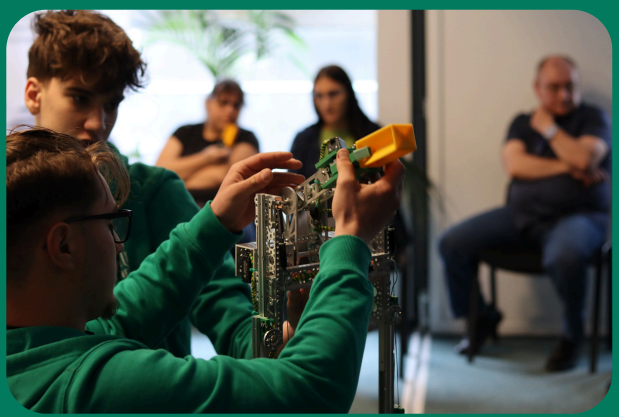


Conclusion

We are sincerely grateful to the **Kärcher** team for their outstanding hospitality, their openness to listen, and the genuine interest they showed in our activities.
This experience provided us not only with encouragement, but also with meaningful inspiration to keep improving and pushing our limits.

ADIENT Visit

April 10th 2025



Introduction:

On April 10th 2025, we had the opportunity to visit the **ADIENT** factory in Pitești — the world's largest manufacturer of Automotive seating for clients across the globe. This experience offered us the chance to interact with members of the industrial community, which today is highly Automated and technology-driven.

Overview:

We were warmly welcomed by the **ADIENT** team, and our presentation took place in a professional yet friendly setting. We spoke to the employees about our involvement in the ***FIRST®* Tech Challenge** program, the **STEM** movement, how we build and program our robots, and the values we promote: **innovation**, **teamwork**, and **continuous learning.**

We also presented our competition robot and explained its mechanical and electronic components, as well as how we manage the software and testing phases. We were pleasantly surprised by the interest shown by the audience, who asked technical questions and encouraged us to keep developing our passion.

Conclusion:

The visit to **ADIENT** was an extremely valuable experience that motivated us to continue exploring the connection between technology and industry. We left with new ideas, greater confidence, and the joy of having discovered a community open to **innovation** and **supportive** of the younger **generation**.

ADIENT

At Adient, our reputation as a global leader in Automotive seating begins with our products – from complete seating systems to individual components – and extends across our entire portfolio.

Workshop on Robotic Process Automation (RPA)

April 22nd, 2025

Introduction

On April 22 2025, our team had the opportunity to attend a specialized workshop on **Robotic Process Automation** (**RPA**), guided by our mentor Emanuel Șerban, who currently works at **UiPath**, one of the world's leading companies in the field of Automation software. The event was organized to help us better understand the impact of **RPA** in real-world scenarios and to give us a glimpse into how modern digital tools can streamline complex, repetitive business processes.

The **workshop** took place in a hybrid format that combined both theoretical and practical elements. It was aimed at helping us bridge the gap between software engineering concepts and their practical, industry-level applications.

The session was particularly relevant to our **FTC** team, as it allowed us to apply **computational thinking** and **programming** logic outside the usual robotics environment.

Overview

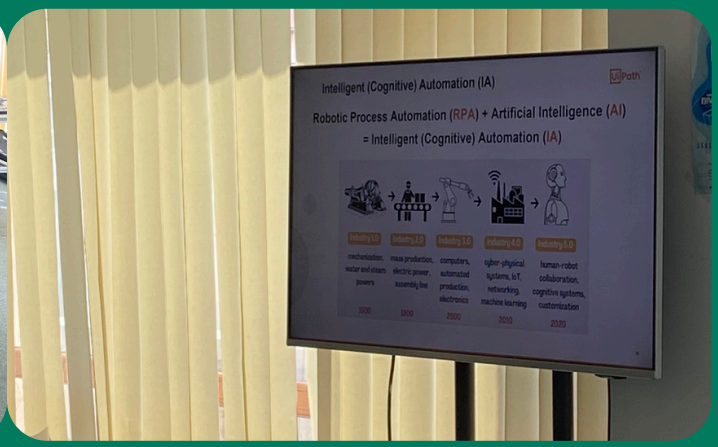
The workshop began with an insightful presentation about **UiPath's** origin story. We learned that the company started in Romania and has since grown into a global leader in **Robotic Process** Automation. Emanuel shared how **UiPath's** mission is to democratize Automation and make powerful digital tools accessible to companies and individuals across all fields, from finance and healthcare to logistics and education.

We were introduced to the fundamental concepts of **RPA**, including how software robots (bots) can mimic human actions to perform repetitive tasks such as data entry, report generation, and database management.

Emanuel highlighted the real-world impact of **RPA** by discussing case studies where companies have significantly reduced time and errors through Automation.

After the theoretical segment, we moved on to a hands-on practical activity using the UiPath Studio platform. Our task was to build a basic Automation process: we created software robots capable of reading a table with information about the teams participating in the **European Premier Event** and exporting it into an Excel spreadsheet. This exercise challenged us to think logically and use conditionals, loops, and data manipulation techniques—many of which align with the programming skills we use in **FTC** competitions.

Despite most of us being beginners in **RPA**, the intuitive nature of the **UiPath** interface allowed us to make quick progress and successfully complete the task. It was a rewarding experience that showed us how Automation can be used not just in large companies, but also in projects like ours, where time-saving tools and process efficiency are essential.



Conclusion

Participating in this **RPA** workshop was a valuable learning experience for our entire team. It expanded our understanding of how Automation works in the real world and introduced us to an emerging field that is becoming increasingly important in both engineering and business.

We gained practical experience with a leading **RPA** tool, learned to identify tasks that are suitable for Automation, and saw firsthand how software robots can be designed and deployed.

Beyond the technical skills, the workshop emphasized the importance of innovation, adaptability, and cross-disciplinary thinking—qualities that are crucial not only in robotics competitions but also in future careers in **STEM**.

UiPath Visit

April 24th 2025

Introduction

In a world that is constantly undergoing digital transformation, technology becomes not just a tool, but a bridge between generations, ideas, and dreams. We had the privilege of visiting the headquarters of **UiPath** — a global leader in **Robotic Process Automation** (**RPA**). This experience was more than just a practical lesson about success in a cutting-edge field; it was living proof that passion and perseverance can lead to remarkable careers. The visit offered us an authentic perspective on the organizational culture of an innovative company and gave us the opportunity to interact directly with professionals shaping the future.

Main Body

From the moment we stepped into **UiPath's** headquarters in Bucharest, we were greeted with warmth and openness by their team. The office tour gave us a better understanding of how a world-class company operates behind the scenes — from modern workspaces and collaborative areas to the professional yet friendly atmosphere that fills the entire building.

UiPath is a global software company that develops a platform for robotic process Automation.

After the tour, we had the chance to give a presentation to **UiPath** employees. During the **presentation**, we shared our experience as part of the ***FIRST*® Tech Challenge** — an educational and technological program that has shaped us not only as young engineers but also as individuals.

We talked about our journey, the challenges we've encountered, the obstacles we've overcome, and the valuable lessons we've learned along the way. We highlighted the core values that guide us in everything we do: **Gracious Professionalism**, innovation, and inclusion — values that we also saw reflected in **UiPath's** company culture.

The open dialogue that followed our presentation was, without a doubt, one of the most emotional moments of the day. **UiPath** employees didn't just listen with interest — they asked meaningful questions, encouraged us, and offered valuable advice based on their professional experience. It was a genuine connection between generations: an inspiring and honest exchange between young people full of dreams and professionals already working to change the world through technology.

Conclusion

The visit to **UiPath** was far more than just a simple field trip or a presentation — it was an inspiring experience that motivated us to dream even bigger. It showed us that innovation is not just a goal, but an ongoing process where **courage**, **collaboration**, and **vision** play essential roles.

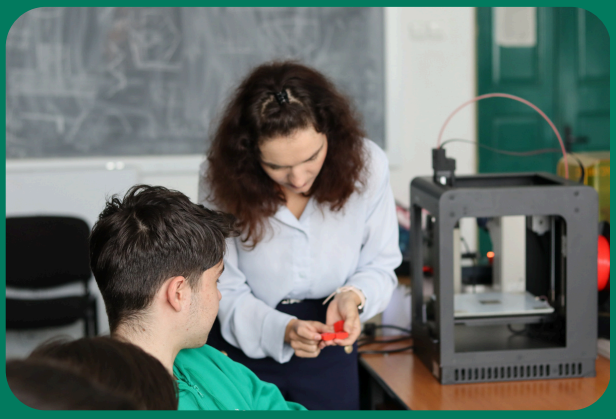
Workshop 3D Printing

May 8th 2025

Introduction

On May 8th, 2025, we had the opportunity to participate in a workshop dedicated to the **3D printing** process, organized by representatives from **UNSTPB** - **CUP**. The main goal of the event was to deepen our knowledge about **3D printing**, a process that plays a crucial role within our team.

Overview



The workshop began with a theoretical presentation, which explained the operating principles of **3D printers**, the types of materials used, and common mistakes that often occur and how to avoid them.

Later, we had the chance to openly discuss with university professors about the challenges we face and how to manage them. We also analyzed certain printed parts under a microscope, gaining insight into the importance of specific variables, such as **positioning** on the print bed or **infill density**.

Conclusion

Attending this workshop was not only a valuable learning opportunity but also a step forward in developing our team's technical skills. The interaction with professors and the access to specialized equipment made this day truly memorable. We thank the organizers from **UNSTPB - CUP** for this opportunity.

UiPath Open Office Day

May 29th 2025

Introduction

On **May 29th**, we had the wonderful opportunity to return to the **UiPath** headquarters—but this time, not for a competition or technical showcase. Instead, we were invited to do something even more meaningful: **introduce the world of robotics to a group of curious and enthusiastic kids**. Our team was excited to share what we've built and learned, and to hopefully spark some inspiration along the way.

Main Body

We started by presenting our robot and walking the kids through how it works—highlighting its design, movement, and the role it plays in our activities as part of the ***FIRST*® Tech Challenge**. Rather than just a technical explanation, we focused on **storytelling**: how our team came together, what challenges we faced, and **how robotics has taught us teamwork**, **problem-solving**, and **creativity.**

The room **quickly filled with excitement**. The kids were **incredibly engaged**—they asked thoughtful questions, explored the robot up close, and offered their **own ideas and insights**. It was clear that many of them were discovering robotics for the first time, and their curiosity and energy made the experience truly special.

We loved seeing **their faces light up** when the robot moved or responded. These kinds of moments remind us why we do what we do not just to compete, but to connect, teach and inspire.

Conclusion

Our visit to **UiPath** was **a beautiful reminder of the impact** we can have by simply sharing what we love. Spending time with these young future innovators was incredibly rewarding and it motivated us even more to continue promoting **STEM** education in our community.

We're grateful to **UiPath** for welcoming us and creating a space where **learning and imagination can flourish**. It was a day full of smiles, questions and enthusiasm—and we're already looking forward to the next one.

FINANCE

APRIL 2024 -JUNE 2025

Introduction:

In order to shape the ideas and plans for each **Season**, we need **careful planning** and **rigorous management** of all the resources we have, whether we are talking about the materials and services necessary for building the robot, producing **promotional** materials to promote the team, other general-use materials, or raw time and money.

Goal:

Responsibility, **good organization, and a realistic mindset** are fundamental for long-term management. Therefore, in addition to the numerous theoretical, practical, and organizational skills developed through our involvement in the ***FIRST*® Tech Challenge** competition, **economic awareness** and focus play an indispensable role in the complete development of young people, alongside the ability to form and maintain relationships with those around them.

Budget:

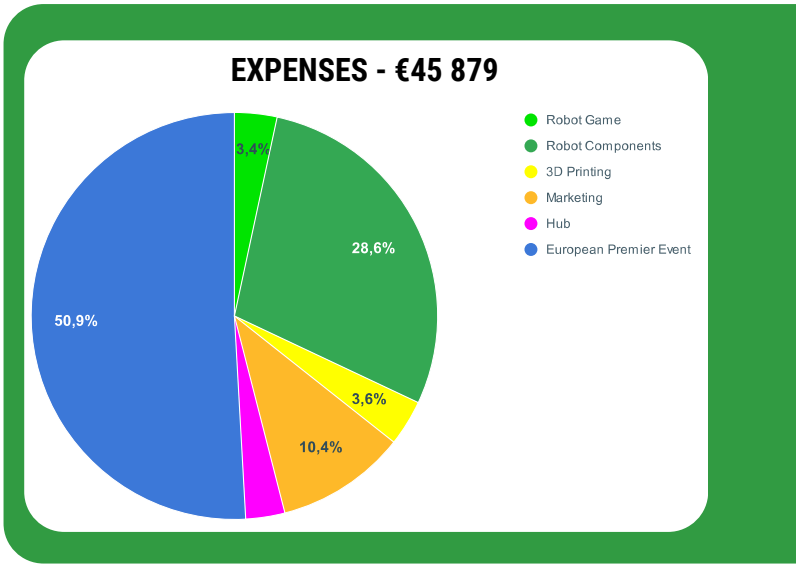
Following a responsible introspection, we have concluded that behind a team that functions coherently, there are many aspects that, at a superficial level, may seem guaranteed or unimportant. From various items necessary for technical success to bills for utilities at the Hub (electricity, water, central heating, rent, or other services), all these factors must be taken into account throughout the season.

Expenses

Thus, we have observed that the sources of collective expenses are mostly divided into well-defined categories, including:

Expense breakdown by category:

- **Robot Components – 28,6%**(parts, materials, tools, and services related to building the robot);
- **Marketing – 10,5%** (promotional materials – stickers, bracelets, advertising materials);
- **3D Printing – 3,6%** (filaments, tools)
- **Robot Game – 3,4%** (game elements);
- **Hub – 3,1%** (stationery, household-use items, protocols for visits, periodic cleaning services, water);
- **European Premier Event - 50,8%** (accommodation, transportation, registration fee, etc.)



The responsibility of managing the funds obtained, prioritizing needs, and making rational spending decisions naturally has a significant impact on us. Another factor that helps us become more aware of the team's progress is the widening range of goods and services we purchase, especially when compared to previous seasons, such as:

- **Robot parts**, which reflect the diversification of its subassemblies and implemented algorithms, implicitly highlighting the members' technical growth;
- **Promotional materials**, which showcase creativity and a stronger connection with the community;
- **Items and actions required to organize** a new series of events, emphasizing the experience gained, along with the ambition and skills aligned with bold new aspirations.

Detailed European Premier Event - 50,8%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
105	03.04.2025	Taxa de inscriere	9.430 lei	Factură & Ordin de Plată / OP (Bancă)	Da	European Premier Event
106	09.04.2025	Bilete avion	36.790 lei	Factură & Card (Bancă)	Da	European Premier Event
107	14.04.2025	Avans 35% cazare	19.250 lei	Factură & Card (Bancă)	Da	European Premier Event
111	29.04.2025	Panza Pop Up	395 lei	Factură & Ordin de Plată / OP (Bancă)	Da	European Premier Event
115	12.05.2025	Rest 65% cazare si Transferuri aeroport	39.315 lei	Factură & Card (Bancă)	Da	European Premier Event
120	23.05.2025	Meniuri pranz si vineri seara	7.200 lei	Factură & Ordin de Plată / OP (Bancă)	Da	European Premier Event
121	23.05.2025	Cutii de depozitare Dewalt	2.150 lei	Factură & Card (Bancă)	Da	European Premier Event

Detailed Robot Components-28,6%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
8	13.05.2024	Șoricei și bit 3mm	42 lei	Factură & Bon Fiscal (Numerar)	Da	Robot Components
15	14.07.2024	Cheder	43 lei	Factură & Bon Fiscal (Numerar)	Da	Robot Components
17	22.07.2024	Piese goBILDA	10.085 lei	Factură & Card (Bancă)	Da	Robot Components
21	23.07.2024	Elastice	10 lei	Factură & Bon Fiscal (Numerar)	Da	Robot Components
30	23.09.2024	Piese goBILDA	6.295 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Components
32	04.10.2024	Fir kevlar	85 lei	Factură & Card (Bancă)	Da	Robot Components
34	21.10.2024	Șuruburi și piulițe M4	300 lei	Factură & Card (Bancă)	Da	Robot Components
35	21.10.2024	Piese goBILDA	3.960 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Components
36	21.10.2024	Piese goBILDA	320 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Components
40	01.11.2024	Cabluri Prelungire Servo	410 lei	Factură & Card (Bancă)	Da	Robot Components
41	04.11.2024	Șoricei și Brelocuri retractabile	295 lei	Factură & Card (Bancă)	Da	Robot Components
44	11.11.2024	Fir kevlar	125 lei	Factură & Card (Bancă)	Da	Robot Components
49	03.12.2024	Servo Axon MINI+	1.075 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Components
52	13.12.2024	Piese goBILDA	15.735 lei	Factură & Card (Bancă)	Da	Robot Components
53	13.12.2024	Furtun intake	25 lei	Fără Factură / BF (Numerar)	Nu	Robot Components
54	16.12.2024	Cabluri și conectori REV	950 lei	Factură & Card (Bancă)	Da	Robot Components
60	17.01.2025	Fir UHMWPE	75 lei	Bon Fiscal / BF (Numerar)	Da	Robot Components
72	05.02.2025	Furtun intake	25 lei	Fără Factură / BF (Numerar)	Nu	Robot Components
75	19.02.2025	Furtun siliconic intake	135 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Components
77	21.02.2025	Cabluri Prelungire Servo	75 lei	Factură & Card (Bancă)	Da	Robot Components
78	22.02.2025	Suruburi	195 lei	Factură & Card (Bancă)	Da	Robot Components
82	26.02.2025	Piese goBILDA	2.455 lei	Factură & Card (Bancă)	Da	Robot Components
84	03.03.2025	Sigurante 20A	30 lei	Factură & Card (Bancă)	Da	Robot Components
86	03.03.2025	Servo-uri Axon (5 MAX+ & 2 MINI+)	4.840 lei	Factură & Card (Bancă)	Da	Robot Components
89	05.03.2025	Controllere PS5 si carlige cercei	980 lei	Factură & Card (Bancă)	Da	Robot Components
93	08.03.2025	Piese REV	3.405 lei	Factură & Card (Bancă)	Da	Robot Components
99	13.03.2025	Clip-uri extensii servo	190 lei	Factură & Card (Bancă)	Da	Robot Components
100	13.03.2025	Furtun siliconic intake	75 lei	Factură & Card (Bancă)	Da	Robot Components
103	29.03.2025	Soricei China Mega Shop	45 lei	Fără Factură / BF (Numerar)	Nu	Robot Components
108	14.04.2025	Controller PS5	480 lei	Factură & Card (Bancă)	Da	Robot Components
109	19.04.2025	Piese goBILDA, Axon si MISUMI	9.490 lei	Factură & Card (Bancă)	Da	Robot Components
114	02.05.2025	Placi policarbonat	100 lei	Bon Fiscal / BF (Numerar)	Da	Robot Components
116	12.05.2025	Piese goBILDA, MISUMI si PLEX	2.135 lei	Factură & Card (Bancă)	Da	Robot Components

Detailed 3D Printing – 3,6%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
2	08.04.2024	Filament 3D - 3 role	600 lei	Factură & Ordin de Plată / OP (Bancă)	Da	3D Printing
12	20.05.2024	Filament 3D - 3 role	665 lei	Factură & Ordin de Plată / OP (Bancă)	Da	3D Printing
20	22.07.2024	Imprimantă 3D Bambu Lab A1 & Accesc	2.060 lei	Factură & Card (Bancă)	Da	3D Printing
22	30.07.2024	Filament 3D - 7 role	1.310 lei	Factură & Card (Bancă)	Da	3D Printing
25	28.08.2024	Policarbonat	575 lei	Factură & Ordin de Plată / OP (Bancă)	Da	3D Printing
51	11.12.2024	Filament 3D - 5 role	1.100 lei	Factură & Card (Bancă)	Da	3D Printing
85	03.03.2025	Filament 3D - 6 role	1.055 lei	Factură & Card (Bancă)	Da	3D Printing
112	01.05.2025	Filament 3D - 4 role	560 lei	Factură & Card (Bancă)	Da	3D Printing
117	19.05.2025	3 x 0.4mm Hardened Steel Hotend	260 lei	Factură & Card (Bancă)	Da	3D Printing

Detailed Robot Game – 3,4%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
16	15.07.2024	Elemente de joc INTO THE DEEP & Tile-u	5.475 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Game
18	22.07.2024	Bandă adezivă teren	135 lei	Factură & Card (Bancă)	Da	Robot Game
66	03.02.2025	Taxă participare Regională SUD	500 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Robot Game
70	05.02.2025	Tiparire Caiete si Colantare Robot	1.482 lei	Factură & Bon Fiscal (Numerar)	Da	Robot Game

Detailed Marketing – 10,5%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
4	20.04.2024	Flyere prezentare	40 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
10	17.05.2024	Stikere	395 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
11	17.05.2024	Brățări	600 lei	Factură & Chitanță (Numerar)	Da	Marketing
13	26.05.2024	Taxă participare STC	100 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
23	27.08.2024	Tricouri Kickoff	620 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
24	27.08.2024	Inscriptionare Tricouri Kickoff	520 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
26	29.08.2024	Lavaliere	750 lei	Factură & Card (Bancă)	Da	Marketing
27	02.09.2024	Coli A4 autocolante	55 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
28	03.09.2024	Colante Robot KickOff	60 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
37	22.10.2024	Stickere	610 lei	Factură & Card (Bancă)	Da	Marketing
39	30.10.2024	Afiș intrare A3	20 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
45	12.11.2024	Hanorace & Tricouri	1.395 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
46	12.11.2024	Inscriptionare Hanorace & Tricouri	340 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
55	17.12.2024	Tricouri Hide & Meet 2025	1.010 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
56	17.12.2024	Inscriptionare Tricouri Hide & Meet 2025	680 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
61	20.01.2025	Tricouri & Hanorace	1.175 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
62	20.01.2025	Inscriptionare Tricouri & Hanorace	440 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
63	29.01.2025	Steag si fata de masa	425 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
65	30.01.2025	Transport Steag si fata de masa	15 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
67	03.02.2025	Lampi RGB de podea	360 lei	Factură & Card (Bancă)	Da	Marketing
69	05.02.2025	Stikere	385 lei	Factură & Card (Bancă)	Da	Marketing
71	05.02.2025	Materiale flori stand	180 lei	Bon Fiscal / BF (Numerar)	Da	Marketing
73	13.02.2025	Materiale flori stand + jocuri stand	185 lei	Fără Factură / BF (Numerar)	Nu	Marketing
79	24.02.2025	Benzi LED pentru stand	555 lei	Factură & Card (Bancă)	Da	Marketing
80	25.02.2025	Tricouri & Hanorace	825 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
81	25.02.2025	Inscriptionare Tricouri & Hanorace	220 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
83	28.02.2025	Baterie externa, inele breloc, hartie A4	405 lei	Factură & Card (Bancă)	Da	Marketing
87	03.03.2025	Bannere	1.070 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
88	05.03.2025	Stikere	1.100 lei	Factură & Card (Bancă)	Da	Marketing
94	08.03.2025	Pop Up	1.010 lei	Factură & Card (Bancă)	Da	Marketing
95	10.03.2025	Geanta Stand	345 lei	Factură & Card (Bancă)	Da	Marketing
97	12.03.2025	Tiparire Caiete si Colantare Robot	2.510 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
101	14.03.2025	Cadru stand	3.675 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
102	17.03.2025	Domeniu highfive.ro 3 ani	215 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Marketing
118	21.05.2025	Inele brelocuri	110 lei	Factură & Card (Bancă)	Da	Marketing
122	23.05.2025	Stickere	915 lei	Factură & Card (Bancă)	Da	Marketing
123	30.05.2025	Tonere, Hartie A4, Inele breloc	410 lei	Factură & Card (Bancă)	Nu	Marketing

Detailed Hub – 3,1%

Nr. crt.	Dată Achiziție	Produse / Servicii	Cost	Documente	Doc. Tipărite	Categorie
1	01.04.2024	Comisioane Bancă Apr 2024 - Mar 2025	348 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Hub
3	20.04.2024	Servețele, hârtie igienică, săpun	60 lei	Bon Fiscal / BF (Numerar)	Da	Hub
5	19.04.2024	Curățenie Hub	150 lei	Fără Factură / BF (Numerar)	Nu	Hub
6	06.05.2024	Hub USB Hama 4 porturi	50 lei	Bon Fiscal / BF (Numerar)	Da	Hub
7	14.05.2024	Scule Yato	70 lei	Bon Fiscal / BF (Numerar)	Da	Hub
9	14.05.2024	Cărucior	240 lei	Factură & Card (Bancă)	Da	Hub
14	08.07.2024	Apă	50 lei	Fără Factură / BF (Numerar)	Nu	Hub
19	22.07.2024	Apă	40 lei	Fără Factură / BF (Numerar)	Nu	Hub
29	07.08.2024	Apa Kickathon	127 lei	Bon Fiscal / BF (Numerar)	Da	Hub
31	29.09.2024	Apă	38 lei	Bon Fiscal / BF (Numerar)	Da	Hub
33	13.10.2024	Hartie igienica si servetele	22 lei	Factură & Bon Fiscal (Numerar)	Da	Hub
38	29.10.2024	Apă	40 lei	Fără Factură / BF (Numerar)	Nu	Hub
42	11.11.2024	Curățenie Hub	200 lei	Fără Factură / BF (Numerar)	Nu	Hub
43	11.11.2024	Cabluri USB și Baterie Șubler	80 lei	Factură & Card (Bancă)	Da	Hub
47	13.11.2024	Cuttere	120 lei	Factură & Card (Bancă)	Da	Hub
48	15.11.2024	Aspirator de mână	160 lei	Factură & Card (Bancă)	Da	Hub
50	09.12.2024	Cabluri prelungitoare active USB	600 lei	Factură & Card (Bancă)	Da	Hub
57	22.12.2024	Cutii, benzi izoliere, consumabile	382 lei	Bon Fiscal / BF (Numerar)	Da	Hub
58	23.12.2024	Apă	50 lei	Fără Factură / BF (Numerar)	Nu	Hub
59	08.01.2025	Cablu retea	45 lei	Factură & Card (Bancă)	Da	Hub
64	29.01.2025	Toner Imprimanta (Cyan & Yellow)	110 lei	Factură & Card (Bancă)	Da	Hub
68	03.02.2025	Apă	50 lei	Fără Factură / BF (Numerar)	Nu	Hub
74	17.02.2025	Dremel si pistol cu aer cald	445 lei	Factură & Card (Bancă)	Da	Hub
76	19.02.2025	Incarcator baterii, mufe, toner impriman	1.205 lei	Factură & Card (Bancă)	Da	Hub
90	05.03.2025	Instant apa calda	140 lei	Factură & Card (Bancă)	Da	Hub

90	05.03.2025	Instant apa calda	140 lei	Factură & Card (Bancă)	Da	Hub
91	06.03.2025	Certificat digital	320 lei	Factură & Card (Bancă)	Da	Hub
92	07.03.2025	Statie de lipit, multimetru, sonde, conect	950 lei	Factură & Chitanță (Numerar)	Da	Hub
96	10.03.2025	Apă	50 lei	Fără Factură / BF (Numerar)	Nu	Hub
98	12.03.2025	Curățenie Hub	200 lei	Fără Factură / BF (Numerar)	Nu	Hub
104	31.03.2025	Incarcator Anker	200 lei	Factură & Card (Bancă)	Da	Hub
110	22.04.2025	Licență software contabilitate	325 lei	Factură & Ordin de Plată / OP (Bancă)	Da	Hub
113	02.05.2025	Apă	50 lei	Fără Factură / BF (Numerar)	Nu	Hub

Sponsor strategy

Introduction:

Sponsors are, for all teams, the only source of financial support, and we are all aware that without their unconditional backing, we would not be able to carry out our activities at the level we currently achieve.
Therefore, as every year, we had to organize ourselves from the offseason period and develop a strategy for obtaining new sponsorships and continuing our collaborations with the partners from the previous season.

Contents:

We started by identifying both the sponsors we have worked with in the past and potential future partners, whether we had previously interacted with them through events or had no prior connection. Thus, by working in **Google Drive**, we managed to categorize them, as mentioned earlier, into an Excel sheet.

Subsequently, after identifying a contact person for each company, we decided to communicate via **emails,** considering this a more **formal approach**. Furthermore, to streamline our work and increase efficiency, we created **three types of email templates** that only required the addition of the personal details of the potential future partner.

In drafting the emails, we focused on presenting the team, our performance, and the values we promote, describing the ***FIRST®* program** and the competition's structure in Romania, and, of course, outlining how they could assist us, should they find the collaboration beneficial.

Conclusion:

So far, we have managed to maintain partnerships with the vast majority of our sponsors from the previous season and have even attracted three new partners, to whom we shared the entire ***FIRST®* phenomenon** and the **values promoted by it.**

Sponsors

The **10 sponsors from the last season** (**Kranz Eurocenter, Advira Paneuro, Eltra Logis, Delta Invest, AGEXIM, Lupa GPS, Smart Academy of Languages Pitesti, Goldplast, Rotary Club Pitesti, Ibis Styles**) whose invaluable contributions played a critical role in the successful execution of our initiatives, have once again expressed their interest in supporting our mission. Their continued commitment shows the strong relationships we've built and the shared values that guide our collaboration.

Through our ongoing efforts to create a meaningful impact within the community, we are proud to welcome 27 new companies and organizations to our network (**IPAD, AMIQ, DCA Dimensional Control, Areon, Roweb, O-MAC, Novel Dev, Amitera Trans SRL, Karcher, Dr Teo, Kirchhoff AutoMOTIVE, SALUBRITATE 2000, EJOT, MAIA, LAGUNA TECHNOLOGY, RIFCO TRADING, SELCA, INTENS PREST, TOYOTA Pitesti, Tic Ton, CONTEXPERT, GIC, INTERTRANS CONTINENTAL, DOLO TRANS OLIMP, Fuchs, TGM Group, DALIRO, Casa Ta**).These new supporters, some of whom have chosen to remain **anonymous (13)**, resonated with our goals and values, collectively contributing approximately X RON in funding. We are excited to have them join us on our journey.

Our partners – companies and individuals who support us out of altruism – (**VIVO! Mall Pitești, Argeș Mall, Princon,** and **the Faculty of Mechanics and Technology of Pitești**) are just as important, as, like with any growing mechanism, numerous aspects and needs arise over time, from cutting parts for the robot and producing promotional materials to organizing events.

KRANZ EUROCENTER

- **Field of activity:** construction
- **Collaboration duration:** 5 years (since our first season, ULTIMATE GOAL)
- **Sponsorship:** The company offers a workspace tailored to the team's requirements (space, utilities) at its headquarters in Pitești, along with the payment of monthly utility bills from the hub

KIRCHHOFF AUTOMOTIVE

- **Field of activity:** supplier to the Automotive industry
- **Collaboration duration:** 1 year(since this season)
- **Sponsorship:** The organization provides financial support to the team

Delta INVEST

- **Field of activity:** plastic acquisition
- **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
- **Sponsorship:** The organization provides financial support to the team

GIC GRUPUL INDUSTRIAL COMPONENTE

- **Field of activity:** plastics manufacturing
- **Collaboration duration:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

AGEXIM

- **Field of activity:** logistics and transportation
- **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
- **Sponsorship:** The organization provides financial support to the team

Rotary Club Pitești

- **Field of activity:** international volunteering
- **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
- **Sponsorship:** The company provides financial support to the team

• **Field of activity:** car service
• **Collaboration period:** 5 years (since our first season, ULTIMATE GOAL)
• **Sponsorship:** The company provides financial support to the team

*AD Garage supports the team through collaboration with two locations in Pitești: AD Garage Advira and ADGarage Paneuro

• **Field of activity:** transport and logistics services
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** road freight transportation
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

- **Field of activity:** Automatisations & industrial design
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

• **Field of activity:** sanitation service
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** real estate developer
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

• **Field of activity:** plastic manufacturing
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Sponsorship:** The company provides material support (workbenches, etc.)

- **Field of activity:** fastening technologies for construction and industrial applications
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

• **Field of activity:** software company
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** construction equipment supplier
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** tourism (hotel)
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** products for micro-agriculture and gardening
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

- **Field of activity**: logistics and transportation
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

- **Field of activity:** distributor and importer of alcoholic beverages
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

• **Field of activity:** spice production
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** car and home air fresheners
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team;

• **Field of activity:** software company
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** car equipment and accessories
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** language courses and other school curriculum subjects
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** car dealership
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** construction company
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** industrial Automation
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** construction field
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** electronics and home appliances store
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** cleaning equipment, full cleaning systems
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company offers financial support to the team;

• **Field of activity:** dental clinic
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

• **Field of activity:** software development
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** car dealer in Pitești
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

• **Field of activity:** transport services
• **Collaboration period:** 1 year (since this season)
• **Sponsorship:** The company provides financial support to the team

- **Field of activity:** construction materials
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

- **Field of activity:** accountancy
- **Collaboration period:** 1 year (since this season)
- **Sponsorship:** The company provides financial support to the team

We also respect the wish of this year's 13 sponsors to remain anonymous.

Partners / Collaborators

• **Field of activity:** shopping center
• **Collaboration period:** 4 years (since the second season, FREIGHT FRENZY)
• **Support:** Together with their representatives, we annually organize the public event – Robotics Challenge

• **Field of activity:** advertising
• **Collaboration period:** 2 years (since the previous season, CENTERSTAGE)
• **Support:** Metal parts cutting

ARGES MALL
UN ALTFEL DE SHOPPING

• **Field of activity:** shopping center
• **Collaboration period:** 1 year (since this season)
• **Support:** Together with their representatives, we organized an event dedicated to sharing the *FIRST®* phenomenon

• **Field of activity:** higher education
• **Collaboration period:** 1 year (since this season)
• **Support:** Invitations to events aimed at developing the team's skills

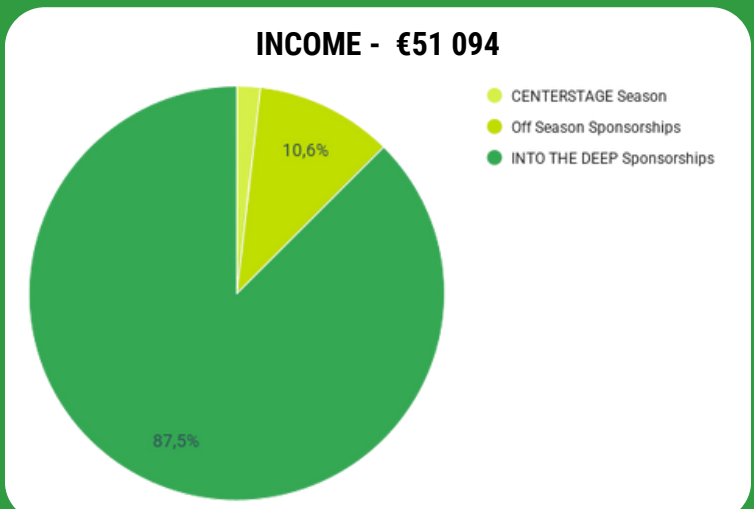
Income

This season's income confirms our continuous improvement in communication skills, our growing persuasiveness with each interaction, and our ability to better understand our target audience—especially when compared to similar efforts in past seasons.

As a result, we managed to increase the funds received from companies by approximately **62%** compared to last year.

Since our participation in the **Southern League Tournament** and qualification for **Nationals**, our team has **successfully grown its income by around 62%, from 98,275 RON to 257,545 RON.**

This significant growth allowed us to invest more in robot development and the creation of a visually compelling booth concept, leading to **total expenses** amounting to **231,259 RON.**



These funds were essential in making our participation in the **European Premier Event in the Netherlands possible**—a top-tier international competition that offered us unique exposure, experience, and growth opportunities.

From the National Stage to the European Premier Event, we successfully brought 19 new sponsors on board

We thank all the sponsors who chose to join us on this journey.

Thanks to your support, we reached the performance of participating in the **European Premier Event** and took our project to the **next level**.

Your contribution meant more than funding—it was trust, motivation, and real support.

We are truly grateful!

BRANDING & SOCIAL MEDIA

APRIL 2024 - JUNE 2025

Branding

Introduction:

With the beginning of the INTO THE DEEP season, we decided to make a change regarding our visual identity. This was prompted by the feeling that the previous design elements and colors no longer fully represent our team, which is constantly evolving with the arrival of new generations of members.

Chromatics & Design Elements

Colors

With the transition to a new competition season within the ***FIRST®* Tech Challenge** program, our team felt the need for a change. Additionally, this change was motivated by the generational transition within the team.
Therefore, during the **Offseason** and the first weeks of the **INTO THE DEEP** season, we organized various **brainstorming sessions** and reached a **new color palette**.

The color palette shapes the framework in which we make our presence felt as a robotics team, from the pit and all the objects present at the stand **(roll-ups, banners, tablecloth, flag)**, promotional materials **(stickers, keychains, flyers, business cards, pins)**, engineering notebooks, portfolio, robot, to the templates used in the online environment **(stories, post covers)**. All of these elements must be harmonious and convey the essence of the team.

319B42

(319B42) Green: This shade of green, associated with both nature and technology, represents our visual signature. It emphasizes concepts such as balance (achieved by combining two primary colors from different chromatic spectrums), regeneration, calmness, awareness, and hope, according to Western cultures.

027A5E

(027A5E) Dark Green: This deep shade of green balances the other four colors, being the only one with cool undertones. It acts as an accent color, providing contrast both visually and symbolically: it conveys seriousness, introspection, ambition, and discipline.

F5983C

(F5983C) Orange: Being the warmest color (created by combining the two primary tones, yellow and red), orange is considered a symbol of joviality, energy, creativity, and transformation.

FFC72C

(FFC72C) Yellow: Yellow was one of the colors we adopted last year. Since ancient times, it has symbolized opulence, the desire for absolute knowledge, and happiness. It is the color most quickly distinguished by the human eye (which is why, in the United States, school buses are yellow, and most road markings or signs designed for visually impaired individuals are yellow).

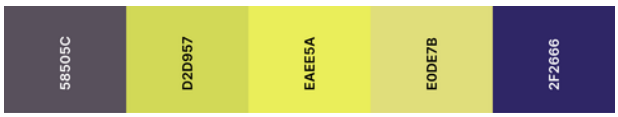
D7F049

(D7F049) Lime Green: Lime green was chosen to create a transition from the primary color to the secondary ones, completing the chromatic sequence evenly on the color spectrum. Since it is often used in sports campaigns to illustrate energy in a classic sense and provide a minimalist, fluid appearance, within our team, it serves as a highlight, providing distinction.

Since **more and more people are affected by color deficiencies** (approximately one in 12 men and one in 180 women - which is **8-9%** of the world's population), we aimed for our palette to be visually pleasing and easily distinguishable for everyone. We tried to avoid issues in text readability or element differentiation, regardless of color perception, by considering the needs of those with visual impairments.

- Our color palette was carefully selected to be distinguishable for individuals with mono-, bi-, and trichromatic vision. The goal is to minimize disadvantages for those with visual impairments while maintaining aesthetic harmony and clarity.

Protanopia (Inability to Distinguish Red Color)



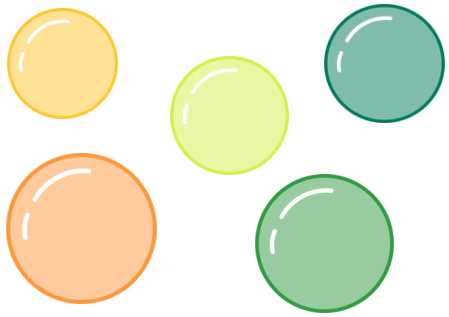
Deuteranopia (Inability to Distinguish Green Color)

Tritanopia (Inability to Distinguish Violet Color)

Achromatopsia (Inability to See Colors)

Shapes

In last season, **CENTERSTAGE**, we used hexagons as design elements, inspired by the game pieces. However, this year we decided to change them.
Our new design elements consist of waves and air bubbles, inspired by this season's theme — water and its protection. We also included in our banners and t-shirts some kind of topographic lines on the background that highlights the depth.



Promotional Materials

Once we finalized the new colors and design elements, we rebranded our promotional items — **including stickers, wristbands, badges, roll-ups, t-shirts, and hoodies.**

For each of these items, we held brainstorming sessions, followed by various iterations and adjustments until we reached the final versions.

Additionally, with the launch of the new season, **INTO THE DEEP, we adopted a few official mascots** — **Spike** the penguin, along with his chicks **Berry, Pine**, and **Peachy**, who accompanied us at all events last year, during the **CENTERSTAGE** season.

Banners

Our team presents its identity and activity through a set of three banners mounted on a metal frame, offering a clear and detailed overview of our work.

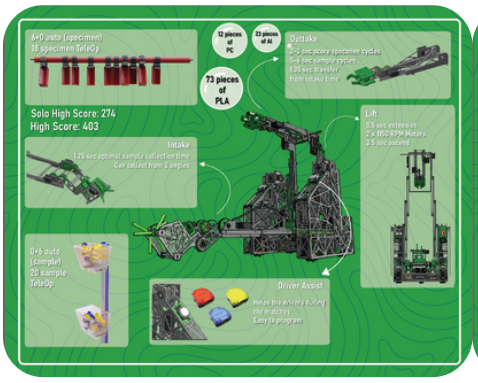
The main banner is the focal point of our booth, featuring the logos of our sponsors, a QR code that links to our social media platforms, and the usernames where interested individuals can find us.

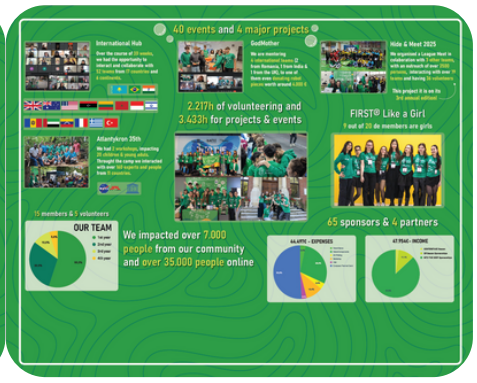
The second banner, placed on one side, provides a technical perspective of our robot, highlighting the components and mechanisms used to ensure its functionality and efficiency in competition.

The third banner, placed on the opposite side, showcases a summary of the most important events we have participated in, along with a clear overview of the team's income and expenses, as well as the total number of hours dedicated to volunteering and events.

With the qualification for European Premier Event, we also decided to include a map of Europe to create a connection between our countries.

Together, these banners reflect the identity, progress, and effort of our team throughout this season.





Flag

The team flag accompanies us to every match, symbolizing our unity, passion, and determination to support our drive team from the stands.

Tablecloth

To complete the look, our custom tablecloth — featuring our logo — adds a touch of professionalism to the booth, reinforcing our team's identity and creating the impression of a well-organized space.

Softs & Design Process

Adobe Illustrator

Introduction:
Adobe Illustrator is an application from the **Adobe Creative Cloud** suite that allows users to create graphic elements for various objects using vectorial graphics.

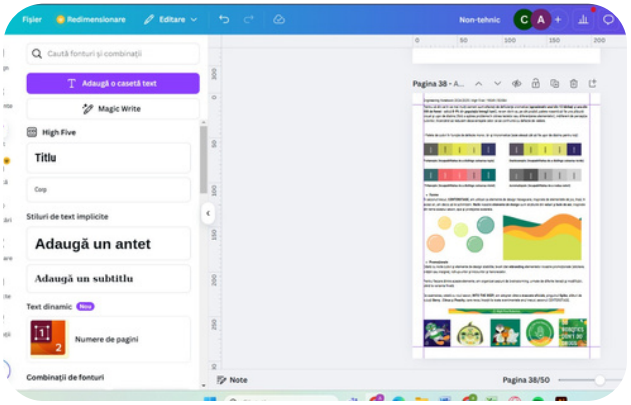
Workflow:
Our team uses this software due to the high quality it provides through vectorial graphics. With its help, we design the necessary materials, such as roll-ups, banners, promotional items (bracelets, badges), as well as decals for the robot, and prints for t-shirts and hoodies.

The application features an intuitive and simple interface, making it easy to use by team members regardless of their department.

Canva

Introduction:
Canva is an easy-to-use online platform dedicated to creating visual content such as social media posts, presentations, posters, or logos. It offers thousands of customizable templates, an intuitive drag-and-drop interface, and a vast library of images, graphics, and fonts.

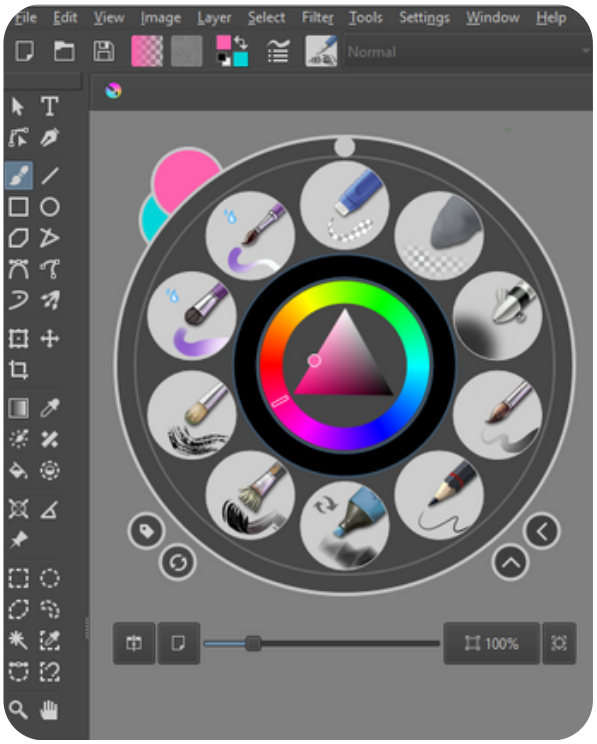
Workflow:
This year, we aimed to enhance the experience of the DTP department, so the design of our notebooks and portfolio was created using Canva. The platform facilitates teamwork by allowing real-time collaboration, significantly reducing the time needed to complete projects.
The interface is user-friendly and accessible even to beginners. It includes a sidebar with options such as: **Templates, Elements, Uploads, Text, and Background**, as well as a top bar where features like saving, renaming projects, and other customization tools are available.



Krita

Introduction

Krita is a free and open-source application for graphic design and digital illustration. It is used by both professional artists and beginners due to its advanced features and intuitive interface. Unlike other digital graphics programs, Krita provides access to a full set of tools at no cost, making it ideal for creating illustrations, comics, and animations.



Workflow

Krita offers a wide range of features that allow for the creation of precise and expressive designs. Some of the most important include:

- **Multiple layers** – each element of the illustration is separated, allowing for edits without affecting the rest of the image.
- **Customizable brushes** – offer a variety of textures and styles, from sketching brushes to those for fine details.
- **Color tools** – Krita provides an advanced color wheel, allowing us to choose precise shades and create our own palettes. We also use HSV or RGBA modes for greater control over color.
- **Precision tools** – help create clear, well-defined shapes, useful for detailed designs.
- **Effects and filters** – make it possible to apply textures, shadows, and special effects for added creativity.

Usage

We use Krita in our projects because it offers us flexibility and complete creative control over our designs. It is an ideal tool for creating engaging visual content, perfect for social media.
The advantages of using Krita include:

- Accessibility – It is completely free, with no subscriptions or licenses required.
- Ease of learning – There are numerous tutorials on YouTube that help users quickly understand the software's features.

Professional quality – It offers a comprehensive set of tools suitable for any type of illustration.

Procreate

Introduction:
Procreate is a graphic design application—an extremely versatile and efficient tool that we've been using since last season to create stickers, robot reveal thumbnails, and other visual materials that reflect our team's creativity and identity.

Workflow:
The app features an intuitive interface and an extensive set of functions, making it suitable for both professional artists and beginners. Customizable brushes, support for multiple layers, and tools like **QuickShape** (for perfect lines and shapes) are just a few of the essential features Procreate offers, helping us bring our marketing ideas to life.

When designing stickers, we use Procreate to make accurate sketches and add unique details that represent the spirit of our team.

We use Procreate in our projects because we can rely on it to deliver creative and well-executed designs—an aspect that can make a significant difference in attracting attention to our team and leaving a memorable impression.

Wondershare Filmora

Introduction:
Wondershare Filmora is an easy-to-use video editing software. It allows you to cut clips, add music, text, and special effects to your videos.
We used Wondershare Filmora with the goal of creating an engaging video for the reveal of our iterations.

Workflow:
With the help of this video editing software, we were able to add dynamic visual effects, smooth transitions, and synchronized music, effectively highlighting the features and functionalities of our robot. Filmora allowed us to quickly edit our video materials, giving us full control over the creative process so that the final result would be professional and impressive—perfect for capturing the audience's attention during the robot presentation.

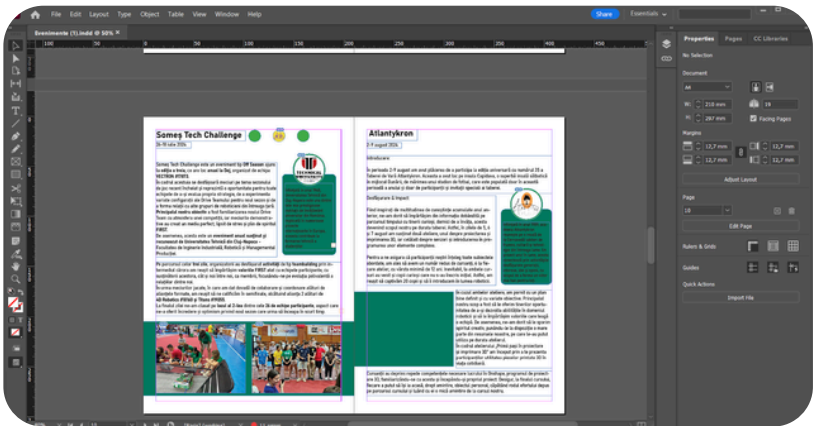
InDesign

Introduction:
Adobe InDesign is a professional software developed by Adobe, primarily used for graphic design and digital or print publishing.

Workflow:

Our team uses this software because of the superior quality achieved through vector graphics. Each year, it helps us successfully create both our portfolio and engineering notebook.

Adobe InDesign offers an intuitive interface and advanced features that enable the creation of professional and visually appealing designs. It is compatible with other Adobe applications, making it easier to edit and integrate visual elements.



The program provides flexibility through grid systems and text styles, offering options for interactive documents, such as PDFs with hyperlinks and animations. It also supports task Automation, exporting materials in multiple formats, and real-time collaboration via Adobe Creative Cloud.

Therefore, our team relies on this software for its wide range of features, which helps us reach the desired level of performance and maintain professionalism in everything we do.

Social Media

Introduction

Over the past few years, the online environment has become the main way for people to connect with each other. Through social media, we've managed—over the course of four competition seasons—to promote the ***FIRST®* community** on a large scale.

Purpose

Our goal is to share innovation, inspire others, and build global communities. The online environment facilitates intercultural connections, bringing together students from diverse backgrounds and encouraging relationships built on shared passions such as technology, science, and competition. By collaborating online, we learn from one another, grow, and gain new perspectives. We are also responsible for sharing snapshots of our team's progress with both fellow competitors and the broader public.

Impact

The most popular social media platforms with a significant global audience are Instagram, **YouTube, Facebook**, and **TikTok,** followed by **LinkedIn**. Since we aim to effectively promote the STEM field and make robotics increasingly known even to those unfamiliar with it, our team has made sure to maintain an active presence on all five platforms.

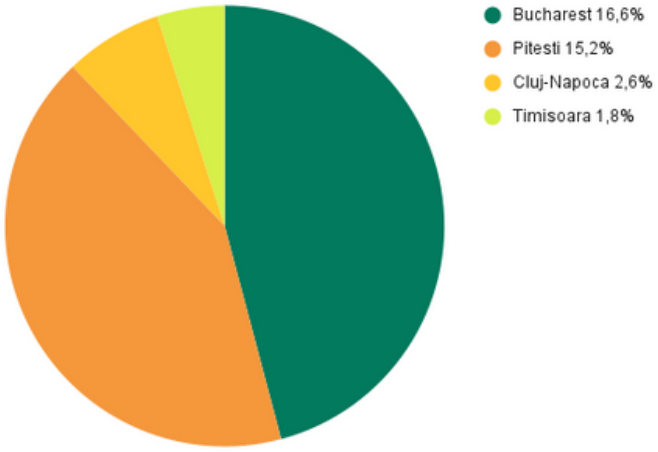
Instagram:

Analyzed period: February 27 – May 27

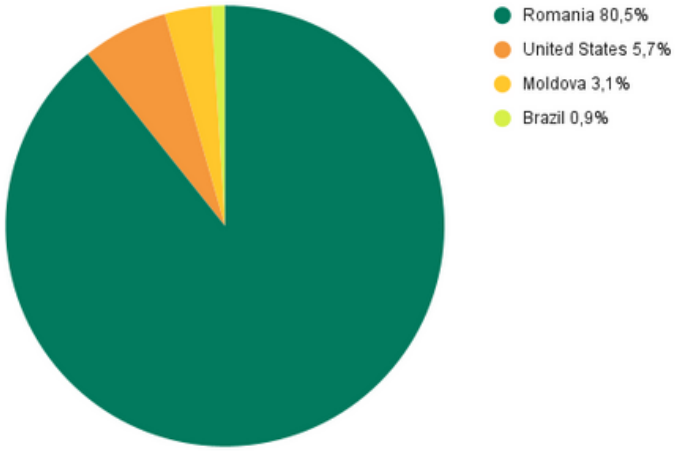
The most frequently used platform through which we've managed to predominantly connect with people who share common interests with us is Instagram, where we've observed a steady growth in the community that regularly follows our activity.

During this period, we recorded **260,287 views**, of which **59.4%** came from followers and **40.6%** from non-followers. The total reach was **23,674 accounts**, representing a **14.6%** increase compared to the previous period.

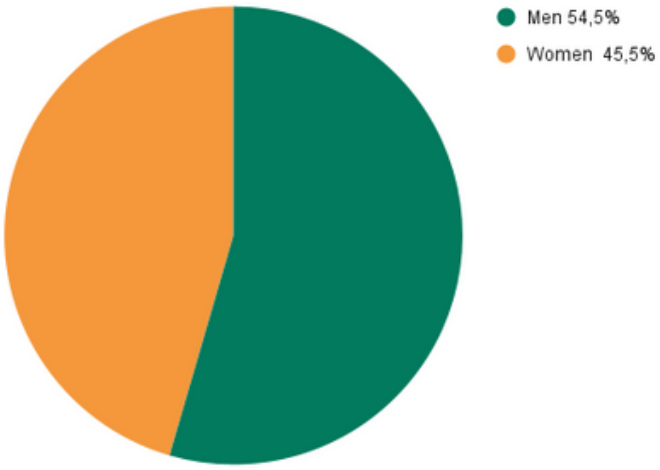
Audience by city



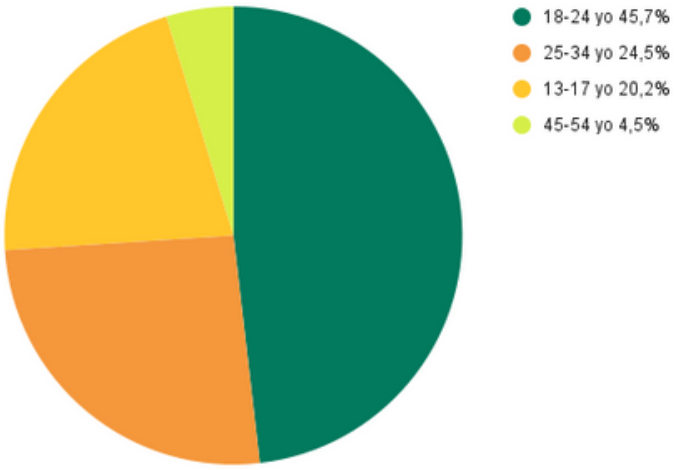
Audience by country



Audience by gender

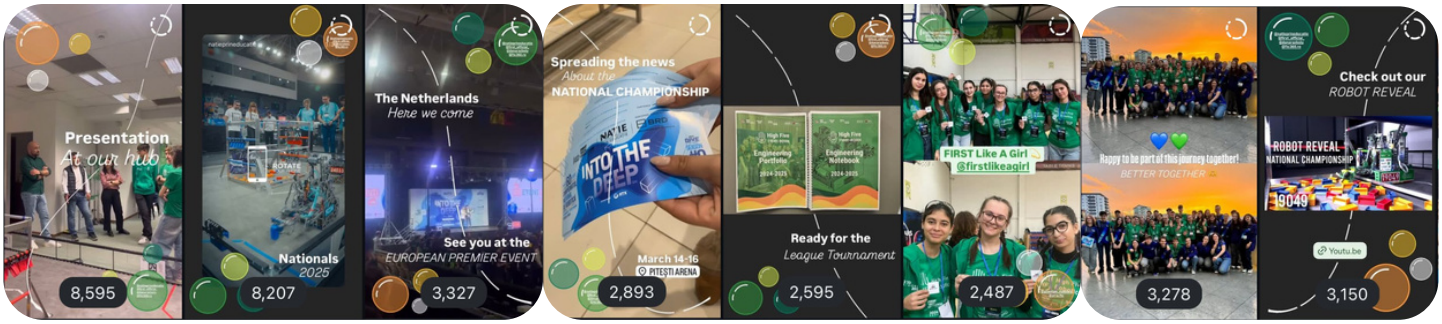


Audience by age



Top 9 posts – Reach

Top 9 posts – Likes



Top 8 most viewed Stories

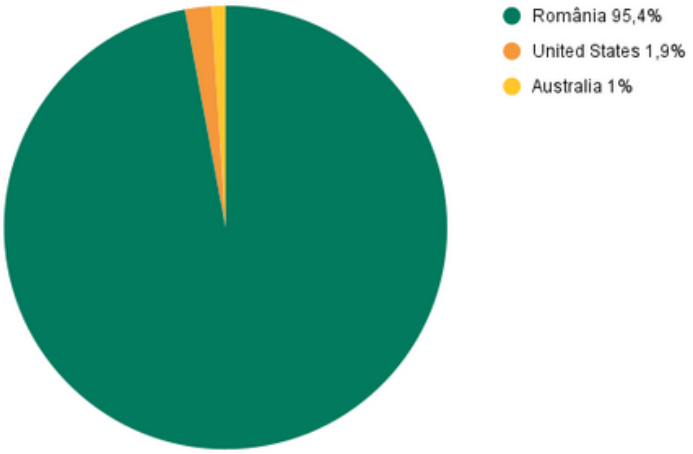
Facebook:

Analyzed period: April 27 – May 27

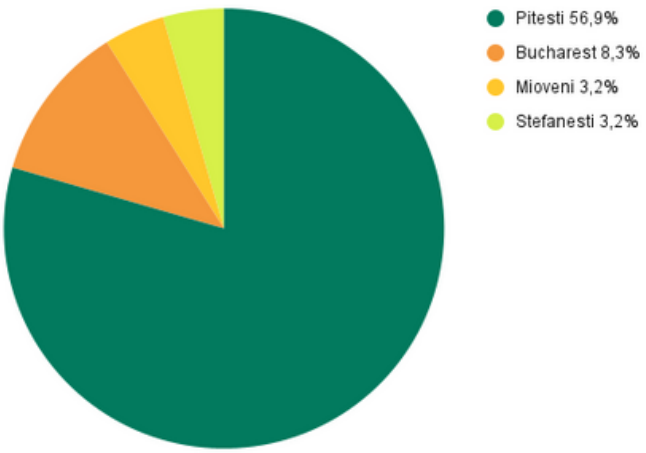
The purpose of using this platform is to expand the influence of STEM fields, particularly among adult audiences.

After analyzing statistical data from the past 30 days, we observed that we **reached 7,604 people**, which is a growth indicator compared to the previous 30-day period.We also gained 1 new follower, and we noticed that our content was viewed almost equally by followers (approximately 50%) and non-followers (approximately 50%).
Additionally, the content received **5,495 views**, had an average watch time of 3 minutes and 41 seconds, and generated **503 interactions**, including **15 link clicks.**

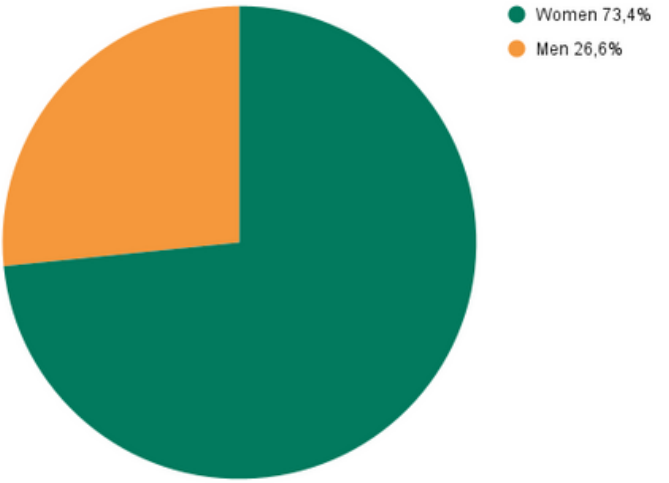
Audience by country



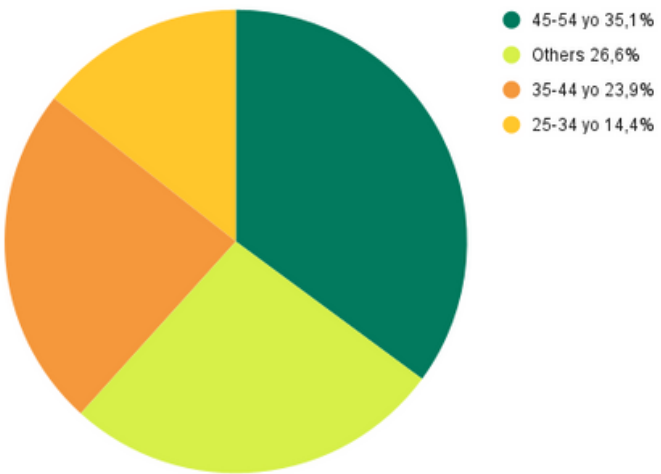
Audience by city

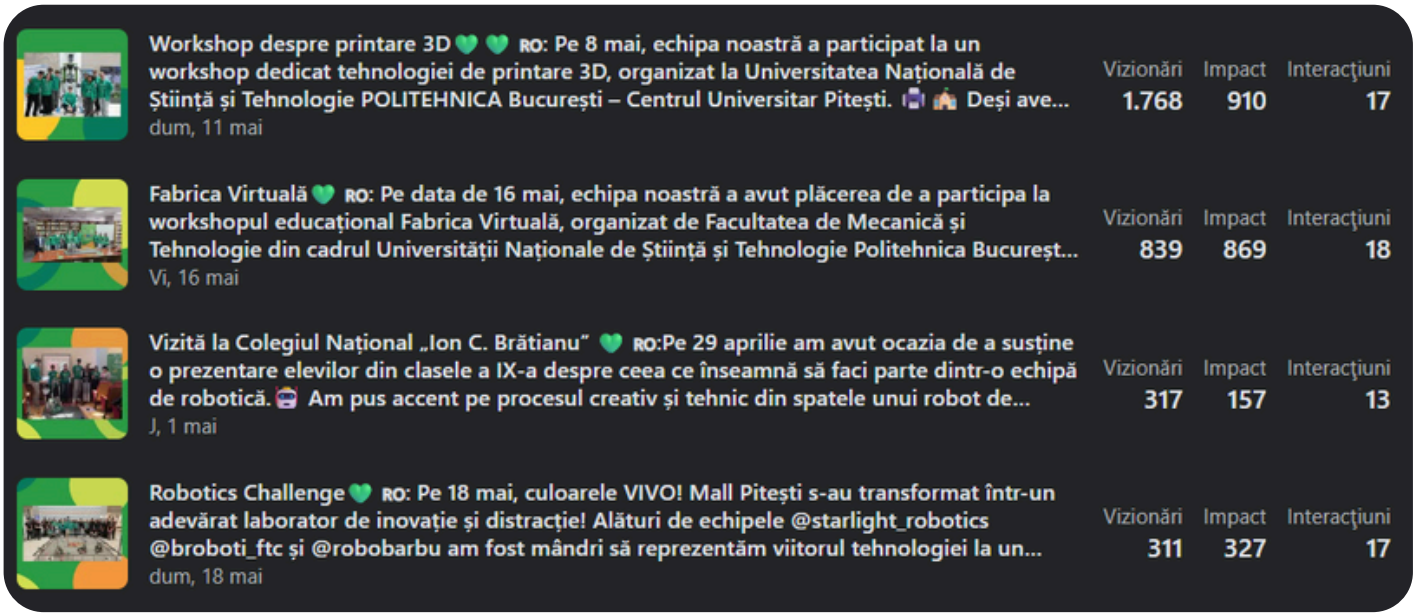


Audience by gender



Audience by age





Top 4 most viewed Post

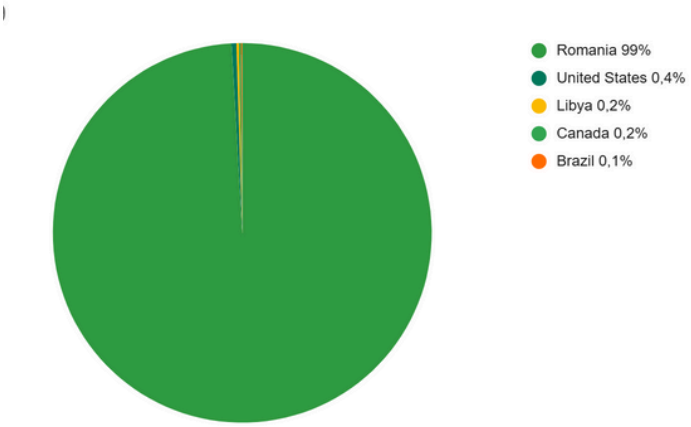
TikTok:

Analyzed period: September 27 – May 27

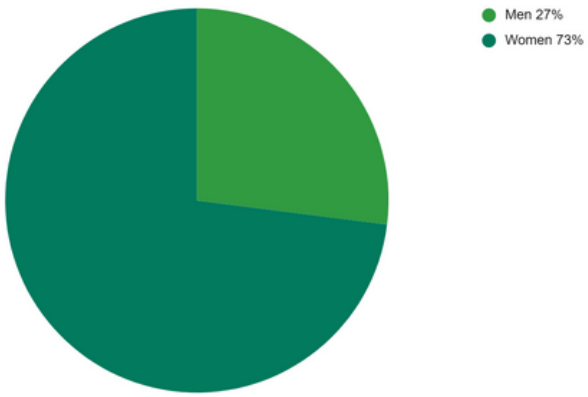
The TikTok app provides a way to promote robotics, especially among children and young people, in informal and fun ways. Although our visibility on this platform hasn't been constantly increasing, it's a way to make the STEM field more known.

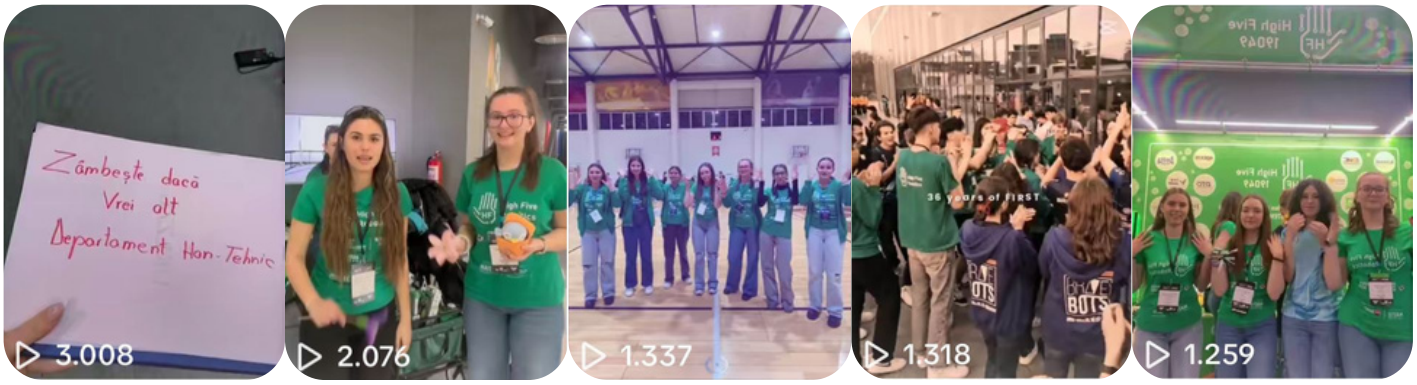
Between September 26, 2024, and May 26, 2025, we managed to attract over **23,000 post views**. Interaction with our community reached a record level, with **1,624 likes**, **99 comments,** and **167 shares.**
Additionally, interest in our profile grew significantly, with 1,591 profile views and a total of 1,380 viewers, including 63 new viewers.
Our follower base increased as well, reaching a total of **268 followers**, with a net gain of **48 new followers** during this period.

Audience by country



Audience by gender





Top 5 most viewed Post on Tik Tok

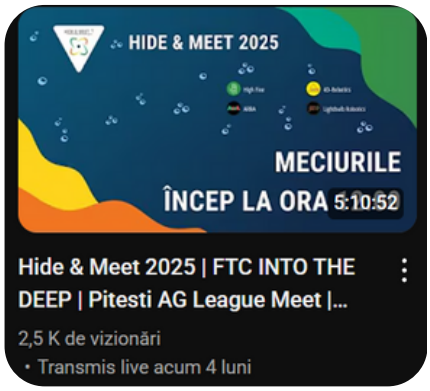
LinkedIn:

Being business-oriented, we use this platform to share the core values of *FIRST®* with users from various fields, such as education, engineering, program or project management.

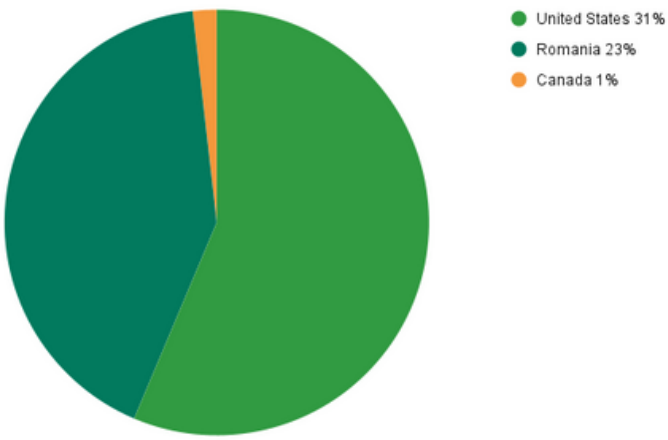
YouTube:

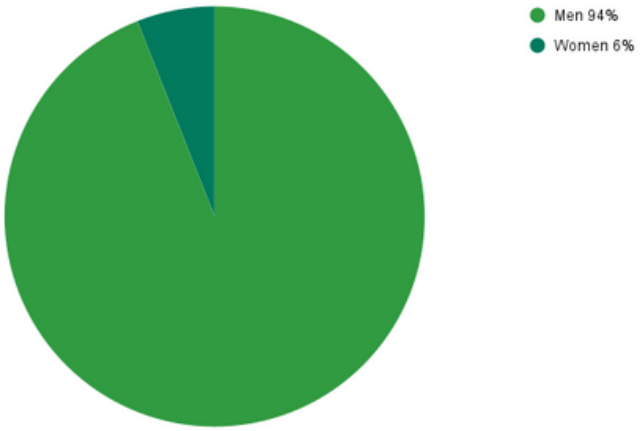
Analyzed period: September 27 – May 27

On YouTube, just like on Instagram, our team has managed to reach a wide audience through engaging videos showcasing the robot, on-field performance, and *FIRST®* competitions.
As a result of these posts, we've been contacted by teams from various countries.



Although our visibility on this platform hasn't been constantly increasing, it's a way to make the STEM field more known.
Between September 27, 2024, and May 27, 2025, we managed to attract **over 52,000 post views**. Interaction with our community reached a record level, with **1,300 likes**, **100 comments**, and **934 shares**. Our follower base increased, reaching a total of **250 subscribers,** with a net gain of **84 new followers** during this period.





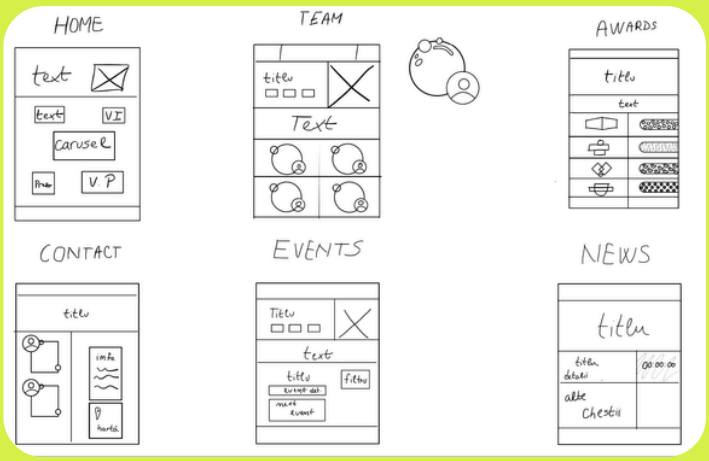
Web Site:

With the beginning of the new season, we revisited our website with the goal of implementing a redesign. We kept the strengths, improved the weaknesses by learning from last year's mistakes, and came up with new ideas, actively involving our volunteers. The redesign aimed to create a more **intuitive UI/UX experience** for visitors and to efficiently deliver the intended information.

To better organize ourselves, we created a **Web Design & Development** team together with our volunteers and started with a brainstorming session to establish the theme of the site, the message we wanted to convey, a Pros and Cons analysis of last year's iteration, and also brought in new ideas.

In the end, we arrived at the current structure, which conveys both the identity and values of the team as well as those of the competition. We present this information in a minimalist, concise, and easy-to-understand manner, for both people familiar with the **FIRST phenomenon** and for outsiders.

With the help of this sketch, we moved on to the next stage, the Wireframe, which involved creating the basic structure where essential elements are placed in the simplest way possible and setting the overall UX, allowing us to focus more on the functionality of the site. The aesthetic part was then addressed in the following stage.



Based on this, we created the website mockup using the Figma software.

It includes the team's journey, performance, members, and all related events. It serves as an effective tool to reach out both to other teams—through resources and the archive of our activities—and to the wider public (including both the ***FIRST*® Tech Challenge community** and those unfamiliar with robotics).

At the same time, it provides a way to showcase our sponsors and partners as a token of appreciation for their support.

Site Design

Our website, designed to capture user interest both visually and through the information it conveys, aims to represent the team's identity and image in the online environment, while also conveying ***FIRST*®'s values.**
The design process started from the desire to harmoniously combine our color palette with suggestive elements of the current season, "Into the Deep" **(such as water bubbles, waves, etc.)**.

Visitors accessing the "High Five" website discover a general presentation of the team, including information about its members, the team's history and performance in each season, contact details, and more.

Figma is an online graphic editor used for creating interface mockups and prototypes. It allows the design of complex and interactive websites and applications, which can be used for development, demonstration, and testing.

Each of the seven web pages that make up our site covers a topic we consider essential, as we aim to offer as much relevant information as possible.

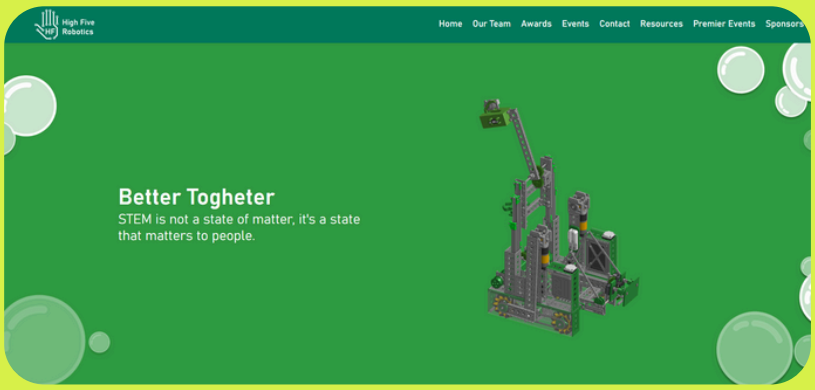
The website development process involved both members of the non-technical department and the technical one. Additionally, we engaged volunteers interested in developing their design and programming **skills using HTML and CSS**.

We also encouraged members and volunteers without UI/UX experience to contribute, and those who chose to help acquired foundational knowledge that can serve as a starting point.
By splitting into teams, we developed the following pages:

1. **Home Page**

The homepage includes basic information about our team, such as the year of establishment—2020—but most importantly, it highlights our core values.

These are the principles we deeply believe in and strive to reflect in all our interactions, both within and beyond the field of robotics.



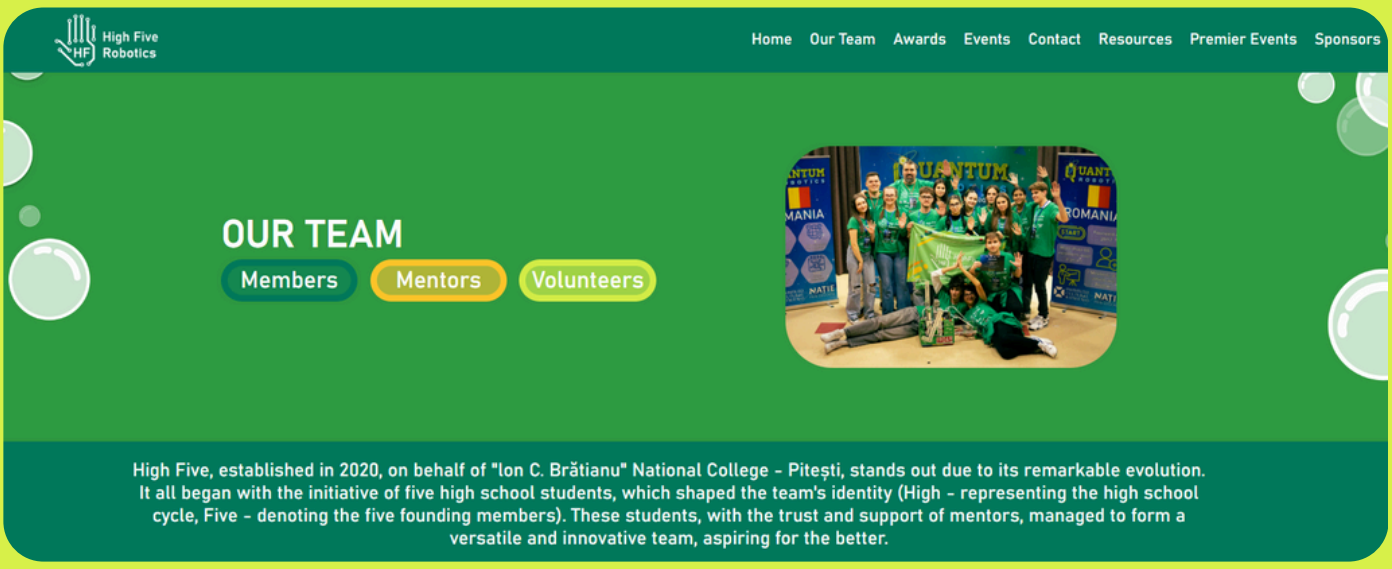
Lower on the page, there's a short description of what **FIRST Tech Challenge** means to us, along with the **"Not a Robot" video from FIRST**, which emphasizes the long-term positive impact of the competition. It breaks down cultural and social barriers and helps us develop teamwork and the drive to work hard for what truly inspires us.

2.Our Team

This page introduces the team by displaying the names of all current members, each accompanied by a photo and a frame containing individual information, making it as illustrative as possible.

3.Contact

To facilitate potential collaborations with other teams or sponsors, we created a dedicated contact page. It includes key contact persons, our location, banking information, and other legal/financial details.



4.News

To keep our audience updated on ongoing or upcoming events, we created the “News” page. This allows other robotics teams, for example, to register directly for the League Meet we’re organizing.

5. Events

The “Events” page serves as a timeline of the events we have participated in or organized. Each event is summarized in an article.

6.Awards

For visitors interested in our journey, we included the “Awards” page, which lists the prizes we’ve won in each season at both League Tournament and national levels.

7.Resources

Lastly, the “Resources” page is an archive of all the engineering notebooks we’ve created over the years. We hope these will serve as a source of inspiration for rookie teams at the beginning of their journey.

Media Presence

Introduction:

This season, we wanted to expand our impact within the community through an active media presence. We understood that visibility online plays a key role in promoting **STEM values** and attracting young people to join this program.

Main Content:

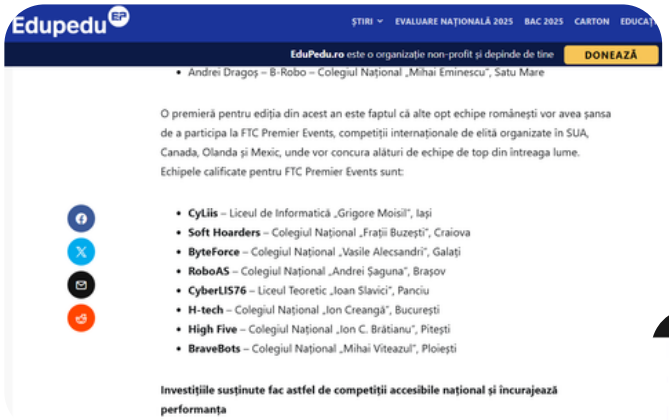
We were featured in **local press, on TV shows, and in various articles**, where we shared the impact of STEM education and our experience in the ***FIRST*® Tech Challenge program**.

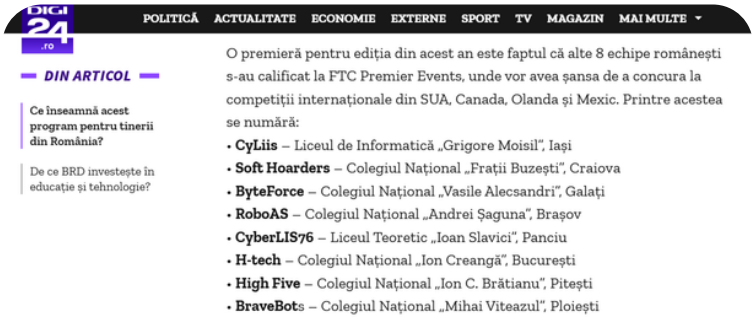
These appearances gave us the opportunity to spread our message to a broader audience.

We had the chance to be interviewed by three national TV stations **(Antena3 Pitești, National Television – Prima TV, and Argeș TV)**. In these interviews, we talked about our team's journey, the values that define us, and, not least, **our qualification for the European Premier Event in Eindhoven, Netherlands**. These were broadcast on multiple channels, giving us incredible visibility—we are truly grateful for the opportunity.

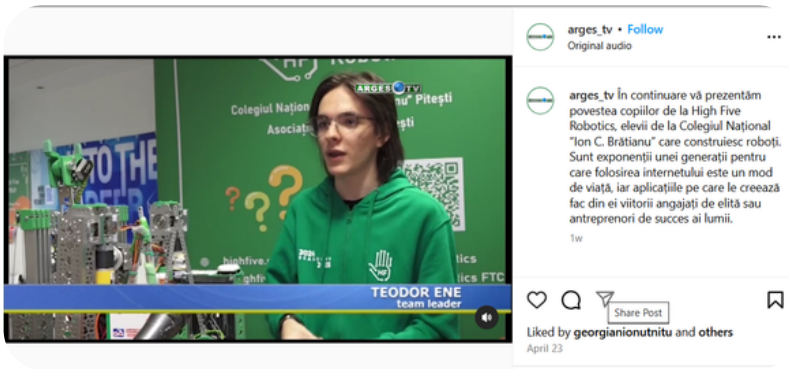
upa ce, săptămâna trecută, au fost felicitati tinerii pitesteni din echipa TehnoZ, care vor reprezenta România la Campionatul Mondial de Robotică de la Houston, la categoria licee, luni, la sedinta extraordinara de Consiliu Local au fost felicitati alti tineri la fel de talentati. HighFive Robotics, Broboți, ARRA, precum și pe Luca Barbu de la 4D Robotics sunt echipele care au fost felicitate de primarul Cristian Gentea si reprezentantii CL Pitesti pentru rezultatele excepționale obținute la Campionatul Național de Robotică, desfășurat la Pitești Arena în perioada 14-16 martie 2025. "*Ne bucurăm și ne mândrim cu pasiunea și talentul lor! Le urăm succes în competițiile viitoare și cât mai multe realizări remarcabile!*", a transmis edilul municipiului Pitesti.

LIFESTYLE 30.03.2025 - High Five Robotics





mpetitie Nationala Romania League Tournament 2025 Pitesti



În cadrul ședinței extraordinare a Consiliului Local Pitești, desfășurată la Primăria Municipiului Pitești, echipa High Five Robotics de la Colegiul Național „Ion C. Brătianu" a fost felicitată și premiată pentru performanța remarcabilă de a se califica la Campionatul European de Robotică, întrecere care va avea loc în Olanda.

Primarul Cristian Gentea le-a adresat tinerilor cuvinte de apreciere, evidențiind talentul, munca și dedicarea lor, iar consilierii locali și directorii de instituții prezenți în sală i-au aplaudat pentru reușita lor deosebită. Alături de ei s-a aflat și directorul adjunct al Colegiului Național „Ion C. Brătianu", Bogdan Ionescu, mentor onorific al echipei, dar și mentorul voluntar Emanuel Șerban, cel care le-a fost un sprijin con- stant în această competiție.

Overview:

Reach:

- **Instagram**: 260 287
- **YouTube:** 52 000
- **Facebook:** 34 087
- TikTok: 23 000

Most viewed post

- **Instagram**: 6 915
- **YouTube:** 6 967
- **Facebook:** 1 768
- **TikTok:** 3 000

Follower growth

- **Instagram:** 14.6%
- **YouTube:** 33.6%
- **Facebook:** 11%
- **TikTok:** 17,91%

The most viewed video on YouTube is the Robot Reveal published on November 22th 2024, with over 6.9K views.

This year, we've also been interviewed by **3 national televisions** and mentioned in numerous articles

BETTER TOGETHER

APRIL 2024 - JUNE 2025

Introduction

The ***FIRST*® Tech Challenge** educational program is not just about robots, but about people working together and acting with the values of **Gracious Professionalism** and **Coopertition** to achieve the impossible (As the founder, Dean Kamen, says: "***FIRST*® is More Than Robots**. The robots are a vehicle for students to learn important life skills. Kids often come in not knowing what to expect – of the program nor of themselves. They leave, even after the first season, with a vision, with confidence, and with a sense that they can create their own future.") and we, the members of ***FIRST*® Tech Challenge Romania** teams, have built a mindset around these values.

That is why, throughout the season, we tried to organize our activities in a way that combines working sessions and events with team-building activities, both within our team but also with other teams.

Halloween October 31st 2024

Continuing the tradition, we also celebrated Halloween together this year in an American-style way: we dressed up in creative costumes, played board games, and since we are a robotics team, of course we also played console games. Everyone brought their favorite snacks which we added into a huge bowl and we had a wonderful evening.

Mystery of the Coral Reef

November 9th 2024

Because of our passion for treasure hunts, on November 9 we accepted the challenge from the organizing team **TehnoZ #15972** to take part in the event **Mystery of the Coral Reef**, which was perfectly integrated into this season's theme.

The missions we had to complete in order to win were diverse, made us think and especially tested our teamwork skills.

In the end, we finished in third place. Even though it involved a lot of walking, the excitement of the teams and the desire to win didn't fade as the hours passed - on the contrary, it grew stronger as we got closer to the final challenges.

Speechless November 24th 2024

On November 24, 2024, the "Speechless" conference took place, organized by the teams **Homosapiens #19053** and **NeuroBotix #19045** at the **Faculty of Industrial Engineering and Robotics**, **UPB**, **Bucharest**. The event brought together robotics teams from all over the country and gave participants a broad perspective on future careers in technology.

Among the speakers were: Liviu Bouruc – **former UNIBUC student**, George Popescu – **UNIBUC student**, Vlad Dieaconu – **Adobe employee**, Marian Bănică – **NASA** collaborator, and Ștefan Petriceanu – **UPB professor**. The presentations covered various topics, from university educational programs to work experiences in startups and corporations. The event was a source of inspiration and information, giving participants a clearer understanding of educational and professional opportunities in the field of technology.

GODMOTHER October 2023 - June 2025

Introduction

The concept of this project was initiated in the previous season, when we set out to support the formation and development of new teams. As a result, we are currently mentoring 4 teams: **Coral Tech #28260** from "Ion Cantacuzino" Theoretical High School in Pitești, **2EZ #28298** from Mumbai, India, **Cassiopeia #27882** from Sutton, United Kingdom, and **Skyline #21071** from National College "Ienăchiță Văcărescu" in Târgoviște, contributing to building and strengthening their journey in future competitions.

Our goal, as mentors, is to guide new teams on their journey, offering support and advice every step of the way. We explain both technical and non-technical concepts that are essential, so they understand the solid foundation on which a team is built. We talk about **how to attract mentors and sponsors, where to find relevant information and how to use resources as efficiently as possible**. We aim to teach them how to perform in any condition, no matter the challenges, all while respecting the values and principles of the **FIRST®** program.
Through this process, we hope to shape a new generation of capable, enthusiastic, and dedicated youngsters, ready to become mentors themselves in the future. Through mentorship, not only is technical knowledge passed on, but also a mindset focused on **collaboration, perseverance, and innovation**, based on ***FIRST®* values**.

4 teams mentored from different countries (Pitești and Târgoviște - Romania, India and UK)

- **Coral Tech** - 28160, Pitești, Romania

Our robotics team represents more than just a group of youngsters passionate about science, technology, engineering, and mathematics; it is a community united by values such as innovation, collaboration, and the desire to share the knowledge we've gained. We proved this through the essential role we played in mentoring a new robotics team, Coral Tech, thus contributing to the growth and diversity of the **STEM** community.
In the beginning of the season, we found out that "Ion Cantacuzino" Theoretical High School in Pitești - located in the same city as us - wanted to start a team to participate in the ***FIRST®* Tech Challenge** competition.

Of course, for any rookie team, the beginning is the hardest part, as the complexity of the game and the season can be overwhelming. So, we decided to help them by approaching mentorship in a structured and empathetic way, dividing the process into several stages.

To offer them initial support, we donated parts worth over €4000

We organized **mentoring session**s to share what we had learned from our own experience, explaining the competition rules, how to organize their team, the roles of each member, how to collaborate effectively, and presenting each department to give them an overview. Through **interactive sessions**, we were able to introduce them to the **FIRST® Tech Challenge** competition and they chose the name **Coral Tech** for their team.

At the same time, through our project, **International Hub**, we had the opportunity to mentor rookie teams from abroad. We responded positively to their request for mentorship, online meetings through which we could support them and answer all their questions.

- **2EZ** - 28298 Mumbai, India

The meeting with the **2EZ** team was the first mentoring session within the **International Hub project**. The rookie team members were curious and asked various questions regarding the challenges we faced this season and how we managed to establish our visual identity. With great pleasure, we answered all their questions and had the opportunity to **show them our notebooks from last season, CENTERSTAGE**, to provide them with a source of inspiration for their own notebooks and portfolios.

- **Cassiopeia** - 27882, Sutton, United Kingdom

The second international mentoring session was with the **Cassiopeia** team from Sutton, England. This was their first year, making them a rookie team, but they also had some experienced members who had participated in a few seasons before. We provided them with **technical advice**, and they shared with us the problems they had encountered, demonstrating their robot's subsystems in a suggestive way. Additionally, we discussed **local outreach strategies, brainstorming innovative ways to present *FIRST*® values** to as many people as possible.

- **Skyline** - 21071, Târgoviște, Romania

During the meeting with the members of **Team Skyline**, whom we invited to our Hub, we held a presentation to offer them useful information and advice regarding team organization, PR, and technical development.
We talked about how we divide responsibilities based on different areas (technical, programming, design, PR, strategy, etc.), the importance of constant communication between team members, and the methods we use to efficiently manage our time during the competition season. We gave examples of how we use various **digital tools** to track our progress and **how we adapt our plans when unexpected challenges arise.**

Conclusion

The mentorship provided by our team had a profound impact on strengthening the self-confidence of both our team and the four teams we mentored. At the same time, we gained a deeper understanding of the importance of social responsibility. Through this process, the relationship between us and the mentored teams became one of reciprocity and respect. In an increasingly interconnected world, such initiatives demonstrate that true progress is achieved through **collaboration, dedication, and the sharing of knowledge**.

Volunteers at Someș Tech Challenge

26-28th July 2024

The spirit of ***FIRST®*** unites communities of young people from all around the world under a common goal, creating long-lasting connections and experiences that develop us from all perspectives: in terms of responsibility, knowledge, skills, and social interactions.

Thus, on July 26-28 2024, **two members** of the team wanted to get involved as **volunteers (two Referees)** at the Someș Tech Challenge, an event organized by the **Vectron #17873** team. The experience was a unique one for us, and the interaction with the **26 teams** brought us even closer to the community of young robotics enthusiasts.

Session on Material Strength

February 21st 2025

Introduction:

On February 21, we attended a session on material strength, organized at the **National University of Science and Technology Politehnica Bucharest, Pitești University Center**, led by **Professor Monica Iordache**.

Contents:

This presentation helped us understand how important materials and their properties are in robot construction, which also aids us in **validating the formulas needed for the engineering design process**.

We learned how various types of materials (metallic, plastic, ceramic) have different characteristics, such as **resistance to forces, density, and hardness**, and how each of these affects or contributes to the overall concept.
Another topic discussed was the **finite element method**, a technique through which we can test, on a computer, how robot parts behave under different conditions, a fundamental aspect in predicting mechanical stress. We also discussed screws and joints, which must be strong enough for a robot to withstand movement and heavy loads.

Conclusion:

The session was a **valuable opportunity** to better understand the principles of materials engineering and to apply this knowledge in the design and optimization of robots for competitions. Additionally, through this session, we were able to communicate and collaborate with knowledgeable and eager-to-help professionals from the technical field.

Gaming night

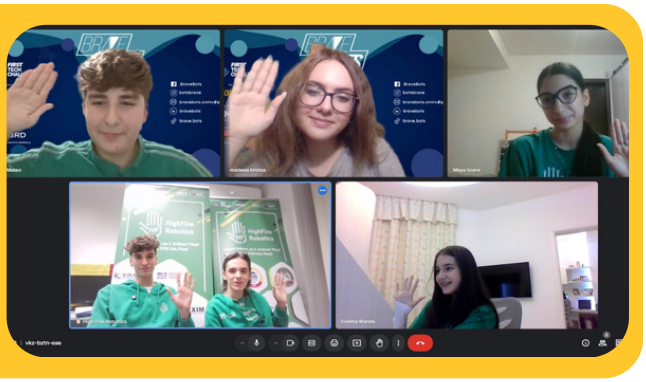
December 30th 2024

Since **we also need moments of connection**, from time to time, we enjoy organizing a gaming night at our hub, where we all gather and play various board games. Performance is important, but so are cultivating a sense of belonging and the well-being of the team.

Thus, the evening of December 30th turned into a game night for us. We played Mafia – a game based on intuition and attention to detail in order to win – and Activity – focused on teamwork.

Brave around the world

January 23th 2025



On January 23, we had the great pleasure of participating in the podcast organized by the **Brave Bots #19141** team, Brave around the World, an informational event that turned out to be extremely enjoyable.

During the discussion, we covered various topics, from how we manage stressful periods and handle unforeseen situations to the story of our team and the funny moments that marked our journey.

We also had the opportunity to share the **lessons learnt** over time, as well as to listen to the perspectives of our colleagues, which helped us see things from a different angle.

Practice

On November 22, January 7, January 29, and February 1, we held **4 training sessions** in order to prepare for the upcoming competitions.
In the first session, aimed at preparing for the first **League Meet** of the season, we invited the **4D Robotics #18160** team to our hub.

In the second session, which was also meant to finalize the organizational details for **Hide&Meet**, the **League Meet** organized in collaboration with **4D Robotics #18160, ARRA #25538, and LightBulb Robotics #23203,** we invited the three teams we worked with for this event.

In the third session, held on January 29, we were once again joined by the **ARRA #25538** team. They helped us prepare for the **4th League Meet**. We simulated matches under the careful observation of members who had earned Referee certificates, recreating the competition atmosphere.

Also, on February 1, after the **League Meet**, we were invited by **BraveBots #19141** to train at their hub, giving us the chance to continue practicing and analyzing our performances under competition conditions.

Open Hub

Being a team from Pitesti and wanting to help as much as we can the teams participating in the League Tournament that was held in our town, our hub was open non-stop during the 4 days and **hosted teams in need of space, printers, parts, etc.** Thus, we welcomed with open arms **10 teams** that contacted us and we were happy to be able to offer them support and help throughout the competition. Following this experience and the feedback received from the teams, we decided to reopen the Hub during the national stage as well.

Our hub was open non-stop for all teams during both the League Tournament and Romania Championship!

FTC Global Ambassador

January 25th 2025

Introduction:

We responded positively to the proposal of the **Cyber Sharks #24270** team from Libya to become Europe's ambassadors in the FTC Global Ambassadors project – a revolutionary virtual event where **6 FTC teams** come together to represent their regions, to respond to interesting challenges and discuss real-world issues such as the endangerment of marine life. Thus, on January 25th, we had our first meeting alongside the other ambassador teams: **Cyber Sharks (#24270, Libya), Atomic (#18630, Texas, USA), XMACHINE (#17801, Brazil), leocopsar (#26487, Indonesia), VegeMight (#17556, Australia)**.

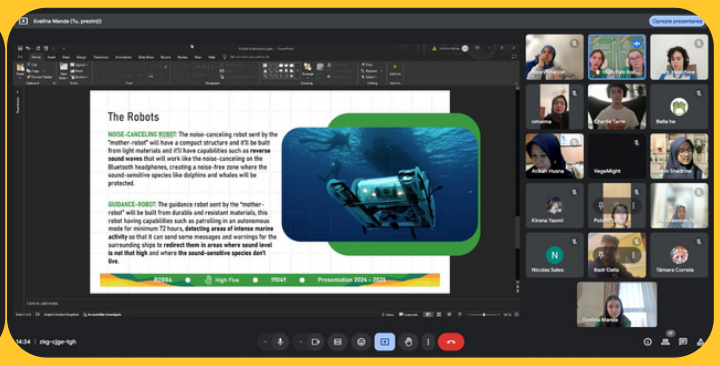
Table of Contents:

After making introductions and getting to know each other, we had a discussion session in which each of us presented solutions to the following question: **"How do human activities contribute to the endangerment of marine species, and what innovative solutions can we implement to protect and restore marine ecosystems?"**.
Each team prepared a presentation answering the proposed question, coming up with innovative solutions.

Our team focused on **marine noise pollution**. In Europe, intense maritime traffic in congested areas such as the North Sea and the Mediterranean Sea is a major source of noise pollution, negatively affecting various animals like whales and dolphins. Additionally, oil exploration zones amplify this phenomenon.
To address this issue and help sound-sensitive marine species maintain their existence and development, we proposed the idea of **a robot that helps cancel out noise**. This robot would have the ability to **reverse sound waves**. The system would work similarly to the noise-cancelling feature on Bluetooth headphones, creating an area where sound-sensitive species, like dolphins and whales, would be protected.
The session was followed by a fun and interactive **"Would You Rather Game"** where we had a great time.
Finally, each participant shared their **FTC** experience. There was a discussion about how this program has changed lives, helping young people realize what they want to do in the future.

Conclusion:

Thus, this event was an excellent opportunity to connect with teams from around the world, discuss important global challenges, and participate in fun activities.



FirstIN

Introduction:

We gladly accepted the invitation from the **BraveBots #19141** team to become ambassadors for the **FirstIN platform – a virtual network designed to connect robotics teams from Romania with the global community**. Alongside **13 other ambassador teams,** we successfully helped create a platform where users share inspirational stories and contribute to building a strong global community on FirstIN.

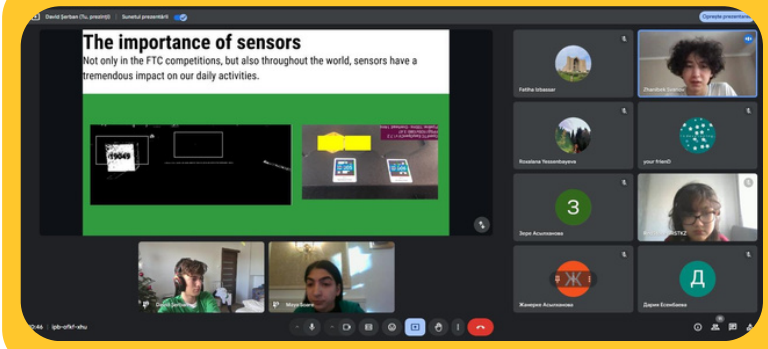
What can you do on this platform?

- Socialize with robotics teams from all corners of the world.
- Create a personal profile and build your network of friends.
- Network, exchanging ideas and strategies for competitions.
- Access exclusive **FTC** resources that help take both your robot and your team to the next level.
- Post and share your special moments from your **FTC** journey.

Redstone Forum

January 4th 2025

Introduction:



On January 4, 2025, I had the pleasure of participating in the International Forum project, organized by the team **REDSTONE #24749** from Almaty, Kazakhstan. The event was held online via Zoom and aimed at fostering an exchange of knowledge and experiences between young people from around the world and teams actively participating in the **FIRST® Tech Challenge** for the **INTO THE DEEP** season.

Development & Impact:

The entire project took place over two days, with three meet-ups each day. Among the topics covered were: **creating an Engineering Portfolio, managing emotions during interviews, principles of robot design, improving programming skills, and developing a stable game strategy, among others.** We hosted a session on the latter topic, and during the meet-up, over 12 students from various countries and robotics teams attended, with the majority being rookie teams.

We actively presented, focusing on clarifying any questions or curiosities and fostering open communication, addressing in detail various concepts that the participants were interested in. For example, we discussed with the attendees which **sensors** are best to use, how to choose the **camera** we want to implement, and the **importance of localization**.
We are proud that, alongside us, 4 other teams from Romania participated, each presenting a course: **4D ROBOTICS #18160, Cyliis #19043, Broboți #19176, and RoSophia #21455**, showcasing the widespread impact of the competition in our country.

Conclusion:

This project represented a perfect opportunity, on one hand, to share the knowledge we have gained over the seasons to help young teams, both rookies and others, and on the other hand, to identify possible obstacles related to both hardware and software components that may arise during the prototyping and testing of various mechanisms.

Volunteers at Robotics Summer Fest

May 31th - June 1st 2025

We participated as volunteers at the Robotics Summer Festival, an event organised by the team **BraveBots - #19141** that featured a mix of robotics, inspiring speakers, music, and engaging activities. As part of the logistics team and the social media team, we contributed to the smooth organization of the event.
We helped guide participants, manage the event flow and capture key moments to share online. It was a rewarding experience that allowed us to be part of a vibrant community, have fun, and support an event that brought together technology, creativity and entertainment.

INTERNATIONAL HUB

November 2024 - June 2025

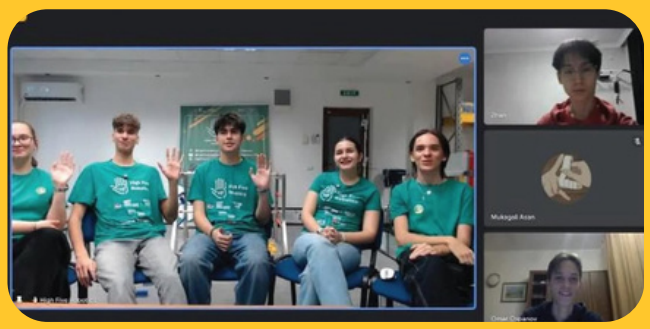
Introduction

The entire project was initiated out of the desire to communicate with robotics teams at an international level, to discover how the ***FIRST®*** phenomenon unfolds in other countries and to build lasting relationships.
Thus, over the course of several weeks, we carried out the International Hub project, aimed at illustrating the global impact of the ***FIRST®*** phenomenon. Through online meetings and open discussions, we were able to overcome language barriers and time zone differences, involving teams from all 3 ***FIRST®*** programs.

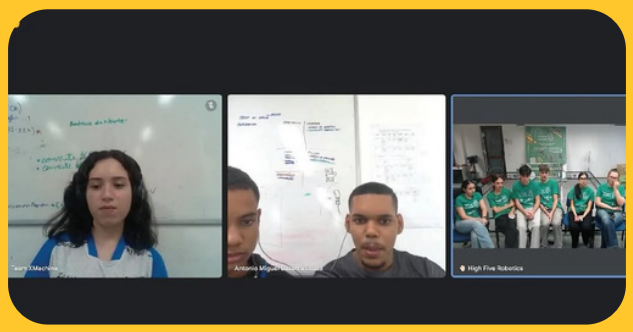
Main body

Through the online meetings we had as part of our International Hub project, we got the amazing chance to meet and talk with **52 teams from 17 different countries**, across **6 continents**. Thanks to tools like Google Meet and Zoom, we were able to connect with people from around the world who share the same passion for robotics as we do.
These meetings were not just about robots—they were about learning from each other, sharing experiences, and building friendships. We also had the chance to talk about our cultures, how **STEM** is growing in each country, and how the ***FIRST®*** **values** have made an impact in our communities, including Romania. We discussed the challenges and goals of this season (**INTO THE DEEP**) and how each team is working to improve.
During the meetings, we talked a lot about how teams are organized. We explained how we split our team into smaller groups—like technical, programming, design, PR, and marketing—and how we keep good communication between members.

We also shared ideas about how to promote our teams. We explained how we make social media posts, how we keep in touch with sponsors and mentors, and how we try to grow our presence online. Some teams showed how they organize outreach events, talk to their communities, and build a strong image for their team.
On the technical side, we talked about many things like how we design the robot using CAD programs such as Onshape. We showed how we make the first robot model in CAD before building it in real life, how we design each part, and how important it is to work carefully so everything fits. Some teams also shared how they work together online on the same CAD file and how they fix design mistakes before building.
We also shared mechanical ideas. For example, we talked about how our intake system works, the mecanum wheels we usually use, and how we built a strong and stable chassis. Teams compared different ways of building robots—what materials they use, how they reduce weight, and how they make sure everything is safe and solid.
Programming was another important topic. Teams explained how they organize their code, how they build Autonomous programs, and how they use sensors like cameras, encoders, and IMUs. We shared tips on how to fix bugs, how to use PID for better control, and how to test different Autonomous paths on the field.
These meetings also helped us talk about problems—both technical and non-technical. Together with the other teams, we looked at the issues we faced and gave each other ideas and solutions. These conversations really helped us make progress and improve our robots and teamwork.



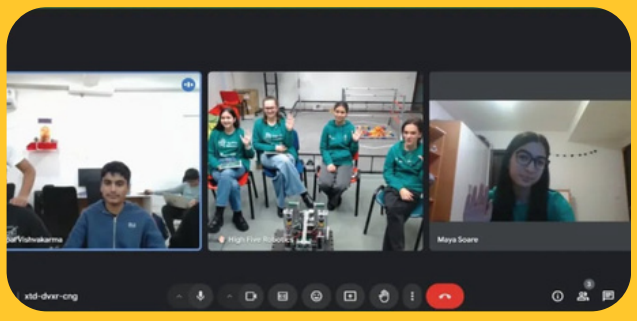
1.Bolt.m3 – #22801, Almaty, Kazakhstan
We have been collaborating with them since the last season, **CENTERSTAGE**, where we organised some mentoring sessions.



2.XMachine - #17801, Salvador, Brazil
They presented to us the huge importance of the non-technical component, impressing us with the complexity and impact of their projects.

3. Cyber Sharks Team – #24270, Tripoli, Libya
They expanded our vision regarding game strategy, with the main topics being mission approaches, the importance of autonomy, and the collaboration within the Drive Team.

4. Black Tigers – #11192, Kfar Yona, Israel
Together with the Black Tigers, we had the opportunity to deepen our knowledge regarding the importance of cultures and traditions.



5. 2EZ – #28298, Mumbai, India
The meeting with team 2EZ was the first mentoring session within this project.

6. Cassiopeia – #27882, Sutton, England
The second mentoring session was with team Cassiopeia from Sutton, England. It was their first year, being a rookie team, but also consisting of experienced members.

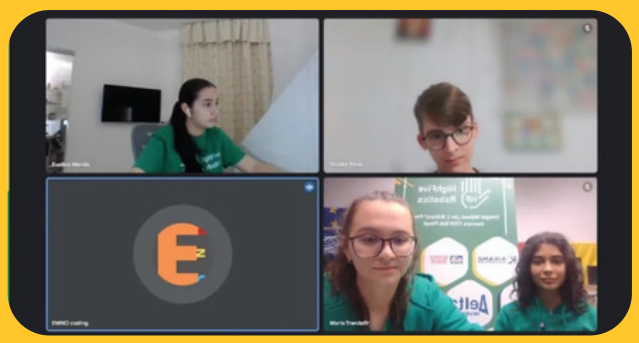
7. Demon Dogs – #22437, New York City, USA
One month after the start of the project, the meeting with the Demon Dogs team was a special one, as they were the first team from the USA in this series of meetings.

8. Aperture – #5064, North Carolina, USA
We spoke openly about the content and aspects of the notebooks and portfolios, with both teams having concepts to learn from those across the ocean.

9. PlumBum – #24475, Vilnius, Lithuania
They told us about their opportunity to be part of the international program ***FIRST*® Like A Girl**, since they are a team made up entirely of girls.

10. Circuitron - #28359, Mumbai, India
They explained the obstacles and technical difficulties encountered so far as a rookie team.

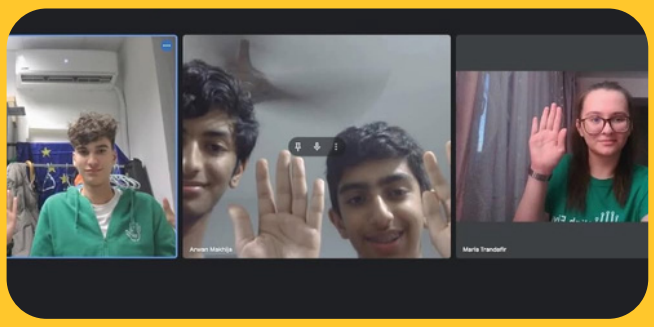
11. Quant – #23004, Astana, Kazakhstan
Invited by the Quant team, who also organized this online meeting, we had the opportunity to actively participate in constructive debates with four teams from different corners of the world.



12. Next Level – Morocco
Since they participate in the ***FIRST*® LEGO LEAGUE** program, the meeting was a new and unique experience. During the session, we learned more about their current season, **SUBMERGED**.

13. LYBOTICS Wizards - #18422, Tripoli, Libya
They shared with us a difficulty that we found we had also encountered, and certainly many other teams both from Libya and our country as well, namely finding sponsors.

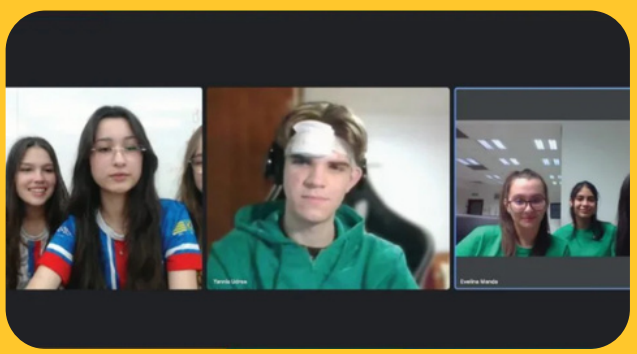
14. Occam's Razor Clams - #636, Rhode Island, USA
We mainly focused on the values of ***FIRST®*** and how important it is for every team to guide their steps in accordance with it's mission and vision.



15. G Force - #19013, Mumbai, India
We exchanged ideas about design and functionality, emphasizing the importance of a solid technical foundation in a robot's performance.

16. StormTech - #16054, Goiânia, Brazil
We focused more on technical topics, discussed our performances, and also talked about events and projects that belong to us.

17. ViperBots Venom - #6209, Texas, USA
We were impressed by the involvement of every member of their team in the conversation.



18. Justice - #21036, Goiânia, Brazil
We addressed aspects related to team management and emphasized the importance of collaboration and effective communication to overcome the obstacles encountered.

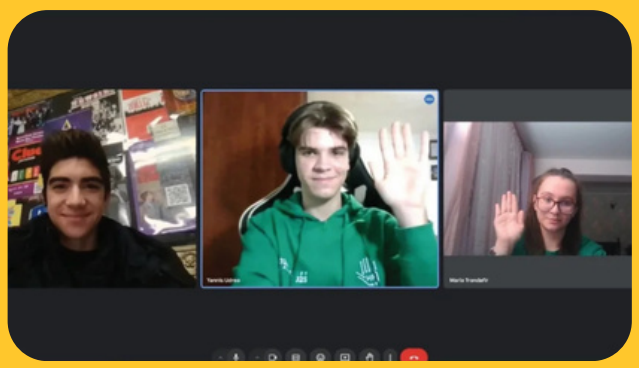
19. Spirit - #25547, Astana, Kazakhstan
The meeting was a wonderful opportunity to exchange experiences and offer support in this early stage of their journey in ***FIRST®*** **Tech Challenge.**

20. Aztechs - #18397, Iowa, USA
We analyzed the differences between available resources, the level of competition, team structure, and the advancement process between countries.

21. Nemeziz - #28689, Almaty, Kazakhstan
We discussed outreach activities in our communities and how to organize events based on the desired audience.

22. Hot Wheels - #28659, Astana, Kazakhstan
We had the chance to present our most recent robot reveal to the team from Kazakhstan, explaining the concepts behind the design and mechanisms.

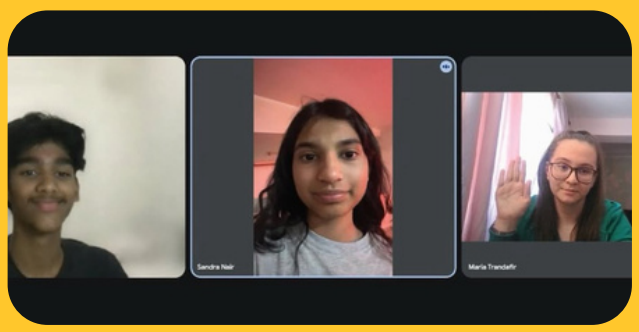
23. RoboHawks - #14461, New York, USA
In the first part of the meeting, we explained the mechanisms that make up our robot, followed by an open discussion about the game strategies we use.



24. Team Hazmat - #13201,Wisconsin, USA
During the online session, we analyzed the evolution of our robots, the challenges encountered, and the differences between the **FTC** competition in Romania and the USA.

25. Team Thalos - #25070, Ierapetra, Crete

It was an inspiring session, where we learned more about the team's work, challenges, and creative approaches and we are very excited to meet with them at the **European Premier Event.**



26. Team Starlink - #24876, Dubai, UAE

We shared our achievements so far, talked about the challenges we've faced, and explored how each team supports the development of its members through responsibility and collaborarions.

27. Team Audaces - #21547, Maracaibo, Venezuela

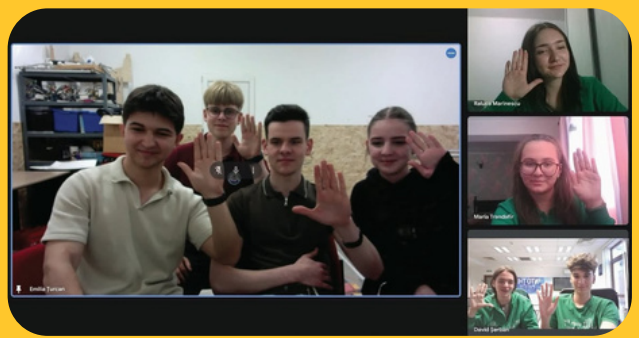
We focused on the mechanical side, where we explored topics like the use of mecanum wheels, different types of drive transmissions, and various construction solutions.

28. Team Portables - #24966, Piraeus, Greece

During the meeting, we discussed strategies for social media management, ideas for improving the organization and promotion of the **FTC European Premier Event**, as well as initiatives related to sustainability and volunteering.

29. Team Techno Storm - #25475, Ungheni, Republic of Moldova

We talked about everything related to the robot systems, as well as scoring strategies during the match.



30. Team RoboRangers - #25590, Chișinău, Republic of Moldova

We exchanged ideas about robot construction, what we improved after the **League Tournament** and national competitions, and how we're adapting our design.

31. Team YuNet - #25483, Chișinău, the Republic of Moldova

We discussed technical aspects of robot construction, from different types of drivetrains to customized solutions for efficient mechanisms.

32. Teams FRITES - #20991, BaguetTechs - #20989, TheFrenchineers - #20990 and Geekos - #9220, Valbonne, France

The first opportunity we've had to interact with a team from the **FRC program**.

33. Team SESI BAT TECH - #17742, Rio Grande do Notre, Brazil

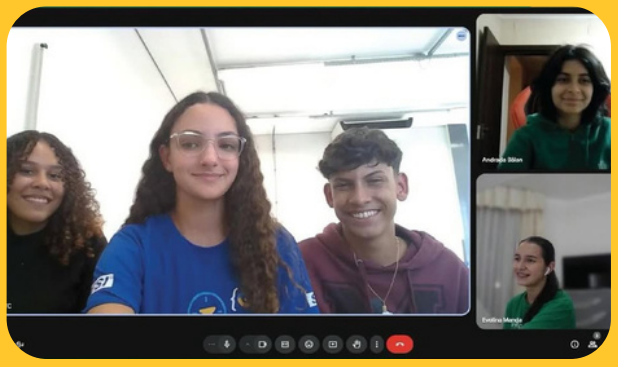
We exchanged ideas on robot design, team organization, and match strategies, while also discussing community involvement and sponsor-related challenges.

34. Team RBL Techmakers – #23147, Neuvilee sur Saône, France

We discussed robot design, game strategies, and time management, while exchanging feedback and learning about international team dynamics.

35. Team MID Chaotics – #25564 Cancaya, Turkey

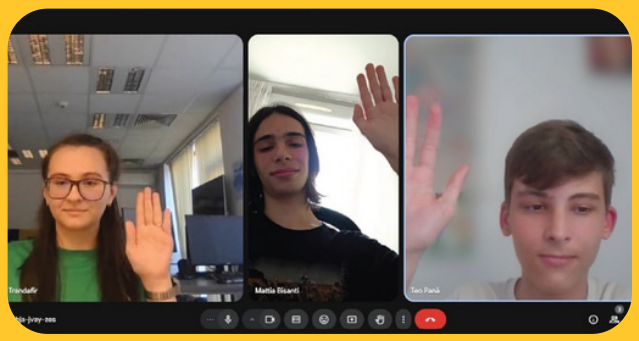
We exchanged ideas for the **European Premier Event**, shared our national journeys, compared portfolios, and presented our robot's **CAD** and design solutions.



36. Team Starbots FTC – #16055 Betim, Brazil

We exchanged experiences and strategies for the **European Premier Event**, presented our robots, and explored how **FTC** is growing as a global scientific community.

37. Team Eggmate, Santa Catarina, Brazil
We discussed mechanical aspects, past events and outreach activities, while exchanging ideas and technical approaches that deepened our understanding of **Global FTC collaboration.**



38. Team Marabouteour - #22225, Antibes, France
We presented our **CAD** model and robot video, discussed design choices, and exchanged feedback and team experiences.

39. Team Marlbots - #3526, LA, USA
We exchanged experiences from the **INTO THE DEEP** season, discussed robot design and team management, and gained valuable insights from their organized and open approach.

40.Team Unity Sunset - #22660 Escada, Brazil
We exchanged best practices in robot design, shared **CAD** models, and engaged in a collaborative, detail-focused discussion that fostered mutual technical growth.

41. Team Med V Robotics - #25498, Beni Mellal, Morocco
We discussed our **INTO THE DEEP** experiences, focusing on challenges, future plans and especially sponsorship strategies.

42. Team ISL Robotics - #22948, Sainte Foy les Lyon, France
We discussed robot design, game strategy, team organization, and preparations for the European Premier Event, gaining insight into international workflows and sharing a collaborative exchange.