

INFERNOX



PORTFOLIO



#28745



DECODE

2025/2026

ABAY FIRST CHAMPIONSHIP

We are Team #28745 InfernoX from Semey, Abay Region. We are students of School-Lyceum No. 50 (IT School) and joined FIRST in the Into the Deep 2024-2025 season.

In our first season, we successfully qualified for CAFC and competed there. This season, we won the Design Award Winner at the Abay FIRST Championship. Our goal is to make this competition accessible and widespread for everyone.



MEMBERS



ALIKHAN
CAPTAIN

Responsible for the main engineering aspects of robot.



ZHANIYA
CO-CAPTAIN

Handles outreach and community engagement

- Engineering team
- Outreach team
- Coding team



ALUA
DESIGNER

Responsible for the robots design and pit zone



ZHALGAS
BUILDER

He makes base of the robot and its construction



ASYLKHAN
CADER

He comes up with an idea for a robot and creates it in 3D



ABZAL
CODER

Handles code for autonomus and tele-op drive

TEAM ROLES DIVISION

Our team has clearly defined roles, including Team Captain, Programmer, Engineering Lead, Outreach Manager, Fundraising Manager, and Handbook Manager.

Leadership is developed through responsibility rotation, mentoring of new members, and active involvement in decision-making processes.

MENTORS:



MAULETOV ALISHER

Alumni of Kyungdong University.

Helps us with project management, Design, Discipline and Outreach



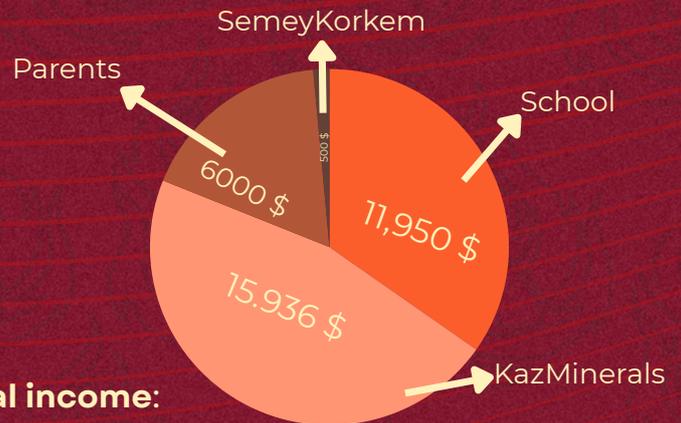
MAKSUTRAULY SERIKZHAN

He leads the engineering and CAD part of the project.

Team members learn 3D modeling by using his approach

FUNDRAISING AND SPONSORS

Our team's long-term financial sustainability strategy is built around three primary sources: outreach-driven partnerships, school support, and our main sponsor, KazMinerals Group. To guarantee consistent financial support over several seasons, sponsor relationships are maintained year-round and fundraising events are scheduled throughout the season.



Total income:
34,386 \$

This year fundraisings report of the InfernoX team

SEASON FINANCE PREPLANNING

Stage	Timeline	Goals	Deliverables &	Progress	Member	Tracking	Risks	Handling
Pre-Season	Sep-Oct	Prepare team	Ready and disciplined team	<input checked="" type="checkbox"/>	All team	Detailed checklist	Low motivation, adaptation after	Team-building activities, internal training sessions
Outreach Opportunitie	Oct-Nov	Increase outreach hours	80+ outreach hours	<input checked="" type="checkbox"/>	Inspire / Outreach	Outreach hour tracking	Limited time and budget	Partnering with school, sponsors, and free
Building Robot	Throughout season	Build reliable robot and code	Autonomous: 12+ artifacts; TeleOp: 120+ solo points	<input type="checkbox"/>	Engineering & Coding teams	Technical checklists	Time pressure, technical challenges	CAD iterations, testing cycles, early prototyping
Competition	Nov-Feb	Gain experience & Qualify to CAFC & Houston	Qualification to Central Asia Championship and	<input checked="" type="checkbox"/> <input type="checkbox"/>	All team	Match analysis, score tracking	Budget limits, team readiness	Sponsorship search, selective competition participation
Post-Season	Mar-May	Train new members	8+ new trained members ready for	<input type="checkbox"/>	All team	Training progress tracking	Lack of new members or interest	Workshops, selections, interactive mini-sessions

OUR SPONSORS:



TEAM SUSTAINABILITY

Our sustainability goal is to ensure team continuity through legacy.copy, where current members mentor 7th-grade students during Post-Season, transferring knowledge and skills to prepare the next generation.



TEAM SUSTAINABILITY

We track our progress with weekly meetings and check list for robot development, outreach, and fundraising.

Чеклист трекинга сезона команды

Этап 1: Предсезон (Pre-Season) Цель: Подготовить команду Результаты: Дисциплинированная и готовая команда Статус: <input type="checkbox"/> Planned <input type="checkbox"/> Ongoing <input checked="" type="checkbox"/> Completed	Этап 2: Outreach / Вовлечение Цель: Увеличить количество часов outreach Результаты: 80+ часов вовлечения Статус: <input type="checkbox"/> Planned <input type="checkbox"/> Ongoing <input checked="" type="checkbox"/> Completed
Этап 3: Строительство робота Цель: Построить надежного робота и код Результаты: Автоном: 12+ артефактов; TeleOp: 120+ очков Статус: <input type="checkbox"/> Planned <input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Completed	Этап 4: Соревнования Цель: Получить опыт и квалифицироваться в САFC и Хьюстон Результаты: Квалификация на Центрально-Азиатский чемпионат и Хьюстон Статус: <input type="checkbox"/> Planned <input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Completed
Этап 5: Постсезон (Post-Season) Цель: Обучение новых участников Результаты: 8+ новых подготовленных участников для следующего сезона Статус: <input type="checkbox"/> Planned <input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Completed	

OUTREACH MISSION

We want to show everyone that robotics is not just for 'smart' kids. Our goal is to make a big community where every school in our city has a team and students help each other.



OUTREACH OBJECTIVES



OUTREACH ROADMAP

Master-Class with ABU "Robotics with Joy" 04.02.25

In School meeting with 7-8 grade students about FIRST 05.03.25

Documentary Film shooting with KazMinerals for President official channel, 06.10.25

Robotics Exhibition on regional meeting of Teachers of Abay 27.02.25

Article about FIRST and robotics from TengriNews with our Mentor and Captain 04.09.25

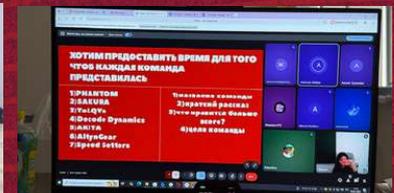
Webinar with 7 FTC teams for acquaintance with FIRST, 05.01.26

Meeting with Professor and Archeologist from ABU for Explore Teams, 26.17.25

Abay FIRST Skrimmage, 12.11.25

Master-Class with Abay IT Valley, "Real-World Robots", 3.12.25

Meeting with Deans List winner "What is FTC Portfolio and why you need it", 27.11.25



Recruiting New Teams and Mentors

STARTING NEW TEAMS

We worked hard to grow the FIRST community. We held master classes and signed official partnerships with schools and universities. We also organized 2 scrimmages and visited kindergartens and orphanages to inspire kids. In total, we reached over 1,000 people, showing them how cool robotics and FIRST can be!



Signing partnerships with Shakarim University, ABU, IT College and Balbobek Kindergarten



Master-Class with Abay IT Valley, "Real-World Robots"



Meeting with Balbobek kindergarden

ARCHEOPOLY

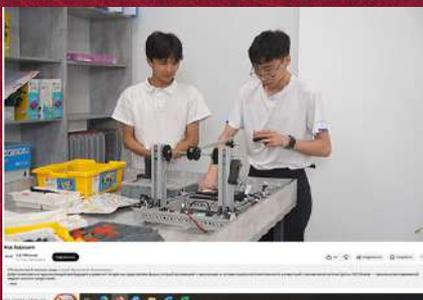
We created "Archeopoly", a custom board game that teaches Kazakhstan's history and robotics through play. To support our community, we visited 2 local orphanages, shared our passion for FIRST, and donated 6 copies of the game.

FIRST STEPS (ABAY REGION)

We launched this project in collaboration with a local kindergarden to start the first FLL Discover team in the Abay region. Our goal is to create a full "FIRST pathway": children start with FLL Discover, grow into FLL Explore, and eventually join our FTC team in school. This project gives kids a complete journey through the FIRST programs, helping them learn robotics from a very young age all the way to graduation.



MAKING FIRST LOUD: ROBOTICS FOR EVERYONE!



Official Video of KazMinerals about Robotics Today



Ученик 11 класса **Алихан Султанбеков** учится в IT-школе-лицее №50 второй год. Отмечает, что, как только узнал, что в новую школу набирают учеников, сразу подал документы. До этого не занимался робототехникой. Потом его класс помогал при проведении соревнований в школе, он заинтересовался и со временем стал главным инженером в команде. Также в соревнованиях участвуют программист, дизайнер, веб-дизайнер и СММ-специалист из числа школьников.

Interview of our Captain for Tengrinews



Interview for President Channel (Documentary Film)



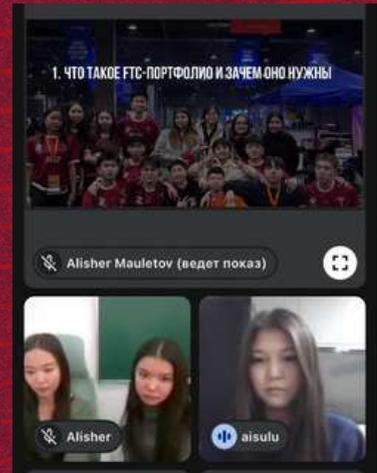
Exhibitions for IT College

HELP FOR BEGINNERS

We organized special online and offline meetings to help new teams understand the world of FIRST. We held over 50 calls with more than 300 participants, sharing our technical experience and tips.

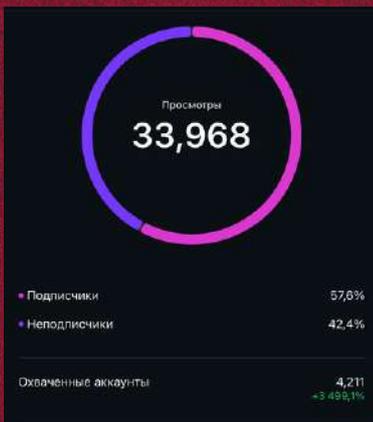


Meet with 7 new FTC teams for acquaintance with FIRST



Meet with Dean's List Winner for 20+ FTC teams

MARKETING AND SOCIAL MEDIA



We are very active on our Instagram to make FIRST loud online. In just the last month, our content reached over 4200 people and gained more than 34,000 views.

INFLUENCE MAP OF INFERNOX



ONGOING & FURUTE PROJECTS



ENGINEERING & OUTREACH COURSE

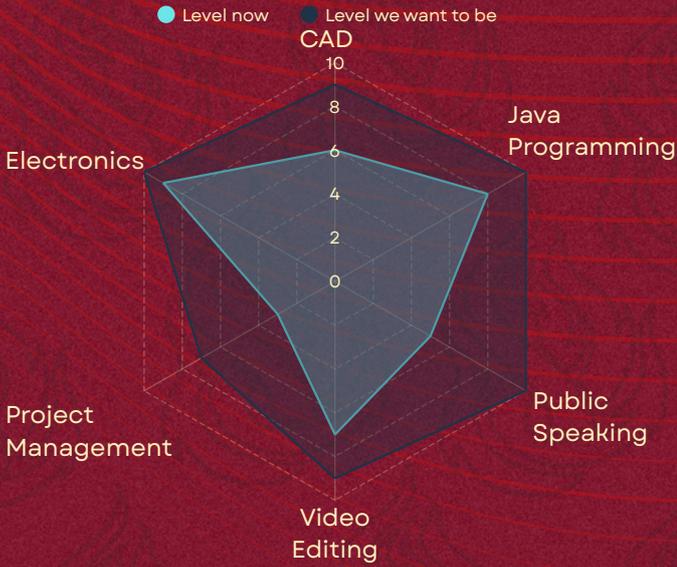
We are creating an Engineering & Outreach Course to help new teams succeed. It covers robot building, coding, Outreach values, and portfolio creation. Currently in development, our goal is to release it soon to help national teams grow faster and understand FIRST better.

TELEGRAM BOT

We developed a Telegram Bot to connect the FTC community across the country. The bot shows a map of teams by city, including which teams have their own labs and practice fields. This helps teams find places to train and contact each other easily. It is a great tool for collaboration: rookie teams get a place to practice, and host teams gain valuable Outreach points by sharing their space!



SKILL MATRIX WITH RADAR CHART



JasSkills 2025 Championship: In the Partnership with IT College of Semey our team could enhance knowledge in Design, Software Engineering, Video Editing and Public Speaking



We collaborated with Astana IT University and 20+ schools to master Drone Racing tech, exploring new STEM fields while promoting FIRST values to 50+ participants.

INDIVIDUAL GOALS

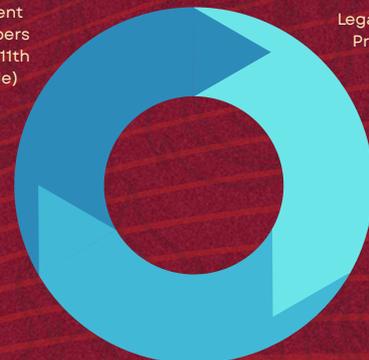
Department	Learning goal	Action steps
Engineering	Master Laser Cutting	<ul style="list-style-type: none"> Learn safety rules for working with a laser cutter. Get familiar with the machine and its basic settings. Prepare simple design files for cutting. Make test cuts from wood or plastic. Cut and assemble robot parts for the competition
Programming	Advanced Navigation	<ul style="list-style-type: none"> Learn how robot navigation works. Practice using PedroPathing for robot movement. Test robot movement on the field. Use sensors to help the robot understand its position. Improve accuracy during autonomous runs
CAD	Custom Precision	<ul style="list-style-type: none"> Learn basic CAD tools for robot design. Design simple robot parts. Adjust sizes to fit the robot correctly. Test parts with 3D printing or CNC. Improve designs based on testing
Inspire	Professional Management	<ul style="list-style-type: none"> Assign roles within the team. Plan tasks and deadlines together. Track progress of team activities. Hold short weekly team meetings. Improve teamwork and time management.

KNOWLEDGE TRANSFER

To ensure team sustainability, we implemented a "Legacy.copy" system. During the Post-Season, our senior members act as mentors for 7th-grade students, transitioning from "builders" to "teachers." This hands-on training transfers technical skills and team culture to the next generation, ensuring our team remains strong and competitive every 4 year.

Current Members (10th-11th grade)

Legacy.copy Program



Rookie Students (7th grade)

VIRTUAL AND IN-PERSON MEETINGS

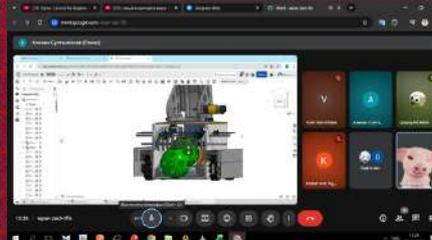
Throughout the season, we held 6 calls with international FTC teams to exchange technical strategies and global best practices. These virtual meetings allowed us to troubleshoot complex mechanisms and refine our engineering approach with teams from different regions.



Homosapiens
Conducted workshops on Outreach strategy, Sponsorship acquisition, and Event management



Broboti
helped us implement HD Mecanum Vectors Intake Wheels and shared expert knowledge on intake vectoring.



Green Arms
Shared with their insight about our Portfolio, robot and this season



Dinonaut, Thailand
Helped with the 360° Shooter and shared with their 3D Cad of it



Merge
Shared with their insight about our Portfolio and Robot



Mid chaotics
Made Special Lecture about Outreach opportunities and how they collaborated with NASA

PROFESSIONAL FEEDBACK 1 (DINONAUT)

Overall, the design demonstrates a solid and well-planned engineering approach and would be rated at approximately 7 out of 10. The intake concept is sound; however, performance could potentially be improved by evaluating the use of a gecko wheel mechanism. With further iteration and the implementation of a properly optimized 3D-printed component, the intake system is expected to operate more effectively.



#27572



#30355

PROFESSIONAL FEEDBACK 2 (BLACK BOX)

The use of additive manufacturing is well justified; however, certain components would benefit from further structural refinement and increased rigidity to improve overall mechanical robustness.

The meetings with key stakeholders and company representatives demonstrate a strong level of initiative, networking skills, and strategic thinking. These interactions resulted in valuable partnerships and laid the foundation for long-term collaboration and project development.

CONNECT BEYOND FTC



To support our FLL Explore team (TechnoArcheos), we met with Professor Ulan Zhangaliyev, archaeologist and discoverer of the 3rd Golden Man. He provided professional insights into archaeological fieldwork, helping our students integrate authentic historical research into their project.



Meeting with Eldar Mamedov, Chairman of the Board of KAZ Minerals Management LLP

PARTNERS & CONTRIBUTORS



KAZMINERALS

Invested 15,386\$ to our School and Team for development



ELDAR MAMEDOV

Chairman of the Management Board of KAZ Minerals Management LLP



ZHANNA ASYLKHANOVA

Vice-president of ABU, shared with our knowledge with her



SHAMSHIYA KAIRBEKOVNA

Principal of IT college, shared with our knowledge with her



ABAY IT VALLEY

Technopark of Semey, helped with organization of 2 Master-Classes



DEPARTMENT OF

EDUCATION OF THE CITY OF SEMEY



SEMEYKORKEM

Invested for our team's pit zones for the last season



ULAN KURMETKALIV

Senior Lecturer, Archaeologist, Department of History and Geography.



ZARINA KUTPANOVA

Organizer of AITU KazRoboDrone 2.0



ESKENDIR BAISEITOV

Full-Stack developer from Shora Inc. Helped us with Tepe-Op code



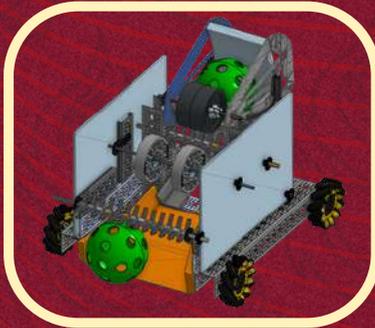
AYAULYM ARGYNGAZINA

Regional Lead of Astana Hub, assists us to improve Outreach in the Abay Region

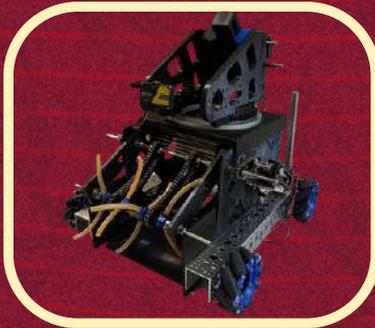


IT STEP ACADEMY

Helped us with development of FTC Courses and Outreach in Abay Region



INFERNO V1

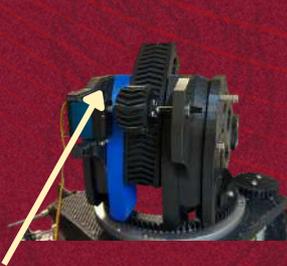


INFERNO V2

THIS SEASON DEVELOPMENT

In the current season, our objective is to develop a universal robot capable of accurately scoring in the **Goal from both launch zones**. To achieve this, we designed and implemented a shooting mechanism based on a **3D-printed shooter** with an adjustable projectile launch angle.

To improve targeting accuracy, a HuskyLens camera is used for **AprilTag detection and tracking**, enabling automatic adjustment of the robot's positioning and shooting parameters.



Adjustable 3D-Printed Shooter Angle Mechanism

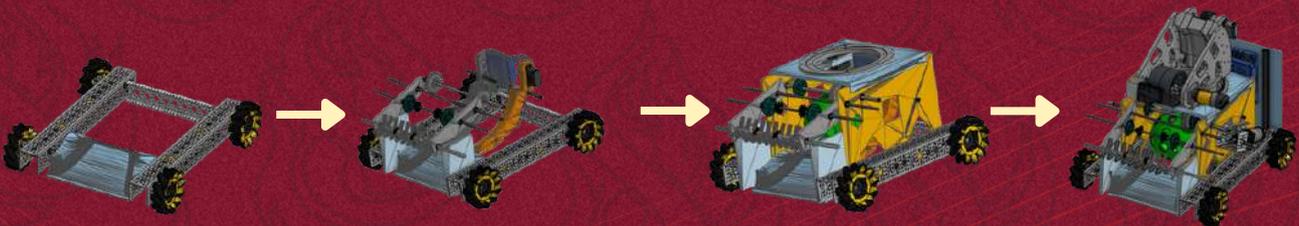


HuskyLens Vision System for AprilTag Detection

CADING PHYLOSOPHY

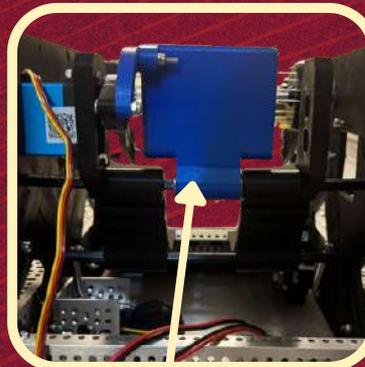
Our team uses a structured design process focused on virtual modeling and simulation to validate designs before manufacturing. Most iterations are completed in CAD, allowing faster development and reduced costs through rapid iteration and early failure.

Pre-Stages Robot Evolution

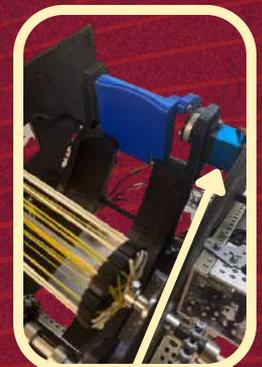


Ramp System

In the Inferno1 robot, artifact collection issues occurred in nearly **32% of attempts**, with artifacts being ejected or causing motor stalls. To address this, we implemented **3D-printed ramps** that guide artifacts into the mechanism one at a time, preventing interference with the motors. Above the ramps, a **servo-driven lift mechanism** raises the ramp to deliver artifacts to the shooter, preventing premature drops and avoiding collisions with other game elements.

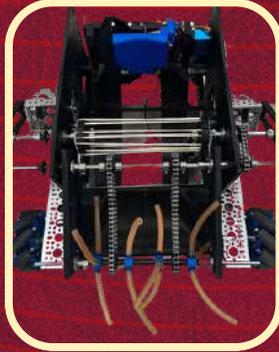
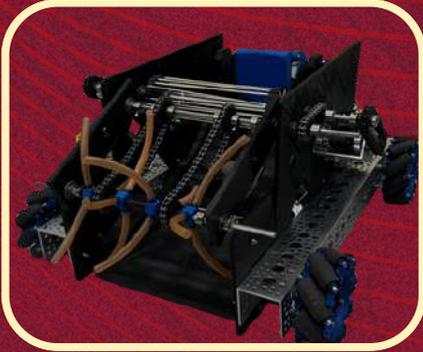


3D-Printed Artifact Ramp

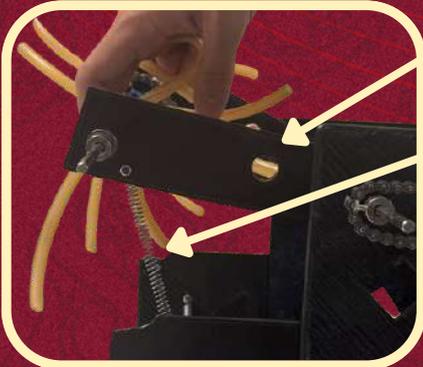


Servo-Driven Ramp Lift

In-Take System



The intake mechanism is mounted to the robot using a **custom 3D-printed component** that provides a lifting motion during artifact acquisition. This design improvement **increased the artifact capture efficiency by 20%**.



3D-Printed Mounting Bracket

Intake Stabilizing Spring

In approximately 20% of capture attempts, the intake mechanism experienced **unintended rotation** during artifact acquisition. To address this issue, we implemented a **passive spring-based solution** that restores the intake to its nominal position, thereby ensuring stable operation during capture.

Out-Take System

To improve artifact shooting efficiency, we developed a **3D-based shooter** capable of tracking AprilTags during matches and rotating up to 270 degrees around the target. For tracking, we utilized a GoBilda HuskyLens camera in combination with a tag recognition system.

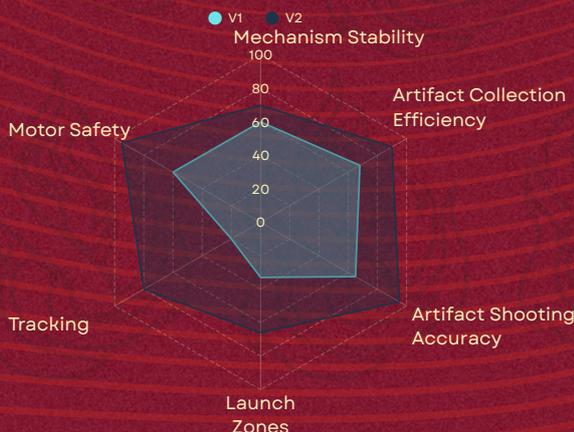


270 degree Servo-Tracked Shooter

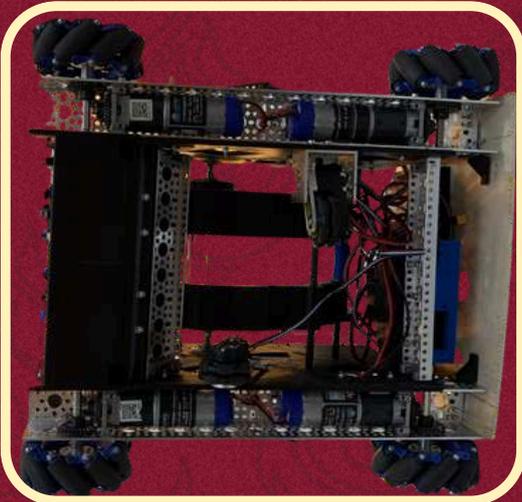
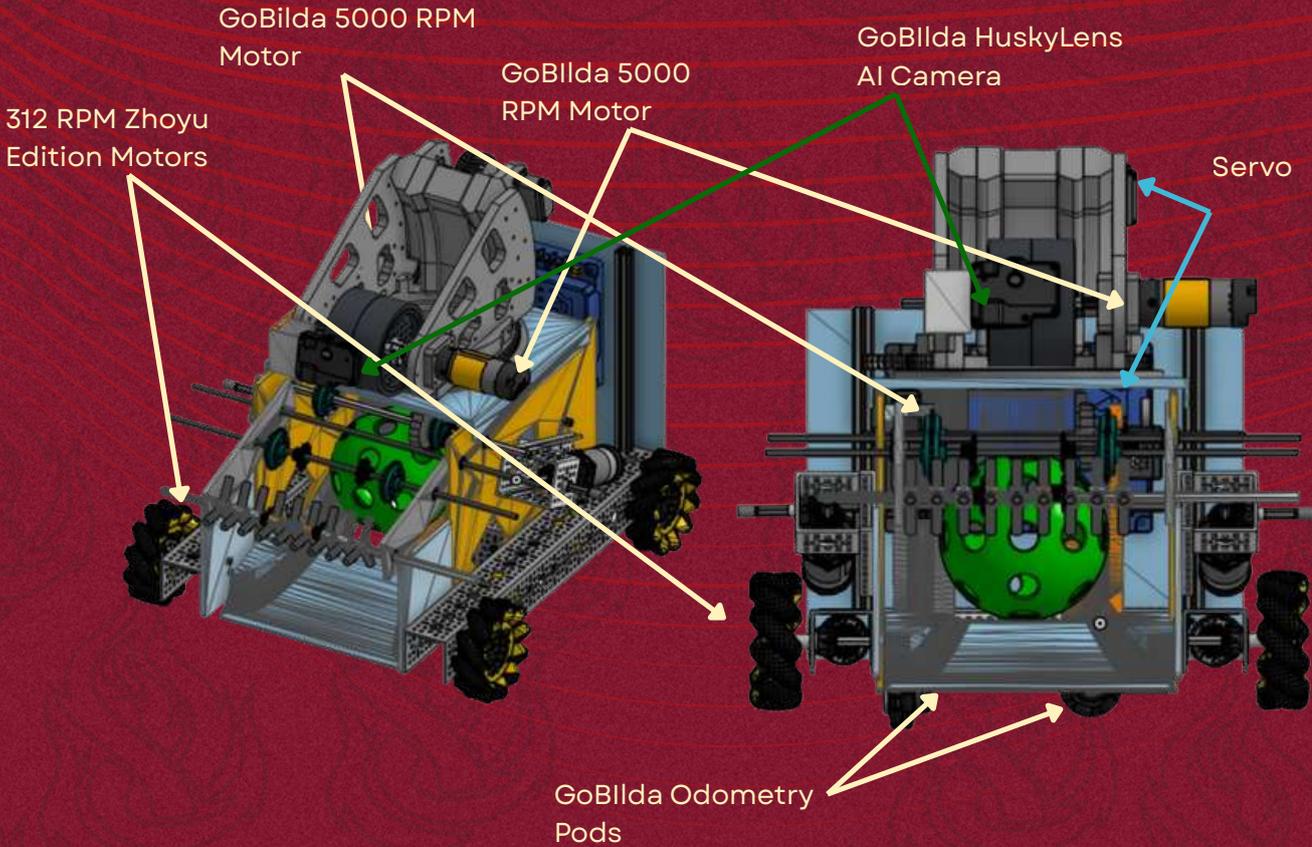


Long-Range Shooter System

To make our robot versatile across different matches, we designed a **dual-system shooter** for both long and short launch zones. This was achieved using a servo-driven gear that adjusts the shooting angle based on the selected launch zone.



The new robot improves on Inferno1 in artifact handling, shooting accuracy, and versatility. Features like 3D-printed ramps, a servo-driven lift, stabilizing springs, and a dual-system 3D shooter with HuskyLens tracking **enhance reliability and performance** across all launch zones.



Chasis Base

- Custom 3D-printed base for optimized weight distribution.
- Full barrier clearance for all mechanisms.
- Free speed 1.67 m/s; match speed 1.42 m/s.
- Two odometry pods for precise position tracking.
- Mecanum wheels enable omnidirectional movement for high agility.
- Reinforced frame ensures rigidity while maintaining low weight.

In-take & Out-take system

- Intake System
- Three-stage intake: octopus-tentacle, chain-driven, and rubber-band on sprockets.
- 2 × Rev HD Hex Motors (5:1) provide speed and torque.
- Outtake & Shooter
- 270° AprilTag tracking on bearings.
- Adjustable-angle shooter powered by 5000 RPM GoBilda motors.



TeleOp

TeleOp control is a critical component of robot programming, as driver-operated control enables precise manipulation of the robot and maximizes scoring potential during matches.

gamepad 1

gamepad 2

LB: intake backward

RB: intake backward

LT: ramp open
LB: outtake backward

RT: ramp close
RB: outtake forward



Up: drive backward
down: drive forward
right: strafe left
left: strafe right

right: turn left
left: turn right

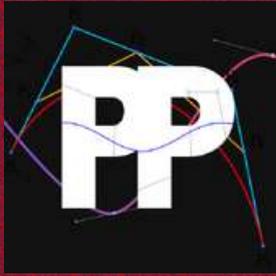
Up: hood up
down: hood down

right: turn right
shooter
left: turn left
shooter

During TeleOp, the shooter automatically tracks AprilTags and adjusts its position in response to target movement. In the event of tracking errors or misalignment from the HuskyLens camera, a second driver can manually control the shooter to correct the camera-based targeting and maintain accuracy.

The hood mechanism provides automatic angular adjustment of the shooter by modifying the outtake angle. This enables accurate scoring from the far launch zone by dynamically adapting the shooter angle during TeleOp operation.

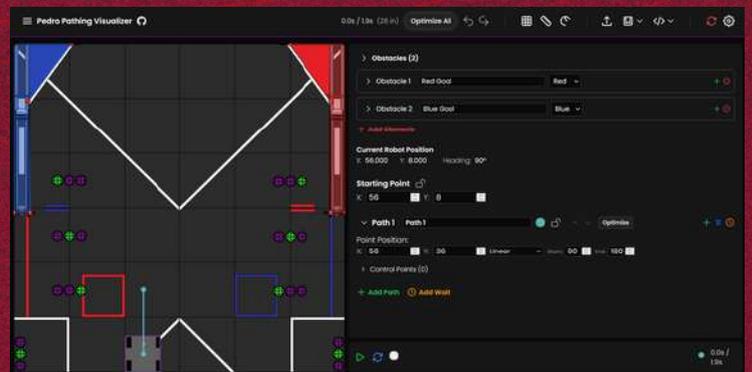
Pedrothing



We utilize PedroPathing for robot programming due to its superior flexibility compared to other FTC libraries. This system accurately corrects the robot's position and orientation, compensating for external disturbances while maintaining the intended trajectory. Additionally, PedroPathing handles curved paths more effectively by applying centripetal force corrections, ensuring smooth and precise navigation along complex trajectories.

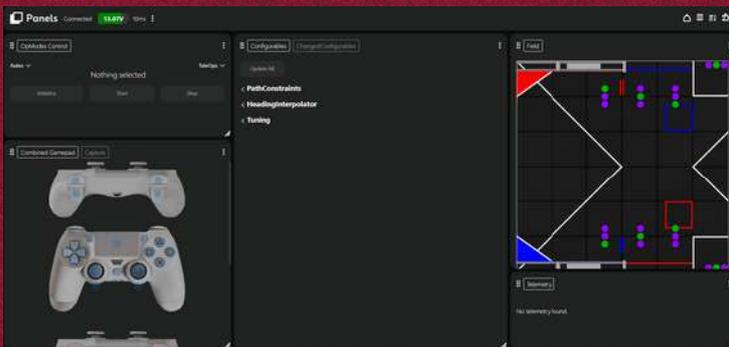
Pedrothing visualizer

The PedroPathing Visualizer provides a structured and user-friendly environment for designing robot paths and automatically generating code compatible with PedroPathing. This approach reduces manual coding effort and allows the team to focus more on higher-level programming tasks and multitasking during development.



Dashboard "Panels"

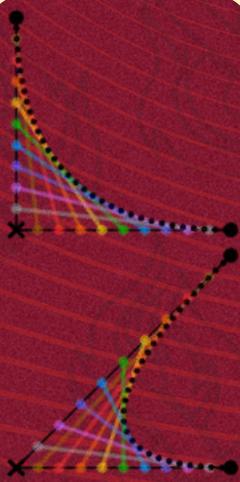
The Dashboard "Panels" enables real-time parameter tuning, live visualization of the robot on the field, and real-time logging and graphing of robot state data. This tool improves debugging efficiency and supports rapid performance optimization during development and matches.



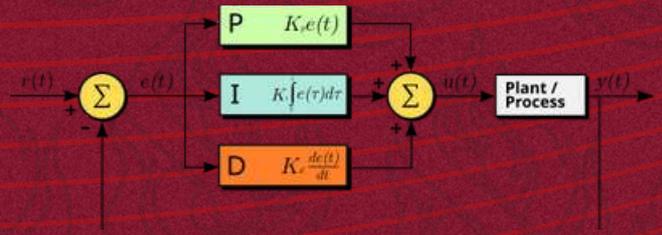
Bézier curve

Bézier curves form the foundation of our robot's path planning. We use them to navigate along curved trajectories, enabling the most efficient routes during autonomous operation and improving overall performance on the field.

$$B(t) = P_0 + t(P_1 - P_0) = (1 - t)P_0 + tP_1, 0 \leq t \leq 1$$



PIDF



We implement PIDF control to regulate both our shooter mechanism and the dynamic speed of the robot. This allows precise adjustment of motion and shooting parameters, maximizing efficiency and responsiveness during matches.

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau) d\tau + K_d \frac{de(t)}{dt}$$

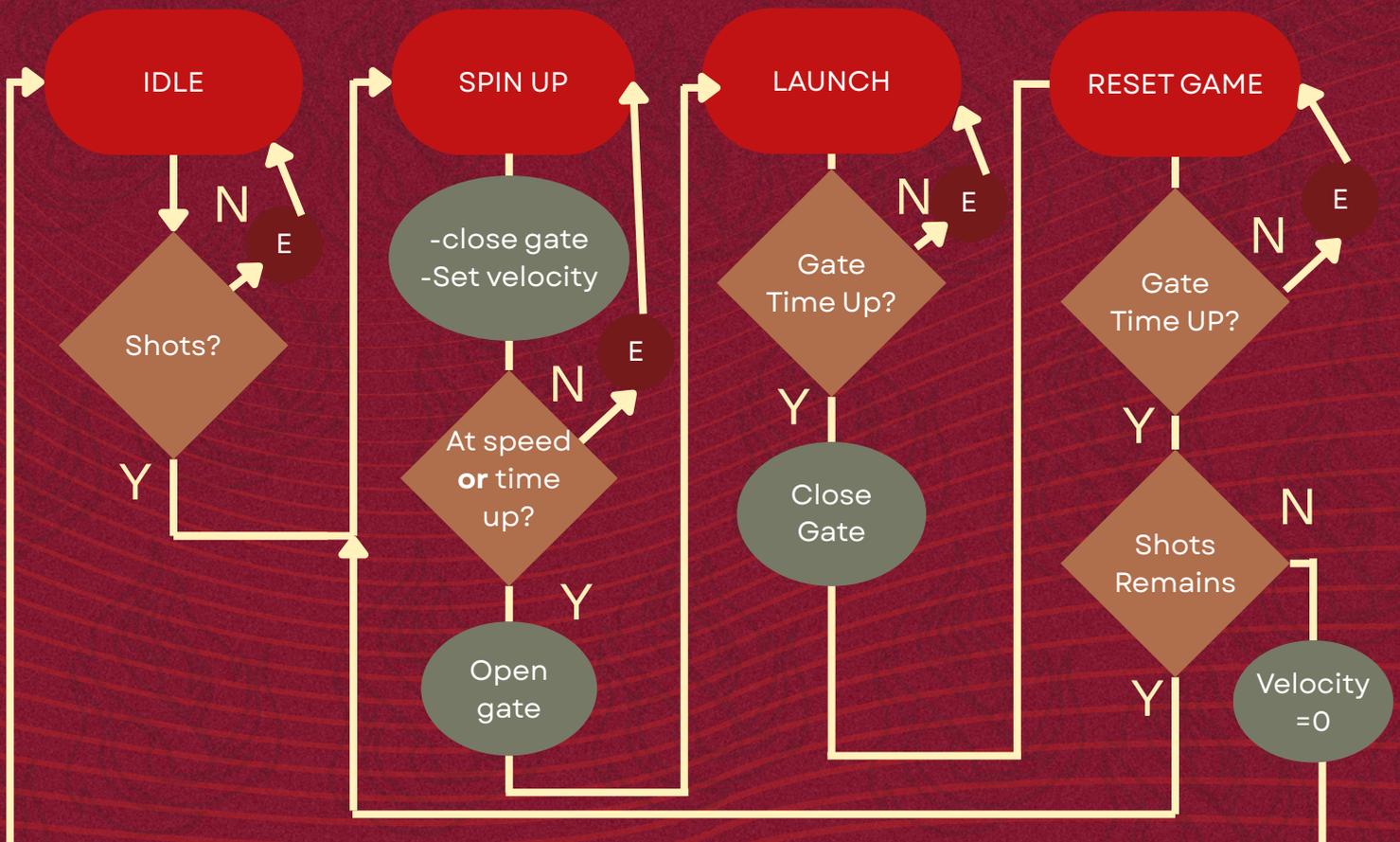


Machine Vision

The HuskyLens camera is used for AprilTag detection and tracking, enabling faster target acquisition and improved shooting accuracy. This machine vision system reduces alignment time and increases scoring efficiency during matches.

Multitask

A multitasking framework is used during autonomous operation to execute multiple actions concurrently. This approach improves efficiency and reduces cycle time, enabling the robot to score more points within the autonomous period.



Core Concept and Identity

InfernoX is a robot designed by Team InfernoX, inspired by the element of fire. Fire represents energy, speed, and adaptability—core values reflected in both our design and competition strategy. Our goal was to create a robot where engineering, aesthetics, and functionality form a unified system.



Elegance, Efficiency, and Maintainability

InfernoX features a simple and efficient modular design. Key components are easily accessible, allowing for fast maintenance and repairs between matches. A reduced number of unique parts improves reliability and minimizes downtime during competition.

Holistic Engineering Design

Design was treated as part of the engineering process. Mechanical, electrical, software, and visual elements were developed together, making the entire robot worthy of recognition rather than a single component.



Inspiration and Design Basis

InfernoX is inspired by the fire element and the character Amber from Pixar's Elemental. This inspiration conveys motion, personality, and intensity, while the fire background represents the environment in which the robot performs confidently.