CROWN
#26438

THE
ENGINEERING
PORTFOLIO

CROWN

#26438

2024-2025

بنـك أبـوظبـي الأول
FAB
First Abu Dhabi Bank

KLARFLO

S&B
SIGHT BEYOND

FADED REALITY
STUDIOS

INTRODUCTION

PAST EXPERIENCES OF PREVIOUS MEMBERS:

- *First Lego League (FLL),*
- *First Tech Challenge (FTC),*
- *World Robotics Olympiad (WRO) ,*
- *F1 in schools,*
- *Independent engineering projects.*

Crown is a fully **student-led team**, built on *collaboration, determination, and a passion for robotics*. While we take pride in our independence, we *recognize* that our journey would not be possible without the incredible **support** from our *sponsors, mentors, and community*.

In addition, we would like to thank our **families, teachers**, and the **broader robotics community** for their encouragement and guidance. While we may not have formal mentors, we deeply appreciate the knowledge we've gained from past experiences, fellow teams, and the FTC community.

ABOUT US

Crown is a newly formed *First Tech Challenge team,* founded in 2024 by a group of passionate students eager to explore the world of competitive robotics.

We extend our sincere gratitude to **S&B, Klarflo, Faded Reality Studios, and FAB** for their generous sponsorship. Their support has provided us with essential resources, including (but not limited to) robot components, competition fees, and tools necessary for our engineering and development efforts. Without their contributions, we wouldn't be able to pursue our vision of building a competitive and innovative robot.

Goals for the season

The primary goal is to *design, construct, and program a robot* that excels in **both autonomous and tele-operated phases**. By focusing on CAD modeling, efficient mechanical structures, and optimized software, the team aims to create a **robust and adaptable robot.**

We focused on strategic planning, refining scouting and analysis for better competition decisions. As a rookie team, drivers aim to develop strong driving skills and troubleshooting abilities for consistency. The team is dedicated to **community outreach and STEM advocacy**, mentoring students and partnering with local schools and sponsors. Through collaboration and innovation, Crown aims to **leave a lasting impact** in its first FTC season, focusing on learning and building a strong foundation for future success.

MEET THE TEAM:

Krishanth is the **Captain** of the team, leading with **vision** and **strategy**. He is also a **skilled Driver**, *operating the robot during matches*. As a **Programmer**, he *develops and optimizes the robot's software*. Additionally, he contributes to *robot design* as a **CAD Designer**. He **overlooks** all the work and ensures that the work done is of the finest, best quality!

KRISHANTH

THE GENERAL

Leads the team, strategizes, and operates the robot, ensuring everything runs smoothly.

THE DIGITAL ENGRAVER

Oversees software development and plans match strategies.

PRERIT

Prerit is the **Lead Programmer**, *overseeing all aspects of the robot's software development*. He also contributes as a CAD Designer, helping visualize and design robot components. As the **Sponsorship Lead**, he develops immaculate presentations which, coupled with his penchant for waffling, allow the team to accrue the necessary to funds to operate in its rookie year.

Dhairya excels as a **Mechanical Engineer**, focusing on the *robot's physical structure and mechanisms*. He also contributes as a **CAD Designe**r, creating precise designs for the robot's components. His dual expertise ensures seamless collaboration between design and construction. Dhairya's work ensures the robot is both efficient and competition-ready.

DHAIRYA

THE KNIGHT

Turns logic into action. Powers autonomous, sensors, and flawless control.

THE BLACKSMITH

Designs and builds the robot's physical structure for efficiency and durability.

ANDREW

Andrew is a talented **Programmer**, contributing to the *robot's autonomous and tele-operated functionality*. He also manages **Social Media and Outreach,** *promoting the team and engaging the community*. In addtition he serves as a **Robot Tester**, *identifying and resolving performance issues*. Andrew is vital in showcasing the team's progress and achievements.

Srinjay is a **Programmer** who focuses on *developing and debugging robot software*. He also works as a **Mechanical Engineer,** ensuring *the robot's design is functional and robust*. Srinjay's contributions ensure the robot operates smoothly in all scenarios.

SRINJAY

THE CRAFTSMAN

Designs and builds the robot's physical structure for efficiency and durability.

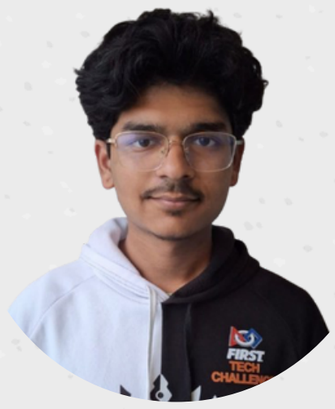
THE SHIELD

Protects the team's strength, ensuring the robot's hardware is solid and reliable & operates the robot.

SIDDARTHA

Siddartha plays a key role as a **Driver**, ensuring precise robot control during matches. He specializes in **Electrical and Hardware systems**, focusing on wiring and hardware integration. His technical expertise keeps the robot functioning reliably. He is instrumental in solving on-field technical challenges.

Shaurya specializes in **Electrical and Hardware systems**, working on wiring and hardware integration. He also takes on a leadership role in **Strategy and Scouting,** analyzing competitors and devising match plans. His technical and strategic skills make him a versatile team member. Shaurya ensures both hardware reliability and competitive advantage.



SHAURYA

THE GUARD

Keeps the robot's systems running and studies opponents' moves.

THE ARMORER

Ensures the robot is battle-ready and performs at its best.

VISHAK

Vishak is a dedicated **Mechanical Engineer,** focusing on building and refining the robot's physical components. He also serves as a Robot **Tester,** ensuring the robot performs consistently under various conditions. His attention to detail ensures mechanical reliability. Vishak's contributions are essential to the team's technical success.

Nathan, when not iterating on the next intake or outtake design with the rest of the hardware team, is busy setting up Instagram lives and brainstorming brand new reel ideas. As the sole TikTok user on the team, his experience makes him an unparalleled asset when it comes to going viral on **Social Media.**

NATHANAEL

THE SENTINAL

Documents the team's journey while maintaining the robot's electronics.

THE STRATEGIST

Plans the team's next moves and records their achievements.

GOKUL

Gokul is the **Team Notebook Manager,** responsible for documenting the team's journey and achievements. He also takes on a key role in **Strategy**, analyzing game rules and developing match plans. His dual focus strengthens both team organization and competitive edge. Gokul's work ensures the team is prepared both on and off the field.

Name	Programming	CAD	Engineering	Strategy and Scouting	Social Media and Outreach	Sponsorship	Notebook	Driving
Krishanth	Proficient	Proficient	Assisted	Primary	Assisted			Primary
Prerit	Primary	Proficient	Assisted			Primary		
Srinjay	Proficient		Proficient	Assisted				
Dhairya		Proficient	Primary			Primary		
Andrew	Proficient	Assisted	Assisted		Primary		Primary	Assisted
Siddartha		Assisted	Primary		Assisted			Primary
Shaurya			Primary	Primary				
Vishak			Primary					Assisted
Gokul				Primary			Primary	
Nathanael		Assisted	Proficient		Primary			Assisted

IMPACT

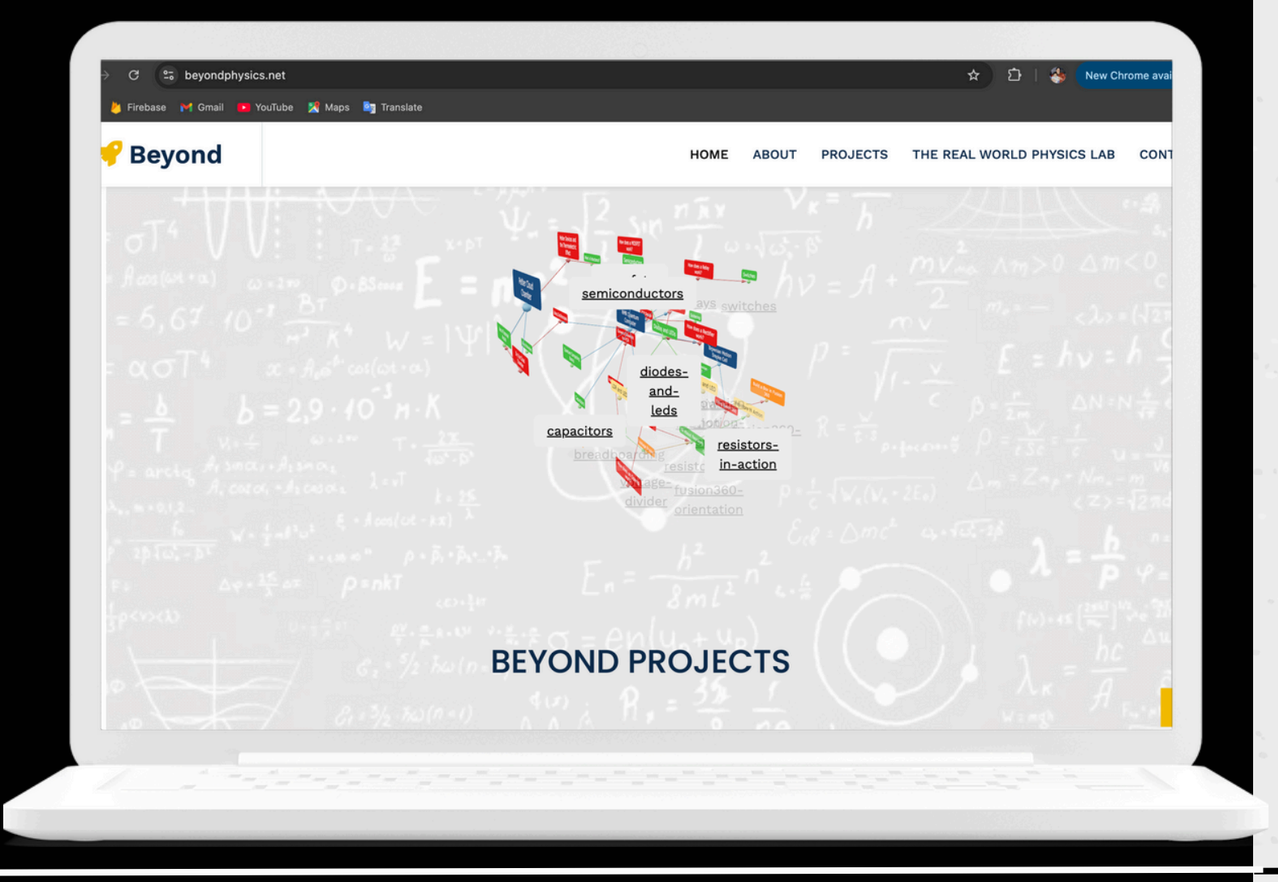
SUSTAINABILITY PLAN

Our sustainability plan for FTC Crown focuses on long-term success through strategic recruitment and mentorship. To attract new members, we scour hold recruitment drives at school events, offer an application process, and provide training sessions led by experienced mentors.

By engaging with corporate sponsors, school faculty, and students passionate about STEM we spread awareness, Additionally, we maximize resource efficiency by reusing materials, such as screws and components, from previous FTC competitions, thanks to our experienced team members.

COMMUNITY OUTREACH

BEYOND PHYSICS



Beyond Physics is a platform designed to inspire innovation through hands-on physics projects. It goes beyond typical experiments, encouraging creativity and deeper STEM exploration. https://beyondphysics.net

Stats:

10k+ active users from 46 countries

15+ videos and simulations

NMR Quantum Computer, Peltier Chamber

OUTREACH OUTSIDE SCHOOL

Beyond our school outreach, we took our robot to a mall, walking around with it to capture attention and spark curiosity among young STEM enthusiasts. This hands-on initiative allowed us to engage with the public, answer questions, and inspire children to explore robotics and technology in an interactive way.

beyondphysics.net

ENGAGEMENT

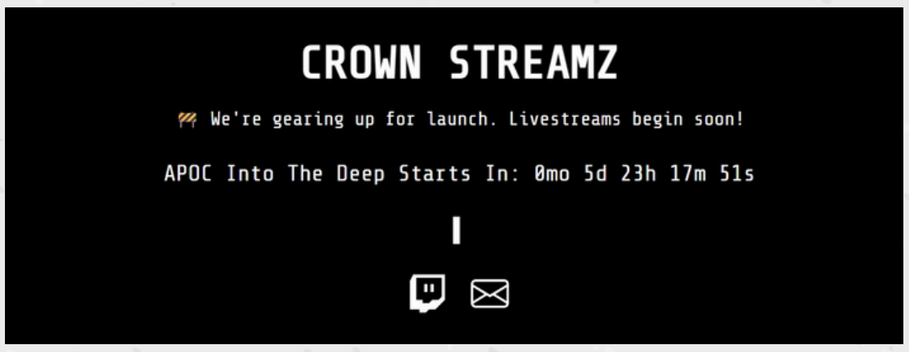
CROWN FTC has been actively involved in various outreach initiatives, starting with community engagement **within their school.** Through these efforts, we have been able to share their knowledge, inspire younger students, and generate interest in robotics and technology. Their work has also been displayed, allowing more people to witness their progress and innovation.

Additionally, the team has showcased their work at **ExoMath,** focused on mathematical and technological advancements. This platform enabled us to highlight their problem-solving skills, creativity, and engineering expertise, reinforcing our impact in the academic community.

THE DIGITAL ERROR

The Digital Error captures, edits, and shares CROWN's journey — managing media, filming matches, and shaping our story online.

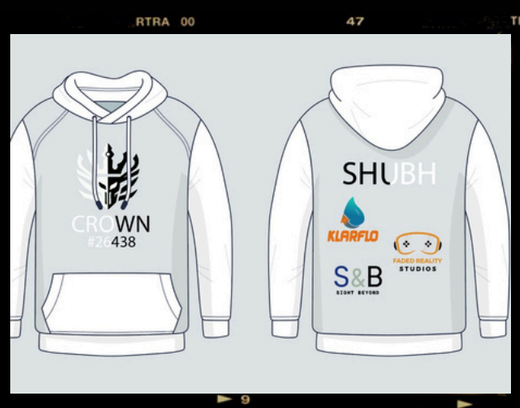
Collaboration has played a key role in our journey, as we worked with **DPSD Vocals,** a student-led podcast, to spread awareness about robotics and STEM. We organized an outreach event impacting over 300 students, showcasing our robot's capabilities through live demonstrations. Team members mentored and guided students in engineering, design, and coding, fostering interest in robotics and encouraging future involvement in STEM fields.



Looking ahead, we presented our robot at AI Week, in Dubai taking place from 21st to 25th April, 2025. This event was a significant opportunity for us to showcase the robot in front of a large audience and expand our outreach further. Through these experiences, the team continues to strengthen its presence in the STEM field while inspiring the next generation of innovators.

SPONSORSHIPS

THE ARMOURY



DEVELOPMENT

HOODIES

The hoodies unify the team and showcase sponsors. Designed for their comfort and durability, they promote both team identity and sponsor visibility at events.

BANDS

The wristbands represent team unity and sponsor support. Featuring the team logo , they offer comfort and visibility outside events.

PINS

The pins showcase team spirit and sponsor support. With the team logo , they provide a compact and visible way to promote both the team.

PARTNERS AND FUNDRAISING

Dhairya Maheshwari

Request for Sponsorship: CROWN FTC Robotics Team

I hope this message finds you well. We are **CROWN FTC**, a dedicated and competitive FIRST Tech Challenge (FTC) robotics team. We are reaching out to you in hopes of forming a sponsorship partnership that will mutually benefit both your company and our team.

We believe that we share values of innovation and community impact, and would be an ideal partner in supporting our mission. Sponsorship would not only provide vital financial support for our team but also offer your company significant visibility at local and national FTC events, where we showcase your brand to a wide audience of students, professionals, and tech enthusiasts. Additionally, your sponsorship will be featured prominently on our team merchandise, including hoodies, wristbands, and magnets, which will further amplify your exposure.

Enclosed with this email is a detailed sponsorship proposal outlining the different levels of sponsorship and the associated benefits for your company. We would be honored to have you as a sponsor and partner in our journey toward success.

Thank you for considering this opportunity to support the future of robotics and innovation. We would be happy to discuss this in further detail at your convenience. Please feel free to contact us through this number: +971505141693 or via email.

Looking forward to your positive response.

Warm regards,
CROWN FTC Robotics Team
DETAILED SPONSORSHIP PROPOSAL

SPONSORSHIPS AND ADDED BENIFITS

The Royal Crown Sponsor
(Gold Level)
Contribution: $7000+
Target Audience: High-Profile Major Brands
Benefits:
Exclusive Branding, Event Exposure, Social Media & Marketing, Custom Merchandise

The Noble Scepter Sponsor
(Silver Level)
Contribution: $1000
Target Audience: Established Brands
Benefits:
Prominent Branding, Social Media, Selective Event Exposure, Custom Merchandise

The Loyal Herald Sponsor
(Bronze Level)
Contribution: $300
Target Audience: Local Businesses, Emerging Brands
Benefits:
Branding Exposure, Marketing Merchandise Exposure

FAB

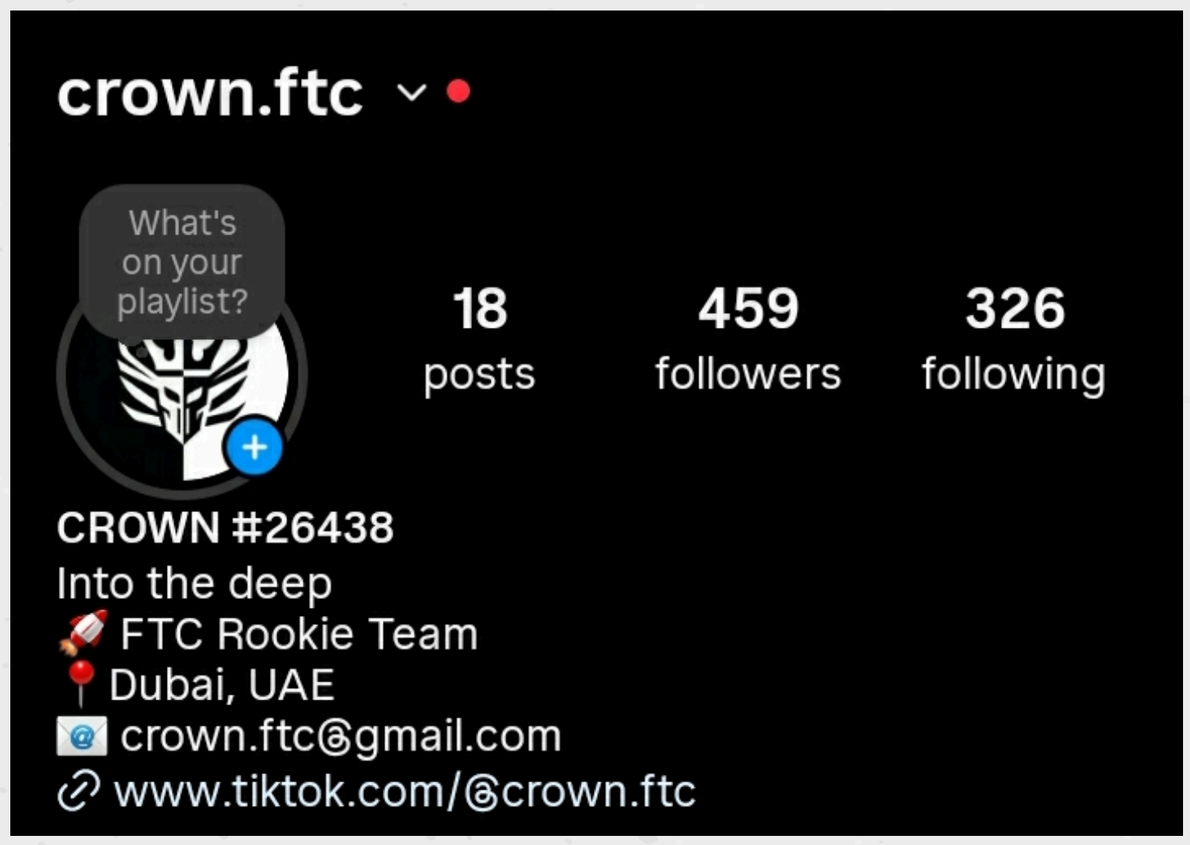
KLARFLO S&B SIGHT BEYOND

FADED REALITY

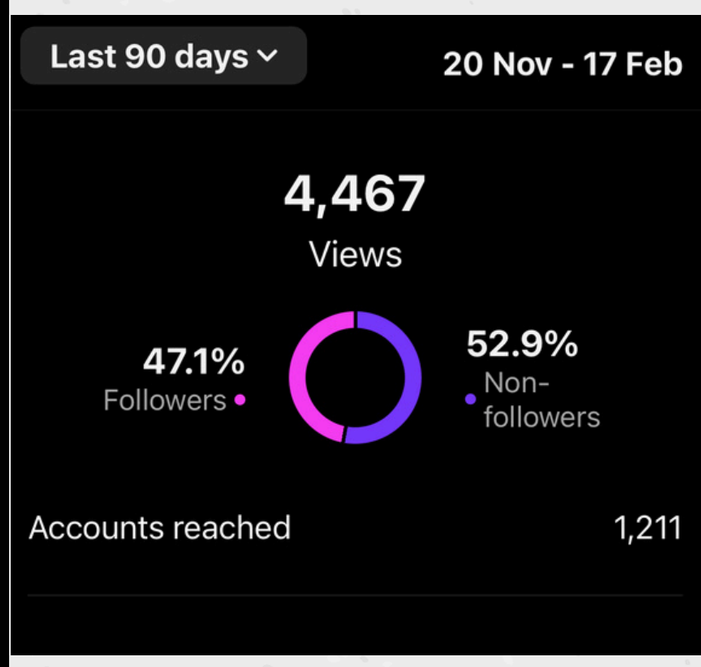
SOCIAL MEDIA INFLUENCE

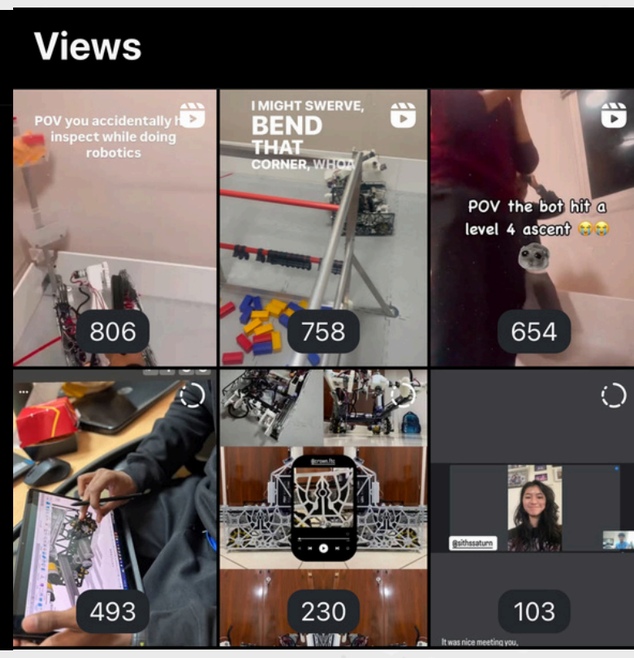
LinkedIn helps us to connect with professionals, sponsors, and the tech community, sharing team accomplishments and promoting STEM education.

LINKEDIN

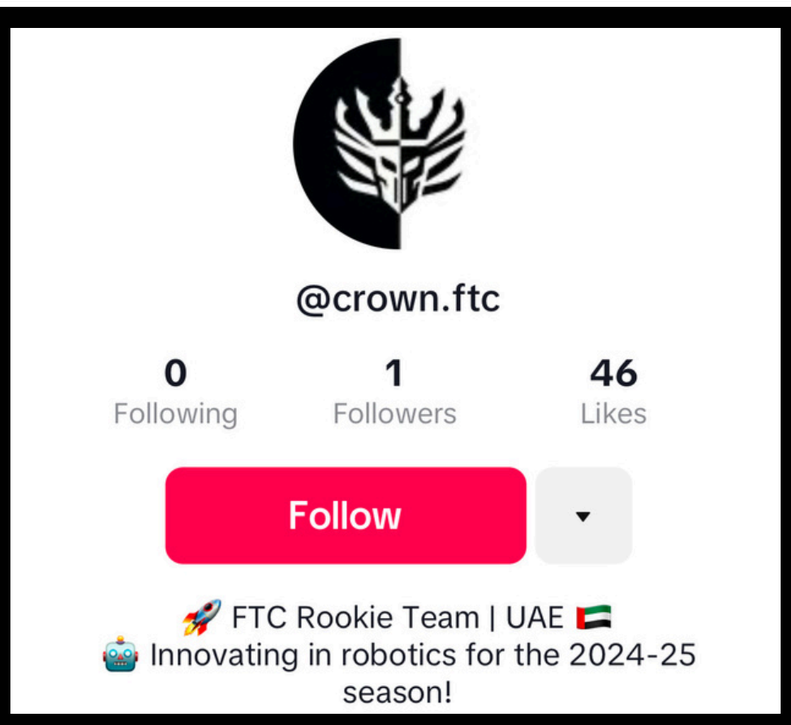


INSTAGRAM (@crown.ftc)





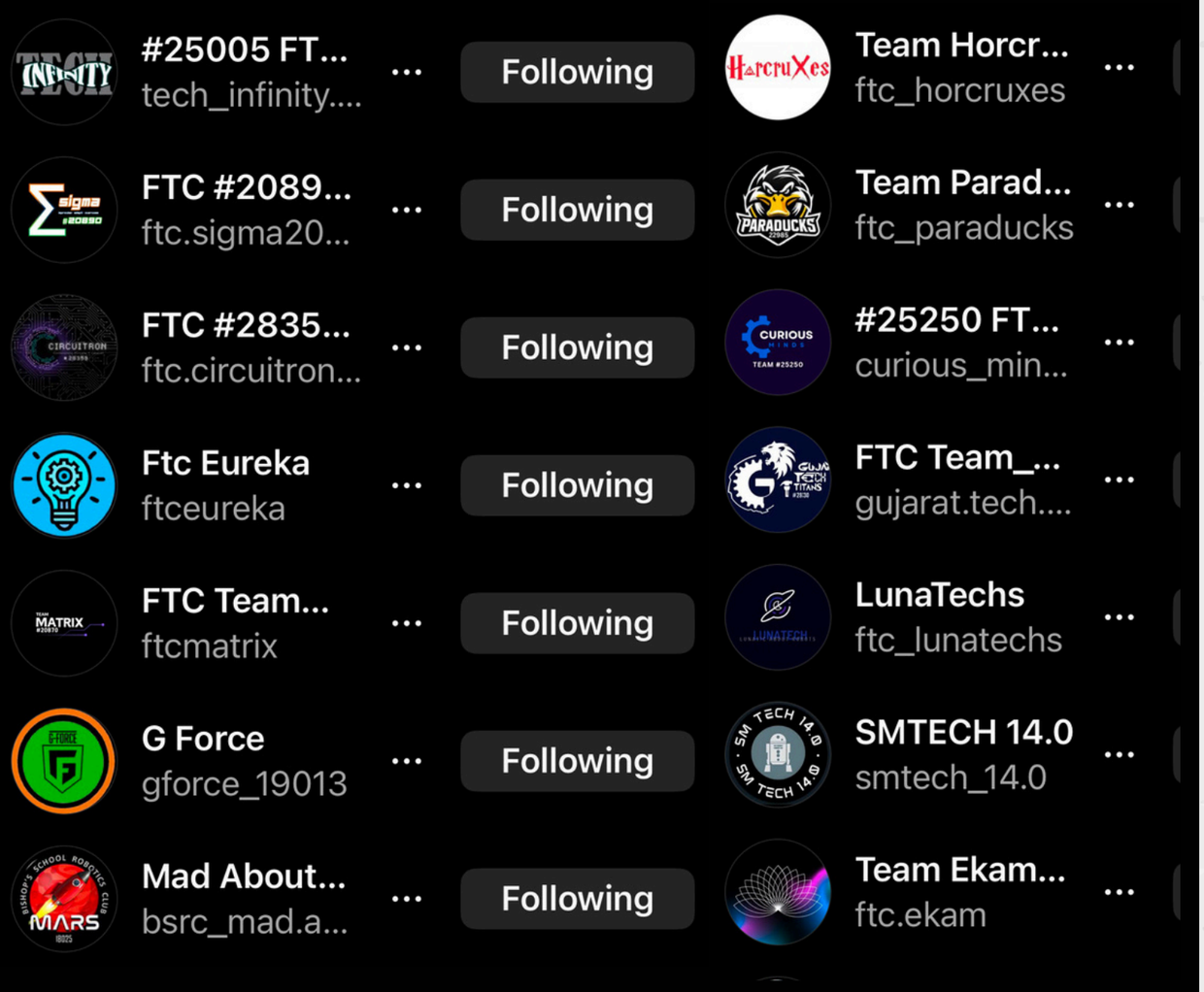
Instagram is key for the share team updates, achievements, and engage with the robotics community. It boosts team visibility and promotes STEM education through visual content.



TIKTOK

TikTok allows us to showcase dynamic team moments, behind-the-scenes content, and exciting robot highlights, engaging a younger audience with creative videos.

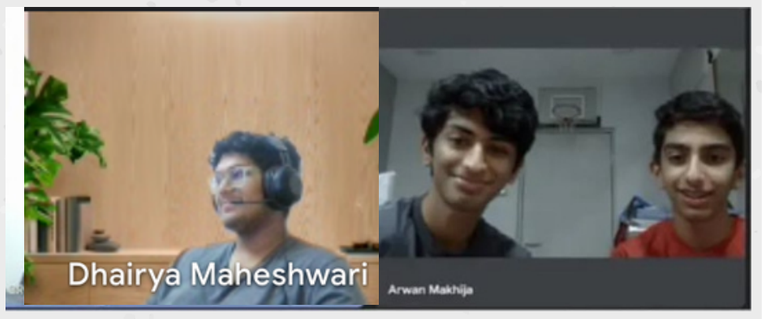
NETWORKING



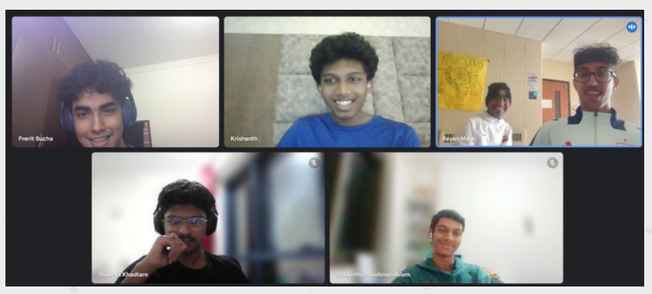
We connected with FTC teams in India through dedicated group chats. Additionally, we followed their social media pages to stay updated and strengthen our network.

COLLABORATIONS

U-FORCE

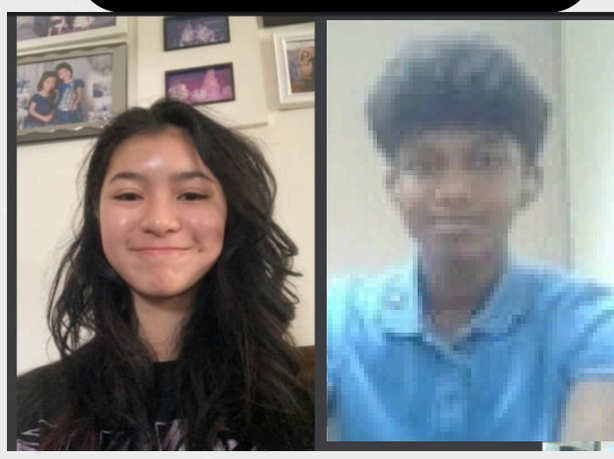


G-FORCE



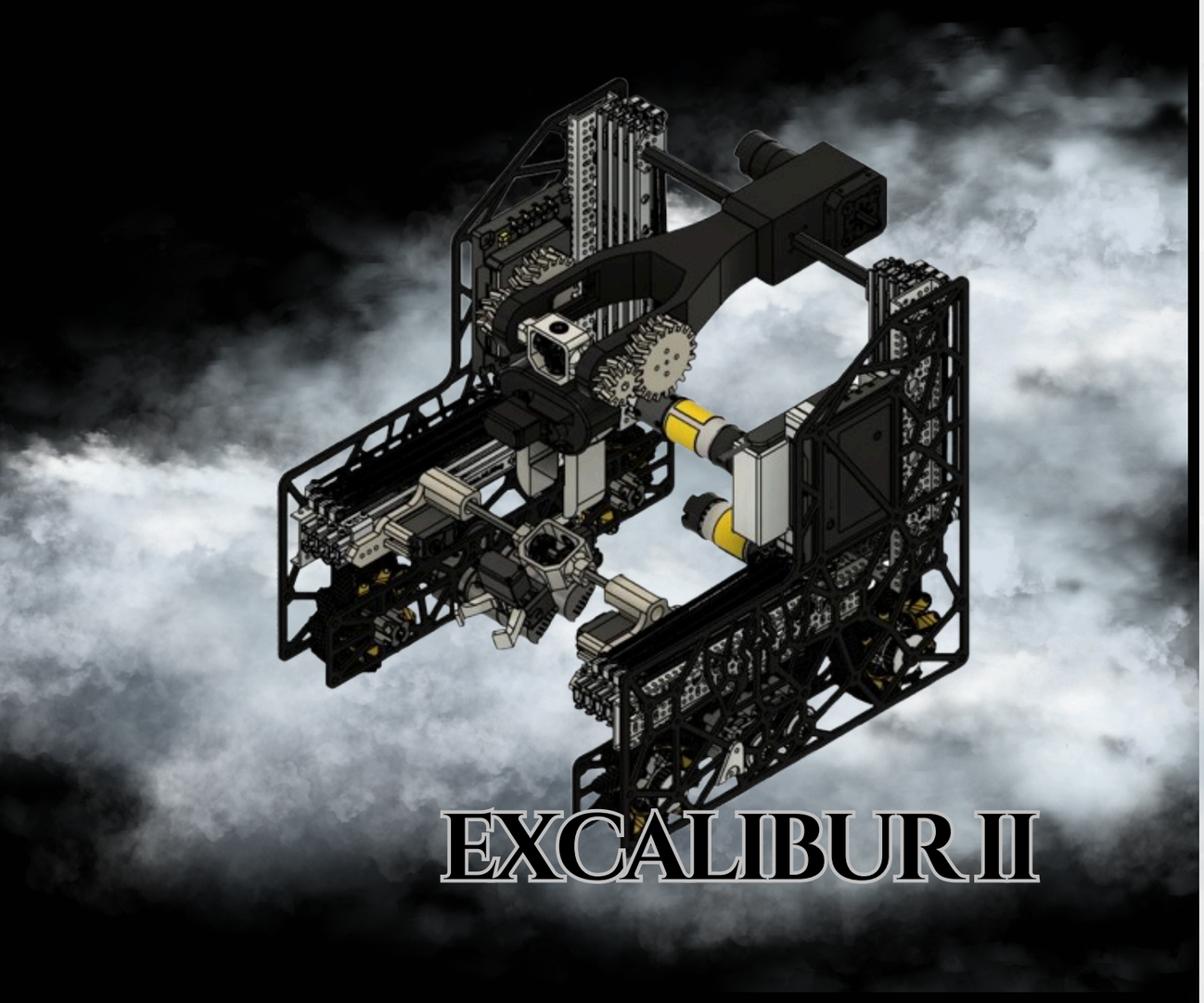
HAZMAT

We collaborated with select FTC teams by joining Google Meet sessions to discuss strategies, share insights, and refine our approaches. These meetings helped build strong connections and enhance teamwork across regions.



SITHS SATURN

BLUEPRINT



Mobility & Drivetrain:
Should we use mecanum wheels for omnidirectional movement or prioritize simplicity and traction with a tank drive?

Intake & Outtake Mechanism
How do we ensure quick and precise object collection and placement?

Arm & Lift Mechanisms
What's the most effective way to extend our reach while maintaining balance and speed?

Weight Optimization:
How do we keep the robot lightweight while ensuring durability?

③ 2D SKETCHING & INITIAL PROTOTYPING

Once we finalize the core objectives, we created rough 2D sketches to visualize different design possibilities. These sketches help us evaluate the feasibility, movement, and component placement before transitioning into CAD modeling.

ENGINEERING PROCESS

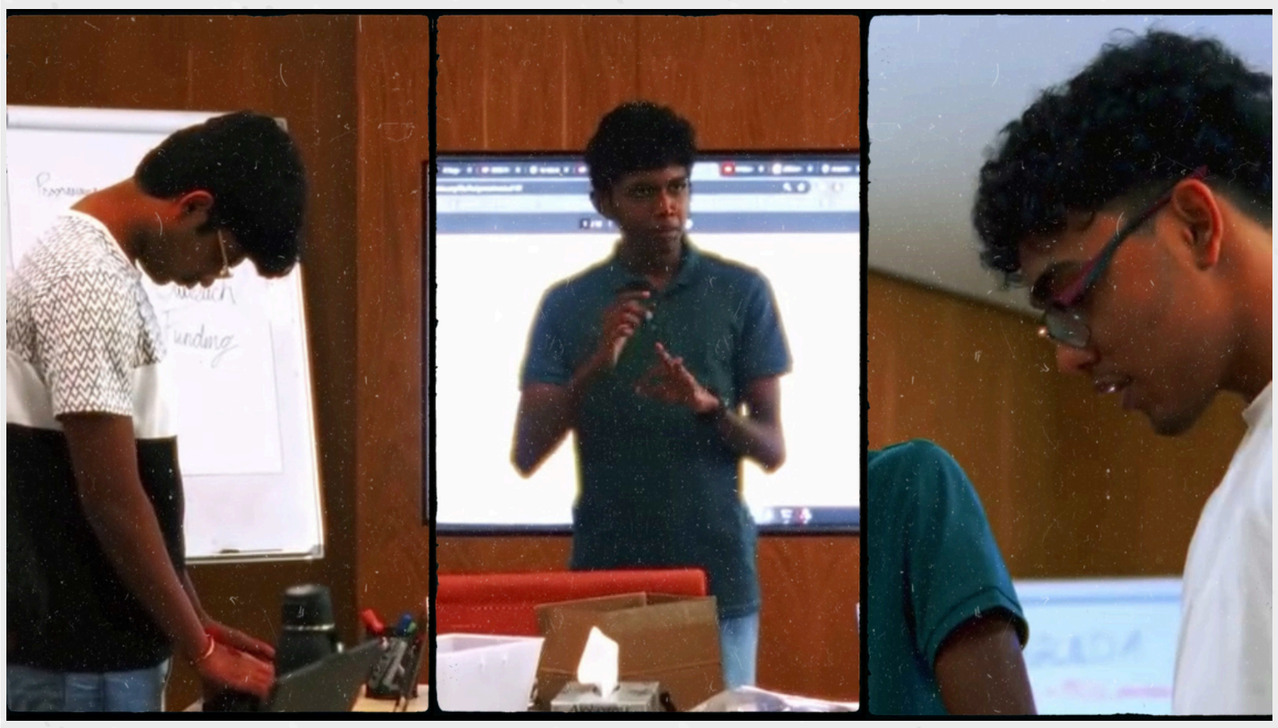
THE ROYAL VISION

① DESIGN PROCESS

The design phase is where we brainstormed and conceptualized our robot, considering various factors such as game strategy, *weight distribution, efficiency, and control.*

② UNDERSTANDING THE CHALLENGE

Before jumping into designing, we thoroughly analyzed the challenge, identifying key game elements, *scoring opportunities, and potential obstacles.* We discussed various robot functionalities and establish key priorities:



BRAINSTORMING MEETING #1

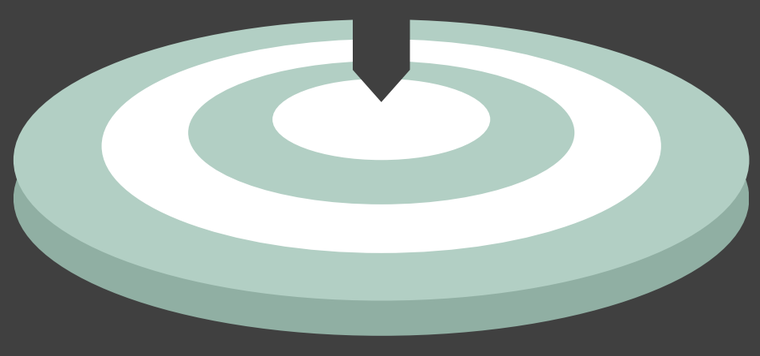
④ EVALUATING & SELECTING A DESIGN

- Functionality
- Simplicity and robustness
- Size constraints
- Scalability

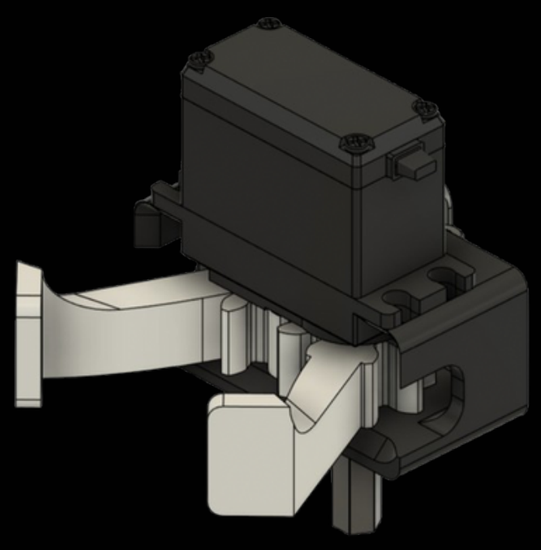
THE FOUNDRY

PROCESSES

- Component Breakdown — 01
- Iterative CAD Refinements — 02
- Fabrication (3D printing) — 03
- Laser Cutting & Machining — 04
- Assembly — 05

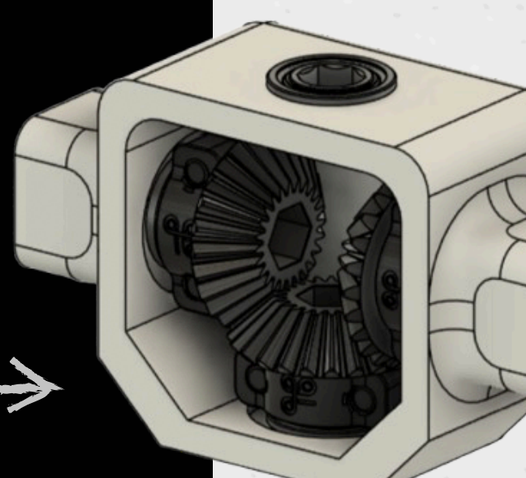


V2 Final:- Outside grab mechanism.
Pros: Simple and reliable design



V2-FINAL

Differential Module
Designed for 2-axis rotation for both the intake & outtake.
Pros: 2x Torque, Modular design



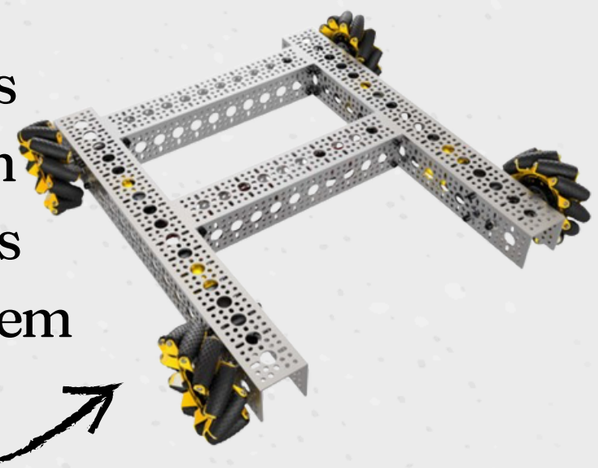
CAD PROCESS

We use Fusion 360 & Onshape for all our CAD modeling, enabling us to create detailed 3D models, simulate movements, and test clearances before fabrication.

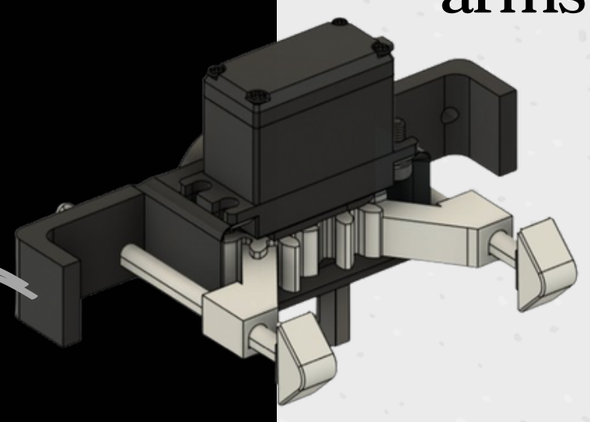
We broke the robot into key subsystems, modelling each separately:

01 Chassis & Drivetrain:
Base frame, motor mounts, wheel placements

Drive Train: Used goBilda's Strafer Chassis with 104mm GripForce mecanum wheels
Served as a base for subsystem development



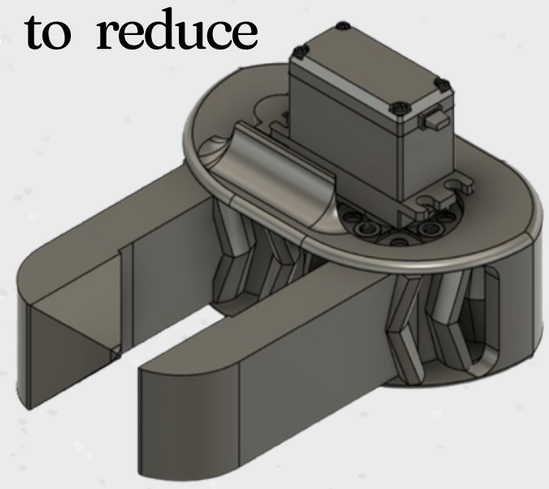
02 Intake & Outtake Mechanisms:
Roller positioning, motor-driven arms



V1-INITIAL

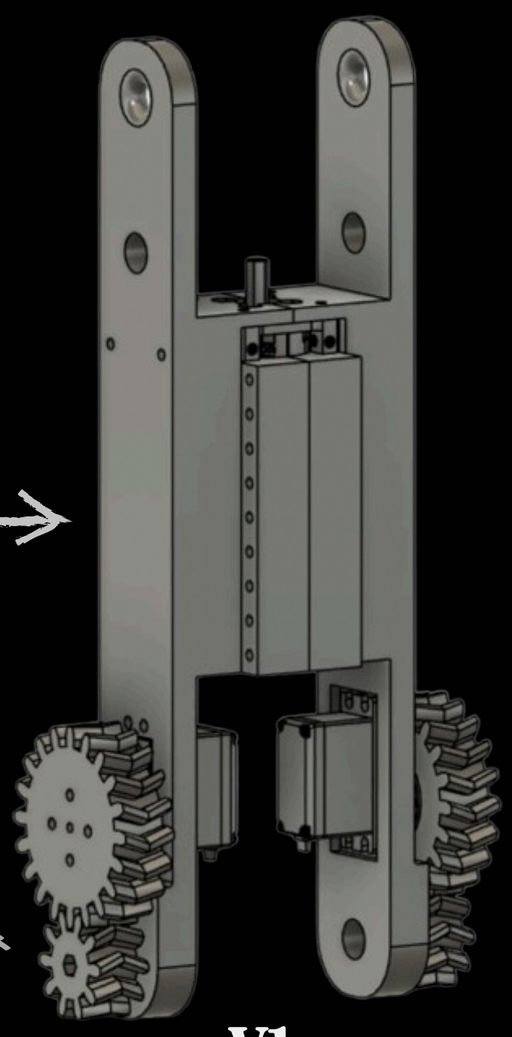
INTAKE
V1: Extending prongs for inside-grab mechanism.
Pros: Could pick up clustered samples
Cons: Very unreliable, required high precision

Outtake:
Capable of grabbing samples in both horizontal and vertical orientations
Utilizes herringbone gears to reduce axial load and backlash

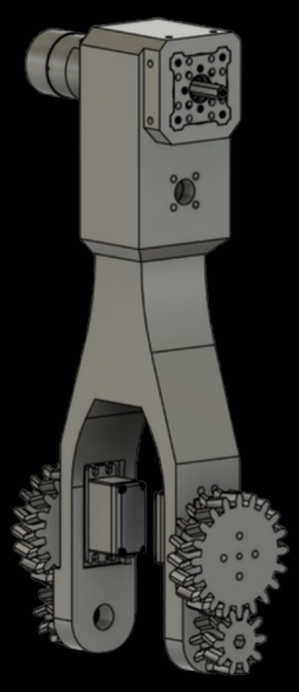


03 **Outake Mechanisms:** Pivot points, weight balancing

V1
Dead axle arm powered by a motor on the arm itself
Cons: Required high torque, gear skipping due to inertia, speed limitations



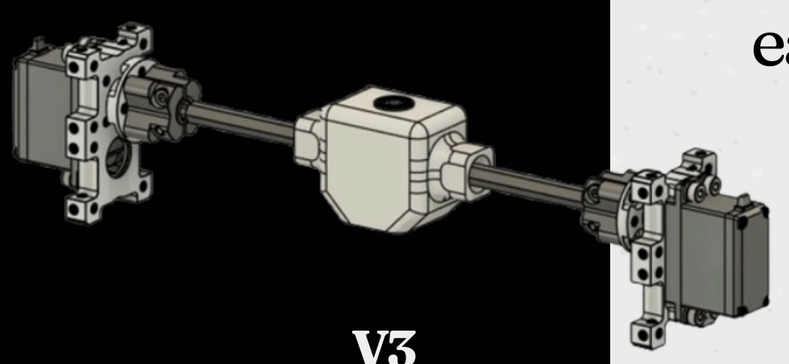
V1



V2
Motor-powered dead axle arm with motor acting as a counterbalance
Results: Successfully resolved previous issues

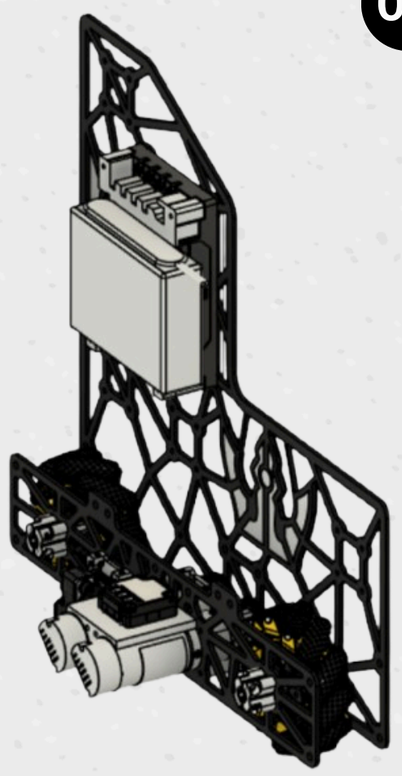
V2

V3
Servo-powered systems enable consistent and precise transfers, improving reliability, efficiency, and accuracy across repeated tasks with controlled motion.

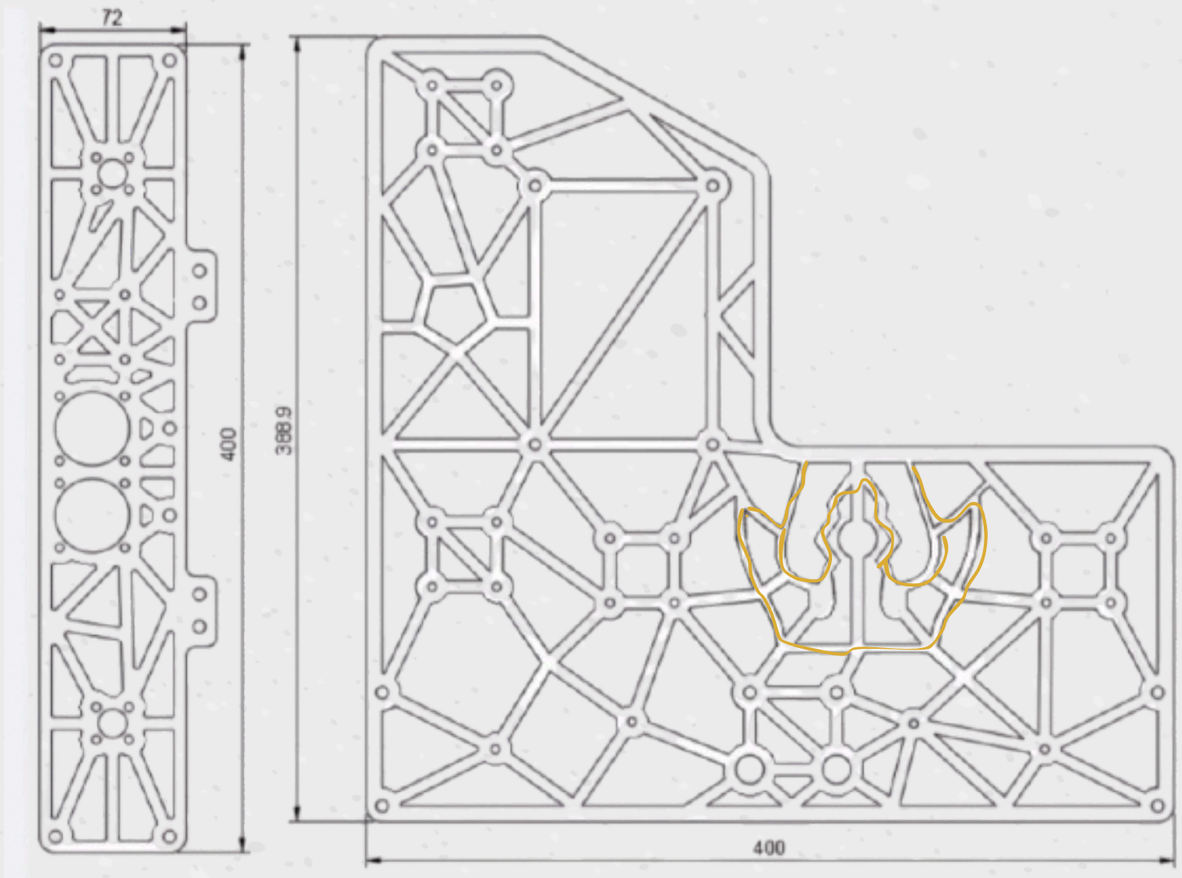


V3

04 **Electronics Mounting:** Space allocation for battery, control hub, and wiring



05 **Custom-made** using 2mm laser-cut stainless steel. Belt-driven for improved efficiency. Better packaging with custom mounting points. Aesthetic and functional upgrade



ITERATIVE CAD REFINEMENTS

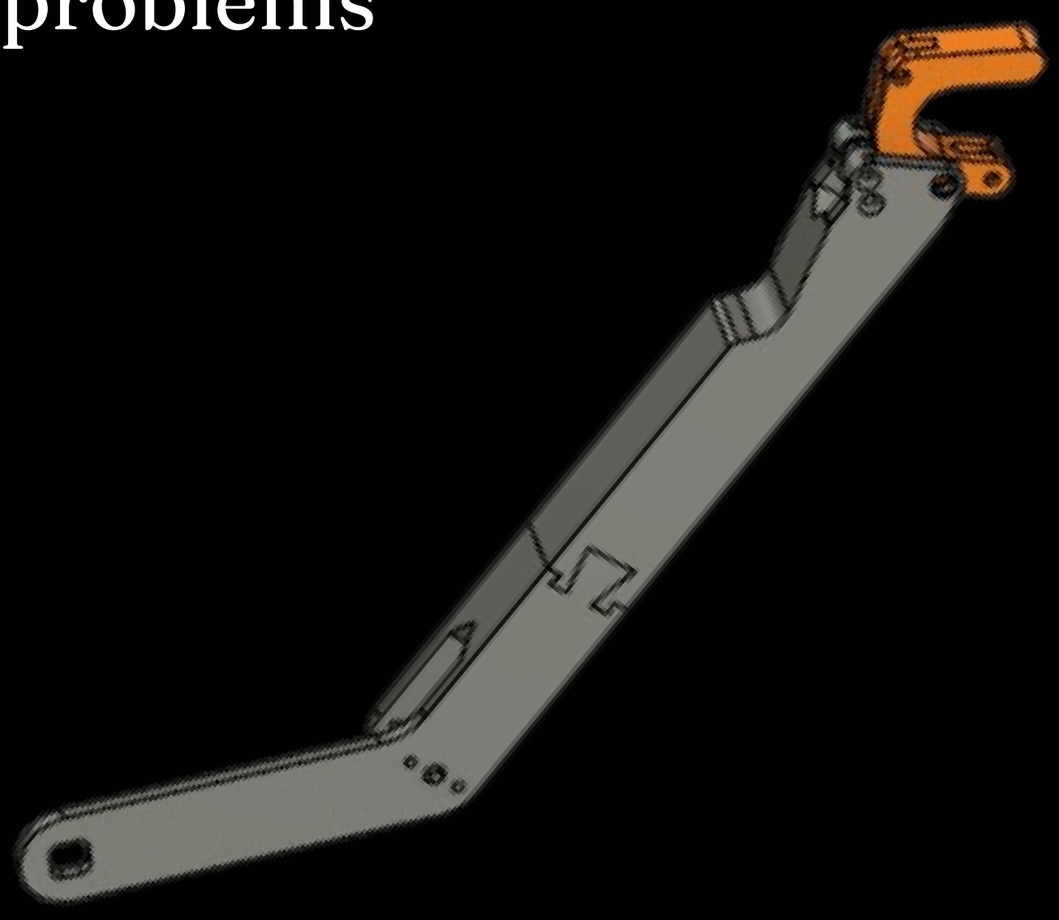
Using CAD, we tested different iterations, refining the design with each cycle:

- **Checking Fit & Interference:** Ensuring components don't collide
- **Simulating Movement:** Testing rotation, extensions, and gear interactions
- **Weight Distribution Analysis:** Ensuring balance and stability
- **Load Testing:** Evaluating structural durability under force

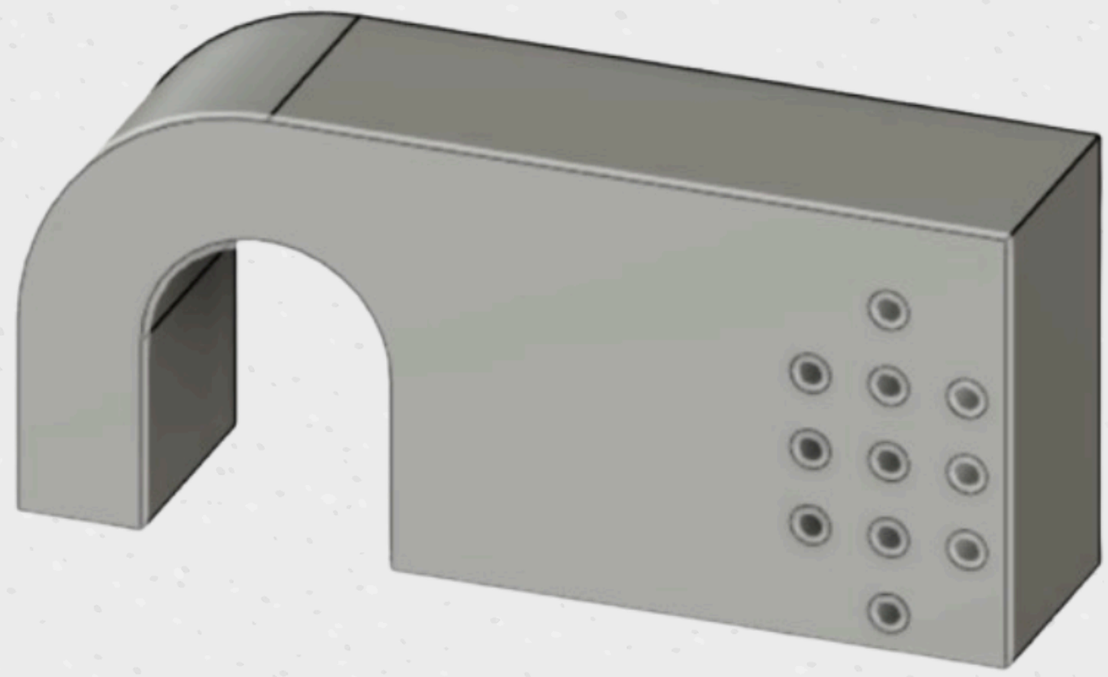
HANG MECHANISMS

V1 DESIGN

Our V1 hang was attached to our vertical slides and capable of doing a level 2 ascent. However, it was quite inconsistent, due to the low torque of the 435 RPM motors. Often times the robot would not full come off the ground and the hang would not be counted. This design let us hang around 50% of the time without problems



V2



V2 DESIGN

V2

This design was created to solve the problem of our low torque vertical slides. As we are using 435 RPM motors for our linear slides, these do not provide enough torque for a consistent level 2 Ascent. To deal with this we used a 43 - RPM motor, in conjunction with a winch, to power this arm. On the other side of the robot, we mounted a passive arm. Which is released by a latch attached to hooks on the vertical slides when the match begins.

THE ROYAL CRAFT
FABRICATION

Once our CAD model was finalized, we move into the fabrication phase, where digital designs are brought to life. We use a combination of **3D printing, laser cutting, and metal machining** for manufacturing our parts

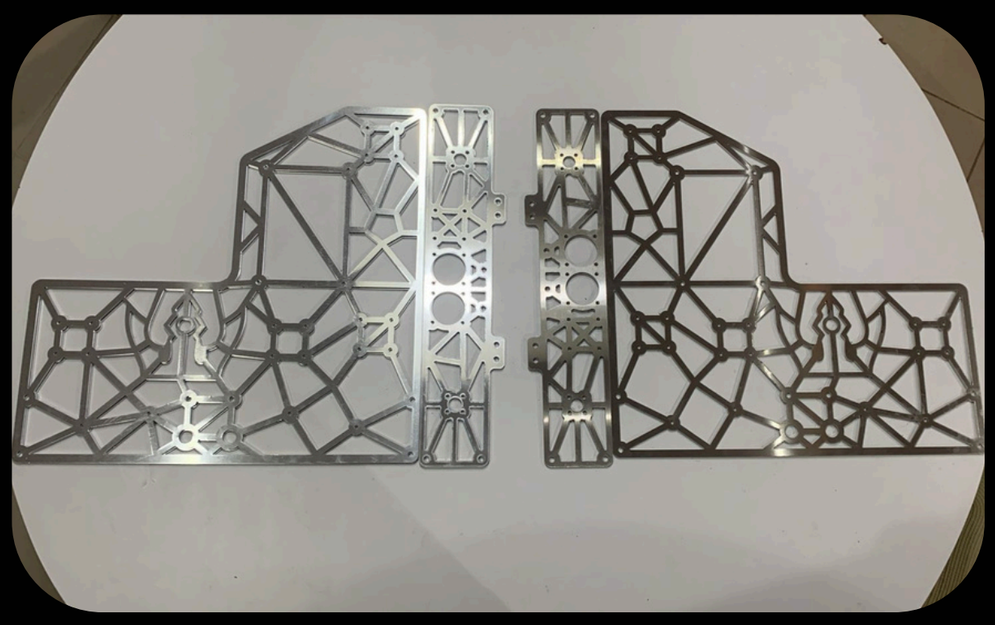
3D PRINTING

We used a **Creality K1 Max printer** and **Hyper PLA filament** to rapidly prototype and manufacture structural and functional components. Advantages of 3D printing:

- **Rapid Prototyping:** Quick iterations and adjustments
- **Lightweight & Durable:** Optimized designs without excessive weight
- **Custom Components:** Unique geometries tailored to our needs

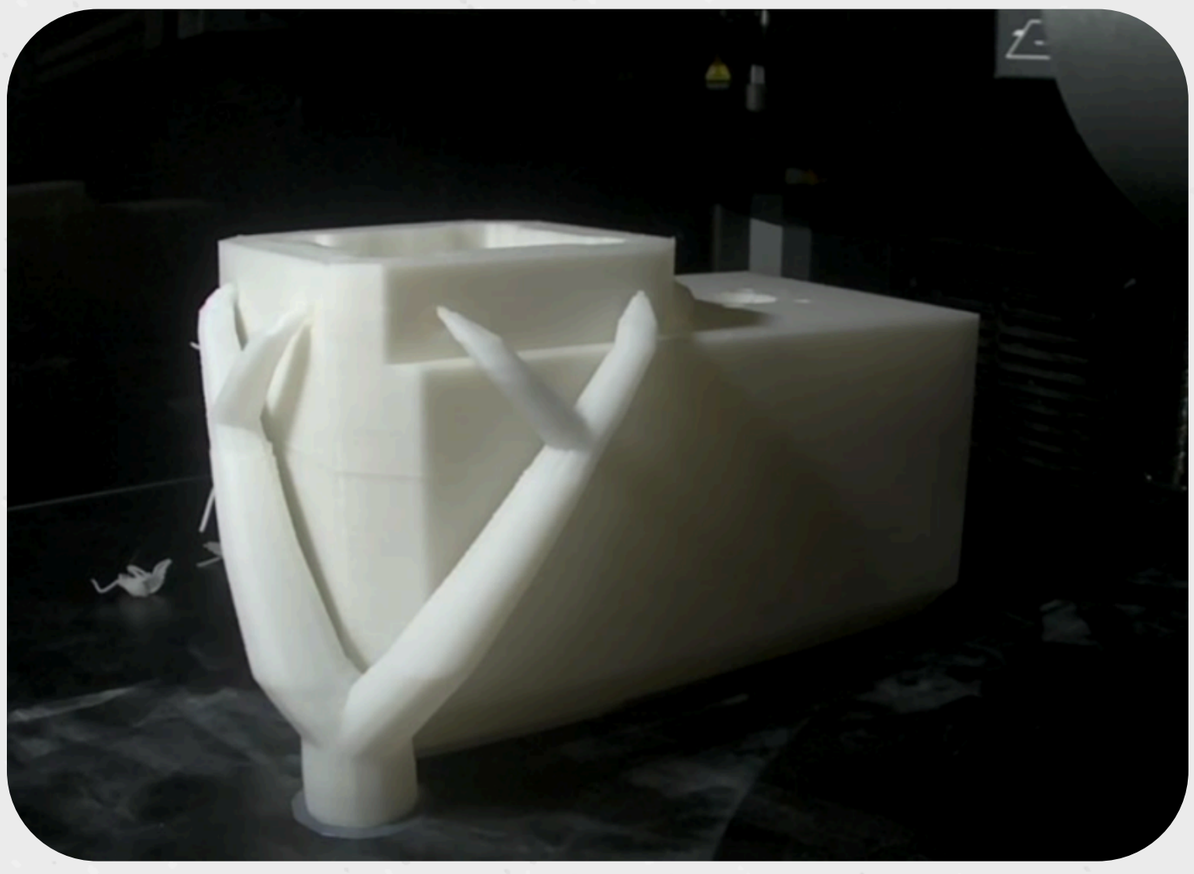
LASER CUTTING & MACHINING

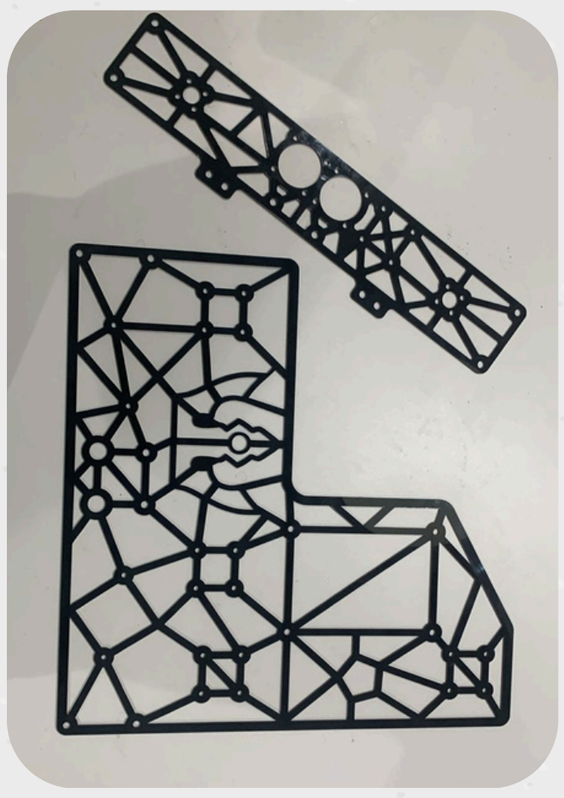
For structural parts, we used **2mm laser-cut stainless steel,** providing *high strength, precision, and durability* for the chassis and mounting brackets.

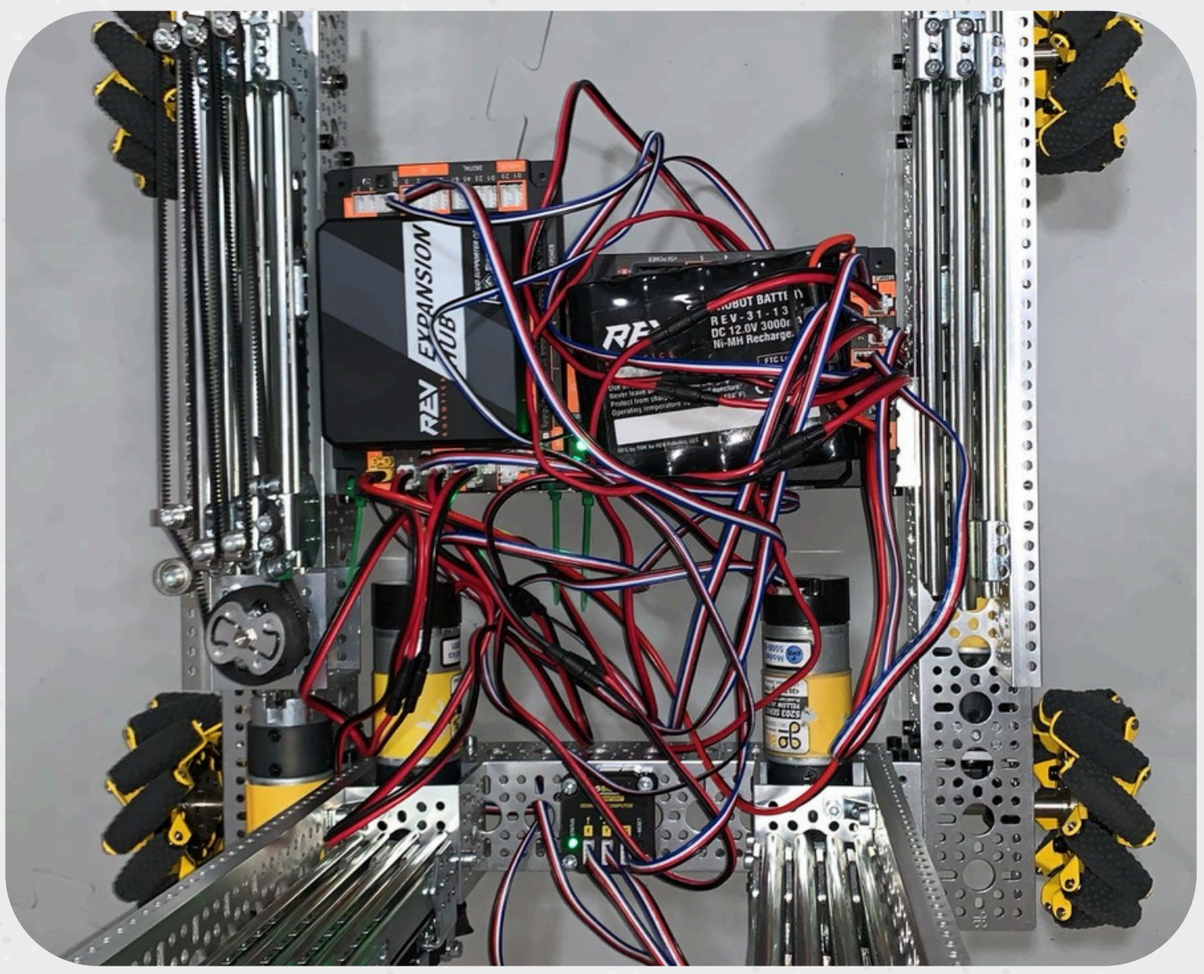


ASSEMBLY & INTEGRATION

Once fabricated, components were assembled, integrating motors, servos, gears, and electronics. Wiring is carefully routed to avoid tangles and ensure efficient power distribution.







COMBAT PREPARATION

TESTING & VALIDATION

With the robot assembled, we moved into rigorous testing and refining to ensure mechanical reliability, efficiency, and real-game performance.

- **Drivetrain Testing** – Checking mobility, speed, and maneuverability
- **Intake & Outtake Testing** – Ensuring smooth and efficient object handling
- **Arm & Lift Testing** – Measuring extension range, torque, and stability

ITERATION & REFINEMENTS

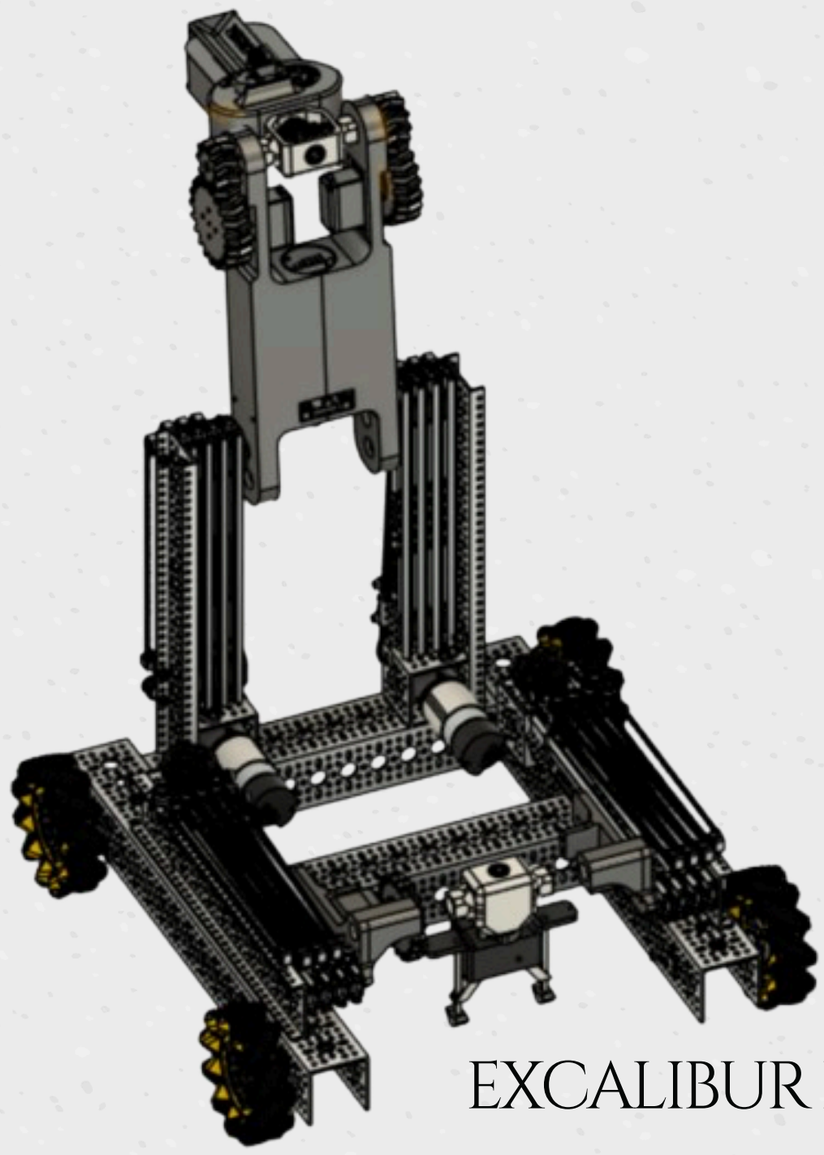
No design is perfect on the first try, so we identified weak points and make iterative improvements.

Some Scenarios:

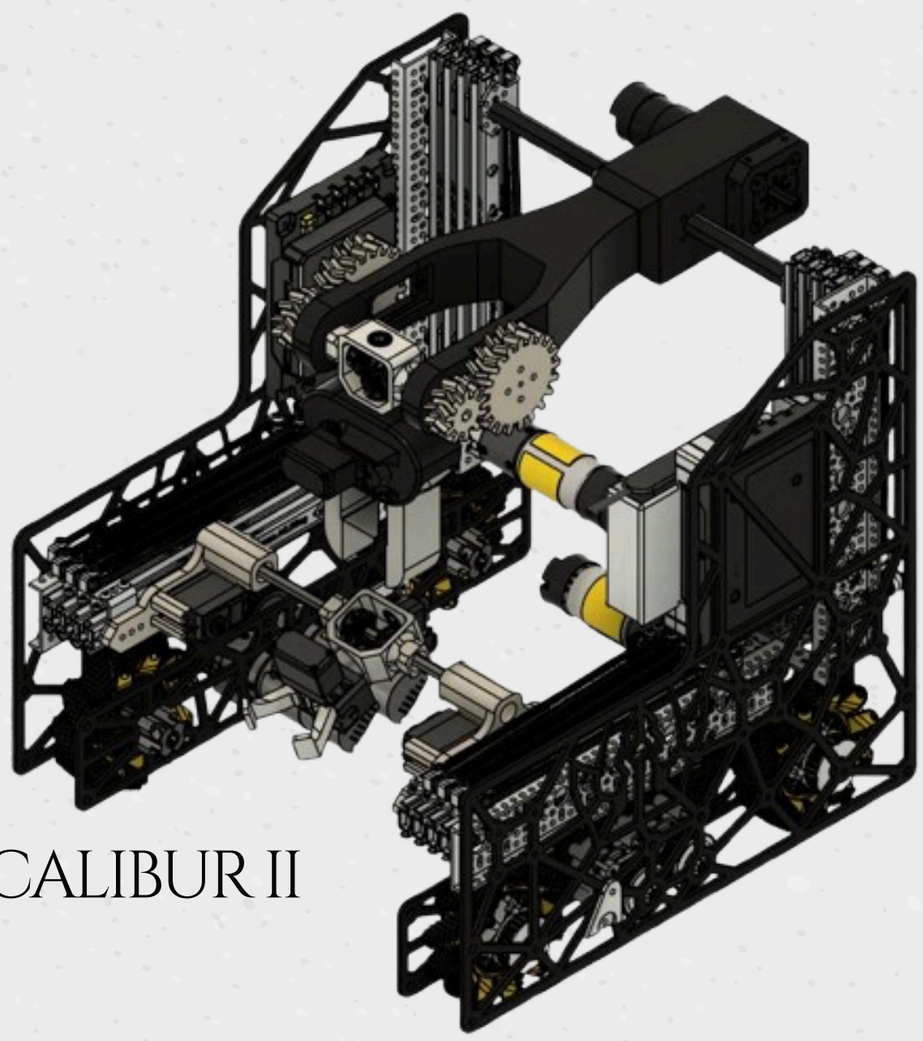
- **Drivetrain Issues:** Lack of traction → Switched to belt-driven mecanum wheels
- **Intake Failures:** Passive mechanism unreliable → Redesigned with active grabbing
- **Arm Pecision Problems:** Motor powered arm → Shifted to servo-powered arm
- **Weight Imbalance:** Too front-heavy → Rearranged electronics & added counterweight

FINAL ROBOT CONFIGURATION

- **Drivetrain:** 312 RPM Belt-Driven Mecanum Wheels
- **Vertical Slides:** 2x 435 RPM Belt-Driven 4-Stage System
- **Extendo:** 1150 RPM Belt-Driven 3-Stage Mechanism
- **Frame:** 2mm Stainless Steel Side Plates

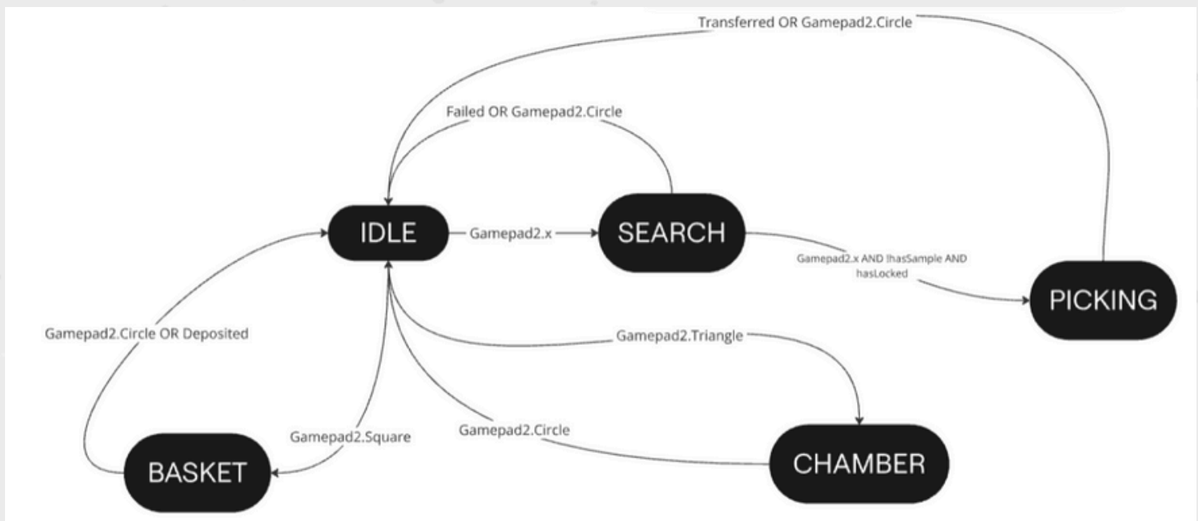


EXCALIBUR I



EXCALIBUR II

THE ROYAL SCRIPT:
CODE & CONTROL



Finite State Machine (FSM)

- It is for non-blocking parallel tasks
- Each subsystem has a **sub-FSM** for modular control

OpenCV Assisted alignment

- Uses **contour detection** to identify and track samples
- Outputs pose data to adjust intake automatically

PIDF

- Ensures smooth and accurate motor control
- Helps maintain stability and precision in movements

```
double output = (kP * error) + (kI * integral) + (kD * derivative) + (kF * sign(setpoint));
output = Math.max(minOutput, Math.min(maxOutput, output)); // Clamping output
```

```
f (Objects.equals(color, "Red")) {
    color = "Yellow";
    gamepad2.setLedColor(255,255,0,200000);
else {
    color = "Red";
    gamepad2.setLedColor(255,0,0,200000);
```

Gamepad Feedback

- Provides **rumble and lighting** feedback to drivers
- Indicates intake status and target sample color

```
gamepad1.rumble(100);
```