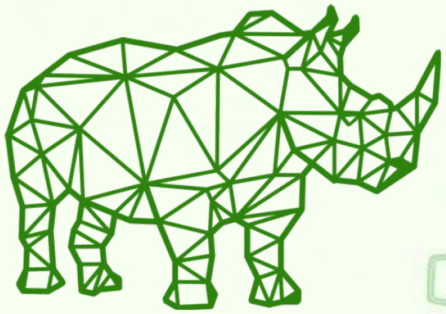
ROBO RHINOS #11254



TEAM PORTFOLIO

FIRST

DECODE™ presented by RTX

ROBO RHINOS #11254

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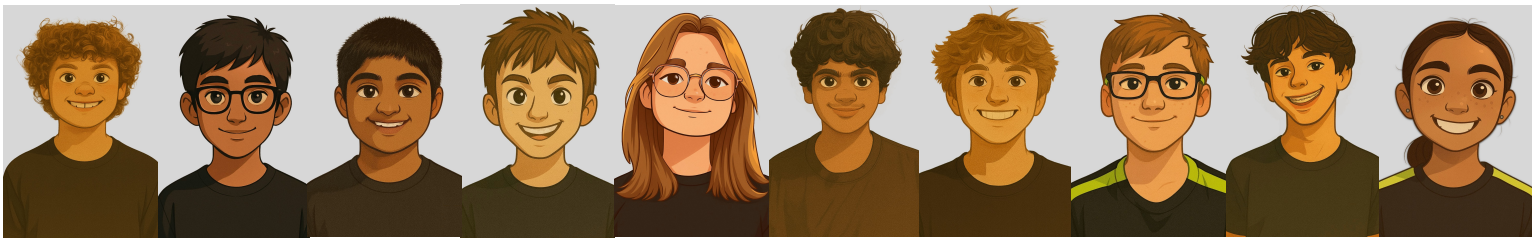
ROBO RHINOS #11254

OUR TEAM

Expertise, Leadership, and Team Sustainability

THE ROBO RHINOS - UNITED WE CHARGE!



Drew K.	Gavin P.	Abhijay K.	Andrew D.	Evie C.	Ari A.	Logan P.	Jakob C.	Ethan D.	Priyanka H.
8th grade	7th grade	7th grade	7th grade	8th grade	8th grade	8th grade	8th grade	8th grade	8th grade
L: Build	**L: Build**	**L: Program**	**L:Program**	**L: Drive**	**L:Program**	**L:Sponsor**	**L: Marketing**	**L: CAD**	**L: Outreach**

- **Robo Rhino Sub Teams:** Sponsorship, Game Strategy, Programming, CAD, Build, Marketing, Competition Team, Drive Team, and Outreach (all)
- All students actively contributed to 3 or more subteams, gaining valuable experience across Robotics and STEM
- Leadership roles were established within each subteam, further developing teamwork, decision-making, and project management skills.
- Recruited new team member for 2025, and secured 2026 roster after 8th graders graduate to FRC

Origin

The Robo Rhinos (Team #11254) started over a decade ago (2014) as a seven student, all rookie FLL team. The team has continued on with a mix of 7th & 8th graders. Many of the graduated team members have gone on to join FRC with the Novi High School Frog Force, Team #503 & Detroit Catholic Central Shambots, Team #5907. The Robo Rhinos continue to charge forward…United We Charge!

Season Goals

COMMUNITY

Promote FIRST and get kids excited about robotics

Help disadvantaged teams with building and strategy ideas

TEAM MEMBERS

Recruit and train new team members

Staggered teammate ages for sustainability

Provide CAD and Programming training to all

Improve time management skills

ROBOT

Chassis completed prior to Kickoff

Robot V1 hardware complete 1 week prior to 1st Qualifier

Learn to work with Vision

Learn programing for LimeLight, Husky Camera, gyro, LED, and odometry sensor

RESULTS

Excel at problem solving and respond to challenges

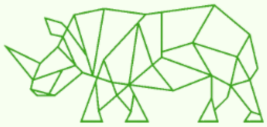
Have fun with our teammates and other teams

Be proud of our hard work

ROBO RHINOS #11254

OUTREACH

Community Impact Overview



1700+
Student interactions

558
Team hours volunteered

164
Mentor hours volunteered

10-15
Teams mentored per week

15
Professionals Connected

24
Outreach events

Events	Team hours	Mentor Hours
Detroit Zoo Boo Outreach	40	8
Frog Force - CAD and Programming Training	21	0
Multi-Day STEM Camp	166.5	28
Motor City Alliance	148.5	55.5
Novi Community Fest	22.5	5
Novi Road Clean-Up	4	2
OHM - CAD / 3D Printing Outreach	27	18
Orchard Hills Elementary Outreach	30.75	11.25
Robots in the Park	27	9
Village Oaks Elementary Outreach	30.75	11.25
Professional Outreach	20	10
Sponsor Night	20	6

NEW for Qualifier 2/3

ROBO RHINOS #11254

OUTREACH

Motivating students with STEM

MOTOR CITY ALLIANCE

On Saturday mornings we mentored FLL teams with the Motor City Alliance, helping kids with building and iterating their Lego robots and their strategies for gameplay.

MULTI-DAY STEM CAMP

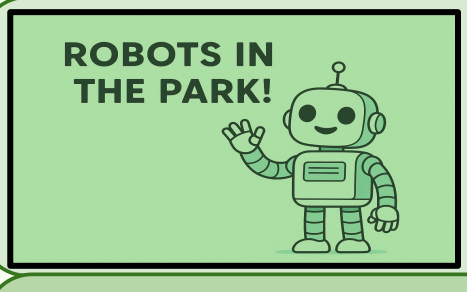
We participated in a multi-day STEM camp, assisting students with their lessons, experiments and leading with gracious professionalism.

ELEMENTARY SCHOOL PRESENTATIONS

We presented to Village Oaks and Orchard Hills Novi Elementary Schools about FIRST ROBOTICS and interacted with over 400 students.

DETROIT ZOO BOO

We presented to trick-or-treaters at the Detroit Zoo explaining robotics and how to get involved. We demonstrated our robot to them and distributed business cards to contact us!



ROBOTS IN THE PARK

This event featured FIRST teams of all levels. Through Novi Parks and Rec, this event allowed us to connect with our City and engage with the future STEM students. This event was held in August at Lakeshore Park.

NOVI COMMUNITY DAY

We attended Novi Community Day and presented FIRST robotics and our robot to over 100 people.

ROBO RHINOS #11254

OUTREACH

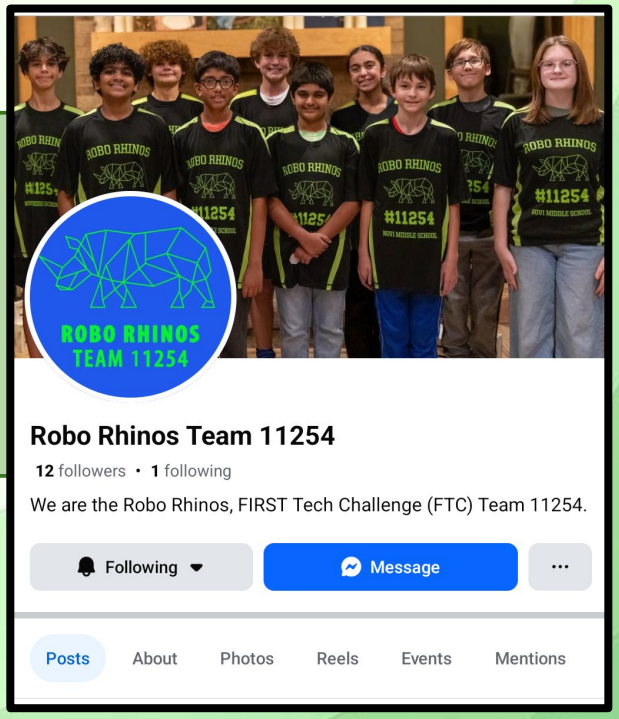
FIRST Ambassadors

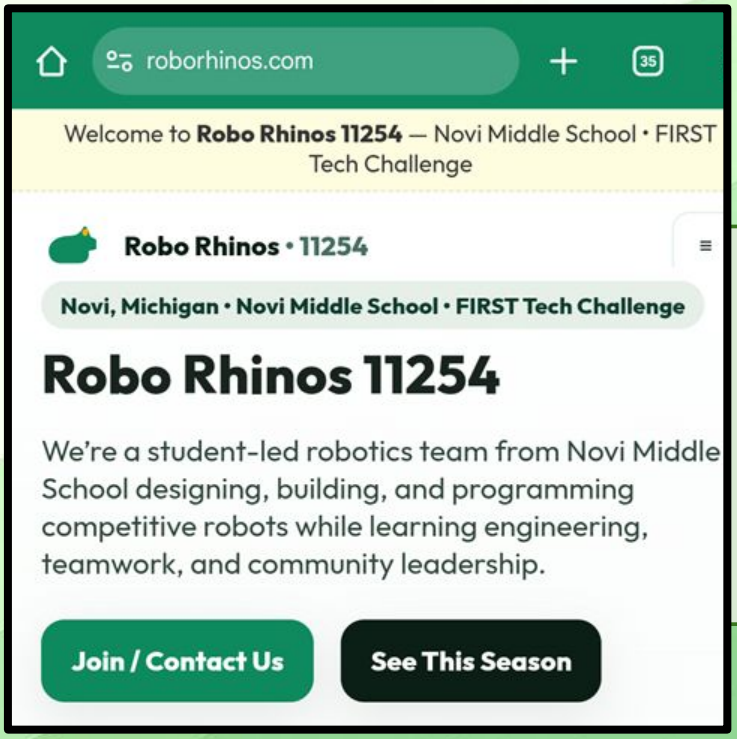
BUSINESS CARDS

We created business cards with a QR code to distribute during outreach events. We talked with kids and parents to direct them to our website and FIRST.

ROBOTICS SOCIAL MEDIA

We used social media to share pictures and information about our journey to get other people excited about robotics.





ROBOTICS WEBSITE

We created a website to share information about our team and FIRST robotics. To contact us click the green Join/Contact Us button.

Professional Connections and Testimonials

Joe Kidd, Director of CADD, OHM Advisors

Connected with OHM Advisors for an outreach and training event focused on CADD, modeling and 3D printing.

"Hosting the Robo Rhinos for an evening was a fun experience. Their aptitude for technology was incredible. Their energy and creativity leave little doubt they will become future leaders in stem"

Toye Akintoroye, Engineering Technician, OHM Advisors

The 3D Printing in-person learning session was intriguing for the whole team. OHM Advisors were outstanding mentors and helpful to connect what we were working on to the real world.

"Everyone was so enthusiastic, and I could tell that being a part of this team means a lot to them. As a former FIRST and VEX competitor, it's encouraging to see the next generation working hard at achieving a shared goal. I know they'll all go far in life!"

Jeffrey Dudek, ZF Engineering Solutions

Led engineering discussion on autonomous driving, driver assistance camera safety systems, innovation and the design process. Provided robot design suggestions.

Carly Martinez, 4th Grade eacher, Village Oaks Elementary

Village Oaks teachers are thankful that Robo Rhinos took the time to present, explain and demonstrate all about Robotics to our elementary students. They brought so much excitement and curiosity and about robotics to our third and fourth grade students. As always, great job, Robo Rhinos!"

Demetris Coleman, PhD, Chief Technology Officer, Motmot

Provided the team insights on future of autonomous robots during Sponsor Night.

"Working with the Robo Rhinos was awesome. They were deeply curious and dove into autonomous robot questions. If this is the next generation, our field is in good hands."

Michael Krygier, PE, Director Innovation and Development

Led insightful discussion with team on the engineering process focusing on design iterations and testing specific to their robot design and 3D printed parts.

Shaun Kalinowski, Manager Application Engineering, MathWorks

Provided the team programing insights to Robo Rhinos during Sponsor Night.

"I work with scientists/engineers who turn years of learning into remarkable achievements. Seeing Robo Rhinos solve problems with creativity and composure was impressive and made me wonder what incredible things they'll accomplish in the future."

NEW for Qualifier 2/3

Additional Profession Connections: Sean Egan (Founder / CEO Eganix), Bill Anderson (Senior Vice President Atwell), Jeremy Allen (GM Manufacturing Engineer), Ebrahim Shariff (GM Manufacturing Engineers), MC Moritz (OHM Advisors Project Engineer).

Fundraising / Sponsorship

1. Strategy

The Rhinos understood the importance of funding and reestablishing existing relationships with the engineering community. Also, researching new partnerships and startup companies engaged in STEM would aid in funding, mentorship and outreach opportunity. At the beginning of the season we decided to set measurable benefits for each sponsor and create sponsorship tiers.

2. **Financial Projections and Assumptions**

We knew from previous experience that two robots, spare parts and multiple regional events were likely. Expense estimates were created, and we established a funding target of $10,000 to meet our initial goals. We set measurable goals of 4 gold, 4 silver, and 6 bronze level sponsors to hit our funding goal.

3. Requests for Funds

a. Approaches: 1. Email requests 2. Phone calls and 3. Application submittals

b. Sponsor Tier Creation:
- Gold - $1000+ contribution and / or direct face to face mentoring
- Silver - $750 Contribution and/or virtual interaction
- Bronze - $500 Contribution and/or virtual interaction

c. Sponsor Benefits:
- Large, medium or small logos on Rhino Tee Shirts. Logo on newly designed sponsorship banner. Logo on Robot. Website recognition and more!

4. Sustainability and Gracious Professionalism

It was understood that gracious professionalism required our team to thank and recognize each sponsor. Letters have been prepared for each sponsor and hand signed by each team member as donations are received. Monthly updates and links to our webpage and event results are emailed throughout our journey. We also understand that staying in touch with our sponsors after the season is important for our team's financial sustainability.

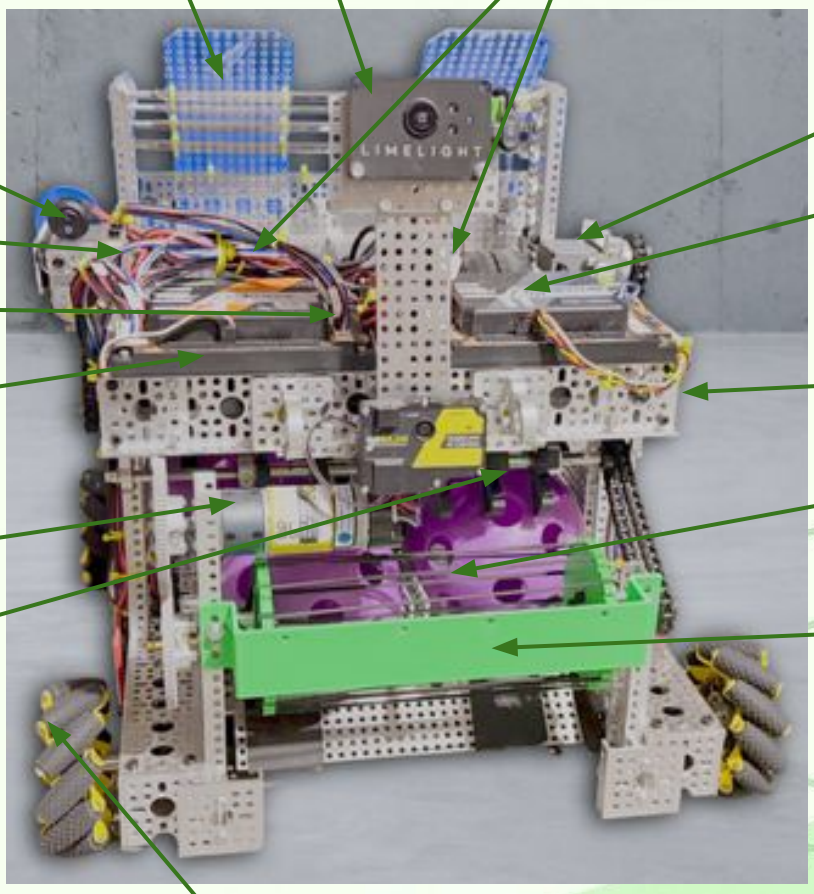
THANK YOU SPONSORS FOR HELPING US EXCEED OUR GOAL!!!

2025 - Income		
Carryover	Carryover Budget 2024	$4,972.91
Gold Sponsors	OHM Advisors, Eganix Inc, Mathworks, Haley, GM, Motmot, Pipeline	$7,250.00
Silver Sponsors	Atwell	$750.00
Bronze Sponsors	G2 Consulting, HESCO, Redzone Robotics, Kennedy Industries, Team UIS, JGM Valve, Athingz	$3,250.00
Team Fees	Novi Community School District registrations	$1,500.00
Total Income		$17,722.91

2025 - Expenses		Planned	Actual
Build	Structure, motors, wheels, fasteners, wood for prototyping, tools	($7,500.00)	($6,416.56)
Outreach	Business cards, web hosting, wristbands	($1,000.00)	($465.63)
Competition Expenses	T-shirts, banners, team merch, poster and portfolio supplies	($3,500.00)	($2,617.37)
Team Meals		($1,000.00)	($537.10)
First Challenge Fees	Competition registration fees and field supplies	($1,000.00)	($919.51)
Budget		($14,000.00)	($10,956.17)
Anticipated Rollover to 2026 Season		**$3,722.91**	

Thank you Sponsors for believing in our Robo Rhinos team and the future of youth in STEM!

ROBOT OVERVIEW



GAME STRATEGY

AUTONOMOUS

- Preload 3 artifacts
- Read motif on obelisk
- Launch 3 artifacts per the motif
- Pick up 3 more artifacts
- Launch 3 more artifacts

NEW for Qualifier 2/3

TELEOP

- Collect artifacts
- Sort by color
- Independently launch green vs. purple
- Long range launch

NEW for Qualifier 2/3

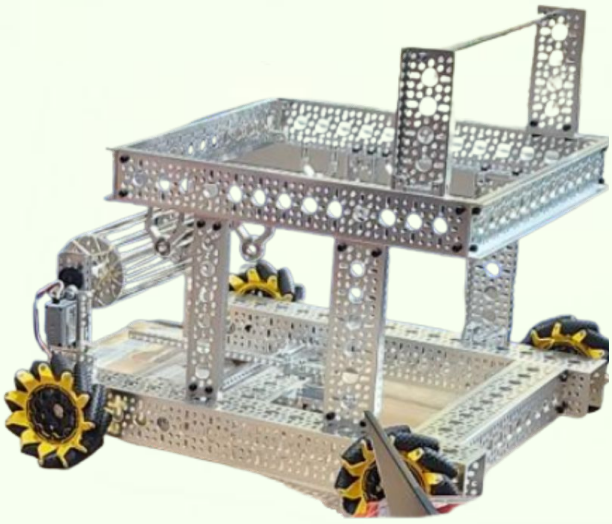
END GAME

Qualifier 1: Park

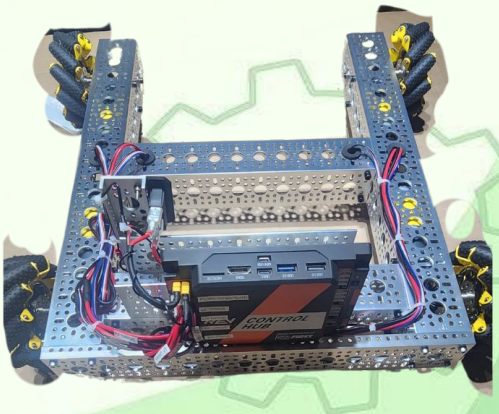
Plan to complete Lift for Qualifier 3.

ROBOT DESIGN

Chassis / Wheels



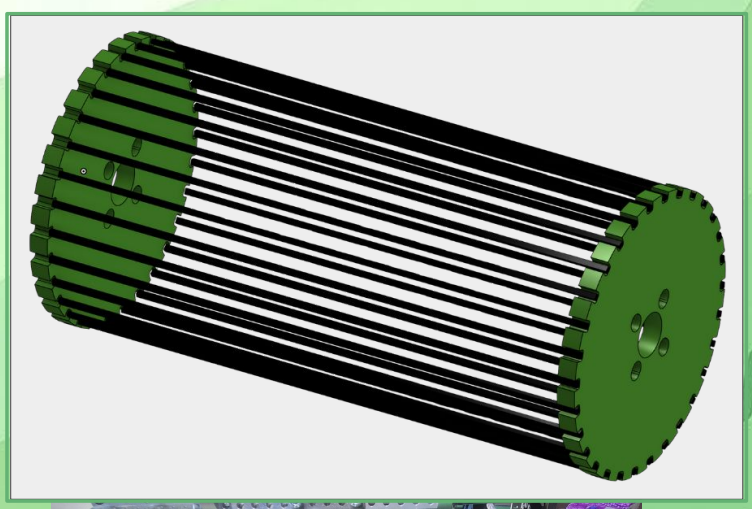
- GoBILDA parts with upgraded motors
- Mecanum strafing wheels with a grip force mechanism to prevent slipping on the field.



Intake

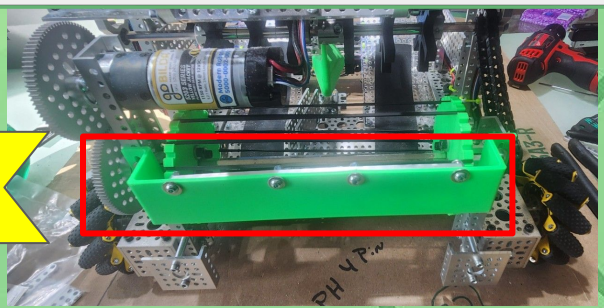
Rubber band and gears design

- Mesh system to effectively fit the artifacts
- Better grip on the artifacts when we pull them in
- Gears are 3D printed



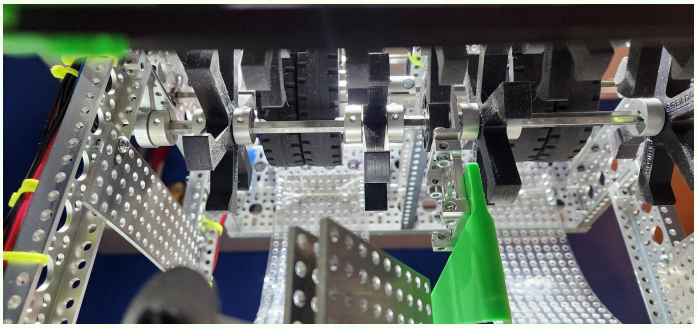
- Robot redesign to add intake guard and bumpers reducing robot-to-robot tangling risk

NEW for Qualifier 2/3



ROBOT DESIGN

Loader Wheels



We are utilizing 2 sets of Gobilda boot wheels, with the first set being 72mm sized wheels connected to a single shaft that passes the Artifacts into the second set of intake wheels.

The second set of intake wheels are Gobilda 96mm boot wheels that are on independent shafts connected to separate servos. This set of wheels allow us to select which color of artifacts to shoot based on color.

NEW for Qualifier 2/3

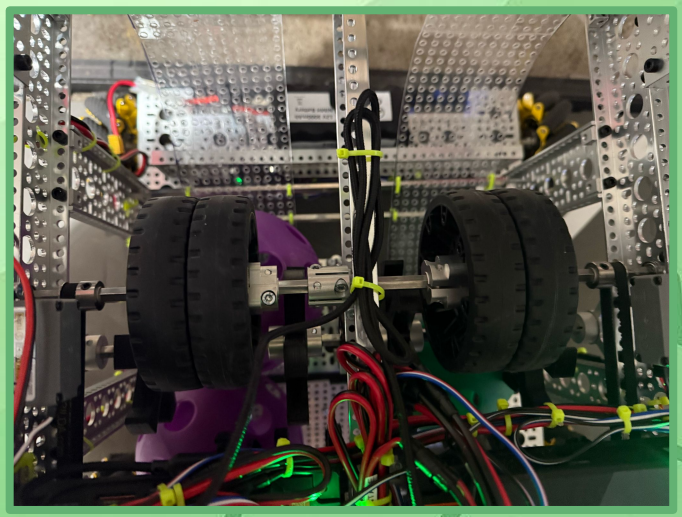
- Tape added to the launch ramp to add additional grip to reduce artifacts from slipping

Flywheel

Design elements:

- Hog wheels
- Rex rods
- Two 6000 rpm motors to power it all.

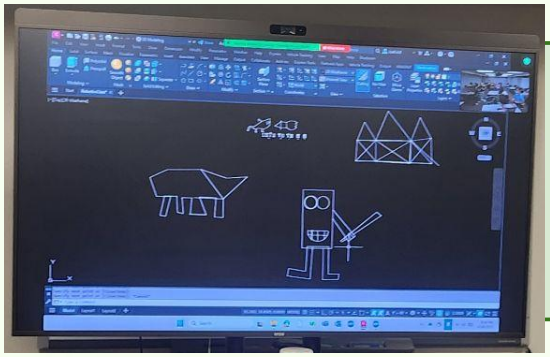
We took inspiration from the goBILDA's "Three Day Robot" and used polycarbonate as a track to guide the ball into the flywheel so we could launch artifacts.



- Added collar to ensure center bearing stays secured
- Operator option added to run the launcher in reverse if the artifact is stuck

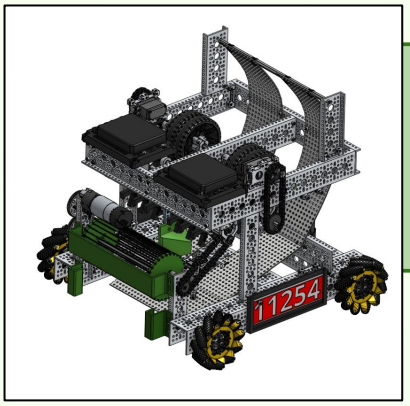
NEW for Qualifier 2/3

CAD

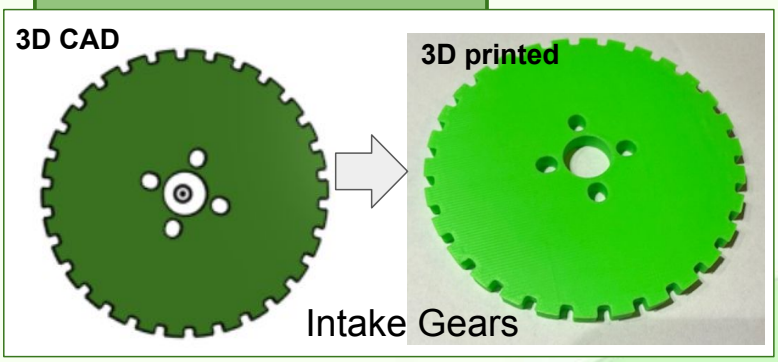


Taking CAD training classes in advance helped us to understand the design process from experts.

We designed custom components based on optimization process having multiple iterations until we were fully satisfied with the solution.



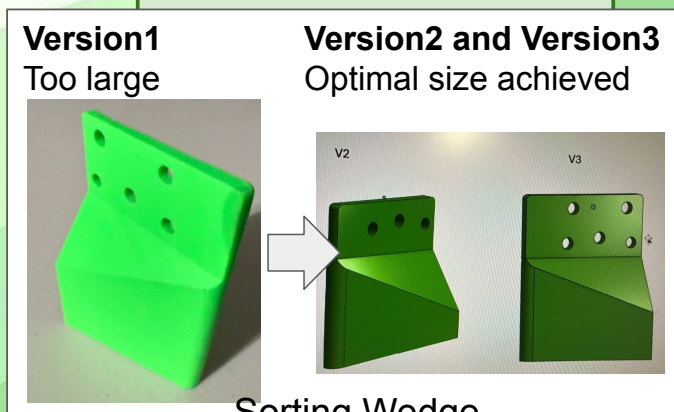
We used 3D CAD model as a guide to build our actual robot.



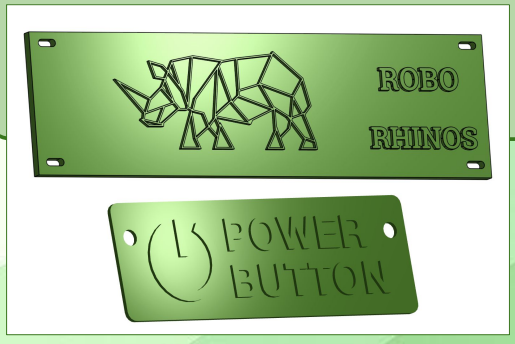
Components were designed in 3D CAD, then we 3D printed the items, followed by a trial in actual robot and then the process repeated.

Version1
Too large

Version2 and Version3
Optimal size achieved



We designed our Logo sign in CAD.



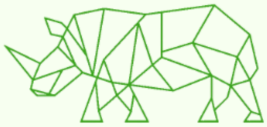
NEW for Qualifier 2/3

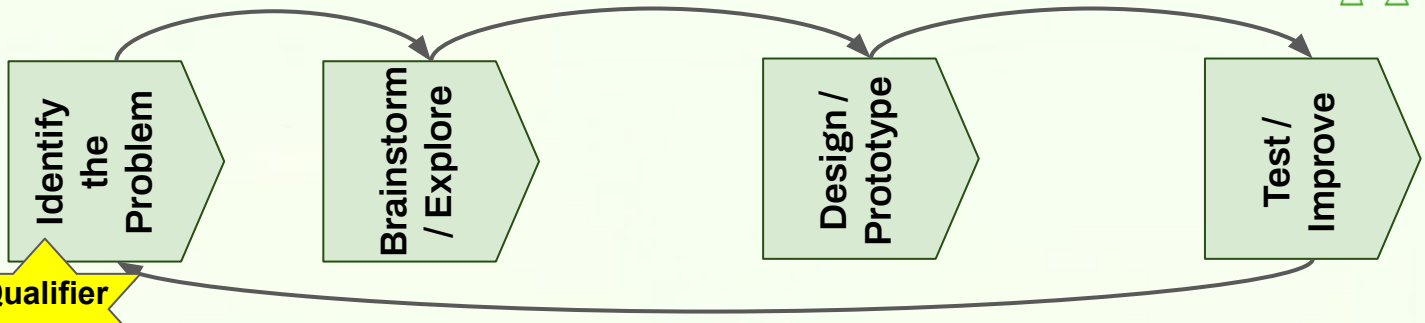
3D printed intake guard and bumpers were added to reduce robot-to-robot tangling risk.

ROBO RHINOS #11254

ENGINEERING DESIGN PROCESS

Engineering Design Process used throughout robot and programming development.





Qualifier 1

How to sort the artifacts	- Spindexer - Manual sorter - HuskyCamera	- Spindexer exceeded size constraints - Manual Sorter added	- Sorter was stabbing artifacts during testing (Washer added)
Teleop inaccurate aim	- LimeLight auto aim - LEDs	- Robot challenging to operate with auto aiming - LED added	- LED tested successfully first time
Artifacts stuck in intake	- 3D Printed wedge - Extra plates	- Attached new parts to robot	- Required 3D printed wedge modification
Intake not collecting consistently	- Band sizing - Band spacing - 3D printed custom gears	- Redesigned Intake with new parts	- Required 3D printed gears iterated twice

Qualifier 2/3

Intake tangled with alliance partner	- Low Channel - 3D printed guard - 3D lower bumpers	- Low Channel exceeds allowable dimension - Using smaller 3D printed guard	- Redesign intake to accommodate intake guard - Tested to ensure intake operated correctly
Not shooting long range effectively	- Adjust Limelight to read April tags from everywhere - Auto Aim with Limelight	- Redesigned new bracket for Limelight	- Fine tune auto aiming and launch velocity
Auton limitation: 3 artifacts	- Increase speed - Speed up launch sequence	- Incorporated programing updates	- Programing design iterations / prove-out

Future Improvements

Speed up auton for second artifact set	**Completed for Qualifier 2/3**
Shoot from far launch area	**Completed for Qualifier 2/3**
Use HuskyCamera for sorting	In Process
Add Lift functionality	In Process

Basic Controls

To code the motors, we have to initialize them, setting direction and configuring encoders. We then have to use functions and blocks like set power, to make the motors move.

By moving the specially-shaped Mecanum front and back wheels in opposite directions, we can move the robot side to side, also known as strafing, allowing for greater efficiency and precision during the robot game.

Velocity Control

We are using 2 high speed motors for our flywheel launcher. Both motors are connected to the same shaft. We started using normal power commands like other motors, but noticed the flywheel took a while to get up to speed and the distance accuracy worsened as the battery drained.
Since both motors are attached to the same shaft, we decided to use an overall velocity control instead of using the motor encoders for each motor. We measure the velocity with the encoders and compare that to the launch velocity we want. We use the error to adjust the power commands so the velocity is consistent and accurate for full and low battery voltage. The flywheel spins up faster now too. We do the velocity control in auton and teleop.

NEW for Qualifier 2/3 Determined optimal velocity for long range launch

Auton using Sensors

We have 4 auton programs per alliance for a total of 8. We have 3 different starting positions (at goal, at obelisk, at farthest launch are). Each auton launches 3 artifacts and picks up more artifacts getting ready for teleop. We use the gyro sensor with closed loop control to drive straight from the starting position and use the odometry pods for distance. Our first move gets us to a good position to use the gyro to turn toward the obelisk. We use the LimeLight to read the motif and then gyro to turn to the goal. Once we are facing toward the goal, the LimeLight uses the April tag to accurately aim the robot at the goal. The launch sequence is then initiated using the launcher motor encoders with closed loop control for velocity. We then continue using the gyro and odometry to go pick up more artifacts setting the team up for success in teleop.

NEW for Qualifier 2/3 Each auton launches 6 artifacts (improved from 3 in Qualifier 1)

Odometry

The odometry pod is a mounted wheel sensor that allows us to track distance and where we are on the field. These pods are used in pairs, for the x axis and y axis. The pinpoint computer is what we plug the pods into. The computer communicates with the control hub, and is what we code after installing the online drivers. We use these to move specific distances during the autonomous period of the game setting us up for success.

LimeLight

The LimeLight camera is a sensor we use to track april tags. We have to calibrate it by plugging the camera into a computer, then into the robot and using the pipelines - configurations for what to detect - to act on it. This year, we will use it to tell what the obelisk says for the motif in each game, as well as, distance for launching, and automatic targeting.

The angle of the LimeLight camera mounting is very important. We determined the angle range for where we are looking for the obelisk and goals. Then we looked where all those ranges overlap and set the LimeLight camera mount angle to the middle of that range. We find the april tags much more reliably now.

NEW for Qualifier 2/3

Added automatic targeting in Telop to allow for improved aiming and long range launch accuracy. Raised limelight higher to be able to read all April tags from anywhere on the field.

LEDs

The drive team had trouble aiming the robot properly in teleop, so we mounted LEDs to the back of the robot. We use the LimeLight camera to determine which way the driver should turn and use the LEDs to indicate that. When the robot is aligned to the goal, the LEDs indicate that as well letting the operator know they can launch. There are 2 LEDs toward each side for the driver and one in the center for the operator. These LEDs make it much easier for the driver and operator to score.

Gyro

We are using the built-in IMU Gyro sensor for additional positioning during the autonomous game. This sensor is already a part of the Rev Control hub. We use the yaw so we know where the robot is facing. We can use this for programs like turn to angle and drive straight. For drive straight, we drive at an angle and use closed loop control by measuring the error. We then use the error to adjust wheel motor power commands to keep the robot on angle. This allows us to accurately drive the robot around the field.

HuskyLens Camera (Planned for future implementation)

HuskyLens cameras use artificial intelligence for object, AprilTag, and color recognition in a self-learning process.

We plan to use color recognition to automatically sort between green and purple artifacts to match the given motif. We can use this in an **if/do** block for moving a sorting servo to push artifacts into the FlyWheel/Launcher.

HuskyLens Camera

GRATITUDE

Throughout this season, we have worked hard as a team to use the core values as we **DISCOVER** new skills, **INNOVATE** during the design process, **IMPACT** our community by spreading our love of robotics and programming, **INCLUDE** everyone while using great **TEAMWORK**, and all while having lots of **FUN**!

We would like to thank the FIRST program, our sponsors, mentors/coaches for educating us, and RTX for sponsoring the event making our FTC journey possible.
Thank you for reading our portfolio,
we hope you enjoyed this as much as we did.