Guide to using the notebook (for team, omit page when submitting for tournament)

Rules:

1. Only new pages will be printed as proof of not editing old ones, so DO NOT edit older pages in any circumstances.
2. When making a new page, copy and paste slide 2 into the latest end of the notebook and then edit it accordingly (title, what you did, date you wrote it, who contributed to it, and page number at the bottom)
3. Do not add anything that would get you or us in trouble with the school or with vex
4. Remember to log new entries (pages) in the table of contents.
5. Ask nevin if you have any questions

Slide Template (Title Here)

High Stakes Digital Notebook

Team 6978B - Roger66

Members: Nevin Zerby, Elijah Cooke, Eric Nolting, Miles Burson, Derek Marcum

Start Date: 6/8/2024 - Format made by Nevin Z.

Important Information

This is the first digital notebook for team 6978B - Roger66

This team is part of Highland High School's VEX Robotics Program. If the binder/book containing these pages is found, find an official of HHS or a team member of 6978 to return it.

Other information:

VexForum account (run by Nevin Zerby) - @soritarian1

Third-Year VEX team

Format used created by Nevin Zerby and team 6978

Ask Nevin in person or on the Forum if you want to use the format

IMPORTANT - Note for Judges

A very important note for judges - to help understand the notebook and some choices made

As you can see, the first 50 or so pages are mostly content involving rules and such, that are not necessary in a conventional notebook. These are not put in so that they can “inflate the book” or to be filler content. These were put in as a show of our competition intent and a reminder of what our build parameters are.

Additionally, you may see that these pages are heavily text-based and almost completely devoid of pictures. This is because we had not had any practices or meetups yet, and could not do any real designing, building, testing, group brainstorming, etc. as we did not even have a team. Please do not use the “style” of these pages to be taken into consideration as to how our notebook is written - real entries begin once we first get our team together, and truly ramp up at about page 80, where we had done enough where we could consistently add actual pictures and changes. After competitions started (around page 130), the notebook underwent a change to make it so that it read more like a true notebook, rather than a journal of unclear content.

Notebook Specifications PT.1

Titles - Bold Roboto Condensed 43

Regular Text - Roboto Condensed 24 (non-bold)

Captions on images - Alegreya 18 (non-bold)

`Table of Contents Entries - Roboto Mono 22`

`Page notes (date, contributors, etc) - Roboto Mono 17`

Additional spaces between paragraphs are usually in size 20, to account for page size, as when it is 24 it can cause text to exit the page slightly. When there is only one space in a page, it is usually decreased to 16 or 18, to prevent text running off the page, but also to prevent blank spaces near the bottom. On regular pages, we use single spacing, but not these.

We use a larger text size like 24 rather than the general 12 because a smaller text size would be very hard to write in with the computers we are provided with at our school. We have deemed this necessary.

Notebook Specifications PT.2

The book will use numerous color codes, especially for categorization to the multiple steps of the Engineering Design Process, which we will follow in our building, designing, and documentation. The following colors correspond to:

Light Red - Identify

Light Orange - Brainstorm

Light Yellow - Select

Light Green - Create (Program, Design, Build, Notebook)

Light Blue - Testing

Light Purple - Repeat

Light Gray - Scheduling/Other

Dark Gray - Tournament Recap / Notes

The book, in normal pages, will usually use single-spacing between sentences and paragraphs and such.

Not all parts of every tiny process will be documented - for example if we do multiple tests and fixes on a system during 1 day that would mean 24 pages, which we cannot do.

Identify pages will be used as introductions to new ideas.

Table of Contents: Chapter One

Table of Contents: Chapter Two

Table of Contents: Chapter Two

Table of Contents: Chapter Two

Table of Contents: Chapter Two

Table of Contents: Chapter Two

Table of Contents: Chapter Two

Table of Contents: Chapter Three

Table of Contents: Chapter Three

Table of Contents: Chapter Four

Table of Contents: Chapter Five

Table of Contents: Chapter Five

Table of Contents: Chapter Five

Notebook Chapter One Introduction Pages

The purpose of this section is to introduce the team, notebook, robot, and more before going through our designs, building, competitions, and any other activities that we do in the season. There is not extensive documentation or pictures in this section as there was not any robot yet.

Introduction to The Notebook

Welcome to 6978B - Roger66's VRC Digital notebook for the VEX Robotics 2024-2025 season, High Stakes.

Some important things to note before continuing:

1. This notebook was made with its own format. We decided that using our own template that we have created (rather than an official or community one) was the best option going forward for several reasons. (i.e. show proof of original writing, more streamlining, etc.)

2. This notebook will not have practice pages edited after their initial submission so as to remain having good clarity and so as to be shown as truthful to what we have done.

3. In most cases, this notebook will probably be printed out and put in a binder, page by page. This makes it easier to carry around and submit, and also provides proof of honesty in terms of not changing things about pages. (Explained on page 3)

Notebook Organization PT. 1

We plan to organize the notebook and how we make entries, developments, and such in certain ways. We want to make sure that the development of the book, the team, and the robot are all as clear as possible and qualifying well under the Notebook Judging Criteria (See pg. 4).

How will we do this? Well, we will try to make entries consistent and as detailed as possible, while still being readable and making it clear what was done and what the goal of the entry is. This is our notebook lead's third year of being a team notebook lead, but first year of doing a digital one, and with the digital notebook it opens more opportunities for more frequent entries and easier ways to collaborate with teammates so everyone has more say and gets to put more of their insights and projects into the book.

Notebook Organization PT. 2

There are several reasons why we decided to choose a digital notebook, rather than a physical notebook like had used previously. There are some huge benefits:

1. Faster to Create
   - Digital notebooks are much easier to edit and add on to on the fly
   - Much faster and easier (in most cases) to type rather than write

2. Naturally Neater / Better Formatted
   - Due to being typed instead of written, digital notebooks are naturally far neater
   - Using all the available tools, it is much easier to format the book how we want it and get our points across in a nicer, better organized fashion

3. Easier to collaborate
   - It is easier for any member to work on the book at any time, even at the same time, due to it not being physical.

Notebook Organization PT. 3

Some do believe that using a digital notebook can be less trustworthy or genuine than a physical notebook, for several reasons. Despite this, we decided to do a digital notebook, because those problems can be solved.

Issue 1: How can you know if the book has been edited to correct previous mistakes or imperfections?

We have a school rule that means after we have printed out pages, they are final and we may not reprint those pages. This means you will always get pages as they were made the first time.

Issue 2: How can you know that the content of the book was not stolen or copied from other sources?

We will quote and link to where we have taken unofficial content from (with permission) if we do. Part of why we have our own template is so that it does not look like we could have just taken someone else's book and called it our own.

Introduction to The Team

Originally made on 6/8/24 - Rewritten and reformatted to give more details about the team alongside pages 6 and 7 which were added alongside the change on 6/21/2024.

About the team: We are all 14 years old, and third-year VEX players, with two years in the MS leagues and this being our first in HS. We are all from Highland High School. Nevin, Elijah, Eric, and Miles shared a team for those two years alongside another member who no longer participates in VEX. Derek joined the team this year, though he has been in sister teams before. Elijah is the captain.

Nevin Zerby - Programmer/Notebooking Lead

Nevin has been at Highland his whole life, and this is his third year in VEX, with the same roles. Previously, he was on a team with the same people except that instead of Derek there was a student named Carson who had the same roles. He hopes to once again make their team recognized by others, and at least make it to state like before.

Introduction to The Team

Eric Nolting - Builder, Design

Eric Nolting has been in robotics for two years, since 7th grade. He has also been to states twice in that time, He has been on the same basic team since 7th grade and is planning to stick with them the rest of high school.

Miles Burson - Builder, Design, Strategy

Miles Burson has also been in robotics 2 years, since 7th grade. He's been to states 2 times. His team has been with the same team as the rest of out team besides Derek Marcum. And he is also planning on sticking on the same team as well, for as long as he can.

Introduction to The Team

Derek Marcum - Builder, Design, Drive-Team

Derek Marcum has also been in robotics 2 years, since 7th grade. He's been to states 1 time. My team has been different for both 7th to 8th but, I am also planning on sticking on the same team for the rest of highschool. Doing my best, no matter what.

Elijah Cooke - Designer, Build, Driver, Captain

Elijah has been in robotics for 2 years. He has been to states twice and made it into the round of sixteen both times. I have been on the same team for all my years and plan to stay on it. I plan to make a effective Vex design to have best chances for winning.

The Notebook Judging Rubric

VEX Engineering Notebooks are generally judged off of the official rubric, which is below. We will follow it as best as we can, in order to improve our documentation.

CRITERIA	PROFICIENCY LEVEL		
ENGINEERING DESIGN PROCESS	**EXPERT** (4-5 POINTS)	**PROFICIENT** (2-3 POINTS)	**EMERGING** (0-1 POINTS)
IDENTIFY THE PROBLEM	Identifies the game and robot design challenges in detail at the start of each design process cycle with words and pictures. States the goals for accomplishing the challenge.	Identifies the challenge at the start of each design cycle. Lacking details in words, pictures, or goals.	Does not identify the challenge at the start of each design cycle.
BRAINSTORM, DIAGRAM, OR PROTOTYPE SOLUTIONS	Lists three or more possible solutions to the challenge with labeled diagrams. Citations provided for ideas that came from outside sources such as online videos or other teams.	Lists one or two possible solutions to the challenge. Citations provided for ideas that came from outside sources.	Does not list any solutions to the challenge.
SELECT BEST SOLUTION AND PLAN	Explains why the solution was selected through testing and/or a decision matrix. Fully describes the plan to implement the solution.	Explains why the solution was selected. Mentions the plan.	Does not explain any plan or why the solution or plan was selected.
BUILD AND PROGRAM THE SOLUTION	Records the steps to build and program the solution. Includes enough detail that the reader can follow the logic used by the team to develop their robot design, as well as recreate the robot design from the documentation.	Records the key steps to build and program the solution. Lacks sufficient detail for the reader to follow the design process.	Does not record the key steps to build and program the solution.
TEST SOLUTION	Records all the steps to test the solution, including test results.	Records the key steps to test the solution.	Does not record steps to test the solution.
REPEAT DESIGN PROCESS	Shows that the design process is repeated multiple times to improve performance on a design goal, or robot/game performance.	Design process is not often repeated for design goals or robot/game performance.	Does not show that the design process is repeated.
INNOVATION/ ORIGINALITY	Team shows evidence of independent inquiry from the beginning stages of their design process	Team shows evidence of independent inquiry for some elements of their design process	Team shows little to no evidence of independent inquiry in their design process
USEABILITY AND COMPLETENESS	Records the entire design and development process in such clarity and detail that the reader could recreate the project's history.	Records the design and development process completely but lacks sufficient detail	Lacks sufficient detail to understand the design process.
RECORD OF TEAM AND PROJECT MANAGEMENT	Provides a complete record of team and project assignments; team meeting notes including goals, decisions, and building/programming accomplishments; Design cycles are easily identified. Resource constraints including time and materials are noted throughout.	Records most of the information listed at the left. Level of detail is inconsistent, or some aspects are missing.	Does not record most of the information listed at the left. Not organized.
NOTEBOOK FORMAT	Five (5) points if the notebook has evidence that documentation was done in sequence with the design process. This can take the form of dated entries with the names of contributing students included and an overall system of organization. For example, numbered pages and a table of contents with entries organized for future reference.		ZERO POINTS (DOES NOT MEET CRITERIA) If awarding zero points, please include details in the "NOTES" area below.

The Engineering Notebook Judges' Rubric

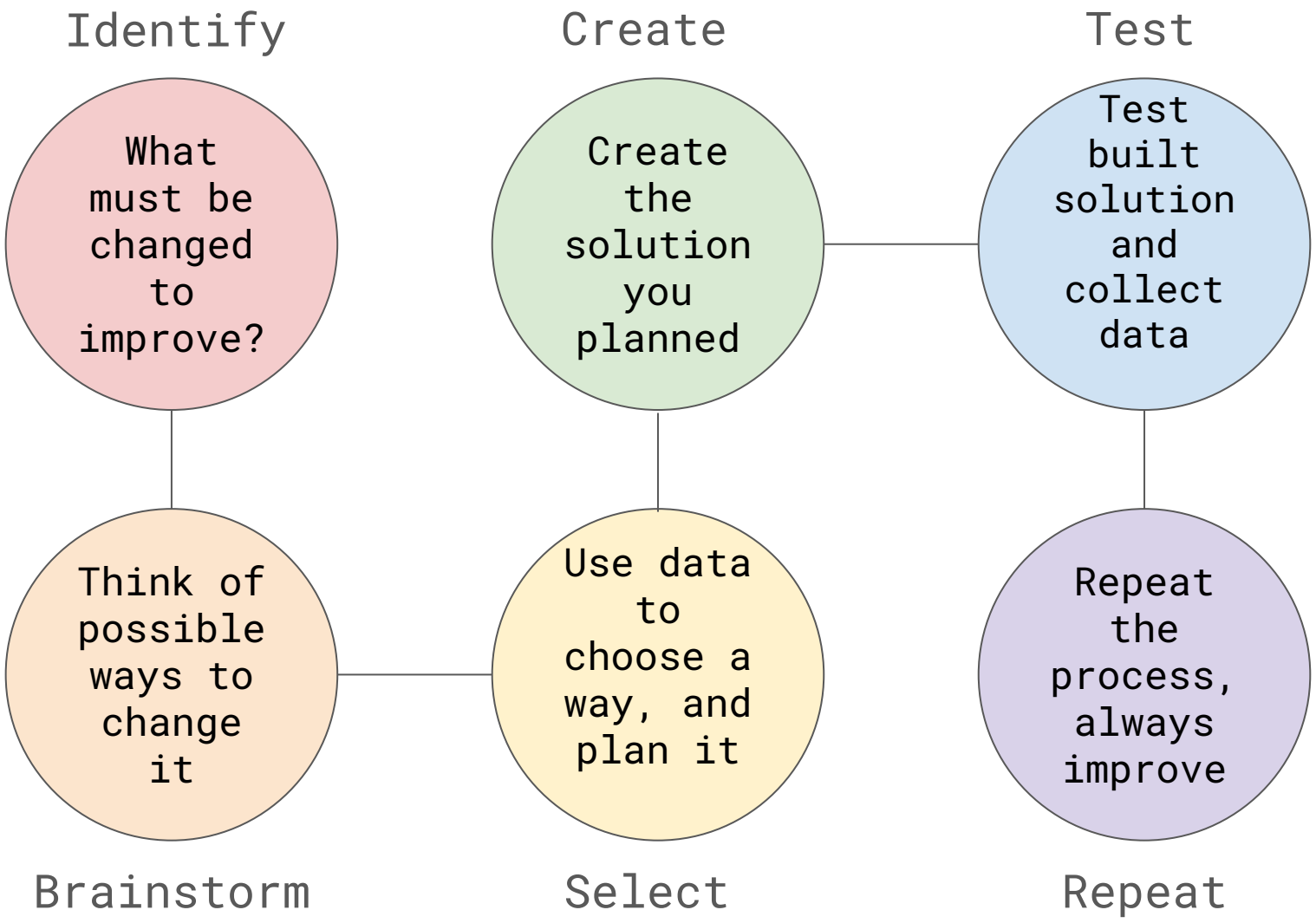
Date of Writing: 6/8/2024

Contributors: Nevin Zerby

Continued on:

The Engineering Design Process

An extremely important part of designing, improving, and learning about things, especially in engineering and in VEX, is understanding and implementing the Engineering Design Process.



We will use the engineering design process throughout the season, to help us create and improve an effective robot.

The Engineering Design Process

Identify

The first step in the 6-step variant of the Engineering Design process is generally Identify.

This means you need to identify a problem or area of the design (in this case, the robot/program) that could be improved.

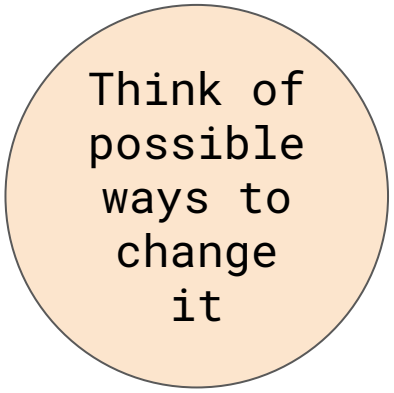
As the first step in the process, it is arguably the most important, because there's always something in the design that can be improved. You just need to figure out what it is, then you can perform the rest of the process, and continue improving the performance of your design.

Examples:

- You realize that your lift is quite slow, and this is an issue
- You realize that your robot doesn't turn consistently during autonomous, and is messing it up

The Engineering Design Process

Brainstorm



The second step in the 6-step variant of the Engineering Design process is generally Brainstorm.

This means you need to take the problem or improvable area you have identified and think of ways to fix/improve it.

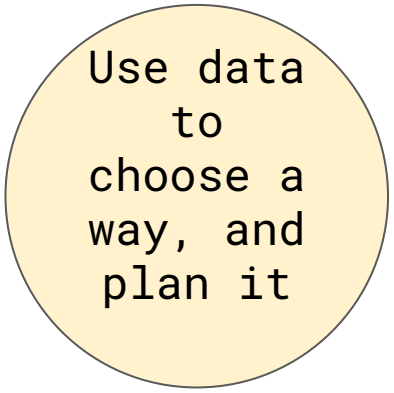
As the second step in the process, it directly follows the first. After identifying the issue, you need to think of ways to fix it. The rest of the process is built off of using these ideas you have come up with.

Examples:

- You think about how you could change the motor on your lift to make it faster, or make it lighter
- You learn about sensors and PID, Odometry, and other loops, and think you could use those to improve your turning consistency

The Engineering Design Process

Select



The third step in the 6-step variant of the Engineering Design process is generally Select.

This means you need to choose one or more of the solutions or improvements you brainstormed, and maybe test them to find the best.

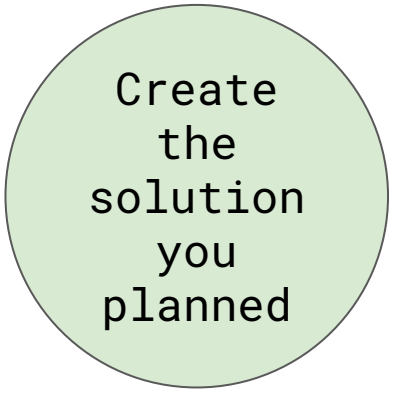
The third step of the process, it marks the halfway point. Once you have brainstormed ideas, you need to systematically test and choose one or more, and figure out which is best for your situation.

Examples:

- You decide to make your lift lighter because it had better results and is more versatile
- You decide to make a PID loop with a sensor because it is simpler, easier, and more fitting for your situation than something like an odometry loop.

The Engineering Design Process

Create



The fourth step in the 6-step variant of the Engineering Design process is generally Create.

This means you need to build or create the solution(s) that you brainstormed and chose for the issue or imperfection you identified.

As the fourth step in the process, it is very important as you must actually create what you have been planning throughout the process, and finally begin to improve your design with it.

Examples:

- You remove/replace some of the metal on your lift to make it lighter as you had planned
- You add a sensor to your robot, then code each part of the PID loop you had planned to make your autonomous turning and movement consistent

The Engineering Design Process

Test

The fifth step in the 6-step variant of the Engineering Design process is generally Test.

This means you need to test your creation that you made with the rest of the process, and see how well it works, and how it compares to the previous.

As the fifth step in the process, it is the final part of a cycle before it starts again. It means actually putting what you've made with the process in action, seeing if your creation works well, if it is better than it was previously, and if it was truly the best option.

Examples:

- You see that your lift is much faster now that it is lighter and not bogged down.
- With the loop implemented, your robot now turns much more consistently and has been improved.

The Engineering Design Process

Repeat

The sixth and final step in the 6-step variant of the Engineering Design process is generally Repeat.

This means you need to repeat the process, which you should always do. You can always improve anything, even in the slightest. It's never perfect.

As the sixth and final step in the process, it is maybe the most important because it makes sure the cycle keeps going. You should always repeat the Engineering Design Process, always improving, always making things better. There will always be something to fix or change.

Examples:

- You realize that your robot might not be strong enough, so you begin the process again
- You realize that the code for your motors sometimes stops during a match, so you begin the process again

Documenting With The EDP

Documenting alongside the Engineering Design Process is important, so we can show that we have gone through these design cycles. The Notebook Judging Rubric (See pg.6) emphasizes this, saying that we have to show evidence that our design and documentation were made alongside the EDP.

How will we do this? Well, when we go through a cycle, we will explain what we did for each part with a page or part of a page. We will color code parts of pages/full pages that go over each part of a cycle, using the colors in pages 7-13 (see the colored bars at the top of those pages). For example, if we are making a page about how we are brainstorming solutions to inefficient drive-base design, it will be color coded as orange.

Documenting and designing using the EDP isn't just for points on the rubric, as it is a tried-and-true method of efficiently improving your design, and it is always good to have old data and information to fall back on later, so that you know exactly how you did something and why.

High Stakes: The Game

The game of High Stakes is interesting and intricate, and is unique especially to the games our team has participated in previously. (Spin Up and Over Under)

In the case that this is being viewed digitally, the link to the High Stakes game reveal video is here. This video explains the basics of the game, with some specifics on dimensions of certain parts and how to score points.

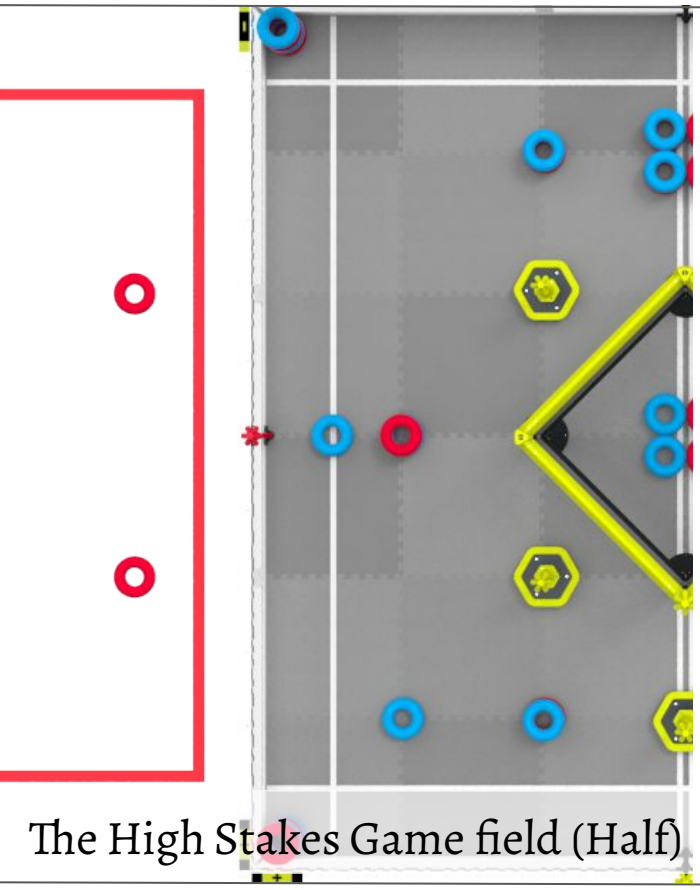
All the specifics, rules, and other important details like how to score Autonomous Win Points are explained in the Game Manual. We will go over parts of the game, especially rules and details from the manual, in the following pages.

According to the Game Manual, “The object of the game is to attain a higher score than the opposing Alliance by Scoring Rings on Stakes, Placing Mobile Goals, and Climbing at the end of the Match.”

We will go over the game in multiple parts.

High Stakes: The Field

For space sake, we have taken half of the field as an image (below) rather than the whole field. The field is “mirrored” on each side, so this is fine and should get the point across. The half shown is the “red” side, containing half of everything.



The High Stakes Game field (Half)

According to the official Game manual, the field includes the following:

- 5 Mobile Goals, 1 Stake each
- 4 Wall Stakes, 2 Allied, 1 not
- 1 Ladder with 3 levels and one High Stake
- 48 rings, 24 of each color
- 4 Special Corners, 2 being Positive Corners, the other 2 being Negative Corners

As for scoring, there is the following:

- 6 point Autonomous bonus
- 1 point per ring scored on stake (3 if it is the Top Ring)
- Climbs grant 3 points at level 1, 6 at level 2, 12 at level 3
- Rings on stakes in the corner will have new values (pg.17)

High Stakes: The Field Pt.2

An important part of the field is the corners. There are Positive Corners and Negative corners. If a mobile goal carrying rings is placed onto a Positive corner, the point values for all rings on it will double. If it is placed on a Negative Corner, all rings on it will have opposite scoring, or will have their score multiplied by -1.

It is impossible within VEX rules to have negative points, so rings scored on a goal in the corner will be counted as 0, and will rather *take away* their original point values from your total score. While they are scored as 0, they have a net value of the opposite of what they were before. (Note that if you have 0 points, yet have rings on a Negative goal, you will remain at 0 points rather than going into a negative point range.)

Another thing to note about the field (specifically the stakes) is that each stake can only legally fit a certain number of rings. Mobile goal stakes can hold a total of 6 rings each. Wall stakes can hold a total of 2 rings each. The High Stake can only hold 1 ring. If additional rings are somehow squeezed on or set on top of a stake, they will not count.

High Stakes: Measurements

It is important to know the specific measurements of game elements so that the robot can be created to interact with them accurately.

A High Stakes Ring

The “rings” used in the game all have the following measurements:

- 7 inch outer diameter
- 3 inch diameter of “hole”in middle
- 2 inch thickness

A Mobile Goal

The mobile goals in the game all have the following measures:

- 10 inch maximal diameter (hexagonal)
- 14.5 inch total height (base & stake)

No other measurements are explicitly listed in the manual, but will be tested later.

The Ladder

The “ladder” in the center is a 36x36x46 inch structure with rungs at 18, 32, and 46 inches respectively. No other measures for rungs or the High Stake are explicitly given, will be tested later.

Date of Writing: 6/10/2024

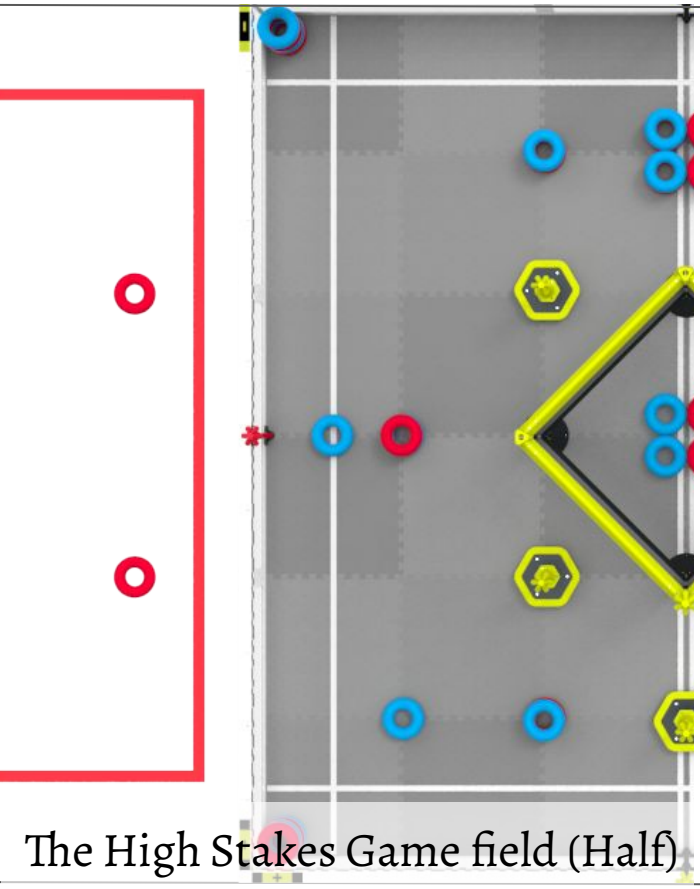
Contributors: Nevin Zerby

Continued on: 20

High Stakes: Autonomous PT. 1

The autonomous period is an important part of the game. It occurs within the first 15 seconds of the match, and consists of completely autonomous movement, the robots moving purely from code and not from a controller. In High Stakes, there are many rules about Autonomous, unique parts of it, and a new Autonomous Win Point. We are using the half-picture again to help explain autonomous plans, and how it works.

Also, to note, in High Stakes, the winning alliance of the autonomous period is granted 6 points. (In a tie, both get 3.)



The High Stakes Game field (Half)

All regular game rules apply during the autonomous period, but there is also a rule against crossing the Autonomous line, which is a pair of tape lines across the middle of the field. Any robot crossing it (touching any of the field on the other side of it) will result in that alliance's immediate loss. If both alliances do this, it will result in an autonomous tie.

High Stakes: Autonomous PT. 2

During the Autonomous period, you can score an Autonomous Win Point, which is functionally the same as a Win Point. (You get win points by winning Auton and matches.)

To score an Autonomous Win Point in High Stakes, your alliance must complete all four of the following tasks during the Autonomous Period. The tasks are:

1. Score at least three (3) rings
   - Place them on stakes

2. Have a minimum of two (2) stakes that have at least one (1) rings scored on them

3. Neither robot contacting/crossing/breaking the plane of the Starting Line

4. Complete the Autonomous period with at least one robot in contact with the Ladder

You must additionally not break any autonomous rules.

High Stakes: General Rules

Within VEX, each game usually has a similar variation of the General Rules set. This is true for High Stakes as well. Here is the list general rules from the Game Manual:

G1 - Treat everyone with respect.
G2 - V5RC is a student-centered program.
G3 - Use Common Sense.
G4 - The robot must represent the skill level of the team.
G5 - Robots begin the match in the starting volume.
G6 - Keep your robots together.
G7 - Don’t clamp your robot to the Field.
G8 - Only 3 Drive Team Members, only in Alliance Station.
G9 - Hands out of the Field.
G10 - Controllers must stay connected to the Field.
G11 - Autonomous means “no humans.”
G12 - All rules still apply in the Autonomous Period.
G13 - Don’t destroy other robots.
G14 - Offensive robots get the “benefit of the doubt.”
G15 - You can’t force an opponent into a penalty.
G16 - No holding for more than a 5-count.
G17 - Use Scoring Objects to play the game.

High Stakes: Game Rules

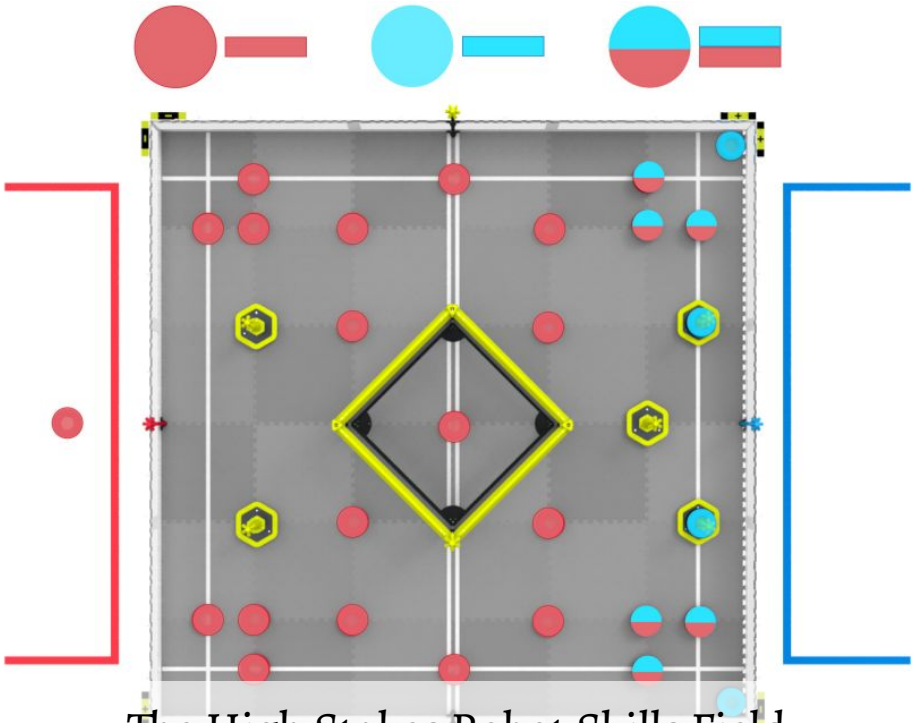
While there are the general rules that apply to each game, each game has its own rules, including High Stakes. There are the Specific Game Rules, the Robot Rules, and the Skills Rules which are varied between each game. This page will go over the Specific Game Rules.

SG1 - Starting A Match.
(Robot has to start not touching other robots, not having too many preloads, and not breaking other rules)
SG2 - Horizontal expansion is limited. (to 18”x24”)
SG3 - Vertical expansion is limited.
SG4 - Keep Scoring Objects in the field.
SG5 - Each Robot gets one Ring as a preload.
SG6 - Possession is limited to 2 Rings and 1 Mobile Goal.
SG7 - Don’t cross the Autonomous Line.
SG8 - Engage with the Autonomous Line at your own risk.
SG9 - Don’t remove opponents from the Ladder.
SG10 - Alliance Wall Stakes are protected.

The purpose of this page is to show our build parameters and competition intent. Rules are not always necessary for the notebook, but they can be important for showing our intent.

High Stakes Skills: Explanation

Each game has the Skills challenge, in which a robot is in the field on its own and must score as many points as it can within a minute while under a slightly altered ruleset. There is Driver Skills, in which the robot is driven throughout the duration, and Autonomous Skills, in which the robot is controlled entirely by a program.



The High Stakes Robot Skills Field

The Skills field is arranged like this, with an altered amount of rings and a rearranged set of field elements. Skills strategies need to be unique and efficient to score well with this new field.

There are some other intricacies such as teams being able to decide to stop early, by showing a Skills Stop Time. This does not alter scoring, but serves as a tiebreaker if needed. Otherwise, the run will be cut off immediately after one minute.

High Stakes Skills: Rules

Skills has a special set of rules that make it work differently from a regular match. Here are the eight rules:

RSC1 - All regular rules apply unless stated otherwise. Unless another rule says otherwise, all regular rules apply.
RSC2 - When you get to run Skills is determined by when you got into the line. Each team gets 3 Driver and 3 Auton runs.
RSC3 - Robots must start in a Red Alliance legal position.
RSC4 - Blue rings only score points if they are Top Rings, are the only Blue ring on the stake, and all Red rings are scored.
RSC5 - Any Red Ring scored above a Blue Ring has no value.
RSC6 - No ring gets Top Ring scoring if a ring on the stake has no value according to RSC4 or RSC5
RSC7 - No Corner Modifiers (Positive & Negative)
RSC8 - Skills Fields are not required to have the same modifications as Competition fields.

- Each Ring scored on a Stake - 1 Point (see rules)
- Each Top Ring scored on a stake - 3 Points (see rules)
- Climb - 3 Points, 6 Points, 12 Points for levels 1, 2, and 3
- Mobile Goal Placed in a Corner - 1 Point (1 Point is added to the score instead of modifiers in Skills.)

How a Tournament Works

A standard VEX tournament works as such.

Qualifier Matches:

There is a scoreboard ranking every team present on their performance in Qualifier matches, based on scored points, win points, and other details. The amount of matches is unclear, but they always have the standard of a 15 second autonomous period and a minute and 45 second driver control period.

Alliance Selection:

All teams present send a representative (the Captain) to line up first to last according to the team's ranking on the leaderboard. The top 16 teams may each choose another team to be their Alliance partner for the rest of the tournament. If a top 16 team chooses another top 16 team, the next team moves up and will be able to choose a partner.

The Tournament:

All 16 alliances that come out of the selection are put in a single-elimination bracket and all games are played until the finals. The winner wins the tournament. At certain large events, the Finals are a best of 3, rather than a single game.

Tournament Awards PT.1

Most VEX tournaments will offer several awards for the teams participating. Earning some awards is purely just for the honor, but some can qualify for state/regional events, and at some signature events and at state/regional events, they can qualify a team for Worlds. This page and the next go over the generally recognized awards. They are as follows:

Main Judged Awards

Design is granted to the team with the most effective design process and notebook that fits their robot.
Excellence has the criteria of Design, plus the team has to be top 40% in Driver and Autonomous Skills as well as Qualifiers.
Judges' Award is given to a team judges believe deserve special recognition and credit, but may not fit other awards.

Tournament Awards

Tournament Champions (the alliance that wins the bracket) both receive an award, almost always qualifying.
Tournament Finalists (the alliance that loses finals in bracket) both receive an award.
Tournament Semifinalists (the alliances that lose semifinals in bracket) - a rare award, but World Qualifying if gotten at States.

Tournament Awards PT.2

Skills Awards

Skills Champion - Team with the highest combined Driver and Autonomous Skills score. Ties are broken by whoever has the higher Autonomous Skills score, or by lowest Stop Time.
Skills 2nd and 3rd Place - Teams with second and third highest combined Driver and Autonomous Skills scores.

Other Awards

Create Award is granted to a team with a creative engineering solution and effective robot, sort of a mini Design Award
Amaze Award is granted to a team with a robot that is well rounded and well performing, sort of a mini Excellence Award
Think Award is granted to a team with very effective or otherwise difficult to make/creative autonomous programming
Innovate Award is granted to a team with a unique robot and strategy, that thinks out of the box or is not seen before.
Build Award is a team with a well-made robot that is effective in what it does and is consistent with its construction.
Energy Award is for a team that exudes the most positive energy and brings cheer to an event/tournament
Sportsmanship Award is for a team that extends the greatest sportsmanlike values and is nice to others.

VexForum and its Usage

There is an official VEX website, VexForum, in which people can ask questions and discuss things regarding rules, team establishment, ref calls, favorite moments, building strategies, and more. It is useful for many reasons and is also a way to connect with the VEX community.

We plan to be somewhat active within the VexForum via Nevin Zerby's account @soritarian1. This will allow us to learn many things, get strategies, understand rules and game components better, help others, and be a bigger part in the VEX community as a whole.

Nevin have already made quite a few posts, either asking questions or answering them, and it has helped a lot. It has solved complicated code errors, clarified rules, shown us some strategies and cool robot showcases, and we've even seen other teams that we have met in person on there.

We understand that using it may seem like we're going to copy other people on it, but we won't. We need to have a unique robot to follow the rules, learn, progress, and, in the sense of the game, maybe perform better than the rest.

Individual Studies: Build

Some of the most important parts of a robot and its' build are the drive-base, intake/collection system, and lift. Since our team has not gotten together yet (or been fully decided - our coach technically picks the teams) we wish to do an individual study with the knowledge we have and our experiences.

As a standard, we will go over as many regular designs as there are that we would find applicable and appropriate for this season, go over pros and cons, and decide which one we believe would theoretically work the best.

These "statistics", ideas, and decisions are not reflective of the team's efforts, as that is not possible at the moment, and tests are also not being actively taken for similar reasons. When our team is together, we will most likely do these studies again, but with input from all members, more information, and the possibility of running tests.

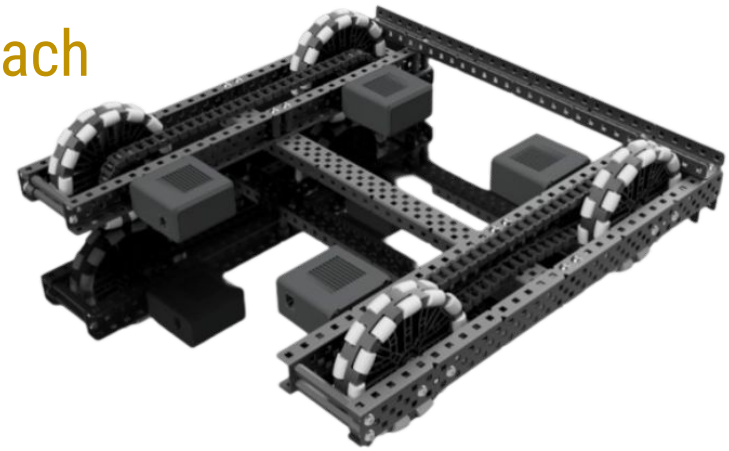
It is also important to note that we (at this point) have no direct experience with some of the build ideas that will be gone over, and will be using what we have witnessed in person and seen online.

Individual Studies: Drive-Base

The first set of possible choices we will go over are the options for our Drive-Base, or where our wheels and chassis go.

Option One: Standard “Tank Drive” (Omni-Wheels)

- Most common drive-base, often most reliable
- Versatile
- Two wheels on left and right each
- 2 way movement
- Decent turning
- Moderate strength
- Easy to push from the side



Option Two: Standard “Tank Drive” (Friction + Omni Wheels)

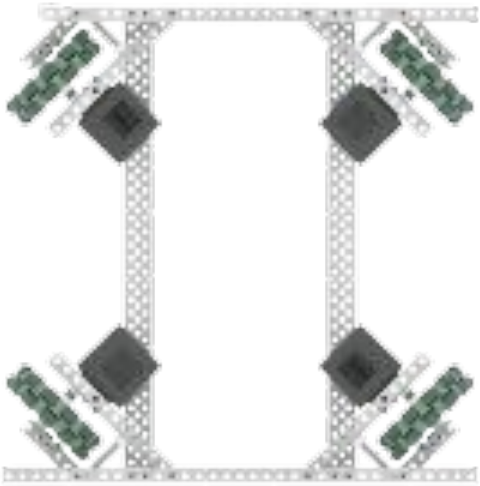
- Almost as common, reliable
- Versatile
- Two wheels on left and right each
- 2 way movement
- Moderate strength
- Rather bad turning

Individual Studies: Drive-Base

The first set of possible choices we will go over are the options for our Drive-Base, or where our wheels and chassis go.

Option Three: “X-Drive” (Omni Wheels)

- 8-directional drive
- Great turning
- 4 wheels arranged on opposing sides of an octagonal base
- Weak, but hard to push
- Low strength
- Less versatile



Option Four: Mecanum Drive (Mecanum Wheels)

- Versatile
- 4-directional drive
- Hard to push
- Two wheels on left and right each
- 2 way movement
- Moderate strength
- Not that reliable
- Huge, clunky wheels

Notebook Chapter Two
Season Beginning Pages

The purpose of this section is to go through our first robot build (before major rebuilds), the events of our early season, being the start of our practices and first team meetup through our first tournament and its results.

Season Updates: School Starts

Our season has not officially started yet but our engineering and planning class and school has. Our team is pretty much together, and we can start planning and such. Our practices will start in a couple of weeks, and we can plan, test code, and maybe start building, so that we are ready for competitions in November or maybe December.

We're learning/relearning some stuff first, and we will probably go over some of this here, as the whole team will be getting this information at the same time.

From now on, "Individual Studies" will no longer be fully individual and will have some input from other team members, as to provide a wider view of some concepts and ideas, and to get an idea we all agree on, at least to start.

The first practice is on 9/17/24. Teams will (probably) be selected, as well as names, letters, and more, if possible. Let it be known that we are working in a room alongside several sophomores, juniors and seniors (we are freshmen.) We will not be "cross-teaming" during practices (as in making other teams help us.)

Date of Writing: 9/6/2024

Contributors: Nevin Zerby

Continued on: 34

SEASON BEGINS (Practices)

Our season practices have begun. Our team is not fully clear, but as of now it will include Nevin Zerby as chief programmer and notebook lead, as well as Elijah Cooke as a designer and builder, Miles Burson as a builder and scout, and Eric Nolting as a builder, utilitarian, and pit team. We may include a fifth member, though we are unsure at the moment. They will participate in the notebook, and they will be added to our team introduction page very soon.

Our practices are 2:30-6:30 PM on Tuesdays and Thursdays, with the first hour being not so much a practice as a planning period/free period, to make sure it is fair for the students who share our high school and the local community college, Tri-Rivers, who won't arrive until 3:30.

We will go into more detail about this as we go on, and we will get the team to make pages about themselves and some of their plans very soon. As of now, we are expected to go to 6 tournaments (excluding State and World, if applicable), with our home HS tournament and our home Blended tournament being guaranteed. We will also likely go to the Mount Vernon HS tournament, and a couple of others.

Season Beginning: Details PT.1

As stated, we will have practices every Tuesday and Thursday when possible from 3:30-6:30, with a 1-hour period beforehand for some planning and organization when needed.

We will also occasionally have Saturday practices at much longer times, but those will probably be smaller. Nevin will not be present for the Thursday practice this week.

Our “guaranteed” tournament appearances are linked (from robotevents.com, a useful resource) if this is viewed digitally:

Highland Holiday Blended Qualifier
Highland HS Qualifier
Mt. Vernon HS Qualifier

A list of possible tournaments we may go to:
Dan Spak @ Firestone - Kennedy Group @ Brecksville-Broadview - West Holmes - Motion Control @ TSCC (Fremont) - Roller Coast RoboClash @ Cedar Point - Pioneer Blended @ Elyria - Marion Harding - Kalahari HS Open - Barnesville Blended - Washington CH Blended

Season Beginning: Details PT.2

Most likely we will go to these additional tournaments:

- Motion Control Robotics @ Terra S.C.C. (Fremont)
- Pioneer Classic Blended @ Elyria High School
- Washington CH Blended @ Washington CH High School

Our plan is, for the start, to have the whole team (primarily the builders) working on a starting robot design so we have something to begin building off of, while we record it in the notebook and collect some of their views and opinions of it. After a little bit, we'll start doing Engineering Design Process slides like previously, and at any practice we have a goal of 3 pages in the notebook, not including those from teammates. Nevin will be doing most of it, being notebook lead.

Once there are enough parts of the robot set up, we will begin coding the parts/electronics of it and begin all the loops/functions/callbacks for driver control, and develop that as we go through. Once we have the robot fully set up, or at least a base, we will begin autonomous programming with a goal of winning an autonomous win point over else unless a better option suddenly comes up.

Post-Practice Notes 9/17/24

Our first practice was completed last night, and here are some notes and plans regarding the outcome of the practice and what will happen now:

- Derek Marcum most likely joining team

Derek will be an assistant builder and designer, and most likely will work as a scout, and if applicable, match loader. He will have notebook input as will the rest of the team. However, as teams have not been finalized, there is a chance he does not join us.

- Nevin will not be present next practice.

He may have the rest of the team fill in for notebook duty during it, and finalize their pages later so that we can get a view of everything he may have missed.

- Robot designing has begun.

All we have so far is a rough sketch of half of our drivebase, and we will go into much more detail based on our research/tests/results and also probably insert photos of our first sketches.

Post-Practice Notes 9/19/24

Nevin was not present for the 9/20/24 practice, and the others were unable to work on the notebook due to other circumstances, and have asked me to make this summary.

We drew up and tried to submit multiple designs and strategies to our coach, but they were denied and we were sent back to the drawing board. A full design has not yet been made because of this, and we will work on it at the next practice, which is one of few Saturday practices and will take place on 9/21/2024, where we may also start building. We will document this process as well as we can, and maybe start documenting an Engineering Design Process design cycle.

We're using inspiration for a clamp from a robot reveal video on YouTube, and we may use others for inspiration for other parts, but we will have our robot be unique and we aren't going to simply copy another robot.

We've decided on an 8-wheel, 6 motor drive with 360 rpm geared motors. This will mean a very strong, large base, which will be hard to push, and will have mobility and strength advantage over most opponents.

Date of Writing: 9/20/2024

Contributors: Nevin Zerby

Continued on: 39

Practice Goals/Plan: 9/21/2024

For today's practice, we have the following goals:

- Get an approved design with our coach
- If the above goal is fulfilled, begin building
- Finish an Engineering Design Process cycle
- Document the cycle

We will also have finally submitted our finalized tournament list, as some things have changed outside of our control. This includes not being able to attend Kalahari US Open due to other Highland teams taking up our slots for it, which we could not apply for as Derek was not a finalized member of the team yet. (But now that he is, we can get spots for other ones.)

Since today's practice is a 4 hour morning practice, things will probably go differently, but the plan is to finish a basic sketch design, submit it, and then we can create it and test it, then repeat the design process for each part of the robot. We will try to fully document this process as best we can whenever it happens, with the proper color codes we set up previously.

At the time of writing, the practice has literally just started, and only Eric has gotten here, so this is all we have for now.

Date of Writing: 9/21/2024

Contributors: Nevin Zerby

Continued on: 40

Updated About Us Pages

We have made more, and more detailed About Us pages, editing the original 6/8/24 Page 5 and adding a new page 6 and 7, changing every single page number in the corners, “continued on” bits, and the entire table of contents, so that it can be shown towards the start of the book as many are, so that one can understand our individual experiences in robotics and some other aspects. This proved an organizational challenge, but it has worked, and now the notebook is better for it.

At the time of writing this, only Nevin and Eric have written their parts, but the others will come soon, and will almost certainly be there by the time anyone is reading this.

Additionally, some starting pages have been reformatted and edited to more fit the organization and style of the rest of the book, and to be more clear and efficient at conveying the necessary information, while also looking cleaner and more uniform both in general and to the rest of the book.

More of these changes will likely be made soon, and they will be mentioned when they are, to improve overall clarity.

Beginning Process Summary

Our initial first run of the Engineering Design Process was not fully documented, but it was shorter than usual due to the circumstances of starting the season. As a summary:

- Identify

Our problem was that we had no robot, and we needed an effective robot to play High Stakes, but to do that first we needed a drive base.

- Brainstorm

Together the team brainstormed different ideas and potential drive base ideas, even incorporating the Individual Studies, and we narrowed it down to a 6-wheel omni drive, an 8 wheel (6 motor) omni drive, and a 4-wheel mecanum drive.

- Select

After thinking about and discussing all the pros and cons, we eventually decided on an 8 wheel, 6 motor omni-wheel drive, with blue motors (600 rpm) geared down to 360 rpm to guarantee maximum strength, as well as a decent amount of speed.

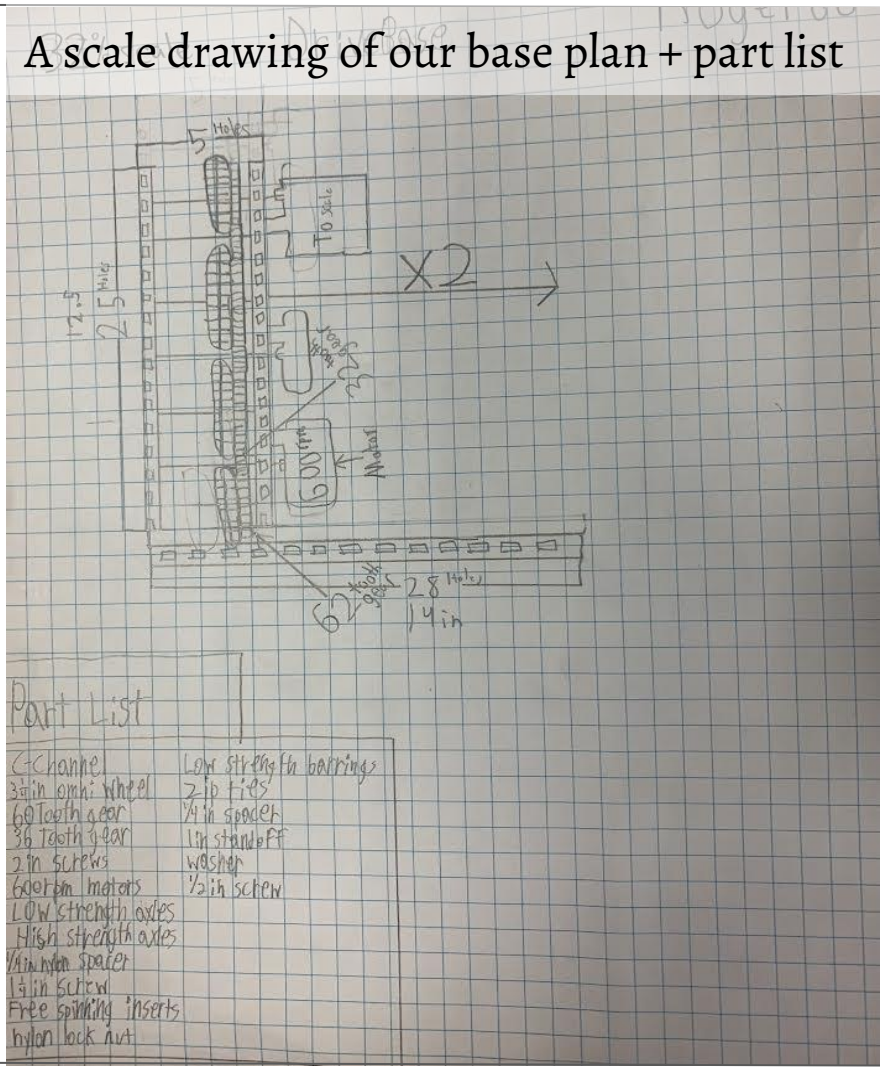
On the next pages we will go over the rest of the process in more detail, as it is active. We are building as we write this.

Drive-Base Initial - Create/Build

As the first parts of the Drive Base design process were summarized in the last page, it is now time to document the Create part of the process, where we build the first base.

Pictured here is the first design sketch of the drive base, showing some details as well as a parts list we will use to build. First, we prepared the wheels by screwing gears to them so that they can be geared up more accurately and easily once they are on the base itself. Then, we fitted the wheels to the metal base halves, evenly spaced.

A scale drawing of our base plan + part list



For attaching the wheels to the base, we used bearings with zip-ties (see why on page 49) and then we started making the connections for the base that goes around the wheels go.

Using Zipties on Bearings

When attaching wheels and gears and such on driveshafts to our base, we, instead of the standard 3-hole bearing with a screw and nut in each of the empty holes alongside the driveshaft hole, we put in zip-ties.

We have done this previously, and have discovered multiple reasons why it works, and in experience, it definitely has.

- Lighter Robot

  Even if the amount is tiny, this lowers the weight of the robot and drivebase, making it just that slightest bit faster.

- Easier to work with

  Zip-ties are much easier to work with in this case, because they are faster to put in, and, when deconstructing so that the robot can be worked with, or destroyed post-season, instead of going through all the unscrewing, you can just clip the ties.

- Sturdiness

  Zip-ties are far more sturdy than they seem, and are more consistent than screws, as they can't fall out, can't unscrew themselves, and are simpler.

- Budget

  Simple. Zip-ties are far cheaper than screws + nuts.

Beginning Coding Process

We've also begun the basic coding process - we're new to V5 Pro, and have been learning some of it on the spot, but it is working. The image at the bottom does not include everything, of course, just the declarations of our electronics. We are taught to do them directly like this, typing them out manually, rather than through the electronics menu. This gives us more customization, and also helps teach us code for the future.

The rest of the code is in the competition format, and all the includes and such are there, as well as code for controller axes, and at the moment, running this code would allow a robot of our planned size with our planned 6 motor base, to drive and turn with a split arcade controller drive, just as intended.

```
brain Brain;
controller Controller;
motor LF = motor(PORT13, ratio6_1, true);
motor LM = motor(PORT2, ratio6_1, true);
motor LB = motor(PORT14, ratio6_1, true);
motor RF = motor(PORT18, ratio6_1);
motor RM = motor(PORT5, ratio6_1);
motor RB = motor(PORT19, ratio6_1);
digital_out clamp = digital_out(Brain.ThreeWirePort.A);
motor_group LeftDrive = motor_group (LF, LM, LB);
motor_group RightDrive = motor_group (RF, RM, RB);
drivetrain Drivetrain = drivetrain(LeftDrive, RightDrive, 10.21017, 14, 15, inches, 0.6);
competition Competition;
```

The current declarations in our code for High Stakes on VEX V5 Pro.

Date of Writing: 9/21/2024

Contributors: Nevin Zerby

Continued on: 45

Post-Practice Notes - 9/21/24

Attendance:

- Miles was not present
- Derek was not present
- Elijah was late slightly (30 minutes)
- Eric & Nevin present entire practice (4 hours)

Since Derek and Miles were not there, we could not build very efficiently, so we did not make much. Nevin focused on reorganizing the notebook, and writing a couple extra pages based on the start of our processes.

Elijah and Eric worked on the drive-base build process explained during that practice's pages. At the moment, it is at a point where it should be able to be completed in the next practice if the whole team is present. That is also the likely goal for the next practice.

Planned attendance for the next practice is full at the moment, though this may change. We will now start listing attendance on every post-practice page, and will make one after every practice from now on. The next practice is on 9/24/24.

Date of Writing: 9/23/2024

Contributors: Full Team

Continued on: 46

Practice Goals/Plan 9/24/24

Our practice has started for today. Derek is not here, and he has an important football practice, so he is not able to come. Otherwise, attendance is full, except that Nevin will be leaving an hour early (5:30, practice ends at 6:30) for a family event.

Practice plans:

- Complete drivebase, with help of Miles now that he is here
- Start preparing electronics, so that we can test driving
- Document rest of drivebase engineering design process
- Start designing next robot parts (lift, clamp, etc)

Our basic code is completed, there doesn't seem to be any more we can do at the moment without being able to test with the bot. At the moment, it includes what is in page 50, plus a little more. (Split-Arcade drive for 6 motor, 8 wheel drive, as well as a clamp and lift, and competition-formatting.)

We have realized that it is very important to show how we use our time, and since we now have a few practices' experience, we will use one of the next pages to make a Gantt chart of our time distribution, as well as some additional details as to how we spend our practice time.

Season Schedule Update

We have received a finalized update to our season schedule. It is shown at the bottom of the page. We are going to six tournaments, being Motion Control Robotics, Highland Blended Holiday, Mt. Vernon, Elyria (Pioneer Classic Blended), Washington CH Blended, and the Highland HS tournament. At the end of the list is the Highland MS tournament, which our club requires us to work at as scorers, field assemblers, managers, and more. This helps us develop a better understanding of the game, and also allows us to understand what the tournament workers are doing at our tournaments, so we know how to respect them and their schedules.

This is our tournament schedule for High Stakes, plus one we are working at.

6978B

Event	Location	Date	Leave HHS (estimated)	Back to HHS (approximated)
Motion Control Robotics	Terra S.C.C. (Fremont)	Sat, Dec. 7	6:00am	7:00pm
Highland Blended Holiday	Highland	Sat, Dec. 14	Not Leaving	All Day!
Mt. Vernon	Mt. Vernon HS	Sat, Jan. 4	7:30am	5:00pm
Pioneer Classic Blended	Elyria H.S. P.A.C.	Fri, Jan. 10	1:30pm	Midnight
Washington CH (Blended)	Washington CH HS	Sat, Feb. 1	5:45am	7:30pm
Highland HS	Highland HS	Sat, Feb. 8	Not Leaving	All Day!
Highland MS	Highland MS (working)	Sat, Feb. 15	Not Leaving	All Day!

Date of Writing: 9/24/2024

Contributors: Nevin Zerby

Continued on: 48

Our Time Distribution Plan

We initially planned to use a Gantt chart to display this and convey how we want to distribute our time, however we could not find a sufficient way to insert one or an alternative chart that would fit our needs, so we made a rudimentary “chart.”

Nevin (Notebook Lead & Head Programmer)

3:30 Recap, plan, and other pages **4:30** Test autonomous or new electronics code if possible **5:30** Finishing pages, process documentation until **6:30** (Before events, extra coding time)

Elijah (Captain, Builder, Designer, Strategy)

3:30 Planning + Begin building **4:30** Help test code, assist teammates **6:00** Finish building and clean up. (Before events, extra drive practice time)

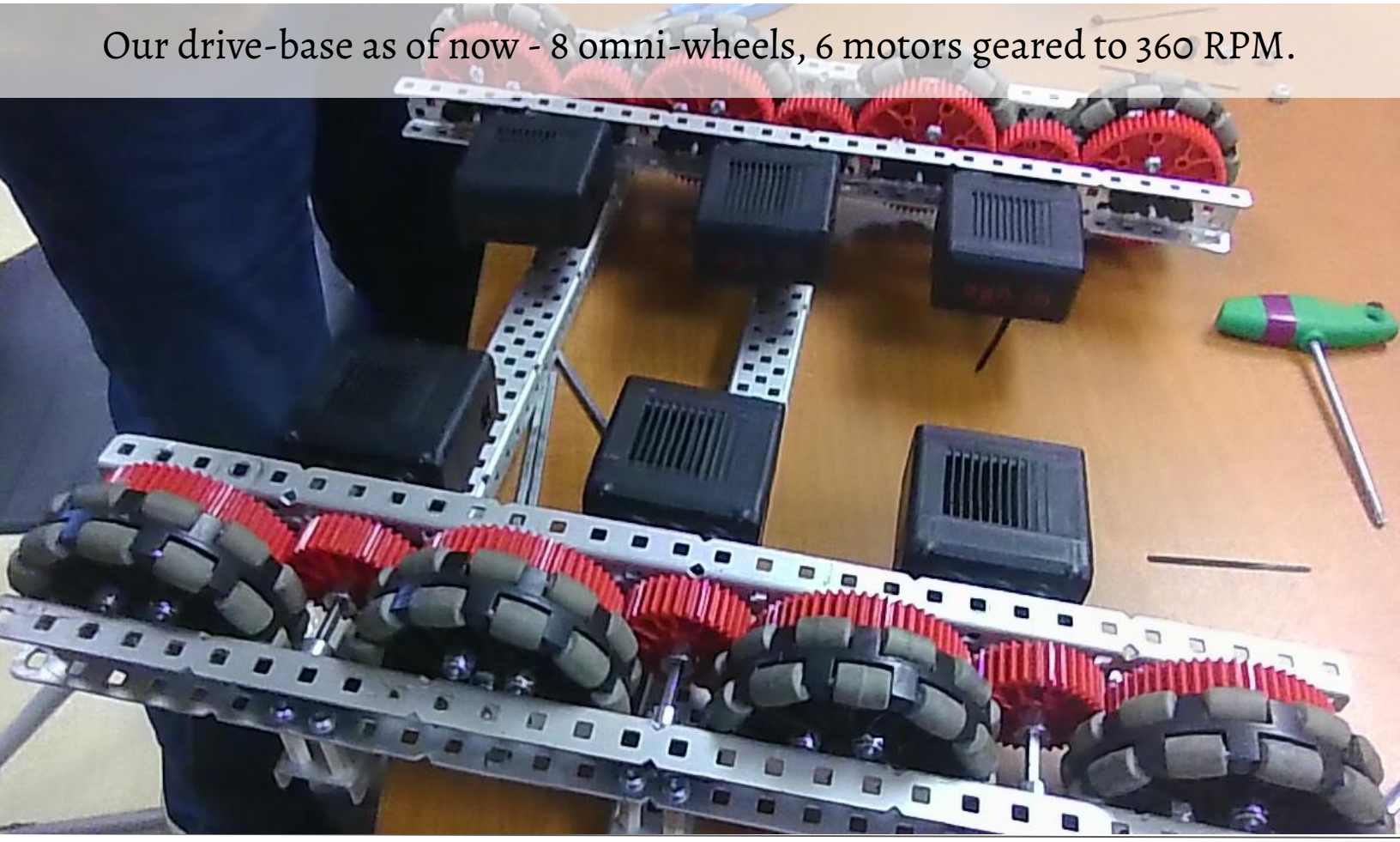
Eric & Miles & Derek (Build, Strategy, Utility)

3:30 Build planning, gathering materials and such **4:30** Focus on build and some testing when applicable **5:30** Assist code tests, do match-loading and backup driving practice. **6:00** Final tests, relay information, finish building and clean up. (Before events, troubleshoot robot and find possible problems)

Drive-Base Initial Build - Part 2

Pictured at the bottom is an image of our now-finished (for now) drive base. Continuing from the events on page 48, we finished assembling each identical half of the base, used 2 c-channels to connect them, and then attached the in-between gears (making a 60-36 ratio with the blue motors, final RPM being 360) and then finally the motors on those smaller gears. The drive-base build is complete, and has the dimensions of ~15” x ~15”. The wheel base (center of left wheels to center of right) is 12.5”. We will show our tests when we attach a brain.

Our drive-base as of now - 8 omni-wheels, 6 motors geared to 360 RPM.



Date of Writing: 9/24/2024

Contributors: Nevin Zerby

Continued on: 50

Additional Practice Building

At today's practice, after the drive-base was completed, we began building some smaller next components and parts, including a sled concept, the sides/borders for our intake, a clamp concept, and we also tightened the robot and attached the intake side-parts. We also started planning the intake spot, as well as where we will be mounting the brain, radio, and wires/other electronics.

More is to be done and will be documented later, as Nevin will not be here to witness and document all of it, as he is leaving early as stated in this practice's intro page. Teammates will fill in the rest:

After Nevin left, we finished the intake arm that is now mounted on the front connected to the two side parts we put on. We added an additional bar to the middle to make the structure more sound, and we added two vertical bars to put the rest of the intake and the lift on next. - Miles

We want to work on the intake more now, and we may be able to finish it next practice, and then move on to the other mechanisms. - Elijah

Date of Writing: 9/24/2024

Contributors: NZ, MB, EC

Continued on: 51

Post-Practice Notes - 9/24/24

Attendance:

- Derek not present
- Nevin left early
- Miles, Eric, and Elijah present all practice

Derek had another football practice, but he will be able to show up to practices again soon. Since 4 of us were present anyway, we were able to make more progress than we could without Miles as well and Elijah coming late. We got the drive-base done, as well as the starts of some other builds (particularly the intake) and their individual designs. Now that there is a tournament schedule, we will do some more research and get some more information about them so that we can make plans for each one.

Otherwise, we should have full attendance next practice, as we know that we will not be having any reason to leave, and the team should not have anything else in the way, as it is a special practice that is from 5:00 to 8:00 rather than 3:30 to 6:30, which also means that some things will be organized differently, and we will not have the 1-hour planning phase beforehand as usual.

Date of Writing: 9/25/2024

Contributors: Full Team

Continued on: 52

Practice Goals/Plan 9/26/24

This practice is organized differently due to schedule conflicts with the coach and some students, and is placed from 5:00 PM to 8:00 PM rather than the usual 3:30 to 6:30. The entire team is present, except Derek, who will show up later.

Practice plans:

- Complete intake, a team effort with the builders
- Figure out electronics mounting plan
- Begin placing lift specifications based on possible clashes with the intake placement
- Run basic intake tests, proof of concept and such

Football practices should soon not get in the way of a lot of robotics practices, so Derek and some other football players should be able to show up more often and do more. This will mean that we will be able to get stuff done faster, and also get additional input from Derek who might end up doing some notebook work with a builder's perspective.

Update: Derek has arrived (30 minutes late) and will assist building, so the process should go faster and he will likely be able to write a page or two at today's practice.

Initial Intake Design Process

As some of the intake's design process was missed so far in the notebook, it will be summarized similarly to how it has been before, where the first three steps were done in one page.

Identify: We need an effective intake for picking up the rings and placing them in clamped mobile goals.

This one's much clearer and obvious, as will all initial "identify" sections will, as our issue is that we don't have one.

Brainstorm: We thought of several ideas based on robot reveals we've seen, and our previous experience with intakes.

We took material ideas from VexForum, YouTube, our sister teams, and even just previous yearly experience, as we know what works with field element materials, like the OU tri-balls.

Select: After going through all our ideas, we eventually decided on a flex-wheel floating intake that goes upward.

We realized that this was the best option, as it worked very well for us in Over Under, and many good teams use it this year.

Initial Intake - Build/Create

With the start of the process summarized, the build can now be explained as it goes. Firstly, as we finished the drive-base last practice, we made small side parts for the intake to be attached to, in the form of very short bars coming out of the front, on the inner edge of each part of the base.

At the end of last practice and at the start of this practice, we made a roller part with a high strength driveshaft with six light gray (squishier) mini flex-wheels. We added a small bar above them to prevent damage, and then put the edges of the driveshaft into two more smaller bars via drilled bearings, and attached them to the short mounted bars we added previously.

We spread out the flex wheels evenly along the driveshaft with spacers between them, and between a couple of them we added smaller sprockets to chain it to the motor we will set up. It is a “floating” intake because the bars from the intake are connected to the mounted bars via regular driveshafts, rather than being static. This makes it smaller, which is good for size-checks on large robots, but also more dynamic, being able to pick up in different situations and more effectively. We put in a slanted polycarbonate piece, and the lower intake is done.

Code Progress + Plans

There's a limit as to what we can do with the code right now, as the brain and wires and such are not connected yet, however the basic code, declarations, and all sorts of comment blocks have been finished, with all the specifics we have so far, and helpful blocks to assist with organization and to use if we are not present to understand the code.

Since we cannot work on other stuff, we will continue on our PID research we started and worked on last year. PID is short for Proportional, Integral, Derivative, and is used to make hyper-accurate and self-correcting autonomous runs, and sometimes even assists with driving in some situations. It is complicated and difficult to do, and we were only able to make a P loop last year. It will be explained as best as we can later on.

We do not fully understand it yet, nor will we be able to test that, so that probably will not be for a while. Here is a useful document that explains how it works, and while we believe we understand the concept and how it works, we have no clue how to implement it into code and nothing we have tried has worked. Here is the link, if being viewed digitally: Link

Post-Practice Notes 9/26/24

Attendance:

- Derek late by about 90 minutes
- Eric, Nevin, Elijah, Miles all present for entire practice

We made a good amount of progress this practice, with quite a bit of building, new design ideas, and notebook progress from multiple team members. Miles wrote his introduction, Eric finished his, and multiple full pages were made. We built and nearly finished our intake, and made progress on the rest of the build, specifically the lift and clamp. We have had clamp designs prepared, and the existing items will be tested. Of course, they can't be until we get a brain mounted and electronics set up, which will most likely be done during the next practice, unless something comes up.

Except for Derek, we should once again have full attendance, and we will do more planning, especially for tournaments and how we will set them up. We might discuss how we will do scouting and such, and our alliance selection criteria. We will also do our same, regular building, notebooking, and possibly testing if we get the brain ready. Our practice will be another normal one (3:30 - 6:30) as regular.

Practice Goals/Plan 10/1/24

Today's practice is back to normal. Elijah, Eric, Miles, and Nevin showed up on time, Derek has not arrived yet. As usual, the team is focusing on building while Nevin works on the book and continues the PID research.

Practice plans:

- Finishing touches on Drive Base
- Finishing touches on lower intake
- Progress on upper intake
- Mount brain, wire motors and such and find ports
- If possible, code research and testing with robot

This practice is going to be a normal one, there is not too much to report about schedules or structures. We will document what happens here, and finish getting the introductions from the team, who are doing it later as they are busy building and discussing design ideas. Nevin will be doing more research on PID loops and their effects, and so far we believe we have figured out how to make a basic P drive loop. Next, we will be looking at a turning loop, though we might have to go back to scratch as we do not know if they would work as we are not able to test on the robot yet.

The Upper Intake / Lift - Design

Identify: We require an efficient way to carry rings from our lower intake to the peak of our robot, where we can drop them onto a clamped goal.

We don’t have one yet, so there’s no existing one to change, but this one is more clear.

Brainstorm: We together thought up a collection of possible solutions, and since we already had a bar, this was mostly about the shape of the track carrying it up. The options were tank-chains or regular chains, and then what we would use to “carry” the disc (like a hook for it to stay on as it went up), and then the drop-off method.

Select: We thought about it and gauged the merits, and after talking about it, testing miniature prototypes, and more, we decided on a regular chain for speed and a polycarbonate hook for keeping on the disc on a size we can change, and also because it looks more unique and shows proof of our robot being our own.

We have already started building it, and will this practice.

Initial Lift - Build/Create

Our lift build has been in progress for quite some time, and has been focused on by the team during this practice. The initial lift / upper intake bars were placed as soon as the drive base was complete, so as to gauge where the initial intake would be and where it would connect with the lift.

We now have a second set of bars with the lift motor, a driveshaft, and the red sprockets, and we have set up the driveshaft and accompanying sprockets for the upper bars, as well as the chain we have created with the hook we chose in the previous page to ferry the rings up to the top of the robot to drop them into a theoretical clamped goal that we would have attached. The chain is ready, but not on yet, for other reasons.

Due to a phone/communications error, the photo was lost.

Date of Writing: 10/1/2024

Contributors: Nevin Zerby

Continued on: 60

Code Research - PID

Today a main focus was research on more in-depth code ideas and strategies, and most importantly and particularly, more concepts of implementation of Proportional, Integral and Derivative loops for autonomous. We've done tons of research on VexForum, various documents like George Gillard's, and sites like the Ascend Robotics site which has more of a guide.

While we could have just taken code, the point is to learn, not to copy others. We believe we have found how to make our own style of P loop, and we are working on turning that into a PI and then PID loop once we are able to test the first one when our robot is ready. For the concept, here's our explanation, inspired by the Ascend individual part explanations.

PID stands for Proportional, Integral, Derivative. Proportional helps your motors based on present data. Integral helps them based on past data. Derivative helps them based on predicted future data. They use all these things to more accurately slow down the robot before it reaches its goal to prevent overshooting / fishtailing (P), to prevent undershooting and stalling (I), and to prevent overshooting or errors (D). It is incredibly good and useful for making an effective auton.

Post-Practice Notes 10/1/24

Attendance:

- Nevin, Eric, Miles, Elijah all present entire practice
- Derek did not come to the practice

There was good progress this practice in multiple areas. We finished the intake + chain + hook base, we prepared plans to improve it, and we did extensive research on PID, how it works, and how to code it, and finally figured out how to actually do it. We also put a back bar on for the clamp to be attached to, and we slightly adjusted the lower intake so that it picks up better and transitions to the lift / upper intake better.

The notebook had its regular updates, but some things will be changing soon as for how it is structured and how it will be written from now on. On another note, our coach announced that we will have the ability to take robots home to work on them soon - on the conditions that the team has an average of 15 hours of practice (so far, more soon scaling with practices), have shown progress, document planned changes beforehand, and have every team member agree to what will happen and sign a form that will be turned in to the coach. We already have a form filled out, and might take the robot home very soon.

Date of Writing: 10/3/2024

Contributors: Full Team

Continued on: 62

Practice Goals/Plan 10/3/24

Another normal 3:30-6:30 practice. Elijah, Eric, Miles, and Nevin showed up on time. Derek is not here and may not show up once again. We are, as usual, focusing on building while Nevin works on documentation and code research. In the meantime, however, Nevin might pull teammates to work on their own pages to document their experiences, so we can get a better view.

Practice Plans:

- Make diagonal bars on Upper Intake/Lift
- Attach full chain to the lift
- Replace top intake driveshaft with high-strength
- Prepare robot to be taken home if possible
- Start making team “pamphlet” for interviews

Another normal practice, however the room layout was moved. Tables have moved and the field was moved, and is now better prepared for driving practice, however we still do not have a brain and such mounted. The upper intake is being finished first, then it should be mounted so that we can test everything, post more engineering design process pages, and start new processes.

Build Continuation - Intake

Due to having to focus on some small fixes and Derek not being present, we have not been able to accomplish much this practice, however we have worked on and done the intake transition area. We set up bars with diagonal connectors on both sides, and set up a motor between them. The necessary driveshafts were replaced with high-strength ones so as to prevent bending and to increase general intake strength.

The bars are now ready for the rest of the intake and the transition zone to be imported onto them. At the moment, the way the intake works is that it picks up rings and bounces to accommodate the situation. Then, the hook from the upper part comes around and grabs the ring, and brings it up, then due to how the hook is angled, slams it down, meaning that it should go on goals effectively. We have not received field elements other than the singular ring yet, so we can not do testing, however we do have a 3D printed goal that needs to be worked on and filed, and it should be ready by the time we have motors for the intake set up and connected to the brain.

We also moved some gears to fix minor issues with the lower intake. It now works fine, and we will stick with it.

Date of Writing: 10/3/2024

Contributors: Nevin Zerby

Continued on: 64

Notebook & Presentation Ideas

After looking at many other examples, talking to sister teams, and seeing official and unofficial resources, we think that the current notebook formatting might not be the most efficient or effective way to display our process for designing, building, and testing the robot, code, and other related items. We will be going over a few ideas that might show up in the coming pages, to improve the book as much as possible, as well as some other plans and ideas for interviews and more.

Idea 1: The Pamphlet

One idea that we will almost certainly go with, we want to make a pamphlet and “cards” for our team. We got the idea from our former senior team, who did it to great success, so we want to put our own spin on it and make ours unique.

The idea is to make a 3-5 page foldable pamphlet that shows pictures of our robot and specific mechanisms, has other details like robot size and motor RPMS, has introductions and information about the team members, and more. The purpose of this is to give it to judges during interviews for them to see and understand our ideas. We will also give it to scouts to show why we would be a good pick for alliance selection.

Notebook & Presentation Ideas

Idea 2: More Tables

One notebook specific idea is to use more tables to convey changes and such and to document the engineering design process. This is often more clear, and shows more proof of our use of design matrices and rating/testing our different ideas when choosing them.

However, the reason we haven't used them yet is because they have the downside of being very clunky and not fitting in the book well. Additionally, Google Slides (where this book was made) has a limited selection of different types of graphs and charts, and a lot of them aren't what we want or need.

Idea 3: Prioritize Design Process

A thought that we have is to prioritize and categorize everything into the design process categories. This would mean putting every page into a different category - like this, for example, would be a Brainstorming page.

This would mean that all pages would have the colored bars - it could show more proof of our more discreet usage of the process, but could also undermine the more literal usages.

First Intake Completion + Test

After putting together all the new stuff for the intake, it is almost completely finished besides some finishing touches and slight tweaks that may be needed. Even though we do not have a brain mounted, we took an extra one and connected it to a motor, and used Nevin's code to run the intake / lift parts. They work perfectly fine and well, and the idea that while depositing the ring the intake hook slams it onto the goal seems to work, though the angle is a bit off. We do have plans and solutions for this, though, like making the clamp tilt the goal towards the robot more. This will all be done very soon.

The crude tests did work well, but there can be much improvement. We might make the chain fuller, and we are almost definitely adding more hooks, as we only have 1 but could probably have 3 or 4 to increase the speed of the intaking and the consistency.

We tried to get a picture for this page, but it was lost.

Post-Practice Notes 10/3/24

Attendance:

- Nevin, Eric, Miles, Elijah all present entire practice
- Derek arrived 1 and a half hours late (5:00)

Once again, a 3:30-6:30 practice. We made the same progress we were working on, though it was a bit slower due to certain circumstances. Nevin took the time to make some pages about some possible notebook development. Things will change a lot in the notebook after we finish the base robot, which should be soon, as the pages will be almost purely design processes and tournament results, as well as the practice intro and outro pages.

After discussing with our coach, we have decided to let Elijah take the robot home and work on it, alongside some input from the rest of us, as the coach has allowed us because we have sufficient hours and experience, have been productive as much as possible at practices, and will be filling all the criteria. One of which is making a page about the plans for this time, and then making pages for what happened and all the details about it that we have. The following pages will cover that once there has been significant development in the robot.

Robot Take-Home #1 Plans

This will be the first time this season that the robot will be leaving our school building, and the first time it will be worked on outside of a practice. It will be brought to Elijah's house, and he will work on it with some input from the builders this weekend, and details and information will be relayed. The plans for this weekend are as follows:

- Finish clamp for the goal

It's been in the works for a while, it just needs to be attached and tweaked slightly to tilt the goal due to the intake position

- Mount brain, battery, and radio

This is all fully necessary for making the robot run, and this will mean we can finally test things like autonomous and velocities.

- Tweak intake/lift

Due to the way it is positioned, after some basic tests (not enough to be documented, mostly happened by using our hands to push it, not a brain / motors) the rings can get blocked, so we are extending it and making the chain and track longer. It will make it more accurate and easier to work with

- Identify any issues with the previous systems to see if any additional developments can be made

Date of Writing: 10/5/2024

Contributors: Nevin Zerby

Continued on: 69

Robot Take-Home #1 - Tweaks

During the robot take-home session, many developments have been made and will be made, and in the following pages what is done so far and what will be done until the next practice. To start, a lot of small tweaks have been made - note that the picture in this slide was taken at the same time as the ones that will appear in the following slides.

The following smaller tweaks were made to the robot, which did not need to be categorized into their own pages:

- Zip-Ties on top of lower intake

  A small change with multiple purposes. It means it can be used more to prove contact with things like the ladder for autonomous win points, can help prevent accidental double possession, and makes the robot look better.

- Intake mount re-gearing

  The intake is now mounted with sturdier metal gears.

- Tilted polycarbonate area

  Shifted slightly for contact

The lower intake as of 10/5/24.

Date of Writing: 10/5/2024

Contributors: Nevin Zerby

Continued on: 70

Robot Take-Home #1 - Lift

More of the same planned edits to the lift have happened, there were some more changes. As shown in the picture, you can first see that we replaced the regular chain with tank chain, because it is sturdier and after additional “fake” testing we realized that a regular chain is too fragile for what the intake might go through in rougher matches and such.

The hook was also very slightly changed - you may see that the polycarbonate has been cut to grab rings better, and a second and third hook have been added so as to be able to intake faster, more reliably, and with less risk of breaking.

All of them are made in the same way as the first: 2 standoffs with a pentagon shaped polycarbonate piece screwed on as a scoop.

The upper intake and hooks as of 10/6/24.

Date of Writing: 10/6/2024

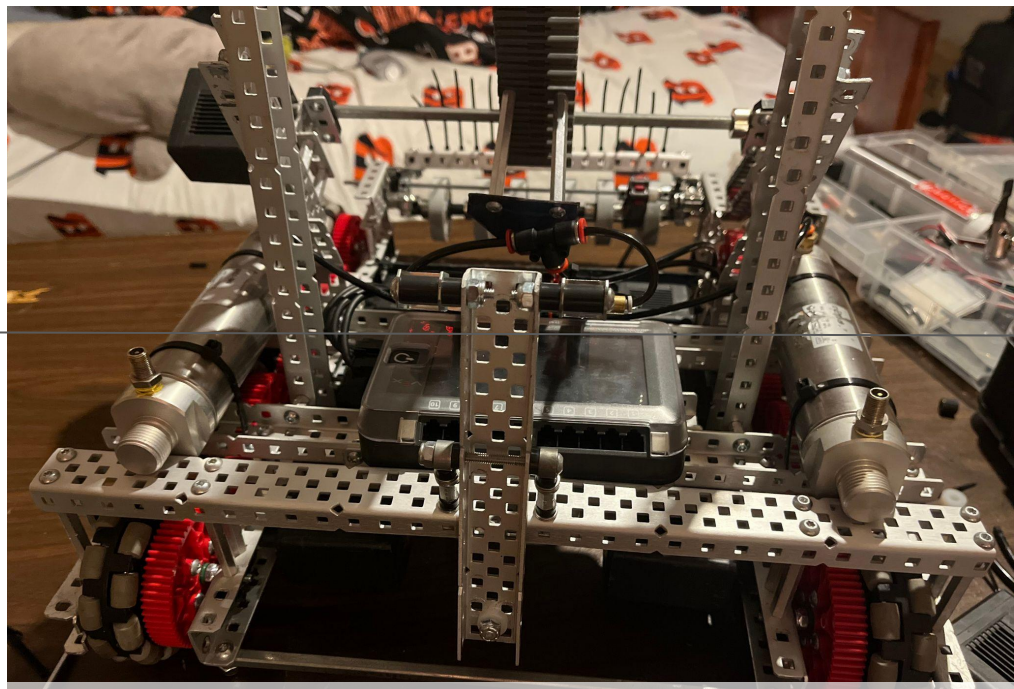
Contributors: Nevin Zerby

Continued on: 71

Robot Take-Home #1 - Brain

Another very important (potentially the most) development made during the take-home session was the mounting of the brain, battery, 2 radios (a failsafe - for when one gets unplugged or loses connection during a match - this has saved us multiple times, and many other teams have used it, some getting the idea from us), and most of the necessary cords.

This is possibly the most important development so far because now the robot can be properly tested, and test pages can be published for all our previous design process sets. Additionally, this means that we can test autonomous programming and velocities, like autonomous PID and driver control settings (motor stopping modes, visual things on screen, gear correction, et cetera)



The back view of the robot as of 10/6/24.

This also means we can do driving practice, so that we are more ready for our first game (s) of this season.

Date of Writing: 10/6/2024

Contributors: Nevin Zerby

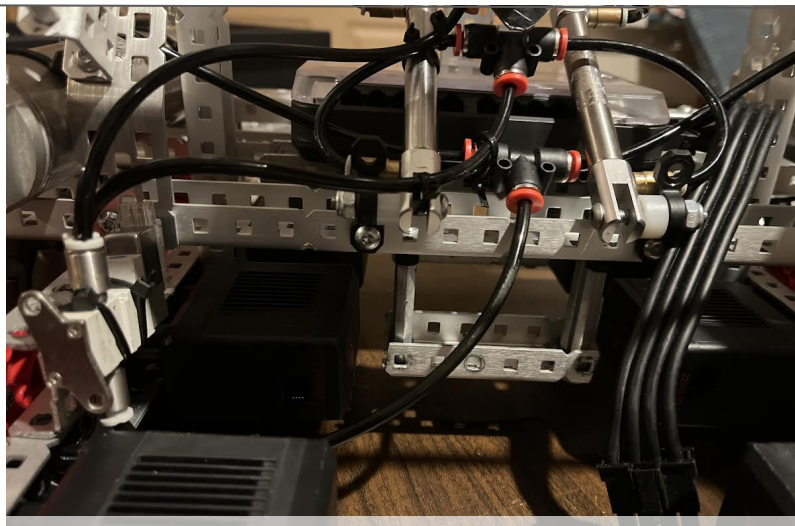
Continued on: 72

Robot Take-Home #1 - Pneum.

One more important thing that we have added, though only loosely planned before, were the pneumatics/tanks. We realized that the sides of the robot had perfect spots for the tanks, and that they would also be able to easily connect to the brain as well as the pistons that we planned to use for the clamp near the back. Those have all been placed on the robot.

The pneumatics and their system are important because we planned since the start to use them for the clamp, but slightly leaned ourselves more towards using motors - however after realizing that we would need to tilt the goal more towards the robot, even after shifting the lift as explained previously, we figured out that we could simply just use a single bar attached to the pneumatics to tilt back and forth to easily grab goals.

Additionally, having the pneumatics and their tanks on the robot means that we can, in the future, make more things with them if deemed necessary, like a hook for climbing the big ladder or something similar.



The under-clamp area as of 10/6/24.

Date of Writing:
10/6/2024

Contributors:
Nevin Zerby

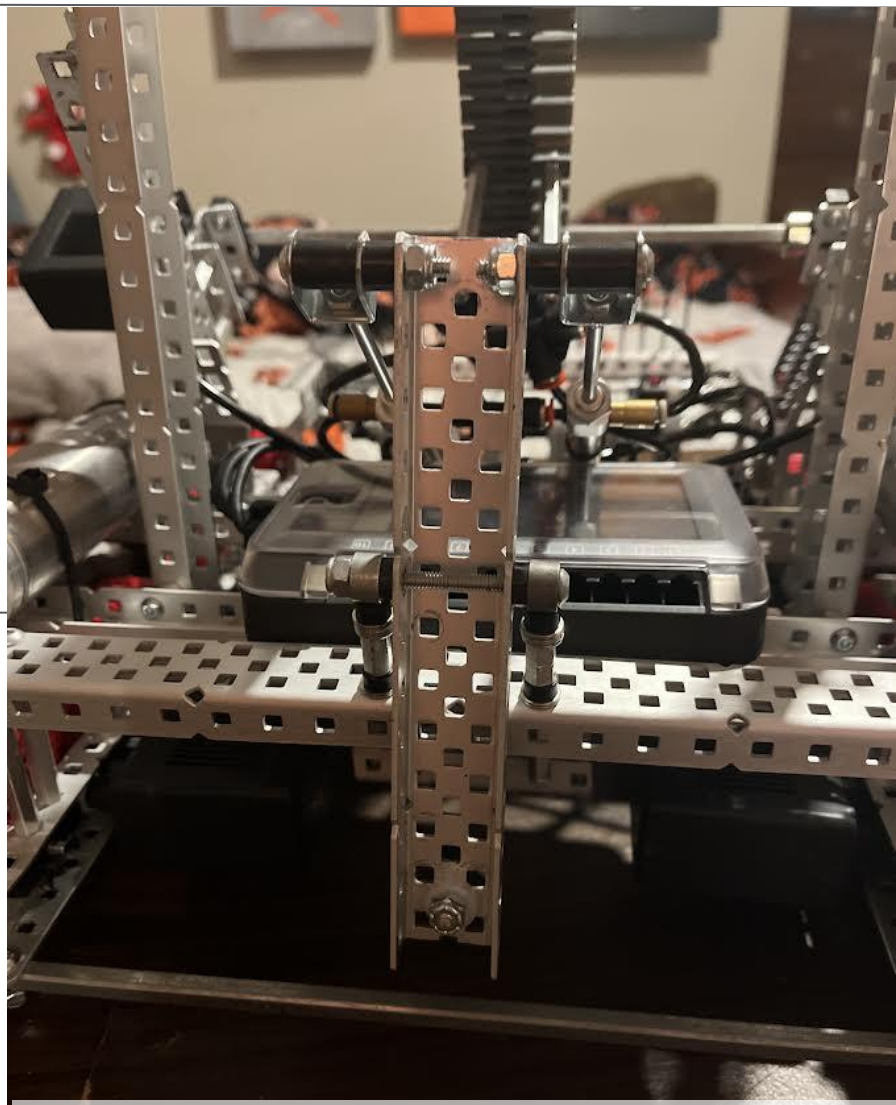
Continued on: 73

Robot Take-Home #1 - Clamp

As partially explained in the previous page, we have also finally added the clamp, though there were some changes since we remade it. Firstly, it's now just a simple bar - this works very well for how simple it is, and would be very easy to replace, tweak, or remove when needed. Since it is powered by pneumatics, we attached 2 parallel pistons to it for extra grab.

We will be testing it as soon as we're back to our school for practices, since we now have the 3D printed mobile goal, though it sort of seems to be a little bit inaccurate, it's all we have.

The clamp is tilted extra so that it could theoretically move the goal towards the robot more, so that the lift can slam rings directly onto it and score as efficiently as it possibly can.



The clamp as of 10/6/24.

Date of Writing:
10/6/2024

Contributors:
Nevin Zerby

Continued on: 74

Notebook Overhaul

After careful research, discussion with teammates and coaches, and consideration, we have decided to go with a modified version of Page 71's Idea 3. Essentially, almost every page will be sorted into being a step of the design process, and future pages will be made so that they fit specific parts of it especially, like a page where it's just going over autonomous testing we will ostensibly state that that is the purpose of the page, and then color code it blue, accordingly. This page will be a "select" page, as it selects an idea that was brainstormed in pages 70/71, and begins putting it into action. The table of contents, however, has been already changed accordingly and will continue to be in the future. Some pages that are uncategorizable (schedules, organizational stuff, etc.) will be colored in grey, with the design process pages being colored in red, orange, yellow, green, blue, and purple, as outlined in the "how to read the book" pages.

Regular design process specific pages will continue most likely, to show / summarize what happened in the core parts of each step in the process, as proof that we are working, designing, building, and documenting under the guidance of the Engineering Design Process.

Practice Goals/Plan 10/8/24

Once again, another regular 3:30-6:30 practice. Elijah and Nevin are the only ones present. Miles and Eric are on a field trip and will not arrive, and Derek is at football and will not arrive until later into the practice. Now that there is a brain mounted, we can finally do tests - and there will be tests today and probably pages about it. We will do some motor testing and setup, while Nevin's focus will be doing the notebook revamp and documentation while Elijah works on the build.

Practice Plans:

- Do final intake tweaks
- Add motor cords and find ports and such
- Fix cords and ports in code
- Test motors
- Fix miscellaneous things found imperfect in testing
- Document everything that happens

Another normal practice, though only 2 of us will be present for the large bulk of it. A lot of the practice will be taken by testing and stuff like that, as we finally are able to. We have also received 25 blue rings from another group, so we can do more tests with that rather than us all sharing 1 red ring.

Code Readying + More Details

The code has been readied for the testing and such, as we have done tons of work on motor cords, ports, and coding them. Now that we have everything for that ready, and we previously had the drive code ready, we are about ready to test it. The drivetrain is now ports 10, 9, 8, 1, 2, and 3, our intake is port 7, our inertial sensor is port 18, and a clamp in pneumatic (digital-out, 3-wire) port B. It's ready for testing, though the cords are being set up and the robot is getting some other tweaks. The code for declarations and driving, as of now:

```
//declare electronics
brain Brain;
controller Controller = controller(primary); //primary - might add second ctrl later
//six motor drive, names are abbreviations. Port, internal ratio, reverse true/false
motor LF = motor(PORT10, ratio6_1, true);
motor LM = motor(PORT9, ratio6_1, true);
motor LB = motor(PORT8, ratio6_1, true);
motor RF = motor(PORT1, ratio6_1);
motor RM = motor(PORT2, ratio6_1);
motor RB = motor(PORT3, ratio6_1);
//intake motor
motor Intake = motor(PORT7, ratio18_1);
//inertial sensor
inertial Inertial = inertial(PORT18);
digital_out clamp = digital_out(Brain.ThreeWirePort.B); //clamp for mobile goals
motor_group LeftDrive = motor_group (LF, LM, LB); //left side motor group
motor_group RightDrive = motor_group (RF, RM, RB); //right side motor group
//drivetrain - numbers are wheel size x pi, track width, wheelbase, and gear ratio
smartdrive Drivetrain = smartdrive(LeftDrive, RightDrive, Inertial, 10.2102, 12.75, 12, inches, 0.6);
```

The declarations and drive code as of 10/8/24.

```
//motors - set axis - rpm scales with how far you push the joystick(s)
LeftDrive.setVelocity(Controller.Axis3.position() + Controller.Axis1.position(), percent);
RightDrive.setVelocity(Controller.Axis3.position() - Controller.Axis1.position(), percent);
Drivetrain.drive(forward);
```

Code Testing, Results, Changes

We have now done the first testing for our code, and we tried multiple different parts. Here are our results:

Drive Testing (Drivetrain, driving, turning, etc)

- Driving - “Perfect” from the start

Ran as intended, with correct scaling velocity, good torque, etc. and went quickly and smoothly. We are happy with it.

- Turning - Too fast, remedy unclear

Our turning is too fast, because due to how we have the joysticks set up the turning velocity is 100% (we are used to ~65%) by default and cannot be changed through the conventional method. Nevin did some studying, but we have decided to make a VexForum post to figure this out, as we could not find a solution. Other than the speed, it is fine.

Intake Testing (Lower Intake & Higher Intake/Lift)

- Pickup - Subpar, though can be fixed

The intake did not pick up as well as expected in the lower part, though we have figured out that we could fix the velocity in the code and it would improve, and then lower it slightly (a very small fix) to make it work for us. The change was made, as it was simple, and did not require its own page.

Code Testing, Results, Changes

Intake Testing - Continued

- Speed - Subpar, though very easily remedied

  We didn't set the velocity high enough, and the sprockets are chained for too much torque. Changing both fixed it.

- Transition - Mostly working

  The transition area works fine, though every once in a while when the hooks coincide with where parts of the ring is it can slow down the process very slightly, but on the next hook's approach this is pretty much immediately fixed.

- Lift - Working, deposition unclear

  The lift works fine and as intended, though how well it deposits is unclear due to our 3D printed goal not fitting rings (the top is too big)

Clamp Testing (Angle, Pneumatic Speed)

- Speed - Pretty much immediate

  They're pneumatics, so there's very little delay. It works.

- Angle - Imperfect, easily remedied

  The angle isn't quite what we want, as it doesn't tilt the goal enough toward the back of the robot for ring deposition. This is easily fixed, and how we are doing it is by adding a bit on the end to catch the goal and tilt it a bit more.

Post-Test Changes

Intake and Upper Intake / Lift

- No major changes

Clamp Changes

- Slightly readjusted
  Tilted to the side a bit, more accurate
- Added buffer for correct angle
  Screwed a few spacers on the bottom part, it holds the goals at a better angle now.

Code Changes (Turning)

- Fixed turn velocity, now works
  Had to ask about this on VexForum after testing several things, but eventually decided we had to. @iseau395 gave us our answer, which was to simply multiply the axis 1 position by what percent turn velocity we would have wanted if the regular command worked for this situation. We decided on 0.75 (75%) as our reduction.

Other Building Changes

Prepared for re-sprocketing intake, as it isn't quite as fast as we would like.

Post-Practice Notes 10/8/24

Attendance:

- Nevin and Elijah present entire practice
- Derek not present (football)
- Eric and Miles not present (field trip)

Another regular 3:30 - 6:30 practice. This practice was different as only Elijah and Nevin were present, and so most of the practice was taken up by testing and tweaking based on those tests, as per the Engineering Design Process. Otherwise, Nevin did some more code research, and looked up some concepts we might use on VexForum, and then we documented our tests as best we could to prove our process. Meanwhile, Elijah did the tweaks we found necessary via our tests, and helped move the robot closer to being ready for a tournament.

On Thursday (next practice day) morning, we will also have a split (by our school lunch break) 1-hour build/development period where we will be making some small changes and Nevin will finish documenting what happens. Everyone will be present for this, and everyone will be at the later practice for the entire time except for Derek who says he will be there for a majority of the time.

Date of Writing: 10/10/2024

Contributors: Full Team

Continued on: 81

1-Hour Build Day 10/10/24

Today, in our morning Engineering class, we have 1-hour build day. It comes in 2 30 minute periods as we have lunch in the middle. Our whole team is here for this entire thing, and we plan to just do small tweaks and tests, and observe the idea of using 2 5.5 watt motors on our intake rather than 1 11 watt.

During the first 30 minutes we discussed the 2 5.5W motor idea, and eventually agreed on doing so. We removed the chain and started putting them on. We also reinforced part of the intake connector bar with more screws to make it extra durable and stable. Additionally, we removed the 11 watt motor which the two parts of the intake were sprocketed to, so that we could put the 5.5 watt motors on each part individually. Nevin made the necessary code (new motors + motor group) for this.

During the second 30 minutes we actually put on the 5.5 watt motors, and tested them. We initially found them to have too little torque, but we realized that they weren't fully connected. Now that is fixed, and we are doing very basic code tests on them, though they seem to work quite well. The pneumatics (clamp) were tested a little more and are still up to standard - we were seeing how the strength scaled with air.

Date of Writing: 10/10/2024

Contributors: Nevin Zerby

Continued on: 82

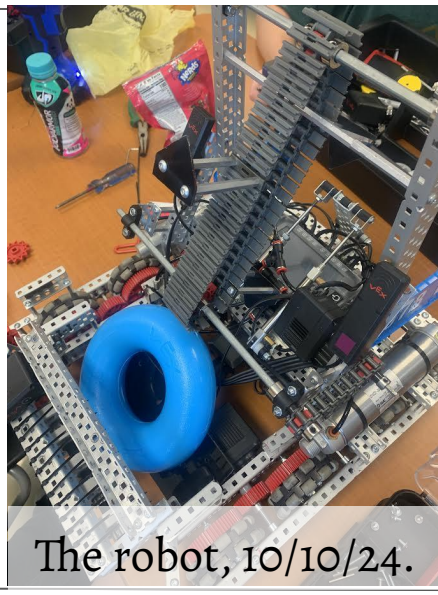
Practice Goals/Plan - 10/10/24

This practice, all of us are present except for Derek, who will arrive at about 4:30. A normal practice, we will be focusing on finishing up the intake so that we can do a bunch of tests and code and such. We finally got a 3D printed mobile goal with a correct-size top for us to deposit rings on that we can finally test with.

Practice Plans:

- Add 5.5 watt motors completely to intake
- Test the 5.5 watt motors in code
- Finish re-chaining intake
- Run drive / turn velocity tests
- Test with mobile goal
- Document it all

Pictured here is our robot as of the start of today's practice, with a ring in it for scale and showing of storage. Today we will be using these rings and our new goal to find out if we deposit rings correctly, and maybe have a sort of ramshackle scrimmage with our limited amount of field parts (only rings)



The robot, 10/10/24.

Date of Writing: 10/10/2024

Contributors: Nevin Zerby

Continued on: 83

The Intake Jam Issue - Part 1

Our first thing we did this practice was to re-test the intake after we edited it during this morning's 1-hour build time. We realized that it still has the jam issue, where the ring gets stuck in the spot shown in the picture below. We have had this issue for a little while, and it is part of the reason why we "tweak the intake" in almost every build / post-build page. Now, we think we have the answer for this, which is adding polycarbonate.

We already have a sheet of it on the lower part of the intake, but there is an open space that the ring falls into, which we will also be covering with polycarbonate so it does not fall in that area.

We have found newer sheets of the material, so it will be less beaten up than the pieces we have used before, which also means that this time it will move smoother.

The intake "transition" as of 10/10/24.

Date of Writing:
10/10/2024

Contributors:
Nevin Zerby

Continued on: 84

Polycarbonate Siding Idea

Recently we were thinking about the issue that many robots, including possibly ours have, which is that rings, other field elements, or other robots can get stuck under ours which can lead to a disqualification on either side or our robot breaking possession rules, or in the most likely case, it simply not being able to move anymore due to being caught.

What we have done in the past years, which has worked very well, is placed polycarbonate sheets on each side of the robot as to prevent this, and also to serve as a shield to prevent other stuff from hitting the robot or items getting stuck in the motors or gears. We will likely cut from the piece below.

However, the rule <R19> says that there can only be a limited amount of polycarbonate, being an amount that would be able to be cut from a 12” x 24” sheet of it. We already use a good amount in the intake, so these siding parts would probably be much smaller than usual, however they are usable.

A long polycarbonate sheet, to be cut and made into our sides in the future.

Date of Writing: 10/10/2024

Contributors: Nevin Zerby

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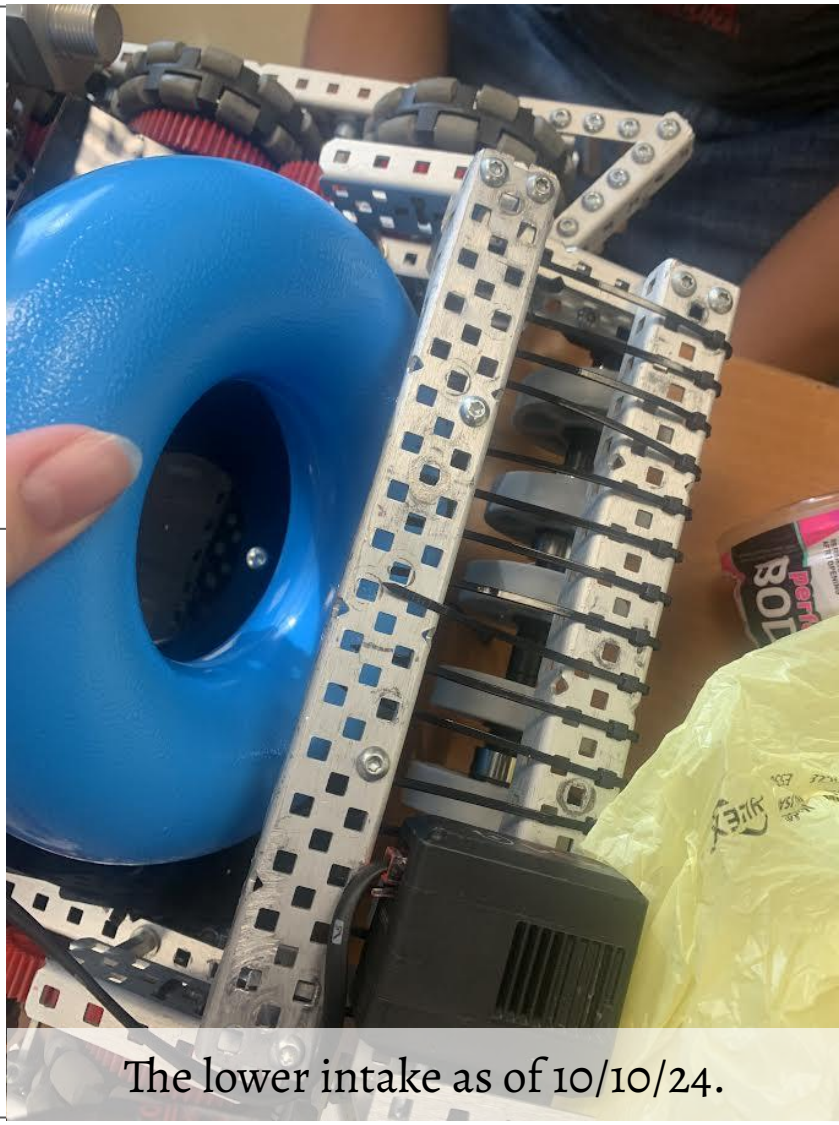
The Intake Jam Issue - Part 2

After testing, adding the polycarbonate solved one problem, but brought to light another. The current issue is that the rings kept getting jammed in the intake. The exact reason isn't clear, but after analyzing more, we have a set of ideas:

- Shorten standoffs on underside of intake
  If they are gone, the ring cannot get stuck on them.

- Add new standoffs on top
  If we add new smaller standoffs to the topside of the lower intake, the ring can not flip over the top and get stuck above the intake.

- Add blocking layer on top
  We could add a small layer of metal or other material to prevent the ring from exiting the intake from any other way than via the upper part, so that it does not escape.



The lower intake as of 10/10/24.

Date of Writing: 10/10/2024

Contributors: Nevin Zerby

Continued on: 86

Ring Deposition Problem + Fix

Our lower intake is fixed for now, however now that we have had the ability to test with a working goal, the clamp angle is apparently off, which we did not know as no rings were able to fully go on the older 3D printed goal. They would bounce off.

The rings land on the goal either barely and like in the picture, or bounce off the front, so we need to fix the clamp.

From our tests, we found that when we move the clamp and adjust the goal a certain way, rings will deposit in a perfect way. The goal is to set the clamp to hit that angle.

We decided to do this by supporting the bottom of the clamp with standoffs (so as to limit how far down it will go when it grabs the goal) and this appears to work fine. We have tested it a little more.

A 3D printed artificial mobile goal.

Date of Writing: 10/10/2024

Contributors: Nevin Zerby

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Post-Practice Notes 10/10/24

Attendance

- Nevin, Elijah, Eric, Miles all present entire practice
- Derek showed up late (football)
- Practice ended a little bit earlier than usual

Another mostly regular practice, 3:30 to about 6:15 this time though as it was shortened for some other irrelevant announcements (shirt/sweatshirt designs/buying, color, etc. as well as some schedule changes for the other teams).

During the practice, we did a lot of tests and attempted fixes for our intake jams, and we ended up figuring it out after multiple changes. We also discussed and visualised adding polycarbonate siding (see pg. 90) as it would help with robot “defense”, make it bigger, and also help protect from things getting caught on/in/under the robot on the sides and in the wiring.

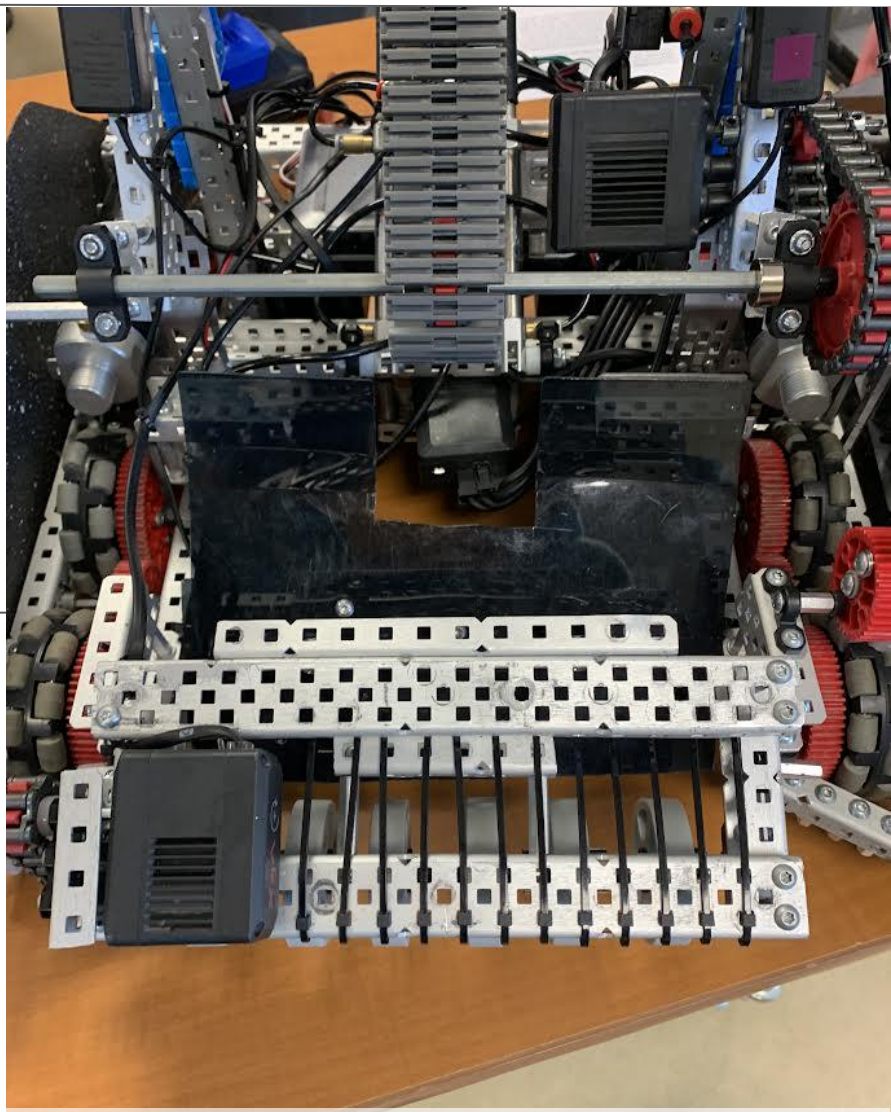
We also once again prepared for a robot take-home session, at Elijah’s house once again. The plan is to develop a lift and put in all the ideas and such we laid out for the intake motors, the intake jam fix, and the clamp angling.

Robot Take-Home #2 - Intake

As previously mentioned, we decided to do another robot take-home run to fix/analyze more potential issues and also finish putting in the changes we planned for the intake and such (like 5.5 watt motor intake, lift attachment, intake (both parts) readjustment, et cetera) and then, after seeing what changed from all that, discuss what we should do next.

We edited both parts of the intake. For the bottom part, we switched the motor for the 5.5, but what we also did was push back the part that was hanging off, so as to intake more efficiently.

The middle part did not need to be changed or fixed, but we added a bar to take away some slack on the top part and we also replaced the polycarbonate hooks with better screw hooks.



The front of the robot as of 10/15/24.

Date of Writing: 10/15/2024

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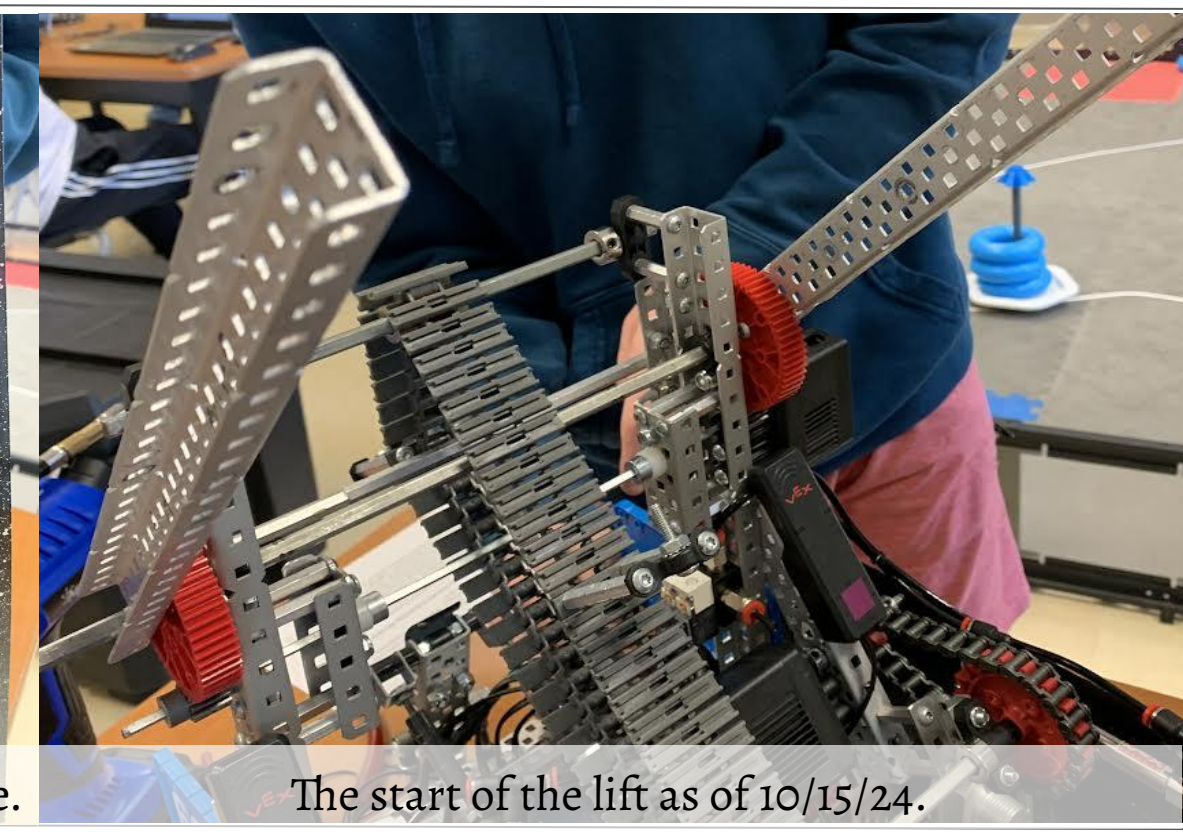
Robot Take-Home #2 - Other

We added the first part of the lift we loosely talked about before, being the two red gears and bars mount at the top of our “tower” area, really a simple addition. We also attached the polycarbonate sidings as we had lines out, there are large pieces on each side. The polycarbonate was also spray-painted for both cosmetic purposes and to make it less see-through.

As for the lift, during tonight’s practice, we will be adding an additional middle bar and then continuing/changing the lift as we go, though we already have plans for how we will add a ring picker on it (for placing rings on wall stakes.)

A siding piece we’ll use.



The start of the lift as of 10/15/24.

Date of Writing: 10/15/2024

Contributors: Nevin Zerby

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1-Hour Build Day 10/15/24

We had another 1 hour build day in our morning Engineering class. From now on, unless pretty much nothing happens, we will be making at least one page about these small build days every time they happen. This one was rather uneventful, but it was mostly taken by thinking up new plans based on what was changed during the take-home session.

We discovered that an ongoing motor problem that caused our turns to scale strangely, not be able to be lowered, and stall out, was caused by one of our motor cords being faulty and not sending the right amount of power. Now, the robot is stronger.

We did some other testing after that, and the robot drove smoother and very slightly faster, as well as the turning being fixed. In the meantime, while trying to figure out the fixes, some drive code was discovered that had a slight error that was tweaked, improving it despite it not being the cause of the turning issue. The lift motor was coded in, though we did not have time to put it in a port or test it, same with the newly configured intake motor. We decided to swap the 5.5W motor on the upper intake for an 11W blue motor (600RPM) and instead use the 5.5W one for the lift, as an 11W was unneeded.

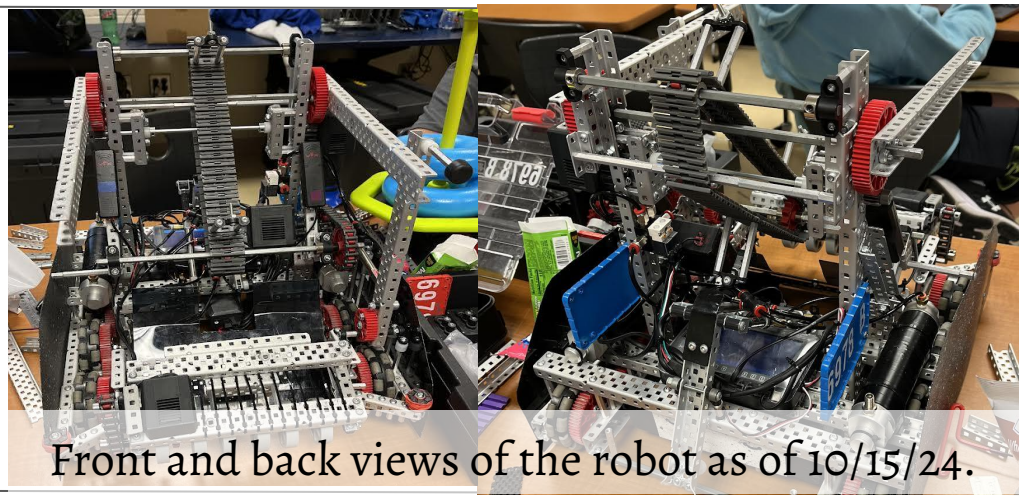
Practice Goals/Plan - 10/15/24

This practice, another normal practice, and with, as usual, full attendance for the entire practice minus Derek. This morning we had a build day where we spent part of it discussing plans for this practice, in how we will test, build, and continue the design and documentation process. Another important note is that at the beginning of this practice we were informed that we are getting real field mobile goals.

Practice Plans:

- More tests on “fixed” drivetrain/turns
- Try artificially lowering turn velocity
- Develop lift/lift bars
- Run tests on intake with the real goals
- Prepare and test lift motors
- Document it all

Here are two pictures of the robot as of the beginning of today’s practice, with our front clamp up, and the lift neutral.



Front and back views of the robot as of 10/15/24.

Date of Writing: 10/15/2024

Contributors: Nevin Zerby

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Testing With The New Goals

Since we have the real field mobile goals now (rather than our 3D printed one which was apparently underweight and slightly undersize) we can do better, more accurate tests with our intake and clamp. We don't think the old one was accurate.

Clamp & Clamp Angles

- Clamp works perfectly fine.

  Works same as usual, though the grip seems to be a little bit weaker due to the new goals being a good bit heavier. Not a big problem, can be fixed with an additional grip spacer.
- Clamp angle slightly off

  Clamp angle off a bit again, rings bounce off the top a little bit though tilting it more allows them to go on smoothly and "perfectly", so we are shifting the clamp very slightly again.

Intake (Upper & Lower)

- Lower Intake works fine.

  Mostly same as usual, though can jam if upper intake does.
- Upper Intake works fine, but can only do 5 out of 6 rings.

  After depositing a fifth ring, it can catch on it, meaning it will not be able to place on a sixth one. Rare but easy to remedy jams also happen, but they barely cause any issues.

Other Practice Activity

We haven't done a ton so far this practice, though what we have done has been in several areas, hence the multiple design categorizations on this page. Besides the tests and small build bits in the last page, we also did the following things:

Building (Both intake areas, clamp, lift)

- Intake (Lower) Changes
  No large changes, very slight adjustment to stop jams
- Intake (Transition) Changes
  Polycarbonate cut slightly to stop intake hook from catching on it, pressed downward to prevent intake jamming
- Intake (Upper) Changes
  Top bar shifted so that it deposits more accurately on goal
- Clamp Changes
  Metal at bottom bent for better, stronger goal grip
- Lift Changes
  Horizontal under-bar added, prepared for more building

Design (New ideas, choices, plans)

We discussed several ideas, particularly with the lift build, and decided on more horizontal structure bars, which we might build next practice. We also discussed putting flex-wheels on the top of the upper intake, but after testing it did not work.

Post-Practice Notes 10/15/24

Attendance:

- Nevin, Elijah, Eric, Miles all present entire practice
- Derek not present (football)

Another regular practice, everyone but Derek having full attendance. This practice focused mostly on intake and clamp tweaks and changes, as we got new test data and new ideas since we now have access to real competition mobile goals rather than our 3D printed ones which were slightly off. We also did some lift progress, as it was just recently added. We did some drive-tests, and they worked well, the intake seems to work consistently at this point.

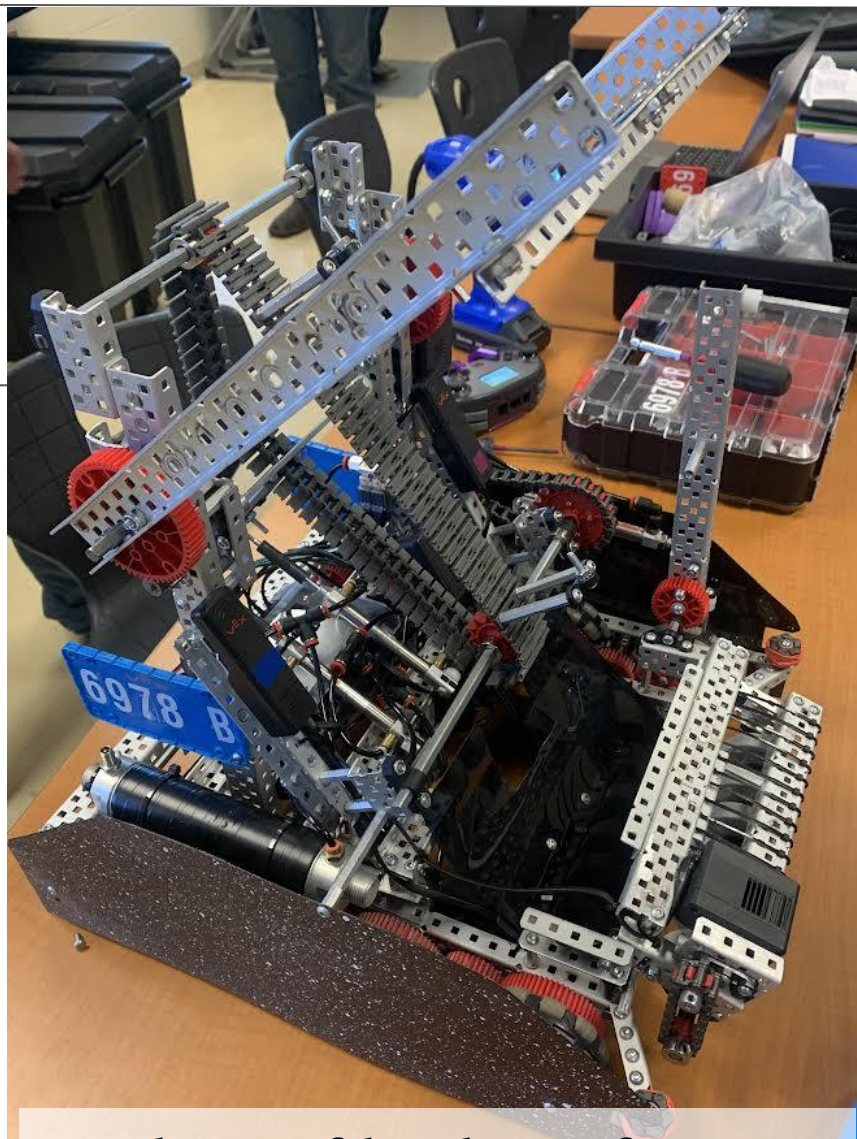
Another milestone/note here is that we have now hit 100 pages in the notebook, a large milestone, and it will serve as a marker for some changes that will be happening in accordance with even more advice from VexForum and now one of the Vex community discords, Robolytics, which has many very well performing teams including several worlds qualifiers, even some worlds winners and other very well known teams. We will also be using this resource to get criticism for our build/book and also get inspiration from famously effective designs.

1-Hour Build Day 10/17/24

Another 1 hour build day is happening today. It will mostly be used for working on the lift, so that we can eventually use it. We are also going to do some tests with drive velocity and such now that we have solved our turning problem (which was caused by a faulty motor cord). We will be lowering the in-place turning velocity by multiplying the axis 1 by a smaller decimal.

Now that we have it (for the time being) finalized, we reinforced the front clamp slightly for stability reasons.

As for the lift, we added a polycarbonate piece with a hinge so that intaking reverse at a certain point deposits a ring onto it, for placement on wall stakes. We're working on it a bit more, changing which nuts we use, and then we will do extra testing in the field, for we have one now.



A side view of the robot as of 10/17/24.

Date of Writing: 10/17/2024

Contributors: Nevin Zerby

Continued:

New Field & Tests

We have finally gotten the parts for our new field, including the wall stakes and the ladder, alongside the mobile goals and such. We do not have the corners or the tape set up yet, but we will most likely do that in tonight's afternoon practice. We did a few tests in the field and found that:

We cannot quite go under the ladder, though it is very close. The top of our tower is just a little bit too tall, however we sometimes make it through if we tilt correctly. We will be shortening the tower a bit so as to allow us to go under, which means a better way to cross over and a tactical advantage.

There are many smaller or less known advantages to being able to go under the ladder. You can put a goal under there, and it might prevent a couple of robots from being able to reach it. Also, endgame is safer.

Our field with ladder, not set up or taped yet.

Date of Writing: 10/17/2024

Contributors: Nevin Zerby

Continued:

10/17/24 Practice Cancelled

Our afternoon practice on 10/17/2024 was canceled due to school power outages, so we were not able to do the regular 3 hours of work. Instead, we talked to each other and we planned out what we would do in the next build day in terms of the next design ideas and possible code tweaks.

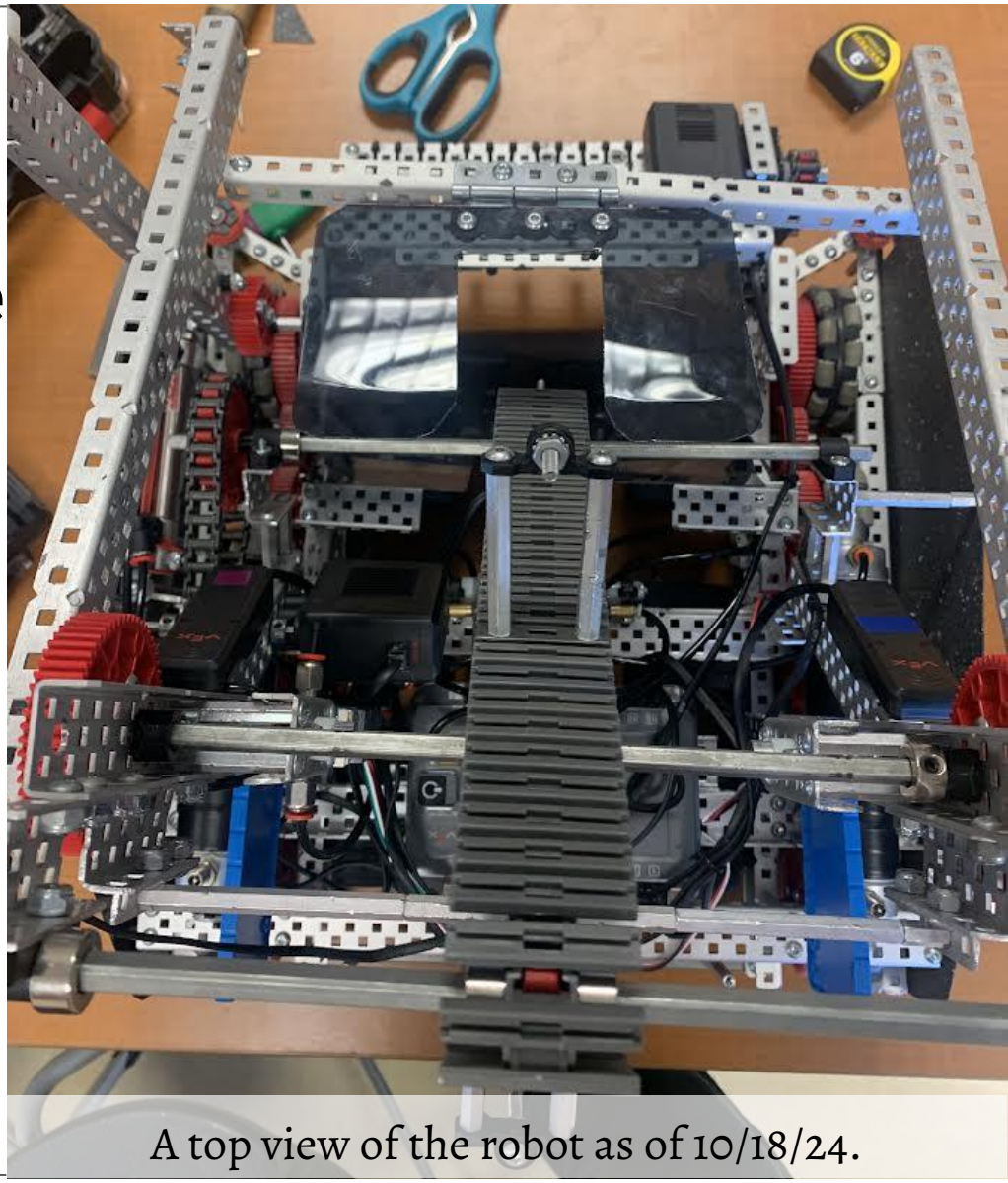
In the meantime, we received feedback from a few sources on our robot and notebook. We went through some brainstorm sessions, and decided on implementing or testing some ideas in the next build days/practices. First off, a note for the book about one of a few changes it is going through:

The two things that are mentioned the most by people looking through the notebook are, first, the amount of filler in the earlier parts, and second, the lack of pictures. That is mostly to blame from the lack of practices at the start, as there was no robot or designs to take pictures of. This change has already been put in place, as one might notice, that we are including relevant pictures in almost every page to be more transparent about what we are doing. This both solves the problem of lack of pictures, as well as taking up space so we feel less need to write “filler” in the book.

1-Hour Build Day 10/18/24

Today's 1-hour build day was extra productive, as we had to make up for the loss of last night's practice. There is full attendance, and the focus is, once again, the lift, but especially our redirect which was briefly mentioned before. We got the idea of the redirect from the robot reveals of the highly successful team, 1010W, also known as Ten Ton Robotics.

The redirect is a cut piece of hinged up polycarbonate, which is used for catching the rings which are placed on it by the intake. With this, we can then flip the rings onto the wall stakes, which we can not do with our intake. This means we can not only score more, but it can be used to reach the ladder for a chance at AWPs.



A top view of the robot as of 10/18/24.

Date of Writing: 10/18/2024

Contributors: Nevin Zerby

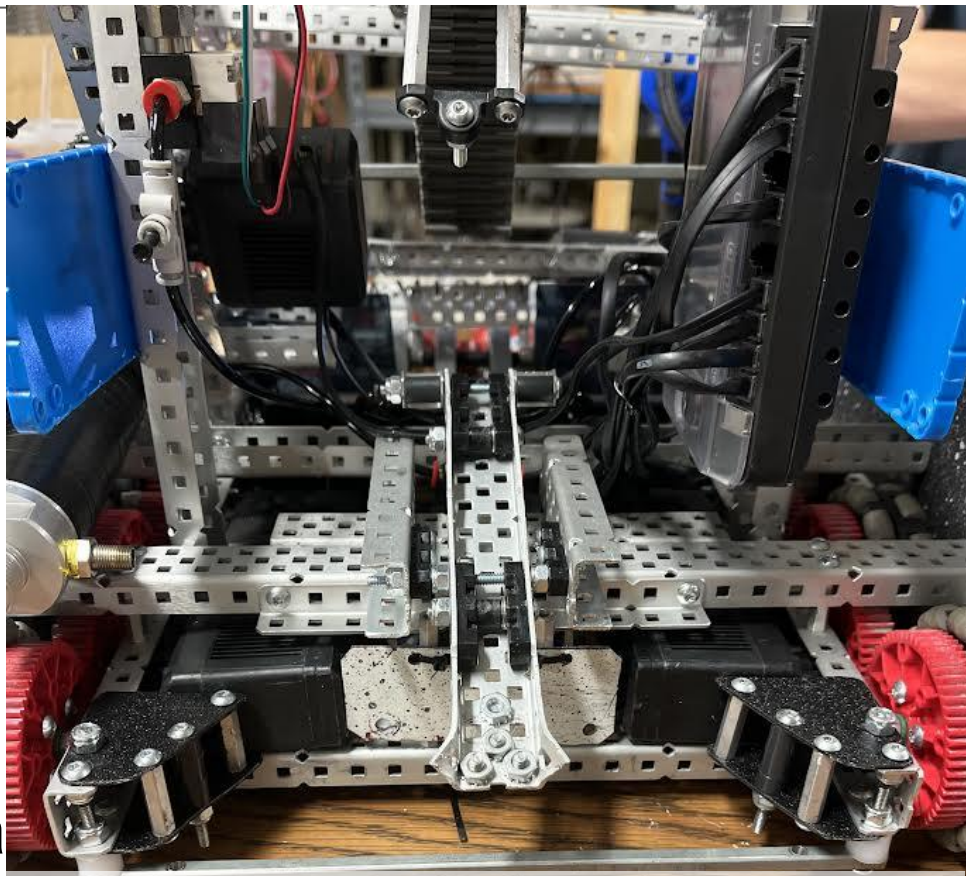
Continued:

Robot Take-Home #3 - Back

For our third robot take-home session, the focus shifted. The idea was to work on the redirect, clamp, and even how our robot looked (which is important for being a better presented pick in alliance selections, and helps our team get a name).

Firstly, we worked on a few different things on the back of the robot - as shown in the picture, the clamp was re-bolted once again for stability, and we added a couple of “sideways sleds” - the black parts that channel the goal into the center.

The purpose of these is to make our clamp yet more consistent, and it should help keep goals in place so that we don’t let go of them. We got the idea after looking at old pictures of our robot last year, which used sleds to get over the center bar in Over Under. There’s also a base to stop “entangling”.



The back of the robot as of 10/22/24.

Date of Writing: 10/22/2024

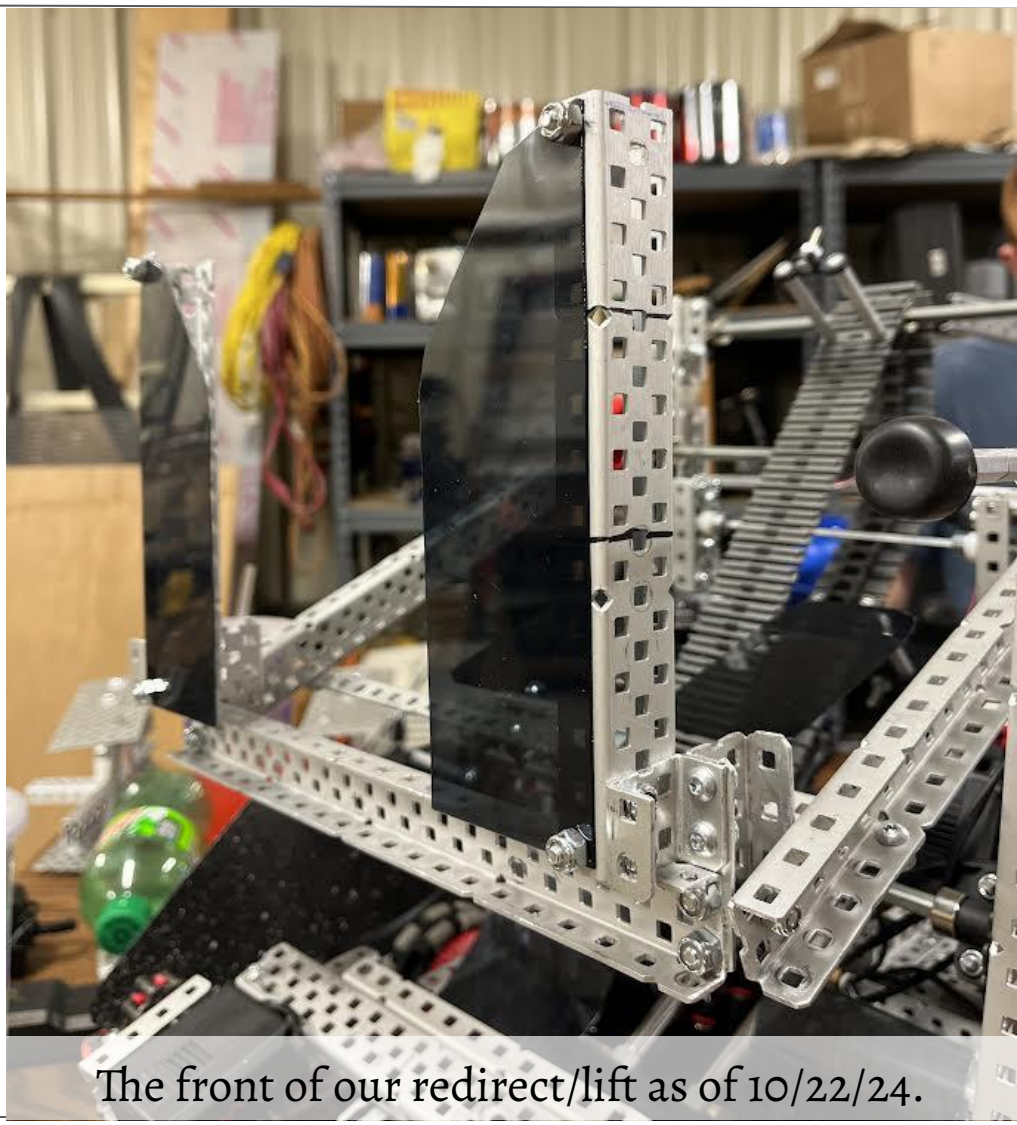
Contributors: Nevin Zerby

Continued: 100

Robot Take-Home #3 - Redirect

Another main focus of this weekend's take-home session was our redirect mechanism. It was explained in detail previously, but a picture and some explanation as to how it was built and the changes it went through should help clarify intent. The purpose of the redirect system is to take take rings from the intake and to filter them out into our lift, which will then "flip" rings onto wall stakes and such for more scoring options.

This idea is pretty widespread now, but we got our idea from a modified design sketch we made early on that came from what 299V Ace (which is quite a well-performing team) presented in their robot reveal videos. We've temporarily detached it just so that it's easier to build on without the rest of the bot around.



The front of our redirect/lift as of 10/22/24.

Date of Writing: 10/22/2024

Contributors: Nevin Zerby

Continued: 101

1-Hour Build Day 10/22/24

Today's 1-hour build day is focused on our redirect/lift system, as it is the main thing (besides autonomous code) that we have left to do before our November 9 competition. The lift is still detached as explained, so we can do more with it. If we finish it in this build day, it should be put back on the robot this practice so that we can potentially work on autonomous programming and such, both for match and for skills.

We recently received a good resource for programming, compiled by a member of team 96138A, which contains several helpful links for different code categories, which come from multiple sources. For digital viewers, the link is here. It contains links from many reputable coding sources, including ones we have used before, like the Purdue SIGBots wiki, and Orange Depot. One specific resource we plan to look at more is another PID guide from Orange Depot, which we cannot list here due to our school computers blocking the link and access to it (though it will be viewed from a non-affiliated device.)

One last thing we did was we placed a reinforced axle on our intake so as to stop rings from falling out of it and to increase robot integrity.

Date of Writing: 10/22/2024

Contributors: Nevin Zerby

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Practice Goals/Plan 10/22/24

Another regular practice, with full attendance the entire practice, from the entire team. There was a build day previously. The build day was used for some intake and lift and redirect reinforcement, preparing for what we could do next.

Practice Plans:

- Finish intake axle addition
- Run intake tests
- Develop PID & Mini tests
- Test robot overall useability
- Finish redirect, prepare for reattachment

Since we have everyone, we have individual plans for us all:
Derek - Build, work on minor tweaks like intake tests/rebolting
Eric - Build, assist with redirect & possible reattachment
Elijah - Build, work on redirect & intake, supervise
Miles - Build, work on the intake reinforcement & assist
Nevin - Develop PID and do testing with Senseis*

*Senseis are miniature square-bots (12in x 12in) that have 4 wheel, 4 motor drive and are used by our school for code/field testing, they are not at all tournament viable

Date of Writing: 10/22/2024
Contributors: Nevin Zerby
Continued:

PID Development & Testing Pt.1

One of the main focuses for the 10/22/2024 practices was coding and developing a Proportional, Integral, Derivative program for autonomous, which makes it much more accurate.

Proportional Development - Creation

Proportional, Integral, and Derivative are different when doing turn or drive functions, and Proportional is the most important. “error = setpoint - ([Average motor position] or [Inertial sensor position]);” Is the main part of P code, using “error” as the difference between where your robot is and where you want it to go. Another core part of P and PID in general is “float velo = (error*kP);” This shows the motors that their velocity will scale based on error, though regulated by a value called kP to scale.

Integral Development - Reinforcement

Integral works by increasing the velocity a bit more based on extra error, which helps get to the target faster, prevent undershooting, and prevent stalling. The core part of integral is simply repeatedly running “integral += error” when the error gets to a low point, meaning that the integral will increase as it goes. Then, the value is added to the velocity with its own regulator, making it “float velo = (error*kP) + (integral*kI);”

PID Development & Testing Pt.2

Derivative Development - Completion & Safety

Derivative works by taking the current error and subtracting it by the previous error value (“derivative = error - preverror”) which regulates the overall value and makes it go down more consistently, thus making the velocity scaling more smooth and also preventing overshooting. The derivative value is also added (though it is generally a negative number) to the main value, making it finally “float velo = (error*kP) + (integral*kI) + (derivative*kD)” and completing the core PID scaling.

Testing - Variable Changes & Accuracy

Test #	Type	Ideal	kP/kI/kD	Real Res.
1	Turning	90 deg.	.5/.5/.5	80 deg, stall, went slowly & inaccurate
2	Turning	90 deg.	.05/.5/.5	~87 deg, stall, faster but yet slow
3	Turning	90 deg.	.01/.5/.5	~89 deg, stall, still slow but good
4	Turning	90 deg.	.01/.8/.5	~90 deg, still a bit slow, much better
5	Turning	90 deg.	.015/1/.5	~90 deg, decent speed, accurate
6	Turning	90 deg.	.015/1/.2	90 deg, better speed,less drop off

Date of Writing: 10/24/2024

Contributors: Nevin Zerby

Continued:

Miscellaneous Build Progress

We made a bunch of miscellaneous build progress / changes on several different things this practice:

Intake - Flex Wheeling, Reinforcement, Accuracy

- Flex Wheels added to top of the intake

Several good teams do this, and during previous tests it didn't work, thought well to try it again now that the intake has gotten so many smaller tweaks - it now works better, it gets on roughly 20% more rings, and betters consistency in depositing.

Redirect/Lift Extension & Prep.

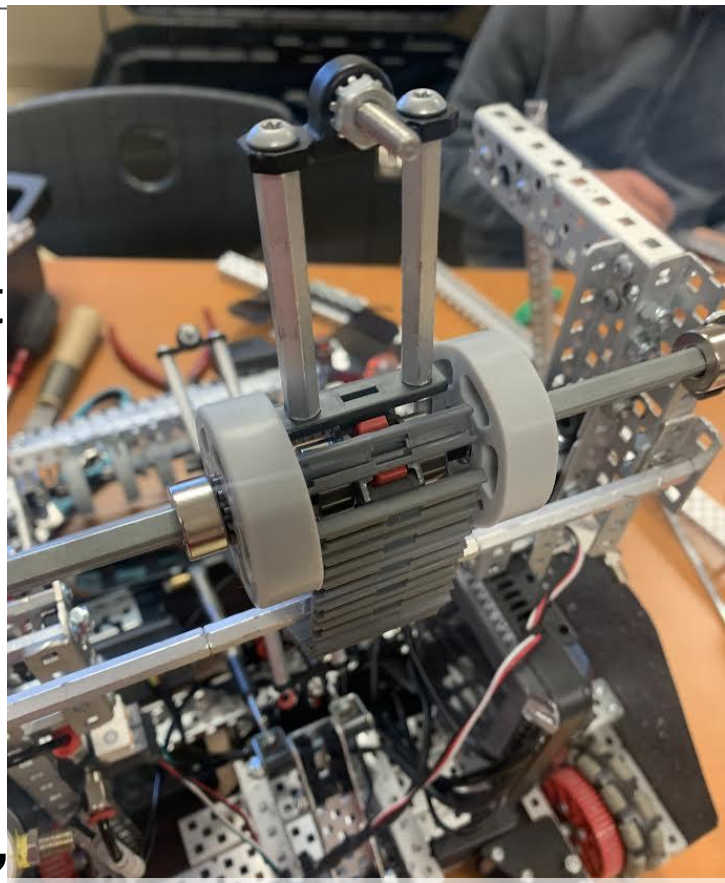
- Bars added to top of "tower"

From these bars the lift will hang, without them it would be hung right on the tower which would mean poor motor connection and the lift directly colliding with the intake.

Minor Redirect Build Process

- Finished main flap parts of it

The redirect is almost done, and is now capable of actually redirecting, though we had no time to put it on.



The upper intake as of 10/24/24.

Date of Writing: 10/24/2024

Contributors: Nevin Zerby

Continued: 106

Post-Practice Notes 10/22/24

Attendance:

- Nevin, Eric, Elijah, Miles present entire practice
- Derek present most of practice - came in late because of football practice, around 4:30

This practice was normal too, but next practice will be a very shortened one due to our school having a “meet the teams” night for fundraising, encouraging new students to join our VEX MS and HS programs, and just giving parents insights. The goal for the next practice will probably be to simply have the robot ready for presentation and some minor driving demonstrations, as we may not be able to build much else.

As for code, that will be more focused on the PID - there are some issues with it. As outlined in page 110, the tests ended with it working well, however it does not exit the loop, and that means that while it will do one thing perfectly, it won’t move on to the next. The loop will be tweaked and worked with as much as it can be, and once it finally works, it will be moved to our regular robot’s code, and then re-tuned for that, as each value (Proportional, Integral, Derivative) each require “tuning” - changing values called kP, kI, and kD based on robot specifics.

Practice Goals/Plan 10/24/24

This practice is significantly shortened, only being from 3:30 to 4:30 at which point we clean up and then move on to our event for fundraising, helping people understand vex, and encouraging new people to join, and we can see our MS teams. Attendance for practice is all of us except Derek and miles, but Derek is coming to the event.

Practice Plans:

- Tweak / finish redirect
- Tune PID
- Catch up on book

There's not much to do this practice, so:

Eric & Miles - Redirect work, reattachment
Elijah - Intake work, finish putting on the axles
Nevin - Tune PID and catch up notebook

10/24/24 Practice Activity

Overall, this shortened practice did not allow us to do very much, so our accomplishments were small. We did as follows:

Redirect Progress

This practice's building was mostly focused on developing the redirect system, for which we changed a bunch of things. We reattached the lift for the time being, and we added the pistons for the pneumatic part at the end, which catches the rings. The lift was attached via the red gears, but since we didn't have time, we took it back off.

Code/PID Progress

As for the code, the PID was finally mostly completed - it just had to be tuned and moved to the real robot's program instead of the one for the square-bot. Some time was spent doing tuning (starting with the P value, as the others were to be done afterwards)

A side view of the robot as of 10/29/24.

Date of Writing: 10/29/2024

Contributors: Nevin Zerby

Continued: 109

Post-Practice Notes 10/24/24

Attendance:

- Nevin, Eric, Elijah present entire practice
- Miles not present at practice or event
- Derek not present at shortened practice, present at event

This practice was different as it was cut short by our event for fundraising and promoting robotics, and so Derek was not able to come, however he did show up at the event, but Miles was not able to. For the next practice, the plan is to finally finish and reattach the redirect, and tune the PID if possible.

At the event, we had to take off the lift, as we did not have time to finish the mounting for it, so in its neutral state it would hang down and interfere with the intake, and we needed to show functionality. Our team was introduced more fully to the middle school teams (and the rest of the high school teams did so too, and vice versa) and the parents and possible future robotics students. We did demonstrations with the robot and did a fake scrimmage with our sister teams after giving the adults a briefing and showing them the reveal video, and it went well. We also got more insight on how the middle school teams that we were with last year are doing, and will see later.

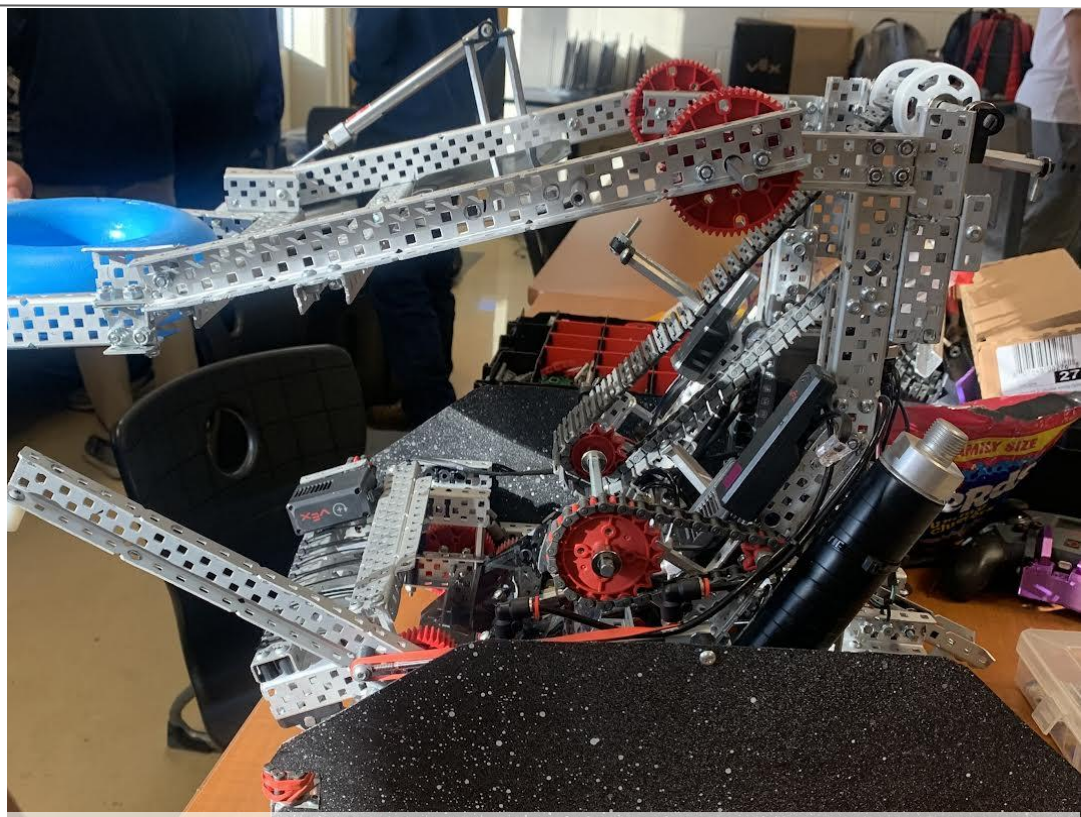
Practice Goals/Plan 10/26/24

This is one of our less common Saturday practices, so some people were not able to show up, though our team was present for the most part. The practice was still 3 hours, however, being from 9:00 AM to noon rather than 3:30 - 6:30.

Practice Plans:

- Reattach lift/redirect
- Tune PID
- Catch up on book
- Finish miscellaneous robot projects

Here is a picture of our robot from the last practice, before we took the lift off for the event. There will be more updates to it, like mounting a second piston, as we had not fully finished it. Pictures will be taken and put in.



A side view of the robot with a ring as of 10/29/24.

Date of Writing:
10/29/2024

Contributors:
Nevin Zerby

Continued:

Code Progress 10/26/2024

During today's practice, we finally truly fixed the PID's main code - there were a few errors, and they were fixed differently.

Loop Not Exiting

The issue turned out to be caused by our loop exit values being too small. Expecting the robot to turn to within 0.1 degrees, remain there, and not stall in the process, is unrealistic, so it was changed from 0.1 to 0.5 and then eventually 1 degree to make it exit the loop most of the time. It doesn't every time, but with tuning, it is possible to make the values accurate enough.

Polishing & Carryover

This process was actually done between practices, on a home computer - the code for the squarebot PID was carried over, cleaned up, and changed according to our actual robot's motor values and such. However, this does mean that it will need re-tuning, and we have not had time to do that yet.

"Autonomous Predictions"

Basic programs have been made for where we would probably have the robot go in a perfect world, say that our code works as planned after tuning. There are ones for both auton sides.

Date of Writing: 10/29/2024

Contributors: Nevin Zerby

Continued:

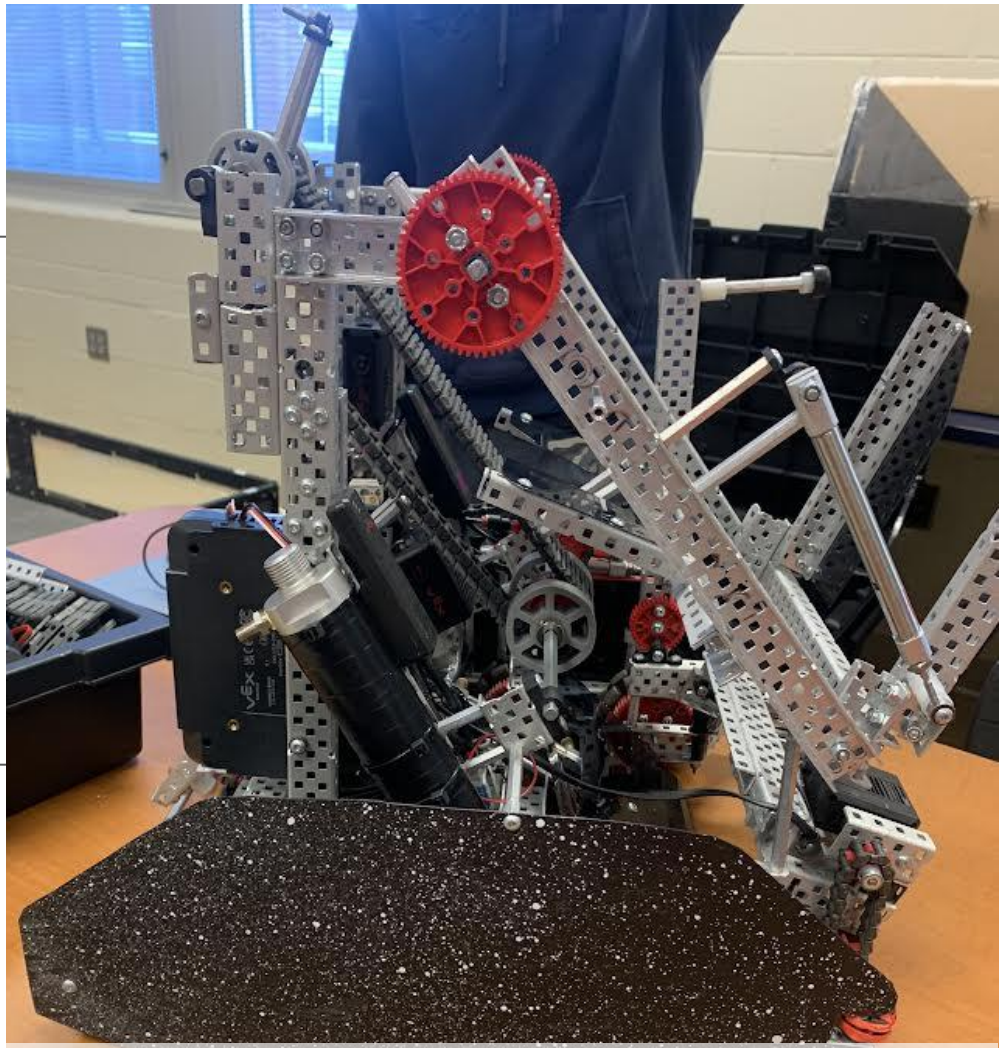
Build Progress 10/26/2024

We made limited build progress this practice, due to the strange setup and some other unrelated issues that impaired what we could do, though we did make some good progress on our lift/redirect, reattached it, and it is now nearly finished.

The reattachment was smooth, and now necessary as we have finally gotten the gears corrected (as shown) with screws so that the rest of the lift does not interfere with the intake mech.

Secondly, we added spacers to our joint for the pneumatics on the lift, to increase the bit's consistency - otherwise the piston would bend.

Finally, we added more joints to the lift's redirect, so it can now undulate rings better.



The robot with the lift down as of 10/29/24.

Date of Writing: 10/29/2024

Contributors: Nevin Zerby

Continued: 113

Post-Practice Notes 10/26/24

Attendance:

- Nevin, Eric, Elijah present entire practice
- Derek not present (scheduling issue)
- Miles not present (family trip)

This practice didn't do a ton, as there were only 3 of us present. The build goal for the next practice (Tuesday, 10/29/2024) is to finally finish the redirect, as we still have to sprocket it.

As for notebook goals, it is to catch up to the book as it is a few pages behind due to code focus in the past couple practices. Also, a discussion of possible book changes will occur - it has been noticed from critiques one critical flaw the book has, and if that might mean it could be a good idea to rewrite and reformat it.

Finally, as for code, the goal is to finish "autonomous predictions" for both code sides, and, if possible, tune and test the code, though the robot may not be ready for that.

Practice Goals/Plan 10/29/24

A regular 3:30 to 6:30 Tuesday practice, however there will not be full attendance as our school is hosting an unrelated event that Eric and Miles are required to attend from 4:30 onward. They will not be present for a majority of the practice.

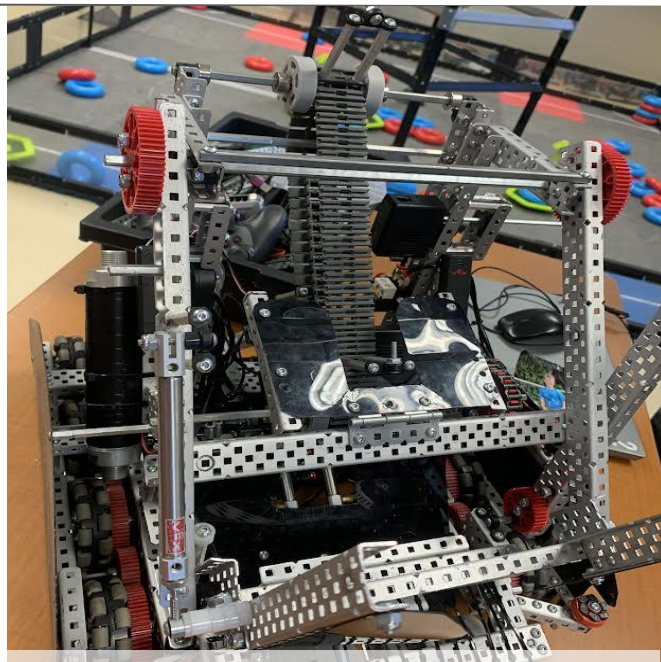
Practice Plans

- Finish redirect/lift

(Sprocketing, any additional tweaks, tests)

- Finish “autonomous predictions”
- Tune PID (if possible)
- Test PID (if possible)
- Run autonomous tests (if possible)

Pictured to the right is a front view of our robot as of the beginning of today’s practice, with the lift and redirect fully attached. Work still has to be done, and there may not be time to work on genuine autonomous tests because of it, and especially because of the slower building pace that will be caused by Eric and Miles’ absence.



Top of the robot as of 10/29/24.

Date of Writing: 10/29/2024

Contributors: Nevin Zerby

Continued:

Lift Build, Motor Tests, Removal

After finally putting on the lift, we came across an issue that we had unfortunately not anticipated due to missing testing for it previously. The single, weak 5.5 watt motor was not enough to work or hold our heavy intake/redirect. We tried several different tests and solutions:

Test - Motor Swap

Our first idea was to swap out our 11 watt motor on our intake for the lift, which would mean that the intake would be powered by 11 watts instead of 16.5. However, while this did not seem to have great impact on the lift, it also made the intake too weak and slow in testing, so we did not stick with it.

The Decision

We decided that we should remove the lift for now, and while we have new lift ideas that we will compile as a brainstorm session, we will put them off until after the first tournament so that we have time to work on our intake (which received some critique) and to code/test autonomous.

As for the intake, the plan is to raise it up, and make it less dense so that it picks up rings easier, rather than struggling.

Brainstorm: Future Rebuild

As we are coming closer to our first tournament, the team has discussed several ideas for a rebuild that may happen in the future, maybe after this tournament, maybe after the next one, depending on our performance and our ideas.

Drive Base

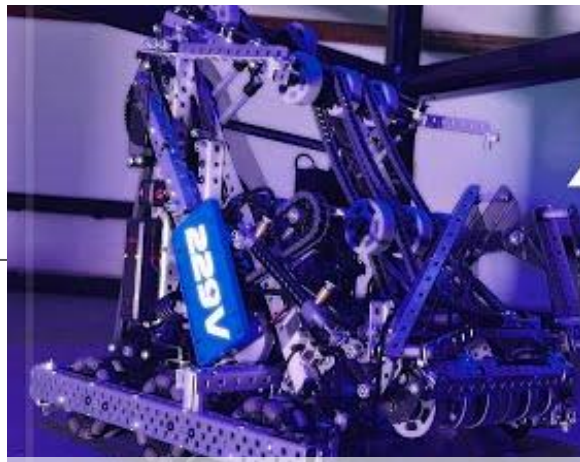
We have decided that we would want to stick to a 6 motor, 8 wheel drive base - though other things might change:

- Replace 2 omni-wheels with friction wheels for traction
- Change gearing of the motors for a little more RPM (speed)

Intake

We've considered doing a "hood" intake, which is one of the two most common options alongside the "hook" type we use.

- Generally more consistent: see below-right image, a hood intake used by a well performing team, 229V - Ace. We have gotten inspiration from their builds before.



An image of Ace's robot.

Notebook "Rebuild"

It has been taken into consideration if we might rewrite, though not now, if ever.

Date of Writing: 10/31/2024

Contributors: Nevin Zerby

Continued: 117

Post-Practice Notes 10/29/24

Attendance:

- Nevin, Elijah present entire practice
- Derek arrived late (football)
- Miles left early (school event)
- Eric left early (school event)

This practice was mostly taken by working on, testing, and then eventually removing the lift again, though it is now fully off and dismantled, and we are ready to work on the intake.

We are having a build day on Thursday (10/31) before that day's practice, so we will hopefully be able to work on the intake then, finish it during the practice, and then finally work on autonomous programming as we are likely just not going to the first competition with a lift at all, unless we find a quick, simple solution, though it is not planned at the moment.

At the moment, we have 9 hours of practice time and an undetermined amount of build-day time before our tournament, so we are now entering crunch time. The notebook will go through a couple of structural changes upon the end of the first competition, and our results will be fully documented.

1-Hour Build Day 10/31/24

Today's 1-hour build day is focused on systematically testing and tweaking the intake. The tests were not as uniform as usual, but they will be documented as they were.

Initial Intake Tests

The intake was semi-consistent, but would very often miss on the top stage due to instability or flip out or stall on the first. So we attached a small, long v-bracket onto the first stage's top.

Post-Bracket Tests

With the bracket on, discs did not escape as much, but they did have the issue of getting jammed more often or getting stuck between the hooks and the bracket. We decided to look at some other, more efficient intake designs and we made our intake float (hang) more, and then moved it up two holes.

Post-Float Tests

With the intake floating more and higher up, rings almost never got stuck or flipped over due to how high up it was, but rings didn't go in as fast or easy, as there was less traction. To remedy this, we decided to extend the polycarbonate sheet under it slightly and bend it up to make more contact.

Practice Goals/Plan 10/31/24

Another regular 3:30 - 6:30 Thursday practice, but we will be having a short 30 minute meeting from 4:00 to 4:30 for a design talk with our coach and our other teams, as well as a schedule discussion to make sure people are on track for it. Several people are missing (not from our team) because of Halloween, so the practice is not structured quite as usual.

Practice Plans

- Finish intake tests and tweaks
- Review putting together or putting on a new lift type
- Plan autonomous (if possible)
- Do some driving/strategy practice for tournament

On the side is a rough side view of the robot at the moment, after taking off the new lift and after lifting the intake. Low image quality due to camera issue.

Robot side as of 10/31/24

The team is mostly going to work on the intake today though we may start with a new lift, as we have talked together and are still unsure, but it may mean no auton.

Date of Writing: 10/31/2024

Contributors: Nevin Zerby

Continued: 120

Ring System Tests & Building

We went off of the tests we did in the 1-hour build to work on the intake more, and test off of our results.

Post-Bending Tests

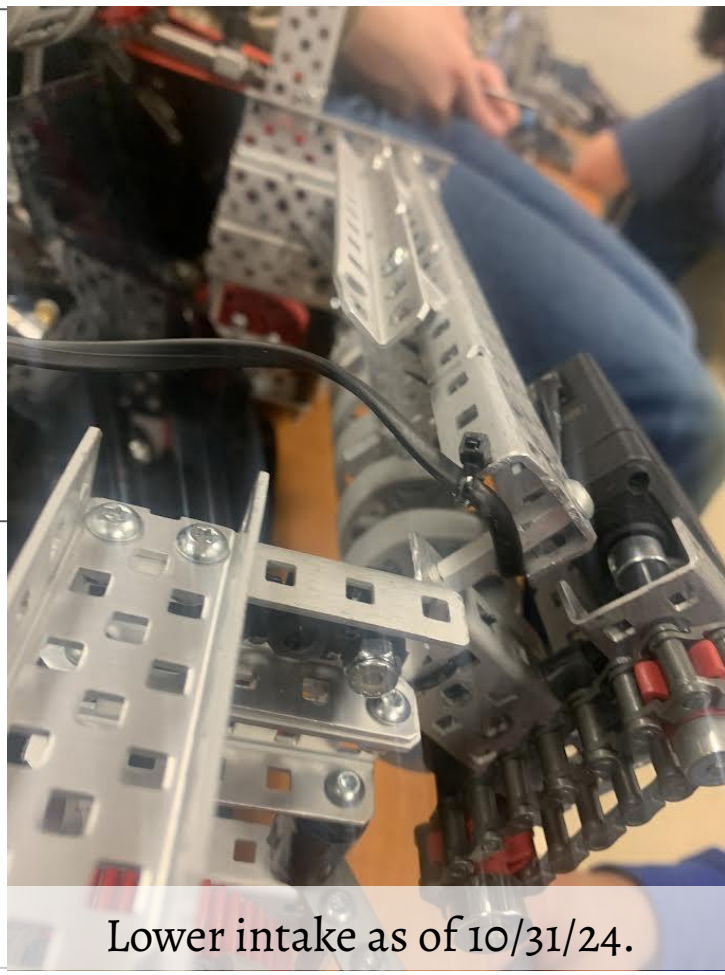
After extending and bending the polycarbonate, the intake had some better contact, though we had to file it slightly, which didn't change how it worked but made sure the robot would never scrape the ground or bottom of the field. However, now that that was better we noticed the inconsistencies of the top.

Testing/Research for Upper Intake

We did a collection of tests, and the intake was a bit inconsistent, and we noticed that it had an extra bit of friction which we fixed, but the inaccuracy was clamp-based.

Testing/Research/Move for Clamp

Since we had changed so much about the intake in small parts, the goal angle was no longer right. We put keps nuts on it to remedy it.



Lower intake as of 10/31/24.

Date of Writing: 10/31/2024

Contributors: Nevin Zerby

Continued:

Lift Plans & Beginning

After discussing it extensively and brainstorming different lift types, we finally decided that we will at least start making one before the first tournament, despite low time left.

We added bars on the front for an additional mount, as we're doing a different type of lift from the last one, as that one did not work and we also have found designs that should be theoretically better than the last in efficiency regardless.

We're doing this now as our intake, after our better, more systematic tweak-testing system was finally put to work correctly. It will be used much more throughout the notebook from now on - as it is also very easy and efficient to document and gets our points across as well in just a page or two.

We did some on-field tests and the robot worked well.

Front of robot/start of lift as of 10/31/24.

Date of Writing: 10/31/2024

Contributors: Nevin Zerby

Continued:

Post-Practice Notes 10/31/24

Attendance:

- Nevin, Elijah, Eric, Derek all present entire practice
- Miles present first half of practice (left for Halloween)

This practice focused on finishing our intake tests and building, and the beginning of the new lift. There is now a special Saturday practice on 11/2 so that we have extra time to prepare for the tournament on 11/9. The focus for that practice will be working on and finishing the lift, and if we do that, we may have time to start the autonomous tests and tuning after.

Here's the robot as of the end of this practice to the side, for reference as to what we will start with the next practice.

Full view of robot as of 10/31/24.

Before the first tournament, a bunch of statistics and specific pages will be put in the robot, like a brain map, a recap of our RPMs and gearings, and a basic game plan for the matches.

Date of Writing: 10/31/2024

Contributors: Full Team

Continued: 123

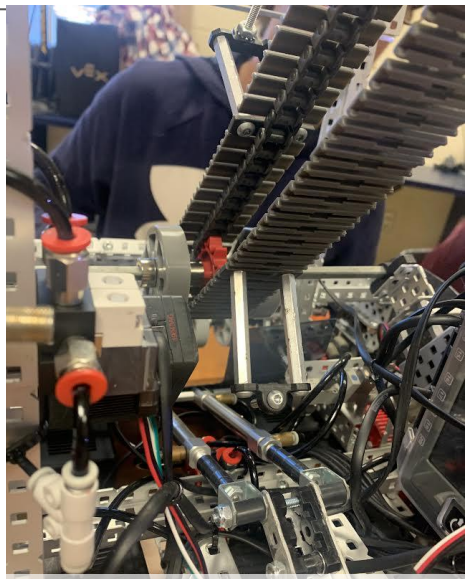
Practice Goals/Plan 11/2/24

This practice is a special rare Saturday practice which is for the teams competing at our first tournament (our schedule differs between sister teams) from 9:00 AM to 12:00 PM. It's to give us more time to prepare for our first tournament next weekend. We want to have our lift finished and finally do auton.

Practice Plans:

- Complete new lift & redirect
- Finish any remaining intake tweaks
- Begin PID tuning
- Begin autonomous testing
- Discuss tournament strategy
- Practice driving/scrimmage

The intake is now much more effective and functional than it was before, and no longer focusing on it gives us so much more time to work on the lift. We are doing a Lady Brown mechanism, which is a sort of shaken redirect which "snatches" rings directly from the intake to be flipped over onto stakes. It is a common design, and effective.



Back as of 11/2/24.

Date of Writing: 11/2/2024

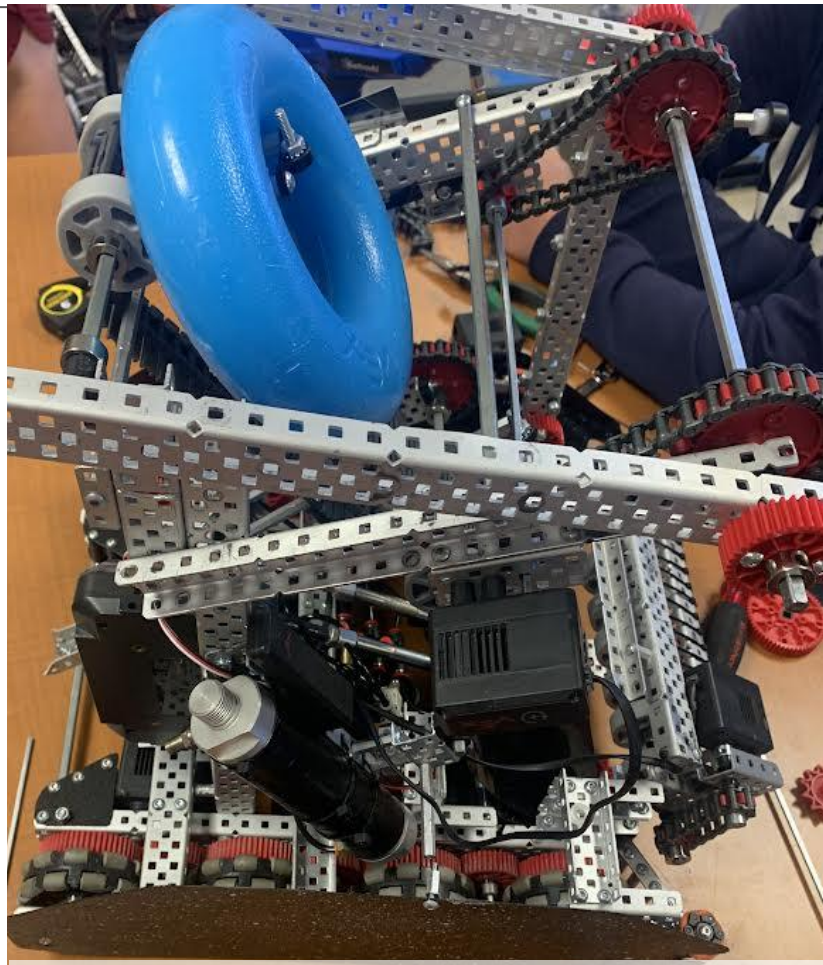
Contributors: Nevin Zerby

Continued: 124

The Lady Brown (Lift) Build

For our new lift and redirect system, we are using a popular design called the “Lady Brown” popularized by teams like 229V - Ace and 2029C - Inception that is now used by many effective teams worldwide. The way it works is that it is an extended bar attached to another bar and put on a motor (it doesn’t require a super strong motor, a 5.5W is more than enough) so that the bar can go down and take a ring off of the top of the intake. In the image below, ours is incomplete, but it’s what we managed.

We attached a diagonal bar that was partially held with a high strength driveshaft, and we put a sprocketed shaft at the end for connection of the other bar, which is powered by a 5.5 watt motor on a regular driveshaft. We still have to add the “grab” part so that the disc would actually be picked up by it, and could be flipped from there onto a theoretical wall stake or even mobile goal.



The lift/redirect as of 11/2/24.

Date of Writing: 11/2/2024

Contributors: Nevin Zerby

Continued: 125

Post-Practice Notes 11/2/24

Attendance:

- Nevin, Elijah, Eric, Derek all present entire practice
- Miles left early towards end of practice (family)

This practice once again focused on working on the lift and its new system we're using, a mechanism usually known as the Lady Brown, which is considered a "meta" build. Due to the complexity of building it, while we made a lot of progress, we were not able to finish it any may not for a while. In the coming week, we should be able to so that we can finally do auton.

Additionally, during this practice we took the time to watch two local tournaments in the background - the Firestone HS tournament, and the North Union MS tournament. The MS tournament didn't give us much insight in terms of strategy, except for showing our MS teams, so we focused on watching the HS one, where we got some insight on how the local teams are doing right now and how they play/how we might play against them. We also saw who we might talk with to alliance.

We will be going with/against many of those teams on the 9th, so it was important to see this specific group.

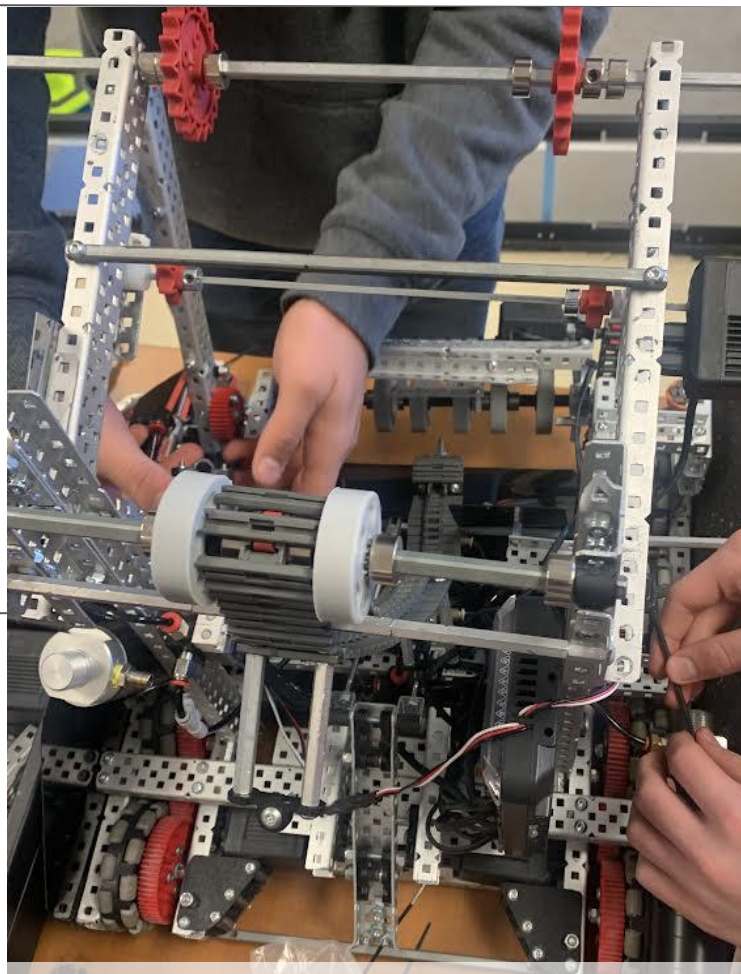
1-Hour Build Day 11/5/24

Today's 1-hour build day was focused on the lift system (Lady Brown) and building it. It's not complete enough for testing yet, so it is still fully in the building/fly designing stage.

As for build progress in today's build day, we had to move the outer part (as shown in the picture on page 130) as it was sticking out too far and could have caused robot size limit issues, depending on the situation. It was off in the picture.

We additionally replaced the weak low strength driveshaft that part of it was working on with a high strength axle, to improve its resilience and prevent bending or breaking. We didn't do it before because we didn't have one on us.

We also discussed the idea of putting a passive hang on the lift so as to be able to score an extra three points (first level of ladder) in matches and skills runs.



The top of the robot as of 11/5/24.

Date of Writing: 11/5/2024

Contributors: Nevin Zerby

Continued:

Practice Goals/Plan 11/5/24

Today is one of our last practices, a regular Tuesday 3:30 to 6:30 practice in preparation for our first tournament, as we officially enter crunch time, as it is the last week before it.

Practice Plans:

- Work on Lady Brown (lift)
- Adjust doinker bar
- Make/prepare passive hang on the lift
- Scrimmages from 5:30 - 6:30
- Program autonomous if possible/available

The team has unfortunately decided that unless we somehow manage to have time for it with quick building, really fast tuning, and more build days, we will likely not have a real skills autonomous or even a fully made match autonomous as we simply don't have the time due to our robot not being finished fast enough.

However, we have been informed that we will not only be having mostly build days this week in our class, but we also have a mini-practice the day before the tournament on Friday from 2:30 to 4:30 to help us finish preparing, so we may finish.

Lady Brown/Lift Progress

We are making more progress on the lift's Lady Brown wall stake mechanism. Firstly, we have started work on the new set of upper bars for it, and already added sprockets and such to it, and will continue to work on it throughout the practice. This differed version will no longer have any expansion issues, and should also allow us to go under the middle bars without bumping into them. As yet another added bonus, the new height means we should now be able to add a passive hang on.

Shown to the side is what we have at the moment, with the new high strength axle running across and the sprocket that will be get chained over to a motor soon. The motor being used can be seen at the very bottom. It is a 5.5 watt motor, as we are conserving watts (max of 88) and we do not need it to be especially strongly powered.

Side view of lift as of 11/5/24.

However, this new development is going to take yet more time, and we are running out of time before the tournament.

Date of Writing: 11/5/2024

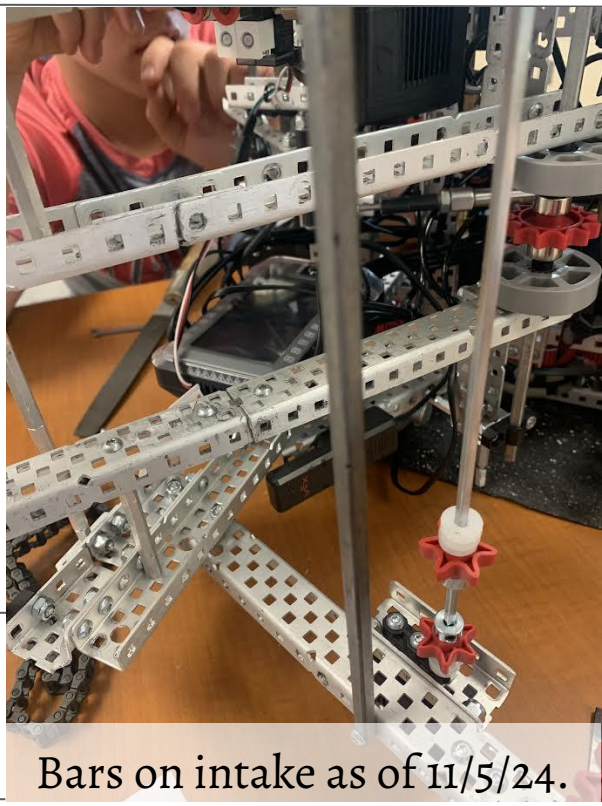
Contributors: Nevin Zerby

Continued:

Intake Bar Addition & More

With our new lift mechanism, we ran into one large issue, and that was that moving it down made it clash with the intake, so we have added bars to the intake. These bars will not only regulate it and prevent them from clashing, but as rings go up they may “ride” on these bars and will fall off less and move on straighter, with also less risk of them going into the rest of our mechanisms in jamming. The bars also provide a platform for the Lady Brown to grab them off of, rather than just relying on hoping they end up in the right position and having to repeatedly move the intake and waste tons of time on getting them on the exact top part perfectly.

Doing this, of course, also gives us the ability to test out our intake more, and tweak it as we need, for we might due to the bars being added. This might change the chance of jams, or friction on the intake, or even rings hitting the metal and bouncing off of it.



Bars on intake as of 11/5/24.

We had a scrimmage planned for today, but we were not able to have it.

Date of Writing: 11/5/2024

Contributors: Nevin Zerby

Continued: 130

Post-Practice Notes 11/5/24

Attendance:

- Entire team present entire practice
- Nevin left very briefly towards the end (school event)

This practice, we nearly finished our lift, but we made major tweaks to both it and the intake, including adding bars on the intake that actually ended up increasing its consistency (because of the strengthening of it, better holding of rings, and providing a platform) and made it possible to make a more versatile lift (as the intake was more confined).

The lift / Lady Brown mechanism is almost completed, but still needs rechaining (due to our sprocketing, the chains would skip which meant risk of breaking/falling off and risk of it jamming or jumping) which we can do by moving the sprockets forward and putting a standoff across to push them into position. We also need to put on mesh for actually grabbing the rings / retaining them.

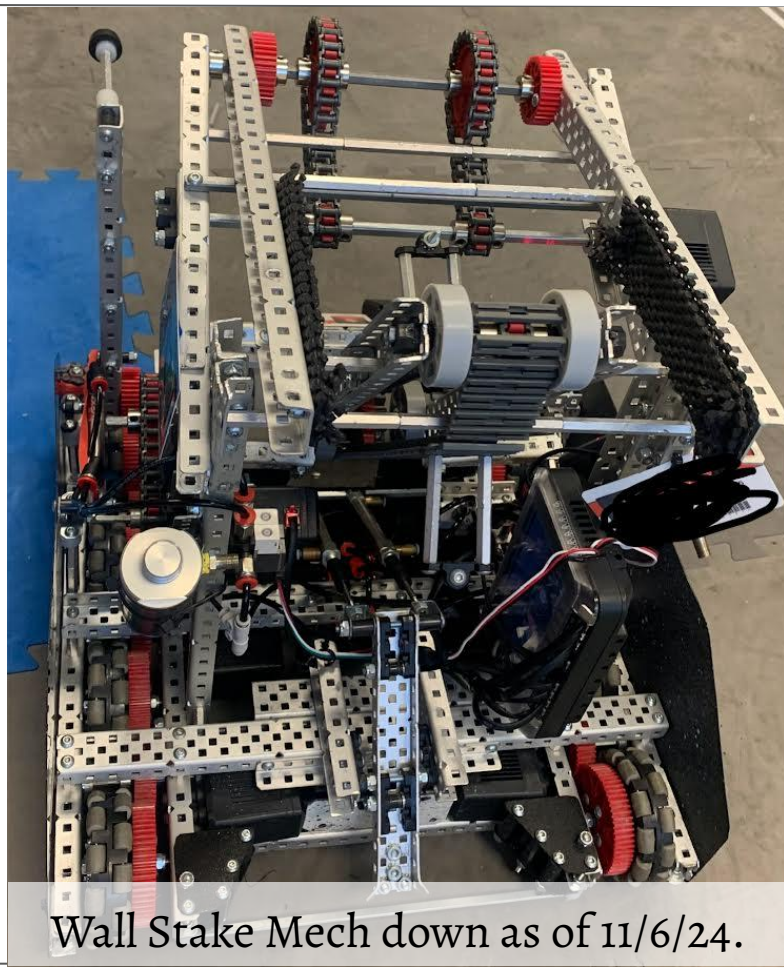
We will have another build day tomorrow, where we should finish the lift mechanism finally and potentially begin tuning the PID provided we have time afterwards, though it is unclear.

1-Hour Build Day 11/6/24

During today's build day, we put mesh on our Lady Brown wall stake mechanism. We put 1 layer on each side, and tested, but without much success. We then tried putting 2 on each side, and while we could then grab rings, it was inconsistent.

Now, we are going to be making the mesh parts smaller and more concentrated, so that the ring doesn't get stuck in it and doesn't fall off as easy. We need to be able to flip them over efficiently without letting them slip away or get stuck.

To the right is a picture of our robot as of the end of the build day - we took a few good pictures that we will use to try to get good alliances/scouting during the tournament. You can see how the mesh is on, with the wall stake mech at the "off" position, being aligned with the top of the intake. When run, it will move around and flip over so that it would hug a wall stake.



Wall Stake Mech down as of 11/6/24.

Date of Writing: 11/6/2024

Contributors: Nevin Zerby

Continued: 132

Practice Goals/Plan 11/7/24

This is our final full practice before our tournament on Saturday, though we do have a half-practice on a different schedule tomorrow (2:30-4:30 rather than 3:30-6:30) and we will not only have our regular building and testing, but there are scrimmages between our teams for strategy/driving practice.

Practice Plans:

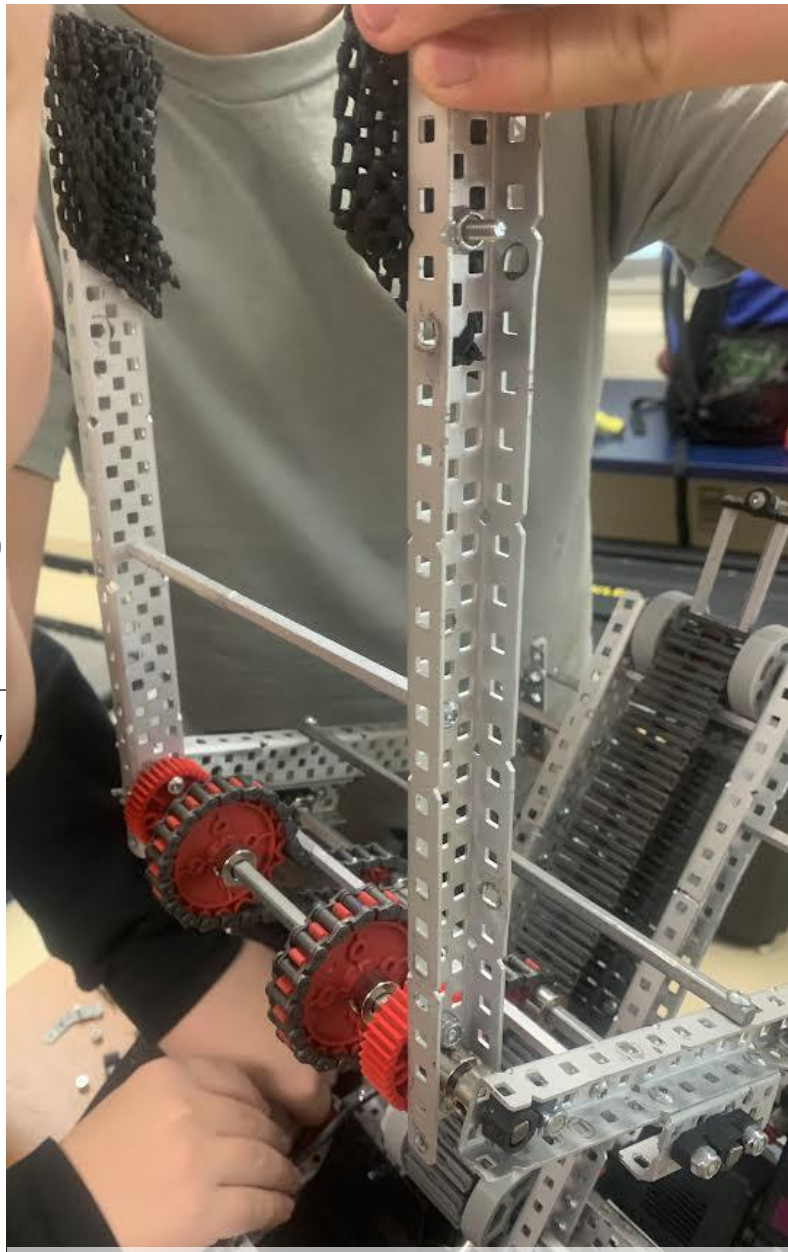
- Finish our wall stake mechanism & code tests for it
- Tune PID
- Test autonomous
- Do scrimmages
- Finish book for printing
- Other tournament readiness things (wire management, etc)

We are running very low on time before the tournament, and it is a big, difficult one. It is hosted by the 2011 teams, which won 6 worlds awards total last year, not including division semifinalists. Performing well will be a challenge, but could mean a lot if we succeed.

Notebook progress may be suddenly cut off, as a printing time is not set yet and may have to be done on the fly.

LB Building & Code Testing

Since we had different meshing on, we tried more with the wall stake mechanism, though we ran into a problem: that the simple spin forward & backward button commands weren't precise enough for it. To remedy this, we made the commands ones like spinToPosition, which made the mechanism spin to specific motor degrees (i.e. 90 or 180 degrees, using the built in motor encoders.) This ended up working better, but did not fully fix it, so we are working on the meshing again and testing to get the right amount.



Wall Stake Mech up as of 11/7/24.

It is being worked on actively as there is very little time before our competition and we find that having a good wall stake scorer is necessary for a competition like this one. We will not be able to do scrimmages, most likely, as a goal was mistakenly taken.

Date of Writing: 11/7/2024

Contributors: Nevin Zerby

Continued:

Post-Practice Notes 11/7/24

Attendance:

- Entire team present entire practice

Our final full practice, it was taken up by finally completing our wall stake mechanism (Lady Brown) and doing our scrimmages. We were not able to work on autonomous, though we may be able to make some code during our one-hour build day tomorrow. We were only able to do 2 scrimmages due to time constraints, but we won both of them, one 35 to 0.

We have decided to put our PID on hold for the time being, as it is far too time consuming, and we have less than 3 hours to code 3 autonomous programs for the tournament. We do not have time to extensively tune 3 values each for both drive and turn PIDs, no time to troubleshoot other potential issues (i.e. loop not exiting), and no time to speed test it. As an alternative, we have decided to use the internal motor encoders to make an autonomous via heading values, which is far simpler and faster, while it is less precise, it is enough for simple autonomous programs (all we have time for regardless) and can be coded extremely fast. The reason we didn't do it before is because we had an inconsistent drivebase before.

1-Hour Build Day 11/7/24

Today's 1-hour build day will be split into three parts, as Nevin was able to to coding during the "break" (our school lunch break that splits two 30 minute build periods) to test and think about autonomous aside from the other two periods.

Period One

Finished all remaining standout robot tweaks (bent metal on the wall stake mech to increase consistency and prevent jams, and also an extra standoff to make the intake float better)

Break Period

Started trying to tune PID, ran into initial issues (reversed motors), continued tuning, but ran out of time. After consulting coach, the team agreed to just use motor heading code.

Period Two

Worked on autonomous with motor heading code, successfully completed an entirely consistent 2 ring rush-side autonomous that also ends touching the ladder for an autonomous win point possibility (provided our teammates can score a ring as well.) We didn't have time to complete our other side of autonomous, though we may be able to at today's practice.

Robot Specifics & Motor Map

Here our our robot's summarized specifics, documented for the tournaments ahead. They are here to show our robot's features, and to be used in interviews or for alliance scouting.

Motor Distribution

6 Motor (66W) drivetrain, 360 RPM with external gear ratios, distributed to 8 omni-wheels (no PTO), all regular Motors
1 Motor (5.5W) lower intake, 200 RPM, a Smart Motor
1 Motor (11W) upper intake, 600 RPM, a regular "turbo" Motor
1 Motor (5.5W) wall stake mech, 200 RPM, a Smart Motor

Pneumatics

2 Air Tanks (100 PSI each, 200 PSI total)
2 Piston Clamp on back of robot (Single-Acting)
1 Piston "doinker" on front of robot (Single-Acting)

Robot Size & More

~18 Inches wide (12 inch wheel base)
~15.5 Inches across (12.75 inch track width)
~17.5 Inches tall (able to go under middle bar)

Ports

Left Drive: Ports 10, 9, 8 - Right Drive: Ports 1, 2, 3
Intake: Ports 7, 5 - Lift: Port 11 - Clamp: Port B - Doinker: Port A
Inertial Sensor: Port 20 - Radios: Ports 12, 13

The Brecksville Tournament PT1

At the Brecksville-Broadview Heights tournament on November 9th, each team (including ours) participated in 6 qualification rounds. We ended up with a 4-2-0 Win-Loss-Tie.

Match 1 (Qualifier #8)
Won 21-6, paired with 62007A against 6978W (sister team) and 23037C. Focus on mobile goals and scoring rings on them.

Match 2 (Qualifier #30)
Won 27-14, paired with 9185C against 6008Y and 7882X. Focus on corner defense with goals. Autonomous victory.

Match 3 (Qualifier #49)
Lost 25-14, paired with 91775B against 91775C and 2011F. Focus on corner defense. Pneumatics seemingly unplugged by other team before match, so doinker unable to perform.

Match 4 (Qualifier #71)
Lost 31-24, paired with 7316F against 60883B and 6008G. Offense game, focused on speeding around field to grab goals.

At this point, it was apparent that goal defense was the meta.

The Brecksville Tournament PT2

Match 5 (Qualifier #79)
Won 30-24, paired with 45434W against 6008D and 91124B. Focus on mobile goal corner defense again.

Match 6 (Qualifier #93)
Won 28-20, paired with 45434R against 23037B and 2011G. All over the place, between goals, but a lot of wall stake plays.

Qualifier Total Results
4-2-0 W-L-T, 18th place of 71 teams. 10 Win Points.

Alliance Selection
Before alliance selection, we talked to several teams, especially 6008G (above us), 2011D, 2011B, 6008P, and 7316X. However, 6008G decided to go with another team, and both of the 2011 teams got picked before it was our turn. We ended up picking 7316X and became 16th seed.

Round of 16
As 16th seed (6978B & 7316X) we went against 1st seed (2011F & 2011K). We lost 31-28. There was a lot of competitive play, but they won because they prioritized wall stake points.

Tournament Reflections (Breck.)

At the tournament, we noticed a lot of things to go over and change with the program, robot, specific mechanisms, driving style, priorities, and even the notebook.

Driving & Strategy

We found that in the tournament there was a heavy focus on rings in mobile goals in corners, which was as expected, but we noticed that in more competitive matches they were weighted on wall stakes, because of the large point values from having Top Rings scored. We did not focus on wallstakes.

Robot Build Ideas

A lot of teams, including well-performing ones at the tournament used redirect mechanisms rather than “lady brown” wall stake mechanisms. We decided not to use those, however a popular form of intake was a modified hook intake, similar to what we had but more vertical/steep, so as to increase consistency, be smaller, decrease travel time, and generally be more accurate due to being closer to parallel with the goals.

Code Ideas

Our program worked better than expected, but we need the PID.

“Chapters” For Rebuild

The most widely held criticisms for the current book are that it is, firstly, written more like a journal than a log (more professional and concise), and secondly the lack of important content in the starting pages which were made pre-season.

We thought about it extensively, and we do not think the current notebook format or style of writing is the most effective at displaying our process for finding problems, thinking of solutions, making an educated choice from those options, building/creating them, and testing them.

We think that it might be the best course of action to make a “Book 2” or a new “chapter” since we are also doing a half rebuild on the robot. We will probably do this for each rebuild, to show the difference between different building stages and also to keep the notebook as efficient and correct as possible.

It will be kept within the same digital slideshow, however, because it will be easier to organize, keep track of, and print/use for tournaments. Separating pages will be added to show when we transition from one “chapter” to another, as there will likely be more than just one or two.

Notebook Chapter Three
Post-Brecksville Pages

The purpose of this section is to go through our new ideas and changes after our first tournament, and all the events involving it (like practices and other sessions) and to also provide a chance to change how the notebook is written from this point forward.

Chapter 3 Book Changes

Going into the new “chapter”, the book will be receiving some heavy changes, especially to the newer pages, as the old formatting and writing was not as effective as we wished. One of the changes was the introduction of the chapter system itself, to show difference between the phases of the document and its creation as well as that of the robot and program.

The first sets of pages (chapters 1 & 2) are especially ineffective as they do not get points across well, are overloaded, and do not provide any pictures, which is not good even though there was nothing to take a picture of. They are still mostly necessary, but may be “reworked” or re-worded entirely in the future, or condensed. As for actual pages, going into this 4th chapter, they will be written much differently and likely formatted in a different way as well. We understand fully that being inconsistent with notebooking and formatting is not always seen as professional, but we have found this change necessary so as to bring our design across effectively.

To remedy this issue, we may, at some point in the season, provided enough time, completely rewrite and reformat the book so as to have it be consistently descriptive and effective.

Identify Problems: Intake

We are to do a rebuild as we have identified several issues with the intake that we found during the competition over the weekend. Here we have identified a few issues to work on.

Issue 1: Intake Speed

Our intake was not fast enough for our purposes, only being able to put on one or two rings in the time that a better-tuned robot at the competition could have put on five.

Issue 2: Intake Angle

Our intake's angle was not optimal. We found that the intake angle was not the best, as it was too gradually sloped and flat.

Issue 3: Intake Pickup

Our lower intake pickup speed was not optimal, and it may have been because the floating intake was not good enough.

We need a solution that can solve all of these problems. We have changed our way of building the robot, so we will start off doing each mechanism one by one, starting with the intake. Together, as a team, we are to brainstorm a solution that solves all of these problems in an efficient and simple manner.

Brainstorm Solutions: Intake

For our intake rebuild, we have to brainstorm several solutions for it to determine which one is the best and solves each of our problems in the most efficient way.

Solution One: Re-Angle Intake

Pros: Solves intake angle issue, making it steeper, also means it can go faster by being at a steeper angle, so the rings go up.
Cons: Too big, we wouldn't be able to rework the lower intake.

Solution Two: Replace Intake Metal

Pros: Decreases size, meaning less weight and potentially slightly more speed, also allows us to rework the lower intake.
Cons: Doesn't fix intake angle, keeping inconsistencies and also not adding as much speed as we need to be a good robot.

Solution Three: Re-Angle & Replace Metal

Pros: Decreases size, less weight, lots of extra speed, can rework the lower intake & transition area way more.
Cons: Time-consuming and difficult, would need a lot of tuning.

We have our next tournament in early December, so we should have plenty of time to work on the intake & rebuild.

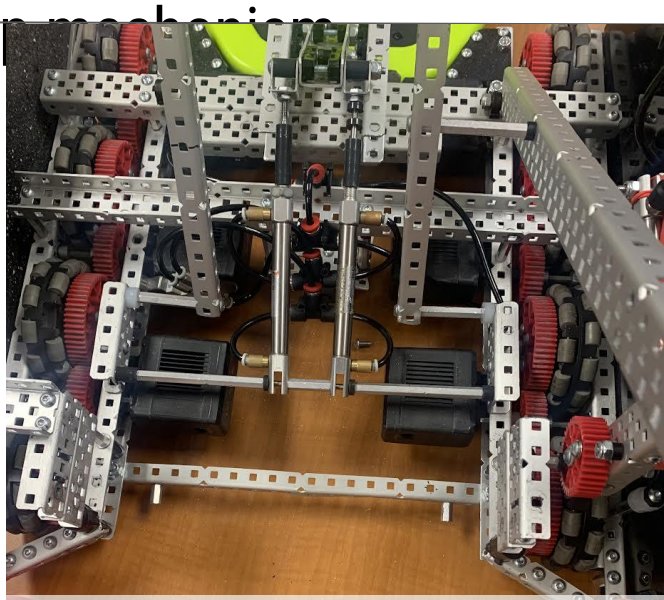
Select Best Option: Intake

After extensively discussing it with the team, we decided that since our time constraints are not too heavy, the best course of action is to go with Solution Three, which was to re-angle the intake (make it steeper) and also replace the thicker metal around it with C-Channel pieces to make it lighter.

The Plan: Intake Re-Implementation

Since we need to re-implement the intake, we have decided to use today's 1-hour build day and the upcoming practices later this month to work on it. The plan is to first prop up two cut C-Channel pieces onto our current drive-base (see below) which was salvaged from the rebuild alongside our "doinker" mechanism and our mobile goal clamp mechanism.

When we decided to rebuild, we fully unattached all of the old intake parts, our wall stake mechanism, and the entire lift, but we left the clamp, "doinker", and our entire drivetrain as they worked as we wanted them to, so we are not going from scratch. The intake is to be put in the middle.



Our drivebase as of 11/13/24.

Date of Writing: 11/13/2024

Contributors: NZ, EC, EN

Continued:

1-Hour Build - Intake Building

We have a 1-hour build day today, and our focus will be working on the new intake type we chose after brainstorming.

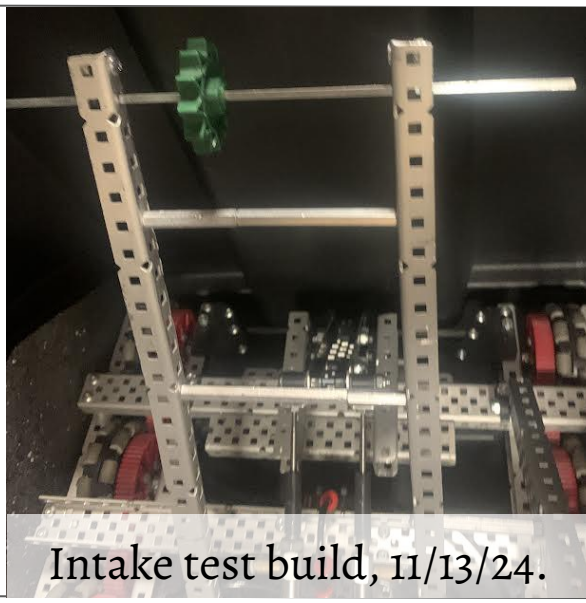
Attendance:

- Nevin, Elijah, Eric, Derek all present entire session
- Miles not present entire session (school event)

Build Progress: Intake

We started building the new intake, as to plan, by first adding 2 cut C-Channel pieces (shaped like small Vs) opposite each other in the center of the drivebase, at a steep, nearly vertical angle. At intervals of roughly 5 holes each, we put in standoffs to keep the pieces of metal together, and we put in a sprocket on a low strength driveshaft, which we plan to use for chaining.

To the right is how we got the intake mounted, and it is ready for putting a chain on it and testing. We put an insert (low strength) into the sprocket so we could do a simpler low strength shaft rather than our old high strength shaft which proved not fully consistent for it.



Intake test build, 11/13/24.

Date of Writing: 11/13/2024

Contributors: NZ, EC, EN

Continued: 146

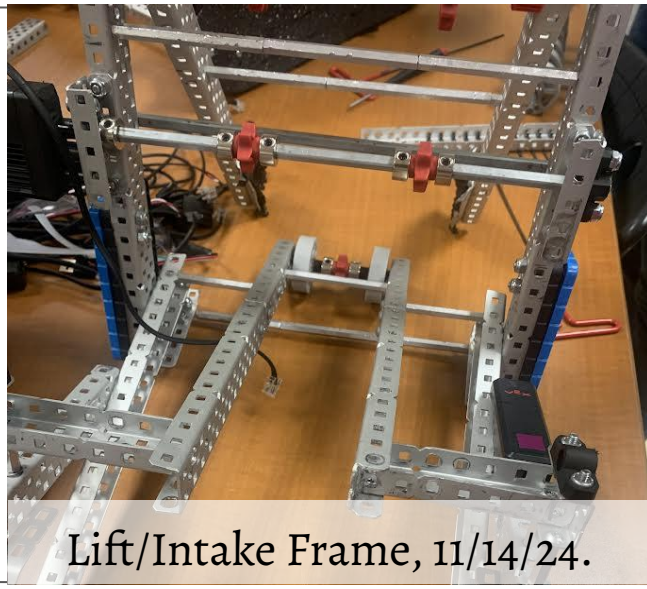
1-Hour - Intake Test & Decision

Since it was finally ready, we decided to try to put on chaining for the new intake test build. It was not successful. We could not get chain links to fit in the correct way, and we realized that it would be too weak and not reinforced enough to be stable. The intake was too skimpy for our purposes, and when we tried to chain it and tired to put rings on it it failed.

Decision: What Next?

We have decided that the best thing we can do is to remove the intake test build and simply reuse our old intake and lift but modify them. This will be far faster to complete, and is a structure we are comfortable with. Not working it completely from scratch should make it easier, and faster as there is less to build. So, all we have to do is tune it rather than build it fully.

To the right is the old intake/lift connection base that we took off and partially dismantled previously. During our next 1-hour build (11/14) we will be modifying it and getting it ready to be added back after we finish taking the test build from the last page off.



Lift/Intake Frame, 11/14/24.

Date of Writing: 11/14/2024

Contributors: NZ, EC, EN

Continued: 147

1-Hour Build - Intake Modifying

We have another 1-hour build day today, and the focuses will be to first take off the test build, then start modifying our old lift and intake frame. We will redesign the lower intake too.

Attendance:

- Nevin, Eric, Elijah, Derek present entire session
- Miles not present entire session (out sick)

Build Progress: Reattachment

We started re-attaching the frame for our intake and lift, after discussing again how we would do it, we started by re-screwing it on the angle pieces at the bottom. This was the easiest way to start, as it would keep it stable during the process. We did not have much time due to other class activity.

1-Hour Build - Work on Frame

We have another 1-hour build day today, once again focusing on the reattachment of the lift/intake frame, but also on discussion about how we can bend the intake differently.

Attendance:

- Entire team present entire session

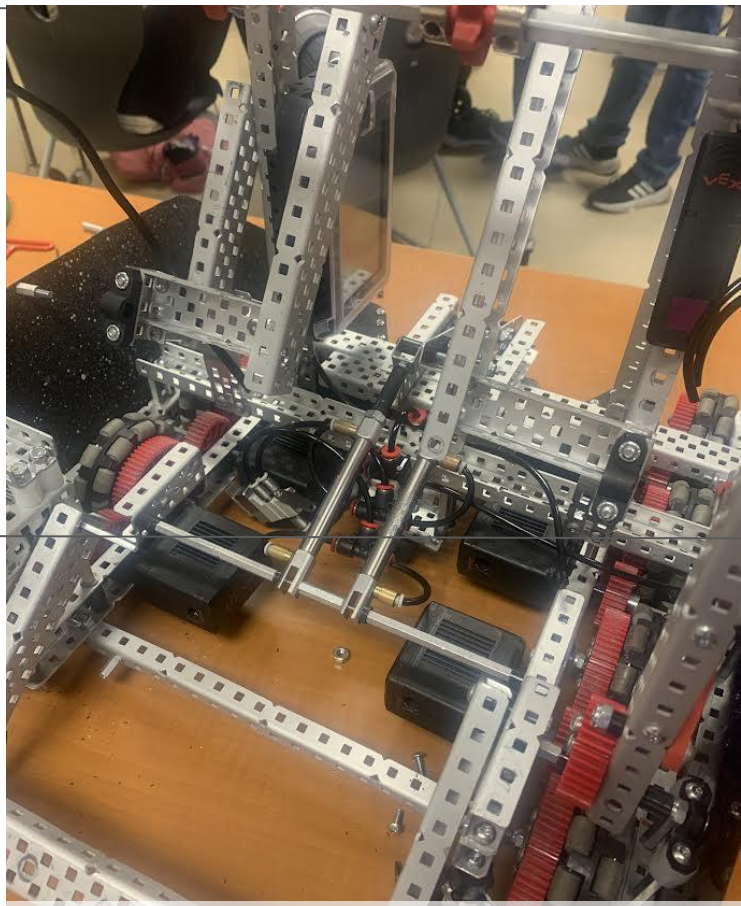
We have our first 3-hour practice session in a while later, so we should be able to work on the robot more and discuss then.

Build Progress: Reattachment

We simply just kept screwing in all the new nuts and screws to put the frame back on, there was not really anything special that occurred regarding the robot.

Intake Discussion & Decision

We discussed throughout the build session the idea of re-angling the intake, and we decided to go with the original plan for steepness.



Half rebuilt robot as of 11/19/24.

Date of Writing: 11/19/2024

Contributors: NZ, EC, EN

Continued: 149

New Code & Intake Discussion

We got together as a team during our pre-practice time to discuss ideas for how we will make sure we are ready for the next tournament (especially with the code), how we will manage our time from now on, and how we will fix the intake.

New Time Management & Code Time

It became clear after the last tournament that it is important that more time is allocated towards programming and getting an effective autonomous program, but we must do so in a way that doesn't get in the way of our building. We found that we may be able to use the lunch period (between our two session halves for our 1-hour build days) for programming, as we will not be able to build anyway then, but will have access to the robot and the field.

We also wish to change our time management method otherwise, and a show of how and why as well as a Gantt chart of our new time management will be put in if possible.

Intake Fixing & Changes

It has been made clear that we want to work on and change both parts of our intake, and we have decided to shift the top part's angle, and put a differently hooded floating bottom part.

Practice Start - 11/19/2024

Attendance:

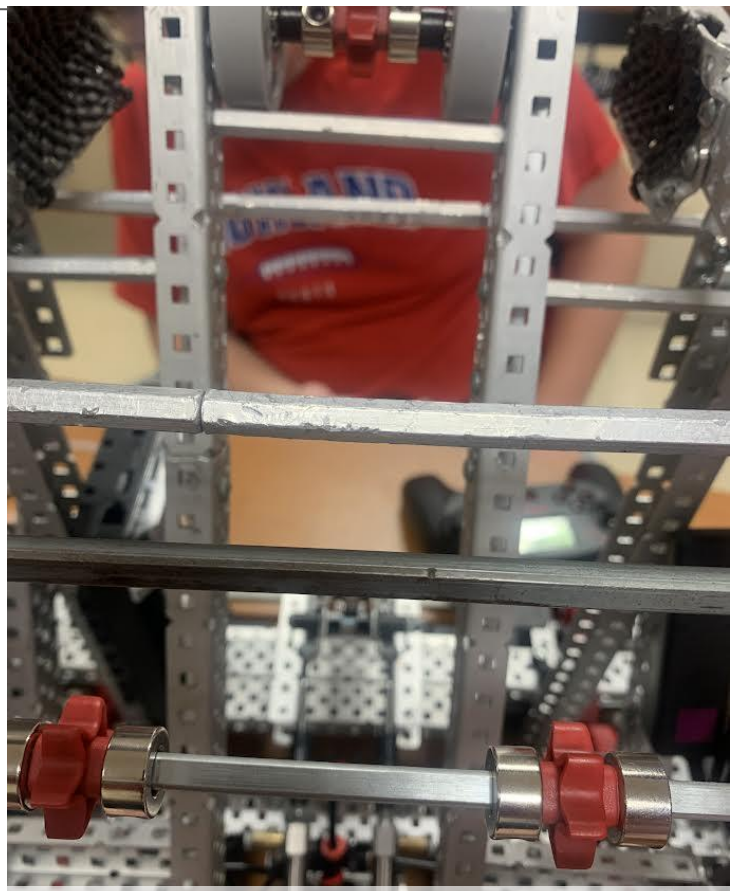
- Nevin, Elijah, Derek, Miles present entire practice
- Eric late by about 30 minutes

Goals:

- Finish reattaching the lift/intake frame
- Decide on new intake specifics
- Mount brain for future autonomous testing & PID tuning
- Work on lower intake designing

Initial Practice Activity: Intake Fix

We finally actually physically fixed the intake angle - it is now steeper and goes higher. This means the rings will be more consistent and harder to fall off, and it is now able to drop the rings onto the goals instead of flipping them on - which eliminates a possible problem of rings getting stuck between hooks and the top of the goal, which is one that hindered us frequently.



Unchained Intake as of 11/19/24.

Date of Writing: 11/19/2024

Contributors: Nevin Zerby

Continued: 151

Lower Intake Work & Floating

Flex-Wheel Redistribution / Movement

Instead of six barely spaced flex-wheels in the center, we now have 6 central ones that are spaced twice as much (for intake accuracy even if we don't hit a ring head-on) and also two flex wheels on the outer edges to push away rings we won't be able to get or to stick onto rings so that we can simply turn into them rather than having to "chase" them.

Different Bar Length & Floating

We shortened the bar length so it can float lower by default, allowing it to grab lower rings more accurately, but it should also be able to float more freely now, which lets it adapt to ring angle and/or at what stage it is in the intake. Additionally, the extra freedom in floating means that it will be able to pick up double-stacks in situations where it is fully necessary, like certain Autonomous runs. Also, it doesn't need to be as accurate in auton, as it does not have to hit rings fully head on.

Lower Intake with new Flex-Wheel distribution as of 11/19/24.

1-Hour Build - Intake Chain Idea

Identify Issue: Chain Snap Risk

After some basic testing and watching the chain work, we realised that when we run the lower intake the chain is at risk of snapping, which would mean we are unable to score rings on any stakes at all, severely depleting our performance.

Brainstorm: Chain Modification

We thought of a few solutions to this issue:
Shorten Chain by 1 Link - Tightens chain and reduces slack
Lengthen Chain by 1 Link - Loosens chain and increases slack
Move Chain to Safer Position - Puts in less risky position

Select Solution: Move Chain

After discussing the possibilities, we decided that shortening the chain would not work as the extra tightness would make the motor run less efficiently and also make the floating not work. Lengthening it would give it too much slack and make it have a risk of simply falling off rather than just snapping, and it also might skip, reducing efficiency. The best option would be to move the chain to a safer position - which we determined as the outer part of the intake - so that the rings don't hit against it or push on it, and so that there is less stress on it.

1-Hour Build - Misc. Work

After we had a discussion about how we are moving the chain for the lower intake, the focus was on actually making the chosen changes to the intake as well as some miscellaneous work on parts like the upper intake track.

Attendance:

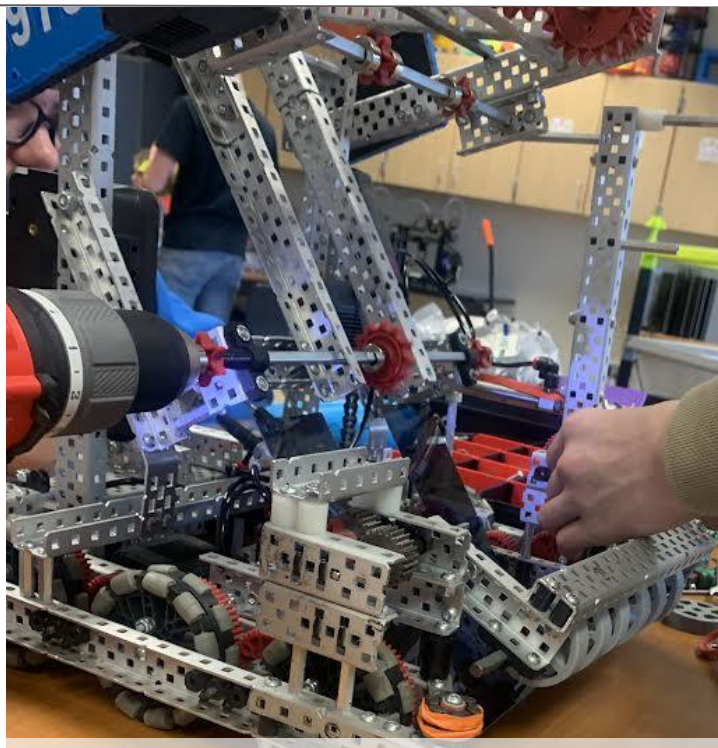
- Entire team present entire session

Work on Lower Intake Starts

We de-attached the lower intake again to swap the metal sides and put the chains on the outer parts.

Other Miscellaneous Work

We did some other miscellaneous work on the robot, including one idea that we have used before (to quite a bit of success) where we run a drill on a high-strength shaft to help “break in” the bearings. Additionally, we prepared the upper intake for chaining & actual usage once we have it finished and ready.



Intake Work on 11/21/24.

Date of Writing: 11/21/2024

Contributors: Nevin Zerby

Continued: 154

Practice Start - 11/21/2024

Attendance:

- Nevin, Elijah, Miles, Derek present entire practice
- Eric did not arrive until 5:30

Goals:

- Finish “breaking in” high-strength shafts
- Re-chain intake (top and bottom)
- Run intake tests
- Mount brain upright

Initial Practice Activity: Intake Preparation

Our main starting activity for this practice was to work more on the “breaking in” of the high strength shaft being used for our upper intake - by running it with a drill to smooth out the bearings. After doing it for most of this morning’s 1-hour session, as well as starting out the practice by doing it, we finished it and it ended up being even more effective than expected, almost completely removing any shaft friction.

In the process of running it with the drill, we also found that in one spot (the direct sprocket from the motor to the upper intake) the chain was skipping, and we fixed that as well.

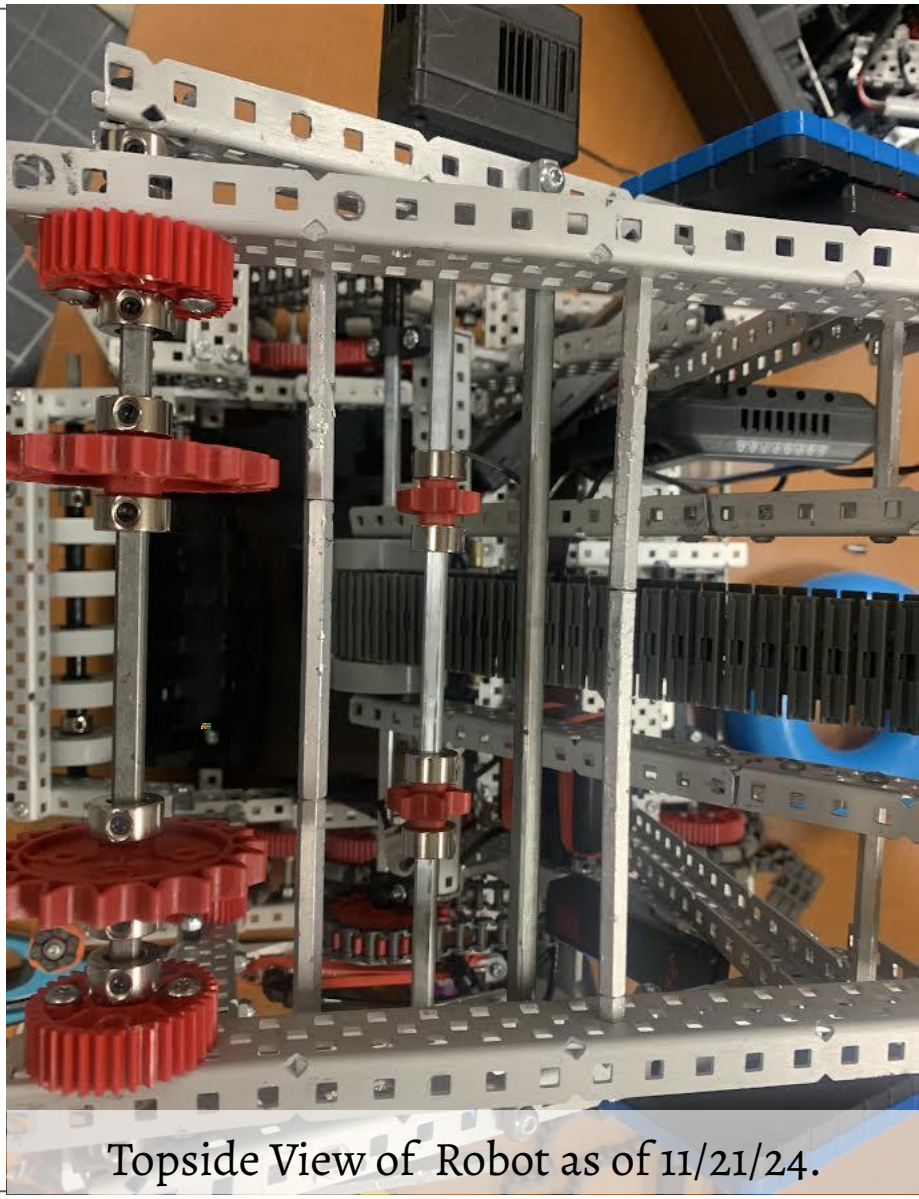
Intake Work & Testing (Both)

By far, the main focus this practice has been the intake, though it has shifted from being just one part of the intake at a time to working on the entire intake as well as the system part where it moves from the lower side to the upper side of it. Also, we got the correct chaining set up with the sprockets on the motor, so it should run at the desired speed when we try it out.

In-Field Intake Testing

We ran some intake tests in the field to simulate the most realistic environment we could without involving other robots. The following things were noted:

- Inconsistencies with going onto stakes
- Rings easily flipped out of the lower intake
- Friction on intake gears causing slow upper intake
- Lower intake floated much better than before



Topside View of Robot as of 11/21/24.

Date of Writing: 11/21/2024

Contributors: Nevin Zerby

Continued:

Intake Issues - Identify & Brain.

Identify: 3 Intake Issues

During our testing on the field with our new intake, we were able to identify a few issues with it, being upper intake friction slowing it down, rings flipping out of the lower intake, and a few inconsistencies with the rings being put on mobile goals.

Brainstorm: Solutions for all 3

We brainstormed some solutions, multiple will be chosen as there are issues in multiple areas. Some solutions we made:

- Re-gear / re-sprocket / re-chain upper intake

  Makes it easier to see what is causing the friction, and also gets us fresher and less damaged gears for the future.
- Add longer spacers to clamp

  Adjusts clamp angle, necessary as it needs to be at a different angle to work with the intake's new steepness
- Add metal bar to back of lower intake

  Stops rings from flipping out by blocking them entirely
- Add polycarbonate "flaps" to top/back of lower intake

  Stops rings from flipping out most of the time, doesn't interfere with the upper intake
- Add new motor to lower intake

  Gives more power to the lower intake, at cost of watts

1-Hour: Intake Select & Create

The focus of today's 1-hour work day is to choose new fixes we brainstormed previously, and then implement them onto the robot and do some minor tests on the field.

Attendance:

- Entire team present entire session

Selecting Brainstorm Options

We decided to choose and start building the following solutions from the previous page:

- Re-gear/re-chain/re-sprocket upper intake
  Can help deal with friction, and also better future durability
- Add longer clamp spacers
  Simplest way to get new mobile goal stake angle for intake
- Add polycarbonate "flaps" to top/back of lower intake
  Adds simple stoppers to keep rings from flipping out of the lower intake, but doesn't interfere with rest of intake and doesn't smash down rings so they jam

Building Begins

We started the building process for these by adding the flaps first, hanging over the edges of the intake from the side parts.

1-Hour: Intake Build/Tweaks

The focus of today's 1-hour work day is to finish building the basic fixes we selected and started on in the last session, and then test them and systematically tweak them as we go.

Attendance:

- Entire team present entire session

Build Continuation: All Selected Solutions

- Regear/rechain/resprocket Upper Intake

We did this first, and we ended up also choosing to change the sprocket ratio from 6-12 to 6-18. This means the upper intake now runs at 200 RPM, which is equivalent to a green motor. We considered changing it to being a direct green motor to increase consistency, but there was no room.

- Intake Poly Flaps

We repositioned these on the edges of the intake, tests WIP

- Clamp Adjustment

Simply made the spacers longer on it.

Upper Intake motor sprocketing as of 11/26/24.

Date of Writing: 11/26/2024

Contributors: Nevin Zerby

Continued: 159

Practice Start - 11/26/2024

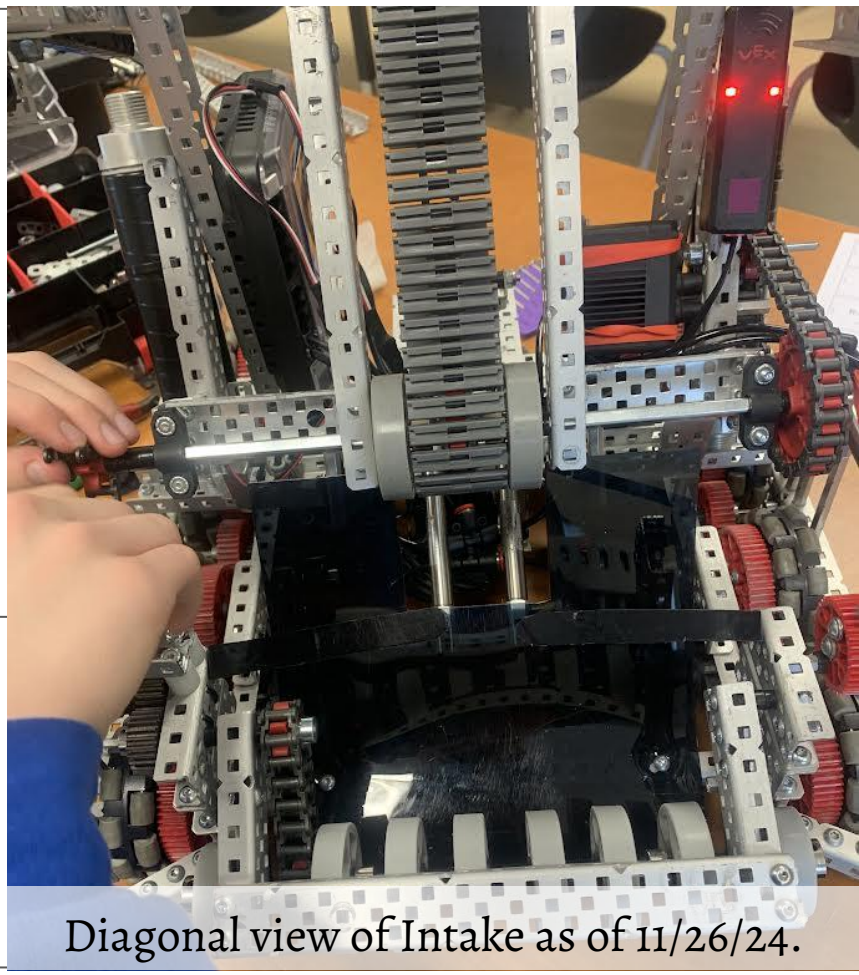
Attendance:

- Nevin, Derek, Elijah present entire practice
- Eric, Miles not present entire practice

Goals:

- Finish building the three intake solutions
- Run drive tests to see intake efficiency and issues
- Add more hooks to intake
- Start wall stake mechanism build

Pictured to the right is our intake, still with the singular hook as we have not added the rest back to it yet. See the new floating angle for the low intake, which we didn't fully illustrate in the book before.



Diagonal view of Intake as of 11/26/24.

We're starting work on a possible sped up version of the intake (400 RPM) where it should run much faster.

Date of Writing: 11/26/2024

Contributors: Nevin Zerby

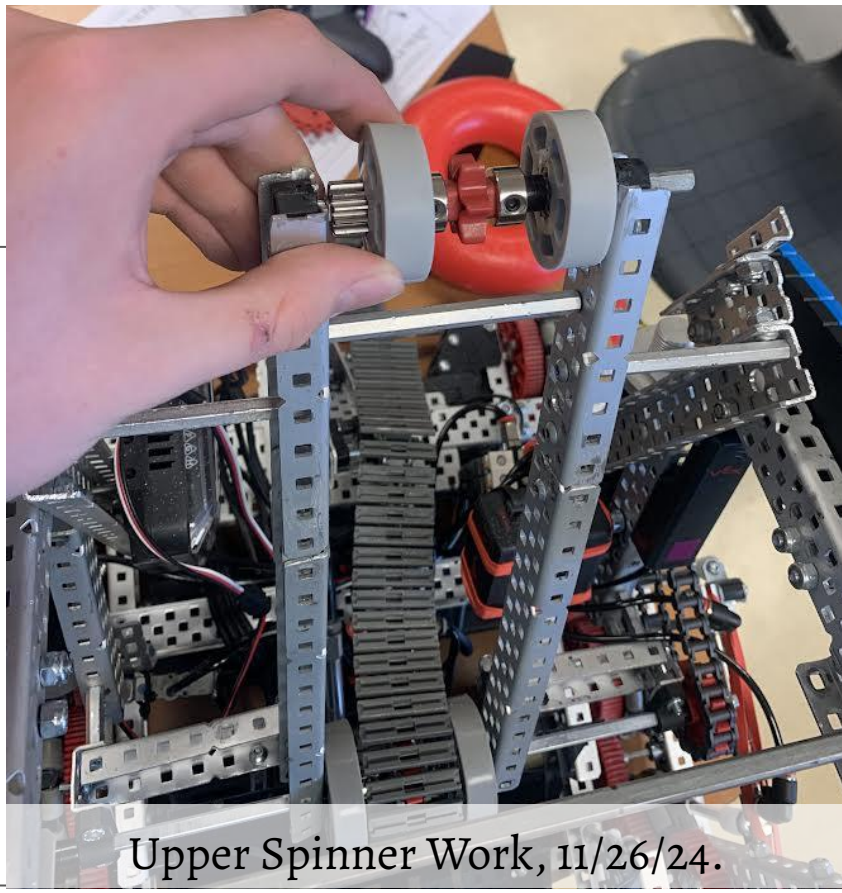
Continued: 160

Sped Up Intake Work / Cutting

Intake Speed-Up Building & Possible Issues Fixed

We changed the sprocketing on the upper intake from 6-18 to 6-12 so that it runs at 400 RPM instead of 200 RPM. We know from previous experience that this may cause issues of slight inconsistency, though we may be able to remedy this with other simple changes. We started work on testing this, and we came across two main issues: Firstly that the hooks got caught up easier and secondly the destabilizing of the mobile goals. We worked to fix this by once again tweaking the clamp angle and then we cut down the metal at the top of the intake, which had the secondary benefit of making it easier for the robot to go under the Ladder.

We had to de-attach and reassemble the top spinners on the intake and also the ring track to do this, but it is done and we can now add it back with additional smoothness and an easier way to cross the field. We are filing it as well.



Upper Spinner Work, 11/26/24.

Date of Writing: 11/26/2024

Contributors: Nevin Zerby

Continued: 161

Different Intake Type Tests

We eventually decided to run tests on a few different upper spinner types for our upper intake, to see which one is most optimal and if one might be able to fix our inconsistency issue. When we are finished testing these, we will select one to use.

Flex Wheel & Spacer (Original)

Speed/Friction

Decent speed, moderate friction, a little extra rubbing

Consistency

Moderate consistency, with flex-wheel pulling changing things

Spacer Only

Speed/Friction

Higher speed, lower friction, minimal rubbing

Consistency

Low consistency, irrational ring paths without stabilization

Flex Wheel Only

Speed/Friction

Decent speed, mild friction, some rubbing

Consistency

Moderate consistency, with flex-wheel pulling

Intake - Switching to Hood

Identify Problem: Intake Not Satisfactory

After extensive discussion and looking back at previous pages, we unanimously decided that we do not have a satisfactory intake in many ways. It takes too many tweaks, which each end up bringing new problems and new shifts, and even when it is in its better forms, it doesn't last long enough or consistently.

Brainstorm Solutions: Only One Real Option

There is only one real option/solution for switching our intake - there are only two meta intake forms, and those two are also the only two we would like to use. Those options are hook (what we have now) and hood, which is done by having sprocketed together driveshafts with flex-wheels on them, which is what we are switching to.

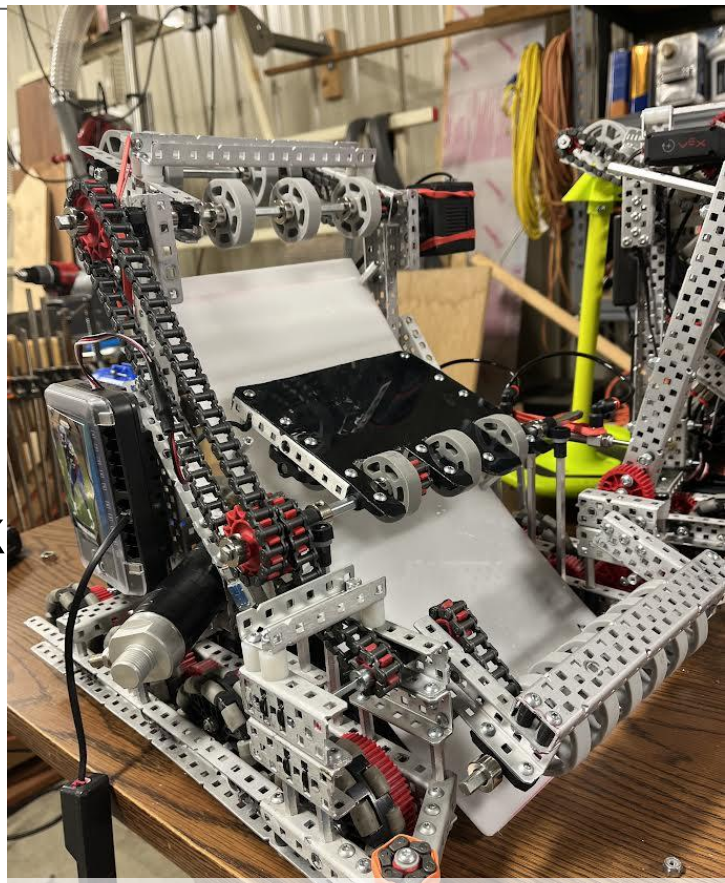
Select Best Option: Hood Intake and How We Build It

Since it is our only option, and we have unanimously decided it is a good option nonetheless, we are rebuilding to a hood intake. Part of the reason we are doing this is because we are having a school Thanksgiving break, and we will be able to take the robot home during this time, so we will have extensive time (about a week) to build a new intake, eliminating a time crunch.

Robot Take-Home #4 - Intake

The focus of this fourth (and longest) robot take-home session is to completely transition from a hook intake to a hood intake. Besides meaning a complete intake redesign, this also means the removal/replacement of our wall-stake mechanism, as a “lady brown” (simple ring flipper) does not work with a hood intake due to not being able to grab the rings from the top. The wall stake mechanism usually used is called a “redirect”, one of which we had beforehand but scrapped due to it not working properly with our motor count and heaviness.

A “hood” intake is an intake design used in the meta, and it was made popular by many teams, like 229V Ace and some others. It has the general same lower intake part as a hook intake, but as the name suggests, the top part is not a hook track, but a relay of several axles with flex wheels on them, that form a hood over the ring and pull it up. In the center you may see the first part of our redirect, explained next.



Our new hood intake as of 12/1/24.

Date of Writing: 12/2/2024

Contributors: Nevin Zerby

Continued: 164

Robot Take-Home #4 - Redirect

During the take-home building, we also made the very start of the base of our redirect, a system we have used before but not explained fully. We do not expect to be able to have a full redirect done by the time of the competition (December 7th), but we will have time to start on it and then time to spare to fix any intake issues and do things like driving and autonomous tests and practices. We should then be able to finish the redirect with plenty of time left for the next tournament, which falls on December 14th, exactly a week after this one.

We should have three practices to finish this work. This take-home as well as the intake redesign give us time for it in practice sessions.

This new intake design seems like it should be much more useful especially for autonomous, as it is much more lenient with goal-catch angles and is also generally more consistent. Also, its elevation does mean we can easily touch the bar.

New hood intake as of 12/2/24.

Date of Writing: 12/2/2024

Contributors: Nevin Zerby

Continued: 165

Practice Start - 12/3/2024

Attendance:

- Nevin, Elijah, Derek, Eric present entire practice
- Miles late by a couple hours

Goals:

- Test intake both in and out of field
- Resume building start of redirect
- Do driving practice
- Time trials on intake & driving

We were not able to accomplish much during this practice due to frequent interruptions unrelated to the practice, but we did manage to go through most of our simple goals. We did extensive intake tests in and out of the field, and did some driving practice. We also came up with a pros and cons list that shows why we will keep the new intake, and why we chose it.

Hood Intake Pros: Able to go under ladder better, higher consistency, much more stake leniency, no risk of ring flipping in both top and bottom of intake, pushes rings down on stakes.
Hood Intake Cons: Slower by usually a couple hundred RPM, bigger, higher friction and static, damage can make it useless.

1-Hour: PID Tuning Work

The focus of today's 1-hour work day was to tune the Turn and Drive PIDs, and start basic autonomous testing with them.

Attendance:

- Entire team present entire session

We started the PID tuning with the Turn PID, which we determined as more important than Drive PID for now, as it makes our turns more fast and accurate, and that affects the autonomous program much more. We would place the robot so that it was parallel to the white tape line, then run the Turn PID to go 90 degrees, and repeatedly tuned and ran it, turning it over and over again. This took a while.

The values that had ended up working in the end were a P multiplier of 0.01, an I multiplier of 0.0005, and no D as we did not need it. We have successfully tuned our Turn PID accurately.

```
void TurnPID(float setpoint) {
  Inertial.setRotation(0, degrees);
  float error = setpoint;
  float integral = 0;
  float derivative = 0;
  float preverror = 0;
  float velo = 0;
  float kP = 0.01;
  float kI = 0.0005;
  float kD = 0.00;
```

Our Turn PID code variables as of 12/4/24.

Date of Writing: 12/4/2024

Contributors: Nevin Zerby

Continued: 167

Practice Start - 12/6/2024

Attendance:

- Nevin, Elijah, Derek present entire practice
- Eric, Miles not present entire practice

Note: 12/5/2024 practice was cancelled due to weather, so this practice was lengthened from 2:30-4:00 to 2:30-5:30 for time.

Goals:

- Work more on redirect
- More drive practice
- PID tuning & autonomous testing

We did a lot of work on the redirect, adding the top bars as well as setting up the gearing on a high strength driveshaft strung between them. We are doing a short take-home before the tournament tomorrow, but the pages will be omitted for the tournament submission as we need to print tonight and will not have time to tomorrow.

We also did some autonomous testing, though we weren't able to do a ton due to us working on the redirect for longer than expected. We will also be working on it at the tournament tomorrow, in times like between matches and such.

Motion Control Tournament PT.1

At the Motion Controls tournament on December 7th, each team (42 teams were present) participated in 6 qualification rounds. We ended up with a 3-3-0 Win-Loss-Tie.

Match 1 (Qualifier #8)
Won 29-12, paired with 6403A against 6978Y and 40938A.
Focus on corner defense, top rings. Auton and AWP victories.

Match 2 (Qualifier #14)
Lost 41-6, paired with 8609N against 2011D and 3264A.
Heavy focus on ring scoring/wall stakes. Auton and AWP won.

Match 3 (Qualifier #28)
Won 39-6, paired with 11124X against 40938C and 3264T.
Corner and goal defense, unique auton. Auton and AWP won.

Match 4 (Qualifier #39)
Lost 37-28, paired with 3264H against 2011K and 11124P
A difficult, strong match against 2 of the top performers of the tournament, nearly won despite weaker teammate. Auton lost, point difference came from opposing alliance having high wall stake agency and ours not having it.

Motion Control Tournament PT.2

Match 5 (Qualifier #49)
Lost in points 40-15, paired with 2011G against 40938D and 6008P, won win point due to 6008P disqualification. Focus on goal contesting, autonomous won, both teams scored an AWP.

Match 6 (Qualifier #54)
Lost 22-6, paired with 11124W against 2011B and 40938B.
A speed-based match, lots of field circling. AWP scored.

Qualifier Total Results & Alliance Selection
We ended up 11th out of 42 teams due to our AWPs, despite us technically going 2-4-0.
For alliance selection, we had picked out a few teams (6008G, 6008P, 11124X, and a couple others) but all of them ended up being picked by teams above us and we finally chose 6978Y.

Round of 16 (#2-1)
Won 30-5 against 3264T and 3264J, with a match focus on corner goals. Autonomous won.

Quarterfinals (#1-1)
Lost 38-3 against 2011D and 2011B. Top ring/wall stake focus.

MC Tournament Reflections PT1

We found that there were some differing yet pretty clear metas for matches and how robots are built, and some shifts.

Match Metas

As for match metas, while there was still a focus on filling up goals and camping corners like before, now that more robots have wall stake mechanisms, wall stake scoring is important.

Build Metas

As for build metas, it seemed that hook intakes took over hood intakes in popularity again, as while hood intakes are generally more consistent and easy to tune, really good hook intakes can go much faster and some can even score on alliance stakes, plus the mechanism (called a Lady Brown) for wall stakes that goes with hook intakes is much faster, easier to make, and lighter than the one used for hood intakes (called a Redirect). For example, one team that we saw that had a very good hook intake was 2011D - Dopamine. They ended up having a high skills score and also won the whole tournament and had a very high qualifications ranking. We may try to make a fast hook intake similar to theirs over Christmas break, as while we like the hood intake we have, there can always be improvements.

MC Tournament Reflections PT2

Team Inspirations

There were many well-performing teams at the Motion Controls tournament. Some ones that we took special note of were 2011D, 2011K, and 6008P. All of these teams had very fast and efficient hook intakes, and fast robots, which both seem to be increasingly part of the meta as time goes on, and we might take inspiration from them. We were unable to find photos.

Design & Notebook Ideas & Review

At the tournament, our team, 6978B, won the Design Award. While it was not state-qualifying due to the lower amount of teams present, it is still a milestone for us and showed us what we can do right, and what we can build on in the design book and interviews. After our interviews, we took some notes:

- Interviews are easier with smaller teams

Only 3 of our 5 teammates were able to show up to this tournament, and it seemed much easier to fit 3 people into the topics in the time limits than it would have been to fit 5

- Update notebook again

We told the judges about some notebook plans, such as listing parts used for new additions to the robot. This should make the book better/clearer, and make it easier to recreate our bot.

Notebook Chapter Four
Post-M. Controls Pages

The purpose of this section is to go through our new ideas and changes after our second tournament, and all the events involving it (like practices and other sessions) and to also provide a chance to change a few things with writing - such as adding parts lists to new additions and such, so that the robot's history may be recreated.

Post-Tournament Issues/Ideas

At the Motion Controls tournament, we realised we could have a much faster intake and a much simpler/faster wall stake mechanism, and the only real solution seemed to be going back to a hook intake, though a much different type from our last one.

After the Motion Controls tournament, we made a team decision that during our Christmas break we would try to design and build a “fast hook” intake - which would be structured differently from our old one, as it would be much more vertical (meaning less tuning and more consistent stake scoring, plus less jams with the lower intake or Lady Brown) and would also likely use a faster RPM, perhaps 600RPM. There would also be various other small changes - i.e a smaller Lady Brown wall stake mechanism for the more compact intake and different hooks - we used screws before, but pieces of Delrin plastic would probably fit our purposes better.

However, we plan to use the hood intake at least until the Highland Blended tournament on December 14th, as we do not have time to redesign/rebuild before then and it will be a much easier tournament than the last two. The hood is not bad.

1-Hour Build - Fixes & Drive PID

During the bulk of today's 1-hour build time, we spent it making small fixes we noticed for the hood intake as we do not plan to rebuild it or even attempt to until after the Highland tournament at the end of the week. Nevin spent the break time doing some Drive PID tuning and tests.

Attendance:

- Eric, Derek, Nevin, Elijah present entire session
- Miles not present entire session

Build Work & Fixes

We made a lot of small fixes from issues that came up during the tournament. Our "doinker" got bent and tilted from pulling around a goal attached to 2011B during our final matches, and our upper intake had some inconsistencies. We rebuilt our doinker with a new 1x2x20 Aluminum C-Channel, with around 15 smaller black spacers inside to keep it stable. There are 2 2-inch standoffs on the bottom to scoop rings, and one on the top to make sure the upper part of the stack goes with the rest.

Brief Drive PID Tests

Little progress was made on this, but we found a math error.

Date of Writing: 12/10/2024

Contributors: Nevin Zerby

Continued:

Practice Start - 12/10/2024

Attendance:

- Nevin, Elijah, Derek, Eric present entire practice
- Miles not present entire practice

Today's sole goals are to test intake RPMs and some tweaks.

Intake Sprocket Ratio Tests

The first things we did during the practice were test some intake chain sprocket ratios. The one we had since we built it and the one we used at the tournament was 12-12, where the whole intake would have run at 200 RPM.

- 12-6 Test (400 RPM)

We tried a 12-6 ratio, but it was too weak and couldn't take rings very well due to their slight but still present weight.

- 18-12 Test (300 RPM)

We tried a 18-12 ratio, which was faster than the original but stronger than the 12-6, but while it could take one ring at a time just fine, it struggled with 2 due to still having low torque.

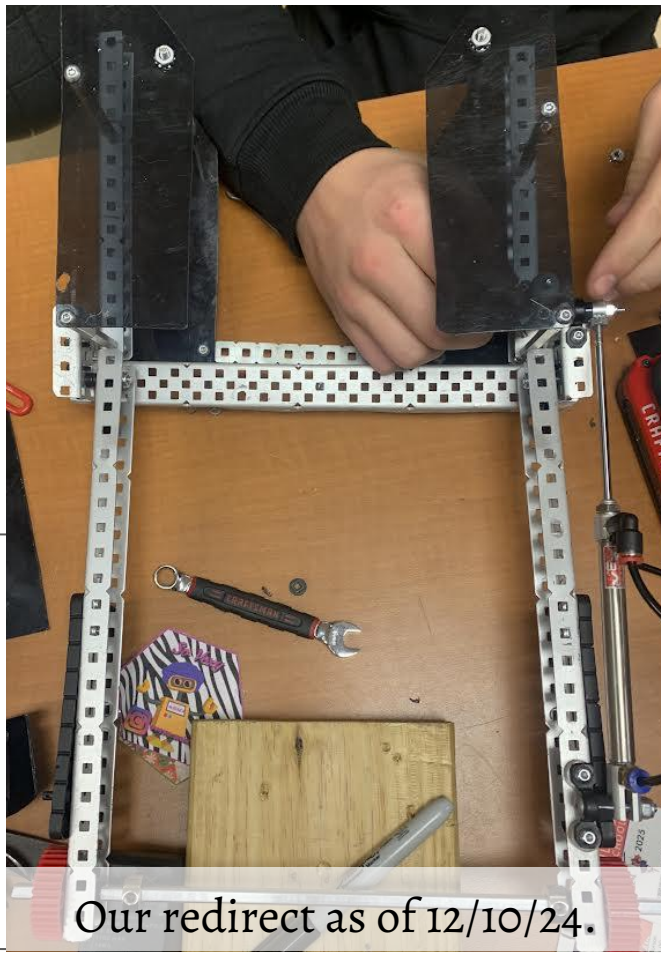
Our intake sprocket chain ratio, back at 12-12 (200 RPM) as of 12/10/24.

Practice Work - New Redirect

During this practice, Eric did a ton of work on the redirect system. As shown in the picture, it is made up with different pieces from how it previously was, as the size of our old one was not working very well for our purposes, with these parts:

- 3 1x2x22 cut aluminum c-channels, one placed on each end of the center one lengthwise, sticking out
- 2 32-tooth high strength gears on the outer metal edges
- A high strength drive-shaft between those metal pieces

Aside from screws and standoffs and such, the rest of the parts include some specially cut bits of polycarbonate, which would form the cage around the rings. One new addition we made to this redirect is using the green screw benders, which are firmer and work better than the makeshift flex-wheel design we had.



Our redirect as of 12/10/24.

We are likely going to attach this during either one of our 1-hour build days or during our Thursday practice. Once we do, we can do autonomous work and start on Skills autonomous.

Date of Writing: 12/10/2024

Contributors: Nevin Zerby

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1-Hour Build - Intake Shifting

Most of today's 1-hour build time was used to try out shifting the intake, and seeing its new perks and changes.

Attendance:

- Entire team present entire session

Intake Shift Down

We were thinking about ways to quickly make small changes to our intake to make it as efficient as possible, and one idea that came up was to shift down the top part of the intake that had the purpose of pushing rings onto the stakes. We ended up unscrewing it, and replacing it exactly as it was 2 holes down.

Lowered Intake Test & Perks

This new change ended up pushing rings onto the goals faster and more consistently, a better result than expected, and had two unexpected benefits as well, being that it now no longer required rubber bands, which eliminated a possible place of inconsistency, and it also is now able to intake directly onto Alliance Stakes, though it takes a perfect angle and some time to set up. We spent a large part of the session testing ways to make this faster by driving the robot up in different ways.

Practice Start - 12/12/2024

Attendance:

- Nevin, Elijah, Derek present entire practice
- Miles present from 3:30 to 5:30 (left early, school event)
- Eric not present (school event)

Practice Goals:

- Find more ways to increase intake efficiency
- Lower intake friction
- Practice intaking onto alliance stakes
- Improve autonomous
- Fix & tune Drive PID

Intake Friction Removal

We realized that our intake had way more friction than we thought - we never truly noticed because we got used to it. We did a lot of things to remove it, like “breaking in” the bearings again, and fixing some small chaining errors. We added lubricant in the bearings for all of the intake driveshafts, and we ended up replacing the high-strength driveshafts that held the middle two sets of flex-wheel rollers, as they were starting to bend. In the end, the friction was decreased dramatically, so we decided to test faster intake RPMs again on it.

New Intake RPM Tests PT.1

Since our intake now had dramatically lower friction, we decided to once again try different intake RPMs as they may function better with the now stronger intake.

200 RPM Full (Original) (12-12 Sprocket Ratio)
Fully working and strong, but somewhat slow and inefficient. Put on rings very consistently, ~97% success rate.

300 RPM Lower 200 RPM Upper (18-12 Sprocket Ratio)
Fully working, mostly strong, decent speed but slower at top. Put on rings very consistently, ~97% success rate.

400 RPM Lower 200 RPM Upper (12-6 Sprocket Ratio)
Almost fully working, slightly weaker, good speed but slower at top. Put on rings quite consistently, ~93% success rate.

600 RPM Lower 200 RPM Upper (18-6 Sprocket Ratio)
Almost fully working, but somewhat weak. Very good speed but dramatic difference between top and bottom speed caused small jams. Put on rings quite consistently, ~90% success rate.

600 RPM Full (12-12 Sprocket Ratio, Blue Motor)
Working a decent amount, weak in some parts. Great speed, but upper part put rings on too fast and caused inconsistency. Rings flew off occasionally or overshot, ~75% success rate.

New Intake RPM Tests PT.2

After going through all our options, we ended up deciding on the 400 RPM Lower and 200 RPM Upper intake, with the 12-6 sprocket ratio, as it ended up being the most efficient for us. We could very consistently and quickly intake rings.

In-Field Testing & Autonomous

We tested the new intake RPM extensively in the field, and it was successful and helped deal with our issue of having a slow intake, as lowering the friction really did strengthen it. We also tested it in our autonomous programs, starting with some basic autonomous (2 rings for each corner) and it excelled, being better than the previous intake, especially in speed.

Alliance Stake Testing

It was unclear if this would help us score rings on alliance stakes with the intake faster, so we tested it more, and despite the upper part of the intake not being sped up, it did go on the stakes much easier due to the momentum pushing it to the top faster. We now have alliance stake scoring with our intake as a viable scoring method, which we plan to use in the last fifteen seconds of each match to score extra Top Rings while our goals are protected.

Extensive Drive PID Work

Throughout the practice, we did a lot of work on the Drive PID. We had to do a lot of tests, probably around a hundred, so they could not be accurately documented here.

Initial Issues & Solution

Initially, our Drive PID had an issue where it would stop at roughly 17 inches when trying to go to 24 inches (about a tile's length). We ended up finding out that the cause of this issue was that we forgot to account for gear ratios in the function code, which was necessary as the motor would spin how far it thought it should, but the gear on the wheel wouldn't.

Extensive Testing & Tuning

The gear ratio fix ended up fixing the issue, but it still required tuning. We did probably around a hundred tests on a set of tiles we brought out of the field, and slowly tuned the kP, kI, and kD. In the end, we were able to get the robot to go where we wanted, but we could not get it to end the loop as of yet.

```
float error = (setpoint * (360/(3.25*pi)) * 1.6667);
float integral = 0;
float derivative = 0;
float preverror = 0;
float velo = 0;
float prevelo = 0;
float kP = 0.006;
float kI = 2.5;
float kD = 0.020;
```

Our DrivePID initialized values as of 12/12/24.

Date of Writing: 12/12/2024

Contributors: Nevin Zerby

Continued:

1-Hour Build - Redirect Finish

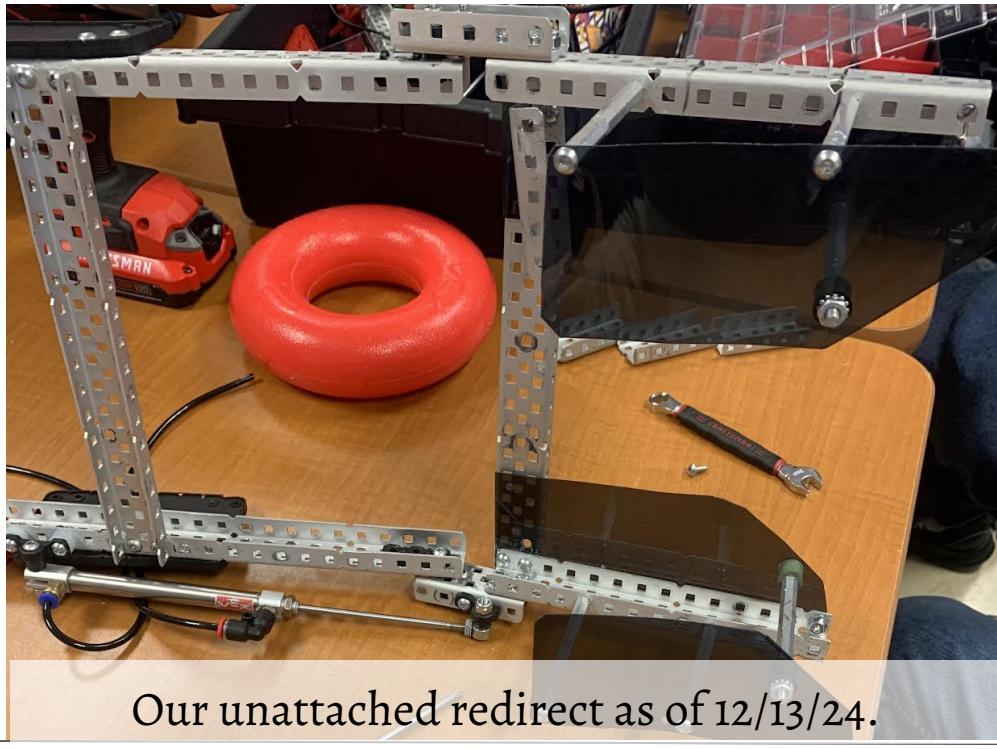
Most of today's session was spent finishing up our redirect wall stake mechanism and preparing attachment to the robot.

Attendance:

- Entire team present entire session

Redirect Finishing

Eric and Elijah did a bunch of build work on the new redirect while Derek did our school-assigned CAD modeling, Miles did robot tests, and Nevin wrote these pages. The additions to the redirect include one double-acting piston on one side (second one is not necessary) and a "ring cage" to make sure the rings stay in the redirect, made of a cut 5-hole c-channel mounted on with a swiveling small shaft collar. The rings can slide in past these, but they will swivel out meaning that the rings shouldn't be able to go back out of the cage.



Our unattached redirect as of 12/13/24.

Date of Writing: 12/13/2024

Contributors: Nevin Zerby

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Practice Start - 12/13/2024

Attendance:

- Nevin, Derek, Elijah present entire practice
- Eric, Miles not present entire practice

Note: Shortened practice, remaining time for competition setup

Practice Goals:

- Finish redirect work
- Attach redirect
- Finish Drive PID timeout
- Skills autonomous testing

Miscellaneous Robot Work

This practice started with a lot of miscellaneous work, mostly on the redirect. We started finalizing it by adding another layer of the “ring cage” by adding c-channel gussets on top, mounted by standoffs above the lower ones. We also used wipes to wash off the intake again, to eliminate even more friction.

4 Ring Autonomous Creation

A 4 ring autonomous was finally made for the negative side in a special time period after our 1-hour build time session. After a lot of testing, it became very much consistent and efficient.

Highland Blend Tournament PT1

At the Highland Blended Tournament on December 14th, each team (48 teams were present) participated in 6 qualification matches. We ended up with a 6-0-0 Win-Loss-Tie.

Match 1 (Qualifier #1)
Won 40-0, paired with 50298B against 17325E and 67410B.
Focus on corner rush and corner defense. Auton and AWP won.

Match 2 (Qualifier #19)
Won 41-0, paired with 67410C against 43050A and 43050Z.
Focus on corner rush and negative attempts. Auton victory.

Match 3 (Qualifier #33)
Won 48-2, paired with 6978D against 6390A and 43011E.
Focus on filling goals as fast as possible. Auton victory.

Match 4 (Qualifier #47)
Won 23-5, paired with 6390F against 6390R and 6978A.
Focus on goal rush and wall stakes. Auton and AWP victory.

Due to low wall stake competition, wall stakes seemed important, but very few teams present could score on them.

Highland Blend Tournament PT2

Match 5 (Qualifier #57)
Won 33-6, paired with 72247C against 17325H and 17325B. Focus on goal and corner rush, corner defense. Auton victory.

Match 6 (Qualifier #72)
Won 17-12, paired with 72247A against 6978Y and 6978Z. Focus on goal filling and rushes, autonomous victory. Our solenoid attached to our doinker broke, but we still got corners.

Qualifier Total Results & Alliance Selection
We ended up 1st out of 48 teams due to going 6-0 and getting AWPs, so we had first pick of any team.
We were split between the second and third place teams, 6978Y and 6978W, but we ended up going with Y due to their wall stake capabilities and effective autonomous.

Round of 16 (#1-1)
Won 52-3 against 72247A and 67410A, with a match focus on corner rushing and goal filling. We got them all. Auton victory.

Quarterfinals (#1-1)
Won 35-15 against 6978X and 43050Z, stake focus, auton won.

Highland Blend Tournament PT3

Semifinals (#1-1)
Won 23-18 against 6978E and 6978A. Heavy corner defense focus, with a couple of wall stakes. Autonomous victory.

Finals (#1-1)
Won 37-19 against 6978W and 6978C. Heavy goal rush focus, with some corner defense as well. Autonomous victory.

Skills (Autonomous & Driver)
Ran all 3 driver and all 3 autonomous runs.
Final driver run was 44 points, our highest so far.
Final autonomous run (made entirely during the tournament in a practice field) successfully scored 6 rings and put first goal in corner, but mis-clamped second goal, and despite intaking all 5 of the intended rings, none went on, and as it was put on the corner it ended up scoring 18 points.
Total score of 62 points, 2nd place skills behind 6978Y's 67.

Interviews
First interview had no time limit, so we tried to talk about everything, but had to get rushed off to a match. Second interview we overlooked some important topics, 5 minute limit.

High. Tournament Reflections

Match and build metas did not seem to be much different at this tournament, as it was blended and also did not have the most competitive teams. Very few bots were capable of doing wall stakes, so it showed their importance for those who could score on them. As for matches, a goal defense meta remained.

Team Inspirations

Saw another nice hook & Lady Brown design from 20080X CrossFire, though we do not plan to work the same as it if we rebuild. We might spray-paint metal like they did, for the looks.

Design & Notebook Ideas & Review

We had some more notebook ideas involving following the rubric more thoroughly, and we realized our interview was subpar. We did not go over all the rubric topics, and spent too much time going over our robot specifications. We plan to do a practice interview with a coach, and write up a better plan.

Overall Results & Awards (State Qualifying)

We ended up winning Tournament Champions with 6978Y, and we also got the High School Excellence award due to getting 2nd place Skills, 1st place in qualifiers, and a solid notebook.

Notebook Chapter Five
Post-Highland Pages

The purpose of this section is to go over our new plans and ideas after our third tournament, and it will also go over the full drivetrain and intake rebuild that we are going through afterward.

Post-Tournament Issues/Ideas

At the Highland Blended tournament, we figured out some things about our robot that we wanted to do, and shortly after we discussed what we wanted to do with it in the future, especially since we are now state qualified as we won two qualifying awards at the tournament.

Interview Plan Changes

We want to make a full interview plan that is more effective than the old one, that can also function under a time limit. We will briefly go over each part of the Judges' Rubric, to try to get the best score we can and up our chances at judged awards like Excellence, Design, Judges', Build, and others.

Intake & Drive Rebuild Plans

We have discussed all this a lot previously, but we have decided that since we have the lengthy Christmas break and then some extra time before our next tournament (Jan. 25th) we will rebuild our hood intake to a hook intake. Our hood worked, but it was a low difficulty tournament. Hook intakes are faster and allow the use of the Lady Brown mechanism. As for our drive, we want to rebuild to a 2.75 inch wheel drive with a faster RPM drive, going from the original 360 to 450 or 480.

Full Intake & Drive Rebuilds

Identify The Issue: Intake Speed/Efficiency

We've known for a while that the hood intake is not at the best speed it could be, and speed is very important for goal rushes, autonomous, and corner control.

Brainstorm/Select Ideas: Only One Option (Vertical Hook)

We unanimously agreed that the best solution is to simply go and do a vertical hook intake, as a well-built vertical hook can be very fast and efficient, and has the added bonuses of being able to work with a Lady Brown wall stake mechanism (much faster and easier than a redirect) as well as some being able to intake directly onto alliance stakes like our hood can.

Identify The Issue: Drivetrain Speed/Type

Another point of importance is the speed of the drivetrain. Controlling corners and being able to rush is very important in this year's game, and a faster drivetrain is something we need.

Brainstorm/Select Ideas: New Speeds

We want to have a faster drivetrain, and our options were going up from 360 RPM to 450, 480, or 600 RPM. We finally decided on 450 RPM with 2.75 wheels, as it has the best speed/torque.

Practice Start - 12/17/2024

Attendance:

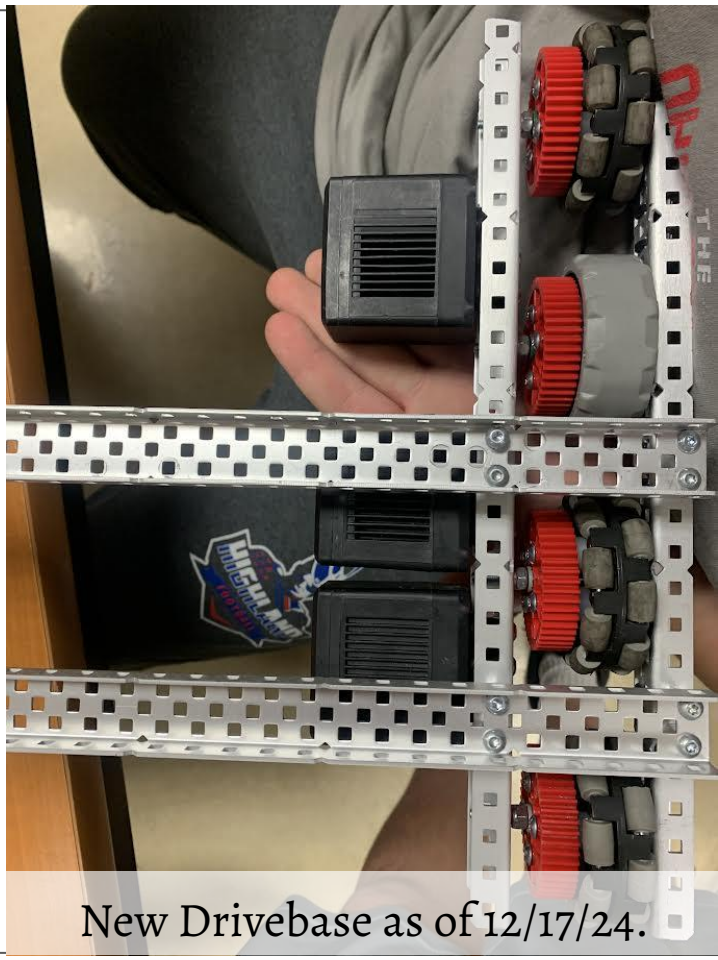
- Nevin, Elijah present entire practice
- Derek late by about 30 minutes
- Eric, Miles not present entire practice

Practice Goals:

- Assemble parts and a plan for new drive-base
- Build new drivebase
- Scavenge/dismantle parts of old robot

Drivetrain Work & Future Plans

We started making the drivetrain, and we have it about half done at the time of writing. It is made with 8 2.75 inch wheels, 2 being traction wheels and the remaining 6 being omni-wheels. We will be running them on blue motors geared down 36-48 to 450 RPM. This time, we are also using screw joints for the attachment, which should make the wheels spin more nicely.



New Drivebase as of 12/17/24.

Date of Writing: 12/17/2024

Contributors: Nevin Zerby

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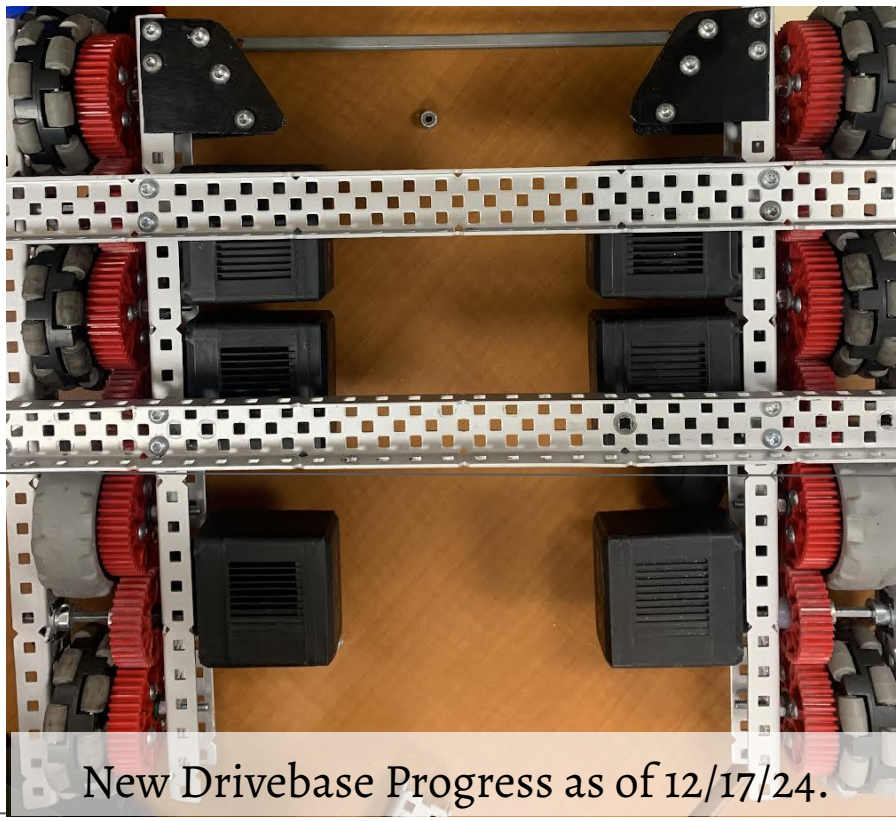
Practice Progress & Discussion

We spent the rest of the practice discussing other options for how we might want to build the drivebase, while we finished this first prototype. The drivebase had a lot of progress, as we finished mirroring it and added the back clamp ramps and bar.

Other Options / Usage

We thought again about some other options that we could go with, and we had some options: Go with the old drivetrain again, as we are more comfortable driving with it, change the wheels on this new build to 3.25s for more familiarity and speed, or even try a direct drive blue motor 600 RPM drive. We once again decided to just keep this new drivetrain, and once we have the rest on we can test it in the field and then see if we would like to choose any other things.



New Drivebase Progress as of 12/17/24.

Plans for Clamp & Intake

We planned out the addition and connection spots for them, clamp spot all ready.

Date of Writing: 12/17/2024

Contributors: Nevin Zerby

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1-Hour Build - New Drive/Clamp

Most of today's session was spent focusing on finishing the drivebase and adding the clamp/intake mounts.

Attendance:

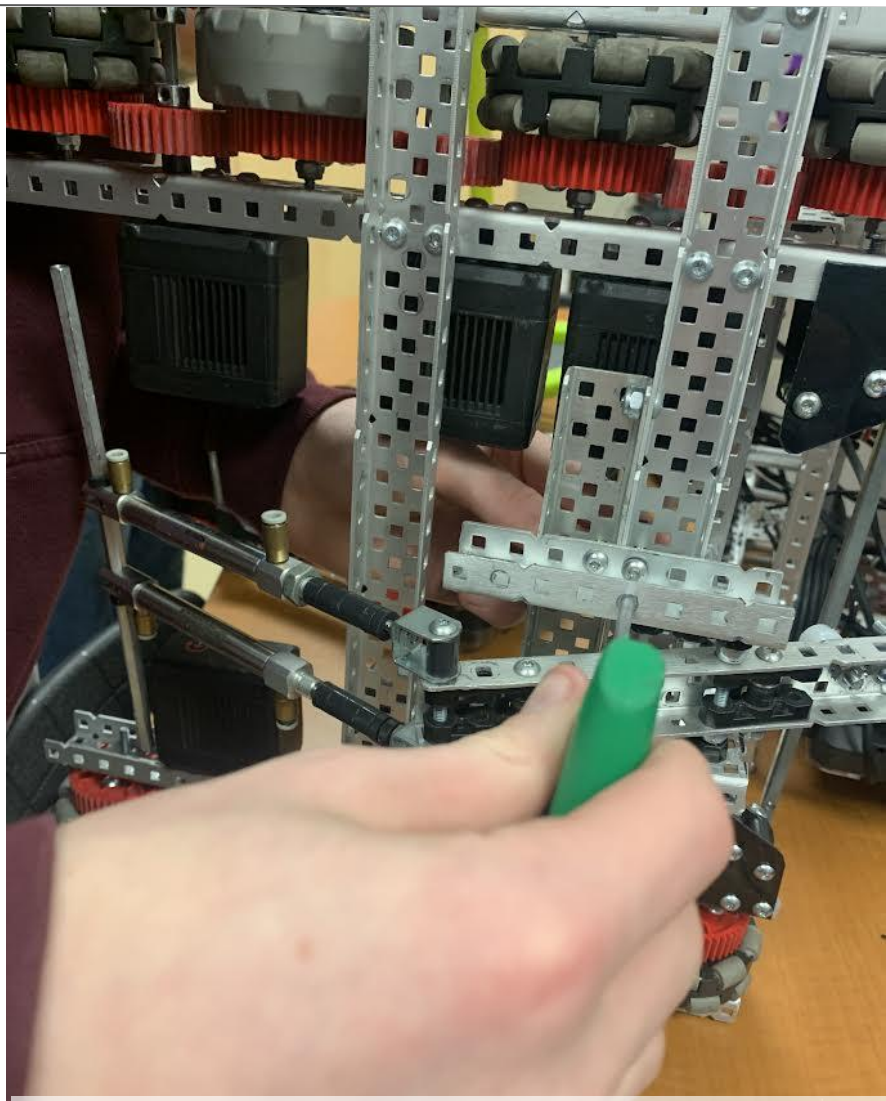
- Eric, Nevin, Elijah present entire session
- Derek, Miles not present entire session

Final Drive Work

We did some finishing work on the drivebase, adding the 30 hole channels across the top, attached with standoffs.

Clamp Addition

We added the rest of the clamp around the ramps by attaching two 8x2x1 channel pieces to the topside, where we positioned the driveshaft on which the other clamp piece (10x2x1 channel) was held, alongside the pistons.



Clamp Reattachment Work as of 12/18/24.

Date of Writing: 12/18/2024

Contributors: Nevin Zerby

Continued: 192

Practice Start - 12/19/2024

Attendance:

- Nevin, Eric, Derek, Elijah present entire practice
- Miles not present entire practice

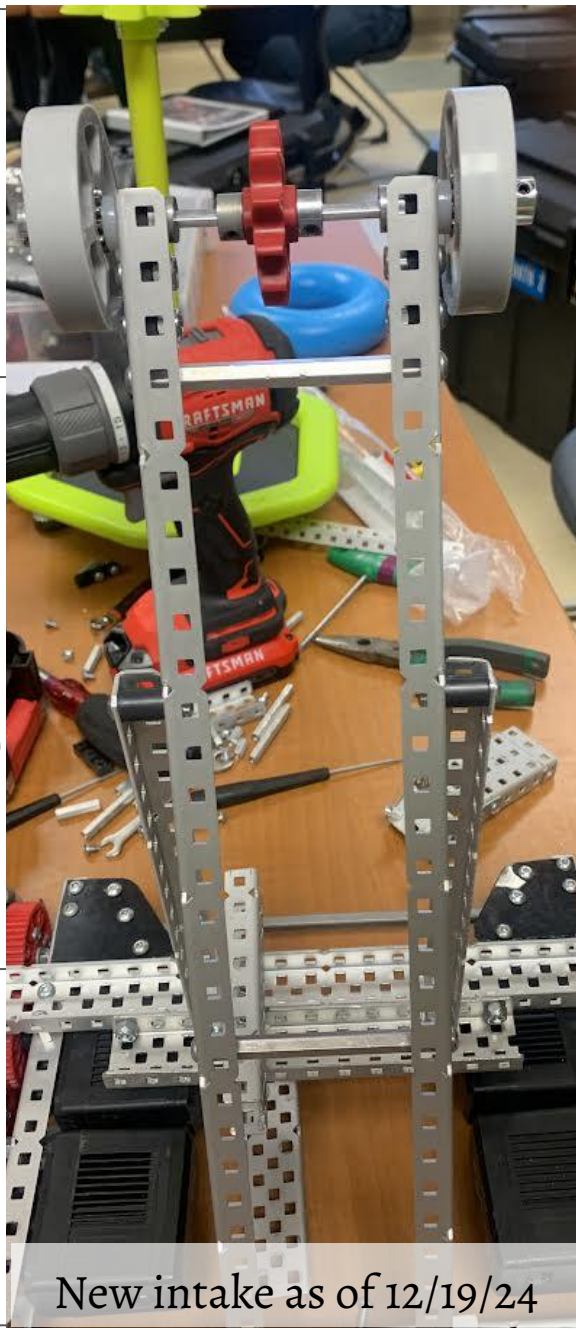
Note: Shortened practice from 11:45 to 2:15, not 3:30 to 6:30

Practice Goals:

- Mount hook intake prototype
- Decide on a clamp design
- Mount clamp prototype

New Intake Work - Mount & Prototype

We made a prototype of our new hook intake, made of two 1x1x31 aluminum angle channels, triangle braced with 1x1x16 ones, and put together with some standoffs. There's flex wheels on a low strength shaft with a 12-tooth sprockets.



New intake as of 12/19/24

Clamp Results & Redesigning

We tried using the clamp from our old bot, but it was too high up to work right, so we are designing a new one to put on.

Date of Writing: 12/19/2024

Contributors: Nevin Zerby

Continued: 193

Code Libraries - Research/Use

Recently, the team has looked into using code libraries for some of our programming, and we have discussed it a lot.

Definition / Examples of Code Libraries

Code libraries are special declarable pieces of code that are used in core VEX programs. By default, when using VEX code, besides the basic “default” C++ libraries, there are also two ones that are VEX specific, being “v5.h” and “v5_vcs.h”. In this case, the libraries being discussed are libraries made by other VEX competitors for others to publically use. These are legal in the rulebook, provided that a team can explain them. The one we will probably use is 2775V’s JAR Template for V5 Pro C++.

How to Use & What to use for

These libraries serve the purpose of making advanced coding (in this case, mostly autonomous coding with algorithms like PID, Odometry, and in some libraries, even Pure Pursuit) faster and easier for those who understand them and can work with them. The intention of their existence is to make it so people can make an autonomous program much faster and more effectively, without wasting precious time and brainpower to do so. It doesn’t make everything for you, so you still learn/work.

Practice Start 12/20/2024

Attendance:

- Elijah, Nevin present entire practice
- Derek late to practice by 45 minutes
- Eric and Miles not present entire practice

Note: Another shortened practice from 11:45 to 2:15

Practice Goals:

- Put on new intake chains
- Build and mount new clamp design
- Move over old lower intake

New Intake Work

We put on the chain (tank chain) for our new hook intake, with one prototype screw-hook for testing, which we will later replace with a Delrin hook. We tested it with a 600 RPM direct blue motor, and it seemed to work well. We tried intaking onto a goal that we “clamped” by holding down the clamp with our hands and simulating its’ angle, and the rings went on mostly.

Old Lower Intake Transfer

It was easy to transfer over the old lower intake, as the new base is the same size. We simply screwed it into the new one.

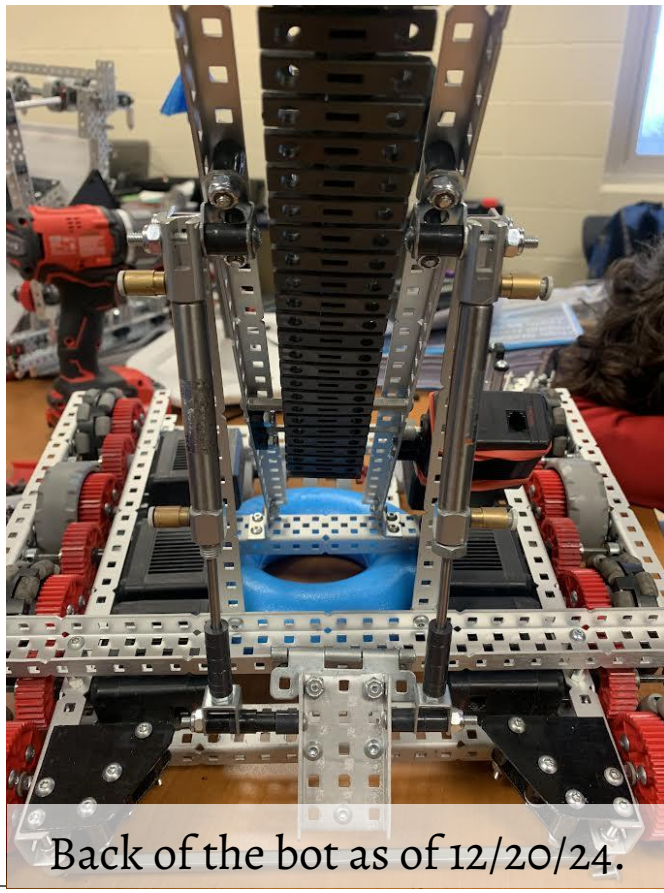
Intake Tests & Clamp Work

New Clamp Design/Build/Attach

We made a simple new clamp design, a 1x3x5 c-channel put on the same pneumatic set as before, with some screws in it with spacers on them. We carried over the same mobile goal aligners (see the black sled things in the image) for this clamp.

Intake & Clamp Test Results

We were unable to test the clamp with air yet, because we do not have the tanks or the code or the brain set up. We ran some tests on how the intake placed rings on there, by holding the clamp with our hands and running the motor we had hooked up to the other brain. When we did the tests on it, rings pretty consistently went on, but sometimes the hooks would get caught because the rings would get stuck too fast. Our plan for fixing this is to put on the new hooks and also to put “ring guides” hanging off the end, which would help push rings to the back of the goal to prevent this as best as possible, without catching.



Back of the bot as of 12/20/24.

Date of Writing: 12/20/2024

Contributors: Nevin Zerby

Continued: 196

Take-Home & Tournament Plans

Updated Tournament Plans & Schedule

Due to availability, registration filling up, and other factors, our tournament schedule for the rest of the season is changed to:
January 25 - Barnesville Blended Tournament
February 1 - Washington Court House Blended Tournament
February 8 - Highland High School Tournament (Home)
March 15 - 2025 Ohio High School State Championship
This list is not 100% final, as we may be going to a seperate tournament from Washington Court House on February 1st.

Take-Home Pre-Planning

We have had a robot take-home planned for the holiday break, which are as follows. The robot is at Elijah's house, and he now has an entire VEX High Stakes game field for testing.

- Improve Intake (extensive testing, possible adjustments)
- Finish "Locking" Clamp (Can also clamp corners of goals)
- Make mounting area above front of robot for wall stake mechanism (known as a "Lady Brown"), brain, and tanks
- Make Lady Brown wall stake mechanism and put it on
- Improve pre-roller (lower intake) (shift back, add "forks"underneath for faster ring pickup, etc.)
- Do drive testing and practice with "new" robot

Robot Take-Home #5 - Preroller

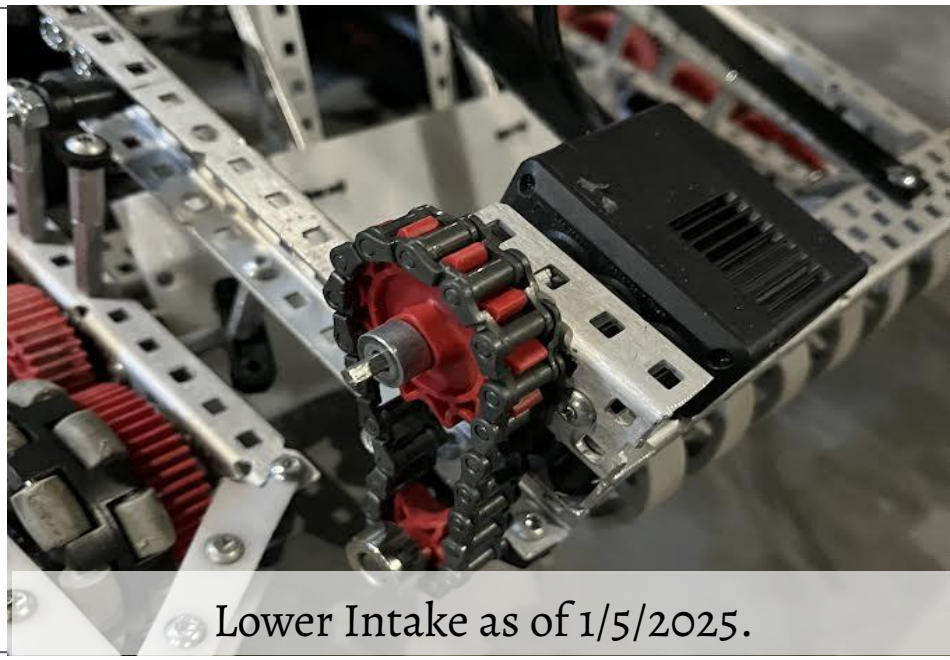
Note: The pages about the build results are written at the end of the break, due to the team mostly being busy with holidays. Also note that what used to be called the Lower Intake will now be referred to with the shorter common jargon of “preroller”

Lower Intake (Preroller) Placement & Tweaks

One of the first things done during this take-home session was some small adjustments to our new preroller. The first thing we did was add an additional, smaller flex-wheel to one end of the mechanism, as doing that had previously worked fantastically. However, we were unable to put one on the other side due to it now having its own motor, a 5.5 watt. We also shifted the entire mechanism back one hole, as it tested more efficiently.

Ramp Vs. Fork Intake

One thing we tested was the performance of forks (polycarbonate pokers) versus a ramp as shown. The ramp was smoother, so we ended up keeping it for our lower intake.



Lower Intake as of 1/5/2025.

Date of Writing: 1/5/2025

Contributors: Nevin Zerby

Continued: 198

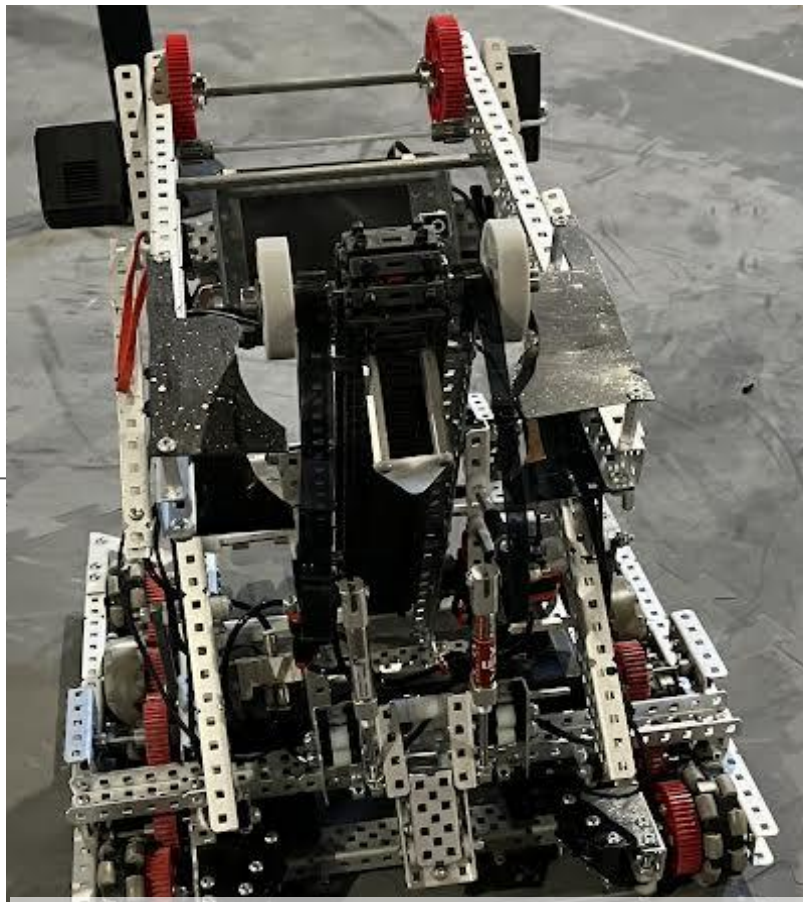
Robot Take-Home #5 - Intake

Hood to Hook Rebuild Continuation

We unanimously decided to continue the rebuild from a “hood” upper intake to a “hook” upper intake, as it is much faster in most cases and is able to work with the Lady Brown wall stake mechanism, which is faster, simpler, easier to build, and easier to tune than the hood intake’s common “redirect” mechanism.

Hook Material Change

We were originally using screws specially added to bearings as our “hooks”, but now that we have access to more Delrin and a way to cut it, we were able to make Delrin hooks to replace the screws, which are much more consistent, and lighter.



Back of the bot as of 1/5/2025.

Intake Chain Zip-Tying

We zip-tied every link of our intake chain, as we found that it could not only make them more resistant, but also it can grip/keep on rings far better.

Date of Writing: 1/5/2025

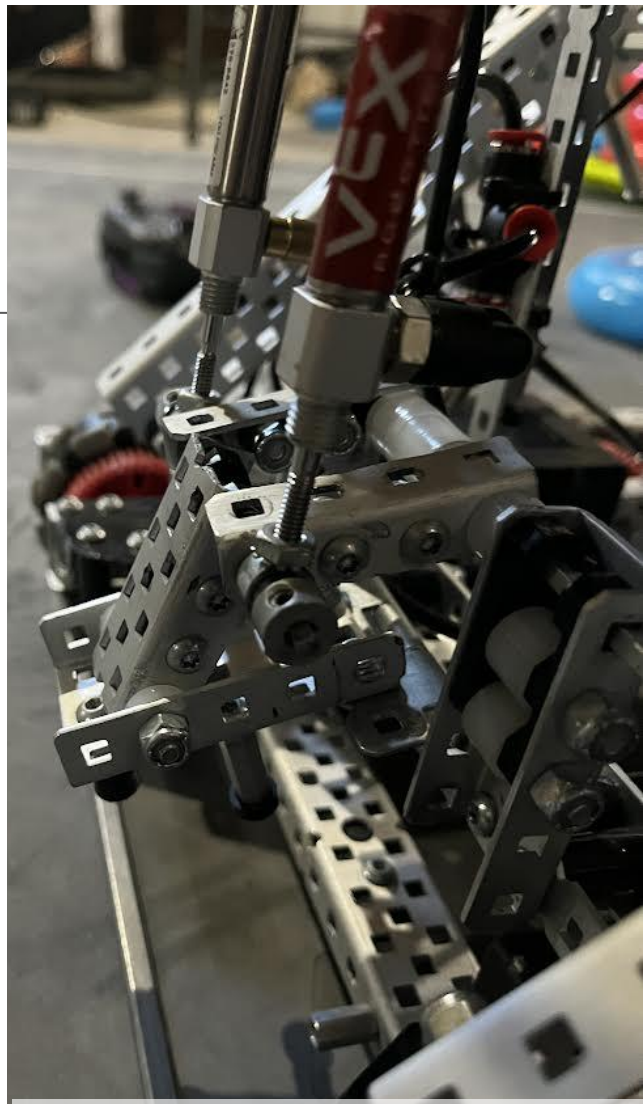
Contributors: Nevin Zerby

Continued: 199

Robot Take-Home #5 - Clamp

Locking Clamp - Function & Purpose

One of the big things we changed was doing a different design for our locking clamp. Locking clamps are different from regular mobile goal clamps as they have an extra small piece of c-channel (usually cut to about 4 holes) and some screws on it so that the channel can slide past them and “lock” onto the goal, making it so that the clamp can not be pulled up without releasing the pneumatics, making it far harder for goals to be “stolen” from the robot.



Locking Clamp as of 1/5/2025

Our Clamp Build & Conclusions

We decided to put a cut 2x1x5 piece of c-channel onto the 3x1x5 piece that we had already been using for our “regular” clamp, and orient it so that when it was pushed down it would slide past the screw on it and lock it into place until the pneumatics were deactivated. It seems to work quite well, and after testing, it is very hard to take off of goals. We are satisfied.

Date of Writing: 1/5/2025

Contributors: Nevin Zerby

Continued: 200

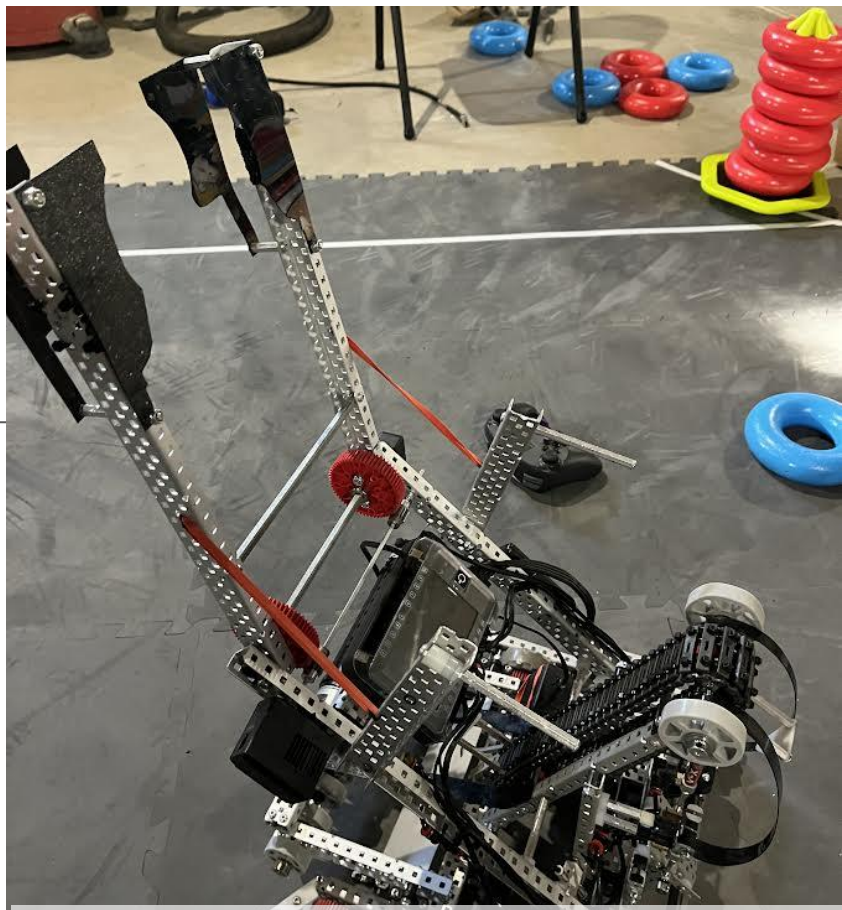
Robot Take-Home #5 - Stakes

Why We Use a “Lady Brown”

As repeatedly said, we decided to use a common type of wall stake scoring system, with our own tweaks to it. This version is common on robots using hook intakes, known as Lady Brown.

What A Lady Brown Is

It is a common wall stake scoring mechanism which functions simply by being mounted at the front of the robot, where it can lay a second set of bars across the “top” of the upper intake (assumed to be a hook type intake, like ours) where it will passively grab rings, so it can simply rotate and place them onto wall stakes easily.



Our wall stake mechanism as of 1/5/2025

Building A Lady Brown

Ours is built uniquely to work with our robot, as it uses our polycarbonate “cases” on it, which are directly put on the standard c-channel bars. They function better on our robot.

Date of Writing: 1/5/2025

Contributors: Nevin Zerby

Continued: 201

Robot Take-Home #5 - Hang

Passive 1st Tier Hang Built Attempt

We have been inspired by a common 1st tier “passive” hang design which we may use, where two c-channel bars are added to the Lady Brown mount with standoffs on the ends, and then rubber banded to the mechanism so that they will come up when the Lady Brown does, allowing the robot to simply drive into the ladder and hang, while not using an extra motor or pneumatic part. We attempted to build some, but they were unsuccessful. We might try again after the break, as the team would like to test more.

Hang Mechanism as of 1/5/2025

Other Hang Ideas

Firstly, we may just make the same sort of thing again, but with new hole amounts and possibly Delrin hooks that can be shaped instead of the inconsistent standoffs. Otherwise, we may just try other types of hangs, like pneumatic bars on the front of the robot.

Date of Writing: 1/5/2025

Contributors: Nevin Zerby

Continued: 202

Robot Take-Home #5 - Other

Ring Guides on Intake

When we were testing the hook intake, we found that since it was less consistent than the old hood intake, we needed to find a solution. We found that part of the issue was hooks getting stuck on the rings, and another was the rings not going on the right part of the goal. We found that the best way to solve both of these issues was to add “ring guides” to the back of the intake - small polycarbonate parts which flex, but still push rings further back so that they don’t get in the way of the hooks and go directly to the goal.

Side of the whole robot as of 1/5/2025.

Field Testing Results

As we now have a field available during our take home sessions, we were able to drive the robot and test its mechanisms. We found them working, with a few minor tweaks to improve performance.

Date of Writing: 1/5/2025

Contributors: Nevin Zerby

Continued: 203

1-Hour Build - Robot Preparing

Most of today's session was spent working with our new ring guides, and taking apart the rest of our old robot.

Attendance:

- Nevin, Eric, Miles, Derek present entire session
- Elijah not present entire session

Ring Guide Work & Conclusions

We were doing some basic intake tests since we needed to be sure it fully consistently worked, and while it did work, there were some issues with the ring guides. It turned out that the polycarbonate we were using for the guides was too thin, and if the intake were to move wrong in the slightest at any point, the guides would snap. We took them off temporarily so we could make new ones, which we brainstormed and decided to use heat-gunned Delrin plastic, which should be more durable.

Deconstruction of Old Robot

Eric and Miles worked on deconstructing the remaining parts of the old robot while Nevin and Derek worked on the guides. Deconstructing the robot gave us extra parts we could use in the future and also more room in our robot storage space.

Date of Writing: 1/7/2025

Contributors: Nevin Zerby

Continued: 204

Practice Start - 1/7/2025

Attendance:

- Nevin, Derek present entire practice
- Elijah not present entire practice (vacation)
- Eric and Miles not present entire practice (school event)

Practice Goals:

- Make and test new ring guides
- Code Lady Brown rotations
- Rearrange and survey motor ports
- Start PID tuning for new drivetrain

Coding Progress

We did a little bit of code testing, and confirmed that we did indeed need to do new PID tuning on the new drivetrain, and did some starting tuning, but did not get super far. Additionally, a basic Lady Brown arm code was made, specifically with rotations so that it could stop at specific points where the rings could go directly in without it needing to be manually adjusted.

Ring Guide Work

We measured out new ring guides, but we do not have access to Delrin or a heat gun for a while, so we will move on for now.

Date of Writing: 1/7/2025

Contributors: Nevin Zerby

Continued: 205

1-Hour Build - Ring Guide Finish

Most of today's session was used for testing new Delrin ring guides at different spots on the back of the robot.

Attendance:

- Nevin, Eric, Derek present entire session
- Miles, Elijah not present entire session

Ring Guide Spot Testing

We made new ring guides out of bent Delrin, on the back. We had to test them in different holes because of the resilience.

3 Holes Down

Rings bounced off, could not go onto the goal.

4 Holes Down

Rings barely went on, difficult.

5 Holes Down

Rings went on well, but 5th and 6th rings would get caught. We moved it to 4 holes and we used zip-ties to pull it back.

Ring Guides as of 1/8/2025.

Date of Writing: 1/8/2025

Contributors: Nevin Zerby

Continued: 206

1-Hour Build - New Doinker

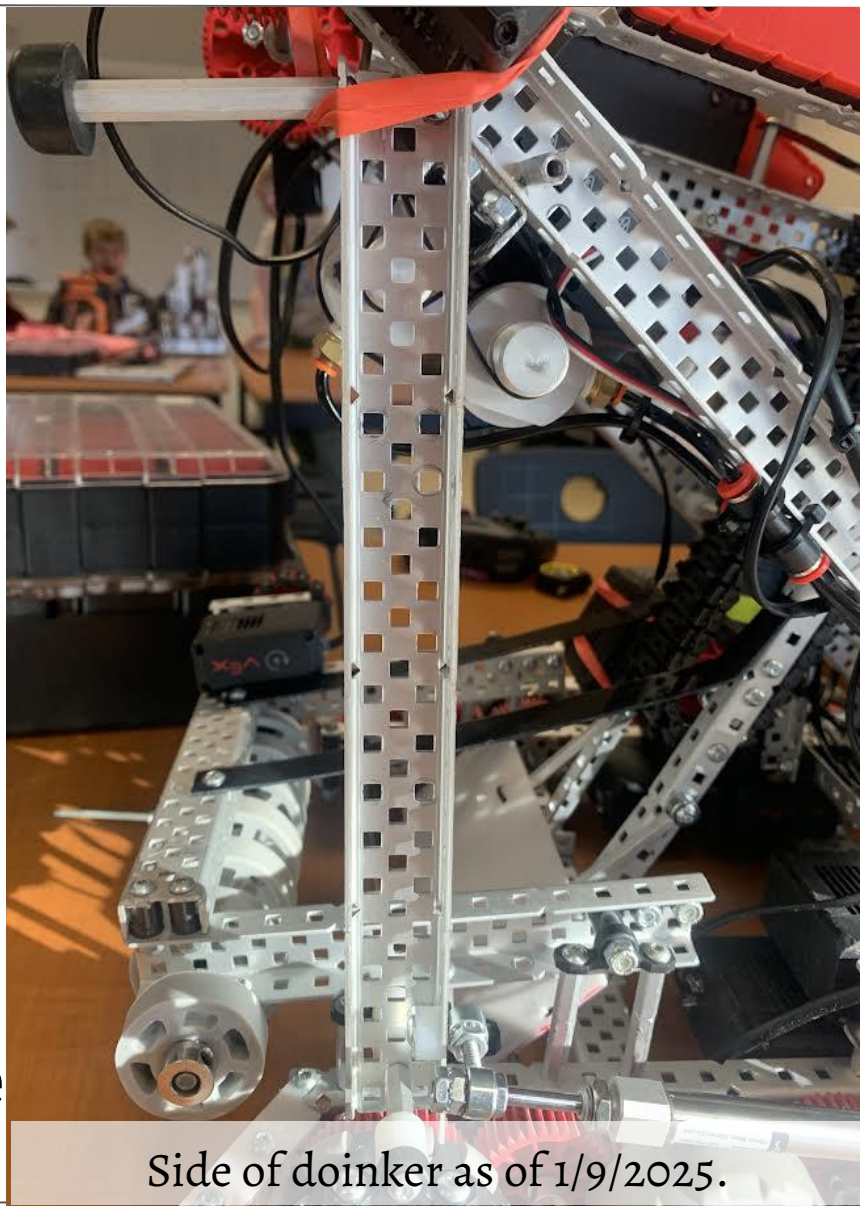
Most of today's session was used for making a new "doinker" mechanism for our robot.

Attendance:

- Nevin, Miles, Eric present entire session
- Elijah, Derek not present entire session

Doinker Bar Building

Since we found the "doinker" on our old robot very efficient, we decided to start making a new one. Due to the ruling, as well as our bot being smaller, we are able to make one that can extend much further. We ended up using a cut 20x1x2 c-channel piece with a 2-inch standoff and a bumper on the end. We attached it to the bit at the end of a piston, which we mounted on an extra piece of c-channel on the side.



Side of doinker as of 1/9/2025.

Date of Writing: 1/9/2025

Contributors: Nevin Zerby

Continued: 207

Practice Start - 1/9/2025

Attendance:

- Nevin present entire practice
- Elijah, Miles, Derek, Eric not present entire practice

Practice Goals:

- Tune PID further for accuracy
- Develop autonomous programs
- Test autonomous programs

Code / Autonomous Work

A majority of the practice was spent working on the autonomous program for matches, as there was not much to build and Nevin (programmer) was the only one present from the team. A “Rush Side” code was completed which scored a consistent six points, with 2 top rings (one on each goal)

Lady Brown Wall Stake Work

We found that the Lady Brown that Elijah had made did not work, as we were unable to test it previously to see if it would. Nevin cut some pieces off of the polycarbonate to prevent it from hitting the top of the intake, and tightened some screws that made it tilt and bend, but it was still too long for easy use.

1-Hour Build - Doinker Work

Most of today's session was spent continuing work on our doinker, as we experimented with different spots to put it.

Attendance:

- Nevin, Eric, Miles present entire session
- Derek, Elijah not present entire session

Doinker Placement Ideas

We tried moving the doinker forwards, but we found that it not only was less stable but also interfered with our autonomous program since it stuck out past the intake even in the "up" position. We moved it back and reinforced it, and it was better.

Miscellaneous Tweaks to Doinker

We made a bunch of small changes as we went, to improve it:

- Moved rubber bands down
  This made it safer and slower, and less damaging.
- Cut off bottom part
  Part of the bottom area was sticking down and occasionally stuck on the wheels, but we cut it to fix this
- Flipped around pneumatics
  We changed the orientation of the wiring/parts for safety.

1-Hour Build - Intake Outside

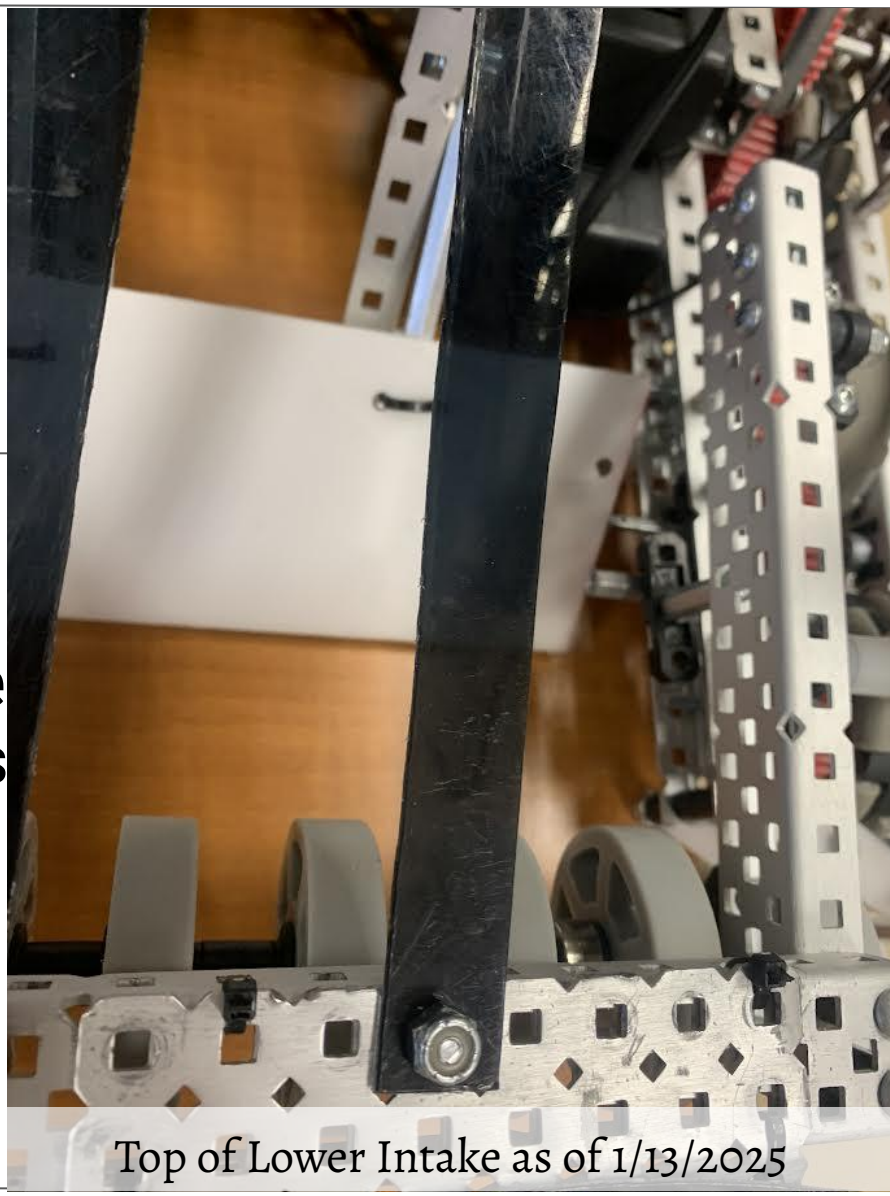
Most of today's session was spent making the outside of the intake, also known as a "fingernail" mechanism.

Attendance:

- Nevin, Miles, Eric, Derek present entire session
- Elijah not present entire session

"Fingernail Mechanism"

We started working on a simple but common robot part known this year as a "fingernail" mechanism on the outer part of the lower intake. The purpose of it is to push rings off of stacks, meaning it is easier to intake rings at the bottom of stacks and also makes it possible to intake rings directly from the 4-ring corner stacks in the autonomous period. We added a metal piece for it.



Top of Lower Intake as of 1/13/2025

Date of Writing: 1/13/2025

Contributors: Nevin Zerby

Continued: 210

1-Hour Build - Fingernail Mech.

Most of today's session was spent making the outside of the intake, also known as a "fingernail" mechanism and making the doinker safer.

Attendance:

- Nevin, Eric, Derek present entire session
- Elijah, Miles not present entire session

Continued "Fingernail" Work

We finished fastening a flat metal piece onto the top of the intake with zip-ties, so we surveyed some pieces of polycarbonate and Delrin plastic that we could add to it.

Doinker Work/Tests

Our doinker still had the issue of getting caught on/behind the motor for the Lady Brown, so we tried putting mesh on it, which failed, so we put on a lock collar with a screw as a stopper for it.

Doinker tip/stopper as of 1/14/2025

Date of Writing: 1/14/2025

Contributors: Nevin Zerby

Continued: 211

Practice Start - 1/14/2025

Attendance:

- Nevin, Derek present entire practice
- Eric, Miles, Elijah not present entire practice

Practice Goals:

- Add polycarbonate to the intake for the “fingernail”
- Make autonomous route for “slow side”
- Code autonomous route for “slow side”

Plastic Addition to Intake

We drilled holes into a piece of plastic and zip-tied it to the bent metal piece we added to the intake previously. It works.

Autonomous Work

Now that we have a consistent “rush” side autonomous that gets 6 points, we did work on a “slow” side auton that would score at least 7 points.

Polycarbonate on the intake as of 1/14/2025.

Date of Writing: 1/14/2025

Contributors: Nevin Zerby

Continued: 212

1-Hour - Doinker & Autonomous

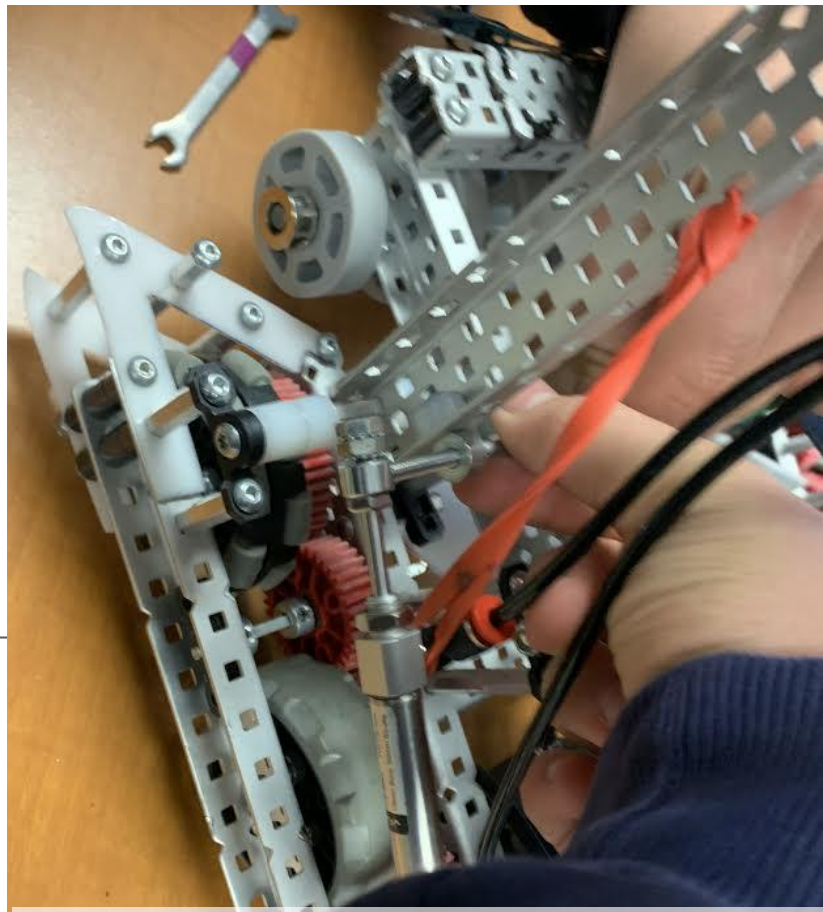
Today's session was spent split between working further on the doinker and doing autonomous testing on the field.

Attendance:

- Nevin, Eric, Derek all present entire session
- Miles, Elijah all not present entire session

Doinker Work

We did yet more miscellaneous doinker work, including more rubber band movement, a test of moving the piston mounting spot forward, and adding a bit (1-inch stand-off, and a screw) at the top for a "stopper" to prevent it from getting stuck behind the motor for our wall stake mechanism.



Doinker as of 1/15/2025

Further Autonomous Worktime

We polished and finished code for a "slow side" autonomous, which could consistently score.

Date of Writing: 1/15/2025

Contributors: Nevin Zerby

Continued: 213

Robot Take-Home #6 - Intake

Lower Intake Rearrangement

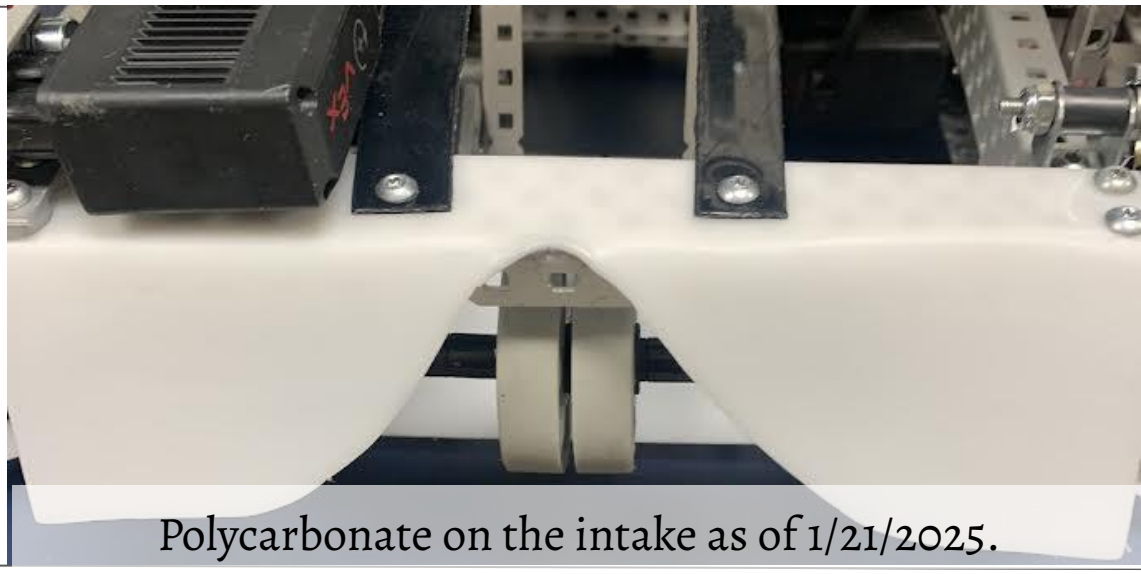
We started out by doing some work on the lower intake, at Elijah's house. Firstly, we spread out the flex-wheels so that they were in 3 groups of 2, as this picked up rings much better and made it so that they would not spin in place.

Important Additions

Additionally, we added a better version of what we called a "fingernail" by using a specially cut piece of Delrin that we screwed on. This allows us to pick up rings directly from corners during autonomous, which may help us get a higher score. Also, we added a piston that can lift the intake during autonomous, which allows us to take rings from the top of stacks to score extra points.

Color Sort Tests

We tried making a color sorter with an optical sensor, but it did not work as the sensor was misplaced.



Polycarbonate on the intake as of 1/21/2025.

Date of Writing: 1/21/2025

Contributors: Nevin Zerby

Continued: 214

Robot Take-Home #6 - Other

Clamp Looseness Fix

Our clamp had been having issues while testing autonomous that caused it to be quite loose, so we fixed it by simply re-tightening the screws that held the pistons (they were off slightly) and lengthening the goal holding standoffs.

New Back Ring Guides

We made new ring guides again, as the Delrin ones were too inconsistent as they were too solid. Rings would bounce off, so we needed to bring back the polycarbonate which was softer and could bend. To stop them from breaking like they had before, we bent them less.

Back of the robot as of 1/21/2025.

Lady Brown Shortening

We shortened the bar of it by about 3 holes.

Date of Writing: 1/21/2025

Contributors: Nevin Zerby

Continued: 215

Code Development At Home

Miscellaneous Code Tests

- Lady Brown / Lift Point Testing

We tried a bunch of different ways to “turn to point” with the Lady Brown, and started developing a PID, though we could not use it yet due to some gear ratio issues.

- Intake Color Sort Testing

We got an optical sensor to work and successfully pick up and sort colors, but due to its placement we realized we would need a distance sensor to make it stop at the right times.

Rush Side Autonomous

We incorporated the new intake lifter pneumatics into this code, allowing us to pick up an extra ring in the middle of our side, scoring 7 points and enabling us to score a “solo” autonomous win point. Additionally, the PID got more accurate.

Slow Side Autonomous

We changed the autonomous route so that it firstly pushes rings out of the way and scores directly onto the alliance stake with the intake. Then, it now goes directly to one of the stacked rings first, allowing us to beat many robots to the ring and prevent them from bumping the bot and messing up the run.

Practice Start - 1/21/2025

Attendance:

- Nevin, Elijah, Derek present entire practice
- Eric late to practice by about 1 hour
- Miles not present entire practice

Practice Goals:

- Test Lady Brown
- Test Fingernail Mechanism
- Draw out Delrin side-plates

Delrin Plating & Fingernail Design

We designed new Delrin side-plates to prevent drivetrain damage and to streamline it without wall-rides. We also used some Delrin to make a new “fingernail” mechanism. We decided to cut a small u-shaped hole in the front of the fingernail, as this allows us to simply drive up to and auto-align our Lady Brown on wall stakes.

New Addition Testing

The fingernail is still not made exactly as we want it, because it is not bent down enough, and cannot grab the bottom ring in corners. However, the aligner and side panels work very well.

Practice Start - 1/22/2025

Attendance:

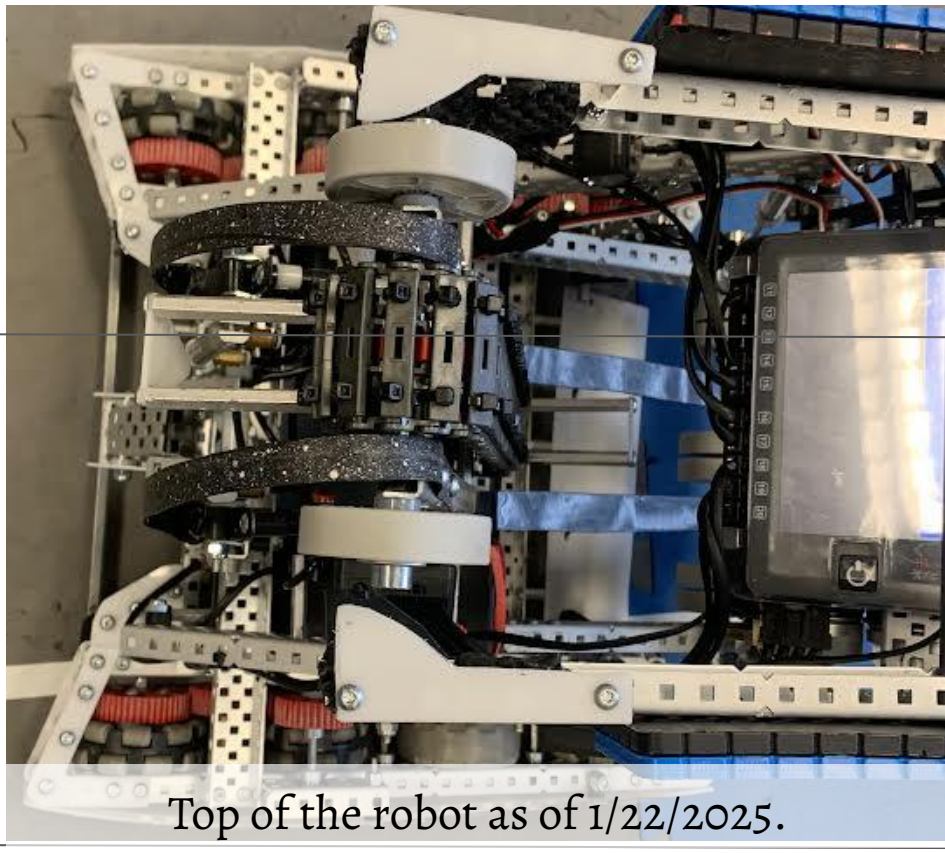
- Nevin, Elijah, Eric present entire practice
- Miles, Derek not present entire practice

Practice Goals:

- Get Lady Brown fully working
- Tune and finish Rush Side Autonomous

Lady Brown Work

We kept working on the Lady Brown mechanism, and we got it to finally work on wall stakes, and we also discovered that we could load another ring in the bottom of our intake while having one prepared in our mechanism as well.



Top of the robot as of 1/22/2025.

Rush Side Autonomous

The program had some inconsistencies with the clamping of the second goal, which were fixed by driving it further toward it.

Date of Writing: 1/22/2025

Contributors: Nevin Zerby

Continued: 218

1-Hour - Lady Brown Issue Fixes

Most of this session was spent working on the various small issues in the coding and building of our Lady Brown.

Attendance:

- Entire team present entire session

Lady Brown Build Issues & Build Fixes

The first issue we ran into was that the rings would not always go into the mechanism, as it was too tight. We tried bending it out, but that made it too loose. Eventually, we simply replaced the c-channels that made it up and it became more consistent due to the better quality of the metal.

Lady Brown Code Issues & Developing Fixes

There were some issues with the Lady Brown code, causing:

- If hit, could get permanently stuck on wall-stakes and make robot unable to move
- While turning, would force the robot to continue its previous actions or stop other actions entirely
- Inconsistent stopping points

We decided to try several different things, such as switching degree turns to timed turns, and temporarily used those.

Practice Start - 1/23/2025

Attendance:

- Nevin, Elijah present entire practice
- Eric, Derek late by about an hour
- Miles left early after about an hour (sporting event)

Practice Goals:

- Research solutions to Lady Brown code issues
- Further tune PID
- Design an elevation mechanism

Miscellaneous Code Work

The PID was tuned slightly more. It was inconsistent on shorter turns, causing it to mess up autonomous sometimes. We set it down on the field to do a couple of 45 and 90 degree turns, changed the values, and then tested again repeatedly. Also, we researched a way to solve the Lady Brown problems, but ran out of time to implement and test them.

Elevation Mechanism Ideas

We had a basic elevation mechanism made during one of the previous take-home sessions, but it did not work, so we took it off. We decided we want to try to make a sturdier version of it.

1-Hour - Code Threads and PID

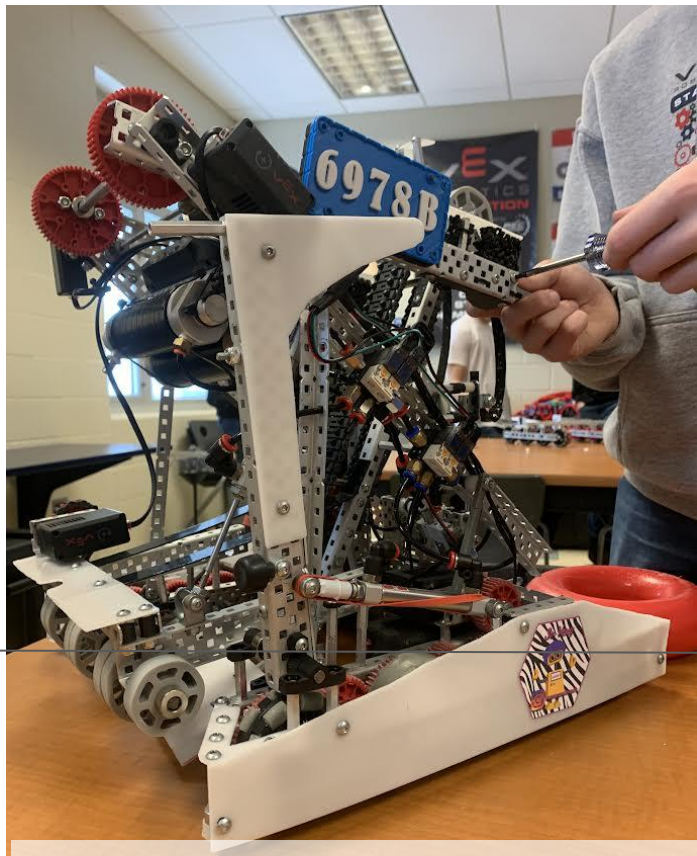
Most of this session was spent working on various developments to our C++ code, as well as learning and researching some new methods for fixing some problems.

Attendance:

- Derek, Nevin, Elijah, Miles present entire session
- Eric not present entire session

Use of Threads for Lady Brown

An issue that we had been having for a while was that we could not move our Lady Brown arm right if it were to get caught on a stake and it would also cause the robot to not receive commands correctly. The solution turned out to be using threads, a method in which two bits of looped code can run parallel to each other without interfering.



Robot as of 1/24/2025.

More PID Tuning Work

We did testing on smaller turns, and got all error down to 0.1 degrees

Date of Writing: 1/24/2025

Contributors: Nevin Zerby

Continued: 221

Practice Start - 1/24/2025

Attendance:

- Nevin, Elijah, Derek, Eric present entire practice
- Miles not present entire practice

Practice Goals:

- Drive testing/practice with fast Lady Brown scoring
- Tune drive/turn PID
- Develop autonomous program

Drive Test/Practicing & Results

Elijah did driving practice as he is the driver and needs to be prepared and used to this newer robot for the coming tournaments. While practicing with the Lady Brown, we found that we would occasionally need to change the height of it in the code. This was caused by a motor issue where the encoder values would “drag”, so we decided to start making and later tuning a PID for the lift to prevent this from happening.

Drive/Turn PID Tuning + Autonomous

We found that the best PID tuning method is to alter P, I, and D values separately and test them on 45 and 90 degrees. Our rush auton now ends by intaking a 3rd ring into a ladder touch.

Date of Writing: 1/24/2025

Contributors: Nevin Zerby

Continued: 222

At-Home Template/Odometry

During a brief at-home coding session, we had another look into the possibility of using Odometry code and/or a Vexcode V5 Pro template known as JAR Template, developed by 2775V.

Odometry: Definition and Usage

Odometry and its offshoots (Pure Pursuit, etc.) are advanced coding algorithms that base movement based on where the robot thinks it is in the field. It uses a coordinate system, and advanced odometry uses special unpowered wheels hooked onto rotation sensors to track how far the robot has moved. It could be very good for autonomous programming, especially skills, but it is very hard to get working on its own, and needs to be tuned in a way unfamiliar to us even in code templates.

JAR Template & Other Code Templates

Code templates are used to have a preset code, usually including things like untuned PID and Odometry, as well as things like RAMSETE and Pure Pursuit. The reason we might use them is for simpler tuning for an encoder-based Odometry, or to try to set up code quicker when needed. The only template available on Vexcode V5 Pro that is not exclusive to VS Code / Pros is JAR-Template, by Jackson Area Robotics.

1-Hour - Lift Work & Rush Side

This session was spent partially on working on new pieces for the lift (or Lady Brown) and partially on the Rush Side autonomous program.

Attendance:

- Entire team present entire session

Lady Brown / Lift Build Work

We decided to replace the polycarbonate pieces on the top of our Lady Brown arm with smaller pieces of Delrin, as they did not bend as much and could allow the ring to “lock” into the arm, and they were smaller so that it would catch and get stuck less in the event of a jam or otherwise.

Rush Side Autonomous Finish

Our turning PID was tuned slightly more, with the final scaling values of 0.019 kP, 0.001 kI, and 0.12 kD. With the more accurate and slightly faster turning, we were able to turn our rush side autonomous into a more theoretically correct form by making all the turns their intended degrees. It now accurately puts a ring on the first goal, turns to the next, puts a ring on it, turns, lifts the intake to score another ring, and taps the ladder.

Date of Writing: 1/27/2025

Contributors: Nevin Zerby

Continued: 224

1-Hour - Lady Brown PID & Tune

This session was spent mostly on developing a PID for more accurate and consistent Lady Brown turns and tuning it.

Attendance:

- Nevin, Elijah, Derek, Miles all present entire session
- Eric not present entire session

Developing Lift PID

We initially just took our turn PID and replaced the inertial sensor and drive motors with the rotation sensor and lift motors, but it did not work until we flipped the motor.

Tuning Lift PID

The lift PID requires less general accuracy than the turn PID, so we were able to simply just do a PI loop and run it well.

```
void LiftPID(float setpoint) {
  float error = setpoint;
  float integral = 0;
  float derivative = 0;
  float preverror = 0;
  float velo = 0;
  float kP = 0.1;
  float kI = 0.01;
  float kD = 0;
  while(fabs(error) >= 0.5) {
    error = setpoint - Rotation.position(degrees) * 0.167;
    derivative = error - preverror;
    preverror = error;
    if (fabs(error) < 10 ) {
      if(error <= 0.5 && error >= -0.5){
        integral = 0;
      }
      else{
        integral += error;
      }
    }
    velo = (error*kP) + (integral*kI) + (derivative*kD);
    lift.spin(forward, (12*velo), volt);
    wait(20, msec);
  }
  lift.stop();
  Brain.Screen.print("done");
  wait(20, msec);
}
```

Lift PID Code as of 1/28/2025.

Date of Writing: 1/28/2025

Contributors: Nevin Zerby

Continued: 225

Practice Start - 1/28/2025

Attendance:

- Nevin, Elijah, Derek, Eric present entire practice
- Derek not present entire practice

Practice Goals:

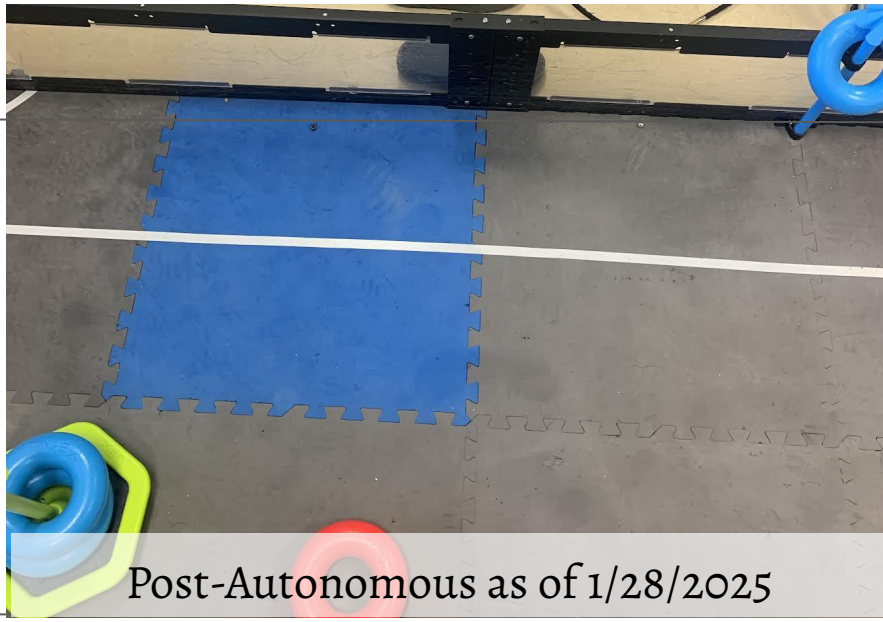
- Make sure lift PID works and tune it further
- Test faster autonomous PID
- Develop “slow side” and Skills autonomous

PID Changes & Tests

Lift PID is confirmed to work consistently now, may be able to make it more consistent by adding more variables, but unnecessary at the moment. Turn PID has been tuned enough that it can in theory turn at 99% velocity for most of the turn and still be in 0.1 degrees.

Slow Side Autonomous

With the optimized PIDs, it is now easier to code a slow side autonomous. It scores three rings as shown, but it runs out of time for a fourth.



Post-Autonomous as of 1/28/2025

Date of Writing: 1/28/2025

Contributors: Nevin Zerby

Continued: 226

1-Hour - Autonomous Alignment

Most of this session was spent doing further autonomous work, to get them as consistent and well-working as possible before the tournament on Saturday, February 1st.

Attendance:

- Entire team present entire session

Autonomous Aligning and Tools

It is very important in an autonomous program, even if you have the code theoretically perfect (none is, or could be) to have a consistent and good starting position. The best way to do this is to do it in a field-centric way, as eyeballing does not always work very well. Rings, goals, and in some cases even walls can be off-center or badly set up, so we have made ways to align both autonomous starts. For the “rush” side, we set it up directly against the sturdy wall. For the “slow” side autonomous, we made a metal bit that we can align the bot on that has been consistent on every use.

Image lost due to camera error.

Date of Writing: 1/30/2025

Contributors: Nevin Zerby

Continued: 227

Practice Start - 1/30/2025

Attendance:

- Nevin, Derek, Elijah present entire practice
- Eric, Miles not present entire practice

Practice Goals:

- Make full omnidirectional clamp
- Switch lower intake RPM from 200 to 600
- Finish match autonomous and start skills autonomous

Omnidirectional Clamp

Our clamp had the issue of more than occasionally grabbing goals at a slightly wrong angle, which would cause it to miss rings on it. Our clamp is already able to clamp corners of goals, but if it clamped off at all it would be inaccurate. We fixed this by adding screws to the axle that lies below our mobile goal aligner, and increasing the size of the spacers on them. We were unable to get a picture due to a camera error. However, this clamp fix did work and fixed our rush side autonomous.

Lower Intake RPM Switch

We switched the motor on our lower intake from a green motor to a blue motor, and reduced some friction, it works better now.

Date of Writing: 1/30/2025

Contributors: Nevin Zerby

Continued: 228

WCH Blended Tournament PT1

At the Washington CH Blended Tournament on February 1st, each team (57 teams were present) participated in 6 qualification matches. We ended up with a 6-0-0 Win-Loss-Tie.

Match 1 (Qualifier #12)
Won 36-14, paired with 45133D against 4180A and 45133F. Focus on mobile goal filling as fast as possible. AWP + Auton.

Match 2 (Qualifier #26)
Won 32-26, paired with 67410E against 14323J and 10565Z. Corner focus, but wallstakes won the match. Autonomous win.

Match 3 (Qualifier #33)
Won 34-3, paired with 62016A against 43160B and 67410B. Full mobile goals in corners scored points. AWP + Auton win.

Match 4 (Qualifier #48)
Won 37-0, paired with 45135E against 43160F and 43160N. Another game of full mobile goals in corners. AWP + Auton.

These qualifiers were less competitive than many, and so our robot's ability to rush for goals and fill them was important.

WCH Blended Tournament PT2

Match 5 (Qualifier #58)
Won 32-13, paired with 13727B against 14323K and 43160J. A mixed game, though we dominated wallstakes. Auton victory.

Match 6 (Qualifier #77)
Won 34-22, paired with 4810C against 45135B and 67410C. A slightly more competitive match, with a mix of wall stakes and goal filling, corners very contested. Autonomous + AWP won.

Qualifier Total Results & Alliance Selection
We ended up 1st out of 57 teams due to going 6-0-0 and getting 4 AWPs, so we had first pick of any team. We had talked to 45133J throughout the tournament, and they were a very well-performing but non state-qualified team who was high in the rankings and also was top of Skills. We chose them.

Round of 16 (#1-1)
Won 36-11 against 8823J and 45135C. Another game of corner goal focus, though negatives came into play. Auton victory.

Quarterfinals (#1-1)
Won 40-4 against 43160J and 43160E. Corner heavy + Auton.

WCH Blended Tournament PT3

Semifinals (#1-1)
Won 40-14 against 8823U and 45133F. Another competitive game, but lots of top rings won the game. Autonomous victory.

Finals (#1-1)
Won 32-16 against 45133K and 45133H. Very competitive game, ended up being won by autonomous and top ring covers.

Skills (Autonomous & Driver)
Ran all 3 driver and all 3 autonomous runs. Runs almost all did not go as according to plan, and so our scores ended up at a 40 for driver and 19 for autonomous, both scores we were not happy with. We found the issues with the driver runs, and in post-tournament testing managed to get up to 56, and we simply never had enough time to tune the autonomous runs, and they are planned to score 45 points when completed. Our lower skills score may have cost us excellence, but we got 3rd.

Interviews
This tournament had “open interviews”, where multiple panels of judges were available to visit, with no time limit and no second interviews. We managed to go over everything slowly.

WCH Tournament Reflections

Once again, match and build metas did not seem extremely different from this tournament, but there were a few things that stood out. We also realized just how valuable autonomous is, and how important it was that we finally got a consistent AWP autonomous, as it won us multiple matches and put us in 1st.

Team Inspirations

Our alliance partner, 45133J, had a working ring rush mechanism and a better “fingernail” mechanism than we did, and we plan to make similar ones to both of those.

Design & Notebook Ideas & Review

We all agreed that our interview was not one of our best, and may have been why we did not get the Excellence award. There is a lot that could be changed, in both the book and interview. The interview could have been far more concise and planned out, and the book simply needs some revamps that take time.

Overall Results & Awards (State Qualifying)

We ended up winning Tournament Champions with 45133J, as well as 1st in qualifiers, 3rd in Skills, and the Innovate award due to our submission for our unique omni-directional clamp.

Practice Start - 2/4/2025

Attendance:

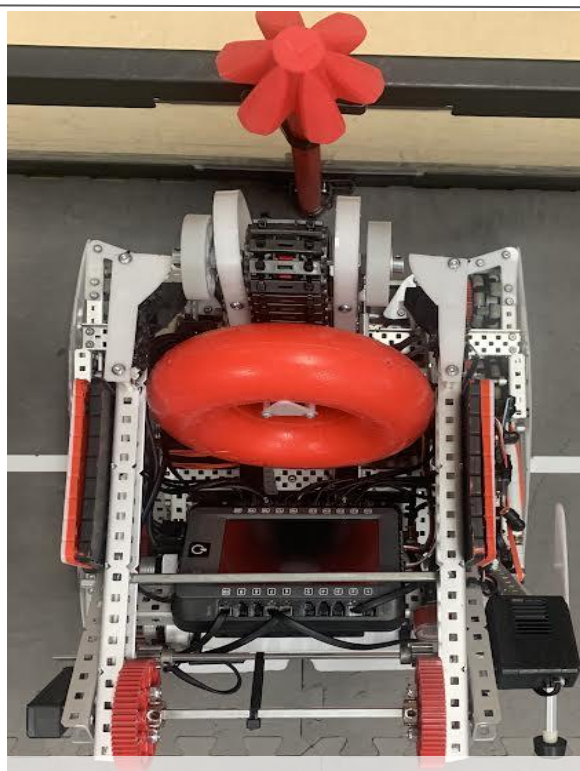
- Nevin, Elijah, Derek present entire practice
- Miles, Eric not present entire practice

Practice Goals:

- Polish and finish Skills Autonomous
- Ensure “ring-side” autonomous works
- Driving / Lady Brown practice

Skills Autonomous Complete?

After tuning and running more math on our skills autonomous program, we can successfully score 35 points provided it is set up correctly. This is a good score, and since we are now at max speed on both our drive and turn PIDs, it might be the best we can currently get, though we are working on getting an additional 5 by putting a goal in the corner.



Skills Setup as of 2/4/2025.

Other Testing

The ring-side autonomous still works. More driving practice.

Date of Writing: 2/4/2025

Contributors: Nevin Zerby

Continued: 233

Practice Start - 2/6/2025

Attendance:

- Nevin, Elijah present entire practice
- Eric, Miles, Derek not present entire practice

Practice Goals:

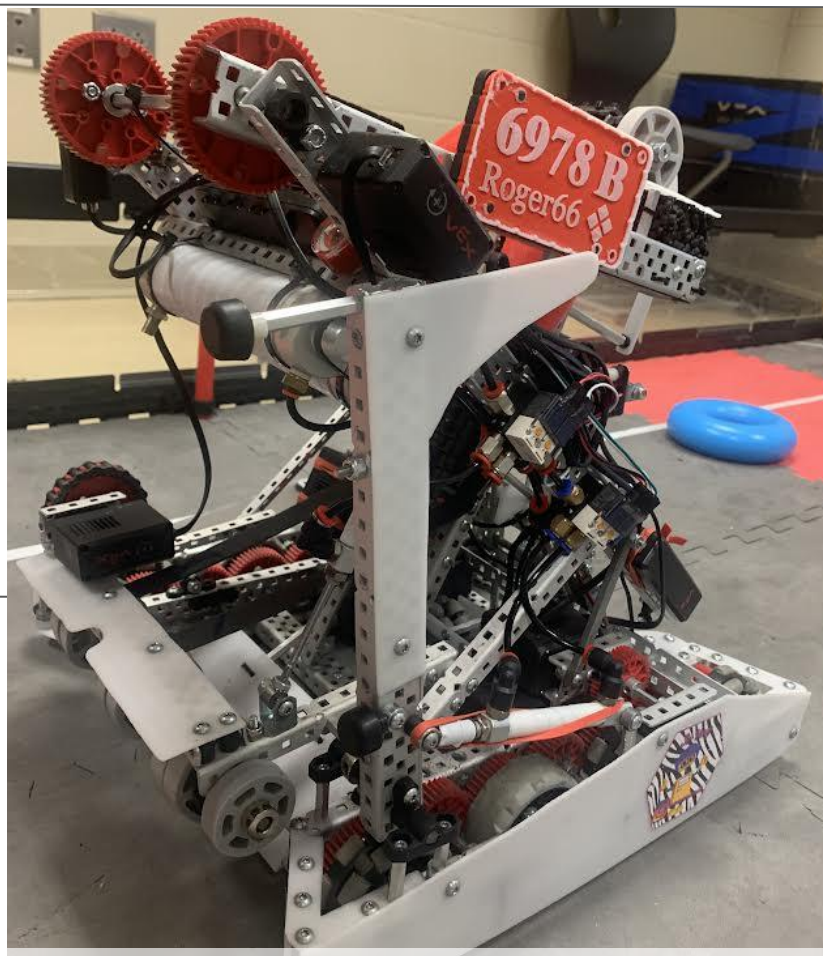
- Tune Lady Brown build and code again
- Scrimmages
- Prepare for tournament

Lady Brown Final Tuning

We finally got the Lift PID fully working, and it is now very consistent. Also, we removed a standoff from under the bit of mesh on it, and it now has much more ring tolerance.

Practice & Preparation

We did some more driving and Lady Brown practice, and it did go well. However, there was a bit of accidental damage done.



The Robot as of 2/7/2025.

Date of Writing: 2/7/2025

Contributors: Nevin Zerby

Continued: 234

1-Hour - Robot Prepare/Repair

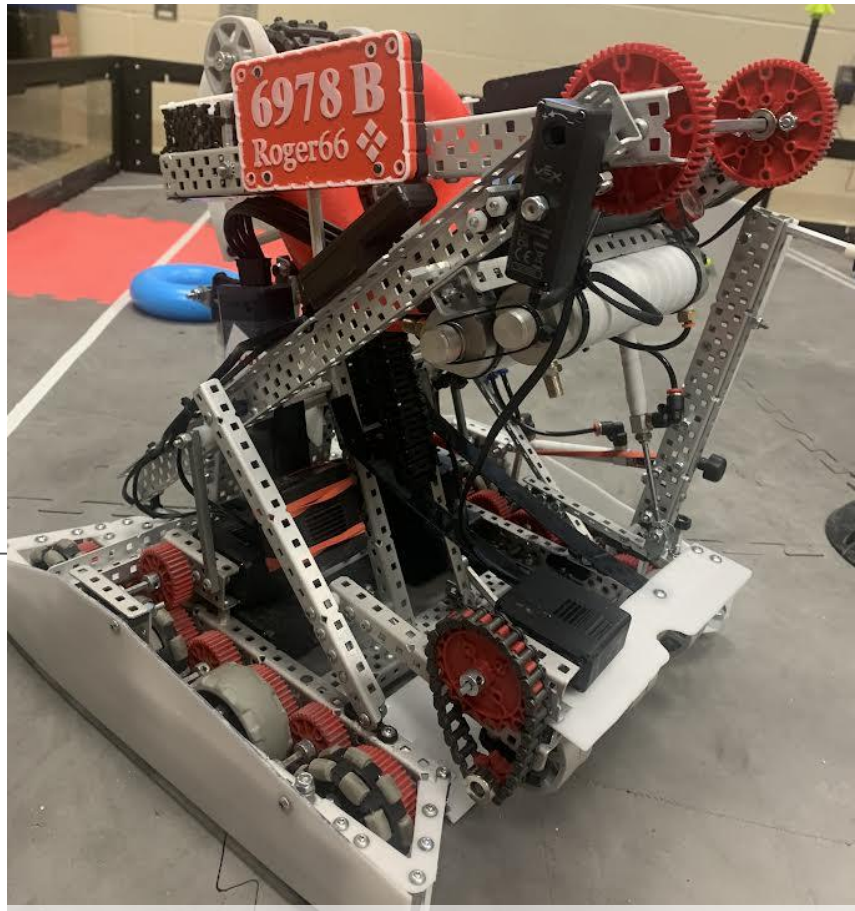
Most of this session was spent between fixing the damage that was done to the robot, some was spent going through brain updates, and the rest was general tournament preparing.

Attendance:

- Entire team present entire session

Damage Fixing

We worked on fixing the damage onto the bot from the practice that happened yesterday. Due to some issues with the field, we ended up taking a lot of damage to our wallstake bit. We fixed it by replacing the bars and zip-tying some parts for additional support.



The Robot as of 2/7/2025.

Brain Update & Preparation

We went through a brain OS update, which changed some code, but we fixed it quickly. We drove some and are ready.

Date of Writing: 2/7/2025

Contributors: Nevin Zerby

Continued: 235

Highland HS Tournament PT1

At the Highland High School Tournament on February 8th, each team (51 teams were present) participated in 6 qualification matches. We ended up with a 6-0-0 Win-Loss-Tie.

Match 1 (Qualifier #2)
Won 49-14, paired with 6008A against 4805B and 6741S. Focus on corner control. Autonomous and AWP won.

Match 2 (Qualifier #18)
Won 16-0, paired with 45434V against 45434E and 6008G. Wall stakes were strong on points. Autonomous and AWP won.

Match 3 (Qualifier #34)
Won 22-6, paired with 45434M against 6978V and 6008X. We had a majority on top rings, winning it for us. Auton and AWP.

Match 4 (Qualifier #43)
Won 37-18, paired with 11124X against 3264E and 14760A. Our autonomous got us a lot of early points. Auton and AWP.

This competition was much more competitive than the last, but we were also stronger wallstake and autonomous scorers.

Date of Writing: 2/11/2025
Contributors: Full Team
Continued: 236

Highland HS Tournament PT2

Match 5 (Qualifier #61)
Won 42-8, paired with 6008P against 6978W and 6978D. We were able to take advantage of corners early. Auton and AWP.

Match 6 (Qualifier #67)
Won 36-18, paired with 6008D against 6403Z and 14760B. Varied scoring match, but wallstakes helped. Auton and AWP.

Qualifier Total Results & Alliance Selection
We ended up 2nd out of 51 teams with a 6-0-0 Win-Loss-Tie and 6 AWPS, the maximum amount of Win Points. The only team ahead of us was 6008A, who had an identical record, but more Strength of Schedule points. We discussed with a lot of teams including 11124X and P, multiple 6008 teams, and 45434V. We ended up pairing with 45434M, due to their intake.

Round of 16 (#5-1)
Won in points 42-0 against 6008H and 6978W, but we were disqualified due to double possession after an opponent placed a goal just next to 45434M, causing them to mistakenly ram it and possess it. The official score was 0-0, and counted as a loss, so we did not move on to Quarterfinals. Auton won.

High. Tournament Reflections

This was an interesting tournament, as while we performed extremely well in qualifiers (better than expected), we also came in second due to having a very good schedule. We learned a lot, including to be more careful to avoid being disqualified, as we believe we had a very good chance at winning the whole tournament. Congratulations to 6008D/X.

Team Inspirations & Apollo One (6008A) Interview

The 6008 bots seem to mostly have been rebuilt, all to similar structures of smaller bots with vertical Lady Brown mounts. The strategy is interesting, and seemed to work for them, as they were some of the best performers. We may look into it.

After the tournament, we had a brief interview with 6008A, as they were the Skills, Qualifier, and Excellence winners at the competition. They suggested we switch to VSCode PROS and LemLib, which we were unable to previously due to school rules. We may bring an extra computer for that.

Skills Results

Our skills results were not great, and likely cost us awards. We ended with a 52 Driver, but due to build/glitches, a 3 Auton.

Date of Writing: 2/11/2025

Contributors: Full Team

Continued: 238

1-Hour - Reconfiguring Robot

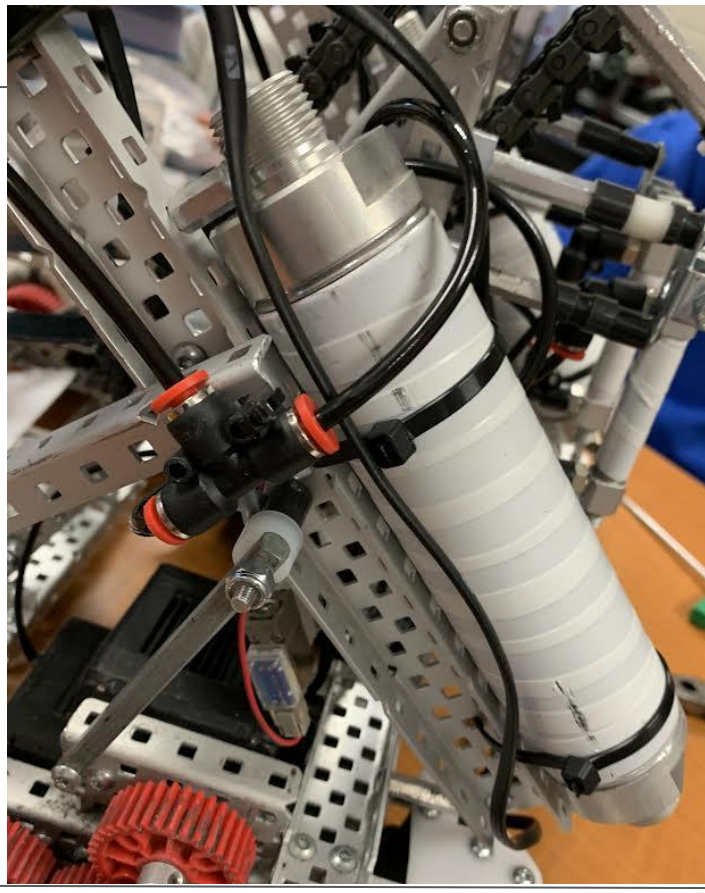
Most of this practice was spent on generally reconfiguring the robot by moving tanks (weight distribution), rewiring, and finding a new spot for battery mounts and such. All present.

Tank Movement and Reasoning

We decided it was necessary to move our tanks, as one of the only major problems we have been able to find with our robot recently was that it had a tipping issue, which we determined to have been caused by the robot being top-heavy. We realized that the best way to fix this would be to move the battery and the air tanks lower and further out.

New Battery Mount

Another thing we needed to do was find a new battery mount. We found that the best spot to put the tanks were on the back sides of the Lady Brown mount, which would conflict with where the battery was placed beforehand. We found that we can put it on the front of the bar, held by standoffs and zipties easily.



Date of Writing: 2/12/2025

Contributors: Nevin Zerby

Continued: 239

Practice Start - 2/12/2025

Attendance:

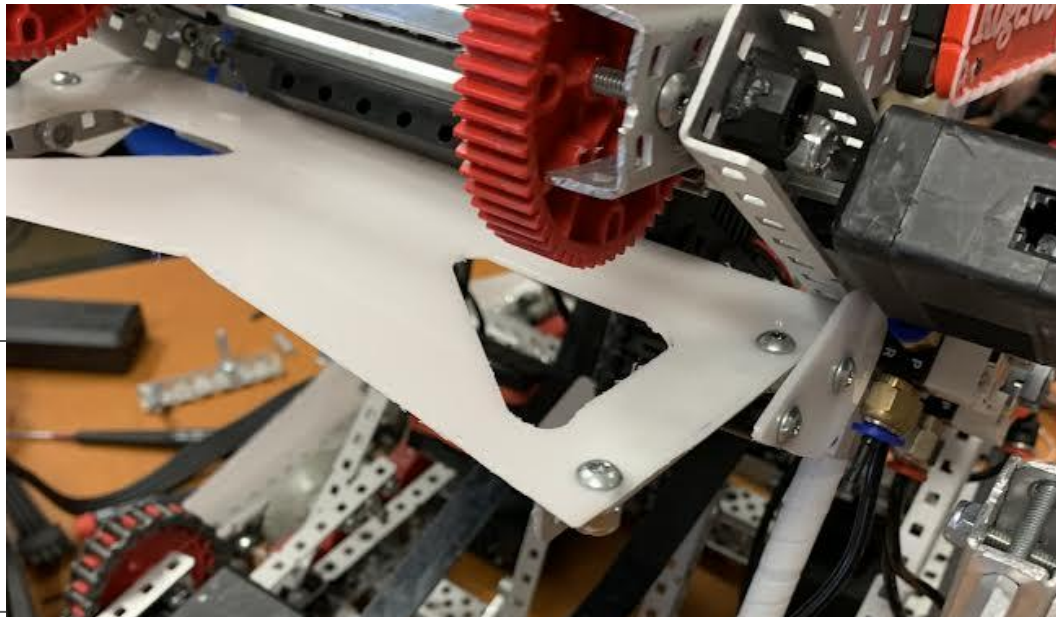
- Nevin, Elijah, Derek all present entire practice
- Eric, Miles not present entire practice

Practice Goals:

- Create new guider for our Lady Brown
- Finish rewiring

Creating a new “Guider”

We initially had one on the front of our intake, a piece of Delrin that was cut specially to fit around wallstakes for easier robot placement. We decided that it would be best to take that off, and put on a higher, much broader one near the mounting of the Lady Brown. We made it with a broad, hand-cut Delrin piece that we mounted with other small, screwed in pieces. It seems to be much better.



Rewiring Progress

We finished re-wiring the robot / brain.

Date of Writing: 2/12/2025

Contributors: Nevin Zerby

Continued: 240

Practice Start - 2/13/2025

Attendance:

- Nevin, Elijah, Derek all present entire practice
- Eric, Miles not present entire practice

Practice Goals:

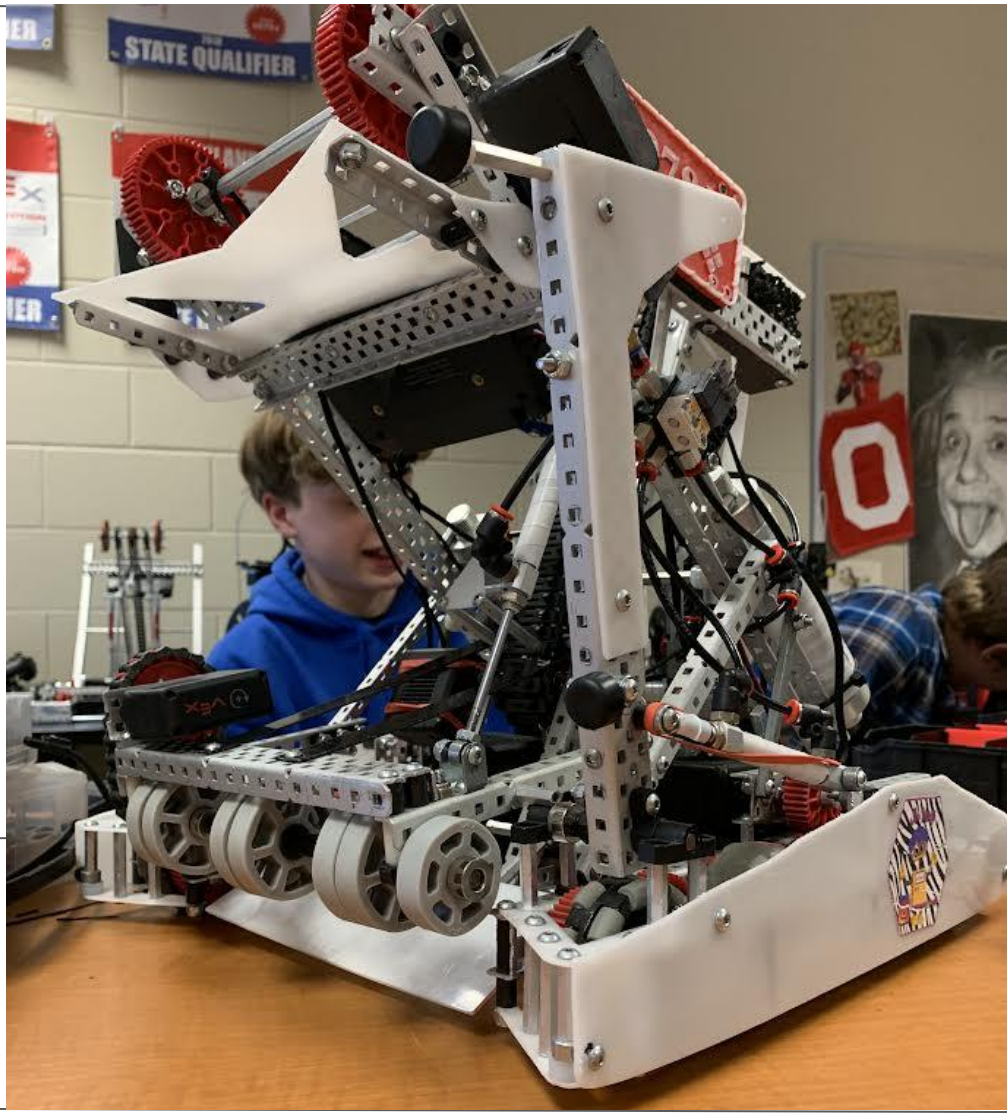
- Work on a 5-ring autonomous program
- Code new wiring on robot

5-Ring Autonomous

We re-tuned the drive PID slightly so that it could be more accurate at the highest speeds, and with this extra time saving we were able to develop a consistent 5 ring autonomous with a color sort installed.

Wiring / Code Finished

All the wiring code is now completely done.



Date of Writing: 2/13/2025

Contributors: Nevin Zerby

Continued: 241

1-Hour - Goal Rush Autonomous

We spent most of this session developing the start of a goal rush autonomous with the doinker. The purpose of this is to be able to beat faster opponents to the center goal in auton.

Attendance:

- Nevin, Derek, Eric, Elijah all present entire session
- Miles not present entire session

Autonomous Pathing Decision

We decided to go with a very simple autonomous pathing, as it would be the quickest and the most efficient in practice. We simply set up the robot facing the middle goal, and it drives towards it (intaking and throwing out the first ring, keeping the second, and later throwing out the third) and grabs it, pulls it back, turns, scores the kept ring on the other goal, turns, grabs the first goal again with the clamp, and proceeds to intake the preload (placed next to the bot initially) and then turns, puts up the lifter, grabs the upper center ring, and then touches the ladder. We chose this pathing because it is (at least as far as we know) the safest, fastest, and most efficient way to get an autonomous win point on the goal side. If we beat the other teams to the goal, they will also score less and potentially fail.

Final Competition Prep (Milford)

Attendance:

- Nevin, Elijah, Derek all present entire session
- Eric, Miles not present session

Programming Progress

Finally got our color sort fully working in both driver and autonomous in all 5 of our robot programs. Additionally, we made sure that the 5-ring autonomous programs are fully consistent, and are almost done developing a goal rush code that could be finished during the tournament.

Build Progress

We started building a second doinker, made specifically for taking single rings from the corner as well as doing a ring rush. Additionally, the Lady Brown guide is fully consistent now as well. We do not have much time left, but we should be ready for Milford when we go.

Notebook Chapter Six States & Preparing Pages

This section goes over the various design, build, programming, strategizing, writing, and other changes we are going through to try to prepare us as best as we possibly can for when we go to the Ohio State Championship on March 15th, 2025.

Cancellation & New Schedules

Our trip to Milford was regrettably cancelled last minute due to a weather advisory being placed on our area, and our school not being able to legally send us.

There have been some schedule changes, and as we are nearing the end of the season, here are the following things we have left on our schedule, as well as some possibilities

Guaranteed:

- Practice Schedule stays the same, however should be more productive / field focused due to several of our teams not qualifying for states and not being there to use the field
- Ohio State Championship on March 15th, 2025.

Possible:

- North Union Late Season Scrimmage on March 1st, 2025. This is on our list, and we may sign up our state qualified teams (B, Y, E) to go, though it depends on their availability.
- High School Worlds in May 2025. If we manage to qualify for worlds, we will go unless there is a sudden, terrible circumstance for all of us or a financial difficulty. We do plan to go if we can, and compete for as long as possible.

Notebook/Interview Changes P1

We have come together both as a team and as a robotics organization to discuss what we should do in the future with our notebook and our interview strategy, as one of the best ways to attempt to qualify for Worlds is to get a Judged Award, and those are very important and very heavily rely on the quality of our team's book and interviews.

An extremely important part of this is making sure that we can follow and fit the rubrics for both the Engineering Notebook and for Interviews so that we can explain our processes more effectively and also have a higher chance at obtaining a judged award and achieving a worlds spot from it.

CRITERIA	PROFICIENCY LEVEL EXPERT (4-5 POINTS)	PROFICIENT (2-3 POINTS)	EMERGING (0-1 POINTS)	POINTS
ENGINEERING DESIGN PROCESS *All Awards*	Team shows evidence of independent inquiry from the beginning stages of their design process. This includes brainstorming, testing, and exploring alternative solutions.	Team shows evidence of independent inquiry for some elements of their design process.	Team shows little to no evidence of independent inquiry in their design process.	
GAME STRATEGIES *Design, Innovate, Create, Amaze*	Team can fully explain their entire game strategy including game analysis.	Team can explain their current strategy with limited evidence of game analysis.	Team did not explain game strategy/strategy is not student-directed.	
ROBOT DESIGN *Design, Innovate, Build Create, Amaze*	Team can fully explain the evolution of their robot design to the current design.	Team can provide a limited description of why the current robot design was chosen, but shows limited evolution.	Team did not explain robot design, or design is not student-directed.	
ROBOT BUILD *Innovate, Build, Create, Amaze*	Team can fully explain their robot construction. Ownership of the robot build is evident.	Team can describe why the current robot design was chosen, but with limited explanation.	Team did not explain robot build, or build is not student-directed.	
ROBOT PROGRAMMING *Design, Innovate, Think, Amaze*	Team can fully explain the evolution of their programming.	Team can describe how the current programs work, but with limited evolution.	Team did not explain programming, or programming is not student-directed.	
CREATIVITY / ORIGINALITY *Innovate, Create*	Team can describe creative aspect(s) of their robot with clarity and detail.	Team can describe a creative solution but the answer lacks detail.	Team has difficulty describing a creative solution or gives minimal response.	
TEAM AND PROJECT MANAGEMENT *All Awards*	Team can explain how team progress was tracked against an overall project timeline. Team can explain management of material and personnel resources.	Team can explain how team progress was monitored, and some degree of management of material and personnel resources.	Team cannot explain how team progress was monitored or how resources were managed.	
TEAMWORK, COMMUNICATION, PROFESSIONALISM *All Awards*	Most or all team members contribute to explanations of the design process, game strategy, and other work done by the team.	Some team members contribute to explanations of the design process, game strategy, and other work done by the team	Few team members contribute to explanations of the design process, game strategy, and other work done by the team.	
RESPECT, COURTESY, POSITIVITY *All Awards*	Team consistently interacts respectfully, courteously, and positively in their interview.	Team interactions show signs of respect and courtesy, but there is room for improvement.	Team interactions lack respectful and courteous behavior.	
SPECIAL ATTRIBUTES AND OVERALL IMPRESSIONS *Judges, Inspire*	Does the team have any special attributes, accomplishments, or exemplary effort in overcoming challenges at this event? Did anything stand out about this team in their interview? Please describe:			TOTAL POINTS

This also means that we will change it.

Date of Writing: 2/18/2025

Contributors: Full Team

Continued:

Notebook/Interview Changes P2

After coming together as a group, we have all collectively decided on a few things that must happen to become a better team, especially in the organization, design, and clarity areas.

Interview Tactics - Rubric Reconsideration

We were previously loosely following the old rubric, and now that we have full access to the new one, we will do a full-team study of it and make sure that all of us spend set amounts of time (perhaps on a script) going over each subject in the rubric so that we can convey as much as possible during our limited interview times, impress the judges, prove team organization and design integrity, and hopefully win awards. We will still follow a similar interview structure (Nevin on code and notebook, Elijah on design, and Eric/Derek/Miles on various building specifications), but we want to refine it so that we specifically go over the things on the list and do so thoroughly.

Team Notebook Awareness

We have understood as a team since the start that the notebook has mostly (almost entirely) been handled and managed by Nevin, and the team plans to work together on the future pages to ensure an all-round view and full coherency.

Notebook/Interview Changes P3

Notebook Organization/Formatting Change

Various organizational changes will be made to the notebook,

Date of Writing: 2/18/2025

Contributors: Full Team

Continued: