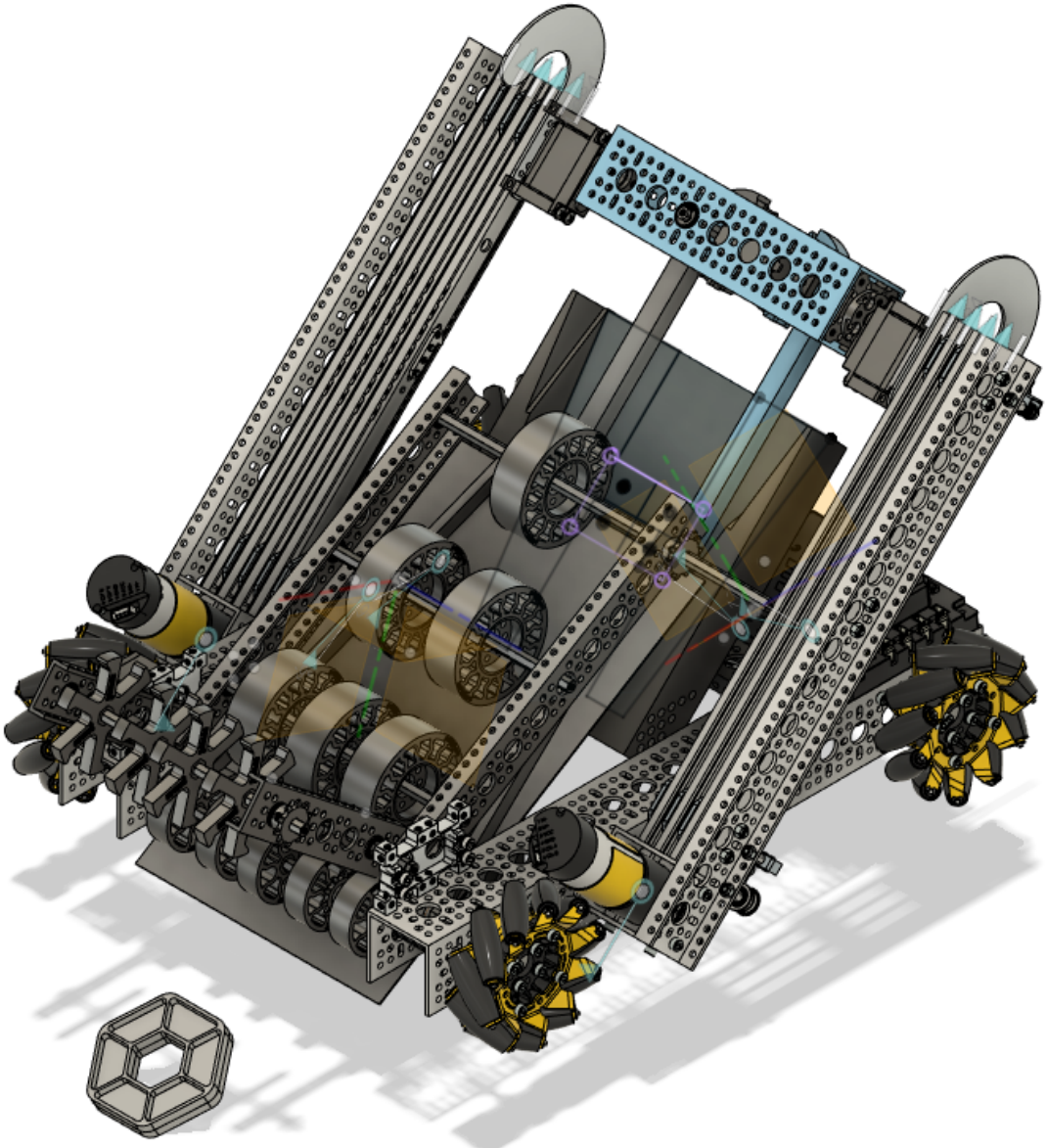
WOLVES ROBOTICS ENGINEERING PORTFOLIO 2023/2024

#5661



FIRST TECH CHALLENGE

CENTERSTAGE℠

Team Introduction

Who Are We?

We are **FTC team #5661 ~ Wolves Robotics 1 (Varsity),** located in Goodyear, Arizona at Estrella Foothills High School.

We are a **non profit team** and solely rely on concessions during home games, merchandise, sponsors, and donations. Our team hopes to provide a chance to learn **important life skills** such as teamwork, communication, leadership, and self confidence.

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The EFHS Engineering Club was founded by our first president Sarah Charles during the 2010-2011 school year. While planning activities for the year, robotics was of high interest. The first robots were made from a kit of parts and they were front loaders. Being a new club, we did not have a lot of money and the kit robots were affordable and fun. The students were excited to build and race their robots, but the desire to do more was great. After a TV special about FIRST robotics, the future was clear. Fundraising began, a rookie team grant got us our first set of parts, and the rest is EFHS robotics history!

Meet the Pack

Our Coaches:

Mr. Matteson
Head Coach
Years Mentoring: **5**

Mr. Lynch
Assistant Coach
Years Mentoring: **4**

Our Members:

Deagan M.
Junior
Years In FTC: 3

Samantha C.
Junior
Years In FTC: 3

Derek L.
Junior
Years In FTC: 3

Luis V.
Junior
Years In FTC: 3

James B.
Junior
Years In FTC: 2

Baden A.
Junior
Years In FTC: 3

Shawn S.
Junior
Years In FTC: 2

Brendan L.
Senior
Years In FTC: 3

Post 2023 Season Thoughts and Goals

Main Problems:

The 2022-2023 season was overall not very good for our team, however you can't have success without failure. This season had many things that went wrong which can prove to be major learning points for us. Some things I believe as a team we could work on were: Communication, Teamwork, Organization, Planning, and Participation.

Next Season Goals:

*These were quotes from our members

My personal goal for the following season was to spend more time focused on our notebook / portfolio as that was our most lackluster part of the season. I had reached out to team #18625 (Trivium Nightmares) on tips on how we could improve our portfolio and one of the members had recommended a video they created to help teams build their portfolio. These tips helped seriously improve my vision on our portfolio. - Luis Valledor

My goals for this season are to utilize the engineering design process in our robots development and focus on sponsors and the notebook - Ethan Huskinson

Our 2022-2023 season was full of mistakes that negatively affected our seasonal performance. Thankfully, we were able to note all of the mistakes we made throughout the season and take the opportunity to learn and grow from them. We noticed large mistakes, such as assigning roles like “Notebook Lead,” that put a stop in our progress. We still took note of our smaller mistakes, like not ordering new parts, as they harmed our performance and made us replace components more often than needed. Our main goal is to apply our improved teamwork and mechanical skills to this season. - Deagan Miller

Outreach

SkillsUSA:

On April 11 - 12 many of our members competed in the Skills USA for the Urban Search and Rescue. This event was quite the fiasco for our team but in the end they were able to problem solve their way through it. Originally our members wanted to use the FTC Power Play bot, but decided to disassemble the bot because the chassis wasn't up to their standards. In the process of rebuilding the chassis they realized that the bot wasn't going to be fully coded in time for the event and decided to use a VEX robot. Here's the final thoughts from one of our members who competed: "We built a center wheeled drive vehicle and that worked horribly at the competition. Because of the center wheel drive, the car couldn't get any power on the front wheels when it went up the ramps. We found out that tank treads and big RC car like wheels were perfect for a competition like this. Deagan and I didn't place so well after completing all the trials and final tests. We finished 2/5 trials. We re-learned that time management and materials are a big part of robotics" - Derek Lara

Steam Camp:

From May 22 - 26 we went to our local middle school **Westar Elementary** to work the robotics section of steam camp. Every day from 8:30 to 2:30 we worked with kids from kindergarten up to grade 6. During this we pushed the ideologies of **FIRST Robotics** such as teamwork, engineering, and creativity. The biggest goal for most groups was to build their robot **VEX** kits and drive them. The Kids who were in Kinder to 1st grade built with Legos so they can have a beginner mindset when it comes to building. The kids from 2nd grade to 3rd grade built the chassis of the robot while we had the arm already prebuilt for them. This allowed them to work at their rate and be able to drive their bot. From 4th grade to 6th they built their full robots with assistance from us. Overall this helped us show our community what we as a team do and have the kids excited to pursue engineering in the future.

Outreach

Club Rush:

On August 18th we had a robotics section at our schools club rush. Club rush is an event held at our school where over the course of our both lunches all of the clubs our school offers is in the auxiliary gym with creative posters and displays of the club. We set up our tent for robotics with our wolf ears on top, handed out flyers detailing what the club was and what it offered, and we had a small field with 2 drive bots where people could come test and drive the robot. This helped reach out to our new freshman more and we got plenty of early signatures of people who were interested.

We decided that the lab needed a little rearrangement this year and we decided to move the shelves to better maximize space and find items easier.

Kickoff:

Kickoff was very special for our team this year. This was our first kick off that we could attend as a team. We arrived at our school bright and early at 6:30. When the game was shown for the first ever time we all knew this game was going to spark some very interesting ideas. The game seemed much more technical and creative with many ways to fit several components onto the robot.

HOCO Parade:

Our team decided to partake in our homecoming parade. During this we spent our time in robotics creating banners to showcase our club. we also went to one of our team members house to fill up balloons and fully decorate our float for the parade. this helped push our club out more to the school and brought in a few new members.

Fundraising

Booster Club:

This season we were in need of money and made it one of our goals to get some cash to buy some new parts. We decided one way we can help our club and keep our parents apart of it too is starting a booster club. We started a booster club where our parents could donate to help us with purchasing all the things required to run the club. These include: new **goBILDA** parts for our bot, Hotels for long distance competitions that require us to stay the night, team lunches/dinner, and much more! Additionally, the money parents send are for tax credit so they get their money right back into them!

@efhsroboticsboosterclub

Sponsors:

Sponsors were also equally as crucial this year and we decided that our sponsorship portfolio could use a redesign from freshman year. Once we had created a new portfolio (check it out here!) we sent it out to our sponsors. We created tiers so companies could donate to us and they would get rewards based on the amount they send. Our sponsors are listed below!

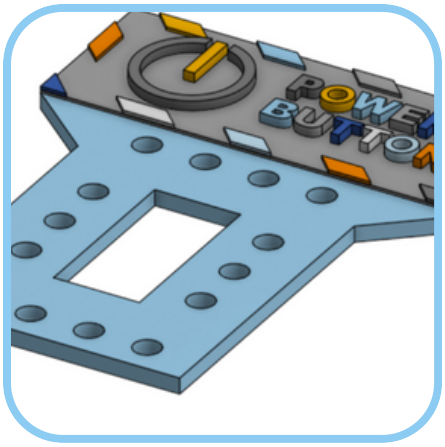
WEST COAST AUTOMATION

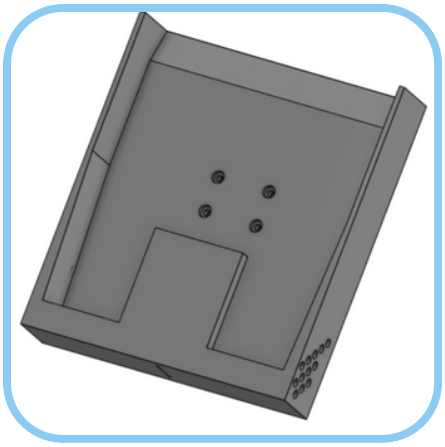
HICKMAN'S FAMILY FARMS

TRANSWORLD Business Advisors

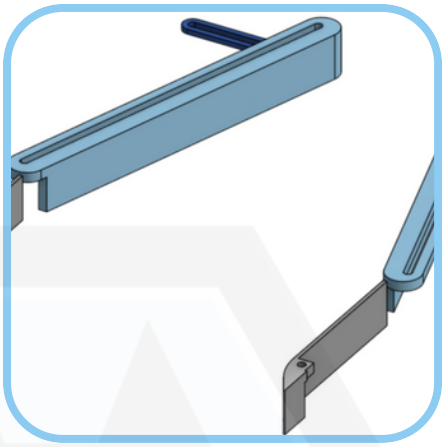
Engineering Process

CADing:

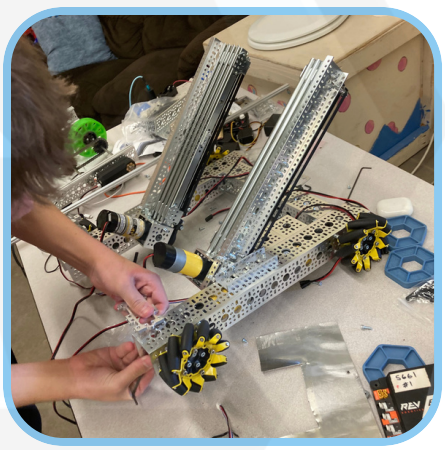




This year we decided to use Computer Aided Design (CAD) to build our robot in a virtual space before building it for real. So, all we need to do when we start our meetings is put it together like a Lego set. At first we were using **Onshape** because it was free and you can use it in your browser but we quickly realized we were limited by the software, so we switched to **Fusion 360**, by using their assembly mirroring tool and other features. The downside with **Fusion 360** is that you need a beefy computer to run it and that it is a .exe program which we can t run on our school computers. Now, we use both **Onshape** and **Fusion 360**. We use Fusion 360 for our assembly of our bot. We use **Onshape** for quick CADing and CADing at school since we can use it on any computer with internet.
We decided to 3D print our axles for our intake because we couldn't get metal parts. We quickly realized that was a bad idea and asked our friends at Trivium if we could get some and they graciously gave us some.



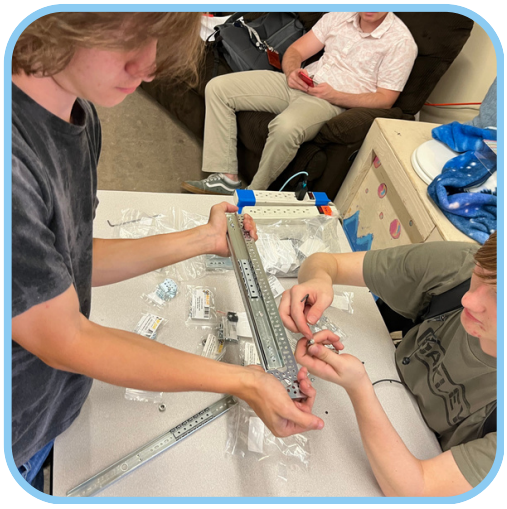
Chassis:



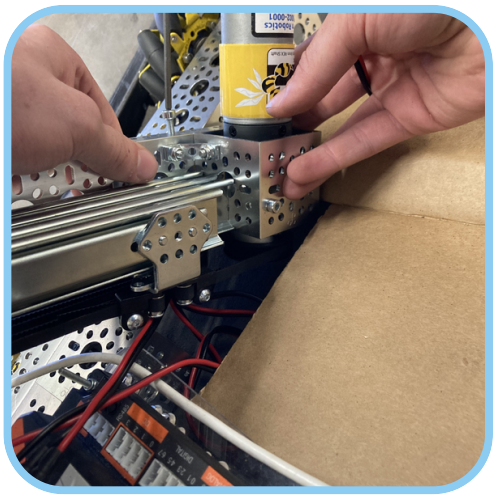
To familiarize ourselves with the new goBILDA parts, we followed the Strafer Kit Instructions. We put together the chassis and figured out how the motors could be placed inside the bars. Eventually, we realized that the Stafer Kit was too wide for our end goal design, so we replaced our width bar with a smaller width bar, allowing us to stay within the 18x18x18 inch constraints while ending up with the design we intended on competing with.

Engineering Process

Arm:

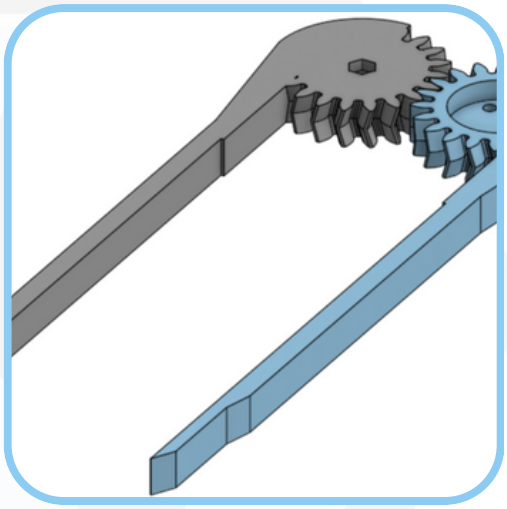


We ordered two linear slide kits and assembled them whilst following the instructions. We weren't familiar with these new linear slides, but we eventually figured out that we could attach them to the robot at an angle. This would be a huge advantage because the backdrop for the pixels is set up at a 60 degree angle. The closest we could get was a 45 degree angle, so we needed to figure out how to make up those last 15 degrees to get a controlled pixel drop. The linear slides were far enough apart that another goBILDA bar could be attached between them. We used the advantage of placing servos inside the bars to attach a servo onto each side of the bar. This allowed us to rotate the bar separately from moving the linear slides. That solved our 15 degree problem, all while providing us with an area to attach our 3D printed claw.



Claw:

For a claw we decided to go with 3D printing as it allows for more options on how we can build it and provides several new and creative ideas to grab pixels out of our storage area. Our designs had a few slight changes where we printed our sticks to our claw to be too short or too long and it would cause problems.



Engineering Process

Re-Designs:

For Re-Designs we had an issue in our pre season where we could only pick up one pixle at a time, so we decided to add foam to the claws so we'd be able to pick up two at a time. For the Drone launcher we had an issue where the drone would break due to the rubber-band and wouldn't launch. We designed a 3d printed launcher inspired by team 503 Frog Force. We designed the drone launcher to fit inside a single u-channel and use a servo to launch. After our last competition, we redesigned our tilting arm due to a shot servo so we 3d printed servo brackets out of carbon fiber nylon and PLA CF which allows us to use a servo saver from gobilda. This also allows us to use one servo instead of two. We used Carbon fiber material to make sure the parts wouldn't break instead of brittle PLA teams usually use.

Software Processes

Autonomus:

Starting off this year we experimented with several systems to aid in general autonomous systems, from Vuforia (before it was removed), Tensorflow, AprilTags, dead wheels, etc. We found that each of these methods is applicable to a specific portion of autonomous. Our first approach was to use Tensorflow for prop recognition, however, due to the immense scale of data required for accurate detection, it was put on the backburner. After the game was revealed, there were 2 obvious options for prop detection: some sensor or Tensorflow. As said earlier, Tensorflow wasn't really an option, so we opted first for a color sensor which didn't really work out due do external factors, then an MR range sensor. This proved to be quite accurate and is the method we use for detection currently. The next issue was accuracy. This season we obtained dead wheels for localization, which meant we could use **RoadRunner**, a popular path following kinematics library which includes localization math. This meant for autonomous we could use accurate path following for complex detection algorithms. The general idea behind our current iteration is to check 2 positions at the same time by aligning the robot to face both, then following pre-set paths to place the purple pixel and same for golden pixels.

TeleOp:

Compared to Autonomous, TeleOp is much simpler. To make writing both programs easier, we followed a common practice of encapsulating most robot logic in separate classes that is common between both Autonomous and TeleOp. This didn't leave much code for TeleOp, which led us to develop more driver assistances to make scoring easier. The first assistance came from researching roadrunner and allows the robot to auto-align with the board and transfer robot control to the "placer." After they finish placing the pixel, control is automatically switched over to the "driver" and the slide, arm, and claw are reset. This led to rapid placement and intuitive control. Another assistance added to avoid error is collision avoidance. This system relies on robot localization to avoid colliding with pre-programmed areas on the field, like the backdrop to avoid running into it accidentally. All these systems helped make the drivers perform at their fullest.

Competitions

Scrimmage:

Our first time sending our robot into action was at Trivium Prep. Academy where our robot exceeded our expectations. Overall, out of 5 matches that we played we won every single one. However, even with all of the success we had many improvements that we needed to work on. First being our plane would fire extremely fast and high into the crowd. Second, our intake system had no way to prevent picking up multiple pixels at once, and last, our robot's autonomous failed at placing the pixel at the correct April tag. Overall, we were very lucky to have this opportunity at Trivium that showed what we were already good at and what we needed to improve on before the Roadrunner Qualifier on 11/18.

Road Runner Qualifier 11/18:

This competition gave us a lot to work on as a team so we could be better. Many problems arised such as: The drone launch failed every time, our robot would collide with others in the autonomous phase, poor driver communication, broken servos, bad batteries, and much more. We couldn't be more happy about this outcome though. As an engineering team, all of these problems and issues are exactly what we wanted as it gives us many things to work on in our off-time before our next competition. We created an improvement section in our team group chat so we could all work together to make our team the best it can be. Even with all of these minor mistakes and flaws we placed 2nd after qualifiers going 5-0 and became a finalist team captain. During this competition our drive team decided to go dressed like "Men In Black" so our team would be much more recognizable and help make our team more noticed this year by other competing teams. this would also push the recognizability of our team helping out our sponsors.