Iron Horse Robotics

#13900

We spread interest in STEM, succeed in the challenges with which we are faced and exhibit gracious professionalism while accomplishing our tasks.

Philip Simmons High School
3080 River Village Drive
Charleston, SC 29492

Our Team




Brian S

Cullen S

Dylan C

Ethan R




Erik P

Joseph B

Luis N

Nick J




Olivia T

Sam S

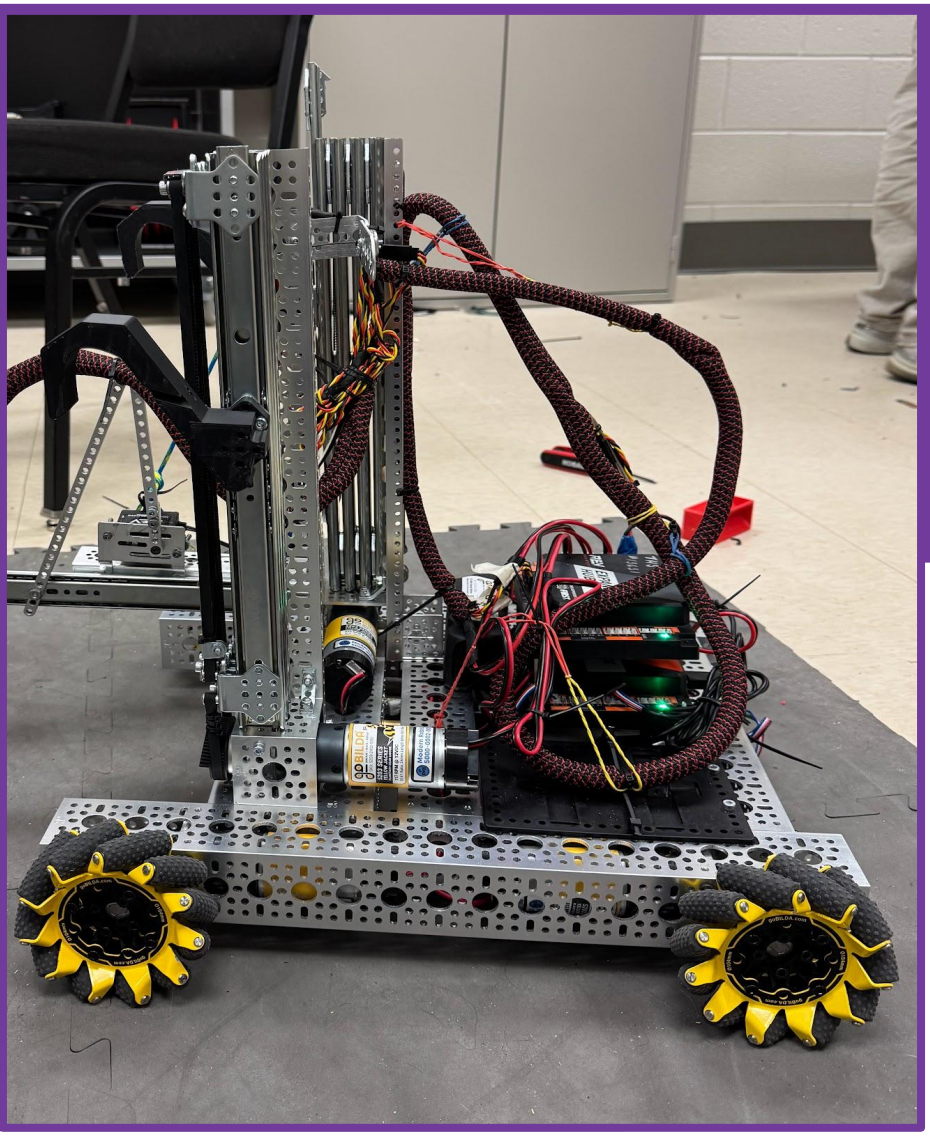
Spencer F

Thomas T


Coach Sablotsky

Coach Stambaugh

Our Robot



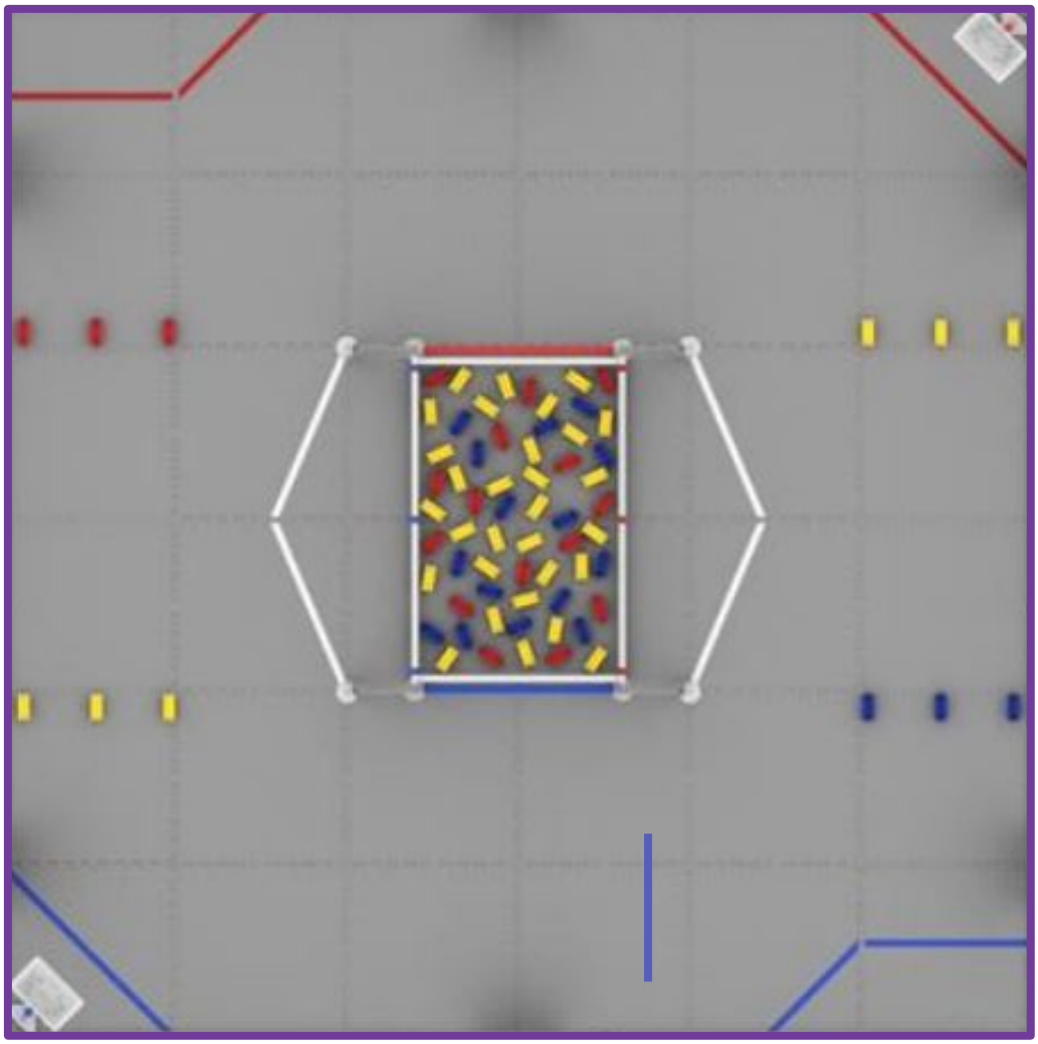
Description:

This year's robot is built on a GoBilda mecanum drive train featuring a sample claw and two retracting hooks. We've built two independent slides on either side of the robot, powered by yellowjacket motors. The slide on the right side of our robot has a 3D printed hook attached which is used to suspend on the lower bar. The slide on the left side of our robot features a built arm with a 3D printed claw. The claw arm uses a four hex motor to tilt the arm assembly forward and a servo is used to extend the arm out. Finally, two servos are used to rotate the 3D printed claw at the end of the arm assembly.

Our Game Strategies

Summary:

Our game strategies primarily focus on placing samples in the tiered-bucket. We are confident that we can place samples in the upper bucket to score the most points. We also have a fully functioning system for suspension on the first rack. We have decided not to go for points for configuring specimens to place on the horizontal beams.



Autonomous:

For the autonomous section we will be focusing on picking up and placing samples in the upper bucket of tier-bucket in the corner of the field. Using their Java expertise, the coders have been able to allow for odometry based movement which allows for more complex maneuvers and park.

Drive:

During our drive section, we will be scoring points by placing samples in the top bucket of the tiered-bucket. Our slide extension system is robust enough to be confident that we will be able to score points in the upper bucket. The sample placement will be our primary way of scoring points.

Endgame:

In the endgame, our primary focus will be gaining points from suspension of the robot on the horizontal beams. We have decided not to go for parking points on the floor. Our custom 3D printed hooks will hold our robot in the endgame to score those points.

Design Iterations

Claw Design Iterations:

Our team had originally chosen a claw design utilizing a rubber medical band as its material granted exceptional. It's usable surface area, however, proved to be its fatal flaw as the robot would consistently have to be re-adjusted so that the claw could reach within range of a game piece.

Claw Design I:

We had implemented an exercise band for our claw to move throughout the game field. Contrary to commercially available claws, its dexterity allowed it to transport game pieces in an quick manner. However the issue was the texture of the rubber didn't hold the sample as effectively as we had hopped.

Claw Design II:

Our new 3D printed plastic claw can hold samples much more effectively, our 3 pronged design ensures that the sample is securely held by the side and the front. Our claw now allows us to make sudden movements and move at full speed without the sample wiggling or falling out of the claw.

Hook Redesign:

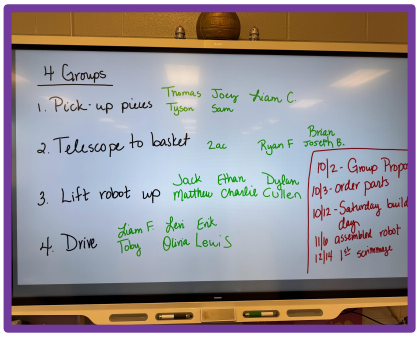
The current hook design went through multiple iterations and we eventually designed a custom 3D printed hook that would fit in GoBilda's specifications and that was angled according to the horizontal beam it would attach to. The initial hook was improperly angled, which is why we had to try again and innovate.

Design Process

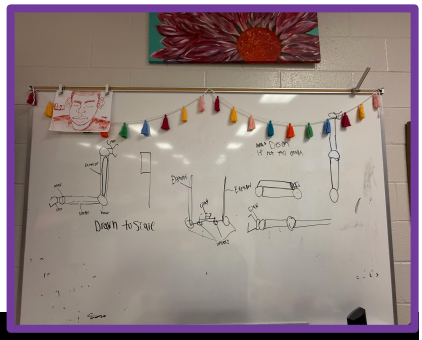
Problem Statement:

We must design a robot to attach specimens (combinations of samples and clips) on a color-coordinated horizontal pole, fully suspend itself on two 13 inch beams, and place samples in a multi-tiered bucket, in accordance to the team's alliance color.

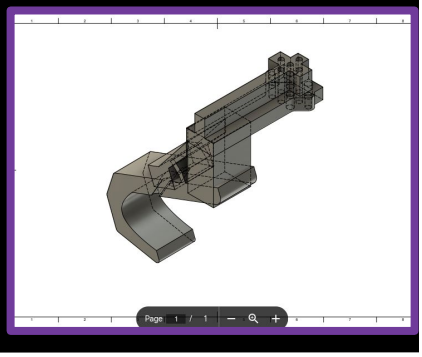
Brainstorm:



On one of the first days of our competition season, we decided to split the team into 4 groups based on the problem they would be working on. For example there would be a group for picking up pieces, and one just working on the drivetrain. This process differed from last year where we made teams based on roles, like coders and builders.



The team that would be working on suspension of the robot drew rough sketches on a whiteboard on how they wanted to suspend. They thought of a plan to retract the suspension mechanism by folding it into the main robot's footprint so that it would fit in the required space. They also made CAD sketches on how the hooks would fix themselves on the horizontal beam.



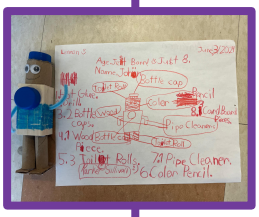
Our CAD sketches were properly measured according to GoBilda's specifications and implemented with 3D printed plastic. We tested this design on our robot and it was a drastic improvement from our previous designs. The robot was able to suspend itself without breaking the hooks.

Solution:

We developed a solution to fully suspend our robot using drawer slides and custom 3D printed hooks. We also solved the problem of placing samples in the upper bucket by using another drawer slide and a custom 3D printed 3 pronged claw to ensure maximum stability. Our final problem, attaching specimens, we have yet to solve.

Season Timeline

Summer:

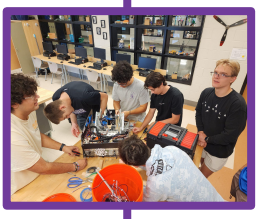


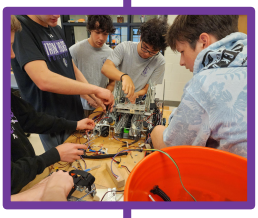
- Over the summer we hosted the 4th annual STEM camp from June 3rd to 7th
- We introduced over 20 kids to FIRST robotics
- We taught multiple engineering fields, such as chemical, aerospace, and mechanical engineering through activities like elephant toothpaste & catapults

October:

- Started strategizing what routes we wanted autonomous to work on
- Drivers brainstormed routes to take and controls for suspension and claw
- Started a sister team Iron Phoenixes (Team #28370)
- We constructed the game field & moved into our new robotics room
- Began construction of the robot & ordered parts we might need

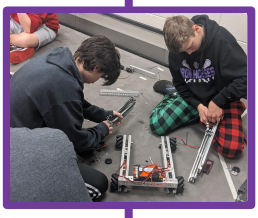
September:





- Game released on September 7th
- Meetings began every Wednesday
- We recruited new members to our team
- We brainstormed ideas for the robot, thinking about what mechanisms we wanted to prioritize
- Disassembled and scavenged from last years robot

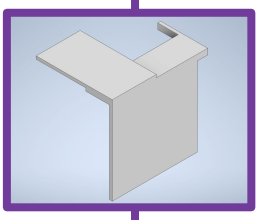
November:



- We began having meeting every Tuesday afternoon after school in addition
- We developed an innovative claw mechanism that would be able to grip the specimen at any angle
- We also began coding using Java in Android Studio
- We planned on going for all awards this year, like last year

Season Timeline

December:

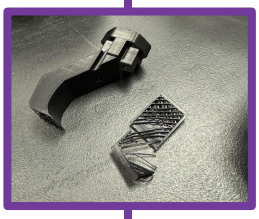


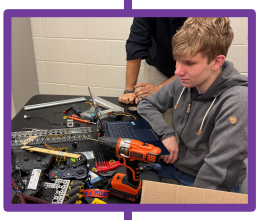
- We attended our first scrimmage at Military Magnet, we spent the time improving our robot
- During our first meeting after the scrimmage we worked on the the portfolio and judging to match the feedback of the judges
- We also began modeling 3D parts for the robot, like the claw

February:

- In February we will be hosting state qualifiers which involves us setting up our school to host, a team-wide effort, we plan to qualify for states with our new claw design
- If we make it to states, we will spend additional time working out how our robot should place specimens on the color-coordinated beams and ascend to second rung

January:



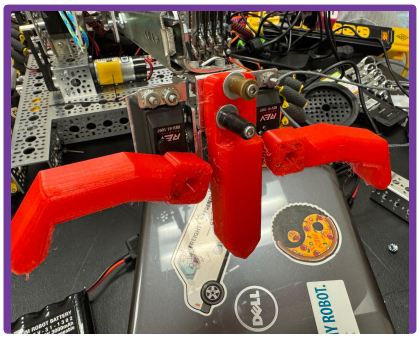


- In January we started printing and installing the 3D parts that we designed in December
- We took photos for each team member for the portfolio
- We cleaned house and reorganized to fit our growing needs
- Our coders worked on our autonomous program so that it would be ready for state qualifiers later this week.

Future Plans:

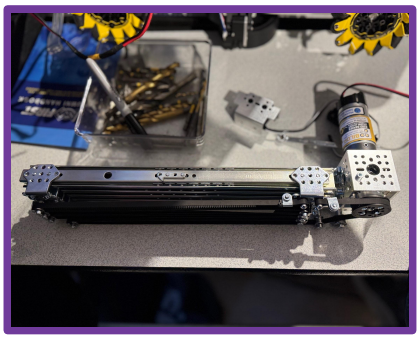
- Later this year we will plan to attend the Charleston Air Show where our team gets first hand experience on the wonders of engineering
- We will also host our annual camp over the summer to raise money for next year's competition
- Our team is actively researching other opportunities for outreach for FTC

Robot Mechanisms



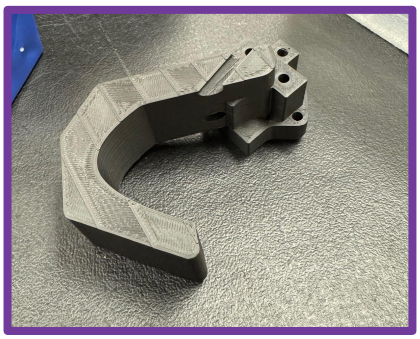
Plastic Grip:

Our 3 pronged plastic claw was engineered to pick up samples most effectively. We had engineered rubber grip using an exercise band before, however we realized that we traded it's grip strength for maneuverability. So, we eventually decided to switch to a 3D printed plastic grip.



Retractable Slides:

The slides will assist in lifting the robot onto the submersible. The drawer slides were initially added for stability however its high torque and compact design makes it an effective method at scoring points.



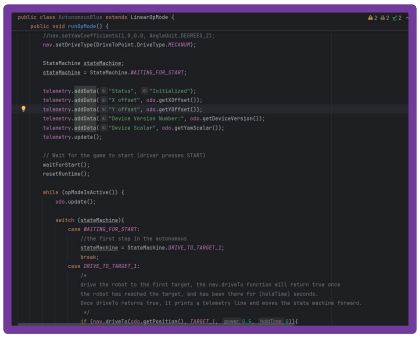
3D Printed Parts:

3D Printed hooks will be used for suspension, we are able to make hooks that fit the specific bar it will hang from. We also had printed our new grip mechanism for placing samples in the upper basket.

How our team has innovated:

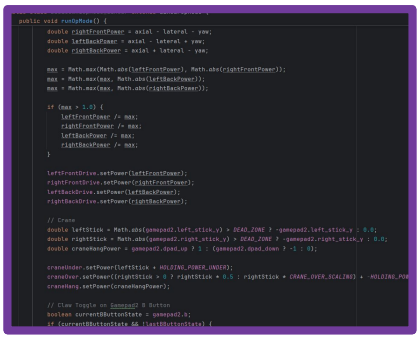
Our team has innovated by using many different materials to help build our robot, the main ones would be the exercise band used as a rubber grip so we can grab our blocks, or using drawer slides to be our suspension system. Our team also innovated by being able to design and 3d print new parts. Our claw and hooks are custom designed on Autodesk by members of our team.

Programming



Autonomous:

We use the GoBuilda Pinpoint library to create effective autonomous capabilities with the use of odometry pods. This enables the robot to find itself on a XY coordinate plane to optimize precise autonomous movement.



Tele-Op:

For our tele-op, we have split our code into several discrete classes containing the majority of the logic and servo management code. We utilize the graduated inputs of the controller to achieve finer control over parts of the robot. We utilize the buttons for less intricate actions.

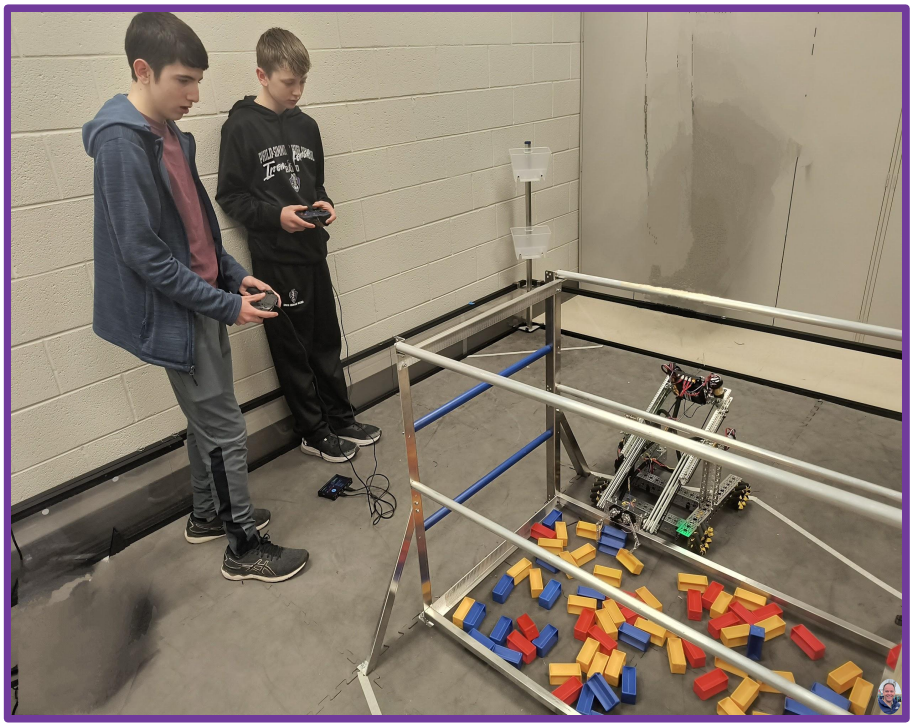
Why we use Java:

We use Java because, unlike block code, Java provides a more customizable framework and library for development of the robot. Java is also far more applicable to careers in programming, which helps prepare our programmers for the future.

Our Code:

We utilize FTC libraries, GoBilda libraries, and a significant amount of our own code to create a modular system which is easy to refactor and understand for our programmers. We have created the control logic for our robot by coming up with the basic structures and testing it along with the builders and drivers in order to assure its effectiveness in its tasks along with its usability for our drivers.

Our Sister Team



Instead of hosting a selective process such as tryouts to determine each individual's competency, we accept everyone so long as they show genuine interest. This year our team generated so much interest that we decided to form a second sister team. Our new team, honorably named the Iron Phoenixes, functions similarly to a JV team since it is made up of members with less experience. Our two teams are heavily encouraged to communicate, build on each other's ideas, and recommend changes.

Outreach

Our outreach opportunities throughout the years have been plentiful. Some of the most significant events of this season were the airshow and 2024 summer camp. The summer camp is a program we run every year to raise money and awareness for robotics. This past year we had over 20 kids attend over a week long period. We dedicated each day with them to a different branch of engineering. The kids engaged in a variety of activities including learning what happens when you mix hydrogen peroxide and dish soap (elephant toothpaste), the science behind how a trebuchet works, and coding processes. They also learned the design process by a week-long activity of building a wooden robot.As for the airshow this past year, we were fortunate enough to have a space for our own booth. We represented FIRST Robotics by letting kids drive our robot, ask questions about the program, and encouraging them to check out all of FIRST's leagues.

Iron Horse Robotics

#13900

We spread interest in STEM, succeed in the challenges with which we are faced and exhibit gracious professionalism while accomplishing our tasks.

Philip Simmons High School
3080 River Village Drive
Charleston, SC 29492