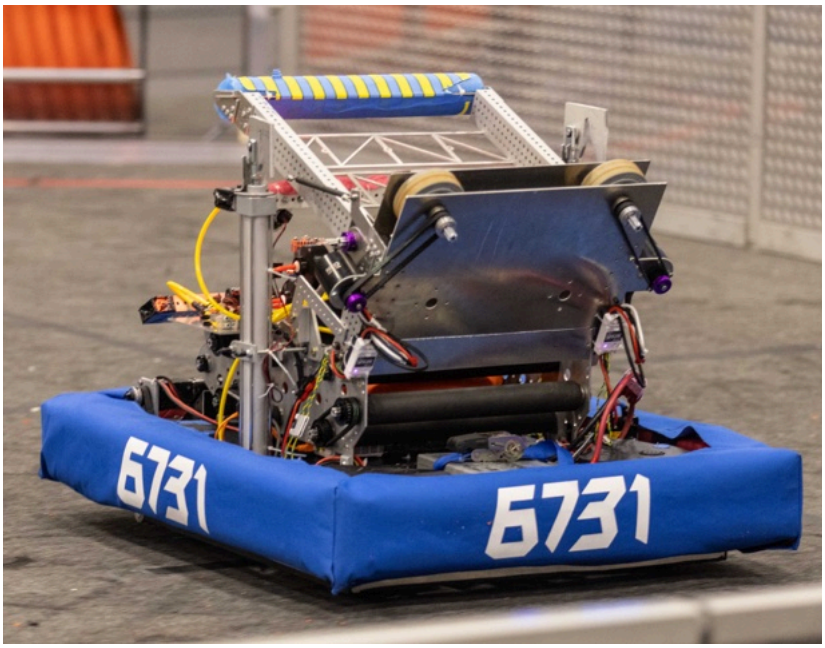
Record Robotics Annual Report 2023-24

Belmont STEAM Alliance Corp.

Record Robotics is a student-led team that prioritizes the leadership and hands-on involvement of all students. Throughout the season, our members focus on teamwork and problem-solving skills while learning how to build a robot, culminating with the team's participation in FIRST competitions during March and April.



The FIRST program also inspires our students to pursue careers in STEM fields, with this year's graduating seniors choosing majors in engineering, computer science, robotics and physics. In addition to this, our students develop important life skills: leadership, collaboration, time management and decision making. We see our students gain in confidence every season, and it is wonderful to witness their enthusiasm and passion for STEM.

Pictured above: Record Robotics and our Winners banner at the Bridgewater State University District Event, March 10, 2024

Pictured left: Maestro, our 2024 robot, on the competition field at WPI, March 30, 2024

Record Robotics

Belmont STEAM Alliance Corp.
30 Church St, Suite 310
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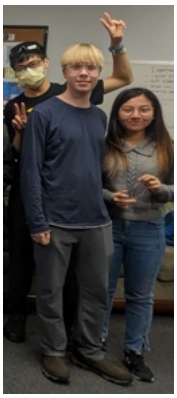
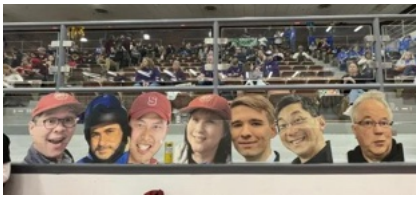
Our Year in Review

Thank you for your support of Record Robotics #6731 for the 2023-24 season!





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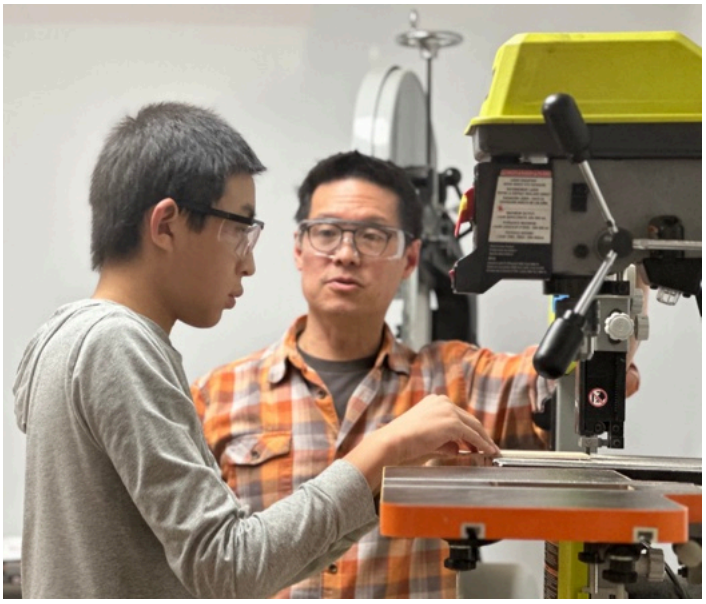
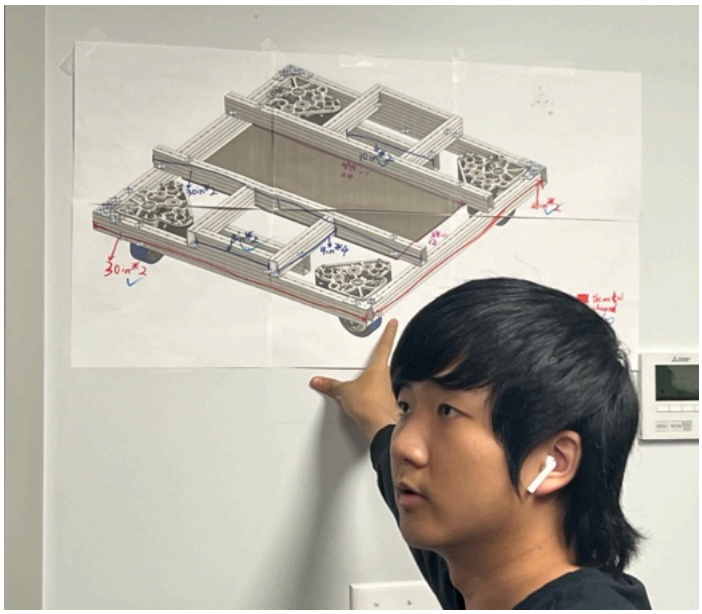
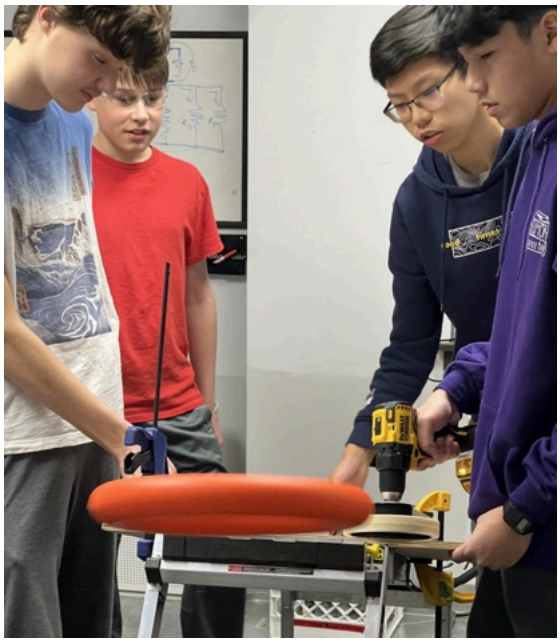
Designing the Robot



The 2024 FRC challenge was to build and program a robot that could pick-up foam circles and shoot them into two scoring receptacles of differing heights, then lift itself up to hang on a metal chain. Our Record Robotics team got together to watch the FRC Challenge Kickoff announcement on January 6th, then subsequently formed small groups to brainstorm and prototype different components of the robot, as well as create CAD models. Team members and mentors met four days a week throughout January and February to get the robot built - we only had nine weeks from kickoff until our first competition!

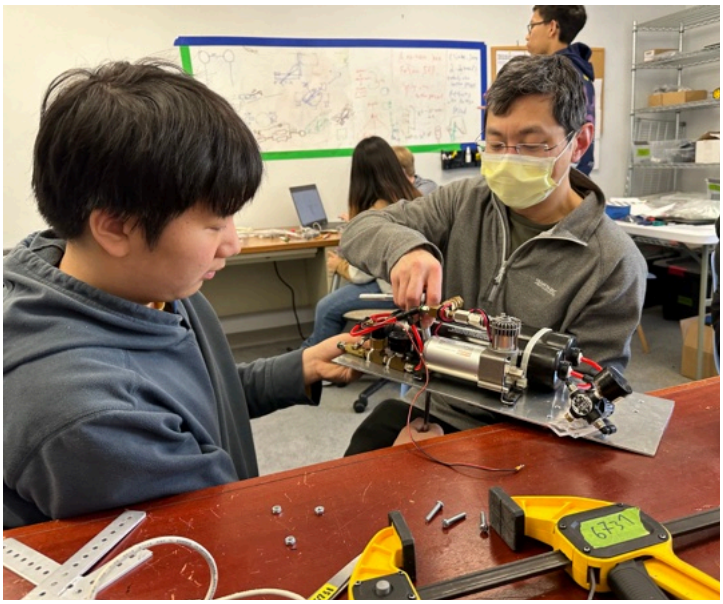
This year, our team made significant progress in exploring new options to enhance our robot's performance. We made three major changes: implementing a swerve drive system, integrating pneumatics, and making use of a waterjet to cut custom parts.

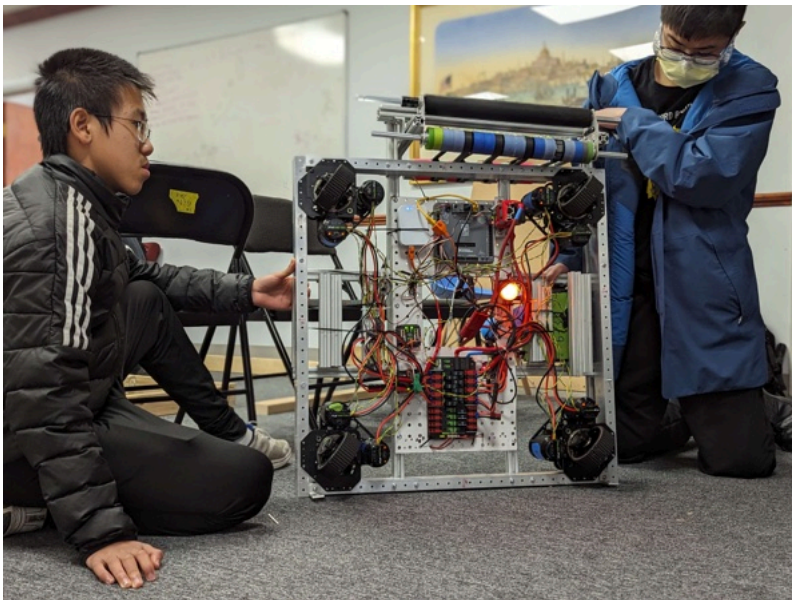




On this page: Students brainstorming at our Build Season kick-off meeting (top left); using the workshop drill press (top right); working on CAD for the robot base (bottom left); and prototyping the shooting mechanism of the robot (bottom right)

Building and Programming the Robot





The swerve drive was one of our most ambitious projects. With swerve drive, each wheel can rotate individually around its central axis, enabling the robot to move in any direction without changing its overall orientation. This makes the robot much faster when following a curved path and more flexible in what it can do. We spent months during the 2023 summer researching the swerve drive model we wanted, after which students and mentors worked together to figure out how to assemble it during the fall pre-season.

The integration of pneumatics into our robot was challenging. The students had never worked with pneumatics before, but with the help of mentors, we implemented pneumatics in our amp-scoring mechanism and climbing system. This allowed for simple constant force and consistent linear motion, making repairs easier and expanding our possibilities for rapid movement on the robot.

In order to save time on machining during build season and allow for more precise, complex parts on our robot, we decided to switch to using more custom-cut parts. This was a challenging decision as we did not have consistent access to such technology. To work around this, we found services that machine-builds custom parts, and one of our engineering lead mentors guided us in using the machine shop at Harvard University, which we took full advantage of to build our robot.

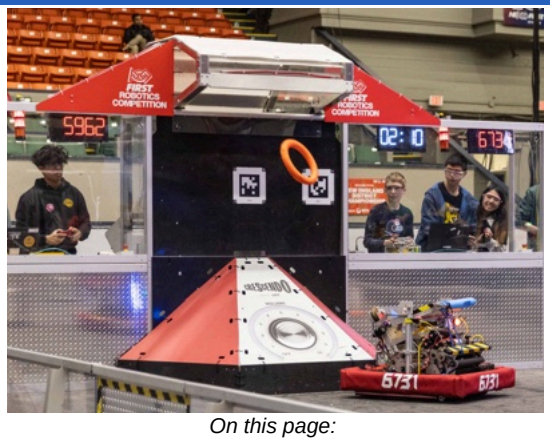
On this page: Learning about pneumatics (top left); working on the swerve drive base (top right); and cutting custom parts using water-jet technology (above)

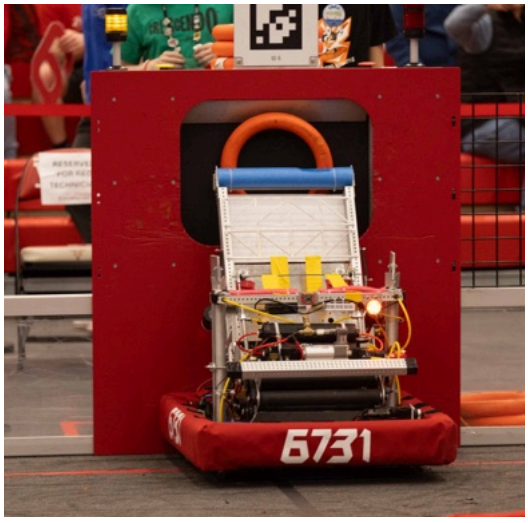
Our programming division also massively contributed to our success; implementing a different code structure and a new auto system that vastly increased our productivity and adaptability. By shifting to a more command-based code architecture, we made our codebase more readable, easy to develop, and beginner-friendly. We also managed to pivot our autonomous code to WPILib's Pathplanner, which allows us to develop more complex routines more quickly, reliably, and with more fine control over all important parameters of our auto routines. This also allowed us to reliably develop auto routines on the fly, making us extremely effective in competition.

On this page: Programmers working together to develop and implement the code to operate Maestro (bottom left and above)

Competitions

Bridgewater (March 8-10), WPI (March 29-31), and District Champs at the Big E (April 3-6)





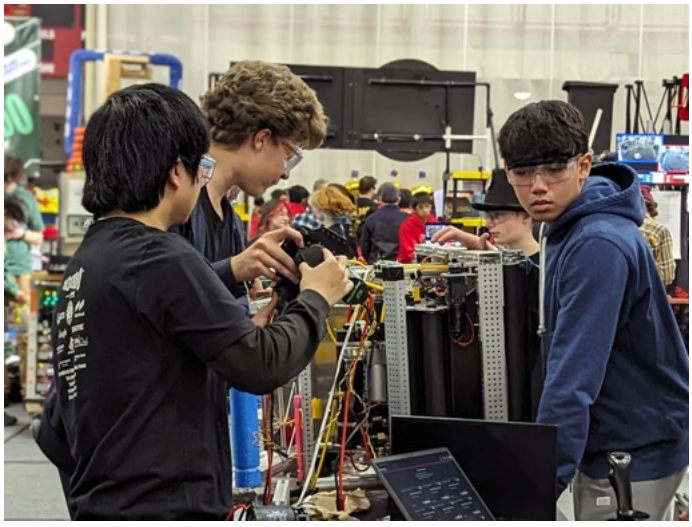
On this page:
Maestro scoring in the 'speaker' (top left); our lead engineer, Eli Cai, proudly displaying our winners medals (top middle); Maestro scoring in the 'amp' (top right); and working in the pit (middle right)

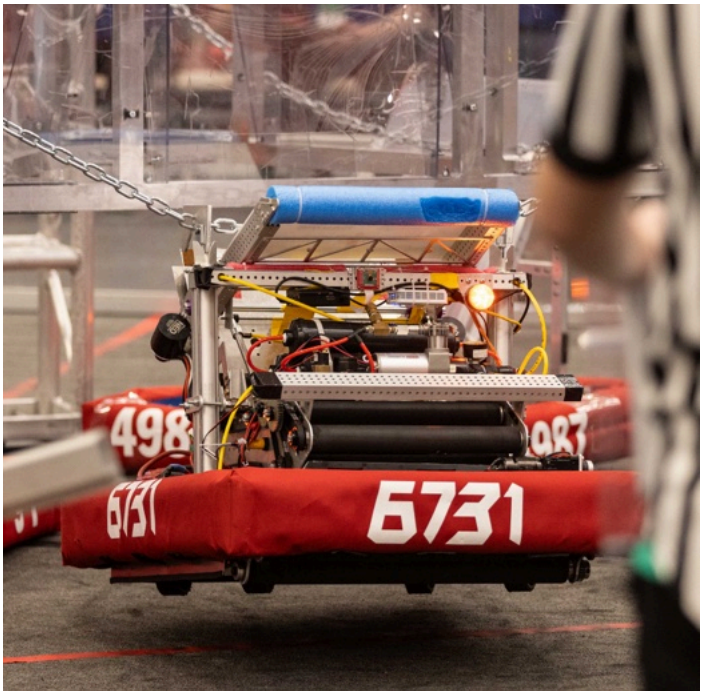
For each competition, robots are put through twelve grueling preliminary matches against each other over a period of two days. Even the toughest robots struggle to maintain both the integrity of their machine and the enthusiasm of their teammates. Record Robotics won the NE District Bridgewater event along with our partner teams 125 and 78, then finished in third place at the NE District WPI event with teams 1100 and 3205. We even made it into the New England FIRST District Championship in Springfield for the first time in our team's history!

During our Bridgewater competition, our Dean's list nominee, Ethan Djajadi (one of our co-captains), was selected as one of two finalists.

Attending District Championships for the first time as a team was exciting, exhausting and nerve-wracking. The venue is a lot larger than we were used to, with teams competing simultaneously on two identical competition fields. We competed valiantly, but in our last match Maestro suffered significant damage, and we were not selected for the elimination rounds.

Record Robotics finished the season 46th out of 182 teams in New England - our highest-ever ranking!





Our District Champioships drive team at the Big E (above); Maestro hanging on the chain during the end game (right)

Outreach

Led by Record Robotics and Belmont STEAM Alliance

Ligerbots STEM fair

December 2023

Our friends the Ligerbots, a robotics team based at Newton High School, hosted a STEM fair where Record Robotics ran two activity stations. We had lots of kids solving an invisible ink mystery and making Caesar's ciphers to decode a message.

Burbank STEM Night

April 2024

For the third year in a row, Record Robotics attended a special STEM night at one of Belmont's elementary schools. The event was packed with families, and our new robot Maestro was at the center of the action!

Geek Is Glam

October 2023

Geek Is Glam is an event for girls in grades 4 through 8, sponsored and organized by the Girl Scouts of Massachusetts and held at Worcester Polytechnic Institute. Record Robotics was invited back to participate for our second year and we love this event!

Belmont Town Day

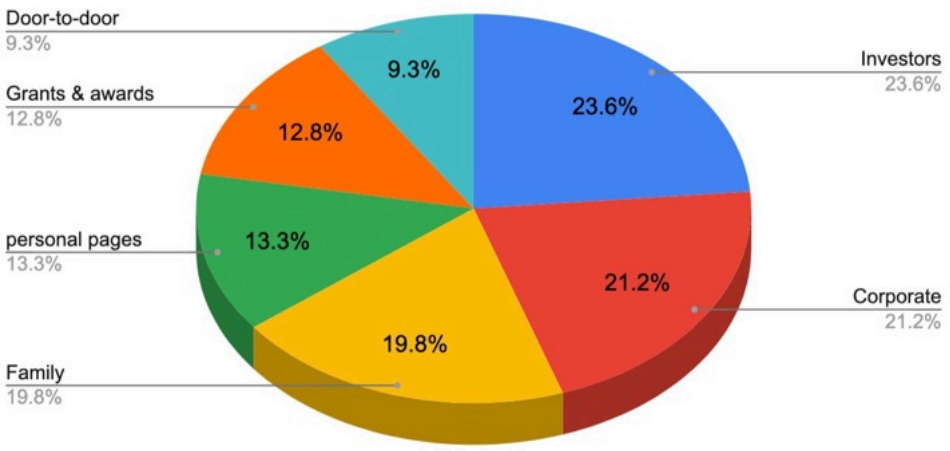
September 2023

One of our favorite annual events is Belmont Town Day. We demonstrated our robot Munchkin and our local families loved interacting with it. The young kids really enjoyed trying to catch the balls as we launched them from our flywheel.

Finances

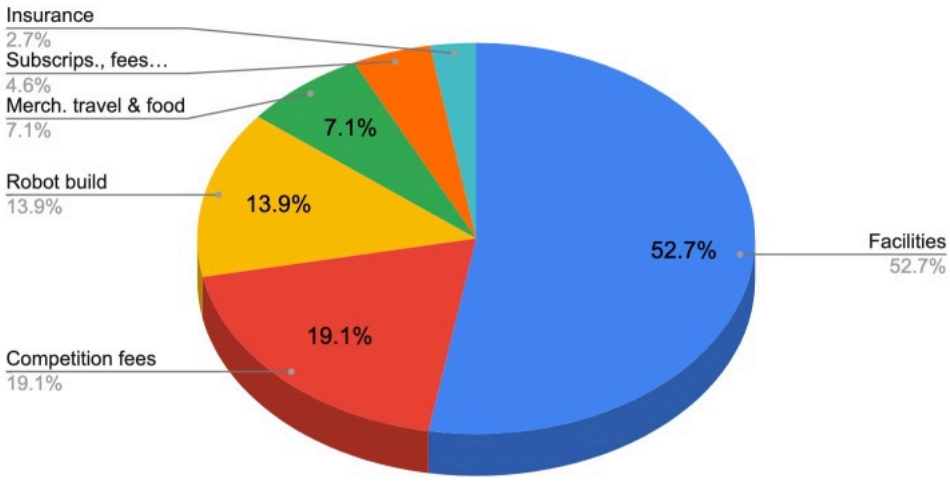
Donations and Expenses

DONATIONS	
Investors	$13,800
Corporate	$12,384
Family	$11,556
Causevox personal pages	$7,760
Grant applications	$7,500
Door-to-door	$5,459
TOTAL	**$58,459**



Record Robotics supports its activities via corporate sponsorships, STEM grants and individual contributions. We rely heavily on our members' families and individual supporters of STEM activities in the community. Our major team fundraiser is our door-to-door campaign, which helps promote awareness of FIRST and STEM as well as raise necessary funds. Our team members also design and write online personal fundraising pages through Causevox, which they send out to family and friends over the winter holidays, asking for donations to help fund the building of the robot. This year our Causevox campaign raised $7.8K, the most our team has ever raised!

We succeeded in reaching our corporate fundraising goal this year, and are very appreciative of the generous donations from our sponsors, in particular those from top sponsors Motional ($2.5K) and Teradyne ($1K). We are also extremely grateful for the donations we received from the Belmont Lions Club ($1.3K) - our team so enjoyed getting to know their members as well as helping with their holiday wreath making. Our fundraising/marketing team researched and applied for multiple grants this year, and were successful in receiving from RTX ($2.5K) and M&T Bank ($2.5K). We also applied for an award from Watertown Savings Bank for non-profit organizations that have a meaningful impact in their community, and won $2K.



EXPENSES	
Facilities	$28,499
Competition fees	$10,325
Robot build	$7,489
Merch. travel & food	$3,827
Subscrips., fees & misc.	$2,463
Insurance	$1,439
TOTAL	**$54,042**

The cost of facilities - rent for our workspace and utilities - made up over 50% of our expenses. Our competition fees were higher this year because we qualified for District Championships, which costs a further $4K on top of the initial $6K of fees. Surplus funds from last year were used to build our new swerve drive base, and then we spent an additional $7K from this year's funds on our robot build. Other main expenses included team merchandise (T-shirts, pins, competition banner, and gifts for sponsors and graduating seniors), food (providing dinner to the team during long competition days), travel (transporting robot and tools to competitions and outreach events), and insurance. We also pay subscription fees to Amazon and to our email list company. The bulk of miscellaneous costs this year were the purchase of the FIRST LEGO League kit, the fee for a booth at Belmont Town Day, the printing of promotional materials and the deposit towards an end-of-year bowling party for the team.

Finances

Fundraising and Budget Management

Pictured above: Students en route to do door-to-door fundraising; Right: Two students out raising funds and STEM awareness

Team Fundraising

In early November, pairs of team members went to different Belmont neighborhoods to tell people about Record Robotics and fundraise for donations. The students were happy to discover that town residents were encouraging and supportive, and the team raised over $4000!

Budget Management

The team's financial mentor reports weekly to our core mentors and student captains during leadership meetings. Our Record Robotics Google Drive contains a dedicated and secure section for finances, including our yearly budget, the list of major sponsors, and the details of our quarterly income and expenses. Sponsorship and grant proposals are written and tracked by our fundraising division, which includes a group of students and adult mentors. Our purchasing system allows team members to request approval for necessary items, with the financial mentor completing and tracking all purchases. All Record Robotics financial operations are overseen by the Treasurer and the President of Belmont STEAM Alliance Corp.

Pictured left:
Our 2024 T-shirt design, "Punkus," created by student Marketing lead, Luca Hu

Pictured above: Marketing members writing to sponsors during pre-season