rambam rambots

ENGINEERING PORTFOLIO

team #17384

2023-24

The RAMBOTS

about us

The Rambam Rambots is a 5th-year FTC team operating as a program of Rambam Mesivta in Lawrence, New York.

Our team was founded by Captains Eliezer G. and Jacob Z. as a way of growing our school's robotics program from a four-person RoboCup Junior team to a significantly larger FTC team. This improved student involvement and allowed for an environment conducive to our members' education.

Previously, we've been known as the Rambam Ravens Robotics (our school insisted that we match its athletics program), Ravenotics, or simply the Rambam Robotics Team. Everything changed, however, when a RoboCup announcer innocently mispronounced our school's name as Ram·Bahm, aptly dubbing us the "Rambam Rambots." The name has stuck ever since.

The RAMBOTS

meet the team

Bezalel G.

1st year in FIRST • Freshman

Hardware

Rami K.

2nd year in FIRST • Junior

Design, Hardware

Michael L.

4th year in FIRST • Senior

Driver

Ari M.

3rd year in FIRST • Junior

Hardware, Software

Shmuli M.

2nd year in FIRST • Sophomore

Design, Hardware

The RAMBOTS

meet the team

Siggy O.

3rd year in FIRST • Senior
Manager, Hardware

Shmuel R.

3rd year in FIRST • Junior
Captain, Design, Hardware

Dani R.

3rd year in FIRST • Senior
Hardware

Ezra R.

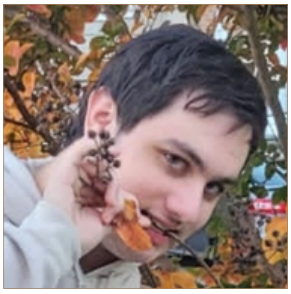
1st year in FIRST • Freshman
Hardware

Ariel S.

2nd year in FIRST • Junior
Hardware

The RAMBOTS

meet the team



Eitan S.

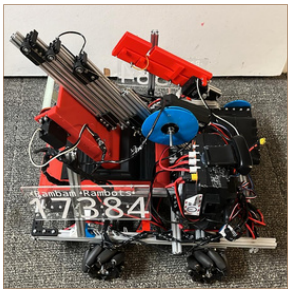
2nd year in FIRST • Senior

Hardware

Rudi W.

1st year in FIRST

Mentor



Popcorn

1st year in FIRST

Robot

popcorn

During a meeting in January, one of our team members decided to make microwaved popcorn. This set off the fire alarm in our lab and confused many of our school's administrators.

The robot's name was then decided unanimously.

The RAMBOTS

our mentor

Our mentor, Rudi W., is in his first year at FIRST. He takes a hands-off approach to our team's work, allowing us to explore, create, and fail, all while offering guidance along the way to ensure nothing goes horribly wrong.

our mission

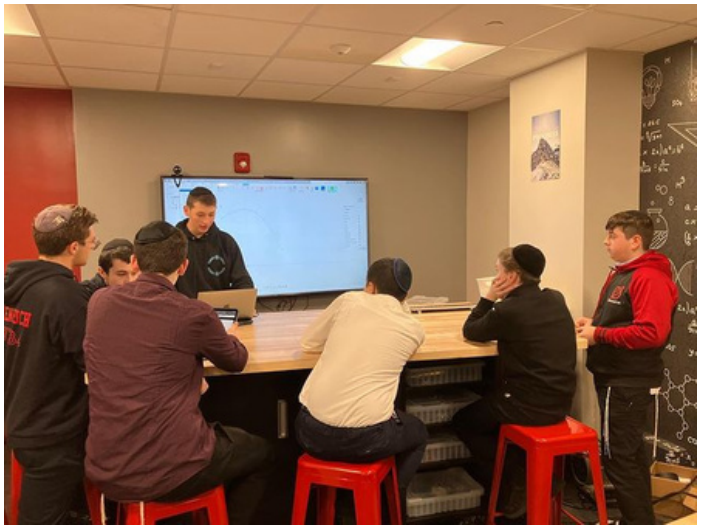
Our team's mission from day one has been to create a space for students of all experience levels to learn, grow, and have fun. We make efforts to embody our school's motto of "Torah, Midos, Excellence" throughout our work. As a result of our often-restrictive budget, one of our priorities is the efficient use of parts from previous years (when applicable) to keep team expenses down while creating the best robot (and inspiring the most students!) possible.

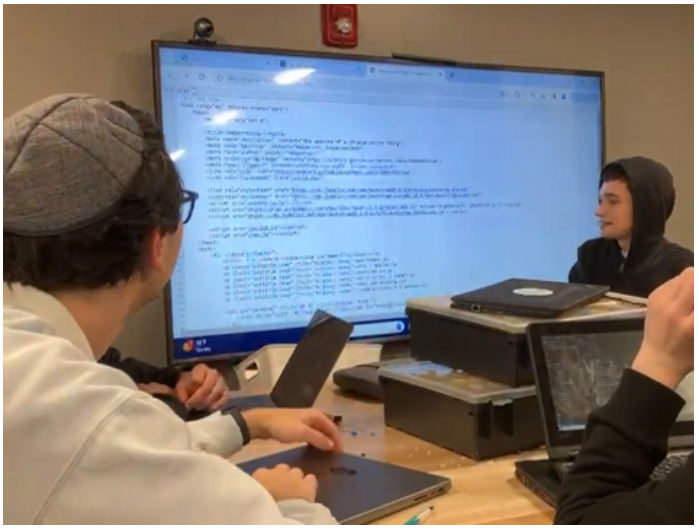
The RAMBOTS

our outreach

We lead a STEM club in our school to encourage curiosity for robotics, meeting once every week to provide instruction for tasks ranging from 3D modeling to basic programming. At our school's annual open houses, we demo our robot to incoming freshmen.

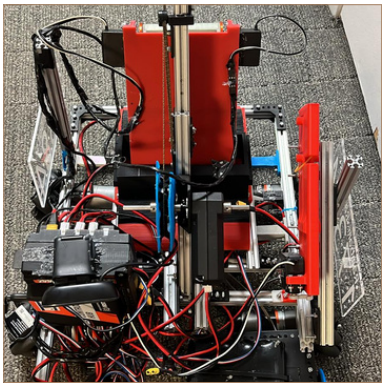
We are members of an active Discord server with over 20 other teams from Long Island, where we discuss design, portfolio, outreach (how ironic!), and all things robotics.

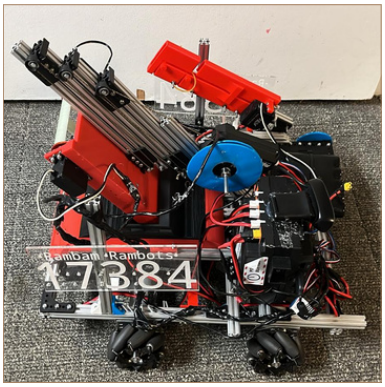




The RAMBOTS

our robot

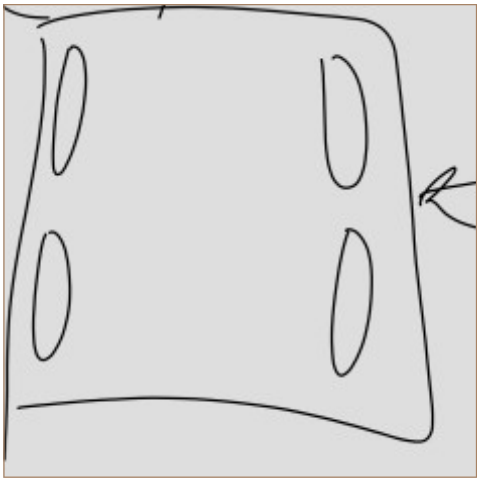


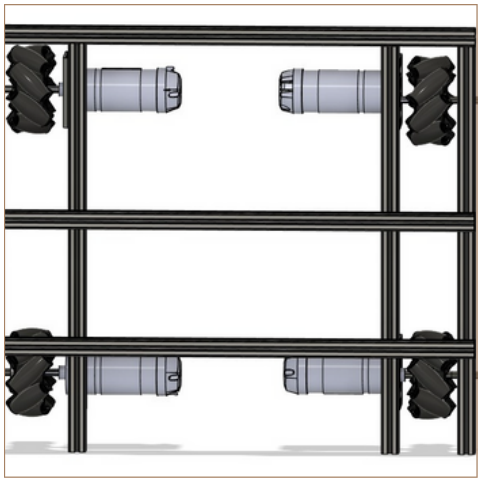


Popcorn features a Mecanum drive composed of Rev HD Hex Motors and Rev extrusions, an intake mechanism of Andymark compliant wheels powered by Core Hex Motors and fed by laser-cut plastic-composite rectangles, an arm consisting of a 3D-printed pocket connected to a four-stage cascading linear slide, and a 3D-printed drone launcher designed in collaboration with team 14380 Blue BotBuilders. We will continue to innovate and redesign as we approach upcoming competitions.

mecanum drive

Three years ago, we purchased a set of mecanum wheels for the 360-degree driving they enabled. We decided to reuse these same wheels and motors (Rev HD Hex Motors with a 40:1 Gearbox) for our robot's drivetrain. See the sketch of the mecanum (left) and a CAD model of our implementation (right).

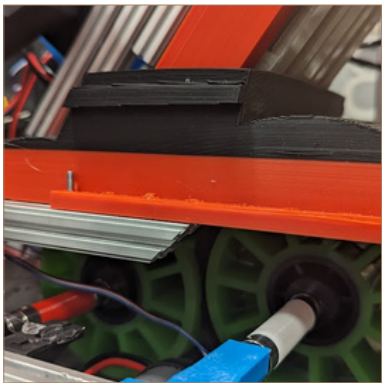
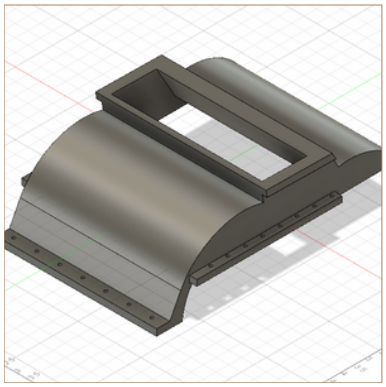
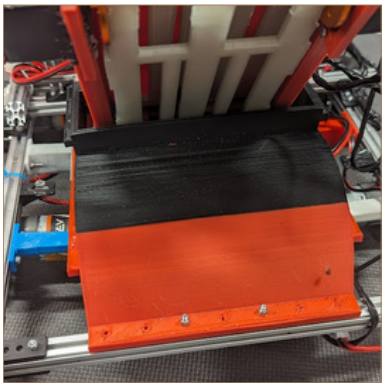
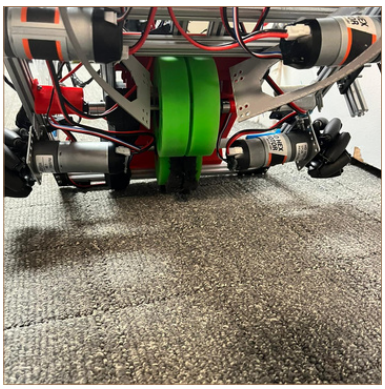
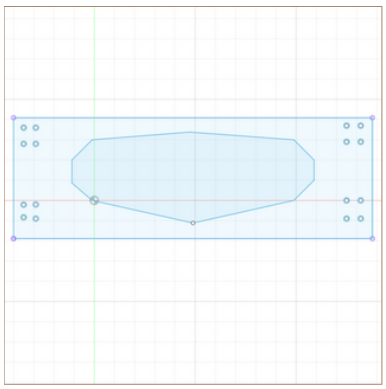
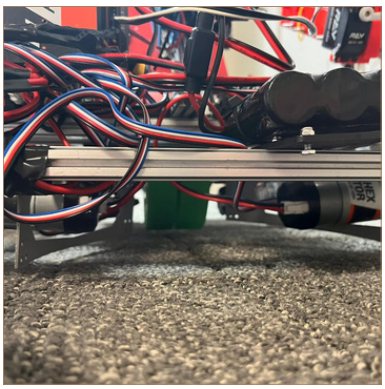




intake

Our intake system is composed of two Andymark compliant wheels that spin in opposite directions (by two Core Hex Motors, each with a 40:1 Gearbox) to propel pixels upward into our pocket when driven over.

The system guides pixels into our pocket using a 3D-printed funnel, fed by two laser-cut plastic-composite rectangles attached to the underside of our robot.

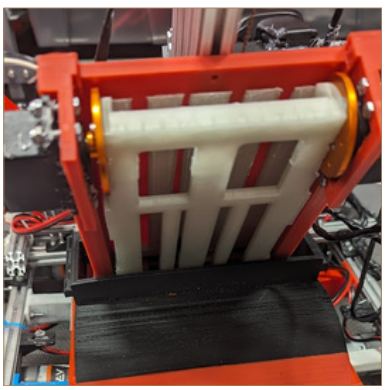







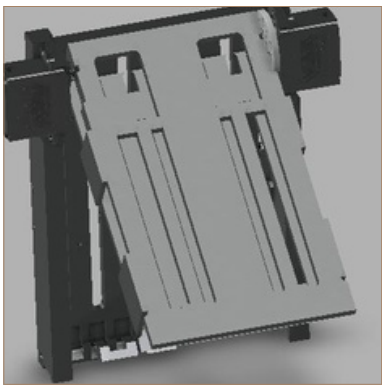
arm and pocket

Our arm is a four-stage cascading linear slide powered by a 40:1 Core Hex Motor, with a custom-printed pocket secured on the final extrusion by hexagonal screws.

Our initial design saw the addition of a claw, which would grab the pixels from the pocket, but we decided against that iteration due to efficiency issues.

Our intake system feeds our pocket, which consists of two separate 3D-printed pieces. Pixels are kept inside the pocket by rotating “teeth” along the interior piece, while two Rev servos attached to servo horns rotate the exterior piece to place pixels on the backdrop.



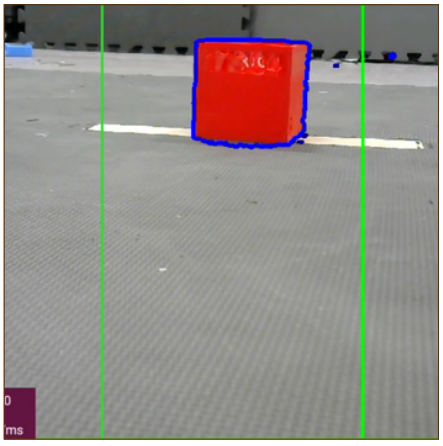


software

During our autonomous mode, we utilize OpenCV to mask out all non-red/blue colors (depending on our alliance). Our webcam's view is then split into three rectangular segments, with each being scanned for our alliance-colored prop. The segment containing our prop is selected, and preprogrammed driving instructions are executed. Previously, we had issues with object detection, but that was solved by detecting the area of the prop as opposed to its surrounding rectangle.

We write code for our robot using Java in Android Studio and use GitHub to collaborate and share our code with other teams. Our robot's code can be found on our website.

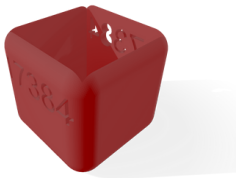
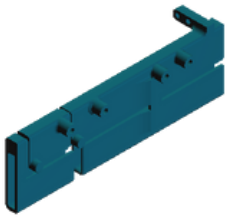
```
for (int i = 0; i < segregatedMats.length; i++) {
    List<MatOfPoint> contours = new ArrayList<>();
    Mat hierarchy = new Mat();
    Imgproc.findContours(segregatedMats[i], contours, hierarchy, Im
    hierarchy.release();

    MatOfPoint largestContour = findLargestContour(contours);
    if (largestContour != null) {
        Imgproc.drawContours(segregatedMatsColor[i], contours,
        Imgproc.drawContours(segregatedMatsColor[i], contours, cont
        areas[i] = Imgproc.contourArea(largestContour);
    } else areas[i] = 0;
    segregatedMats[i].release();
}
Core.hconcat(Arrays.asList(segregatedMatsColor), input);
for (Mat mat : segregatedMatsColor) mat.release();

double greatest = Math.max(areas[0], (Math.max(areas[1], areas[2])))
if (greatest == 0) biggestBlob = NONE;
else if (greatest == areas[0]) biggestBlob = LEFT;
else if (greatest == areas[1]) biggestBlob = MIDDLE;
else if (greatest == areas[2]) biggestBlob = RIGHT;

return input;
```



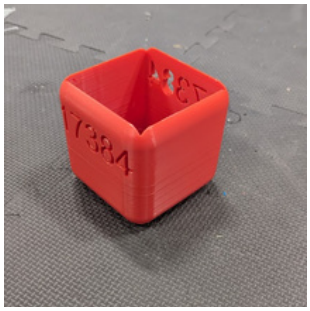
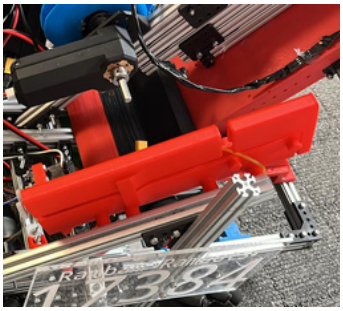
miscellaneous

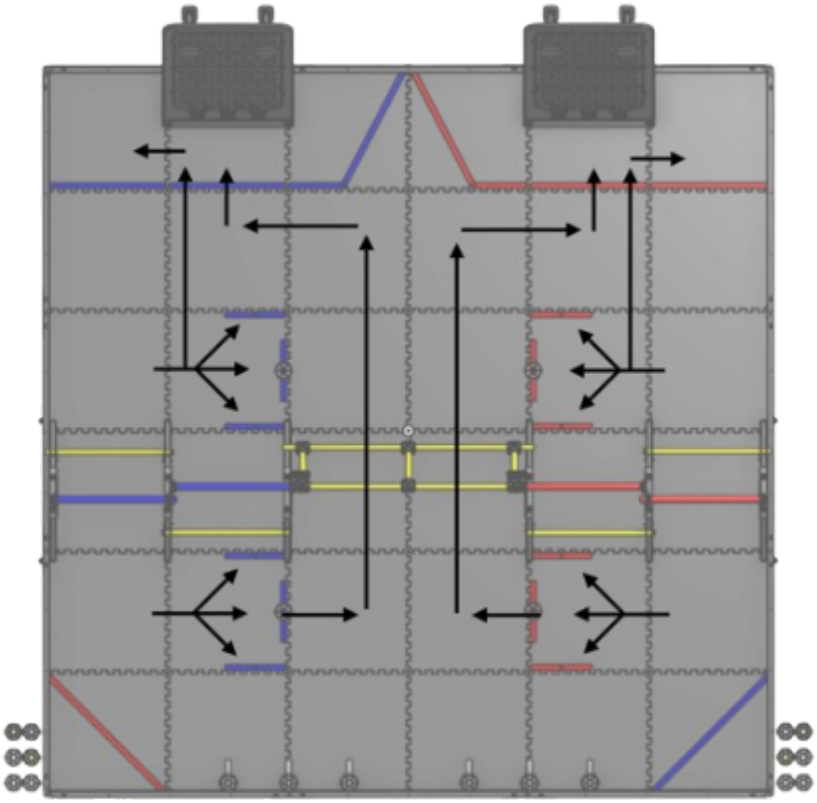
- **Control Hub mount** - we designed a vertical mount for our control hub and expansion hub to free up space for our intake mechanisms.
- **Custom team prop** - we designed a custom prop for object detection, aiming for simplicity with a small 3.1-inch x 3.1-inch x 3.1-inch cube.
- **Drone Launcher** - we collaborated with team 14380 Blue BotBuilders to design a custom drone launcher powered by a Rev servo to launch our drone into the first zone using a rubber band released by a servo horn.

CAD

Robot



autonomous strategy

In the autonomous period, our robot will detect the randomized task (using our team prop) and place a purple pixel on the required spike mark (20 points). Aided by motor encoders for precise movement, we will then score a yellow pixel on the aligned column (20 + 5 points) and park in our alliance's backstage area (5 points). A diagram of this can be seen above.

driver-control stategy

Our plan for the driver-control period is to start by placing two yellow pixels on the backdrop to create a mosaic with the pixel scored in autonomous (16 points), place white pixels to reach the first set line (16 - 22 points), and alternate between purple/green/white pixel placement to generate additional mosaics.

Our driver-op score is calculated as follows:

3**p** + 10**m** + 10**s** points, where

- **p** is the # of pixels placed on backdrop.
- **m** is the # of 3-pixel mosaics formed.
- **s** is the # of set lines surpassed.

endgame period

Our plan for the endgame period is to launch our drone into the first landing zone (30 points) and park in our alliance's backstage area (5 points).

The RAMBOTS

find us online

- **Website:** rambots.rambam.org
- **Instagram:** instagr.am/RambamRambots
- **TikTok:** tiktok.com/@RambamRambots
- **YouTube:** youtube.com/@RambamRambots
- **FTCScout:** ftcscout.org/teams/17384

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