Spring 2019 Volume 24

Monkey Business

News of The Funky Monkeys, Lynbrook High School Robotics, FIRST® Team 846

Editor-in-Chief
Shriyanshu Kode
Editor
Anna Shaposhnik

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FIRST Regional Experience

A firsthand regional experience.

Karan Parikh (soph.)

As a rookie, I had no idea what a robotics competition would look like, or how competitive it really was. Whenever I asked a veteran member, I would get responses ranging from "Hype" to "Loud." I noticed the excitement in the veterans' eyes when we decided to fly to Canada. After returning from the competition, I understood why.

I was astounded to see all the different designs the teams had thought of to pursue the various aspects of the game. A few robots prioritized playing defense on the opposing alliance with their powerful and fast drivetrains. When the idea of countering defensive robots was first brought up to me on the first day of build season, I was confused. I thought being defended was a problem that we would just have to deal with. However, the team quickly realized how dominant defense would be in this game, and resolved to use hexagonal bumpers – a crucial tool against defense. Our robot's ability to swiftly collect and deploy both cargo and hatch panels

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On the Field, In the Action

One student's opinion on volunteering at a FIRST regional

Hanzen Shou (soph.)

When I flew to Canada for the regionals, I was excited to see my first Robotics Regional. My plan was to help scout matches, cheer the team on, and watch the game. What I did not plan for was becoming a volunteer and dedicating more than ten hours helping to run the tournament. At first, I was concerned that it would be boring and take too much time. Looking back, I was spectacularly wrong: the ten hours sped by incredibly quickly thanks to just how amazing the experience was.

As a part of the queuing team, my

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About Build Season

A narrative on the six best weeks of being a Funky Monkey!

James Jiao (sr.)

One hundred students. Six weeks. One robot.

It all started on January 5th, Kickoff Day, with students huddled together in one member's living room in anticipation for the game reveal. That day marked Day 1 of a six-week long period known to robotics teams as "Build Season," an intense yet rewarding experience where teams must design, machine, assemble, and program a fully functioning 125-pound robot to compete in this year's game.

In this year's game, Destination: Deep Space, teams must build robots to collect rubber balls, called cargo, and thin plastic disks called hatch panels, and place them onto the cargo ship and rocket. After we understood the rules of the game, our team wasted no time and moved to the first step of Build Season: strategy and prototyping.

In the first week of Build Season, our team developed a game plan and brainstormed ideas for what our robot will look like. Senior members worked alongside rookies to create a list of robot functionalities for what our robot should be able to do to compete with other top teams.

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Regional *Continued...*

made us an offensive robot, while other robots prioritized stopping their opponents from scoring.

Never having experienced a regional before, I didn't know for sure what to expect from matches. Qualification matches began, and saying that I was surprised would be an understatement. Enthusiasm was everywhere, whether a team won or lost. Our first few qualification matches were rough for the untested robot and nervous drive team, as the robot was being heavily defended despite its hexagonal bumpers. Our team, however, had another brilliant way to counter defense. Using a slider system, the intake system on the robot can move left and right without the drivetrain of the robot needing to be moved. In other words, when the robot was being knocked around by a defense bot, the slider could simply be moved left or right until properly aligned with the rocket or cargo ship. These features along with the building confidence of the drive team allowed us to go from a robot struggling to score a single hatch panel, to one of the highest scorers there. Playoffs were about to begin, and as a top-eight team, we needed to pick our alliance. I was amazed by the thought process and strategy behind alliance selection. Using scouting data, we chose an ideal alliance, which in our case was two offensive robots, and one full-defense robot.

James Jiao (sr.), Aayush Shah(sr.), Garret Peake (sr.), and Kunal Sheth (jr.) going crazy after a nail biting win, sending Team 846 to the Canadian Pacific Regional finals.

"Enthusiasm was everywhere whether a team won or lost"

The Canada Pacific Regional was my first robotics competition, and I was not disappointed. Getting to travel to another country to see the robot I helped put together work with and compete against robots from all around the world was unbelievable. Even though we didn't win the regional, it was a fantastic experience to be able to travel with a whole team of students and mentors, all working towards one goal.

On The Field *Continued...*

job was to call teams from their section in the pits when they had a match. Because of this, I had the chance to see almost every single team in action working on their robots. The coordination of these teams was truly impressive. A person would be on the computer, furiously typing in last minute code to optimize their robot just a tiny bit more. People would be working all over the robot: checking air pressure, fixing wires, and replacing the batteries. Finally, everybody would take a step back. The person manning the computer would press a key to test the robot. Batteries were charged, motors were working, all subsystems were functioning as intended. The robot was ready for action.

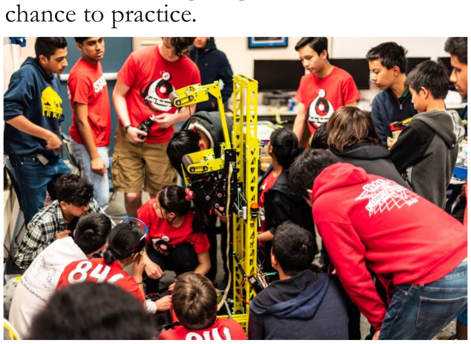
As time passed, everyone in the queuing teams began working more efficiently and grew in coordination. As a result, I became closer with my team and soon everybody settled into their roles. As a runner, I learned where all the teams were located. My teammates who were redirecting the robots as they approached the arena also got faster. Bringing robots to the field was no longer a challenge. During breaks in the action I really enjoyed talking about all the robots with my volunteering team. Being able to watch the matches up close was great, but being able to do so with an awesome team was even better.

Working as a volunteer at the Canadian Pacific Regional was an absolutely amazing experience. I saw the ways that teams worked on their robots and I was also part of a fantastic team that helped run the event. I will surely cherish this memory for years to come.

Hanzen Shou (soph.), Benjamin Gao (soph.), Ruijia Xing (soph.), and Ivie Xue (soph.) volunteering at the Canadian Pacific Regional.

Build Season *Continued...*

In the meantime, Joonha Hwang (so.) led a group of students to begin work on the field elements, critical for testing our finished robot and giving our robot drivers a chance to practice.



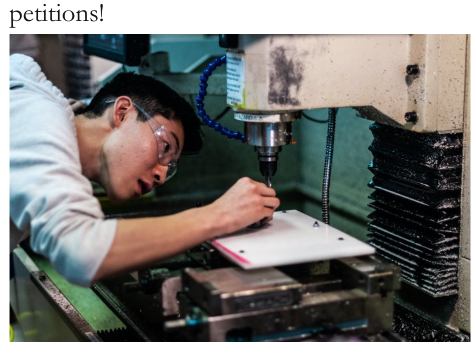
The team frantically assembling the robot hours before the deadline on Stop Build Day.

Then came the design phase, where the robot was divided and student leads took charge of each subsystem.

The software and electrical teams also begin preparing for when the robot will be finished. Lead by Kunal Sheth (jr.), Alvyn Wang (so.), Isha Venkatesh (so.), and Zachary Wu (jr.), also begin preparing for the completed robot.

One hundred students.
Six weeks.
One robot.

After six long weeks of hard work, it was finally time to bag our robot, SpaceRex. On the final day of build season, the team worked feverishly to complete the robot on time. With only ten hours remaining, the team worked together to assemble and wire the entire robot. But while Build Season may have come to an end, the next chapter in the robotics season had just begun: competitions!

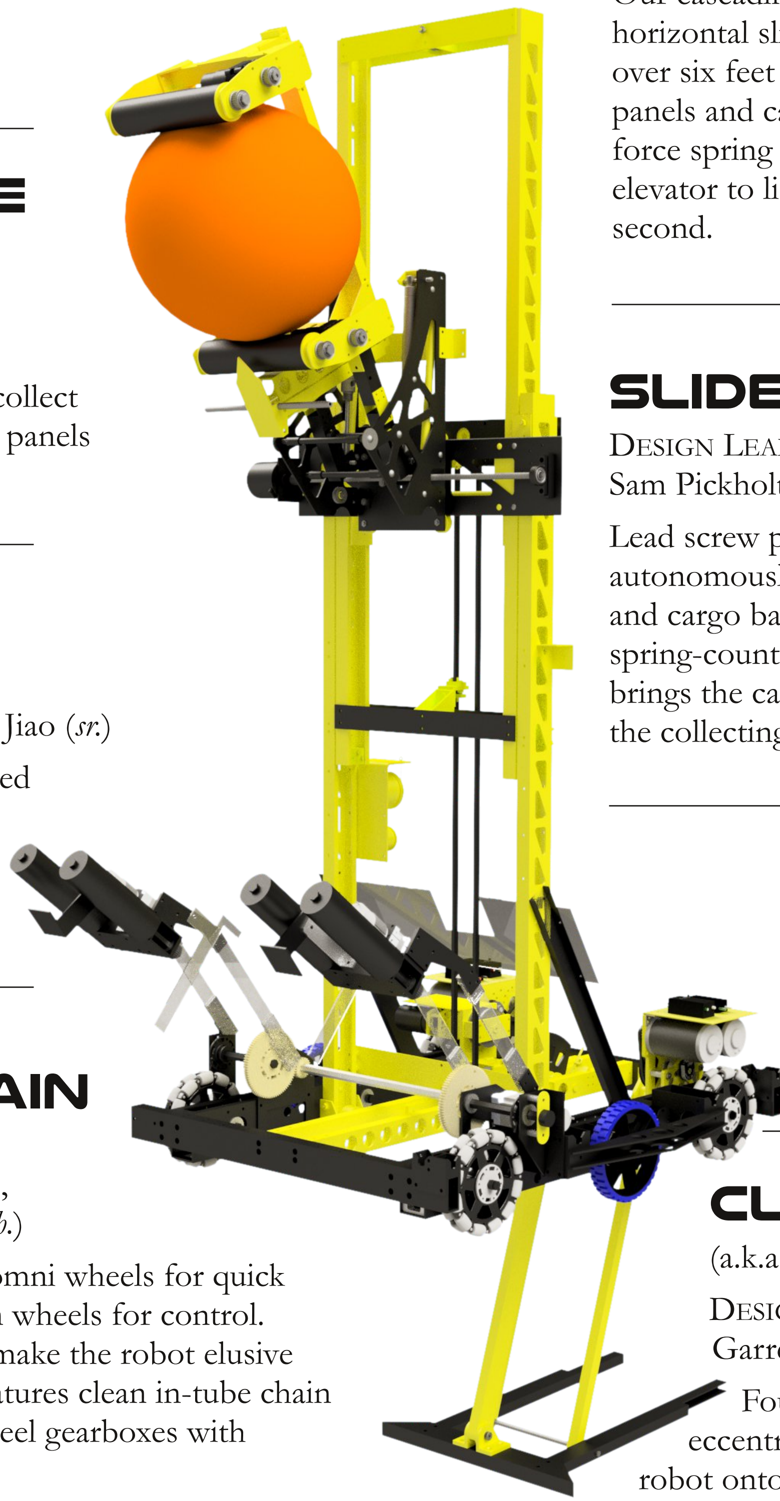


James Jiao (sr.) changing the cutter on the CNC mill while machining a part for the elevator.

Introducing:

SPACEREX

Height: 86in Width: 33in
Length: 32in Weight: 118lb



CARRIAGE INTAKE

DESIGN LEAD:
Andrew Ng (*sr.*)

Combined intake to collect and score both hatch panels and cargo balls.

GROUND INTAKE

DESIGN LEAD: James Jiao (*sr.*)

Spring-counterbalanced crowned rollers to center cargo balls into the carriage.

DRIVETRAIN

DESIGN LEADS:
Anna Shaposhnik (*jr.*),
Catherine Zheng (*soph.*)

A robot base with 4 omni wheels for quick turning and 2 traction wheels for control. Hexagonal bumpers make the robot elusive against defenders. Features clean in-tube chain runs and over-the-wheel gearboxes with integrated electronics.

ELEVATOR LIFT

DESIGN LEAD: Jonah Soong (*jr.*)

Our cascading elevator lifts the horizontal slider and carriage intake over six feet into air to deliver hatch panels and cargo balls. A constant force spring motor allows the elevator to lift up in just over a second.

SLIDER

DESIGN LEAD:
Sam Pickholtz (*soph.*)

Lead screw powered slider autonomously aligns hatch panels and cargo balls to the goals. The spring-counterbalanced pivot brings the carriage collector from the collecting to scoring position.

CLIMBER

(a.k.a "The Cobra")

DESIGN LEAD:
Garrett Peake (*sr.*)

Four-bar linkage with an eccentric pulley that raises the robot onto level 3 of the habitat platform in just 3 seconds!

Aligning with Line Scanners

How our software team tackles problems with creative solutions

Kunal Sheth (jr.)

In this year's robot game, drivers must align the robot to our goals with a depth accuracy of ±1.5" from 20ft away. My depth perception is not nearly good enough to perceive such distances, let alone correct for them. Thus, early on in build season, we planned to rely on the robot's sensors for automatic alignment.

I originally thought of using a conventional 2D camera and some OpenCV code to track the white lines on the ground which mark the goals. However, one drawback was apparent—the competition mandated RoboRIO is not powerful enough to run resource-heavy vision processing on top of real-time robot control code.

Kunal Sheth (jr.) testing a line scanner sensor.

Another option was to use a co-processor, but in the past, we have experienced that co-processors are unreliable, not to mention the added networking latency. Using a coprocessor would make our robot unreliable and would force us to make calculations off of single points in time, or "snapshots", instead of being able to perform control based off of the line's real-time position.

To keep our system fast and reliable, I took a lower-level, electrical approach: using a 1-dimensional grayscale camera, akin to a barcode scanner. By processing a single line of 128 grayscale pixels (as opposed to hundreds of thousands of RGB values), we greatly reduced the load on the processor.

Taking this lower-level approach required hard real-time capabilities to control the sensor array's exposure: hard real-time capabilities which a JVM cannot offer. So, my next plan was to use a separate microcontroller to interface with the sensor and relay data back to the RoboRIO (our main processor). While this strategy adds another point of failure, it still proved far more reliable than a coprocessor because it does not rely on higher level networking.

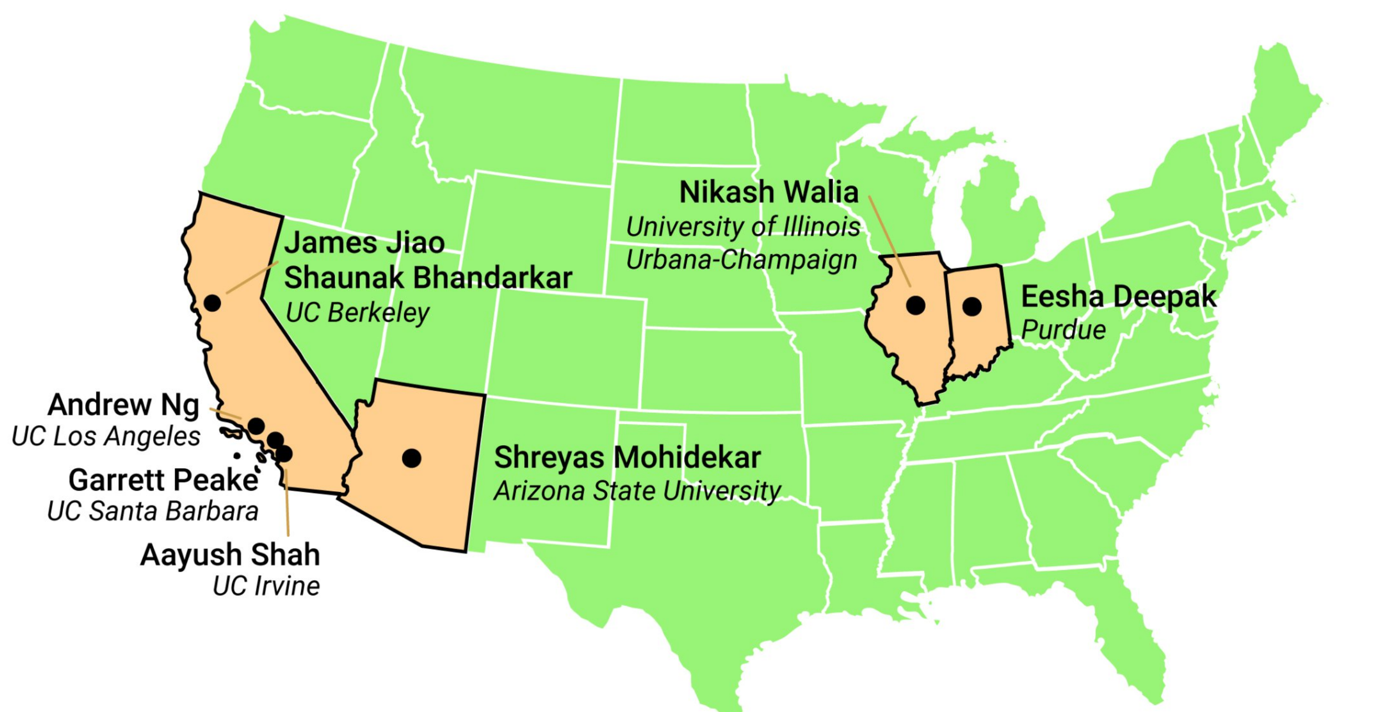
Unfortunately, the RoboRIO proved a major obstacle, with almost all standard forms of two-way communication (to dynamically set exposure, thresholding, and calibration values) either incompatible with my microcontroller or have outright broken implementations. Eventually, I ended up having to implement my own protocol based on pulse width modulation.

All in all, the line scanner was key to our robot's performance on the field. Knowing that collection and deployment would be handled automatically allowed me to drive faster and focus on higher-level aspects of the game, like getting around defense.

Alvyn Wang (jr.) and Andy Min (fr.) working on software for the robot.

My favorite result of this project is that it makes our robot look like a chicken. Running real-time control directly off the lines current position makes our robot's collector seem to just float in one place (like the head of chicken) as the robot's body moves side-to-side.

Where can you find the class of 2019?



graphic by Anna Shaposhnik (jr.)