Golem 6706

Engineering Portfolio

SHANGHAI **REGIONAL**
COLORADO **REGIONAL**

FIRST

golem6706-shenzhen.github.io/golem6706-shenzhen/

About Us

We are Golem, a FIRST Robotics Club from Shenzhen Senior High School. Since its establishment in 2017, we have been committed to promoting young people's interest in STEM (science, technology, engineering, mathematics). As one of the most senior high school student robotics teams in China, we have won numerous awards internationally. In addition, we have also received support from companies such as Shenzhen Huisi Tong Technology Co., Ltd. and Shenzhen Douxiaodou Technology Co., Ltd., showing the excellence of Shenzhen youth in the field of STEM.

Our Robot

Overview & Design Philosophy

This year, we've designed our robot with a focus on simplicity, efficiency, and consistency .

- ***Drivetrain*** – the foundation of the robot .
- ***Collector*** – retrieves CORAL from the station .
- ***Elevator*** – transports the game piece, with
- ***End Effector System*** on top – manipulates CORAL and ALGAE .

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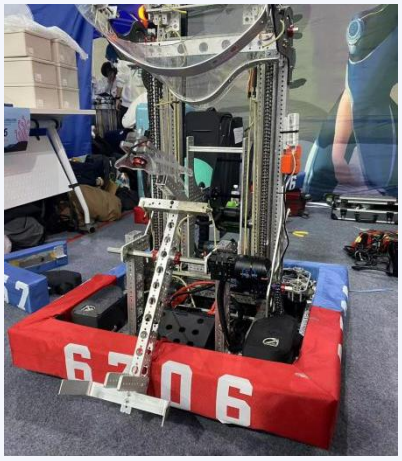
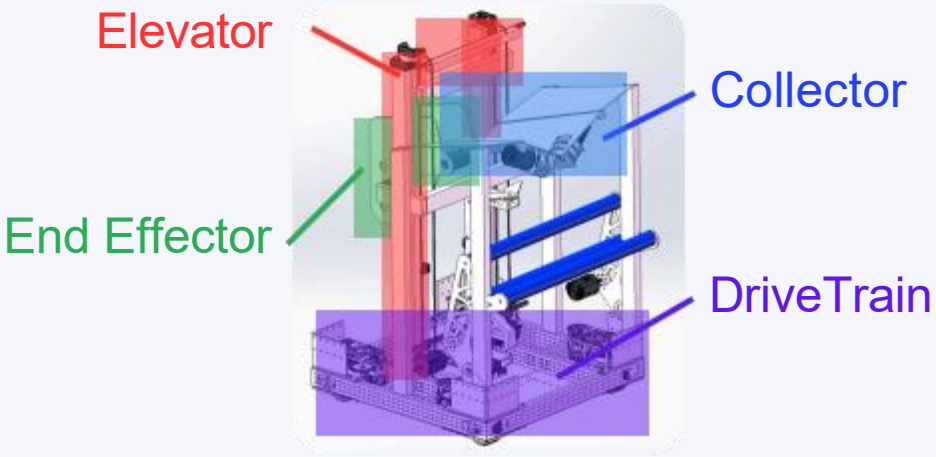
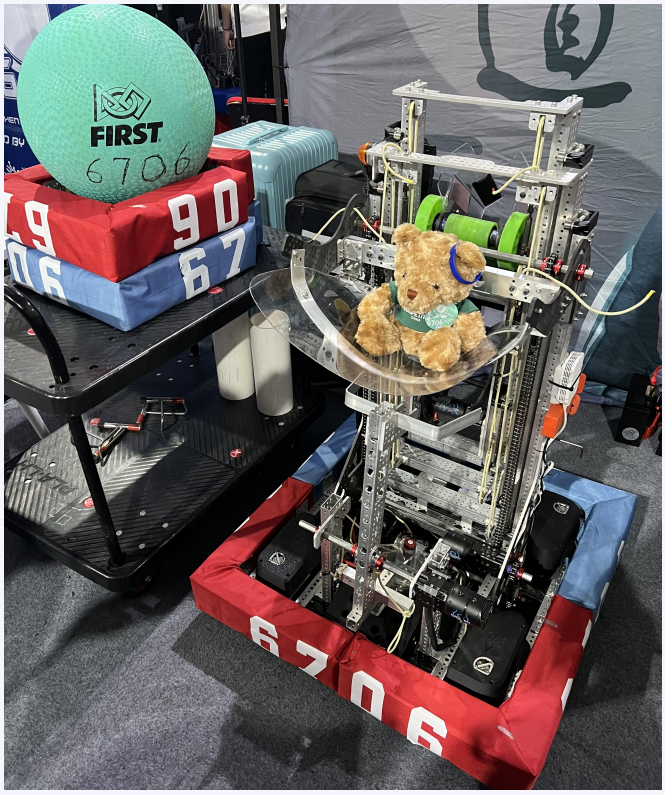




Our Robot

Robot Story

Our initial design included a variety of features . However, after two weeks of brainstorming, trials, errors, and multiple iterations, we refined it into a much simpler design to ensure consistency .

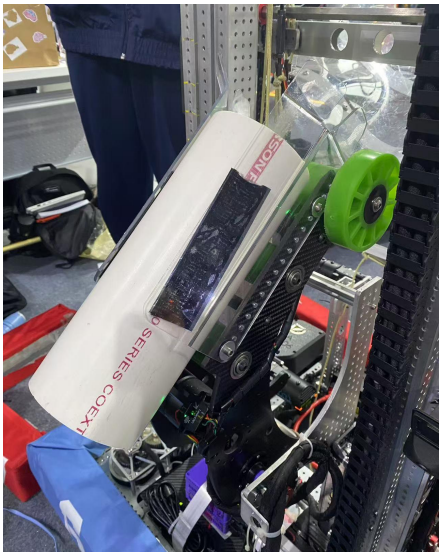


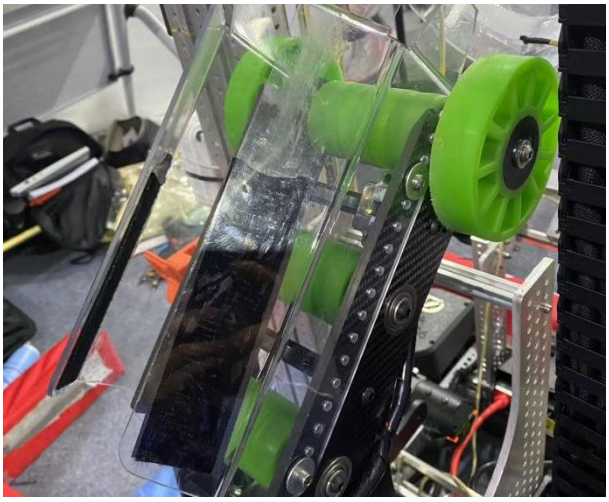
It's also worth noting that this is our team's first season building a Devbot . We constructed a semi-complete robot to validate our design and practice driving, and it has proven to be highly effective .

Our robot

Collector Mech

The collector, secured in the back of our robot, is responsible for obtaining CORAL from the CORAL station . The design starts with a funnel system to center the CORAL; the four paralleled powered wheels are able to quickly transfer the CORAL to the End Effector System to score .

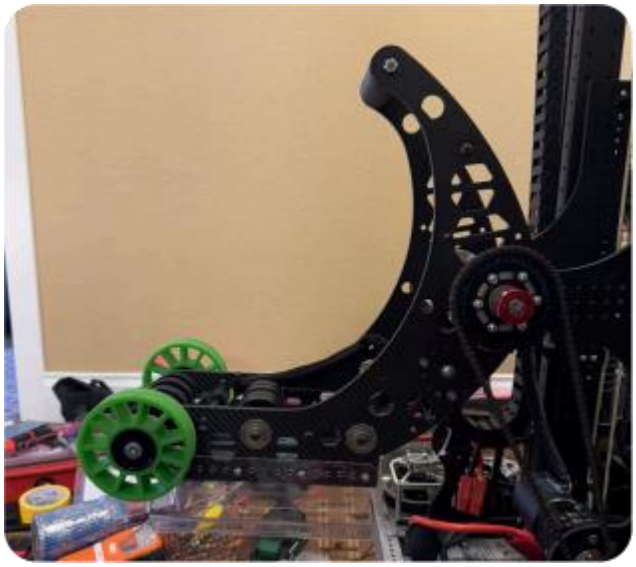




During testing, we found out that the CORAL sometimes gets stuck in the wheeled transfer system . Which we added a guiding board to help push down the CORAL in place for a successful intake .

Our robot End Effort System

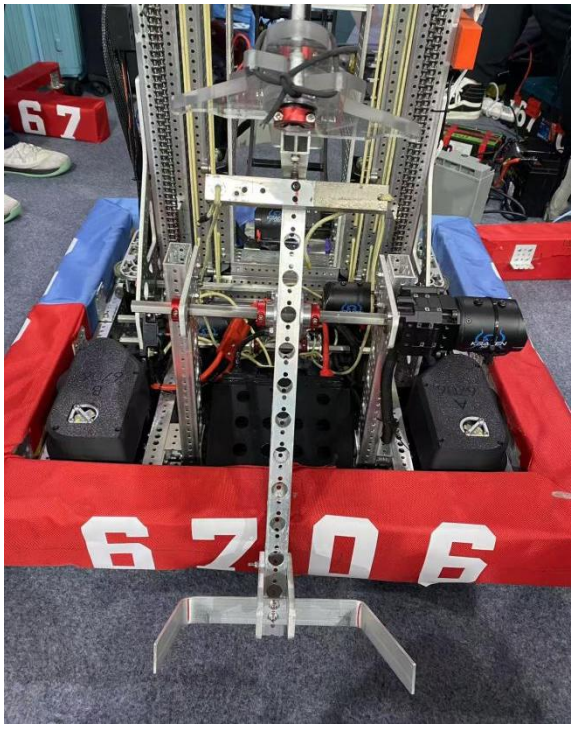
Building on the WCP Competition Concept design, our End Effector System integrates a ***CORAL*** manipulator atop an arc-shaped ***ALGAE*** manipulator . Mounted on a chain-driven arm mechanism and a chain-rope-driven double-stage elevator, it can be positioned at any angle and height, enabling scoring at all levels of the ***REEF***.



Our robot Climb Mech

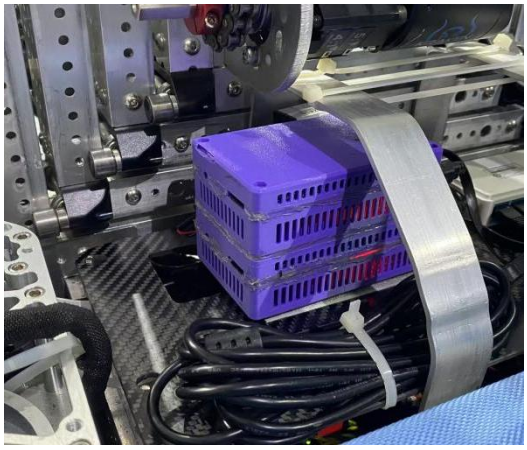
Catching the ***CAGE*** in the competition is a crucial challenge . To address this, we designed two specialized mechanical hooks that securely lock onto the cage without requiring electricity .

The hooks are powered by rubber bands, utilizing a triangular structure that causes them to retract inward . When the robot approaches the cage and triggers the hooks, they will quickly snap into place, tightly locking onto the bottom beam of the cage . This process takes less than five seconds, significantly improving climbing efficiency and reliability .

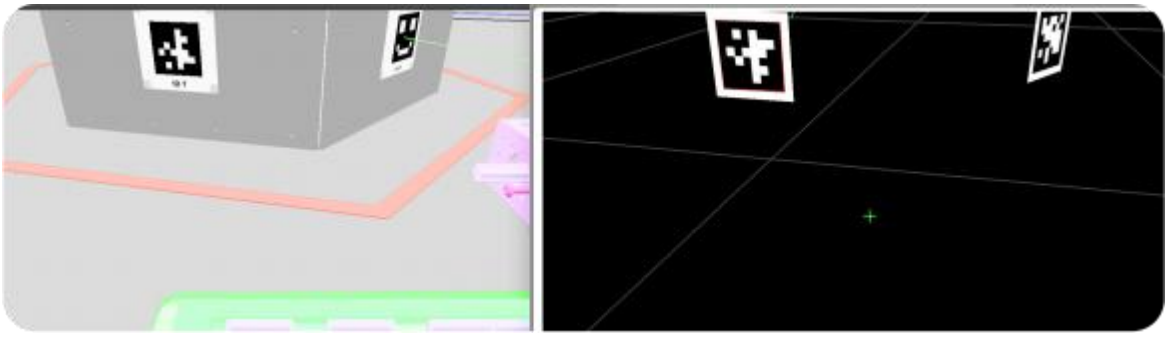


Controls AprilTag Alignment

The Reef auto-alignment system is a key component of our strategy in this year's precision-focused game .
To achieve this, we use four sets of cameras and Orange Pis to detect AprilTags on the ***REEF***.

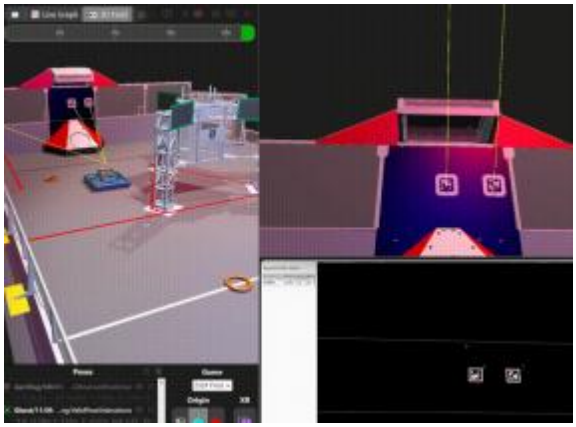


The cameras precisely measure the relative positions of the AprilTags and use algorithms to determine the robot 's position on the field .



Controls

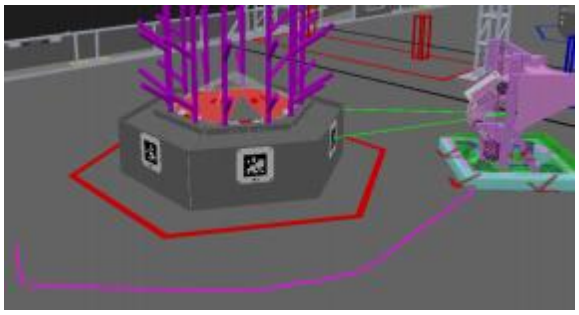
Making the alignment more precise

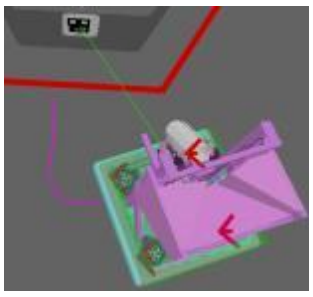


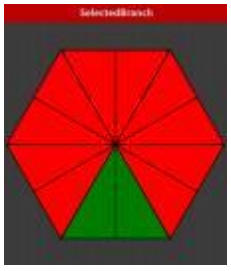
We implemented a custom filtering algorithm to reject invalid AprilTag observations caused by dirty camera images, along with a Kalman filter to fuse vision and odometry data .

Our alignment process consists of two steps:

1 . ***Path Finding*** – We use an A* algorithm to navigate toward the target while avoiding obstacles .
2 . ***Fine Adjustment*** – The robot moves slowly toward the target, continuously correcting its position based on vision observations .





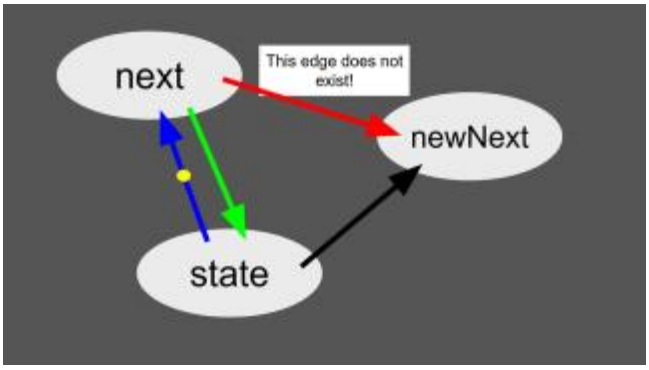


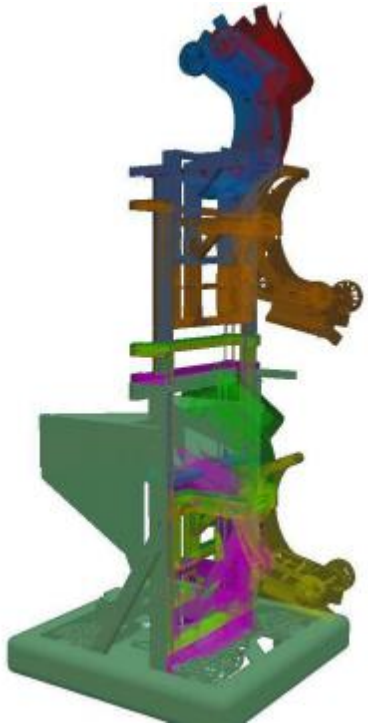
Controls SuperStructure Motioning

The arm and elevator form the superstructure, positioning the End Effector System at any height and angle . However, they can encounter a "dead zone, " which may cause the mechanism to jam .

To prevent this issue, we created a list of predefined "poses" for the superstructure . These poses are known to be safe, allowing the system to transition smoothly between them without jamming .

When the superstructure transitions from one pose to another, an algorithm determines the quickest and safest path to reach the target position .

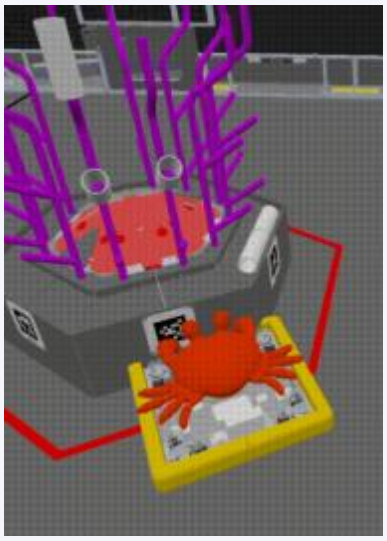




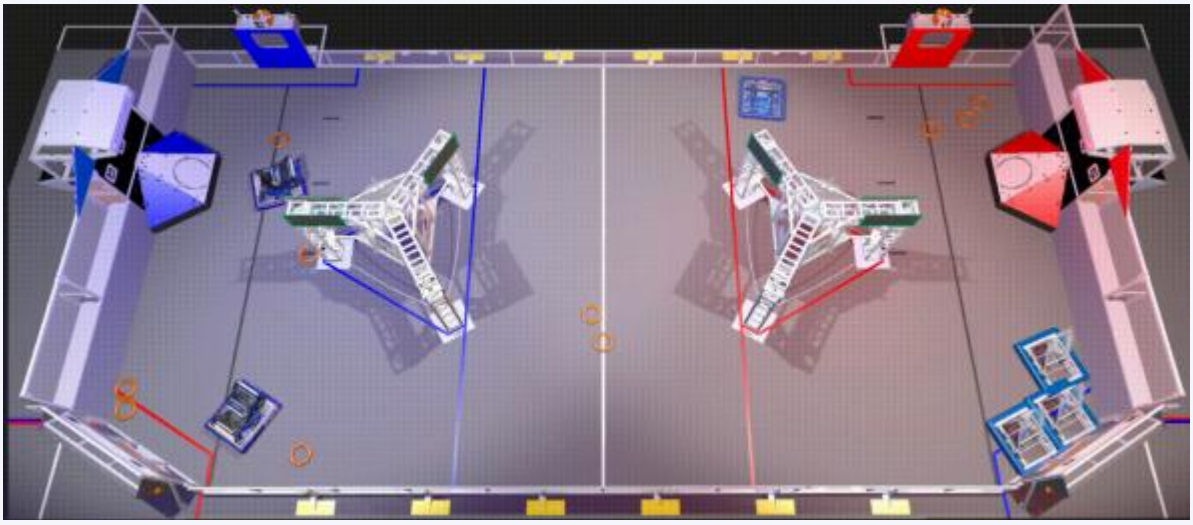
Controls

Simulation Technology

Since the offseason, we've been using a custom physics simulation engine to model the robot and its interactions with the arena .



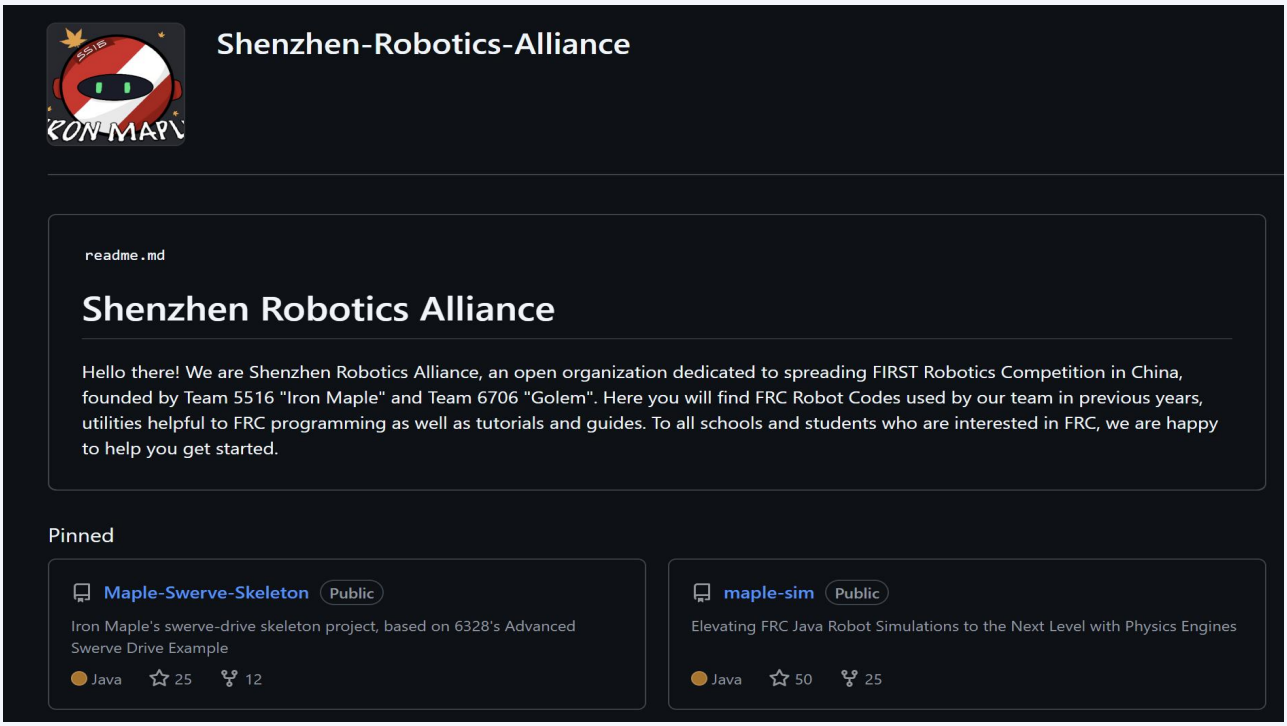
A realistic robot simulation enables us to test code and practice driving without a physical robot . This not only streamlines debugging but also allows us to develop and refine robot code before the hardware is complete .



Contributions to Open-Source Community

For efforts in the aspect of community, we found an open organization named Shenzhen FRC Alliance, which brought together multiple FRC teams, including 5516, 7594, and 6304. This platform allows member teams to share resources, knowledge, and strategies, thus strengthening the entire

FRC ecosystem. To be specific, we now host 42 repositories on GitHub; write guidelines for beginners on Notion, and share CAD for construction. Shenzhen FRC Alliance is open to everyone. On chiefdelphi, our posts about open-source physics simulators and scouting WebApp are pretty popular.



https://github.com/Shenzhen-Robotics-Alliance

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Thank You!

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