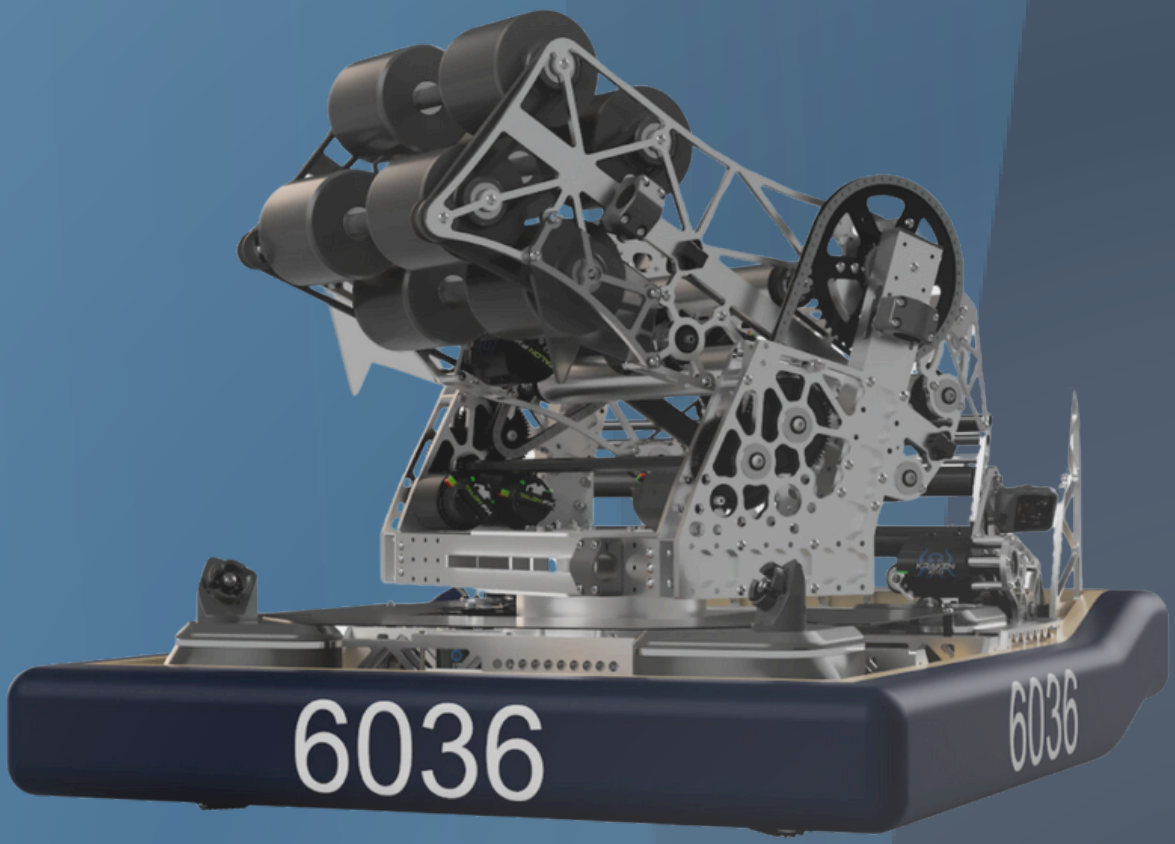
PENINSULA ROBOTICS



Snoopy

Technical Binder

2024

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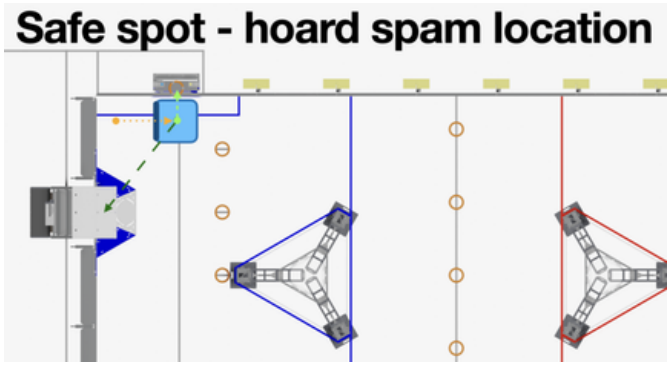
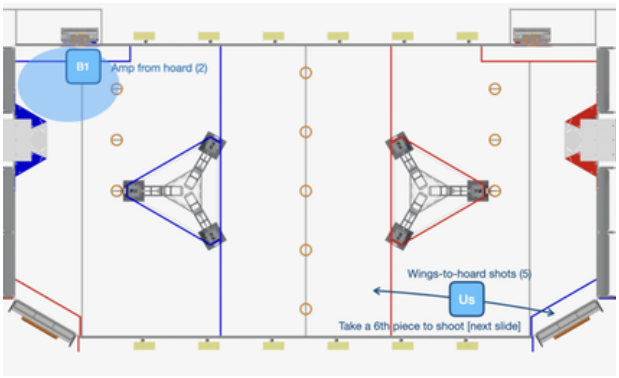
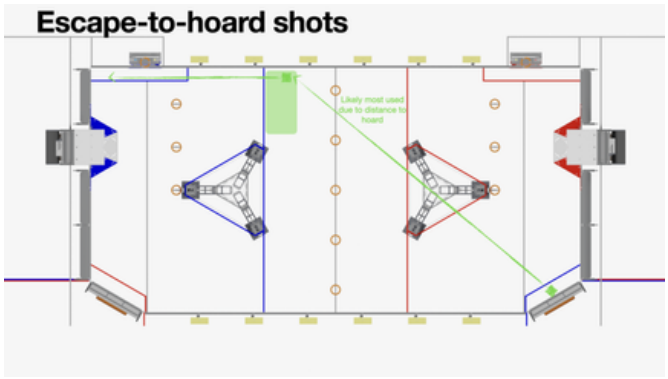
GAME STRATEGY



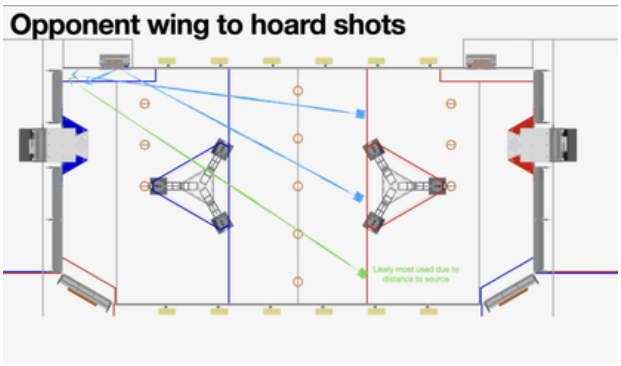
- Utilizing the turret, we can pick notes up from a hoarded location and not have to turn the chassis to make shots into the speaker and place notes into the amp from within the safe zone



- In our hybrid cleanup/hoarding strategy, we take hoarding shots for an alliance partner to amp and then come in to clean up 3-4 notes into the speaker during the period to maximize 5-pointers and not waste notes on 2-pointers



- Under circumstances of high congestion, we can take an “escape shot” from the source into midfield to be picked up by a partner or ourselves on the way back
- This can also be used strategically even in times of low congestion to maximize notes moved across the field
- This is a viable strategy to decrease wasted time across the alliance at the highest levels of play



- With accurate full-field vision, we can dynamically take “hoard shots” to a set corner location where we can pick notes up from for cleanup during an amplified period
- With the turret, doing this under defense and congestion becomes much simpler

DRIVEBASE

The Drivebase holds the electronics and maneuvers the robot around the field.

SDS MK4i Modules

- L3.5 reduction modules allow for high top-speed
- Krakens X60s for drive and Falcon 500s for steering
- Covers protect modules from dirt and prevent grease from escaping

Chassis

- ⅛" aluminum frame rails on 3 sides and 1/16" frame rail on intake side
- ⅛" aluminum pocketed belly pan strengthens chassis and holds electronics
- CNC machined boat bumpers with WCP cone bumper mounts

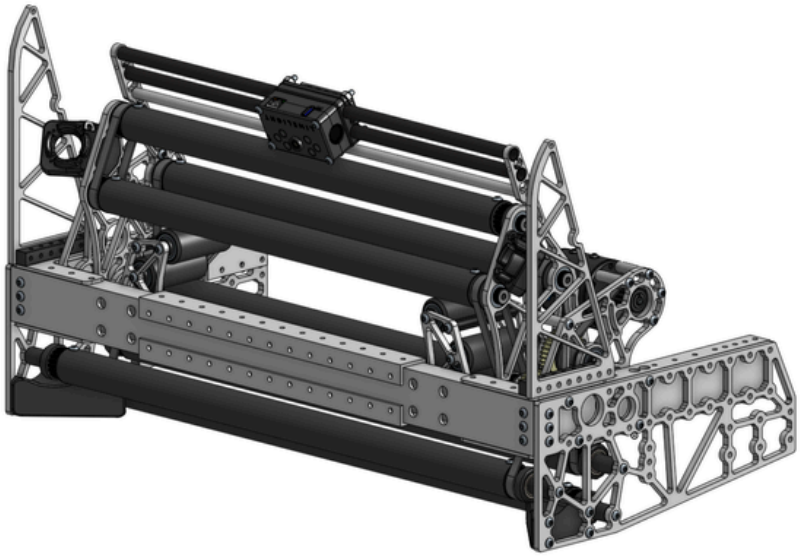
Electronics

- Battery bottom mounted with connector under the baseplate.
- Custom quad hot-swappable sliding Orange Pi cases with Pololu buck regulators
- Custom cable strain reliefs for CANivore & Orange Pis
- Packaged to fit under 2 inches with ample room for wiring

Software

- Dynamic power regulation for harder acceleration and higher top speed

INTAKE



The intake collects notes under the bumper and brings them into the shooter.

Construction

- ⅛” aluminum tubes mount to swerve modules to stiffen intake plates against impacts
- C channel mounts to front intake rail to prevent bending
- Angled plates protect Limelight and cameras from stage while climbing

Rollers

- 7 belt-driven rollers powered by 1 Kraken 500
- 1.25” OD 1/16” ID polycarbonate tubes wrapped in Cat Tongue grip tape contact notes
- Live and dead axle roller designs allow replacing each roller by removing 2 bolts

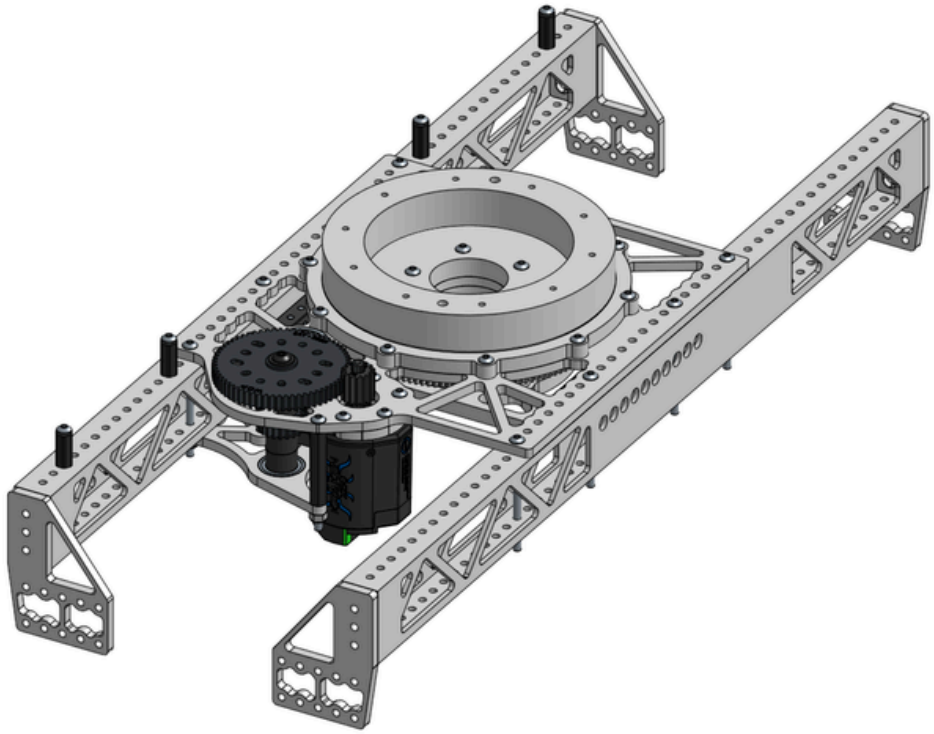
Serializing

- 3D printed wedges partially center notes upon acquisition
- Idling rollers fully center notes to handoff to the shooter

Limelight

- Limelight 3 on 12mm carbon fiber rods attached to clamping plates with Coral TPU used for real-time note pose estimation and mapping

TURRET



The turret rotates the pivot and shooter to score on all sides of the robot.

Gearbox

- 43.6:1 reduction powered by 1 Kraken X60 actuates turret
- Custom laser-cut 25DP spur gear rotates the final stage
- Overcrowded gear fits and adhesive-backed shim tape reduce backlash

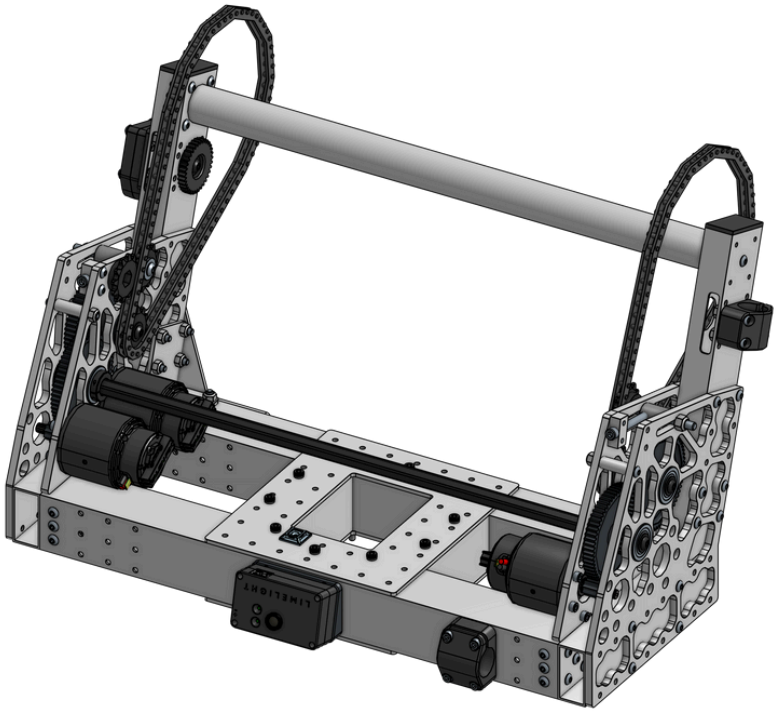
Double Bearing Support

- 7.25″ OD 6.25″ ID X-contact upper bearing and a 110mm OD 60mm ID lower bearing combine to improve moment load capability significantly
- Withstands dynamic loads from robot and stage impacts as well as climbing

Electronics

- Wires routed through both bearings allow for 720-degree turret rotation
- Absolute encoder tracks turret rotation to simplify robot setup

PIVOT



The pivot mounts to the turret to pivot the shooter and power the climb.

Construction

- Box beam construction is stiff and light
- 10 bolts connecting pivot to turret allow for quick replacement

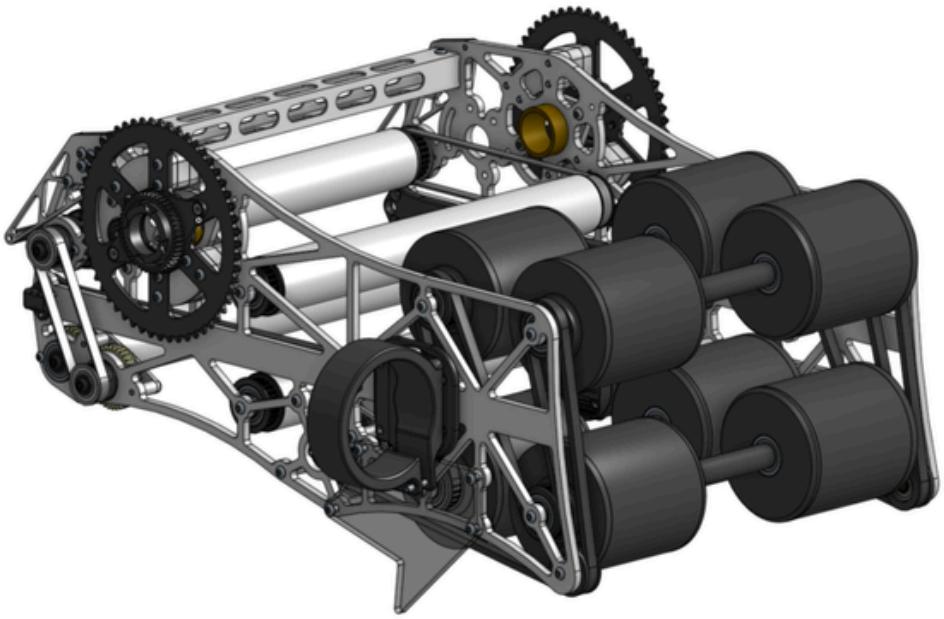
Gearbox

- 115.2:1 reduction powered by 3 Kraken X60s quickly rotates pivot and holds robot up after climbing with break mode
- ½" Thunderhex shaft connects both sides of the gearbox and acts as a hard stop for the shooter
- Custom chain tensioners engage idler sprockets to easily tension chain

Electronics

- 3D printed parts clamp to wire conduit to manage wires into the shooter
- 3D printed gears directly couple absolute encoder to the pivot's rotation

SHOOTER



The shooter uses pitch and yaw adjustment to climb and score into the speaker, amp, and trap.

Rollers

- 4 1.75” diameter aluminum tubes index the notes into the shooter
- Mix of bare and cat-tongue tape for controlling spin and facilitating handoff
- 8 4” diameter polycarbonate rollers with 3D printed end caps for increased note contact time
- Double-sided timing belt and dead-axles to reduce weight and spin-up time
- Dual Kraken X60s independently power each side at a 7:10 speed differential for added spin.

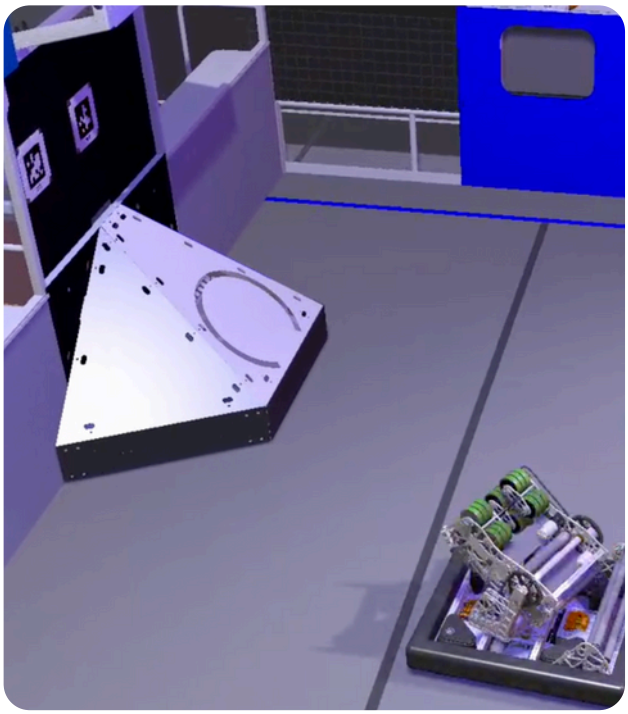
Blower

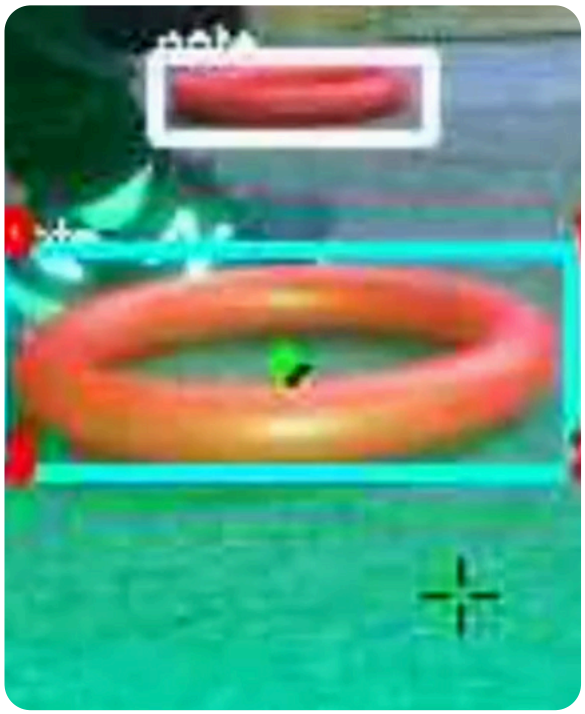
- 3D print clamps onto Milwaukee M12 Compact Blower to open the trap door
- Powered by 775pro motor

Climb

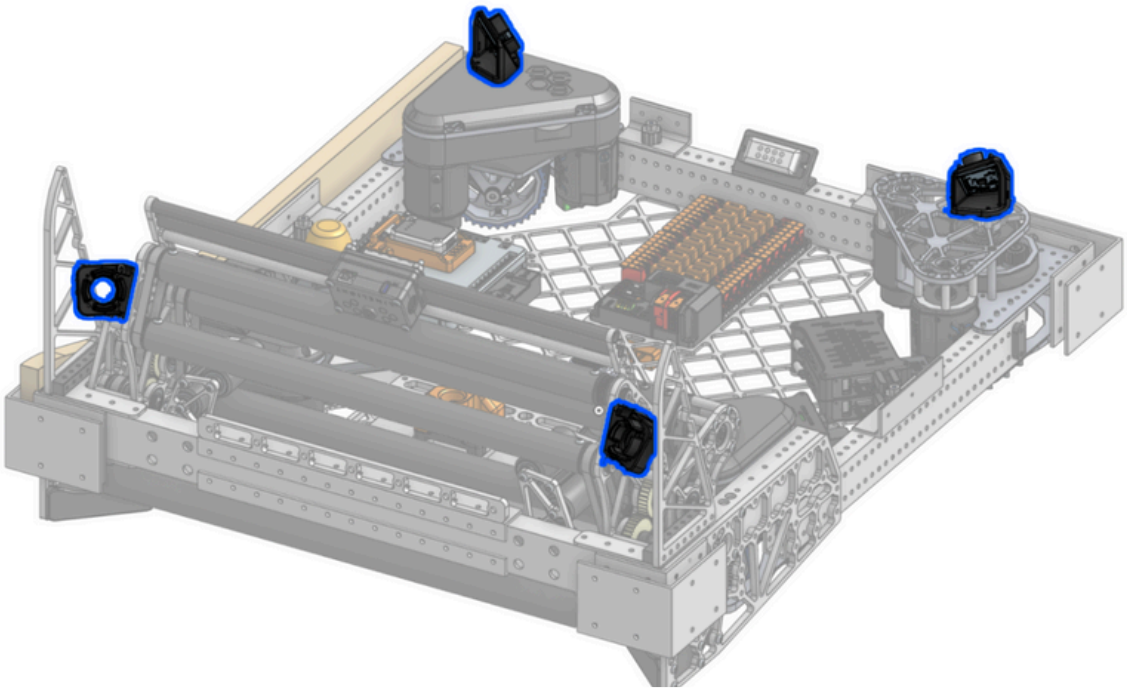
- Hooks grab onto the chain to climb by pivoting the shooter
- Polycarbonate hook construction prevents bending

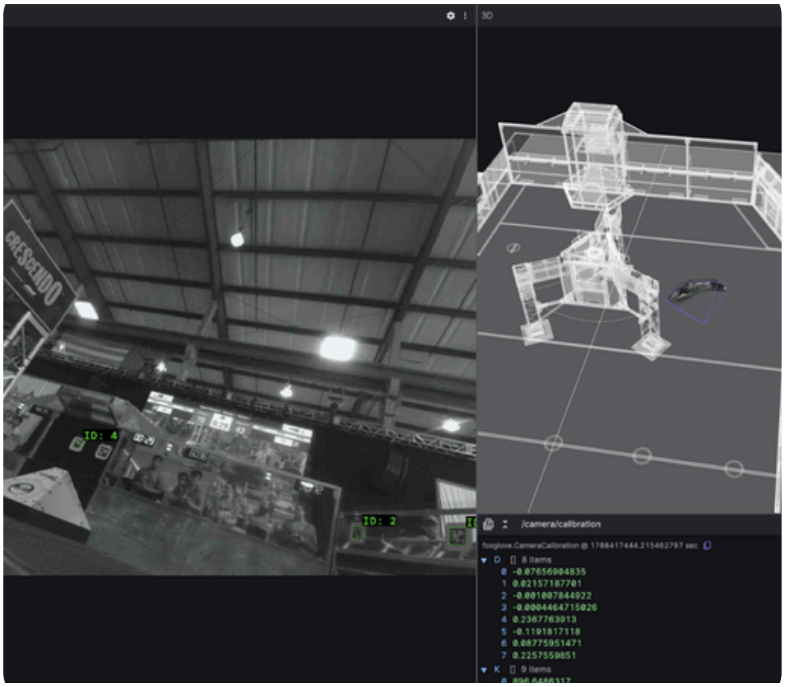
PROGRAMMING





VISION

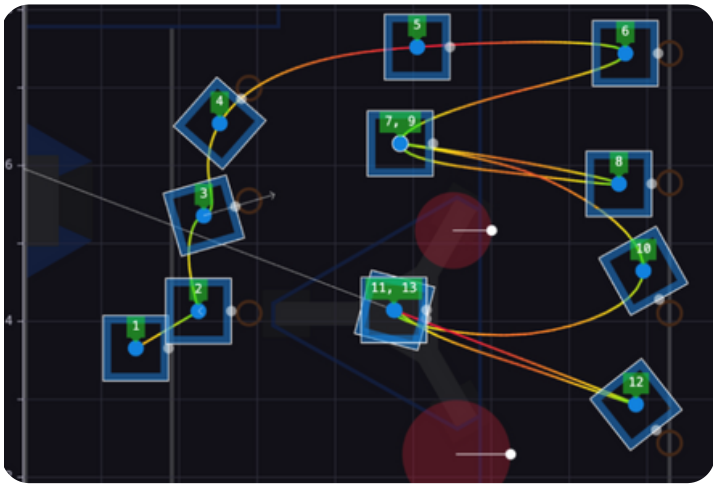




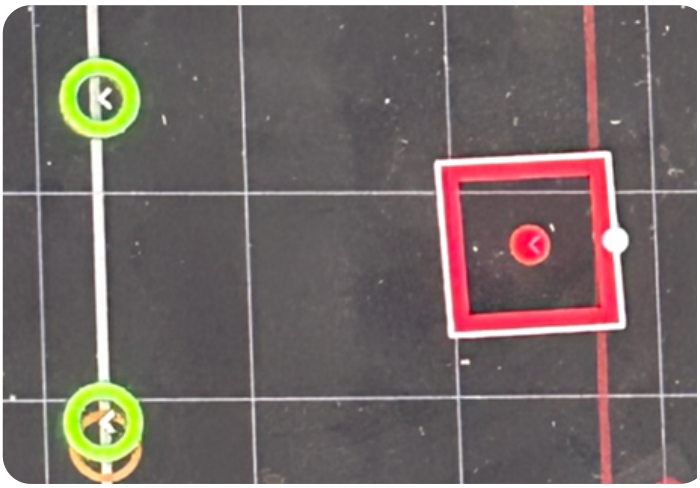
- 4x OrangePi 5s running “Peninsula Perception” for 1600x1200 @ 50fps Apriltag detection across 4 global-shutter cameras
- Kalman filter fusion on-Rio with latency compensation and outlier rejection
- 5000-frame per-camera calibration for accurate intrinsics for undistortion and projection
- Mcap log capture for debugging including video, detections, and pose estimation

AUTONOMOUS

- Custom trajopt (Peninsula Planner) for optimal trajectory generation under physical constraints such as voltage, current, friction, motor power and trajectory constraints such as waypoints and 2d obstacles



- Full note pose estimation from a custom-trained object-detection model and an intelligent note-type identification for dynamic and efficient auto replanning



- Easy to make autos that don't require tuning as software uses many sensors to determine when it can feasibly accomplish tasks such as shooting and intaking

```
new ParallelRoutine(
    new ContinuousIntakeShootRoutine( timeout: 30),
    new DrivePathRoutine(new WantedTrajectory(sweep),
```

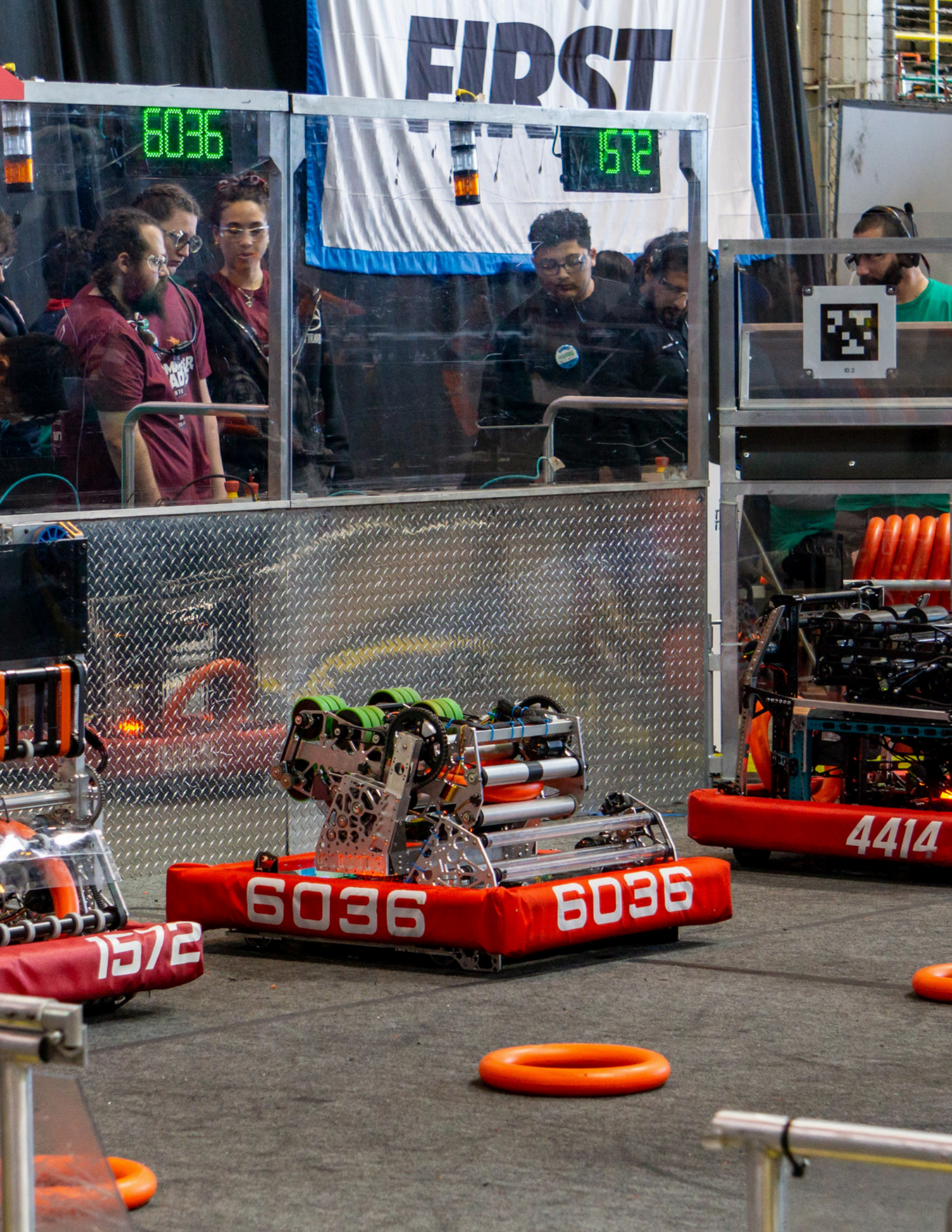
TELEOP

Power & Speed

- Dynamic power management to load balance between swerve and shooter spin-up and utilize regenerative braking
- Demand-based switching to allow for harder drive acceleration and faster top speeds

Aiming & Shooting

- Automated superstructure to maximize note “cleanup” throughput
  - Utilizing beam-break sensors & encoder positions/velocities
  - Time-optimized note handoff to minimize turret snap back-and-forth between intake to shoot
- Specialized iterative shoot-on-move solver to allow shooting under acceleration as well as high velocities (recomputed at 250hz)
- Vision built to be robust enough to be able to shoot from between wing and midline consistently on a real field
- Uses an interpolating map with a polynomial smoothing for pose-based pitch adjustment on the pivot
- Pose-based Feedforward calculations on top of PID for turret to shoot while robot rotates at a high angular velocity
- Intelligent pose-based turret wrapping to minimize wrapping during shooting periods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