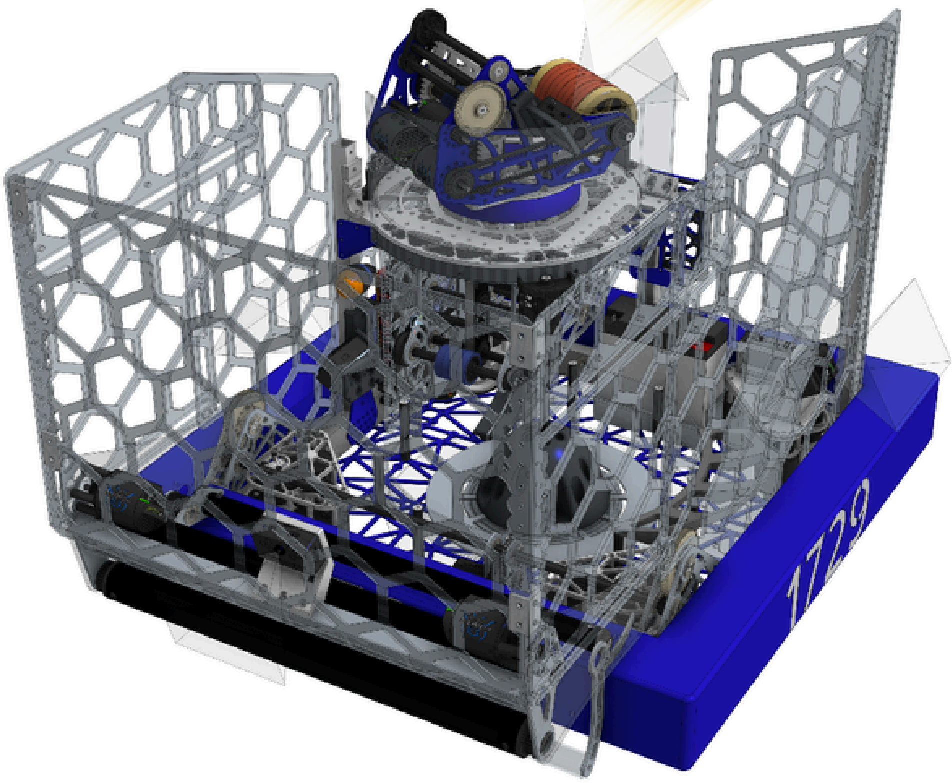
FRC 1729
TEAM INCONCEIVABLE

GLADOS

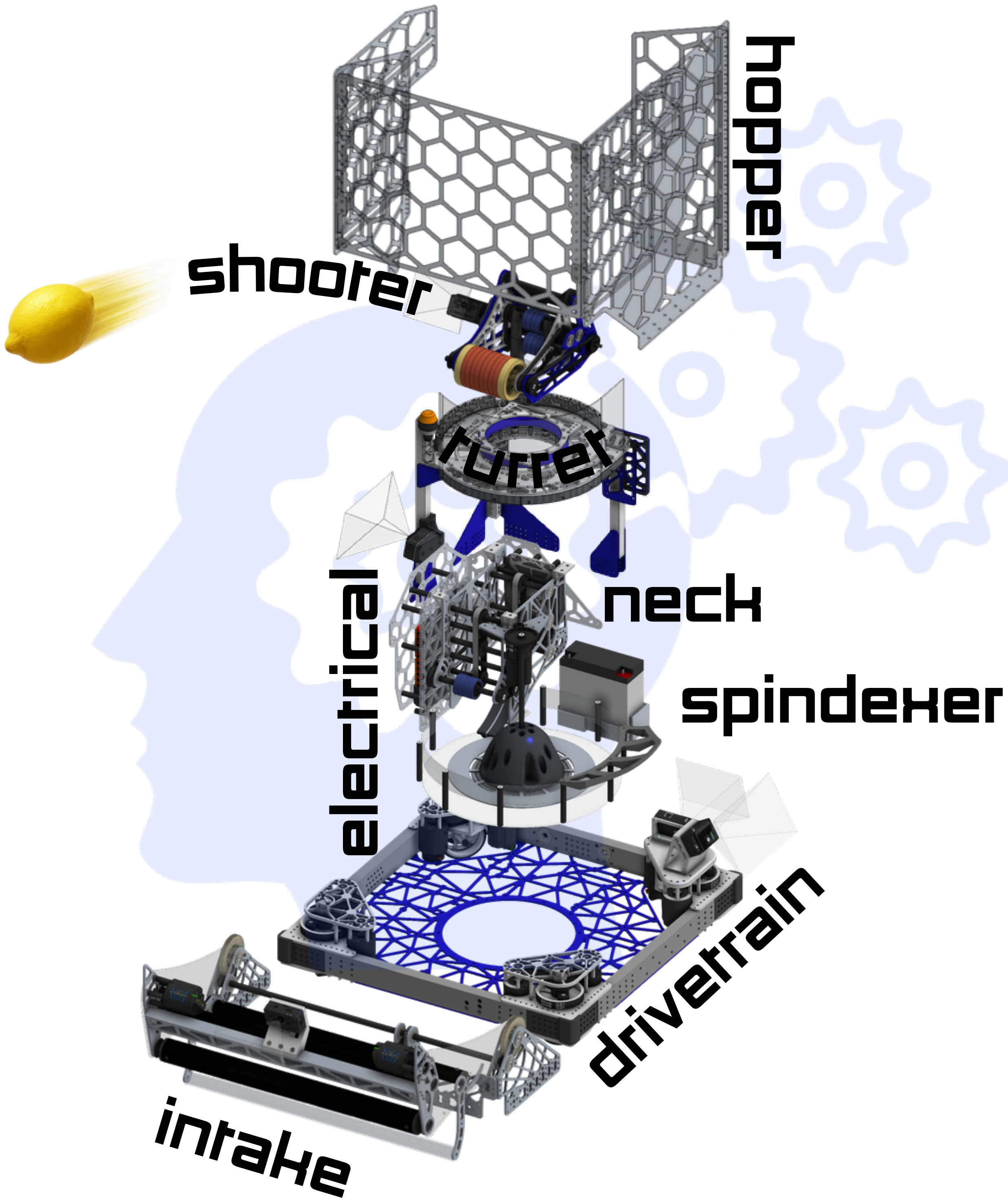


Guided Lemon Artillery & Defensive Ordinance System

2026
Technical Binder

REBUILT™

General Robot Subsystems



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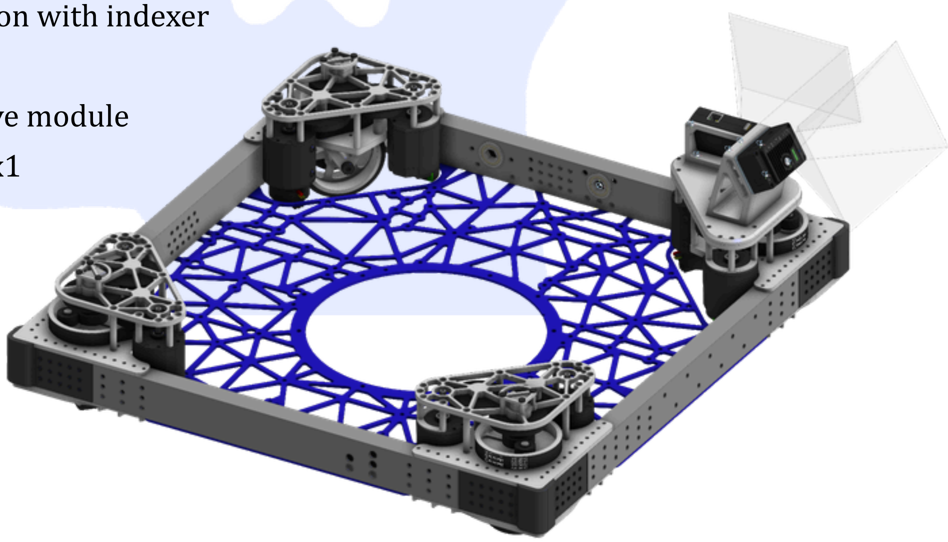
Drivetrain

Design Requirements:

- Drivetrain shall traverse all bumps without high-centering, with ≥1.5 in ground clearance under load.
- Drivetrain and superstructure shall remain below 30 in at all times.
- Drivetrain shall fit within a fixed 110 in ROBOT PERIMETER while preserving central volume for mechanisms.
- Drivetrain shall achieve 14–16 ft/s geared free speed with traction adequate for fast cycles and defense.
- Drivetrain structure shall withstand repeated full-speed and off-axis impacts over an entire event without performance loss.
- Drivetrain shall allow precise low-speed alignment to the hub and depot, including when on the bump or contacting fuel.

Details:

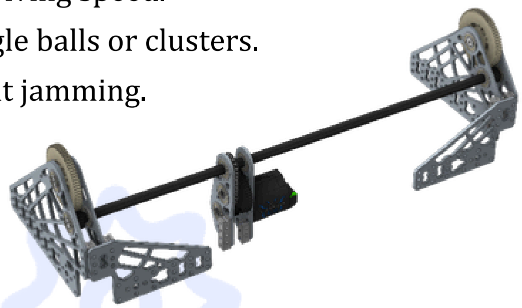
- Swerve Modules
  - MK4i SDS Swerve Modules
  - L2 Gear Ratio
  - Kraken x60 Drive Motor
  - Falcon 500 Steer Motor
- Custom Frame Rails
  - Fully custom in order to minimize frame weakness
  - ⅛ inch wall 1x2 inch 6061-T6 aluminum box tubing
  - Machined In Shop on an Omio X8
  - Belly Pan with Ribbed lightening pattern and center spindexer bearing cut-out (2.5 lbs)
  - Direct integration with indexer
- Cameras
  - Back Left swerve module
  - LL4 x1 + LL2+ x1



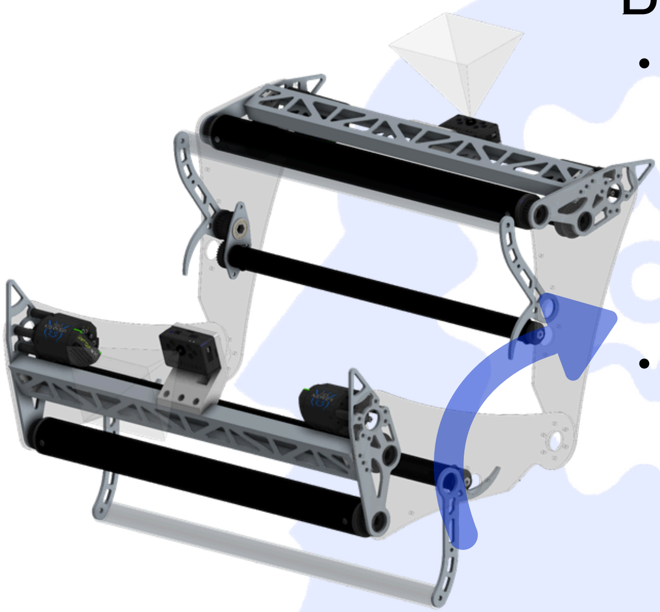
Intake V3

Design Requirements:

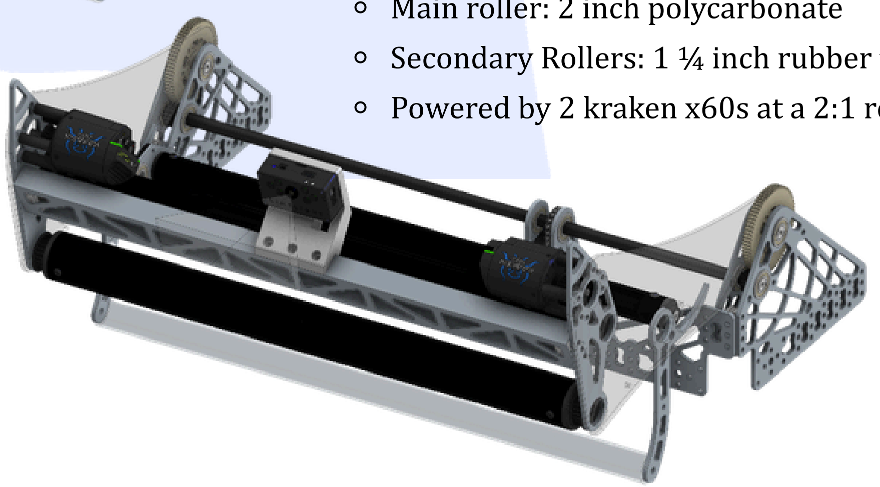
- Intake shall reliably acquire 15 cm FUEL from any orientation at full driving speed.
- Intake shall maintain “touch it, own it” control, minimizing loss on single balls or clusters.
- Intake shall handle FUEL size, wear, and compression variation without jamming.
- Intake shall span a wide pickup width (bumper-to-bumper or close).
- Intake rollers shall run at ≥2× robot max drive speed.
- Intake shall withstand repeated hits and side loads when deployed.
- Intake shall fully stow inside the frame perimeter and deploy reliably.
- Intake shall feed FUEL to the indexer in a controlled pattern suitable for high throughput.
- Intake shall be easily serviceable, with quick access to common wear components.



Details:

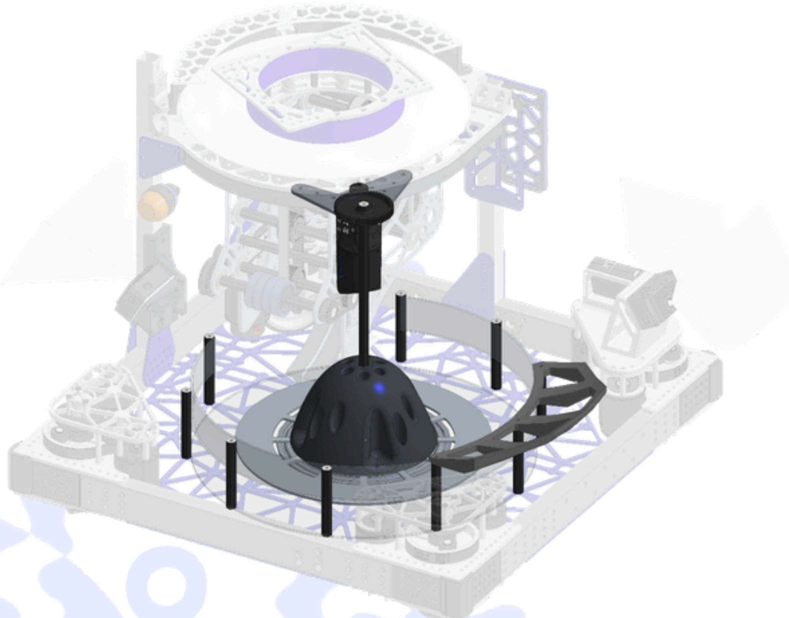


- Intake Deployment
  - 3/16 inch 6061-T6 Aluminum side and front Plates
  - Shaft that spans the width of the intake in order to achieve even deployment
  - #35 chain to absorb shock and load
  - Total gear ratio of 97.2:1 from Kraken x60
- Intake
  - Polycarbonate side panels with aluminum housing plates for rollers
  - 1x2 inch ⅛ inch wall aluminum box tubing as brace
  - Aluminum spring loaded deployable foot
  - Main roller: 2 inch polycarbonate
  - Secondary Rollers: 1 ¼ inch rubber tubing
  - Powered by 2 kraken x60s at a 2:1 reduction



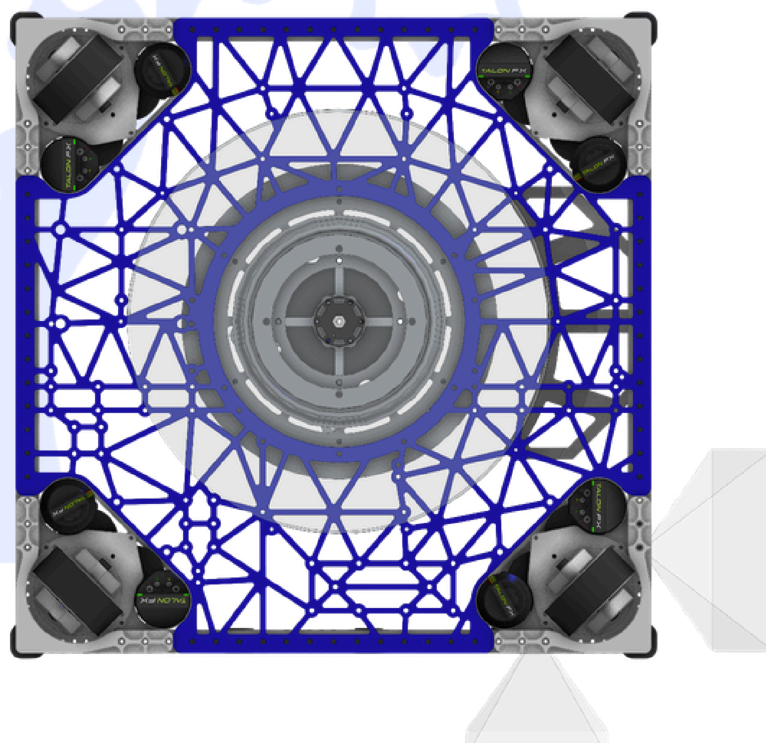
Design Requirements:

- Indexer shall accept FUEL across its full width without stalls or bounce-outs.
- Indexer shall create a controlled single-file stream to the shooter at the target rate.
- Indexer shall maintain positive control around the full arc
  during motion and impacts.
- Indexer shall tolerate FUEL size/compression variation without jams or double feeds.
- Indexer structure and construction shall endure continuous cycling without misalignment.
- Indexer shall be versatile towards a large variety of agitation setups.



Details:

- Spindexer
  - 13.5 inch diameter ⅛ inch aluminum spinning floor with cat toungue tape.
  - Can fit 7 feul in the track
  - Through bearing that goes through bellypan in order to combat getting when traversing the bump or driving on feul
  - Lazy susan bearing embedded in bellypan
  - Kraken x60 powering indexer with a 16.4:1 gear ratio
  - As space efficient as possible in order to allow for maximum hopper capacity
  - Provides secondary support to turret structure through live axel



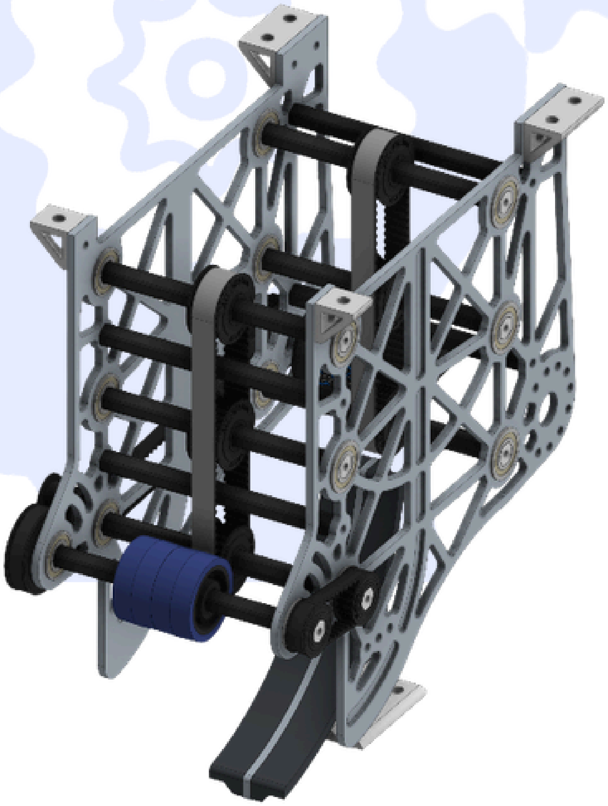
Neck

Design Requirements:

- Neck shall allow consistent throughput of feul from indexer
- Neck shall not limit the BPS of the robot and must be able to keep up with shooter
- Limit deadzones throughout
- Isolate from electronics to minimize vibrations

Details:

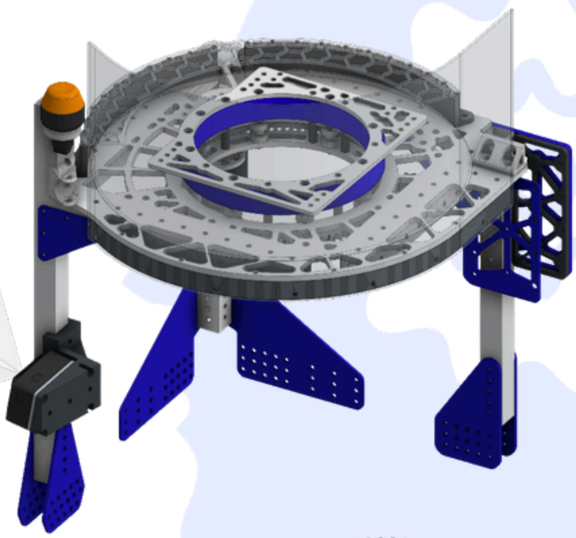
- Neck
  - Two belts with rubber coating that feed the ball into the shooter
  - 775 Pro with a 10:1 gear ratio and 5:3 belting with a total reduction of 16.7:1
  - 3/16 inch 6061-T6 aluminum plate made from old firetruck parts
  - Isolated from the indexer and electronics via mounting through turret panel
- Ramp
  - Aluminum spine
  - PETG 3D printed ramps

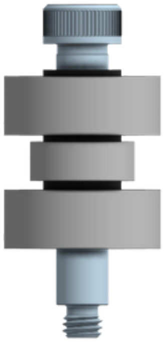


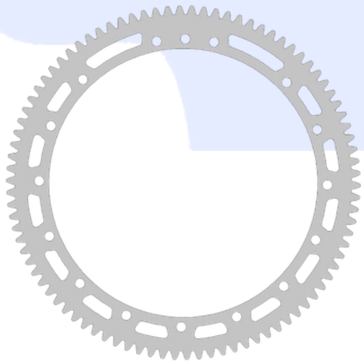
Turret

Design Requirements:

- The turret shall provide sufficient rotation range to aim at the HUB from all planned shooting locations without reorienting the drivetrain.
- Turret motion shall be precise and repeatable, enabling consistent targeting within the shooter's required accuracy window.
- The turret shall integrate cleanly with vision and sensor feedback to support automated target tracking and "shoot while moving" capability.
- The turret structure and bearing system shall be stiff and robust enough to maintain alignment under robot acceleration, impacts, and rapid firing.
- Turret cable and hose routing shall allow full motion without snagging, wear, or limits on firing cadence.
- The turret shall interface reliably with the tridexer indexer, accepting FUEL at the designed handoff point without bounce-back or jams.







Details:

- Superstructure
  - It is all made out of 1/16 inch 1x1 inch square 6061-T6 box aluminum tubing.
  - Supportive brackets outside of the turret made out of ⅛ inch.
  - Initially designed to help support the weight of our climber.
  - Uses gussets as opposed to tube plugs.
- Turret Bearing Stack
  - ¼-20 shoulder bolts with 0.75 and 0.5 inch bearings that sandwich the turret plate.
  - Low tolerance washers used to space to 1/64 of an inch.
  - Mounts to polycarbonate wire run which then mounts to a neck for the wiring.
  - Machined azimuth gear out of 3/16 inch aluminum.
- Other Features and Integrations
  - Polycarbonate shield with custom 3D printed bracket.
  - 3D printed wire run shields.
  - RSL and wire run mount.
  - Support to incorporate climber.

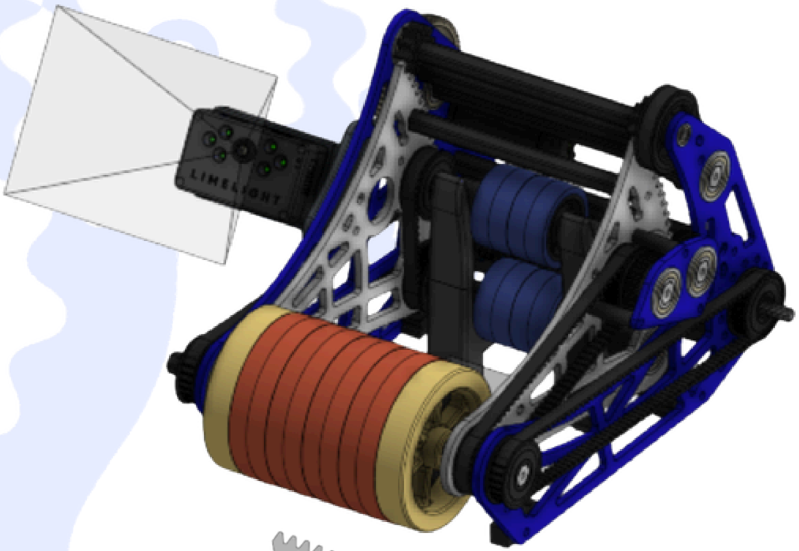
Shooter

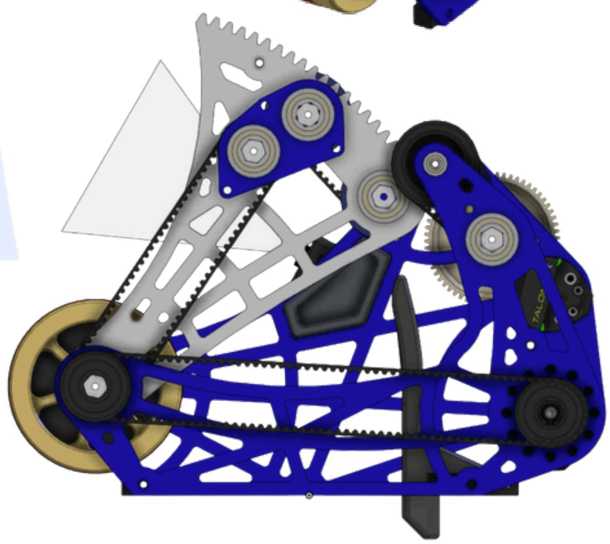
Design Requirements:

- Shooter shall consistently score 15 cm FUEL in the HUB from all planned shot locations at the target rate.
- Shooter shall accept a continuous stream from the tridexer without RPM sag or starvation.
- Shooter wheel, hood, and compression shall produce a stable, repeatable trajectory with minimal bounce-outs.
- Shooter shall use closed-loop control to reach and hold commanded wheel speed (and hood angle, if used) quickly.
- Shooter shall tolerate normal FUEL variation (size, wear, surface) without significant loss of accuracy.
- Shooter and turret mounting shall remain stiff under acceleration, impacts, and rapid firing so aim does not drift.
- Shooter subsystem shall allow easy access to wheels, hood, and sensors for maintenance and iteration.

DETAILS

- Two Kraken x60s with 1:1 gear ratio powering the shooter wheels
- Kraken x44 with a 10:1 gear ratio powering hood rotation
- 1.5 lb 4 inch flywheel
- Two sets of hood wheels to cancel backspin
- Wheels:
  - 4 inch 40a Stealth Wheels x3
  - 2 inch 50a Sushi Wheels x4
- Two 3D Printed PA6-CF Guides for guiding the ball at any hood angle
- Custom machined 10 dp gearing on hood plates
- 10 tooth 10 dp PA6-CF gears driving hood rotation
- All 3/16 inch 6061-T6 aluminum plating
- Limelight 3 mount made of 95a TPU that meshes with lightening pattern
- Capable of launching the feul 80+ feet
- Hood angle of 12° - 78°
- Shooter wheel spins at 5000+ RPM





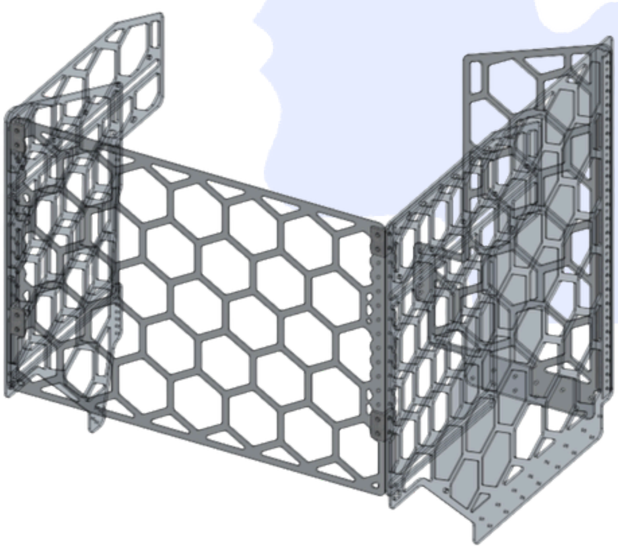
Hopper

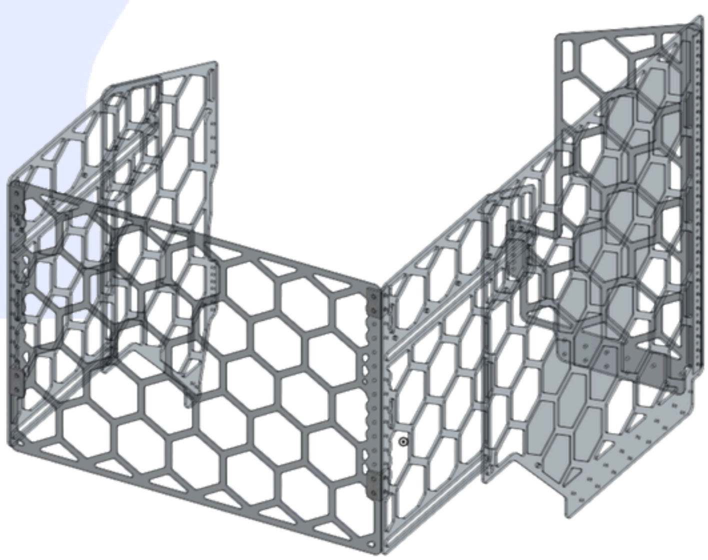
Design Requirements:

- Hopper shall store the maximum amount of fuel possible while integrating with the other robot subsystems.
- Hopper shall be as light as possible without flexing outside of our frame perimeter.
- Hopper shall be tall in order to minimize bounce out while going over the bump.
- Hopper shall have a consistent deployment mechanism that deploys with the intake and does not jam.
- Hopper shall prevent fuel from getting caught or jammed, as well as minimizing dead zones.
- Hopper shall be able to withstand robot-on-robot collisions, being flexible enough to not be damaged.
- Hopper shall allow other parts of the robot to be serviceable and not inhibit maintenance on other subsystems.
- Hopper shall allow all of the cameras a clear and unobstructed view of the April tags.

DETAILS

- Hopper walls machined out of 3/16 polycarbonate
- Aluminum brackets throughout for structural integrity
- ½ inch bearings for sliding mechanism with washers and machined polycarbonate brace in order to prevent the walls from detaching
- Total of 12 inches of deployment
- Sponsor panel on the left hopper panel
- Hexagonal lightning pattern in order to conserve weight
- Mounts to drivetrain and turret structure
- Easily maintainable and replaceable

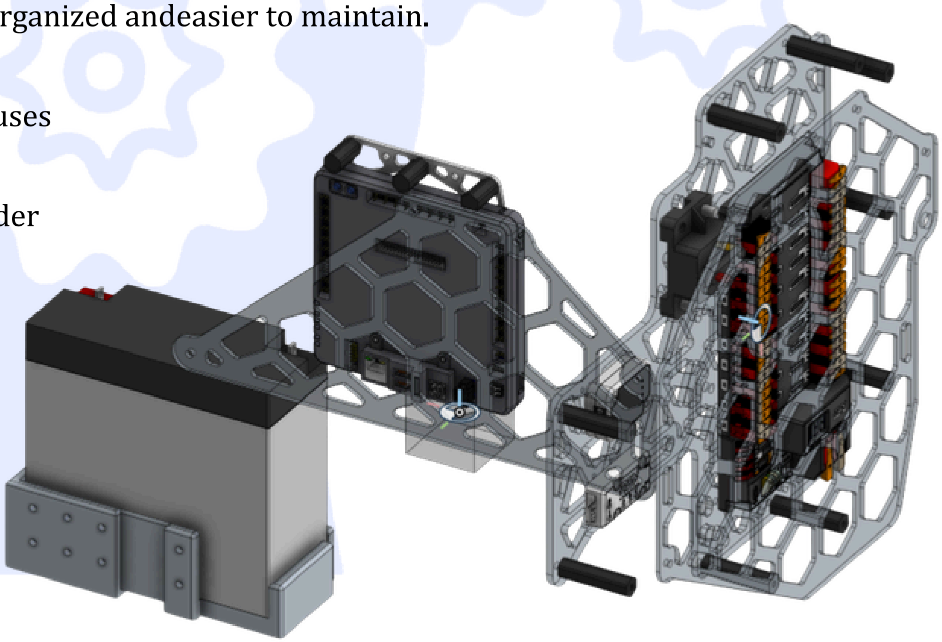




Electrical

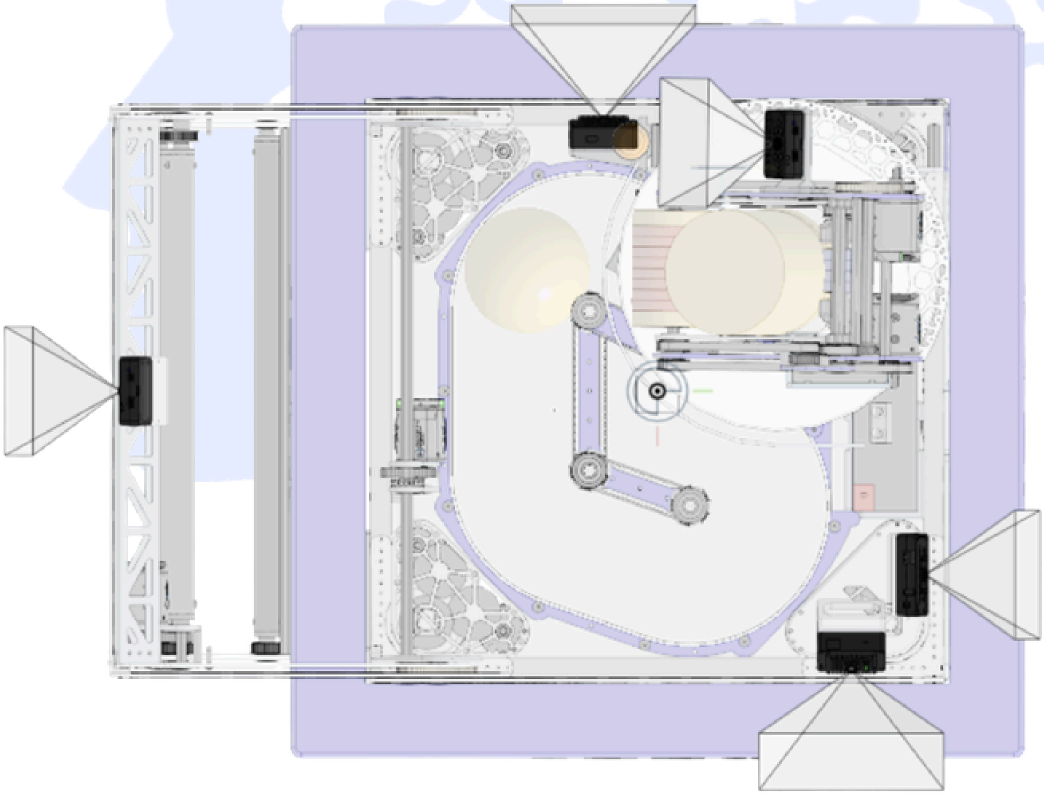
Information:

- Electronics are mounted to the hood panel on custom ⅛ inch polycaorbonate, with polycaarnbonate covers
    - The rio is isolated from neck vibrations by mounting to the turret superstructure
    - The electronics side panel also is isolated by mounting to the superstructure instead of the neck
- Electronics side panel:
    - PDH
    - CANavors x2
    - Main Breaker
    - Ethernet switch
    - VRMs x2
- Wiring
    - **All wiring on robot is Soldered, there are very few snap connector connections**
        - This has enabled us to have far less electrical failures compared to previous years, and has made the whole of the wiring more organized andeasier to maintain.
- CAN
    - We run three individual CAN buses
        - RIO CAN
            - Intake Motor and encoder
        - Lower CANivore
            - Drive train motors and encoders
            - Intake deployment
        - Upper CANivor,
            - Every motor on /near the turret structure



Information:

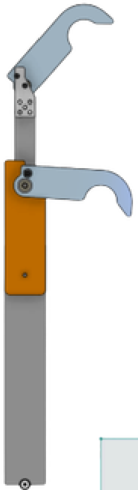
- There are five cameras on the robot
    - Two Limelight 4s
    - Two Limelight 3s
    - One Limelight 2+
- We use MegaTag 2 for field localization, we use our LL4s and our LL2+ for april tag tracking and pose estimation for more consistent autos and to automatically aim our turret for shoot on the move
- We use the LL3 on the front of our intake to track Feul, or "Lemons" as we call them. This allows us to autonomously hunt Feul in blind spots on the field and in auto.
- We have one LL3 mounted on our turret for even more accuracy of our shot, we use this camera to see if our turret is accurate and if not we fall back on it for stand in place shooting.

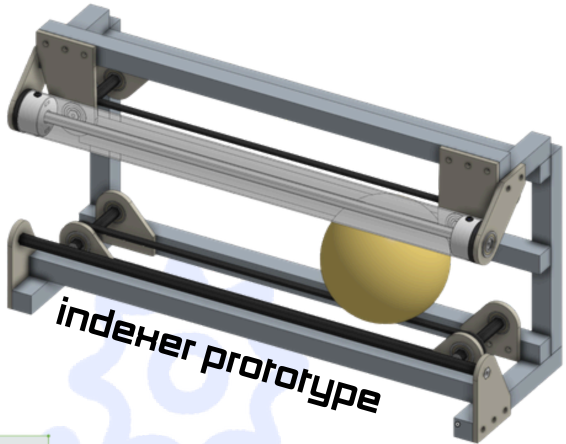


Automation

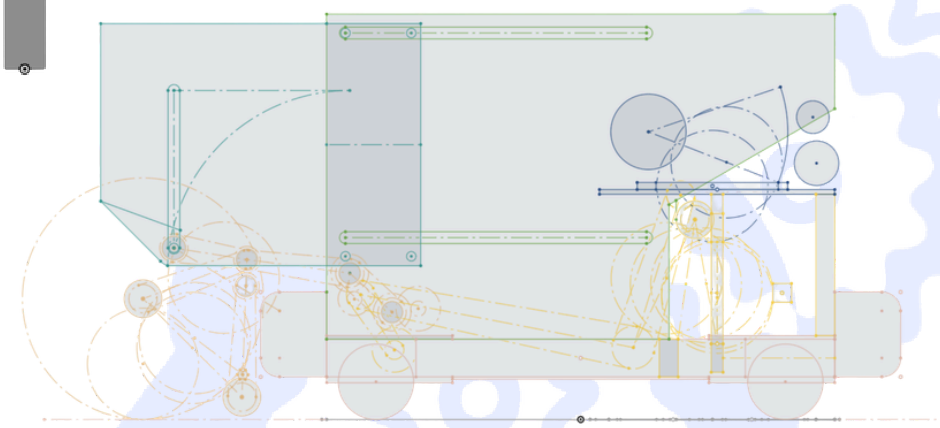
Our robot automates shooter positioning and vision-based navigation for scoring game pieces

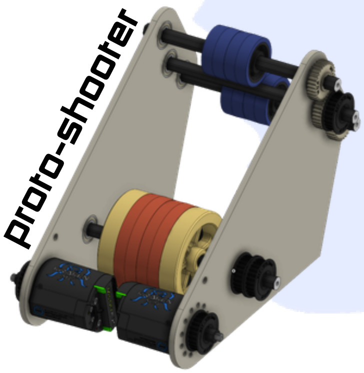
- Vision Odometry
  - Continuously fuses AprilTag detections from multiple Limelights ("limelight-left", etc.) with wheel odometry. Left-facing camera provides field-centric pose updates every periodic() cycle for accurate positioning.
- Auto-Aim Presets (Driver Buttons)
  - A button: AutoPoseHubScoreCommand - Turret aims/positions for speaker scoring using vision pose data.
  - X button: AutoPoseHubPassLeftCommand - Automated pass to left community position.
  - B button: AutoPoseHubPassRightCommand - Automated pass to right community position.
  - Y button: Manual hub preset + 1-second wait. (Deadman Shot)
- PathPlanner Autos
  - Full autonomous routines via AutoBuilder with named commands ("aimHub", "passLeft", "passRight"). Supports field-relative trajectories flipped for red/blue alliance. Pose estimator handles vision corrections.
- Field-Aware Behaviors
  - Robot detects if it's in alliance zone (within 2m of goal center) using fused odometry. Supports operator perspective flip (0°/180°) based on alliance color.
- Shooter Automation
  - Turret subsystem with Kraken (TalonFX) relative encoder reverts to precise mechanism-degree positioning. Hood/Flywheel configs enable automated shot profiles. Linear speed compensation from swerve state.


climber prototype

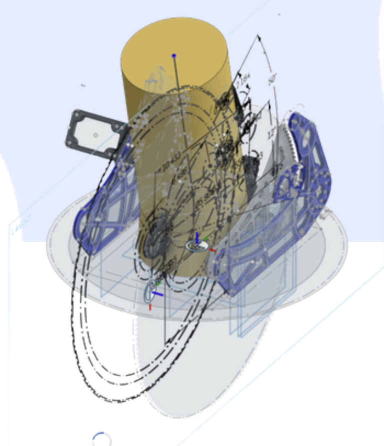

indexer prototype

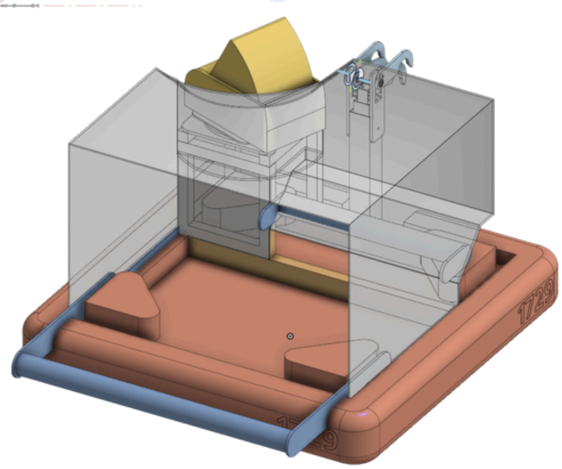
master sketch

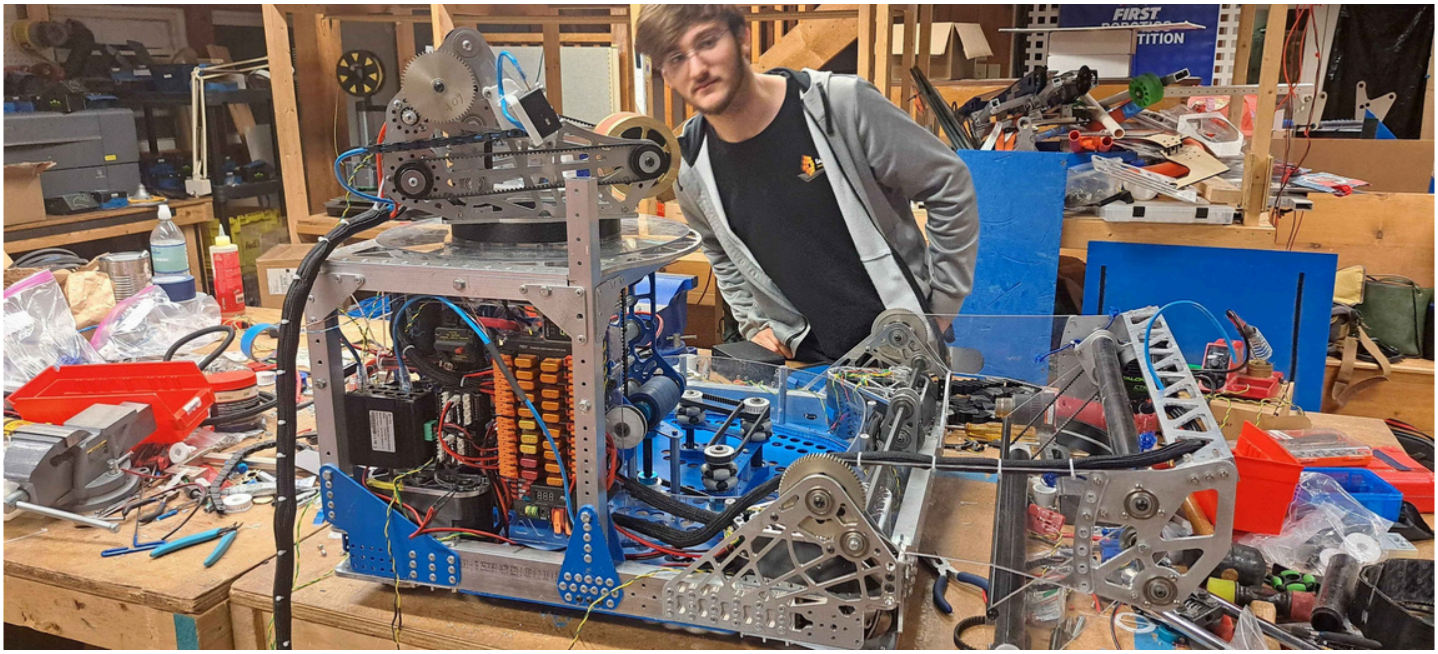



proto-shooter

shooter math




day 2 krayon cad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