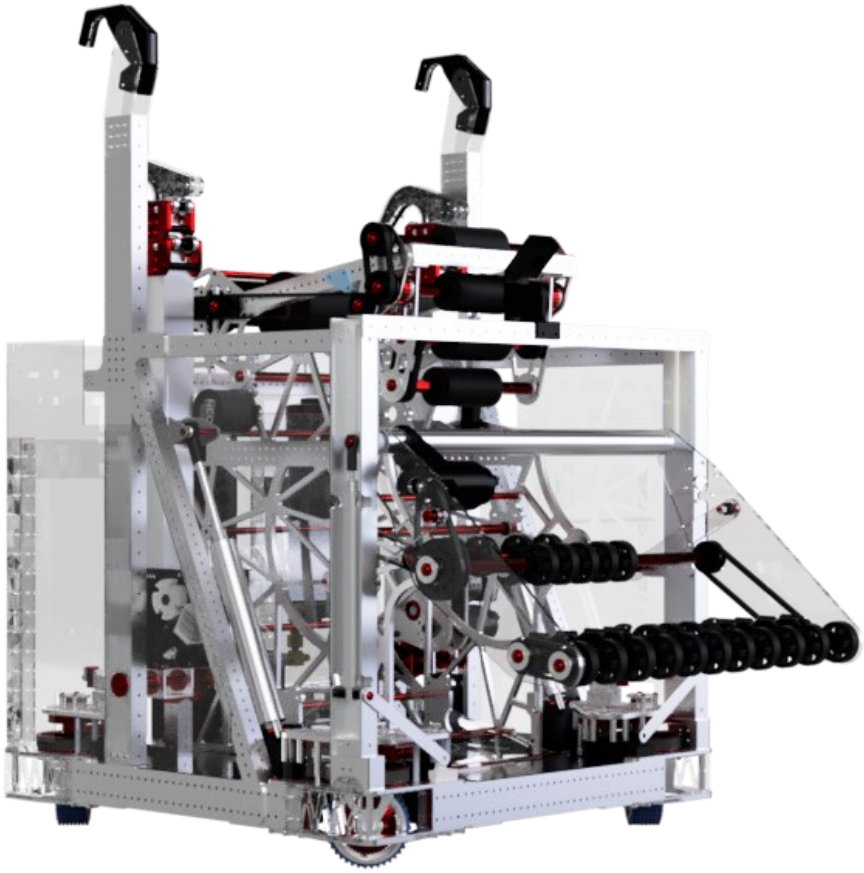
FRC Team 1987
The Broncobots

2022 Technical Book



4,208+ Student Hours

24 Students

This student led team designed, built, and programmed this robot. Students designed the robot in onshape and programmed in Java. Mentors stepped in when needed.

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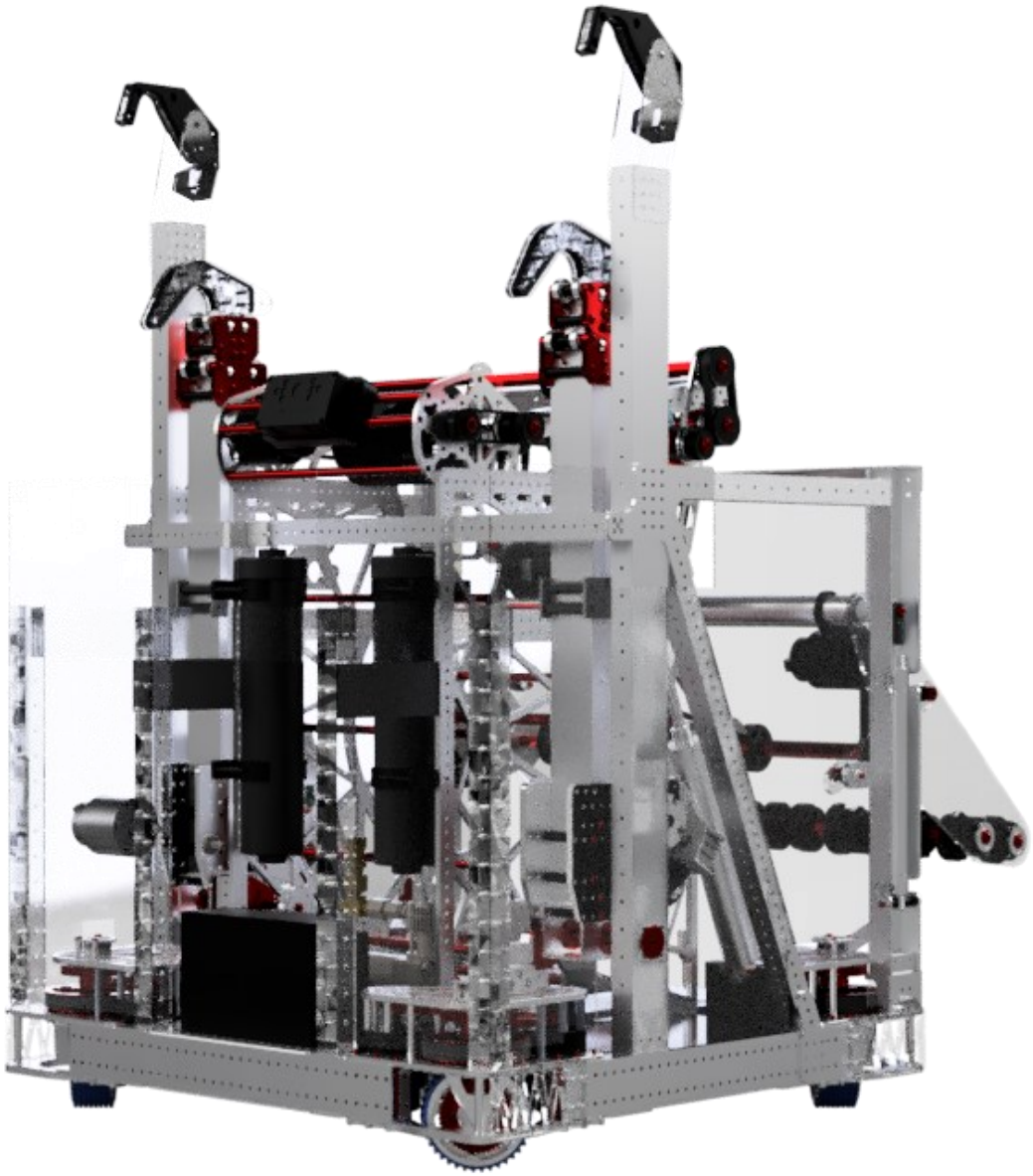
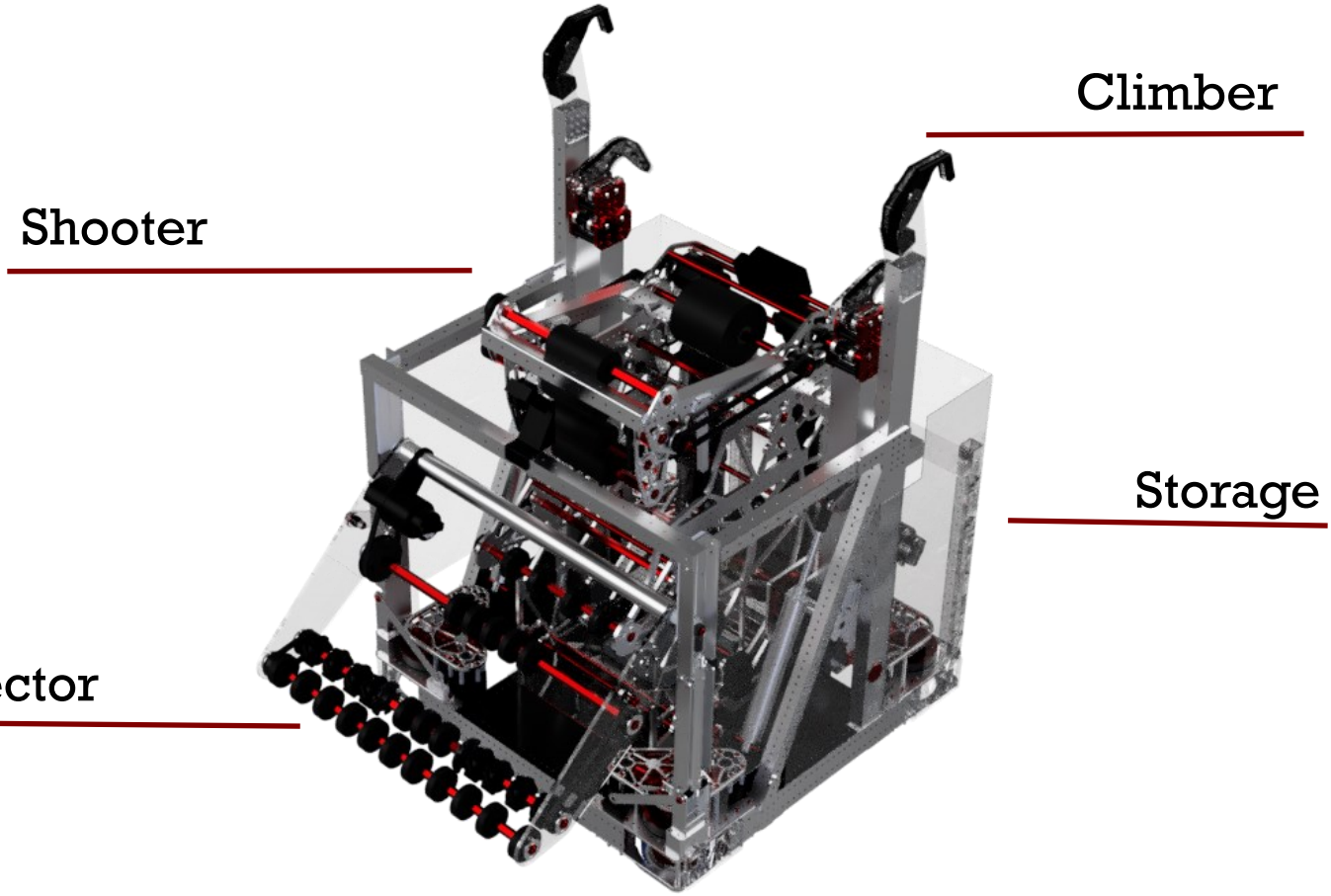
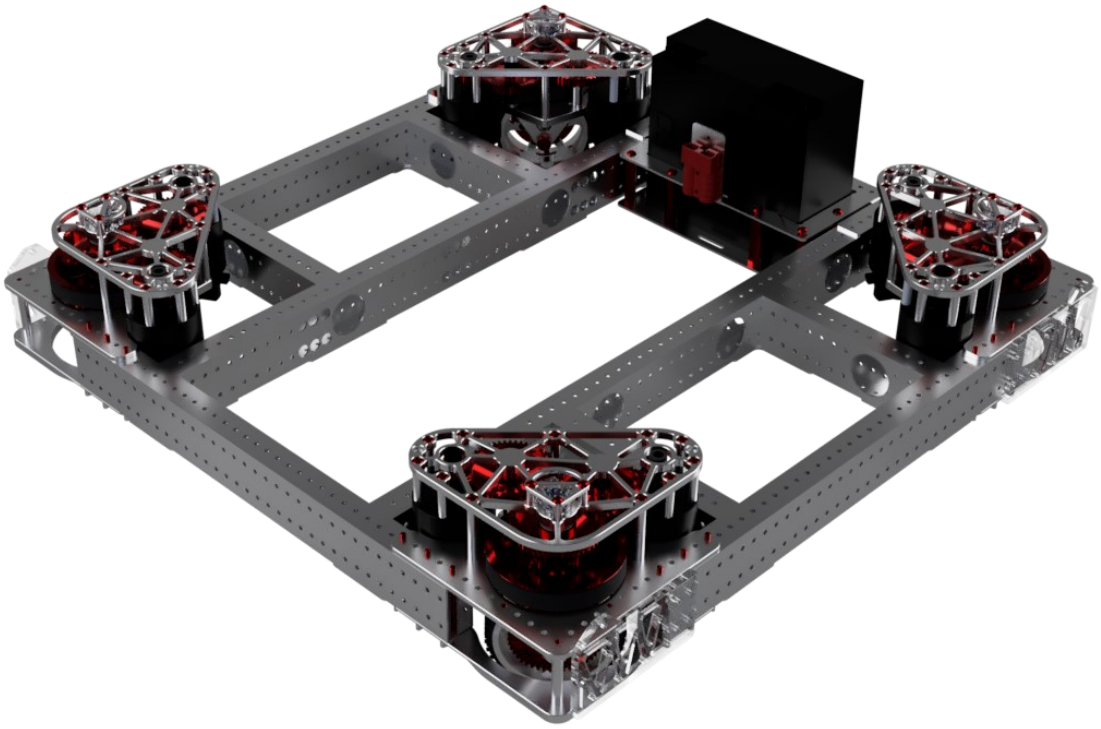
Mystery Machine




Climber
Shooter
Storage
Collector

DRIVE TRAIN

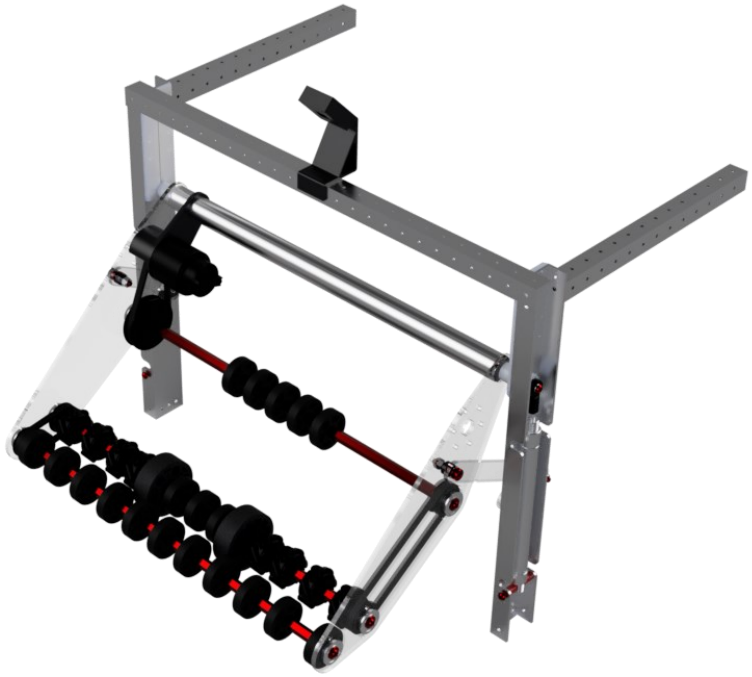
Mechanism



- 4 Swerve Drive Specialties MK4i Modules
- Powered and Driven by a total of eight Falcon 500 motors
- Modules are inverted for motor protection and space saving

COLLECTOR

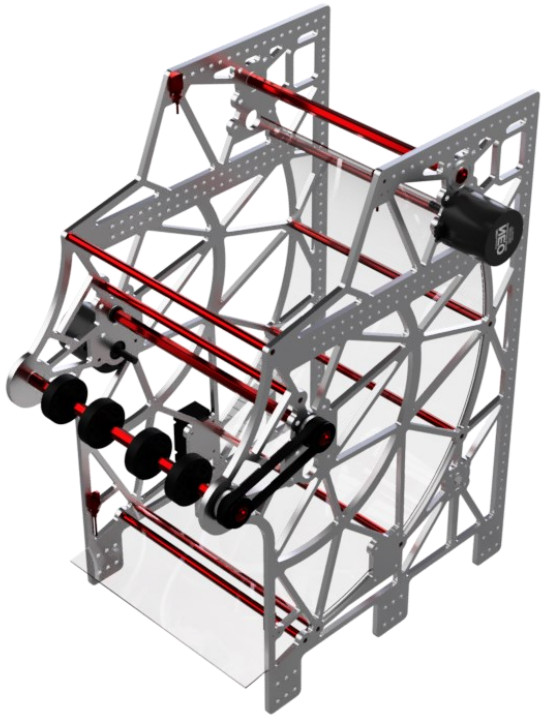
Mechanism



- Actuated using two 3/4 bore pneumatic cylinders, each with a 6” stroke
- Three rollers comprised of 2” compliant wheels, 2” mecanum wheels, and 3” compliant wheels
- Intake rollers powered by a singular Falcon 500 with a 1:2.5 reduction
- Provides the driver vision through an onboard camera system

STORAGE

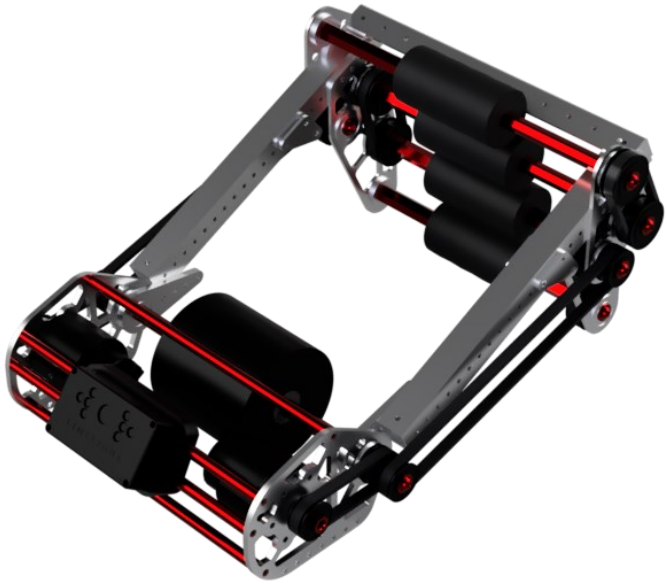
Mechanism



- Two NEO 500s powering a 5:1 reduction
- First and third rollers use 2 inch diameter compliant wheels
- Second and fourth rollers use two 1/4 HD compliant wheels
- Aluminum plates and structure water jetted for tolerance

SHOOTER

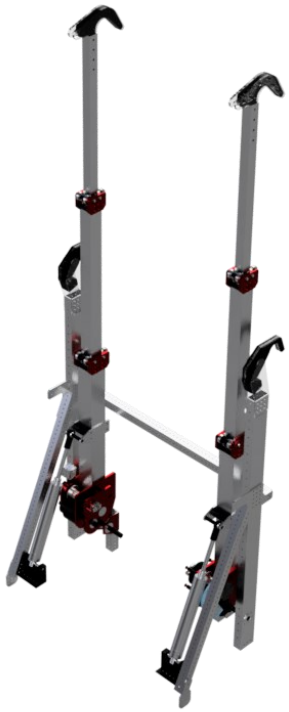
Mechanism



- Two Falcon 500s powering a 1:1.2 reduction.
- Four 4 inch diameter Vex Flywheels in the front.
- Aluminum plates and structure water jetted for tolerance
- Adjustable shooter hood powered by two linear actuators.
- Belt connecting main flywheel axle to rear anti-backspin axles, with 2 inch Stealth compliant wheels.

CLIMBER

Mechanism



- Uses two flipped Climber in a Box modules
- Rigid arms attached directly to structure
- Uses two 3/4 in bore, 6 inch throw pneumatic pistons to rotate telescoping arms
- All hooks made with a combination of 3D printed parts and Lexan
- Rigid arm hooks are spring-loaded using surgical tubing

PROGRAMMING

Software

Drive Train

- Magnetic encoder on each of the four swerve modules to measure steering absolute position.
- Closed loop PID control for autonomous commands.
- Autonomous commands utilize the Path Planner tool to follow paths using motion profiling.
- Odometry fuses data from Falcon internal encoders, CANcoders, and navX2 IMU to track field-relative pose.
- Falcon motors and CANcoders within the drive train are linked via a CANivore, providing a differentiated CAN bus, allowing for more bus bandwidth.

Collector

- The collector is able to be deployed based on the Driver controls. Collector operation ceases upon reaching max storage capacity or button is released.

PROGRAMMING

Software

Storage

- Line-break sensors placed on the entrance and exit to monitor for cargo.
- Collection will stop once the max cargo capacity is reached (2 cargo).
- Shooting will not occur unless cargo load is greater than 0
- Cargo elements are only released to the shooter once RPM has reached the target speed.

Shooter

- The shooter RPM is determined based on odometry coupled with Limelight™ data through an interpolated tree map.
- The variable-geometry hood works in tandem with the shooter speed to control the arc of shots. The shooter is designed to prioritize Upper Hub shots.

PROGRAMMING

Software

Vision

- The Limelight™ camera is utilized for automatic targeted shooting in both autonomous and tele-operated modes.
- An onboard camera positioned above the collector provides a real-time image while collecting far from the Driver Station or where otherwise not visible.
- Visuals from the Limelight™ allows for further aid in aligning with the hub.

Climber

- The climber is coded to operate in the safest way possible, with step-by-step commands for the climb sequence divided amongst four separate buttons
- Fails-safes are built into the code to prevent climber arm extension during regular match time.

PROGRAMMING

Software

Drivers

- Driver uses Xbox controller with commands and command groups assigned to buttons.
- The Driver receives haptic feedback. While collecting cargo and aligning for a shot, the Driver controller will "rumble" until the target angle is reached.
- In the event that the telescoping arms do not reach the required height, the Driver controller is outfitted with commands located on the D-Pad to incrementally increase and decrease the arms.
- The Co-driver uses many alternative commands to solve the issues of a jam in the storage by releasing cargo from both the entrance and exit.
- Buttons situated on the Co-driver controller are able to increment and decrement the cargo count in order to match the actual count.

PROGRAMMING

Software

Scan to see our robot code

URL: https://github.com/FRCTeam1987/Robot2022

Organization: FRCTeam1987