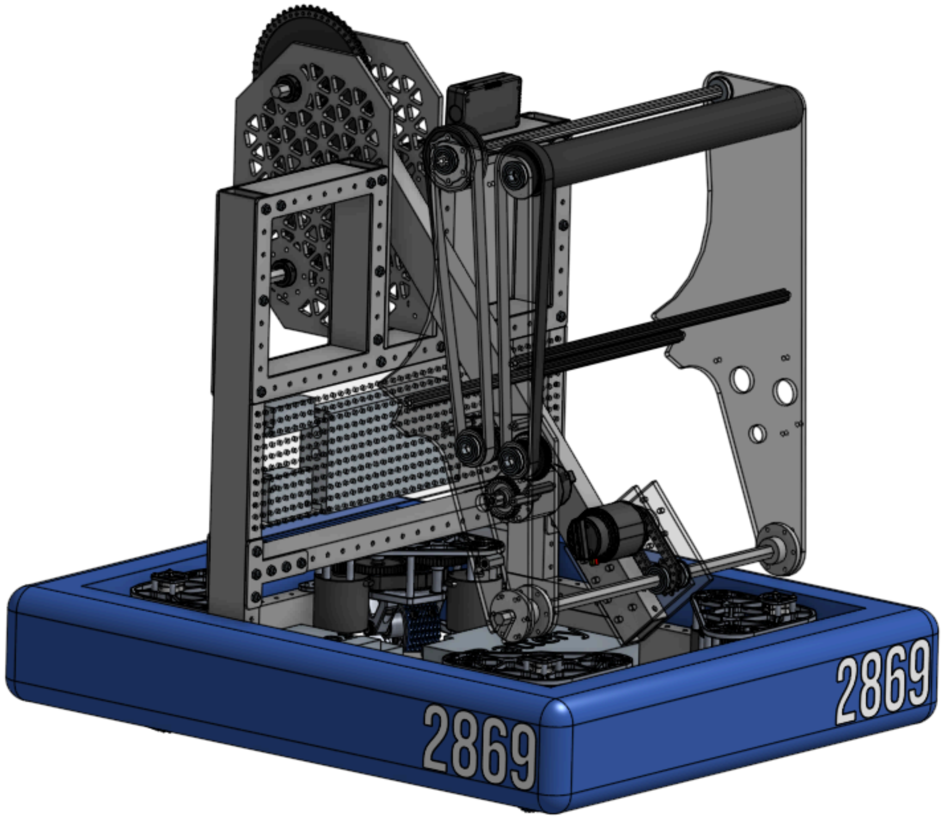


Pulsar

2023 Technical Binder

2869 The Regal Eagles

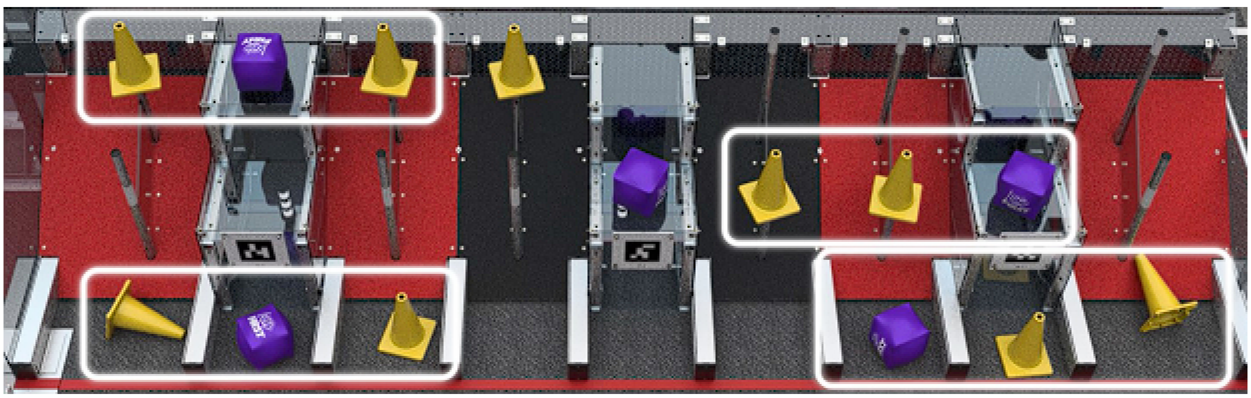
Created by Ankur Raghavan

Table of Contents

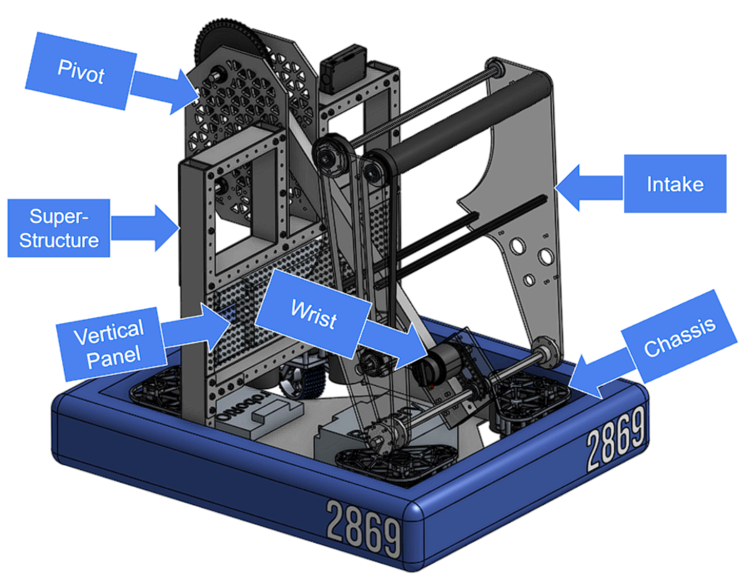
Foreword

The 2023 Season Game - Charged Up

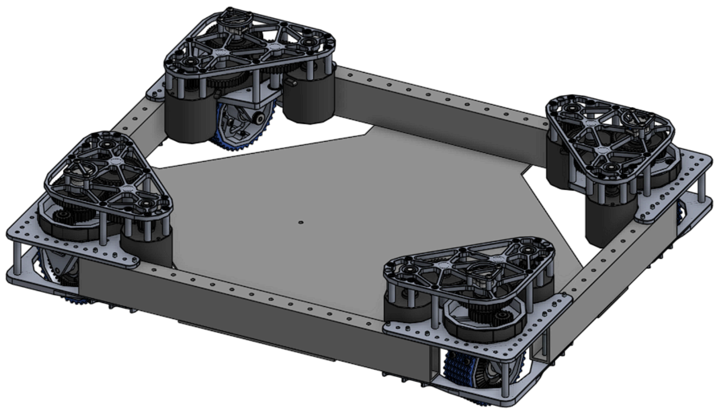
The game consists of two major objectives. The first is to place cones onto poles located in the grid. The second is to place cubes onto platforms on the grid. These pieces should be arranged into groups of three horizontally to gain the most points.



Our Robot



DRIVEBASE



The Drivebase allows our robot to move across the field quickly and efficiently. We chose swerve drive because it allows for more maneuverability than tank drive and more defense resistance than H-Drive or Mecanum.

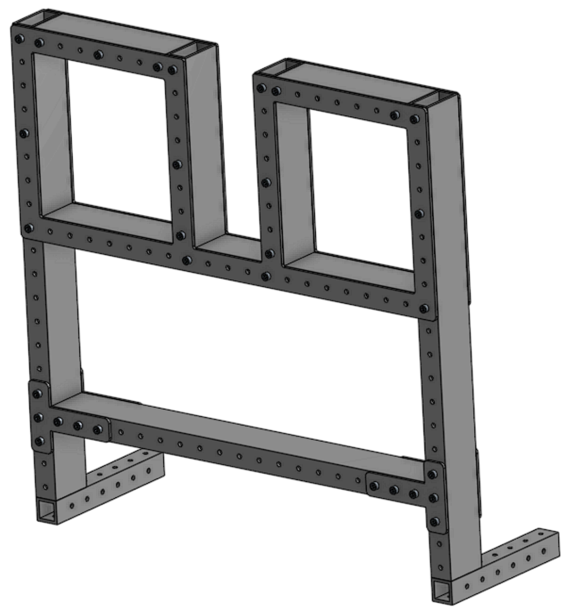
SDS MK4i Modules

- L2 drive reduction (4.3 m/s) with 4” Blue Nitrile treaded wheels (later replaced with Colson wheels)
  - Balanced between high top speed and high acceleration.
- Neo motors for drive and steering
  - Proven and tested motors/

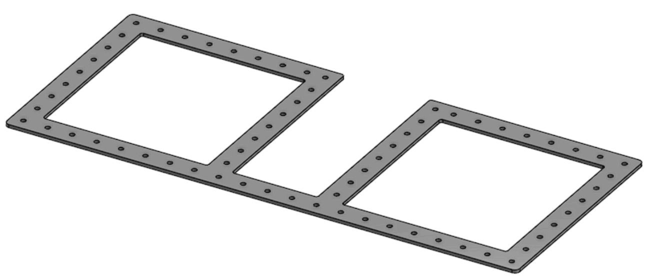
Chassis

- 21” by 26” frame
  - Allows us to fit in small spaces and onto the charge station with 2 other full-size robots
- 1/8" aluminum bellypan to enhance structure and lower center of gravity
- Solid Aluminum 2x1 bar in the front of the robot to lower and bring forward the center of gravity

SUPERSTRUCTURE



The Superstructure gives additional rigidity to the frame. It also allows for a place to mount the pivot assembly and the vertical panel.

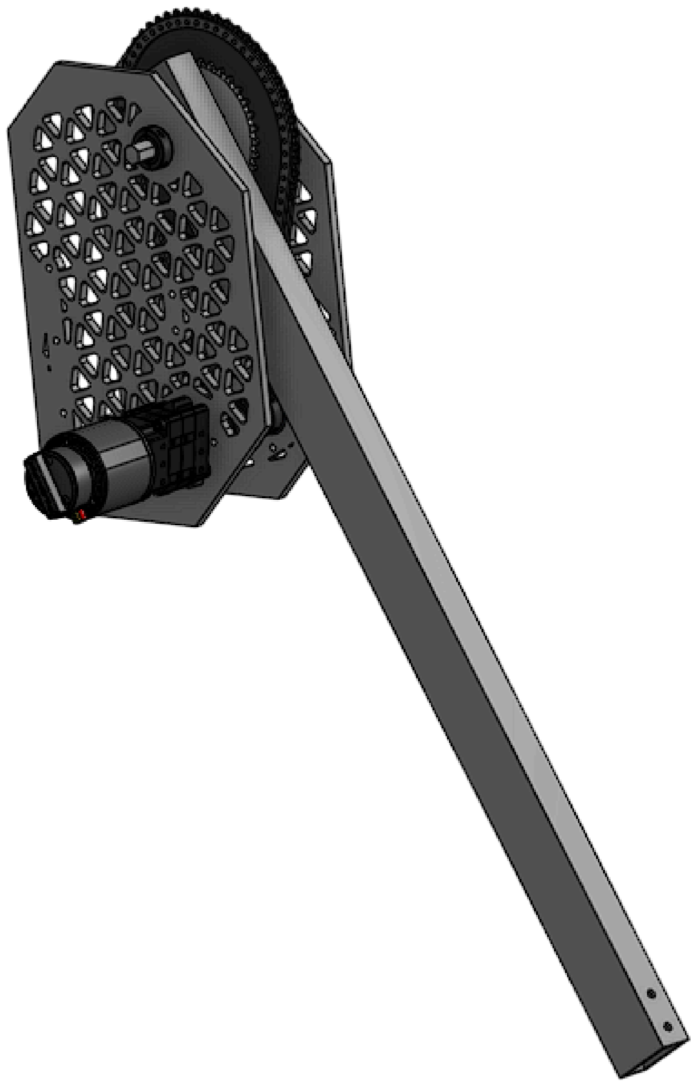


The top gusset is CNC milled out of aluminum and lines up with the 2x1s behind it.

Improvements:

- Started with a 32” tall structure but we had problems with tipping over, leading us to add ballast.
- Converted to a 21” tall structure to reduce CG

PIVOT



The Pivot controls the main arm movement. This allows for fast scoring.

Pivot

- 1 Falcon 500 drives 36:1 Max Planetary Gearbox into a 4.5:1 chain reduction.
- Pictured is the ISOGrid Version of the plates which did not get manufactured due to time constraints.

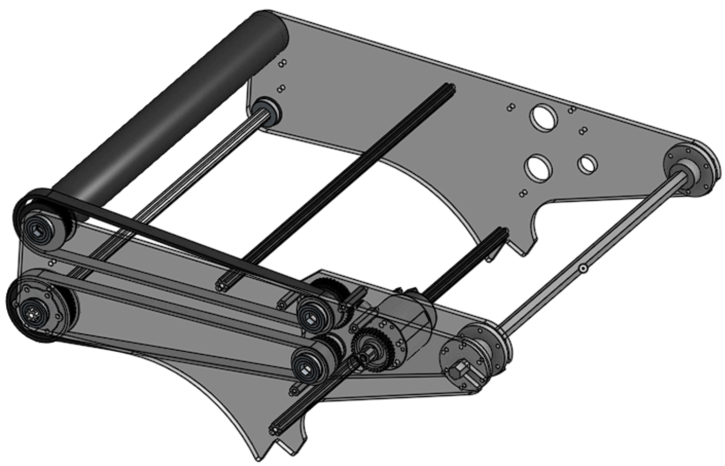
Arm

- Moves the full 300 degrees in under 0.5 seconds
- 30” long to allow scoring at all levels

Improvements

- Arm changed from 20” to 30” to allow for increased scoring capabilities.

INTAKE

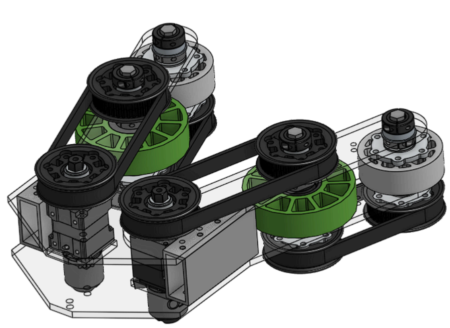


V3 Roller Intake

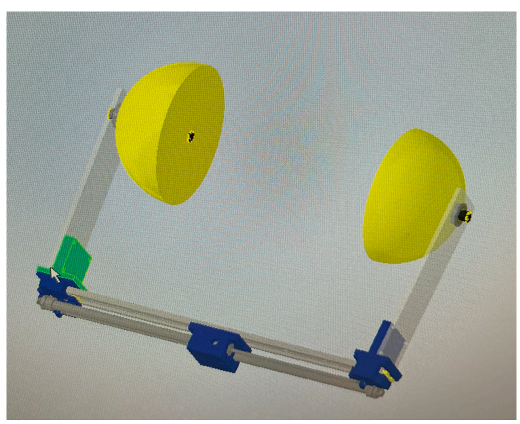
The intake allows for quick pickup and dropping of both cubes and cones.

- Cones are intaked through the small opening at the end.
- Cubes are intaked through the large opening on the top
- A hard stop was used with the bar at the bottom.
- A Falcon 500 was used to power the intake at a 1:1 gear ratio
- Plates made of 1/4“ Lexan with aluminum shafts provide structure

Previous versions:

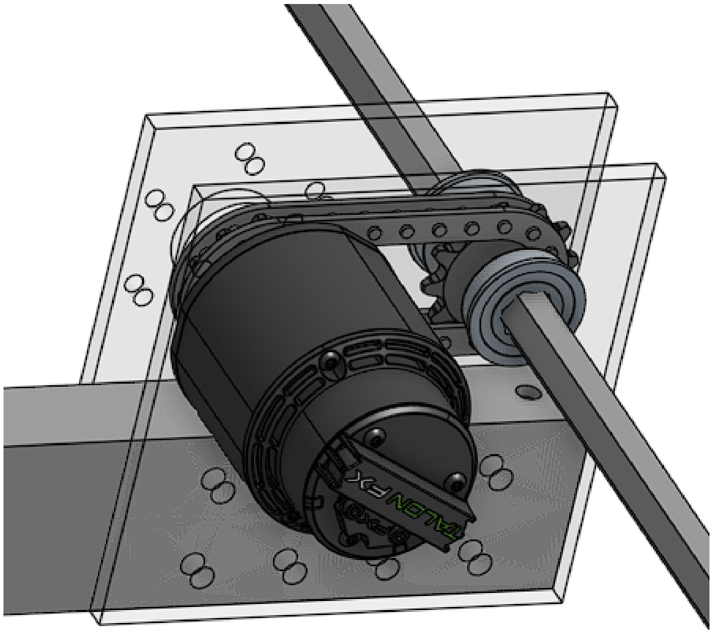


V2 - Wheeled Intake



V1 - Pneumatic Grabber

WRIST

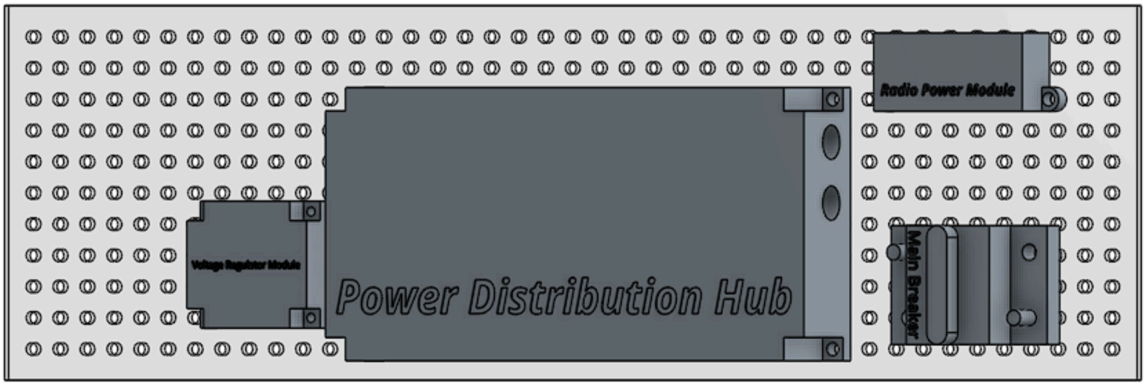


The wrist allows for extra manipulation of the game elements. This allows us to go for further goals while keeping the robot size small.

Wrist

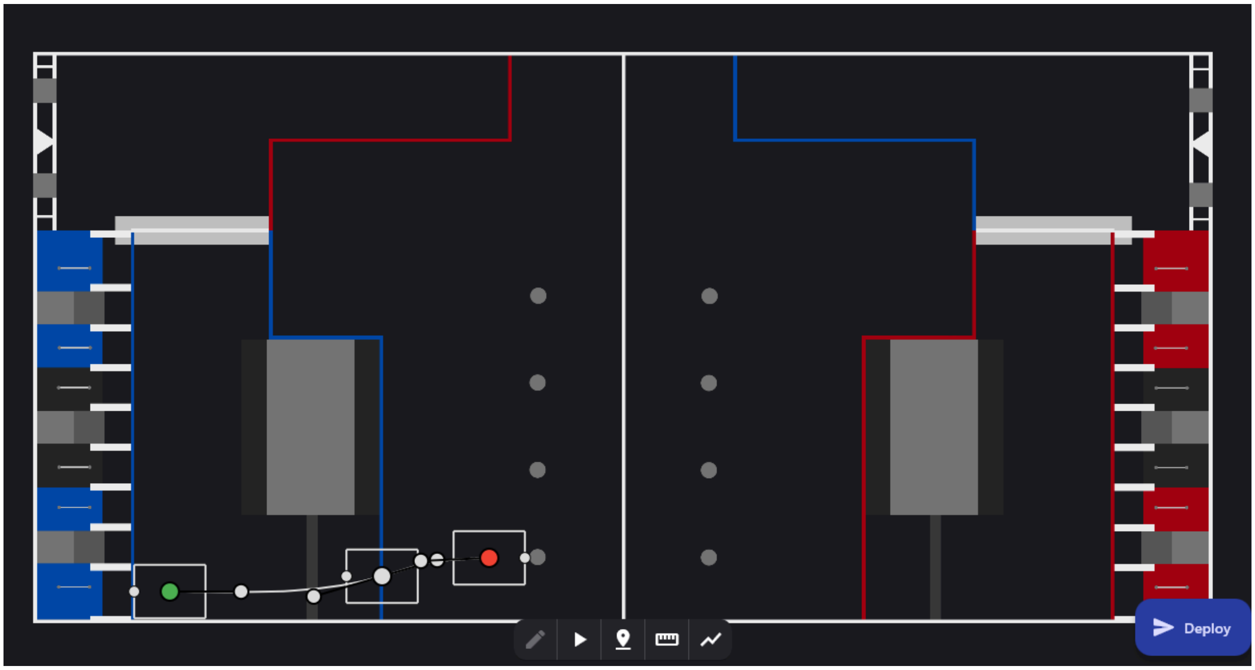
- 1 Falcon 500 drives the wrist with a 60:1 Max Planetary Gearbox Reduction (not pictured) into a 1:1 chain.
- Attached to Pivot Arm with up to 8 ¼ 20 bolts.
- Attached to Intake by a hex shaft.

ELECTRONICS VERTICAL PANEL



- The vertical panel for electronics allowed us to have better access to the wiring.
- The battery is mounted on the bellypan near the front to adjust our center of gravity.
- The radio is mounted on the top of our superstructure to get the best connection to the field and for the visibility of LEDs.
- The RoboRio is mounted on the belly pan to have the most accurate gyroscopic data

AUTONOMOUS



Path Generation

- Paths were created using a program called PathPlanner. The robot determines the best route to follow the path and get from the starting point to the destination. It accounts for the rotation present in swerve drive robots
- Optimized to minimize the time per journey

Joining Multiple Commands

- We use a command-based structure for our robot code. To accomplish Autonomous goals we have to string many commands
- We use the Sequential Command Group to run the routes.

TELE-OP

Driver Controls

- The driver uses one flight control stick as input.
  - The xy movement results in the translation
  - The twist results in rotation
  - Trigger slows down to 60% speed

The operator uses a button board as input.

- Each position of the arm is a button on the bottom
- Buttons for live adjustment beyond the setpoints on top
- Control the intake with buttons on the right
- Has E-Stop functionality for the arm and intake

Driving

- Standard Field-Centric control of the swerve drive
- Odometry using gyro and wheel encoders
- Velocity Constraints to ensure battery usage doesn't exceed the maximum amount
- Computes the desired velocity and works backward using inverse kinematics to determine module speed and direction.