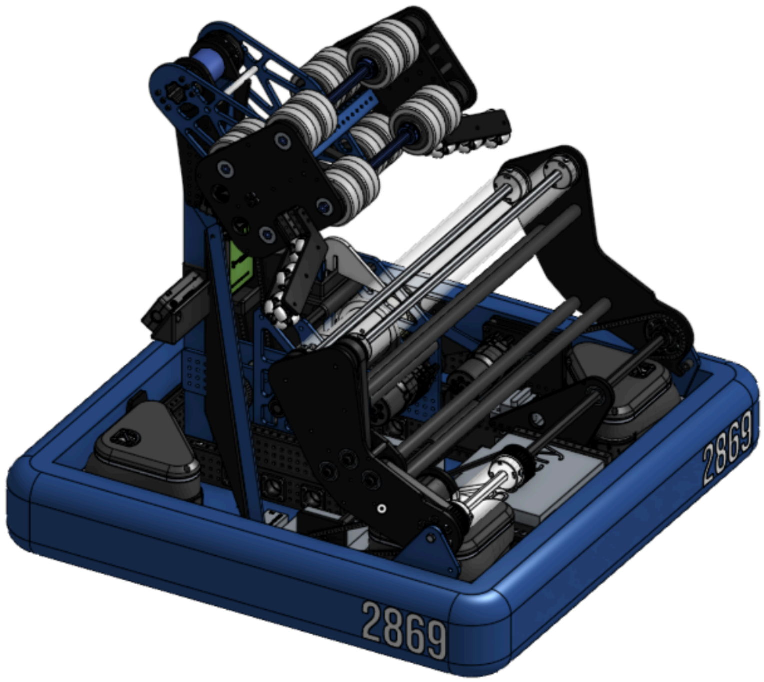


ARPEGGIO

2024 Technical Binder

2869 The Regal Eagles

Created by Ankur Raghavan

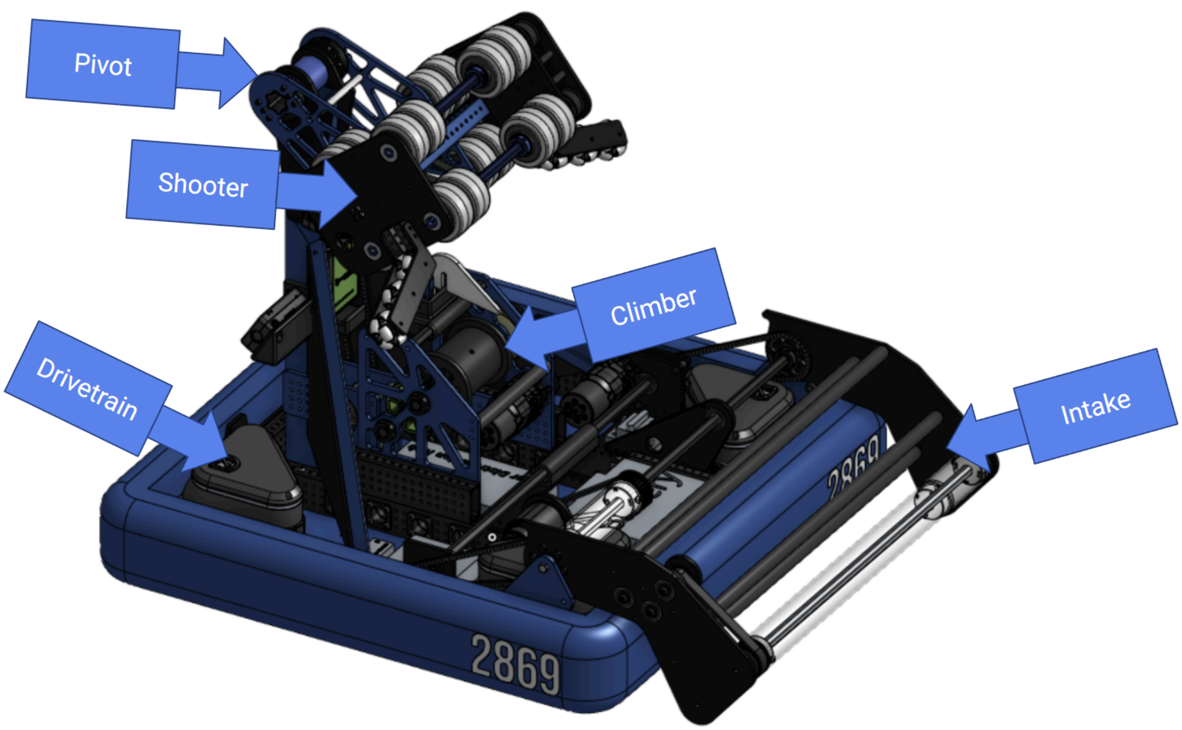
Table of Contents

Foreword

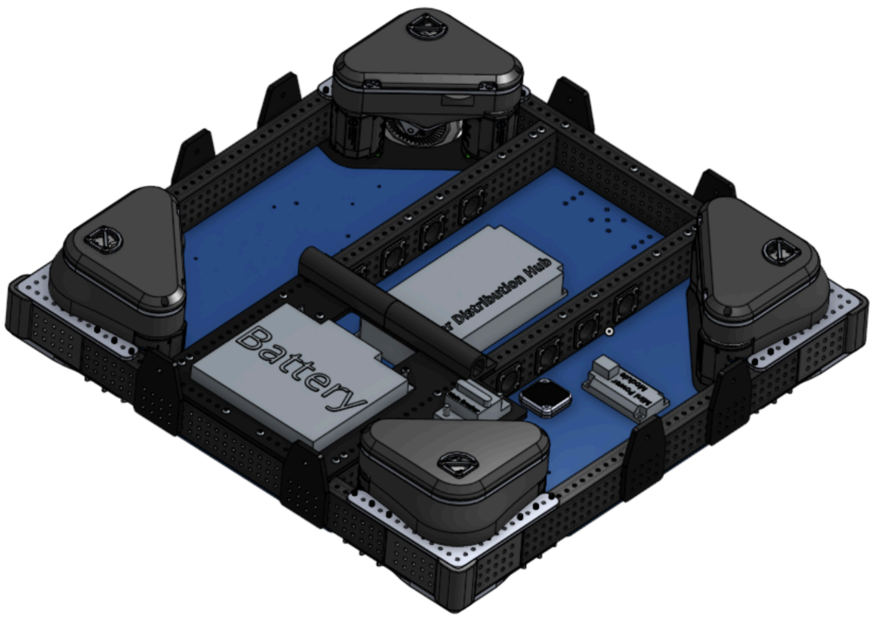
The 2024 Season Game - Crescendo

This game consists of three major objectives, shooting “notes” (orange rings) into the speaker, placing notes into the amp, and climbing onto a horizontal chain on the stage.

Our Robot



DRIVEBASE



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

SDS MK4i Modules

- L2+ drive reduction (5.4 m/s) with 4” Colson wheels
    - Balanced between high top speed and high acceleration.
    - Colson wheels have better wear characteristics and coefficient of friction than traditional treads
- Kraken X60 motors for drive and steering
    - High torque motors for faster acceleration

Chassis

- 26” by 26” frame
    - Square chassis reduces tipping and improves weight distribution.
- 1/8" aluminum bellypan to enhance structure and lower center of gravity
- 3D printed cable protectors in the crossbars to allow for wire management
- Lexan swerve protectors to prevent dirt from the field surface getting into the chassis.
- 3D-printed swerve covers to protect the gears from foreign objects

PIVOT

The Pivot controls the shooter's movement. This allows for scoring in the amp

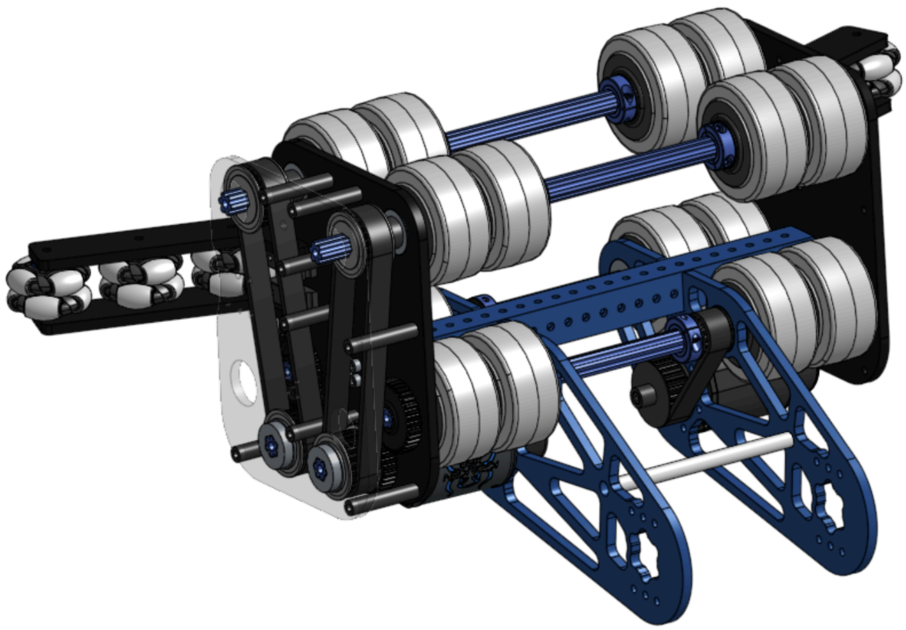
Features:

- 1 Neo drives 25:1 Max Planetary Gearbox into a 9:15 chain reduction.
- The motor stays on the bellypan to reduce the center of gravity.
- Not pictured is a chain tensioner that improves manufacturability, and reduces error across a large distance.

Improvements

- Upper plates changed to aluminum from Lexan to reduce wear from the bearings
- A 3D-printed spacer was placed between the plates over the bearings to enforce the correct distance.

SHOOTER



The shooter allowed us to shoot notes into the speaker and place them into the amp.

Features:

- Powered by 2 Kraken X60 motors with a 1:1.67 up-duction.
- Split front back to allow for purely mechanical storage of notes when placing in amp
    - The back wheels will spin forward and the front wheels will spin backward to prevent the note from going past them. The note will then be halfway in and can be moved by the pivot for amp scoring.
- 16 Colson wheels that improve contact with the note
- Omni-wheels to direct the note to the shooter if off-center
- A mechanical stop at the correct angle for shooting, reduces energy needed for shooting.

Improvements:

- Pocketed aluminum plates that reduce weight and improve structural stability
- Added more tubes across the shooter to improve rigidity

INTAKE

The intake allows for quick pickup and passoff of notes.

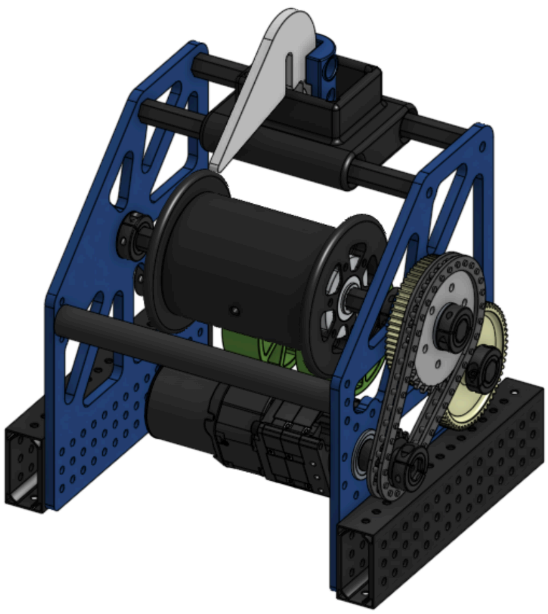
Features:

- Flips down to intake from the ground; Flips up to pass to the shooter.
- Mechanical stop with a shaft that the main plates hit
- Moving plates made of .25” Lexan and stationary plates of .25” aluminum.
- Dual chains to even out the movement of the intake
- Pivoting powered by 1 NEO Vortex motor with a total of 31.25:1 reduction
- Intake Spinning powered by 1 Kraken X60 motor with a 2:1 reduction
- No motors are moving.
- Chain tensioner to reduce skipping when pivoting.

Improvements:

- Changed Plates from Lexan to aluminum to reduce warping and wear.
- Added a support plate to reduce warping of the pivoting shaft
- Added more crossbars to reduce twisting and keep the note in the correct location
- Fine-tuned the compression to improve ground pickup.

CLIMBER



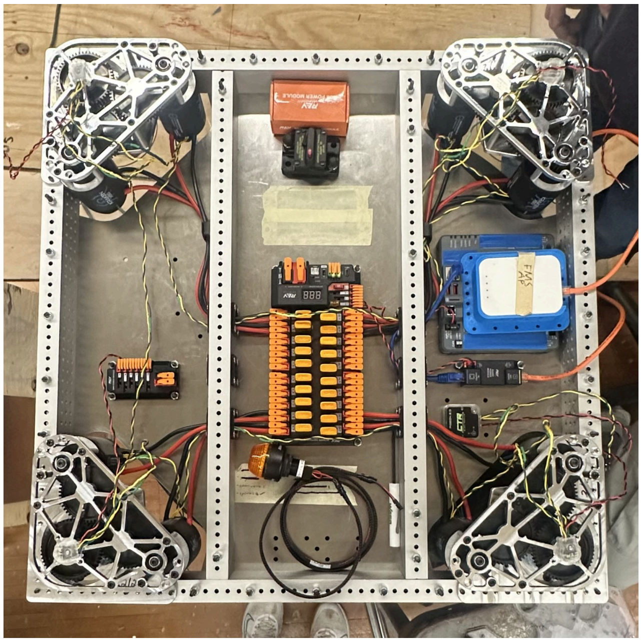
Features:

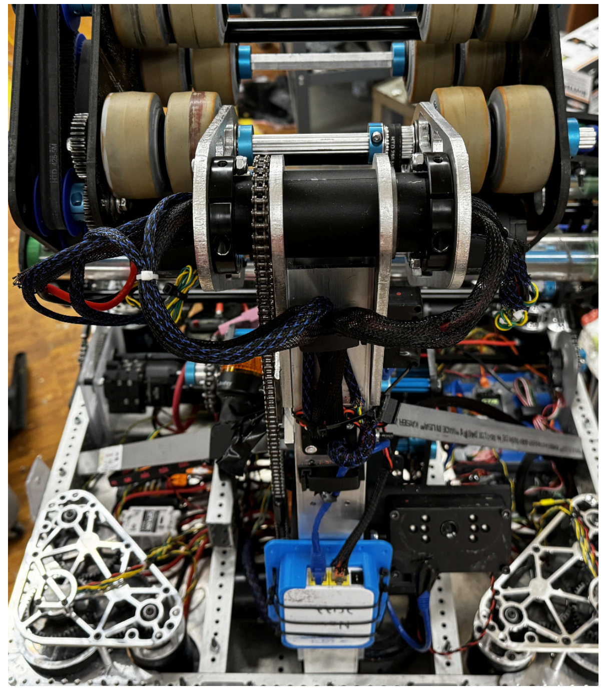
- Carbon-fiber rollable tube with a hook on the end to grab the chain.
- Powered by a Falcon 500 with a 125:1 gear ratio
- Compliant wheels maintain contact with the tube and ensure it goes up smoothly.
- Very rigid when extended
- Does not back drive under robot weight
- Pictured pocketed aluminum was not manufactured due to time constraints, instead unpocketed Lexan was used

Improvements:

- Added more tubes to constrain the rollable tube to go up where expected
- Reduced the gear ratio to allow for quicker operation

ELECTRONICS

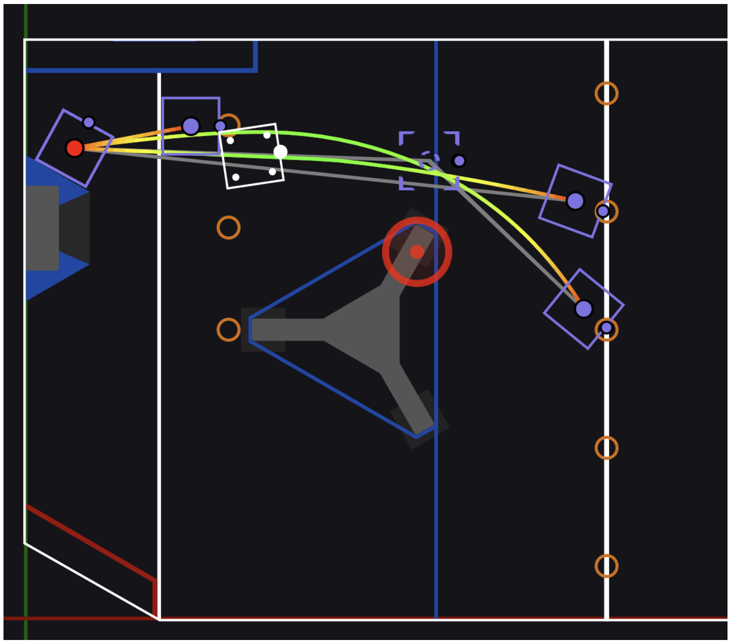




Features:

- Centralized Power Distribution with wire channels for wire management.
- All electronics except the radio mounted to the bellypan.
- Power and CAN wires that leave the bellypan in braided cable protectors to keep them safe and routed through box tubing
- Radio mounted to the shooter structure to improve connectivity.
- Separate CAN Bus for Drivetrain, on a CANivore, and the other motors, on the rio bus.
    - This allows for the drivetrain to run faster, and allows that if a wire gets cut on the upper structure, it will not affect our driving.

AUTONOMOUS

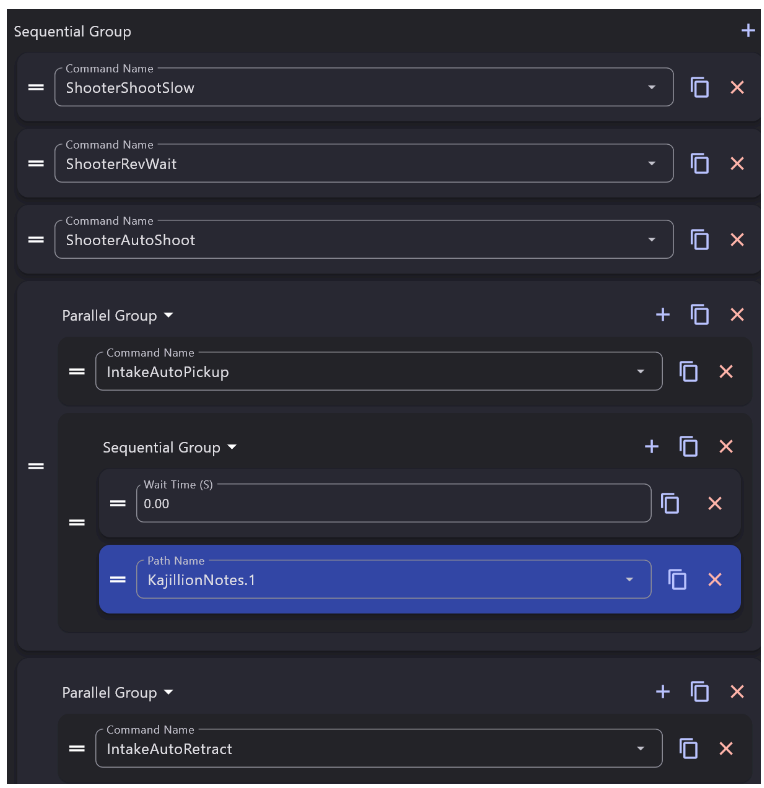


Path Generation

- Paths were created using a program called Choreo. This program is given a set of poses that the robot should get to and it can create the most efficient path between them.

Following Paths and Adding Commands

- We use a command-based structure for our robot code.
- We used PathPlanner to follow the generated paths. We also added commands in between each section of the path.



TELE-OP

Driver Controls

- The driver uses one Xbox controller as input.
  - The Left stick movement results in the translation
  - The right stick results in rotation
  - Trigger slows down to 60% speed
  - Y button resets the pose for field-oriented control

The operator uses a button board as input (labels aren't correct in this image)

- Automatic intake, transfer, and shoot buttons on the left and top
- Manual buttons on the right for all subsystems
-

Driving

- Standard Field-Centric control of the swerve drive
- Odometry using gyro and wheel encoders
- Computes the desired velocity and works backward using inverse kinematics to determine module speed and direction.
- Acceleration constraints prevent the robot from attempting to do something it cannot do.