



THE BUCKS' WRATH

TECH BINDER



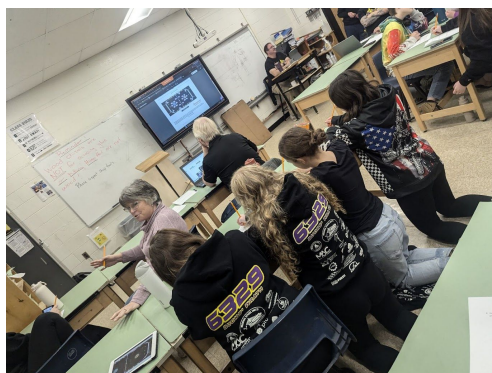
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PRIORITY LIST

MUSTS ON KICKOFF

- Drive
- Deep Climb
- Intake from Human Player
- Score Algae in the Processor
- Intake Algae from the Reef
- Auto Align to Reef
- Intake and Score on Opposite Sides
- Score Coral on Levels 2-4



WANTS ON KICKOFF

- Shallow Climb
- Ground Intake Coral
- Ground Intake Algae
- Place Algae in Barge
- Auto Align to Human Player
- Drive Under Shallow Cage
- Score Coral L1
- Hold Coral and Algae at the Same Time

WONTS ON KICKOFF

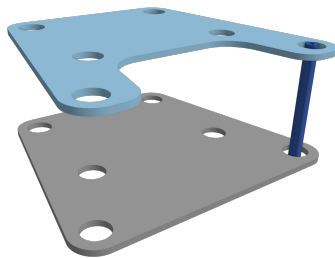
- Shuttle Coral and Algae
- Buddy Climb
- Move Scored Coral on the Reef
- Score from Both Sides of Robot
- Shoot Algae



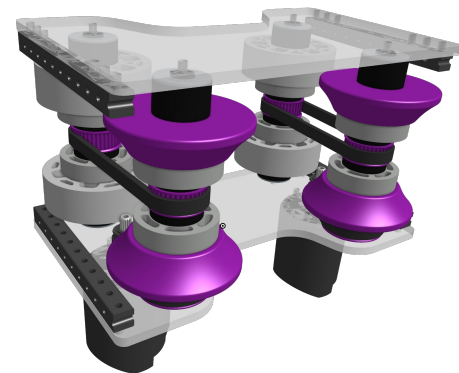
DESIGN PROCESS

1. Brainstorm possible solutions as large group
2. Divide into groups of three to make crude wooden prototypes to test the validity of the design.
3. Regroup and present prototypes to narrow down options.
4. Refine remaining prototypes out of wood.
5. CAD and machine prototypes out of wood.
6. Machine out of more robust materials and integrate motors.
7. Present solutions and choose a final design to integrate into robot.

PROTOTYPE

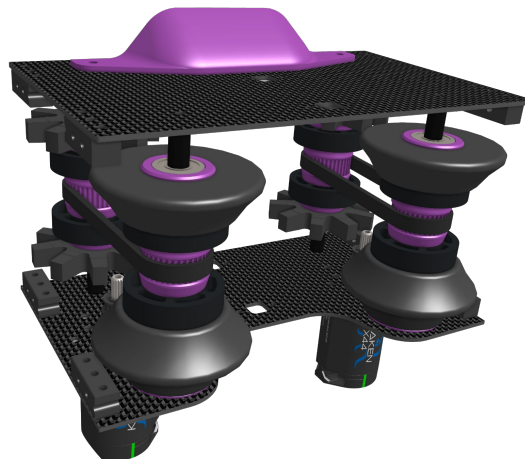


Rough CAD Wood Prototype



Alpha Robot Version

FINAL DESIGN



Competition Robot Version

- Shortened nut strips
- Changed to X44s
- Added WCP star wheels for centering
- Changed to 3DP Axles
- Added hood for sensors
- Changed to MAX Composite

6329

PRESENTS



ROBOT DIAGRAM

Algae
Scoring

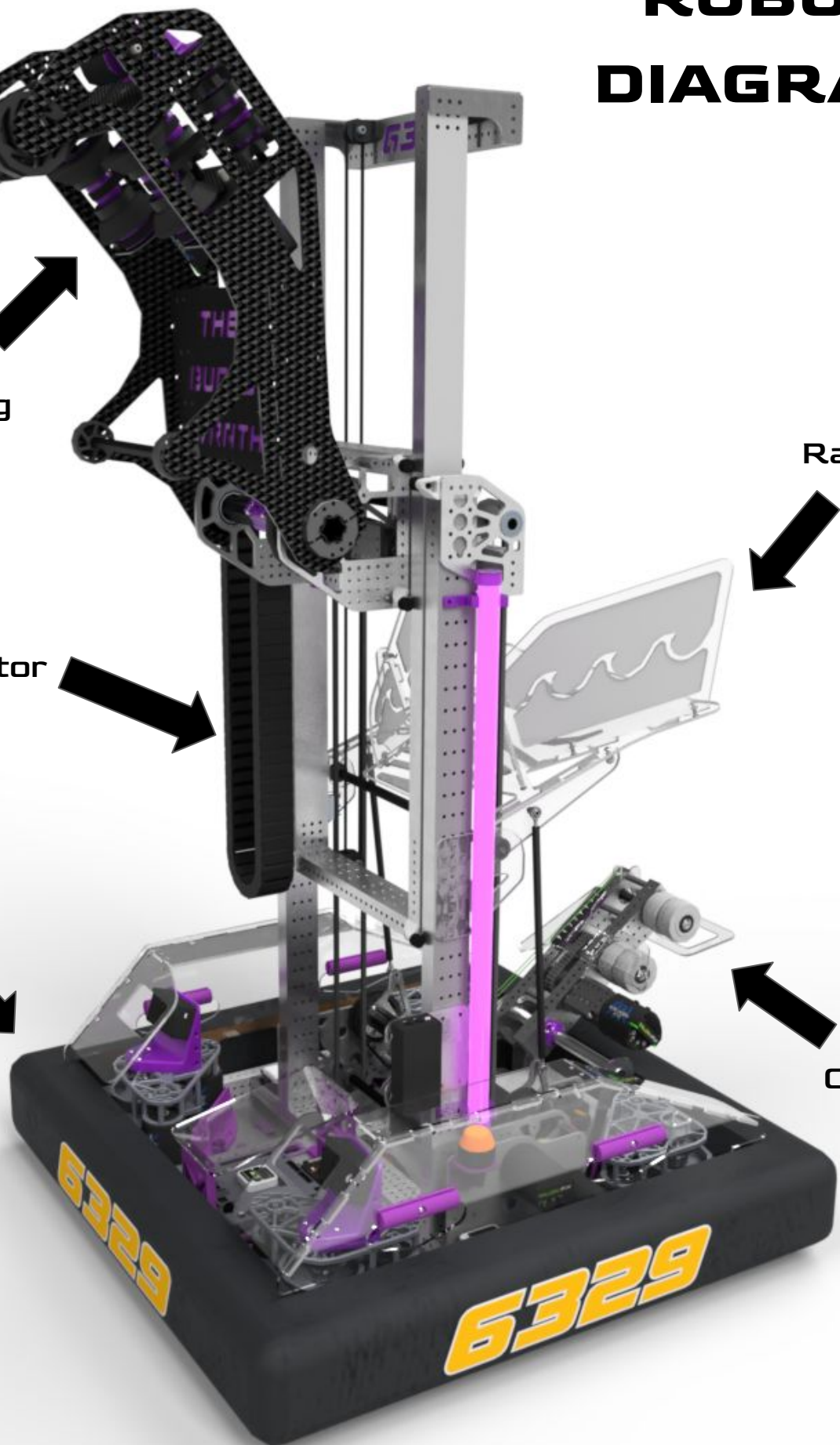
Coral
Scoring

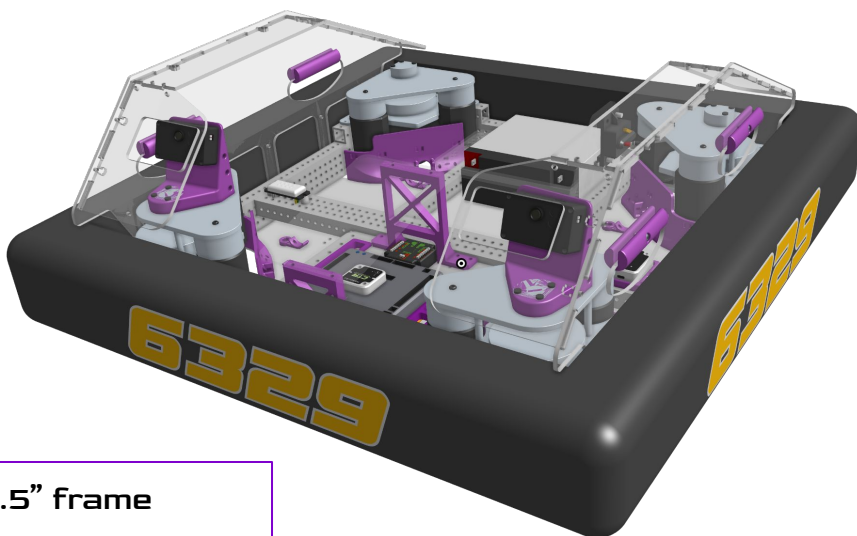
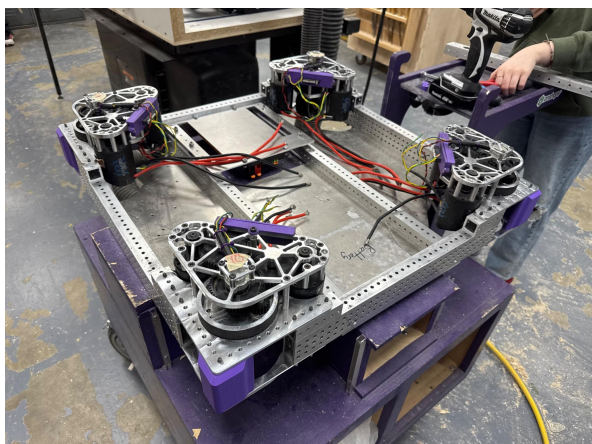
Elevator

Drivetrain

Ramp

Climber





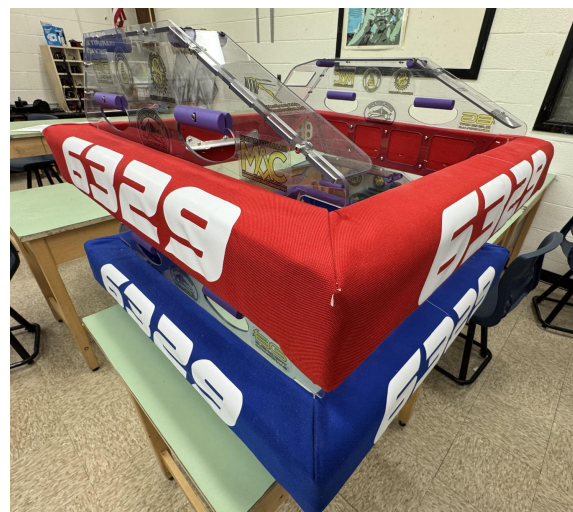
MECHANICS

- 26.5" x 26.5" frame perimeter
- 113.5 pounds
- SDS MK4i L2 swerve modules
- Drive and steering powered by Kraken X60
- Free speed of 15.5 ft/s
- 1/8" aluminum belly pan



CONTROLS

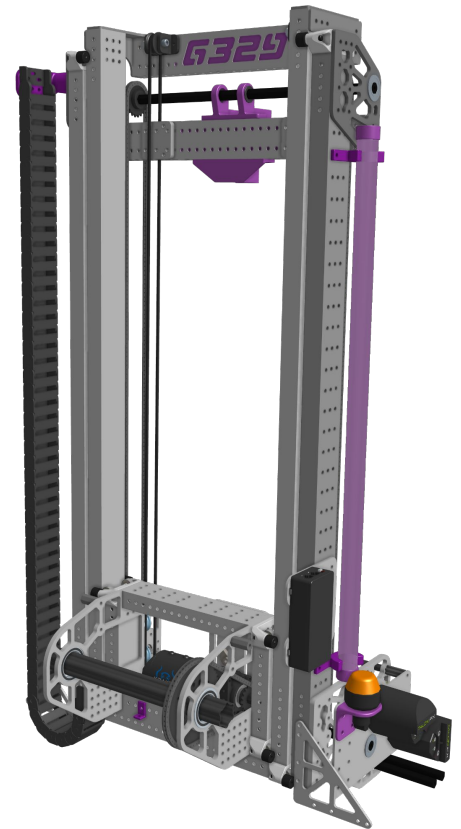
- Field oriented driver control
- Cardinal directions for robot orientation using a Pigeon
- April Tag alignment system for scoring on reef



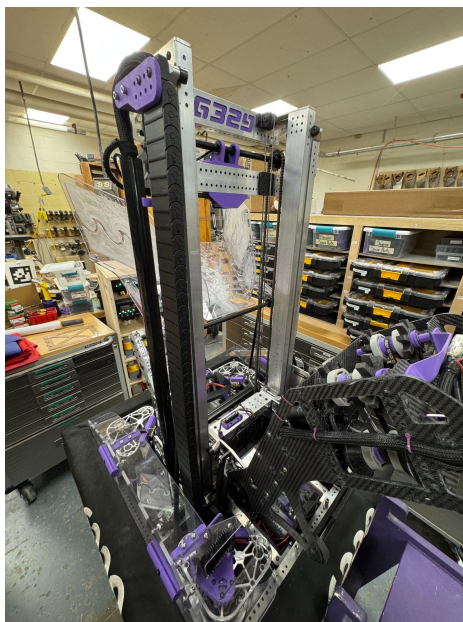
ELEVATOR

MECHANICS

- Cascade style
- SDS billet bearing blocks
- Custom 2 Kraken gearbox design
- 8.33:1 Gear Ratio
- Full range of motion in 0.3 seconds
- Open top design allowing for longer travel in smaller packaging
- All 1/16" tubing allowing for low center of gravity
- LED Diffuser Tube
- 3D Printed Inserts



CONTROLS



- Custom implementation of motion magic allowing for constant control and maintaining position
- Preset heights for all scoring locations as well as joystick control for tuning
- Smart shooting control based on elevator height



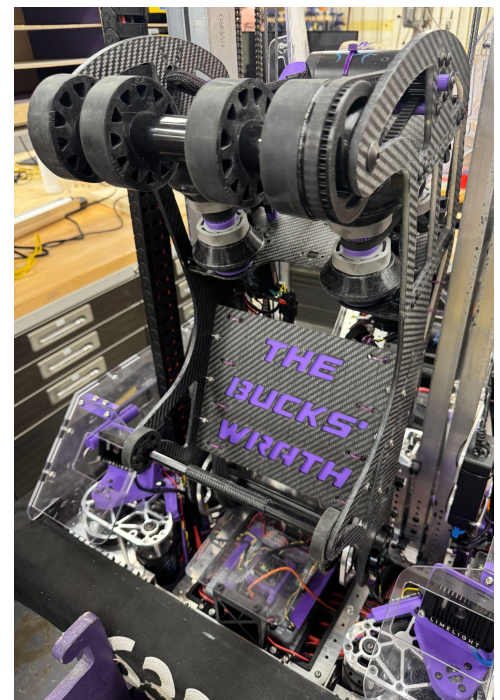
MECHANICS



- Integrated Coral and Algae scoring with a single mechanism
- 60 degrees of rotation from the wrist
- Kraken x44 powered single horizontal roller for Algae
- Twin Kraken x44 powered vertical rollers for Coral
- Three CANrange sensors for coral detection and placement in the intake
- Custom TPU intake wheels to center and hold the Coral

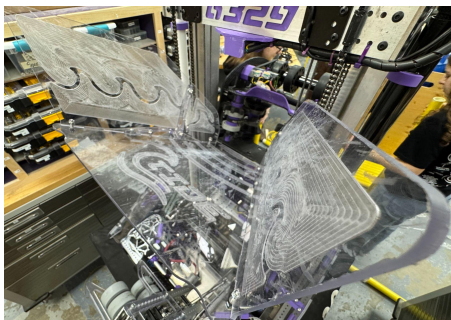
CONTROLS

- Constant coral detection allows for perfect placement of the coral every time
- Custom implementation of motion magic allowing for constant control and maintaining position
- Preset angles for all scoring locations as well as joystick control for tuning
- LED signals to signal game piece acquisition





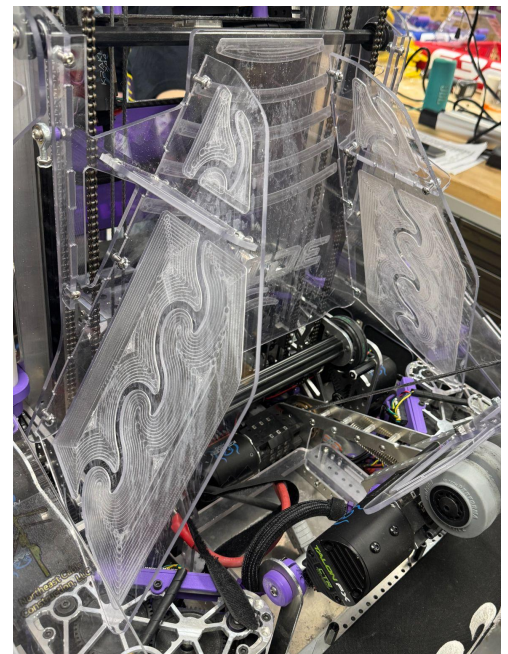
MECHANICS



- Over center design allows for the ramp to hold itself up mechanically even through the constant pounding of use
- Kraken X60 powered pivot to allow for space to climb
- Ramp pivot also allows to unjamming of the intake when mistakes happen
- Lightweight design allows for lower center of gravity using all custom parts

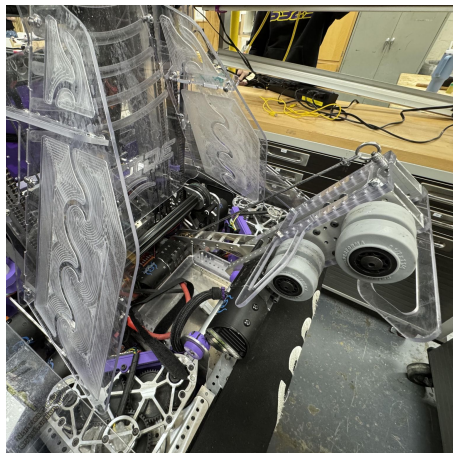
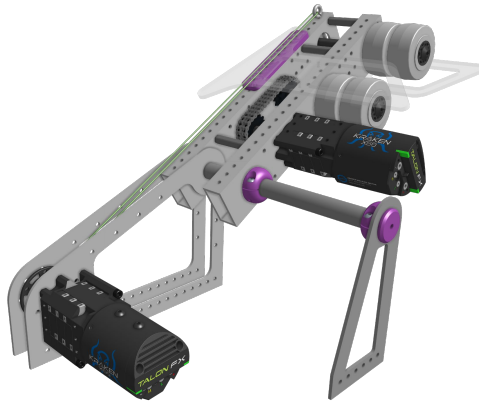
CONTROLS

- Custom implementation of motion magic allowing for constant control and maintaining position
- Preset heights for intaking, dumping jammed coral, and climbing





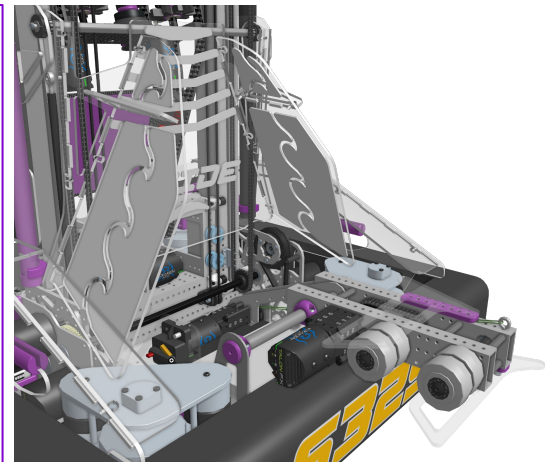
MECHANICS



- Pivoting arm controlled by a winch powered by a Kraken X60 with a 100:1 MAX Planetary
- Pivots on a 3/4 inch aluminum tube made by REV
- Spring loaded deploy
- 2.5 inch colson wheels powered by a Kraken X60 with a 100:1 MAX Planetary
- Lexan wedges for centering the cage
- Also serves to protect the robot from falling Coral

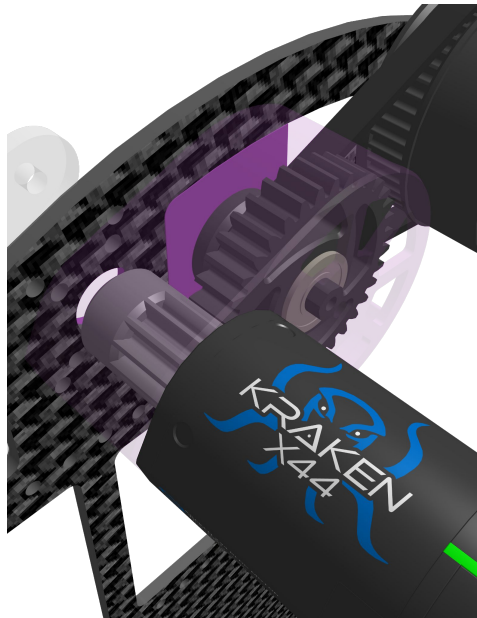
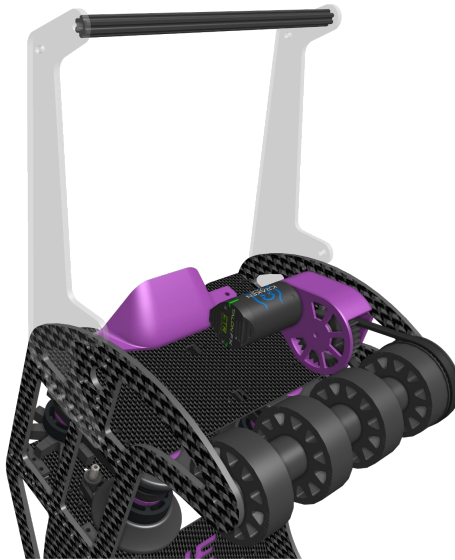
CONTROLS

- Driver button to drop the climber and ramp at the exact right timing
- Independent joystick control for both the rollers and winch to allow to adjustable climb positions in any situation
- Flashing LED lights to indicate to the driver when it is time to go climb using the game state
- Camera to aid driver in alignment



ITERATIONS

HORNS + GEARBOX



THE ISSUE

- We struggled to hold onto algae when removing it from the reef
- We could not reach the barge to score algae

THE SOLUTION

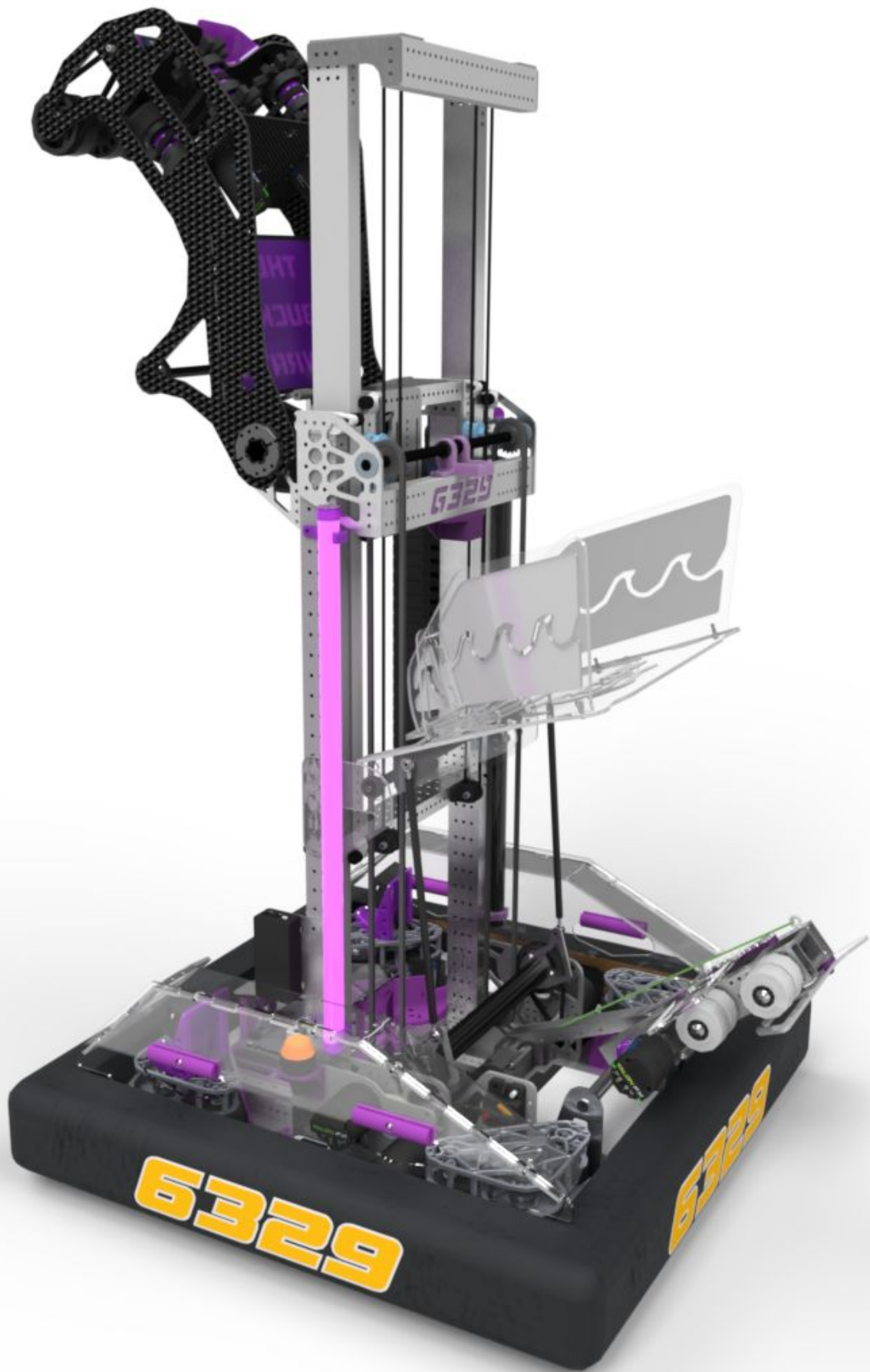
- New custom 3d printed gearbox to increase the gear ratio improving our grip on the algae
- Added upper horns with a crossbar to hold algae above the intake
- New command scheme so the robot knows where we want to score the algae and run the intake, hold, and score commands in the correct direction
- To be able to score in the barge we need to be driving forward slowly and release the algae as the elevator is reaching its peak creating an arced shot with backspin

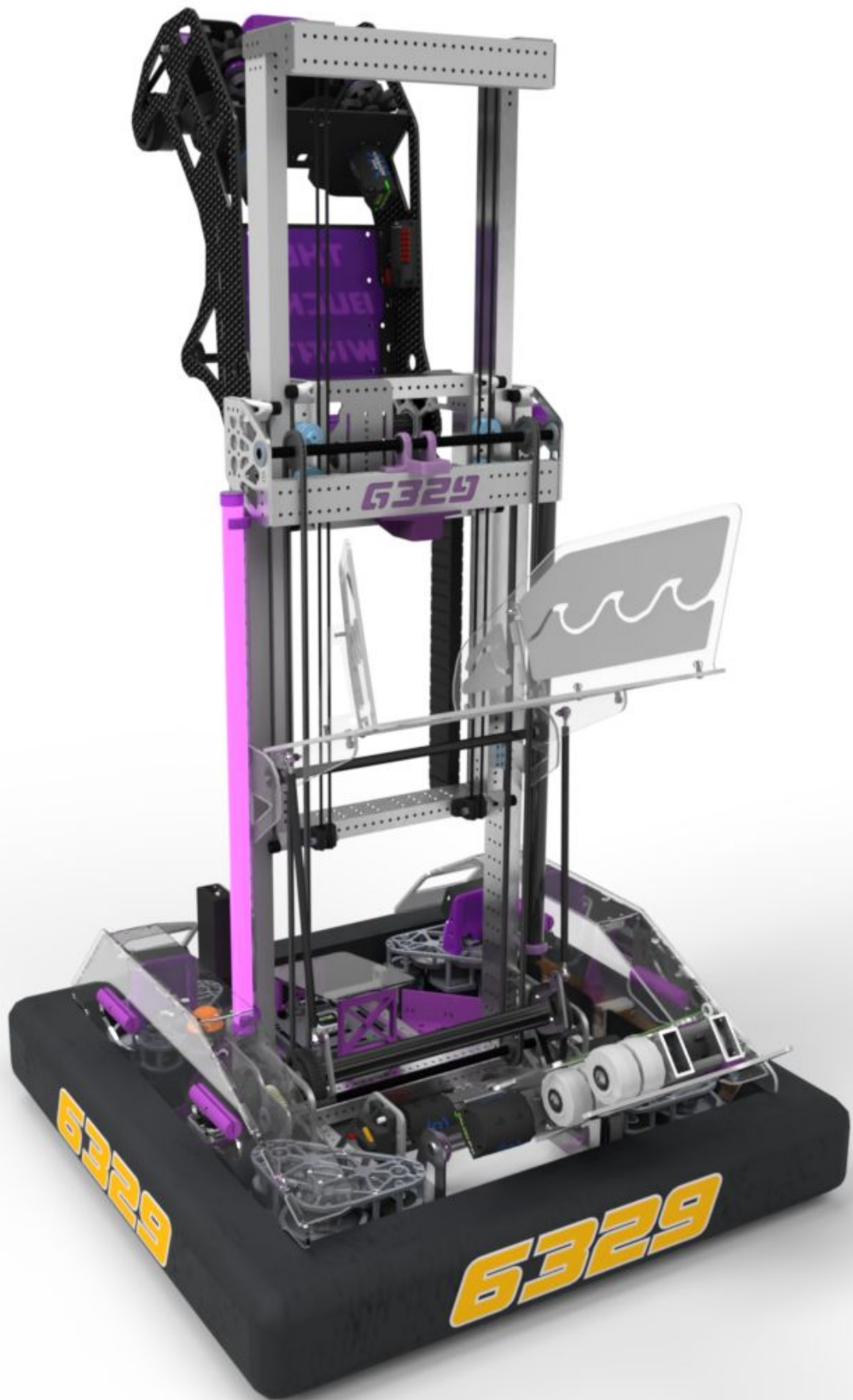
COMMAND IMPROVEMENTS

- New fully autonomous scoring routine that scores the coral, pulls the wrist back, and brings the elevator down all at the same time to improve cycle time
- Intake command for coral runs fully autonomously and only starts when it senses a coral in the ramp and is constantly working to keep the coral in the correct position


```
36 public final static int Elevator_UP = 0;
37 public final static int Elevator_DOWN = 1;
38
39 public int upPositionLimit = maxUpTravelPosition;
40 public int downPositionLimit = -1;
41 private int targetPosition = 0;
42 private double arbitraryFeedForward = 0.0;
43
44 private final static int onTargetThreshold = 2000;
45
46 private final SRXGains upGains = new SRXGains(Elevator_UP, p:0.09, i:0, d:0.5, f:0.02, iZone:2000);
47 private final SRXGains downGains = new SRXGains(Elevator_DOWN, p:0.04, i:0, d:0.1, f:0.011, iZone:2000); // was 0.011
48
49 private void setTargetPosition(int targetPosition) {
50     this.targetPosition = targetPosition;
51 }
52
53 private void setTargetPosition(int targetPosition, double acceleration, double cruiseVelocity) {
54     this.targetPosition = targetPosition;
55     this.acceleration = acceleration;
56     this.cruiseVelocity = cruiseVelocity;
57 }
58
59 private void setTargetPosition(int targetPosition, double acceleration, double cruiseVelocity, double upGains, double downGains) {
60     this.targetPosition = targetPosition;
61     this.acceleration = acceleration;
62     this.cruiseVelocity = cruiseVelocity;
63     this.upGains = upGains;
64     this.downGains = downGains;
65 }
```









Electronics

RoboRio	1	Andymark
Radio	1	WCP
Power Distribution Hub	1	REV
Pigeon 2	1	WCP
Mini Power Module	2	REV
CANdle	1	WCP
LED Lights	1	Amazon
LED Diffuser Tube	27"	Wired Signs
120A Breaker	1	Andymark
Limelight 4	2	WCP
Voltage Regulator Module	1	CTRE
Energy Chain	1	WCP

Elevator and Wrist

Kraken X60	3	WCP
100:1 MAX Planetary	1	REV
Elevator Block Kit	8	SDS
String and Pulley Kit	2	Thriftybot
60T 20DP Steel Gear	2	WCP
36T 20DP Gear	1	WCP
12T 20DP Spline Pinion	2	WCP
18T #25 Sprocket	1	WCP
22T #25 Sprocket	4	WCP
54T #25 Sprocket	1	WCP
#25 Chain	654 links	WCP
Spline XL Shaft	11.5"	WCP
Spline XL Flanged Bearing	2	WCP
0.0625" Aluminum Tube	214"	WCP
0.25" Aluminum Plate	126.5 in ²	Bangor Steel
0.125" Aluminum Plate	101 in ²	Bangor Steel
½" Hex Shaft	49.5 in	WCP

Drivetrain

mk4i L2 module	4	SDS
Kraken X60	8	CTRE
CANcoder	4	CTRE
0.125" Aluminum Tube	68"	Bangor Steel
0.125" Aluminum Sheet	498 in ²	Bangor Steel

Ramp

Kraken X60	1	WCP
12T 5mm Pulley	1	WCP
0.1875" Polycarbonate	372 in ²	
⅜" Hex Shaft	25"	WCP
½" Hex Shaft	16"	WCP
0.125" Aluminum	9 in ²	Bangor Steel

Climber

Kraken X60	2	WCP
100:1 MAX Planetary	2	REV
18T #25 Sprocket	4	WCP
#25 Chain	80 links	WCP
0.125 Aluminum Tube	25"	Bangor Steel
0.125" Aluminum	54 in ²	Bangor Steel
0.1875" Polycarbonate	36 in ²	
⅜" Hex Shaft	10.5"	WCP
½" Hex Shaft	13"	WCP
¾" Aluminum Tube	10"	REV
1.875" Colson Wheels	4	VEX

Scoring Mechanism

Kraken X44	3	WCP
½" Hex Shaft	20"	WCP
⅜" Hex Shaft	22"	WCP
⅜" Round Shaft	10.5"	WCP
0.1875" Polycarbonate	50 in ²	
0.2" Max Composite	296 in ²	REV
0.1" Max Composite	166 in ²	REV
1.25" Versaroller	9"	VEX
2" Flex Wheel	10	WCP
3" Flex Wheel	4	WCP
5" Star Wheel	4	WCP
12T 5mm Pulley	1	WCP
16T 3mm Pulley	2	WCP
70T 3mm Belt	2	WCP
105t 3mm Belt	2	WCP
85t 5mm Belt	1	WCP

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