FRC 6328
2018 Robot Design

The Revenge of Bot-Bot

6328

MECHANICAL ADVANTAGE

LITTLETON MA

Overview

We will be going over the following topics in our 2018 robot design binder.

- Strategy
- Drivetrain
- Elevator
- Cube Intake
- Climbing Hooks
- Code

Strategy

We will be going over the following topics in our 2018 robot design binder.

Game Task	Blue Alliance - Scale	Red Alliance - Vault
Switch Ownership	135	135
Scale Ownership	125	-
Boost PowerUp	-	15
Force PowerUp	-10	20
Levitate PowerUp	-	45
Vault Cubes	-	15
Total Points	250	230
Points - Switch	**115**	**95**

We analyzed a scale owning strategy versus a vault strategy, and determined owning the scale is more critical for winning matches. We assumed each alliance would own their switch for the entire duration of the match, negating those points. Then, one alliance focused on scale ownership, and the other on PowerUps and getting cubes in the vault. Even if the scale alliance did zero climbs, and the vault alliance scored as many cubes as possible and got every PowerUp, **the scale alliance would still win the match.**

Strategy

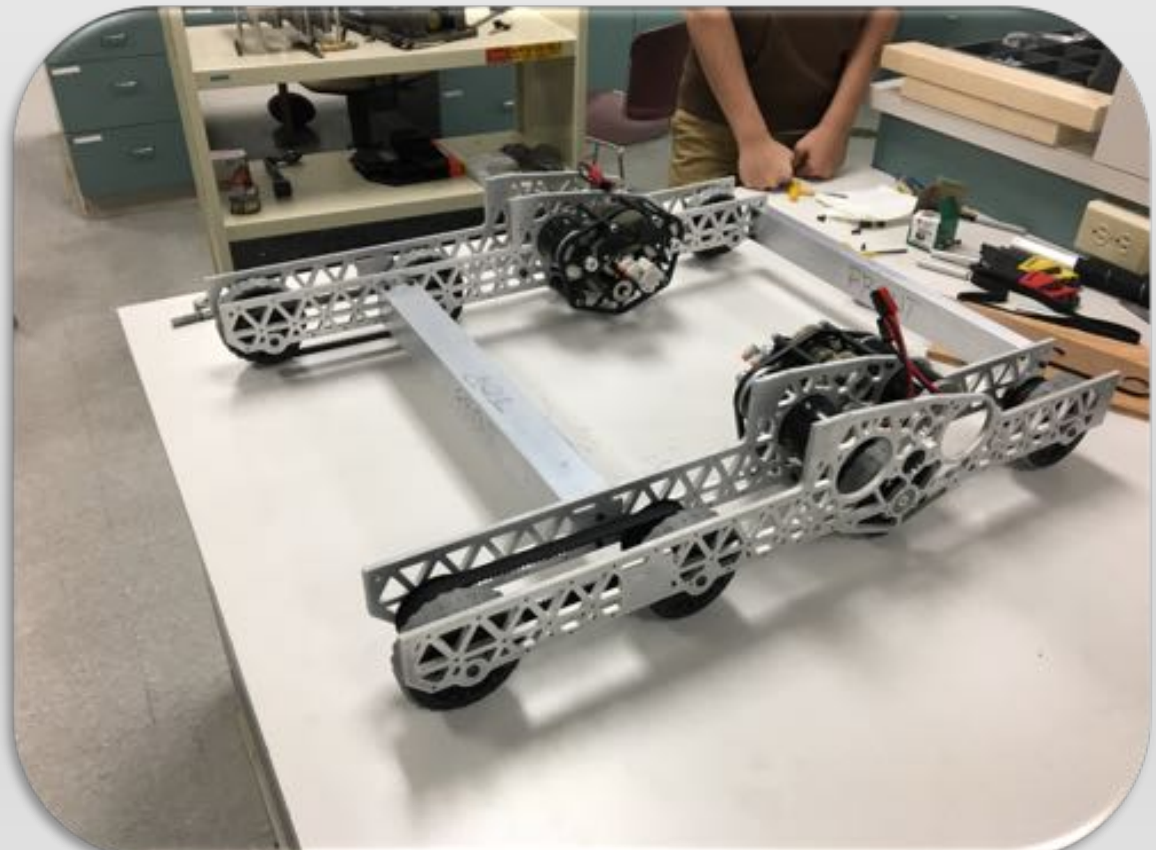
Based on our game analysis, we determined the following strategic priorities.

1. Own the scale
2. Score cubes in autonomous on switch and/or scale
3. Climb
4. Score cubes in exchange

Drivetrain

Our chassis is made of 4, water-jet, ¼" aluminum plates. We utilized an iso-grid lightning pattern to reduce ~50% of the weight while maintaining ~80% of the strength.

We use West Coast Products DS pneumatic shifting gearboxes. We designed one side of the gearbox plate into our chassis rails to simplify assembly and reduce weight. Our low gear is set for 7.4 ft/s and our high gear is set for 16 ft/s.

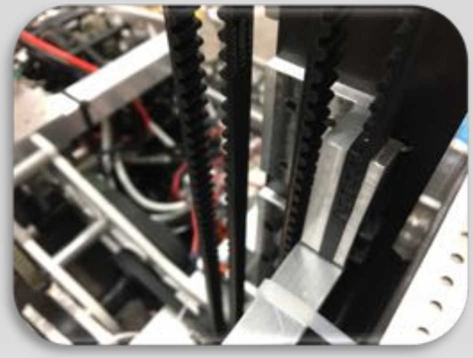


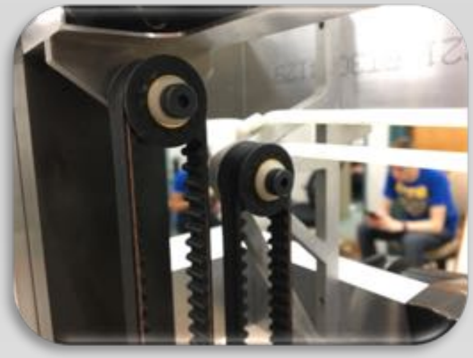
Elevator

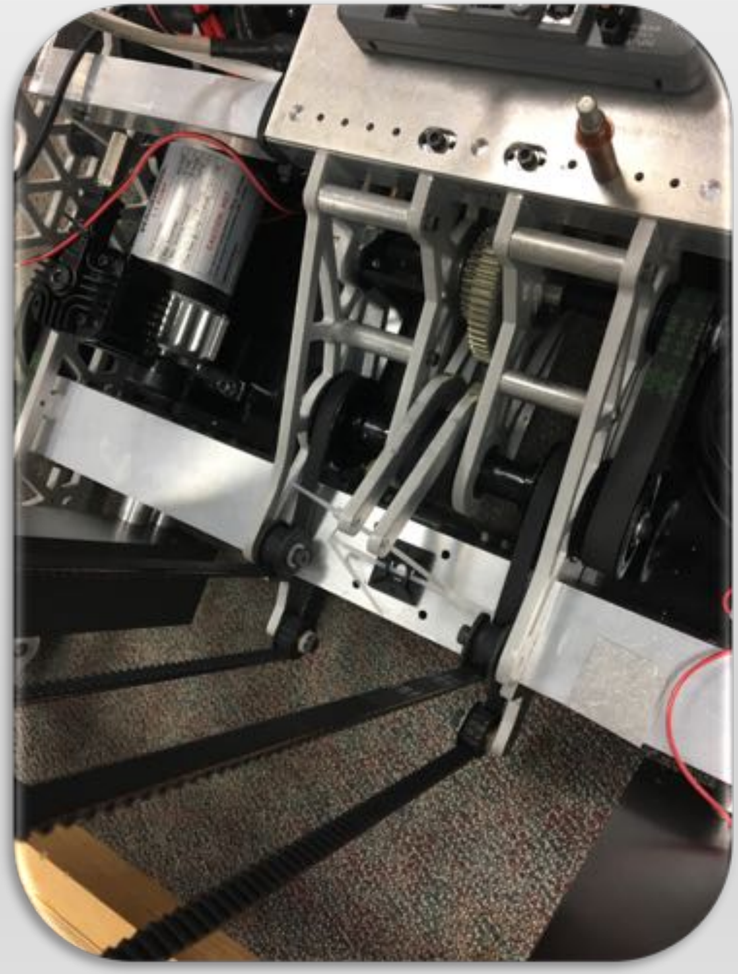
We use a 2-stage elevator to lift cubes into the switch and scale and to climb at the end of the match. Our elevator is driven by a custom, ball-shifting gear box powered by 4, 775-Pro motors. High gear is set for ~5 ft/s and is used for raising cubes. Low gear is set for ~1.5 ft/s and is used for climbing.

The gearbox is built into the center of our robot. It is primarily constructed of water-jet, ¼” aluminum plates. We also incorporated a pneumatic brake into the gearbox so when we climb, we can hold the robot in position without having to stall the motors.

We use a system of 3D printed pulleys and belts to drive the 2-stage elevator system. We also designed a custom piece to connect the belts lengths.

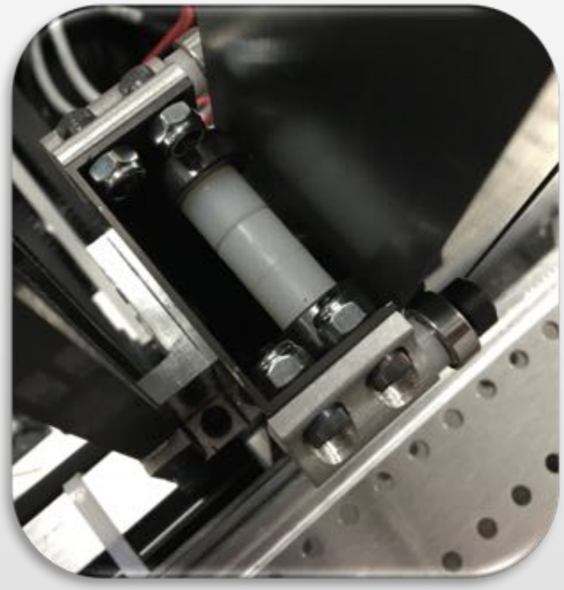






Elevator

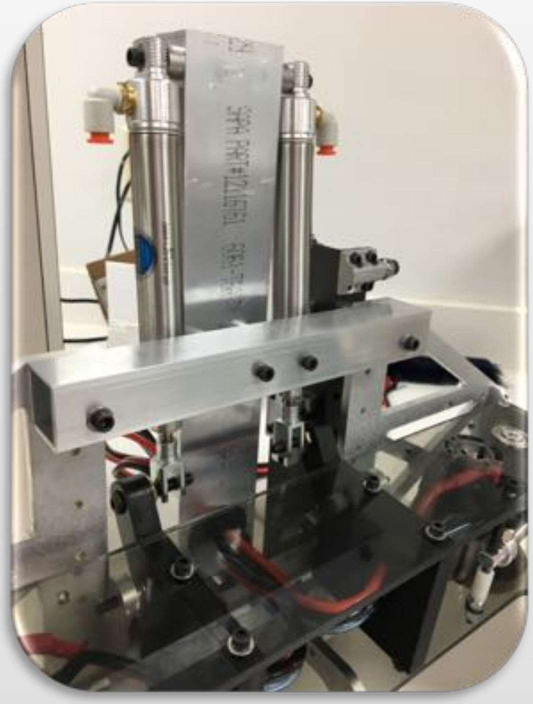
Our elevator stages are made of 2’ x 2’ x 1/16” and 2” x 1” x 1/16” aluminum tubes. We had the tubes hard-coat anodized for superior bearing performance. This prevents ruts from wearing into the aluminum from the bearings rolling on the tubes.

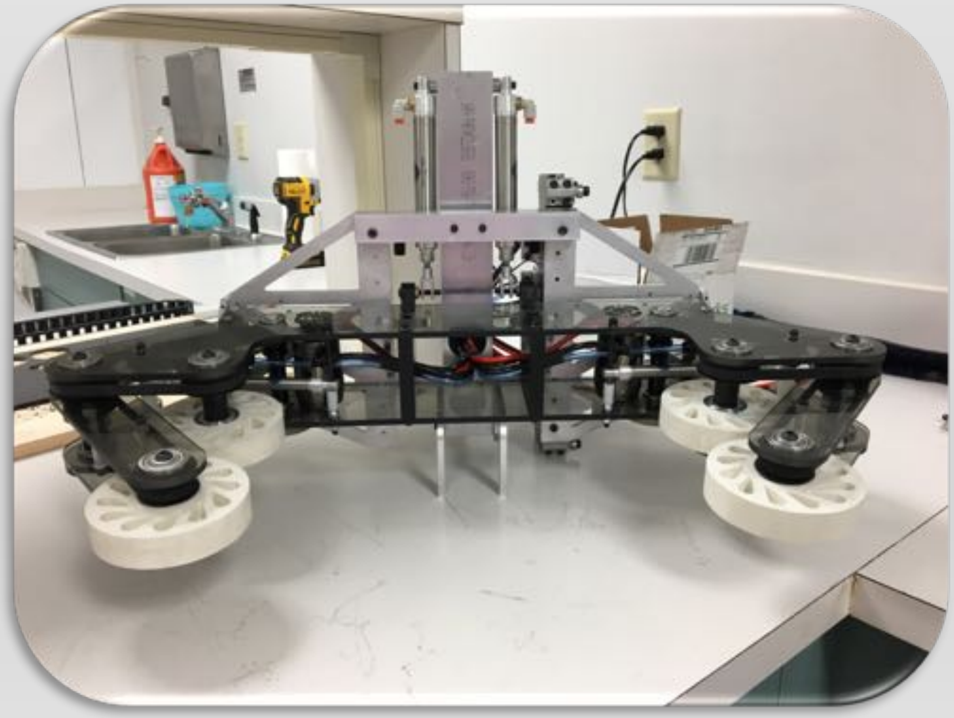


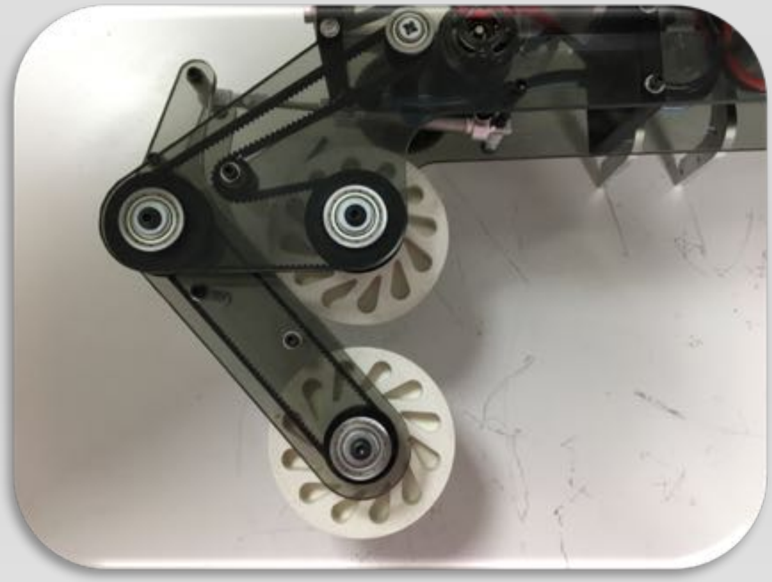
Our roller assemblies are comprised of 3/8” bearings, shoulder bolts and custom elevator blocks. The elevator blocks connect the roller assemblies to the elevator tubes.

Cube Intake

Our cube intake uses 4 Fairline, compliant wheels powered by 2, 775-Pro motors. We use a linkage with 7/16" pistons to provide ~5 lbs of squeeze on the cube. When deployed, the intake is outside of the robot starting configuration. We designed a linkage system with 2, 3/4" pistons to store the intake vertically.

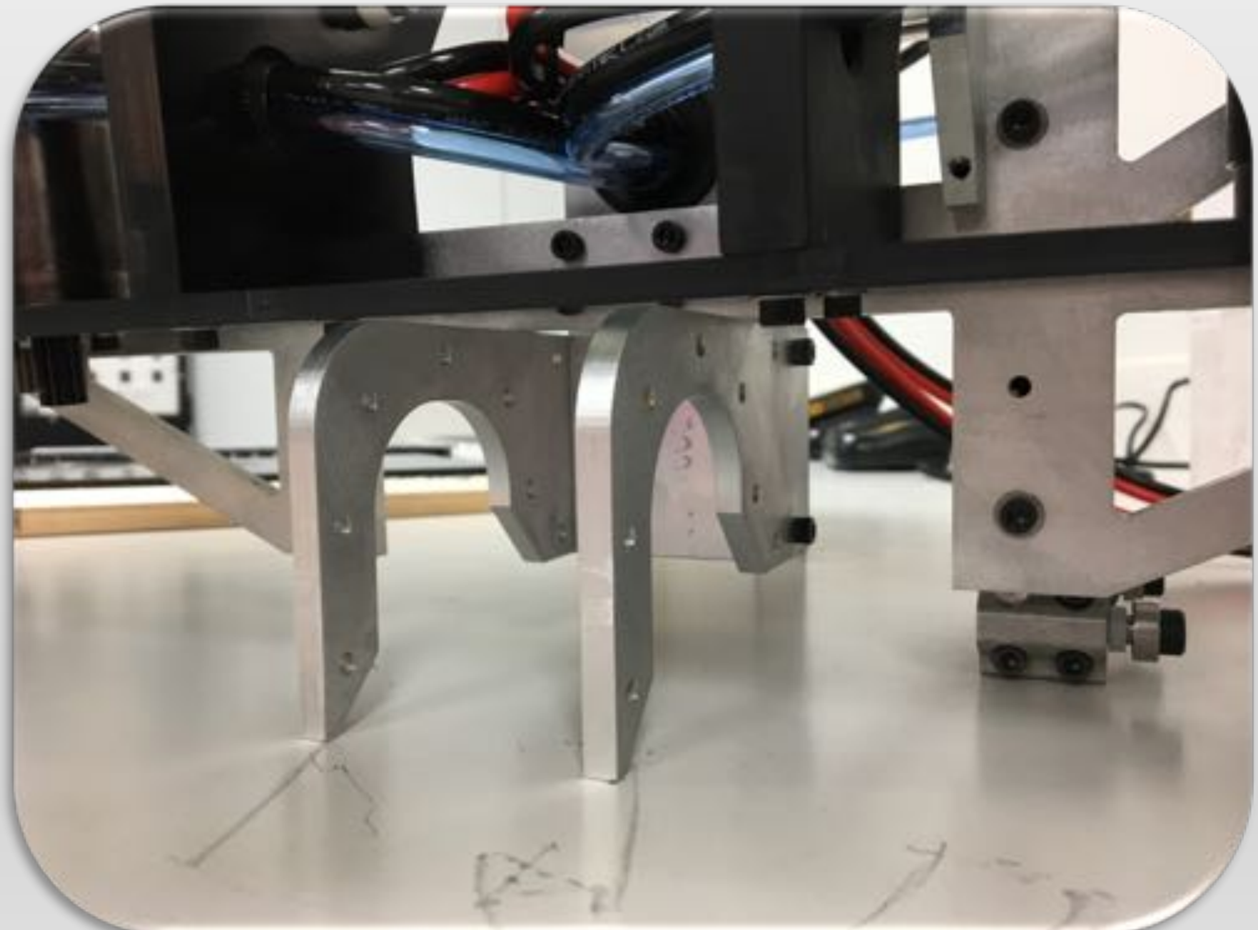






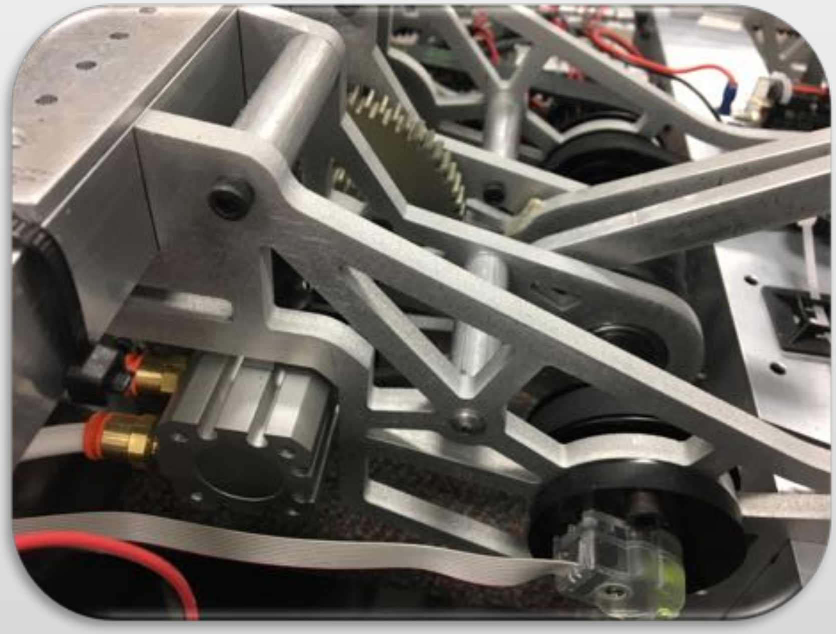
Climbing Hooks

We designed our climbing hooks into our cube intake system. They are located on the bottom of the intake so they will move up and down with the elevator. The hooks are made from ¼" aluminum plates and were cut on a CNC router.



Basic Code Structure

- Our code is written in Java and utilizes the command-based robot system.
  - The code is divided into subsystems for each mechanical system and commands that use the subsystems
- Closed loop drive control
  - Provides more repeatable, responsive drive
  - Adjusts actual motor power based on data from the encoders
    - Encoders measure distance travelled and speed
- Auto driving
  - Turn to angle
  - Drive distance
  - Motion profiling
    - This is the ability to generate a spline path and follow it
      - Allows much higher time efficiency than straight line and turn
  - Has ability to track cube using vision and drive to it



Basic Code Structure

- Operator button board
  - Has LEDs for feedback running custom system for LED control
- Sensors: encoders on drive & elevator gearbox, banner sensors
  - One banner for sensing when the cube is in intake, another to sense tape lines on field
    - Having data when driving about tape lines help us avoid running into the scale

Autonomous Sequences

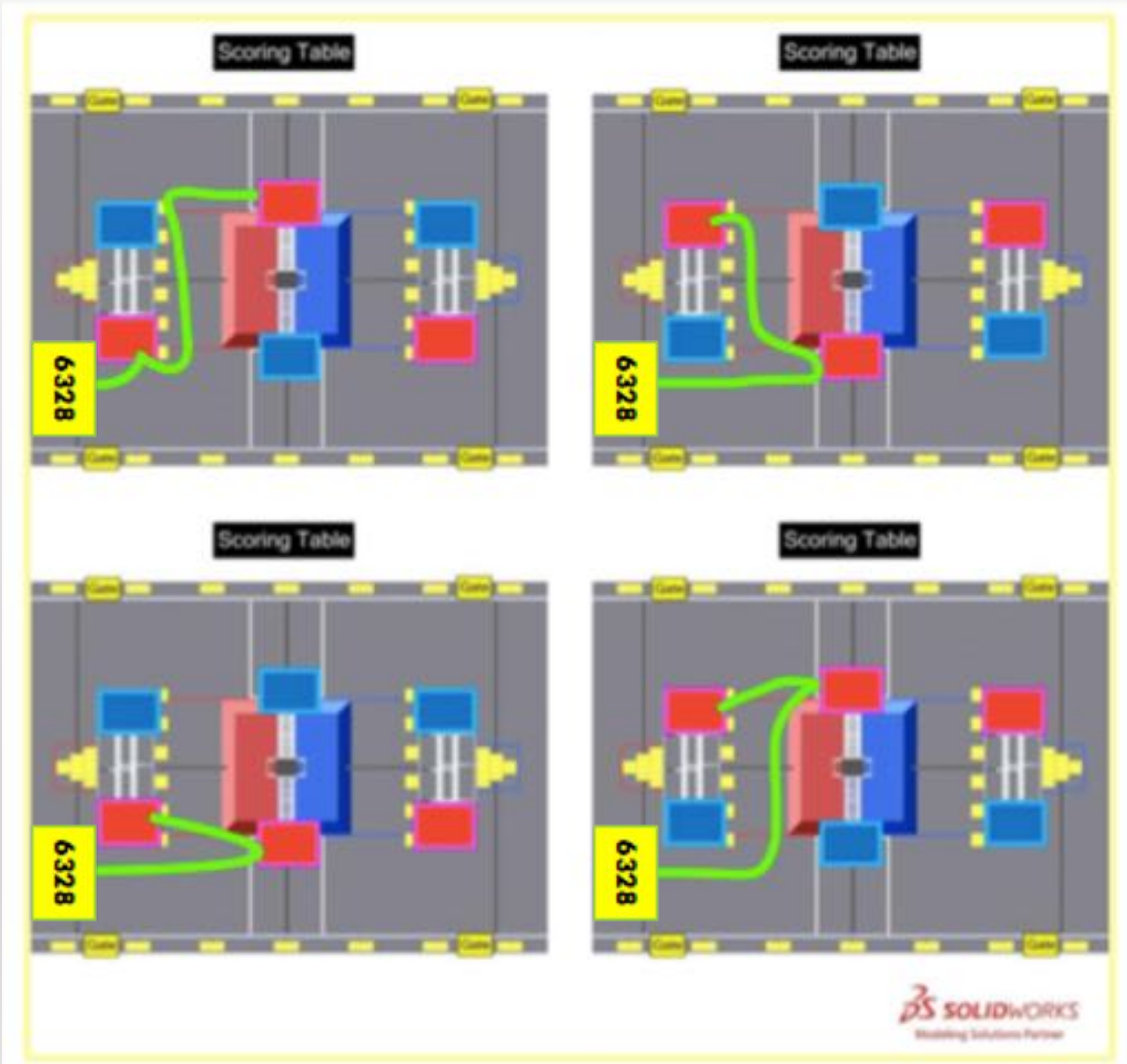
Our team planned multiple autonomous routines that involve scoring cubes on the switch and/or scale regardless of field orientation.

We created motion profiled autonomous sequences that will deliver cubes to both the switch and the scale during auto mode. We start on one side of the field, and based on the field configuration variable inputted to the robot, we run 1 of the sequences seen on the next page. In all but 1 sequence, the robot will deliver in the scale before the switch, as the cubes in front of the switch make for quick and easy collection.

The auto options allows us to specify that either the switch or scale is the priority, stay on one half of the field, or disable the second cube

1. **Switch on our side, scale on other side**
    1. Deposit cube on switch, collect cube by opposite side of switch, deposit cube on scale
2. **Scale on our side, switch on other side**
    1. Deposit cube on scale, drive to other side, collect cube in front of switch and deposit
3. **Scale and switch on our side**
    1. Deposit cube on scale, turn around, collect cube in front of switch and deposit
4. **Scale and switch on other side**
    1. Drive across field, deposit cube on scale, turn around, collect cube in front of switch and deposit
5. **Start in center and deliver to the correct side of the switch (1 cube)**

2-Cube Autonomous Sequences



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