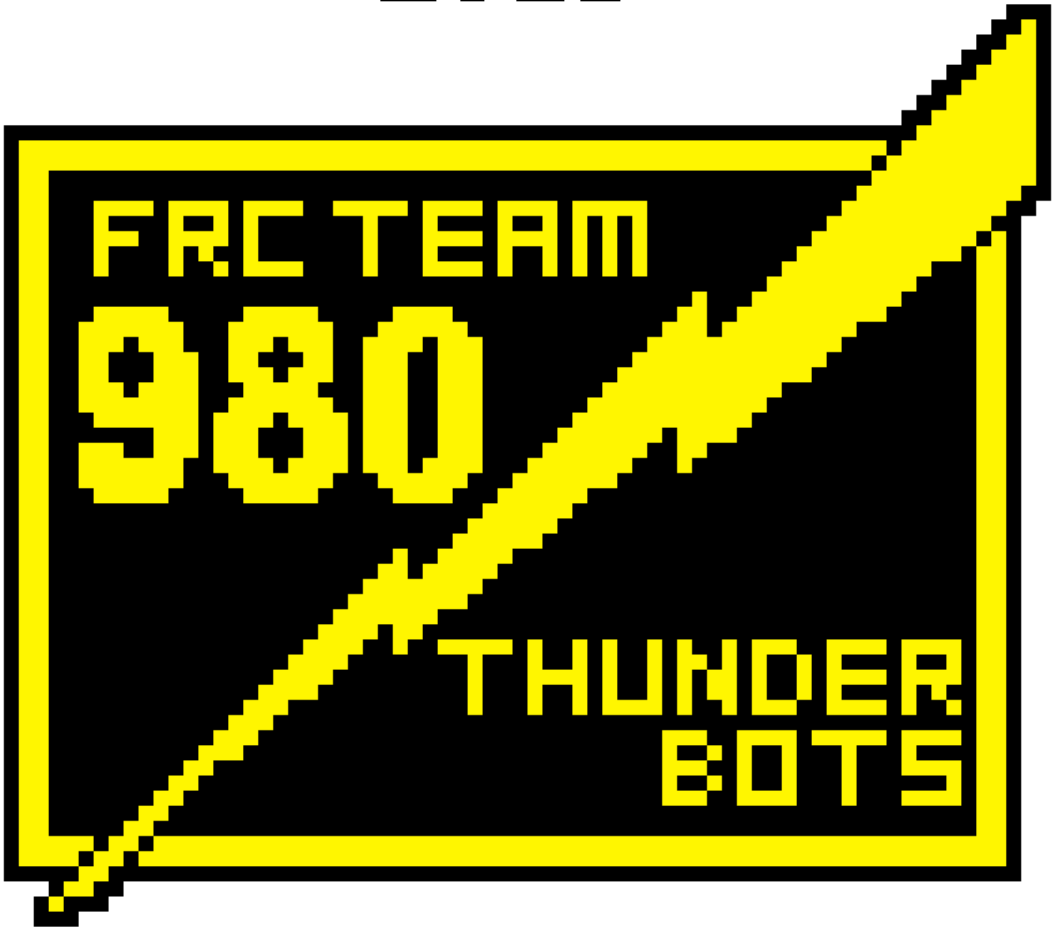
FRC Team 980 ThunderBots

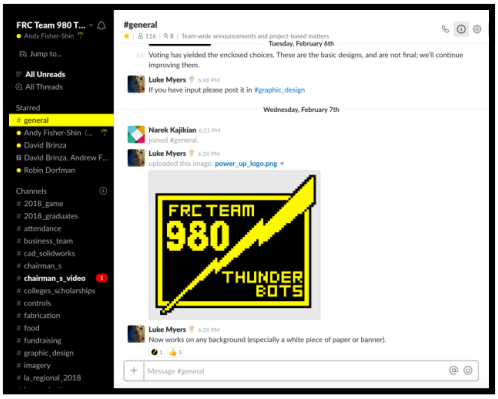
Engineering 2018



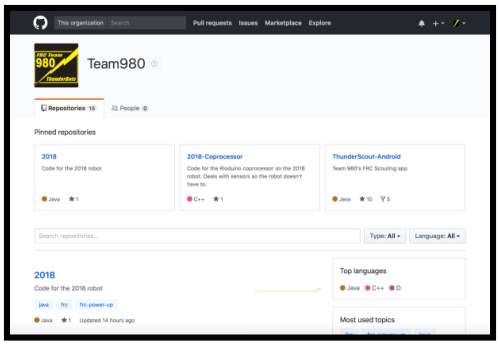
Contents

Organizing Tools

Slack for our team communications

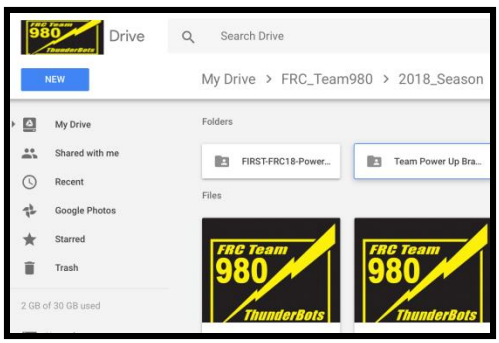


GitHub for controls

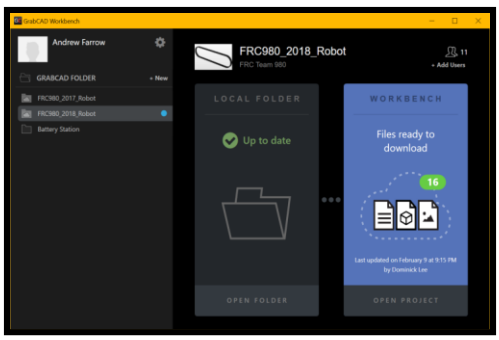


Trello to keep our projects on-track

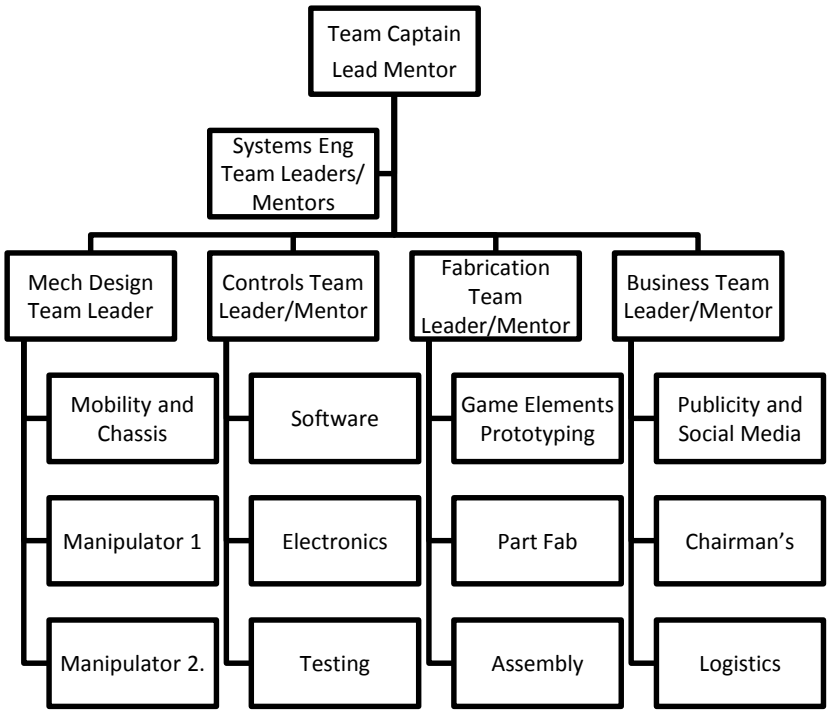
Google Drive for cloud storage



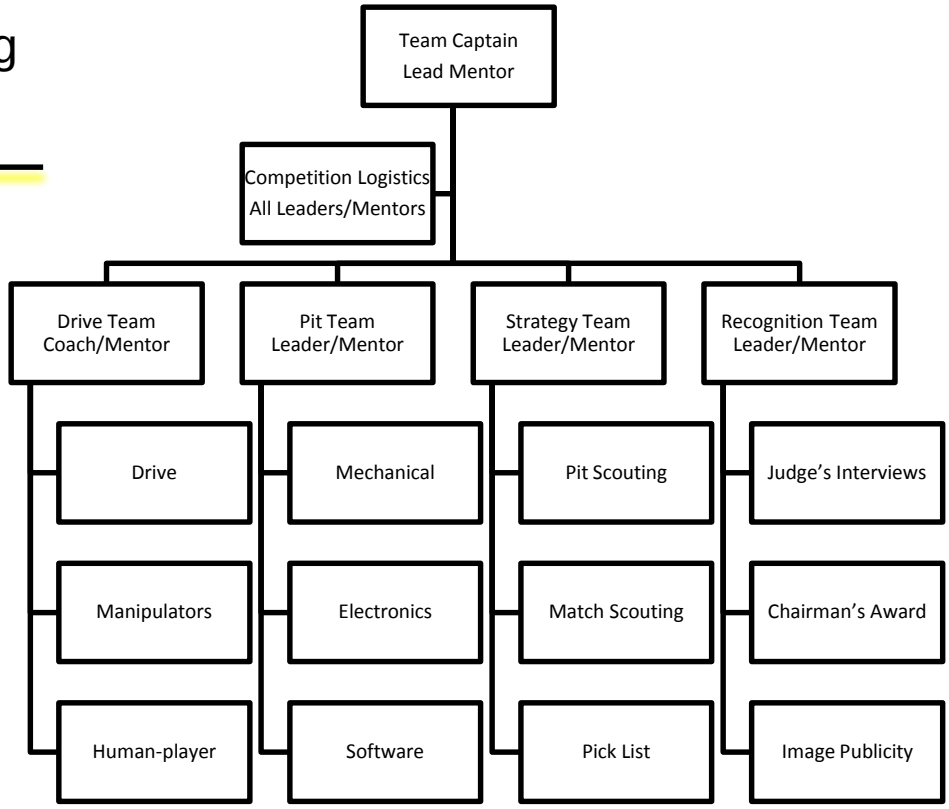
GrabCAD for SolidWorks



Build Season Org Chart



Competition Org Chart



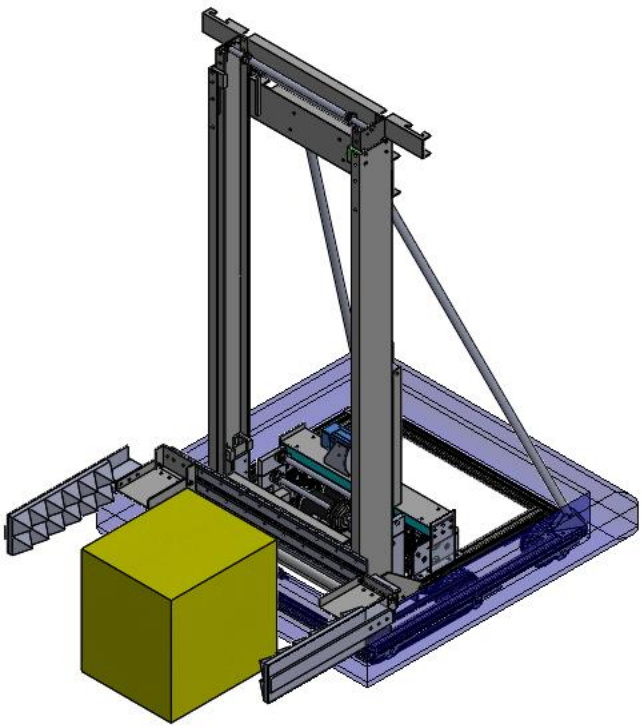
ThunderScout

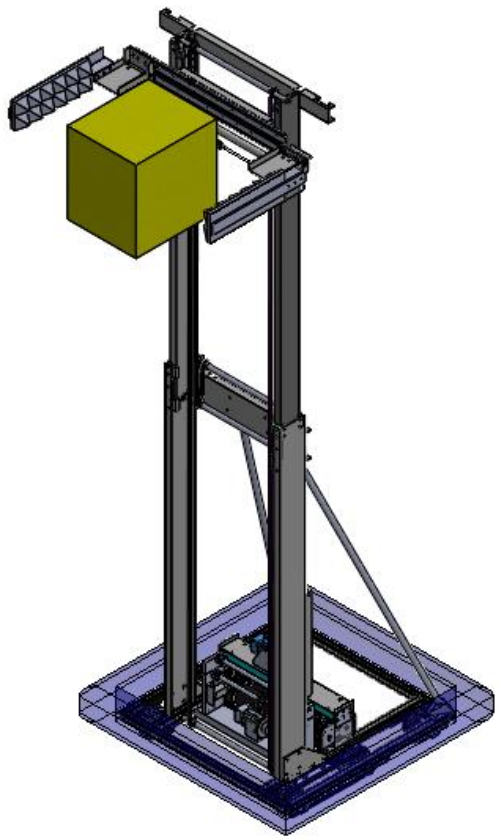
Tablet-based. custom scouting software designed by team member Luke Myers.

Available now on Google Play, Amazon and GitHub.

SolidWorks Models: Lightning XVI

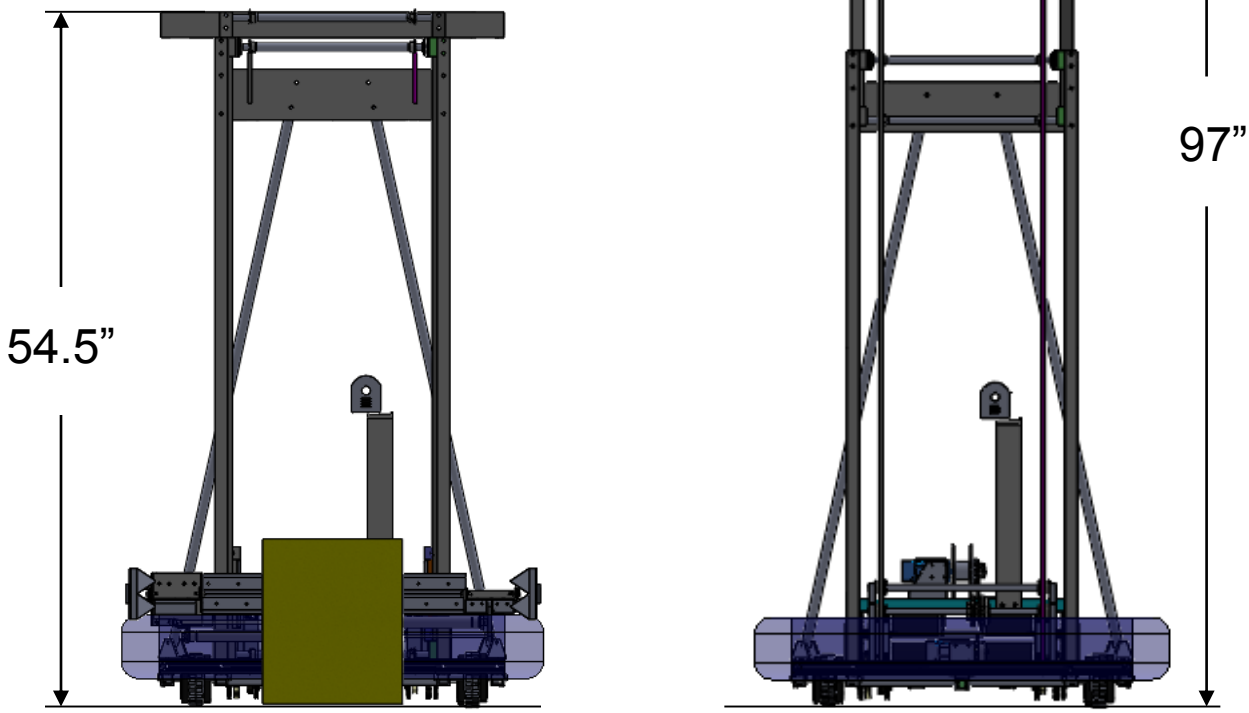
Complete Robot





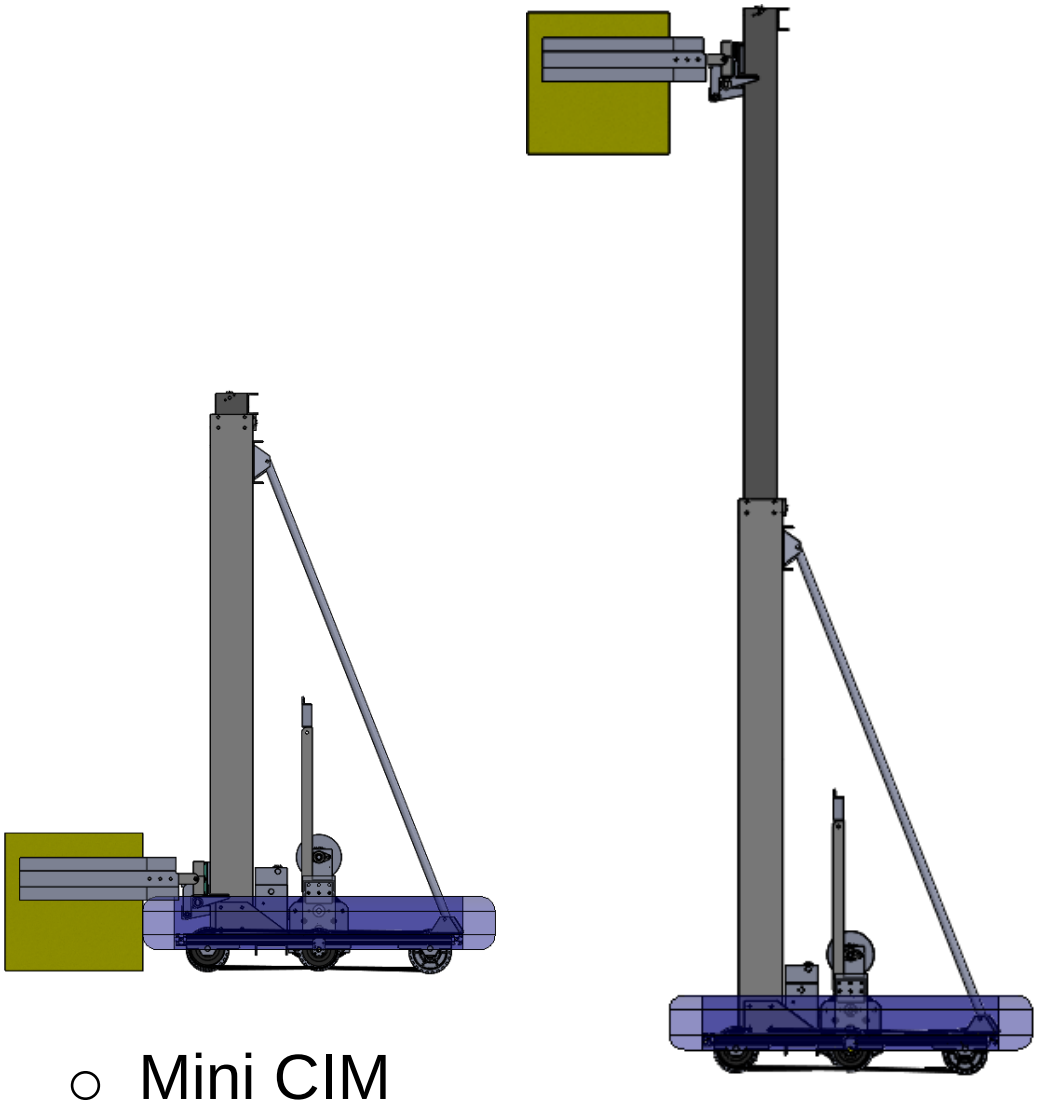
SolidWorks Models: Lightning XVI

Front View



SolidWorks Models: Lightning XVI

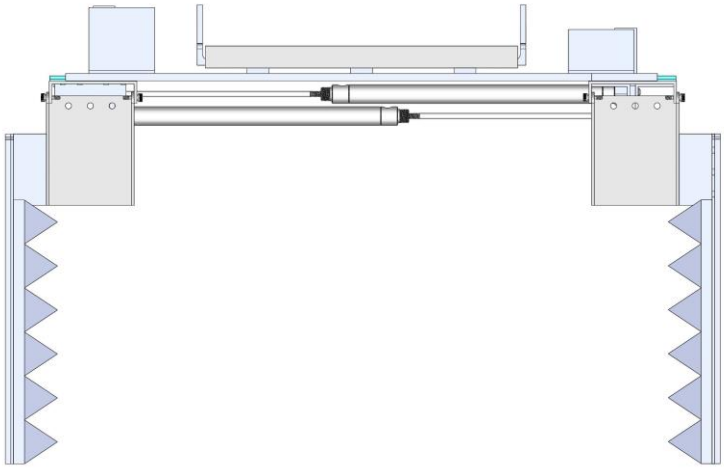
Lifting Assembly

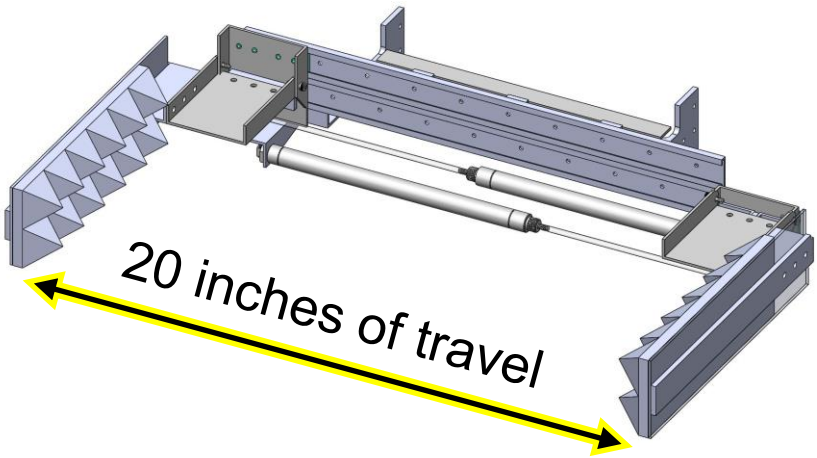


- Mini CIM
- Torque Limiter to prevent motor from causing damage

SolidWorks Models: Lightning XVI

Power Cube Pick Up

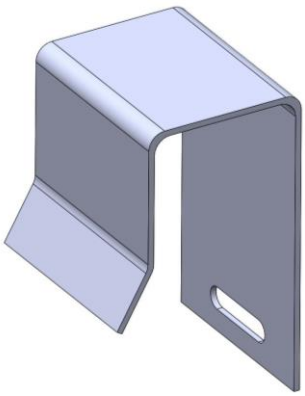


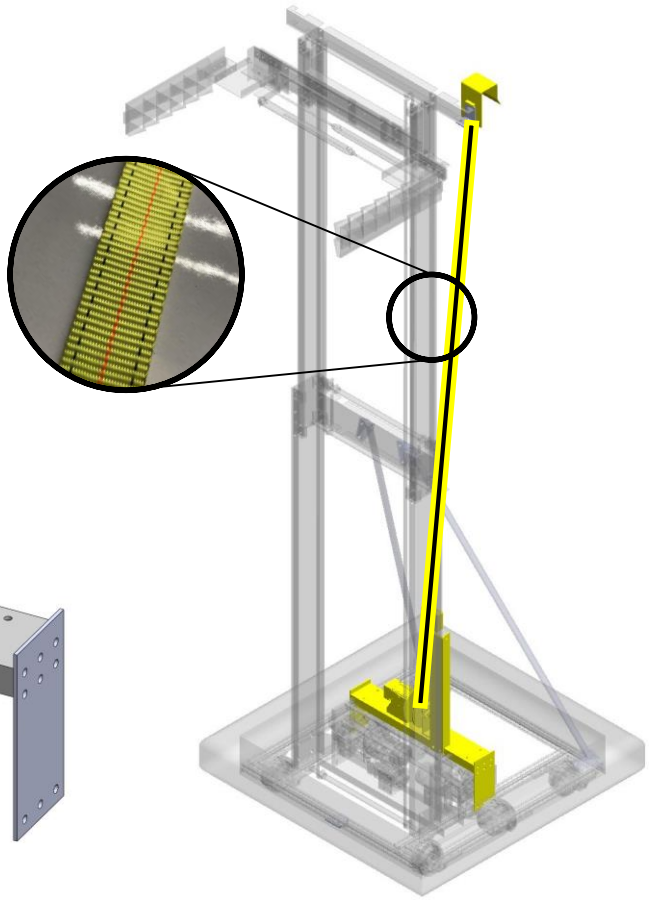


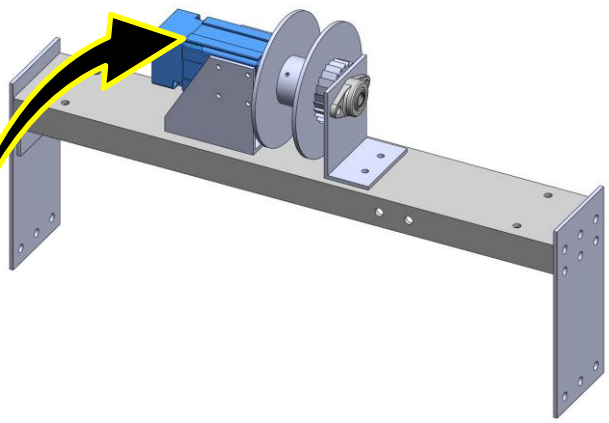
- Up to 90 lbs. of clamping force

SolidWorks Models: Lightning XVI

Climbing Assembly







- 64:1 CIM
- Over 650 lbs. of lifting force

Lightning XVI: Robot Controls/Operations

Autonomous Modes

Mode 1: Switch Scoring
- Center start position
- Determine active switch from FMS string
- Deliver cube to active switch via vision targets within 5 seconds
- Drive around switch, find and capture a new cube

Sensors used: Pixy imager, ultrasonic rangefinder, rotational encoders, Pigeon IMU

Mode 2: Scale Scoring
- Side start position
- Drive to nearest scale
- If FMS string indicates scale is active, score cube. Otherwise, hold cube, do not enter null zone.

Sensors used: ultrasonic rangefinder, rotational encoders, Pigeon IMU

Mode 3: Line crossing (Fail-safe mode)
- Any start position
- If Pixy/ultrasonic sensors not available, use encoders and IMU to drive across line.

Sensors used: rotational encoders, Pigeon IMU

Teleoperations

Pixy code is used in TeleOp for assisted cube capture.
Velocity control to be used for driving (acceleration limited)

Lightning XVI:
Robot Controls: Sensors

Sensor Fusion

We use a combination of target finding/ranging and motion control for acquiring cubes and delivering them to scoring platforms.

The target acquisition and ranging sensors below use a Rioduino coprocessor (MXP-compatible Arduino) for data collection and processing. Target direction/range data is sent to RoboRio via I2C.

- Pixy: small self-contained vision tracking unit. Tracks objects of a color, up to 7 color signatures. Provides size and position of object.
- Maxbotix ultrasonic: sonar-based rangefinder gives distance to object up to 6 m away.
- Mini LIDAR: Infrared based, uses flight time to determine range. Used to detect lift height, backing up the encoder data.

The motion sensors below are processed directly by the RoboRIO, providing data not dependent on the coprocessor. Integral for both Auto and Teleop modes, they allow for fail-safe auto mode that uses only these sensors in case of coprocessor failure.

- Pigeon IMU: 6 axis Gyro/Accelerometer/Magnetometer, self calibrates using Earth's magnetic field. Detects pitch, roll and yaw in degrees, delivers data over CAN bus.
- Rotational Encoders: mounted to drive wheels and lift motor, determines shaft rotations to calculate distance and speed and lift height in Auto.

Software

The Java RoboRIO code and C Arduino code were written side-by-side by two students, making the sensor integration seamless.

Lightning XVI: Drive Station

Shuffleboard is used for data presentation

Steering wheel and joystick combination control driving functions

X Box remote controls lifter, grabber, and climber