Shooter

Boulders are scored in the high and low goals using the shooter. A pivoting design allows Crossfire to shoot boulders over any defending robot while still being able to drive under the Low Bar. This unique capability is made possible with a BAG motor that lifts the shooter into ready position in less than a second. Loading the shooter is just as quick; the shooting flywheels are reversed to receive the boulder from the intake.

Intake

The intake mechanism serves two purposes: retrieving boulders and manipulating the defenses. Rollers on the front of the intake pull boulders into the robot for scoring. The entire mechanism is then used to effortlessly breach both the Cheval de Frise and Portcullis.

Drivetrain

Eight 8 inch pneumatic tires allow the robot to drive over every defense with ease. #35 Chain is used for increased robustness and reliability. A custom 2-speed transmission provides power to the robot and an integrated PTO (Power Take Off) mechanism can be used for a scaling mechanism.

Automated Scoring

Crossfire is capable of scoring in the tower from many locations on the field. Onboard vision processing software calculates the angle and distance between the robot and the goal. A Kangaroo Computer running Windows 10 processes images in Roborealm and returns data to the roboRIO via NetworkTables.

A 9-axis IMU is used to align the robot with the goal while the shooter is lifted to the correct angle with an encoder-fed PID loop. The flywheels are then accelerated to the correct speeds using encoders and a PID loop accurate to ± 5 rpm. A bump switch detects when the boulder has left the shooter.

This automated sequence is used in autonomous and tele-op and allows the driver to accurately score a high goal in seconds.

Anti-Collision Software

Custom software was created to prevent the shooter and intake from colliding during a match. These two mechanisms have intersecting ranges of motion and must be protected from each other. Encoder-fed PID loops detect the positions of both mechanisms and, if necessary, will stop the shooter from raising and lowering so the intake can be temporarily moved out of the way. The entire process takes less than a second and is very reliable.

CAD (Computer Aided Design)

From prototype to final design, CAD software was used to plan and create every aspect of the robot. Computer modeling and design was done entirely by students in Autodesk Inventor. Many parts of the robot were also manufactured by students using 3D printing and CNC machining technologies. Students created technical drawings for parts manufactured by sponsors. GrabCAD software was used extensively throughout the build season for editing and managing revisions on CAD files.