*Brendan and the Jo(h)nathans* NERF turret was the term project for the second mechatronics class at Cal Poly. The goal of this turret was to use closed-loop motor control and a thermal camera to detect a target, aim, and fire a foam dart automatically.

A white and grey machine

Description automatically generated with medium confidence

Figure 1. CAD model of gun, motors, and geartrain. Thermal camera not included.

The main panning axis is driven by a Pololu #4743 12V DC motor with a 50:1 gearbox. Because the gear ratio is slowing down the motor’s rotation to 60 rpm, a 90o bevel gear train with a 1:1 ratio was necessary to avoid reducing the speed further. Worm gears were considered because of their avoidance of backwards driving, but bevel gears were chosen over worm gears because worm gear sets could not be found in a 1:1 ratio.

A grey metal object with a square object

Description automatically generated

Figure 2. CAD isolation of geartrain.

Bevel gears were selected to place the motor close to the table datum while not interfering with the gun’s panning axis.

With each weekly lab assignment, pieces of code were written, and hardware was implemented building up to the term project. The main pieces are as follows: motor controller, including driving the DC motor and reading its encoder, tuning the closed-loop proportional and integral gains, cooperative multitasking to drive two motors simultaneously, and finally configuring the thermal camera using inter-integrated circuit (I2C). All software documentation can be found at INSERT DOXYGEN HTML LINK .

A NERF Stryfe gun was modified to have its flywheels turned on from software, and the trigger was pulled by a servo to push darts into the flywheels.