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Introduction

Problem: This project aims to spark student's interest in STEM fields by replicating a missile defense system.

Constraints: The launcher must adhere to DEVCOM's rules. For example: the launcher must fit in a 1ft-by-1ft-by-1ft box, it must not shoot further than 6ft, it must include an E-stop and pause switch, and it must function on its own during the competition.

Design

Figure 1 below shows the completed launcher. The main components that can be seen, such as the launcher itself and housing, were made by the Mechanical Team. The insides, illuminated by the red light, are the electrical team's contributions which are further elaborated upon below. The final projectile used can also be seen in figure two.

Power: Power was split into two parts, the 24V 600W supply and a 5V 50W supply. The 24V supply powers the mechanical portion's motors. The 5V supply powers the Processor, Motor Controller, and Extra Subsystem.

Figure 1: Completed Launcher

Team: (Left to Right) Katie Swinea, Jonathan Neal, Finlay Patoto, Kevin Ulrich, Garrett Armstrong, Savannah Metzler

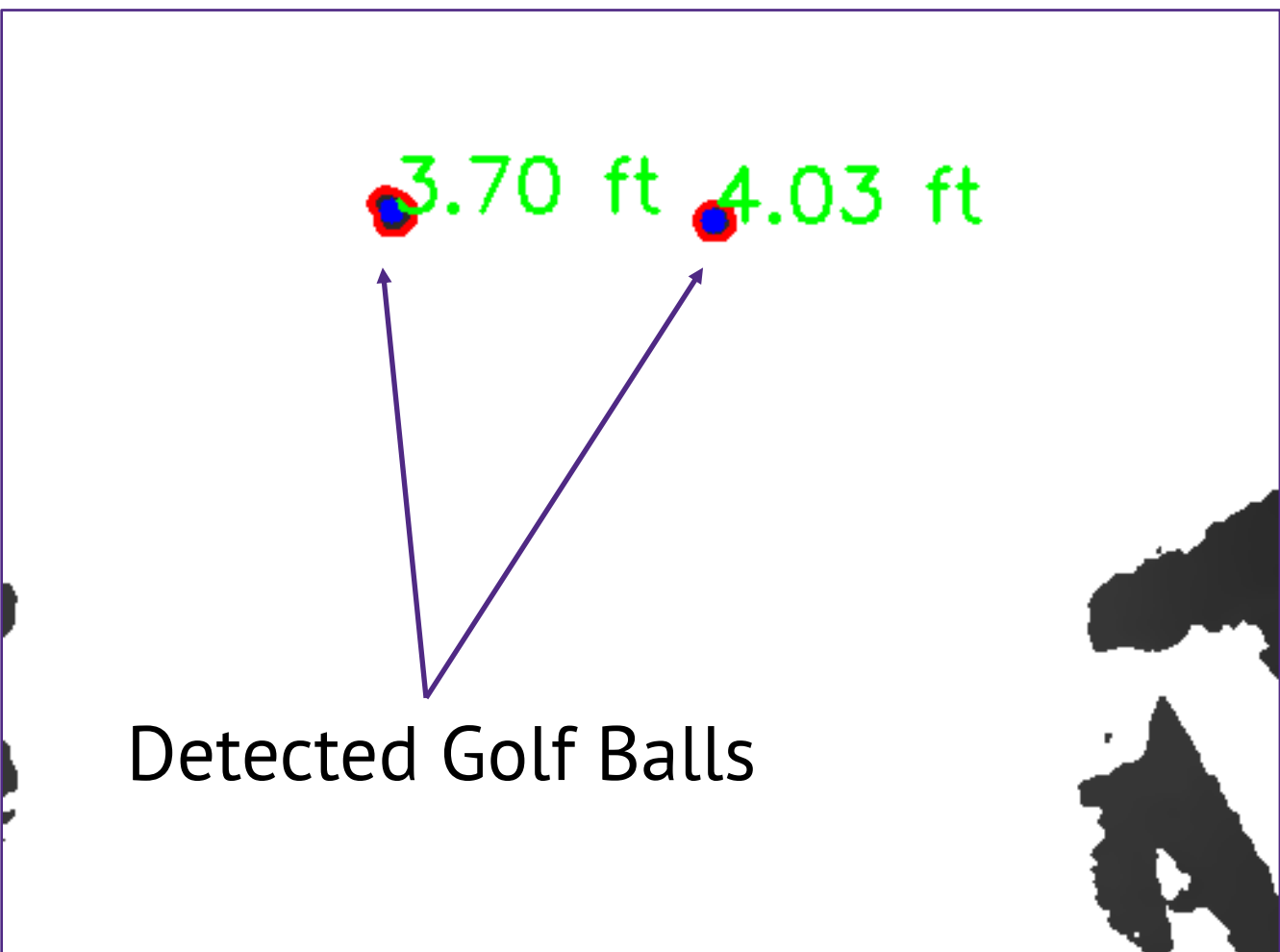Figure 2: Final Projectile
(Nerf Bullet with hot glue stick inside)

3.70 ft 4.03 ft

Detected Golf Balls

Figure 3: Camera Detecting Two Golf Balls

Processor: The Jetson Nano was chosen as the processor because of its capabilities. It gathers data from the camera and determines the line that the golf ball is traveling on.

Image Processing: Figure three shows the Intel RealSense camera's detection abilities. It is detecting two golf balls on the gameboard and displays the distance of the coordinates.

Interceptor Controller: This subsystem controls all the mechanical portions of the design. It retrieves data from the Jetson Nano and converts it to movements for the motors to properly aim the launcher to one of the fifteen preset locations.

Extra: This system encompasses the mandatory pause switch as well as the lights and sounds that play before the interceptor fires at the golf ball.

Experimentation

- The emergency stop, pause switch, lights, and firing sounds were implemented.
- The ECE and ME portions of the project were integrated successfully.
- The golf ball interceptor can successfully locate the ball, aim, and shoot.
- The launcher moves to fifteen different locations based on the line where the golf ball is detected.
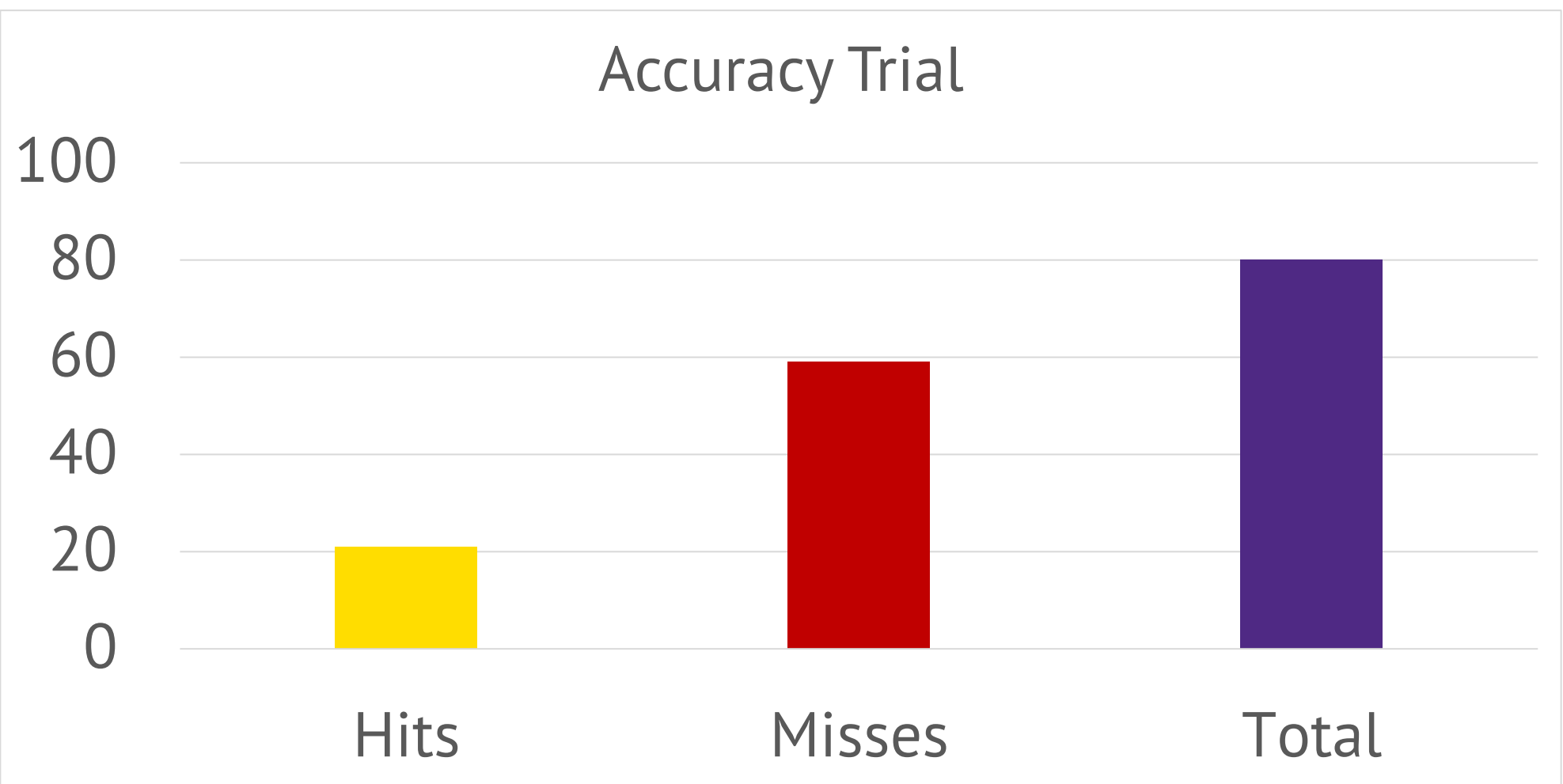
Accuracy Trial

Accuracy: For the accuracy trials, a total of 80 trials were conducted. The total number of noticeable hits was 21. This sets the accuracy at 26%.

Conclusion:

The team was able to successfully create the golf ball interceptor within DEVCOM's specifications found in the rulebook. The team is overall pleased with the final result. The final budget is shown below.

Electrical Budget:

Subsystems:	Total:
Power	162.00
Extra	35.19
Interceptor Controller	27.60
Processor	229.40
Camera (Sensor)	314.00
Total:	$768.20

Combined Budget:

Team:	Total:
Electrical	768.20
Mechanical	290.00
	$1058.20