Nerf Turret

Cole Harding, Justin DeClark, Clay Wilson, Ike Sheehan, Michael Swango, Cody Boogaart
Advisor: Sameer Sharma, PhD
Trine University
One University Avenue, Angola, Indiana 46703

Trine University
Electrical and Computer
Engineering

Introduction:

We have created a hobbyist nerf turret with color recognition. The cost to build the turret is less than $1000. This turret is perfect for a hobbyist, as a complete product like this doesn't currently exist, and the knowledge gained by creating it is invaluable. This nerf turret recognizes red, green, or blue 1 by 2 foot rectangles(shirt size). It aims and hits targets standing still or walking past the turret from 5 to 15 feet away. The horizontal field of view is 90° and the vertical view is 45°. The color that is targeted is selected in an app and can be changed whenever the user decides to change it. The app also has a live camera feed to see where the turret is pointed, and an arm/disarm button.

Figure 2: Image of the Nvidia Jetson Nano computer. This is used for all the GPIO and computation of scripts.

Materials and Methods:

Software:

- ROS for inter-process communication
- Python 2.7 for all scripts
- Intel real sense library for vision tracking
- Python socket server for smartphone to computer IPC
- Python web server for livestreaming video feed to the smartphone
- Android studio for developing the smartphone application

Hardware used in the project consisted of:

- Nvidia Jetson Nano
- Intel Realsense d435 camera
- Progressive automotions PA-14P linear actuator with feedback
- Lazy susan bearing
- Stepper motor w/ stepper motor driver
- 12v power supply
- Wood for frame
- Nerf Rival Khaos MXVI-4000

The testing methods for this project included:

- Tested individual accuracy of both turret axis
- Tested inter process communication between smartphone, computer, and hardware
- Tested useable range for vision tracking

Figure 1: Image of the intel real sense camera used for vision tracking

Results and Discussion:

- The nerf turret horizontal field of view is 180 degrees
- The nerf turret recognizes color targets between 5-15 feet away using the 1' x 2' color targets
- The nerf turret is armed and disarmed by the smartphone app
- The smartphone app receives live camera feed from the turret
- The smartphone app sends the desired target color to the turret
- The turret shoots in bursts when the target is in sights

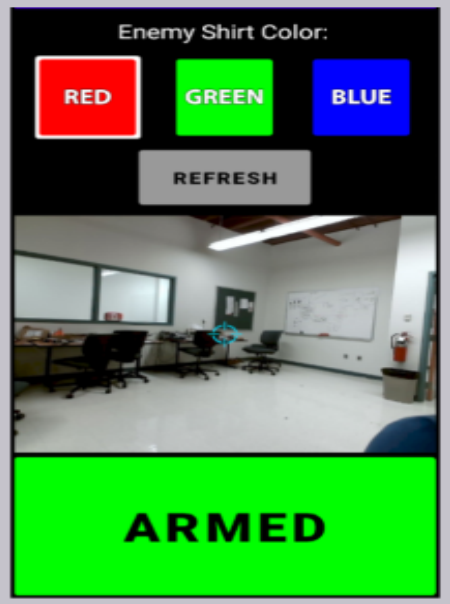

Figure 4: Image of the smartphone app user interface.

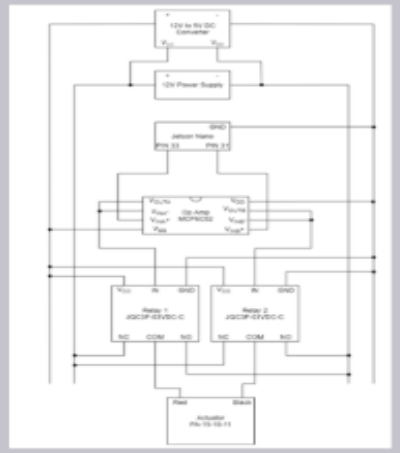

Figure 5: Wiring diagram of the linear actuator circuit

Figure 3: Sequence diagram for our software processes.

Figure 4: Image of the final product for our design

Conclusion:

Our team has constructed an autonomous sentry gun nerf turret that targets a specific shirt color. The parts we used are easily available online, although it is an expensive product to produce at this time. The size of the turret may not be suitable for children, as it is not a toy. This turret is more suited for hobbyist use, as it can be easily modified to track faces, shapes, or colors. Additionally, the nerf gun could be swapped out to fit other applications, such as a baseball pitcher or a paintball gun. By releasing our product into the public eye, we hope we are able to spark ideas and or interest into the minds of aspiring engineers.

Future Work:

The following are ideas to improve the project:

- Find an alternative solution to the turntable
- Use one camera for both live streaming and vision tracking
- Create the turret frame out of aluminum instead of wood
- Create a feedback loop with the actuator to be able to know the exact position of it
- Add manual controls to the mobile application

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