Proposal for Autonomous Automatic Turret

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**Project Idea:**

We plan to use a Motorized Rage Fire foam gun combined with more motors and sensors to make an autonomous turret that will fire at moving heated targets.

* The gun comes with a tripod that has a movable head with 360° range of motion in the x and y directions and around 90° of freedom in the z direction. We will constrain the turret to only move in the x and y directions so it will only fire at the height of the tripod. We will then attach to the head a DC motor with an encoder so we can control the speed, direction, and position that the motor turns to. Using the encoder, we can use a PID algorithm to create a PWM signal to input to a DC motor driver which will translate it and control the motor how we want.
* To sense the targets, we will create a ring of ~20 PIR sensors around the tripod. Each sensor emits a signal every time it detects motion which we will read to determine the location of the target. Each sensor has a FOV of about 100° around it, however, the sensor does not tell us where in its field of view (FOV) the target is in, so by using the overlapping FOVs of the sensors, we can more accurately calculate the location of the target.
* Finally, to actually have the gun fire, we will use a servo motor to press on the firing trigger on the back of the gun.
* All of these components will be connected and controlled through a Raspberry Pi 4. We will also create a mobile app that will communicate with the Pi over WiFi and allow the user to manually control the turret in a “Manual Mode” and allow them to switch between manual and autonomous operation.
* If time permits, we would like to add a camera to the top of the gun that would stream live video to the app and allow the user to see where the turret is aiming in Autonomous or Manual Modes.

**Timeline:**

Our major checkpoints and their expected date of completion are as follows

| 4/1 | Test and assemble individual components |
| --- | --- |
| 4/8 | Couple components Create control flow |
| 4/15 | Finish mobile app  Start camera integration |
| 4/22 | Testing and Refinement |
| 4/23 | Presentation! |

**Expected delivery:**

Our final deliverable product will be a completely autonomous and remotely powered turret which the user can connect to through an app. The only time the user should physically interact with the turret is to reload the gun, change the batteries, or if something on it is faulty.

**Required Hardware Components:**

Below is the list of hardware components, some of which we have ordered but others we have acquired through Duke Labs and the Foundry

* Raspberry Pi 4
* Pi Camera Module V2
* X-Shot Insanity Motorized Rage Fire by ZURU 72
* DC Motor with Encoder and Gearbox
* DC Motor Driver
* Servo Motor
* PIR Sensors
* 12V Battery
* 12V Battery Holder
* AA Batteries
* 12V to 5V Step-Down