Executive Summary
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Autonomous Vehicle with Missile Defense System

Summary -

The idea of this project was to create fully autonomous vehicles that were armed with a turret and a cannon that through the use of a camera were able to identify and fire at two different types of vehicles, RC cars and drones.

This project involved interfacing a Lego Mindstorms robotics kit to a Raspberry Pi via a BrickPi shield. This allowed us to control various sensors and motors from the Lego Mindstorms robotics kit through the Raspberry Pi. We created a custom made PCB to allow for control of the cannon which had multiple motors, limit switches, LEDs and etc. We used a small turret that we were able to modify to be controlled via the Raspberry Pi as well. Through the use of a Raspberry Pi Cam we were able to use OpenCV to identify different shapes, which were assigned to drones and RC cars. Once we identified a drone or RC car we were able to track and target it with our cannon, then when we had a good shot we would fire at them.

Challenges Faced -

There were many challenges faced during this project. The biggest individual challenges were creating and using the custom PCB that allowed for control of the cannon. The other biggest individual challenge was getting OpenCV trained properly to allow for maximum targeting potential with minimal negative results. The main overall challenge would have to be connecting all of the various components together using Multiprocessing in Python. We had to have 4 different processes (firing, OpenCV, cannon, and navigation) all communicate with each other and work in sync with each other.

Suggestions -

A suggestion for next year would be to take all of the work that took us multiple weeks to perfect (mainly the PCB for the cannon and OpenCV and the corresponding cascade files) and reuse them next year. You could possibly still introduce these things to the class to show them how they can do them and learn themselves, but then they can use the prebuilt options to allow for faster time to completion. If they are able to get to completion faster than more ideas can be implemented like mapping, peer to peer, and etc.

Conclusion -

In conclusion this project was probably one of the most memorable and informative projects we have done here at University of Washington Tacoma so far. To be able combine all of the various aspects that

we did into one unified design, while learning new things like PCB design, image recognition, and autonomous navigation, just shows how far we've come as students. Hopefully this project gets repeated by future students and extended into more advanced systems. Hopefully we all benefited from this project as well as the Computer Engineering program as well, so that this carries on and influences more students to come to University of Washington Tacoma