

First Person Shooter

Project Details:

The goal of this effort is to develop a complete targeting control system. In its most basic form, the system will be capable of

- Using a PC to capture an image from a webcam
- Processing the image to identify the position of a particular key in the frame (such as a color or shape)
- Adjusting the camera's pan and tilt so that the key is centered in the image

The NUWC technical directors will be available to provide suggestions and feedback to the URI Capstone team members, but it will be the responsibility of the team members to identify the hardware and software used to complete this task. The bulk of the development effort on this project will be spent on image processing and pattern recognition. We suspect that Matlab would be an appropriate environment for developing these algorithms on training images, though it would likely be too slow for attempting to do anything resembling a real-time system.

This project has two sets of requirements: threshold and goal. The thresholds are the minimum capabilities required to consider the effort a success. The goals are additional desired capabilities beyond the minimum requirements. Below is a list of these two sets.

Threshold

- Capture image from camera showing key on a white background
- Import image into image processing software
- Identify position of key in image and estimate (X,Y) location in pixels of key center
- Command camera pan and tilt changes
- Recapture image, re-compute key (X,Y) , report difference between re-computed (X,Y) and image center (X,Y)
- Command some sort of action, such as flashing an LED to simulate weapon firing
- Quantify sources of system error

Goals

- Track key with moderate background clutter
- Decrease system latency sufficiently to track a key that moves slowly among clutter

There are several additional capabilities that can be implemented if the goal requirements are met with sufficient accuracy. These are very ambitious goals.

Extra Credit Goals

- Mount some sort of launcher (such as a small Nerf gun) to pan/tilt camera and develop electromechanical system to active it
- Attempt to estimate range and correct gun pan/tilt
- Speed up system sufficiently that it is able to track key using position prediction based on current motion

Team requirements:

This project will consist mainly of image processing with some control as well. Embedded system (i.e. microcontroller) programming is recommended for the LED activation to simulate firing. The team will benefit from prior knowledge of pattern recognition and Windows or Linux API programming.

Development Phases:

- Hardware selection
- Image processing and recognition research to develop most appropriate key
- Webcam image integration
- Webcam pan/tilt control integration
- Image processing and recognition development and testing
- Firing system development and integration
- Total system integration and testing

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