Target Tracking with U.A.V.s

Erik Cowley

The public's familiarity with U.A.V.s (Unmanned Air Vehicles) is largely limited to military drones and the infamous drone strikes. However, civilian U.A.V. platforms are rapidly gaining prominence; the last few years have seen a flood of research exploring benevolent applications for drones.

For example, perhaps a couple is out rock climbing, and want to film the experience. However, neither of them can film since one of them is climbing and the other is belaying, and they do not want to bring along a "third wheel" as a camera person. It would be useful if they had a smart U.A.V. that could film them with little or no intervention.

This project aims to develop a controller program for camera-equipped Quadcopters, that allows it to track, follow, and maintain focus on a set target. The controller program will be hosted on a mobile device, as to provide a convenient interface for the user.

Video and other sensor data is streamed from the Quadcopter to the controller. The controller takes the video, finds the target and estimates the location of the quadcopter relative to the target. It then uses a motion model to adjust the trajectory of the quadcopter accordingly.

The quadcopter model that will likely be employed in this project is a Parrot AR.Drone, which is controlled via wifi (iOS and Android devices are officially supported with controller apps). It comes equipped with a camera and streams live video to its controller. It also has one USB port, which could be used for connecting extra sensors or other modules if needed. Parrot offers an SDK for development of custom controller apps on Android, though the community has produced SDKs for other platforms.

It is important that the app has the option of toggling manual control of the quadcopter for safety purposes. Manual remote control of the Quadcopter is not a focus of this project, so this section will be borrowed from an existing control app.

The product will be significantly less practical if it offers no obstacle avoidance, as it will not be capable of operating in tight or crowded spaces. Implementing obstacle avoidance using only video would be very difficult; the quadcopter must face the target at all times and is essentially blind in other directions. Thus, obstacle avoidance would almost certainly require the mounting of peripheral rangefinder sensors. To interface the sensors with the AR Drone's main board, a breadboard and arduino would probably be required. Also, the sensor data would somehow need to be routed to the controller. We see that dealing with obstacle avoidance turns out to be a fairly demanding task; this issue will be addressed as time allows.

During the final presentation simple demonstration of the final product will be given. Some videos taken using the project may be shown. There will be discussion of the technology behind the project.

Timeline

10/29   The AR Drone and other necessary hardware is acquired.

11/5   Review existing libraries

12/7   Literature review
        Android SDK for AR Drone review

12/17   Basic implementation of target tracking

1/21   Refined implementation of target tracking
        motion model implementation

2/4   Testing and revision
        Obstacle avoidance review of options

2/18   Thesis first draft

2/25   Obstacle avoidance implementation

3/29   Thesis final draft