Stable Quadricopter Flight and Telepresence using the Android Platform

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1 Motivation

1.1 Objectives

When we started this project, we had many different use cases for the helicopter – automatic target tracking, panaroma creation from the video stream, even getting it to bring forgotten homework assignments from our apartment to class. However, for the first iteration of both the hardware and the software, we set our sights on more immediately-acheivable goals: telepresence and stable flight control. For telepresence, we wanted to be able to visualize the Android device's location, orientation, acceleration and velocity in real-time, as well as receive a video stream that compensated for network latency and low bandwidth. For stable flight control, we wanted a system that could maintain a hovering state within a narrow radius of a given point (our target radius was ten feet) and could respond to commands sent from a host computer.

1.2 Progress

To date, we've accomplished two major things. We have telepresence between an Android device and a desktop or laptop computer, using our Android application and our Java program, and we have an entire stack of software ready to control and stabilize a helicopter. Unfortunately, due to unexpected hardware failure (which will be discussed in section 2.4), we were unable to get the hardware to a functional state before the end of the semester. However, the helicopter is fully constructed and, when we receive the missing part, we will have a helicopter that is ready to fly.

1.3 Future Goals

The first goal is to acheive stable hovering. This will require a fair amount of debugging, considering how much of our stability and navigation software remains untested in the field, as well as manual tuning of PID values (as will be discussed in section 3), which will no doubt be a lengthy process.

We have also discussed various uses of the helicopter platform we have created. Currently, we would like to implement blob tracking to allow the helicopter to track objects as they move. This would allow the helicopter to track us as we walk around a field, or take a video of of a skiier, or even to act as a robotic sherpa to follow us while carrying light objects. We would also like to implement dynamic panorama creation, in which the helicopter performs a series of predefined acrobatics to take photos which cover a solid angle of 180 degrees. From this, we can create a panorama from the helicopter's current location; such birds-eye panoramas would be unusual, if not unique, and would be both creatively and technically interesting to generate.

2 Hardware

2.1 Design of the Chassis

The chassis was designed to be as modular as possible.

2.2 Hardware Selection

2.3 Hardware Usage

2.4 Hardware Failure

3 Pilot Android Application

4 Server Software

5 Communication