Optimizing Contour-Control Trajectories for Quadrotor Video Shots

Project description

In recent years, research proposed several solutions for quadrotor camera tools to specify aerial video shots executed by a quadrotor with a gimbal and a camera. These optimization schemes expect keyframes specified in time and space and based on them generate quadrotor and camera states. With this approach, users are required to mentally map distances in time and space so that the generated trajectories have smooth dynamics over all keyframes. For a more user-friendly approach, the goal of this thesis is to reformulate the trajectory generation problem to directly generate globally smooth trajectories. This could be implemented by generating a time-free trajectory first and then formulate the robot control generation as an infinite horizon contouring control problem (for a similar method see [LINK]). In this thesis, students should review the literature on trajectory generation, contour control and quadrotor camera tools. After that, a generation method, which optimizes position and timing of quadrotor trajectories should be implemented. The method should run at interactive rates (preferably on the full quadrotor model) in order to be used in an existing quadrotor camera tool.

Figure 1: A DJI Phantom, Horus and our own quadrotor camera tool and some aerial footage

Keywords
Trajectory generation, contour control, optimization

Context
The goal of this project is to implement a contour control optimization scheme for quadrotor camera trajectories on the full quadrotor model (preferably at interactive rates).

Work packages
- Literature survey on state-of-the-art quadrotor camera tools, contour control and trajectory generation algorithms
- Implement a contour control optimization scheme for quadrotors
- Test and evaluate the system
- (Integrate it into an existing quadrotor camera tool)
- Analyze results and write up the thesis

Required skills
- Solid knowledge in control and optimization
- Highly motivated and independent

Type SA/MA
Time period Autumn 2016
Internal supervisors Christoph Gebhardt cgebhard@inf.ethz.ch, Tobias Nägeli tobias.naegeli@inf.ethz.ch, Otmar Hilliges otmar.hilliges@inf.ethz.ch