Universität Stuttgart
Institut für Flugmechanik und Flugregelung

Localisation of an UAV for Docking Purposes using AprilTags

Master Thesis

Background:
Autonomous drones show a huge potential in a variety of future applications (e.g. inspection tasks, precision agriculture, monitoring of wildlife and disaster sites). Unfortunately, their operating range is limited by factors such as battery capacity, disk space for data recording, etc. This problem can be addressed by autonomous docking procedures that enable the drone to connect to another, general aerial platform to replenish the batteries and offload data.

Problem Definition:
Accurate relative localisation methods are vital to successful aerial docking. The drone is dependent on an exact estimate of its own position relative to the docking port. There exists a variety of different localisation methods. For robot applications, the AprilTag has turned out to deliver good results. To improve the robustness and accuracy under the influence of external disturbances such as reflections and shadows, there exist approaches that combine multiple AprilTags. These are mounted at known locations and different angles around the docking port. The position estimates can then be fused using a method similar to a Kalman filter. An interesting question is if there exist optimal positions and angles of the AprilTags.

Task:
- The overall goal is the creation of a ROS package that implements the aforementioned approach.
- Realisation of a Gazebo simulation to test the approach and results.
- Development of a method similar to a Kalman filter to fuse the position estimates resulting from the different AprilTags.
- Development of an optimisation approach to determine the optimal position and orientation of AprilTags.

Requirements:
- Interest in localisation techniques
- Experience with ROS / Gazebo desired
- Good programming skills in Python / C++
- Good academic performance

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