Sprint Report #6

Summary
Team Expeditus was unfortunately unable to complete the tasks for sprint 5, but the team was able to make measurable progress towards the goals. After deciding not to pursue simulation, the team members began to focus on message passing and offboard control between the flight controller and the Odroid. After multiple issues with multiple approaches to the AR tag tracking, the team was able to successfully get the AR Track Alvar library up and running.

Team Work

- **Jonathan Dixon:** Worked on documentation.
- **Dylan Geyer:** Worked on documentation.
- **Christopher Smith:** Worked on UAV localization.
- **Steven Huerta:** Worked on UAV localization.

Uncompleted Tasks

As an owner, I want the UAV to autonomously land on the landing pad without damaging the craft

- **Modify/Rewrite implementation as necessary**
  To achieve this task, the team required the UAV to localize itself as soon as it entered offboard control by the ODroid. The purpose of this was to overcome the very poor flight controller data that the team was encountering when conducting initial tests of offboard control. Localization using the GPS and IMU data alone can result in poor estimations of distance travelled, particularly when obstacles to GPS are nearby. While our team was not intending to ensure stability of our landing in GPS denied or poor environments, we felt that this was necessary after poor localization estimates while testing outdoors in relatively unobstructed areas.

  The method for localization follows documentation found at **Visual Position Estimation**. This involves the installation of some ROS packages to estimate the position by fusing IMU data with visual odometry. Below is a brief description of the two largest components of this approach.

  - **Visual Odometry**
    The Visual Odometry package is an implementation of the fast semi-direct monocular visual odometery algorithm. This method is particularly advantageous as it overcomes the problem of high computation needs associated with SIFT/SURF based feature detection/matching. Features are extracted from the initial image and compared with features extracted in the next sequential image. Features that are matched between images can be compared for relative motion. Monocular motion is relative
  - **Sensor Fusion**

As an owner, I want the UAV to autonomously land on the landing pad with the correct orientation.

- **Modify/Rewrite implementation as necessary**
  As mentioned in the previous section, our team has not completed the tasks relating to the landing, which are dependent on:

  - Estimate of Pose
  - Providing the commands to the flight controller to move the UAV to the landing pad.

  AR_TRACK_ALVAR will provide estimation of the orientation of the AR tag relative to the camera. This will be used to correct the orientation of the craft. As message passing from and to the flight controller is solved through the use of MavROS, the team will now concentrate its efforts to correct issues offboard movement control. This, as mentioned previously, is the result of insufficient information for the flight controller to estimate its position.

@inproceedingsForster2014ICRA, author = Forster, Christian and Pizzoli, Matia and Scaramuzza, Davide, title = SVO: Fast Semi-Direct Monocular Visual Odometry, booktitle = IEEE International Conference on Robotics and Automation (ICRA), year = 2014