VTOL UAS Status Report 1 Summary

Nicholas Darden, Vivian Fakharizadeh, Zavia Harris, Richard Jones, Trent Jones, Joshua Lee, Ryan McLaughlin, Rushal Patel, Brendan Regan, Quinton Vehon

Visual Odometry Subgroup: Trent Jones**,** Zavia Harris, Quinton Vehon

New Raspberry Pi 3B+ boards were purchased for the lab so that each of the members, including the newest member, could work on setting up Raspbian, the Pi camera, and the OpenCV/Aruco libraries onto the Pi. This increased problem solving, as well as knowledge on understanding the hardware and its respective software. Since WiFi in the lab was inconsistent, PuTTy and VNC viewer were installed onto the team member's laptops to operate the Raspberry Pi through Bluetooth without the need of an external display, keyboard, and mouse. After integrating the needed MSVC++ code onto the Pi, the members worked together to calibrate the Pi camera to recognize ArUco markers from the installed libraries. This calibration required printing large pre-determined markers from the library onto printer paper, holding the markers near the Pi camera lens and receiving correct recognition feedback from the Pi. Future work includes research on translating C++ script onto the Raspberry Pi which currently reads Python.

Dead-reckoning (IMU) Subgroup: Richard Jones, Ryan McLaughlin, Brendan Regan

After setbacks from the inertial measurement unit not being able to read any movement data on MatLab due to non-matching external mode applications, the D.R. subgroup and Dr.Mekky diagnosed the device and fixed the error. Research then continued on an Extended Kalman filter to fix bias from the IMU caused by the drift effect (where the IMU senses small noise acceleration despite being held in place). To do this the subgroup is working to sum all bias on a single axis and divide by the total time of movement, implementing a subtraction of average bias early in the IMU position code. The EKF code uses a two-step process of predict and update to continually correct the IMU drift. This optimizes the UAS's position, which is crucial to a flight within flight path parameters.

Sensor Integration Subgroup: Nicholas Darden, Vivian Fakharizadeh, Joshua Lee, Rushal Patel

After much discussion between the Sensor Integration subgroup and Dr.Mekky, it was decided that since the geofence failsafe for the GPS can be disabled before flight, the Raspberry Pi could take over GPS feed requirements. This idea could be implemented through coding the Pi to use the initial GPS lock signal as the origin point for the UAS flight, followed by a hard shutoff of the GPS. The Pi would then send spoof signals to the Pixhawk flight controller, using the IMU feedback as its signal on changes in flight. Currently the subgroup is working to connect the GPS directly to the Pi that has been programmed with Raspbian and a framework of the commands and signals has been drawn up. Future work will include coding the Pi to interpret IMU feedback information as GPS signals to the Pixhawk. The subgroup has also been working with a graduate student on the Fixed-Wing Platform UAS to setup Mission Planner parameters and fully configure its Taranis Display Telemetry controller.

Although the entire VTOL UAS team will not be integrating required sensors to the Fixed-Wing Platform, as it is out of our project scope, our work thus far is on track to finishing the sensor integration and test flight of the Quad-rotor UAS.