Immediate Goals for the Hardware Sub-team of the Texas Drone Estimation Lab

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Introduction

The Texas Drone Estimation Lab (DEL) is currently divided into three sub-teams to efficiently allocate work towards accomplishing the overarching goals of the NASA USRC grant from which our funding is derived. The hardware sub-team has focused on developing a drone capable of manual flight with tasks including airframe manufacturing, electronics selection, design, and implementation, and manual flight test procedure creation. For the Fall 2023 semester the hardware sub-team should accomplish a number of goals that extend the capabilities of DEL and promote overall team success. To this end, the following document briefly details the most important objectives for the team to accomplish in the Fall of 2023.

Objective #1: Redesign/reimplement avionics on wooden bird test stand

To accomplish a number of tasks relevant to DEL, the avionics of the drone should include sensors and the flight computer within the powering and data handling system. The hardware team should provide an effective pipeline of components that allows software oriented DEL teams to test estimation and motion planning software. Implementing the new avionics design on a test stand allows for issues to be resolved more easily and more safely.

Objective #2: Implement new avionics design on drone #2

The current drone is capable of manual flight and should be kept operational to provide important flight data to the simulation and estimation team. However, a new drone with a new avionics design should be manufactured to provide for future goals

such as autonomy, swarm autonomy, on-board ellipsoid generation, and object detection.

Objective #3: Conduct GPS-based autonomous flight with drone #2

The overarching goal of the hardware sub-team will be to develop a pipeline of tools that allow for the overarching goals of DEL to be realized. To this end, although our final goal is to use GPS-denied navigation techniuqes, conducting a GPS-based autonomous flight will provide a stepping stone to further developments.

Objective #4: Update drone #1 with new avionics design

Drone #1 is currently capable of manual flight and therefore capable of providing flight data to software focused team members that require said data. To still be capable of providing flight data, drone #1 will not be updated to the new avionics design until drone #2 is flight tested to ensure the team has at least one flight capable drone at all times.

Objective #4: Conduct swarm flight

A relevant section of the DEL work should be focused on the production and visualization of interacting error ellipsoids from multiple drones. Hardware can provide for this goal by developing a set of drones capable of performing autonomous flight as a pair or in multiple numbers.

Objective #5: Learn about object detection and sensor data acquisition

A final goal for the Fall of 2023 should be to learn about object detection and specifically the data acquisition and handling involved given our flight computer and flight controller of choice. Although hardware will not develop data handling procedures or motion planning algorithms based on sensor data, the hardware sub-team can

provide data by developing functioning electronics and understanding software and hardware interactions.

Conclusion

In short, the hardware sub-team should develop a drone architecture that positions the overall DEL team to accomplish it's goals. Specific objectives for the Fall of 2023 include a redesign and reimplementation of the avionics, autonomous GPS-based flight, swarm drone flight, and research into the hardware/software interactions for object detection.