RED Delivery System

(Recovery and Deployment System)

Team Members:

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Client: Markus Wilde - mwilde@fit.edu

Client Meetings: Weekly meetings with faculty advisor (Dr. Wilde) and the Aerospace Senior Design Professor (Dr. Demoret) to discuss purpose, requirements, funding, and functionality of the RED System. These meetings are set to take place on Fridays at 4:30pm.

Goal and Motivation: RED (Recovery and delivery) system is a project that is designed to help others in need by delivering medical supplies utilizing unmanned aerial systems. It is a two-stage delivery system which consists of a fixed wing mothership (parent) and a multirotor (child). The main objective of this project is to develop a system which accurately delivers goods from one place to another in a very short period of time. The project was originally envisioned to deliver medical kits to people trapped in emergency situations; thus, to achieve this objective, we plan on having an autonomous flight of both the UAVs and building an autonomous package deployment system to make precise deliveries. The scope of the project has not changed from the previous semester.

Approach: The key features of the RED Delivery System that allow autonomous delivery of a payload are: constant exchange of GPS data, control systems for deployment of the drone, and the implementation of flight commands (from Raspberry Pi to Pixhawk Radio). The constant data exchange will consist of using the Pixhawk radio's GPS module, to provide both Raspberry Pi's with the other's location. These GPS locations will also determine which stage of the mission the system is in. The hardware for the control systems will consist of sensors that

determine successful deployment/docking and notify the software subsystem that the docking stage of the mission is complete. There is also a camera for image tracking attached to the Raspberry Pi (on the drone) that is responsible for locating a pattern on the mothership's docking mechanism. The flight command implementation will send the appropriate flight commands based on the current mission stage and GPS coordinates, so the system can act autonomously.

Novel Features/Functionality: The RED Delivery System is a completely autonomous system that completes a mission based on a precise GPS coordinate input (the target location for payload delivery) from the end user along with hardware sensors and image tracking to determine the processes of the autonomous software subsystem.

Technical Challenges: The RED Delivery System is composed of a multitude of hardware, networking, and software systems, which makes isolating any errors difficult. Due to the limited processing power of the Raspberry Pi it is expected to be challenging to maintain efficiency when the PreciseDocking state calls for image processing. Since there are so many components, there is a power budget that must be carefully maintained at all times so that all subsystems have sufficient power in the air. Other technical challenges include timely communication between the Raspberry Pi's and having continuous assurance that all subsystems are functional during the whole mission.

Milestone 4 (February 17) :

- Image Tracking: After testing several possible patterns to train the software, provide a demonstration of the selected pattern and the accuracy of detection.

Milestone 5 (March 23) :

- Image Tracking: Integrate image tracking into the system to execute during the PreciseDocking state of the mission.
- Autonomous Docking: Provide a demonstration to display the drone's ability to use the integrated system to find the pattern and correct its flight path to reach the docking position. The demonstration will also show that once the docking position is reached, the drone will rise into the docking mechanism, which will guide it into the latch for a successful docking.

Milestone 6 (April 20) :

- Autonomous Mission Completion: At this stage, the system shall have all individual functional subsystems, that are then integrated to form a complete system that is capable of completing an entire autonomous delivery mission.

Milestone 4 – Task Matrix			
Task	Andrea	Miguel	Marley
Image Tracking (Research)	Research existing approaches and source code	Find the best hardware to complete the task (resolution/compatibility)	Research existing approaches and source code
Image Tracking (Implementation)	Build on selected approach to implement custom pattern recognition on Raspberry Pi	Provide patterns for training and determine the most effective solution for the RED System	Build on selected approach to implement custom pattern recognition on Raspberry Pi

Approval from Faculty Sponsor

"I have discussed with the team and approve this project plan. I will evaluate the progress and assign a grade for each of the three milestones."

Signature: _____ Date: _____