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UAS Obstacle Database for University Traffic Management System

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Project Title

UAS Obstacle Database for University Traffic Management System

Faculty Information

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I. Project Description

This RCEU project will build the foundation for a unmanned aircraft systems (UAS) traffic management system by developing a comprehensive obstacle database for the UAH campus. UAS traffic management (UTM) uses obstacle databases to create corridors of flight for UAS, or drones, in urban environments. UTM is a key component to the future of autonomy in complex operations and environments, such as city centers, medical districts, airports, and disaster response. The UAS Research Programs at UAH have been supporting NASA and FAA research programs for advanced air mobility (AAM) and are seeking a student to support the development of a campus wide obstacle database for testing autonomous operations and technologies.

II. Student Duties, Contributions, and Outcomes

a. Specific Student Duties

- Perform literature review on current concepts of UAS autonomy and UTM
- Collect the height and location of obstacles on campus that pose a risk to low-altitude UAS operations
- Support aerial mapping missions and geographic information systems (GIS) analysis with UAS, including structure from motion (SfM) 3D modeling
- Develop a geospatial database consisting of the type, location, shape, and height above ground of all obstacles on campus
- Integrate obstacle database into Pixhawk flight controller and geofencing features on a UAS
- Support flight testing and obstacle avoidance with obstacle database

b. Tangible Contributions by the Student to the Project   (10% of Review)

The RCEU student will conduct field work on campus with the mentor to collect geospatial information of every potential obstacle on campus including vegetation, buildings, signs, and other restricted flight areas. Multiple products are expected to result from this project including a geospatial database used in UAS flight controllers to test obstacle avoidance of autonomous flight as well as a detailed report outlining the current state of autonomy, rules and regulations required for more complex future autonomy. The student will also serve as a key member of the aircrew during aerial mapping missions on campus.

c. Specific Outcomes Provided by the Project to the Student   (30% of Review)

The RCEU student will learn through local subject matter experts at UAH and the local community as well as through literature review the current state and future of UAS operations. The student will also receive direct training in UAS operations in controlled airspace as well as visual observer (VO) training common in UAS operations. The student will also receive instruction for FAA Part 107 exam preparation and be fully prepared to receive an FAA Remote Pilot Certificate which can be used by the student beyond the RCEU project.

III. Student Selection Criteria

This creative research opportunity is seeking a student to with computer programming, data structure skills, and an interest in UAS technologies. This project is open to all interested students at any academic rank but students with experience in remote control vehicles (air, ground, or sea) and 1-3 years of programming coursework are encouraged to apply. Students of any college and program of study are encouraged to apply.

IV. Project Mentorship *(30% of Review)*

The AUSOME RCEU Project will have access to the University of Alabama in Huntsville's (UAH) Unmanned Aircraft Systems Integration Lab located at the Rotorcraft Systems Engineering and Simulation Center (RSESC). Mr. Casey Calamaio, a Research Engineer at RSESC with a background in geospatial applications and unmanned systems is the primary mentor for this project. Calamaio will mentor the student in training material development, practical UAS flight training, and use of the AUSOME educational resources. An additional resource for the AUSOME RCEU student is the UAS Research Programs team which consists of experts in the UAS field with backgrounds in engineering, payload development, remote sensing, modeling and simulations, and aeronautical operations. In the unlikely absence of Calamaio during the period of performance of the RCEU20, Mr. Jerry Hendrix, Director of the UAS Research Programs will be the primary mentor for the student. Additionally, UAH is a core member of the FAA ASSURE Center of Excellence for UAS and a leading university on the national team. The student shall join the mentor at least once a month to report directly to FAA leadership during monthly Technical Interchange Meetings. This will introduce the student to research management and the ability to communicate research progress at multiple levels. For development of a drone obstacle course, the student and mentor will work with the UAH student chapter of the Association of Unmanned Vehicle Systems International (AUVSI). In addition to resources at UAH and the USSRC, the student will also be exposed to the local drone community involved in this program including the Pathfinder chapter of AUVSI once a month at the Board of Directors meeting held monthly at the USSRC Executive Conference Room.