Enhancing c-UAS Capabilities using a 3D LiDAR

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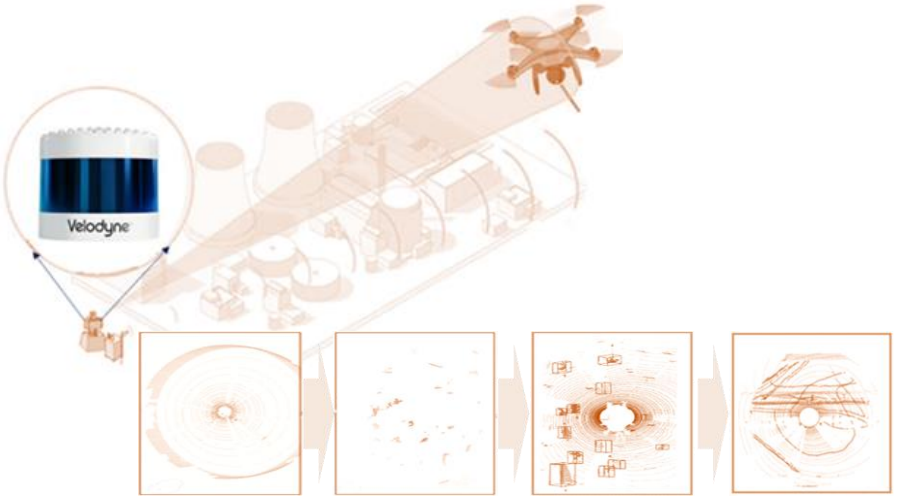
Consortium for Robotics and Unmanned Systems Education and Research



Envisioned LiDAR-based detection and tracking system to counter intruder sUAS

Problem Statement

- This research proposal deals with the development of the concept and algorithms, prototyping and assessment of feasibility and performance of a lightweight mobile three-dimensional (3D) 360^{o} LiDAR system for detecting and tracking of intruder sUAS.
- Phase 1 includes the overall architecting of the proposed system in the Model-Based Systems Engineering development environment.
- Phase 2 deals with the development of filtering, detection, tracking, and identification algorithms (the latter involves a deep-learning technology).
- Phase 3 involves integrating a Velodyne LiDAR Alpha Puck sensor with a high-performance Alienware laptop featuring the Intel 10-core i9 processor, 64GB DDR4 memory, and NVIDIA GeForce RTX 2080 GPU for fast data processing.
- Phase 4 will utilize a variety of different scenario-based experiments with multirotor and fixed-wing sUAS executing different scaled missions / maneuvers.

Impact

- The scientific and technological impact of this research is in the development of the LiDAR-based c-UAS system concept, its prototyping, development of the 3D point cloud processing algorithms, quantitative feasibility evaluations.
- It is envisioned that a live experiment will be conducted to simulate a full c-UAS effects chain to protect the Military Operations on Urbanized Terrain test site at Fort Ord or Combined Armed Collective Training Facility at Camp Roberts from a fleet of specifically developed and manufactured multirotor and fixed-wing intruder and kamikaze sUAS. A variety of different scenarios / sUAS operating modes will be used to fully assess system's performance.
- Hence, this research will also have a practical (organizational and legal) value to DoD (including operations at CR, NPS and NPS-FL MAF) and FAA.

Transition

- An interest to the counter-drone technology that is used to detect and intercept intruder drones is growing worldwide caused by the potential security threats drones may pose to both military and civilian entities. The U.S Department of Defense (DoD) budget allocated over $1B of the FY'19 to develop and field these technologies (from FY'18 to FY'19 the c-UxS technologies budget almost doubled).
- Both NPS and SATCOM got their c-UAS systems but the CONOPS and detection technology is neither mature or fully tested.
- Potential follow-on funding through NRP, U.S. Army and U.S. Air Force. N9 - Warfare Systems has expressed an interest to support this research topic in FY22 already. There is an interest COMSUBPAC too (the talks have started already). The U.S. Army TENCAP is looking to collaborate on testing alternative technologies at Camp Roberts and Yuma Proving Ground.

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