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Announces the Ph.D. Dissertation Defense of

Kimoy Williams

for the degree of Doctor of Philosophy (Ph.D.)

Unmanned Aerial Systems Path Planning with Dynamic Rerouting Using a Space-Time Graph

Monday 9th February 2026, 10:00am
Virtual Presentation: Zoom link
https://fau-edu.zoom.us/j/87893471801?pwd=mooVjsLc87BwNmRIMVm2L6OapIypuC.1
Meeting ID: 878 9347 1801
Passcode: feHa23

DEPARTMENT: Electrical Engineering & Computer Science

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ABSTRACT OF DISSERTATION: Urban airspace management for UAS presents significant computational challenges due to dense traffic, dynamic constraints, and the need for conflict-free trajectory coordination. The increasing reliance on autonomous aerial vehicles with a forecasted high growth rate, requires continuous improvements in path planning strategies to ensure efficiency, safety, and adaptability in complex environments. Specifically, the development of a new UAS algorithm must effectively address key challenges such as computational efficiency and adaptability to dynamic environments. Therefore, developing a dynamic rerouting mechanism to complement effective path planning is a critical research priority necessitated by the demand for real-time adaptation. This fundamental challenge motivates our proposed approach, which draws inspiration from established optimization models used in commercial package delivery and supply chain management.

This dissertation introduces an adaptive replanning algorithm that leverages a space-time graph representation to ensure safe, efficient, and scalable UAS operations with a variety of request rates. In this body of research, we formally define the UAS Path Planning with Dynamic Rerouting problem and propose a novel algorithm for path computation that utilizes a space-time graph to compute collision-free trajectories. We also introduce a dynamic rerouting mechanism that activates when an enroute UAS deviates beyond a predefined threshold. The computational complexity of our path computation algorithm for n aircrafts is $O(nTlogT)$, where T is the maximum path duration, demonstrating the algorithm's scalability with the number of UAS. The proposed framework integrates a multi-parameter simulation environment encompassing data from complex urban topologies. Performance evaluations were conducted through simulation experiments using a real-world urban maps of the Miami and Fort Lauderdale downtown regions, showcasing the scalability and efficiency of our approach with thousands of UAVs.

BIOGRAPHICAL SKETCH: Kimoy Williams was born in Trinidad and Tobago. She earned her BSc. In Mathematics in 2012 and her MSc Mathematics in 2014. She began her career in aviation Revenue Management in 2015. She subsequently held a variety of roles ranging from Pricing Analyst to Director of Systems and Development. Her current position is Senior Director of E-Commerce and Omnichannel Analytics. Kimoy plans to continue her career in the aviation industry.

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CONCERNING PERIOD OF PREPARATION & QUALIFYING EXAMINATION
Time in Preparation: 3 years

Qualification Examination Passed: 2023

Published Papers: M.Cardei, K.Williams, I.Cardei, "UAS Path Planning with Dynamic Rerouting using a Space-Time Graph," *ACM Transactions on Spatial Algorithms and Systems (TSAS)*, (Accepted).