2021 NSF CYBER-PHYSICAL SYSTEMS PRINCIPAL INVESTIGATORS' MEETING

CRII: Towards Optimal Information Gathering in Unknown Stochastic Environments

Award # 1929571 / Award Date: May 2016 / Zak Kassas, University of California, Irvine)

Challenge:

- Prescribe a trajectory for an unmanned aerial vehicle (UAV) to navigate from a starting location to a target location in a partially known stochastic environment, while guaranteeing that the UAV's position uncertainty is below a desired threshold.

Solution:

- Developed an efficient approach to generate "multipath volumes" around structures, which introduce biases in GPS and cellular signals
- Developed a path planning algorithm guaranteeing that the signals along the prescribed path carry sufficient information to localize the UAV with desired accuracy

Project info:
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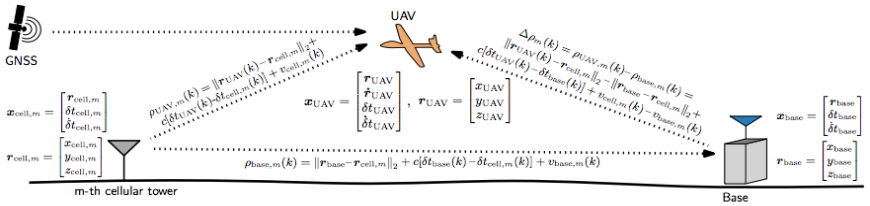
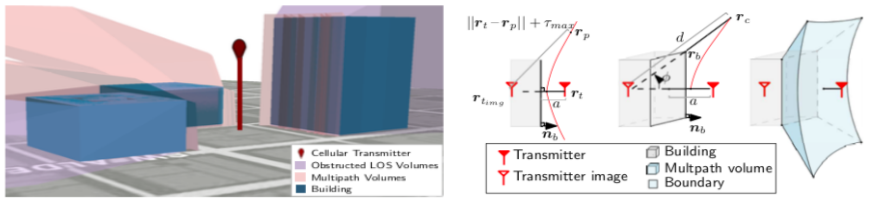
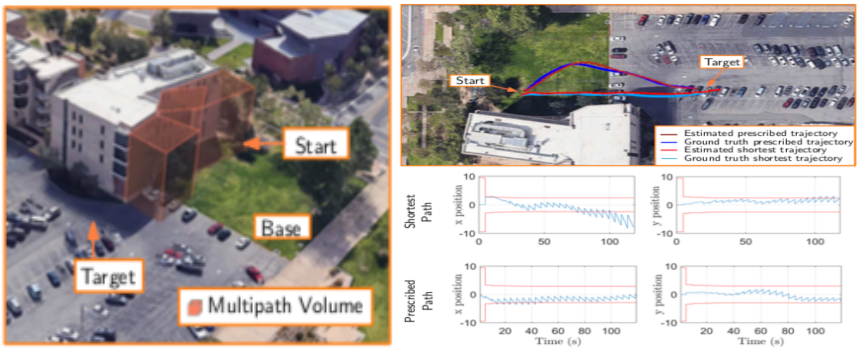


Proposed Framework



Multipath Volumes



Results

Scientific Impact:

- A computationally efficient approach for over-bounding the constructive and destructive signal interference in poorly known stochastic environments, based on binary classification
- A path planning algorithm, which guarantees that information content in measurements along the path will not violate desired uncertainty
- Selection strategy for information sources to use

Broader Impact:

- Navigated UAV safely to desired location, while reducing position root-mean square error by 31% and maximum error by 59%, over current state-of-the-art
- Hosted 50 middle-school students for a day-long Game of Drones competition