

EAGER: Aerial Communication Infrastructure for Smart Emergency Response



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Introduction

Motivation

When disaster strikes down the commercial cellular tower, there is critical need of communication infrastructure for information dissemination and coordination among various emergency response.

Goal

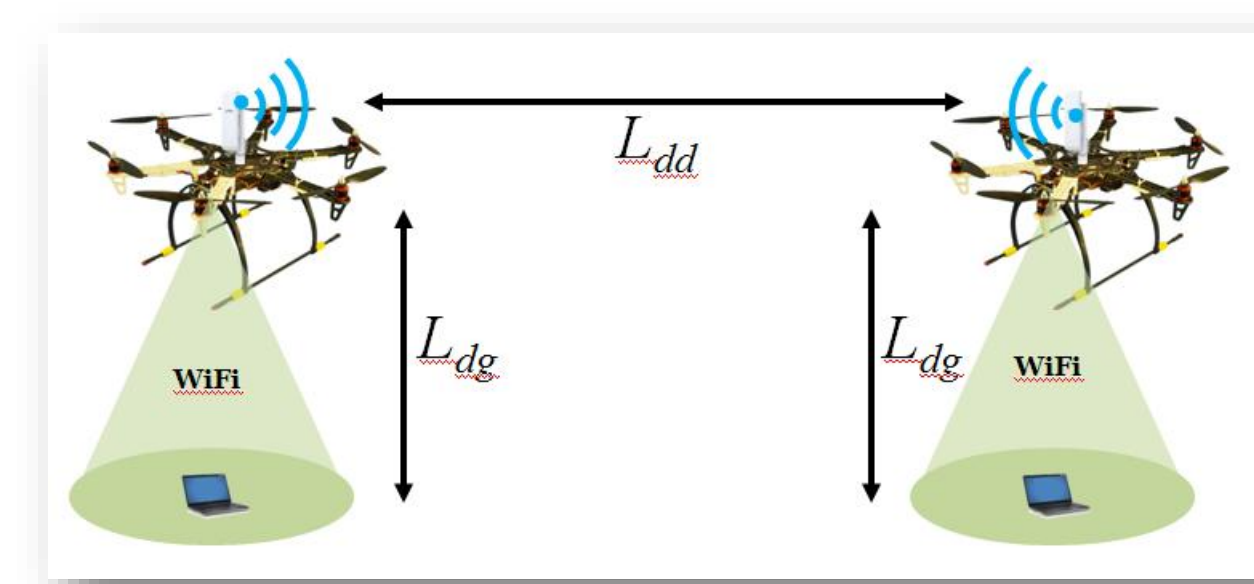
To exploit an early concept of a flexible, low-cost, and drone-carried broadband long-distance communication, infrastructure and investigate its capability for immediate smart-city application in emergency response.

Research Tasks

- Development of cyber-physical systems (CPS) technology that enables robust long-range drone-to-drone communication infrastructure.
- Practical drone system design and performance evaluation for Wi-Fi provision.
- A systematic investigation of its capability to address smart-city emergency response needs, through both analysis and participation in fire-fighting exercises as case studies



People cluster around a cell tower next to a highway in Dorado Puerto Rico after Hurricane Maria destroyed the island's electricity and telecommunications infrastructure. (Photo by Hector Retamal / AFP / Getty Images)



Research Illustration

An illustration of the proposed work



- On-demand robust drone carried long-distance communication channel
- Integrated directional communication and decentralized control design
- Cost-effective, broadband, and flexible configuration

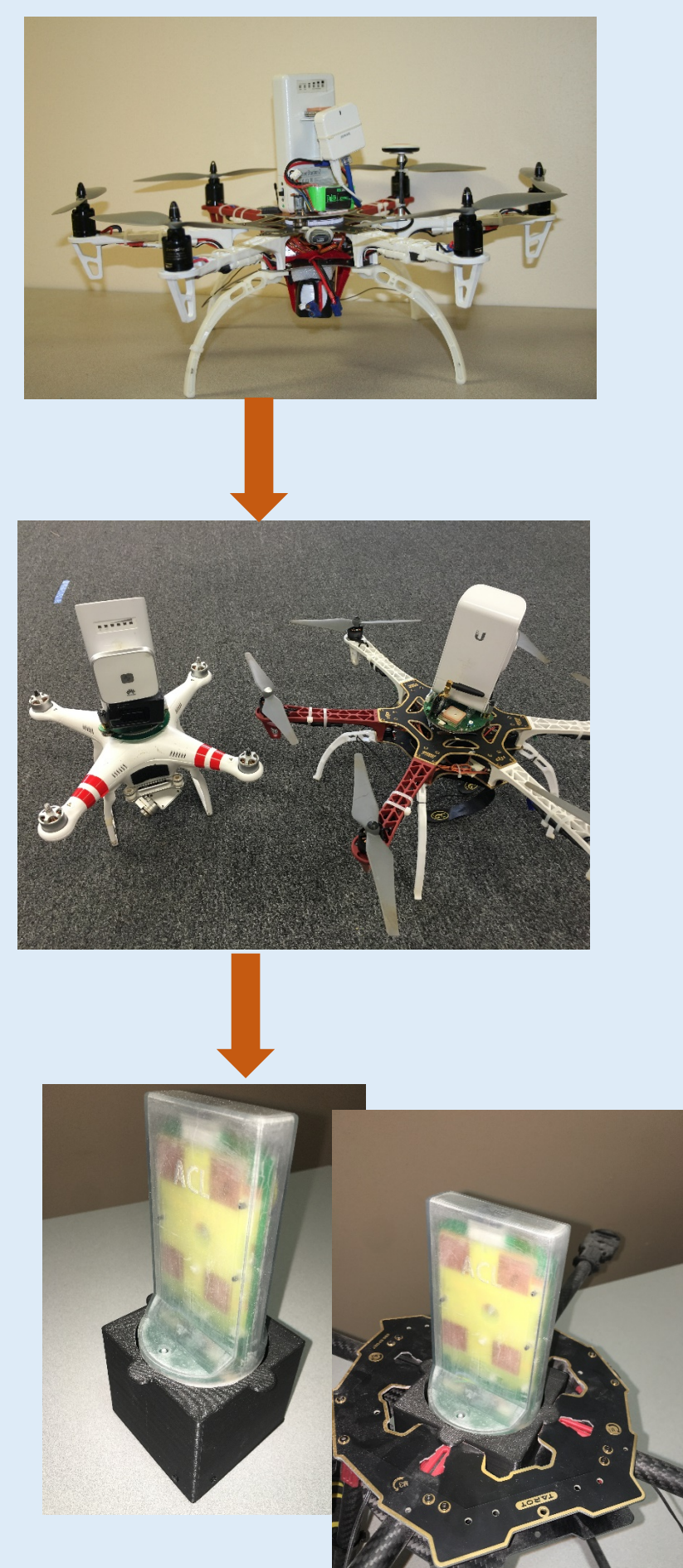
- Drone platform design
- Directional antenna design
- Communication performance

Throughput for the 1km link

- Emergency preparedness department (NCTCOG)
- Austin Fire Department
- Denton Fire Department
- Tarrant County Fire Service Training Center

Research Progress: Intellectual Merits

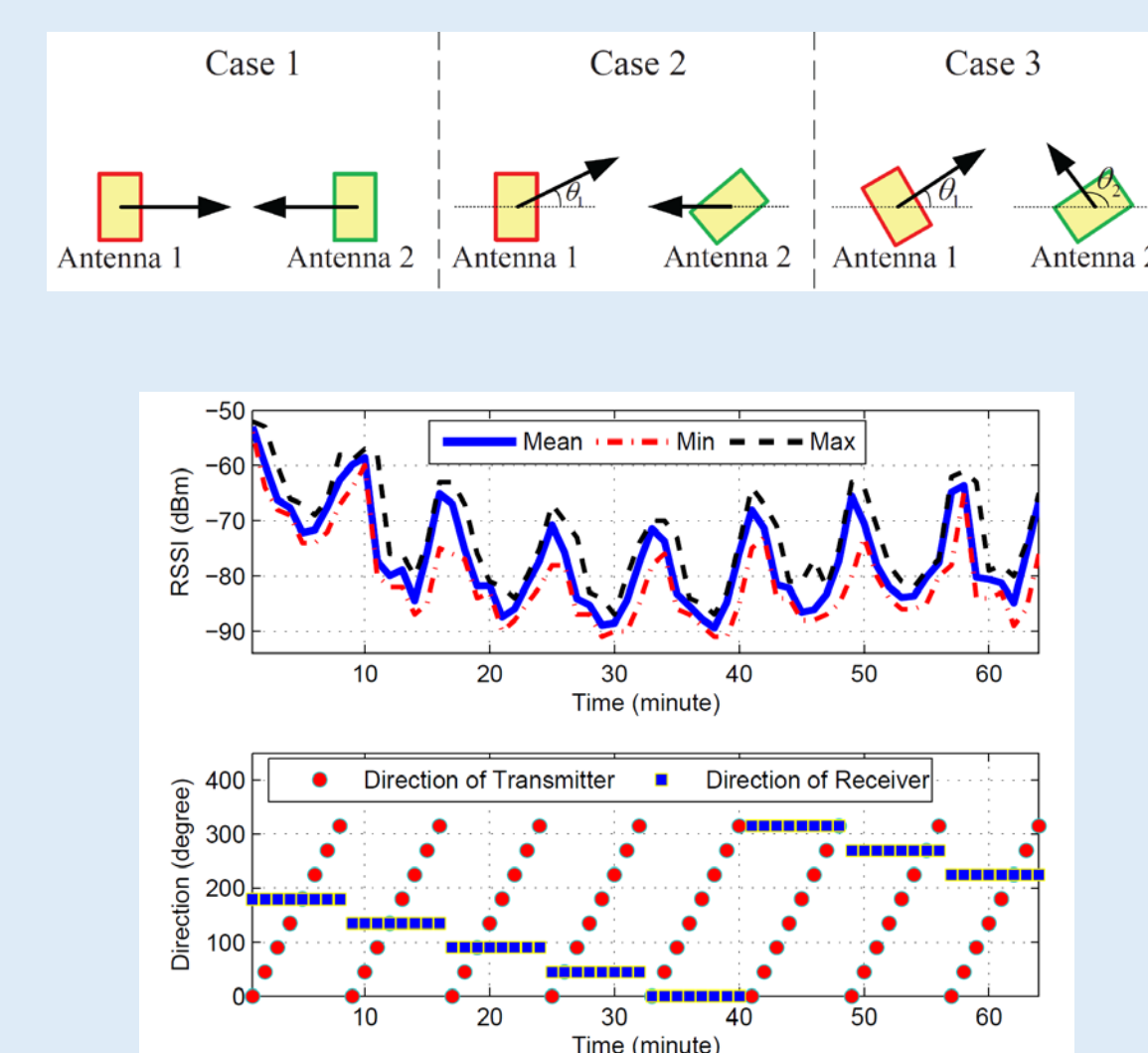
Drone-carried Wi-Fi System



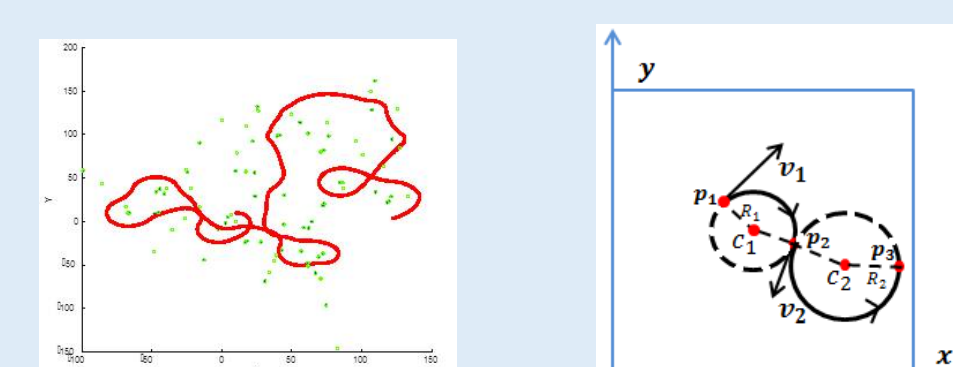
Standalone but integratable system design

Decentralized control

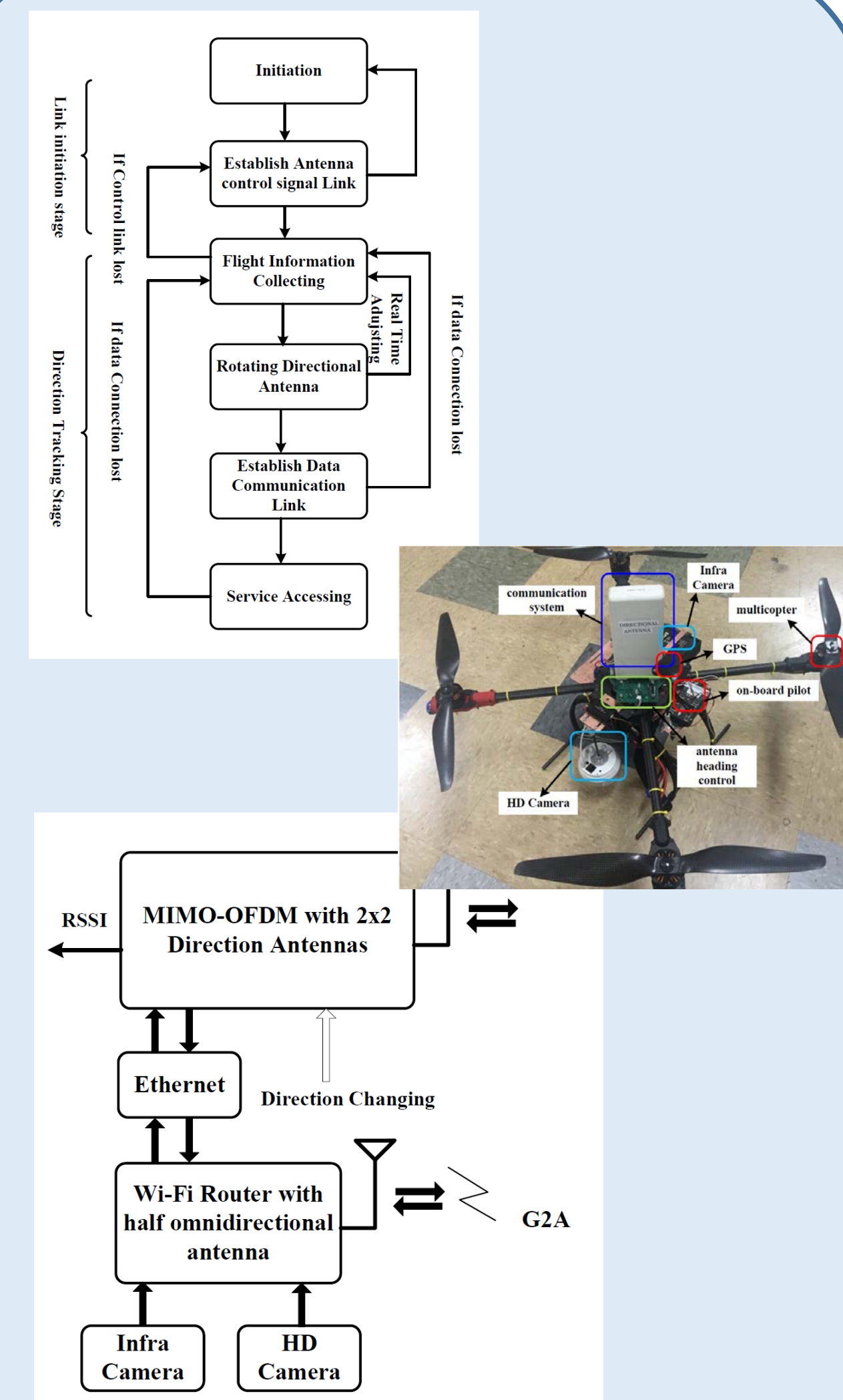
RSSI Modeling



Random Mobility Modeling, Learning, and Tracking



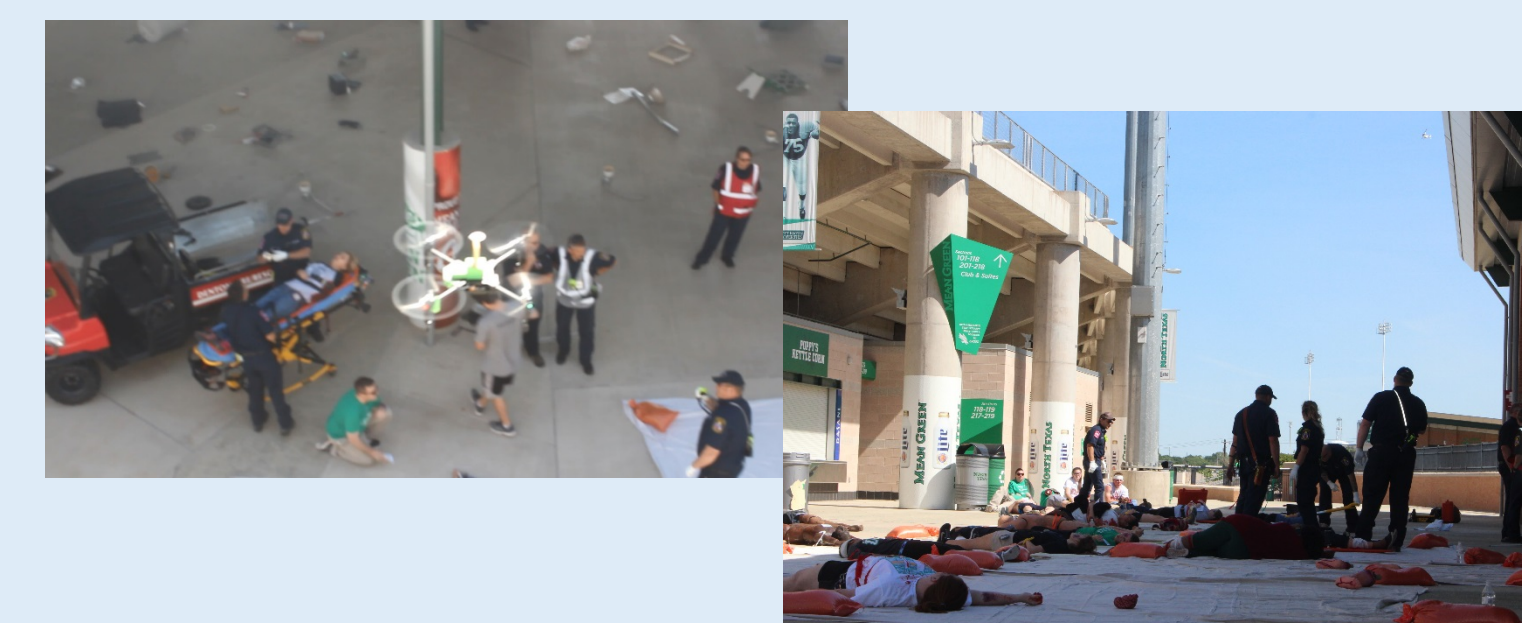
Implementation



Research Progress: Broader Impacts

Field Test

Demonstrated with the University of North Texas and City of Denton in Apogee Stadium on May 5, 2017. The purpose of this full-scale disaster exercise is to provide a training platform on an explosion, suspicious device, and mass casualty incident.



UNT's Stars at Star, a research showcase to business and government leaders in Collin County at Dallas Cowboy World Headquarter in Frisco.



Outreach

- Invited demonstration at Denton 9/11 Memorial Bell Tower, September 2017
- Invited demonstration at UNT Apogee Stadium, May 2017
- Invited demonstration at Denton Public Safety Day, September 2016
- Demonstrated at GCTC Expo, June 2016
- Invited demonstration in the 2016 Emergency Preparedness Summit invited by deputy district director, April 2016
- Demonstrated at Defense Innovation Challenge, December 2015
- Involved high school students and undergraduate students in the project, supported by the Tech Titan of the Future –University Level Award