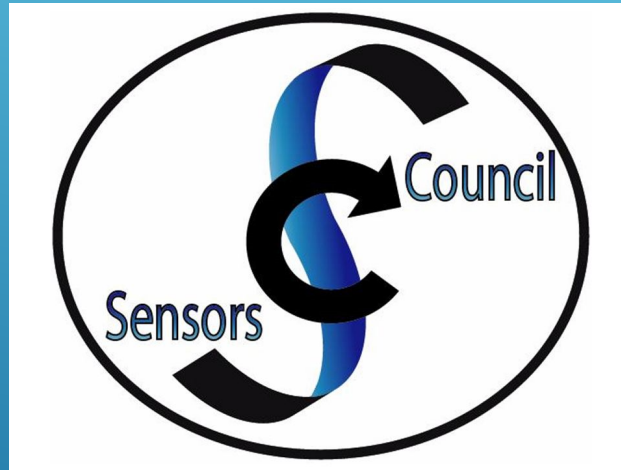# Deployable Communication Systems and IoT for Public Safety

Professor Kamesh Namuduri
Electrical Engineering, University of North Texas

Outline

- Introduction – building blocks for public-safety and challenges
- Global City Team Challange
- Deployable communcation systems
- Internet of Things for public-safety
- Challenges and future work

GCTC Demonstration
Aerial Communications, Incident Command System, and Analytics

Payload: LTE eNodeB + EPC, Web Services

Edge Processing: NICS + Analytics

Integration with Public Safety Architectures in City of Denton, Texas
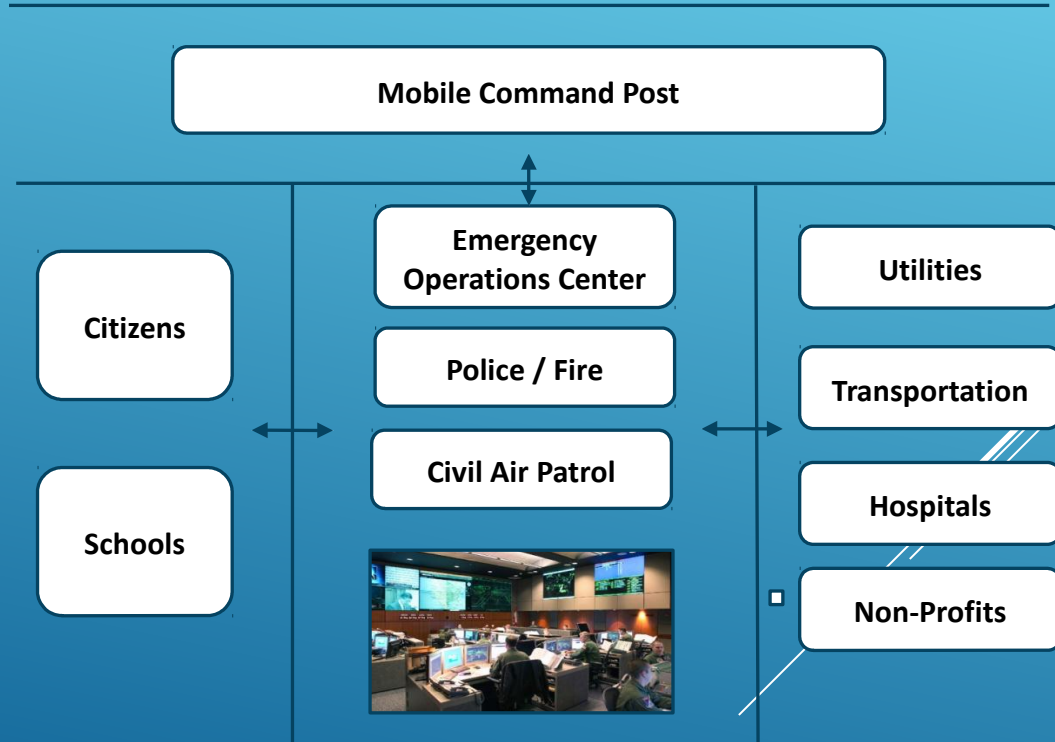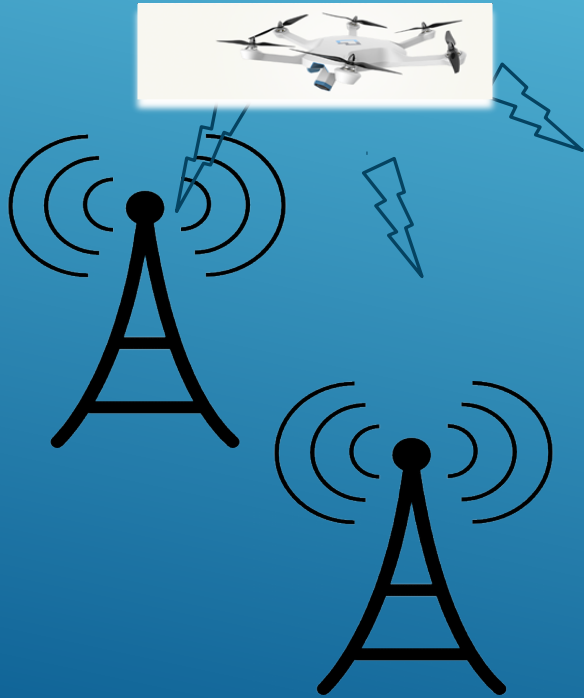
GPS

Communications

Situational Awareness

Analytics

GCTC Demonstration
Aerial Communications, Incident Command System, and Analytics

Building Blocks for Public Safety & Disaster Relief Operations

- Deployable Communications (UAS, LTE eNB, EPC, Long Distance Radios)
- Sensor Data Aggregation (Edge Computing and Analytics)
- Incident Command system (GIS based Dashboard + Chatroom)
- Situational Assessment (Cloud Analytics)
- Decision Making (Actionable Information for Incident Commanders)

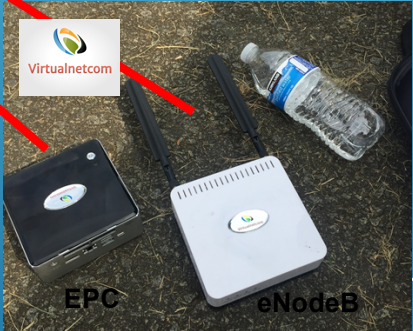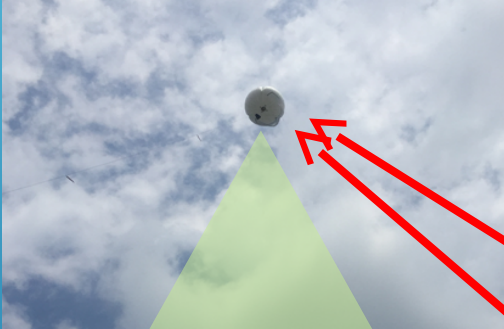**Aerial Deployable Communications Systems**
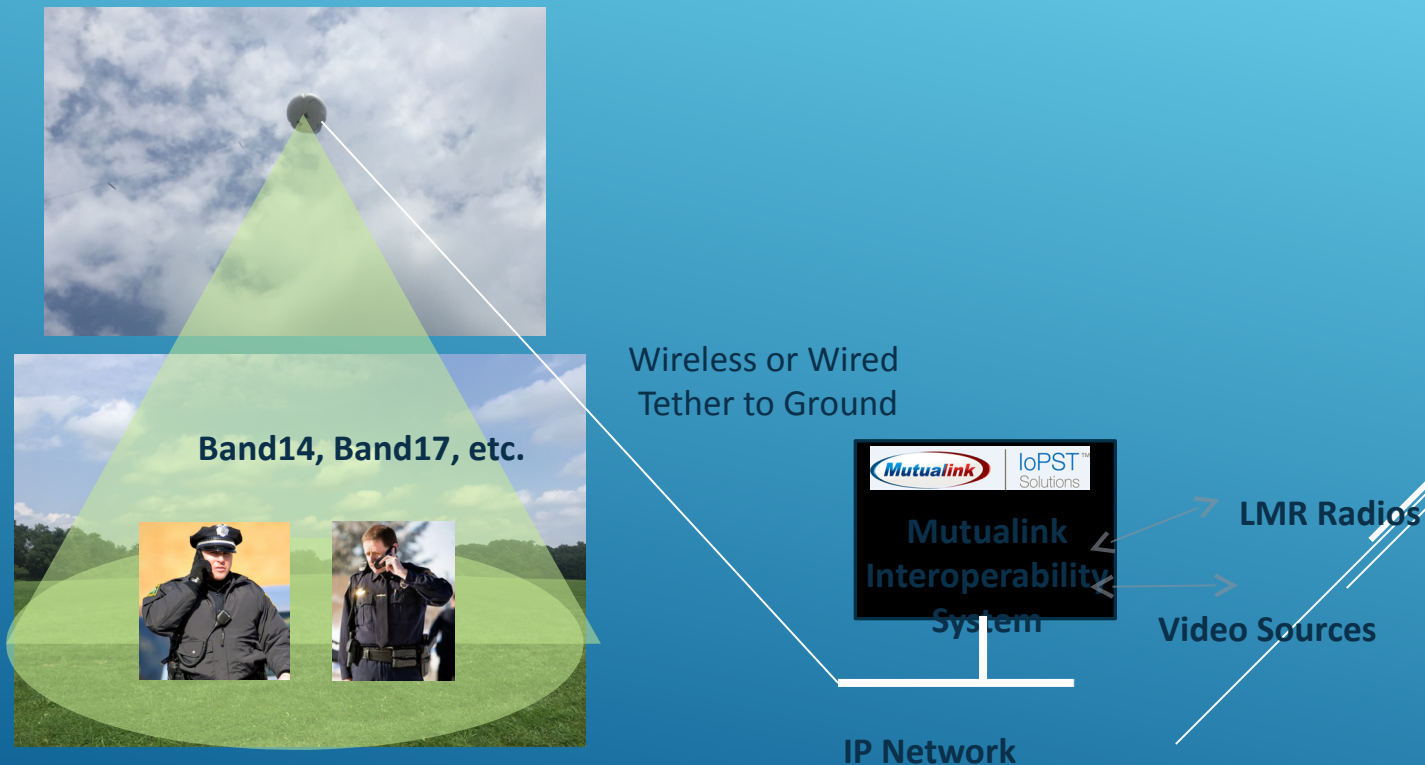
Situational Assessment and Decision Making Tools

LTE eNB

UAS

Edge Analytics

Flying Cell Towers

(Drone, Balloon, Aerostat, etc.)

Cellphone Coverage Bubble

Virtualnetcom

EPC   eNodeB

Ground-based Interoperability Services

Band14, Band17, etc.

Wireless or Wired
Tether to Ground

Mutualink | IoPST™ Solutions

Mutualink Interoperability System

LMR Radios

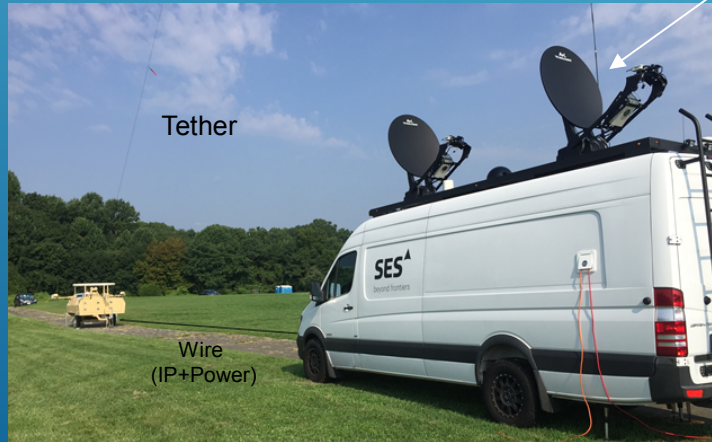Video Sources

IP Network

Optional Internet Connection Provides Integration with Nationwide Secure Emergency Network and Other Services

Band14, Band17, etc.

Wireless or Wired Tether to Ground

Mutualink IoPST™ Solutions

Mutualink Interoperability System

LMR Radios

Video Sources

IP Network

Optional Connection To Internet
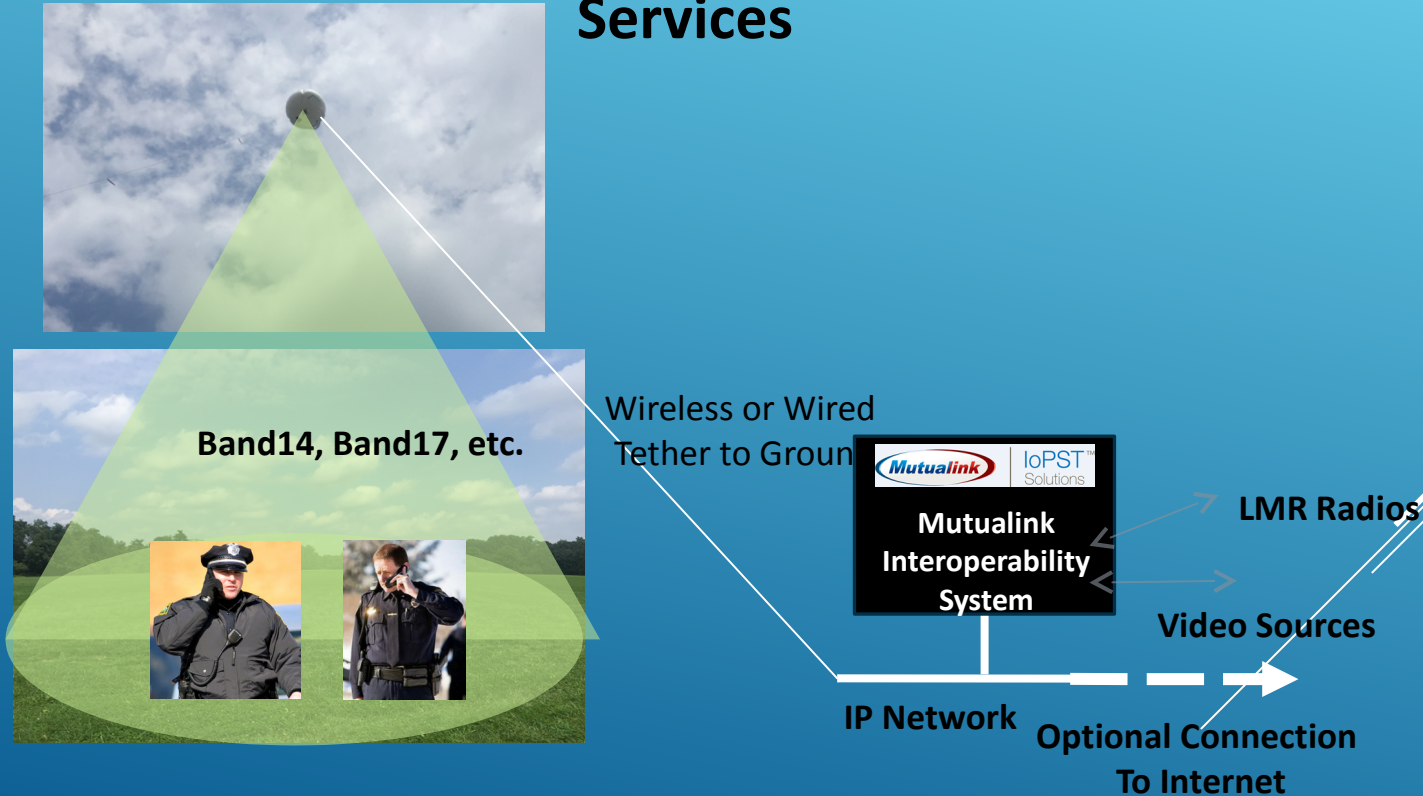
An Example

To/from Internet
Via Satellite

Tether
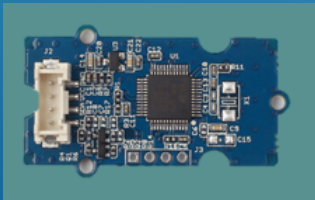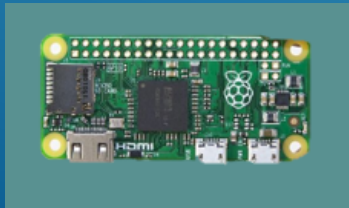
Wire
(IP+Power)

IoT for Public Safety
Gateways for Data Acquisition, Analysis, and Dissemination

○ Safety gadgets for firefighters

○ Smart phone apps for sharing information

○ Situational awareness applications
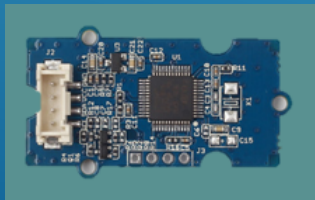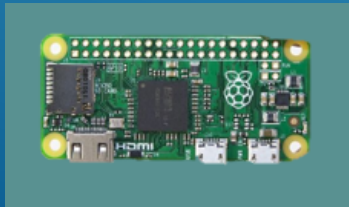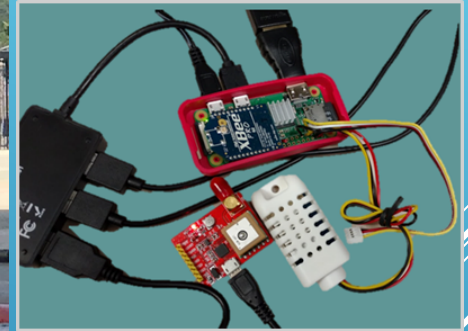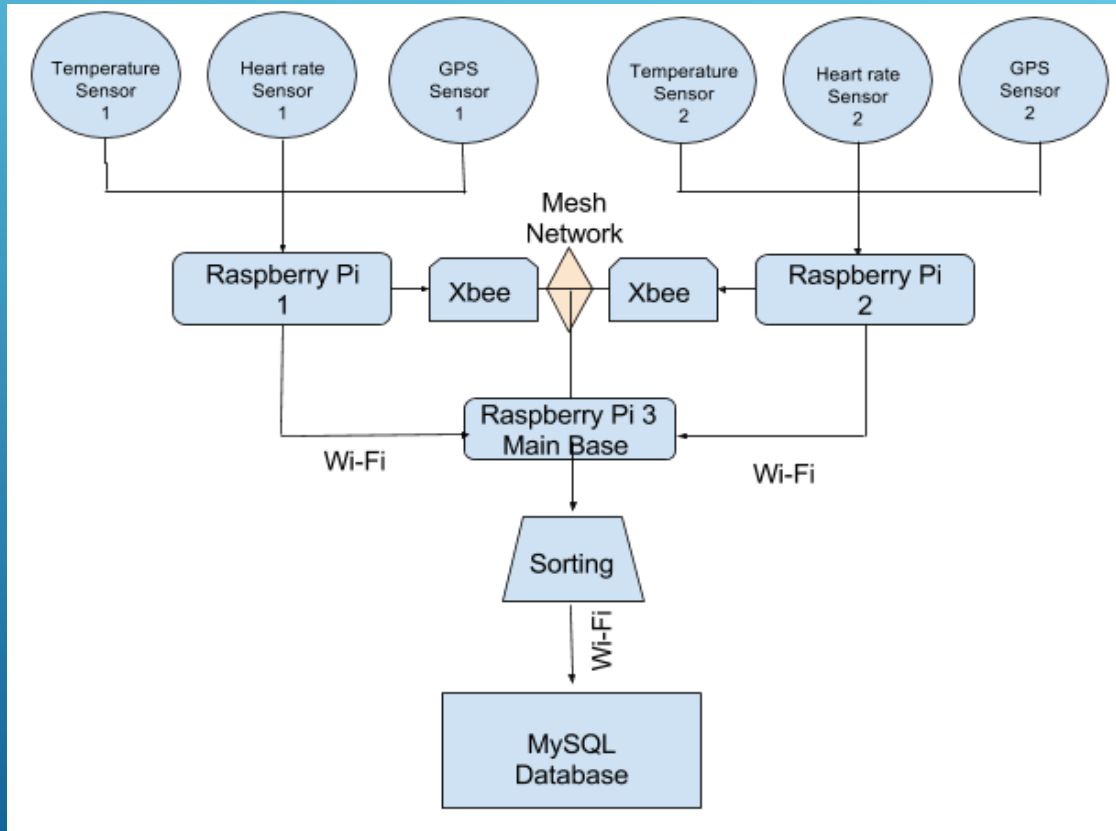
○ Edge analytics

IoT for Public Safety
Gateways for Data Acquisition, Analysis, and Dissemination
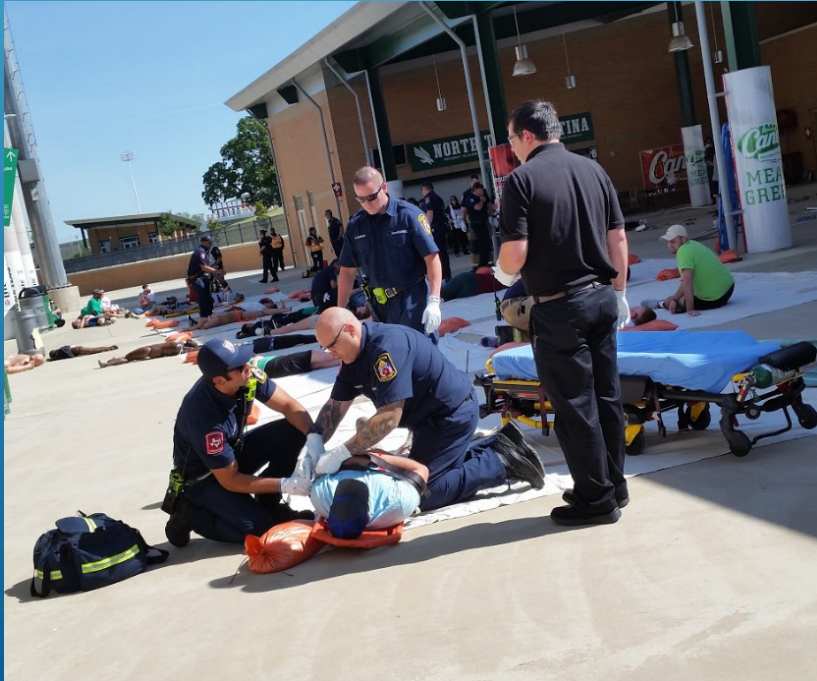
Safety Gadget for Firefighter
- [ ] Raspberry Pi Zero W
- [ ] Raspberry PI GPS Module
- [ ] Grove - Finger-clip Heart Rate Sensor
- [ ] AM2302 DHT22 temperature and humidity sensor
- [ ] XBee WiFi Module - PCB Antenna
- [ ] LiPo battery

Network of Gateways

UNT Emergency Exercise Friday, May 5th, at Apogee Stadium

Data Collected from the Safety Gadget for Firefighter

Smart Phone Application for Information Sharing

- Portable system that can be deployed on a UAV

- Phone app for sending text/images

- Raspberry Pi Server for collecting data

- GUI for data display and Displaying
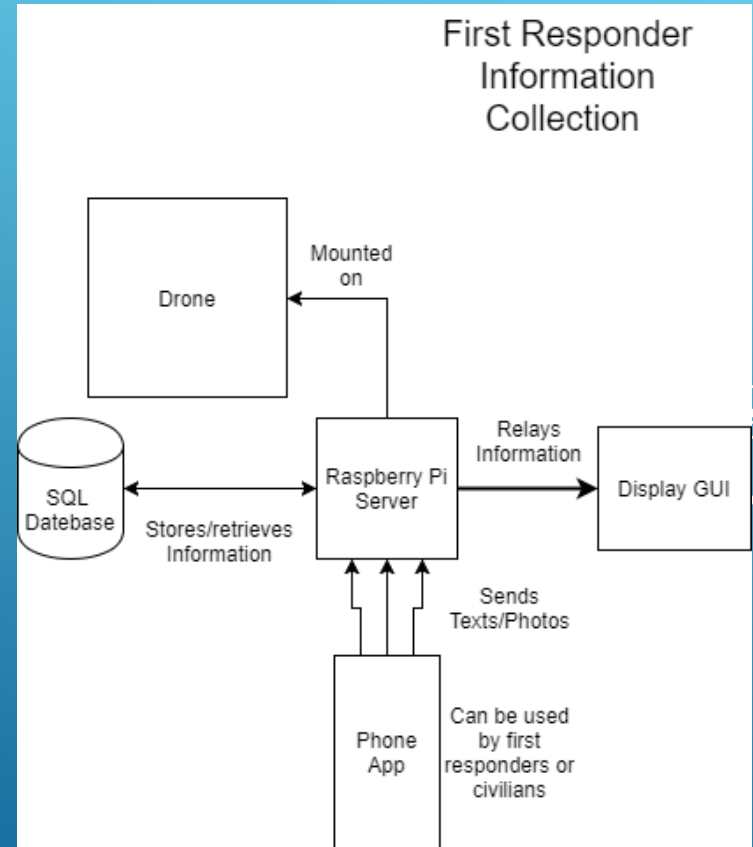
Smart Phone Application for Information Sharing

- Built on Android Studio Environment and socket programming

- Can share text and photos

- Sender's role (first responder, citizen, volunteer, etc.)

ResqueMe: Situational Awareness Application for First Responders and Volunteers
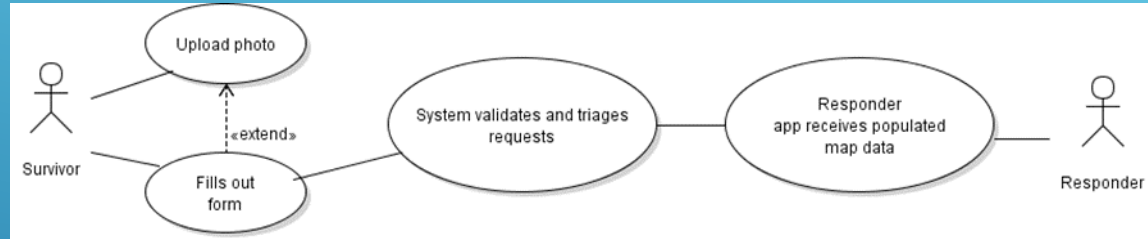
- A platform built upon the input of volunteer search and rescue personnel and first responders that have responded to various mass casualty disasters.

- It expands first responders capacity to handle overwhelming requests for help by involving both trained search and rescue organizations, response organizations, and volunteers.

- The platform gathers, tracks, and controls the flow of information which is crucial to responding to dynamic situations in a manner that allows for the most efficient use of resources.

Challenges and Future Work

- Long Distance and Mesh Networking Radios
- Self-Organization / Adhoc Networking
- Autonomy
- Interoperability