

Abstract

INTRODUCTION: We created an autonomous quadrotor UAV system to: 1) quickly map outdoor disaster zones to prioritize rescue efforts and 2) create 3D maps of building interiors for remote diagnosis of trapped victims.

PROBLEM: Fresh aerial imagery allows first responders to target high-damage areas. However, satellites can take 8-10 days to reach the disaster area, and post-storm clouds obstruct clear view. Non-military satellite imagery is capped at a 50 cm angular resolution. Other imaging UAVs range from \$10,000 to over \$100,000.

ENGINEERING GOAL: The design and construction of an affordable aerial photography system for rapid map acquisition coupled with indoor 3D scanning.

PROCESS:

1. A high altitude UAV autonomously captures imagery of an area.
2. Servers identify keypoints and stitch images together into map overlays.
3. Low altitude quadrotors capture high resolution panoramas at keypoint clusters.
4. Indoor 3D maps are generated with drone mounted RGB-D cameras.
5. Victims are automatically detected in images and reported to disaster responders.

IMPACT & RESULTS: We created a system that captures outdoor aerial imagery, first person panoramas and 3D indoor point clouds. Each quadrotor in the network costs < \$500. Features as small as 5 cm are discernible in our generated panoramas. **Our system has an order of magnitude better resolution than the best satellite imagery available.** Victims are automatically detected to speed the search process.