



Research Summary

Drones and Other Technologies to Assist in Disaster Relief Efforts



WHAT WAS THE RESEARCH NEED?

The purpose of this project is to expedite the use of emerging technologies such as drones at TDOT for disaster preparedness, response, mitigation, and recovery. The state of Tennessee deals with many natural disaster threats such as tornadoes, flooding, landslides, and earthquakes. TDOT plays a critical role in preparing for, responding to, and recovering from these disasters. The use of advanced and

emerging technologies such as drones, sensing technologies, machine learning methods, and optimization techniques could significantly improve disaster relief efforts.

Project Number:
RES2021-05

TDOT Lead Staff:
Brandon Webb
Roadway Design Division

Principal Investigator(s):
Dr. Shuai Li | PI
University of Tennessee,
Knoxville

Project Term:
September 2020 to May
2022

WHAT WERE THE RESEARCH OBJECTIVES?

The overarching goal of this research is to expedite the use of emerging technologies such as drones at TDOT for disaster preparedness, response, mitigation, and recovery. Three research objectives were pursued in this project.

- Objective 1: Identify and study hardware systems that can be used for disaster relief.
- Objective 2: Identify and study software systems that can be used for disaster relief.
- Objective 3: Develop use cases and workflows for potential implementation.

WHAT WAS THE RESEARCH APPROACH?

The research team reviewed current practice and system configurations for drones and other emerging technologies in disaster relief efforts, providing useful insights for TDOT to understand the uses of these technologies. In addition, a generalizable framework based on 3D reconstruction, deep learning, and optimization was proposed for processing drone-acquired data and drone mission planning, which can be applied in various disaster scenarios. The research team also investigated the use cases as well as general workflows for using drone systems and software tools in different types of disaster scenarios, including post-disaster infrastructure systems surveys, landslide investigation, and flooding assessment.

WHAT WERE THE FINDINGS?

The key findings include:

- This research led to a generalizable method for using drones and artificial intelligence-enabled software/data processing tools, providing TDOT an implementable framework to collect, process, and analyze critical data before, during, and after disasters for disaster preparedness, response, and recovery.
- This research produced use cases and workflow for using drones in different types of disaster scenarios for potential implementation in Tennessee. The implementation of these advanced technologies will help address several concerns that TDOT is facing with, including post-disaster infrastructure surveys, landslides and floods, therefore, could help TDOT to improve the efficiency and effectiveness of disaster relief efforts.
- The potential and feasibility for using drones in disaster relief efforts such as post-disaster infrastructure survey and structure assessment and landslide investigation were demonstrated via field experiments, confirming the promise of drones to assist disaster relief efforts.

IMPLEMENTATION AT TDOT

This research produced uses cases and workflow for using drones in different types of disasters scenarios for potential implementation in Tennessee. The implementation of these advanced technologies will help address several concerns that TDOT is facing with, including post-disaster infrastructure surveys, landslides, and floods, therefore, could help TDOT to improve the efficiency and effectiveness of disaster relief efforts.

MORE INFORMATION

Find the final report here: https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2021-final-reports/RES2021-05_Final_Report_Approved.pdf.