

Project: Situational awareness with LiDAR and Thermal Data in underground mine in post-disaster scenario

In the aftermath of an underground mine disaster, responders face extreme challenges in locating survivors and assessing conditions. Visibility is often nearly zero due to dust, smoke, and darkness, which makes navigation and hazard detection exceedingly difficult. Unstable structures and unknown hazards compound the risks, creating a critical need for enhanced situational awareness. This project proposes a system that integrates LiDAR scanning and thermal imaging to provide important information of the environment from mines, tunnels, and closed corridors in post-disaster scenarios. The goal is to give rescue teams immediate insight into the environment, enabling the location of trapped personnel, assessment of structural integrity, and identification of hazardous conditions without direct exposure to danger.

To address this issue the proposed solution employs high-resolution LiDAR to generate a detailed 3D map of the underground environment, even in complete darkness, capturing structural details and any changes due to the disaster. Simultaneously, thermal cameras will detect heat signatures of survivors and fires, effectively enabling vision in darkness and through smoke to locate trapped personnel and hotspots. By fusing these data streams, the system produces a comprehensive, real-time visualization of the scene that can be delivered to rescue operators via heads-up displays or remote monitors. This integrated approach enables responders to visualize collapse patterns and assess structural stability (via the LiDAR map) while immediately pinpointing survivors and dangerous heat sources (via thermal data). Expected outcomes include faster and safer rescue operations, as teams can plan optimal paths and avoid unseen dangers, ultimately improving survival rates. We will also create a dataset for this project. The research and engineering impact of this project will be a significant advancement in underground disaster response technology, potentially setting new standards for mine safety and emergency management.