Equipment Distribution for Structural Stabilization and Civilian Rescue

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ABSTRACT

The efficiency of Urban Search and Rescue operations depends on the supply of appropriate equipment and resources, and an efficient damage assessment facilitates deployment of these resources. This paper presents an Information Technology (IT) supported system for on-site data collection to communicate structural condition, track search and rescue status, and request and allocate appropriate resources. The system provides a unified interface for efficient gathering, storing, and sharing of building assessment information. Visualization and access of such information enable rescuers to respond to the disaster more efficiently with better situational awareness. The IT system also provides an interface for electronic resource requests to a geospatial resource repository service that enables a spatial disaster management environment for resource allocation. Request and deployment of critical resources through this system enables lifesaving efforts, with the appropriate equipment, operator, and materials, to become more efficient and effective. System development at the Illinois Fire Service Institute has shown promising results.

Keywords: Decision Support System, Electronic Resource Requests, Geographic Information Systems (GIS), Radio Frequency Identification (RFID), Urban Search and Rescue (US&R)

INTRODUCTION

Critical resources such as heavy construction equipment are required in conditions when human power is not sufficient to perform Urban Search and Rescue (US&R) operations. The performance of search and rescue depends on the delivery of these critical resources. As US&R operations involve the location, rescue, and initial medical stabilization of victims...
trapped in confined spaces, inefficient equipment delivery could delay civilian rescue. At the same time, safety of the rescuers is one of the most important responsibilities of US&R and structural stability of damaged infrastructures is a key component of rescuers’ safety. FEMA US&R Structural triage is the process of evaluating structurally compromised buildings to determine operational priority (US Army Corps of Engineers, 2008). The priority is set based on factors such as occupancy, known victims, probability of live victims, collapse mechanism and structural condition. To keep track of search and rescue information at structurally compromised buildings, building marking systems (BMS) are used in the current practice. As technical rescue operations for major disasters tend to be in the order of hours/days, these marking systems are imperative for effective communication and allocation of rescue forces. In a lifesaving scenario, standardized information for building identification, conditions assessment, hazards and victim status is of great importance. However, challenges in the current practice have been identified. This paper presents an Information Technology (IT) supported system that addresses the challenges for on-site data collection to communicate structural condition, status of US&R operations, and to request resources for stabilization of those structures for search and rescue within those structures.

GAP IDENTIFICATION

From lessons learned in recent disasters, information gathering for critical decision making has been recognized as one of the greatest challenges in disaster response. Response efforts cannot reach their full potential without the information needed to make critical decisions. For example, after the 9/11 terrorist attacks, the authorities were not fully aware of available resources and did not have complete access to available information. As a result, resources were deployed inefficiently, which compromised the effectiveness of response operations (National Commission on Terrorist Attacks Upon the United States, 2004).

Distribution of resources during disaster response operations has been characterized by various shortcomings that inhibit efficient and effective decision making. Setting priorities for allocation of limited resources is one of the challenges (National Commission on Terrorist Attacks Upon the United States, 2004). Efficient information gathering and decision making for distribution of resources is critical to support disaster response efforts.

A large number of engineering parameters such as the type of structure, patterns of collapse, and shoring alternatives play important roles for decision making. These factors contribute to decision making for prioritization of rescue activities and in some cases are vital in ensuring the safety of the rescuers. For example, in-structure route selection is critical to quickly and safely access victims trapped under a partially collapsed building. As such, structural triage and BMS has been one of the key features carried out by the engineering workforce on US&R operations (McGuigan, 2002). The information gathered (such as the structural triage) is then disseminated to the stakeholders for decision making (setting up operational priority for buildings). In other words, critical information needs to be communicated to or retrievable by numerous levels of command at different times and stages of disaster response. However, the information is usually transferred through paper copies, which cannot be effectively distributed.

For example, once a triage or BMS is complete, the primary communication method in the current practice is in paper format. It can easily take 24 hours for the paper copy to reach the Incident Command. Since triage is a base of information decision makers use to set priorities of response efforts, the delay in information dissemination compromises the timing for decision making. An alternative would be through verbal radio transmission but this can be both incomplete and unreliable. If other actors need access to the information, locating and retrieving the information in paper copies, which cannot be effectively distributed.
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