Chapter 42
RETRA:
Web Based Resource Allocation Tool for Emergency Management

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ABSTRACT

In this paper, the authors introduce a real time web based tool for resource allocation (RETRA) that can assist the incident commanders and resource managers in the complex task of emergency resource deployment for multiple simultaneous incidents that occur in close geographical proximity. RETRA real time inputs include the location of the emergency sites and the required resources with associated priorities. It generates an optimal deployment plan so that emergency sites with highest priorities for a resource are assigned that resource in the least amount of time. The optimal solution is presented graphically using Google Maps. RETRA can be used for emergency resource deployment at the initial response stage of a disaster. [1]

INTRODUCTION

Over the past quarter century, 3.4 million people lost their lives due to disasters worldwide. Disasters are generally considered "low probability – high impact" events. Natural and man-made disasters, such as earthquakes, floods, plane crashes, high-rise building collapses, or major nuclear facility malfunctions, pose an ever-present challenge to public emergency services. Disasters are by definition unpredictable, dangerous and overwhelming. Optimal deployment of emergency resources in multiple mass casualty incidents is a challenging task due to the competition for limited available crucial resources (e.g. emergency vehicle with emergency personnel). Timely allocation of resources during an incident plays a crucial role in an effective response process.

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In case of mass casualty events, multiple incident command system organizations like dispatch centers, Emergency Operations Centers (EOCs), Area command will be involved in the distribution of the resources at the initial response stage. Hence, coordination between these entities is important. If not well coordinated, this influx of resources will lead to an inefficient utilization of much-needed assets, reducing the effectiveness of the response. Coordination can be achieved by providing situational awareness about the emergency resources to each of the entities. Situational awareness of the emergency resources is about informing the resource availability to each of the entities, current location of the resources and estimated arrival time of the emergency resources at the emergency site. The Institute of Medicine & Centers for Disease Control and Prevention reported as emergency response includes diverse audience, it is recommended that communications in preparedness and response should be improved (2008). A web based decision support system can provide a common operating picture to diverse audience and can thus help in coordination.

It is very important to consider Geo-spatial data in emergency management response (National Research Council, 2007; Skinner, 2011). Geospatial data should be an important part in all the phases of emergency management like response, recovery, mitigation and preparedness and geospatial tools should be used by all the agencies involved with emergency management (National Research Council, 2007). It is mentioned in Skinner (2011) that 80% of information required for emergency decision making involves location based information. Hence the use of maps and geographical information systems form an important role in the emergency response decision making process. Hence any emergency response decision making system should use a GIS for improvements in disaster response.

Disaster events are characterized by heavy differences between demand for healthcare services and supply of healthcare services by the resource providers. This surge capacity in healthcare is characterized into three categories (Altevogt & Institute of Medicine, 2009):

1. **Conventional capacity:** Enough medical resources like staff and supplies are available to follow daily practices;
2. **Contingency capacity:** Enough medical resources are not available to follow the daily practices. Instead with the available resources a functional equivalent to the daily practices can be provided;
3. **Crisis capacity:** Available resources are not even sufficient to provide functionally equivalent care to the patients. In case of Contingency and Crisis capacity situations, the scarce medical resources like paramedics and ambulances must be distributed to the multiple disaster sites based on the priorities before additional resources are available from the neighboring jurisdictions.

In this paper we propose a Real Time web based tool for Resource Allocation (RETRA), that optimizes resource deployment time at the initial response stage. RETRA system is unique since it is the first system that considers the following important requirements:

1. Multiple resource depots and multiple emergency sites in close geographical proximity;
2. Resource requirements and their priorities at each emergency site, as required in FEMA (2010),
3. Real time inputs that can affect the resource allocation like location of the emergency site;
4. Easy to use web based graphical user interface using Google maps.

As compared to our previous work (Inampudi & Ganz, 2009; Inampudi & Ganz, 2010) in this