Resource Allocations for Humanitarian Response: Introducing a Software Tool Based on SWRL Enabled OWL Ontologies

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ABSTRACT

Resource allocation is one of the most important tasks in organizing humanitarian response to humanitarian crises. It is not only that adequate and efficient resource allocation save lives and reduce damages caused by humanitarian crises, but resource allocation must be fast and efficient to save time and resources. Given that resource allocation is a type of a decision-making process, it is expected that decision on resource allocation are based on accurate and relevant information generated at various stages of humanitarian response. In this article, the authors promote Semantic Resource Allocation tools which a) collects and interprets the semantics of an environment where resource allocation is required and b) the reasons upon the semantics of that environment in order to make appropriate resource allocation. The tool is built with computations based on SWRL enabled OWL ontologies. The prototype has been implemented as a desktop application which can also run in mobile/wireless environments, including Android smart phones.

KEYWORDS


INTRODUCTION

Hazardous situations in human environments, with which we are not prepared to deal, may end in humanitarian crises (HC), ranging from drought, flooding, famine and hurricanes to wars, earthquakes and volcanic eruptions (Sphere Project, 2010). The correct information, which is either collected or created during HC, is essential in managing humanitarian response (HR), saving lives and bringing such environments back to their normal state (UN, 2007). Many countries cannot deal with HC. They appeal to the international community to intervene and help in mitigating the catastrophe (HPG, 2006). There are various ways of addressing HC, but making a correct and prompt decision on who is going to intervene in HC, why, when and how they can help in HC, remains one of the most crucial and complex tasks in HR. Resource Allocations (RAloc) often takes longer than expected (FEWSNET, 2001), (Charny, 2004), (HPG, 2005), (Margesson & Taft-Morales, 2010) and its efficacy depends on information availability and reliability (Morrison & Cohen, 2005), (Bharosa & Jansen, 2009). One of the most difficult tasks for decision makers in HR is to find appropriate humanitarian organizations

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to respond to HC. For every HC the list of requirements is different and needs in HC might not suit all humanitarian organization profiles.

The role of a coordinating body during HR is very important because it acts as a hub connecting:

- Actors, such as Donors (D), Agencies (A) and Implementing Partners (P)), which provide help;
- Sectors (S) which refer to the technical services provided by actors to affected populations, such as food, water, health, shelter, education; and
- Locations (L) which refer to the place where the affected population live.

In efficient RAAlloc, the coordinating body uses its accumulated human experience to reason upon Agencies, Sectors and Locations, and performs RAAlloc by selecting the best possible combination of Agencies and Sectors to work with each other in a particular Location. Given that RAAlloc is a complex process, where decisions are taken under enormous pressure of time and resources, HR must be tailored to a particular HC and consider cultural, political and organizational practices and regulations. Having information systems, with well-structured repositories and the exchange of their contents in place, is one of the prerequisites for informed RAAlloc (Shamoug & Juric, 2011; Shamoug & Juric, 2011A; Shamoug & Juric, 2012; Shamoug et al., 2012; Shamoug et al., 2012A; Shamoug et al.; Shamoug & Juric, 2017). Decision makers in RAAlloc rely on such changes rather than waiting for accurate and exact information, which may come late, or not at all (Kari, 1998). RAAlloc must be progressive, iterative, interpret what is going on rather than what should be done (Pollack-Johnson & Liberatore, 2006). It should collect data from people/machines, support data planning/tasking and provide data analysis (Kozlowski & Klien, 2000; Mackenzie, 2004; Lee & Cummins, 2004; Balci et al., 2011).

THE PROBLEM TO SOLVE: CREATING AN AUTOMATED TOOL FOR SEMRAALLOC

In this paper we propose a software tool for Semantic Resource Allocation (SemRAAlloc) with slightly different characteristics compared to other tools in decision making. The tool enables:

- Continuous support in RAAlloc from day one of a HC and assistance in decision making, regardless of how much information is available;
- Collection and interpretation of the semantics of an environment where RA Alloc is required;
- Reasoning upon semantics of that environment to make appropriate RA Alloc.

The emphasis is on the understanding the meaning of available (and constantly changing) information and very quick decision making based on it. It is obvious that SemRA Alloc sits between a range of data repositories with information relevant to the HR coordinating body. Decisions on RAAlloc vary from day to day and always focus on urgent issues on a particular day / time of HC (Shamoug et al., 2014). Therefore, the tool also allows the input of various types of information from heterogeneous repositories and gives provision for accepting data from media and social media.

The idea of building SemRA Alloc, which manages the semantic of environment struck by HC, as itemized in a)-c), requires a new computational model, which powers the tool. If we used solutions from the Artificial Intelligence (AI) filed for managing the semantics of RA Alloc, we would build a very complex software product. It would be difficult to scale and run it in constantly changing environments of HC. What we need here is a slick and easy to install/operate software tool, which addresses these changes by focusing on various moments in HR where decisions on the RA Alloc are to be made, sometimes on an ad-hoc basis. Instead of building a demanding expert system to manage the semantics of RA Alloc, we deliver a very similar functionality by creating a modern application,
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