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Adaptive Ontology Use for Crisis Knowledge Representation

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ABSTRACT

In a crisis the problem of the lack of a shared platform or similar communication methods among the collaborators usually arises within a few hours. While a crisis requires rapid response of emergency management factors, ontology is generally represented in a static manner. Therefore, an adaptive ontology for crisis knowledge representation is needed to assist in coordinating relief efforts in different crisis situations. The article describes a method of ontology modeling that modifies the ontology in real time during a crisis according to the crisis surroundings. The method is based on modeling a basic predefined multilingual ontology while allowing the expansion of the ontology according to the crisis circumstances and the addition of other languages within the crisis time limitations. An example of ontology use based on a sample Katrina crisis blog is presented. Motivation for multilingual ontology use is supplied by the Boxing Day Tsunami crisis. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *Crisis Information Mapping; Knowledge Representation; Multilingual; Ontology*

INTRODUCTION

Rapid response in a situation, such as a crisis, usually entails bringing down physical as well as logical barriers to allow fast transfer of critical information. Knowledge Representation is generally used to refer to representations intended for processing by computers, and in particular, representations consisting of explicit objects and of assertions about them. The representation of knowledge in such explicit form enables computers to draw conclusions from knowledge already stored. However, during a crisis there exists a massive amount of information relating to new concepts not yet represented. To provide a rapid response it is necessary to build a new knowledge

representation system sometimes in a matter of hours.

According to the Munich Research Group (Munich, 2005) website, most definitions of the term "crisis" include ten characteristics: 1) an unusual volume and intensity of events, 2) 'change of state' in the flow of international political actions, 3) disruptive interactions between two or more adversaries, 4) abrupt or sudden change in one or more basic system variables, 5) change in the external or internal environment, 6) threat to basic values, 7) high probability of involvement in military hostilities, 8) awareness of finite time for response, 9) surprise, and 10) uncertainty.

Based on these definition characteristics, knowledge representation during rapid response situations will be influenced by the mass production of information relating to multiple events. Communication will be limited in scope between the participants. Chaos and lack of official chain of control and decision making can be expected in this situation. Furthermore, the most critical aspect might be the time limitation.

Figure 1 shows a blog entry posted by a New Orleans resident at the beginning of the U.S. Katrina crisis (The survival of New Orleans Weblog, http://interdictor.livejournal.com, 8:54 am, August 30th, 2005). The request in the text to receive relevant information can be viewed as a simple query posted in natural language. The request for information presented in the figure requires a knowledge representation relevant to crisis that can be expanded and matched to specific incidents and locations.

The article presents a model for designing an ontology-based knowledge representation during a situation with time constraints. The article describes the steps and the resources required to build a satisfactory solution which can serve as a basis for setting up the rescue and support systems under these time constraints.

The rest of the article is organized as follows. Section 2 provides related work. Section 3 presents the concept of crisis ontology. Section 4 describes the ontology design and Section 5 describes aspects of the ontology implementation. A discussion and implementation of ontology for the Katrina crisis and the Boxing Day Tsunami crisis are presented in Section 6. Finally, section 7 presents the conclusion and further research.

Figure 1. Sample blog posting during Katrina crisis - August 30th, 2005

> Right now, it's a matter of survival. There are 3 important aspects to surviving this: you need food/water/medicine, you need personal protection, and you need the means to conduct personal hygiene in such a way that you're not creating more of a problem than you're solving. For any media out there reading this, it would be very helpful for you to post guidelines for survivalist hygiene.