

Chapter 38

Multilingual 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. This chapter 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.

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 representa-

tion 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:

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Multilingual Crisis Knowledge Representation

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.

Box 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 blog requires a knowledge representation relevant to crisis that can be expanded and matched to specific incidents and locations.

The chapter presents a model for designing an ontology-based knowledge representation during a situation with time constraints. The chapter 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 chapter is organized as follows. The next section provides related work, followed by a section which presents the concept of crisis ontology. The sections after describe the ontology design and the aspects of the ontology implementation. Then a discussion and implementation of ontology for the Katrina crisis and the Boxing Day Tsunami crisis are presented, followed by the conclusion and further research.

RELATED WORK

A common definition of an ontology considers it to be “a specification of a conceptualization” (Gruber, 1993), where conceptualization is an abstract view of the world represented as a set of objects. The term has been used in different research areas, including philosophy (where it was coined), artificial intelligence, information sciences, knowledge representation, object modeling, and most recently, eCommerce applications. In his seminal work, Bunge defines Ontology as a world of systems and provides a basic formalism for ontologies (Bunge, 1977), (Bunge, 1979). Typically, ontologies are represented using Description Logic (Borgida & Brachman, 1993), where subsumption typifies the semantic relationship between terms.

The realm of information science has produced an extensive body of literature and practice in ontology construction, e.g., (Vickery, 1966). Researchers in the field of knowledge representation have studied ontology interoperability, resulting in systems such as Protégé (Noy & Musen, 2000). An adaptive ontology model that allows the ontol-

Box 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 of survivalist hygiene.

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