Faculty of Engineering and Information Technology

Agent-Based Modelling for Disaster Management Knowledge Analysis Framework

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UTS

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Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as part of the collaborative doctoral degree and/or fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Sydney, November 2017

Dedi Iskandar Inan
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Abstract

In Disaster Management (DM), reusing knowledge from best practice and past experience is envisaged as the best approach for dealing with disasters. It is important to recognise however that there are no identical disasters. But there are obvious similarities. The challenge is to identify the similarities in the diverse complex characteristics inherently intertwined in the DM knowledge. There are often various autonomous entities: individuals, agencies, organisations, involved in the DM that are coming with their interests, hierarchy structures, resources, and etc., that need to be interacted and communicated with in DM. They have to deal with uncertainty and time-sensitivity as the critical factors otherwise any single situation might lead to the catastrophic.

An authoritative agency typically leads the combat of a disaster. The agency organises and elicits the knowledge subsequently structure it into a sharable and reusable format, the Disaster Management Plan (DISPLAN). DISPLANs are maintained by the authoritative agencies encompassing the Prevention, Preparedness, Response and Recovery (PPRR) phases. In a case of disaster, the DISPLAN will be activated to be accessed by the stakeholders. However, accessing the knowledge out of the DISPLAN is challenging. Knowledge in DISPLANs tends to be structured in a business specification format. Accessing the knowledge can have a subjective element. The fuzziness and the intertwine of knowledge across all PPRR phases in their structure can hinder access in a timely manner.

This dissertation contributes to development of a knowledge transfer analysis framework to unify access to DISPLANs through a unified repository. This framework is developed following Design Science Research (DSR) methodology in Information System (IS). Agent-Based Models (ABMs) are used to code the DISPLANs to enable their transfer into a repository. ABMs enable the representation of many DM characteristics and processes expressed in the DISPLANs. The Object Management Group (OMG) Metamodeling Framework is then used to create a repository that is ready for storing the content of ABMs. The repository itself is underpinned by a metamodel structure that facilitates the retrieval and DM decision making processes in the context of their use. The overall approach is evaluated using DISPLANs from the State Emergency Services (SES) in Australia. The framework is successfully used to analyse and convert the SES DISPLANs into the metamodel based repository. The resultant approach and repository enable better access, sharing and maintenance of the DM knowledge.
Publications

A number of publications as the outcome being produced from this thesis are in peer-reviewed of an international journal and conferences and a poster presentation.

Conference


Journal


Award

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