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Introduction to Collaborative Technology for Coordinating Crisis Management (CT2CM) track

Chihab Hanachi[1], Francois Charoy[2] and Serge Stinckwich[3]

I. Introduction to the Session

In crisis situations (natural or industrial disasters, riots, ...), the different actors managing crisis resolution have to act simultaneously in emergency to reduce its impacts on the real world. To achieve this common goal as effectively and efficiently as possible, these actors (police, military forces, medical organizations, non-governmental organizations but also emerging groups) have to collaborate and act in a coordinated way. By using the word coordination, we include all the work needed for the actors, for the connected integration of their information systems and also for the flexible synchronization of their efforts, in order to handle the crisis in the most efficient way. This coordination may occur during all the phases of a crisis, from the mitigation to the recovery phase.

Coordination raises several problems such as the definition of the universe of discourse, without which it would be impossible to solve the various semantic conflicts that are bound to occur between several autonomous and heterogeneous actors and their Information Systems. It involves the finding of partners, emergent partners integration, their collective decisions, partners plans negotiation and the synchronization of the distributed and concurrent execution of their actions and plans.

Moreover, in a highly dynamic, open, unstable and uncertain environment, such as the one met in crisis context, coordination should be rethought to be more reactive, proactive, adaptive, robust and visible for all the partners while preserving the essential part of their autonomy.

In this context, organizations have developed in the years several team collaboration tools like SAHANA (`http://sahanafoundation.org/`) or the WORKPAD infrastructure (`http://www.workpad-project.eu/`) based on information and communication technologies, that facilitate the distribution of control and information exchanges and gathering useful to crisis coordination.

Giving this context, the aim of this track is to examine how collaborative technologies can support coordination and interworking between the different actors involved in the crisis management and its resolution. It may concern the crisis management team, the actors on the field as well as their interactions. It may concern also all the phases of the crisis resolution.

This is the second edition of this track at the WETICE series of conferences. This year, the track features 6 regular papers and 5 short papers selected from 16 submissions.

II. Summary of Selected Papers

A. Collaboration and agility

- (1) Ines Di Loreto, Monica Divitini and Simone Mora. **Collaborative Serious Games for Crisis Management: an Overview** (L)
- (2) Lisa Wood, Bernard van Veelen, Sander van Splunter and Monika Buscher. **Agile Response and Collaborative Agile Workflows** (L)
- (3) Nada Matta, Sophie Loriette, Mohamed Sediri, Jean-Marc Nigro, Yann Barloy, Jean-Pierre Cahier and Alain Hugerot. **Representing Experience on Road Accident Management** (S)

B. Scalability and social content

- (4) Martin Wirz, Tobias Franke, Daniel Roggen, Eve Mitleton-Kelly, Paul Lukowicz and Gerhard Tröster. **Inferring and Visualizing Crowd Conditions by Collecting GPS Location Traces from Pedestrians' Mobile Phones for Real-time Crowd Monitoring during City-scale Mass Gatherings** (L)
- (5) Daniela Pohl, Abdelhamid Bouchachia and Hermann Hellwagner. **Supporting Crisis Management via Sub-Event Detection in Social Networks** (L)
- (6) Babiga Birregah, Tony Top, Charles Perez, Eric Chtelet, Nada Matta, Marc Lemercier and Hichem Snoussi. **Multi-layer Crisis Mapping: a Social Media Based Approach** (L)

C. Technology and theorical models

- (7) Imene Lahyani, Ismael Bouassida Rodriguez and Mohamed Jmaiel. **Towards Self-healing Publish/Subscribe System on MANET** (L)
- (8) Sakkaravarthi Ramanathan, Christophe Chassot, Thierry Desprats, Michelle Sibilla and Jean-Paul Arcangeli. **Adaptive Communication Agent for Crisis Management System** (S)
- (9) Thi Ngoc Anh Nguyen, Yann Chevaleyre and Jean-Daniel Zucker. **Optimizing Sign Placements for Crowd Evacuation on Road Network in case of Tsunami Alert** (S)

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- (10) Houda Benali, Narjs Bellamine Ben-Saoud and Mohamed Ben Ahmed. **Toward Building an Emergency Management System-of-Systems on the Fly** (S)
- (11) Ladislav Novk and Mria Luskova. **Statistical Methods for Industrial Processes Risk Assessment** (S)

The selected papers cover the following three main issues : Collaboration and Agility, Scalability and social content, Technology and Theory.

D. Collaboration and agility

Agility in the common sense is the ability to react quickly and easily to a stimulus. Applied to crisis management, this is also a useful concept: response organizations have well-defined procedures and processes but at the same time should be able to recombine them during extreme conditions in order to solve anticipated events. We selected 3 papers for this session: 2 long and one short.

The first one by Ines Di Loreto et al. (1) describe one way to foster the collaboration by using serious games. The authors analyze the state of the art of serious games in the context of crisis management and present some design implications. This paper shows the importance of learning and training during the preparedness phase of crisis management, especially to develop skills related to team management and coordination. The ability of playing roles (and also switching roles) in a serious game allows learners to understand the process regarding communication and collaboration in this context.

The second paper focus on agile response for crisis management. Lisa Wood and al. (2) develop a proposal based on the idea of collaborative agile workflows. Agility is here people's ability to reconfigure knowledge, skills and ressources on the fly at runtime during the occurence of a crisis. In order to support the collaboration in an emergency response, this paper use workflows, annotations and self-management techniques to improve the awareness.

The last paper of this session by Nada Matta et al. (3) study the several dimensions on how to represent emergency management situations based on experience feedback. The main idea is to help the actors to take decisions during management of road accident by using experience-based method.

E. Scalability and Social Content

Crisis situations most often involves large number of persons, a lot of events and communications, on potentially very large area. Getting an accurate idea of the situation and of its evolution is then a very important question for responders when they try to coordinate their operations and take decisions where the life and death of people is at stake. Nowadays, more and more people have at hand, knowingly or not, communication devices and sensors that can provide very useful information implicitly or explicitly to central authorities in charge of event and crisis management. The problem is then to be able to interpret this potentially very large amount of information, to make sense of it at the pace of the event, i.e. in near real time. This is what the papers in this session proposed to do regarding three different kinds of situations.

The first one by Martin Wirz et al. (4) proposes to leverage the localisation information provided by the GPS and smartphones of large crowds to provide the police with dynamic visualisation of potentially critical crowd situations. By collecting very large amount of data from smartphone they were able to provide visualisation that were considered by the police forces as more effective than video based method to detect critical situations.

The second one by Daniela Pohl et al. (5) follows a very popular vein in current research on crisis management. It proposes to analyse user generated content in real time to detect sub-events that require specific attention and/or immediate response. They propose to use clustering algorithms to sort out unrelated pieces of information in order to make sense of them. It is well understood that the amount of information provided by people during an event will most probably grow exponentially and that this kind of approach could be of first importance to help responders to make sense of it.

The third paper by Babiga Birregah et al. (6) also make use of user generated content to understand people needs and to map them during the event. Although it is preliminary work, it is an original way to use the information provided by tweets that could be combined with other sources of informations. This is a very important challenge to be able to map as accurately as possible all kinds of data, coming in real time in order to give the more accurate and timely view on an evolving situation.

These three papers are all useful and original proposals in the tremendous effort engaged by a lot of teams in the world that try to make sense of the information provided by large crowd explicitly or implicitly in order to help responders to do their job in the most effective way.

F. Technology and Theory

To deal with complex situations, crisis management requires distributed technology support with a high quality of services and possibly grounded on theoretical foundations.

In this session, we have selected one long paper and four short ones.

The work of Imene Lahyani et al. (7) presents a QoS framework for Crisis Management Systems abstracted as a set of distributed nodes communicating via a publish/subscribe protocol. It uses a Mobile Ad Hoc Network (Manet) that can self-organize its topology, and the quality of service degradation prediction is based on a theoretical model ARIMA (Auto Regressive Integrated Moving Average Formula).

The paper written by Sakkaravarthi et al. (8) describes the design of an agent framework that helps to ensure uninterrupted communications and that supports rescuers' efforts in coordination and cooperation in crisis management. The approach is designed to work in situations where network access fluctuates and is unreliable. The work focuses on

context awareness using a distributed approach, which is undoubtedly the best approach in such situations.

The paper presented by Thi Ngoc Anh Nguyen et al. (9) introduces a mathematical model for optimizing the placement of evacuation signs in case of a Tsunami with respect to evacuation time and casualties. Thereby the problem is two-fold: to simulate the evacuation and to optimize the sign placement. In this paper, the problem is solved by a combination of evacuation simulation and sign optimization modeling the evacuees as memory-less stochastic agents and solving the optimization problem with mixed integer linear programming (MILP).

The paper presented by Houda Benali et al. (10) gives an overview of how to approach the interoperability of emergency management systems (EMS) by using a System of System (SoS) engineering approach. Thereby an analysis of a SoS of EMS simulation systems is performed, identifying weaknesses in the used approach (High Level Architecture) and giving suggestions about emergency management SoS requirements.

Finally, the paper of Ladislav Novk et al. (11) describes high level statistical methods for risk assessment of industrial processes risks. It also shows how these methods can be combined with other mathematical theories in case of statistical data lack.

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