Concept for Intelligent Integrated System for Crisis Management

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ABSTRACT

In this document, we describe the need for providing a uniform common picture that is missing in several crisis management decision support tools. Through research, we have reviewed some existing crisis management support systems in use and noted key user requirements that these tools are missing. A significant point of this research is to stress the importance of developing a decision support system that would improve the way an ideal support system would collect, analyze and disseminate necessary information to a crisis management decision maker. We also note the importance of ensuring that such a tool presents information to its user over a user friendly interface. The structure thus developed should be a standalone application that could be incorporated into existing platforms (Rinkineva, 2004) such as cell phones, PDAs and laptops.

Keywords

Intelligent Visualization, Intelligent Decision Support, Crisis Management Support, Usability of Information Systems.

INTRODUCTION

Time and again in our daily lives, we experience news of people who have lost their lives or property as a result of a natural or a man made catastrophes. The extents of such crises vary extensively from those that cause a small public scare, to those that create unprecedented destruction of resources and uncountable loss of lives as was seen with the Tsunami or the hurricane Katrina; and the most recent example is the earthquake that struck in Haiti. Crisis management is important in the mitigation of such unexpected occurrences.

There are many systems that have been developed or are still being developed to facilitate crisis management support for communication and decision making. In this paper, we examine some crisis management tools' effectiveness in assisting crisis decision makers with the provision of timely information that would enhance effective management of a crisis. We also provide an argument for a crisis management support system that would provide a uniform interface across multiple user applications (Li and Wang, 2009) to allow for its wide use. Most crisis scenarios always involve chaotic scenes that require communication and decisions to be made quickly (Hallberg and Jungert, 2009).A structured knowledge based decision support system for crisis handling (Andrienko and Andrienko 2007) is needed to assist in such scenarios where the crisis management personnel are under immense pressure to provide guidance in handling an abnormal situation.

Fink(Fink, 1984) classifies the life cycle of a crisis into four stages that describe the life cycle of a crisis; Prodromal, Crisis Breakout, Chronic and Resolution. The earliest symptoms of a crisis occur at the Prodromal stage. If the evidence of an early crisis warning is not resolved, then the crisis gets to the Breakout stage. Continued failure to tackle the crisis at the breakout stage results into a chronic situation; therefore the earlier a crisis is resolved, the lesser the damages that will be experienced.

Reviewing Statement: This paper represents work in progress, an issue for discussion, a case study, best practice or other matters of interest and has been reviewed for clarity, relevance and significance.

METHODOLOGY

Based on literature survey the generic user requirements for an integrated crisis management system were identified. Some existing systems that are currently used in different countries were selected. The evaluation of each existing system's capabilities against the requirements that were identified was then carried out. An assumption that a partially met user requirement was to be considered as completely not met for tabulation convenience was made.

Background Information of some existing models

Both the Geoconference and GeoChat tools were selected since the use of Geogoraphic Information Systems (GIS) was witnessed in the aftermath of disasters such as Hurricane Katrina and the September 11 terrorist attacks in New York (Kevany, 2003). WIS (Web based Information System) and CATS Aims are used in Sweden for emergency preparation and planning in local Swedish institutions. Finally, Microsoft Vine is currently under development and testing in the U.S. and could be deployed to other regions in the future.

WIS (Web-based Information System)

WIS was developed by the Swedish Emergency Management Agency (SEMA) as web-based crisis management software[1]. It is used by crisis management personnel to share information before, during and after a crisis has happened. The goal of the software (WIS) is for it to be used by government agencies such as country councils and municipalities to create a situational assessment in emergencies through active sharing of data[2].

GeoChat

GeoChat[3] is developed by California based InSTEDD[4] (Innovative Support to Emergencies Diseases and Disasters) company. It is a flexible open source group communications technology that lets crisis management team members interact with each other while maintaining shared geospatial awareness over multiple platforms, or networks through SMS, email, or map surface using a web browser. Most of the mobile networks globally have support for GeoChat SMS services[5].

Geoconference

GeoConference is developed by TGIS Technologies Inc[6] and owned by the PCI Geomatics of Ontario Canada. The Geoconference tool is a client-server, web based application that consists of a shared and synchronized workspace (maps and imagery) that can be accessed in real time. Conceptually the workspace has a background map of layers from a variety of sources and a foreground containing pointers controlled by session participants. Through web based collaboration Geoconference can greatly improve coordination during an emergency situation. In the year 2009 Swedish Civil Contingencies Agency[7] made a decision to use GeoConference software to assist with their emergency preparation and planning thus expanding its use outside Canada.

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[1] http://www.krisberedskapsmyndigheten.se/templates/EntryPage____5722.aspx

[2] http://www.krisberedskapsmyndigheten.se/upload/17309/wis_maj-2008_eng_faktablad.pdf

[3] http://geochathelp.com/doku.php

[4] http://instedd.org/

[5] http://geochathelp.com/doku.php?id=faq:coverage

[6] http://www.pcigeomatics.com/

[7] http://www.gpsworld.com/gis/government-military/news/swedish-civil-contingencies-agency-selects-pci-geomatics039-geospatial-

Microsoft Vine

Vine is developed by Microsoft[8] and requires a dashboard application download from the web that is logged into through a windows live account. The goal of Microsoft Vine is to improve the crisis management of disasters through better communication. Vine's interface takes the form of a map; Figure 1. Where geo tagged notifications pops up if a new story or public safety announcement sourced from 20000 news sources as well as the National Oceanic and Atmospheric Administration (NOAA) happens in a specific location. Microsoft vine operates through three forms of communications; emails, cell phone text messages' and alerts that are sent and received through Vine's client software.

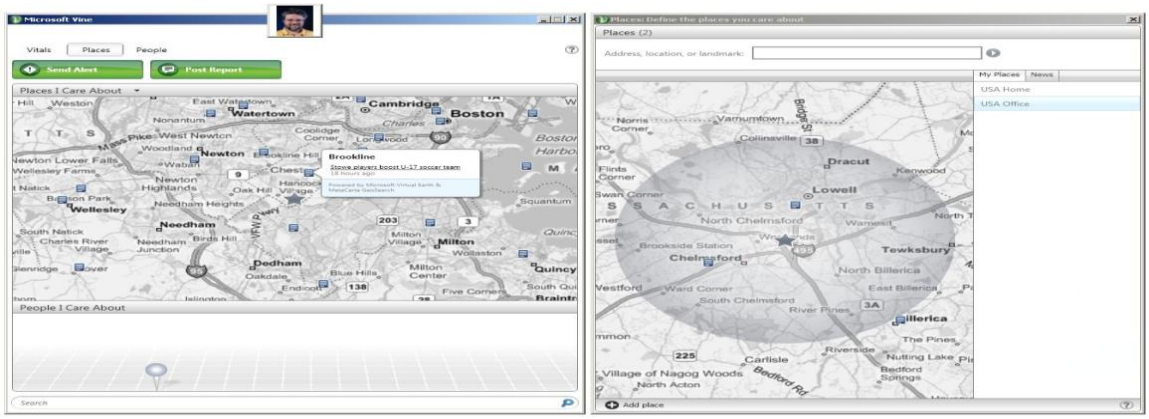

Figure 1. Microsoft Vine web-client Interface

CATS Aims (Adaptive Integrated Management Systems) [9]

CATS is a disaster relief planning, training and operational support system that provides an automated tool for first responders and emergency management to prepare and respond to a disaster. It is developed in Sweden by BAE Systems; one of the leading military products manufactures.

System evaluation

The evaluation of the crisis management support systems against user requirements (Bautavicius and Lee, 2007) in the crisis management circle are shown in Table 1. The software tools were reviewed based on their ability to:

- Support smooth collection and recording of incident information by the users.
- Use stored information to generate probable scenarios that would result from a crisis situation.
- Pre load typical crisis issues and corresponding appropriate actions used to handle crisis situations of similar nature.
- Support the tracking of event progress.

User Requirements	Geo conference	WIS	Microsoft Vine	CATS Aims	Geo Chat
1. Can the system be used with other portable devices and support communication between users? 2. Is the system designed for use in a distributed environment? 3. Is training on using features, description of fields and how each function works readily available to users? 4. Does the system have predefined facilities and interfaces to allow input of data by users?	**1,3**	**1,3,4**	**1,2**	**2,3**	**1,2,3**

[8] http://www.vine.net/default.aspx

[9] http://www.baesystems.com/ProductsServices/bae_prod_cits_aims.html

User Requirements	Geo conference	WIS	Microsoft Vine	CATS Aims	Geo Chat
1. Can the system generate suggestions for the user to develop based on a user query? 2. Does the product use a widely recognized information collecting source? 3. Does the system provide instructions on how to generate queries of different scenarios? 4. Does the system provide a pre defined interface to allow addition of custom routines by the user?	**2,3**	**2**	**2,3**	**1,2,3**	**2,3,4**
1. Can the product visualize data according to actor roles and provide correct information. 2. Does the system summarize procedures according to various scenarios described by user? 3. Are tools to create custom reports available on the system? 4. Can the product be used with common Operating Systems, networks, disk storage, cell phones etc?	**1,3**	**3,4**	**3,4,6**	**1,2**	**2,4**
1. Can a user record work progress in the system? 2. Does the system track actor actions and produce reports for review. 3.Does the system provide automatic information source update 4. Is there a consistent user interface amongst a wide range of users for the product?	**3,4**	**1,3,4**	**3**	**4**	**3,4**

Table 1. System evaluation against defined user requirements

Key:

- The values 1, 2, 3, 4. Represent a specific system requirement a systems should meet.

Since almost all of the systems evaluated here meet the listed user requirements partially, a clear need exists for the development of a better crisis management support system that would incorporate more user requirements to assist crisis management personnel in their duties.

Vision for a decision support system

The goal of the planned support system's intelligent visualization is to provide a user with the information that is necessary for rapid perception and proper understanding of a task to be undertaken (Andrienko 2008). An Actor as seen in Figure 2, refers to the crisis management personnel who are responsible for the implementation of directives of the Decision Maker (User) during a crisis. In Sweden, an example of an actor would be the municipality and county council administrative staff, the police force or the fire department.

The expert systems A, B, or C will collect scenario information from a crisis incident and provide input data (Asplaugh and Anton, 2008) for the Decision Support System Interface (DSSI).The support system then generates a report based on the information requested by the User. If the system meets specific user requirements as expected, then it will be able to help crisis management decision makers to obtain and send the correct messages to the various actors. The structure we plan to develop aims to improve the coordination of information collected from the expert systems and the information presented to the User.

We are currently working on a clear graphical representation (Mackinlay 1986) of the envisioned system design. A description for each behavior expected from an individual concept will be developed and modeled into a use case. Quality scenario and use cases development will communicate clear user needs from the system to be developed. The design process will gain a clear understanding of what is required (Asplaugh and Anton, 2008) by the users of the system. We then plan to develop a scenario structure that will show mutual relations of the parts that determine the whole meta-model. During the design phase we will construct a shared event diagram

to show the extent to which specific events are shared. This extra information will help analysis make better and quicker decisions while creating an episode. The scenario context diagrams will make explicit the temporal relationships between scenarios. Initially inadequate scenarios will have their quality improved to the level where satisfactory software could be developed (Asplaugh and Anton, 2008). We plan to demonstrate how the expert system would handle a single scenario.

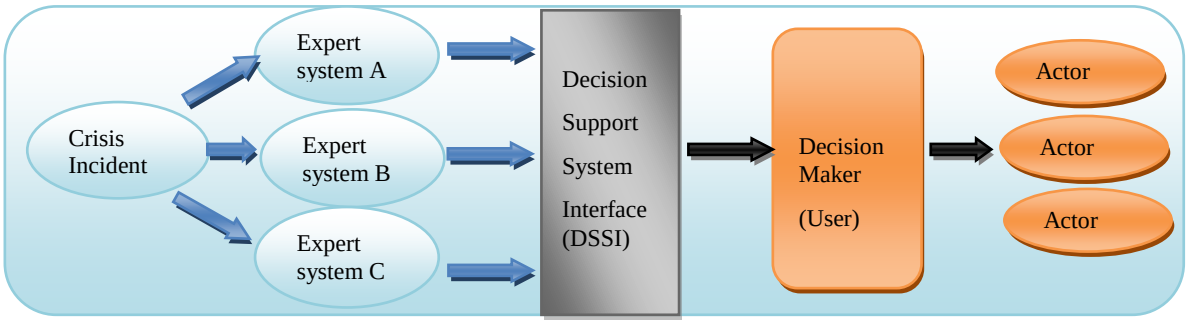

Figure 2. Support System Diagram

CONCLUSION

From our study we see the need of developing a structure for a completely new crisis management software tool. An integrated, intelligent system that is modeled to address specific user requirements will greatly improve the crisis management process. A stand alone prototype that could be incorporated into already existing and widely used applications such as cell phones, PDAs and laptops would improve the response of civilian population when a crisis occurs. Currently most crisis management tools are only available to government authorities or local community administration personnel. A tool providing a user friendly graphical interface that ordinary civilians can access would improve response to a crisis in terms of communication from the decision maker to the Actors.

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