A Dialog Action Manager for automatic crisis management

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ABSTRACT

This paper presents the results of our research on the development of a Dialog Action Manager – DAM as part of a complex crisis management system. Imagine the utility of such an automatic system to detect the crisis and to provide support to people in contexts similar to what happened recently at the underground in London and Madrid. Preventing and handling the scenarios of terrorism and other crisis are nowadays maybe the most important issues for a modern and safe society. In order to automate the crisis support, DAM simulates the behavior of an employee at the crisis centre handling telephone calls from human observers. Firstly, the system has to mimic the natural support for the paradigm '*do you hear me?*' and next for the paradigm '*do you understand me?*'. The people witnessing the crisis event as well as human experts provide reports and expertise according to their observations and knowledge on the crisis. The system knowledge and the data communication follow the XML format specifications. The system is centered on the results of our previous work on creating a user-centered multimodal reporting tool that works on mobile devices. In our paper we describe the mechanisms for creating an automatic DAM system that is able to analyze the user messages, to identify and track the crisis contexts, to support dialogs for crisis information disambiguation and to generate feedback in the form of advice to the users. The reasoning is done by using a data frame and rule based system architecture and an alternative Bayesian Network approach. In the paper we also present a series of experiments we have attempted in our endeavor to correctly identify natural solutions for the crisis situations.

Keywords

Dialog Action Manager, Crisis Management, Reasoning.

INTRODUCTION

Observations play an important role for the accurate determination of the real context for any crisis event. The human witnesses located at the crisis are able to make reports based on their observations. Nowadays the unique system 112 is able to receive and store the reports from the people accessing the service and further on to help qualified personnel take the most appropriate actions for solving the crisis case. However, the 112 service relies on the effective contribution of humans to communicate to the reporting person over the phone, to store and classify the data and to send official instructions to the specialized personnel such as police, ambulance and fire brigade.

On the other hand, automated systems may be able to collect the data provided by various observers and process it to create the context awareness of the crisis management system. The functionality of such a system has specific requirements such as extracting the meaningful information and interpreting the incoming data, tracking the crisis event in time given the evidence and generating support for the users in terms of advice and action. The users are equipped with mobile devices that run parts of the complex crisis management application. During the work on a crisis event, the system should keep contact with the users so as to provide help and ask for more, detailed information related to their perception on the crisis.

In contrast to systems that rely on information gathered from sensors, human observation already includes semantic interpretation. A smoke sensor will set an alarm in case smoke has been sensed. A human observation provides a report about the smoke in the case this smoke is related to a dangerous situation/crisis situation.

Human observation is composed of concepts. Humans are able to express concepts by words, icons, schematic drawings etc. In previous work [3] we have designed a tool for multimodal reporting. The user is free to use some modalities or a combination. The way the user decides to make use of the modalities supported by the user interface depends of each situation. While accessing the device interface, people usually use their hands. However, sometimes in case of overload or miscommunication or in the context people speak different languages a multimodal related way of communication is more appropriate.

A research question aims at answering the question on how the system should manage dialogs with the human observers, how the data should be stored, processed and generated. The working scenario assumes a very dynamic context in which the users possibly speak different languages. Moreover, seldom is the case that the users are themselves well organized. In such a case, the system receives only pieces of information that sometimes contradict each other in terms of the meaning they carry. Solving the ambiguity is an important issue to ensure for a correct functioning of the crisis management system. Part of these problems regarding the automatic processing of the user reports and the feedback the system has to generate back to the real world, are to be solved by the DAM - Dialog Action Manager component. The first task of the DAM is to sustain a natural communication between the human observers and the system.

Figure 1. IconMap reporting tool

The contribution of this paper is the introduction of a technology that stands for a replacement of the human for an equivalent 112 service. The major tasks are to interpret and classify the user reports and to generate the support to all the human participants. In our endeavor, we have used the previous work [3] we had done on the realization of a system for crisis management to help collect the user input and to facilitate the communication among users (Figure 1). The user interface accommodates various multimodal types of inputs consisting of icons, text, drawing and photos. This is possible by making use of the hardware capabilities of the mobile device of the user. The user can select icons from the icon list on the left side of the application and create icon sequences to represent their knowledge about the crisis events. Each icon sequence is linked to an event that takes place at a certain location on the map. The entire mechanism of processing the user reports is based on the map-wise representation of concepts and events. The user interface has the ability to group the icons in categories by selectively presenting them in an order that depends on the working context. The multimodal interface helps the user to formulate the icon-based input by anticipating the most probable icons to be selected at a certain moment of time. The text is another type of input the user can make use of in order to make crisis reports. The user interface has special visual components that support the dialog among users. A text icon allows for storing the text-formatted data along with regular icon sequences. The user interface provides tools also for the pen input. The multimodal support for the system makes sure the users are able to use the type of input they like or they need.

RELATED WORK

The work of [7] describes a system for routing people outside a dangerous area using a personalized dynamic routing algorithm in case of emergency. The architecture is based on the support provided by mobile agents. Each human user is supervised by a specialized agent that learns the behavioral peculiarities of its human counterpart. The interface of the system uses a set of graphical iconic representations that allows the user to provide his input accordingly. The research in [13] presents the use of an icon language for describing crisis situations and its integration with blackboards in MANETs [1]. The work of [3] investigates the use of the emerging computing model of Dynamic Data-Driven Applications Systems as base for the emergency medical treatment decisions in response to a crisis. By linking real-time sensors, procedural and geographic data, the system manages to produce decision support at the site of the incident, at local centers and at the central point of coordination. The work of [7] tackles the issues that rise from the integration of an intelligent agent software robot into a crisis communication portal for sending news alerts on mobile devices. The research described in [17] proposes a distributed multi-agent architecture for crisis response management and presents solutions for providing the necessary support. The work presented in [14] provides a classification of artificial coordination strategies in terms of skill, rule and knowledge. The research is applied in a case study of medical personnel for casualty allocation in the crisis response domain. The conclusions reflect the trade-off between efficiency and flexibility indicating the strategies of knowledge-level coordination as the most effective, and skill-level as the most efficient. The change of operational requirements can be optimally handled through the knowledge-level strategies as opposed to the performance of skill-level strategies in such context.

The paper [16] presents a variation of the Partially observable Markov decision processes (POMDPs) called Hidden Information State (HIS) model and shows the performance of the algorithm for an tourist information application.

A dialog management model based on finite state automata for determining the confidence on the user's identity is presented in paper [8]. The approach uses a Bayesian network for fusing information from different channels such as face, image and speech. An objective function is maximized by dynamically changing the model weights so as to identify the shortest path from the initial state to the goal state.

The work of [9] addresses the requirements of disaster relief operations and proposes a solution based on an extension of the existing Belief-Desire-Intention BDI model having the capability of situation awareness. The work of [12] describes a general language-centric framework for multimodal human-machine interaction. The major capability of the approach is the algorithm for fusing multimodal information streams using agents. A special type of agent has been developed to deal with anaphora during the regular human-system interaction sessions. In the paper [4] the authors propose a Bayesian approach for the handling the user model and the dialog manager policy for a more natural human communication with a robotic wheelchair. The result is a robust dialog manager that is capable of learning from interaction data and that achieves better results than the hand-coded model version in a simulation environment.

MODEL

Our DAM simulates the behavior of an employee in a crisis centre handling telephone calls coming from the direct observers. The automated system follows the steps any human observer performs in figuring out what is going on at the site of the crisis. The first task is to receive, store and analyze the incoming messages from the users. If necessary, additional info, new info, etc. are requested so as to obtain complete, unambiguous information.

The system has a repository of data and scripts that are used for handling various crisis contexts. The initial data represent the 'world knowledge' of the system and consists of information about roads, buildings and public facilities. The scripts represent sets of rules to be used during the analysis and decision stages. They are based on logical relationships among entities considered to be of an interest in crisis domain.

In order to run the analysis, the system determines the relevant scripts (frames or Bayesian Networks, as it will be detailed further on) and extracts the semantics from each user message.

The Dialog Action Manager (Figure 2) includes an incoming report filtering component. The first task of the message filtering component is to determine whether the newly arrived report is related to any of the crisis events the system already handles. In order to do that, the Dialog Action Manager parses the newly received report and decides if the information regarding the observation has relevance in any of the known crisis contexts the system knows about. In this way any new message is analyzed and included in the group of messages being associated to the same crisis event.

In the case of semantically contradictory incoming reports, new scripts are selected from the system repository for efficiently matching with the requirements of the dynamic context. If no script is available, the system generates dialog sessions during which more information regarding the crisis is required. A crisis event may be seen as a dynamic and complex phenomenon that develops over time. In order to generate an as accurate as possible representation of the crisis context, the Dialog Action Manager has to perform a tracking of the crisis event on a time basis.

All the incoming reports that are sent by the observers in the field are initially processed and interpreted according to their characteristics.

The parsing of user messages it is important that the string of concepts (represented by words, icons, drawings etc.) has a previously assigned time stamp. To understand a message, we consider it as a string of concepts and not as a picture of related concepts.

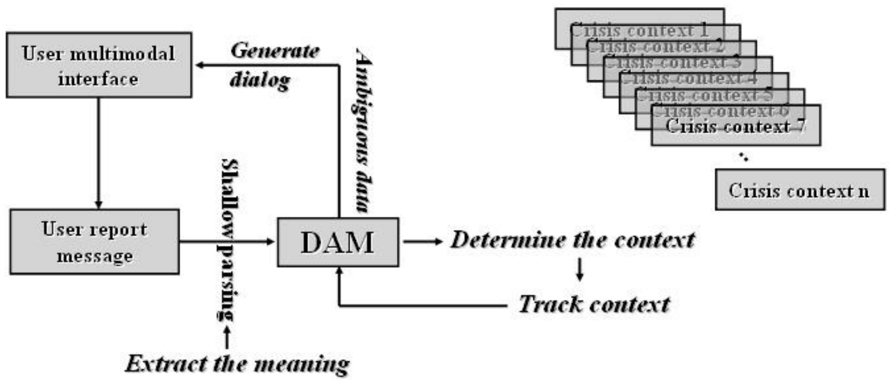

Figure 2. The diagram of the Dialog Action Manager in the context of handling the crisis events based on user inputs

Multimodal User Interface

The architecture of the system is centralized, and allows for the integration with the central crisis control room. The DAM component supports user profiling. As part of this procedure, the system keeps track of the accuracy of the user reports and assigns confidence weights to each report received. This information is used for estimating the elements of the crisis context. The input of the system is multimodal. The user can access the interface of the automated system using icon sequence, text, pen input and photos taken using his/her mobile device.

As depicted in Figure 1, the user has access to an interface which is based on multiple types of inputs. The user can make use of icons, text, pen input and photos. The components of the interface are working in conjunction with street maps and are time-labeled. The maps include streets, crossings, houses etc. and are all defined using XML format. The concepts are placed on the map. The relations among the maps and the concepts are clearly defined. For instance, an icon illustrating a victim that is placed on a road crossing means that the victim has been observed lying on the ground at the crossing area.

The user interface is designed so as to allow the user to provide the input regarding the observation on the crisis event. At the same time, the interface can present the system feedback back to the user and so to complete the full human-system interaction cycle.

Information Fusion

We envisage the architecture of the Dialog Action Manager as a multi step process. Just like in the case of dialogues between humans, at the first step we propose integrated solutions for handling the paradigm “do you hear me?”. Secondly, we introduce algorithms to sustain the functionality behind the paradigm “do you understand me?”. Consequently, the DAM first parses each message and the message should be grammatically correct with no missing info, no impossible relations etc. Then, after some interaction the DAM tries to understand the message, so it tries to find the relevant crisis context.

In our approach, we have used XML specification for representing the concepts from different modalities in one uniform language. The concepts that can be represented by words, icons, drawings etc. have been defined in XML. In our approach we don't consider or support other ways of communication.

The semantic meaning of geometric symbols is also well defined. If, for instance, somebody draws a circle somewhere on the map, the person wants to focus the attention to the area represented in the inner part of the circle. Moreover, if an arrow drawn on the map relates two existing objects on the map area, the user wants to indicate a causal relation between two objects. The XML defines the semantic interpretation of a message including an observation.

The incoming data provided by the users is parsed by the crisis management application. Firstly the reports are segmented in relevant informational clusters. Secondly, the clusters are linked to crisis events.

The automatic crisis management system makes use of two types of data. The first is the static data base of facts and action rules that constitute the initial knowledge of the system. The second type of data is the knowledge acquired during the regular working sessions, while solving various crises. A special tool (Figure 3) has been developed for creating the static database. The knowledge of the system is build and stored in a XML file that has the XML schema.

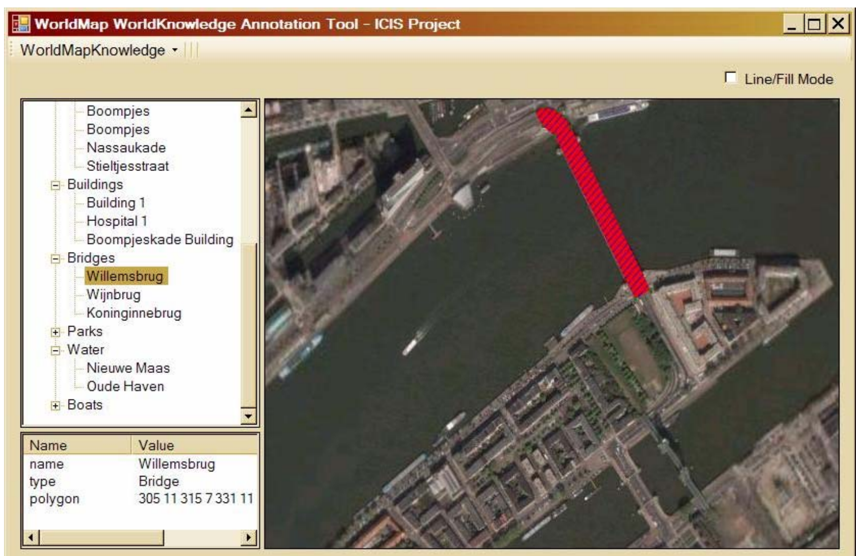

Figure 3. World knowledge annotation tool

Given a set of rules, the dialog between a user and the system follows a distinct path. The scope of the dialog also depends on the information the user provided already and on what the system knows about the crisis. For instance, in Figure 4 the user has just sent a report following his observation according to which there is smoke somewhere, in the town. The system allocates a new crisis data handler for the new crisis context and tries to fill in as many information as possible from the local observers. Consequently, the Dialog Action Manager asks the user if he/she can see any victims. If the response of the user is positive, the crisis management system will take special action and formulate specific advice to the rest of the users. The rule-based system makes use of a set of rules that are defined following a series of experiments on which subjects were asked to play the role of the specialized personnel counterparts that normally work on such cases.

As soon as one user provided information regarding a crisis and the system associated the report with a new crisis context, the information becomes available also to the users that will subsequently access the system.

Figure 4. IconMap tool (left) and the feedback generated by the Dialog Action Manager

Semantic interpretation/dialogues

Human beings understand a message about a crisis event because the string of concepts triggers similar situations in their memory. To imitate this mechanism of the humans, we have designed scripts of probable crisis situations, which we want to be recognized by the automatic system. We represent the system knowledge in two ways.

Firstly, we use data frames that contain labels to describe the situations. The labels are represented by concepts that may be or not directly observable. For instance, in the example of traffic accidents, the probable concepts are: cars, bicycles, people, victims, policemen/cars, firemen/cars etc.

Secondly, we have focused on Bayesian networks as a more appropriate way to represent the system knowledge. According to the methodology, the concepts are to be represented by a graph for which the nodes are the concepts and the links are the relations. By introducing weighting measures, some links are able to get stronger then others. The great advantage of the approach is that the presence of some concepts has an impact on the probability of occurrence of others. For example, a man and a woman may be related and the relation is changing in the case one of them holds a gun directing to the other. An example of a Bayesian Network is illustrated in Figure 5. The concepts used in the example are: *bomb*, *victim*, *running people*, *ambulance*, *police car*, *fire*, *smoke* and *terrorist attack*. The relations reflect dependencies among elements pointing to interactions modeled from real crisis environments. One of the major problems we have faced during the design of the reasoning under uncertainty by using Bayesian Networks is the sparse nature of the data. In case of BN we have computed the Conditional Probability Tables (CPT's). Usually a corpus is created based on logged dialogue sessions. Such a corpus helps at the determination of an accurate CPT's. In our case most of the CPT's are set by experts. The final Bayesian Networks have been subsequently tested in the experiments focusing on train scenarios, as presented in the next section.

The world knowledge of the crisis system is designed based on different scripts and concepts. Moreover, certain relations are defined for the specific scripts. A disadvantage of our approach is that we consider only a limited number of scripts and a prior detailed design of those scripts is necessary for the system to work. For the current research, we have developed the limited set of scripts based on our study at the crisis centre in the Netherlands [1]. Similarly, the people at the emergency centre consider only those situations they know from the past or from trainings. In previous work [10] we considered crisis situations in trains, bombing (abandoned luggage), aggressive behavior etc. We designed scripts and frames and Bayesian Networks for 25 situations. Next, we asked stand up comedians to play those situations and we collected video recordings. And as a last step, we asked students to consider themselves as passengers in the train and to use PDAs' and phones to report about what they observe in each situation. The functionality of the Dialog Action Manager assumes the initial centralization and preprocessing of incoming messages from the users. The next step is the semantic interpretation of the data the system acquired. If, following the analysis, the DAM decides there are messages that present incompleteness, ambiguous or contradictory information then specific user-system dialogs are generated as feedback. The system tries to reduce the informational inconsistency by requesting additional information so as to obtain clarification or completeness.

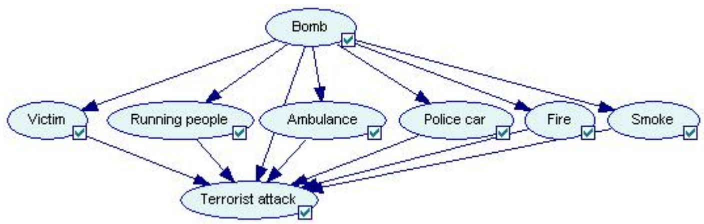

Figure 5. Example of a Bayesian Network used for handling crisis scenarios

The rule-based system assumes the use of data frames that include slots pointing to informational elements contained in the ontology of the system. The slot elements represent data whose levels of abstraction range from the input data level to the high semantic level. Mostly data at high level of abstraction is used to describe specific states or properties of elements as well as the dynamics of a complex crisis context.

```
…
IF (STATE(USER(DIALOG.userID))  IS OPEN_FOR_DIALOG) AND (CRISIS_EVENT.HAS_VICTIMS IS NOT(KNOWN))
        THEN MAKE_DIALOG(ASK_USER(userID+", are there victims?");
…
IF (STATE(USER(DIALOG.userID))  IS OPEN_FOR_DIALOG) AND
        (CRISIS_EVENT.HAS_VICTIMS AND (CRISIS_EVENT.STATE_VICTIMS IS NOT(KNOWN)))
                THEN MAKE_DIALOG(ASK_USER(userID+", what is the state of the victims?"));
…
IF (STATE(USER(DIALOG.userID)) IS OPEN_FOR_DIALOG) AND
        (CRISIS_EVENT.HAS_VICTIMS IS KNOWN) AND (CRISIS_EVENT.STATE_VICTIMS IS KNOWN)
                THEN MAKE_DIALOG(ASK_USER(userID+", what is the cause of the crisis?"));
…
```

Listing 1. Example of IF-THEN rules for managing a human-system dialog

Listing 1 and Listing 2 depict examples on how sets of rules can be used to make dialogs and to take actions strictly depending on the state and the dynamics of the crisis contexts. According to the rules in listing 3, the ambulance is send to the spot of crisis in the case there are victims and their state is unknown or uncertain. The state of a concept is assumed to be uncertain when the case regarding the concept has not been solved (e.g. the victims/fire have not been handled yet by specialized services). The third rule of the example in listing 3 presents the case of sending the fire brigade to the crisis scene when there are still spots of fire. The fifth example shows the rule for sending fire brigade when there are trapped people at the crisis spot. An interesting example is the fourth rule. It makes use of the information the system has related to the gas reported by the witnesses and acts for the prevention against the extension or the occurrence of other fire spots at the scene of crisis.

In the case of user text inputs DAM recognizes keywords by applying a shallow parsing. During the process, the system assigns values to elements in data frames according to the encountered keywords. The keyword check also takes into account synonyms by using WordNet lexical database [3].

```
...
IF CRISIS_EVENT.HAS_VICTIMS AND
        (CRISIS_EVENT.STATE_VICTIMS IS NOT(KNOWN) OR CRISIS_EVENT.STATE_VICTIMS IS UNCERTAIN)
                THEN TAKE_ACTION(CRISIS_EVENT,SEND_AMBULANCE);
...
IF CRISIS_EVENT.STATE_POLICE IS NOT(KNOWN) OR (CRISIS_EVENT.STATE_POLICE IS KNOWN AND
        CRISIS_EVENT.STATE_POLICE IS REQUIRED AND CRISIS_EVENT.STATE_POLICE IS NOT_PRESENT)
                THEN TAKE_ACTION(CRISIS_EVENT,SEND_POLICE);
...
IF CRISIS_EVENT.HAS_FIRE AND (CRISIS_EVENT.STATE_FIRE IS NOT(KNOWN) OR
        (CRISIS_EVENT.STATE_FIRE IS KNOWN AND CRISIS_EVENT.STATE_FIRE IS UNCERTAIN))
                THEN TAKE_ACTION(CRISIS_EVENT,SEND_FIREBRIGADE);

IF CRISIS_EVENT.HAS_GAS AND (CRISIS_EVENT.STATE_GAS IS INFLAMABLE) AND (CRISIS_EVENT.STATE_GAS IS UNCERTAIN)
                THEN TAKE_ACTION(CRISIS_EVENT,SEND_FIREBRIGADE);

IF CRISIS_EVENT.HAS_VICTIMS AND
        (CRISIS_EVENT.STATE_VICTIMS IS TRAPPED) AND (CRISIS_EVENT. STATE_VICTIMS IS UNCERTAIN)
                THEN TAKE_ACTION(CRISIS_EVENT,SEND_FIREBRIGADE);
...
```

Listing 2. Example of IF-THEN rules for generating the system response as support in crisis situations

The newly received messages are subsequently processed by the DAM in order to determine the relevant crisis context which would best match to the current data in the user report. In the case there is no candidate context DAM waits for additional information to be extracted from new incoming messages. That can be achieved by creating a dialog with the user for asking for more precise information or by processing messages sent by other users that regard the same crisis event.

The message manipulation procedure implies that DAM sorts the incoming user reports based on similar keywords, attempts an extensive analysis and eventually stores the data in a Blackboard system. The Blackboard system has the role of administering the messages namely to remove the old messages and the replace and to combine the previous messages given specific criteria. As soon as an observation report has been associated with a crisis context, the Dialog Action Manager tries to determine the semantics represented by the content of the report. Given an already known crisis context, the new crisis report might bring new evidence to support the current hypothesis the system previously generated, according to the dynamics of the crisis event. On the contrary, in some other cases the incoming report might provide useful information that would imply decreasing the probability of occurrence for some of the previously generated hypothesis.

The novelty that the use of a Dialog Action Manager brings to the functionality of the crisis management system is represented by the higher efficacy in automatically handling the information related to the crisis events. More specifically, given a certain crisis context, the system is able to refine the knowledge it has by further generating proper dialogs with the users. In most of the cases, the users are the physical observers which are located in the area containing the crisis. Additionally, the system can facilitate the intervention of human experts during the process of determining the meaning of user reports and during the process of taking decisions regarding the actions to be taken. The experts may be located at the central control room, in the crisis field or elsewhere. The special personnel of the fire brigade, ambulance and police is considered to have a higher degree of expertise and so their reports are handled by the system as having higher confidence weights.

RESULTS

All the observations coming from the field are stored and tracked. The system attempts to classify the crisis event as being one of the standard crisis scenarios from the system repository. At this level the solution for removing the ambiguity on different crisis scenarios is solved by employing the description and properties of each crisis context that are available in the repository as system knowledge. The classification represents a continuous process updating the event properties as soon as new evidence is made available by the system reasoning. According to the description of the current recognized crisis context, the system is able to generate feedback to the users in the form of support for distinct actions. All the user reports are collected and processed in an automatic manner. Human experts can also access the preliminary information of such automatic modules of the crisis system and can finally make adjustments on particular parameters of the results. This stands for the highest layer at which the ambiguity in partial, user observations can be decreased.

We have conducted a series of experiments for determining the basic elements of the user report that naturally trigger specific assumptions regarding a crisis context. For the experiments we have started by reusing the scenarios and results of the previous research [10] we have conducted for automatically detecting the aggression (in the trains) and the abounded luggage (on the train station) in the Netherlands. In both cases we defined scripts, made recordings of the scripts acted by standup comedians/students and analyzed the scripts. Finally students were requested to view the video and behave as train passengers and send messages based on their observation.

The users were presented different crisis contexts and they were allowed to send reports by using the multimodal *IconMap* reporting tool we have developed. The goal was to collect all the reports, to analyze them and to further generate the ontology for the crisis management system. The entire rule-based reasoning mechanism is based on the data frame information structuring paradigm. The frames contain attributes representing the main elements in the crisis ontology. Additionally, the development of the Bayesian Network probabilistic models has been tackled for modeling the informational uncertainty that is typical in such situations.

The second experiment has been set to analyze the way the humans evaluate a crisis context. The aim was to efficiently derive sets of rules which would help in automatically assessing the crisis events based on the reports the users provide, following the observation of the crisis.

The third experiment we have conducted has had the goal to identify guidelines in the process of taking decisions for specific crisis situations. The subjects were presented various scenarios implying certain crisis situations. Given a specific crisis context, they had to choose what they thought is the best action to be taken, as part of the plan to completely solve the crisis case. For instance, if, according to the evaluation performed by the system, there is fire or smoke, a plausible action is to advice for calling the fire brigade. This advice is directly targeted to the personnel in the crisis control unit. It represents the result of the automatic reasoning system and is considered to be at the highest level of abstraction. The final decision of what to be done is of the human personnel at the crisis control unit. Part of the decisions generated automatically for each crisis context, are also used as support for the advice for the civilians located at the field of crisis. The Dialog Action Manager is used to update the system knowledge on the crisis by sustaining individual dialogs with the system users and by analyzing the user feedback for each separate dialog.

The last experiment we have conducted implied the measurement of the quality and the performance of the Dialog Action Manager. The idea was to engage the subjects in crisis working sessions and to record the human-computer interaction and the working states of the system. The subjects have been later presented the recording and asked to mention what is their impression over the quality of the system functionality. The abovementioned experiments represent ongoing work.

CONCLUSION

In this paper we have presented the partial results of the work on a system for the automatic management of the crisis events, with a focus on the Dialog Action Management component. The system supports a centralized architecture, user profiling, automatic crisis event evaluation, dialog management and support for decisions regarding the most suitable actions to be taken. The reasoning system consists of a rule-based algorithm. We have conducted several experiments for identifying sets of rules to be used in various crisis contexts. One important task of the system is to track each crisis event in time by considering the dynamics and peculiar events according to the incoming reports sent by the human observers. Further work is set on researching the possibility to create des-centralized versions of the algorithm for being used in ad-hoc networks. Furthermore, an extension to the described system is to integrate the reports not only from human observers, but also data generated by networks of sensors, such as gas or fire sensors, automatic facial expression and gesture recognition and other kind of detectors. Another research topic is to investigate the use of other reasoning algorithms. In our approach we have used expert systems and Bayesian Networks. A main focus would be on studying more the algorithms for reasoning in conditions of uncertainty. Such an attempt would be very suitable for an application for crisis management due to the non-deterministic nature of the hypothesis being evaluated. Another interesting idea is to investigate the use of dynamic scripting and competing hypothesis [15] in the way of evaluating various crisis contexts and of taking certain actions. The contribution of the paper to the research community resides in the novelty of the approach for the Dialog Action Management. Ongoing work is set to complete the experiments we have conducted for testing the functionality of the system.

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