

DEVELOPMENT OF INTEGRATED INFORMATION SYSTEM FOR TOTAL DISASTER MANAGEMENT

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ABSTRACT

In this paper, we propose a new system for a successful disaster reduction based on our experiences on real disaster situations. In our opinion, increasing the number of people that can imagine the pre- and post-disaster scenario is the key issue to be addressed in order to effectively reduce the disaster damage. Only by increasing the people's imagination capabilities, they can appropriately prepare measures before a disaster and react during a disaster situation because most of the times this will be their first disaster experience.

It is impossible for the people to be well prepared before the event if they cannot understand what a disaster situation looks like. This includes all society members: politicians, public officials, researchers, mass media people, professionals, general public, etc.

This paper presents the Integrated Information System for Total Disaster Management as a tool to increase the people's disaster situation awareness and to effectively reduce disasters.

1. INTRODUCTION

Based on past experiences of real disaster situations, it is clear that the lack of the ability of people to imagine the disaster situation is one if not the most important issue to address in order to effectively prepare before the disaster and to rightly respond after the event. If people cannot understand what it will be like when an earthquake strikes or there is a terrorist attack and as time goes, it will be difficult for them to take proper actions in case any of these event occurs.

Most of the society members seldom encounter disaster situations. Thus, the accumulation of personal experiences is very difficult. This is true not only for the common public, professionals or mass media people, but also for politicians, public officials, or researchers working in disaster related fields. It is desirable to have a tool, which can help people to learn from other's previous experiences and to assist them to prepare for a disaster.

Recent technological advances allow a very efficient management of data as well as simulation of various situations through powerful computers.

This technology can be applied in the disaster mitigation field to help the people imagine a disaster situation and in this way enhance their actions previous, during and after the event. This technology allows combining not only the existing information of previous disasters but also the latest development of the research community such as structural collapse analysis, fire propagation simulation, human evacuation simulation, etc.

This paper presents the Integrated Information System for Total Disaster Management as an attempt to use the latest technologies of data management for the purpose of disaster reduction.

2. INTEGRATED INFORMATION SYSTEM FOR TOTAL DISASTER MANAGEMENT

The Integrated Information System for Total Disaster Management is a new concept of disaster information management by which the information is organized in a way that enhances its usefulness for disaster reduction. It is composed of four modules: 1) universal disaster environment simulation module, 2) data archive module 3) e-learning module, and 4) Web 3D-GIS module. The first three are functional on the latter one. Figure 1 shows the integration of the four modules of the proposed system.

2.1 Universal Disaster Environment Simulation module

This module, which is a simulation module, combines different numerical techniques for modeling earthquake source mechanism, strong ground motion, structural collapse behavior, human evacuation, fire spreading, disaster response, organizational response, post-event economic situation, etc. It also includes a new generation of disaster manuals and the disaster imagination method, i.e. Meguro Method. Details of each disaster environment may be found elsewhere. Figure 2 shows the Universal Disaster Environment Simulation module components.

2.2 Data Archive module

The second module's purpose is to prepare a disaster information database with a newly proposed format by which the people can easily use the past disaster information. With this module various types of disaster information can be added and the database maintained and controlled. The items included in the system are past disaster investigation reports, interesting photos and videos, newspaper articles and lessons learnt from the past disasters. In addition to these, numerical results obtained with the first module are also included, thus increasing the accuracy of the universal simulation module. This database is permanently updated in a dynamic and interactive ways. Figure 3 shows the Data Archive module.



Figure 1: Integrated Information System for Total Disaster Management



Figure 2: Universal Disaster Environment Simulation module



Figure 3: Data Archive module

2.3 e-learning module

The e-learning module is normally considered a learning system from the user's viewpoint. However, in this case, it is regarded as a data input/collecting system from the system developer's side. With this system, the level of disaster knowledge of the ordinary people can be understood. It is an information interface. With this module, the information that the users generate with the Universal Disaster Simulation Environment module by varying different parameters and performing several analyses can be included in the Data Archive module database.

With the e-learning module, young and old generations can easily access the system due to its user-friendliness. It can be operated by touching the display as shown in Figure 4. Our aim is to use this technique to help the people learn by themselves how a disaster situation is. We are planning to develop simulators in which the user can choose which role he or she wants to play in a disaster scenario and observe the evolution of the situation according to his/her actions.

2.4 Web 3D-GIS module

The Web 3D-GIS module contains urban environment information in spatial and time domains. This system database is always updated and maintained. In this module, we use a 3D-GIS database in which one-by-one structures in an urban area such as Tokyo Metropolitan area in Japan, are inputted. With this system, users can see the urban scene in three

dimensions from different viewpoints such as on the ground and from the air, i.e. bird-eye.



Figure 4: e-learning module

3. CONCLUSIONS

The proposed model combines the most advanced simulation techniques for discussing the various physical and social phenomena related to disasters. The so-constructed database is useful for the crisis or disaster management. It helps to discuss the phenomena for different conditions: time, natural and regional characteristics, disaster mitigation potential level, and social system. With this system, we can increase the experience database using simulated crisis management examples. These examples are educational materials, which help to increase the imagination capability of the crisis situation. Although real crisis situations are the most valuable, in practice they seldom occur. The importance of simulating crisis situations is clear in this context not only as a tool to train people to imagine a real disaster situation but also to train them to properly prepare before the disaster and efficiently react after it. This is the best way to efficiently use the time before the event.

During a real event, inputting the real physical and social conditions to the system can help estimating the disaster situation rapidly with a very high accuracy. This information can be used for proper crisis management or decision-making support. This system can be used in the normal situation as a crisis management education supporting system and at the real disaster situation as a disaster crisis management or response support system. With this system the user's imagination, the current situation understanding and disaster response capabilities can be increased and the effects of disaster

measures done before, during and after the event can be evaluated. The proposed system can efficiently contribute to increase the total disaster management capability of the society.

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