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INTEGRATED INFORMATION SYSTEM FOR TOTAL DISASTER MANAGEMENT

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ABSTRACT: It is impossible for the people to prepare well before a disaster if they cannot understand what a disaster situation looks like. This includes all society members: politicians, public officials, researchers, mass media people, practitioners, the general public, etc. Increasing the number of people who can really 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 the event and react properly during a disaster situation. 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.

Key Words: disaster information system, disaster management, computer simulation, e-learning, data archive, GIS

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 of the most important issues to address in order to effectively prepare before the disaster and to rightly respond during and after the event. If people cannot understand what it will be like when an earthquake strikes or terrorists attack and as time goes, it will be difficult for them to take proper actions in case any of these events occur.

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, practitioners 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 to imagine a disaster situation and to 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 by 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.

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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 last one. Figure 1 shows the integration of the four modules of the proposed system.

Figure 1. Integrated Information System for Total Disaster Management

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, management 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. The input parameters for the simulations can be obtained from the Data Archive and E-learning modules. Figure 2 shows the Universal Disaster Environment Simulation module components.

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 can be maintained and controlled. The items included in the system are past disaster investigation reports, photos and videos, newspaper articles, lessons learnt from the past disasters, etc. In addition to these, numerical results obtained with the first module using various parameters and other data collected through the E-learning system are also included, thus increasing the database quality and size.

This database is permanently updated in dynamic and interactive ways. Figure 3 shows some of the components of the Data Archive module.

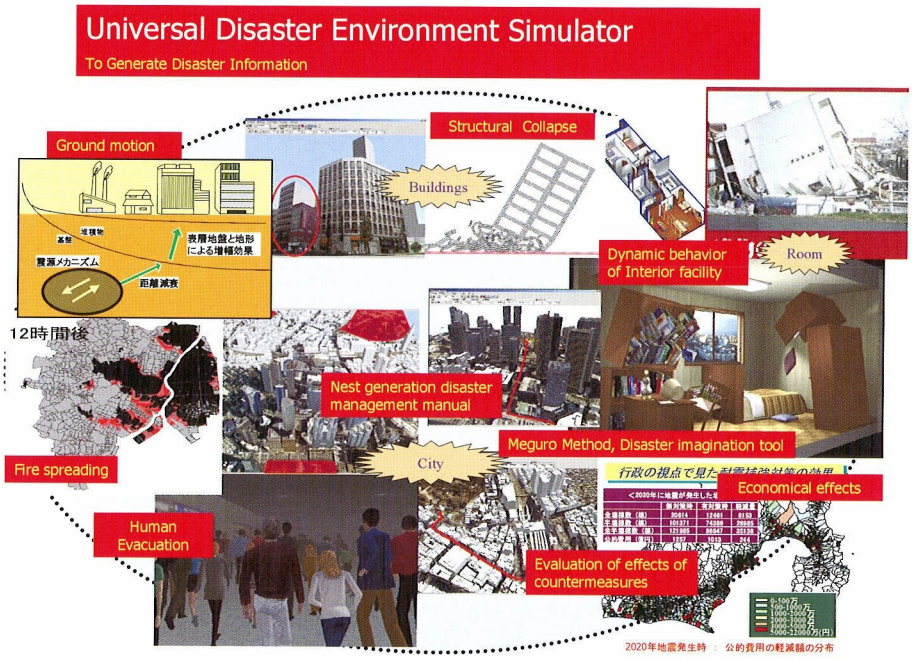

Figure 2. Universal Disaster Environment Simulation module

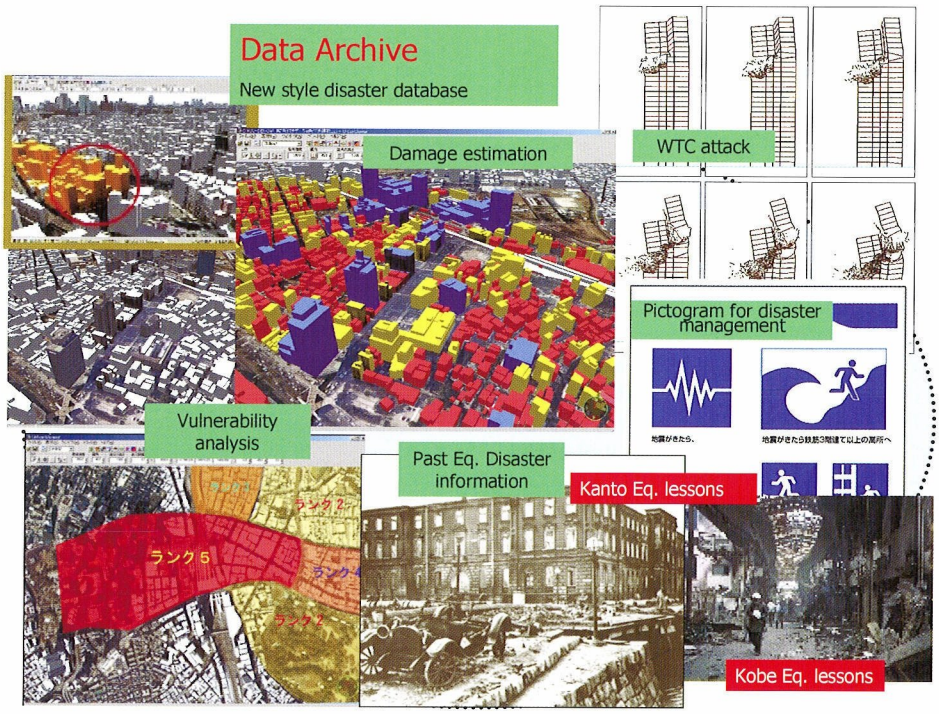

Figure 3. Data Archive module

E-learning module

The E-learning module is normally considered a learning system from the user's viewpoint. Howe in this case, it is regarded as a data input/collecting system from the system developer's side. With system, the level of disaster knowledge of the ordinary people can be understood. It is an informa 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.

Figure 4. E-learning module

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 structure in an urban area, such as Tokyo Metropolitan area in Japan, is 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.

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 social characteristics of the region including disaster mitigation potential level. 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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