Building a Victims Master Database Using the GeoWrap Method without a Primary Key

Keiko TAMURA

Risk Management Office, Niigata University, Japan [1]

Munenari INOGUCHI

Research Institute for Natural Hazards and Disaster Recovery, Niigata University, Japan [2]

Reo KIMURA

School of Human Science and Environment, University of Hyogo, Japan [3]

Takashi FURUYA

Center for Risk Management and Safety Sciences, Yokohama National University, Japan [4]

Haruo HAYASHI

Disaster Prevention Research Institute, Kyoto University, Japan [5]

Keywords

Component, GeoWrap, Integrated database, Victims Master Database

Abstract

The research team developed a GeoWrap Method that joins tables from different databases using spatial location relationships instead of primary keys. This technique made building master database possible in order to support disaster victims, which was consisted of the data retrieved from the several sets of administrative database of the daily work and combined them into Victims Master Database. Tokyo Metropolitan government accepted the importance of previous arrangement for going through those procedures.

Introduction

In the event of a disaster in Japan, local governments provide many types of administrative services to victims. Before the provision of these services, victims have to be identified and apply to the support programs. Victims are identified on the basis of building inspections for the assessment of building damages. The results of the building inspection are compiled in a database and certification of the degree of building damages are in turn granted to the victims.

Previously, a basic database was constructed to manage the certifications for the degree of building damages. However, this database did not contain geo-reference information. Therefore, this database has limited utility for providing basic information for providing subsequent support services to victims.

[1] tamura@gs.niigata-u.ac.jp, 8050 Ikarashi Nino-cho, Nishi-ku, Niigata, 950-2181, JAPAN
[2] inoguchi@gs.niigata-u.ac.jp
[3] rkimura@shse.u-hyogo.ac.jp
[4] t-furuya@ynu.ac.jp
[5] hayashi@drs.dpri.kyoto-u.ac.jp

Theory

In order to circumvent these issues, in this research we decided to develop a database to house the results of building inspections with geo-reference, and to grant certification of the degree of building damage based on this geo-database. Furthermore, we proposed to develop the VMDB to store a variety of victim information that can be used in concert with the geo-database of building damage certification to facilitate effective and prompt support services to victims. Local responders can also use the VMDB to provide a plethora of administrative support to victims. The proposed effective work flow is shown in Figure 1.

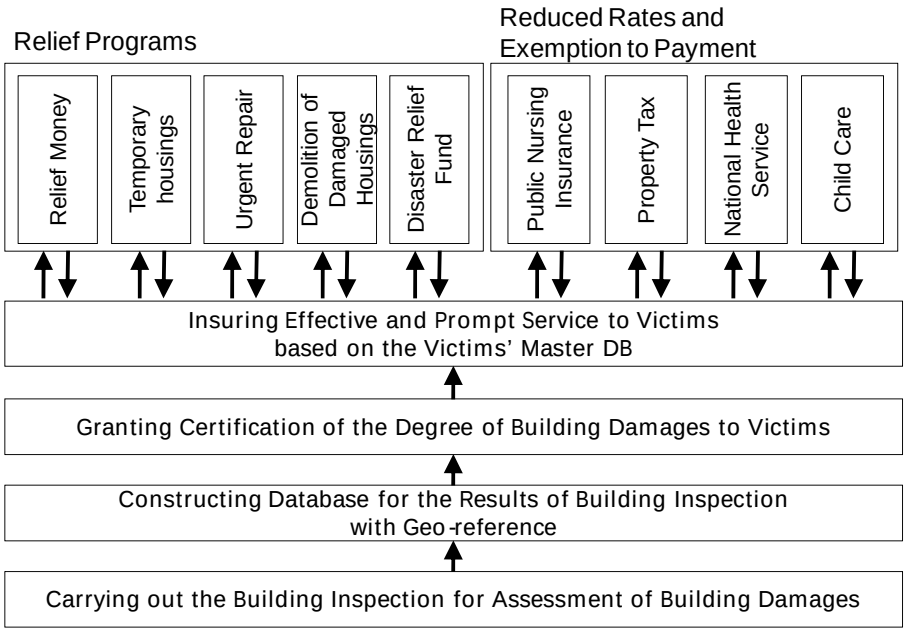

Figure 1. Work Flow of Administrative Support

Method

Requirements for issuing a Disaster Victim Certificate on the basis of a victim's application are: To identify an individual or a household on the Basic Resident Register (Juumin kihon daichou), to identify which house is their primary residence where their life is centered, and to find out the results of a building damage certification survey. To gather these required pieces of information, it is necessary to extract and collate the applicable data from the (1) Basic Resident Register, (2) Property Taxation Database, and (3) Building Damage Certification Survey. Items (1) and (2) are databases for a normal time, and item (3) is a database built after a disaster occurs. There are a plethora of issues listed below that affect the ability to connect items (1), (2), and (3) together.

1. Basic Resident Register and Property Taxation Database do not share a common primary key

The primary key of the Basic Resident Register is an individual number or a household number to designate a resident. On the other hand, the primary key of the Property Taxation Database is a house number used to set tax on a building. The Property Taxation Database may also contain an individual number in some

municipalities if the tax payer is a resident of that jurisdiction. However, this is not standard procedure. Therefore, these two databases cannot immediately be combined.

2. The only primary key of Building Damage Certification Survey is location

The Building Damage Certification Survey is organized according to locations used to conduct a survey at disaster afflicted areas. Therefore, information on the residents and houses is not known, and as such, Basic Resident Register and Property Taxation Database and Building Damage Certification Survey cannot immediately be combined.

2.3 Proposition of Novel Technology to Combine Databases with Different Primary Keys

Our research and development team developed a GeoWrap Method that connects data from different databases using spatial location relationships instead of primary keys. The GeoWrap Method employs the Geographic Information System (GIS) to position information from each database in a space, and the spatial distance between pieces of information is designated affinity. This affinity assigns weight between the pieces of information and provides rank order among the pieces of information. Therefore, the information from each database is converted into spatial information. The spatial information was then taken into the GIS to calculate affinity based on spatial distances among the pieces of information. This was an automated process for generating flexibly connected pieces of information (See Figure 2).

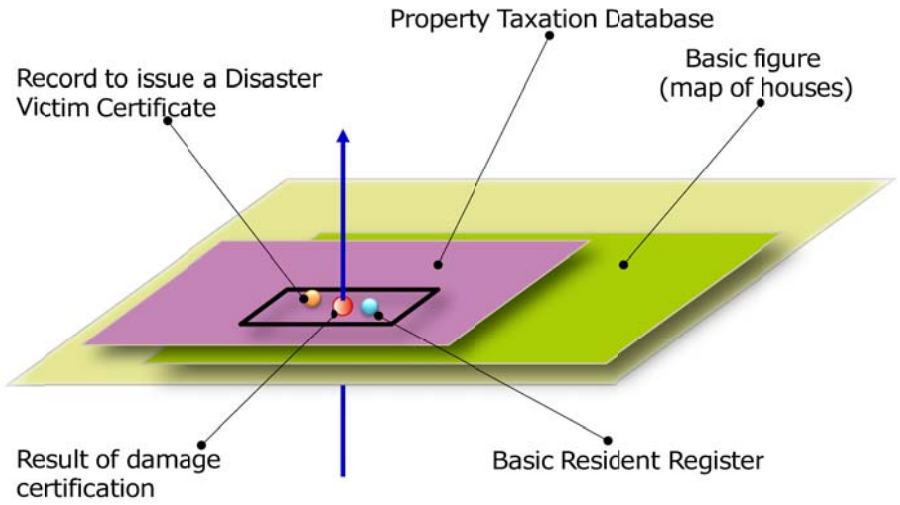

Figure 2. Work Flow of Administrative Support

4. The Purpose of Issuing the Building Damage Certification

When a resident applies for a Disaster Victim Certificate, a simple search of the "resulting data that are flexibly connected together in a space" makes a resident identify their primary residence based on the information provided. By presenting a Building Damage Certification Survey result, we can let the resident complete the entry of the Victims Database. A major feature of this system is that it effectively combines automation as an optimum solution and a real solution provided by humans.

Results

1. Installing a graphical interface using a map

Visualization of rank ordered information in each database on a map would facilitate an applicant identifying their primary residence based on his or her actual place of residence.

2. Installing a graphical interface using a map

List information would be color-coded for each database and displayed on a map. Rank order information would be made into a list for each database and displayed at the bottom of a map. An applicant would compare the map and the list to make the following selections (Figure 3):

(Basic Resident Register) the displayed address information for the applicant match the actual information

(Property Taxation Property) property taxation information displayed as the primary residence match the actual information

(Tremor Survey Research Results) in the applicant's opinion, the displayed results of the building damage certification survey accurately reflect the damage due to the earthquake

(Fire Damage Survey Results) in the applicant's opinion, the displayed results of the building damage certification survey reflect the damage due to a fire

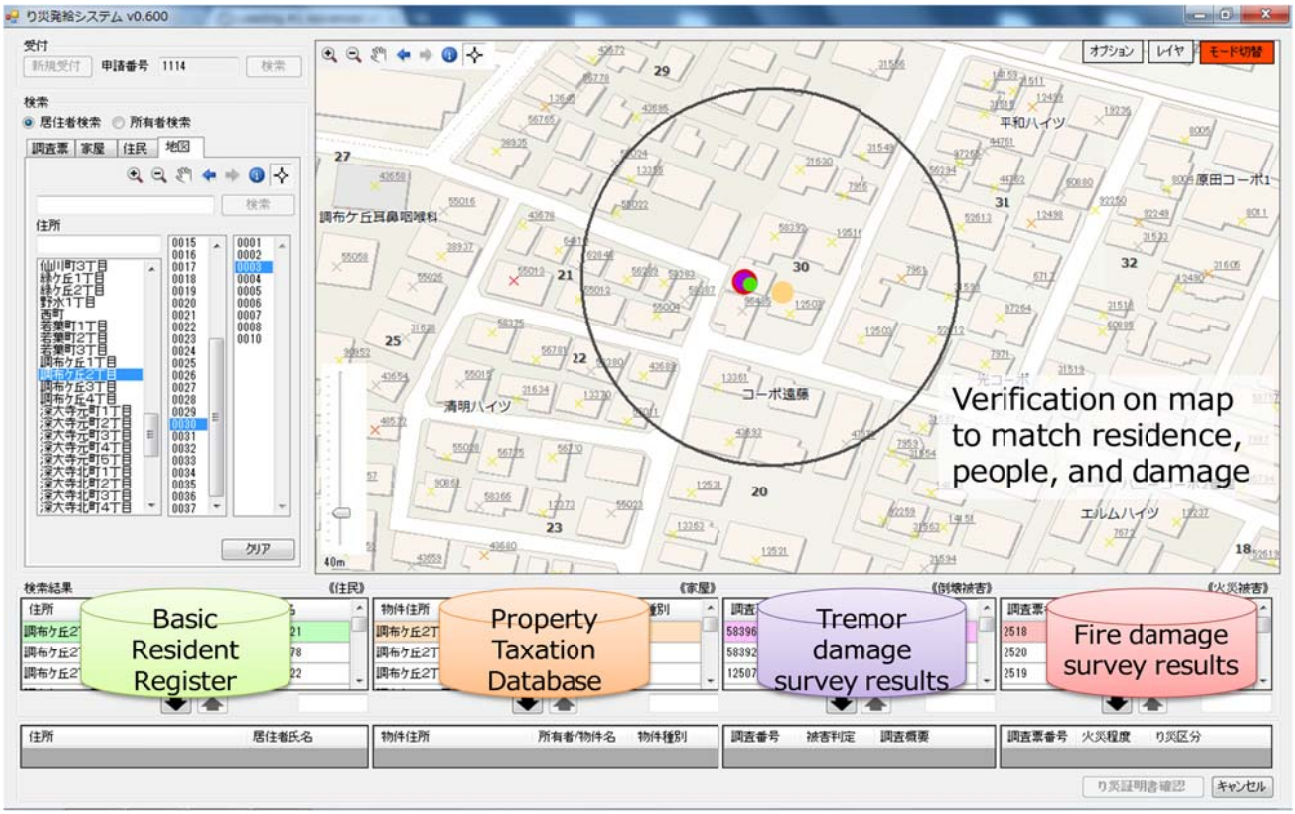

Figure 3. System to Apply and Issue Disaster Victim Certificate
(Interactive information search system between an applicant and a municipality clerk)

3. Development Environment

This system was implemented in an environment to coordinate DBMS (Database Management System) and GIS. For the DBMS, an SQL server was used as a server-client database system. The SQL server can be substituted with MS-Access (MDB) if only a client alone is used. A GIS server or GIS server runtime can be selected for the GIS function.

Apply the System of Building a Victims Master Database to the impacted area of Tohoku Earthquake

1. The devastating Disaster in Tohoku Area in Japan

The Tohoku Earthquake was a magnitude 9.0 (Mw) undersea mega thrust earthquake off the east coast of Japan that occurred at 14:46 JST on Friday, March 11th, 2011. This strong earthquake caused huge and destructive tsunami waves that reached heights of up to 40.5 meters (133 feet) in Miyako in the Iwate Prefecture and travelled up to 10 km (6 miles) inland in the city of Sendai. Approximately 15,200 people lost their lives and over 8,600 people were reported missing. The number of houses that were partially or totally destroyed in the disaster was about 160,000. The tsunami caused a number of nuclear accidents, primarily the on going level 7 meltdowns at three reactors in the Fukushima I Nuclear Power Plant complex. The resulting evacuation zones affected hundreds of thousands of residents that resided in the afflicted areas including 10 prefectures and 241 cities, wards, "" districts, and villages. Because of experience from past disasters, Japan has a variety of well-organized support services to help the victims to rebuild their lives. However, standardization of the workflow in order to effectively offer these support services and build support tools are not sufficient. The amount of work required is extremely large since the areas of disaster are widespread and a large number of people need to receive support services. Therefore, it necessitates the establishment of a workflow and support tools. Herein, we describe the generation of a Victims Master Database in order to effectively provide support for victims.

2. The Research Field of Iwate Prefecture, one of the most impacted area

In Iwate Prefecture, 12 cities and villages along the coast suffered damages, and many victims are currently trying to rebuild their live. As a shared infrastructure for all these cities and villages, we installed a server within the Iwate prefectural office to implement the VMDB system. This server was installed on a LGWAN (also called Iwate Information Highway) that connects cities, and villages in Iwate Prefecture. This enabled network access from information terminals at each municipality in a closed environment with a high level of security, and safe and stable system operation.

After the Tohoku Earthquake occurred, many administrative functions were damaged and some of them were actually broke down. During that time administrative officers started to provide service of life reconstruction support for the victims in their temporary offices. As a result their work styles and workflows lacked coherence and nobody can detect how much support service had already provided for victims or had not provided yet. 7 cities and villages out of 12 now use the service of Web-Based Victims Master Database System for supporting the process of life reconstruction for re-organizing their works. 7 cities and villages aimed for realizing the situation being nobody who had not much support would be left (Figure 4).

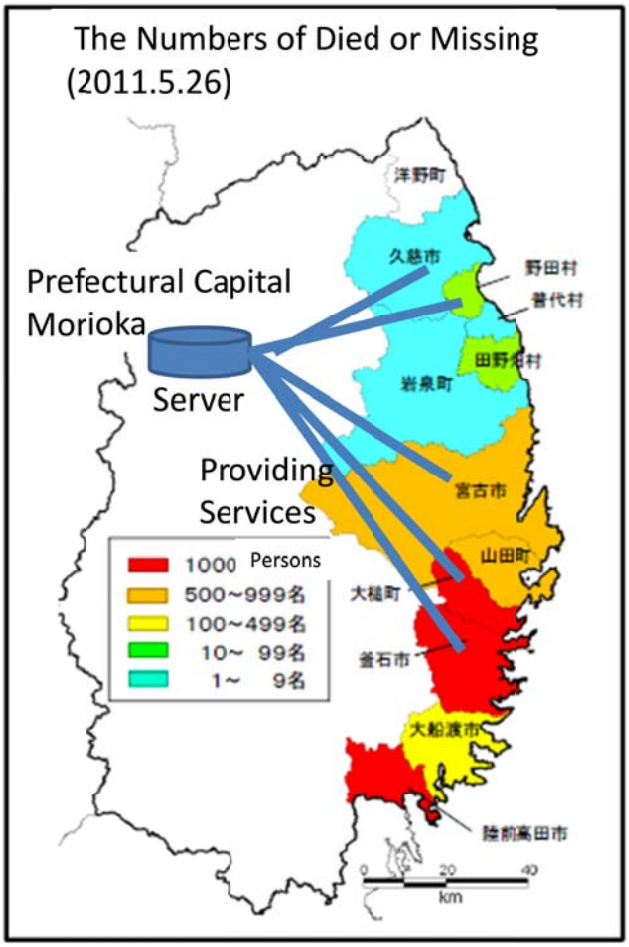

Figure 4. Services of Web-Based Victims Master Database System
for supporting the process of life reconstruction

Conclusions

Although the system developed through this research is based on experiences from past disasters, knowledge about wide-area, complex disasters such as the Great East Japan Earthquake is not adequately incorporated. We are planning to make revisions to the system in order to combat the challenges that will surface as this system is continually used. Earthquakes are expected to occur in Tokai, Tonankai, and Nankai regions around Japan in the middle of the 21st century. We would like to further improve this system to aid in the early recoveries from these potential future earthquakes.

Author Biography

Keiko TAMURA, Ph.D.

Professor, Risk Management Office, Niigata University, Japan

2004-2006 Researcher, Research Center for Disaster Reduction Systems, Disaster Prevention Research Institute, Kyoto University, Japan

2006-2009 Associate Professor, Research Institute for Natural Hazards and Disaster Recovery, Niigata University, Japan
2009- Professor, Risk Management Office, Niigata University, Japan
Munenari INOGUCHI, Ph.D.
Assistant Professor, Research Institute for Natural Hazards and Disaster Recovery, Niigata University, Japan
Reo KIMURA, Ph.D.
Associate Professor, School of Human Science and Environment, University of Hyogo, Japan
Takashi FURUYA, Ph.D.
Assistant Professor, Center for Risk Management and Safety Sciences, Yokohama National University, Japan
Haruo HAYASHI, Ph.D.
Professor, Disaster Prevention Research Institute, Kyoto University, Japan