ADVANCED REAL-TIME DISASTER INFORMATION MAPPING TECHNIQUE BY INTEGRATING UBGI (UBIQUITOUS GEOGRAPHIC INFORMATION)

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ABSTRACT:

Recently UBGI (Ubiquitous Geographic Information) refers to a new service technology with ubiquitous computing environment and geological information service. Specifically, it helps to solve human problems using ubiquitous computing such as sensing and recognition technologies and information processing technology and offers integrated, updated, and automated services related to geological information. This study took a look at technology design using UBGI services to obtain and display real-time data when disasters occur. For this, hazard data was acquired from detecting WSN (Wireless Sensor Network) by ordering a data packet at the disaster site such as forest fire, landslide and flood. In addition, WSN hazard observation data was transformed into the spatial data type for visual service in real time. This result could be expected to enable the effective and safe management of disaster scenarios by monitoring and managing data in real time.

1. INTRODUCTION

In just a short period of time, information and communications have changed from personal computers to the Internet as a sea of information to CDMA (code division multiple access), HSDPA (High-Speed Downlink Packet Access), and WIBRO (Wireless Broadband) to ubiquitous technology that enables getting information anytime, anywhere.

Communications technology connects any information online for provision to users in real time. It is also integrated with mobile phones - which are portable and easy to carry - and used in all areas where technology is needed.

In addition, the ubiquitous technology enables putting and keeping information in a small chip as well as receiving data and identifying the relevant information in real time through communications technology.

This function forms a part of the spatial information technology that manages and stores data related to locations. Thus, it helps to develop UBGI, which is ubiquitous geological information combined with communications technology, mobile phones, and ubiquitous technology.

As we are facing the dawn of ubiquitous computing by emerging mobile devices and distributed applications, personalisation is leaving the desktop domain, because adaptation and context awareness play a major role in Ubicomp in order to realize the user friendliness postulated for Ubicomp application[Zipf, A and Jöst, M., 2005].

UBGI is designed to put and keep information in a small chip and identify the location and route. It can also be used for disaster management.

In recent years, natural disasters including forest fire, floods, and earthquakes have occurred frequently; the size of the damage has also increased. In the case of disasters, an immediate response to the danger and damage is required by obtaining information on the area hit by the disaster.

Thus, this study sought to gather information on the areas hit by disasters and to deal with the collected information for use in the system for managing disaster information based on UBGI to determine the danger and damage in disaster-hit areas in real time and maximize the use of UBGI technology.

For this, hazard data was acquired from detecting WSN (Wireless Sensor Network) by ordering a data packet at the disaster site such as forest fire, landslide and flood in first section. Secondly, WSN hazard observation data was transformed into the spatial data type for visual service in real time. This result could be expected to enable the effective and safe management of disaster scenarios by monitoring and managing data in real time.

2. TREND OF RELATED TO UBGI (UBIQUITOUS GEOGRAPHIC INFORMATION)

UBGI is a spatial information technology featuring ubiquitous technologies including USN (Ubiquitous Sensor Network) and RFID (Radio Frequency IDentification) and spatial information technology. In other words, data stored in a chip or collected by sensors are received through communications technology; the relevant information is then displayed together with data on locations as new spatial information technology.

As shown in Figure 1, UBGI includes GIS Technology, LBS (Location Based Service)/Telematics, and Sensor Technology. It can be marked with the common factor of each technology.
Possible application of UBGI range from typical LBS, to environmental monitoring by new mini-sensor(Smart Dust etc.) to telematics and logistics. The need to manage position of so

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main objectors and persons leads to question regarding moving objectors in spatial DBs[Zipf, A and Jöst, M., 2005].

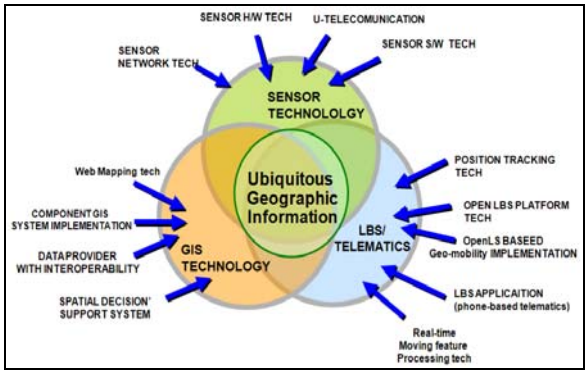

Figure 1. The concept of UBGI technology

3. ACQUISITION OF HAZARD DATA FROM DETECTING WSN (WIRELESS SENSOR NETWORK)

WSN is an effective way of obtaining information on disaster scenarios in real time. WSN transmits the gathered data to the network through a small send-receive set board with sensor. As shown in Table 1, this study sought to show how to get data on typical disaster types in real time.

The content collected through WSN was defined by data on temperature as obtained by the temperature sensor and data on smoke detected by WSN's ultrasonic sensor in forest fire disaster, data on location and altitude as obtained by the GPS sensor, data on noise and vibration as obtained in real time by the Mic sensor, data on the intensity of sunlight as obtained by the light sensor in landslide disaster and data on running fluid and elevation as obtained by the GPS sensor in flood, respectively.

Disaster type	**Forest fire**
Content collected through WSN	Data on temperature as obtained by the temperature Sensor
	Data on smoke detected by WSN's ultrasonic sensor
Disaster type	**Landslide**
Content collected through WSN	Data on location and altitude as obtained by the GPS sensor
	Data on noise and vibration as obtained in real time by the Mic sensor
	Data on the intensity of sunlight as obtained by the light sensor
Disaster type	**Damage due to storm and flood**
Content collected through WSN	Data on running fluid and elevation as obtained by the GPS sensor

Table 1. Hazard data from detecting WSN

Figure 2 shows the architecture of WSN for information on disaster scenarios. With the GPS module attached to a Hardware Platform, data on the point of observation at hazard site can be received in real time and connected with GIS. This architecture of hazard detecting WSN is almost similar to others commercials staffs expect GPS modules and sensor modules for each hazard type like forest fire, landslide, flood etc.

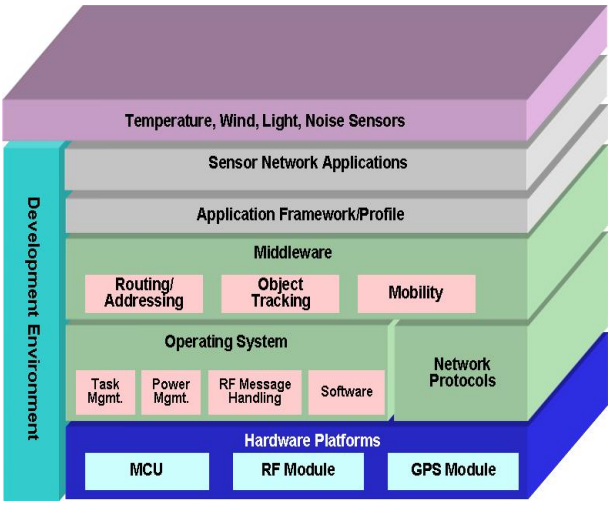

Figure 2. The architecture of hazard detecting WSN

The data gathered by the sensor makes a packet. As shown in Table 2, a packet was designed to send the data through a wireless communications network such as CDMA and HSDPA.

Hazard type	**Forest fire**	**Landslide**	**Flood**
NID	x01	x01	x01
SID	x01	x01	x01
Value	x01	x01	x01
	x02	x02	x02
X	x01	x01	x01
	x02	x02	x02
	x03	x03	x03
	x04	x04	x04
Y	x05	x05	x05
	x06	x06	x06
	x07	x07	x07
	x08	x08	x08
Z	x09	x09	x09
	X10	X10	X10
Direction	X11	X11	X11
	X12	X12	X12

Table 2. The packet design of WSN

4. TRANSFORMING WSN HAZARD OBSERVATION DATA INTO THE SPATIAL DATA TYPE

Since the dynamic hazard data collected by WSN are measured with the continuous flow of time as discrete sample, real-time interpolation is required for temporal resolution that creates spatial data with lines and sides from each point.

In other words, spatial interpolation is carried out for factors by disaster type. Using materials on the locations of randomly distributed sensors, values between the materials are obtained: Kriging, Spline, and IDW (Inverse Distance Weight) as shown in Figure 3.

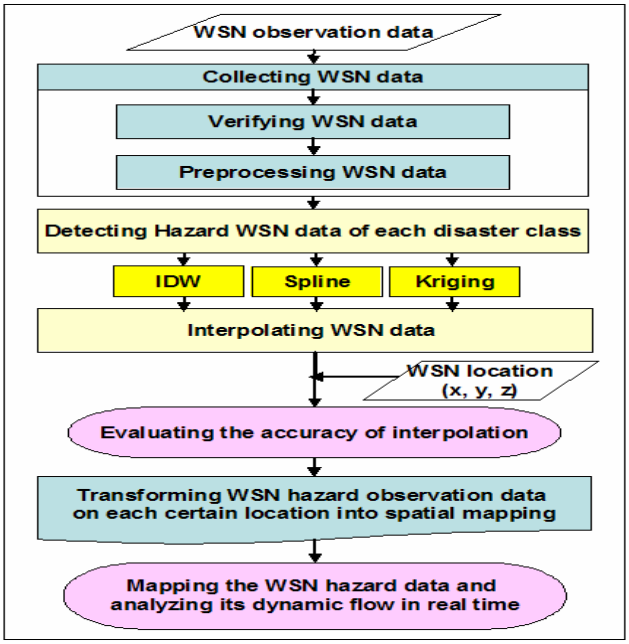

Figure 3. Transforming WSN data into spatial data type

Figure 4 shows the results of spatial data from the materials (by disaster type) on disaster scenarios by classifying the real-time information obtained through WSN in visually. As you see here, there showed the cases of mapping WSN data of landslide, forest fire, flood disaster area in real time.

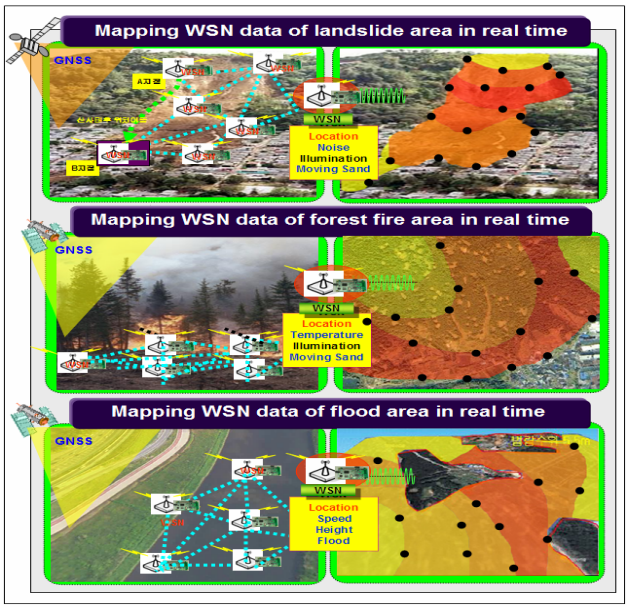

Figure 4. Mapping hazard data from WSN

5. CONCLUSION

When integrated with ubiquitous technology and spatial information technology, UBGI enables identifying real-time data on disaster scenarios anytime, anywhere.

This study designed WSN to get information on disaster scenarios through UBGI, suggested ways of obtaining data on disasters factors on a case-to-case basis, and displayed the gathered data based on GIS.

For this, hazard data was acquired from detecting WSN by ordering a data packet at the disaster site such as forest fire, landslide and flood. In addition, WSN hazard observation data was transformed into the spatial data type for visual service in real time. This result could be expected to enable the effective and safe management of disaster scenarios by monitoring and managing data in real time.

UBGI technology is expected to enable the effective and safe management of disaster scenarios by monitoring and managing data in real time.

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