

A Study on Multi-media Disaster Information Contents to provide Disaster Alert Service to the Public

Beom-Jun CHO*, Ki Bong KWON*, Hyun Chul KIM*, Sungbo KANG*

*Korea Information Technology Valley Co., LTD., South Korea

beomjun.jo@gmail.com, miokjerry@naver.com, guscjfk0422@gmail.com, carbo@naver.com

Abstract— Most disaster warning systems currently in operation provide disaster information only through text or voice. Therefore, it would be quite difficult for many of the elderly, the foreigners, and the disabled to recognize the information to respond timely against disaster. In addition, due to the limitations in the information that text format can carry, there are limitations in providing accurate disaster situations. In order to solve these problems, research on technologies to provide more disaster information by including various multi-media contents and on technologies that can automatically generate multi-media contents is being carried out. In Korea, there is a high-level infrastructure that can employ and provide multi-media disaster information by utilizing the latest ICT technologies such as '5G' and 'UHD' along with digital signages and bus information systems. Utilizing this infrastructure, 'Location customized information' and 'multi-media information' can be provided. In particular, while utilizing the standard CAP (Common Alerting Protocol) suitable for the Korean environment, disaster alerts can be immediately transmitted including the localized multimedia information. This study aims to find a way to deliver more disaster information than the current system and contribute to reducing damage to lives and properties of people in case of disaster.

Keywords— Disaster Information, Multi-media, Disaster Alert Service, CAP (Common Alerting Protocol), Customized Information

I. INTRODUCTION

The development process of information and communication technology is divided into before and after the start of 'Telecommunications'. The communication before the start of Telecommunications can be called 'Native Communication', and after that can be called 'Tele-Communications (1st generation ~ 2nd generation)' and 'Information Communication (3rd generation~ 4th generation)' [1]. In Korea, the form of information contained is also changing with the development of information and communication elements starting from the founding of Gojoseon. From an auditory form such as the 'Emilé Bell' to a visual form that is a combination of smoke and torch light, there has been attempts to deliver information more quickly and accurately [2]. As the transition from the analogue era to

the digital era went on, the quantitative and qualitative information provided to the public has been also changed.

Due to the recent complex types of disasters and the outbreak of COVID-19, the public is demanding a lot of information unlike before and necessitates more intuitive and accurate information. In the past, it was difficult for the vulnerable such as the elderly and the foreigners to recognize the situation clearly since the amount of disaster information focused only on text and voice was quite limited. This made it difficult for them to make quick decisions in response to disasters. In order to improve this situation, disaster related information has begun to be displayed on visual media (TV, electronic signboard, mobile phone, etc.). In addition, due to the development of the latest ICT information and communication technologies (UHD and 5G, etc.), it is possible to communicate a large amount of information in both directions in contrast to the previous situation when providing only a small amount of one-way information was possible.

In providing visual disaster information through TV, the introduction of UHD makes it possible to provide a large amount of multimedia information including images, which is quite a departure from proving a small amount of information through subtitles. In particular, due to the capabilities of ATSC 3.0, bidirectional communication is possible for high-definition/high-capacity content by providing IP transmission to digital TV broadcasting systems. Through this, users can access more accurate and diverse disaster information while checking the necessary information through the TV screen. The form of contents provided for these new processes should also be differentiated from the existing one. Research on providing disaster information contents suitable for new types of video media such as UHD TV, various electronic signs such as digital signages, DMB, and mobile phones is needed.

II. HISTORY OF INFORMATION COMMUNICATION AND ALERT SYSTEM IN S. KOREA

Until now, the alert system have had a very close relation to the development of communication technologies. Various information contents including alerts have been provided through various communication systems, and historical facts need to be investigated to understand these processes.

A. History of Information Communications in S. Korea

Humans have been feeling the need for “Communication” to communicate their intentions since the prehistoric times [2]. Even in Korea, there was a means of communication called ‘Native Communication’ until the era of “Tele-Communication” which began in 1885. The first Native Communication delivered information by engraving on bones, trees, and walls through ‘text (hieroglyph)’ or ‘pictures’. Through this, many efforts were made to deliver information more accurately.

Figure 1 shows a representative medium for ‘hearing’, and it was created by King Gyeongdeok of Silla and completed by King Hyegong to spread the merit of King Seongdeok in Silla.



Figure 1. Sacred Bell of Great King Seongdeok located in Bongdeok-Temple, S. Korea (source: Wikipedia homepage)

After that, in the Goryeo Dynasty, “Bongsudae (烽燧臺)” was created as a means of communication to deliver emergency news to the capital through smoke and fire (Figure 2).



Figure 2. Bongsudae of Bongdon, Hwaseong, located in Suwon, S. Korea (source: The Academy of Korean Studies, 1989)

In addition, there were communication media in the form of documents through text, such as “Pabal (擺撥)” and “Wooyeok (郵驛)” as ‘Native Communication’.

With the introduction of telegraph facilities from the Qing Dynasty in 1885, the era of “Tele-Communication” began in earnest. From then on, through communications using radio waves, the speed of industrial development has also progressed rapidly owing to the unprecedented increase in the amount and the transmission speed of information.

As we entered the “3rd-generation”, which can be called full-scale information communication, what used to be ‘communication between people and people’ has been developed into ‘communication between people and machines’ and ‘communication between machines and machines’. Along with the development of information and communication, the development of ‘alert’ method is also accelerating. Table 1 summarizes the development process of information and communication technologies mentioned above.

TABLE 1. INFORMATION AND COMMUNICATION TECHNOLOGY DEVELOPMENT PROCESS

□□□□□ □□ □□□□□ □□□□□ □□□	Tele-Communication		□□□□r□□□□□ □□ □□□□□□□□□□ □□□	
	The 1st generation	□□□□ □□d□ □□□□ r□□□ □□	□□□□ □rd□ □□□□ r□□□ □□	□□□□ □□□□ □□□□r □□□□ □
Body movements, Language, and Physical tools	Telegraph	Telephone	Data communication	Convergence of communication and computer technology

B. History of Alert System in S. Korea

As previously suggested, the paradigm for alert is also changing with the acceleration of digitalization of information. Alerts can also be divided into ‘auditory type’ and ‘visual type’, and alert systems are also changing in S. Korea with the development of information and communication.

In the modern era, the first alert system in S. Korea for disasters was a siren installed at Namdaemun Fire Station in 1924. Since then, sirens for civil air defense situations were created before, during, and after the Korean War in 1950, and various disaster alert systems were established until 2000. All of the alert systems up to this point provided “auditory type” alert such as siren.

The spread of TV started in 1956, but it wasn’t until 2002 that the first analogue disaster alert broadcasting service began. Starting with this, a ‘visual form’ of alert was provided to the public. As we gradually entered the era of digitalization, a new type of alert system emerged with a shorter time difference than ever before. In particular, it can be seen that with digitalization, it is changing from ‘auditory alert’ to ‘visual alert’. Figure 3 shows the history of these disaster alert systems.

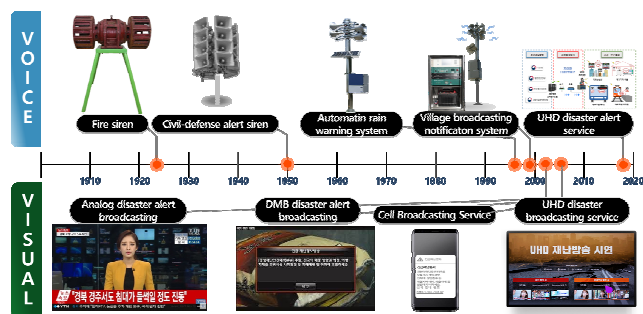


Figure 3. History of alert in S. Korea

III. PROPOSAL OF MULTI-MEDIA DISASTER INFORMATION CONTENTS FOR ICT MEDIA

By utilizing the recent development in information and communication technologies, it is possible to help the people to quickly and accurately recognize the disaster situation. In accordance with this trend and the demands of the people, the main issues to be addressed in the disaster alert service are 'location customized information' and 'multi-media customized information'.

'Location customized information' is the provision of differentiated information for different disaster alert recipients according to the location of the alert recipients to provide appropriate disaster information contents. Through this, it will be possible to relieve fatigues from too much information by preventing careless overuse of disaster alerts. In addition, 'multi-media customized information' should be provided based on the purpose and operation of multimedia so that optimized contents can be provided through various media capable of providing disaster information.

Various disaster information contents can be provided through multimedia (text, voice, image, video). This paper will cover various medias except 'video'. In case of 'video', further research is needed to ensure that it can be created appropriately for the medium required.

A. Location customized Information

Due to the recent COVID-19 situation, too much disaster text information is constantly being pushed to personal smartphones in Korea making many people to be tired and ignore it. This is why people want to get more accurate information according to he or she is located. "Location Customized Information" calculates the predicted range of damage according to the location of the disaster, and can issue an alert using medias within the predicted area. It is necessary to use a different media for displaying the alert according to the regional range of the alert issuing area, and the efficiency of the alert delivery can be increased (Figure 4).

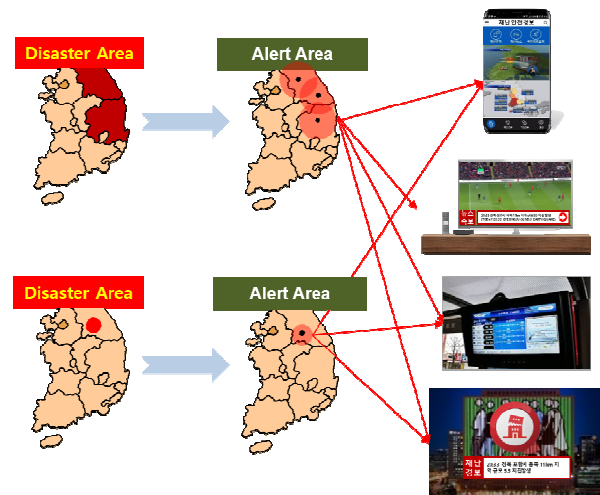


Figure 4. Examples of medias used according to the region where the alert is issued

A technology that can guide an evacuation route based on the predicted location of dangerous regions due to a disaster and the location information of the user (alert recipient) can be applied. Figure 5 shows an example of providing disaster evacuation information based on user location. It provides emergency disaster evacuation information only to users in the affected areas where a large fire occurred. It provides evacuation detour to the safe destination considering also the affected area from the COVID-19 outbreak. In order to provide such disaster information, a protocol including necessary items should be provided.

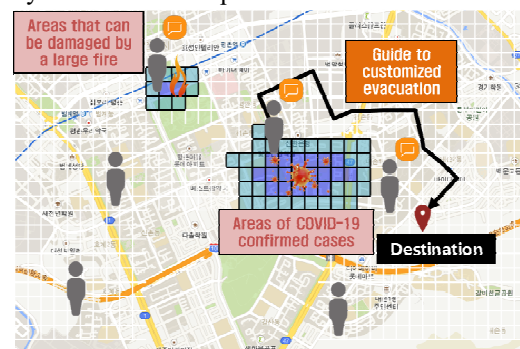


Figure 5. Example of guidance on evacuation routes according to the alert issuing area and user location

B. Multi-media customized Information

Standardized and designed multi-media contents types for disaster information can include 'Text', 'Voice', 'Image', or 'Web'. For these types of contents should be appropriately provided to each media, they should be automatically and quickly created.

First, 'Text' and 'Voice' should be defined slightly differently depending on the target media. In the case of text, it must be standardized and created differently due to the limitations in the possible number of characters depending on the media type. The 'Voice' is created by converting to 'wav' file and 'MP4' file through TTS (Text To Speech) based on the generated text, so that it could be played back in the

corresponding media. As for the standardized disaster information, the issuing agency, the time of occurrence / announcement, the outbreak / alert area, and disaster response tips are basically provided (Figure 6). However, it was made to provide slightly different information depending on the disaster. Such information should also be provided in a standardized protocol.

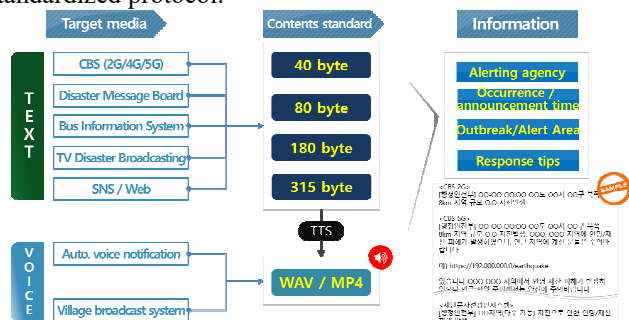


Figure 6. Text and voice standards converted by media

In addition, it is possible to provide 'image' and 'web' disaster information contents through various video media (personal smartphone, TV, digital signage, urban electronic display, etc.). In the case of personal smartphone, 'URL links' are provided to provide more detailed information along with multilingual information through Cell Broadcasting Service (CBS). Detailed information provided on the 'web' can be checked through this link (Figure 7). Of course, it may be difficult in 2G, 3G, and 4G terminals due to the limitation of the number of characters. However, 5G can provide enough links because more characters are possible. The protocol for Cell Broadcasting Service (CBS) for 5G was standardized through TTA [3]. Personal smartphones are emerging as an optimal media that can deliver customized information to users. Through this media, urgent information (disaster occurrence location, response tips, shelter location, etc.) can be provided for users to quickly respond to a disaster that has occurred, and further information can be checked through a web page that can be accessed through the link (Figure 7).

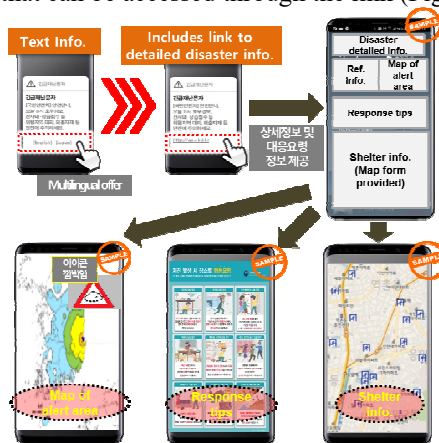


Figure 7. Example of disaster information display through personal smartphone using 5G

In the case of TV, only text information in the form of closed captioning has been provided until now. However, as

UHD gradually spreads, disaster information contents suitable for the new media should be prepared. For example, through ATSC (Advanced Television Systems Committee standard) 3.0 and AEAT (Advanced Emergency Alert Table), which are international standards for UHD, not only broadcasting networks but also communication networks can be utilized. Then, disaster information in a different form can be provided through a link provision (Figure 8). By providing 'link' information to existing subtitles, contents can be automatically generated so that more detailed status information can be provided. Based on this, in consideration of the scalability of information provided through broadcast screens, a technology for providing disaster information contents applying IBB (Integrated Broadband Broadcast) and HBB (Hybrid Broadcast Broadband) has also been prepared.



Figure 8. Example of disaster information display through UHDTV using UHD

Digital signage is not currently being used as a disaster alert media, but it is emerging as an excellent media to provide disaster alert services in urban areas. Various disaster information can be provided through digital signage. In particular, it is possible to provide evacuation contents through number of different signages so that many people can quickly evacuate through provided route information in case of a disaster (Figure 9).



Figure 9. Example of disaster information display through digital signage

C. Application Protocol

As mentioned above, in order to provide multimedia disaster information contents for each media, a standardized protocol including related information is required. Based on the information contained in the protocol, multimedia disaster information can be automatically generated and provided systematically.

In this study, 'CAP' is applied as a protocol for automatically generating multimedia disaster information contents for different media [3] [4]. Figure 10 is a protocol standardized in the United States for the unified disaster alert system. Korea also promoted standardization according to the particular domestic situation based on the US protocol. In the standardized protocol, 'Parameter' is defined to provide optimal information for each media, and the server operating each media can use this protocol by 'Parsing'.

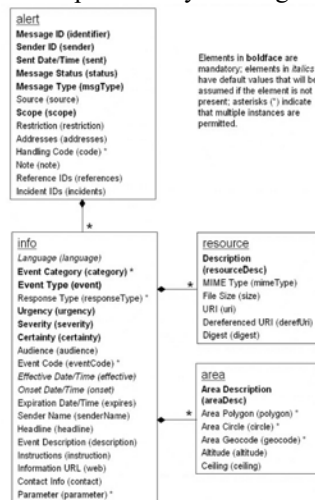


Figure 10. American standard protocol for unified alert of disaster

IV. CONCLUSIONS

This paper presents matters related to disaster information contents to provide information related to occurred disaster through visual media. First, the history of the development of information and communication contents in various media and the form of warning was introduced. Next, contents in a form applicable to UHD, 5G CBS, and open screen in which the latest ICT technology is applied, and a plan for automatic generation along with elements of multimedia disaster information contents for this purpose are proposed. Finally, the direction of the development of disaster information provided to the public in the future was presented.

ACKNOWLEDGMENT

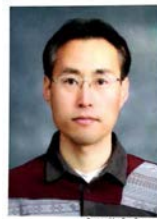
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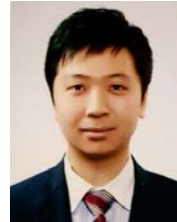
Beom-Jun Cho received the B.S. degree in geophysics and Master's degree in seismology at the Chonbuk National University. After graduating, he worked as a researcher at the Korea Meteorological Administration for 3 years, and as a researcher at the Polar Research center, attended the Winter-Crew as a geophysical field at King-Sejong Station in Antarctica. In 2012, he moved to his current job and is project manager for research on various businesses and R&D on disaster prevention, and is researching new technologies based on ICT.



Ki Bong KWON received the B.S. degree in electronic computing at Incheon University in 1995. He joined KITValley in 2002 and has been involved in various government projects as CTO. In particular, he contributed to the development of many technologies in the disaster field through collaborative projects with the Ministry of Public Administration and Security and other related organizations.



Hyun Chul Kim received the B.S. degree in Earth and Environmental Sciences at Chonbuk National University in 2016. From 2016 to the present, he is working at the Research Planning Division of KIT Valley Co., Ltd.. The position is a senior researcher, and his duties are planning and executing national R&D projects.



Sungboo KANG received the B.S. degree in department of physics at the Seoul National University in 2010. He joined KIT Valley Co., LTD., his current office in 2017, and is carrying out development work under the development headquarters. His position is Senior Researcher.