EFFECTIVE RISK MAP DATA SERVICE PLAN THROUGH WEB AND APP SYSTEM LINK

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KEY WORDS: 3D GIS, Risk Map, Floods, Disaster Prevention, Decision Support System

ABSTRACT : Human living environments are changing worldwide due to the recent increase in natural disasters and their intensity. Natural disasters not only directly affect the safety of the citizens and their properties, but they also cause enough damage to the SOC facilities, which are major elements of human living environments. In particular, SOC facilities, when damaged by disasters, may infringe the rights of the citizens regarding safety, and they have direct or indirect socio-economic effects. For this reason, many studies on disasters are focused on the countermeasures against the collapse or loss of SOC facilities. Web-based disaster data service and management systems are part of the countermeasures in the operation. The status data in such web service systems need to be transferred to the on-site investigators for their prompt response. Therefore, a plan has been suggested in this study for an immediate and effective risk map data transfer between 3D disaster data expression systems, which deal with damage data on SOC facilities (e.g., bridges, beams, and dams) under disasters, and the on-site assistance applications. First, a module that links the map data to the systems was developed. A disaster data processing and compression technique was applied to the module afterward. The suggested data service plan will allow the disaster management and on-site response personnel to closely share the data through prompt and efficient transfer of high-capacity disaster map data.

1. INTRODUCTION

The change in human lives led to the change of their natural environment. The abrupt change of the natural environment has positive effects, as well as negative effects, such as the increase in natural disasters and climate change. As natural disasters and climate change greatly affect human lives, humans have constructed and utilized management systems with various information technologies for response and control. In particular, the studies have been focused more on the disasters in cities. City flooding and heat waves are the leading disasters in these areas. City flooding, in particular, causes human and economic damage to an extent. Numerous SOC facilities are constructed and deployed in the vicinity of the rivers in order to respond to city flooding and minimize the damage. Plans have been prepared to continuously manage these facilities and quantify the damage in the event of a disaster emergency. Most of the management systems developed through the studies on the SOC facility management are performing their independent roles, and the policy drafts and decision-making are based on their information. The use of these independent disaster systems, however, is difficult when a prompt response is required due to the outbreak of a disaster, and when a scenario-based precise prediction information with the convergence of various data is required. Therefore, a system that can integrate the display and DB systems created for city flooding was developed in this study in order to transfer flood-related information to onsite managers, policy makers, and people who need onsite information in real time.

2. STUDY METHOD

Scenario-based prediction and display systems for city flooding are generally developed under the web GIS environment. These systems have local servers and they display diverse information that have been accumulated in these servers after processing via web viewers. The DBs that exist on a server are visualized by a web viewer, and the visualized information is provided to the organizations or managing personnel that require the information. The information is converted for deployment to the web environment. The processing, conversion, transfer, and compression of data are performed in the local server. This way, the data can be transmitted and received in a stable manner, as compared to a mutual communication network that is constructed in the web viewer environment. However, transferring and displaying disaster information with massive data to onsite managers, policy makers, and personnel, who require onsite information in real time, face some limitations in the devices owned by these personnel or in the wireless communication network. The amount of transferred information must be small for the personnel to receive them in real time, and there should be no omission in the information. Therefore, a module that can compress and process a massive amount of visualized city-flooding information, and then transfer the data to onsite mobile devices was developed. The developed module saves the visualized flood information that is displayed on the web viewer as images, and compresses these images via encoding. The compressed information is saved and accumulated

in a local server, where it is later decoded when transferred to mobile devices. The information acquisition and compression functions of the module capture the real-time flood information, which are visualized on the web viewer every second, and convert the information into a PNG-type array. The accumulated PNG data are encoded for the ease of data transfer and data security. The developed module supports BASE64 string-type encoding. This encoding is performed for data security and ease of accumulation of local-server DBs. BASE64 converts the binary data of 8 bits into 62 character strings and 2 signs.

The encoded data are again decoded to the PNG type for transfer to mobile devices. The PNG type requires bigger capacity than the other image data, as it acquires the flood visualization data on the web viewer without loss. Therefore, PNG-type images are compressed through the three functions among the various functions of JPEG for a fast transfer. The compression function of the developed module compresses the images with various minimal loss compression rates of 25 (75% compression), 50 (50% compression), and 75 (25% compression). JPEG-type compression may cause losses in images, but the quality is sufficient enough for the naked eyes as reference.

Figure 1. Image comparison between PNG file and 75% compressed JPEG

The capacities of the compressed images showed that the text file in Figure 1 was at the highest with 875 kb, the PNG file was 629 kb, the JPEG (75) was 104 kb, the JPEG (50) was 73 kb, and the JPEG (25) was at the lowest with 50 kb. The images can be fully used in the mobile environment that has a generally lower resolution than the PCs.

3. STUDY RESULT

In this study, a module was constructed for the efficient data transfer between the existing 3D disaster information display system and the applications for onsite support. The efficient JPEG method was also suggested through the comparison of image formats in order to ensure an immediate transfer of information. The module on the web captures and encodes the main information simulated in the disaster information display system, and the local server stores the information. C/S reads, decodes, and compresses the stored information.

4. Conclusion

In this study, a module was constructed for an efficient data transfer between the existing 3D disaster information display system and the applications for onsite support. The efficient JPEG method was also suggested through the comparison of image formats in order to ensure an immediate transfer of information. Most of the integrated systems for disaster response and control have large-scale platforms, and they have modules instead of integrated codes connected in an automated system in a server. As disaster information contain geographic information and diverse related information, it require different capacities and file formats. Transferring such information to onsite applications through the existing file formats may reduce efficiency and speed, and may not contribute to disaster response as intended. Therefore, in this study, the images on disaster information were acquired by using the development environment of the existing system for a prompt information transfer. In order to reduce server overload and web operation instability, a system that can compress images with a module was designed and constructed. Through this study, a module was constructed that was capable of organically integrating web systems, mobile applications, and DBs. Based on the results of this study, it is expected that an effective disaster response will be possible in the future. Faster data transfer will be possible if the problems with JPEG, such as blocking, are resolved by applying the parallel-processing programming techniques (e.g., CUDA and OpenCL) and the JPEG 2000 technique, based on the utilization of GPU.

5. ACKNOWLEDGEMENT

This research was supported by a grant (13SCIPA01) from Smart Civil Infrastructure Research Program funded by the Ministry of Land, Infrastructure, and Transport (MOLIT) of the South Korean government and by Korea Agency for Infrastructure Technology Advancement (KAIA).

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