

Implementation of an Interactive Information Sharing System for Disaster Measure Operation

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ABSTRACT

This study develops an interactive information sharing system for disaster measure operations, called “HyperRem.” It consists of the HyperRem-Master and the HyperRem-Node. The HyperRem-Master aggregates information held by meeting participants and visualizes it on a large display. The HyperRem-Node transmits information to the HyperRem-Master by flicking operation from mobile terminals and laptops owned by meeting participants. HyperRem saves screen states visualized on a large display to a database in chronological order, and the saved screen states can be reused. A reuse function and a playback function are implemented to reuse past screen states. The reuse function enables users to resume meetings by restoring past meeting contents to the large display. The playback function provides a review function for past meetings to absentees via a dedicated web page. The operability, functionality, effectiveness, and applicability of HyperRem were confirmed in an evaluation experiment with 10 subjects. The survey results of all five measures revealed an overwhelmingly positive response.

KEYWORDS

Disaster Support, Information Sharing, Interactive Operation, Large-Display, Meeting Support, Mobile Application, Multi-Surface Environment, Natural Disaster Reduction

INTRODUCTION

When a large-scale natural disaster occurs in Japan, emergency management headquarters is established, under the direction of the head of the local government, to discuss disaster response decisions, and future responses. Emergency management headquarters meetings are held many times after the disaster occurs (Miyagi Prefecture, 2015). However, emergency management headquarters have pointed out various problems in information sharing, collecting, and decision making (Joso-City Flood-Control Measure Verification Committee, 2015).

On the other hand, when it comes to daily meetings, the mainstream method is to share information on digitized materials, using a large display or projector. In such a meeting, digitized materials are shared among participants by physically connecting a large display installed in the meeting room to a laptop. This method has the following advantages:

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- It unifies the recognition of decisions among participants in the meeting.
- It clarifies the focus of the discussion by visually sharing the meeting agenda.

In general, the contents discussed at a meeting are shared among participants after the meeting as minutes (Whittaker et al., 2005). However, minutes often contain only conclusions, and the discussion process leading to the decision may not be described. In order to solve these issues, there is a method that allows non-participants to view the meeting later by recording the audio and video of the meeting (Cutler et al., 2002). However, if the duration of the meeting is long, users need time to view it (Nathan et al., 2012). Therefore, it is necessary to have a mechanism to help users grasp the contents of past meetings quickly.

In their previous research, Hirohara et al. (2017) constructed a disaster countermeasure decision support cloud system using a large, high-definition display. This system provided disaster information input and output functions to support information collection and sharing at disaster response headquarters. This system also provided an interactive sharing function, which can share disaster information on a laptop or tablet terminal to a large, high-definition display with one touch, and one click. However, since this system is not implemented with functions that can be used during normal times, it is not helpful in an emergency. In addition, this system cannot share dynamic information, such as decision-making processes.

RELATED WORKS

Kusakabe et al. (2007) developed a disaster information system based on task analysis during disaster response. This system provides task support at emergency management headquarters by classifying and sharing a large amount of disaster information, using an electronic map and an electronic bulletin board. However, this system was not developed to share information in real time. Chokshi et al. (2014) developed an ePlan Multi-Surface to support emergency response planning exercises. This system shows tweet information transmitted by residents, visualizes town flow data, using military and emergency simulation systems, and has a tiled display of the town from a video camera. In addition, the desktop is installed in the same space as the tiled display, and the user can reflect information from the tabletop to the tiled display. However, this system cannot pause and resume the meeting by saving the information displayed on the screen during the meeting.

Osaragi et al. (2017) developed a real time, synchronous system for collecting, sharing, and using disaster information. This system can collect information from field staff at the time of the disaster, and it can simulate fire spread to support fire-fighting and rescue activities. Nevertheless, this system is not equipped with functions that can be used during normal times. Kubota et al. (2014) developed a disaster information sharing system using open source WebGIS. This system contains a disaster information registration function that receives photos and status updates from the local government staff at the disaster occurrence site by e-mail and stores the data on WebGIS; furthermore, there is a disaster information visualization function that visualizes disaster information stored in WebGIS on a map. Like the above system, this system was not developed with functions that can be used during normal times.

Focusing on systems that can share information in meetings and open spaces using large displays and laptops, Jiang et al. (2008) developed “WeSpace.” This system can share multiple PC screens on a large display by unifying the output formats of different kinds of software. Shen et al. (2003) developed “UbiTable,” a system that automatically switches the content in a direction that is easy for the user to see. In addition, this system enables the user to set the download and viewing authority of the shared contents, taking user privacy protection into consideration. Everitt et al. (2006) developed “MultiSpace,” a system that can aggregate images and text information from all mobile terminals connected to the environment by using the tabletop as a central hub for the information sharing environment. Kukimoto et al. (2014) developed “HyperInfo,” a system that visualizes contents on the

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