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Reliving Museum Visiting Experiences on-and-off the Spot

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ABSTRACT

We have developed a GUI tool and a mobile MR system for reliving experiences at museums. The GUI tool was developed to provide services based on content made from activity logs and to enable effective analysis of visitors' behaviors using the logs. In addition, by running the GUI tool on a mobile MR system, users can browse visitors' activities with a sensation of realism on the spot. This paper describes the GUI tool and a pilot user study that was conducted to evaluate it.

CR Categories and Subject Descriptors: I.3.6 [Computer Graphics]: Methodology and Techniques - Interaction Techniques; H.5.2 [Information Systems]: User Interfaces – Graphical User Interfaces.

Additional Keywords: wearable mixed reality system, reliving experience, museum guide, GIS.

1 INTRODUCTION

Wearable systems that record user activities have recently attracted a great deal of attention because they have many potential applications, such as in marketing and equipment maintenance logs. Methods of visualizing for such large-scale-activity data are as important as technical issues in wearable systems such as localization and miniaturization.

We conducted a pilot user study of our wearable 3-D guide system at a science museum in Japan [1]. The guide system provided visitors with descriptions of museum exhibits, route recommendations, and notifications of time-scheduled events.

During the pilot user study, we recorded visitors' activity data that consisted of their positions, orientation, audio, and video with timestamps. Interview scenes were also recorded by two video cameras. We recorded these data so that we could analyze the visitors' behavior in detail and we could consider providing services based on content made from the actual activity log.

Using datamining techniques, it might be possible to find some interesting data from a large-scale activity log. However, it is difficult to effectively use multimedia data such as audio and video data that record visitors' behavior or interview scenes with datamining. The sense of meaning in multimedia data can be interpreted most effectively when data are presented to actual people.

On the other hand, by preparing content from activity data logged by the guide system, it is possible to provide services such as those enhancing the learning experience with museum content and exhibits through "corporeality," or to provide services where plural visitors can prepare their own recommendations by accumulating activity logs with the Web 2.0 model. In these cases, intuitive ways of presenting the activity logs represent a very important issue.

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Figure 1. Mobile MR System Hardware Configuration

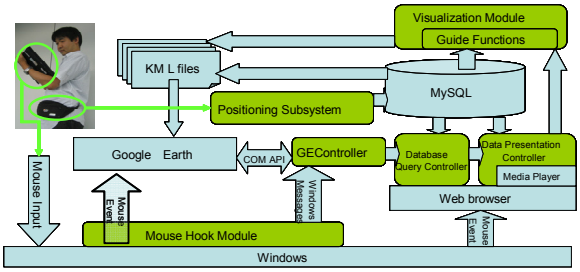

Figure 2. System Software Configuration

We have been developing a GUI tool for reliving museum-visiting experiences using actual activity data that were logged in the pilot user study at the science museum.

2 DESIGN POLICY

We decided to design our GUI tool for reliving experiences by considering the following scenarios.

Scenario 1) Reliving experiences after returning home

In this scenario, we used the GUI tool on a desktop PC. When a user queries data on a visitor ID, the GUI tool retrieves and shows the corresponding log data. When he or she indicates the time he or she wants to check by moving the time slider, the GUI tool searches for corresponding data from the position table, and visualizes them. At the same time, the GUI tool searches for a video file that contains a scene at the indicated time. If it exists, the scene is displayed on the video area. When the play button is clicked, the GUI tool is set to a mode where it updates the time to be visualized automatically. In this mode, 3-D visualization, the video file, and the audio file are played synchronously.

Scenario 2) Behavioral analysis of users

In this scenario, video files with recorded interviews and questionnaire data are also used as query keys that specify the visitor ID. For example, when the user sees a subject reporting on some activities in front of an exhibit about "bicycles" in the interview video, he or she can relive the scene by clicking the text word "bicycle" displayed in the script window that shows the script text of the interview. In addition, the tool provides a function whereby users can prepare links from the text to a position on the 3-D map, so that it enables them to find the scenes easily afterward.

Using the mobile MR system to analyze visitors' behavior on the spot, users are able to observe visitors' activities with a sensation of realism. For example, they can go to places where problems have been reported and relive the experience with the presented content. Moreover, to check whether other visitors have

had trouble in the same position, users are able to retrieve log data with their own positions and orientation and relive the other visitors' experiences at the location where the problem actually occurred. When a user focuses on a particular visitor's activities, he or she can track back the time to be visualized and relive the visitor's experience to observe these activities from the beginning.

We decided to design the GUI tool with two design policies to effectively present a large-scale activity log including multimedia data in these scenarios.

Recapturing the scene: The GUI tool should reproduce the output of Google Earth with audio and video that records a past visitor's situation to impart the sense of this that the user wants to relive. In addition, reliving the situation on the spot using a mobile MR system provides the user with a sensation of realism.

Providing effective method of data selection: We should provide functions that search data using not only the visitor ID and time but also the position and orientation to provide user interfaces that enable the data to be queried effectively and switched to allow the situation to be relived. In addition, we should provide a function that links a scene in an interview video to a position on the 3-D map to query the data by using this video to analyze the behaviour of users.

3 Configuration

Figure 1 is a composite photograph of the hardware configuration for the mobile MR system. The system estimates a user's position and orientation with a positioning subsystem that combines Kourogi's measurement method [2] [3] with map matching.

The GUI tool consists of a database-query controller, a data-presentation controller, 3-D visualization display area, and video display area (Figure 3). The database-query controller includes GUI components to input visitor ID, time range, 3-D position, orientation, and keywords. The current position, orientation, and time can be used as input for the mobile MR system. The data-presentation controller includes "play" and "stop" buttons and a slider for indicating the time range and timestamp of all data. The current position, visitors' trajectories, and guide content are displayed on a map of the 3-D visualization area.

The system uses Google Earth for 3-D visualization. Other GUIs are implemented using HTML forms, JavaScript, and Active X technology on a web browser. The MySQL is used as a database. The GUI tool shares many software components with the guide system to reproduce visualized 3-D views of the museum guide system. All these components are managed by PHP scripts. Figure 2 outlines the system's software configuration.

4 Confirmation of System Operation Capabilities

Using the actual data logged in the pilot user study, we confirmed the system's operating capabilities designed by the two scenarios that we previously discussed. It was easy to follow Scenario 1 on a desktop PC. For Scenario 2, we conducted a pilot user study to ensure that subjects could follow past visitors' activities using our GUI tool with the mobile MR system at the science museum. Four subjects did a task and made some comments. From observing subjects while they were reliving a past visitor's experience and evaluating their comments, we found the following:

1) Video data that record past visitors' activities are very important clues that enable their activities to be followed on the spot. Subjects were able to know which exhibits a visitor had been most interested in having spent a long time there.

2) When the camera angle or light conditions changed drastically in the video data, subjects lost the correspondence between the visitor's position in the video and the real environment. In this situation, the visualized position on the 3-D map was useful to regain the correspondence. However, as we visualized the raw data for the recorded position, which included measurement error, subjects were not able to regain the correspondence in some cases. As a result, all subjects treated the visualized position log as a supplementary clue.

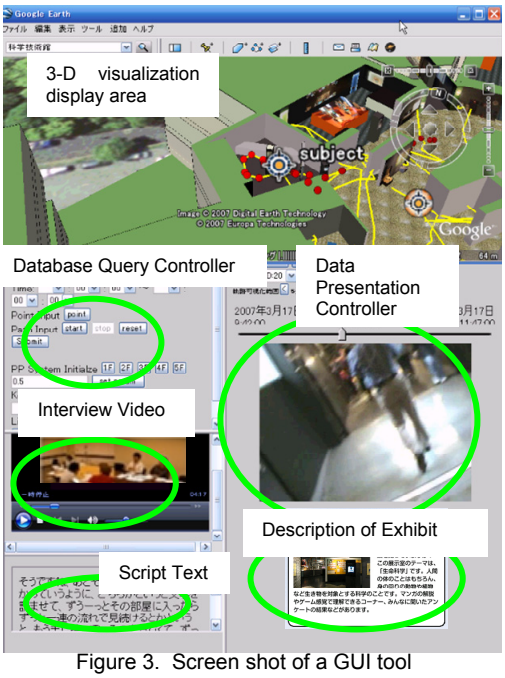

Figure 3. Screen shot of a GUI tool

3) Because a normal slider was used to control the time to present the activity log, one subject reported that he was not able to control the time as he had wanted. Actually, we observed that all subjects only used the slider when they wanted to skip scenes.

5 Conclusion

Our GUI tool and guide system should be useful for actual visitors to museums. Users can relive their experiences on their desktop PCs after returning home. They also can relive the experiences other visitors had. These kinds of relived experiences are expected to enhance learning experiences with museum content and exhibits through "corporeality".

The mobile MR system as a tool for behavioral analysis is also useful. It gives a sensation of realism when users observe visitors' activities on the spot. Improving user interfaces to enable presented time points to be selected from long-term activity logs, such as those with durations of two hours is future work.

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