Visitor Movement as Implicit Human-Computer Interactions in Museums

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Abstract: This paper outlines a novel location-based visitor assistant system in museums. It introduces visitor movement as a user-friendly and natural mechanism for enabling visitors. It enables visitors to explicitly or implicitly select annotation content about the exhibits and answer quizzes about their knowledge by their moving to specified spots in a museum. We operated the system at a science museum in Japan and received many positive evaluations from visitors.

Introduction

The use of location-based visitor-assistance services in museums has received much attention from researchers over the years, because it enables visitors to view or listen to annotation information about exhibits at the right time in the right place. There have been several academic or commercial attempts to provide the services in museums. However, most existing attempts automatically select and adapt annotation content according to only the current positions of visitors independently of visitors' interest and knowledge. As a result, visitors tend to be puzzled (or bored) because the content is beyond (or under) their knowledge and interest. A typical solution to this problem is to have each visitor explicitly input their interest and knowledge by user interface devices, e.g., buttons, mice, or touch panels. However, such operations are difficult to visitors, in particular children, elder, handicapped people, and often prevent them from watching exhibits. To solve the problem, this paper a new system for building and managing location-based visitor assistance services in museums. The key idea behind the system is to use visitors' movements between exhibits as an implicit operation for selecting the annotation that they want to know and evaluating their learning from exhibits, because visitor movement is one of the most primitive and natural behaviors to them in museums.

System Overview

This system supports one or more spots at a museum, where each spot corresponds to a specified space, e.g., in front of exhibits, and visitors can watch or listen to annotation about its exhibits and interact with the system through their movement. The system consists of two parts: location information server and user assistant manager. The former is constructed on a location-aware middleware, called *M-Spaces* (Satoh, 2007). It is responsible for detecting the spots that visitors currently stay at and maintaining information about the spots that they previously visited. The latter is responsible for maintaining relationships between the routes of the spots, annotation content, and navigation, and controlling output devices, e.g., displays and loud-speakers located at the spots connected through a wired/wireless network. These relationships are defined in a route-dependent event specification language, which was designed for the system by extending an itinerary language for mobile agents (Satoh, 2006). Since the system can aware the number and duration of each visitor's staying at every spot, when it detects the presence of a visitor at a spot, it selects appropriate annotation content according to the number, duration, and the visitor's profile, including the spots that he/she previously visited. It next plays the content by using output devices located at his/her current spot.

Figure 1 shows the language's several constructors corresponding to basic interactions. The first is to navigate visitors to specified neighboring spots. The second is to inform visitors that they arrive at the final spot. The third enables visitors to explicitly or implicitly select one spot or route among one or more spots or routes close to their current spots by their moving to their selecting spot or a spot of their route. The fourth corresponds to a quiz and enables a visitor to move to one of the spots corresponding to the quiz's choices. For example, when a visitor moves to a spot corresponding to the correct or (incorrect) answer, the system modifies his/her profile maintained in it. The system is general-purpose and independent of any museums and the underlying systems, including location sensing systems. In fact, curators or administrators can easily specify scenarios that they want by defining sequences consisting of these constructors.

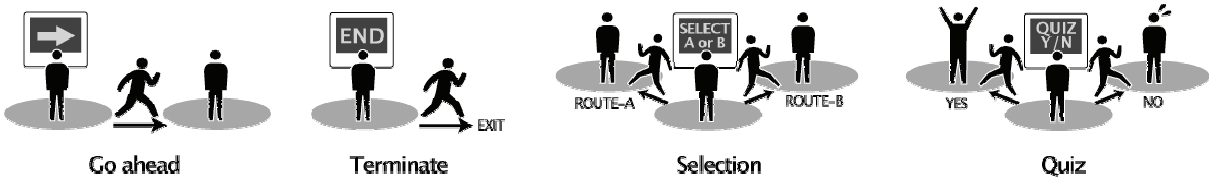

Figure 1. Four basic patterns of specification language.

Experiments

The system has already been used and evaluated in the Museum of Nature and Human Activities in Hyougo, Japan with an active RFID tag system, as shown in Figure 2 (a). Figure 2 (b) shows a sketch map about spots located at the museum. The experiment supported four spots in front of animal stuffed specimens, e.g., bear, deer, raccoon dog, and wild boar. Each spot could provide five subjects of annotation animations about its animal, e.g., ethology, footprint, feed, habitat, and feature and had a display and RFID reader whose coverage range almost corresponded to its space as shown in Figure 2 (c). An operator initially provided each visitor with an pendant including RFID tags before the visitor's experience.

We provided two kind of experiments to evaluate the availability and effectiveness of the system. The both experiments offered visitors with the annotation animation about the animals that are in front of their positions so that they can learn the animals with their observing the corresponding specimens. The first also is to enable each visitor to explicitly select the subjects that he/she wants by his/her movement to one of the spots corresponding to his/her selecting subjects. The second is to provide each visitor with several quizzes to review something about the animals that they learned by selecting the spots corresponding to his/her answers.

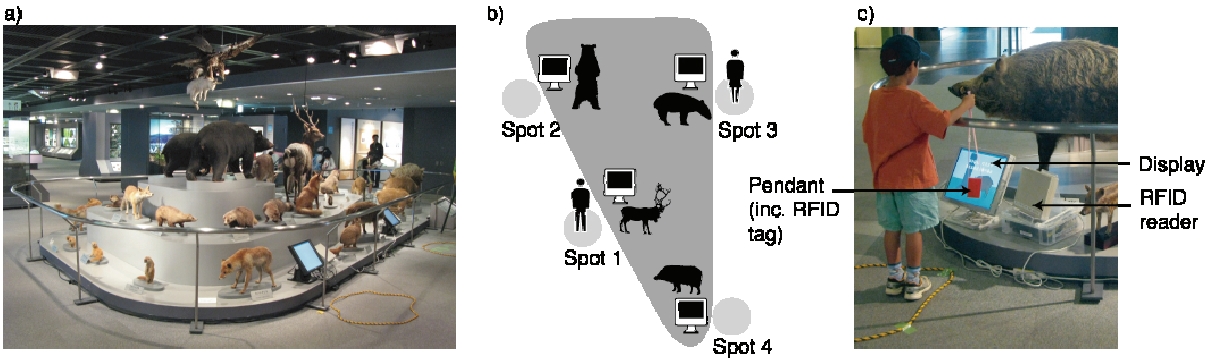

Figure 2. Experiment in the Museum of Nature and Human Activities in Hyogo, Japan.

Evaluation

This paper presents a basic evaluation on the second experiment in the museum for the reason of space. The experiment provided more than one hundred visitors with a course consisting of twelve annotation animations and three quizzes about the animals. Most of the participants were groups of families or friends who were from 7 years to 16 years old. After their experiences, 76 people of those who participated the experiment answered questionnaires about their answers to the quizzes and their feedbacks on the system in addition to their genders and ages. Almost all the participants had positive feedbacks on the system. Their typical feedbacks are listed as follows:

- We were very interested in or enjoyed the system.
- We could easily answer to the quizzes by our moving between the spots.
- We gained detail knowledge about the animals with our watching them in front of our standing positions.

Nevertheless, a few of the participants (less than 5 percents) have negative comments, e.g.,

- We impressed the quizzes themselves to be difficult.

Since most of the above visitors were failed at some of the quizzes and in young age brackets, they seemed to be impressed by the difficulty of the quizzes rather than the operation of the system itself.

Conclusion

We constructed and evaluated a location-based visitor assistant system for museums. It is characterized by using visitor movement as a user-friendly mechanism for selecting annotations about exhibits or answering quizzes so that it can naturally acquire individual visitors' interest and knowledge through their movement between exhibits and adapt the annotations to the interest and knowledge in addition to the exhibits that they previously watched/listened to and their current positions.

References

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