Online Note Sharing in a Mobile Self-Guided Tour System

Hui-Huang Hsu* and Hsuan-Ting Liao
*Department of Computer Science and Information Engineering
Tamkang University, Taipei, Taiwan
Innovative DigiTech-Enabled Applications & Services Institute (IDEAS)
Institute for Information Industry (III), Taipei, Taiwan
*huihuanghsu@gmail.com

Abstract

This paper presents a self-guided tour system that allows a visitor to instantly share his/her notes or remarks about exhibits with others through the Internet. The note/remark not only can be stored with the exhibit information to be accessed by other visitors, but also can be broadcasted through microblogging in a timely manner. This provides an interaction mechanism for the visitor to feedback his/her remark on a certain exhibit to the administration and to share it with friends instantly. A prototype system for such an environment was realized through the RFID and mobile technologies. The architecture and the development of the prototype system are illustrated in this paper.

Keywords: *Self-guided tour systems, mobile computing, ubiquitous computing, RFID, microblogging*

1. Introduction

Self-guided tour systems have been used in museums and art galleries for long. With the systems, the visitor can receive detail information of the exhibits. Traditionally, a handheld device with voice instructions is carried by the user. The user follows the guidance and listens to the information of the exhibits. However, the user cannot freely choose any object he or she is interested in. This is not able to meet the need of the visitors. Moreover, these voice instructions are pre-recorded and updates are needed for all handheld devices if the exhibition is changed.

Handheld devices with wireless communication capability have become very popular in recent years. Personal digital assistants (PDAs) and mobile phones can be easily acquired with a reasonable cost. Self-guided tour systems with such wireless handheld devices allow instant downloading of exhibition information from the server. Hence maintenance of exhibition information is made easy under such a client-server architecture. Furthermore, interaction between the visitors and the system becomes possible with the wireless connection. Feedbacks from the visitors can be collected simultaneously when they are still around a certain exhibit. Such feedbacks are important for the officials and organizers of the exhibition to know how the visitors think about the exhibition.

To provide exhibition information to the user through these wireless handheld devices, identification of the exhibit is needed first. One solution is to use positioning technologies, like GPS for outdoors and wireless LAN for indoors, for location-aware services [1, 2, 3, 4]. However, the positioning accuracy is always a concern and the cost is high. The other way for such information service is to use the Radio Frequency IDentification (RFID) technology [5, 6, 7]. A passive RFID tag is posted near a certain exhibit. A handheld device attached with an RFID reader is used to read the unique ID number of the exhibit; the multimedia information regarding to the object is then downloaded from the server. In this research, the RFID technology is chosen due to its ease-of-use and accuracy.

A blog is a type of website that shares information from events to personal feelings and thoughts in reverse-chronological order. Microblogging is a type of personal blog that emphasizes more on capturing a moment in time [8, 9]. It allows the user to post a message with less-than 140 characters via text message, email, or instant messaging tools. With microblogging, people can broadcast and share their current status, activities, and remarks instantly. We would like to utilize the power of microblogging in the self-guided system to help publicize the exhibition.

This research designed an integrated framework for a mobile self-guided system. A PDA attached with an RFID reader is used as the handheld device in this system. It can

978-0-7695-3967-6/10 $26.00 © 2010 IEEE
DOI 10.1109/CISIS.2010.121

download exhibition information (from both the official and other visitors) via the wireless network when the RFID reader detects an RFID tag. The user can leave any message to the official server and use the "mail to blog" function to post the message to his/her personal microblog, simultaneously. People on the Internet can share his/her visit in real time. The official can decide later if the message is proper to be made public to other visitors. This mobile environment can be an excellent information-sharing platform for exhibitions in any form.

In the remainder of the paper, related researches are first discussed in Section 2. The architecture of the RFID-based self-guided tour system is presented in Section 3. Instant information sharing as an additional function to the tour system is also proposed. This function can be realized by the popular microblogging. The development of a prototype system is then shown in Section 4. Finally, a brief conclusion is drawn in Section 5.

2. Related Work

RFID and mobile technologies have been used in museums and art galleries. A custom-designed RFID application called eXspot was deployed and tested at the Exploratorium [5]. Exploratorium is a science museum located in San Francisco, where the visitors can practice hands-on science. In the system, an RFID reader is mounted near each museum exhibit; the visitor carries an RFID tag which was registered at a registration kiosk earlier with the visitor's email address. By placing the RFID tag near every exhibit he or she visits, the visitor bookmarks the exhibit in the system. This could also trigger cameras nearby to take pictures. The visitors can review all the records on the kiosk or personalized web pages on the Internet. The eXspot system surely enhances visitors' museum experience, but it does not address the issues of collecting feedbacks from the visitor and broadcasting the feedback on the Internet in real time.

In [6], an example of using the RFID technology to creating an interactive environment in an art gallery of a university in Taiwan is introduced. Same as our design, the user carries a handheld device with an RFID reader to retrieve the exhibit content via detecting the RFID tag associated with the exhibit. The system contains a blog unit which is a communication channel between the *author* and visitors. Presumably, the author is the official who manages the blog. When a visitor initiates a subject, the author and other visitors can follow. The blog is more like a forum for discussions, which allows the officials to know the thoughts of the visitors about a certain exhibit and the exhibition. This blog unit is different from a normal blog system. In our system, the feedbacks from the visitors are *exhibit-centered*. That means remarks on the same exhibit are stored together with the exhibit information. Moreover, the aim and purpose of the blog were not quite the same as ours which focused on a timely sharing of information on the Internet.

A museum conceptual model based on RFID was proposed in [7]. Both passive and active RFID tags are used in the model. Thus it can support automatic positioning of the mobile device and consequently location-aware services can be provided. The user needs not manually select the information/service he or she needs. However, to use both passive and active RFID simultaneously, a hardware problem has to be dealt with first. An RFID reader that can read both passive and active tags is yet to be produced. Also, the paper focused on providing location-aware information while our system aimed at online note/information sharing by the visitors.

There are other researches focusing on location-aware services for exhibition shows or tourist guide. Although in our view the RFID technology is a simpler way to know the visitor's intention, the positioning technologies used for such services are worth of discussions. In [1], indoor location-based services in exhibition show, named the *Wireless Exhibition Guide*, were developed and evaluated. Portable personalized location-sensitive information systems in museums, conference centers, and art shows can be built based on it. The work tried two indoor positioning systems – *iGPS* and Wireless LAN. The term *visitor orientation* with emphasis on visitor satisfaction is raised as an important strategy. In [2] and [3], GPS-based outdoor tourist guide applications are presented. Both of them provide rich information for the visitor according to his/her location and context. In [4], the *Dynamic Tour Guide* based on a mobile agent was developed. It can plan an individual tour and offer location-based interpretation. Generally speaking, there are two essential issues in these researches. The first issue is the positioning accuracy which was also discussed in [1] and [3]. The other one is the incorporation of the user context. This is a complicated problem involving *ambient intelligence* research and is not in the scope of this work.

3. System Architecture

The system architecture of the RFID-based self-guided tour system is shown in Figure 1. A PDA with an RFID reader is carried by the user. The user can detect an RFID tag associated with an exhibit by the reader. The reader interprets the radio wave to obtain a unique identification (ID) number of the exhibit. The PDA sends this number to the content management system (CMS) through the wireless LAN and the Internet. The CMS responds with the multimedia information related to the exhibit of that ID number. The PDA then displays the information on the

screen. If the user would like to add a note or remark on the exhibit, he or she can write a short message and submit it to the CMS for official approval. The message is also sent to the user's personal microblog via email. The message is immediately broadcasted to other users in the microblogging system.

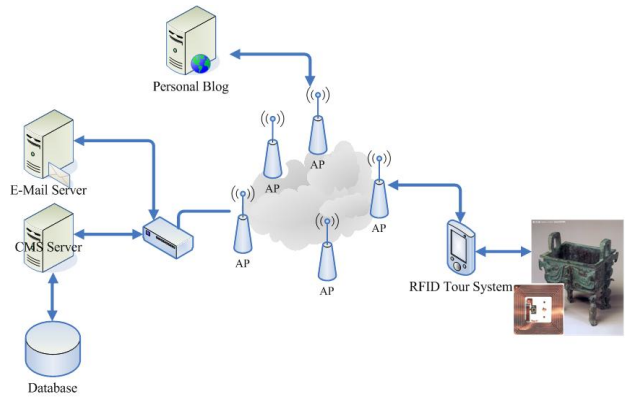

Figure 1. An RFID-based self-guided tour system

There are five modules in the frontend mobile tour system on the PDA held by the visitor as shown in the upper half of Figure 2.

- The RFID reader module converts the radio wave from the RFID tag associated with an exhibit to a unique number.
- The RFID identification module is responsible for transmitting the control protocol commands and receiving the response from the RFID reader. It then identifies the exhibit object corresponding to the tag ID number through communication with the backend system.
- The wireless communication module is responsible for transmitting data to and from the backend system through the communication interface provided by the PDA.
- The exhibition content display module is responsible for displaying the content of the exhibit information to the user.
- The visitor interaction module is the interface for the visitor to write notes/remarks to the CMS and his/her personal microblog.

There are four modules in the backend content management system (lower half of Figure 2).

- The wireless communication module is responsible for receiving and responding to the network communication and data transmitted from a remote mobile tour system.
- The RFID tag mapping module is a middleware that is responsible for matching the RFID ID number from the mobile tour system with the database in the CMS, and passing the retrieved information associated with the ID number back to the mobile tour system.
- The exhibit (object) content repository module stores the exhibition content of all the exhibits. The content information of all exhibits is stored in an HTML format. The mail-to-blog control module is used to transmit the user notes/remarks to his/her personal blog.

4. System Development

The RFID technology plays an essential role in this mobile tour system. It is a contactless sensing technology using radio-frequency electrical waves. The RFID reader detects RFID tags within its detection range. Each RFID tag has a unique identification number. The reader detects the identification number and sends it to the middleware to find the corresponding information, e.g., product ID or name. In this research, we used a CF-card reader, CF-1700T by Sunion (http://www.sunion.com.tw/) with a working frequency at 13.56 MHz. The reader needs to be attached to a PDA. It consumes power supplied by the PDA at 15mA (max) in operation and 4mA in idle. The reader can read RFID tags that followed the ISO15693 standard. The maximal distance for reading the tags is 10 centimeters. The PDA used in this research is of ASUS A716 series with an Intel Xscale PXA255 400 MHz processor. It runs on a Microsoft Windows Powered Pocket PC 2003. The PDA has a CF Type II slot to plug-in the RFID reader and can access wireless LAN through WiFi. With the popularity of the wireless LAN, this mobile tour system can be implemented easily.

The software tools used in developing this tour system were Visual Studio 2005, ASP.Net, and WordPress. Visual Studio supports application development in pocket PCs or smart phones with WinCE OS very well. It was used to develop the programs running on the PDA. ASP.Net, on the other hand, has an integrated Web development platform. The Web contents developed by ASP.Net can be displayed on any browser and any platform, like WAP mobile phones or PDAs, without any problem. WordPress was used to set up a blog system for our experiments. WordPress is a shareware (http://wordpress.org/). The blog system built by WordPress accepts posts via email-to-blog.

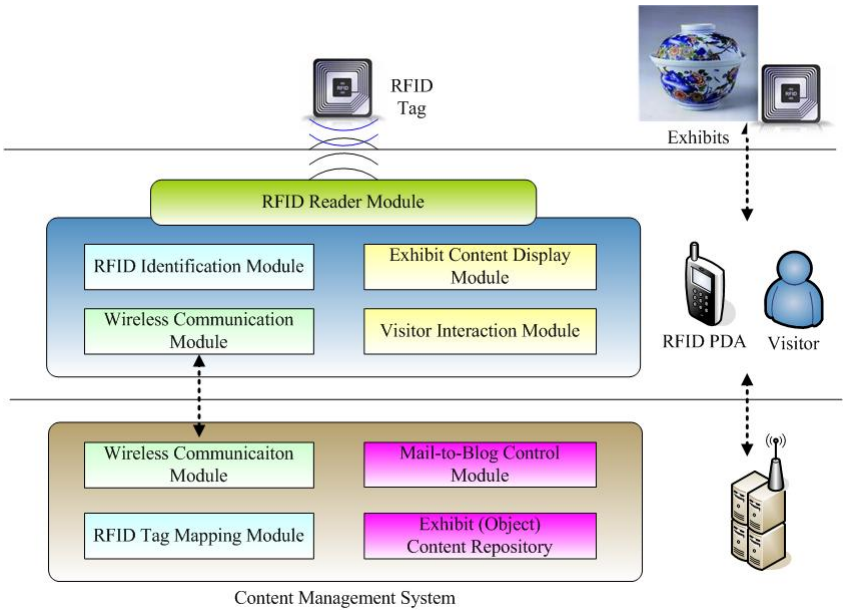

Figure 2. System modules

The subsystems including the content management system, the mobile tour system, and the online information sharing system, are introduced in the following. In the content management system, the exhibition organizer can manage the multimedia information of all exhibits and the short notes/remarks from the visitors. A user-friendly interface was designed and it makes the management much easier. The database manager needs no background in webpage design; however, he/she can choose to use HTML to have a special design for a particular exhibit. The manager can also read and decide if a note or remark from a visitor is appropriate for the public.

In the mobile tour system, there are two tabs – one for reading the RFID tag of an exhibit, and the other for browsing the downloaded information of the exhibit. Figure 3 shows that in the *Read Tag* tab, the RFID reader attached to the PDA has been initialized and an RFID tag is read. Figure 4 shows that in the *Tag Browser* tab, the information of an exhibit has been downloaded and displayed on the PDA. The notes/remarks shared by other visitors can also be read by clicking a button at the end of exhibit information.

Figure 3. Read a tag ID

Figure 4. Client display of exhibit information

The visitor can choose to read other visitors' notes/remarks and share his/her note or remark by clicking "add a note/remark" in the online information sharing system. This can be done instantly while the visitor is appreciating an exhibit. After the note or remark is input in the text area, the note/remark can be saved to the database server of the system; it can also be published on the Internet through the personal blog of the visitor (Figure 5). The note/remark input in the text area in Figure 5 can be added to the personal blog of the visitor instantly (as shown in Figure 6).

Figure 5. Interface for adding a note/remark

Figure 6. A note/remark posted on the personal blog via e-Mail

5. Conclusion

In this research, a mobile RFID tour system was developed. The system allows the user to freely select any exhibit to read detail information on a handheld device. The visitor can write a short note or remark when he or she is appreciating the selected exhibit. The note/remark is saved to the system database as a user feedback; it can also be shared to other visitors or broadcast on the Internet through the visitor's personal blog. The system not only can be used in a museum or an art gallery, but also can be used in outdoor scenic sites, exhibition shows or even department stores for advertising purpose.

Most mobile phones can access the Internet through wireless connection nowadays. Also, the hand-writing recognition technology is matured and such software tools are becoming popular on mobile phones. Text input on the mobile phone is not a problem anymore. Furthermore, with the advances of mobile devices, we can expect that mobile phones with a built-in RFID reader will be on the market very soon. Thus, from the technological aspect, the developed system can be easily deployed.

References

[1] A. G. Pateli, G. M. Giaglis, D. D. Spinellis, "Trial Evaluation of Wireless Info-Communication and Indoor Location-Based Services in Exhibition Shows," *Lecture Notes in Computer Science*, *3746*, 2005, pp. 199-210.

[2] D.-J. Park, S.-H. Hwang, A.-R. Kim, B.-M. Chang, "A Context-Aware Smart Tourist Guide Application for an Old Palace," *Proceedings of the 2007 International Conference on Convergence Information Technology*, November 2007, pp. 89-94.

[3] T. Simcock, S. P. Hillenbrand, B. H. Thomas, "Developing a Location Based Tourist Guide Application," C. Johnson, P. Montague, C. Steketee (Eds.), *Conferences in Research and Practice in Information Technology Series*, 21, Australian Computer Society Inc., Australia, 2003, pp. 177-183.

[4] K. ten Hagen, M. Modsching, R. Kramer, "A Location

Aware Mobile Tourist Guide Selecting and Interpreting Sights and Services by Context Matching," *Proceedings of the 2nd International Conference on Mobile and Ubiquitous Systems: Networking and Services*, July 2005, pp. 293-301.

[5] S. Hsi, H. Fait, "RFID Enhances Visitors' Museum Experience at the Exploratorium," *Communications of the ACM*, 48(9), September 2005, pp. 60-65.

[6] H. T. Lin, C. H. Chiu, C. F. Lin, S. M. Yuan, "Implementing an Interactive Environment with RFID Technology: Example of an Art Gallery," *Proceedings of International Conference on Convergence Information Technology*, November 2007, pp. 1457-1462.

[7] R. Tesoriero, J. A. Gallud, M. Lozano, V. M. R. Penichet, "A Location-Aware System Using RFID and Mobile Devices for Art Museums," *Proceedings of the 4th International Conference on Autonomic and Autonomous System*, March 2008, pp. 76-81.

[8] A. Java, X. Song, T. Finin, B. Tseng, "Why we Twitter: An Analysis of a Microblogging Community," *Lecture Notes in Computer Science*, *5439*, 2009, pp. 118-138.

[9] C. Honey, S. C. Herring, "Beyond Microblogging: Conversation and Collaboration via Twitter," *Proceedings of the 42nd Hawai'i International Conference on System Sciences*, Jan. 2009, pp. 1-10.