Vorschlag einer ortsabhängigen Edutainment-Plattform

Proposition of a Location-based Edutainment Platform

Dr. S. Nikiel,
Institute of Control and Computation Engineering
University of Zielona Góra
ul. Podgórna 50, 65-246 Poland
e-mail: S.Nikiel@issi.uz.zgora.pl

J. M. Pfeiffer, S. Süß,
Fachhochschule Giessen-Friedberg
Wiesenstr. 14, D 35390 Gießen
e-mail: Jan-Michael.Pfeiffer@mni.fh-giessen.de

Zusammenfassung:
Drahtloser Zugang zu Edutainment-Inhalten ist einer der wichtigsten Faktoren im Hinblick auf mobile Lernsysteme. Multimedialer Inhalt, auf den intuitiv und breit gefächert zugegriffen werden kann, ist entscheidend, um Benutzer an ein System zu binden. Dieser Artikel präsentiert eine ortsabhängige Lernplattform als technische Basis für eine Vielzahl möglicher Edutainment- oder Museumsanwendungen. Bluetooth-basierender Zugang zu multimedialen Daten garantiert kosteneffektive Lösungen, die für mittlere und kleine Museen, Galerien und Lehranstalten geeignet sind.

Abstract:
Wireless access to edutainment data represents one of the most important factors with regard to the mobile learning systems. Multimedia content that can be accessed in an intuitive and diversified way is crucial to bind users to a system. This article presents a location-based learning platform as the technical basis for a wide range of possible museum and edutainment applications. Bluetooth based access to multimedia data guarantees cost-effective solutions available for medium and small museums, galleries and educational institutions.

1. Introduction

Cultural institutes, museums and exhibitions face new challenges with pervasive digital technology [1]. Intuitive wireless access to multimedia data as a mean for learning must be considered in modern knowledge media design. Digital video, images, text and sound/music have familiar appearance that can explain background information for exhibited artifacts [2,3,4,5,6,7]. Experiencing multimodal information can cause immersion in the imaginary world providing broader context to the exhibition [8,9,10]. Highly motivating learning environments can be created this way. Digital technology also assures language localization of the presented information. Although digital media is widely used to present information about collections on the Web, there is still need for proper and cost-effective integration of wireless communication, digital media and popular terminals such as mobile phones and PDAs [3]. Concerning wireless access, there are several technologies supporting mobile information systems, including WiFi, IrDA and GSM [4,5,6,7].

Outdoor mobile Augmented Reality systems usually exploit GPS and powerful but rather awkward notebooks [7,8,9,10]. Generally user location systems rely on GPS based services that are not working in closed areas such as museums and exhibitions. Museum visitors are usually provided with a mobile device at the beginning of their visit. They can walk around the artifacts such as sculptures or stand close to paintings and they get additional information to this exhibit. The information is displayed (on demand, e.g. by scanning barcodes or by manual input of ID) on

a Tablet PC or PDA. Some devices may be tracked to provide consistence of virtual and real scenery in Augmented Reality applications [6,7,8,9,10,11,12,13]. For closed but open areas (to avoid signal reflections), a localization of user can be performed with positioning in WiFi networks or with infrared interfaces.

Popular types of interaction the selection of information and alternation could support visitors with more engaging tasks. Most systems provide a simple selection of a media object by clicking on its icon on a mobile device [6,7,8,9,11,12,13]. The selection is sent along with the position to a central server that sends back updated and customized information. This technique is used to deliver specific information to the user standing in front of an exhibit. This article proposes the Bluetooth-based edutainment platform as the technical basis for a range of low-cost mobile learning and promoting solutions.

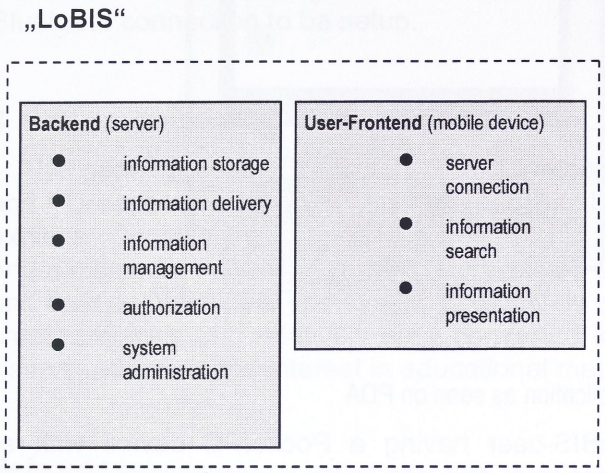

Fig.1 General architecture of the LoBIS

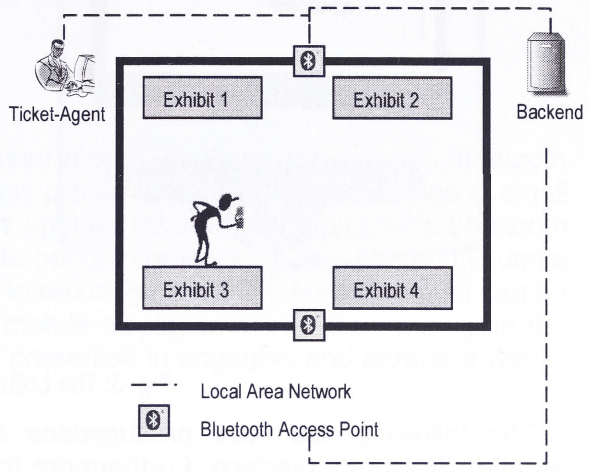

Fig.2 A sample showroom and a communication architecture

2. LoBIS- a mobile edutainment

The LoBIS (Location-Based Information System) is a proposition of a Bluetooth-based multimedia environment delivering data that is adapted for mobile devices. System functionalities include storage of digital media, administration and wireless delivery of information based on user input related to his/her location. Information describes the exhibits currently faced by the user. The visitor can access different media displayed on the PDA (Figure 1). The system is divided into user front-end and content delivery back-end parts. Due to low performance of processors utilized in mobile devices, it is useful to relocate most data processing to the back-end computer. This computer manages a database for all digital media that can be delivered to the visitor. Moreover, the server supplies authorization of users and administration of the whole system.

User front-end part is the application running on a mobile device (Pocket PC). The substantial functions are created to make GUI (Graphical User Interface), to handle communication with the server and to display multimedia content. The LoBIS support different media types: text and text with mark-up features supporting hyper-links (txt, HTML), pictures (JPEG, PNG, GIF), digital audio (streamed Real Media V8 audio format) and digital video (streamed Real Media V8 video format).
Figure 2 depicts a diagram of a sample showroom with 4 exhibited artifacts. The figure shows a rectangular showroom from the bird perspective with 4 exhibition objects. At the upper and lower wall of the room in each case a Bluetooth access point (BTAP) is attached, which is connected by a local network with the backend server. Each BTAP supplies information to exhibition objects, which are next to it. BTAP 1 supplies information for objects 1-2 and BTAP 2 for objects 3-4. If a LoBIS-user moves in the room, his mobile device is always connected to the BTAP with the strongest signal. In an ideal case this means, that this BTAP has the smallest distance to the LoBIS-user. In order to enable the ticket-agent to create and output access tickets, it is also connected to the LoBIS backend via network.

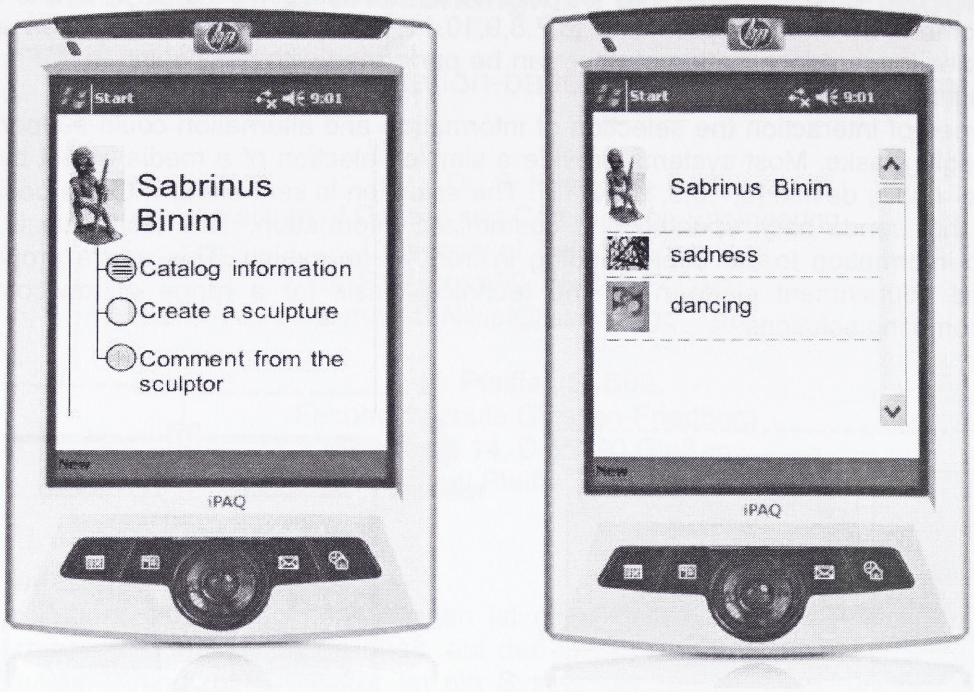

Fig. 3: The LoBIS application as seen on PDA

The following use case presupposes a LoBIS-user having a PocketPC device with an integrated Bluetooth interface. Furthermore the user front-end has to be successfully installed on the mobile device.

1. The backend generates an access-ticket. This is issued to the LoBIS-user by the ticket-agent.
2. The user front-end connects to the backend using this access-ticket.
3. The LoBIS-user moves through the museum and stops in front of exhibition object number 4. He wants to retrieve additional information about this object. He looks on his mobile device and sees all exhibition objects close to him.
4. The user selects exhibition object number 4 (Sabrinus Binim) from a list of objects. The user-front-end asks the backend, which information is available for object number 4.
5. The backend looks up the information available and creates a list. This list is sent to the user-front-end.
6. The LoBIS user selects the information desired. The user front-end requests the information.
7. The backend gets the information from its database and sends it to the user front-end.
8. The user front-end presents the information on the mobile device.

Based on actual location of the user, a customized menu with appropriate list of media objects is ready to be streamed and played at the PDA device (Figure 3).

3. Some remarks on bluetooth

The Bluetooth technology was developed primarily to replace the wires that connected electronic devices with a wireless interface. It was not designed to provide location-based services. Therefore it is bound to certain constraints and issues with using Bluetooth for such kind of applications. Bluetooth has a range, which depends on the power and varies from 10m to 100m. Downstream bandwidth is enough to deliver approximately seven live streams of digital video

(totally 732 kbit/s). Two Bluetooth enabled devices will establish a connection with each other only if they are within this distance of each other. It is this feature that can be leveraged for location-based services. Whenever a user is close to a LAN access point his mobile device will establish a connection. It means that if one LAN access point is servicing one exhibit then the other exhibit should be at least 10 meters away. Alternatively if one LAN access point is servicing multiple exhibits the user will have to select the exhibit whose information he wants to see using his device. One way in which this can be overcome is by asking the device to tune to the strongest signal since that would indicate the exhibit the user is closest to (there are three signal strengths-detection ranges: far, medium and close). A Bluetooth chip limits the number of simultaneous connections that can be established to it. If the LAN access point needs to service a large number of connections then the number of Bluetooth chips in the LAN access point would also need to be increased thus increasing the cost of the LAN access point. It takes close to four seconds for a Bluetooth connection to be setup.

4. Conclusions

The paper proposed a prototype of Bluetooth-based mobile edutainment system. Bluetooth and PDA are low-cost mobile media solutions that may prove to be useful in wide range of small exhibits. Considering further development for smart phones (already equipped with Bluetooth and multimedia capabilities) the system will be able to handle communication with various users and their own devices. The system is relatively easy to reconfigure. Digital media content can be created quickly and relatively easy converted to fit mobile displays. This system may gain the visitors' attention and interest in educational material presented in engaging and attractive way.

References:

1 Sauter J., Monath. G, "The New Media at Museums and Exhibitions", Proc. of EVA Berlin 2004, p.21

2 Renault S., Stachel O., "Experience-oriented 3D Kiosk with Contactless Interaction for Exhibitions and Museums", Proc. of EVA Berlin 2004, pp.40-46

3 Blanchebarbe M., "Information Transfer with Multi-Media Guidance Systems", Proc. of EVA Berlin 2005, pp. 35-36 --limits, techno for museums

4 Mackensen G., "The Economy of Multi-Media Installations, The Match of CMS and PDA in the Overseas Museum Bremen", Proc. of EVA Berlin 2005, pp. 37-41, costs WLAN PDA

5 Shroeder H.M., "Acceptance of Multimedia Guides- Results of a Visitors survey", Proc. of EVA Berlin 2005, p. 42, PDA, IRDA

6 Halbach Ch.,"Mobile City Guide for Locating and Using Tourist and Cultural Attractions", Proc. of EVA Berlin 2005, pp. 151-157, GPS

7 Spiess V., Pfeiffer A., „Smart Information Periphery- Multimedia intermediation systems", Proc. of EVA Berlin 2005, pp. 199-201, WLAN, GPS

8 Holweg D. et al, "GEIST-History Experience at Face", Proc. of EVA Berlin 2004, pp. 87-91

9 Geist home page http://www.tourgeist.de/

10 Archeoguide home page http://archeoguide.intranet.gr/

11 Bieber G., "MOBIS-Mobiles Besucher Informationsystem", Proc. of EVA Berlin 2003, pp. 18-23

12 Gries D., "Mobile Computing in Muesum: Das Projekt eines mobile companion im museum mobile der AUDI AG in Ingolstadt", Proc. of EVA Berlin 2003, pp. 24-28

13 Bieber G.,"A New Generation of Personal Navigation System for Fairs and Exhibitions", Proc. of ISI 2001, Academic Press Canada, pp. 2894-300