EDUCATIONAL CONTENT PUSH TO MOBILE PHONE USING BLUETOOTH IN A MUSEUM

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ABSTRACT
This paper sets out a software development targeting visitors in a museum. The main idea of the project is to implement a low cost system that would provide visitors with educational content about paintings. This was achieved by means of a system that pushes an educational content (images, audio and texts) to mobile phone clients when they are in communication range of a Bluetooth transmitter. On the server side, the software has been developed using the BlueCove library which is a Java library for Bluetooth. The OBEX (OBject EXchange) protocol was chosen for data transfer. On the client side, the application has been developed with Java 2 Mobile Edition.

KEY WORDS
Cell Phone, Mobile Phone, Bluetooth, Museum, Educational Content, Java, OBEX, J2ME

1. Introduction

1.1 Context
The municipal Museum of Pont-Aven [1] was created in 1985 in order to promote the artists who drew their inspiration from Pont-Aven. The well known Pont-Aven School came around Paul Gauguin in Brittany between 1886 and 1896. The work which is presented in this paper was achieved in the framework of the “Maurice Denis et la Bretagne” exhibition from June 6 to October 5, 2009.

1.2 Project targets
The main idea of the project is to implement a low cost system that will provide visitors with educational content about paintings. Such a system can replace traditional audio guide that are lent to visitors.

A quick overview of new developments in this field points out at first the use of PDA [2] [3] that support interactive applications to deliver rich media, such as audio and video, to visitors.

Other examples of developments [4] [5] provide more added value to visitors by means of objects recognition in museums based on images which are taken directly by the visitor. The image is sent to a server; objects are recognized and then the requested information is sent to the visitor. These applications are exciting but they require many types of equipment such as PDA or tablet PC, network infrastructure and servers with database. Such applications are well suitable for large museum.

In our case we were requested to provide a low cost system. For that reason we pay attention to mobile phone. No need to provide any equipment to visitors because most of them own a mobile phone.

A lot of museums are using mobile phones for tours, especially in the US. But it is not “the great democratic tool for reaching new audiences in Europe” [6]. On the one hand, many museums in Europe are located in historic buildings where mobile phone reception is poor. On the other hand, a lot of Europeans have ‘pay-as-you-go’ plans and so, higher per-minute call costs [6].

In order to avoid any additional cost for visitors, the idea is to push an educational content (a multimedia application: images, audio, texts) to mobile phone clients when they are in communication range of a Bluetooth transmitter.
There are many advantages for that solution:

- There is no cost for data transfer.
- The content is stored on the mobile phone and can be read at any time anywhere.
- The content can be easily transferred from one mobile phone to another.
- The visitor is requested to accept or refuse to download the content.
- It is easy to use and does not require any specific knowledge from the visitor.

2. Application overview

2.1 Hardware requirements

Visitors need to use mobile phones that support Bluetooth wireless technology and that implement SUN Java technology J2ME (Java 2 Mobile Edition) [7]. This is the case for most of recent mobile phones today excluding, at this date, iPhone and Android based phones [8].

The Bluetooth transmitter (Figure 1.) has been implemented on a Personal Computer. This was a request from the museum but Bluetooth Access Points that achieve the same job can be found on the market for a cost that does not exceed 400 €. An example can be viewed in [9].

![Figure 1. Bluetooth transmitter](image1)

2.2 Server side

On the server side, the software is in charge to transfer the content to mobile phone clients. This application has been developed using the BlueCove library [10] which is a Java library for Bluetooth. The OBEX (OBject EXchange) protocol was chosen for data transfer because it is commonly available on mobile phones that support Bluetooth wireless technology.

An overview of the software architecture is provided Figure 2. This architecture points out two threads. The first one is in charge of discovering mobile phone clients. The other one is dedicated to data transfer to clients.

The basic behaviour of the server is shown Figure 3. After initializing the Bluetooth device we load configuration data: file name to transfer to clients, timeout for discovering clients, maximum number of clients to be served during one loop, duration to keep clients that were served into clients list (in order to avoid sending file to clients that were already served!).

![Figure 2. Server UML Diagram](image2)

![Figure 3. Server behaviour](image3)

After loading configuration data, starts a three steps infinite loop:

1) Discovering new mobile phone clients.
2) Sending data to new clients that were discovered.
3) And finally, updating the list of clients that were served.
2.3 Client side

The client software has been developed in Java language J2ME [7]. It enables the visitor to choose interface language (French or English) and then to get a main menu that shows the name of paintings of which educational contents are available (Figure 4.).

When a painting has been selected the visitor can decide either to read the text or to listen at audio comments (Figure 5.).

This way this application can easily be reused for new upcoming exhibition or some other educational purposes.

2.4 Content design

The educational content was designed so that changing data does not require changing any source code. Data are simply stored in folders as presented hereafter (Figure 6.). It is very easy for the museum to change all the content of the client application:

1. The first step is to copy the right files in the right directories.
2. The second step is to re-compile the client software.

3. Experimentation

The experimentation was carried out from June 6 to October 5, 2009. Unfortunately, no survey had been performed among visitors during the exhibition. Most of observations and comments are coming from the people in charge of the reception desk:

- Apparently, the most receptive public with this application is the young public.
- Some visitors had difficulties in downloading contents and thus to use these comments while visiting.
- Those who were not able to download the application gave up.
- On the other hand, a lot of visitors were interested in this innovating proposal.
4. Conclusions and future work

A new experiment will be carried out next summer (2011) during “Ker-Xavier Roussel” exhibition. New functions will be added to the software in order to log information from users: number of connexions, mean time to download... and a questionnaire will be set up in order to collect feedback from visitors.

A paradox of the project was the fact that using mobile phone was not allowed in the museum. As a constraint, we had to set as low as possible the volume of audio files.

Downloading the application to mobile phone was too long. Fifteen paintings were described in this application. A multi-language application was easy to implement but it was not a good idea. It would have been more efficient to provide one application per language. Thus the size of the application would have been smaller.

Nevertheless we believe in that solution; especially for short contents. An improvement of this application would be to use a Bluetooth transmitter as an access point to the local network of the museum. Then visitors would be able to send requests to a local server in order to get information about the painting of their choice.

Finally, this project has contributed into the fact that the museum obtained a National Label for the exhibition: “Maurice Denis et la Bretagne”. This exhibition received more than 30.000 visitors.

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