

Technologies for making digital libraries and archives accessible on mobile platforms.

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In this whitepaper we shortly present and evaluate some relevant technologies for making digital archives accessible on mobile platforms like PDA and Smartphones. This paper is based on experiences from a case-study project, our company digiMobile did in autumn 2005.

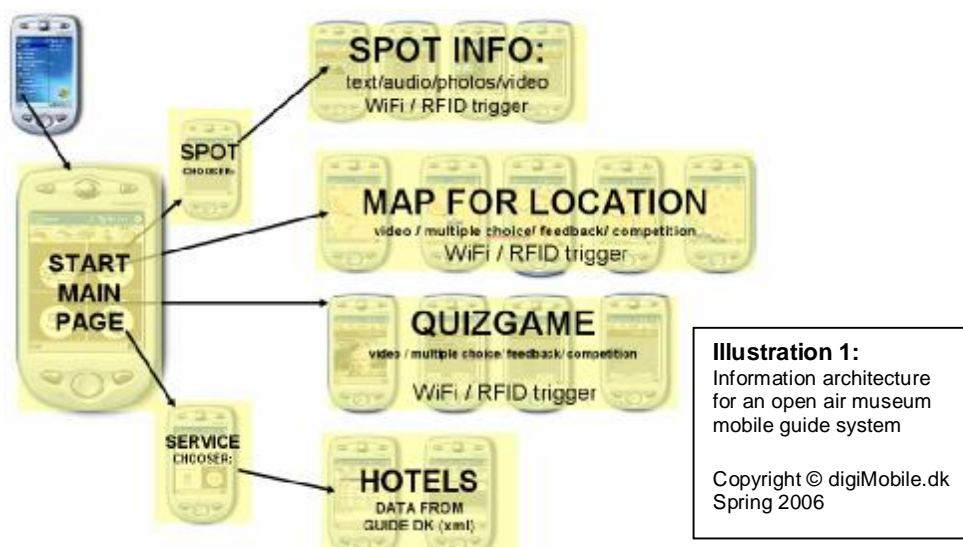
A case study

Together with the Funen Village, an open-air museum located in the city of Odense, Denmark (<http://www.museum.odense.dk/?lang=en>), digiMobile developed a mobile guide and game concept, that integrates technologies such as PDA/SmartPhones, GPS, WLAN and RFID .



The idea was to engage the visitors of the museum much more, especially young segments, by the use of mobile technologies for disseminating interactive stories and location based games, about peasants that lived in the 1800 century rural Denmark.

The content to use, was digitalized and placed in a database system. For the project we analysed the technological possibilities for improving the visitor experiences by the use of mobile devices . In the preanalysis based on a needs and user analysis, we envisioned the following information architecture for the user of the mobile guide system :



Comparative analysis of mobile technologies

Furthermore we did a comparative analysis of the following available mobile technologies for enhancing the visitor experience using mobile devices.

RFID¹ : Short of *radio frequency identification* . A basic RFID system consist of three components: 1) An antenna or coil, 2) A transceiver (with decoder)3) A transponder (RF tag) electronically programmed with unique information. The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Today there is 2 types of RFID systems: Passive (Version 1) and Active (Version 2)

ZigBee²: ZigBee is a coming standard aimed at low data rate applications in wireless networks.

Wi-Fi: Short of Wireless Fidelity or wireless network.

This table shows the specifications for the mentioned technologies:

Properties/ Technologies:	RFID Ver. 1	RFID Ver. 2	ZigBee	WiFi
Price per chip	1-2 €	60-80 €	-?	Built-in
Price per receiver	150 €	1500 €	-?	40-50 €
Transmitting distance	10-25 cm.	1-5 meters.	10-100 meters	10-150 meters
Frequencies	13,56 MHz	865 – 868 MHz	2.4 Ghz	2.4 Ghz
Smallest size	0.4x0.4 mm	A coin	-?	10x10 cm
Battery required ?	No	Yes	Yes	No, (AC)
Battery lifetime	-	about 10 years	2-10+ years	-
2-way communication	No	No	Yes	Yes
Speed	-	-	20-250 KB/s	54 Mbit

¹ http://www.aimglobal.org/technologies/rfid/what_is_rfid.asp

² See <http://www.zigbee.org>

It is worth mentioning, that RFID Ver. 2. still has the best properties in terms of receiving distance (1- 5 meters), but this also influences the price very much.

In our case study, the open air museum needed 30-40 receivers to a total price around 40.000-45.000 €, which was unrealistic for a museum on a low fixed budget.

In the study we also analyzed the advantages and disadvantages of the technologies available.

We have listed our main conclusions in the table below:

Technology	Advantages	Weaknesses
RFID Ver.1: (Passive)	<ul style="list-style-type: none"> • Cheap chip and receiver. • No battery required. • Small chip. • Easy to implement • Location identification in software (Trigger). • Easy to install 	<ul style="list-style-type: none"> • Short transmitting range • No possibility for 2 way communication. • Individual updating of all chips, if you need to change the system
RFID Ver.2: (Active)	<ul style="list-style-type: none"> • Easy to implement • Location identification in software (Trigger). • Bigger transmitting distances • Easy to install 	<ul style="list-style-type: none"> • High price per chip and receiver • Individual updating of all chips, if you need to change the system
ZigBee	<ul style="list-style-type: none"> • Long transmitting range • 2 way communication. • (cheap hardware?) 	<ul style="list-style-type: none"> • Require programming of drivers etc. • No established international standards for this technology for the moment. (Spring 2006)
Wi-Fi	<ul style="list-style-type: none"> • Cheap solution • 2 way communication. • Integration to other digital projects and solutions (Inter/intranet) • Highest possible speed • Long transmitting distance • Hardware (netcard) for PDA 	<ul style="list-style-type: none"> • Difficult to implement location identification in software (Triangulation) • Requires fixed power plug (220v.) • Can be complicated to implement

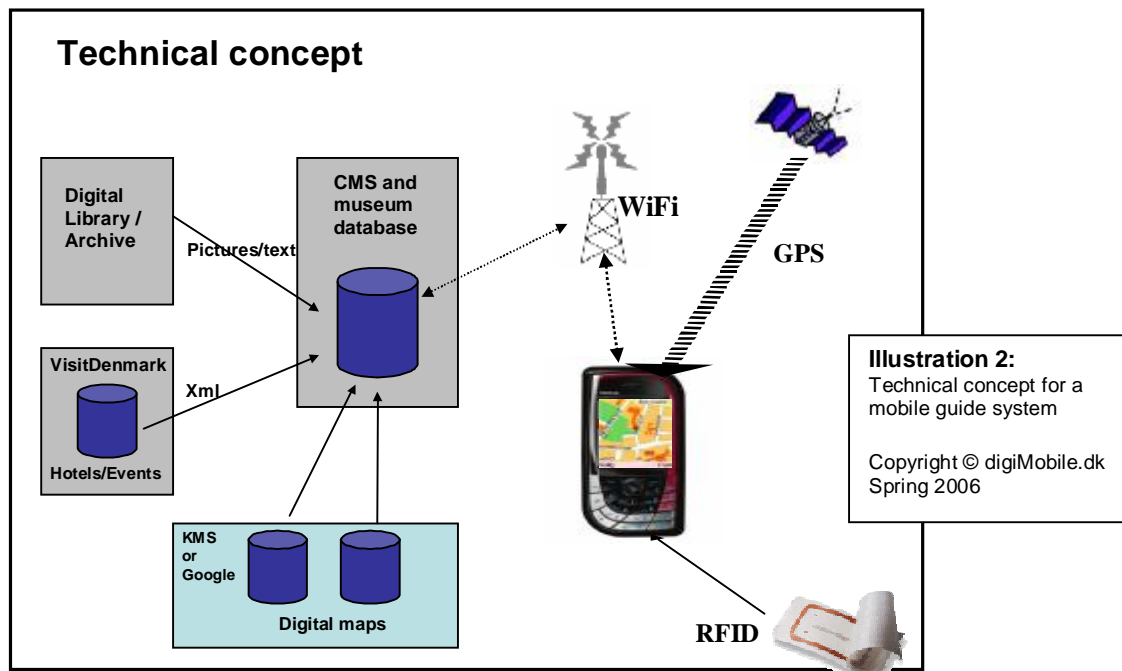
Summary and first evaluations

The above technologies all have unique properties that makes it possible to use them in many applications. In this project, they can be used to enhance the Open Air museum project. Especially RFID together with Wi-Fi are relevant technologies in an interactive mobile guide and game application. If the PDA or telephone has built-in RFID reader, it is a much better choice than GPS for the FL application. This is because of instability in different GPS receivers and problems with high buildings and the weather. Also if some of the artifacts to be seen and experience is inside buildings, this is a simple solution to trigger the application. RFID can be installed in a simple way using either RFID chips or simple label RFID's.

Wi-Fi is the best solution. It will then be possible to transfer huge amount of data between the PDA/Telephone and a web server. Then it will be possible to stream sound and video, and uploading pictures and text with high speed. Most PDA's and some smartphones has a wireless card built into the phone. It will also make it simple for the Museum to enhance the application to a new version or a new application later, because all the content can be downloaded from the web server using high-speed Wi-Fi.

Proposal for an information system

Based on our initial research, the comparative tech analysis and cooperation with the open-air museum, we finally sketched a system, that meets the requirements and should be realistic in terms of technology and economy. This diagram shows the elements in the system:



The elements in the Technical concept :

- User : Mobile device w. GPS and RFID reader –
- Museum place: Wifi (Internet access) /RFID /ZiggBee (interaction) -
- XML for transfer data
- Databases (Hotels(VisitDenmark), Events(VisitDenmark), Photos/texts (CityMuseum), Maps(KMS), XML
- GPS: receiver embedded in th PDA/Smartphone
- CMS for administration for handling connection between digital libraries/archives and mobile info system at museum

About digiMobile :

digiMOBILE is a networking company. We are dedicated in providing responsible and intelligent ICT solutions for companies and organizations in areas such as:

· **MOBILE APPLICATIONS:**

Design, integration of digital content, maps, GPS and RFID's .
Nokia, Smartphones and PDA platforms.

· **ONLINE GAMES:**

Conceptualization, graphical design, programming and testing.

· **CMS/WEBPORTALS:**

Design, test and implementation.

· **LMS APPLICATIONS:**

Video/audio/animation implemented into LMS systems to improve help for online users.

We can offer companies mobile services with smart GPS and RFID technologies on a Windows Mobile platform. We develop GPS, mapping and basic GIS and RFID based applications in Visual Studio for Windows XP, PocketPC, WindowsCE, ActiveX and .NET (1.0, 1.1 and 2.0).

We have a strong foundation in Project Management and Project Accounting. Thereby we have a strong focus on creating projects that add value to our customers and providing an effective framework for the organization.

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