

# MULTIMEDIA PLATFORM FOR MOBILE TOURIST GUIDANCE AND SERVICES IN THE CITIES OF UBEDA AND BAEZA (SPAIN)

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**Abstract:** In this paper we describe an innovative multimedia system that has been installed in the Spanish cities of Ubeda and Baeza whose Renaissance monumental ensembles has been declared World Heritage by UNESCO. The system offers an advanced information service and tourist guide to the visitors, and ensures that every tourist, just carrying an appropriate commercial mobile phone, gets the right information to enjoy and make the most of his visit in town in a personal manner. The service offered by the system to the user is proactive and personalized, taking into account the specific circumstances affecting each user: exact location, track followed, time and date, mobile terminal employed, etc. The user carries a personal device that becomes a new interface between him or her and the surroundings. The platform detects the presence of the user when he or she gets close to specifically determined location points. As a function of the users' context (location, time, track, etc.), the system sends them personalized relevant information. This project has been funded by the "Ciudades Digitales" Program of the Ministry of Industry, Junta de Andalucía, Diputación de Jaén and the City Councils of both cities.

## 1 INTRODUCTION

Nowadays, 85% of the population in Western Europe uses mobile phones regularly, which truly means that they have become another element in our routine, and of course, when we are on a trip, holidays, weekend, etc.

City and cultural tourism has become a popular choice for the population and the number of tourists in this category is increasing every year. However, it is developing in a way that doesn't allow making as much profit from the heritage of our towns and places of interests as it can offer. This means a limited stay of the visitor, a poor quality of the experience and, as a consequence of that, the city may lose economical potential of the cultural and leisure heritage.

Nowadays the visitor may choose between two methods of tourist information: checking brochures,

maps and other materials or hiring a human guide.

The first one involves a short and superficial stay, which is insufficient to take full advantage of all the surroundings can offer. In the second one, the visitor loses flexibility to enjoy his visit on his own way. It may be impersonal, especially if he travels with a group, or it can be extremely expensive.

Ubeda and Baeza, two neighbouring cities in the Province of Jaen (Andalucia), are considered as two of the best examples of Renaissance town planning in Spain. The 16th-century examples of architectural and urban design in Úbeda and Baeza were instrumental in introducing the Renaissance ideas to Spain. Through the publications of Andrés Vandelvira, the principal project architect, these examples were also diffused to Latin America. The central areas of Ubeda and Baeza constitute outstanding early examples of Renaissance civic architecture and urban planning in Spain in the early 16th century. In Ubeda, the aristocracy, exalted to

the highest of the imperial Spanish administration, behaved as real Renaissance patrons, and imitating Italian families as the Medici from Firenze, wanted to be surrounded of beauty, filling Úbeda with sumptuous palaces. Baeza, on the other side, had got a powerful town council that decided to show this power with beautiful public works, such as the pósito (public granary), the alhóndiga (corn exchange), the meat market, the prison, etc. The Catholic Church also decided to embellish his more important buildings, like the Church of St. Mary in Úbeda or the Cathedral of Baeza, besides several transformations suffered by other churches. The result was a so pure classicism that has been compared to the one of the northern Italian cities. UNESCO declared its Renaissance monuments a World Heritage Site in a cultural unity in 2003 (UNESCO, 2003).

Digital Cities Program is a program of telecommunications whose goal is the promotion and implementation of Information Society in a local environment, including topics such as teleadministración, e-commerce / e-business, teleworking, distance learning, telemedicine, applications for groups with special needs, culture, tourism and leisure, home environment and mobility. The Program is driven by the Ministry of Industry, Tourism and Trade with the collaboration of the Autonomous Communities and Local Governments.

Úbeda and Baeza participate in the Digital Cities Program in the Plan Avanza (Avanza, 2009). Its budget is 3.2 million and is funded by the Spanish Ministry of Industry, the regional government of Andalucía, the provincial government of Jaén and the councils of both towns. The program was initiated in late 2005 and it was finished in October 2008. In total, 12 initiatives have been carried out which have sought to involve citizens, businesses and administrations in the use of the Information and Communication Technologies. One of this initiatives was the installation of a guiding system through the mobile phone in the historic centers of Úbeda and Baeza.

In the following section we describe this system.

## 2 SYSTEM DESCRIPTION

### 2.1 General Characteristics

The guiding system installed in Úbeda and Baeza guarantees a complete and a high quality visit, but at the same time it is economical and provides freedom

to the visitor. The system makes the most of the cultural, economic and leisure potential that the cities are able to offer.

It is important to point out that the system doesn't want to compete against the traditional human guides. Far from that, the aim of the system is to ensure that the quality service of these professional may reach as many visitors as possible in a practical way.

The system is primarily focused on those tourists who don't take the services of human guides (most of them), but also on those who take their services as a complement during the visit. It offers an advanced information service and tourist guide to all visitors of a place or surrounding with historic, artistic and leisure heritage.

The system ensures that every tourist gets the right information to enjoy and make the most of his visit in town in a personal manner. Besides, it is a business platform for the commercial and cultural activity of the sector.

It is also a bet for the use of new Information Technologies for the citizens, with the appeal that the tourist experience is revolutionized.

Even more, all the information that the system generates may be used to re-adapt the system itself for possible needs in the future.

The system creates an innovative tourist experience for the visitor and eases his visit to help him enjoy the cultural and leisure offer as much as possible. The features of the system are:

- Freedom: The visitor has his or her own personal guide everywhere and always.
- Proactive: The system automatically contacts with the registered tourist to inform, guide, provide advices, announce events and offer options to continue the visit.
- Intelligent: The service adapts to the tourist's context, in accordance with his or her circumstances: who, where, when and how.
- Interactive: The tourists can ask for information and go deeply into a subject. They can manage their visit freely, choosing the options that best suit to them.
- Convenient: The format of the information and the interaction with the service are intuitive, making it suitable for all people.
- Multimedia: Tourist information includes any digital contents that can be shown or played by the user's handset: audio, text, images, links, etc.

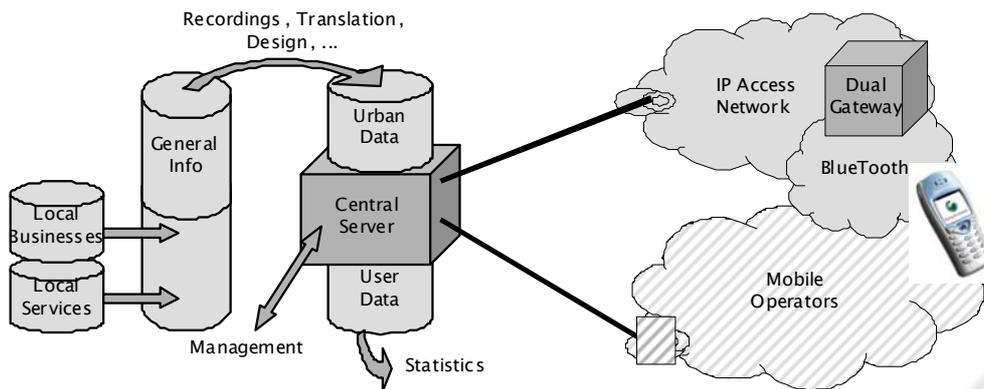


Figure 1: Overall architecture of the system.

## 2.2 General Structure

The system consists of a computing and telecommunication (cable and wireless) platform that must be deployed where the service will be offered.

The final system, result of a R+D+i project, is the solution to the problem of realising the full potential of cultural tourism and providing the most complete information and tourist guide service.

The requirements of this system are quite sophisticated, being necessary to fall back on the most advanced technologies and to use them jointly to give a friendly and comfortable service to the visitor.

The platform structure, represented in figure 1, is complex too, but it is interesting to describe how its main parts actually work: the central server, a wireless network and the terminals (mobile phones).

### 2.2.1 Central Server

The entire operation of the system is coordinated by this brain (central server), fitted with a wideband Internet connection. It manages every tourist's visit as long as he/she is registered.

All the information that the tourist needs is loaded into the server, including not only cultural information but also related to services, business, advices, etc.... These contents are structured in the form of special multimedia messages with audio clips, maps, graphics, links, etc...

The administrators introduce the guiding rules that establish the behaviour of the system depending on tourist circumstances. These norms associate the messages with specifics situations, both present and past. The rules may be as elaborated as required. The central server is always listening, so that it is aware of certain movements of the visitors and their

queries. Upon these events, and according to the tourist's profile and the guiding rules, the system decides whether or not sending a message, which one is the most appropriate and how to do it.

### 2.2.2 Terminals

The handsets carried by the tourist and a special software application running on them are a key part of the system. It makes the service comfortable and intuitive, very easy to use for everyone. The program loaded into the terminal is in charge of managing all communication procedures with the networks and the server so the tourist does not need to do anything at all.

Even the presentation of the messages and the audio clips is carried out automatically so the tourist only has to listen, see and enjoy the visit.

The client software of the system is currently available for mobile phones with either Symbian or Windows Mobile Operating Systems. The number of these phones increases everyday. They are provided by manufacturers such a Nokia, Motorola, Samsung, Panasonic, Sony-Ericsson, HTC, etc.. However, in order to enlarge the compatibility support to most of the handsets in the market, a new version is being developed based on the Java platform (J2ME).



Figure 2: Examples of terminals.

### 2.2.3 Communications Network

In order to offer the services of the system, you need to deploy a special communication infrastructure, which has two functions:

It acts as a permanent link, in both directions, between the tourist and the server.

It is an active environment that detects the presence of tourists at certain places, is aware of their situation and reacts to it (“ambient-intelligence”).

The system uses two wireless communication routes to ensure a quality service at any time and anywhere:

The main one is installed just for the system. Communication through it has no cost. It gives coverage only at the chosen areas.

The second one uses GPRS over GSM/UMTS cellular networks from the mobile operators to ensure a full coverage in town. Its use involves a cost and therefore the system uses it only when necessary.

The main network makes contact to mobile telephones through Bluetooth technology (Bluetooth, 2008). To do that, it uses certain tracking devices that are installed on strategic places and, thanks to the system software, they detect the presence of each visitor. Electric supply may come from regular connections or from the street lighting with special batteries. The deployment in the cities of Ubeda and Baeza comprises of 64 of these devices.

Why Bluetooth?

- It provides an economical communication channel under our control to access the mobile phones.
- Transfer speed is fast enough to offer a multimedia service.
- It is standard, which guarantees inter-working and availability from many manufacturers
- It is widely-extended among current mobile phones
- Low power consumption and small size equipment

The tracking devices have to be always connected to the Central Server. This is achieved by means of an IP network (either private or the Internet) and some kind of access technology, such as Ethernet, 3G or WiFi.

Deploying WLAN hotspots at some locations to provide access to the transport network is being useful. Why Wi-Fi?:

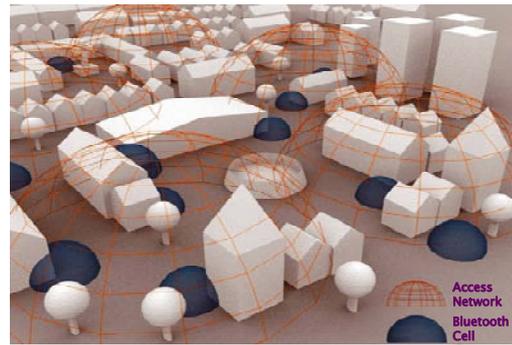


Figure 3: Networks deployment.

- It allows placing tracking devices in places where laying cable lines is not appropriate, because of being difficult places to reach or because of aesthetic concerns.
- It allows modifying the number and location of these devices at any time.
- Infrastructures costs are reduced because there is no cable network installation.
- It constitutes a multi-purpose public network that can be re-used for other services.

## 2.3 Operation

### 2.3.1 Rules and Logic

The system is fitted with special abilities (“Artificial Intelligence”) in order to take its own decisions. The professionals of the local tourism are in charge of teaching it how to guide and give advices. These instructions are captured in a set of guiding rules or logic.

The platform responds to the events occurred in its control area, which fall under two categories:

- Geographical events are originated due to the situation and the movement of the tourist.
- Time events, which are programmed alerts.

As a response to any event, the system checks the rules and also the knowledge accumulated for each tourist. After that, the system decides whether or not sending a message and which one is the most suitable.

It is necessary to indicate several parameters for each rule:

- The event that activates the “rule”.
- Any group of conditions: geographical, temporal and related to contents.
- The specific message that must be sent if all conditions are met.

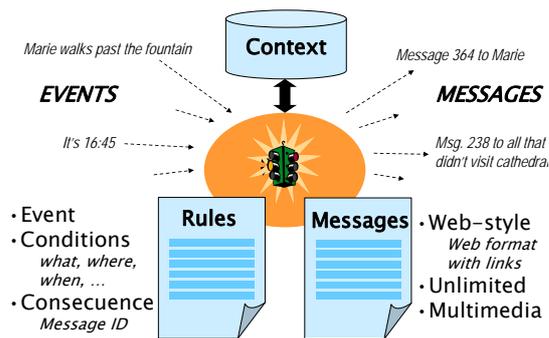


Figure 4: Rules and logic of the system.

### 2.3.2 Multimedia Content

All the information that is loaded into the system to be sent to the tourists has to be structured in the form of special multimedia messages. These messages are much more powerful than the traditional SMS and MMS. Each message consists of:

- A representative information icon
- Title and basic description of the message
- Audio records in any language
- One or more pages with texts and links, as in the Web
- Several images (photos, graphics, etc..) placed into the web pages
- Direct links to telephone numbers for single-click dialling

When the mobile phone receives a message it starts vibrating and playing a ringing tone. The visitor, then, only has to press one button to listen to the audio clip. When it is finished, the user can have a look on the screen at the pages received and navigate through their links to other pages. These may have been previously downloaded or can be fetched on-line via the most appropriate communication channel: Bluetooth, if available, or 3G otherwise. All the messages received are kept in the mobile and arranged in a list, sorted by the time of reception. The user can later browse the list for any received message and then play it again or remove it.

The administrators of the service may add and modify the messages that the Central Server manages at any time to update the tourist, leisure and services guide.

### 2.3.3 Basic Processes

In spite of its technical complexity, the system presents a comfortable service both for the user and

for the administrators.

The regular service is divided in four basic processes:

- Reception and registration: Currently, the visitor applies for the service at the Tourist Office of Ubeda or Baeza or another similar place. The attendant needs to check out if the mobile phone of the tourist is suitable for the system. If it is not, an appropriate handset can be offered, subject to presentation of any proof of guarantee (credit card). Finally, the visitor details must be entered into the system data-base over the Internet. With the new version, which is being developed now, almost every recent mobile phone will be supported and registration will be possible by the tourist himself via Bluetooth or sending a SMS.
- The visit: The tourist is ready to go and walk freely round streets, monuments, museums and anywhere within the surroundings. The system sends the first message to welcome and guide the visitor and it starts managing the visit using guiding rules that were entered previously. When the visitor hears the ringing tone, he only has to press a button to listen to the audio clip in his language.
- Queries: The visitors may interact with the system too, to apply for information or to go deeply into specific subjects. The tourist just needs to select the link that he wants and the downloading process and the presentation are done automatically by the platform.
- End of the visit: The length of the service may be configured by the administrator. Once it is over, the system says goodbye to the tourist who, in case he rented a mobile, will have to return the handset. Subsequently, the system may allow the user to access for consults, even if he is far from the city.

## 2.4 Exploitation

### 2.4.1 Installation and Operation

Before the service is given to the visitors, it is necessary to carry out a platform installation process. This process consisted of several stages:

- Economic analysis: Initial assessment of volumes (rough number of visitors expected and their composition, size of the area to cover, number of points of interest and monuments,...) and making of qualitative decisions such as the type of business model to be applied (types of

fees for tourists and the industry, types of services, professional co-operations, ...)

- Tourist inventory: A list comprising all points of interest that the cities have and want to show to the visitor. It is also necessary to get in touch and gather with those who manage the places of interest (City Councils, other administrations, museums, the Church, etc...) in order to reach agreements of participation or consent and the rights to use information and installations.
- Guide design: Design of routes and sub-routes, storyboards, information flow, advices, procedures of response to tourist behaviour, etc... and the making of guiding rules and initial lists of messages.
- Content production: Out of collected information (texts, photos, street maps, etc.) and the guide design, it is possible to elaborate the messages. This includes several duties such as scripts elaboration, translations, audio records, editing, etc.
- Deployment: It includes several tasks: selection of equipment, fixing and adaptation to outdoor places, connection to electric sources (permanent or from batteries), orientation of aerials, setting up and configuration of software programs, loading of data-bases and files, service and coverage tests, etc...



Figure 5: Examples of installations.



Figure 6: Example installation of a gateway.

### 3 FUTURE EVOLUTIONS

The system was originally conceived as a tool to offer an advanced information and tourist guide service. However, during its design and development a much larger view was adopted, specially to enable a wider scope of applications. It is necessary to understand the main features of the system to see the new ideas of exploitation:

- It provides an economical and high quality network for communication with mobile phones. The versatility of the network is such that it allows its own structure to change continually and even its components may move around.
- The system is aware of whatever occurs in its control area, it knows all the past and present circumstances of the users and it may react to any event. The reaction can be programmed in a sophisticated way, even on the fly.

The flexibility of the system is based on its open design and the technologies used. The platform is an investment for the future and it may support as many different applications as it becomes necessary.

#### 3.1 Technological Evolution

Apart from the current development of a Java version of the mobile phone application, other works are under way in the software and hardware to expand the possibilities of the system and improve its features. These are a couple of examples:

- Precise and complete positioning with GPS: The

current system does not need to know the accurate location of each person to offer a high quality guided service. However, the increase of the location capacity of the platform may be useful for other applications. In those cases, GPS satellite positioning technology may be used. The enhancement is achieved by equipping the user with a GPS receiver that communicates with the mobile phone via Bluetooth and provides its geographical references. This information is sent to the central server for processing and decision making. It is important to be aware that the location service with GPS only works in open areas. In other places, such as inside buildings or in narrow streets, the current tracking mechanisms of the system are the best solution.

- Voice Interface, specially for sightless people: Our intention is to make it even easier to access and control the services provided by the system by adding a voice-recognition mechanism. It is necessary to use techniques of natural language processing. This way, the user would not need either a joystick or the keypad of the mobile phone to carry out any operation.

### 3.2 Services for Sightless People

The way we perceive this world is a mix of the information we receive from all our senses. If one of our senses fails, we lose part of that data. This becomes a mayor problem when the lack of information is visual and becomes critical when it requires an action to be taken by the individual.

The main target of the system for visually-impaired people consists in creating a smart environment around the person that conveys to him or her in audio format all the relevant information related to the surrounding objects and places.

The service may be extended to people with other sensory or physical loss. The mobile phone becomes a new interface with the environment that takes the advantage of the healthy senses.

A number of tracking devices need to be strategically installed in certain places or vehicles to detect the location of the users. By making use of this network and the knowledge accumulated of each user, the system decides whether to send messages and chooses the most appropriate ones.

## 4 CONCLUSIONS

In this paper we have presented a system for mobile

tourist guidance and services installed in the Spanish cities of Ubeda and Baeza. Nowadays, we are about to start its exploitation. Therefore, there are no real statistics of usage or feedback from the tourists. It is not possible yet to carry out an analysis of technical performance or service success and no experimental results of mass usage can be published.

The system is very innovative and uses a variety of technologies (Bluetooth, Wi-fi, GPRS, UMTS, Internet,...). The architecture used is very versatile and allows increasing the number of services offered (for example, for sightless people).

Several projects have been carried out before that make use of Bluetooth technology and mobile devices to offer tourist guidance services. However, none of them can be truly compared to this project since they don't have several key features that make this system unique: web-like multimedia interactivity over Bluetooth, full context awareness with Artificial Intelligence, urban-wide wireless network deployment. Therefore, no references are made to specific projects (mostly commercial products).

We invite anybody who may be interested in this project to visit the cities of Ubeda and Baeza in order to know the system.

## REFERENCES

- UNESCO, 2003. *Report of the 27th Session of the Committee 1st International Conference, 27COM 8C.42.*
- Plan Avanza, 2006. *Boletín Oficial del Estado (BOE num. 297, 13<sup>th</sup> December 2005).*
- Bluetooth, 2008. *The Bluetooth special Interest Group.* <http://www.bluetooth.com/>