An Accesible and Collaborative Tourist Guide Based on Augmented Reality and Mobile Devices

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Abstract. The goal of this project is to provide support for a system of geolocation powered by augmented reality, offering also advanced services such as, context awareness mobile applications and natural interaction related to the concept of ambient intelligent which favour the creation of intelligent environments whose services fit dynamically the demand, not always made explicit, of the user. A design and a development of a location system is obtained that provides extra services based on the positional information of the different system's users. In this way, the user receives specific information of the place where he or she is located. This service is based on the Global Positioning System, from now on GPS. The aim with this platform is to locate, guide and give information to blind people, although it is open to any kind of people. It will allow the users to see information related to a place, to write comments about it and leave objects for the rest of the users to read and see. The information will be shown as a written text and as an oral one and in every moment the location of the user will be traced thanks to the virtual positioning of him or her on a map.

Keywords: context-awareness; location-awareness; natural-interaction; mobile devices; ambient intelligent; GPS.

1 Introduction

The proliferation of devices with communication and process capacity (mobile phones, PDAs, Set-top boxes of digital TV, household-electric…) it has given rise to the birth of a series of new technologies, evolution which it was known later like distributed computing and like mobile computing, and that today is included under the name ubiquitous computing.

These technologies look for to create transparent environments to the user in whom these devices with limited capacity of process and intermittent communication cooperate of intelligent form. In this way, the movable devices are aligned like a perfect technological ally to accede to the mentioned information.

To the question: Do you have computer in your house? The answer would be affirmative in the great majority of the cases. In just a short time they will comprise of our vital surroundings in a high amount. They will be interlocked and they will increase the capacities of daily or new objects, others will control our habitat and many will make the human scope of interaction with a great part of the rest of the world: email, e-commerce, e-services… so that its absence will be lived like vital handicap (like blindness, deafness…) It causes that the services that supports a computer are a problem of crucial importance. On its ergonomics, versatility… will depend that that new "sense", in much superior at sight, hearing… is useful for the accomplishment of the human like being social in the Society of the information.

By all of it, it is necessary to develop projects able to interact with the human and with the own surroundings in which it lives and it moves. Reason why the best way to obtain it is through the mobile devices, that can be moved with the own human. In addition to this, if we added to a system of location and context awareness surroundings to him to the context, at any moment it will be known where he is the human and what or who is surrounding to him.

With this project it is tried to create a support platform to increased reality cradle in GPS and wireless networks to increase the interactivity of the users among them and with the own surroundings.

So thanks to this platform, will be able to be made different applications, simply with a change of information (SD card), the base will be the same for all.

The augmented reality[3], is centered in integration between the computer and the physical surroundings that surround him and tries that the computer harnesses its activities providing to him in every moment nonintrusive information about the real objects with whom interacts and by means of a pursuit of the same ones.

In this project a "Visit Guided" by the city of Oviedo is developed, but of equal way it could have been on any other city or town of Spain, as well as a "Stroll attended for blind", "Asturian mountain Routes", "Jurassic Visit"…. The number of possible applications that can be made with this platform is very high, thanks to the ubiquitous computing, the GPS location system, the context awareness surroundings….

Not only the tourists and visitors are the adressees of the new services based on the information technologies and the communications that can be conceived. Seeing data of establishments and tourist resources, it is possible to raise three types of users[2] like tourist/visitors,final adressees for products and services, propietary of the tourist sector, hotel, restorers, wholesale, propietary of sport facilities, etc. And national, autonomic and local administrations public. In them public resides the management of the cultural goods, the protected natural spaces, etc.

In the great majority of the tourist destinies, the tourist information bureaus provide great part of the information of the tourist destiny, as well as the way to accede to her. Even though strategically they are located in the destiny, all the tourists do not find them accessible, in addition the schedules to attention to the client not always satisfy the necessities with the tourist. All it leads to the necessity to make available of the client so valuable information so that it is consumed without barriers of time or space. [1]

2   State of the Art

In the market some tourist guides for mobile devices exist. Varied as far as the mobile device for that they are prepared, as far as the systems of location, the offered services, etc. All of them with its strongpoints and their errors to correct.

There are more or less basic objectives that all the systems try to obtain, nevertheless all the guides do not obtain it, and although they obtain it, are guides in whom by one either another reason is more easy to ask to someone that to look for the information in the own mobile device. The tourist guides who fulfill the basic objectives have certain similarity as far as the interfaces and in the external vision of the system, but as far as the internal structure of the same one, had in the great majority of the cases to the used system of location, there are remarkable differences.

Also another fundamental point of disjunction exists, is the mobile device with which the visit can be made: mobile telephones (with or connectionless to Internet), pocketpc, pda (both with or without GPS, with or without GPRS, with or without WIFI...) etc. Are obvious that it is not possible in the same way to treat all these different devices in his essence, although all of them are mobile devices after all.

2.1   State of the Art

2.1.1   State of the Art
SMIT [4] is a "Mobile System of Tourist Information" for mobile terminals, as much mobile telephones as PDA' s with WIFI, but these PDA' s if they were pocket PC must have installed the java virtual machine because it is J2ME application, by the other side they were palm, we would not have to install this virtual machine.

As main functions of this system emphasize the following ones:

- To look for information.
- To draw up the best route to its destiny or to draw up routes of interest specifically designed to optimize its time in mobility.
- To locate itself by corner (although also bluetooth can use a GPS).
- To reproduce videos, images, sounds….
- To also look for generic, customized, radial information from the point where we were and by resources.

2.1.2   Advantages
Basically SMIT is a tourist guide who takes advantage of some the characteristics of a mobile phone. For example, all the information downloading from servers, by that it can be continuously updated. Because it is an J2ME application, does not demand a special mobile phone.

Operative in more of 80% of the mobile terminals and wireless in general, it allows to take to the information to any site with universal vocation, offering to the tourist and the citizen the best way to know all the resources in its surroundings (sanitary centers, monuments, hotels, restaurants, museums, parks, pharmacies, parkings, beaches…).

2.1.3 Disadvantages

As all the data download directly from Internet, it is necessary to use a connection of data from the mobile phone. This limits to much the use of any program that demands more or less permanent connection. Still more, if we are going to download images, videos and audio files.

At a graphical interface level, it is very little intuitive and it is looked excessively like an interface of an PC aplication(interminable menus, for example). It is not a serious problem in himself, since it would be possible to be solved with facility leaving free users by some city and registering how they try to use the application (usuary that, to power to be, did not know anything of computer science nor of mobile phones). But meanwhile, it does not seem the sufficiently comfortable thing to use.

That the guide is done in J2ME would work on the mobile phones, but according to http://geomovil.info also it would work in PDA' s, but it says nowhere that only work in PDA' s with Palm O.S., because in PDA' s with Pocket PC operating system(PPC) it would not work because there would be to install the java virtual machine.

2.2 WALLIP

2.2.1 Introduction

WALLIP [5] project is an initiative of several companies of the CAV (Community Autonomous Basque).

It allows to the development of mobile applications with contex awareness of location and the preferences of the user, that will allow to provide suitable suggestions to him frequently and to facilitate their interaction to him with the surroundings, extending its own perception. In this project the platform has been developed, three services (one of mobility, another one for location and another one for management of profiles, all of them integrated in the platform) and two applications of test, a Tourist Assistant and an application of Operation and Maintenance, using a SOA architecture based on Services Web.

2.2.2 Advantages

Wallip allows to know the device positioning independently connection system that it uses at every moment. This location will make the own platform combining the data of the network with geographical information.

The aplication allows to offer the information that is considered necessary for the development of its activity, like people just arrivals to a city and which they do not know the surroundings that surround to them.

The objective of the Tourist Assistant is to provide information on the Points of Tourist Interest near a user based on the position in which they are updated of automatic way at the moment that the user changes of position.

The user can develop his activity of tourist and interact with the application to see with more detail the information of context of his surroundings that interest to him, as a photography of the interest point or to enter in the web page of the interest point.

2.2.3 Disadvantages

At the moment of start the project, the implementation of a Web Service on mobile devices very was not developed, reason why it was necessary to limit the roll of PDA's clients of Web Services.

The Tourist Assistant works with networks Wi-Fi and GPRS, so in a city or town that did not have the cover of these networks would not work in. Nowadays it is normal to find networks Wi-Fi and GPRS in the city, like many mobile phones and PDA's that already come adapted to be able to use these networks, but we extended the field of vision with respect to a guided visit, and not only we were centered in a visit to a big city, but also to a visit through field, like they can be, mountain routes, routes by the towns of Asturias… we can see that it fails the guide in that way.

One of the main disadvantages, is that, different rolls are recognized and from different visitors in a same zone, but they cannot interact with others, nor to share opinions through Tourist Assistant.

2.3 AMIGUIDE

2.3.1 Introduction

Project EUREKA (http://www.eureka.be), called AMIGUIDE [1], and coordinated by Foundation IBIT, offers an interactive tourist guidance system for PDA' s equipped with wireless communications, with the possibility of downloading information multimedia through points of cover Bluetooth and Wi-Fi from the interior of hotels, and through GPRS from the outside. The guide allows to accede to services of location based on the position of the user, who obtains by the GPS system. Therefore and within the present context, project AMIGUIDE has two primary targets:

- Indoor surroundings: Wireless technologies such as Wi-Fi and Bluetooth.
- Outdoor Surroundings: GPRS from cellular telephones or from PDAs.

2.3.2 Advantages

- A new vision which the physical surroundings that surround to us turn the interface to access to the information and to the services that can demand the users.
- The user can plan his trip from an only access point. Thinking in the immense time that implies to prepare a trip, he is desirable that the user has an intelligent agent that he makes in his place this task.

2.3.3 Disadvantages

- When downloading information, the velocity of the downloading will depend on the occupation of the bandwidth. All the application is based on the downloading information through the network, either by WiFi or GPRS, this implies that the application depends on the free bandwidth, whatever with more connections, the less rapidity of data transmission.
- In order to obtain data you depend to have cover in the networks, as much WiFi as GPRS so in a city or town that did not have the cover of these networks would not work in.

2.4   PATRIMONIO MÓVIL

2.4.1   Introduction
The project (accessible in http://www.patrimoniomovil.com and in the tourism web of Salamanca http://www.salamanca.es) [6] has consisted of starting up a service for visitors, that is based on the access to the interactive multimedia information from several platforms (Internet, mobile telephone or PDA).

The user can receive and consult information on the cultural and historical-artistic patrimony of Salamanca, as well as of events and activities in the city.

The application combines the information consultation before the trip and during it: by means of his web page, the visitor can select the contents that interest to take to him with himself during their visit.

It is possible to find applications stops:

- PDA. Once loaded the information, has access to the services of:
  - Mobile Itinerary
  - Monument guide
  - Notebook of the tourist
  - Web page offers connection to Internet from the points destined for it.
- WAP. In this web page it is possible to be acceded to Events Agenda, Mobile Itinerary, Itinerary Alternative, Monument Guide, Information to the Visitor, Help and Supplies and Promotions.
- SMS. With the short messages can be received informtation of the Events Agenda, of Mobile Itinerary, Alternative Itinerary, Monument Guide and Information to the Visitor.
- MMS. If it is had a terminal multimedia, in addition to the services already mentioned, they are possible to be sent postal and to be participated in games.

2.4.2   Advantages
- The starting of service with easy system of consultation information through devices as the mobile phone or the PDA can make the visit to the city simpler and interesting.
- The system of short messages and multimedia has to its favor the ease of use and the great acceptance that first have had between the users.
- The application combines the information consultation before the trip and during it.

2.4.3   Disadvantages
- It is necessary to consider that the profile of the user of this service, is the one of a person with a certain technological culture: the service implies navigation by Internet, handling of a PDA with a concrete operating system, procedure of contents selection and downloading directly of the computer or from the downloading points in the city, etc. This process is easy for one that is familiarized with a PDA or a similar device, but to other users can not be so obvious.
- The navigation web system by mobile phone account with the barrier of the little use of the new services of data. A good help system, that it provides precise and truthful information on the service, the procedure to use it and the cost of himself can stimulate navigation by Internet with the mobile phone.

- The reception of information through short messages presents an obvious disadvantage: the capacity and the limitation of the user interface.
- If in the course of a route always is desired to consult something had to send sms to a number ready to it in order that the wished information is facilitated, the mechanism can be something tedious and uncomfortable.

3   Application

Our Project Vadinia makes use of such kind popular devices to make the interaction with physical environment around us more accessible for everybody. Geographic information is modeled for a multimodal interaction approach using small handheld devices powered by geographic location devices which informs the application about the exact geographic location of the users through the interactive experience.

Fig. 1. Application capture that shows the main form of it

Knowledge about the environment is easily edited in a Context Markup Language (CML) which renders its contents in real time using visual and auditory interfaces, providing an accessible interface for users with different kinds of disabilities. Although the standard interaction with the system is performed though the graphic pointing device of the hand held device (the Stylus in the Pocket PC) it can also be fully operated using the device buttons, providing a full interaction experience for visually disabled users.

This information displayed is powered by the use of Augmented Reality techniques also offering context awareness services and natural interaction; which are related to the concept of ambient intelligent, encouraging the creation of intelligent environments whose services fit dynamically the demand, not always made explicit, from the user.

Designers or Vadinia applications can model the semantic of the geographic information in one or several CML documents with references to the different kind of multimedia objects supported by the system. They can be textual information, images and sounds, which are displayed whenever the user enters inside the range of coverage of a POI (Point of interest) included in the CML. Semantic meta data about this information is also broadcast through the auditory channel. This meta data provides extra semantic meaning for objects (such as images) that certain kind of users (such as blind people) can not perceive.

Once designed, the whole geographic model can be zipped into a single file that can be stored in the memory of the hand held device and loaded into the Vadinia application. Depending on the amount of information modeled, this file can be included in an external memory card.

Nevertheless, dynamic information is distributed and managed through a small network of handheld devices. Small pocket computers powered by wireless networks (Wifi) provide areas of coverage for specific zones of the geographic environment. Inside those zones, users might receive live information from the environment (for instance, are the traffic lights in the green status?) but also information from other users, enabling basic social exchange capabilities and encouraging the future development of collaborative geographic context aware systems.
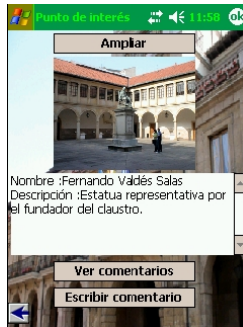

Fig. 2. Application capture that shows an interest point with his description and the possibility of write comments and view comments of others turist

Users of Vadinia-based technologies can use their own view of the the information provided by the system, editing it and submitting it to the system so other users can get information updated by users who have visited the areas before. This approach enables a collaborative editing system for geographic objects, where several users can collaborate to provide life and accurate information for each piece of modeled environment.

Fig. 3. Application capture thar shows the map. the interest points (the blue crosses) and a compass to view the direction

Vadinida works in any pocketpc device running Compact Framework 2.0 and powered by a Wifi and Bluetooth connection. Current user location is obtained using GPS antennas (Global Positioning System) in open sky environments (such as cities, archaeological sites, etc.) and Bluetooth antennas inside buildings.

In order to test Vadinia, we have developed an interactive tourist guide of the city of Oviedo, capital city of the province of Asturias (Spain). The guide includes context aware information about the main monuments and buildings of the town describing their history using text, images and sounds. Users can also attach their own images and texts to the objects discovered during their visit.

In the worl of this application, exists a type of user, with a good defined function in which to the system interaction it talks about. The normal user can make the following operations:

- To begin a visit with or without GPS.
- To see map, satellites, height and position. Thanks to a map, knoledge at any moment where are the interest points and where is the own user.
- To select zone with or without WiFi.
- To configure port COM, the baudrate and the language.
- To see and to select the interest points and the user objects.
- To raise an object and to write a description of itself.
- To extend the image of a interest point and an image of user object.
- To write and to see commentaries on a interest point and an user object
- To see the description of an user object and an interest point.
- To write and to modify a user name on a commentary of a user object and on an interest point.
- To enter a zone with or without WiFi.
- To see and to listen the information of the zone and the interest point where on is.

4   Conclusions

The mobile devices that are used mainly at the moment are mobile telephones and PDA' s. These two devices tend to integrate themselves, and the market already offers some models that connect both concepts.

Vadinia works by an operating system that at the moment already brings many mobile telephones and many PDA' s, not depending on same telephony company so the cover at any moment of the visit is not lost, and not centered nly in great cities with cover in all of it.

Don't forget that the accessibility and usability of the user interface represent a key factor of success. Vadinia has surpassed numerous tests of usability and accessibility with different types of users with different ages and different knowledge from mobile devices, its interface is not looked like the typical applications of PC, avoiding end-less scrolls in reduced screens. Thanks to Vadinia a new concept of museum routes can be installed and be maintained. But not only in museums, also in urban nuclei, archaeological exhibitions and enclosures, commercial amusement parks, hotels and zones services can be conceived that suppose an increase of data traffic for the operator, a new form of attraction and promotion for the final user service and a customized information for the client.

The use of the information and communications technologies represent a different way to satisfy necessities of day by day, can collaborate to improve the security in the displacements and also to find new services that suppose an incentive at the time of showing preference for a tourist destiny or another one. By all these reasons, public administrations beings have to deliver a special attack in promoting and creating necessary the enterprise weave so that this type of innovating and differentiating services is a reality.

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