FINDING THE WAY: SERVICES FOR A MULTI-VIEW AND MULTI-PLATFORM GEOGRAPHIC INFORMATION SYSTEM

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Abstract: Geographic information systems are getting more importance in the last years, especially in organizations where it is important to find an easy way to get to some place. The present paper describes the development carried out in order to make easier the business in organizations with high mobility requirements. The main result of this development is a system that generates several views of the geographic information of an organization in real time. The first view is a web information system that shows graphically all the points on a map, giving multimedia information. It allows interacting with all of them, creating the most suitable routes from one to another, finding hotel, restaurants, etc near the centre. On the other hand, the system also provides information of the points of interest through the main commercial GPS navigators.

1 INTRODUCTION

Mobility has become a fundamental element inside organizations in the last years. Nowadays, most of them are working to enhance it by improving the geographic information services offered to both stuff and customers.

It takes a special relevance in the case of delivery or transport companies, where the knowledge of the customer's locations and the routes to them play a crucial role inside the business.

In general, geographic information systems obtain usefulness in any kind of organizations where it is important to find an easy way to get to some place (Boonthuma, 2007).

The aim of the present paper is to describe a system that will show different views of the geographical information of an organization. For that task, the system will retrieve from a MS Word document all the names and addresses of the points of interest of the organization, and it will show them in 3 different ways: on Google Maps, on Google Earth and on the most popular GPS navigators.

2 THE PROBLEM

One environment where mobility services find a relevant role is at universities with a very wide and spread campus. This is the case of universities for distance education or open universities (Castro, 2006).

Inside these organizations it is possible to find many faculties, technical schools, libraries or study centres in different cities of a country, or even in different countries. This distance makes difficult to go from one centre to another, not only to students but also to university staff. In the case of UNED, the Spanish University for Distance Education, the distributed and distance education model applied makes necessary the creation of new technologies to respond to the challenge of educating more than 200,000 students every year, from more than 15 countries, although mainly in Spain (Martín, 2006).

In the distributed model of UNED, there is no class given in schools and faculties. Face-to-face classes are really given to the students in more than a hundred and sixty study centres, in Spain and other countries, where a tutor teaches the classes physically.

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A relevant problem is the examination of their students, due to the fact that it is in these study centres where the students have to do their exams two or three times every year. For that reason, teachers have to travel to all these centres to control the examination process three times every year. Currently UNED has around 1,100 teachers, what means around 3,000 trips to the study centres every year.

The present paper is the result of the research and development done in UNED in order to make easier the mobility between the different centres of an organization.

3 THE SOLUTION

The main result of this development is a system that generates several views of the geographic information of an organization in real time. For example, it shows where every point is, phone contact, address, web site, etc.

The first view is a web information system that shows graphically all the points on a map, including multimedia information related to them. It also allows interacting with all of them, creating the most suitable routes from one to another, finding hotels, restaurants, etcetera near the centre. On the other hand, the system also provides information about the points of interest for the main commercial GPS navigators, as '*TomTom*', '*Navman*', '*Navio*', '*Viaroute*', '*Garmin*', '*Mio*' and '*Destinator*'.

The system is made up of three main modules, as it can be seen in figure 1, and receives the postal address of all organization's centres as input. This information is specified in a MS WORD document that is read as an XML file. The first module obtains the GPS coordinates of the centres using the postal address read from the document.

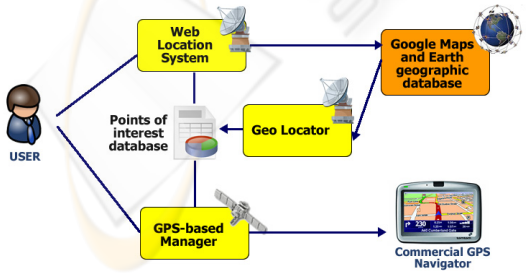

Figure 1: Logic representation of the system.

The second one uses these GPS coordinates to generate several maps with all the points in real time, allowing the interaction between the user and the points. One of these maps is shown on Google Maps including all the points of interest of the organization. *Google Maps* is a web-based geographic information system property of Google. The system also shows a textual description about every point on *Google Maps*. The other kind of maps generated by this module is shown on *Google Earth (Jones, 2006)*. This application is similar to *Google Maps*, but it is not web-based. It offers the advantage of provide multimedia content in every point of interest (Jones, 2007).

The third module is a web service that puts available all the information of the centres for different GPS navigators in a web site. Thanks to this system, customers will have available more than 9 ways to visualize the geographic information of their organization, one web-based (*Google Maps*), another one based on the *Google Earth* system, and seven more views for commercial GPS navigators, as it will be described in the following points.

3.1 Getting GPS Coordinates

One of the most important aspects inside this development is how to translate postal address into GPS coordinates. (Diggelen, 2002) The reason is because it is necessary to know them to allocate every point in its location.

In order to achieve this translation, a database with the correspondences between addresses and GPS coordinates is needed. The solution was to use a Google service that offers information about places on a map, allowing interacting with it. This service, called Google Maps, has an API available to find information of places through a web service.

In figure 2 this translation process can be seen graphically. First of all, the 'Geolocator' module read all the addresses from a database. Then it sends a request of information to the Google Maps API, specifying the output desired, in this case the GPS coordinates.

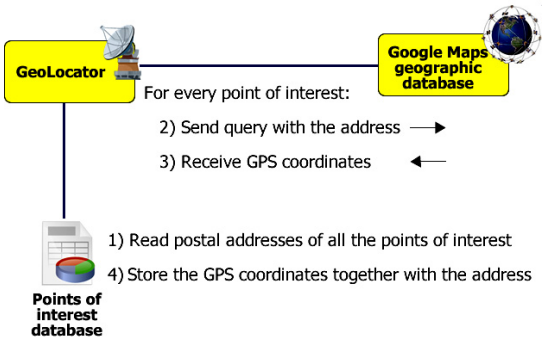

Figure 2: Getting GPS coordinates through the address using Google Maps database.

The result of this request is an XML document with all the information related to this address, such as state, country, postal code, etc. In this case the only information needed is the X, Y and Z GPS coordinates. Once all the coordinates of the points of interest have been obtained they are stored again in a database.

All this information will be used by other modules to generate the different views.

3.2 Creating a Web Mapping System on the Fly

In recent years there has been an explosion of mapping applications on the web such as *Google Maps*, and *Live Maps (Teranishi, 2006)*. These websites give the public access to huge amounts of geographic data with an emphasis on aerial photography (Eick, 2007).

The developed system takes advantage of these applications, mapping own content into them. As it can be appreciated in figure 3, it is possible to add information of every point, such as phone contact, address, web site, etc.

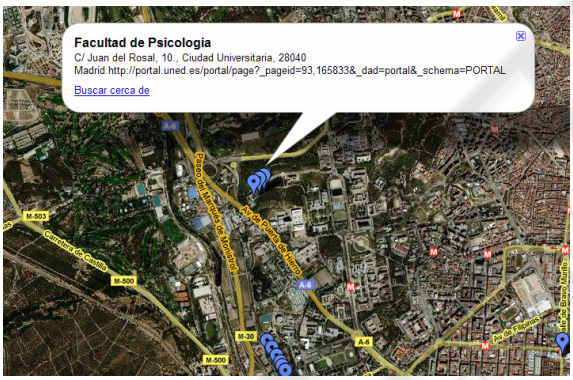

Figure 3: Mapping content into a Geographic Information System.

In addition, the system allows looking for any kind of services near the point of interest. For example, it is possible to find hotels near a point, getting a full description of them. Other interesting searches could be restaurants, rent-a-car companies, pharmacies, etc. In addition, thanks to this tool, it is easy to create optimum itineraries from one centre to another.

The mapping of the website with content of our organization is carried out using the *Google Maps* API. According to it an XML document with all the information related to the points of interest must be created and integrated into the *Google Maps* website.

This XML document is made up of several 'Placemark' tags. Every one of these tags contains other tags with the information of one point of interest, including the name, a description, and the exact GPS coordinates.

When the customer asks for information the system takes the information of the points of interest from the database, and generates the XML document in real time, mapping it into a *Google Maps* map.

3.3 Mapping Information on *Google Earth*

The system also enables a more advanced visualization mode using *Google Earth*, that includes all the functionalities that the *Google Maps* representation offers but with less limitations.

In the same way the XML document is created for Google Maps, another one is created in real-time for Google Earth. Here it is possible to include not only textual information of the points of interest, but also images, audio, videos and even include the content of other web sites. It opens the door to a wide range of applications, specially related to tourist information. For example, it could be possible to provide multimedia information about every monument of a city.

3.4 Generating Geographic Information for Commercial GPS Navigators

Finally, the last visualization modes are for commercial GPS navigators. The system generates geographic information documents for 7 different kinds of GPS navigators. These documents can be downloaded from the UNED website through the Internet connection of the mobile device. Depending on the kind of navigators the user will choose one document or another.

Once the mobile device has downloaded the suitable document, the customer only has to activate the new points of interest inside his navigator.

This service helps the user to find the best way to go to any point of the organization using his own GPS navigator. Thanks to it, the user will have all the points available inside the navigator.

In addition, many GPS navigators offer the possibility of finding other services near a point. For example restaurants, parking, pharmacies, etc.

In figure 4 the files of two different GPS navigators are shown, Garmin and Navman, they have totally different contents and structures.

```
GARMIN

<?xml version="1.0" encoding="ISO-8859-1"?>
<gpx>
  <wpt lat="-3.675551" lon="40.426984">
     <name>Place 1</name>
  </wpt>
  <wpt lat="-3.744280" lon="40.476073">
     <name>Place 2</name>
</wpt>
  <wpt lat="-3.693109" lon="40.411586">
     <name>Place 3</name>
</wpt>
</gpx>

_____________________________________


NAVMAN

-3.675551, 40.426984, "Place 1"
-3.744280, 40.476073, "Place 2"
-3.693109, 40.411586, "Place 3"
```

Figure 4: Points of interest files for two different GPS navigators: Garmin and Navman.

The first one, Garmin, is an XML document describing every point of interest with the tags: latitude, longitude and name. In the second case, the chosen navigator is Navman. It uses a comma-based schema. In first place appears the latitude, in second place the longitude and finally the name of the point of interest. Following these structures is possible to generate a document with the information of every point of interest of the organization in real-time.

4 CONCLUSIONS

This paper describes the geographic information services that are appearing to improve the mobility not only in the university environment but also inside any business with mobility needs.

The described system offers different ways of using the geographic information of an organization. It uses different programs: web, PC-based, and different GPS navigators. This is the real added value of the system, the possibility of generating different views of the same information from a text document.

The aim of this development is to offer updated geographic information in real-time, with independence of the platform or the device used by the user. Mobility can not depend on the device, the operative system or the size of the screen.

This system helps users to find the best way to go wherever they want to go, using whatever devices they want to use anytime.

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REFERENCES

S. Martín, M. Castro et al, 2006. Ubiquitous and biometric applications on distance education. An alternative to the traditional examination. *I International Conference on Ubiquitous Computing: Applications, Technology and Social Issues*, pp. 39-42.

C. Boonthuma, I.B. Levinstein et al, 2007. Mobile computing: Opportunities for optimization research, *Computer Communications*, Volume 30, Issue 4, 26 February 2007, Pages 670-684.

Castro, M., Gil, R., Martin, S. Et al, 2006. New Project on Secure Education Services for On-Line Learning. *9th International Conference on Engineering Education*.

F. Diggelen 2002, Indoor GPS Ttheory & implementation. *IEEE Position, Location & Navigation Symposium*.

D. Saha and A. Mukherjee, 2003. Pervasive Computing: A Paradigm for the 21st Century, *Computer, IEEE Computer Society*, Volume 36, Issue 3, May 2003, pp. 25-31.

W. Jones, 2006. Microsoft and Google vie for virtual world domination. *Spectrum IEEE*. Volume 43, Issue 7, July 2006 Page(s):16 – 18

M. Jones, 2007. Google's Geospatial Organizing Principle. *Computer Graphics and Applications, IEEE*. Volume 27, Issue 4, July-Aug. 2007 Page(s):8 - 13

Teranishi, Y. et al, 2006. MapWiki: a ubiquitous collaboration environment on shared maps. *Applications and the Internet Workshops, 2006.*

Eick, S., 2007. GeoBoost: An AJAX Web 2.0 Collaborative Geospatial Visualization Framework. *Aerospace Conference, 2007 IEEE*. 3-10 March 2007 Page(s): 1 – 10.