

GIS Application Research in LBS environment

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Abstract— This paper presents the **Applicative Research Activities in GIS area (Geographical Information System) carried out within the scope of Liaison Project. The use of GIS in the field of LBS (Location Based Service) is a recent and innovating research orientation. GIS is used for more than 30 years in landscape management (regional planning). Through new research applications such as navigation and localisation in LBS environment, a new way of development is in process. The merge of LBS technologies and geographical knowledge will be the next challenge to take up for the GIS industries**

I. INTRODUCTION

GIS Applications are usually used to display and manage location on digital map. Recently, with the growing interest on LBS, GIS technologies have to be adapted. Today more than ever, GIS integration must be transparent for end users in order to benefit from the rendered service.

From the GIS point of view, the geographical component and the associated services are the master piece of a LBS platform. In the LIAISON project, the research of a new GIS application platform is focused in an independent central GIS core to provide common services for multiple professional mobile purposes¹ such as:

- Police;
- Fire Brigade;
- Urban Waste Collection Service;
- Security;
- ...

The main challenge of the GIS research in the LIAISON project is to create this unique GIS core platform for convergent applications including numerous innovative features such as:

- Indoor 3D visualisation and tracking;
- Indoor route Guidance;
- Dynamic POI;
- Multilingual translation;
- ...

This paper presents the choices applied to meet the needs for the project according to 2 axes: The constraints related to the materials and those related to the applications and end-user specifications.

¹ For more details regarding the scope of application, please refer to the LIAISON website <http://liaison.newapplication.it>

II. GIS PLATFORM REQUIREMENT

From a strategic point of view, the LIAISON project respects the mind of the Galileo program – the GIS part of the LIAISON program is built exclusively on European Technologies that have been developed on open source operating systems that meet the international standard.

So, we distinguish 2 parts:

- GIS core available on LBS server
- and cores available on client applications.

As well, we must distinguish the operating system used for the LBS server and the one used for the client applications.

A. GIS LBS Core Server

For the LIAISON project, it has been decided to build a GIS LBS core on an Open Source Operating System. The selected OS for the LBS server(s) is Linux Debian, in release Sarge 3.1. The server architecture is based on Tomcat 5.5.12 or above + JRE SUN 1.5.0.7.

Regarding the GIS application: the Linux GIS core is based on GeoConcept (from the eponym company). The interface development environment for the programmers has been created using the QT tools from Trolltech (an European company) it's a cross-platform application development. It includes a C++ class library and tools for cross-platform development and internationalization.

This development platform for the LBS applications allows interacting with the standardised SOAP and OpenLS formats.

Lastly, the server registers the data into MySQL, an open source database

B. GIS LBS Core Client

Three GIS LBS Core Clients are developed to work with the following architecture clients:

- Enteos Mobile phone prototype, a Linux-based smart phone prototype.
- Itronix tablet PC based on Windows Xp
- Internet Web Access

The two last configurations are not in open source format in order to show the interoperability of the server architecture with third-party clients. This choice is also strategic in order to be able to propose the results of our studies to the greatest number, and in particular to organizations, the pre-equipped

with traditional data-processing tools which are the Windows based PC and the Internet browser.

III. GIS PLATFORM APPLICATION

GIS application in LBS is recent (less than three years) as shown in the following figure. Because GIS offers are both connected to map and telecom business models, the GIS LBS business model of GIS offers for LBS is still in progress and it will be always a subject of discussion and modification for a while!

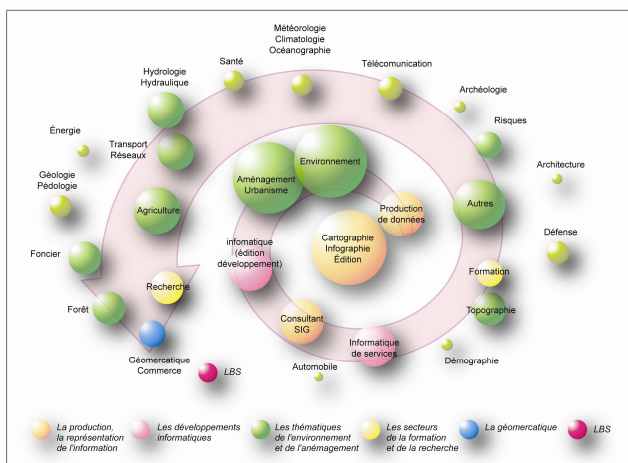


Figure 1 GIS LBS application, a recent offer.
(Source: Adapted from H el ene Mathian,
CNRS-University Paris I)

A. GIS LBS Server Application

GIS LBS Server Application could be a suite of different server applications in order to improve the performance. The research in application development of services provided by a GIS LBS Server can either be used in LIAISON by JAVA interfaces, or XML interfaces and for some specific cartographic extension in C/C++.

The services developed on Linux cover the following LIAISON LBS needs:

- Geocoding
- Reverse Geocoding
- Multilingual Geocoding and reverse
- itinerary
- tracking
- Route guidance
- Display Map Services

If these services have to be split on different hardware machine for a better performance, Map Storage requires also more than one server dedicated to map delivery.

B. GIS LBS Client Application

Clients could be mobile (GIS mobile phone – Tablet PC) or

static (Computer in office, Remote Control Centre). Programs developed on clients are identical to the one of the server. Libraries only are changing because of a different architecture and also the way to catch the maps from the server (via OpenLS or HTTP or via a JAVA interface on mobiles).

On the contrary, using a mobile requires the study of the network protocols for a fast data transfer. For example, in order to use a USB wired broadband connection between a mobile device and a PC, a Java GIS module has to be done. And maps stored on the Transflash mobile device can be transferred via TCP/IP over USB.

To deal with all the combinations of network found on the field, GIS has to improve the speed of map display in mobile or static client. To take up this challenge, the LIAISON Project uses a GeoConcept Technology call HTC (High Traffic Client) for high traffic networks or alternatively low bandwidth networks.

This HTC module is a java website hosted by Tomcat, which is used to provide a caching mechanism for map backgrounds. It is based on the fact that most of the requested information by the users in the map is static, and always the same (roads, parks, usual POIs, etc.). However, this information can be much longer to draw than the dynamic part of the picture, and therefore can charge the system with very redundant calculations. Thus, a way of storing the map backgrounds as images in cache has been set up, and dynamic information, which takes much less computing time and much less image storage space, is requested and sent separately.

C. GIS LBS End User Client Application

The Client Application is made by a panel of European companies in the following research area:

- Modelling and 3D graphic interface application from MobileGIS (Ireland). This topic covers 3D modelling and 3D graphical interface visualisation. The Montelibretti site and one Iberdrola site will be fully designed to prove feasibility.
- Route guidance and emergency coordination from Telespazio (Italy). This topic covers the research and development on indoor route guidance, 2D and 3D path algorithms based on specific topological model. Telespazio will be also working on Emergency Assistance: sensors for taking decisions of the type of emergency will be developed.
- User profiling application from Universitat Polit ecnica de Catalunya (Spain). This topic covers the use of location for personalised information delivery based on user's profile. Active and passive identification techniques of terminal and net profile will be under research.
- Multi-Lingual application from DEMOK-(Greece). This research topic covers the implementation of Multilingual Request Transcription Service. It will integrate an automatic language independent information extraction service. That will enable the user to communicate with

the LIAISON system in a language of his/her preference.

--Customised billing application from University of Athens-(Greece) This topic covers the frameworks for charging and billing, and respective requirements will be studied. Open APIs will be investigated.

D. Data

Geographical data in GIS is always a critical part! Availability and cost are in the middle of the problems encountered by the users. LBS requires an heterogeneous data set:

--Static and descriptive geographical data (2D data for localisation map, 3D data for the building modelling)

--Dynamic geographical data (location of work unit, cars...).

In the case of the LBS, the GIS must manage additional data called communication or information data that can be interpreted as map data.

--Dynamic POI to help guidance.

--Data from heterogeneous telecom network

The LIAISON project is an opportunity to fix some experimental rules and workflows in data capture and modelling.

IV. CONCLUSION

GIS implemented in LBS application needs a real merge of heterogeneous knowledge and a real common will to build a new vision of the location for professional mobile services such as Police, Fire Brigade, Electricity, urban Waste, security...

The main issues can be resumed for GIS LBS by 4 items:

--To build a flexible GIS Core

--To use standardised exchange format of internal and external data to interact with third-party applications

--To find a compromise between standardisation and effectiveness

--The need to find a specialised team for implementation

If GIS applications for LBS are focused on improving the guidance in a heterogeneous environment (indoor, outdoor or out of path), they must also take into account some analysis point of the user requirements:

--User performance targets

--User Environment and constraints

--User Business Model acceptance

GIS application for LBS must be considered as one piece of a huge mosaic called LBS. The LIAISON project is a research laboratory to understand which of all these pieces have to be adjusted.

In addition to the technical challenge, there is an exciting human experience provided by the LBS platform thanks to the improvement of the LIAISON Project Partnership.

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GeoConcept SA designs, develops, and markets solutions for handling and exploiting geographic information on PCs. Powerful, yet universally accessible, their software products are aimed at leading edge market sectors such as geomatics, geomarketing, and geoptimisation.

For close to seventeen years now, GeoConcept has grown progressively while steadfastly adhering to three guiding principles: a policy for ongoing technological innovation, a firm belief in the need to democratise GIS technology (affordable systems, user-friendly interface, web-based solutions...), and ongoing investment in integrating new technologies enabling a geographic approach to problem-solving.