GI AND LOCATION BASED SERVICES – PRINCIPLES AND SOME EXPERIENCES WITH APPLICATIONS FOR MOUNTAINEERS

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1. INTRODUCTION

Several surveys, studies and prognosis conclude Location Based Services (LBS) will be among the most requested applications in the field of mobile communication in the near future. One reason for that is that these services can assist people in many situation to find a proper decision even in emergency situations.

Location based services obviously require the position of the user and the possibility of wireless communication. But the real value for the service is generated from Geoinformation (GI) which is shown below.

AGIS – the GIS lab of the University of the Bundeswehr (Federal Armed Forces) Munich has been focused on this topic during the last years. Amongst others we addressed the topic to assist people wandering and hiking in the mountains or wilderness.

Wandering and hiking is one of the most favourite leisure activities for people living close to mountains. For example in the mountainous region of the alps every year nearly 40 million citizens of the European Union – sportsmen, nature enthusiasts or simply tourists - are searching for recreation. For mountaineers the determination of the own position and the orientation and navigation to the desired destination is a steadily recurring task. Not only the information about the way but also some hints about the close and midrange environment are of assistance.

In this context a prototype for a location based service for mountaineers has been developed in 2001 with funds from the European Commission in the VISPA project which has been carried out successfully with a partner, the IfEN company, located in Poing near Munich, Germany. This project has also been supported by the German Alpine Club and Mountain Search and Rescue teams mainly by defining user requirements and testing the system.

Recently we started a second project – also supported by the European Commission called Paramount, with the partners IfEN GmbH in Poing, AGIS at the University of the Bundeswehr Munich, the Instituto Cartogràfic de Catalunya (ICC) located in Barcelona, the Bavarian Mountain Search and Rescue Service and the Austrian Mountain Search and Rescue Service. Within this project extended services for mountaineers should be developed including information services but also tracking of people and sophisticated data acquisition methods.

The paper presented includes the following:

- General Aspects for GI and Location Based Services
- A short description of the VISPA system and experiences with the system
- An outlook of the goals of PARAMOUNT
- Conclusion for location based services

2. GENERAL ASPECTS AND SELECTED APPROACHES

For establishing a location based service a number of requirements have to be fulfilled, mainly these are:

1. Positioning
2. Wireless Communication
3. Geographic Information / Data
4. Appropriate Client and Server Hard- and Software

Regarding item 1 (Positioning) in principle different methods are suitable. In cities very easy things like the manual input of addresses can be applied. Also positioning techniques based on communication networks are available. Our context – a location based service in a rural / mountainous area – as well as the accuracy requirements of about 10 – 20 meters restricts positioning to the usage of GPS [Sayda and others, 2002]. But in mountains not in all areas GPS might be available through the whole day because of lack of satellite sight.

For item 2 (wireless communication) also different techniques are available in principle. But as we were not willing to invest in any specific infrastructure, for example in wireless LANs, we used GSM and an available extension (see below). Also GSM normally is not available everywhere in the mountains because a very dense network of mobile network transmitters is required there.

Within location based services geographic information (item 3) e.g. in form of streets, ways, trails and all kinds of points of interest obviously always plays the key role because without them only limited information can be provided.

In consequence hat means for all the 3 items – also called 3Gs (GPS, GSM,GI) - mentioned here one as to investigate if these things are available in the areas of interest. This has been done within PARAMOUNT for the Alps and Pyrenees (see below).

Item 4 (Appropriate Client and Server Hard- and Software) will be discussed in the next chapter.

3. VISPA

VISPA is the acronym for "Virtual Sports Assistant" and represents a project carried out within the ASTRON program founded by the EC (European Commission). The primary objective of VISPA was to proof the technical feasibility of such a system.

VISPA consists of a mobile client which can communicate with a server via the GPRS extension for GSM (a wireless communication standard defined from the **g**roupe **s**pécial **m**obile also called the global system for mobile communication). Fig. 1 gives an overview on the client and the server.

Regarding the Client – Server communication on a higher level Internet technology can be used [Leukert and Reinhardt, 2000]. The transfer of requests and results (data ..) in our case is based on a protocol defined in XML. This topic will be addressed in a separate paper in near future.

The following functionalities have been chosen for implementation in VISPA within the proof of concept demonstrator:

- Based on the current position of the user, maps in different scales can be downloaded and visualized.
- Provision of the user's position graphically (in the map) as well as numerically.
- Downloading and displaying of points of interest (poi), like huts, summits…
- Further factual information on a POI, e.g. phone numbers, business hours
- Providing the user with different functionalities for the following use cases:
  - Where is the next shelter?
  - How do I get back to the trail?
  - How do I get from my current location to a selected destination?
- Guidance of the user along the previous calculated route. The user is guided along a set of waypoints, the distance and direction to the destination.

Figure. 2 gives an impression of the clients look a like.

To allow for a better orientation the user can download images rendered from 3D data. Therefore the position of the user and the viewing direction is transmitted to the server. According to these parameters the server computes an image representing a virtual view from the user's position. Fig. 3 shows two examples of such rendered images with different textures. In the left one additionally a proposed route is displayed (red line).

VISPA has been tested in an approx. 30 km * 30 km area in the Bavarian alps using different kinds of digital terrain data, mainly:

- hiking trails and other vector data,
- huts and other points of interest,
- Digital terrain model,
- Orthophotos,
- Scanned Maps

VISPA has been tested together with members of the German Alpine Club (DAV) in the test area mentioned above. The main results:

- The main goal – the technical feasibility of such a system – could be proven.
- Users accept such a system and find it helpful for purposes of guidance, information and safety.
- In the selected area the GSM and the GPS availability was good.
- The accuracy of GPS during this test was in the range of 10 to 15 meters which is really satisfying for these purposes.
- The pretty low data transfer rate of GSM / GPRS is not really a limiting factor because the compressed map data and also the POI information can be transferred in practise with average waiting times between 5 and 10 seconds which was accepted by the users. Routing services and the provision of rendered images took somewhat longer and was in the range of 30 to 50 seconds. But for these services pretty ´quick´ solutions have been used which can be optimised and improved considerable.
- There is a number of possible extension to such a service which could be identified here and most of them are considered in Paramount (see next chapter)

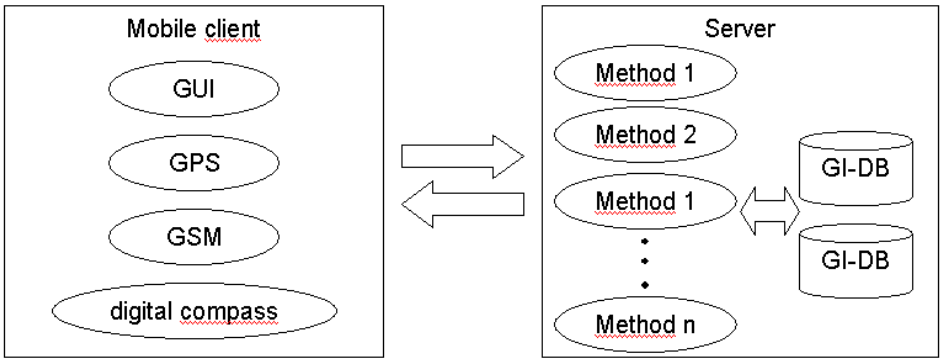

Figure 1. An overview on the client and the server

Figure 2. An impression of the clients

4. PARAMOUNT

This project has been started in February 2002 so it is just possible to outline the scope of the project and some first preliminary results.

In the first part of the Paramount project the following availability studies have been carried out for the Alps and the Pyrenees:

- GSM availability
- GPS availability
- GI Availability
- G3 Availability synthesis

Fig. 4 the result of the synthesis of G3 (GPS, GSM, GI) synthesis for the Pyrenees just to give an impression of this work. It shows that Paramount services would be feasible in a considerable part of the area (shaded area).

It goes beyond the scope of this paper to include more results here. Information on this topic can be got from the paramount web site (www.paramount-tours.com)or from the authors directly.

Further goals of Paramount are:

- The definition of an overall system architecture including the necessary interfaces to other servers / services and the corresponding protocols. The VISPA system and the services implemented there will act as a starting point for that.
- An overall definition and realization (prototype) of services aiming on
  - Information and
  - Safety of users
- As many users with GPS receivers are going the same ways and the GPS accuracy is rather good we plan to investigate how this data can be used to update GIS data bases

To reach this goals the following three major service groups will be defined and implemented (as a prototype):

- INFOTOUR provides fundamental services, which allows the user to access any information mainly via Internet. These are for example maps or points of interest (e.g. huts or summits), but also weather forecasts and so on.
- SAFETOUR will increase the safety of hikers through several services. For example the user can be informed about upcoming thunderstorms. Also the hikers should have the possibility to be tracked by the system in dangerous areas or when they hiking alone. This allows for transmitting the position of the user in dangerous situations to a S&R team.
- DATATOUR should provide a possibility to reduce the database maintenance costs. Mainly a procedure should be established allowing for automatically updating the database. Therefore the data (tracks) from willing users should be used. From this information trails should be derived, compared to existing ones and if necessary the database is updated.

5. CONCLUSIONS AND OUTLOOK

It could be shown within the VISPA project that location based services for hikers and wanderers are technically feasible. As a result from the G3 synthesis we also can state that such services would be possible in large areas of the Alps as well as of the Pyrenees.

In the near future the Services implemented in VISPA will be improved and extended and grouped in 3 main categories. The practical tests in the Paramount test areas are planned for spring / summer 2003.

It has to be mentioned also that possible business models for the services described above have to be developed and discussed too.

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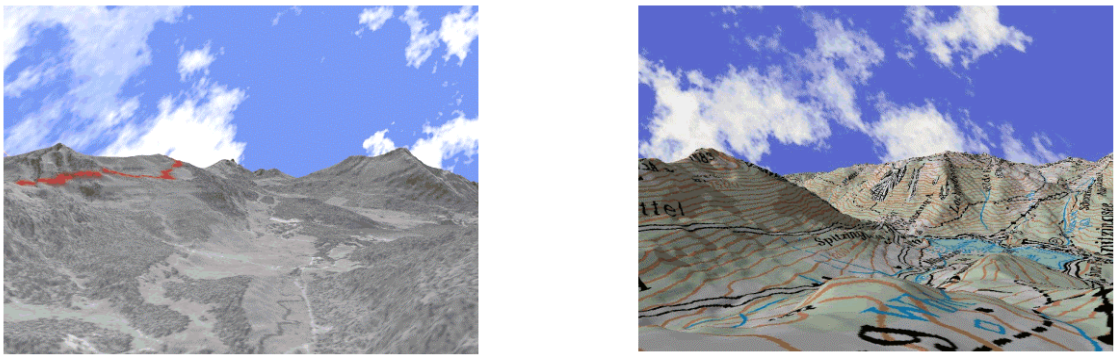

Figure 3. Two examples of rendered images with different textures

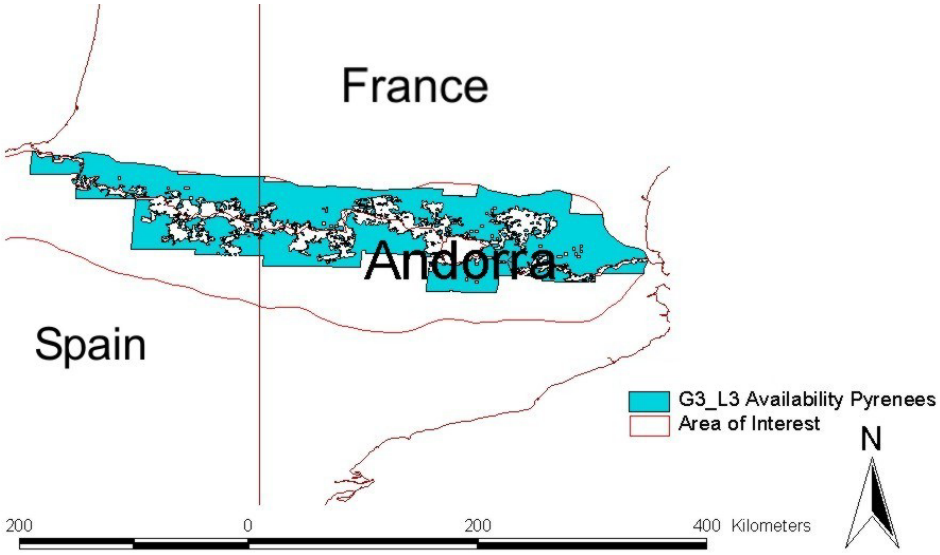

Figure 4. The synthesis of G3 (GPS, GSM, GI) synthesis for the Pyrenees

LITERATURE

Leukert, K. and Reinhardt, W., 2000. GIS Internet Architecture, Paper presented at the *XV ISPRS Congress*, Amsterdam

Sayda, F., Reinhardt, W., Wittmann, E., 2002. Aufbau eines positionsbezogenen GI Service für Bergsteiger, *Proceedings GISSIT 2002*