The VIT-System: Experiences with Developing a Location-Aware System for the Internet

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Introduction

A lot of information is interesting in a local context, e.g. the bus schedule of the local bus station or the location and opening hours of the closest supermarket. Therefore, location-aware access to information and services is an important feature of applications for mobile and ubiquitous devices. Most existing location-aware systems have been designed for certain applications, for example office information systems or tourist guides. At the University of Stuttgart we have developed a system for location-aware information access that serves as a platform for different kinds of information systems. Its main objectives were the seamless integration with existing Internet mechanisms and protocols and the intention to make publishing location-aware information as easy as setting up a page on the World Wide Web.

Functionality

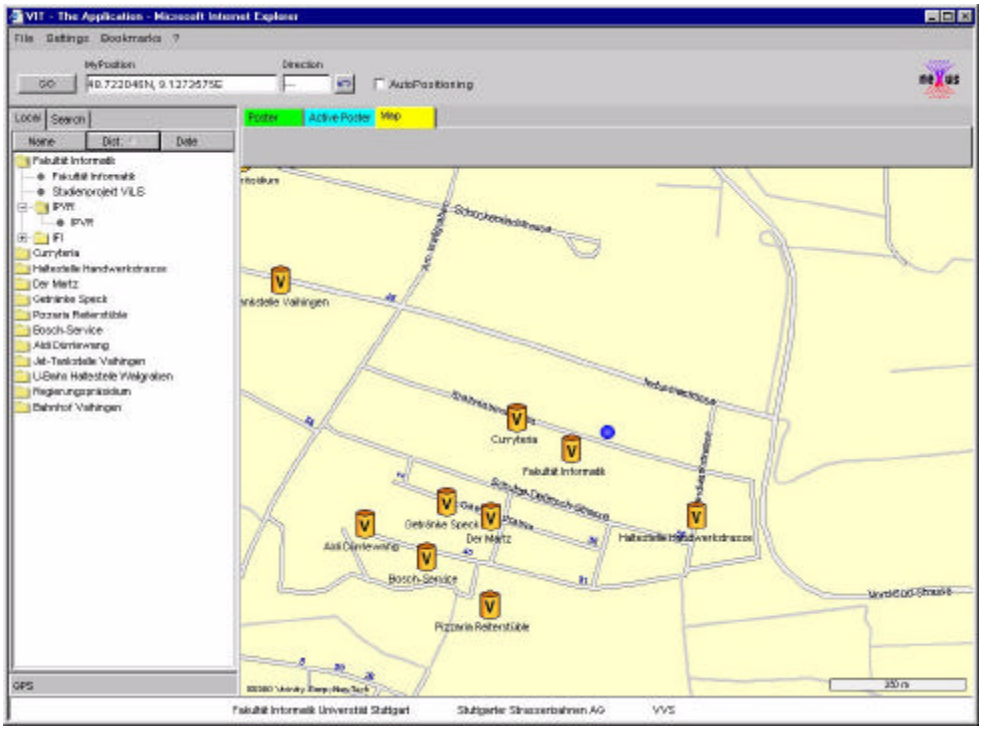

Figure 1 Screenshot - Virtual Information Towers

The system is based on the metaphor of Virtual Information Towers (VITs), which are an electronic equivalent of real-world advertising columns. VITs are associated with a certain geo-

graphical position and have a given range of visibility. They host items of information, which are called posters, and services that are relevant at the given location. A mobile user has access to the information on all the VITs that are “visible” from his current position. The visibility of individual posters can be restricted so that they can only be seen from a certain direction. Apart from these “passive” posters, active posters are supported that become visible automatically when the user enters the respective area of visibility. Some VITs allow users to post simple notes on a “blackboard”.

Figure 1 shows a map with VITs as seen by the user on the client we have developed. The current position of the user is indicated by the big dot. Left of the map in Figure 1, there is a list of currently visible VITs, which allows the user to browse through the hierarchical content of the respective VITs. The user can also search for a certain VIT and, if the VIT provides this functionality, attach his own notes to it.

Architecture

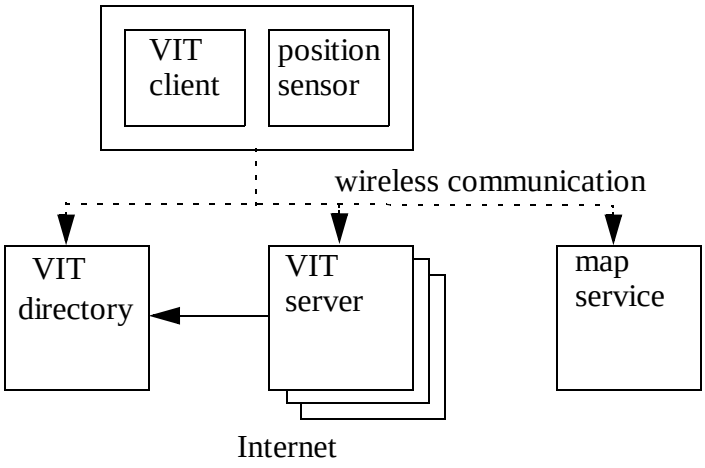

Figure 2 Architecture VIT System

The VIT system is realized as a client-server system. A *VIT client* runs on a mobile device and allows its user to access the VIT system through wireless communication. The client determines the current location of its user using a positioning system (e.g. GPS). It then shows a list of the VITs that are visible from this location. The list is periodically updated by querying the VIT directory. Posters, which are ordinary web pages, can be loaded from the corresponding VIT server and a map of the current environment of the user can be displayed, which is provided by the map service (Figure 1).

A *VIT server* is based on a Web server. It manages the table of content for one or more VITs. The table of content is encoded in XML. The VIT server also manages the posters, if they are not located on another web server. The table of contents and posters of a VIT can be queried. If available, it also provides access to the blackboard of a VIT. The VIT server registers the VITs it manages with the VIT directory.

The *VIT directory* contains links to all available VITs and is used to find the VITs that are visible from a certain geographical location. The answer to such a query, contains, besides the name of the VIT, a link to the corresponding VIT server, where the client can query the contents of the VIT.

Discussion and Future Work

The VIT system can be used in a lot of different application areas. A town may set up VITs to inform about tourist sites, the time tables of public transportation or the office hours of the municipal authorities. A museum may use VITs to provide information about the exhibit in front of which the user is standing. Finally, companies and shops could inform the user about their products. In the beginning, these kind of applications may be limited to small areas. However, we believe that applications like the one presented here will eventually be integrated to provide a global system, which provides the user with important information wherever he goes.

The VIT system presented could be a basis for such a global system, when a suitably distributed VIT-directory is used. The advantage of the Virtual Information Tower metaphor for such a system compared to some of the alternative approaches is that it allows the structured presentation of information pertaining to a given location.

Currently, the client consists of Java Applets that have been developed for a notebook computer based on a web browser. All information is encoded in XML and standard Internet mechanisms are used for the communication. Therefore it should be easy to port the client applications to other platforms, e.g. PDAs.

Since the VIT system uses standard Internet technology, it is easy for different content providers to simply add their VITs to an existing system. All that needs to be done is to add the VITs to the VIT directory and put the VITs on their existing web server.

A problem that has not been totally solved yet, is how to deal with a very large number of VITs that are visible at a certain location. Right now, the VIT system uses a simple filtering mechanism based on keywords. Keywords are assigned to all VITs. All VITs that have a keyword listed on a “positive list” and no keyword listed on a “negative list” are shown to the user. However this approach is not sufficient in all cases and we would like to experiment with other approaches in the future, e.g. the use of channels.

We see the VIT system only as a first step for providing location-aware information to mobile devices. The main advantage is that it is relatively easy to make information that already exists in form of a web page available in its local context. However, the information is limited to fixed locations and thereby to static objects. Also, the VIT metaphor may not be useful for all purposes.

The Nexus project we are currently working on goes much further. The goal is to develop a global platform for spatial-aware applications. The platform will maintain a distributed, dynamic model of the real world augmented by virtual objects like the VITs we have presented here. It will also keep information about the location of mobile objects. Thereby it is possible to obtain all sorts of information regarding spatial and other relations between different objects.

Our focus in the VIT project has been on users with mobile devices, but the same technology may also be useful for smart devices in an ubiquitous computing environment for collecting information about nearby objects, available devices and services.

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