LBS System Design and Prototyping of Digital Campus

Hao ying
Beijing University of Civil Engineering and Architecture, Beijing, 100044, China
Haoying@bucea.edu.cn

Wan Shanshan
Beijing University of Civil Engineering and Architecture, Beijing, 100044, China
wss@bucea.edu.cn

***Abstract*—Based on the analysis of the development of the digital campus at home and abroad, and campus LBS service status and problems of the construction and campus information needs of spatial information services is considered we research the existing digital campus architecture and proposed the overall framework based on the digital area campus LBS platform and we design center platform, mobile terminal functional structure, the establishment of a terminal positioning campus LBS platform prototype demonstration system based on digital area map query, three-dimensional browsing, navigation guides, tracking and monitoring, and SMS notification,**

Keywords- LBS; Digital campus; positioning technology

I. INTRODUCTION

The concept of digital campus first proposed in 1990 by the American Clermont University Kenneth Green and he sponsored a large-scale research project named The Campus Computing Project[1]. With the University information system construct in depth, digital campus has a special function as a digital region and it is the reality of campus space in the data space of extension and expansion at the same time, so the campus as an important part of the city amount of information related to spatial or the information including the content of location are urgently needed to be provided to enhance utilization of limited resources on campus for the teachers, students, administrators and support the school daily management, especially the teaching and research work. So the concept of digital campus occurs correspondingly.

Campus construction mainly includes five parts of the network infrastructure, basic services platform, network application support platform, network information service systems, decision support systems. Network infrastructure, including the campus network as well as for the network to provide services of the server system etc.; network foundation services platforms, including Internet services and to achieve the upper network applications that rely on the basis of service; application supporting platform, and decision-making support system is a core part of the digital campus it includes public management support systems, office automation systems, digital libraries, teaching resources, library, online teaching system; information Service System is a user-oriented system which is designed to provide users with a unified interface for various applications service.

In this paper we discuss the construction of indoor and outdoor location in campus based on LBS platform and virtual reality, and make it a successful example. It can not only bring break points and characteristics for the applications of global navigation satellite system, but also provide students and visitors the unprecedented tour guide, navigation and other kinds of location related information services which can cast a new image for the school. The methods of design and implementation of digital campus based on LBS and virtual reality construction will provide a new idea for the LBS service district, city, region and country[2].

II. RELATED POSITIONING TECHNOLOGY OF LBS

LBS gets the location of the mobile end-user telecommunications mobile operator's radio communications network or external positioning information, according to the user's location information in support of the GIS (Geographic Information System) platform, to provide users with the security position and orientation, charges, information, tracking, and other value-added information services business.. LBS obtains a terminal user position location though some positioning means and transmits it to the server by some kind of network, the server end makes corresponding response to the user terminal through some network[3].

LBS is related to the main techniques, positioning technology, communications and network technology, GIS technology, data and database technology.

LBS services, location information is the key, the positioning has thus become one of the key technologies. Open outdoor environment, the Global Positioning System (GPS) to provide a very accurate positioning information, At the same time, there is also increasing demand for information on indoor positioning, museums, major sports venues, airports, exhibition halls, office buildings, warehouses, underground parking and so the need to use accurate indoor positioning information. Of LBS users are individuals and groups in the city, and put forward new demands on their mobile characteristics of traditional positioning technology. It is driven by this demand, a variety of positioning technologies. Here are a few key positioning technologies.

A. Satellite positioning technology

Satellite navigation technology due to its global coverage and precise positioning accuracy in LBS has a very good application. In outdoor open area, as long as the received signal of the four GPS satellites, it is possible to obtain the accuracy of ten meters wide single positioning accuracy. However, if the use of GPS, GLONASS or GALILEO

satellite navigation and positioning system for indoor positioning, can not use ordinary receiver positioning satellite navigation and positioning system, launched in the indoor environment navigation signal attenuation is very large, and must be used with other positioning methods such as pseudo-satellites.

B. *Assisted GPS technology*

Assisted GPS technology mainly depends on the completion of the GPS satellite positioning operation. The mobile station needs to receive at least four of the GPS satellite signal, positioning calculation is completed based on such information, and the calculated result is reported to the network. GPS technology in general, require the GPS receiver in all airspace within search you can use the GPS satellite. Usually, this search takes a very long time. It can not meet the needs of the fast-moving positioning. In GPS technology, the network according to the cell where the mobile station is currently located, determine where the cell over the GPS satellites, would provide that information to the mobile station. The mobile station based on this information will shorten the search time, and faster completion of the available satellite search process. After the search is completed, the mobile station needs and the interaction of the network will be used to calculate the location of the mobile station transmits the information to the network, to calculate the location of the mobile station by the network.

C. *GPS positioning based on the mobile station*

Who need fast continuous positioning LBS services (such as real-time dynamic car navigation), may be required every few seconds to refresh the terminal position information. In this case, AGPS is difficult to meet the time requirements. Accordingly, in order to improve the positioning interval of time in the case of continuous positioning, the GPS positioning based on the mobile station. And AGPS is different, based on the mode of the mobile station location, the location calculation all done by the terminal itself, the terminal is always in the GPS tracking state, reducing the time of interaction with the network. Time to first fix (TTFF) is basically the same AGPS mode with AGPS and GPS satellite information needs to be obtained from the network side.

D. *Positioning technology based on wireless sensor networks*

With the development of wireless communication technology, the 21st century will soon enter the era of wireless Internet from the network era, the rapid development of wireless communications technology and low-power embedded technology, wireless sensor networks bred. Its characteristics of low-power, low-cost, distributed and self-organizing wireless sensor networks since been given the information age information perception changes. Wireless sensor networks by the deployment of the monitoring area of a large number of cheap micro sensor nodes, formed a multi-hop self-organizing network through wireless communication.

III. SYSTEM FRAMEWORK

Considering LBS services support and specific request and characteristics of the campus network, we give the general framework of the system (Fig.1). Central servers consists of multiple servers which may be separate hardware placed on one or more centralized servers. I/O gateway services server is responsible for distribution of request and return of interfaces for terminal users. Network management server is responsible for network and security services. Authentication server is responsible for user authentication management. Charge server is responsible for charge management. Database server is used to storage navigation data, raster data, metadata, external data, and the location of the monitored terminal data. Location server obtains the terminal location information. Navigation server is used for navigation and related calculations. WebGIS server provides Internet-based GIS services.

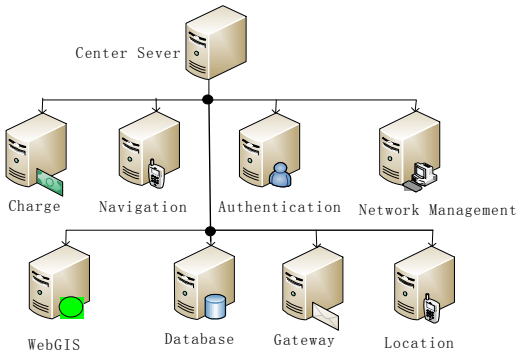

Figure 1. LBS system architecture

LBS system function module is divided into eight parts shown as Fig .2.

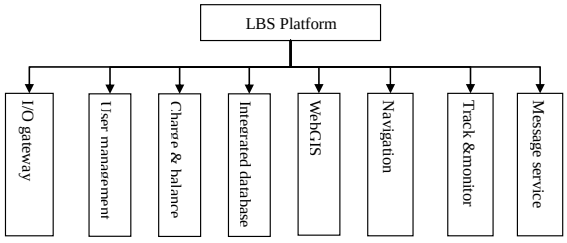

Figure 2. LBS function modules

Location-based service is a service, so let as many users as possible can enjoy this service. However, the current terminal wide range of LBS services to try to diversify, to support from the simple to the complex variety of terminals, and LBS services based on its functions and features to provide the most suitable.

In LBS, the location is the key information. Due to the different positioning of the terminal is different the accuracy of the obtained position is also different. For ordinary mobile terminals to obtain location information from the wireless network, the positioning accuracy of about 100m; terminal with GPS positioning function alone positioning accuracy of about 10m, but in the room can not be used; for terminal

positioning accuracy with GPS function in the number of ten meters high positioning accuracy in the wide open spaces in the building positioning accuracy will be lower. Positioning precision requirements are different, depending on the demand for location-based services and the demand of the positioning mode is also different. If you only need to probably determine the location, with the positioning of the wireless network; if necessary navigation and other services, you need a high positioning accuracy of GPS and other positioning. In any case, high precision, and spend less location information is positioning the direction of development.

IV. SIMULATION EXPERIMENTS

Based on the digital area digital campus LBS platform overall design ideas, a university is taken as an example to demo and verify LBS platform within each function can be realized[4].

The software system is developed on the Windows xp operating system. LBS tracking system chooses Mapx secondary development platform where GIS embedded. WebGIS is the second development using ArcIMS. Three-dimensional GIS is ArcScence secondary development. Database is Microsoft SQL Server.

LBS platform system includes three-dimensional campus roaming, location, path query, voice services[5].

A. The information inquiry

It means information browsing and querying. It includes information inquiries 3D Visualization Browser school history to reproduce the changes to the campus playback, that part is not a must, but beneficial for enhancing the image of the school;

It supports zoom in, zoom out, pan, full map, ranging basic map operating. And it support a variety of query feature, you can query by category, name, and to support fuzzy query. Support within the specified range queries, you can query all feature information on the current map. Support feature information query feature the name of the website, you can view, in line with the user's actual operation of a variety of needs.

B. Location-based services

It means map query service, location-based services, such as schools navigation tour guide (multilingual) services, tracking and monitoring services, public facilities management services, SMS services;

C. Route queries and path planning

D. SMS service

Center can send the users bulk SMS separately or by group. SMS content including weather, publicity. Dynamically updated information, such as weather information, the large auditorium program information, study rooms spare information

E. Navigation Service

When the proposed navigation sent request the terminal to the center, the center planned navigation information according to the location of the terminal and the navigation map, and returned to the terminal.

F. Tracking and monitoring

It includes real-time monitoring, historical track playback, statistical analysis of data, reports and so on.

The main interface of LBS platform system is shown as Fig.3. Though the function demonstration and long term application the LBS platform is proved validation and high efficiency.

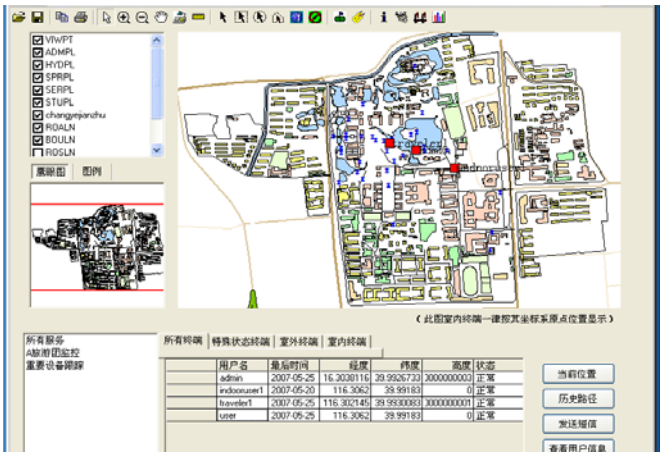

Figure 3. The main interface of LBS platform

V. CONCLUSIONS

LBS provides for the campus dynamic management and planning an effective, modern management tools, it can effectively improve the level of university management, handmade decentralized management can not be compared.

Therefore, the construction of indoor and outdoor positioning with digital regional campus LBS platform and become a successful example, may not only become the breakthrough point and features of the school the GNSS its application research, but also for teachers, students and visitors the unprecedented tour guide, navigation and other location-related information service, casting the new image of the school. At the same time, the campus is a part of the city area. Campus LBS platform is about indoors and outdoor positioning technology with digital area. The ideas and methods of construction for LBS services provide instructions for the district, city, regional, and even the use of the country.

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