Application of GIS in Campus Navigation

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Keywords: GIS; Campus Navigation System; Component Technology; SuperMap

Abstract. With the development of the university's strength, the population of campus has been increasing year by year, and the area of the campus has been continuously expanding. This has caused many inconveniences for the new arrivals and visitors who are not familiar with the campus to understand and visit the campus. In order to provide school freshmen and campus visitors with more convenient services, the campus navigation system was studied and designed based on GIS technology. The system includes four function modules for map query, campus navigation, campus environment preview and campus profile, and provides an interface with the existing system integration. The system is easy to operate, low cost, easy to manage and upgrade, and has strong practicality. This facilitates people from all walks of life to better understand the famous century-old prestigious school and provide them with timely and accurate information. At the same time, it also strengthens the construction of digital campuses and lays a foundation for the school to establish a comprehensive campus management system integrating science, intelligence, and networking in the future.

Introduction

In recent years, with the reform of China's higher education management system, many universities have been merged one after another, so that the same college has multiple campuses, which brings a lot of inconvenience to students' teaching and management. At the same time, colleges and universities campus area is larger, more buildings, the ground and underground pipe network, power supply and communication lines cross distribution, the information with the management of routine difficult to achieve effective management. In addition to the general urban building information, the campus information includes student information and student information on the use of related buildings in the school. Therefore, it not only relates to the management of the map entity itself, but also includes its users' management. Geographic information systems can not only integrate spatial information and non-spatial information on a unified platform for management and analysis, but also develop various application modules based on geospatial data and its unique spatial analysis methods. It provides decision-making and analysis for campus development planning, resource optimization and emergency handling of emergencies. This paper is based on the above understanding. Combined with the existing drawbacks of the previous navigation system, it puts forward to establish a university campus environment navigation system based on geographic information system. The system interface design uses the most commonly used menus and toolbars to drive tasks, integrates heterogeneous platforms and intelligent function kernels into a customized interface. It blurs some specialized knowledge and concepts, making it more convenient for teachers and students to use.

The Development of Campus GIS

"Digital Earth" and "Digital City" are hot topics of geospatial information research in recent years. With the development of campus information construction in various countries around the world,

the concept of “digital campus” appears accordingly. The "Informationized Campus Plan" is considered to be the earliest emergence of the concept of digital garden. In the process of practice, the concept of digital campus has been gradually improved and expanded. Broadly speaking, the digital campus is based on the Internet .Using advanced information technology tools to realize the full digitalization of the environment, including equipment, classrooms, resources such as map books, handouts, courseware, and information, and activities including teaching, learning, management, service, and office work, etc. Building a digital space on the basis of expanding the spatial dimension of realistic campuses, improving the management efficiency of the campus from the west, expanding the functions of traditional campuses, and ultimately achieving a comprehensive informatization of the educational process. Then it can achieve the goal of improving the quality of teaching, research and management.

With the development and widespread application of information visualization technology and GIS technology, another concept of digital campus has emerged, namely the construction of visualized virtual campus on the basis of real campus. This is a spatial information model based on the geographic coordinate system of the earth. It collects, sorts, stores, analyzes, and optimizes various information of the real campus through the information network. Further, it simulates, performs, analyzes, and deeply understands the entities and phenomena in various resources, the ecological environment, the social environment, and the teaching environment.

Now many colleges and universities have established their own campus geographic information systems, combining GIS technology with traditional management information systems, and using the space management and spatial analysis functions provided by GIS to solve many problems that are difficult to solve with conventional management methods. However, the construction of a digital campus is a complex and large project. On the one hand, it requires the coordination of various aspects within the school to rationalize the internal management mechanism of the school. On the other hand, the construction process should be planned in an integrated manner and carried out in stages. Therefore, the campus geographic information system should first classify the classification management modules and function modules, and then implement the functions of each module one by one. At the same time, we must also consider the mutual relations and information exchange between each module to achieve systematic management.

Related Software and Technology Related to Campus Environment Navigation System

About SuperMap. SuperMap GIS 6.0 is a new generic desktop geographic information processing application platform developed by Beijing SuperMap Geographic Information Technology Co., Ltd. Its technical characteristics are: SuperMap is a full-component development platform, there are eight ActiveX components, 121 objects, plus 2120 interface data compatibility, support for a variety of vector data format conversion (such as AutoCAD SXF, SWG format), and more Source space data is seamlessly integrated to support massive data processing, and supports multiple databases such as Oracle, SQL Server, and Access. It can be adapted to large-scale system development with massive image compression technology and can quickly restore display.

Component Technology Foundation. COM is the abbreviation of Component Object Model. It is a technology that allows objects to interact with each other across processes and across computers. It is a specification of mutual interfaces between components, and is a common foundation between OLE and ActiveX. Its role is to enable various software components and application software to interact in a unified standard way. COM is not an object-oriented language, but a binary standard that has nothing to do with source code. COM establishes a link between a software module and another software module. After such a link is established, the modules can communicate through a mechanism called "Interface on Object". The COM standard has increased. Ensure complete security mechanisms for systems and components, and extend to distributed environments.

Component GIS. Based on component technology, the combination of component technology and GIS technology has brought GIS to a new stage—components. GIS (Components GIS, referred to as ComGIS). It overcomes the shortcomings of long development cycle, low reuse rate, and high cost caused by the traditional software development model. The basic idea of component-based

software development model: Decompose the major functional modules of the system into several controls. Each control performs a specific function, between each GIS control, and between GIS controls and other non-GIS controls. It can be easily integrated through visual software development tools to form The final GIS application. Controls are like a pile of assortment of building blocks, and they each implement different functions. According to the needs of the "building blocks" to achieve a variety of functions, it constitutes an application system.

System Development Language and Database Selection

The system can be developed with SuperMap Object 6.0, a component GIS software, in a software development environment such as VB and VC++. The design choice of the campus environment navigation system was developed under the VB6.0 environment.

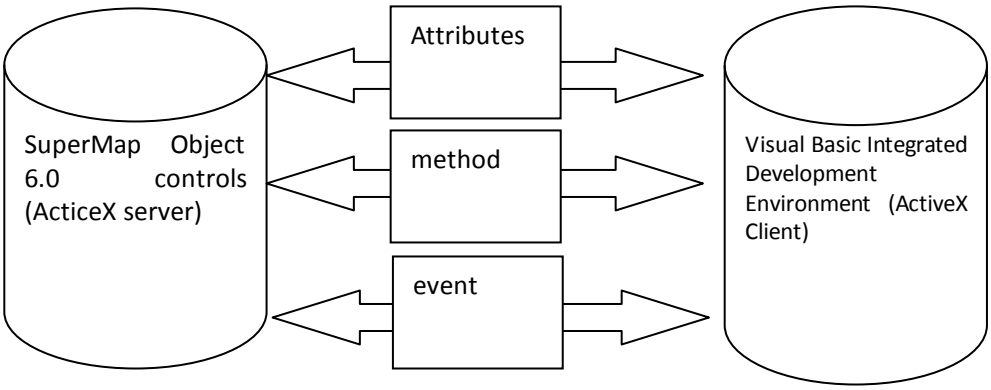

Figure 1. Finite SuperMap and Visual Basic development environment

Combining SuperMap with VB6.0 and environment to develop the system, it is very convenient to embed the map processing function into the application program, and it can be compiled into an exe file and run away from the SuperMap software platform. At the same time, SuperMap Object 6.0 can quickly and easily embed maps in the database management system to enhance the spatial query and spatial analysis capabilities of the system. By changing SuperMap Object 6.0, you can analyze and visualize attribute data, create and edit map features, and map display results. In addition, SuperMap Object 6.0 can be used to display the campus environment in three dimensions to enhance the visibility of the system.

Due to the large amount of data used in the system, various attribute data related to spatial data are stored in the Access table, connected to the Access table through ADO in the VB6.0 environment, and directly accessed in the table by means of SQL statements to manage various attribute information.

Functional Design of Campus Navigation System

The functions of the campus navigation system mainly include four function modules: map query, campus navigation, campus environment preview and campus profile.

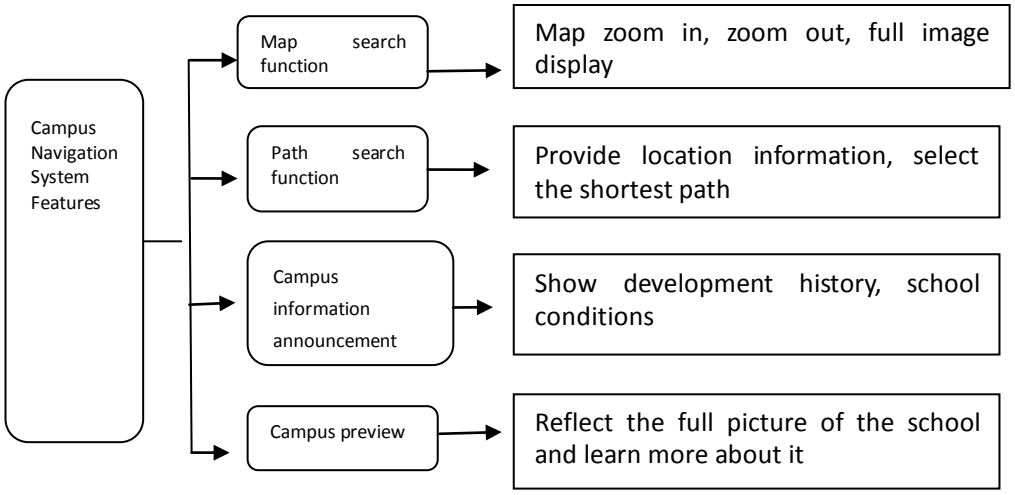

Figure 2. Finite System Functions

(1) Map query function design. The map is imported into SuperMap 6.0, and the SuperMap 6.0 is hierarchically edited and exported to the SDB file format as a data source. By using the low-level development tool VB6.0 to add Super Map Object controls to the toolbox, the methods such as zooming in, zooming out, and roaming provided by SuperMap are presented in the form of buttons, so that the user can intuitively understand the overall layout of the map.

(2) Path search function design. Path analysis is the most basic function of GIS. Firstly, set the network analysis environment and parameters, and set the site and analysis results. Create a new SoNetworkSetting dataset and use the network node NodeEx method to analyze the shortest path between several IDs. After the data analysis is performed, the analysis result can be obtained. This function accurately provides the school road conditions and building facilities to visitors, helping them to familiarize themselves with the location and information of various types of building facilities on campus and selecting the optimal route. The user selects the starting point and the destination point to obtain the shortest distance and the general travel time.

(3) Campus information query function design.This system uses SQL Server as the relational database organization attribute data, and connects through the code between SQL Server relation tables. The main code is used to identify and connect properties. In the VB environment, data including teacher database, course subject library, and classroom information library are accessed through the connection with the SQL table. In addition, in the single-machine mode programming process, through the sub-window in the TextBox control to update the specific day of the main campus activities to achieve campus news on the day of the query.

(4) Campus preview function design. Click the mode programming process, click the campus preview function menu, in the pop-up sub-menu, click the Label control of the facility you want to preview, the pop-up sub-window in the Picture Box control to meet the user to upload pictures, while using the Wlnsock 1 control to meet the user Upload pictures to show your own campus requirements. This function specifically shows the real shot maps of the various facilities on campus. Through the visual image display, the user can understand the school more intuitively.

The Main Features of the System

Convenient and Easy to Operate. In all functional modules, the graphical user interface is simple, convenient, and straightforward. It integrates the various processes of the system organically.

Real-time and Accuracy. This system provides the latest information of a university. It can update and unify the data in real time, enabling users to get the latest information on the campus when they use it.

Practicality. The system includes the shortest path selection function, so that visitors can quickly understand the campus and the system is more humane.

Summary

In recent decades, GIS technology has developed rapidly and has been successfully applied in all walks of life. However, the application of it to campus navigation systems is still rare in China and is not mature enough. The application of technology to university campuses, a special humanistic and social environment, and the development of a campus navigation system with practical value are inevitable in the automation and scientific management of universities. The system describes the distribution of campus teaching facilities, living facilities, other buildings, and relative location relationships. The basic functions of the geographic information system are realized, such as editing operations such as adding, modifying, and deleting features, and mutual visits between graphics and attributes. In the research and development process of the campus environment navigation system, due to time, manpower, and other subjective and objective factors, the system has many aspects that need further in-depth research; at the same time, with the progress of science and technology, GIS technology continues to improve, the campus The navigation system must also continue to move forward. Therefore, there is still much work to be done in the future research and development process.

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