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Design of Digital Campus Application System based on WebGIS

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Abstract

With the rapid development of computer technology, geographic information system (GIS) technology has made continuous progress, its application scope is more and more extensive. The rise of Flex provides a rich and colorful representation of web-based geographic information systems. General university campus area is large, a variety of teaching service facilities and life service facilities, all kinds of teaching information for school teachers and students has the characteristics of dynamic change and large amount of information, it is difficult to achieve effective management with conventional management methods. Construction based on Flex and Webservice in MAPGIS IGS API component development of Browser/Server architecture system - digital campus information system. The system uses the powerful data management, spatial analysis and visualization function of GIS, combines GIS, computer network, map and other technologies and means, digitizing the existing campus resources, superimposing the campus spatial data and attribute data, integrates the spatial query and spatial analysis function, and finally forms a virtual reality digital campus information system.

Keywords

WebGIS; Digital Campus Information System; System Design.

1. Introduction

Geographic Information System (GIS) is an emerging discipline integrating computer science, informatics, geography and other sciences. With the support of computer software and hardware, it applies the theories of system engineering and information science to scientifically manage and comprehensively analyze geographical data with spatial connotation, so as to provide the information needed for planning, management, decision making and research [1]. Campus geographic information system (GIS) is an emerging information processing system that can simultaneously process campus attribute information and spatial information, and realize visual management of spatial information [2]. Digital campus information system makes full use of GIS data management function and map visualization function to establish a service-oriented digital campus information system.

Compared with the traditional campus web page, digital campus information system is more intuitive, vivid and realistic. The existing campus web page abstracts the real campus into two-dimensional text description and picture display to let users know about the campus [3]. Users who have never been to the campus can only construct an imaginary campus scene in their minds. The university digital campus information system will be the campus of the natural environment, cultural environment directly presented in the system, users in the browsing as

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immersive understanding of the school's teaching facilities, teaching environment, classrooms, libraries, scientific research equipment, laboratories, etc.

The digital campus system based on GIS technology can realize the panoramic plane simulation of the campus, which makes people's overall understanding and perception of the school become relatively easy, and create an intuitive feeling for people. The application of GIS technology to the campus, through the query, analysis, browsing and other functions to achieve the operation of the campus scene, more concise and convenient to provide all teachers and students to the layout of the campus and resources comprehensive cognition and utilization.

In the traditional campus management, the spatial information of the campus is displayed in the form of a single, static map. The spatial location information and campus attribute information are managed separately. The input, analysis and management of the system attribute data almost do not involve the spatial information. However, the data required for campus management and planning is based on spatial data. Visitors visiting the school, freshmen registration, and planning of campus buildings all need to know the geospatial and humanistic information of the campus in advance [4,5], such as query and positioning, path analysis, and thematic map output. The traditional campus management system can no longer meet the needs. To sum up, the university digital campus information system is based on the traditional campus, using the powerful data management, spatial analysis and visual expression functions of GIS, combined with computer, network, map and other technologies and means, to digitize the existing campus resources, and combine the spatial data and attribute data of the campus for visual expression [6,7]. At the same time, the function of spatial query and spatial analysis is integrated to form a query and display system that can display the panoramic view of the campus. Visitors will be able to enjoy the local customs and attractions of the campus, learn about the school and department Settings, student organizations, visit the school organizations, and obtain information about study and life services. Thus for the university campus management to provide more convenient, more abundant information, more humanized management system.

2. System Design

2.1. Requirement Analysis

University digital Campus Information System is a service-oriented geographic information system developed for teachers and students (especially freshmen) and friends who are interested in the college. Campus teachers and students spend more than 10 months on campus every year, and more than 10 hours on campus every day. The changes of an organization or a shop on campus affect all aspects of their life and their safety and stability. Only by mastering all kinds of spatial information and attribute information on campus in real time and accurately, can teachers and students better understand and adapt to campus life, better enjoy the services of various hardware and software facilities on campus, and better immerse themselves in and revel in campus life. How to make students familiar with the campus environment as soon as possible, grasp the distribution characteristics of campus facilities, understand the various functional institutions and student organizations on campus, is another starting point of this system design. University Digital Campus Information System service campus teachers and students and interested in the college of friends outside the service geographic information system. Based on this system should have the following basic functions:

1) The interface design should be consistent, coordinated, intuitive and transparent to users.

2) Follow the unified operation standards, take user experience into consideration, and take users as the center, so as to achieve the effect that the response of the software to user behavior and user expectations should be as consistent as possible.

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3) The interface should be the right size for the aesthetic point of view, feel coordinated and comfortable, can effectively attract the user's attention.

4) The foreground and background color collocation is reasonable and coordinated, the contrast should not be too big. The main color should be soft, with affinity, and resolutely put an end to harsh colors.

5) Flexible human-machine interaction, eliminating redundant input; Data interaction is fast and flexibility for keyboard and mouse input is supported.

2.2. System Design Principles

1) Practicability: Ensure that every system submitted to users should be practical, and can solve the practical problems of users' demand for campus information, so as to achieve satisfactory results for users.

2) Simplicity: The system should be as simple as possible (including the simplification of the code and the simplicity of the user's operation steps) under the premise of achieving the predetermined goals and having the required functions, which can reduce the processing time, improve the system efficiency, sublimate the system quality and facilitate the implementation and management.

3) Flexibility and adaptability: refers to the system's ability to adapt to changes in the external environment. As a campus geographic information system must have considerable flexibility, in order to adapt to the constant changes of the external environment, and the system itself needs to be constantly modified and improved. A flexible and adaptable system requires each part to be independent and easy to change, so as to improve the performance of the system and constantly meet the changing requirements of the system objectives.

4) Consistency and integrity: consistency means that information coding, collection and information communication in the system should meet the standards of consistent design specifications; Integrity means that the system exists as a unified whole, and the system functions should be as complete as possible.

5) Security: Now almost all computer viruses come from the network, Web applications should try to adopt five layers of security system, namely network layer security, system security, user security, user program security and data security. The system must have high reliability, strict permission management for the use of information, and technically, strict security and confidentiality measures should be adopted to ensure the reliability, confidentiality and data consistency of the system.

6) Reliability: The index of system reliability is the average time between failures and the average maintenance time. The former refers to the average time between two failures, which indicates the safe running time of the system. The latter refers to the average repair time after a failure, which indicates the maintainability of the system. Only a reliable system can guarantee the quality of the system and get the trust of users, otherwise it is of no use value.

In order to store and manage university spatial data and attribute data effectively, this paper designs a database which takes spatial data and attribute data as storage objects. Spatial data and attribute data are stored and managed separately. The map spatial data is processed in MapGIS K9 map editor software and stored in the local database of MapGIS enterprise Manager, and the attribute data is stored in the "lzjtu" database (SQL server 2008). In the design of spatial database, the spatial database [8] is first established through data layering, layer management, attribute coding and spatial index design for spatial query, positioning and display. Then the attribute database design, the attribute database input school hardware geographical location, introduction and other information and campus software introduction display and other attribute information, finally establish the connection relationship between the spatial

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database and the attribute database, realize the display and query of campus geographic information.

2.3. Map Spatial Data

Data is one of the core contents of the system. The query, analysis and other functions to be carried out by users are based on a complete and accurate spatial database. Therefore, before the university campus information database, it is necessary to collect all kinds of relevant basic information as accurately as possible and establish a complete database. Spatial data of university campus include: dormitory buildings, school canteen, basketball courts, football fields, supermarkets, hotels, teaching buildings, laboratories, addresses of colleges and offices, school network, characteristic campus scenery points, etc. The Digital Campus information system of Lanzhou Jiaotong University adopts layering and block technology to organize and manage spatial data, and divides the campus map into several layers according to its functions. The whole map is the result of the superposition of all layers. After dividing the layers, the system can control the display and hiding of the layers according to whether the user selects the layer to display or not.

2.4. Conceptual Structure Design of Attribute Database

Conceptual design refers to the establishment of the database conceptual structure of the whole system from the bottom up on the basis of data analysis, the view design from the user's perspective, and then the view integration, and finally the integrated structure analysis, to get the final result. The components of the conceptual model (E-R model) include entity, attribute and relation. The E-R model is represented by the E-R diagram. The entity is the transaction involved in the user's working environment, the attribute is the description of the entity's characteristics, and the relation is the relation between the entity and the attribute.

After obtaining the above data items and data structures, various entities and their relationships that meet the requirements can be designed, and then these contents can be expressed by Entity-Relationship diagram, that is, E-R(entity-Relationship) diagram, laying a foundation for the following logical structure design.

3. System Implementation

This system is based on Flex and WebService in the MAPGIS IGS API B/S architecture system, database using SQL Server2008.

Flex is an efficient, free, open source framework for building expressive Web applications. Flex uses GUI interface development, using XML-based MXML language. Flex has a variety of components for WebService, remote objects, drag and drop, column sorting, charting, and more.

Flex+ MapGIS IGS: Flex secondary development based on MapGIS IGS, provides control type and code type two secondary development methods. Control development, direct use of functional controls, similar to Flex provides all kinds of web controls, simple answer easy to learn. In the Flex network development, the use of web controls at the same time, you can use code to achieve, are object-oriented programming, are providing class attributes and methods. Based on Flex development features, IGS Flex secondary development library also provides a set of class libraries, users can realize the corresponding functions through this class library programming. Functional components and code programming each have advantages, the two closely combined, flexible application.

SQLServer2008: is a trusted, efficient, intelligent data platform. It provides the following key features: database protection, less time spent on server administration operations, increased application stability and system execution performance optimization and prediction capabilities.

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3.1. Map Service

1) Map release

Attach the lzjtu_5.map map documents involved in the university digital campus information system to MapGIS GDB, and then configure the corresponding documents to the vector data service of GIS server.

2) The display of maps

First drag the IMSMap Map container control, then drag the VectorMapDoc control into IMSMap to set the map document name, server address, and display range of the map container.

3.2. GIS Operation Functions

1) Simple query:

First activate the layer to be queried under the number directory, then click the query button in the Map operation tool in the upper right corner of the window, hold down the left mouse button, drag the mouse, you can see the circle displayed on the screen with the mouse click position as the center and the mouse drag distance as the radius. Release the mouse, the system automatically displays the geographic information in the area covered by the circle. In the information display window, users can click the geographic information they are interested in to view its corresponding position on the map.

2) Compound query:

The operation process is similar to simple query. You need to enter search conditions.

3) Topological analysis:

First activate the layer to be queried, then select the first element, then select the second element, set the tolerance radius, click Submit, and finally get the topology analysis results.

4) Superposition analysis:

First activate the layer to be queried, connect the MapGISlocal database, select the layer to be analyzed, set the overlay type and tolerance radius, click Submit, and then view the decomposition results.

5) Buffer analysis:

Activate the layer to be queried first, find the area that needs buffer analysis, click the buffer analysis menu from the right button, set the buffer radius, and click to view after submission.

4. Conclusion

From the data level, all the spatial data and attribute data related to campus life are input. Spatial data sources are reliable, information positioning is accurate, layer Settings are clear and reasonable. The attribute data source is reliable, the information is rich and comprehensive, and it is the latest edition of the campus. Most of the information data is stored in the SQL Service database, which is convenient to modify and update, which is conducive to the later system management and maintenance. From the functional level, the system has carried out reasonable classification and diversified display of campus information from five functional modules: map operation, adding annotation, information query, "new" eye contact and quick query. Fully consider the campus teachers and students in the life of various needs. From the optimization of the system, in order to compress the system files, improve the system running speed, from the unified picture pixel specifications, to reduce the pop-up operation of the window, some optimization work has been done.

The system also has the problem of running too slow. For the problem of slow system running speed, the next step is to optimize the system code and the use of system resources. At the same time, due to the short time, some data is not real, so it is only used and used in the early

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debugging of the system, and the real reliability of the attributes and spatial data should be improved in the later stage.

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