The Application of GIS in the Construction of Smart City

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Abstract: With the development of economy and society and the advancement of science and technology, cities are facing more and more problems, and the construction of efficient, intelligent and sustainable smart city has become an inevitable trend in future urban construction. GIS, with its powerful functions, has injected technical force and vitality into the construction of smart city, bringing huge opportunities to solve the problems faced by cities. After summarizing the concept and application advantages of GIS, this paper analyzes the application of GIS in smart city in detail, including smart transportation, municipal underground pipeline, urban emergency service system, land use planning and construction, and urban fire safety. The application analysis shows that GIS has more advantages in the construction of smart city, and it is expected to bring some references to the application of relevant technical means in smart city, so as to lay a solid foundation for improving the efficiency and level of urban construction and governance, thus better serving the daily life of urban residents and improving the efficiency of government decision-making.

1. Introduction

With the acceleration of urbanization process, urban problems such as lack of resources and energy, rapid population growth and environmental degradation need to be paid more attention. The construction of smart city is an important measure to improve the urban governance system and promote the modernization of governance capacity. The construction of smart city is based on digital big data, which is in line with the trend of social development. Using big data to implement urban smart management, the combination of smart city and GIS alleviates the current problems faced by the city [1-2]. Nowadays, most cities have begun to construct smart cities. The wide application of GIS can improve the accuracy and timely processing ability of urban information analysis, realize the visual development of spatial information data, improve the efficiency of spatial data analysis and management, and promote the intelligent development of digital operation mode of smart cities.

2. Definition

2.1 GIS

GIS (Global Information System) — Global information system is a geographic information processing system, which mainly relies on computer and uses engineering planning theory and advanced technology to collect, store, analyze and process urban geospatial data. It can promote the comprehensive analysis and scientific management of geographic data, and better promote the implementation of specific work such as scheme decision-making, formulation, planning implementation and operation management. 3D GIS can automatically process spatial data, transform it into intuitive information and display it to users, so that users can have an intuitive view of 3D spatial scene, which brings convenience to users and attracts users' attention.

Because of its own advantages, GIS provides methods and technology for other related disciplines, and also promotes its own improvement. The integration of GIS and BIM Technology, the combination of urban building spatial information and surrounding environment, promotes BIM from micro to macro, because BIM Technology is meticulous, all aspects of micro spatial information, can carry out efficient and scientific information analysis and processing; When GIS is combined with surveying and mapping technology, the problem of Surveying and mapping

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information processing is used in urban road traffic planning, urban space planning and design, urban municipal facilities planning, urban resource development and management, etc., which improves the construction efficiency [3]. At the same time, GIS can be combined with GPS, RS and other technologies.

2.2 Smart City

Smart city is the product of social development, its construction is a long-term and complex process, and smart city construction is also developing with the progress of science and technology. Now there is no clear conclusion about smart city, so there are different definitions of smart city. The European Commission first proposed in 2007 that smart city is an investment in urban human, material, social and financial capital, urban road traffic, municipal and other basic information equipment to promote the healthy growth of the economy. At the same time, it attaches importance to the role of intelligent management of natural resources, and compares it with a factor to promote the healthy growth of the economy in combination with various methods. With the development of economy, the definition of smart city has changed [4-6]. It is defined as: to promote the maximization of urban functions, to analyze, integrate and process all kinds of information in urban operation by means of modern means while promoting the sustainable and healthy development of the city, to establish intelligent models of urban planning and construction, service management and other aspects, involving social services, business activities, environmental health, road traffic, etc., but in fact Quality is to use all kinds of advanced technology to improve the quality of urban life development, promote the efficient management and operation of the city, meet the needs of residents' living environment and quality, and promote the sustainable and healthy development of the city.

3. Application Advantages of GIS

3.1 Data Query, Collection and Storage

With the progress of science and technology, the level of intelligence has been gradually improved, the combination of GIS and smart city has become more and more close, and its advantages have become increasingly apparent. In the process of smart city development, there is a huge amount of data, and its demand for GIS query, collection and storage data has also been increasing. GIS can run through the whole process of smart city construction, the core of which is to establish a geographic information database, and input object graphics and attribute feature data into the database, however, in this process, wrong data may be collected, which requires GIS to modify the graphic data in real time, and to provide accurate smart city data, so that the construction personnel can query and store the required data in time, so as to make efficient and quick use of big data for analysis and application in the process of smart city construction, and improve the accuracy and reliability of smart city construction data, which can be used in a great way To improve the utilization rate of information and data and promote the efficient development of smart city.

3.2 Real Time Positioning, Data Acquisition of the Platform

Combine the map and geographical element information published by the intelligent city geographic information platform with the accurate positioning function of the satellite system to locate the graphics in real time and quickly obtain the geographic location information of the graphics. Combine "Internet" with "cloud data", based on the latest map and geographic element information services, collect the problems faced in the development and construction of smart city, upload the problems to the infrastructure construction platform of smart city by using the network, analyze and sort out the latest geographic information data by professionals, obtain the relevant situation analysis map of smart city construction on demand, and promote the development of smart city Smart city runs efficiently and intelligently.

3.3 Data Visualization

Real three-dimensional visualization is the basic feature and function of GIS. It has accurate and

detailed geometric features and realistic texture details. It has so-called "photo texture". Real and realistic is the most obvious feature of GIS data visualization. It can improve the quality and clarity of graphics and images, and obtain realistic scene effects. GIS uses the technology of three-dimensional simulation to collect, analyze and sort out the data of graphic information, and simulate the collected data to form three-dimensional map. Combining GIS with the actual situation of urban construction, a three-dimensional map model of smart city is established to simulate and deduce the future construction of smart city, which is convenient for urban planners to find and solve the problems in urban operation in time.

3.4 Efficient and Scientific Operation Everywhere

Due to the continuous progress of Beidou System in China, smart cities can obtain all day, precise, scientific and reliable positioning and navigation information, which promotes the scientific, efficient and everywhere operation of GIS and provides convenience for urban planners. GIS equipment can be carried with you to quickly locate the location of the planning and construction site, and timely feedback the problems found in the process of urban planning and construction to the relevant service platform, in order to improve scientific decision-making and efficient service level.

4. The Application of GIS in the Construction of Smart City

4.1 GIS Applied to Intelligent Transportation

Transportation plays an important role in the process of urban construction. It is not only the link between cities, but also the basic thoroughfare of people flow and logistics. In the process of smart city construction, because GIS can collect fine data information, in the process of urban road traffic operation, it can realize the whole process supervision of vehicle operation track, carry out all-weather location of urban vehicles, and promote the collection, analysis, query and storage of GIS traffic information. Its information includes the location of vehicles, license plate number, driving speed, driving direction and vehicle appearance, etc. It uploads the traffic information to the system database, which is convenient for the supervision and management of the road traffic system, and provides convenience for the government departments to understand the actual situation of road traffic and make scientific decisions. GIS can also provide the best travel route, facilitate the intelligent travel of residents, and alleviate the urban traffic congestion to a certain extent.

4.2 Application of GIS in Municipal Underground Pipeline

Municipal underground pipeline is an important infrastructure of the city. The traditional way of layout often focuses on the layout of pipelines, making all kinds of underground pipelines mixed and staggered, which is very easy to damage the pipelines. At the same time, people come and go on the road, human production and life construction activities affect the safety performance of underground pipelines, and the aging and untimely maintenance of pipelines lead to serious threats to the safety of the public. Therefore, the application of GIS in the municipal underground pipeline plays an important role in the construction of smart city. The real-time monitoring, three-dimensional spatial simulation and visualization of GIS are used to pay attention to the pipeline operation in time so as to facilitate the maintenance and management of the staff. GIS is used to simulate the best spatial layout of municipal pipelines and build a scientific underground pipeline management service system, which can provide reference for the government to formulate policies, promote the underground pipeline planning to reasonably consider the location, buried depth, horizontal and vertical clear distance of various pipelines, improve the service quality of pipelines and reduce unsafe factors.

4.3 Application of GIS in Urban Emergency Service System

The important purpose of urban emergency management is to maintain the normal operation of urban development. When there are problems in the city, relevant departments should implement emergency management measures in time to promote the stable development of the city. The urban

emergency management system established by GIS is an important system to ensure the basic safety of urban residents and provide urban emergency services. The data collection, real-time monitoring, spatial analysis, map comprehensive function and visualization function of GIS promote the integration of geospatial data and information such as the time, location, surrounding buildings and construction conditions, and safety hazards in the process of urban construction. It is convenient for the public to understand the urban emergency circumstances in real time and intuitively, and reduce the potential safety hazards. Realize the city emergency management system to monitor and prevent the city, provide emergency services, emergency resource management control, visual plan management, etc., provide scientific research and analysis for the city emergency management, make the government departments directly understand the specific situation of the city, and improve the efficient decision-making ability and level of emergency management services of the government departments.

4.4 Application of GIS in Land Use Planning

Urban land use planning is a basic planning strategy formulated by the relevant government departments. Within the designated planning and construction plot, based on the current economic development status and natural ecological conditions within the plot, and in order to meet the needs of national and economic development, it is of great significance to the rational use of urban land resources, which promotes the stable and healthy development of the city. However, with the rapid development of urbanization in China, the land types are diverse, and the complexity and uncontrollability of various influencing factors in urban land use planning make the old land use planning difficult to adapt to the current situation of urban development. In the construction of smart city, the spatial analysis function of GIS is used to manage the land data with various types and large quantities in land use planning, and the dynamic real-time monitoring function of GIS is used. When there is a big deviation between the planning and the actual prediction, corresponding correction is made according to the actual situation, which can reduce the workload of repeated modification of planning and improve the scientific and reasonable land use planning Sex. At the same time, the functions of data collection, storage, spatial analysis, editing and mapping of GIS are used in urban land use planning to promote the formulation and modification of planning and design methods, service implementation management, ensure the accuracy and scientificity of planning implementation, and improve the efficiency of planning implementation.

4.5 Application of GIS in Urban Fire Safety

In the process of urbanization in China, there are many urban problems, and fire is a more serious social problem, which brings many adverse effects to the city, not only makes the residents lose property, but also threatens the life safety of the residents. Therefore, it is very important to maintain the city fire safety. However, the traditional fire rescue planning is difficult to adapt to the current situation of the city, and scientific and reasonable urban fire safety planning needs to be implemented. In the urban fire rescue, the collection, real-time monitoring, input, editing, storage and analysis functions of GIS are used to pay attention to the urban fire situation and analyze the specific information of the location and size of the urban fire in all aspects, so that the firefighters can rescue in time and reduce the negative impact of the urban fire. Using the spatial analysis function of GIS, combined with the urban road conditions and traffic flow, the paper compares and calculates the shortest time for firefighters to reach the fire point, determines efficient fire-fighting and rescue measures, determines the best arrival path, reduces the harm caused by the fire, and maintains the safety of life and property of residents. At the same time, the location and number of fire stations shall be set reasonably according to the distribution location, layout and urban traffic conditions of urban buildings and fire-fighting facilities.

5. Conclusion

At present, the construction and development level of China's smart city still needs to be improved. When GIS is applied to the construction of smart city, it can make use of the functions of

GIS, establish the future planning model of the city based on the current situation of the city, and compare and analyze the disadvantages, for the purpose of accelerating the construction of smart city. However, when GIS is applied to the construction of smart city, there are still many adverse effects and constraints. Relevant professional and technical personnel should deepen the research on GIS, improve the application technology and level of GIS, and promote the more efficient and intelligent development of smart city.

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