

# The Application of GIS Technology in the Construction of Smart City

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**Abstract:** At present, China's urbanization process is accelerating, urban pressure is gradually increasing, and urban problems are becoming more and more serious. The GIS technology based on the powerful analysis function of computer provides a new solution and response strategy for the construction of smart cities. This paper focuses on the application of GIS technology in smart city construction, mainly involving the construction of GIS technology platform, resource integration, smart transportation, urban planning and emergency management. And the role of 3D visualization, spatial analysis and real-time data sharing based on GIS in the process of smart city construction, and on this basis, the future GIS industry is prospected.

**Keywords:** GIS Technology, Smart City, GIS Application.

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## 1. Introduction

With the acceleration of urbanization construction in China, the number of urban population continues to increase and the scale of population continues to expand, urban intelligent management becomes more meaningful. The combination of smart city and GIS has also become a hot topic of social research. The application of GIS technology in the construction of smart cities can effectively get rid of the urban development dilemma, achieve the collection, processing, analysis and management of a large amount of data and information, improve the urban management ability and service level, enable the full coverage of urban monitoring in various regions and periods, and share information resources in various urban management departments, enhance the rationality of management decisions, and improve work efficiency and economic benefits. Smart city construction is a new path for high-quality development in China, and GIS technology is an important technical support for smart city construction.

## 2. GIS Is Widely Used in The Construction of Smart Cities

### (1) Application in platform building

At present, with the continuous development of Chinese cities, in order to adapt to the requirements of a higher level of smart city construction, Chinese smart cities have entered an era of smart platforms oriented by cloud services. Based on the new practice of national urbanization construction in recent years, the construction of smart cities has ushered in an unprecedented development opportunity. The development of urban informatization and intelligence has created more demand for real-time and visualization of geographic information [1]. The traditional geographic information system can no longer meet the needs of spatial data processing in today's smart city construction. GIS technology will directly affect the quality and efficiency of smart city construction. Therefore, there are many smart platforms based on GIS technology.

The construction of a smart cities requires the support of a

large number of social and economic data. The use of GIS technology can effectively analyze and visualize the current geographical situation, construction status and other basic information of the city, and provide a comprehensive and reliable planning for urban construction. These smart platforms have effectively made up for the above shortcomings, and at the same time, they have enabled the sharing of urban data and information resources, which can better plan urban space, ensure the correctness and authenticity of all data in the planning, and promote the improvement of social management efficiency and quality. At the same time, the application of GIS technology also better promote the development of the city towards informatization, technology and multi-dimensional direction, and provide people with a better living environment.

### (2) Application in resource integration

GIS technology has the functions of acquiring information, storing information, inquiring information, processing and analyzing information, and can realize the transformation of spatial concept from abstract thinking to concrete graphic thinking, so as to realize the collection, storage, application and comprehensive expression of spatial data information. GIS can make use of unique geospatial database to provide effective support. By analyzing and applying geographic models, diverse and profound results can be obtained, which has good scientific analysis guidance and decision support for the construction of smart cities. At present, GIS technology plays an increasingly important role in urban planning, traffic management, land management and disaster prediction.

GIS technology has a strong ability to capture and analyze information. Specifically, its characteristics are reflected in the following three aspects: first, it can provide effective support for information collection, management, analysis and effective output of information on the basis of efficient and low redundancy geographic information database, and it is compatible with multiple spatial data, and it can systematically integrate multiple spatial, dynamic and complex data. Secondly, when using data, we can make full use of the spatial operation model to strengthen the effective study of the spatial information content, so as to provide an important basis for the subsequent decision-making. Third, it

can meet the needs of the development of spatial data management. With the help of powerful information platform, it is convenient for users to continuously expand the platform modules according to their own needs, thus providing long-term and effective support for spatial data management [2].

#### (3) Application in intelligent transportation

As an important link to connect a city, transportation is also the main channel for people and logistics in the city. Its convenience determines the distribution of an industry, the development of a city's economy and the flow of people. At present, the biggest traffic problem in cities is traffic congestion, which is a common problem in large and medium-sized cities, and the construction of smart cities cannot be separated from smart traffic. GIS provides a reliable guarantee for people's intelligent travel. The application of GIS for the best path analysis can facilitate decision makers to choose the best way to travel, make travel more convenient, and also reduce urban traffic congestion to some extent. In addition, the data storage, data editing and other functions of GIS can not only realize traffic data management, but also realize traffic data query, analysis, statistics and report functions. The output of traffic map is convenient for the government departments to grasp the road conditions and make decisions.

#### (4) Application in urban planning and emergency management

The application of GIS as a new technology in China's urban planning began in the 1980s. After entering the 1990s, the economic development speed of China's mainland has increased significantly, and the scale of urban construction has also reached an unprecedented level. This sudden change has led to a sharp increase in the workload of the urban planning department, forming a strong demand for the use of modern information technology to improve planning and management, and the upsurge of economic construction has enabled local governments to have financial resources to support the application of new technologies. The current urban planning geographic information system is mostly used for land management. Its basic content is to record the land use permit data approved by the planning management department in the form of graphics, query and statistics in the attribute database at any time, which brings a lot of convenience to the planning department.

The application of GIS technology to emergency management is divided into four steps: the first step is to establish a comprehensive emergency database. Use GIS to collect and sort out spatial data information, digitize these data resources, comprehensively use and develop information data of all relevant aspects, and build a comprehensive emergency database [3]. The second step is to set up the emergency command and dispatching system. The emergency command and dispatching system is constructed by using the spatial display function and auxiliary decision-making function of GIS to build a comprehensive emergency management solution. The third step is to analyze and predict the simulation. Through rapid collection of emergency information, GIS spatial query and spatial positioning technology are used to analyze the emergency, determine the materials required for emergency management and the allocation of various police resources, and finally determine the emergency route. The fourth step is to release emergency information. With the help of GIS spatial data release function, information collection, storage and classification are realized, and emergency information is released to the

society in the form of electronic map and remote sensing image.

### 3. GIS Technology Promotes the Construction of Smart City

#### (1) 3D visualization technology based on GIS

The application of GIS-based 3D visualization technology to smart cities has great advantages. The traditional form of information is mainly two-dimensional geographic information data. On the basis of two-dimensional geographic information, GIS technology can be used to realize the conversion of two-dimensional information to three-dimensional information, thus greatly improving the expression effect of information, and also greatly improving the accuracy of data. With the help of three-dimensional visualization technology, Users will get better human-computer interaction interface and richer spatial information. 3D GIS applications generally have a huge amount of data information, which determines that 3D GIS must effectively manage the database and efficiently access data. The overall planning and management method of three-dimensional space is a major problem in the process of smart city construction, and is also the focus of promoting urban informatization construction. Visualization technology is a huge advantage in GIS, and it is applied to the construction of smart cities. Especially in the era of big data, visualization technology is the research focus of data mining and analysis, and visual information perception can assist big data analysis [4]. After applying the processing technology related to computer graphics, geospatial data visualization can refine some relatively complex geographical scientific phenomena, natural landscapes and other abstract concepts, and present them to you in a more intuitive form, which will help you have a deeper understanding of intelligent cities.

As far as the practical effect of 3D GIS visualization technology on smart cities is concerned, 3D GIS real-time visualization technology can carry the IOT network and sensor technology system software to dynamically present objects and realize resource sharing, which is impossible for traditional urban infrastructure design renderings and sand technology.

The smart city 3D GIS visualization platform built on the basis of GIS 3D visualization technology gives full play to the visualization display and 3D spatial analysis capabilities of the 3D GIS platform, realizes the functions of business management, Internet of Things perception data, big data analysis data and video monitoring, and integrates the analysis of engineering project data, underground pipe network data, public security data and regional resource matching data on the 3D visualization platform, In order to build relevant applications that meet the needs of smart cities, it provides strong support for the planning, construction and management of cities. To sum up, the 3D visualization technology with GIS as the core, with its own characteristics and advantages, has played an important role in the overall urban planning and engineering construction, and also has important practical significance for the construction of smart cities in China.

#### (2) Spatial analysis tools based on GIS

When the system content is organically connected with GIS related functions, its functions are mostly supported by data basic functions. In this process, GIS and spatial information database are combined to realize the screening, analysis,

management and visual display of a large number of data, which in turn provide the original data and basis for simulation, prediction and analysis of urban planning. With this technology, urban planners can better mine geospatial data information. At the same time, more and more users use satellite positioning and navigation technology and three-dimensional coordinates, and the function realization of three-dimensional geographic information service can be better played out. At the same time, urban planners can strengthen various geographic information terminal systems through various efficient and independent client network platforms, and the expansion of two-dimensional and three-dimensional information management models in the progress of urban surveying and mapping planning is constantly strengthened. This technology has important guiding significance for the rapid construction of 3D digital platform.

In the process of effective implementation of urban planning projects, the key is to formulate and improve the layout plan, actively use geographical technology, and strengthen government support. In this process, if we want to achieve certain development goals according to the nature of GIS, we need to continuously analyze and summarize the geographical distribution characteristics. The application of GIS technology plays a crucial role in promoting various tasks such as urban survey, surveying and mapping, and urban planning projects. In addition, when applying information management methods to two-dimensional planning, the system will improve the pace of urban construction, and simultaneously build an information collection platform to give full play to the role of the standard framework, and effectively expand the overall use of the system. In this way, we can make better use of the information query management function of the GIS system to display the dynamic information of urban development in an integrated way. In order to promote the development of urban planning, build an intelligent smart city, and achieve the goal of establishing effective urban planning and construction [5].

### (3) Real-time data sharing system based on GIS

Data sharing is to enable users who use different computers and different software in different places to read other people's data and carry out various operations, calculations and analysis. At present, improving the efficiency of data utilization and reducing the repeated collection of data are the key to the research of geographic data sharing. The real-time data sharing system established by GIS technology can raise the level of data sharing to a new level. In terms of breadth, it has built a unified spatial database and improved the coverage of various resources; In terms of depth, the functions of GIS, the call and development of third-party systems, and the update of data have been strengthened; In terms of quality, data information has been further standardized and transaction processing capacity has been greatly improved.

Smart city construction focuses on the integrated development of informatization, urbanization and industrialization, so it needs big data technology as support. Digital resources play an important role in the current process of smart city construction. Massive data resources have certain use value, and the real-time data sharing system based on GIS can effectively integrate them, realize resource sharing and promote smart city construction. In order to give better play to the data sharing function, each municipal administration bureau should effectively play a leading role, further strengthen the organizational leadership, refine the division of

responsibilities, and ensure that the data sharing is completed on quality and quantity. It has laid an effective foundation for promoting data sharing.

At present, the construction of smart cities should take multiple measures to promote the convergence and sharing of data resources under the guidance of "Internet thinking". The excellent departments in relevant urban areas should take the projects with remarkable achievements as the starting point, take the lead in launching the departmental "information sharing platform", and promote the informatization process of all urban departments from point to face. It is hoped to realize the integration, sharing and exchange of information resources through this platform, and promote the co-construction and sharing of basic databases and the integration and application of information resources across departments [6].

In order to realize "wisdom" in smart city construction, multi-source data integration is required to integrate heterogeneous data in different fields. This is a complex but highly potential work, which can provide profound insight into the city. For example, in the field of transportation, the diagnosis of traffic congestion and other abnormal conditions needs to integrate multiple data, including traffic data, weather data, road conditions or traffic light strategies. Data sharing helps cities provide better services at the individual level.

## 4. Outlook on the GIS Industry in The Future

With the development of geographic information technology today, it is changing the traditional production mode, management mode, decision-making mode and combat mode in modern war. It has a very broad development space, fosters a huge market capacity, and contains huge potential commercial value. Especially today, when urban planning, land management, energy transportation environment and natural disaster monitoring are increasingly valued by government departments, GIS application has become a hot topic in various industries and even in people's lives. As a big GIS country, China has much to do to study and analyze the trend of domestic and international GIS market and seek to participate in the competition at home and abroad. Most of China's enterprises are small and medium-sized in their initial stage. They have only grown rapidly in the past decade. The personnel hierarchy has become more mature in recent years. The technology, equipment and experience accumulation have gradually matured. Today, China has become a powerful country in the geographic information industry. Looking at the development of the geographic information industry and GIS, facing the future, we should unswervingly follow the path of "grasping the application, building a career through application, making breakthroughs in theory, making innovations in methods, making leaps in technology, and making appropriate positions". By studying and analyzing the changes in the international and domestic economy, we can seize the opportunities, cope with the challenges, and seize the momentum [7].

## 5. Conclusion

From the perspective of GIS application in smart cities and its role in smart city construction, GIS, as an important part of the information industry, is developing at an unprecedented

speed. Grasp the development status and shortcomings of GIS technology, actively analyze the problems arising from the application of GIS in the process of smart city construction, and put forward corresponding solutions, such as establishing and improving various mechanisms, establishing databases, and strengthening the training of relevant talents. All of these will help people to predict the development trend of GIS, develop strengths and avoid weaknesses at a higher level, and better promote the rapid development of GIS technology. Strengthening the application of GIS technology in smart city construction has important practical significance for China's urban construction and social development.

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