



Exploration of the Application of Big Data Technology in Modern Smart City Planning

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Abstract. With the rapid development of technology, big data technology has become an indispensable part of modern smart city planning. This article delves into the various applications of big data technology in smart city planning, including urban spatial planning, environmental monitoring, intelligent transportation management, noise data monitoring, and urban safety management. Through big data technology, urban planners can manage urban resources more scientifically and efficiently, improve the quality of life of urban residents, and promote the comprehensive development of smart cities.

Keywords: smart city; Big data technology; Urban spatial planning; Environmental monitoring; Intelligent Traffic Management

1 Introduction

In today's accelerating urbanization process, how to scientifically and efficiently plan and manage cities has become an urgent problem to be solved. The emergence of big data technology has provided new ideas and means for the planning and management of smart cities. This article aims to explore the application of big data technology in smart city planning, in order to provide useful references for urban planners and managers.

2 Smart City and Big Data Technology

2.1 Smart City

Generally speaking, a smart city is an urban development model that effectively combines advanced science and technology, such as big data technology, Internet of Things technology, etc., to achieve efficient utilization of urban resources, effectively improve urban management level, and enhance the quality of life of urban residents. Compared with traditional cities, smart cities are based on advanced science and technology, planning and managing smart cities can achieve the rational utilization of urban re-

sources, continuously optimize the management level and service quality of cities, and create a green and safe urban ecosystem for urban residents.

2.2 Big Data Technology

Big data technology refers to the technology of analyzing massive amounts of data through cloud computing methods, which can obtain useful information through the "purification" of information. Big data technology can handle a huge amount of data information, especially in the 5G era, providing technical support for the information processing speed of big data and enabling the completion of big data processing work in a relatively short period of time^[1]. The Application of Big Data Technology in Smart City Planning

2.3 Utilizing Big Data Technology for Urban Spatial Planning

Planners can use big data technology for urban spatial planning and create smart city spaces in a reasonable manner. The spatial planning work of smart cities not only needs to consider factors such as land use and housing, but also needs to comprehensively consider urban transportation, so as to make urban spatial planning more scientific. Through big data technology, urban spatial layout design can be carried out reasonably, ensuring the rationality of urban spatial planning. Firstly, planners can use GPS technology to integrate urban geographic information data, including local terrain and landforms, land use, transportation network information, etc., to construct a detailed urban map for modeling and analysis of urban space, allowing planners to have a comprehensive understanding of local spatial use and laying the foundation for the rational allocation of urban land resources^[2]. After obtaining data on the use of urban spatial resources, planners can use big data technology to analyze and make reasonable layouts for commercial areas, residential areas, and green areas. This can not only meet the daily life and work needs of urban residents, but also achieve the goals of greening work and create a smart city. Planners can use big data technology as a core technology to build an urban planning decision-making system. The system can simulate the planning scheme of smart cities and provide visual analysis functions for planners. With the help of the urban planning decision-making system, planners can choose the best planning scheme to meet the planning needs of smart cities.

2.4 Utilizing Big Data Technology for Urban Environmental Monitoring

Planners can use big data technology for urban environmental monitoring when making reasonable plans for smart cities. The creation of urban environment seriously affects the construction of smart cities. Therefore, planners can collect various urban environmental information through advanced information collection technologies such as sensor technology and Internet of Things technology, including urban water quality information, electricity usage information, urban garbage information, urban pollution situation, etc., which can help planners understand the current situation of urban environment and provide reference for urban planning work^[3]. At the same time, it can

also help planners predict urban environmental development and reduce environmental protection costs. By utilizing big data technology for deep learning, automated monitoring objectives can be achieved. Taking urban air quality monitoring as an example for analysis, planners can build an intelligent analysis and decision-making system for air quality monitoring to serve the monitoring of urban air quality. The decision-making system mainly includes components such as information collection system, communication system, data center, and central control platform. The information collection system consists of multiple monitoring devices, which can set up monitoring points in industrial clusters, construction sites, road traffic, and urban blocks in the city, and arrange monitoring devices to collect real-time air quality information. The information collection system will transmit the obtained information data to the cloud server through wireless communication, process it through big data technology, and transmit the processing structure to the central control platform. The central control platform can lock in polluted areas, effectively track pollution changes, and conduct impact tracing analysis, providing solutions for improving urban air quality and assisting in the planning and construction of smart cities.

2.5 Utilizing Big Data Technology to Carry Out Intelligent Transportation Management

Planners should also fully consider the urban transportation situation when planning smart cities. Urban planning should ensure smooth transportation and improve the urban environment, allowing city residents to live in high-quality urban areas. Therefore, planners can use sensor devices and monitoring systems to monitor the traffic environment, which can help planners understand the current operational status of the city. For example, planners can monitor real-time urban traffic congestion and improve it by optimizing traffic signals to enhance the smoothness of urban transportation. Planners can use big data technology for intelligent transportation management, which not only monitors urban traffic conditions 24 hours a day, but also comprehensively predicts traffic flow, helping with intelligent transportation management. Planners can use monitoring devices such as cameras and sensors to obtain urban traffic information, mainly including data on traffic flow, vehicle speed, and traffic congestion^[4]. After obtaining information, planners can use big data analysis technology for processing, in order to make reasonable plans for urban transportation, solve traffic congestion problems, and reduce the probability of traffic accidents. By using big data technology to predict urban traffic flow, plan car travel routes reasonably, and upload real-time data information to commonly used navigation software such as Amap and Baidu Maps, the navigation software will plan reasonable travel routes for drivers, avoid congested road sections, improve traffic congestion, and save travel time for drivers. For autonomous vehicles, there is a greater need for the support of massive data information. Real time traffic conditions can be sensed through information receiving technology, and specific information about other vehicles and pedestrians can be obtained. Real time traffic data information can be transmitted to autonomous vehicles through big data technology to ensure their safe operation.

2.6 Utilizing Big Data Technology to Monitor Urban Noise Data

In the planning of smart cities, planners can use big data visualization technology for planning and management. Big data visualization technology not only has the basic functions of data analysis, but also enables human-computer interaction to visualize data information and facilitate user use^[5]. Through intelligent processing, data will be displayed in a visual structure through visual mapping. The data processing results will be visualized and transformed, and presented in the user interface for easy viewing and application by users. The visual analysis model is shown in Figure 1:

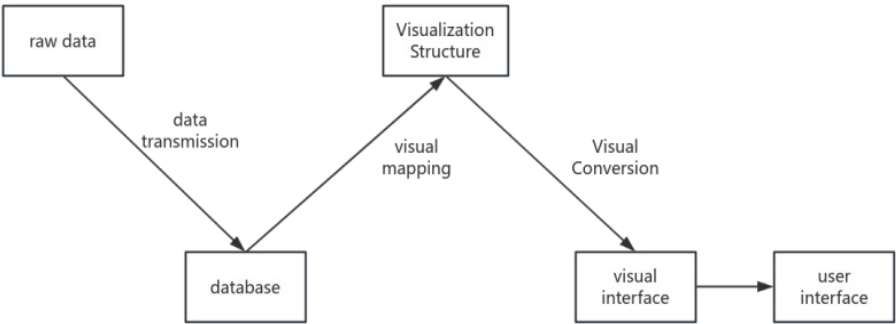


Fig. 1. Visual Analysis Model

When unreasonable data information appears in the data analysis results, the system will provide feedback and repair the data, or clear the unreasonable data to ensure the authenticity and reliability of the visualized analysis results. The human-machine interaction function of the system facilitates user operation, and the system can also present data analysis results to users to help them make decisions.

Andriyenko and other scholars have summarized the logical relationship of three mobile data visualization methods through research. The direct description method can directly present the data point graph after big data processing. If the data information is extremely complex and cannot be directly presented, it should be analyzed and summarized, and presented in the form of a flat graph for easy user understanding. After using big data technology to obtain processing results, planners extract data features and convert them into special graphs for user presentation. As shown in Figure 2:

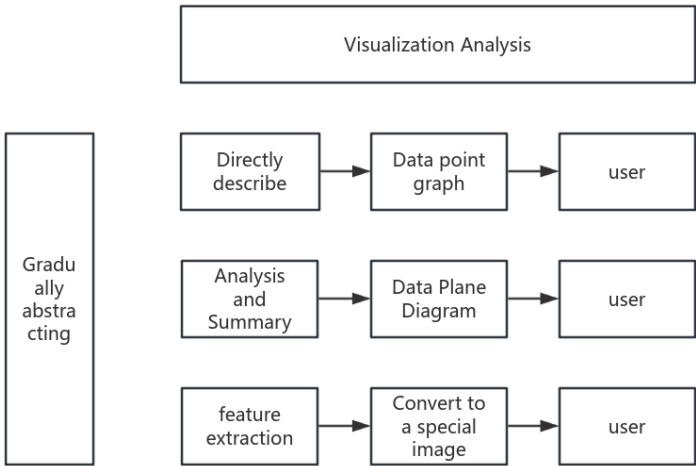


Fig. 2. Logical relationship of mobile data visualization methods

The visualization of data mainly includes the visualization of color, shape, size, space, and other aspects. Planners can use big data visualization technology to analyze urban noise, which is convenient for solving noise problems. The urban noise monitoring work mainly relies on Cadna/A3.7XL noise software. Planners can input building information, urban road vector information, GIS data information, coordinate system and other data in the noise software, and combine them with urban traffic flow information to determine the basic situation of urban noise and effectively restore and simulate it. By calculating the distribution of sound field and noise in the detection area, planners can obtain the noise map and volume data of the area, and understand the urban noise situation through visual display. Among them, red represents that the volume of the area exceeds the standard, and black represents that the volume of the area does not exceed the standard. Through color and spatial visualization, it provides services to users. The system can input specific simulation results, actual measured noise data, and receiving location coordinates into the GIS system to obtain a noise map. Users can directly understand the noise distribution in different areas of the city from the noise map. By combining big data visualization technology with GIS technology, planners can effectively visualize urban noise levels and provide reference for smart city planning work.

2.7 Utilizing Big Data Technology to Strengthen Urban Safety Management

In smart city planning, city managers can use big data technology to strengthen urban safety management. Planners can obtain various data resources through sensing devices, monitoring devices, and social software to monitor potential security risks in the city, such as illegal activities, fires, traffic accidents, and other safety issues. The use of big data analysis technology can help city managers identify and quickly locate safety issues, and adopt reasonable methods to solve safety problems. For example, public security personnel can use social media data and monitoring devices to monitor illegal

activities, timely curb illegal activities, and avoid major safety accidents. We can also rely on big data technology to predict natural disasters, effectively reduce losses, and protect people's lives and property safety.

3 Conclusion

In summary, big data technology plays a crucial role in modern smart city planning. Through big data technology, urban planners can manage urban resources more scientifically and efficiently, improving the quality of life for urban residents. At the same time, big data technology also provides city managers with more convenient and accurate management methods, which helps promote the comprehensive development of smart cities.

Acknowledgment

Fund number: JGZD2023002

Project name: Research and Practice on the Application oriented Talent Training Model under the Background of Industry Education Integration

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