International Journal of Communication Networks and Information Security
ISSN: 2073-607X, 2076-0930
Volume 15 Issue 04 Year 2023

Optimize Urban Infrastructure Planning Based on Big Data and Enhance Xi'an's Urban Image

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Article History

Received: 1 November 2023
Revised: 1 January 2024
Accepted: 8 January 2024

Abstract

Infrastructure is an essential support for urban operation, and a city's image is directly related to citizens' quality of life and the city brand's construction. Urban infrastructure distribution, equipment types, network switching, and other issues have always restricted the development of communication in Xi'an City, and the addition of big data technology has further increased the communication pressure in Xi'an City and affected the image of Xi'an City. In this paper, we take Xi'an urban infrastructure as the research object and combine the python method to obtain the big data information in the network and the data in the wireless self-organizing sensor. Then, the incomplete data was eliminated, the data was mapped to the 0~1 interval logarithmic manner, and a standardized processing set was formed. Set up wireless ad hoc sensor devices, collected infrastructure-related data, and summarized data through extensive data analysis. At the same time, based on social urban image data, public demand data, and urban infrastructure evaluation results, the content of urban planning is adjusted to better meet the expectations of the public and provide targeted planning solutions. Finally, according to the data fitting, the matching of wireless ad hoc sensor network and city image improvement is realized, and the reasonable planning of infrastructure is promoted. The results of urban image analysis show that wireless ad hoc sensor networks and big data technology can simplify the steps of urban infrastructure planning, reduce urban planning costs, enhance the functionality of the infrastructure, reduce the public complaint rate, and meet the requirements of Xi'an urban image improvement.

Keywords: Big Data, Wireless Self-Organizing Sensors, Xi'an, Image of the City, Infrastructure

1. Introduction

Since mankind entered the industrial age, urbanization has become one of the themes of global development [1]. With the continuous increase of population and the continuous expansion of urban scale, the number and scale of urban infrastructure have shown exponential growth, so reasonable planning is needed to enhance the image of the city [2]. In 2022, China's "Work Report" proposed strengthening the construction of urban infrastructure in the western region, enhancing the function of urban infrastructure, and moving towards a smart city. At present, the governments of Gansu, Xi'an, Ningxia and other regions have integrated new technologies such as the Internet of Things, artificial intelligence, sensors, and big data into urban planning to improve the intelligence level of cities and make the functions of smart cities. Urban planning optimization based on big data, as a cutting-edge interdisciplinary field, has attracted widespread attention worldwide [3]. How to carry out urban planning, simplify the steps of urban planning, and reduce planning costs have become important issues facing countries around the world [4]. At present, urban infrastructure planning is implemented on the basis of the original, not only to ensure the original function but also to be reasonably arranged and present the characteristics of distribution [5]. The rationality of urban planning is directly related to the city's future development and the city's construction [6]. As an ancient capital city, Xi'an's infrastructure presents the characteristics of interaction between old and new. New and old urban areas coexist, so urban planning is more complex [7]. The development of computer and communication technology has provided urban image and means for Xi'an urban planning, given more opportunities for people to participate, allowed people to participate in urban planning, and improved the rationality and feasibility of urban planning [8]. In addition, the extensive use of wireless ad hoc network technology and sensor equipment also provides a basis for acquiring urban planning data and identifying related indicators [9]. To this end, big data and communication technology provide objective support for urban planning [10]. At present, foreign countries have achieved good research results in urban planning, but wireless network technology and communication technology in countries such as Europe and the United States, Japan and other East Asian countries cannot meet the domestic implementation requirements [11]. In addition, there are differences in the characteristics, development directions, and planning foundations of different cities, so it is impossible to copy the book [12]. On this basis, this paper analyzes Xi'an's urban planning data and the data based on the existing wireless network self-organization points [13]. At the same time, Xi'an's existing network platform, network urban image, and mobile terminals are used to obtain and analyze massive data and complete the interaction between big data and wireless network self-organizing sensors, with the aim of improving the rationality of urban planning and reducing the cost of urban development [14]. First, based on the technical advantages of big data technology and wireless ad hoc network, the data collection of Xi'an urban infrastructure, preprocessing and standardized mapping of audio, video and multiurban image data to form an infrastructure data collection [15]. Second, the urban infrastructure scheme is quantified, and an independent and chunked data collection is formed, corresponding to the self-organizing sensor to realize the linkage between the two. Third, collect data resources on the network, especially the network resources of the client, to understand and grasp the public's satisfaction with urban planning and the evaluation of urban planning and Xi'an image by various urban image platforms. Fourth, according to the comments and suggestions of various aspects, big data collection, cloud platform collection, and outlier value judgment are carried out to achieve the integration between big data and self-organizing sensors [16]. Finally, according to the evaluation methods of the public and the judgment direction of the public, Understand the real needs of urban planning. Enhance the function of Xi'an's urban infrastructure, promote the rationalization of urban infrastructure, and create a more perfect image of Xi'an. Big data can use the cloud platform to obtain more Xi'an residents' demands for infrastructure and demand for infrastructure functions. Wireless ad hoc network technology can break through geographical restrictions, realize data communication between different infrastructures, form data collections, provide data support for urban planning, and enhance the urban image of Xi'an. Therefore, integrating big data technology and wireless self-organizing network technology can improve the intelligence of infrastructure, enhance its functions, and meet more needs of residents. Therefore, big data and wireless ad hoc network technology have strong advantages and are the preferred solution for infrastructure construction.

2. Related Works

2.1 The Current Situation of Infrastructure Planning in Xi'an

The development speed of domestic cities has accelerated, and Beijing, Shanghai, Guangzhou and Shenzhen have become benchmarks for infrastructure construction. The western and central regions are the domestic urban construction potential areas, and the demand for urban infrastructure construction has surged. Among them, Xi'an, an ancient capital city, has insufficient modernization and imperfect infrastructure, requiring more reasonable planning. At present, Xi'an's lagging planning, traffic congestion, poor drainage, severe environmental pollution and other problems coexist, affecting the image of the entire city. In addition, as a well-known tourist city in China, Xi'an's urban planning is unreasonable, and the planning time is too long, which will gradually affect its image. In the era of intelligent information distribution, more wireless network technology and self-organizing sensing technology are integrated into the construction of urban infrastructure. The communication between infrastructure equipment is strengthened with the help of big data and python technology to enhance the function of technical facilities Some scholars have proposed that wireless self-organizing sensor technology and big data technology be applied to urban planning to drive the development of urban infrastructure planning. Xi'an's urban infrastructure is scattered, and the distribution of new and old cities is unreasonable, which requires distributed technology to achieve it. Wireless self-organizing sensor technology and big data technology can enhance Xi'an's urban image. Currently, the planning of urban infrastructure in China is shown in Table 1.

Table 1. Urban Planning Needs to be Ranked (Source: www.baidu.com)

Ranking	Province (region, city)	City	Plan your needs	The degree of planning
1	Beijing	Beijing	middle	scattered
2	Shanghai	Shanghai	middle	concentrated
3	Guangdong	Shenzhen	middle	concentrated
4		Guangzhou	low	concentrated
5	Chekiang	Hangzhou	middle	concentrated
6	Sichuan	Chengdu	middle	scattered
7	Jiangsu	Nanking	middle	concentrated
8		Suzhou	low	concentrated
9	Hubei	Wuhan	high	concentrated
10	Shaanxi	Sian	high	scattered

It can be seen from the contents of Table 1 that the urban planning needs in the central and western regions are high, while the urban planning needs of the eastern and southern coastal cities are relatively small. Among them, the planning of ancient capital cities such as Xi'an, Chengdu, and Beijing is relatively scattered, mainly because the city alternates between the old and the new, and it is necessary to plan based on the original and to maintain the original ancient charm and style. Therefore, the problems in Xi'an's urban planning are more complicated. Some scholars believe that with the help of wireless self-organizing sensor technology and big data technology, plans on the basis of maintaining the original function could improve the image of the city.

2.2 Advantages of Wireless Ad Hoc Sensor Networks

A wireless ad hoc sensor network is a wireless network composed of self-organizing sensor planning points, which has the characteristics of self-organization, distributed processing, adaptivity, low-power design and data security and privacy protection, and can effectively collect, process and transmit information in the environment through wireless communication collaboration. However, when conducting wireless ad hoc sensor networks, there are often problems of complex data and frequent interference, which affect the characteristic analysis of urban infrastructure planning. To this end, this paper analyzes the characteristics of infrastructure planning in different regions by using big data analysis and sensor network technology interaction, extracts the key values among them, and carries out better interaction. The characteristics of a wireless ad hoc sensor network are shown in Table 2.

Table 2. Transmission Performance of Wireless Ad Hoc Sensor Networks (Source: www.baidu.com,and CNKI)

Peculiarity	Performance
Self-organization	Sensor planning points can spontaneously establish network topology to form a self-organizing network. Planning points can independently select adjacent planning points for communication, network discovery and routing.
Distributed processing	The sensor planning point has distributed data processing capabilities, and data collection, processing, and storage can be carried out within the planning point. This reduces the amount of data transfer, reduces energy consumption, and increases the scalability of the network.
Adaptability	Sensor networks can automatically adjust network structures and communication strategies to adapt to different scenarios and tasks according to changes in network environment and application requirements.
Low power design	Because sensor planning points are typically battery-powered, the design of the network needs to consider minimizing energy consumption at the planning points. This includes the use of low-power communication protocols and algorithms, as well as sleep and wake-up strategies that optimize planning points.
Data security and privacy protection	The data transmitted in the sensor network is often sensitive, so effective security measures such as data encryption, authentication, and access control are required to ensure the security and privacy of the data.

At the same time, wireless ad hoc sensor network technology is a new technology that integrates perception, communication and computing. It provides data collection and monitoring capabilities for all aspects of the city through large-scale, distributed sensor planning points to achieve the all-around perception of the city. These sensor planning points can autonomously form a network for instant transmission and processing of data without human intervention. Compared with traditional infrastructure monitoring methods, wireless ad hoc sensor network technology has the advantages of low cost, convenient deployment and strong real-time performance. By collecting massive data from sensor planning points and using big data analysis technology, we can comprehensively understand the problems in urban planning and provide a scientific basis for urban planning and development. In the process of optimizing urban infrastructure planning and improving urban image analysis, it is necessary to pay attention to the transmission effect, so the sensor planning point should be selected to achieve maximum transmission efficiency. The sensor planning point selection process is shown in Table 3.

Table 3. Planning Point Selection for Wireless Ad Hoc Sensor Network (Data source: Based on post-analysis, self-numbering)

Plan point content	Network discovery	Routing
Sensor data acquisition	5	B
Big data processing	3	D
Plan scenario storage	1、4	F

This paper will take Xi'an as the research object, combined with relevant research and practice cases at home and abroad, to discuss the application of big data-driven wireless autonomous sensor network technology in urban infrastructure planning and optimization. First, we will start with the problems of Xi'an's existing infrastructure planning, analyze the causes of the problems and summarize the existing challenges. Secondly, the principles and characteristics of wireless ad hoc sensor network technology and the application cases in urban planning will be introduced. Then, the specific methods and steps of urban planning optimization scheme are put forward, and its application prospect in improving Xi'an's urban image is discussed. Finally, the feasibility and effectiveness of the proposed method will be verified through data analysis and simulation experiments. The main objective of this study is to improve the planning level and quality of urban infrastructure by using big data support provided by wireless ad hoc sensor network technology so as to promote the improvement of Xi'an's urban image. The optimization of urban planning driven by big data will help improve the livability, sustainable development and intelligence of Xi'an, provide citizens with a better living and working environment, further shape Xi'an's urban image, and enhance its popularity and attractiveness at home and abroad.

3. Methodology

3.1 Identification of Xi'an city Image Status by Big Data Mining

The definition of "urban image" in urban image communication is not limited to mass urban image but also includes physical space. Therefore, urban physical space, public places, infrastructure or life scenes belong to the category of urban image, which plays the role of communication and dialogue together with mass urban image, language and discourse. Xi'an's urban image faces many problems, such as traffic congestion, environmental pollution, tourism and social security. In order to improve Xi'an's urban image and optimize urban infrastructure planning, a series of measures need to be taken: strengthen transportation planning and management, optimize the layout of the road network and transportation system, Strengthen environmental protection efforts to improve air quality and urban environment; Strengthen the protection of historical and cultural sites, improve the quality of tourism solutions, and provide a better travel experience; Strengthen social security management and stabilize the social environment. Big data mining and analysis provide objective data support and problem identification for the current situation of urban image and have important application value in the decision-making of Xi'an's urban image. The specific identification and transmission process is as follows.

Data collection of urban infrastructure planning: traffic characteristic data is a_i, historical and cultural characteristics data is x_i, environmental feature data is d_i, urban image calculation function is η, the importance of characteristics is $No(k_i)$, and the data collection of urban infrastructure planning is shown in Equation (1).

$$tol(k) = \sum a_i \cdot (d_i - 2) \cdot x_i \tag{1}$$

From the above programming code, the city image recognition of urban infrastructure planning can be realized, and the network structure and communication strategy can be automatically adjusted according to the changes in the network environment and the changes in application requirements so as to improve the transmission efficiency of features.

Ranking of city image indicators: weight ranking function $lone(y_i)$, characteristic influence degree calculation function $A(d_i)$, city image index interaction degree sorting $P(d_i)$, big data analysis sorting result $Tf(g)$, city image index ranking is shown in formula (2).

$$Tf(g) = \frac{A(d_i) \cdot P(d_i)}{lone(y_i)} \tag{2}$$

The process of ranking city image indicators is as follows:

```
data = pd.read_csv('city_image_data.csv')
sorted_data = data.sort_values(by=['indicator1', 'indicator2', 'indicator3'], ascending=[False, False, True])
print(sorted_data)
```

3.2 Preprocessing of City Image Data

Under the power of artificial intelligence technology and information technology, Xi'an's urban image can have a high foundation in the three-dimensional perception of the public environment and infrastructure and can collect, process and use a variety of environmental and user data within the scope of business. Wireless ad hoc technology can connect various sensors in the city to achieve real-time data collection and transmission. Through big data analysis, detailed information about the urban environment, traffic conditions, crowd density, etc., can be obtained. These data can not only help the Xi'an urban image of affairs break the phenomenon of "data island" but also provide the data basis for the urban image to do the top-level design but also provide the basis and reference for the urban planning department to optimize the layout and planning of urban infrastructure. However, there are cross-changes between urban infrastructure planning and urban image, so it is necessary to encrypt the city image data to determine the key planning schemes, the image of the planning scheme, and the relevance of the planning scheme. In addition, the occupancy of the sensor and the irregular delay of the wireless group organization network have an impact on the transmission of urban infrastructure planning data, so irrelevant content should be eliminated to realize the simplified processing of characteristic data.

In order to perform a more reasonable analysis of the city image, it is necessary to select the nearest sensor point, and the processing results are shown in Table 4.

Table 4. Switching Rate of Urban Infrastructure Sensor Points (Data source: Wireless Ad Hoc Network Sensor, python Collection)

The acquisition range of the self-organizing sensor point	Sensor point number	Sensor movement	Wireless access point	Self-disciplined system	Multi-hop nodes
Historical and cultural data	7	71.54	68.28	70.65	72.32
	10	69.55	71.34	68.10	66.31
	11	67.67	67.40	72.72	73.60
Traffic condition data	20	72.36	68.90	72.28	65.85
	7	70.38	71.46	71.23	67.29
	13	70.20	68.05	71.19	70.37
Environmental data	20	68.67	68.73	71.78	70.01
	10	75.75	70.14	67.67	71.73
	11	65.88	70.92	67.32	72.13
Tourism resource data	15	69.47	69.24	71.82	73.40
	18	73.96	71.25	67.42	71.79
	6	66.86	69.66	72.08	70.57
Mass feedback data	15	68.12	73.69	73.62	69.48
	2	71.14	69.55	71.36	72.05
	15	68.04	70.57	69.19	67.14

From the identification of the content of the city image data in Table 4, it can be seen that the data transmission integrity of history and culture, traffic conditions, environmental facilities, tourism resources, and public feedback is good, indicating that the operation of each coordination terminal is good. The data in Table 4 are all mapped data, and the data are mapped in the range of 0~1 after the scaling processing of the ln (·) function, and the non-numerical attributes of the data are excluded to ensure the effectiveness of the calculation and processing.

3.3 Big Data Processing of City Image

Referring to relevant literature, the indicators of urban infrastructure construction are obtained, which are the big data driving index (X), urban infrastructure planning index (Y) and Xi'an city image index (Z). Big data-driven indicators are: collecting data (X1), analyzing data (X2) and feeding back data (X3); Urban infrastructure planning indicators are information conditions (Y1), transportation facilities (Y2) and energy facilities (Y3); The indicators of Xi'an city image are material civilization (Z1), spiritual civilization (Z2) and political civilization (Z3), and the results are shown in Table 5.

Table 5. Big Data Collection on City Image (Data source: python Collection)

Indicator	Wireless transmission of short transmission data		The transit end processes the data		Receive short feedback data	
	Maximum ~ Minimum	Mean ± variance	Maximum ~ Minimum	Mean ± variance	Maximum ~ Minimum	Mean ± variance
X1	0.61~1.99	0.34±0.11	0.4~1.78	0.69±0.16	0.61~1.99	0.69±0.11

X2	0.4~1.78	0.34±0.11	0.61~1.3	0.34±0.11	0.4~2.47	1.03±0.11
X3	0.4~1.09	0.34±0.05	0.4~1.78	0.69±0.11	0.4~1.78	0.69±0.05
Y1	0.61~1.99	0.69±0.16	0.61~2.68	1.03±0.16	0.61~1.99	0.69±0.05
Y2	0.61~1.99	0.34±0.16	0.4~1.09	0.34±0.11	0.61~1.99	0.69±0.16
Y3	0.61~2.68	0.69±0.11	0.61~1.99	0.69±0.05	0.61~1.99	0.69±0.16
Y4	0.4~1.78	0.69±0.16	0.61~1.3	0.34±0.05	0.4~1.09	0.34±0.11
Y5	0.4~1.78	0.34±0.11	0.4~1.09	0.34±0.11	0.61~2.68	1.03±0.05
Z1	0.61~2.68	0.69±0.11	0.4~2.47	1.03±0.16	0.61~2.68	1.03±0.11
Z2	0.61~1.3	0.69±0.11	0.61~1.99	0.69±0.16	0.61~1.99	0.69±0.05
Z3	0.4~2.47	0.69±0.16	0.4~1.78	0.69±0.16	0.4~2.47	1.03±0.11

According to the data in Table 5, the mean value and variance of survey indicators such as big data drive, urban infrastructure construction and Xi'an city image improvement all meet the requirements, and there is no significant difference in the mean value of wireless transmission short transmission data, transit terminal processing data and receiving short feedback data, which further shows that the overall data processing effect meets the requirements and can lay a foundation for subsequent analysis.

4. Results and Discussion

4.1 Data Values Obtained by Wireless Ad Hoc Sensors

Based on wireless self-organizing sensor network and urban infrastructure planning characteristics, Wireless Self-Organizing Sensor Network (WSON) is used to collect real-time environment, traffic and other data to provide a basis for planning decisions. However, to ensure that WSON works effectively and provides accurate data, the following conditions need to be met, as shown in Table 6.

Table 6. Conditions for Wireless Ad Hoc Sensor Networks

Condition	Content description
Perceptual override	WSON's perceptual coverage is clearly the key to ensuring data acquisition quality and accuracy. In order to achieve comprehensive and accurate perception coverage, sensor planning points need to be deployed in key locations in the city, including road traffic intensive areas, industrial areas, and environmentally sensitive areas. The number and distribution of deployments should be planned according to actual needs to ensure that the sensor network can collect comprehensive and accurate data.
Network connection reliability	Sensor planning points in WSON need to transmit data to the data centre over a reliable network connection. To this end, it is essential to establish a stable and reliable communication link. Adopt appropriate network topology, transmission protocol and communication technology to ensure real-time transmission and reliability of data.
Energy management	As a wireless device, WSON's sensor planning point

	energy management is an important factor in improving its operating life and stability. It is necessary to strengthen research on energy supply, energy-saving strategies of sensor planning points, distributed energy management, etc., to ensure the stable work and long-term operation of sensor planning points.
Data processing and analysis capabilities	The sheer volume of data generated by WSON requires efficient and fast processing and analysis. To this end, it is necessary to adopt appropriate data processing and analysis algorithms to improve data processing efficiency and response speed.
Privacy protection and security	For data privacy and transmission security issues related to WSON, appropriate data encryption, authentication and access control stricter policies need to be developed to ensure that data privacy and security are not compromised.

In general, the application of wireless ad hoc sensor networks in urban infrastructure planning needs to meet the conditions of sensing coverage, network connection reliability, energy management, data processing and analysis capabilities, as well as privacy protection and security. Only with the support of these conditions, wireless self-organizing sensor networks can help Xi'an urban image play an important role in optimizing urban infrastructure planning and promoting the development of Xi 'an city image.

4.2 Big Data Feature Extraction Process of Urban Infrastructure

Feature extraction of urban infrastructure planning is one of the core steps of optimizing urban infrastructure planning based on big data. By extracting and analyzing the characteristics of urban infrastructure, we can obtain valuable information from the huge data to simplify the amount of information, ensure the quality of data transmission, and provide a scientific basis for optimizing urban infrastructure planning. The specific identification results are shown in Table 7.

Table 7. Big Data Feature Extraction for Urban Infrastructure Planning [Unit:%]

First-class index	Secondary index	Big data features	Wireless ad hoc sensor network rate
X	X1	70.95	85.23
	X2	68.02	75.36
	X3	72.93	65.32
Y	Y1	71.09	68.32
	Y2	68.61	86.36
	Y3	71.03	75.32
Z	Z1	69.96	82.34
	Z2	66.86	92.36
	Z3	75.32	86.36

In the process of extracting big data features in Table 7, data cleaning, processing, interaction and other operations are required to ensure the accuracy and consistency of data, and the integration of big data and wireless ad hoc sensor networks is more objective and data visualization tools are used to show it, and the change process of urban infrastructure planning characteristics is shown in Figure 1.

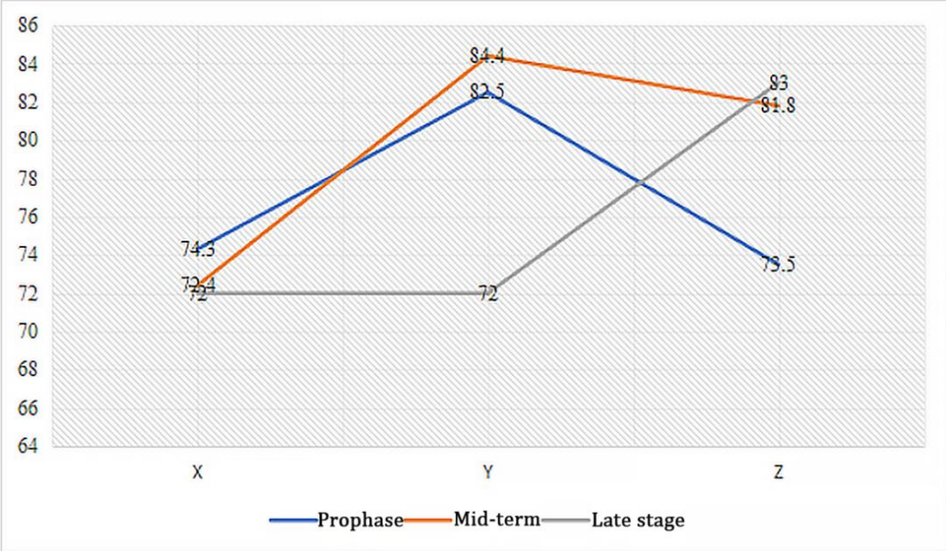

Figure 1. The Urban Image Judgment Process of Urban Infrastructure Planning

As can be seen from Figure 1, from the large amount of data collected, it is necessary to select the characteristics suitable for urban infrastructure planning. Features can be structural or unstructured. Then, through big data analysis, the transmission volume of urban infrastructure planning is simplified, and the wireless ad hoc sensor network improves the data transmission rate and reduces the occupancy rate of the schemer to extract the characteristic information related to urban infrastructure planning from the original data. In summary, the urban infrastructure feature extraction process in urban infrastructure planning based on big data-driven optimization includes key steps such as data collection and preparation, feature selection and extraction, feature analysis and modelling, and feature visualization. This process can extract important features of urban infrastructure and provide a scientific basis and guidance for Xi'an's urban image to obtain first-hand data resources and optimize urban infrastructure planning.

4.3 Feature Recognition Rate of Infrastructure Planning

Changes in urban infrastructure planning will have an impact on city image, data transmission, port compatibility, wireless transmission rates, and frequency band occupancy, so the frequency of changes is reduced, as shown in Table 8.

Table 8. Characteristic Recognition Rates for Infrastructure Planning

First-class index	Secondary index	Data transmission	Compatible data	Key content	Transfer point	Privacy Protection
X	X1	68.14	73.60	78.57	75.03	81.37
	X2	70.69	65.85	79.98	73.86	86.99
	X3	78.62	68.33	81.95	72.63	76.65
Y	Y1	71.32	67.29	75.00	73.15	79.61
	Y2	70.86	70.37	76.03	78.12	81.19
	Y3	68.32	75.63	59.63	72.32	78.32
Z	Z1	65.75	72.33	86.32	72.36	56.33
	Z2	78.66	56.98	71.88	65.33	76.35
	Z3	75.33	76.33	65.33	75.35	85.36

The changes in city identity in Table 8 are shown in Figure 2.

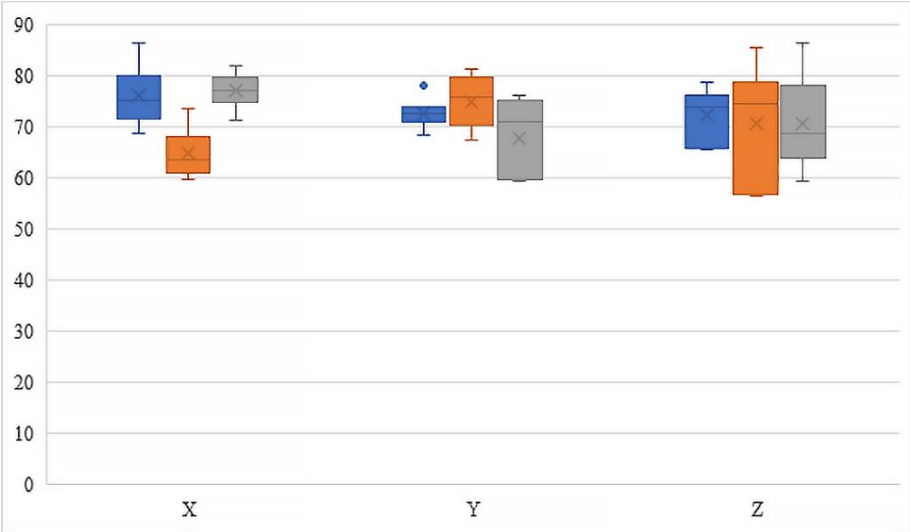

Figure 2. Changes in the Identification of Characteristics of Urban Infrastructure Planning

It can be seen from Figure 2 that under different degrees of feature recognition, the common characteristics and urban image of urban infrastructure planning did not change greatly, indicating that the change in urban infrastructure planning had less impact on the implementation of content. In addition, the change of common characteristics is a fundamental change which has not had any impact on infrastructure planning, which further proves that big data analysis can achieve an effective display of urban infrastructure planning and urban image. The reason is that big data analysis can reduce the error rate of transmission through data simplification, shorten the analysis time of urban infrastructure planning data, and increase the amount of single data transmission since it can fully meet the analysis needs of urban images.

4.4 Application Effect of Wireless Self-organization and Sensor Network Technology

The combined application of wireless ad hoc organization and sensor network technology has played an important role in the process of enhancing the image of Xi'an City. Driven by big data, urban infrastructure planning can be optimized to provide Xi'an with a more efficient, convenient, and sustainable urban living environment. First, wireless ad hoc technology provides an innovative solution for the optimization of urban infrastructure planning. Wireless ad hoc networks can realize automatic networking and communication between devices without manual intervention, greatly simplifying the complexity of network deployment and management. In the urban planning of Xi 'an wireless AD hoc network can be used to monitor and manage traffic flow and the use of public facilities so as to grasp the dynamics of urban operation the first time and leave valuable data through the screening of communication information to achieve the quality and speed of communication content and realize more refined management and scheduling of urban resources. Secondly, the application of sensor network technology can realize intelligent monitoring and data collection of urban environments. By deploying sensor devices in key locations in the city, environmental parameters such as air quality, noise level, temperature and humidity can be monitored in real time, and data can be transmitted to a central planner for analysis and processing. In the process of improving Xi'an's urban image, sensor networks can help to monitor and warn of environmental pollution and provide citizens with a healthier and more comfortable living environment, improve the negative impact of urban residents on the city, improve the city image recognition and form a good city image reputation. In addition, the combined application of wireless ad hoc organization and sensor network technology can also realize the intelligent management of urban transportation. By deploying sensor devices at key locations such as traffic intersections and bus stops, information such as traffic flow and vehicle speed can be monitored in real time, and data can be transmitted to Xi'an Urban Image Information Center and the Traffic Management Centre through a wireless ad hoc network. Based on the analysis and processing of big data, On the one hand, it can transmit emergencies to the information dissemination centre for the first time to ensure the timeliness of information dissemination. On the other hand, it can realize the functions of automatic scheduling of traffic lights, early warning and guidance of traffic congestion, and improve the efficiency and safety of urban traffic. In summary, the combined application of wireless ad hoc organization and sensor network technology is of great significance in optimizing urban infrastructure planning and enhancing the image of Xi'an City. Driven by big data, the refined management of urban resources and the environment can be realized, and citizens can be provided with a higher quality of urban life. Therefore, further research and application of wireless self-organization and sensor network technology have important reference significance for the improvement of Xi'an's urban image.

4.5 Accuracy of the City's Image

The diversity of urban infrastructure planning, the presentation of cultural details, and the interaction of characteristics of different eras require highly accurate network parameters as a guarantee to accurately judge urban infrastructure planning, and the results are shown in Figure 3.

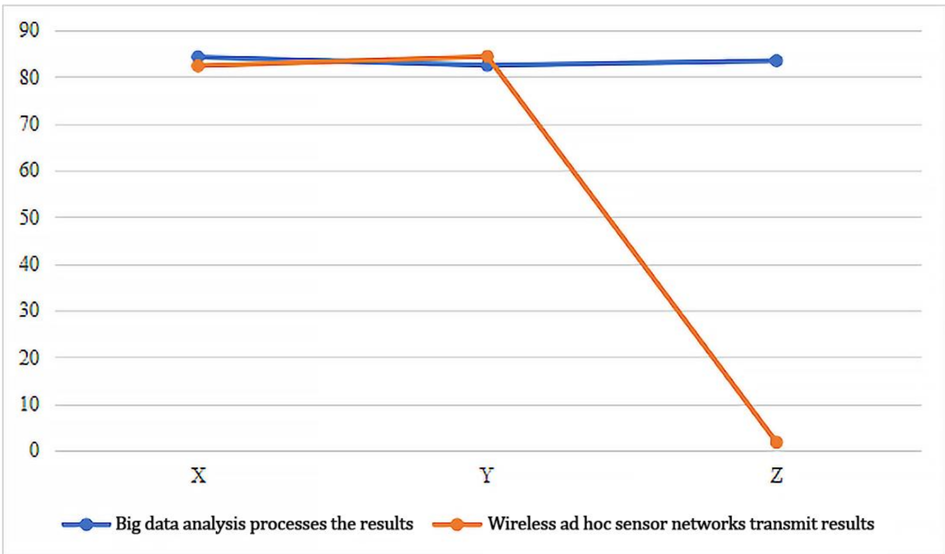

Figure 3. Transmission Accuracy of Urban Infrastructure Planning Feature Recognition

It can be seen from Figure 3 that the transmission accuracy of big data analysis is higher than that of manual identification methods, and the transmission results of urban infrastructure planning are less different from the actual presentation, indicating that wireless ad hoc sensor network transmission can accurately complete the extraction of features and provide comprehensive support for urban infrastructure planning, and the results are shown in Table 9.

Table 9. Accuracy of Urban Infrastructure Planning Programmed

First-class index	Secondary index	Big data analysis processes the results		Wireless ad hoc sensor networks transmit results	
		Xi'an image	Urban planning schemes	Xi'an image	Urban planning schemes
X	X1	88.03	83.72	88.04	85.97
	X2	85.09	86.30	83.28	84.77
	X3	86.72	82.57	83.90	80.98
Y	Y1	89.36	84.31	82.67	83.61
	Y2	89.60	85.18	87.72	86.39
	Y3	87.87	86.36	85.18	90.43
Z	Z1	88.48	84.59	87.72	87.00
	Z2	91.15	89.64	87.57	88.72
	Z3	83.62	84.00	81.73	86.17

It can be seen from the identification process in Table 9 that the recognition of urban infrastructure planning and urban image is relatively high, and the transmission rate of wireless ad hoc sensor network is greater than 80%, mainly due to the extraction of urban image data by big data analysis, which reduces the complexity of data in wireless ad hoc sensor network, and further proves that wireless ad hoc sensor network transmission can meet actual requirements. Moreover, in the process of selecting the irregular terminal of the wireless group organization network, there is no abnormal interference, indicating that the transmission effect of urban infrastructure planning characteristics is ideal.

5. Conclusion

In order to optimize urban infrastructure planning and improve the image of Xi'an city. Based on the characteristics of intelligent information technology, such as high automation and high efficiency, it is used to empower new urban images to break through the traditional "human editing" mode and form a new mode of information collection and feedback, such as "machine automatic" and "big data analysis". This paper proposes a method combining big data analysis and wireless ad hoc sensor network technology, which uses wireless ad hoc technology to achieve a transmission rate of 10Gpits. The test results show that the transmission accuracy of wireless ad hoc sensor network technology is greater than 90%, big data analysis can reasonably select the irregular points of wireless group organization network, and the transmission compliance rate reaches more than 80%, which can effectively optimize urban infrastructure planning and enhance the image of Xi'an city. HelpXi′an urban image to better carry out internal communication activities. However, it is also necessary to solve the problems of data privacy and security, and further explore the potential and application of big data and wireless ad hoc sensor network technology in the field of urban planning. As a special means of production in the Internet era, big data and wireless self-organizing sensors require specific technologies for their collection, storage, processing and transmission. Therefore, in addition to the support of a large amount of data, it is also necessary to use the first wireless self-organizing network technology as an auxiliary in order to better carry out infrastructure construction and enhance the image of Xi'an. At present, the Xi'an urban image generally has the problem of a lack of technical researchers, and technology has a profound impact. With the continuous advancement and innovation of technology, big data, wireless ad hoc organization and sensor network technology will play a greater role in urban infrastructure planning and make greater contributions to improving the image of Xi'an City. At the same time, comparative research, exchange of experience with other cities, and continuous search for innovative methods and strategies, will contribute to the continuous improvement of the city's image. There are still some limitations in this study, mainly because the city scale of Xi'an is large, there are many designed infrastructure data, and the data exclusion criteria are difficult to unify, resulting in certain differences in data analysis. In the future, we will focus on the analysis of relevant data to make up for the above shortcomings.

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