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Research on Performance Evaluation of Urban Furniture Function Design Based on Internet of Things Digitization

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ABSTRACT With the continuous improvement of modern scientific construction, urban development is moving in the direction of digitization. Under the background of digital technology of Internet of things, many cities have new challenges and opportunities in the construction of a new generation. Urban furniture design plays an important role in public areas and activity spaces. It can bring many interactive and spatial elements to people's daily life. At the same time, the functionality and reliability of urban furniture design are also the main contents we pay attention to. How to reflect the applicability of design and evaluate the performance of products is the research content of this paper under the background of Internet of things and digitization. Firstly, it analyzes the current situation of urban furniture design and the specific needs in the digital background. This paper explores the impact of the above factors on the safety of urban furniture from the aspects of urban development, economic situation and user groups. Using Internet of things data modeling and estimation methods to analyze the data changes contained in urban furniture design. Judge the performance changes of furniture design in actual use according to the data information, and analyze the feasibility of people in use. Finally, in the big data environment, with the support of Internet of things technology, this paper studies the sharing function in urban furniture design, and evaluates the feedback effect of shared urban furniture. The results show that urban furniture design under the digital background of Internet of things reflects good feasibility and applicability in modern urban construction. Digital urban furniture has gradually become a new symbol of a city. This paper uses data mining to obtain and analyze the data in the process of urban furniture design, and realizes the standardized processing of user behavior data. It not only meets people's daily needs and the needs of intelligent equipment, but also strengthens the importance of urban furniture design and use in modern urban construction. Compared with the traditional Internet, the Internet of things can combine the wireless transmission network with the actual objects to achieve the purpose of accurately transmitting information.

INDEX TERMS Internet of Things, digitization, urban furniture design, intelligent construction, data mining.

I. INTRODUCTION

As the infrastructure of a city, urban furniture can effectively convey the changes of urban construction concept and humanistic thought [1]. It is the link between the people and the city and between the people and the country. It plays an important role and position in the process of national urban development. In the process of urban furniture space design and image design, we need to consider the changes of design ideas and ideas from multiple directions [2]. Firstly, it analyzes the psychological activities of urban residents, that is, the changes of psychological characteristics and behavioral trends. Take the aesthetics of public space and the aesthetic needs of the people as the main research object [3].

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Reasonably allocate space division and build appropriate furniture and equipment in suitable places. Finally, from the perspective of construction, shape the ideological characteristics and spiritual embodiment of the space scene. That is to reflect the development process and details of the whole city from furniture design. Let urban furniture design as an important carrier of thought and spirit. From the perspective of the spatial idea of urban furniture design, the design concept needs to conform to the development trend and characteristics of the city [4]. The ideal urban furniture can build the track of people's daily life. Many people think it is an open product, which can reflect the applicability and humanistic aesthetics combined with the basic equipment of outdoor activities. Some people also pay more attention to urban public facilities and think that modern atmosphere and public experience need to be reflected in urban furniture design [5]. In conclusion, urban furniture design needs to face the social masses, serve the people, and integrate transportation, tourism, entertainment and other factors into it. It is not only an indispensable link in the process of social modernization, but also an organic part of urban construction [6].

Facing the connotation and details of different cities, we can see a variety of urban furniture design ideas and style changes [7]. Some researchers divide urban furniture from the use function. It can be mainly divided into the following categories: first, public facilities, including sanitary facilities, dustbins, environmental protection facilities, transportation facilities, etc. Landscape facilities are also a part of them. Road signs and map signs are constituent elements of landscape facilities. Secondly, it includes entertainment facilities and service facilities [8]. It can bring convenience and a variety of entertainment elements to people's daily life. Finally, safety facilities are the main component of urban furniture design [9]. With the development of society and the changes of the times, safety performance has become the main factor we consider in building urban facilities. With the advent of the Internet, Internet of things and big data era, more and more architectural styles are developing towards diversified intelligence. Facing the impact of digital life on our people, we still need to follow the pace of scientific and Technological Development in urban furniture design. Combine intelligent equipment with urban furniture to form specific functions and service characteristics, so as to provide people with better service and living atmosphere [10].

This paper is mainly divided into three parts. The first part briefly analyzes the development status of urban furniture design, and explores the impact of scientific and Technological Development on urban furniture design under the background of Internet of things and digital technology. The second part first uses data mining to obtain the traces of urban furniture design over the years. Preprocess and predict the acquired data from the big data environment. Combined with real-time dynamic modeling technology, this paper analyzes the development trend of urban furniture under the digital background. Finally, with the support of Internet of things technology, improve urban furniture design thinking and realize the concept of shared furniture design. The third part analyzes the research results of urban furniture design under the digital background of Internet of things.

II. THE RELATED WORKS

With the rapid development of science and technology, urban modernization is gradually moving towards a new road. People have higher and higher demand for urban space architectural design and related infrastructure [11, [12]. From the aesthetic point of view of urbanization furniture design, intelligent concept has become the mainstream direction. At present, the idea of furniture design in many urban construction is relatively backward and still stays in the traditional design direction and thinking [13]. Most furniture designs are very similar. With the needs of intelligent life, it is difficult to meet the basic requirements of the people. Most urban home design is relatively single and does not develop towards diversification [14]. Regional characteristics and humanistic color are rarely reflected in the current urban furniture design concept. Urban public area is the main place for residents' life and activities. The construction of urban furniture needs to provide help and convenience for local development [15]. Integrate the idea of taking the people as the core into it and give urban residents a better experience. At present, the construction of public areas in big cities is relatively popular, especially in areas with strong public scope [16]. The large gap between urban and rural areas leads to the imbalance of China's urbanization construction. The concept of urban furniture began to flow into China, and has different development processes in many western countries. Facing the development process of China's modernization, how to optimize and improve urban furniture design under the background of Internet of things digitization is the main problem we face [17].

As an important part of urban development, urban furniture design can promote the transformation of mass activities to rich and diverse, and facilitate people's living and working needs [18]. At the same time, the design concept also accommodates many disciplines, such as architecture, art design, urban planning, public sociology, etc. This highly comprehensive interdisciplinary integration makes urban furniture design and modern digital life concepts integrate with each other [19]. In terms of literature research, the domestic HowNet has 872 studies with ''city'' and ''furniture'' as the key words by 2021, of which more than 270 are related to the theme features. The research on urban public infrastructure and outdoor furniture has become the main content in the fields of architecture, engineering, environmental science and so on [20].

Foreign countries have paid more attention to digital urban furniture design than before. Japan considers that digital urban design needs to start from the local based on its own regional culture in the field of art design [21]. Due to the restriction of geographical location and population, urban furniture pays more attention to the function of public space. From space environment to green ecology, urban furniture

combined with Internet of things technology gradually has the characteristics of mobility, interactivity, rapid assembly and disassembly, and small floor space. This flexible form makes urban furniture have stronger application-oriented and cultural characteristics in public areas, and the functional requirements have become interesting and colorful, adding new vitality to the social environment [22]. The design of urban furniture in the United States is more influenced by the masses, but its development history is relatively short. In addition to the strong European aesthetics, the overall style is also influenced by the modern artistic atmosphere. The materials and assembly equipment used are combined with information and intelligent processing methods. The design is simple and generous, and the convenience can be realized from daily interaction. However, from the development of research literature, there are still many deficiencies.

The development of urban furniture in China is relatively slow. With the gradual improvement of China's economy and the gradual enhancement of national strength, the stable development of society has brought more possibilities for urban construction [23]. Although most urban furniture design still continues the historical and cultural characteristics and traces, with the influence of science and technology, it is also gradually developing in the direction of digitization. Many intelligent design management based on Internet of things and big data technology help urban furniture design provide new ideas [24]. More and more convenience services and digital facilities have brought a direct impact on people's life [25]. Based on the development status of urban furniture design, this paper explores the design concept and specific implementation process of urban furniture under the digital background of Internet of things.

III. RESEARCH ON RELIABILITY METHOD OF URBAN FURNITURE INTELLIGENT SHARING DESIGN BASED ON INTERNET OF THINGS DIGITIZATION

A. RESEARCH ON PERFORMANCE EVALUATION OF INTELLIGENT URBAN FURNITURE DESIGN BASED ON INTERNET OF THINGS DIGITIZATION

The concept of Internet of things was introduced into China. It was officially established at the information society exchange conference and has attracted extensive attention from all countries. From the macro concept, the meaning of the Internet of things means that most devices can connect with the Internet to realize the sharing and interaction of data and information resources. This exchange of information and data is not constrained by time and place [26], [27]. Many scientific and technological achievements such as sensor technology, nanotechnology and artificial intelligence technology are reflected in the Internet of things technology. It can take mobile network and Internet as the core framework to realize the interconnection of all things. Identify and apply any object through sensing system and positioning function. So as to complete the functions of positioning, tracking, identification, judgment, monitoring and management of various objects [28]. The relationship between people and social life in the Internet of things is shown in Figure 1.

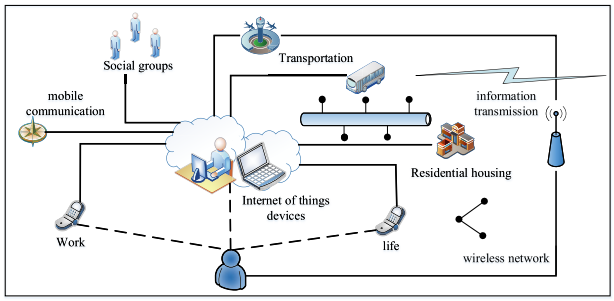

FIGURE 1. The relationship between people and social life in the Internet of things.

The Internet of things is different from the Internet. The main purpose of the Internet is to build a global information and communication network. The Internet of things focuses on information services, that is, the transmission of business information by using the Internet and wireless communication, and the service object is changed from people to all goods including people. As an extension of the Internet, the Internet of things provides users with personalized and privatized services by integrating intelligent objects into the digital world. Compared with the traditional Internet, the Internet of things can combine the wireless transmission network with the actual object to achieve the purpose of accurately transmitting information. At present, the IOT structure system is divided into three levels, as shown in Figure 2.

It can be seen from Figure 2. Firstly, in the perception level, sensors and automatic recognition are the core contents, which can effectively obtain and collect data information. Secondly, in the network transmission layer, mobile network, communication network and Internet can provide query address and transmission link for data, and apply the function of Internet of things to a wide range of areas. Finally, data and information can be safely and accurately transferred to the practical application level. After fast and effective processing, intelligent and digital service functions are realized. With the rise of national economic strength, urbanization is also developing towards diversification and digitization. More and more intelligent terminals and intelligent devices have an important impact on people's daily life. Urban furniture refers to the equipment used in outdoor space in urban construction. Firstly, we investigate the relevant literature on urban furniture design, as shown in Figure 3.

It can be seen from Figure 3 that foreign countries originated early in the research of urban furniture design. Therefore, most foreign researchers are not unfamiliar with urban furniture design, and there are many relevant literatures. The number of documents on urban furniture design in China has gradually caught up, which is also related to China's economic development and modernization. Urban furniture design is divided into several categories. We use structural analysis to express it, as shown in Figure 4.

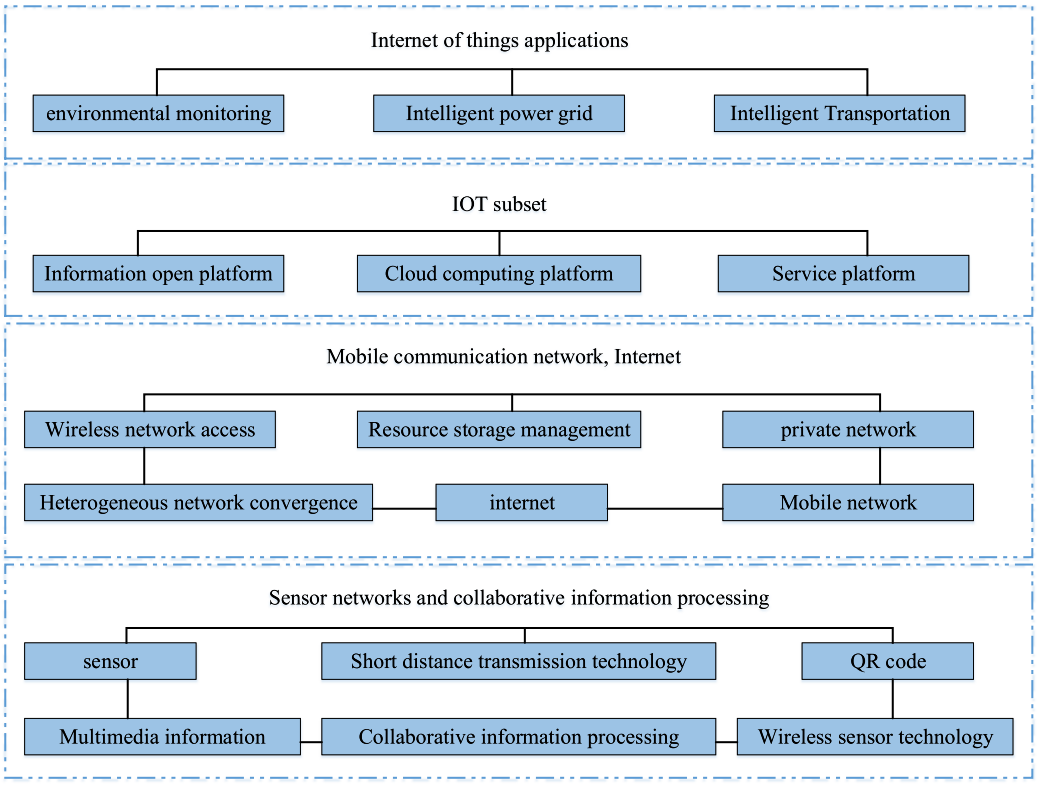

FIGURE 2. Internet of things architecture.

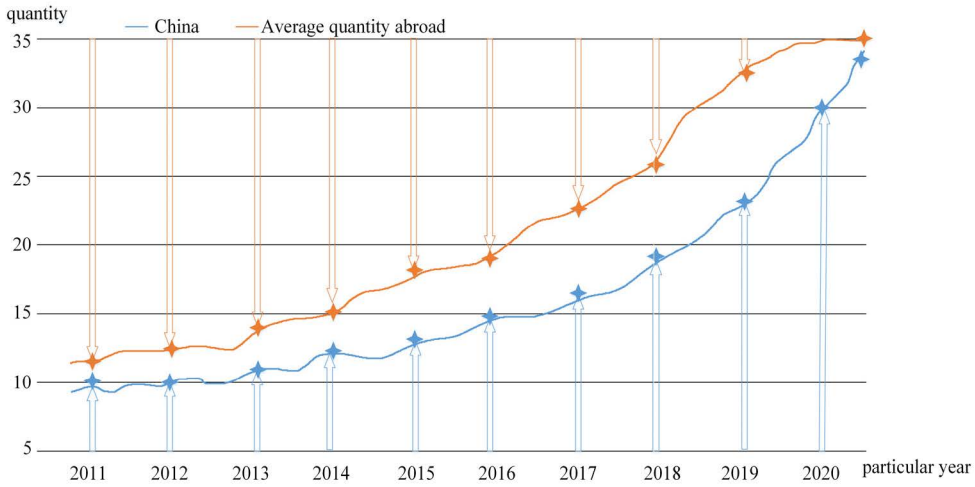

FIGURE 3. Relevant literature on urban furniture design.

It can be seen from Figure 4 that in urban furniture, furniture design of public facilities is common, such as equipment that can meet the needs of people's daily life. Including fitness equipment, bus facilities, telephone booths, mail boxes and other furniture, which are the most basic components of urban construction. We look for some representative urban furniture for analysis, as shown in Figure 5.

It can be seen from Figure 5. These urban furniture are common and frequently used items in people's daily life. With the development of Internet of things and digitization, many new intelligent devices and infrastructure are combined in urban furniture design. This recognizable and intelligent furniture can extract and analyze data in daily use, and exchange data information. Urban furniture in the Internet of things

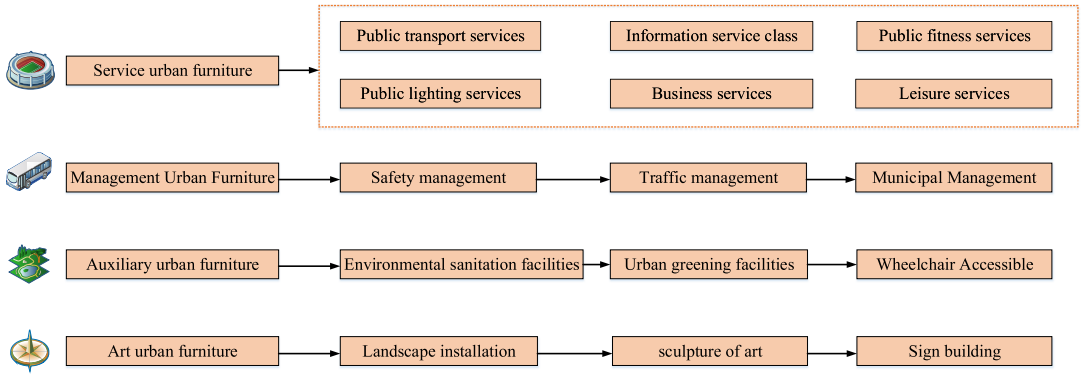

FIGURE 4. Urban furniture classification.

environment can also realize the functions of intelligent learning and behavior analysis.

The functions of smart home include on-site monitoring and server-side monitoring. While completing the monitoring command of the monitoring center, the on-site monitoring terminal also needs to have the function of identification and response. More importantly, it is necessary to complete the server-side implementation of specific hardware operations. With the help of SQL Server database, the server mainly has user login and logout user management, home management, device management, etc. Users send instructions by logging in to the server to meet the needs of remote monitoring.

At present, feedforward neural network is still limited to small or medium-sized systems in complex system modeling. The main reason is that in the face of large-scale problems, the existing neural network learning algorithms either converge too slowly or are difficult to converge. In the Internet of things system, neural network must adapt to various large-scale systems. In this chapter, the improved neural algorithm is used to classify the data in the Internet of things. In order to facilitate data processing and error analysis, this paper is completed on the MATLAB platform.

In the process of implementation, it needs to be improved combined with neural network algorithm. Due to the limitation of each data unit, we need to obtain and analyze the data on the premise of solving the error. First, the input and output results of the data unit are represented:

$$net = \sum_{j=1}^{m} w_{ij} x_j + \partial_i \tag{1}$$

$$o_i = \Psi(net_i) = \Psi(\sum_{j=1}^{m} w_{ij} x_j + \partial_i) \tag{2}$$

The variable $\Psi(net_i)$ represents the data function, m represents the input data node, and ∂ represents the calculation threshold. In the output data, the change values of each data node are:

$$net_k = \sum_{i=1}^{q} w_{ki} y_i + a_k \tag{3}$$

FIGURE 5. Representative urban furniture.

$$net_k = \sum_{i=1}^{q} w_{ki} \mathrm{T}(\sum_{j=1}^{m} w_{ij} x_j + b_i) + a_k \tag{4}$$

After normalization, the above formula can convert the output formula into:

$$o_k = T(net_k) = \Upsilon(\sum_{i=1}^{q} w_{ki} y_i + a_k) \tag{5}$$

$$o_k = \Upsilon(\sum_{i=1}^{q} w_{ki} T(\sum_{j=1}^{N} w_{ij} x_j + b_i) + a_k) \tag{6}$$

where a_k represents the limited range of output data and q represents the number of hidden points. In the combination of Internet of things and urban furniture, it is necessary to consider the error coefficient between the changes of analysis behavior data, and establish the relevant error calculation formula as follows:

$$E_p = \frac{1}{2} \sum_{k=1}^{L} (T_k^p - o_k^p)^2 \tag{7}$$

In the formula, the variable L represents the number of nodes. The overall error formula of all data samples is:

$$E_{Intal} = \frac{1}{2} \sum_{p=1}^{q} \sum_{k=1}^{L} (T_k^p - o_k^p)^2 \tag{8}$$

According to the error coefficient, the weight coefficient and limit change of data analysis can be obtained. The specific formula is as follows:

$$\Delta w_{ki} = -\eta \frac{\partial E}{\partial w_{ki}} = -\eta \frac{\partial E}{\partial net_k} \frac{\partial net_k}{\partial w_{ki}} \tag{9}$$

$$\Delta w_{ki} = -\eta \frac{\partial E}{\partial o_k} \frac{\partial o_k}{\partial net_k} \frac{\partial net_k}{\partial w_{ki}} \tag{10}$$

$$\Delta a_k = -\eta \frac{\partial E}{\partial a_k} = -\eta \frac{\partial E}{\partial net_k} \frac{\partial net_k}{\partial a_k} \tag{11}$$

$$\Delta a_k = -\eta \frac{\partial E}{\partial o_k} \frac{\partial o_k}{\partial net_k} \frac{\partial net_k}{\partial a_k} \tag{12}$$

According to the change of data error and the change of weight coefficient and limit, the data processing formula can be simplified as follows:

$$\Delta w_{ij} = -\eta \frac{\partial E}{\partial w_k w_{ij}} = -\eta \frac{\partial o_k}{\partial net_i} \frac{\partial net_i}{\partial w_{ij}} \tag{13}$$

$$\Delta w_{ij} = -\eta \frac{\partial E}{\partial y_k o_{ij}} \frac{\partial y_i}{\partial net_i} \frac{\partial net_i}{\partial w_{ij}} \tag{14}$$

From the above formula, we can sort out the general formula of Internet of things technology and neural network algorithm in data processing:

$$\Delta w_{ki} = \eta \sum_{p=1}^{q} \sum_{k=1}^{L} (T_k^p - o_k^p)^2 \cdot \Psi(net_k) \tag{15}$$

$$\Delta a_k = \eta \sum_{p=1}^{q} \sum_{k=1}^{L} (T_k^p - o_k^p)^2 \cdot \Psi'(net_k) \cdot y_1 \tag{16}$$

$$\Delta w_{ij} = \sum_{p=1}^{q} \sum_{k=1}^{L} (T_k^p - o_k^p)^2 \cdot \Psi'(net_k) \cdot w_{ki} \cdot \mathrm{M}\prime(net_i) \cdot x_i \tag{17}$$

Finally, it is also necessary to judge the boundary value of the above formula. In limiting data changes, the following formula needs to be defined:

$$\frac{\partial E}{\partial o_k} = -\sum_{p-1}^{o} \sum_{k=1}^{l}, \quad k = 1, 2, 3 \tag{18}$$

$$\frac{\partial net_k}{\partial w_{ki}} = y_i, \quad \frac{\partial net_k}{\partial a_k} = 1 \tag{19}$$

$$\frac{\partial net_i}{\partial w_o} = x_i, \quad \frac{\partial net_i}{\partial \theta_k} = 1, 2, 3 \tag{20}$$

With the support of Internet of things technology, we can integrate digital monitoring and behavior analysis into urban furniture design. Using the above formula to analyze the behavior data can judge the user's experience change of urban furniture design. We randomly selected a part of the population for sample survey to compare the changes in the use evaluation of urban furniture with digital design of the Internet of things. The middle-aged group's evaluation coefficient of traditional urban furniture is defined as group A and the elderly group as group B. The evaluation coefficients of Internet of things urban furniture are C and D respectively, as shown in Figure 6.

As can be seen from Figure 6, compared with the experience coefficient of traditional urban furniture design, the furniture with digital design of Internet of things has obvious advantages in use evaluation. Therefore, it can be seen that

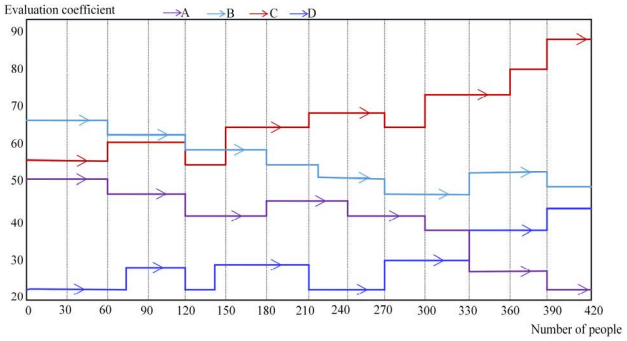

FIGURE 6. Evaluation of different styles of urban furniture by different age groups.

digital urban furniture design can improve the comfort and experience of residents.

B. RESEARCH ON FUNCTIONAL DESIGN OF SHARED URBAN FURNITURE UNDER THE BACKGROUND OF DIGITIZATION OF INTERNET OF THINGS

When designing urban furniture under the digital background of Internet of things, we need to consider the technical characteristics and practical application environment. We need to meet the needs of high humanization, simplicity, security and systematicness. Human activities and life are always considered as the core in the design process. The starting point needs to be built around solving daily needs and practical problems. The choice of furniture design will put user experience and needs in the first place. Not every piece of furniture connected to the digital network structure of the Internet of things can bring good results. In terms of design aesthetics, it also needs to reflect humanization and public aesthetic needs. Use different shapes and colors to distinguish digital products, so as to make urban furniture more distinctive. In the specific implementation, we also need to consider the impact of different gender, different age and different acceptance on the design idea. We analyze the changes of the above three factors affecting the design idea, as shown in Figure 7.

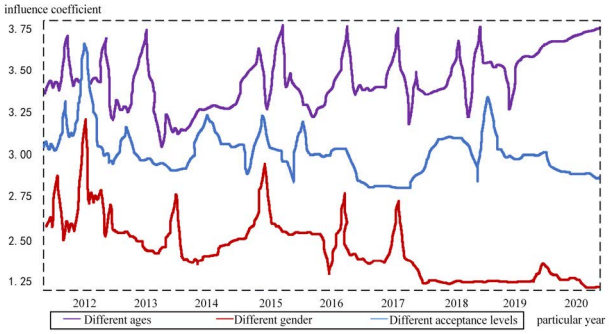

FIGURE 7. Influence of different gender, age and acceptance on design ideas.

From Figure 7 it can be seen that there are many influences on urban furniture design, mainly including gender, age and acceptance level. The age of users has a high influence coeffi-

cient on furniture design ideas, and the acceptance level tends to be the second. Many old people and young children find it difficult to understand the changes of new things and the changes of the information age. The above factors need to be taken into account in urban furniture design. In view of the above situation, we find that there is less interaction between urban furniture and users. This stereotype and lack of personalized design are unfavorable to the development of urban furniture. We need to explore the design concept of high sharing performance under the digital background of the Internet of things and optimize the design ideas of urban furniture. The characteristics of urban space expansion in China have changed from the increase of quantity to the development mode of rational space utilization. With the influence of social complexity, urban furniture design can change the way of interaction between people. The concept of shared furniture design is to share public resources with others to obtain economic and other income. This sharing thinking needs to be discussed in space creation. We track and investigate the users of urban furniture to study people's cognition of shared urban furniture, as shown in Figure 8.

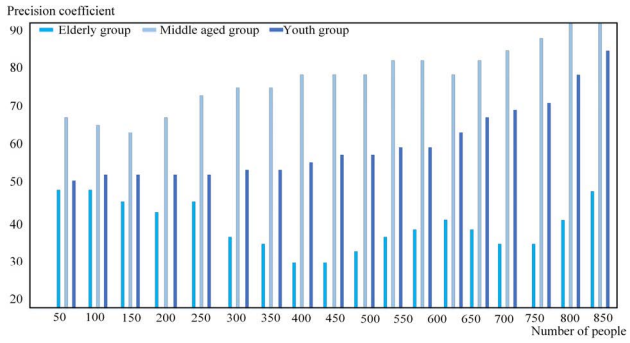

FIGURE 8. Cognition of different ages on sharing urban furniture.

As can be seen from figure 8, most middle-aged people can basically understand what sharing urban furniture is, but this sharing thinking is not extensive among the elderly and teenagers. In order to better popularize shared urban furniture nationwide, we first optimize public facilities under the background of digitization of the Internet of things. Use urban 3D design to analyze user needs. The data mining technology is used to model the applicable population and human behavior, and the data set can be expressed as:

$$y_i = f(x_i) + b \tag{21}$$

According to the introduction of corresponding function, the above formula can be simulated:

$$f(x_i) = w^T \phi(x^i) + b \tag{22}$$

In order to solve the data fusion and similarity problems in the big data environment, we first need to determine the value of function variables, and obtain the deformation of the following formula according to the principle of minimum structure optimization:

$$\min \frac{1}{2}||w||^2 + \frac{c}{2}\sum_{i=1}^{n}\delta^i \tag{23}$$

$$s, t,\ y_i =< w^T x_i > + b + \delta \tag{24}$$

In the formula, the variable c represents the similarity function, which is used to judge whether the error coefficient calculation variable needs to be added. In order to simplify the process of data processing, we need to establish mathematical formulas to optimize:

$$L(w, b, a, H_i) = J(w, b, \delta_i) \tag{25}$$

$$\sum_{i=1}^{a} n_1 \left\{ w^T x_i + b + \delta_i - y_i \right\} \tag{26}$$

According to the principle of data vector calculation, the behavior data can be divided into several matrix formulas:

$$\begin{bmatrix} O, L^T \\ L, \phi^T\phi + C^{-1}L \end{bmatrix} \begin{bmatrix} b \\ a \end{bmatrix} = \begin{bmatrix} O \\ Y \end{bmatrix} \tag{27}$$

Matrix formulas are calculated in units of each data unit. In the digital environment of the Internet of things, the change trend of behavior data is uncertain and full of irregular characteristics. We need to introduce directional vector model for definition:

$$f(x) = \sum_{j=1}^{n} ak(x_i, x_j) + b \tag{28}$$

Collect the historical records in the Internet, clean up the abnormalities in the behavior data, and compare the historical traces to calculate the change law of data nodes. We need to deal with historical traces in a unified way:

$$y_i = \frac{y_i - y_{\min}}{y_{\max} - y_{\min}} \tag{29}$$

In the formula, it represents the size and range of historical data respectively. Judge the behavior nodes and quantity according to the data, and initialize and update the weight coefficient and threshold:

$$k(x_\partial, x) = \exp(\frac{||x - x||^2}{2o^2} \tag{30}$$

In order to compare the accuracy of data analysis and the change of fitting degree, we need to use the accurate fitting model for data processing. The specific process is shown in Figure 9.

As can be seen from Figure 9, the historical data judgment in the digital environment of the Internet of things needs to be normalized and initialized before it can be added to the training sample. In order to better realize the design of shared urban furniture, we take the relevant facilities of Internet of things intelligent bus station as the research object. Firstly, the passengers are investigated and classified from the user's use habits and riding places. We will perform three-dimensional display processing on the information acquisition equipment in the designed shared vehicle system, as shown in Figure 10.

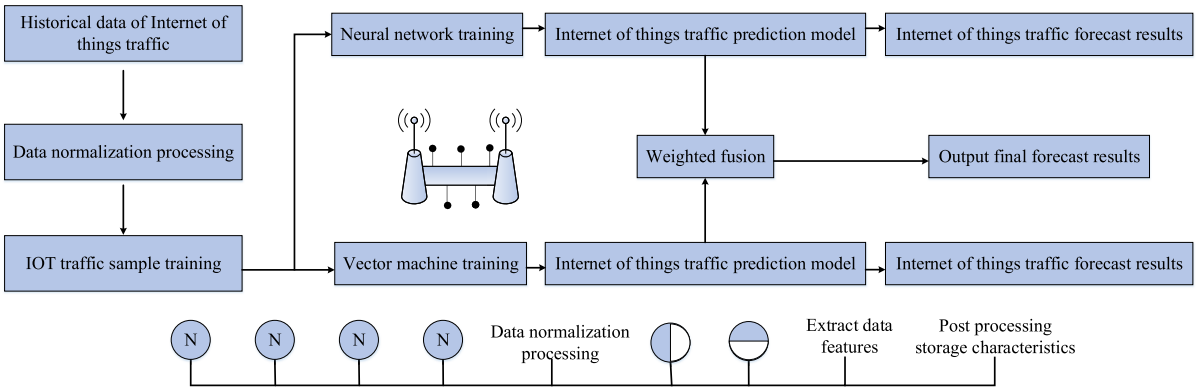

FIGURE 9. Data processing process.

FIGURE 10. 3D display processing of information acquisition equipment in shared vehicle system.

Sensors, bar codes and RFID are the core technologies of the sensing layer of the Internet of things. When wireless sensors output electrical signals, they are vulnerable to external interference or even destruction, resulting in false alarm of sensing data and abnormal operation. Black and white two-dimensional codes like mazes have entered people's lives. RFID technology uses electromagnetic waves for communication and can store a large amount of data. This information is of great value to hackers, so its security risks are also relatively large. Sensing technology and its networking security are the basic units of the Internet of things. Whether the sensor can complete its mission according to the design requirements at the information collection level of the Internet of things has become the key to the successful completion of the sensing task of the Internet of things.

It includes data transmission module and intelligent interactive platform. In order to better design the "smart bus" of shared urban furniture, we also need to optimize the equipment in the Internet of things environment. Analyze and manage the behavior data of shared furniture through big data processing and artificial intelligence analysis, so as to facilitate managers to plan and monitor it.

IV. ANALYSIS OF RESEARCH RESULTS OF RELIABILITY METHOD OF URBAN FURNITURE INTELLIGENT SHARING DESIGN BASED ON THE DIGITIZATION OF INTERNET OF THINGS

A. ANALYSIS OF RESEARCH RESULTS ON PERFORMANCE EVALUATION OF INTELLIGENT URBAN FURNITURE DESIGN UNDER THE BACKGROUND OF DIGITIZATION OF INTERNET OF THINGS

After analyzing the functional requirements of urban furniture design under the digital background of the Internet of things, we further explore the influencing factors such as applicable population and product demand. We randomly selected domestic cities as the research object. Using digital thinking as the direction index of design, combined with urban furniture products, a large number of sketch schemes and concepts are generated under the environment of design principles and intelligent technology. This paper mainly realizes the following three products in the design and research, including urban public environmental protection trash can, intelligent street lamp.

In urban construction, public environmental protection is the main research object. The existing dustbin needs manual cleaning when recycling waste supplies to complete the task. With the acceleration of urbanization, the number of

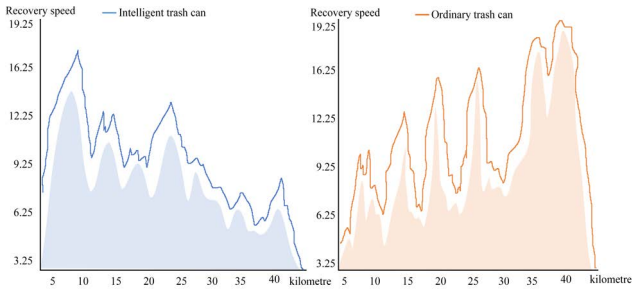

FIGURE 11. Comparison of recycling speed of two garbage cans.

public garbage cans has increased sharply. In order to reduce the consumption of human resources, we need to build an intelligent environmental protection garbage can combined with Internet of things equipment. In this paper, a positioning sensor is placed inside the trash can in the design. Through the central control system, the staff can analyze the height of the garbage can, judge the distance and position by using the locator, and finally notify the environmental protection staff for treatment. The main processes of intelligent environmental protection trash can are: sensor sensing height, transmitting data to cloud server, using data analysis and calculation results and location, and transmitting information for recycling. We compare the advantages of the two kinds of urban furniture in terms of recycling speed and distance, as shown in Figure 11.

As can be seen from Figure 11, the intelligent trash can built in combination with Internet of things technology has obvious advantages in garbage collection speed. When the distance between garbage cans is farther and more scattered, the traditional garbage cans have a significant reduction in recycling efficiency. Therefore, in the urban furniture design under the Internet of things environment, the construction of intelligent trash can is one of our main achievements. Next, we analyze the intelligent street lamp designed in this paper.

As a lighting facility in urban furniture, intelligent street lamp is an important part of public infrastructure. It can not only provide help at night and ensure people's travel safety, but also an indispensable member of urban decoration. In urban furniture design, the traditional street lamp only considers the season and light to control the brightness. In case of sudden bad weather, traditional street lamps cannot provide lighting services in time. On this basis, this paper uses the digital technology of Internet of things to add sensor equipment on the top of street lamps. Use the photosensitive principle to feel the surrounding environment. The actual working principle and assembly are shown in Figure 12.

As can be seen from Figure 12, as the sensor device transmits the real-time data of the surrounding environment in the wireless network environment, after big data analysis, it can determine the changes of the surrounding environment and intelligently control the street lamps to respond. We analyze the energy consumption of the transformed intelligent street lamps in the Internet of things environment, as shown in Figure 13.

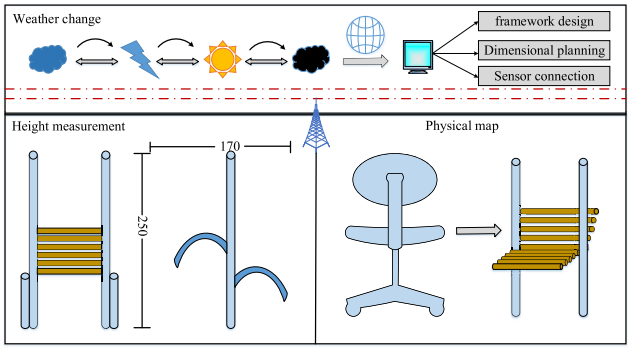

FIGURE 12. Actual working principle and assembly drawing.

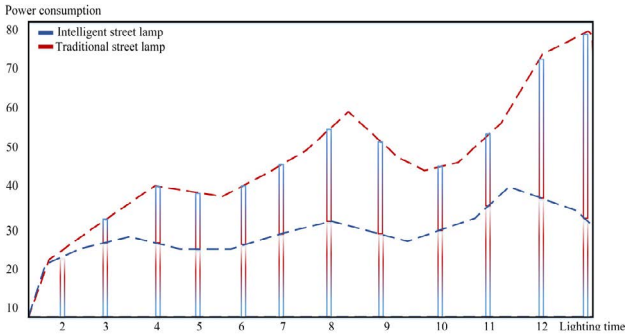

FIGURE 13. Energy consumption analysis of intelligent street lamp in Internet of things environment.

It can be seen from Figure 13 that with the enhancement of lighting time, the energy consumption of intelligent street lamps optimized by the Internet of things has been significantly reduced. From the perspective of ecological and environmental protection, this equipment can alleviate the pressure of China's power system. The combination of urban furniture and Internet of things technology helps us move forward towards modern urban construction. From the above research results, urban furniture in the digital environment of the Internet of things has a good effect in practical application.

B. ANALYSIS OF RESEARCH RESULTS OF FUNCTIONAL DESIGN OF SHARED URBAN FURNITURE UNDER THE BACKGROUND OF DIGITALIZATION OF INTERNET OF THINGS

The relationship between outdoor and space needs to be combined in the design of shared urban furniture under the digital background of the Internet of things. It includes the social connection between people. By sharing functionality, the distance between people and society and between people is narrowed, and the obstacles brought by the sense of space are reduced. We explore the direction of sharing urban furniture in practical application by means of random investigation, and establish the corresponding data table as follows:

According to the above table, shared urban furniture plays an important role in residents' life. We use big data processing

TABLE 1. Practical application of shared urban furniture.

Application Direction	Elderly Group	Middle Aged Group	Youth Group
Work	14.73%	80.98%	9.82%
A Business Travel	1.17%	40.23%	1.23%
Travel	40.65%	70.56%	80.65%
See A Doctor	10.78%	50.98%	49.72%
Daily Life	60.12%	70.34%	72.14%

technology in analyzing the impact of shared urban furniture on human behavior. In order to analyze the performance of this algorithm, we select the appropriate data information from the Internet environment as the test object to further judge the performance of human behavior analysis and data processing. Using big data analysis technology to process historical traces in a large amount of data environment has obvious advantages in accuracy compared with traditional data processing technology, as shown in Figure 14.

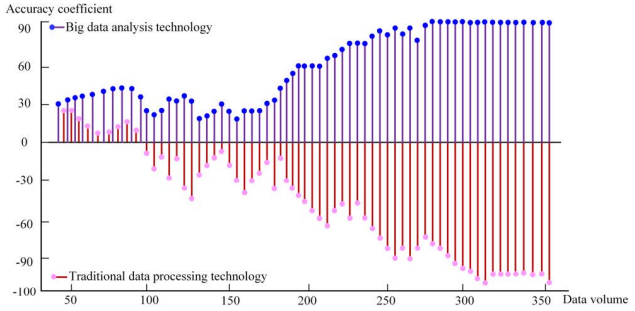

FIGURE 14. Comparison of data processing technology.

As can be seen from Figure 14, the historical traces processed by big data technology can still ensure clear accuracy in the case of a surge in the amount of data. The test data show a good fit, which is in line with the characteristics of universality and ease of use of intelligent shared urban furniture. Finally, it is also necessary to analyze the results of urban furniture design and use in the digital environment of the Internet of things. Taking the intelligent shared bus facilities studied in this paper as an example, we take ordinary urban furniture as the control group to judge the coefficient change of the impact of Internet of things intelligent shared urban furniture on Residents' behavior, as shown in Figure 15.

It can be seen from Figure 15 that the impact coefficient of intelligent shared urban furniture on Residents' behavior is obvious. With the increase of the number of users, the influence coefficient gradually expands. Ordinary urban furniture can only be used as a public infrastructure, which has a low impact on Residents' life. In order to meet the current urban and mass needs, we should widely popularize intelligent shared urban furniture to all regions.

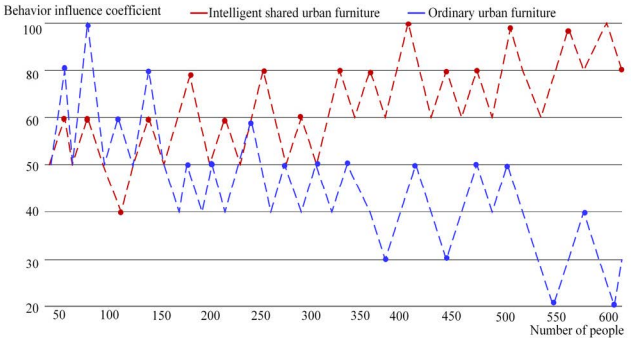

FIGURE 15. Coefficient change of influence of intelligent shared urban furniture on Residents' behavior.

V. DISCUSSION ON DATA RISK COUNTERBALANCE

The miracle of data mining is closely related to machine learning because computer learning algorithms use existing data to predict the unknown. Big data analysis is only a representation or feature of the development of the Internet at this stage. There is no need to be in awe of its myth or maintain awe. In the context of technological innovation represented by cloud computing, these data that are originally difficult to collect and use become easy to use. What factors affect big data analysis, including:

1. incorrect data storage location: some companies send data to outsourcers for storage, but in fact, these data will become other forms in the hands of outsourcers. Usually, these data are related to their own websites or products during the publicity campaign. By combining the daily operation data, we can find out which activities have contributed to user transformation. Some companies still store daily operation data and activity data separately for analysis, and the results will seriously hinder the company's correct understanding of the data and making correct decisions.

2. ignoring the analysis of product data: some developers of start-ups tend to ignore the following data analysis because they are eager for product development: the details of users' specific use of the product, how the product is used in which scenarios, and which parts of the product are used. Generally speaking, these questions will be difficult to answer if there is no data to support the developers' questions to users. As a result, users will no longer use the product, resulting in the failure of product development of the project.

3. unreasonable framework design: Generally speaking, a good data analysis framework should consider the need for long-term use at the beginning of design. Although we can adjust the framework at any time, the more data we accumulate, the greater the cost of adjustment. In addition, we need to record the old and new systems at the same time after the adjustment to ensure that the data will not be lost. After a long time, it will not only greatly reduce the work efficiency, but also be easy to make mistakes.

Big data technology is not only a technical means of scientific analysis and accurate prediction, but also a concept and ability of overall planning. At the same time, big data technology itself and its operation mode still have certain limitations and potential risks and challenges that can not be ignored. We should tap the intrinsic value of big data technology, embed it into the whole process of social risk prevention and control, establish a public risk accurate identification mechanism and dynamic supervision mechanism, and improve citizens' awareness of risk prevention and control.

VI. CONCLUSION

With the advent of the digital era of the Internet of things, many equipment and infrastructure are gradually moving towards the road of intelligent development. In order to better meet people's daily needs and the needs of intelligent equipment, we should pay attention to the design and use of urban furniture in modern urban construction. The development process of many cities is slow, and people's understanding of urban furniture is still relatively simple. In order to improve this situation, this paper studies the thinking and mode of urban furniture design under the digital background of Internet of things. Firstly, the specific functions and related functional requirements of urban furniture are analyzed. Analyze the impact of national regional economic development on intelligent construction. The principle of humanization and simplicity should be considered in urban furniture design. We analyze the functional requirements and applicability of urban furniture intelligent design from the perspective of users. Data mining and big data processing technology are used to obtain and analyze the data in the process of urban furniture design. The behavior data of users were normalized. With the support of the digital technology of the Internet of things, we will break people's traditional ideas and develop urban furniture towards sharing. In the design of shared urban furniture, taking intelligent bus equipment as an example, the user population and system functional requirements are analyzed. Finally, the sharing concept is applied to the actual furniture design, and a variety of design ideas about urban furniture are put forward. The results show that urban furniture, as a traditional design field, can be further updated and optimized under the background of Internet of things and digitization. It provides new ideas and help for human use and modern urban construction. However, there are still some problems to be solved in this paper. The development of existing industries and domestic interest infrastructure are not perfect. There is still a long way to go from industrial applications, especially in sensor networks, where there are no conditions for industrial scale applications. Therefore, the technology needs to be further modified in the future work.

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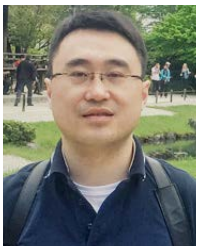

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