

## *Retraction*

# **Retracted: Application of Chinese Traditional Elements in Furniture Design Based on Wireless Communication and Internet of Things Technology**

### **Scientific Programming**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] S. Wu, "Application of Chinese Traditional Elements in Furniture Design Based on Wireless Communication and Internet of Things Technology," *Scientific Programming*, vol. 2022, Article ID 6338339, 9 pages, 2022.

## Research Article

# Application of Chinese Traditional Elements in Furniture Design Based on Wireless Communication and Internet of Things Technology

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The Chinese nation has a history of 5,000 years and has accumulated countless precious cultures in this long history. The Chinese element is the main body that integrates the long-standing similar culture of the Chinese nation into the traditional Chinese culture in a better way. It is the crystallization of the Chinese nation's pursuit and wisdom for a better life. Furniture is a necessity for people's lives and an important carrier and channel for the spread of Chinese art and culture. Chinese culture has experienced thousands of years of accumulation, and the accumulated traditional art and culture are inexhaustible treasures of modern furniture design. The purpose of this article is to study the application of traditional Chinese elements in furniture design based on wireless communication and Internet of Things technology. This article analyzes the wireless communication technology and the Internet technology in detail and then combines them with the furniture to become the smart furniture we are familiar with. Then, from the perspective of traditional Chinese elements, it combines traditional Chinese elements with furniture design and explains the origin of the influence range of traditional Chinese elements in furniture design and the content contained in traditional Chinese elements. Then through a large number of survey market data and a large-scale questionnaire survey, the influence of Chinese traditional elements in the market and the authenticity of this article are proved. According to the questionnaire in this article, it proves the prosperity of our country's market and the development trend of furniture. In this article, the application of Chinese traditional elements in furniture design is analyzed in detail, and the tenon and tenon structure and the culture of the mean are integrated into the furniture design. Then the connection between the intelligent furniture system that controls the furniture and the furniture was tested. According to the test results in this article, ZigBee technology is used for the connection signal of furniture in the indoor environment, which has the advantages of short distance, low complexity, low power consumption, low speed, and low cost. And after 500 sending and receiving experiments, detailed data was obtained. When the distance from the furniture is 70 M, the packet loss rate is about 31.6%, but when the distance from the furniture is 30 M, the packet loss rate is almost 0, which meets the daily routine use. This research not only provides realistic cases for the application of traditional cultural elements, but also opens up new ideas for its integration with people's daily life.

## 1. Introduction

With the progress of the society and the continuous development of the economy, people's quality of life is also constantly rising, so people's requirements for the quality of life are also constantly improving, and furniture is a good way to improve the quality of life. Over the years, foreign furniture elements have continuously poured into our country, which has brought a certain impact on our

country's furniture market [1, 2]. In the modern era with advanced information technology, the concept of smart furniture has gradually emerged, and wireless communication technology and Internet of Things technology have been integrated into furniture. It happens that China is an ancient country with a cultural history of five thousand years. Adding Chinese traditional elements to the design of smart furniture not only inherits the furniture culture, but also satisfies the modern people's pursuit of beauty and the

need for intelligent furniture, thereby expanding the furniture market and promoting the development of the furniture industry [3, 4].

In the research of traditional Chinese elements based on wireless communication and Internet of Things technology in furniture design, many scholars have studied them and achieved good results. For example, Wang Yuhao and Zhou Yang once proposed: With the development of social economy and science and technology, the advancement of various new technologies has been applied to all aspects of life and production. In terms of the Internet of Things, the popularization and application of sensor technology have promoted not only the rapid development of the Internet of Things, but also its production efficiency and information dissemination. Safety and reliability have made people's application of the Internet of Things more and more common in daily life and production. However, sensor technology has not yet formed industrialization. In order to promote the development and promotion of the Internet of Things, it is necessary to strengthen the analysis of sensor technology in the application of the Internet of Things [5, 6]. Li Kai and Zhou Yanpei said: With the advancement of science and technology in China and the popularization of informatization, people's living needs are constantly improving. Traditional home furnishings can no longer meet people's needs, and they are eager for more intelligent furniture. The emergence and development of the Internet of Things provide the possibility for this. The connection and operation of household items through the Internet of Things technology creates an intelligent and humanized furniture for people to make people's lives more comfortable [7, 8]. Incorporating traditional Chinese elements into smart furniture is of great significance to promote the development of China's furniture industry [9, 10].

This paper determines the research direction of the application of traditional Chinese elements based on wireless communication and Internet of Things technology in furniture design and then combines it with furniture design through the analysis of Internet of Things technology and wireless communication technology, so as to obtain the smart furniture design direction. On this basis, it analyzes the cultural history and implication of Chinese traditional elements and then associates them with furniture design, showing the status of Chinese traditional elements in furniture design [11, 12]. This research not only provides a realistic case for the application of traditional cultural elements, but also opens up new ideas for its integration with people's daily life. Especially for our country's furniture industry, it can have a far-reaching impact, so that the development of the industry has an intuitive data-based development reference and has high value in the fields of judging development trends and avoiding innovation risks.

## 2. Smart Furniture Design Based on Wireless Communication Technology and Internet of Things Technology

*2.1. Overview of Wireless Communication Technology.* Wireless communication technology is a communication transmission technology, also known as mobile

communication technology. Wireless communication technology mainly includes microwave communication technology and satellite communication technology [13]. The transmission distance of microwave communication technology is generally about several to tens of kilometers. In addition, microwave communication technology has a large broadcasting frequency band and a large communication capacity. Satellite communication technology uses communication satellites as its relay stations and establishes microwave communication stations to connect two or more ground stations. The daily use of short-range wireless communication technology has the characteristics of low cost, stable, and efficient signal transmission and low power consumption. Currently, low-cost technologies such as Bluetooth, infrared (IrDA), local area network, Wi-Fi, and ZigBee technologies are widely used in the field of wireless communication (Figure 1).

*2.1.1. Bluetooth Technology (Bluetooth).* Bluetooth is a low-bandwidth, high-speed wireless communication technology that works in the 2.4 GHz frequency band. The transmission distance is only 10 cm to 10 m, supporting point-to-point and point-to-multiple communication, flexible networking. The Bluetooth communication speed is about 721 Kbps.

*2.1.2. Infrared Technology.* Infrared technology is a wireless transmission technology with a relatively fast transmission rate. The communication speed can reach 16 M, there is a communication barrier between the infrared signal and the device, and the transmission distance between the two is about 10 meters.

*2.1.3. Wireless Local Area Network Technology.* The wireless local area network bandwidth is provided by IEEE, allowing the wireless local area network to reach a bandwidth of up to 11 M, while supporting transmission rates of 5.5 Mbps, 2 Mbps, and 1 Mbps. Using the 2.4 GHz wireless frequency band, the indoor transmission distance can reach tens of meters.

*2.1.4. Wi-Fi Technology.* Wi-Fi technology is a wireless communication system developed based on IEEE802.11. This technology has the advantages of flexible network operation, fast data transmission rate, and wide area.

*2.1.5. ZigBee Technology.* ZigBee technology is a low power local area network system based on the IEEE802.15.4 standard. Because ZigBee technology uses a simple, self-managed network, and the ZigBee network has low power consumption and supports a large number of network segments, the network range can be expanded by increasing the depth of the ZigBee path.

*2.1.6. UWB Technology.* UWB communication technology is a non-carrier communication technology that uses pulses with very short intervals (ns-level to microsecond-level) for communication. It has the characteristics of strong anti-

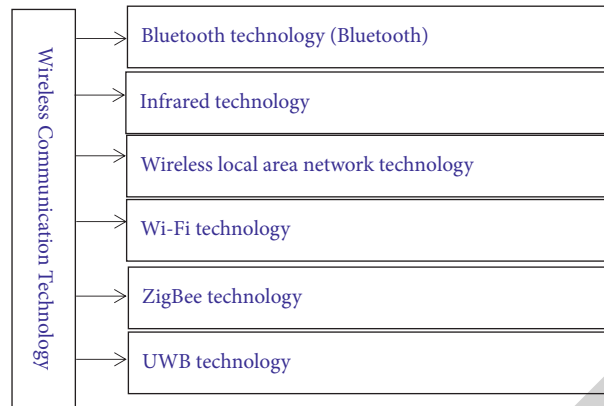


FIGURE 1: The type of wireless communication technology.

interference ability, low power consumption, high bandwidth, and good confidentiality. The transmission rate is very high, up to hundreds of Mbps. The transmission distance is less than 10 m.

**2.2. Overview of Internet of Things Technology.** The Internet of Things is the integration of a large number of mobile devices and receiving devices, including sensors, mobile terminals, industrialized systems, numerically controlled systems, smart furniture gateways, video surveillance, and other points for external network connections. For example, the various components installed by RFID can realize short-distance cloud-based connections through various wireless connections and wired communication networks [14, 15]. Applied to the integration and SaaS functions, the appropriate security protection mechanism is adopted to provide security and provide personalized Internet traceability detection, alarm connection, sending commands, project management, remote control, management Internet upgrades, data reports, decision support, desktop leadership, and other management-oriented service functions to realize an integrated environment of “high-efficiency, energy-saving, and safe management, control, and operation” [16, 17].

**2.2.1. Internet of Things Technology.** Connecting all things through network technology to form a connection between things and the Internet, this is the Internet of Things. For example, integrate sensors into objects such as oil networks, power grids, road networks, water networks, and buildings, and then use the Internet to connect to the Internet of Things.

**2.2.2. Architecture of the Internet of Things.** Perception, interconnection, and then superimposition of intelligence are the hallmarks of the Internet of Things and the value of the Internet of Things. It allows objects to have human “intelligence,” be able to conduct conversations, and then create responsive actions. According to the above description, the Internet of Things can be divided into three parts in terms of architecture.

- (1) The perception part is equivalent to human skin. Identifying “things” mainly includes electronic tags, readers, cameras, and GPS sensors.
- (2) Connection, that is, the network layer, is inseparable from the support of various network standards, through the existing Internet of Things, broadband networks, and other communication networks (including subnets built by ZigBee, GPRS, Bluetooth, and Wi-Fi). To achieve data transmission, the information received from the perception layer is transmitted, distributed, and processed from the network layer [5].
- (3) The intelligent processing part, that is, the application level, is divided into monitoring type, control type, and scanning type according to different application backgrounds. Automated control and intelligent object management utilize various big data technologies and various network algorithms, middleware, and other technologies; this level deeply integrates industry knowledge and industry needs into the Internet of Things to realize industry intelligence.

**2.2.3. Wireless Sensor.** Wireless sensor networks usually consist of three types of nodes

- (1) Sensor node: data collection and reporting to the sink node (Sink node).
- (2) Sink node: responsible for connecting the monitoring network composed of sensor nodes with users and other networks.
- (3) Task management node: to collect the sensor information of the monitoring network collected by the sink node and process and send commands to achieve instructions and operations on the network [6] (Figure 2).

**2.3. Smart Furniture Design.** Smart furniture is to re-construct traditional furniture in terms of structure, craftsmanship, materials, design, etc., and then create new functions based on electronic computer technologies such as

wireless communication technology and Internet of Things technology. The furniture can simulate the intelligent activities of people, and people will collectively call this intelligent furniture. So far, smart furniture is divided into the following three categories (Figure 3).

*2.3.1. Intelligent Electronic Furniture.* The following functions can be realized by using the electronic parts contained in the current furniture: users can use mobile phones and PAD, install APP and other intelligent control software, connect data to the furniture, control the furniture, and realize the functions of playing audio and video, turning on and off.

*2.3.2. Intelligent Mechanical Furniture.* Collection of furniture that incorporates electronic robotic arms and mechanical accessories, such as doors, windows, cabinets that use touch control, and angle adjustments, etc., is done.

*2.3.3. Smart IoT Furniture.* With smart products such as smart TVs and routers as the core, using Wi-Fi and Bluetooth transmission protocols, mobile phones and PAD APP are used to control furniture [18, 19].

## 2.4. The Role of Chinese Traditional Yuan in Furniture Design

*2.4.1. The Concept of Chinese Traditional Elements.* There are many manifestations of traditional Chinese elements, such as painting, music, and opera. It can be written in history books, or it can be passed on through word of mouth. On the basis of the continuous development of society, the concept of Chinese traditional cultural elements also constantly emerges in new categories. Traditional cultural elements that can be used in furniture design include calligraphy, wishful patterns, auspicious clouds, Chinese embroidery, Chinese knots, and other elements [20, 21].

### 2.4.2. Representation of Chinese Traditional Elements

#### (1) Nationalization

The use of Chinese traditional elements in furniture is the inheritance and continuation of traditional elements. By looking for traditional elements and then integrating them into the design of modern furniture, the combination of modern culture and traditional culture is realized, and a modern home design category with both modern and classical flavors is created.

#### (2) Diversification

Furniture styles and traditional symbols are diverse. On the one hand, we understand the connotation of traditional elements and focus on establishing quality and connotation. On the other hand, the combination of advanced foreign design concepts allows traditional Chinese elements to be fully utilized in the design of furniture.

#### (3) Concise

Simplicity is the most effective method, and it is also the most used method. In the process of designing modern furniture, it adds some patterns to our country's classic furniture, making the designed furniture more modern and national. Therefore, simplification and improvement should be made logically to make the pattern simpler and easier to make, and it can also arouse the love of modern people [18, 22].

### 2.4.3. Integration of Chinese Traditional Elements and Furniture Design

#### (1) Combination with wood texture

The Chinese seem to have a natural affinity for wood. Ancient Chinese artisans used extraordinary skills to inject "soul" into it, give full play to its value, and make it full of vitality. Therefore, in Chinese traditional design, whether it is official or private, the wooden structure system occupies a dominant position. In the Chinese traditional furniture design, the statement that the harmony between man and nature is emphasized is to study how to be in harmony with nature, emphasizing the harmonious development of man and nature. In traditional furniture design, the concept of harmonious coexistence between man and nature is very obvious. In addition, the materials of traditional furniture design are very environmentally friendly, of low cost, and easy to use. It clearly reflects the harmonious relationship between man and nature [23, 24] (Table 1).

#### (2) Tenon and tenon structure

Tenon and mortise is a traditional characteristic culture in China and is well-known all over the world. It uses a unique design method, uses wood as a material, and through precise craftsmanship, it is interlocked to create a variety of furniture, showing its unique charm (Table 2) [25, 26].

As a traditional handicraft full of Chinese wisdom, the tenon-and-mortise mechanism is an indispensable skill for ancient craftsmen. The level of craftsmanship can be clearly seen through the structure of the project. It is a traditional Chinese handicraft and a projection of ancient Chinese world outlook and philosophy [27, 28].

#### (3) Moderate culture

Moderate crops are generally symmetrical, and most of them are left-right symmetrical. This idea is widely used in traditional furniture. Round edges without corners, such as Huanghuali Chairs and Roses, are representative of traditional Chinese furniture. In addition, there are more special patterns, such as the dragon chair that only the emperor could sit on in ancient times, and the four masters of plum, orchid, bamboo, and chrysanthemum symbolize integrity and so on. These patterns can make the effect of traditional furniture in the decoration process to a higher level, which is very artistic [29–33].

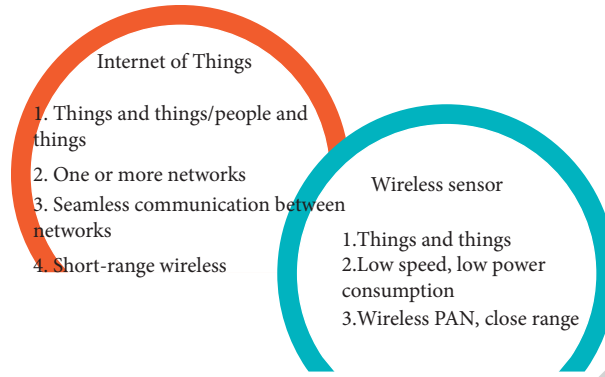


FIGURE 2: The relationship between wireless sensors and the Internet of Things.

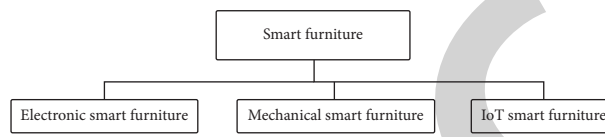


FIGURE 3: Smart furniture design.

TABLE 1: Main material table of traditional furniture.

Wood scientific name	Common name for wood	Family
Sandalwood pterocarpus	Pterocarpus striata	Leguminosae, pterocarpus
Pterocarpus macrocarpa	Caohuali	Leguminosae, pterocarpus
Hedgehog pterocarpus	African yellow pear	Leguminosae, pterocarpus
Pterocarpus	Hainan huanghuali	Leguminosae, pterocarpus
Koshihage	Vietnamese huanghuali	Leguminosae, pterocarpus
Cochin yellow branch	Siamese rosewood	Leguminosae, pterocarpus
Barry dalbergia	Purple rosewood	Leguminosae, pterocarpus

### 3. Smart Home System Based on Internet of Things and Wireless Communication

3.1. *System Demand Analysis.* In the furniture design, an intelligent control system is added to the furniture to facilitate people’s daily life. The entire smart home system must be able to coordinate and control the furniture equipment commonly used in daily life in real time. For example, the intelligent control of the lights is convenient for the use in life, such as automatically turning on and off the lights at a fixed time. Intelligent door and window control and collection of living environment parameters, etc., are to facilitate feedback on the user’s use environment. For example: when the indoor temperature is lower than the set temperature, it will automatically turn on the air conditioner to increase the temperature. When it detects that the room contains toxic and harmful gases or is delayed, it can realize self-alarm and timely remind users. The requirement for the client is easy to operate, with a user-friendly and friendly interface. The test environment is selected to run on the mobile client, the mobile phone used is Redmi K30, and the Android version is 10.0 [34, 35].

3.2. *System Power Control Algorithm.* In wireless communication networks, fair channel interference is the main factor that limits system capacity. Transmission power control, as an effective means to manage cochannel interference, increase channel reuse rate, and increase system capacity, has received widespread attention. As a system for controlling and coordinating various intelligent furniture, the power of the system should be considered when designing, and the optimal distance of the control system in operation should be expected [12].

3.2.1. *Power Control Algorithm Based on Random Approximation.* For the power used by the smart furniture control system, there will be errors in the calculation, and the convergence of the power control algorithm will also change. Based on the above reasons, the algorithm is proposed. The specific formula is as follows:

$$k_{\pi}(\alpha + 1) = [1 - a_{\pi}(1 + \gamma_{\pi})]k_{\pi}(\alpha) + a_{\pi}v_{\pi}(\alpha)\frac{\gamma_{\pi}}{G_{\pi}}. \quad (1)$$

TABLE 2: Some common tenon and tenon structure table.

Common tenon and tenon structure					
Straight tenon	Lattice corner tenon	Round material corner joint	Digging pipe pot tenon	Chuck tenon	Dovetail
Scalloped raglan	Cloud raglan	Traditional heald tenon	Double zongjiao tenon	Dumpling corner tenon with plate	High waist shoulder tenon
Four-sided flat tenon on shoulder	Cylindrical T-shaped joint tenon	Round square combined leg wrap	Cylindrical two-position viding joint tenon	Yuanxiang is stubborn	Save the side slot and install the board
One-leg three-teeth square table structure	Copy hand tenon	Square material angle combined with bed surround to save and connect 4D	The combination of square furniture legs and feet and square support mud	Three straight lumber cross	Jiayunzi waistless leg-wrapping machine stool legs and feet combined with the stool surface
Raglan deformation	Flat mortise and tenon joint	Cabinet bottom	Square timber T-shape combination	Combination of thick plate and tenon	Thick plate out through tenon and tapping head

TABLE 3: Wireless communication technology comparison table.

	Infrared	802.11b	ZigBee	Bluetooth	UWB	SI4432
Transmission medium	Infrared	2.4 G	2.4 G/868 M/915M	2.4 G	Pulse signal	240 M–930 M
Distance (M)	1	90	80	10	10	1000
Rate	16 M	11 M	250 K	721 K	500 M	128 k
Power consumption	Small	Big	Smaller	Bigger	Small	Smaller
Cost	Low	High	Low	Low	High	Low

TABLE 4: ZigBee test data table.

Communication distance M	The number of transmissions	Received	Packet loss rate (%)
10	500	500	0
20	500	500	0
30	500	500	0
40	500	496	0.8
50	500	494	1.2
60	500	485	3
70	500	340	32

In the formula,  $G_\pi$  is the signal gain between mobile station  $\pi$  and the base station that establishes a link with it, and  $v_\pi(\alpha)$  is the SMF output of mobile station  $\pi$  at time  $\alpha$ .

**3.2.2. Power Control Algorithm Based on Received Signal Strength Measurement.** The static power control algorithm can easily obtain a useful estimate of the received signal strength in most systems. Therefore, a series of algorithms are developed around this quantity. The specific formula is as follows:

$$k_\pi(\alpha + 1) = \max \left[ k_{\min}, \min \left( k_{\max}, k_\pi(\alpha) \frac{c_{\text{target}}}{c_\pi(\alpha)} \right) \right]. \quad (2)$$

The received signal strength  $c_\pi(\alpha)$  is output to power  $k_\pi(\alpha)$ , where  $c_{\text{target}}$  is the target carrier power, which is the convergence target of the carrier rate  $c_\pi = k_\pi G_\pi$ , and  $k_{\min}, k_{\max}$  are the lower limit and upper limit of the output power, respectively.

## 4. Data Experiment of Smart Furniture System Based on Wireless Communication Technology

**4.1. The Choice of Wireless Communication Technology.** Calculate the power and applicability of the wireless communication technology according to the above formula, analyze and compare the above several wireless communication technologies, and combine the research and analysis of the smart home. The specific information is shown in Table 3. This article adopts ZigBee technology to build the network inside the smart home [36].

**4.2. ZigBee Technology Test.** In this test, by counting the number of successfully received data at different distances, the packet loss rate of ZigBee communication is finally calculated (Table 4) [37].

As shown in Figure 4, the data obtained through this test shows that when using ZigBee technology, as long as the distance is less than 30 M, the packet loss rate is 0, but once it



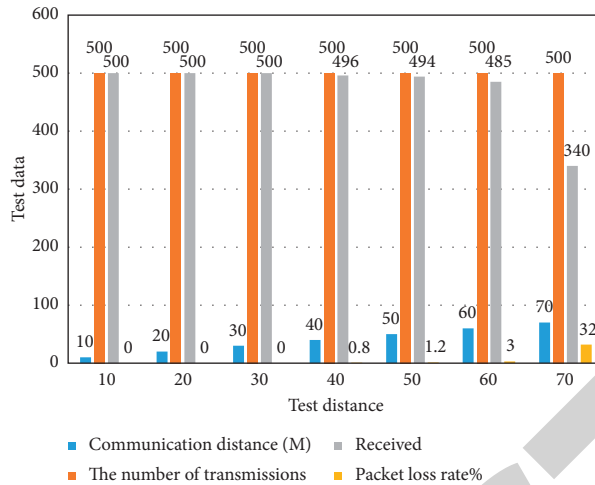


FIGURE 4: Test result graph.

TABLE 5: Indoor environment perception test table.

Temperature value (°C)	Thermometer value	Difference	Humidity value (%)	Hygrometer value	Difference
10	10.18	0.18	30	30.29	0.29
14	14.29	0.29	34	34.53	0.53
18	18.13	0.13	38	38.57	0.57
22	22.48	0.48	42	42.59	0.59
26	26.23	0.23	46	46.77	0.77

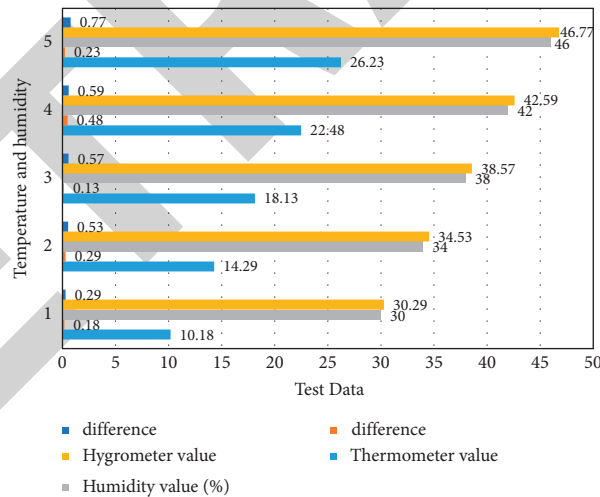


FIGURE 5: Indoor environment detection map.

exceeds 30 M and reaches a distance of 40 M and above, packet loss begins. When the distance reached 70 M, the packet loss rate reached 32%.

4.3. Perception of Furniture Control System. As shown in Table 5, as an intelligent furniture control system, it needs to periodically detect the indoor environment and then choose to turn on or turn off the corresponding intelligent furniture according to the indoor temperature, humidity, and various

conditions [38]. For example, when the user is sleeping, it will automatically turn on the air conditioner when it detects smoke or poisonous gas and promptly remind the user to issue an alarm.

As shown in Figure 5, five sets of data were measured in this experiment. The error value of temperature is less than 0.5, indicating that the accuracy of temperature detection is higher. The humidity test values are mostly between 0.3% and 0.8%, which also has a certain degree of reliability.



## 5. Conclusions

This article describes the breadth and depth of Chinese culture from the perspective of the source of Chinese traditional elements and cultural background, and then from the perspective of the development of the times, the combination of furniture and modern wireless communication technology and Internet technology has become the smart furniture collectively called by modern people. Then, from the perspective of the influence of Chinese traditional elements in furniture design, the position of Chinese mortise and tenon structure and wood in Chinese furniture design is described. This research not only provides realistic cases for the application of traditional cultural elements and makes furniture design more in line with the development trend of the times, but also opens up new ideas for the integration of wireless communication with people's daily life and facilitates the lives of the people.

## Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Acknowledgments

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