

## Design and Realization of Intelligent Furniture based on Modern High-tech

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**Abstract:** With the arrival of intelligent age, human society will develop in the direction of intelligent, modern furniture is also accompanied by intelligent buildings, intelligent home gradually toward intelligent development. This paper discusses the necessity of intelligent furniture. Intelligent furniture is a kind of modern multi-functional furniture, is one of the development trend of modern multi-functional furniture, but also from the development of intelligent building to intelligent home, the inevitable requirement to realize intelligent home. This paper classifies intelligent furniture products, summarizes the ways and methods of intelligent furniture, and summarizes the basic principles of intelligent furniture product design. On the basis of studying the concept of product family, this paper defines the concept of intelligent furniture product family and constructs the intelligent furniture product family from the perspective of functional analysis, which serves for modular design and mass customization production and lays a foundation for the realization of intelligent furniture system.

### 1. Development of modern multi-functional furniture

#### 1.1 Characteristics and styles of modern furniture

Modern furniture reflects modern people's lifestyle, modern technology, materials and economic characteristics, adapt to modern people's physiological and psychological conditions, adapt to modern people's living habits, indoor environment, etc., meet modern people's aesthetic needs. Modern furniture is a broad, changing concept that develops continuously as The Times. Modern furniture has the following characteristics:

##### (1) Universality of furniture use

Since ancient times, furniture has been widely used. All activities of people are related to furniture, such as desk and office chair for work, desk and chair for study, Table and dining chair for people to communicate with others, sofa and bed for rest. With the development of history, the progress of science and technology, and the changes of people's life style, the development of furniture has not been stagnant. [1] New types of furniture, such as children's furniture, SOFO office furniture, multi-functional furniture, etc., are constantly emerging, meeting the needs of different user groups with different functional characteristics.

##### (2) Duality of furniture functions

The dualism of furniture function is to point to material and artistic two respects, the use function of corresponding product and mental function. Furniture is a kind of material existence above all, it is a kind of product, it is the indispensable appliance in people's life. Usually products will pursue spiritual pleasure after meeting the use needs, and art is to meet people's spiritual needs. In today's extremely rich material to design furniture as art creation, can design a popular furniture works.

##### (3) Sociality of furniture

From the history of furniture development, it can be seen that the development of society promotes the development of furniture, and in turn, furniture can reflect the development of society, which is the sociality of furniture. The design style of furniture reflects the cultural characteristics

of The Times, the production level of furniture reflects the development level of social productivity, and the use and purchase amount of furniture reflects the social lifestyle.

Modernism, as a design trend and concept, as a design school, refers to the “modernism” that emphasizes rationalism and functionalism in the design history from the early 20th century to the mid-1960s. Modernism fundamentally changed the traditional design and formed the design style of modernism. Modernism opened the door of modern design, the modern style of furniture also begins popularity subsequently.

## **1.2 Characteristics and development direction of modern multi-functional furniture**

Multifunctional furniture is a kind of furniture form that realizes other reasonable new functions on the basis of the basic functions of the furniture itself, which is a redesign of the furniture.

Multi-functional furniture can be divided into two categories: monomer multi-functional furniture with “one thing and multiple functions” and multi-functional combination furniture with “multiple things and super functions”.

### **(1) Monomer multi-functional furniture**

Monomer multi-functional furniture is a kind of modern furniture products which have the basic functions of traditional furniture and are similar to traditional furniture in shape. [2] Be like malfunction sofa, the function that it increased deck chair on the foundation of common sofa can sit, can lie, the change of two kinds of configuration needs to press the black button of side only can realize, this kind of product has been opposite on market general, some still can swing before and after like rocking chair.

### **(2) Multi-functional combination furniture**

Multi-functional combination furniture is a kind of modern furniture product with different spatial forms, which forms new functions through some functional monomers and changes in the combination of using functions or shapes.

At present, people's communication mostly relies on the network to achieve by mobile phone or computer, and a variety of chat tools also make communication more convenient. A large number of mobile phone control, micro blog control, network has become a material existence that modern people cannot do without.

Product designer of Jerusalem Naom FASS design electronic seat system in order to meet the demand of modern people to the network real-time, set up in every component of a module of USB interface to connect to the Internet, can be easily connected with laptops, Tablets and phones, also can achieve a variety of combination way, according to the requirements of individual users can be very comfortable to lay, recumbent, sitting posture on the Internet.

Modern multi-functional furniture has the following features:

#### **(1) Space saving**

Multi-functional furniture sets a variety of functions in one, with a small space area, easy to achieve functional conversion, so that the space has flexibility, there is a strong practicality, especially for small and medium-sized family to release more space is conducive to improve the flexibility of space utilization. [3]

#### **(2) Novel style**

Most of the multi-functional furniture modeling is simple, novel and unique, in line with the modern young consumer groups seeking new and different, emphasis on self, emphasis on individual aesthetic needs.

#### **(3) Easy to use**

When the function of multifunction furniture is designed, the rationality that considered functional collocation, harmonious sex, satisfy the convenient sex that people USES. The convenience of use is also reflected in the convenience of moving, convenient to change the form, change as needed, the change of form does not need too much effort, general ladies can easily assemble and use.

Modern multi-functional furniture towards two directions: one is the direction of exquisite, the miniaturization, to meet the high house prices under pressure to the needs of the growing number of

medium and small family, small and medium-sized family relative area is lesser, spatial resources nervous, but the life of people with the same requirements, through this kind of multi-function medium to meet. Second, it is developing towards the direction of intelligence. With the continuous progress of science and technology, intelligent furniture can not only meet people's special functional needs for furniture, but also meet people's diverse needs for indoor space of medium and small houses. Smart furniture will make great progress in the future and lead a brand new way of life.

## **2. Approaches and design principles of intelligent modern furniture**

### **2.1 Types of furniture intelligence**

Intelligent furniture is on the basis of modern furniture, use of modern science and technology, the traditional furniture function extension, under the premise of without changing the original basic functions, the machine intelligence, electronic intelligence and physical union intelligence, spatial intelligence at a reasonable and feasible way and the furniture products, has the related intelligence ability of furniture products.

According to the working mode or the level of intellectualization, intelligent furniture is divided into intelligent furniture of mechanical intelligence, electronic intelligence, intelligent of things, intelligent of space and other intelligent types.

#### **(1) Mechanical intelligence**

Mechanical intelligence refers to the integration of mechanical and electrical devices with induction devices and the main body of furniture. [4] When the external changes are perceived, the mechanical part automatically realizes the change of furniture form and functional transformation. In other words, the realization of furniture intelligence is mainly played by the mechanical part.

#### **(2) Electronic intelligence**

Electronic intelligence refers to the electronic science and technology products, new technology into furniture, can be realized with mobile phones, Tablets and other intelligent terminal for data transmission, video playback, can also be achieved by induction other auxiliary functions, easy opening and closing of furniture can also be combined with mechanical intelligent furniture easily change its own form.

#### **(3) Intelligent association of things**

Connect smart furniture with smart terminal phones and Tablets through the network, which can carry out data exchange, data transmission, video and audio playback, and realize functional control of indoor smart furniture through application software installed by smart terminals. Remote control can be realized through the intelligent of the association of things, realizing the network operation of things. Intelligent furniture can also be integrated into other intelligent home systems and can work together with other systems.

#### **(4) Spatial intelligence**

Spatial intelligence, also known as combination intelligence, refers to the different combination of intelligent furniture products can break through the limitations of indoor space and easily change the existing indoor living space. On the one hand, the spatial intelligence of intelligent furniture products can better meet the real-time changing needs of families and individuals for space; on the other hand, it can skillfully use corners and hidden Spaces, and even change the spatial structure of the building itself to meet various needs in limited space.

### **2.2 Ways and methods of furniture intellectualization**

At present, the realization of intelligent products and systems relies on the development and progress of intelligent devices, control systems, big data and new materials. Intelligent furniture also relies on the introduction of intelligent technology and the application of intelligent materials and equipment in furniture products.

#### **(1) Introduction of automatic sensing technology**

Automatic sensing technology is the basis of the Internet of things, which can monitor, perceive and collect information of various environments or monitoring objects in real time, so as to realize

the perception of information in the external world. Sensor is the main device of the sensing layer of the Internet of things, and it is the only means and way to obtain information in the Internet of things. The accuracy, reliability and real-time information collected by sensor will directly affect the processing and transmission of information by the control node. The thermal, reliability, real-time and anti-interference performance of sensors play a decisive role in the performance of the Internet of things application system.

#### (2) Introduction of automation technology

Automation (Automation) refers to the process of automatic detection, information processing, analysis and judgment, manipulation and control of machinery and equipment or systems in the absence of manual labor to achieve the expected goals. Automation technology has been widely used in industry, agriculture, military, commercial and other fields, in production and life have been excellent performance. Civilized human can get rid of heavy manual labor through automatic technology, expand the function of human organs and rescue people from extensive and monotonous working mode, thus greatly improving labor productivity. Automatic equipment can replace people to work in harsh and dangerous environment, avoiding casualties. [5] Automatic equipment can also replace part of the human brain work, simulation of human thinking for decision-making.

#### (3) Introduction of information technology

Informationization is the modern communication, network, database technology as the foundation, summarize all the elements for the research object to the database, for certain people live, work, study and auxiliary decision-making, etc. and all kinds of behavior of human is closely linked with the combination of a technology, using the technology, can greatly improve the efficiency of all kinds of behavior, to promote the progress of human society provides great technical support.

### **3. Systematic design research of intelligent furniture products**

#### **3.1 Physical system and its design method**

The entity system includes the intelligent furniture of various functional types in the home environment, which is the spatial basis of realizing the intelligent furniture system.

The entity system of intelligent furniture is composed of multiple intelligent furniture. In order to make the style of indoor furniture consistent, make reasonable use of space and avoid repetition of functions, the following two design methods are mainly adopted.

##### (1) Combined design method

Combination design refers to the combination of two aspects. On the one hand, it refers to the combination of functions. Each intelligent furniture in the intelligent furniture system has its own independent functions. Combination, on the other hand refers to the space for the rationality of the use of space, free to separation and combination, can make intelligent furniture system can achieve good matching with many kinds of model environment, also in order to satisfy the users of space division, combination of participation, intelligent furniture system of multiple intelligence in furniture monomer can be designed according to uniform modulus, achieve any combination between monomer, this is a reasonable and effective design method.

The combined design should pay attention to keep the individual furniture in the system unified in shape, color and style, with unified visual effect.

##### (2) Intensive design method

Intensive design is a common design method of modern product design and an important method of multi-functional furniture design. Intensive design of intelligent furniture system lies in the induction and overall planning of intelligent monomers in the system. Through intensive design, they become unified and orderly. The realization of network and automation of intelligent furniture system requires wiring and installation of electronic components and mechanical transmission devices inside each intelligent furniture monomer, so there is a need for consolidation and intensification inside each monomer. The purpose of intensive design of intelligent furniture system

is to make it easy to use and move.

### **3.2 Network system and Internet of things**

The network system is a network that connects individual furniture products in the product system, so as to realize the interconnection and interworking among furniture monomers, as well as the overall unified control and integrated management of them. Nowadays, smart home technology is popular and relatively mature technology is the Internet of things technology, now it is applied to intelligent furniture system to achieve information exchange and remote control.

The Internet of things is a new kind of dynamic network that enables people (through PC and non-pc), people and things, and things to things. Now more generally accepted definition of the Internet of things is: “through the radio frequency identification (RFID), infrared sensors, global positioning system (GPS), such as the laser scanner information sensing device, according to the contract agreement, connect any item with the Internet, information exchange and communication, in order to realize intelligent identification, location, tracking and monitoring and management of a network”.

In layman's terms, the web will give objects intelligence, through devices such as sensors, electronic tags and global positioning systems that are attached to them. The application covering the range of small to home network, big to industrial control systems, intelligent transportation systems, and even national and world-class applications, this cover is not content with the content of simple connected, but to create a lot with “computing, communication, control, coordination and autonomy” characteristics of intelligent equipment and intelligent information system. The goal of the Internet of things is to help people have a “thorough perception of the physical world, a comprehensive capacity for office and intelligent processing capacity.”

### **3.3 Application system and its design method**

Application system mainly refers to the application program installed in the intelligent network terminal, which realizes the interaction between human and system through the corresponding interface. It is also an operating system for intelligent furniture system. The design purpose of the application system is to make people have a good use experience, and easy to learn, easy to use. The design of the application system mainly considers the following two aspects:

#### **(1) Interaction design method**

Interaction design is “a series of conversations created between people and products or services. This dialogue is both physical and emotional, embodied over time in the interaction between form, function and technology. Interaction design is people-oriented, focusing on people's needs and experiences. [6] The purpose of interaction design is to establish an organic relationship between the product and its users, so as to effectively achieve the users' goals. For the application system of intelligent furniture system, it is the dialogue between the creator of intelligent terminal and a series of indoor intelligent furniture. This dialogue needs to be implemented through the design of the interface.

The advantage of interaction design is that the design method focuses on the research and analysis of user behavior, and is good at capturing continuous and complex behaviors that change over time. Interaction design adopts the method of system theory, which is good at grasping the whole design according to the specific environment (Context) of the product in the external world.

Interaction design includes two aspects: one is human-computer interaction, the other is interpersonal interaction. Human-computer interaction design is a kind of how to make the product easy to use, effective and enjoyable technology, it aims to understand the target users and their expectations, to understand each other's behavior when users interact with the product, understand the psychological and behavior characteristics of the “people” in itself, at the same time, also includes information on the full range of effective interaction, and to strengthen and expand them. Interpersonal interaction is to use the relationship between products and environment to create interactive scenes jointly constructed by users, products and others, and to promote communication and communication between people. Based on this, Winograd and Saffer defined interaction design as “the design of human communication and interactive space”.

## (2) Interactive interface design

Interactive interface is the display interface of application software installed in intelligent terminal, through which people interact with the system.

The interactive research of intelligent furniture application system focuses on the feedback research of human use behavior and interior space change. User model to refer to mental model, the overall understanding of the many people have living space through the floor plan, because plan can intuitively reflect the indoor space structure, so on the basis of the indoor floor plan to build the user model is the best choice, not only in line with people's psychological model, through the plan more can understand the location information, to indoor intelligent furniture to decorate.

Interactive interface design should follow the principle of simple and easy to use, to understand and follow the product concept, on the basis of reference to mental models and interaction intents for visual design, pay attention to in the design of concise interface information, menu layout is reasonable logic clear, accomplish interface design be clear at a glance, easy to operate and use, get a pleasant user experience.

## 4. Summary

In order to realize the flexibility and changeability of indoor space pattern of living environment, intelligent furniture system objectively requires the design and production to meet individual customization. The significance of building intelligent furniture product family is to realize modular design and mass customization production more easily and fundamentally meet this demand. Current although most intelligent furniture for high-end customers, the price is expensive, but the pursuit of high quality life demand will promote the development of intelligent furniture industry, believe in the near future, intelligent furniture system will become a kind of fashion, a trend with the reduction of costs in the future are expected to enter the ordinary people, bring us a new way of life.

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