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RESEARCH ARTICLE
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Optimizing Space and Connectivity in Kitchen Environments for Rental Properties Leveraging Wireless Network Design

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Abstract

The design of kitchen environment space and connectivity has become a focus of attention in rental properties, and the improvement and enhancement of its environment are crucial for the user's living experience. The article analyzes the current situation and influencing factors of the kitchen environment in rental properties and summarizes the important role of wireless internet technology in optimizing kitchen environment design. It proposes design optimization measures for the space and connectivity of the kitchen environment in rental properties. Two different multi-functional integrated kitchen intelligent products are designed. Through the network connectivity and timely remote transmission of information among various functions of the product, it further promotes the optimization and improvement of the kitchen environment, solves the problems of narrow space and insufficient connectivity faced by rental property kitchens, and provides theoretical guidance for the optimization design of space and connectivity in rental property kitchen environments.

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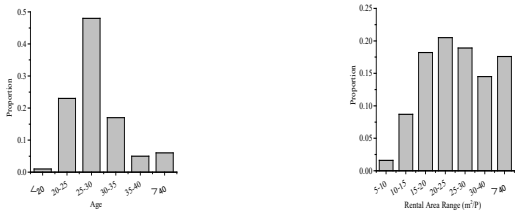
Introduction

With modern society's continuous progress and development, more and more young people choose economically developed cities for employment and life after graduation, which has formed a trend. However, the simple rental property environment cannot meet the continuous improvement of contemporary youth's pursuit of quality of life. At the same time, the continuous progress of wireless internet technology and network communication technology has promoted the continuous deepening of the integration of intelligent technology and home equipment, enabling integrated design and remote control of various home equipment functions, significantly solving the problem of narrow kitchen environment space and connectivity between main equipment functions in rental properties.[1-3] In modern society, rental property services provide great convenience to young tenants' lives and work to a certain extent. In contrast, leasing services can enable asset owners to earn more income by renting their apartments, cars, or time. Currently, the rise of leasing service platforms is accelerating, providing strong support for using idle resources for individuals, increasing the opportunity for recycling, and reducing their asset management costs.[4-5] The large population is China's primary human resource and economic development foundation, and many young people will choose to integrate into urban development in the process of urbanization, which further provides essential support for the sustainable development of rental properties. Through a survey on the age and rental area of urban tenants, it can be found that the proportion of young people under 30 years old among tenants is about 72%; for the per capita rental area, it is mainly concentrated in the range of 15-30 m^2/p, accounting for about 58%

[6]. The specific data is shown in Figure 1. In addition, the function of the kitchen is essential in the per capita rental area, and it is one of the critical factors that tenants must consider.



a. Area Distribution of Young People Renting Houses

b. Age Distribution of Young People Renting Houses

Figure 1. Age and Rental Area of Young People Renting Houses

The rental group is usually students who have entered society or young people who work in different places. Due to economic constraints, most of these people choose to rent affordable single apartments or share them with others, and the kitchen as a supporting environment for housing is also an essential part. However, currently, the rental community is paying more attention to improving the utilization of limited space environment in the kitchen of rental properties, and ensuring the quality of their own kitchen life has also become an essential consideration for the rental community.[7] Faced with the continuous updates of wireless internet technology and limited by the relatively small kitchen environment space of rental properties, more rental groups attach greater importance to the quality of the environment and the connectivity of kitchen equipment based on wireless internet.[8] Therefore, applying wireless internet technology to the design and connectivity of kitchen environment spaces in rental properties can better meet the requirements of the rental community for kitchen environmental quality. Improving the environmental space of rental property kitchens from the user experience perspective, combined with the actual needs of modern young people's rental environment, can enable people to enjoy the fun of cooking in their daily lives. In addition, the deepening application of Internet technology in the kitchen environment can further improve the optimization and intelligence of kitchen space.[9-12]

Based on this, this article combines the application of wireless internet technology and focuses on the kitchen usage needs of the rental community. Combined with the use of network communication technology, it optimizes and improves the design of the kitchen environment space and connectivity for current rental properties. Through research and analysis of the kitchen environment space and connectivity of rental properties, combined with the characteristics of the rental community and the implementation of intelligent kitchen communication network, a multifunctional integrated kitchen intelligent product based on wireless internet technology was designed, which integrates the implementation functions of the leading kitchen equipment and can achieve wireless communication control between multiple functions of the product, greatly improving the problems of limited space and insufficient equipment connectivity in the kitchen environment of rental properties, laying the foundation for the implementation of wireless interconnection and remote access functions of the product.

Current Situation and Influencing Factors of Kitchen Environment in Rental Properties

Analysis of the Current Situation of Kitchen Environment in Rental Properties

In modern society, young people's pursuit of kitchen functionality is not limited to traditional cooking but also further extends the function of the kitchen as an essential component of life. However, rental groups are often limited by the rental area, which restricts the realization of kitchen extension functions.[13-14] In common rental properties, the environmental space of the kitchen is relatively small, as shown in Figure 2, which shows the environmental space of the kitchen in the rental property. Especially for young people working in different places, due to the limitation of rental space, it is a place to showcase a new way of life beyond work and living time, extending the function of the kitchen into a way of life. Although young people face life and work problems nowadays, they still prefer to cook food. Therefore, even for rental property kitchens, rental groups prefer a more suitable spatial environment for the rented kitchen, which can achieve a more convenient and efficient cooking process. Therefore, the ability to clean the kitchen more quickly and improve the intelligence level of the rented kitchen environment space after cooking is of more significant concern. However, wireless internet technology has not achieved more integration in the network communication interconnection between the kitchen environment space and terminal devices.[15]

The rise of information technologies such as cloud computing and the wireless Internet of Things has driven the continuous development of kitchen equipment towards a more high-end and intelligent direction. More kitchen equipment has shown a trend of multifunctional

Fig. 2: Narrow Kitchen Space of Rental Properties

integration or integration, which significantly promotes the relatively narrow kitchen area and connectivity of rental properties.[16] Faced with increasingly strong user demand, manufacturers have launched various innovative home products based on information technology, such as wireless interconnection. A series of intelligent device products appearing in the kitchen and home furnishing market have yet to achieve a deep integration of their own functions and intelligence level. They only add basic modules such as sensors, Bluetooth, or wireless transmission to the existing products and connect them with the application of terminal devices based on communication network technology, thereby meeting the needs of users to control kitchen equipment through terminal devices, unable to improve the spatial utilization efficiency and connectivity of the kitchen environment, and did not truly achieve the level of intelligence in the kitchen.[17-18]

Factors Affecting the Kitchen Environment of Rental Properties

Quality of Kitchen Space Design

Although there are specific differences in design requirements from home kitchens, the basic requirements for the environmental space design of rental property kitchens need to be based on meeting the safety needs of users while also taking into account other needs of users and continuously improving the quality of the environmental space and connectivity design of rental property kitchens around the needs of users.[19-21]

For the environmental design of rental property kitchens, it is necessary to reasonably and scientifically arrange local lighting based on user needs and select appropriate ventilation equipment according to user needs. The humanistic environment design of the kitchen measures the needs of different users in terms of color, material, greenery, and furnishings. It reflects the wide adaptability of the kitchen based on different physiological characteristics [22]. Advocate for the comfort, indication, and decorative functions of colors; advocate for the safe use of materials, clear reminders, and guiding functions. Advocate for simplifying and rationalizing greenery and furnishings, develop interests and hobbies, and enhance spiritual enjoyment in line with the emotional principles of universal kitchen design. In addition, the intelligent environment design of rental property kitchens also needs to consider the interests and hobbies of different users and meet their psychological needs.[23-24] As shown in Table 1, the basic parameters for different kitchen space layout forms and space design requirements are provided.

Table 1: Types and Env ironmental Space Distribution of Kitchen in Rental Properties

Type and Spatial Distribution		Characteristics and Related Parameters
Kitchen type		Single column-shaped, double column-shaped, L-shaped, U-shaped, and annular island-shaped ensure a large operating and activity space.
Space distribution	Floor cabinet	Height 80~85cm, depth 60~65cm
	Wall cabinet	Height 50~60cm, depth 30~45cm
	Hallway	Consider using multiple people simultaneously, no less than 150cm.

In the rental property, the kitchen is a complex system space that integrates multiple functions such as food storage, food preparation and processing, cooking and baking, kitchen utensils storage, and dining. As a necessary space for users' home activities, the kitchen gradually transforms into an intelligent, comfortable space that integrates multiple functions and technologies. The kitchen behavior of users is closely related to the kitchen space. If the kitchen layout is messy and the space is crowded, it cannot meet users' higher-level needs and experiences. In the context of renting kitchen space, if the space limits the user's kitchen activities, it will lead to significant limitations in the kitchen environment space and connectivity functions, unable to meet the diverse needs of users, and even unable to achieve the essential functions of the kitchen. This is also one of the essential factors that cause the low utilization rate of the kitchen.[25] Therefore, the design quality of the kitchen environment space of the rental

property determines the user experience of the kitchen and is also a fundamental condition for the kitchen to perform its functions. Improving the design of the kitchen environment space to create a clean and tidy environment, reasonable space design arrangement, and simple and comfortable kitchen use is the goal of improving the space design quality of the rental property kitchen.

On the vertical spatial scale of the kitchen environment space, ensuring that all kitchen operations are completed with a natural and relaxed body posture as much as possible is necessary. Using the percentile calculation method of ergonomics, determine the most suitable scale for different users as much as possible, and achieve universality in terms of usage scale.[26] For excessively high spaces, a pull-down or elevated method is used to solve the problem, improving usage ability; in low spaces, the pressure caused by excessively curved body movements can be reduced through pull-out methods.

The standard distribution of kitchen space in rental properties is divided into four regional spaces according to their functions.[27] The primary function of the cooking space is to carry out cooking-related operations after the preparation work is completed. The primary function of the washing space is to make sufficient preparations before cooking, including the supply system of cold and hot water, drainage equipment, washing basins, washing cabinets, etc. For storage space, its primary functions are food storage and utensil storage. Food storage can be divided into refrigerated and non-refrigerated storage, and refrigeration is achieved through refrigerators, freezers, etc., in the kitchen. Storage of utensils and supplies provides storage space for tableware, cooking utensils, etc. In addition, the dining space is also a critical component of the rental property kitchen, which mainly serves as a dining area and can also be considered a part of the leisure area. As shown in Table 2, the essential usage functions of different areas have been summarized based on the functional division of each area in the kitchen environment space of the rental property

Application Level of Kitchen Intelligence

The development of intelligent technology has laid the foundation for the improvement of the design of kitchen environment space and connectivity intelligence in rental properties, and the selection of technical means that can be integrated into the intelligent system of the kitchen is more diverse. The existing wireless internet technology is the foundation for implementing innovative kitchens in rental properties. Sensors related to bright kitchens include gravity sensing, infrared sensing, thermal sensing, and temperature sensing. Wireless technologies related to intelligent kitchens include Wife, Bluetooth, Zigbee, and RFID.[28] In addition, the "Internet of Things" of intelligent kitchens connects kitchen smart appliances, achieving information sharing among various devices, and has a unified monitoring management and operating system. Its purpose is to utilize various information sensing devices to connect with the huge Internet network system, thereby forming remote control based on network communication. The intelligent kitchen IoT technology is divided into perception, network, and application. The perception layer task is identifying objects, obtaining, and transmitting. It consists of sensors, GPRS modules, cameras, and sensor gateways. The network layer assists in calculating, analyzing, and controlling information, including the Internet, cloud service platforms, mobile communication, and information center networks. The application layer performs information transmission tasks to achieve intelligent applications of the Internet of Things, mainly including various intelligent kitchen devices.

The intelligent kitchen products on the market require users to issue instructions through smartphone apps, and this network communication function can only be referred to as a single automated product, which

Table 2. Functional Characteristics of Kitchen in Rental Properties

Functional Zoning	Functional Characteristics of Kitchen in Rental Properties
Washing area	Mainly in the form of double pots, multiple faucets are convenient for multiple people to use at the same time.
Cooking area	The multi-range stove is convenient for many people to use, and the Kitchen hood needs to consider the strong suction function.
Raw material preparation area	Consider sufficient operating space for multiple people and communication methods between users.
Storage area	Preset shared storage space, while also considering individual independent storage space.
Electrical equipment area	Individual control mode for personal behavior habits and taste characteristics.

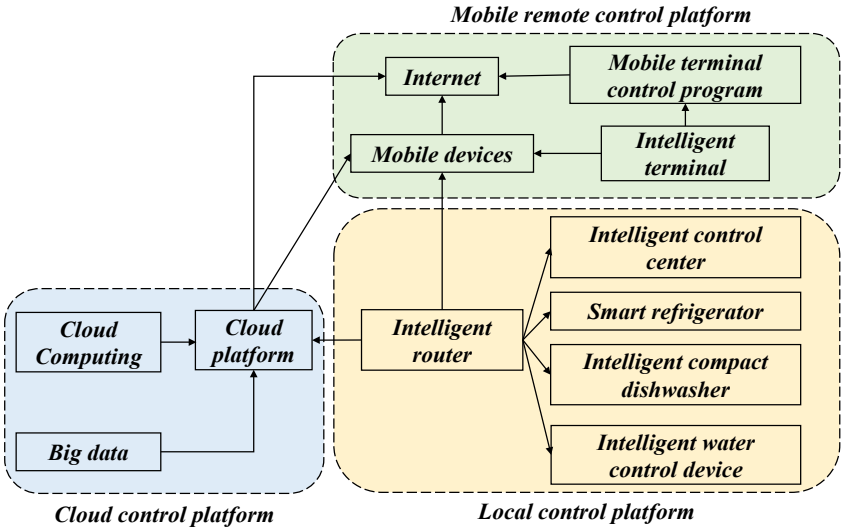


Fig. 3: Schematic Diagram of Network Information Communication for Kitchen Environmental Control System

cannot achieve intelligent connectivity of kitchen equipment. Furthermore, wireless internet technology can intelligently analyze user behavior, usage group characteristics, and operational history data, predict in advance, and provide timely reminders or assistance to users in making judgments, making kitchen products more intelligent.[29-30] Therefore, network communication based on wireless interconnection technology can achieve more intelligent information transmission, achieve remote user interaction, and quickly provide continuous operation and interaction.

As shown in Figure 3, three different dimensions of wireless internet technology network communication commonly used in kitchens are presented. At the local control level, it is mainly controlled by intelligent routers, including intelligent control centers, intelligent refrigerator equipment, intelligent dishwashing, and intelligent water control equipment. The operation control platform level mainly includes cloud computing, cloud platform, and extensive data collection and analysis, which are core links in the whole control system. In addition, mobile remote-control platforms mainly include content such as the Internet, mobile devices, intelligent terminals, and related control programs. Users can remotely interact and control relevant devices in the system by operating terminal devices, playing a role in remote communication input and reading.

Optimization of Kitchen Environment for Rental Property Under Wireless Internet

Application of Wireless Internet in Rental Property Kitchen

The application of wireless internet in kitchens began to gradually emerge in the early 21st century, with the concept of not only optimizing the operation process of kitchens but also reasonably dividing functional areas and meeting different human-computer interaction needs. At the same time, the concept of a dynamic space intelligent kitchen has gradually become popular, with optimized workflow, maximum utilization of space, and sports comfort. Through electric and intelligent accessories, personalized kitchen dimensions, functional allocation of space, and kitchen operation methods can be designed according to user needs.[31]

With the continuous development of modern society, the functional improvement and intelligence of rental property kitchens have gradually become a focus of attention for young rental groups and have further promoted the application of wireless internet technology in rental property kitchens, allowing intelligent methods to enter the kitchen gradually. Intelligent kitchens pay more attention to the intelligence of kitchen electrical products, allowing kitchen equipment to be controlled through mobile clients, including remote control requirements for related devices. Therefore, the application of wireless internet technology in the kitchen environment of rental properties emphasizes the kitchen's functionality and efficiency and product personality and interaction with users. The purpose of wireless internet technology in the design of rental property kitchen systems is to improve the efficiency of kitchen use and the interaction between users and cabinets by creating spatial and interactive order and meeting the diverse communication methods between users.[32-33]

Based on the characteristics and habits of the rental community, in optimizing the spatial design and

connectivity of the kitchen environment in rental properties, it is necessary to transmit information to enable each kitchen facility to perform specific behaviors to meet user needs. From the perspective of information transmission, firstly, each kitchen facility perceives changes and then transmits the information to the kitchen system control platform from bottom to top. Then, the kitchen system control platform combines cloud data and local data and, after thinking and judgment, conveys specific execution commands and related information to each kitchen facility from top to bottom. The kitchen system appears as a receiving point for the kitchen needs of the rental group. Figure 4 shows the basic process of deepening the application of wireless internet technology in kitchen environment design improvement.

Fig. 4: Network Communication Operation Mechanism of Kitchen System

Optimization of Kitchen Environment Design for Rental Properties Based on Wireless Internet

Optimization of Kitchen Environmental Space in Rental Properties

The primary purpose of optimizing and improving the kitchen environmental space of rental properties is to lay the foundation for the realization of kitchen functions while meeting the diverse needs of the rental community for kitchen environmental space. The optimization of the kitchen environment space for rental properties is mainly aimed at dividing different spatial areas. In different functional zones, the characteristics of each zone need to fully utilize wireless internet technology to reflect the functional concept of rental property kitchens.[34]

Faced with the problem of relatively small kitchen areas in rental properties, the design optimization of their environmental space needs to be combined with the application of wireless internet technology to integrate different devices into multifunctional and compact devices while further improving the connectivity between devices and users, meeting the intelligent requirements of wireless interconnection. As shown in Figure 5, integrating wireless internet technology and kitchen environment spatial design optimization provides the design variables that need to be controlled during the optimization process.

It can be seen from the figure that, based on the starting point of functional derivation, the design focus mainly includes four parts, namely intelligent appliances, Functional requirements, product appearance design, and storage requirements. Among them, for the intelligent electrical part, the primary considerations include voice interaction, intelligent temperature, and fire control, and the convenience of operation; In the part of Functional requirements, it is mainly combined with less oil smoke, clean and convenient, no potential safety hazards and low energy consumption; The design considerations for product appearance include low volume, high cost-effectiveness, complete functionality, and a modern aesthetic appearance; The storage function is the most critical essential function, which mainly includes the division of storage areas, multifunctional storage properties, and independent storage space. The coordination and unity between various parts of the design constitute the product's basic design plan.

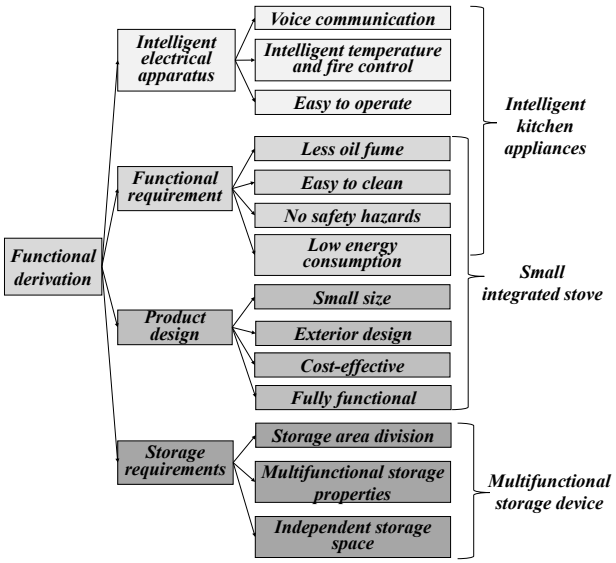


Fig. 5:. Basic Ideas for Product Design and 5

In the design optimization process, the factors that need to be considered in combination with the impact of the product on the optimization of kitchen space mainly include four aspects:

1. Functional requirements include no potential safety hazards, easy cleaning, and low energy consumption.

2. There are storage requirements that need to consider the integration of multiple storage attributes, the division and integration of storage areas, and the design of independent storage spaces.

3. Then there is the intelligence of kitchen equipment, which needs to achieve voice interaction, easy operation, and intelligent control.

4. Based on implementing the above essential elements, a comprehensive optimization consideration will be given to optimizing the kitchen environment space of rental properties and integrating and enhancing multi-functional intelligent products to continuously improve the kitchen environment space.

The functional zoning of rental property kitchens has the same functions as ordinary kitchens but often faces significant constraints in terms of environmental space. Due to the everyday use of rental groups, the kitchen of rental properties often requires two or more cooking areas, along with traditional washing areas, cooking areas, vegetable preparation areas, storage areas, and kitchen electrical products. Therefore, considering the usage functions of different areas, the layout of their environment is generally determined by the spatial size and pattern of rental property kitchens. Common primary forms include single column-shaped, column-shaped, L-shaped, U-shaped, and annular island-shaped. The space and connectivity have been further optimized and improved by analyzing common spatial layout structures in kitchen environments, combined with the application of wireless internet technology. As shown in Figure 6, some typical layout forms for optimizing kitchen environmental space are presented. Among them, single column-shaped and L-shaped are suitable for rental property kitchen environments with relatively few users; The double column-shaped, U-shaped and roundabout shapes are more suitable for meeting the environmental space needs of more users simultaneously using the kitchen.

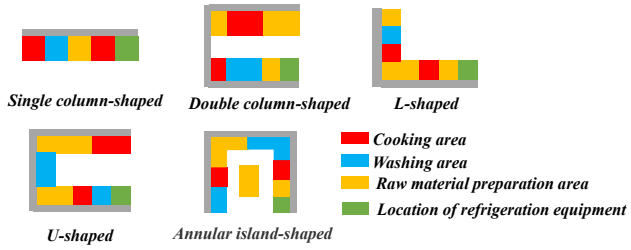
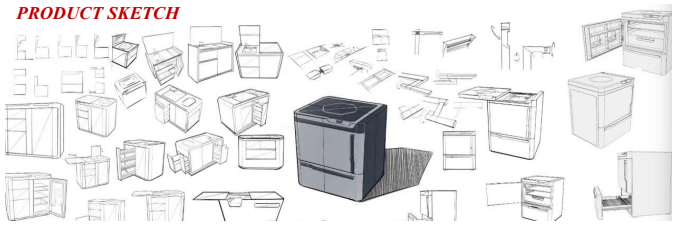


Fig. 6: Common Spatial Layout Forms of Rental Properties Kitchens

While fully considering the optimization and improvement of the kitchen space environment of the rental property to achieve the product design of multifunctional integration, Figure 7 and Figure 8 provide the basic architecture and detailed processing of the product design. Based on the above analysis, combined with the needs of the integrated stove designed for the tenant's life scene, the functions of the leading kitchen equipment, such as dishwasher, refrigerator, and Induction cooking, are integrated to meet the tenant's daily needs for cooking in the rental house. At the same time, the application of wireless Internet technology in kitchen equipment is used to design multifunctional intelligent kitchen-integrated equipment that can be remotely controlled.



a. Design Sketch of the Product

b. Introduction to the Basic Functions of the Product

Fig. 7: Basic Structure of Product Design

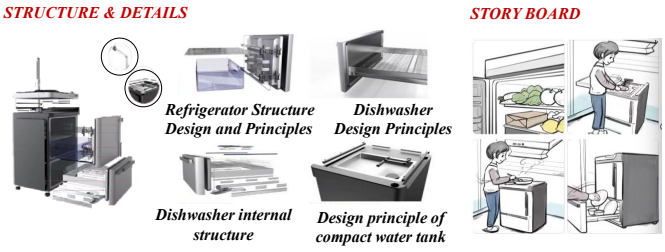


Fig. 8: Product Design Structure and Details

Optimization of Connectivity in the Kitchen Environment of Rental Property

Based on the role of wireless internet technology in leasing kitchen connectivity functions, combined with the designed multifunctional intelligent integrated device, the connectivity of the kitchen can be analyzed from three different levels. Firstly, there is technical interaction. The kitchen comprises cabinets and many electrical appliances, and wireless and Internet of Things technology can connect various products. Therefore, the multifunctional integrated device based on wireless Internet technology is a technical interaction centered on the connection between product systems, achieving optimization and improving kitchen space connectivity. Secondly, there is behavioral interaction, which refers to the connected interaction between users and products, emphasizing user operation behavior and product interface feedback, such as the use function of kitchen products, the human-machine function size of kitchen products, user behavior patterns, appropriate aesthetic and emotional response forms, etc. The problems in interaction between users and products can affect the quality of product use and the coordination and harmony between people and things. In addition, there is also an interaction between people, and the kitchen space is a social activity where multiple people participate, such as family members' communication, family guests' communication, and parents' children's interaction. The design of kitchen environment space and connectivity for rental properties has gradually shifted from a focus on technological interaction to a complex interaction centered on the needs of different users. As shown in Figure 9, based on wireless internet technology, the basic network communication logic for spatial and connectivity interaction in the kitchen environment of rental properties is provided. In different interaction processes, the interaction between products and users and between products is mainly based on data input and display through network communication. In contrast, the interaction between users is more reflected in the emotional interaction between people. This emotional interaction mainly relies on the process of sharing kitchen environment space.

The optimization and improvement of connectivity in the kitchen environment of rental properties is based on wireless internet technology. The overall functional coordination between intelligent electrical products and innovative cabinets is achieved by designing multifunctional intelligent integrated equipment. At the same time, the kitchen space is used as a medium to enhance communication between families and society. The application of multifunctional intelligent

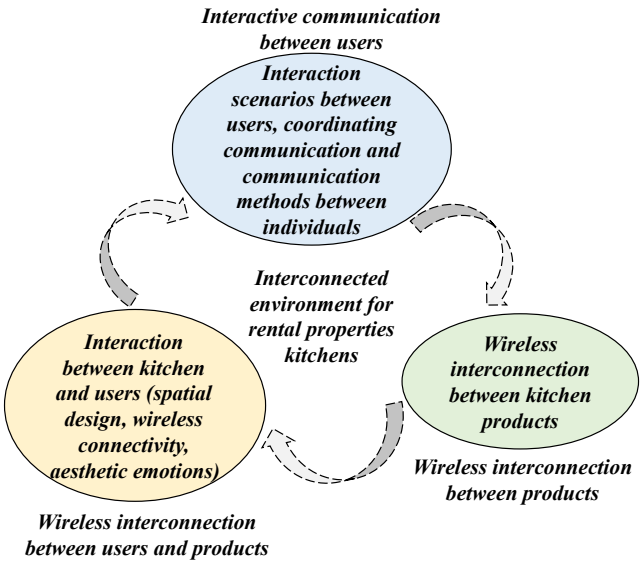


Fig. 9: Basic Logic of Network Communication for Space and Connectivity Interaction in Kitchen Environment of Rental Properties

integrated devices in the kitchen environment of rental properties can meet the needs of rental groups for kitchen environment connectivity and equipment interconnection. The design of this product redefines the concepts of kitchen environmental space and connectivity from the perspective of design theory. It analyzes the particular needs of the kitchen in terms of functional zoning, behavior routes, and human-machine dimensions. Through the above research, the designed product reflects the importance of wireless internet technology in kitchen intelligent systems in terms of functionality. It can meet the remote control needs of kitchen network communication in rental properties.

In order to further integrate the functions of more devices, a more compact and multifunctional integrated device has been formed by integrating functions such as range hoods, microwaves, ovens, dishwashers, refrigerators, etc., and integrating them with washing functions. This device can achieve organic integration of different functions and also achieve users' remote terminal control of the device. As shown in Figure 10, the user operation interface and product functionality are presented. The optimization and improvement of the rental kitchen environment's connectivity are achieved through integrated design, friendly operation interface, and comprehensive functional integration. Not only does it have the advantage of integrated integration, but its characteristics in the space and connectivity of the kitchen environment are more prominent. This product establishes a wireless access point similar to a router by activating the communication module of the kitchen

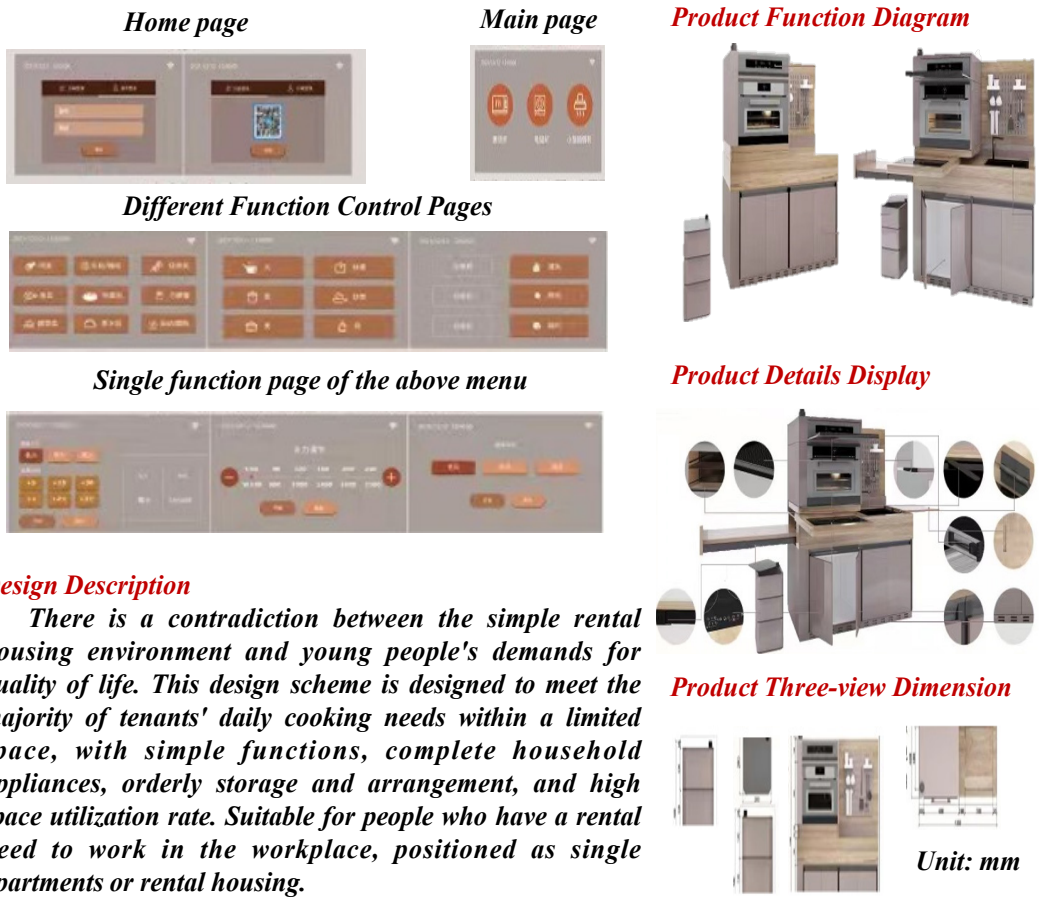


Fig. 10: Product Function and Design Construction Display

appliance itself. The intelligent terminal connects to the wireless access point and sends the account and corresponding password of the target wireless access point that the kitchen appliance needs to connect to according to the transmission protocol of the wireless access point. After receiving the relevant data, the kitchen appliance disconnects data communication with the intelligent terminal. Utilize communication modules to receive wireless access points and connect them to the target wireless access point based on their signal information.

Conclusions

This article analyzes the current situation and influencing factors of the kitchen environment in rental properties and explores the application of wireless internet technology in the kitchen environment. It summarizes the important role of wireless internet technology in optimizing and improving the space and connectivity of the kitchen environment. By integrating the functions of different products in the kitchen and introducing wireless internet technology, the timeliness of communication network information transmission has been strengthened while achieving remote operation over longer distances. Targeted improvements have been made to address the issues of narrow kitchen areas and insufficient connectivity between product equipment in rental properties. In addition, based on the complete integration and utilization of communication network technology and information technology, the advantages of product multi-functional integration have been further utilized, achieving comprehensive integration between different product functions and zones, avoiding the occurrence of poor kitchen experience caused by a lot of equipment, and laying the foundation for the optimization design of space and connectivity in the kitchen environment of rental properties. This provides a theoretical basis and guidance for building a design that is more in line with the integration of intelligent kitchens. At the same time, it is also necessary to address the shortcomings of relatively low customer acceptance and high initial investment costs faced by the further deepening and promotion of wireless interconnection technology in rental property kitchen environments. In addition, combining the advantages of wireless internet in improving kitchen environment space and connectivity, reducing its operational complexity, can be more conducive to the application of wireless internet technology in rental property kitchen environments.

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