

# Research on "i-Home Yunju" Intelligent Home Improvement System based on Virtual Reality Technology

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## Abstract

**With the rapid development of economy and culture, people's home decoration not only stays practical, but also emphasizes aesthetics, creativity and environmental protection, and the home improvement industry has ushered in rapid development. The traditional decoration industry also has obvious drawbacks such as long construction period, opaque price, and unnecessary construction. With the introduction of supply-side reforms, the home improvement industry also urgently needs to improve efficiency, thereby reducing the home improvement burden that modern residents are increasingly concerned about. In response to this problem, the "i-Home Yunju" smart APP was first developed. By exploring the relevant functions of the APP and carrying out innovative design, at the same time, the feasibility of AR and VR technology was analyzed to explore the importance of virtual reality technology to smart home decoration.**

## Keywords

**Smart Home Improvement; Virtual Reality Technology; Artificial Intelligence; Personalized Customization.**

## 1. Introduction

In recent years, with the continuous improvement of people's living standards, more and more people attach great importance to the quality of life, not only the requirements for clothing, food, and transportation have increased, but also more and more attention to living conditions. With the rapid development of economy and culture, people's demand for individualization and customization of house decoration has become more and more obvious. Pay more attention to the overall art of living at home, and prefer to add independent creativity and characteristics to home decoration, and the home improvement industry has entered a stage of rapid growth[1]. Nowadays, buildings in various places are rising and row upon row, people have obvious and urgent decoration needs in the face of brand-new commercial houses or second-hand houses to be renovated[2]. However, nowadays the home improvement industry has obvious drawbacks such as inability to popularize industrialization, lack of personalization and customization capabilities, opaque prices, and lagging information. Many industry pain points are still not penetrated, and users' consumption experience is not good[3]. With the introduction of supply-side reforms, the home improvement industry also urgently needs to improve efficiency, thereby reducing the home improvement burden that modern residents are increasingly concerned about. This project will be based on breaking the traditional home improvement model, solve the pain points such as inefficiency and low industrialization, etc., and open a new market of "Internet + home" improvement model.

This paper proposes to create an intelligent home improvement system with the help of virtual reality technology. By establishing a 3D cloud home improvement model database, promoting the "i-Home Yunju" APP and experiencing VR home improvement achievements, a 3D-integrated Internet home improvement design system will be created to solve the problems in the process of home improvement, including the inability to popularize industrialization, the lack of personalization and customization capabilities, Price opacity, information lag and other issues. Focusing on the "i-Home Yunju" APP and 3D cloud technology as the core technology, we explore the significance of the Internet for the upgrading and transformation of the traditional home improvement industry. Experience DIY decoration design for consumers, obtain professional advice from designers, and complete home decoration design through VR simulation home decoration results, to better meet the needs of the public and promote the leap of the smart home decoration industry.

## 2. Research Status

### 2.1. Home Improvement Market Status

The traditional home improvement market is mostly offline physical stores, and home improvement buyers may not be clear about the quotation information of home improvement companies, which is easy to cause additional expenses and increase decoration costs[4].

The online platform chooses a home improvement company with a long communication service cycle and low efficiency. The graphic design drawing cannot guarantee that the effect after completion will perfectly meet the user's expectations. The style and size of the favorite furniture selected by the user are not ideal, causing users and home improvement. The contradiction between the company and the furniture company has resulted in the phenomenon of constantly modifying the design and rework, which consumes manpower and financial resources [5].

### 2.2. Research Content

Based on solving the pain points in the traditional home improvement industry and the existing smart home improvement field, this paper introduces VR virtual reality technology for innovation and improvement. The integrated Internet home decoration design system solves a series of problems such as the inconspicuous effect of the user's home improvement process, uncontrollable decoration cost, easy disconnection of design and installation, unsecured engineering system, and information asymmetry.

This paper focuses on the significance of breaking through the core technical difficulties for the home improvement field, and explores whether the service level of the home improvement industry can be improved if the home improvement is truly intelligent, cost-effective and customized, in order to truly break the vicious circle of fragmentation in the overall home improvement industry. At the same time, explore the feasibility of related technologies, use the knowledge to design and develop the "i-Home Yunju APP" software, further explore the related technologies of the development of VR home improvement experience system, and learn the construction and adaptation of 3D cloud home improvement model database.

In order to continuously meet the personalized customization needs of home improvement users, in order to realize the vision of building a new Internet home improvement market in China, help the development of China's home improvement industry, alleviate the long-term conflicts between home improvement consumers and decoration enterprises and furniture enterprises, and promote the sustainable and healthy development of the economy and society.

### 3. Research Program

#### 3.1. Software Product Service

Through the design and development of "i-Home Yunju APP" software, its software service functions are enriched. Explore its practical significance in solving the problems of difficult design, troublesome, difficult to compare prices, and low satisfaction after the decoration is completed for the majority of users to solve the new home decoration. It is designed to allow users to be 100% sure about the design and furniture before renovation, and to easily embrace a beautiful new home.

The i-Home Yunju APP is expected to design four categories of services: i-Home cloud home decoration, home-loving games, DIY decoration, and furniture hypermarkets, hoping to make smart home decoration more convenient for people's lives.

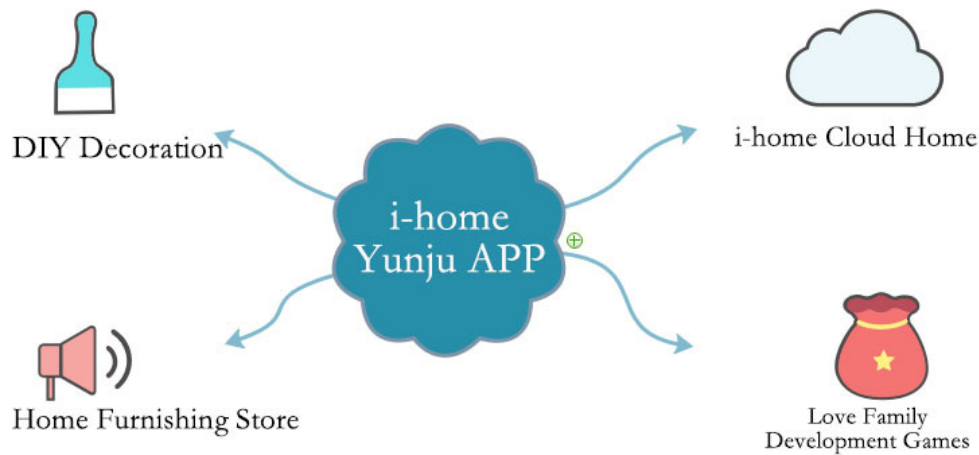


Figure 1. Schematic diagram of four types of services in i-Home APP

##### 3.1.1. HomeCloud Home Improvement

Create a decoration experience exchange and sharing cloud community for home improvement needs and designers, which includes excellent home improvement cases, decoration strategies, and experience exchange forums. For a user who has just had a decoration idea, he may know little about the decoration skills and attention points. At this time, i-Home cloud home improvement integrates the decoration resources, including various tips and experience stickers about home decoration design, which can open the door of inspiration for new users, increase the knowledge of home decoration, and provide users with future experience. DIY design to do the foundation and pavement. At the same time, you can also ask questions in the forum, and other home improvement users or designers who happen to have this experience can help them solve their problems in a targeted manner.

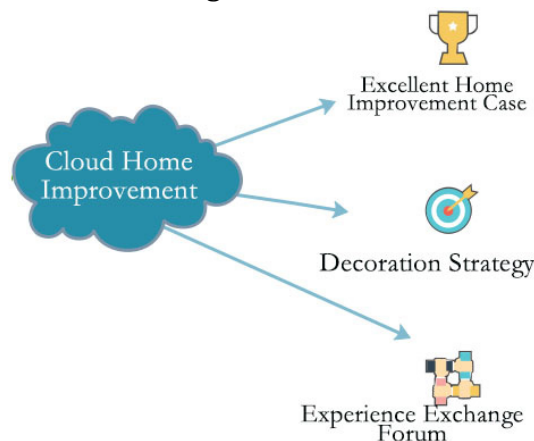
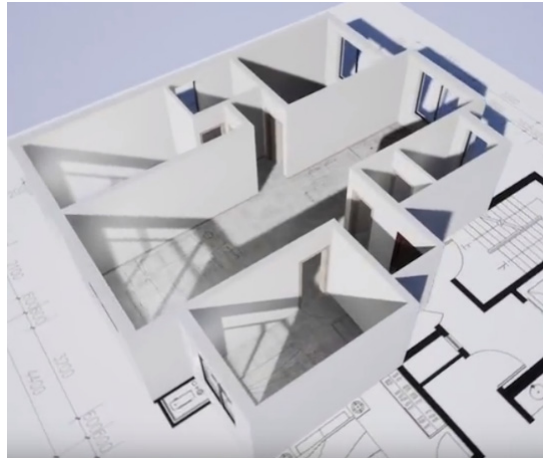


Figure 2. Schematic diagram of Home cloud home improvement





**Figure 4.** 3D drawing

(2) Online positioning: Before the user conducts DIY design, pre-position the user's favorite home decoration style and basic color tone online. Prevent users from dizzying and undecided when choosing furniture. The system will recommend the "Guess what you like" column for the user according to the user's positioning type and apartment type, and strive to help the user to carry out suitable home decoration design with high efficiency and high quality.

The specific online questions are: ① What decoration style do you like? ② Your renovation budget? ③ What is the color of your decoration? ④ What is your favorite furniture brand? ⑤ What is the size of your apartment?

(3) DIY design: The foundation of DIY technology is that the platform needs to perform 3D technology scanning and VR visual transformation on flat furniture. Adding materials for VR effects is a difficult point in software production. We will continue to learn and ask for advice based on our own knowledge in the future. teacher to achieve.

When doing DIY design, users can optimize their choices based on their previous positioning, refer to the platform's recommendations, and design their favorite home decoration with good VR visual effects.

At the same time, the additional advantage of DIY design is the visualization of furniture prices. The furniture scanned by the platform is the real furniture of the furniture companies that have settled in the platform. The material elements are authentic and reliable, and with the real-time update of the furniture in the furniture, the material elements of the platform will be updated synchronously. in this way, users can clearly see the price of each type of furniture while designing DIY, and it is also convenient for users to compare prices and materials of the same type of furniture, so as to make the best choice.

(1) Online guidance: When users design their own houses, they lack professional knowledge, and some designs do not take into account the layout of the house, the overall color matching and other issues. Therefore, after the user submits the design work, the designer should improve it, and use years of experience and professional knowledge to propose amendments to the user to further optimize the quality of home decoration.

(2) Appointment date for VR experience: VR experience is another highlight of this project, which combines the current VR technology and home improvement needs. After confirming the design draft of the home decoration, the user wears the VR device and can truly feel the scene after the DIY design and decoration is completed, so that they can more intuitively feel whether the design is satisfactory; if there is some dissatisfaction, the user can shake the handle, and fine-tune the position of some furniture and furniture, to achieve the effect that the user is satisfied with.

### 3.1.4. Home Store

Establish cooperative relations with major furniture companies in advance, and make as many furniture brands as possible to enter our platform. By 3D scanning the furniture of furniture manufacturers who have entered the platform, we provide users with DIY design material elements. We naturally become a Intermediary between users and various furniture brands.

Home Yunju brings together a number of furniture brand resources, and requires the visualization of furniture prices, materials, origin and other information to allow users to better compare and choose. When users "DIY design", if they have a favorite furniture, they can place an order directly on the platform, and the platform will communicate with the major furniture brands to deliver the furniture to the door intact, and will follow up with the corresponding installation work.

Compared with buying directly at a furniture store, the advantage of buying on this platform is that the platform promises that all furniture can be returned for free if they are not damaged within one week of delivery, and the platform will bear the freight. It is hoped that through this high-quality service, it will gain 100% trust from users and strive to win a good reputation for Internet home improvement.

### 3.2. Hardware Product Service

In the follow-up research, "i-Home glasses" compatible with the i-Home Yunju APP will be launched, as shown below:



Figure 5. i-Home glasses

The hardware product is intended to create a virtual reality home decoration experience for users. At the same time, the glasses also have functions such as movie viewing and entertainment, bringing users an immersive virtual reality effect.

The main features of "i-Home glasses" are: the glasses are connected to the furniture database of the APP, and the furniture materials are updated in real time, so that users can experience and select furniture without leaving home; The house effect created by yourself in the game.

## 4. Technical Solutions

### 4.1. 3D Database Construction

The database will use MYSQL system, which is enough to store the furniture models collected and established in the early stage of this project, and the cost is low. When mature, will begin to use Oracle systems to meet user needs[6].

3D furniture models are developed using 3D scanners to generate the models. Its advantages are low cost, convenience and rapidity, which can make up for the long modeling time of the modeler. 3D scanners can be used to generate model construction data, but the shortcomings of 3D scanners are also obvious, such as low precision and poor appearance, so 3D designers are still required to be responsible for modeling, and at the same time 3D scanners are used as auxiliary means. And need to actively cooperate with furniture companies to reduce costs.

### 4.2. APP and Website Development

The development process of an APP mainly includes user demand analysis, design stage, development stage, testing stage, and release stage. First of all, in terms of user demand analysis, we clarify the target user groups and industry needs of the i-Home Yunju APP, and list the functions to be covered by the APP and the problems that can be solved for users. The design stage is mainly prototyping and UI design, and finally a high-fidelity design drawing is produced. The development stage mainly includes three parts: the server side, the APP side, and the Web management side. Finally, the server is built by the back-end development, and the document interface is provided to the front-end by coding. The front-end designs the page according to the UI renderings, and then starts after the UI layout is completed. Debug interface, the management console is responsible for the data that needs to be displayed. In the testing stage, it is mainly for internal testing of the company, and in the release stage, it is fully launched in the Apple and Android markets.

In the development of i-Home Yunju APP, we use Eclipse to write the server-side code, Java as the server-side, and set a time at the same time. After the user-defined time arrives, the system starts to run according to the code[7].

### 4.3. Development of VR Home Improvement Experience System

The development of the VR home improvement system requires a development team to coordinate, and roughly need product designers, experience designers, visual designers, 3D designers, sound effect designers, development engineers and test engineers in terms of responsibilities. The core technology of this project is 3D modeling and programming development. 3D max software for 3D modeling is easy to operate and powerful enough to build the perfect home environment and furniture models[8].

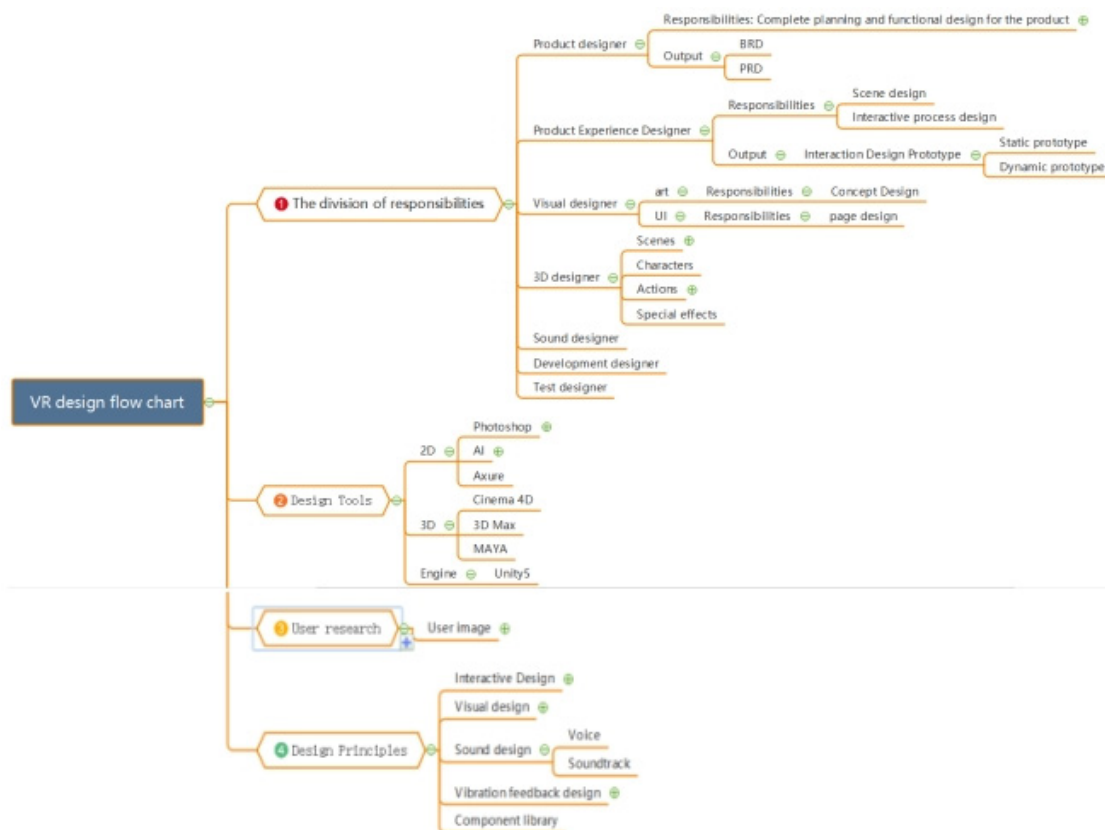


Figure 6. VR flow chart

For programming development in the early stage, the game engine Unity3D is used as the 3D engine for development [9]. Easily create interactive VR home building content. The development process is roughly as follows: first, the product designer needs to make a complete product planning and functional design for the VR system, describe and analyze the needs of the product, market and business, and generate corresponding PRD, MRD and BRD respectively; then the experience designer needs to make a complete product planning and functional design. It is necessary to design for the furniture and interior scenes of the house, and the interaction process for the remote interaction between customers and the house; then the 3D designer uses 3D modeling software to create VR scenes according to the customer's living environment, and makes special effects for user interaction to enhance the system. The smoothness of the operation; the visual designer will beautify the model made by the 3D designer, and design and produce the UI interface; finally, the development engineer will integrate the results for programming to make a complete VR smart home improvement experience system [10]. Specifically as shown in the figure below:

This design includes two units. After the user selects the apartment type, he can enter the interior of the apartment type, and realize free roaming through keyboard operation to visit the interior design details. The indoor furniture can be moved and placed with the mouse, and the material of simple furniture can be changed, and some furniture can be added or deleted.

## 5. Summary of the Problem

(1) Effectively solve the problems of the traditional home improvement model, the lengthy construction period, the opaque price, and the unmet personalization and customization needs of home improvement demanders.

This paper designs and builds a smart home improvement platform, which summarizes the furniture information of major brands in the home improvement industry, and realizes the transparency of furniture information such as price, material, and origin. Consumers can DIY decoration to achieve personalization and customization of home decoration. The APP is reasonably positioned according to the user's preferences. The system will recommend the "Guess You Like" column for the user according to the user's positioning type and apartment type, and strive to help users efficiently and effectively. Appropriate home improvement design with high quality. Users can place orders for their favorite furniture directly from the platform and have them delivered to their door, thereby improving the efficiency and quality of home improvement.

(2) Effectively solve the problem that the current smart home decoration is far from the expectations of users

This article explores the implications of introducing virtual reality technologies (VR, AR). In the early stage of decoration design, according to the flat floor plan provided by the user, it is converted into a 3D three-dimensional map. After the user DIY decoration, it must be improved by the designer, using years of experience and professional knowledge to propose revision suggestions to the user to further optimize the quality of home decoration. After the home decoration is completed, the user wears the VR device and can truly feel the scene after the DIY design and decoration. If there is some dissatisfaction, the user can fine-tune some furniture and the position of the furniture, to achieve the user's satisfaction.

## 6. Conclusion

This paper is guided by the intelligent technology of home decoration, according to the customized needs of consumers for home decoration, combined with the existing virtual reality technology, APP development technology and the development status of the home decoration

market, the innovation of smart home decoration technology and the development of APP and other technologies are carried out. Dig deeper. Carry out feasibility exploration around innovative ideas, make intelligent home decoration more efficient, personalized and transparent, and solve a series of problems such as inconspicuous effects and uncontrollable decoration costs in the process of user home decoration. At the same time, it provides consumers with customized services, improves the quality of life, and finally provides reference value for the development of intelligent technology in the field of home improvement!

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