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## Smart TV Terminal Interface Design for the Elderly Based on User Experience

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# Smart TV Terminal Interface Design for the Elderly Based on User Experience

Yejun Chen<sup>1</sup>, Mingzhu Li<sup>2</sup>

School of Arts, Jiangsu University, Zhenjiang, Jiangsu, 212013, China

\*Corresponding author's e-mail: 1113634965@qq.com

**Abstract.** With the advent of aging society and intelligent era, designing smart product interfaces for the elderly is positively significant to improve their experience and life. Combined with the ideas and methods of user experience, an in-depth study on the elderly using smart TV terminal is conducted through interview, observation, questionnaire, etc. It constructs the personas and user experience map to excavate the pains and opportunities of the products. The current products and interfaces in the market are taken as the case to construct the relationship between the product opportunities and the five elements of user experience to analyze the terminal interface of smart TV and propose the optimal design scheme. It meets the needs of users, improves their experience and offers reference for the design of homogeneous interface.

## 1. Introduction

Smart TV is on the basis of the Internet technology. It has open system and chip together with the application platform that achieve two-way human-computer interaction. Moreover, it is an integration of audio, video, entertainment and data to meet diversified and personalized needs of users. [1]With the progress of the times, more and more terminal functions of smart TV are produced, and the operation interface becomes increasingly rich. These functions bring convenience for young people who are familiar with the Internet, while feelings of the old people are ignored. Faced with many uncommon functions and complex interfaces, intellectualization becomes the obstacle of old people and shake confidence of them using smart TV. As people have an increasing demand for the user interface, user-centered design is one of the trends of the interface design in recent years. Therefore, this research combines the design idea and method of user experience from the perspective of elderly users to enhance the availability of the smart TV interface, improve the user experience, and help the elderly users to use products more efficiently.

## 2. Smart TV terminal interface

Compared with traditional TV, smart TV terminal has more business content. With the operating system, users can not only use the video-watching function, but extend system functions by network operations and installing other plugins.

At present, most smart TV terminals are based on Android system, and the operating mode is similar to mobile phones. The majority of the TV screen is more than 42 inches. At the present stage, two common resolutions of the smart TV terminal are 1920×1080 and 1280×720.

There are few studies on the smart TV terminal interface for elderly users, and most of them are about the webpage and mobile APP. V.Mitchell comes up with the idea of keeping the user interface simple, avoiding multimodal keys and offering information portal appropriate for the elderly by



analyzing their needs, physical and cognitive disorder. [2]Zhai Qianqian carries out the optimization design of smart TV interface on the basis of the use scenarios. [3]Zhang Ren combines the levels and elements of user experience, and creates the user experience design model of smart TV interface. [4]

### **3. Construction and analysis of the user experience map**

User experience map is a visualization tool. From the view point of users, it describes the users' experience of using the products, discovers their pain in the experience, and summarizes the feasible product opportunity. It helps the designers to have a more intuitive impression on the experience of users and guide the follow-up design.

#### *3.1. Constructing user roles and user experience map*

Personas was proposed by Alan Cooper in 1999. [5]It analyzes large samples through a great number of interviews, observations and questionnaires to cluster and segment the users, refine their common features, summarize the comprehensive prototype of the target users, and carry out data visualization.

Constructing Personas can help to make the target users clear, understand the behavioral motivation and psychology, and assist the designers to design products. When determining the level of Personas, it is required to make clustering process for the data through qualitative research such as interview, observation and experience, as well as quantitative research such as questionnaire. [6] It is found that people over 65 years old seldom get access to smart products. As time goes by, old people will get more access to smart products in the future. Therefore, the target users in this paper are old people aged between 50 to 65. 12 people are observed and interviewed, in which 7 are men and 5 are women. The average age is between 50 to 65.

Generally, the user experience map includes the user need, behavior process, emotion experience, stage, contact, pain, opportunity, etc. On the basis of interview and questionnaire, Personas and experience map are constructed, which make it easier to discover the problems of the existing products and the potential demand of users. There are many differences between the survey users in free time and product-using proficiency, so two personas are constructed as shown in Figure 1. There are mainly five stages of the target users to use smart TV terminals: turn on the TV, read the content, choose the video, watch the video, and turn off the TV. By excavating the emotional satisfaction point and dissatisfaction point of the target users, it can be concluded that the major pains in the using process include: the interface level is complex, many videos are pushed without any purpose, and it is hard to find the History Records, Favourites and Search functions. The research excavates the existing pains and opportunities by further analyzing the users' behavior and emotional experience in the experience map to indicate the following design.

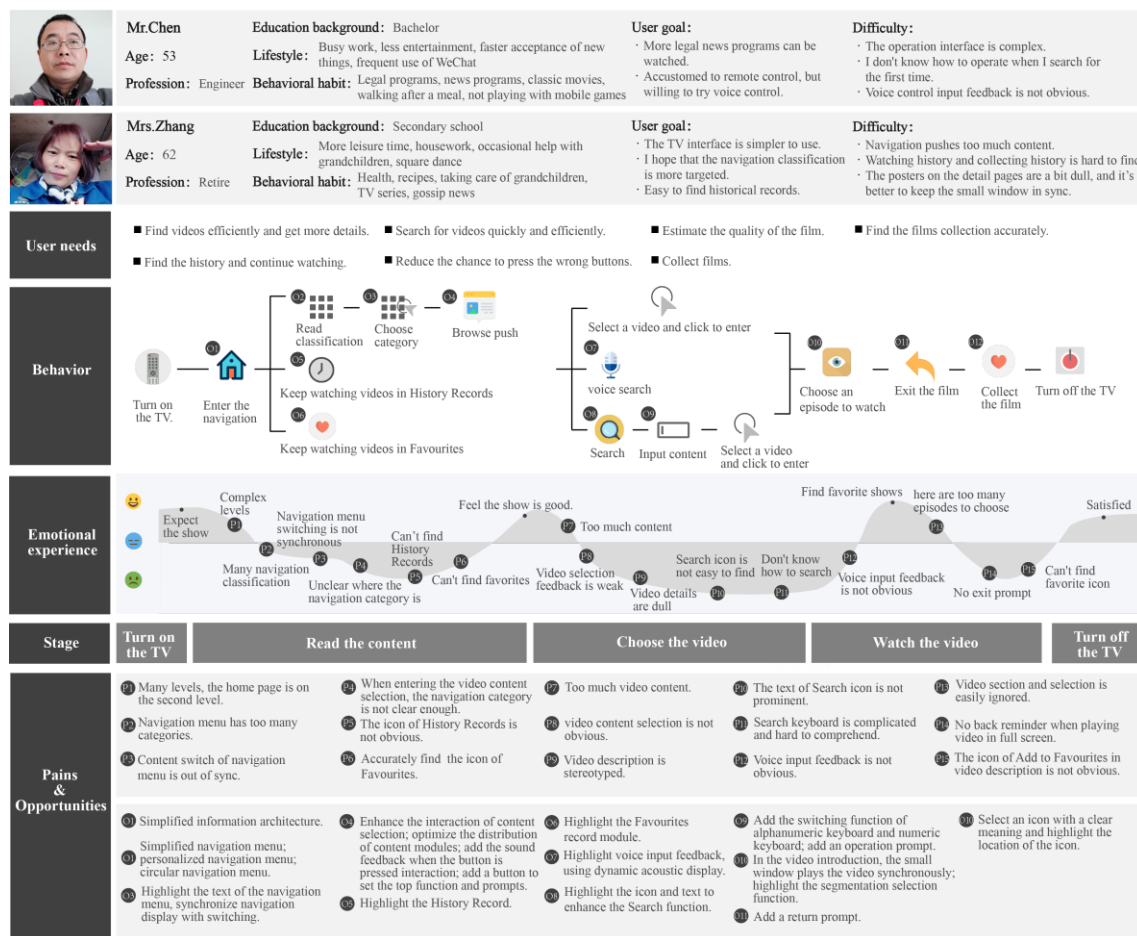


Figure 1. User experience map

#### 4. A case study of smart TV terminal interface design

At present, there are rich smart TV terminal product brands in the market in different styles. According to online and offline surveys, sales volume of Tmall magic box 4A ranks the top. Moreover, it brings a good user experience and wins a high evaluation. Therefore, Tmall magic box 4A is taken as a case to optimize the interface.

##### 4.1. Tmall magic box interface system problem analysis

In the preliminary research, interview and System Usability Scale (SUS) are taken to measure the users' satisfaction with Tmall magic box 4A. The SUS score of the original system is 60.5, and the level is D. In response to the issue that users feel difficult in operation, we focus on the confusing interface, complex content and unapparent icon instead of the problems such as network delay, frequent forced updates, advertisements and member limitation. Some interfaces of the original system are shown in Figure 2. By analyzing the framework and logic of Tmall magic box 4A together with the users' behavior and the research result, it is available to carry out a more definite design for interface optimization.

Jesse James Garrett [7] puts forward the concept of five elements of user experience, and divides them into strategy level, scope level, structure level, skeleton level and surface level. This model is widely recognized and applied to guide the Interaction design. It is found that the original system has solved the problems of P1, P3, P9, P12 and P15 in Figure 1 by adopting the five elements to analyze the above system, while there are still pain points in other aspects. By carefully analyzing the pains

and exploring the problem description and performance, and connect it with the five elements of user experience, it is available to form Table 1.

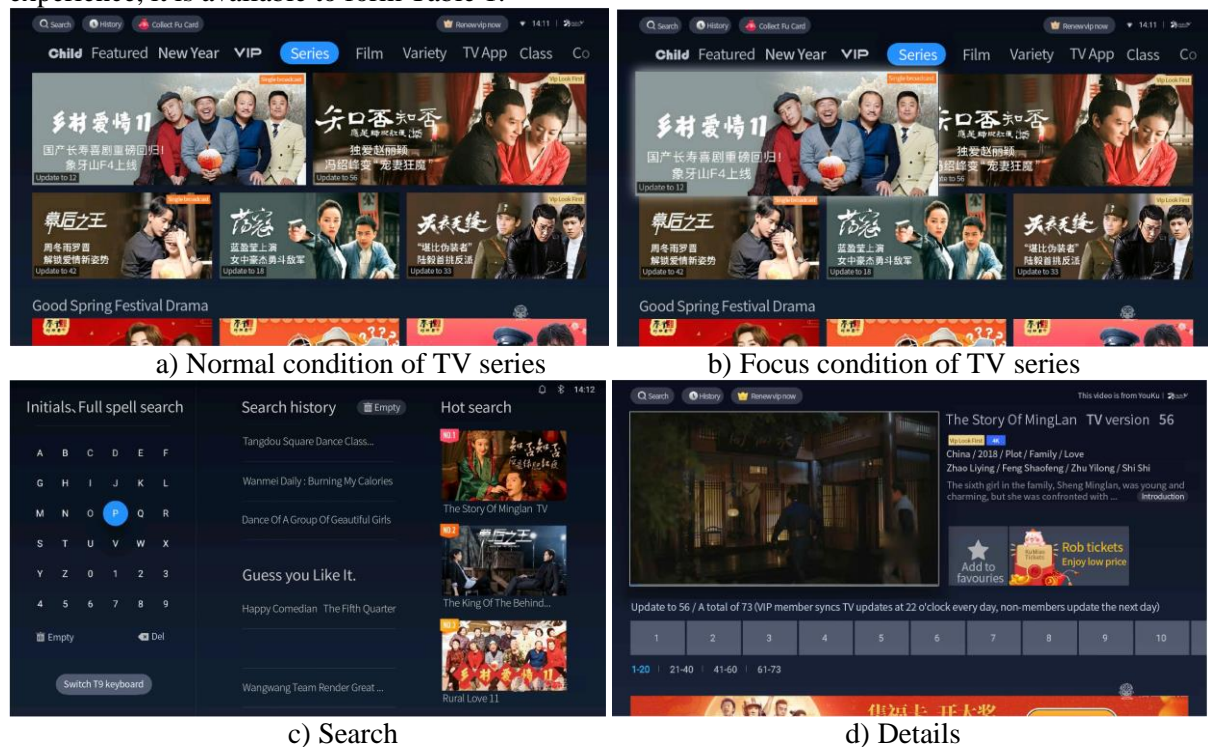


Figure 2. Some interfaces of Tmall magic box 4A

Table 1. Main problems of Tmall magic box 4A

Problem levels	Original system has solved the pains	Original system has not solved the pains	Problem description	Specific performance
Strategy level		P2: Navigation menu has too many categories	Indefinite user types and needs	No distinction for different users Incomplete research on user targets and needs
Scope level	P3: Content switch of navigation menu is out of sync P9: Video description is stereotyped	P2: Navigation menu has too many categories	Some functions should be improved	Some functions are rarely used Display of some functions are not obvious Lack of interface guidance
Structure level	P1: Many levels, the home page is on the second level	P2: Navigation menu has too many categories P5: The icon of History Records is not obvious P6: Accurately find the icon of Favourites P10: The text of Search icon is not prominent	Categories of some functions are illogical Content feedback is unclear	The History module includes History Records, Favourites and Reservations The feedback of the selected image is not obvious
Skeleton level	P14: No back	P8: video content	Too many	Hints of 24 parts of the

	reminder when playing video in full screen	selection is not obvious P11: Search keyboard is complicated and hard to comprehend	navigation menus, lack of personalization Information tips are not obvious	navigation menus are not obvious
Surface level	P12: Voice input feedback is not obvious P15: The icon of Add to Favourites in video description is not obvious	P4: When entering the video content selection, the navigation category is not clear enough P5: The icon of History Records is not obvious P6: Accurately find the icon of Favourites P7: Too much video content P10: The text of Search icon is not prominent P13: Video section and selection is easily ignored	Crowded and flashy content	Interval of the video module is small with many colors favorites module and history record module are not obvious

#### 4.2. Smart TV terminal interface design

An optimization design of the case's interface level is conducted on the basis of user research and analysis for competitive products.

**4.2.1. Strategy level--clarify business objectives and user needs.** Strategy level is the root and orientation of product design. Main content of this level is the user need and product objective. Category and characteristics of the target users in strategy level is not clear, and there is a lack of research on the needs of users. In the stage of user research, needs and goals of the elderly are analyzed constructing the user experience map to summarize the needs and pains of users, as is shown in Table 1. P2, the problem of too many categories in the navigation menu is due to the lack of in-depth analysis of user needs, which can be solved by deleting uncommon menus and adding customized navigation menus.

**4.2.2. Scope level-- identify content requirements and feature requirements.** The research studies the users, analyzes the original system, and utilizes Kano model to classify the categories of smart TV terminal interface needs to guide design, as shown in Figure 3.

The Kano model was developed by Noriaki Kano [8], It takes the influence of user needs on satisfaction as the basis to analyze the relationship between the product performance and user satisfaction. Noriaki Kano divides the model into five attributes: attractive attribute, one-dimensional attribute, must-be attribute, indifferent attribute and reverse attribute. He divides the categories of functional needs through interview and questionnaire. Here four attributes of the model are used to evaluate needs. The yellow part is the attractive attribute. It refers to the needs that won't be excessively expected by users, including voice control, multi-screen interaction, history records, basic information, add to favourites, favorites, etc. The green part is the one-dimensional attribute. It refers to the proportional need of the users' satisfaction and the satisfaction degree of demands, including synchronous jump. The blue part is indifferent attribute, which has no influence on the user experience no matter it is offered or not. It includes popular recommendation, go-to-top button, synchronized small window, etc. The red part is must-be attribute. It is generally the users' basic requirements for

the product, which is the essential attribute or function, including the navigation menu, search function, etc.

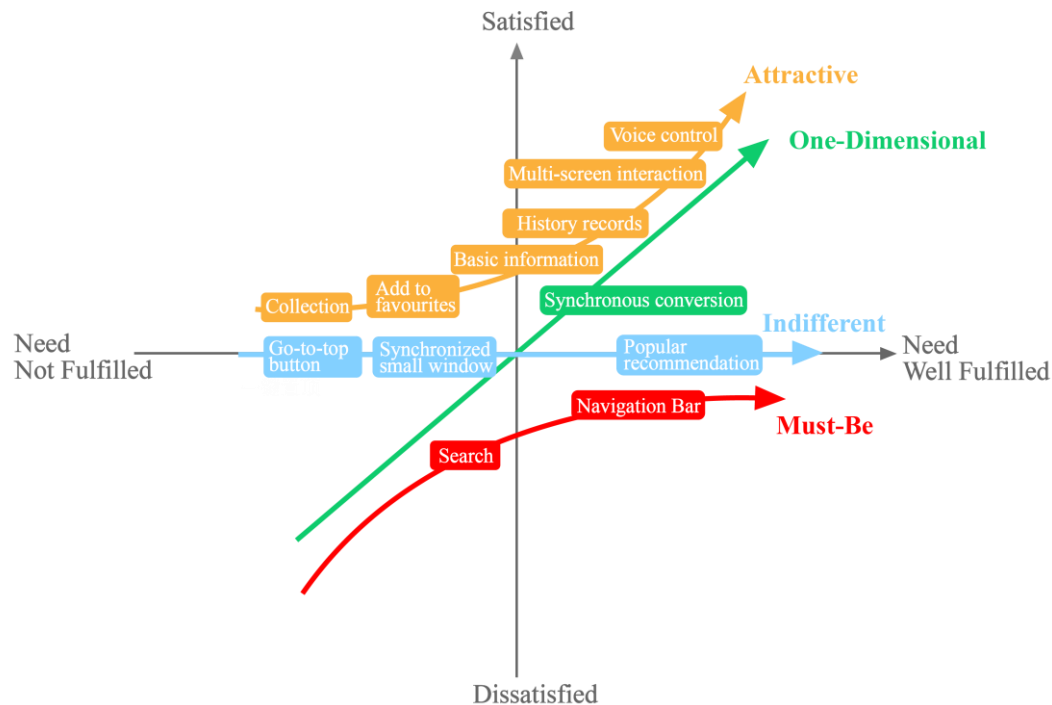
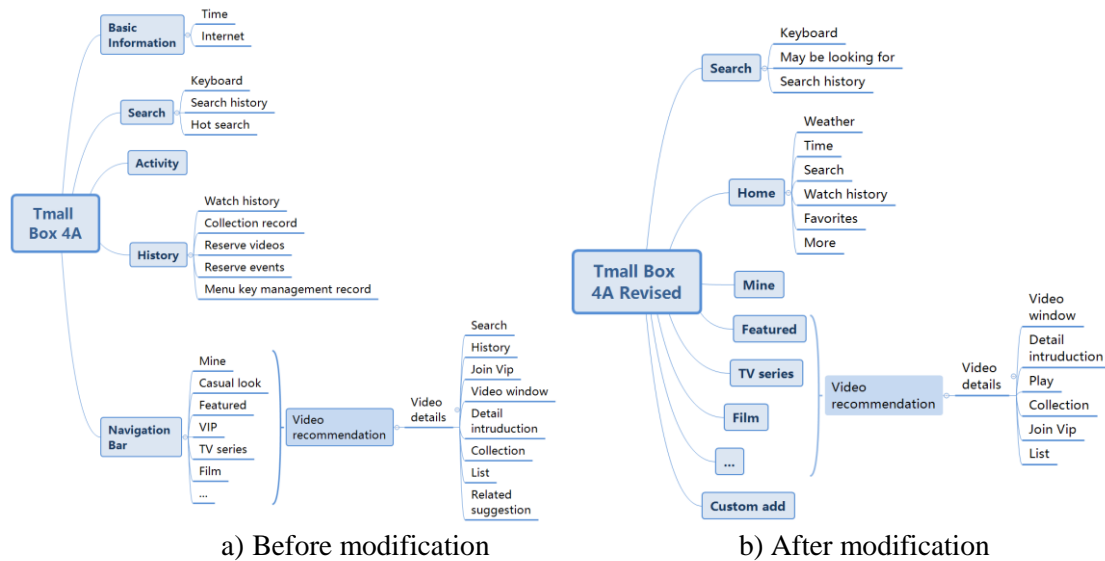


Figure 3. Kano model of Smart TV terminal interface needs

**4.2.3. Structure level-- UX design and information architecture.** Structure level mainly covers Interaction design and information architecture design. We carry out the information architecture and Interaction design of products according to the priority level of user needs. Interaction design pays attention to describing “possible user behavior”, and meanwhile defines the behavior of “how can system cooperate and respond”[9]. Through analysis and organization, the information architecture of Tmall magic box 4A is shown in Figure 4. According to the user needs, the research optimizes the functional classification, interaction and structure. In the aspect of functional classification, it is required to adjust in accordance with the user needs and behaviors. For instance, simplifying the navigation menu function and adding personalized customization, taking circular navigation menu, adding the weather function missed in the original system, the switching function of alphanumeric keyboard and numeric keyboard, as well as the reminder of functional operation, etc. At the optimization function level, history and collection records are located at the next level of history. As the name is misleading, history and collection records are separated from the history and are improved to the higher level to make it more logical that enhances the understanding. According to the research, the functions of movie reservation and competition order can be canceled due to the low frequency of use. Additionally, recent watching record and history can be merged as well as the recent collection and collection history to avoid function repetition. Taking the home page as an example(as shown in Figure 5 a), b)), P2, P5, P6 and P10 in the user experience map are solved.





a) Before modification                      b) After modification  
Figure 4. Changes of structure level of smart TV terminal interface

**4.2.4. Skeleton level--interface design, navigation design, information design.** Skeleton level mainly includes interface design, navigation design and information design. In the field of interface design, the relation and location between the elements and components should be determined in the skeleton level. Based on the previous research on user behavior, the integral interface layout is designed first. It gives priority to the card layout and top navigation menu, and content menu below the navigation menu is changed into horizontal stretch from the drop-down list, making it available to show more content while reducing the operating burden. Moreover, it establishes the operation logic that gray text only displays content, bold white text is the selectable option, and the selected text has a red frame effect. On the basis of keeping the original habits of users, the research strengthens the design of part of the information, such as adding the switching function of alphanumeric keyboard and numeric keyboard, as well as the keyboard operation reminder in the search page to solve the P11 in the experience map, as shown in Figure 5 e).

**4.2.5. Surface level--visual design.** Surface level is the last one of the five elements. It forms the final product design through satisfying the users' sensory feelings after meeting the other four levels. Moreover, it controls the product interface design from the visual level and conveys effective information, including the overall interface layout design, information configuration, icon design, graphic design, color collocation, visual style, etc. Visual presentation influence the intuitive feelings of the users. A good visual presentation can correctly guide the users, convey information and create a pleasant experience. The modified interface maintains the flat design of Tmall magic box 4A and the deep background. It takes a small amount of light gradient color that shows a light and delicate quality. By optimizing the visual element, it is available to help users operate more smoothly and improve their experience. For horizontal stretched menu, there is more blank space to make the information presentation more plentiful, the visual area extension broader, and the responsive interactive animation more delicate. The company color of Tmall magic box is red, so the blue frame of the selected text in the original system is changed into red. The modified interface darkens the unselected texts, strengthens the light floating effect of the selected texts to grasp the visual focus of users. For video content menu display, the menu control layout is too tight. Therefore, when entering the focus state of video content, the control layout will scatter, strengthen responsive interaction and make the visual effect of texts in the content navigation menu outstanding. Taking the normal and focus state of TV series menu as an example(as shown in Figure 5 c), d), P4, P7 and P8 are solved. Optimize favorites and history records module, and take simple icon to solve the surface level problems of P5 and P6, as



shown in Figure 5 a). For P13, it is required to put the segment selection component on the top of the episode selection, and highlight the selection stage by bold text and red bottom line, as shown in Figure 5 f).

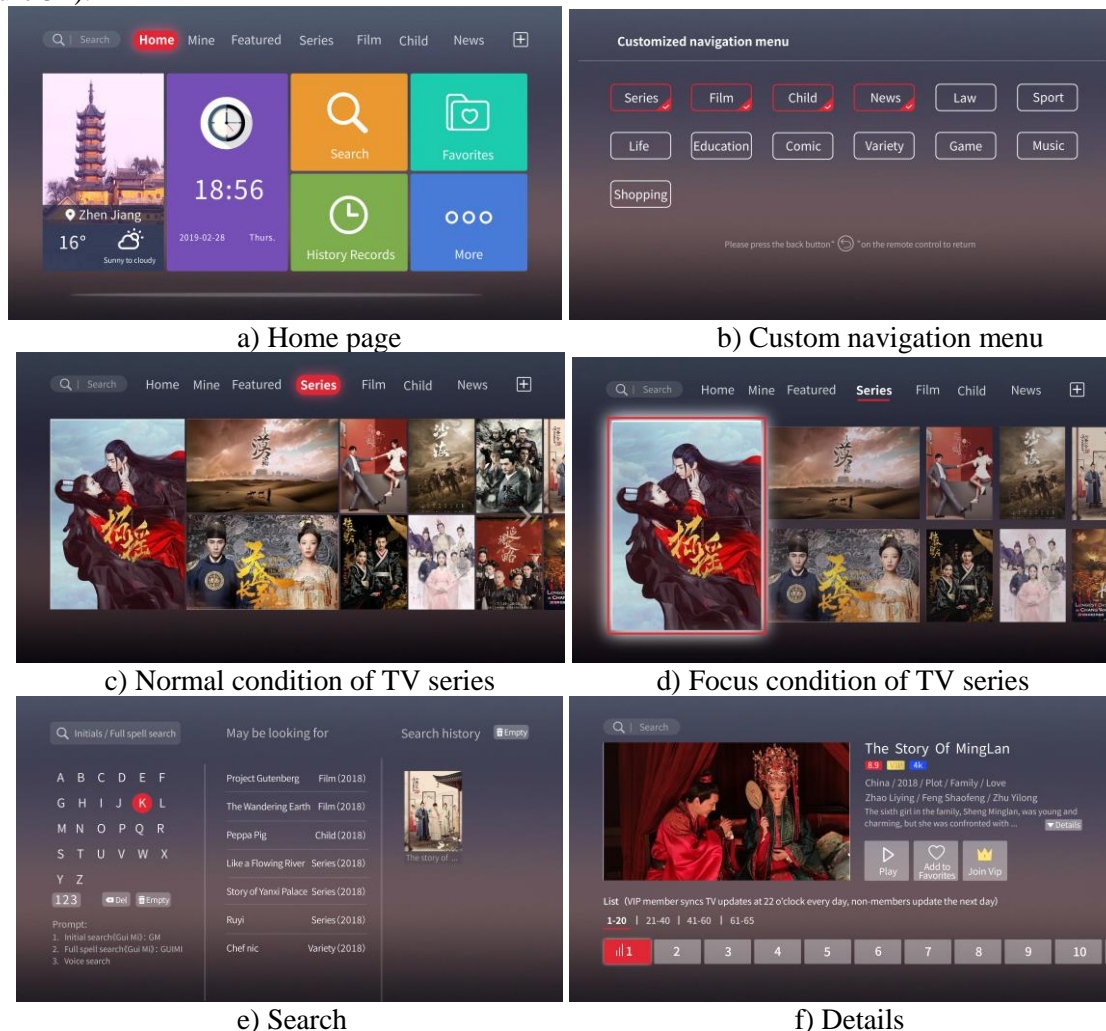


Figure 5. Main interfaces after modification

## 5. Conclusion

At present, smart TV terminal interfaces and functions are complicated. This increases the burden and learning cost for the elderly to use such smart TV terminal. Therefore, it is required that interface design for the elderly should fully understand their needs and improve the operational efficiency. From the perspective of user experience, this study takes users as the center to excavate their needs and pains, and constructs the connection between the product opportunities and the five elements of user experience to analyze and optimize the smart TV terminal interfaces. Accordingly, it improves the user experience and helps the elderly users to use products more efficiently.

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