ORIGINAL RESEARCH ARTICLE

Development and design of an intelligent home care system APP based on technology

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ABSTRACT

The purpose of this article's research is to the background of "Internet +", and whether "Internet + elderly care" can become an important development trend to improve the quality of elderly care services to support family-friendly elderly care services. On this basis, the design background of the smart home elderly care system application or application (APP) is analyzed, and the system architecture and equipment requirements are analyzed based on the characteristics of modern high-tech, which provides prerequisites for the establishment of a new social service system. The problem here is that in the context of population aging, improving the quality of elderly care services has become an important development trend. As for the methodology for the study, reviews of several reading materials from the existing literature become essential. The findings indicate that in the elderly care service, we should actively use big data, the Internet of Things and cloud systems, and other high-tech, combined with the needs of the elderly to scientifically develop and design intelligent home care system apps, to meet the comprehensive construction of a moderately prosperous society and the new normal economic development of society.

Keywords: development and design technology; smart home care system APP; UI design

1. Introduction

From the perspective of China's national conditions, China's population aging has become an important part of population imbalance and limiting social and economic development. As of 2019, there are about 265 million people aged 65 and above in China, accounting for 11% of the total number of people in China, which shows that China has begun to enter an aging society, and the trend of population aging has ushered in severe challenges for China's social and economic development[1]. But behind its challenges, there are also many structural opportunities, among which the concept of "smart home care" is an important concept to optimize the market structure through the function of the intelligent home care system Application or Application Program (APP) can help the elderly break through the limitations of time and space, the application software can experience modern life in an all-round and high-quality way[2].

2. The development background of the smart home care system APP

2.1. China's aging background and related policies

Against the backdrop of a severe aging trend, China has formulated a series of policies. The "13th Five Year Plan" clearly stipulates that China should aim to integrate medical and elderly care in the elderly care industry[3]. Therefore, various regions should establish a comprehensive elderly care service system under the guidance of "medical and elderly care integration" in their development and construction, and continue to expand the coverage of basic elderly care and basic medical care in the construction of elderly care facilities. According to the statistical bulletin of the Ministry of Civil Affairs of China, there were 254 million people over the age of 65 in 2019, and only 2.15 million people chose elderly care institutions[4]. From the data, it can be found that 99% of elderly people in China chose home or community care. Compared with institutional elderly care, community elderly care can fully demonstrate the importance of the community and streets for the elderly while fundamentally breaking through the dilemma of traditional family elderly care[1].

2.2. Pension information construction

In the process of China's informatization construction, big data technology plays an important role. The "Proposal of the Central Committee of the Communist Party of China on the Formulation of the 13th Five-Year Plan for National Economic and Social Development" clearly improves the strategic development level of big data development and construction, and expounds the positive role of big data technology in national economic development and industrial optimization and upgrading in the form of application documents[2]. The Notice of the State Council on Printing and Distributing the Action Program for Promoting the Development of Big Data issued in the same year expounded the connotation of big data from the level of national informatization construction, provided important guidance for the construction of big data target system, put forward key methods and strategies based on practical problems, and comprehensively coordinated the promotion of big data.

Under the guidance of the documents of the State Council, local departments began to release big data construction documents that are consistent with the actual local development situation, laying an important foundation for the development of big data technology in China[3]. China's "Plan" has drawn a grand blueprint for the development and construction of big data, and its content reveals the magnificent development prospects such as the big data industry support system and industry application capabilities, as shown in **Figure 1**.
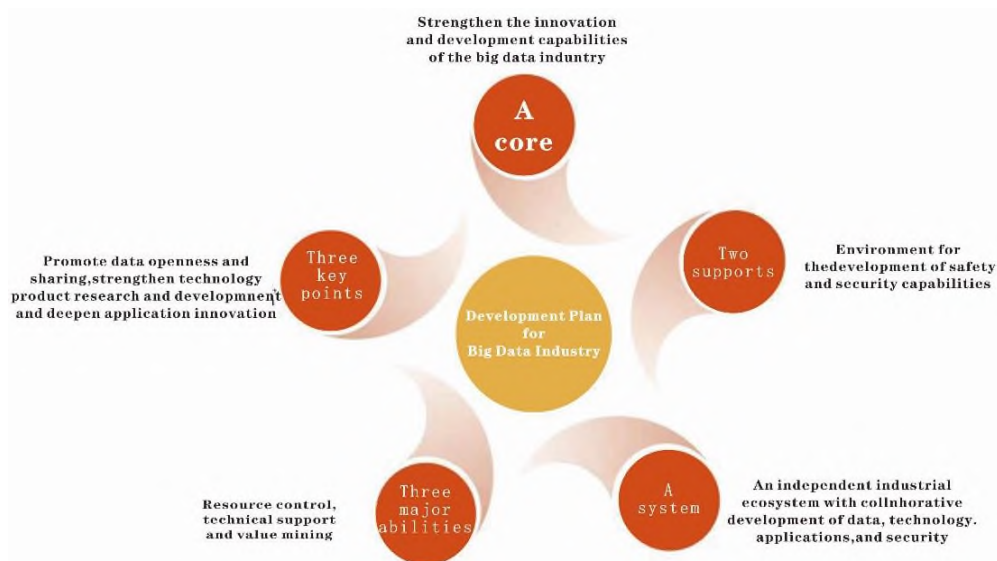

Figure 1. Key points of big data industry development planning.

3. Development status of home care planning in China

In the context of China's aging population and smart home care, provinces and cities in China have begun to explore and innovate smart old age, such as the Guanhu Street smart elderly care platform under the guidance of the Longhua District Civil Affairs Department, and it has taken the lead in various regions of Shenzhen[4]. In the following year, Shenzhen began to build smart pension apartments and signed the Bay Building Agreement in smart pension apartments and carbon cloud intelligence, and the two sides jointly created a "digital vitality circle". At the same time, many developed areas in China have also actively begun to explore smart old-age care, providing a rich experience for China's smart old-age care, although China's current smart old-age products are diverse, different types of product functions are not much different, most of these devices have an emergency call, motion monitoring and health monitoring and other functions[1].

In general, from the current development of home care in China, the planning and layout of community home care facilities mainly take population size as the main standard, and the service radius is clarified in the home care service planning, to achieve hierarchical and diversified coverage of elderly care services[5].

4. Requirements for supporting facilities of smart home care APP

4.1. Hardware requirements

Modern intelligent home care systems can need complete hardware equipment support, according to the overall function of the intelligent elderly care system[2], the hardware design should meet the following requirements: (1) In the context of scientific and technological innovation and development, portable and wearable terminal equipment has become a smart home care APP, an important medium to play a function, but in the selection of wearable devices, the functional characteristics and practicality of the device itself should be fully considered to ensure full performance in the application. (2) The system equipment should be equipped with a good quality circuit board, use the function of the circuit board to dynamically monitor the Electrocardiogram (ECG) of the elderly, and upload the ECG signal through the circuit board, under normal circumstances, in the smart home care APP can be applied filter amplification circuit board, and in the choice of circuit board should tend to low power, cheap price, and small size circuit board. (3) The transmission and processing of ECG signal data of the gateway ECG signal processing and transmission is an important application to present the modern function of the system, so the system construction should focus on the processing and transmission of ECG signals, at the same time, technical personnel should combine the characteristics of ECG signal processing and transmission to select a gateway with perfect functions, and low power and fast processing speed should be taken as important indicators in the selection of gateways. (4) For the tablet computer for ECG signal analysis, a larger screen should be selected as much as possible to provide convenient conditions for managers to analyze the health indicators of the elderly. (5) Controller, the main role of the controller is to control the smart home of the house, but the basic principles of simple operation and stable operation should be followed in the selection of the controller. Finally, in the application of an intelligent home system, it should be equipped with a clear camera to understand the actual situation of the elderly through dynamic inspection, but the clarity and smoothness of the picture should be strictly controlled in the camera selection[6].

4.2. Software requirements

Software is an important medium for entering system commands, so the application of an intelligent home system should focus on the design requirements of the software, and at the same time in the development and design of the intelligent home system should fully understand the subjectivity of the elderly[3]. Hence, designers should fully consider the characteristics of the elderly, such as the elderly group of intelligent equipment and a variety of software acceptance is relatively limited, so the software selection should meet the following requirements: dynamic upload after the collection of health information[4]. Then, the dynamic monitoring

function of the application software implements dynamic monitoring of data information, and remote control can be implemented for indoor electrical appliances, doors, windows, and other ways that can be sent by serial ports, to provide high-quality quality of life for the elderly[1]. ECG signal acquisition software running on the microprocessor can realize efficient sampling of ECG signals, define the host computer's communication protocol, and finally upload the complete data information to the host computer[2]. The software's main function is to obtain the data obtained by the software on the computer side of the Windows system or the mobile phone terminal of the Android system, and then understand the living status and health of the elderly through automatic analysis by the system[3]. At the same time, the software of the system should be connected to the database of the hospital to analyze the detected values, and when it is found that the elderly have heart tube diseases and other potentially dangerous data, the system can timely transmit dangerous information to the hospital or guardians through automated technology[7].

4.3. System requirements

The system architecture of the smart home care system is shown in **Figure 2**. The system can detect the health of the elderly in real-time with the support of the wearable device terminal, filter and amplify the collected ECG data through the ECG acquisition circuit, and then convert the analog signal transmitted by the circuit into a digital signal through the converter, and finally upload the converted data signal to the server End computer, through such a method can be ECG data information application intuitive diagram display, through the ECG presentation for doctors to provide a basis for judgment, and the system can also calculate real-time heart rate results and ECG signal time domain and frequency domain analysis results uploaded to the host computer, through data transmission to upload a variety of health information to the cloud personal health database, when detected containing dangerous information, the system can automatically send alarm information to the hospital or monitoring personnel[4].
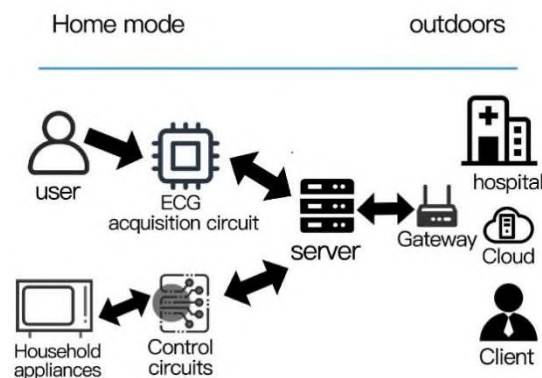

Figure 2. Architecture diagram of the intelligent home care system.

The server terminal host computer can also provide appropriate nursing solutions for the actual health of the elderly, integrate big data information to provide daily care information and basic precautions, including the health information of the elderly and the server of the hospital, etc., and at the same time ensure the regular update of data information during data processing to ensure that medical personnel and guardians dynamically grasp the health status of the elderly[1]. After the health information is uploaded to the hospital database, the doctor can give information feedback based on the physical condition of the elderly, prompting the guardians to adjust the care plan appropriately, and also give a targeted treatment plan for the condition. On the other hand, the elderly can also effectively control the electrical appliances or doors and windows in the home through the server and client terminals and can apply the function of the camera to observe the situation near the house[2].

From the functional analysis of user needs and demand analysis stage, it can be found that the development and design of intelligent home care systems should give full play to the role of basic information

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management, third-party institution management, authority management, task management, and data maintenance[3].

5. Smart home care system design process

The development of an intelligent home care system can effectively collect location information and demand information of the elderly, laying an important foundation for providing high-quality elderly care services[4]. The system construction includes two important media, the portal, and the user terminal, so the system information collection is mainly aimed at these two objects. In the development and design of the intelligent home care system, the system application requirements should be clarified, and the system code and system maintenance should be written under the guidance of the application requirements[1].

5.1. System design process

The design of a smart home elderly care system should strictly follow the design requirements, first of all, the designer should make it clear that the system is oriented to the elderly group in the system design, so the characteristics of such groups should be analyzed in detail in the system design, and the practicality of the website should be improved under the guidance of the characteristics of the elderly, and the product requirements of "community elderly care service ordering" should be fully understood in the system design; At the same time, system developers and designers should fully understand the basic functions of the elderly care service system, such as user login and elderly care service subscription, and at the same time, the psychological and physiological characteristics of the elderly should be strictly followed in the design of user interaction interface; Finally, the later maintenance and modification should be fully considered in the code writing, so the design of the home care service system can apply open source code to provide high-quality services[2].

The design of the User Interface (UI) should give more consideration to the physiological and psychological characteristics of the elderly, so the design of the UI should strictly follow the principle of simplicity and directness[8], and at the same time combine the characteristics of the vision of the elderly. The designer should try to make the font design larger, and the contrast intensity of the color to be larger[9], to meet the characteristics of the reduced color recognition ability of the elderly, as shown in **Figure 3** shown.
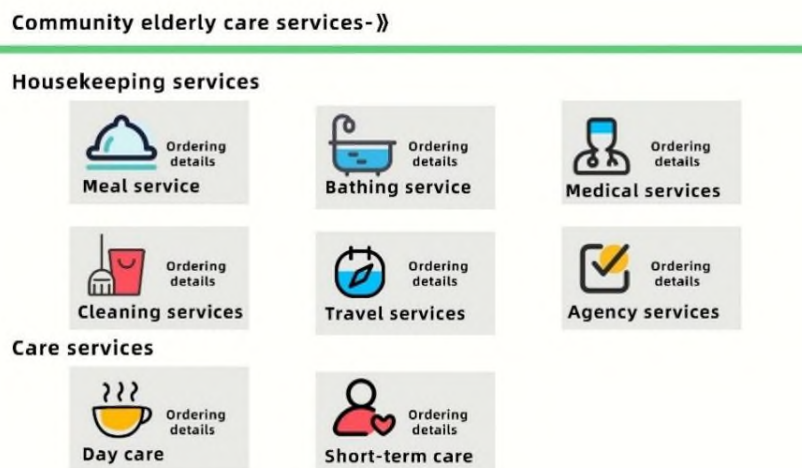

Figure 3. UI page design.

5.2. System design considerations

System development designers should fully understand the functional role of the smart elderly care APP, and then design a complete smart elderly care model driven by functional goals, and integrate it into the home care system, and the application of such a method can significantly improve the management efficiency of the

smart home care system[3]. At the same time, the system covers institutional care, community care home care, and other services, and the elderly can choose their favorite way to enjoy professional services in the system interface. However, in the process of operation and application of the elderly, system developers and designers should pay attention to the application of terminal equipment, can apply wearable devices or mobile phones and other terminal equipment to optimize the service experience of the elderly, for example, through intelligent ordering, health care and other applications can provide professional life guidance for the elderly, in the home care should reasonably apply smart home equipment, such as the application of smart lighting and smart kitchen can significantly improve the quality of life of the elderly. In dangerous locations in indoor spaces, well-functioning sensors should be installed to upload real-time monitoring information to the island terminal equipment in time[4]. System development designers can also design the escort machine AI robot person in combination with the actual situation, and the AI robot can alleviate the loneliness of the elderly by imitating the voice of the elderly or children[1].

6. The methodology

Shannon's Theory of Communication is a mathematical model proposed by Claude Shannon in 1948 to describe information transmission and communication process. This theory is widely used in the fields of information theory and communication engineering and has an important impact on the design and analysis of modern communication systems. The core idea of Shannon's communication theory is that information can be passed from sender to receiver through a transmission system. This transmission system includes the source (sender), encoder, channel (transmission medium), decoder, and receiver. In **Figure 4**, we focus on the process of information transmission and communication, In interface design, some principles and concepts of Shannon's communication theory can be used to improve users' understanding of information and the effect of communication[10].
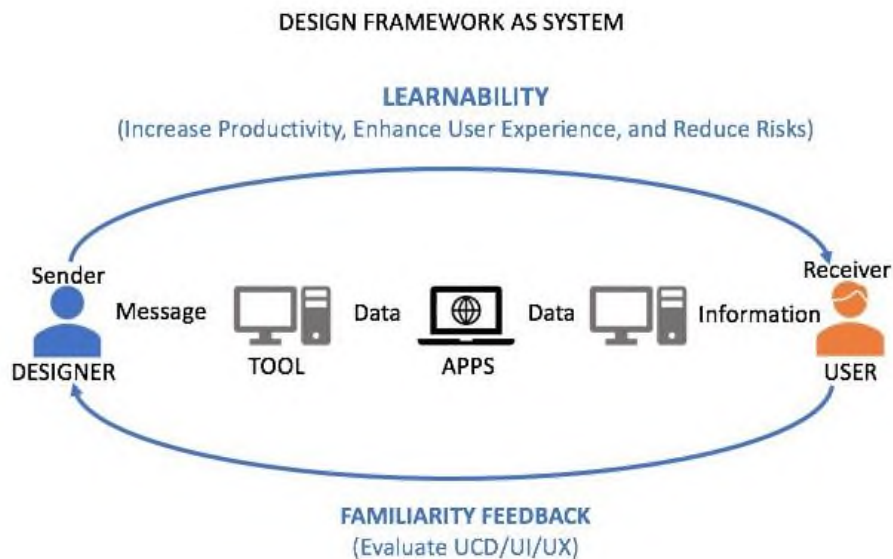

Figure 4. Shannon's theory of communication[11].

Simplify information: By reducing the amount of redundant and unnecessary information, users' attention and understanding of the core information in the interface can be improved. To avoid information overload, ensure that the information presented in the interface is clear, concise, and organized[7].

Use clear language and symbols: Choose concise, unambiguous language and symbols to convey information and avoid ambiguity and confusion. Use easy-to-understand and familiar vocabulary and symbols, so that users can understand and accept the information conveyed[12].

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Provide feedback mechanisms: Provide users with timely and clear feedback on the success or failure of their actions. This feedback can be visual, such as status flashes or effect animations, or it can be text or audio feedback. Through feedback, users can better understand their interactions with the system.

Noise and Interference: Consider possible noise and interference factors when designing interfaces to ensure accurate transmission and understanding of information. For example, input validation and automatic correction mechanisms can be provided when designing input forms to reduce the possibility of user input errors[13].

Adapt to the user's information capacity: According to the user's cognitive ability and the complexity of the interface, reasonably control the presentation method and quantity of information. Avoid overwhelming users with too much information, and lack of necessary understanding with too little information[14].

Reliable transmission and decoding: Ensure that the information in the interface can be accurately delivered to the user during transmission and decoding. Consider using appropriate interface elements, layout, and organization that allow users to easily understand and process information[15].

These principles and practical suggestions can help designers better apply the ideas of Shannon's communication theory, to improve the effect of interface design and user experience.

7. Significance of the study

Meeting the needs of an aging population: The study addresses the growing population of elderly individuals and their increasing use of technology[15]. By designing online application software specifically tailored to their needs, the study contributes to enhancing their digital inclusion and ensuring they can benefit from the advancements in technology.

Improving user experience and usability: Elderly users often face challenges when interacting with standard online applications due to age-related factors. This study aims to improve the user experience by designing user-friendly interfaces, reducing cognitive load, and incorporating accessibility features. Doing so enhances the usability and effectiveness of online application software for elderly users[8].

Enhancing quality of life and independence: Online application software designed with the needs of elderly users in mind can help improve their quality of life and enable greater independence. By facilitating easy access to communication tools, health monitoring apps, social engagement platforms, and more, the study empowers elderly individuals to connect, stay informed, manage their health, and engage in meaningful activities.

8. Concluding remarks

In general, this paper introduces in detail the development background and design process of the smart home care system APP. In the context of the significant increase in China's demand for the elderly, smart home APP is bound to enter the public family in the future, providing a strong guarantee for improving the quality of the elderly[16]. Therefore, in the development and design of intelligent home care APP, we should pay attention to the close relationship between the elderly, children, and doctors, and combine the behavior habits of the elderly to scientifically design the APP interactive system and visual interface to lay an important foundation for maintaining the harmonious development of society[17].

Author contributions

Conceptualization, YL, SZA; methodology, YL; software, VVV; validation, YL, SZA and VVV; formal analysis, SZA; investigation, YL; resources, VVV; data curation, YL; writing—original draft preparation, YL;

writing—review and editing, YL; visualization, SZA; supervision, SZA; project administration, VVV; funding acquisition. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare no conflict of interest.

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