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Design and Development of Smart Elderly Care Apps in Henan, China

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ABSTRACT

As population aging intensifies, smart elderly care has become a crucial means to improve the quality of life for older adults and alleviate the social burden of eldercare. However, the design and development of smart elderly care applications must align with user needs, usability, and accessibility concerns. This study aims to investigate, analyze, and assess innovative models of smart elderly care in Henan Province, focusing on the design and development process of a smart elderly care app. A mixed-methods approach was employed, combining surveys and in-depth interviews to gather data on the needs and preferences of elderly individuals in Henan. Through quantitative and qualitative data analysis, core functional requirements were identified, leading to the proposal of an app design tailored to regional characteristics. The study provides insights into enhancing app usability, improving user experience, and integrating innovative digital health solutions. The findings offer theoretical support and practical guidance for implementing regional smart elderly care solutions

1 INTRODUCTION

Society can be divided into two groups: young and old. Each group may react differently to isolation and loneliness. Especially in the case of older people, social isolation carries many psychological and medical risks (Norman, 2004). It can even lead to depression, but physiologically it reduces the body's ability to fight infection and inflammation caused by stress and anxiety caused by long-term loneliness. This is especially true for older people who live independently, without family support or social connections with others (friendships, participation in regular social activities) (Gumowska et al., 2024). The problem of the aging Chinese population is becoming increasingly serious, and the consequent pension problem has become one of the key topics and hot issues of social concern at this stage. The main group of smart pensions is the elderly, and these groups live in the community, pension institutions, and other living places. Based on the needs of the elderly, through the Internet mobile device and intelligent management system, the home care service model of the "online-offline community" is convenient, efficient, and low-cost (see Liu, Abidin, & Vermol, 2024). The most critical link in this kind of intelligent pension service is the smart pension platform, which is the core position of the whole link. This link describes the process of imagining, creating, and iterating products that solve users' problems or address specific needs in a given market (Toyong, Abidin, & Mokhtar, 2021). The key to successful product design is understanding the end-user customer, the person for whom the product is being created (Zainal Abidin, Sigurjonsson, Liem, & Keitsch, 2008). This can be related to aesthetics and the philosophy of art specifically studying how designers imagine, create, and perform works of art, as well as how people use, enjoy, and criticize art (Crilly, 2005; Karjalainen, 2004). However, with time, the advancement of science and technology, and the changing needs of the elderly,

have led to the low popularity of technology applications, the low digital literacy of the elderly, and data privacy and security issues in using the platform. Therefore, developing smart elderly care in the future requires continuous efforts in technological innovation, policy support, and social cognition (Zhang et al., 2020).

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2 LITERATURE REVIEW

The development of smart elderly care applications has gained significant attention globally, yet empirical studies on app design features, including usability, accessibility, and user engagement, remain scarce. A conceptual framework is necessary to establish design principles that prioritize elderly users' needs. Previous studies (Hung, 2022) highlight the benefits of integrating AI-driven solutions, yet critical analyses of their effectiveness for elderly users are limited. Additionally, Liu et al. (2023) examined the progress of smart elderly care research, emphasizing the need for personalized and adaptable designs. This study addresses this gap by evaluating app design considerations, including interface usability, personalization features, and ethical implications (Karjalainen, 2004; Crilly, 2005).

2.1 The current status of foreign research

Smart elderly care, as a new model of using information technology and intelligent equipment to provide life care and health management for the elderly, has received extensive attention and rapid development worldwide in recent years. Internationally, the concept of smart elderly care was first proposed in Japan and the United States, and gradually promoted to developed countries such as Europe. Smart elderly care in these countries mainly relies on advanced information and communication technologies (ICTs), such as the Internet of Things (IoT), big data analytics, and artificial intelligence (AI), to provide personalized, convenient, and intelligent services for the elderly. For example, the "robotic care system" in Japan and the "smart home elderly care system" in the United States have achieved remarkable results in the market (Hung, 2022).

## 2.2 The current status of domestic research

In China, the development of smart elderly care began at the beginning of the 21st century, and with the support of national policies and technological progress, it has gradually entered a stage of rapid development. In 2013, the State Council issued "Several Opinions on Accelerating the Development of the Pension Service Industry", which clearly stated that it was necessary to develop smart pension services (State Council, 2013). Since then, local governments have responded positively and launched a series of smart pension projects, such as the "Smart Pension Demonstration Community" in Beijing and the "Smart Pension Service Platform" in Shanghai. These projects improve the quality of life and social well-being of older adults by integrating resources and technology (Liu, et al.,2023).

As a populous province in China, Henan has an increasingly serious aging population. According to the data of the seventh national population census, the proportion of the population aged 60 and above in Henan Province has exceeded 20%, and the aging degree is higher than the national average (National Bureau of Statistics, 2020). This phenomenon poses a severe challenge to Henan's social and economic development and pension service system.

At present, elderly care services in Henan mainly rely on traditional family care and community care, but these models have made it difficult to meet the growing demand for elderly care. The miniaturization of family structures and the increase in empty nesters have put great pressure on traditional family care (Ren et al., 2024). Although community elderly care services are gradually developing, the service capacity and coverage are still limited, and it is difficult to fully meet the diverse needs of the elderly.

2.3 Research on smart pension at home and abroad

A total of 42 related articles were retrieved using Web of Science as the foreign literature search database and "smart pension" as the search keyword. According to the How Net database, nearly 2000 related articles were retrieved. Overall, the number of domestic and foreign publications is increasing year by year, and the number of documents has increased significantly since 2019. Figure 1 shows the trend of the number of smart pension publications on the How Net platform from 2019 to 2023.
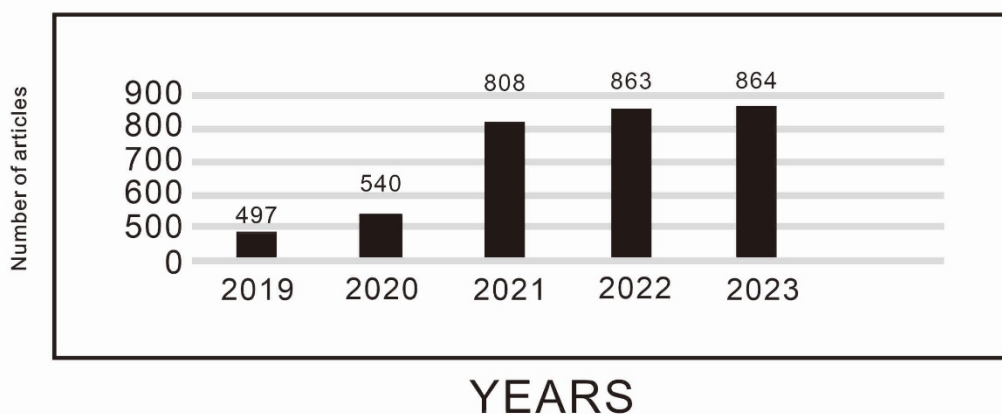
Figure 1 Statistics of research papers on smart elderly care at home and abroad from 2019 to 2023(Source: Liu Ying, 2024, Copyright Consent: Permissible to Publish)

As shown in Figure 1, from the perspective of the number of publications, the research on the field of "smart pension platform" in academic circles at home and abroad is still in its infancy in 2019-2020 and has reached a peak in 2021-2023. Among them, the research carried out by foreign academia started earlier, mainly focusing on the technical aspects of elderly care service facilities (see Butt, 2023; Yang, et al., 2018), while domestic research in this field mainly focuses on the concept definition and model research, which is a research idea with outstanding qualitative research. （Han et al.，2023）

In this context, smart pension, as a new pension model, has broad application prospects. In recent years, the Henan Provincial Government has actively promoted the development of smart elderly care and launched a series of policy measures and pilot projects. For example, in 2019, the Zhengzhou municipal government launched the "Smart Elderly Care Demonstration Project" to provide health monitoring, emergency calls, life care, and other services for the elderly through the construction of a smart elderly care service platform (Henan Provincial Department of Civil Affairs, 2019). These measures have effectively improved the quality of life of the elderly and reduced the burden on families and society. Despite this, Henan's smart pension is still in its infancy, facing problems such as insufficient capital investment, poor application of technology, and lack of professional talents. Therefore, in the future, it is necessary to further strengthen policy support, technology research and

development, and talent training to promote the in-depth development of smart elderly care (Bao et al., 2022).

3 RESEARCH METHODOLOGY

Based on the development and design of the smart elderly care app in Henan, this paper extracts the key elements of the needs of the elderly, discusses the design ideas and models of the smart elderly care app in Henan, and transforms them into specific design practices. Through the cognition of users and developers, the effectiveness of the design model is verified, the smart elderly care app is returned to the public eye, and a more detailed reference methodology is summarized (see Saparamadu et al., 2021; Li et al., 2021), which provides new inspiration for the innovative development of smart elderly care apps and the promotion of digital services for the elderly, and ultimately serves the improvement of the quality of life of the elderly and the design and dissemination of smart elderly care products (see Warell, 2008).

This study adopts a mixed-methods research design, combining qualitative and quantitative approaches to assess the design and usability of smart elderly care apps (Sekaran, 2003; Yin, 2003). The study includes elderly users aged 60 and above in Henan Province, selected through stratified sampling to ensure diverse representation. Caregivers and healthcare professionals were also interviewed to provide insights into app usability from a service provider perspective (Li et al., 2021). Quantitative survey data were analysed using SPSS, and qualitative interview data were transcribed and thematically analysed using NVivo software. This approach ensures a comprehensive understanding of user needs and app functionality (Saparamadu et al., 2021; Warell, 2008).

The framework of this research is based on the stages of the Design Research Methodology (DRM) (see Figure 2). A simple example will help clarify the terms that are used. Note that individual research projects usually focus on one or two stages only, and that iterations between stages will take place. The DRM emphasizes several factors: The need to formulate success as well as measurable criteria (for example, the role of the Criteria definition stage is to identify the aims that the research is expected to fulfil, as well as the focus of the research project); the need to focus Descriptive Study I on finding the factors that contribute to or prevent success; the need to focus the Prescriptive Study on developing support that addresses those factors that are likely to have most influence; and, finally, the need to enable evaluation of the developed support (Descriptive Study II).
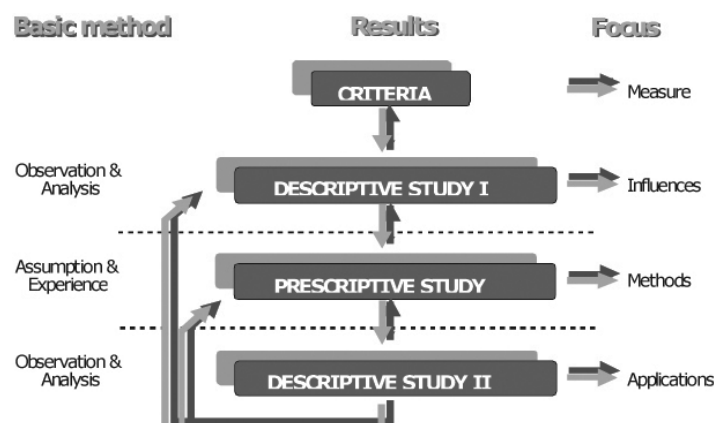
Figure 2 A Design Research Methodology framework
(Source: Blessing & Chakrabarti, 2009, Copyright Consent: Permissible to Publish)

After reviewing a large number of relevant literatures, and absorbing and drawing on the research content of predecessors, the research significance, research content, and research methods were determined. This study adopts a mixed research method, combining quantitative and qualitative research methods, to comprehensively understand the needs and preferences of the elderly in Henan

Province for smart elderly care apps (see Sekaran, 2003; Patton, 2002; Yin, 2003). （Li, & Abidin. 2024）

3.1 Research Questions

RQ1: What is the core demand of the elderly in Henan for smart pension apps?

RQ2: What are the shortcomings of the existing smart pension apps in meeting the needs of the elderly in Henan?

RQ3: In view of these shortcomings, how to design and develop a smart pension app that meets the needs of the elderly in Henan?

3.2 Research Hypotheses

RH1: Older adults in Henan Province have a higher demand for health monitoring, life services, and social interaction functions (Saparamadu et al., 2021).

RH2: Existing smart elderly care apps have deficiencies in user interface design, function integration, and data privacy protection. （Lawani et al., 2021）

RH3: Smart elderly care apps designed through user demand analysis and feedback can significantly improve user satisfaction and the quality of life of the elderly (Li et al., 2021).

The methodology of this study aims to provide a comprehensive understanding of innovative design models, especially in the initial conceptual design phase of the decision-making process (Saparamadu et al., 2021). The study used a natural exploration framework, took into account the flexibility of emergency design, and used purposeful sampling methods to ensure that the data collected were representative (Li et al., 2021). The study used semi-structured interviews and group analysis methods to analyse the collected material, including audio recordings, images, and videos (Anghel et al., 2020). The data was then transcribed and written into reflective notes and sketches, as well as photographs and collected activity materials (see Kamil, Abidin, & Hassan, 2019). To extensively collect and deeply explore the current status and specific needs of the elderly in Henan Province on the issue of smart elderly care, the research team conducted an extensive questionnaire survey and semi-structured interviews for the elderly in Henan Province.

3.3 Data Collection

3.3.1 Questionnaires

This study adopted a random sampling method and aimed to select a representative group of elderly people in Henan Province as the survey subjects. To ensure diversity and representativeness of the sample, the sample will include older adults of different ages, genders, and socioeconomic backgrounds. For the study, the target sample size was set at 300 people to ensure the statistical significance of the data and the universal applicability of the results. In the questionnaire, firstly, the awareness and use status of the elderly on the smart pension service platform were investigated. Secondly, a questionnaire survey was conducted on the elderly who had used the smart pension service platform, with the purpose of discovering the problems existing in the use of the platform and listening to suggestions. Thirdly, the elderly respondents who did not use the smart pension service platform were intervened, and the impact of the smart pension platform on the living conditions of the elderly was analysed. Finally, drawing on the advanced experience of smart home care at home and abroad, combined with the actual situation of Henan Province, this paper explores the smart care model suitable for the elderly in Henan Province.

To ensure the breadth and coverage of data collection, the questionnaire was distributed in a combination of online and offline methods. The online questionnaire was distributed through social media platforms, email, and relevant online communities of older adults in order to reach more digitally capable older adults. Offline questionnaires were distributed in community elderly care service centres,

elderly activity centres and other public places where the elderly gathered, to ensure that those who are not familiar with digital technology can also participate in the survey. This multi-channel distribution strategy ensures that the questionnaire reaches a broad group of older adults and improves the completeness and representativeness of data collection.

3.3.2 Semi-structured interviews

A representative sample of 20 older adults from the survey participants were selected for in-depth interviews to ensure that different age groups, genders, and levels of use of smart devices were covered. The interview content includes the specific needs of the elderly for smart elderly care apps, user experience, opinions and suggestions on existing apps, and expectations for future app functions. Semi-structured interviews are conducted face-to-face or by telephone, each interview lasts about 30 minutes, and the content of the interview is recorded and transcribed.

By encoding the transcripts of in-depth interviews, similar ideas, and topics are categorized to form a preliminary analytical framework. Based on the coding results, the key themes and patterns are identified and summarized to understand the specific needs and experiences of the elderly for the smart elderly care platform. The specific functional requirements and improvement suggestions mentioned in the interview are analysed in detail to provide a reference for the design of the smart elderly care platform.

Given the involvement of human participants, ethical approval was obtained from the relevant institutional review board. Informed consent was secured from all participants, and data confidentiality was maintained throughout the research process.

4 CASE EXAMPLE（Comparative study of apps based on different design methods）

The design and development of smart elderly care applications involve a variety of approaches, each with its own unique advantages and challenges. In this paper, three major design approaches are compared: user-centred design (UCD), technology-driven design (TDD), and participatory design (PD), focusing on their application in the development of smart elderly care applications.

4.1 User-Centred Design (UCD)

User-centred design emphasizes understanding the needs, preferences, and limitations of end users. Apps designed using UCD tend to have higher usability and acceptance among older adults because the design process involves iterative testing and feedback from actual users (Chambers et al., 2002). However, one limitation is that it can be time-consuming and costly because it requires extensive user research and prototyping (Nielsen, 1994). In Figure 3, Focused on the needs of the elderly, Family Protection with Panic/SOS Alerts - The app alerts everyone in your private family group, contributing to family safety, promoting family health and happiness, and bringing you closer to your loved ones.

Figure 3 A private family app for parents and guardians
(Source: From the Internet, 2024, Copyright Consent: Permissible to Publish)

4.2 Technology-Driven Design (TDD)

Technology-driven design focuses on leveraging the latest technological advances to create innovative solutions. In the context of smart elderly care, TDD may involve integrating advanced sensors, artificial intelligence, and IoT technologies into applications. While this approach can result in cutting-edge functionality, it often overlooks the specific needs and capabilities of elderly users, which can lead to lower adoption rates and usability challenges (Xia, 2021). In Figure 4, this senior citizen app makes users feel safe and protected through the access of smart devices (e.g. alarm button, GPS tracking, motion sensors, etc.)
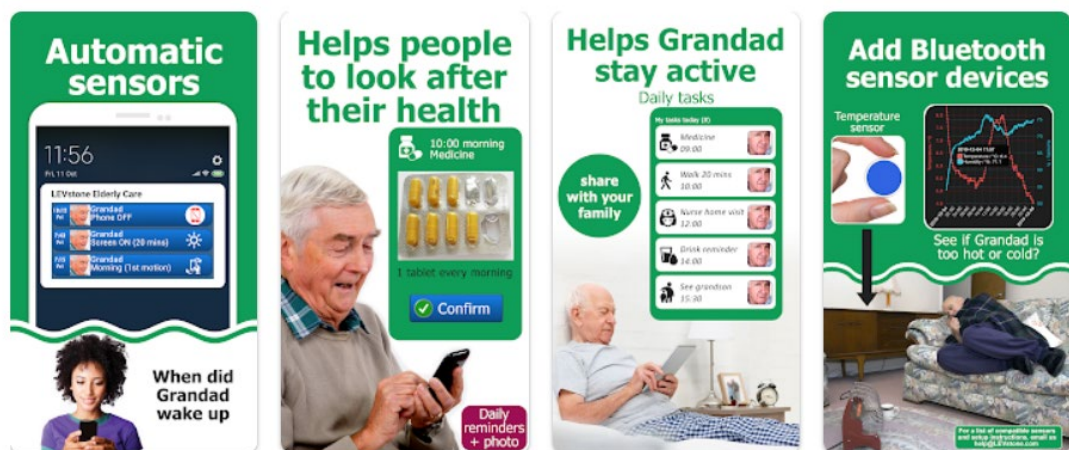

Figure 4 Leverage the latest technological advances to create innovative apps. (Source: From the Internet, 2024, Copyright Consent: Permissible to Publish)

4.3 Participatory Design (PD)

Participatory design involves stakeholders, including older adults, caregivers, and healthcare professionals, in the design process. This collaborative approach ensures that the application meets the diverse needs of all parties involved. Applications developed using PD are often well received by users because the design process is inclusive, which can enhance ownership and buy-in (Rubin & Chisnell, 2011). However, coordinating input from various stakeholders can complicate the design process and extend development time (Strauss & Corbin, 2014). In Figure 5, this app provides care where the user

is and enables health and recovery through holistic personal care. It also meets the diverse needs of older adults and caregivers.
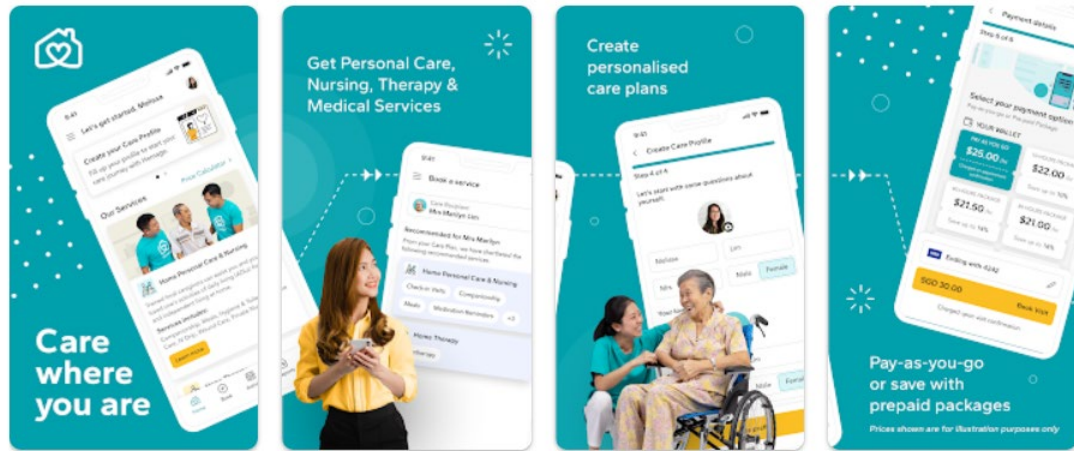
Figure 5 A one-stop solution for a full range of home and community healthcare services. (Source: From the Internet, 2024, Copyright Consent: Permissible to Publish)

When comparing these approaches, UCD provided the best results in terms of user satisfaction and app usability, making it particularly suitable for elderly care apps (Chambers et al., 2002). However, TDD excels at introducing innovative features that can significantly enhance the functionality of an app, although there is a risk of reduced user adoption if it does not meet user needs (Xia, 2021). PD strikes a balance by ensuring that the app meets a wide range of user needs, although the complexity of managing multiple stakeholders can be a disadvantage (Rubin & Chisnell, 2011). When designing, the choice of design approach should be aligned with the specific goals of the smart elderly care app. While UCD is often recommended for its focus on usability and user experience, combining elements of TDD and PD can lead to more innovative and widely accepted solutions. Future research could explore hybrid design approaches that integrate the strengths of these approaches to optimize the development of smart elderly care apps (Zhongyao et al., 2024; Tagie et al., 2023).

5 DISCUSSIONS

The findings indicate that elderly users prioritise ease of navigation, personalized health monitoring, and secure data management in smart elderly care applications. User feedback revealed common issues such as small font sizes, complex menu structures, and lack of interactive support. Practical recommendations for app developers include: Implementing larger, high-contrast text for readability; Enhancing voice command functionality for users with mobility impairments; and Strengthening data security measures to address privacy concerns (Xia, 2021).

5.1 Pay Attention to the Content of the Service

User-friendly design should be strengthened. According to the characteristics of smart devices used by the elderly, a simple and easy-to-use user interface is designed, with a large font size, clear icons, and simple navigation methods, which reduces the operation steps and improves the user experience. In addition, personalized interface setting options are provided, allowing seniors to adjust the font size, colour contrast, etc. according to their preferences to improve the comfort of use.

Enhance function integration and expansion. The health monitoring function is the core of the smart elderly care platform, which should integrate a variety of health monitoring devices (such as

sphygmomanometers, heart rate monitors, etc.) to monitor the health status of the elderly in real-time and provide health warnings and suggestions. At the same time, convenient life service functions such as housekeeping service reservations, online shopping, food and beverage delivery, etc., will be added to provide one-stop services for the elderly. Social interaction features are equally important, and social interaction features suitable for older adults, such as video calls, interest groups, online activities, etc., should be developed to help older adults stay socially connected and prevent loneliness.

Provide professional support and training. Carry out training on the use of smart devices for the elderly, and improve the digital literacy and use skills of the elderly through online video tutorials and offline training courses. At the same time, it provides online customer service and technical support to solve the problems encountered by the elderly in the process of use promptly to ensure the stable operation of the platform and user satisfaction.

5.2 Develop A Service System That Meets the Characteristics of the Elderly Respondents

Improving the scalability and sustainability of the platform is also key. Establish an open platform interface, allow third-party services and applications to access, enrich the service content and functions of the platform, and improve the scalability of the platform. By establishing cooperative relations with medical institutions, community service centres, enterprises, etc., we will jointly promote the development of smart elderly care and realize resource-sharing and complementary advantages.

Regular evaluation and continuous improvement are the guarantees to ensure the long-term and effective operation of the platform. Establish a sound user feedback mechanism, regularly collect the opinions and suggestions of the elderly and their families, and adjust and optimize the functions of the platform promptly. Regularly carry out platform performance evaluation, evaluate the use effect and service quality of the platform through data analysis and user research, formulate improvement measures, and continuously improve the service level of the platform.
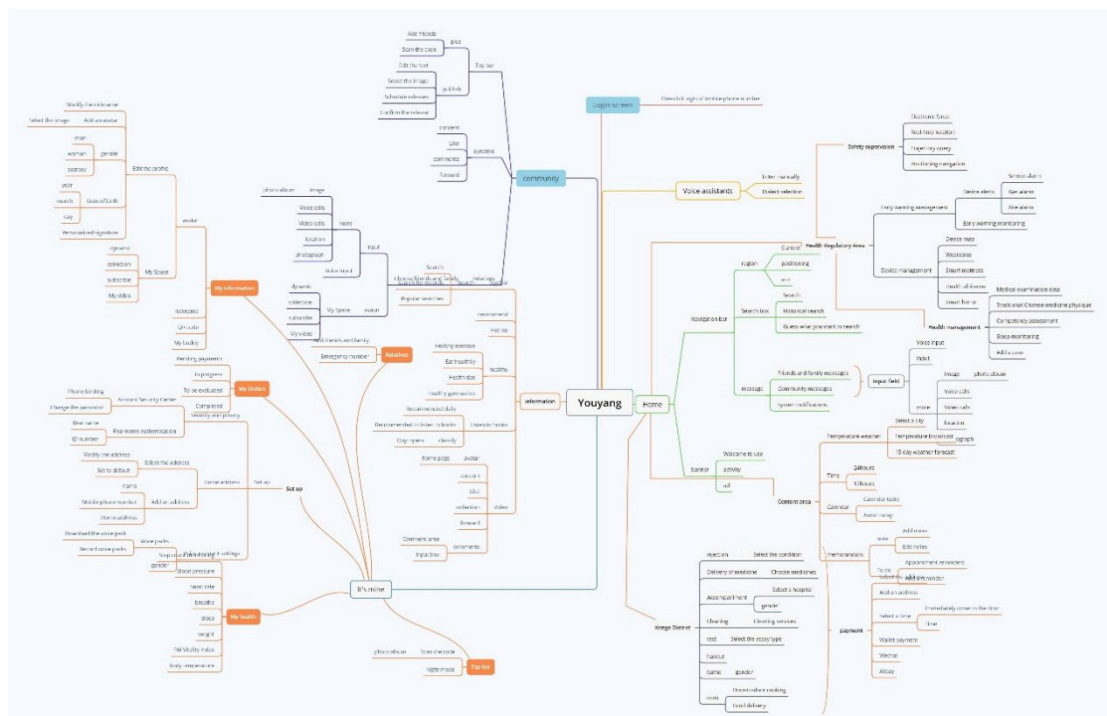
Figure 6 You Yang APP - organization structure
(Source: Liu Ying, 2024, Copyright Consent: Permissible to Publish)

Figure 6 illustrates the initial organizational structure of the app, which is systematically designed to meet the needs of users through different modules and functions. It mainly includes four major sections: "Login Interface", "AI", "Home" and "My", and each section is subdivided into multiple functional areas. Through multi-functional integration, the needs of elderly users are fully considered, and a full range of support and services are provided from health monitoring to life services, aiming to improve the quality of life and happiness of the elderly.

The study contributes to the ongoing discourse on smart elderly care by offering evidence-based recommendations to improve app design, usability, and service integration. Future research should explore AI-driven personalization features and cross-regional adaptability of smart elderly care solutions (Rubin & Chisnell, 2011; Lawani et al., 2021).

6 CONCLUSIONS

Population aging is a major social problem facing China, but the rapid development of artificial intelligence, big data, Internet technology, and other fields provides ideas for solving this problem and also provides new opportunities for the transformation of the pension service model. This study explores the development and design of smart elderly care apps in Henan Province to meet the specific needs of the elderly population. Through systematic research design, including research questions and hypotheses, data collection and analysis methods, as well as specific app development and testing processes, this paper provides an empirical basis and practical guidance for the design of smart elderly care apps.

The results show that the elderly in Henan Province have a high demand for health monitoring, life services, and social interaction. The existing smart pension apps have deficiencies in user interface design, function integration, and data privacy protection. Through user demand analysis and feedback, the optimized design of smart elderly care apps can significantly improve the user satisfaction and quality of life of the elderly

The innovation of this study lies in the combination of quantitative and qualitative analysis methods to fully understand the needs of older adults and translate these needs into concrete design practices. The study not only verifies the effectiveness of the design model but also provides detailed methodologies and practical suggestions for the development of smart elderly care apps in the future.

At the same time, there are some limitations to this study. For example, the sample size is relatively small, which can affect the generalizability of the results. In addition, the study was only conducted in the Henan region, and the needs of older people in other regions may differ. Future studies could expand the sample to cover more regions to verify the broad applicability of the findings.

In short, the development of smart pension should be based on effectively promoting the unification, sharing, and integration of the intelligent service system for the elderly, accelerating the construction of the ecosystem and full-scene application of smart pension, and providing new inspiration for the innovative development of smart pension apps and the promotion of digital services for the elderly with age-friendly smart research, aiming to improve the quality of life and happiness of the elderly and promote the design and dissemination of smart pension products.

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AUTHOR CONTRIBUTIONS

All authors shared the same contribution to the production of this paper.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

Gumowska, A., Abidin, S. Z., & Zbiec, M. (2024, March). Design thinking social loneliness in the time of Covid-19 pandemic. In AIP Conference Proceedings (Vol. 2750, No. 1). AIP Publishing.

Hung, J. (2022). Smart elderly care services in China: challenges, progress, and policy development.Sustainability,15(1), 178.

Liu, X., Chau, K. Y., Liu, X., & Wan, Y. (2023). The progress of smart elderly care research: a scientometric analysis based on CNKI and WOS.International Journal of Environmental Research and Public Health,20(2), 1086.

Ren, W., He, R., Tarimo, C. S., Sun, L., Wu, J., & Zhang, L. (2024). Willingness and influencing factors of old-age care mode selection among middle-aged and older adults in Henan Province, China.BMC geriatrics,24(1), 72.

Zhang, Q., Li, M., & Wu, Y. (2020). Smart home for elderly care: development and challenges in China. BMC geriatrics,20, 1-8.

State Council. (2013). Several opinions on accelerating the development of elderly care services. Retrieved from http://www.gov.cn.

Henan Provincial Department of Civil Affairs. (2019). Implementation Plan for Zhengzhou Smart Elderly Care Demonstration Project. Retrieved from http://mz.henan.gov.cn.

National Bureau of Statistics. (2020). Data of the seventh national census. Retrieved from http://www.stats.gov.cn.

Bao, J., Zhou, L., Liu, G., Tang, J., Lu, X., Cheng, C., ... & Bai, J. (2022). Current state of care for the elderly in China in the context of an aging population. Bioscience trends,16(2), 107-118.

Anghel, I., Cioara, T., Moldovan, D., Antal, M., Pop, C. D., Salomie, I., ... & Chifu, V. R. (2020). Smart environments and social robots for age-friendly integrated care services. International journal of environmental research and public health,17(11), 3801.

Saparamadu, A. A. D. N. S., Fernando, P., Zeng, P., Teo, H., Goh, A., Lee, J. M. Y., & Lam, C. W. L. (2021). User-centered design process of an mHealth app for health professionals: Case study. JMIR mHealth and uHealth, 9(3), e18079.

Lawani, M. A., Turgeon, Y., Côté, L., Légaré, F., Witteman, H. O., Morin, M., ... & Giguere, A. (2021). User-centered and theory-based design of a professional training program on shared decision-making with older adults living with neurocognitive disorders: a mixed-methods study. BMC Medical Informatics and Decision Making, 21, 1-25.

Liu, Y., Abidin, S.Z., & Vermol, V.V. (2024). Development and design of an intelligent home care system APP based on technology. Journal of Autonomous Intelligence, Vol. 7(1), 1-9. DOI: 10.32629/jai.v7i1.1198

Toyong N., Abidin S.Z., & Mokhtar S. (2021). A Case for Intuition-Driven Design Expertise. In: Chakrabarti A., Poovaiah R., Bokil P., Kant V. (eds) Design for Tomorrow—Volume 3. Smart Innovation, Systems and Technologies, vol 223. Springer, Singapore. https://doi.org/10.1007/978-981-16-0084-5_10

Kamil, M. J. M., Abidin, S. Z., & Hassan, O. H. (2019). Assessing designers' perception, analysis, and reflective using verbal protocol analysis. In A. Chakrabarti (Ed.), Research into Design for a

Connected World - Proceedings of ICoRD 2019 Volume 1 (pp. 51-61). (Smart Innovation, Systems and Technologies; Vol. 134). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-981-13-5974-3_5

Zainal Abidin, S., Sigurjonsson, J., Liem, A., & Keitsch, M. (2008). On the role of formgiving in design. New Perspectives in Design Education. In DS 46: Proceeding of the 10th International Conference on Engineering and Product Design Education. Universitat Politecnica de Catalnya: Barcelona, Spain 04.-05.09., 365–370.

Blessing, L.T.M. & Chakrabarti, A. (2009), DRM, a Design Research Methodology. London: Springer-Verlag.

Crilly, N. (2005). Product Aesthetics: representing designer intent and consumer response. Cambridge: University of Cambridge.

Karjalainen, T. M. (2004). Semantic Transformation in Design: Communicating Strategic Brand Identity through Product Design References. Helsinki: University of Art and Design Helsinki.

Norman, D.A. (2004). Emotional design: why we love (or hate) everyday things. NewYork: Basic Books.

Patton, M.Q. (2002). Qualitative Research & Evaluation Methods (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Sekaran, U. (2003). Research Methods for Business: A Skill Building Approach (4th ed.). USA: John Wiley & Sons.

Yin, R. (2003). Case study research: Design and methods (3rd ed.). Beverly Hills, CA: Sage Publishing.

Warell, A. (2008). Modelling Perceptual Product Experience – Towards a Cohesive Framework of Presentation and Representation in Design. In Design & Emotion 2008; Proceedings of the 6th International Conference on Design & Emotion, October 6-9. Hong Kong: Hong Kong Polytechnic University.

Chambers, M., & Connor, S. L. (2002). User-friendly technology to help family carers cope.Journal of Advanced Nursing,40(5), 568-577.

Xia, P. (2021). Security Risk and Protection Mechanism of Privacy Data of the Elderly in the Smart Pension System. In 2020 International Conference on Applications and Techniques in Cyber Intelligence: Applications and Techniques in Cyber Intelligence (ATCI 2020) (pp. 712-718). Springer International Publishing.

Nielsen, J. (1994). Usability engineering. Morgan Kaufmann.

Rubin, J., & Chisnell, D. (2011). Handbook of usability testing: How to plan, design, and conduct effective tests. John Wiley & Sons.

Corbin, J., & Strauss, A. (2014). Basics of qualitative research: Techniques and procedures for developing grounded theory. Sage publications.

Li, W., & Abidin, S. Z. (2024). Innovative Design of Bamboo Weaving Products-Perspective from Hunan Province. Idealogy Journal, 9(1).

Zhongyao, Y., Ramlie, M. K., & Subri, S. (2024). Exploring the Impact of Emotion on Future Sustainable Development Education: Leveraging Virtual Reality Technology. *Idealogy Journal*, *9*(1).

Tagie, G., Merman, H., Taharuddin, N. S., & Johari, R. (2023). Correlation of Interactive Learning and Student's Intellectual Emotion. Idealogy Journal, 8(1).