

The Long-cycle Elderly Care Service Model for Young People: A Case Study of Financial Elderly Care Services Based on Virtual Digital Human Technology

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Abstract: There is a lack of financial elderly care services for young people in China. Such services in traditional ways are unlikely to meet their future needs because of the decreasing workforce. Therefore, the current study aims to establish long-cycle financial elderly care services for young people through virtual digital human technology. Five young people are first interviewed about financial elderly care services; then, a survey is conducted for another sixty young people; after that, needs for financial elderly care services are extracted from the interview and the survey. Based on such needs, this study proposes a financial elderly service model built on design strategies including effective service touchpoints, clear communication, personalized service design, and immersive interaction, which is displayed on an App called REME. This model can be a reference for designing long-cycle elderly care systems.

Keywords: Financial elderly care; service design; virtual digital human.

1. Introduction

In recent years, contemporary young people in China are more anxious about their future elderly care than before. On the one hand pensions may be inadequate in the future (Yang, 2017), on the other hand these young people may not get sufficient services when they are old because of labor shortage in China (Huang & Zhang, 2021)[1]. These young people should early make efforts to reserve and invest in pensions to face with the future challenges. As the most economically active groups in the society, contemporary Chinese young people prepare for pensions as early as possible will not only help themselves in the future but also active the economic market. However, insufficient financial elderly care services for young people (Zhang, Yang, 2022) and shortage of experience in financial management (Hahn, Lee, and Kim, 2022) inhibit contemporary Chinese young people to prepare for future elderly care.

In the context of negative population growth (Qi, Liu & Liu, 2022), labour force shortage (Ding & Xu, 2021), and rising old-age dependency coefficients, virtual digital human (VDH) is a potential resource to guide young people to prepare for future pensions and provide old-age services for them in the future (Guo, 2022)[2]. In consideration of labor shortage in the future, contemporary young people in China need more intelligent and less manual services. VDH can expand human perception ability and give rise to a powerful emerging technology industry (Lily Wang et al., 2021). Digital services can promote the necessity of smart aging services.

Under the current aging society, the main issue is how young people make pension reserves. In order to meet the future challenges of aging, new technologies should be applied in the field of aging services. Considering VDH has an important role in entertainment, healthcare and production industries, this study aims to establish a set of financial elderly care services for contemporary young people in China

with VDH.

2. Literature Review

2.1. Financial Elderly Care Service

Financial Elderly Care was firstly described as "Pension Finance" in Pension Finance (David, 2006), which emphasises that financial pensions are pension asset management, which can help people to obtain long-term wealth accumulation and improve the quality of life[3]. With the arrival of the aging society, financial pension service is an important issue. Under this situation, the lack of future pensions for young people has gradually emerged. The solution to the pension problem depends largely on the development of finance, which gains more attention in recent years (Deng & Li, 2021).

China's aging population (Huang & Zhang, 2021) may lead to insufficient labour to provide pension services when current young people grow old. In recent years, the issue of old age in China has received more and more attention from the society, and the problem of population aging has become more and more serious. In order to achieve the country's future long-term economic and social development, it is necessary to conduct an in-depth analysis of the current trend of population aging in China and the possible impacts and timely adjustment of the corresponding policies and measures, and the use of modern technology combined with financial pension services has become a trend to cope with the aging problem[4].

2.2. Virtual Digital Human Technology

Virtual Digital Human (VDH) means a composite body with human characteristics such as appearance, performance ability, interaction ability and so on, which is created in the virtual world based on computer graphics, graphic rendering, motion capture, deep learning, speech synthesis and other technologies (Guo, 2022). VDH is a good resource

supplement for financial planning apps as the current limited human resources are unable to meet the daily counselling needs of users. It is commonly used in entertainment, education and film production (Yan, 2023). As an extension and mapping of the real world, VDH also means the birth of a new life form (Huang, Xia & Tie, 2023)[5].

Many scholars have investigated the technical aspects of VDH, but Andreas Geiger's team studied them from a realistic interaction perspective, with their app allowing users to manoeuvre virtual scenes in VR and perform assembly tasks with real hands to increase immersive interaction (Andreas et al., 2020). Research by academic Li Jian found that consumers develop positive attitudes towards VDH products when there is a fit between VDH and the real product (Li Jian et al., 2023). Felix Gaisbauer's research has shown the importance of digital human simulation in a number of areas including entertainment, healthcare and the production industry (Felix Gaisbauer et al, 2020)[6].

Communication University of China released the "China Virtual Digital Human Impact Index Report 2021", which states that VDH will be used more in the meta-universe as a new social role. VDH will enter a completely new field and become a digital person with identity characteristics with multiple attributes, companion attributes, and other aspects that create a deeper connection with human beings. The content of the above report is relatively macro, basically does not involve the participation of VDH in the level of financial pension services, this study has selected the field of financial pension services as the research direction, which is one of the blue oceans for the application of VDH. Therefore, how VDH can provide users with more personalised services is also an important research direction of this study.

2.3. The Current Situation and Problems of Young People's Preparation for Old Age

Contemporary Chinese young people are willing to prepare

for future elderly care in advance. They need stable and reliable financial services for elderly care[7]. The young people are the most promising people in the future, with a more personalised choice of retirement mode (Qiao, Zhu, Gao, Tang & Zou, 2023).

On the trend of population aging, diverse needs for elderly care are necessary. The elderly care service industry is in the stage of transformation and upgrading, which puts forward higher requirements and challenges for the elderly care service design. In addition, some youth people currently have advanced awareness of elderly care and relevant investment(Hou & Wu, 2022). Artificial intelligence and other technologies can provide young people with the option to store and invest both monetary and non-monetary resources in advance. Although the current pension industry focuses on the material and spiritual needs of the elderly, pension resources are still insufficient, especially human resources (China Aging Science Research Centre, 2023). Therefore, the current study aims to establish a set of services for their own resources through VDH technology, which is served for their future elderly care.

3. Research Methods and Analysis

3.1. Methods

Figure 1 illustrates the research method of the current study. Young people in China are seen as the target group of this study. This study firstly conducts semi-structured interviews with five young people in China, and then, distributes questionnaires to sixty young people[8]. Young people's financial pension needs and pain points are analyzed based on the interview and the survey. A reasonable and appropriate model of financial pension services is established according to their needs.

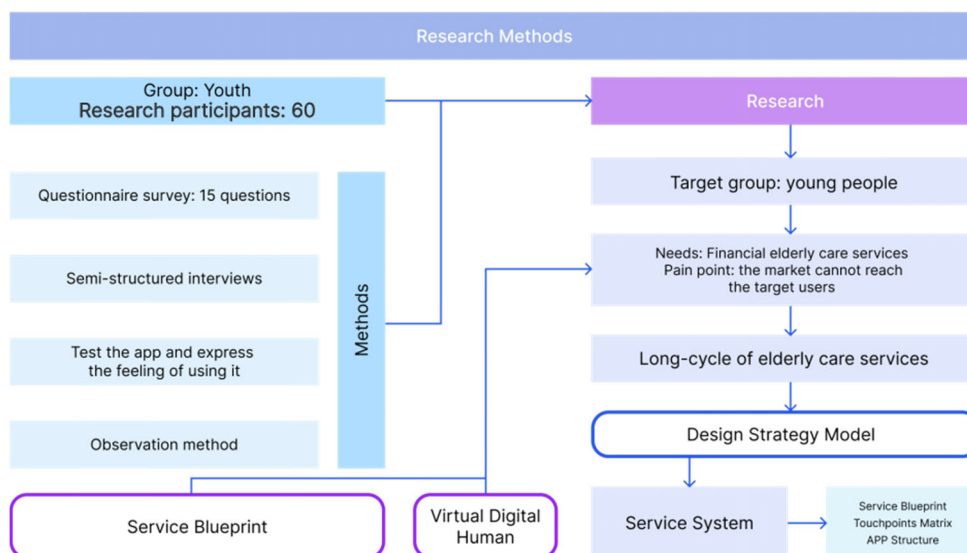


Figure 1. Research Method

3.2. Semi-structured Interviews

This study conducted semi-structured interviews with five young people to extract user needs. They are 22 to 35 years old young people with high education level and income ability, who concerned about the problems and challenges of

financial elderly care. The interviews enable a better understanding of their needs and expectations, and provide references for service design. The interviews were conducted through remote communication by using software(such as WeChat and Tencent Conference), lasting about two hours[9]. The interview mainly discussed the views and experiences in

financial elderly care (see Appendix 1).

Through the semi-structured interviews, user needs are summarised in Appendix 2. For example, an interviewee mentioned that "I feel that there is no systematic understanding of financial elderly care services". After deeper communication, this interviewee pointed out that existing financial elderly care services were fragmentary financial pension management, insurance and investment, which lacked holistic and systematic services. Another interviewee mentioned that "many young people nowadays don't know much about financial services of pension"[10]. Further interviews revealed that this Interviewee believed that young people were confused about the complexity, specialisation and long-term investment nature of pension financial products, so that they needed simpler and easier-to-understand information and guidance.

3.3. Questionnaire Survey

User needs for elderly care services include understanding the system, planning, virtual experience, product diversity, and financial education. To meet these needs, designers can provide a comprehensive guide to the service and conduct educational and promotional activities on retirement finance. While interviews provided some user needs and concerns, they were not sufficient to illustrate their importance, priority, and ranking. Therefore, questionnaires were used to understand user needs and expectations more accurately (see Appendix 1) [11]. This survey was conducted among 63 users, including 32 males and 31 females (aged 22-35). And results of the survey showed that:

1. The main problems of current financial elderly care were serious homogenisation of services, unclear and unambiguous service introductions, and limited regulatory system.

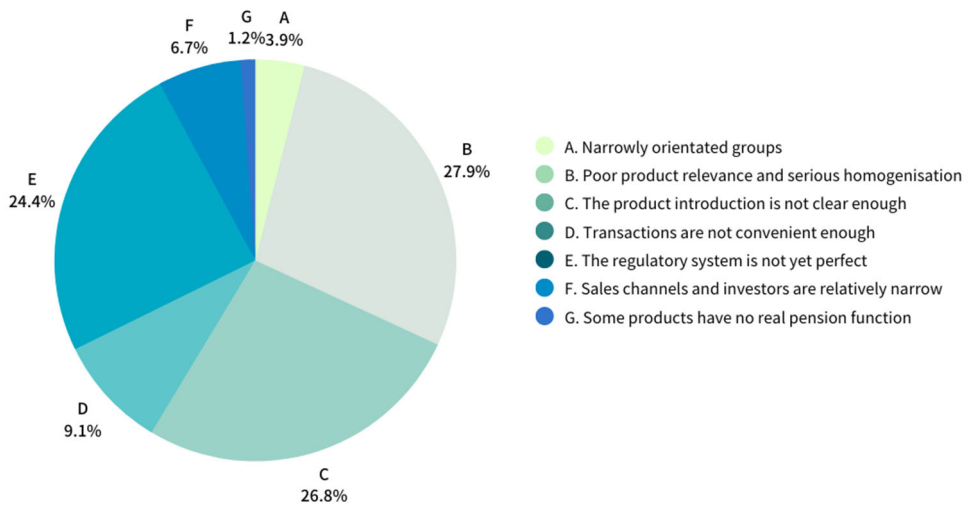


Figure 2. Findings on the shortcomings of current pension finance products

2. A significant proportion of the research users are aware of the importance of pension planning. More than half of the users chose the planning and information push category. 30.6% of them believed that they need pension planning, and they hoped to prepare for their future senior life through financial

elderly care services. 28.3% of them chose the pension policy delivery and interpretation services, which also shows the lack of the current market for the cultivation of awareness of the youth group of the pension.

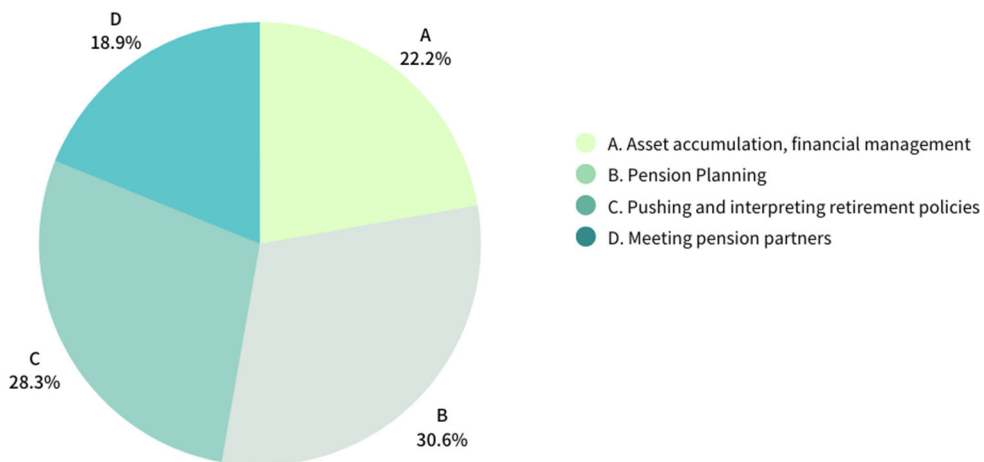


Figure 3. What financial pension services can be offered to young people

3. High awareness of the importance of pension planning and preparation. According to research data, 24% of respondents expressed interest in pension planning services and 23% in retirement planning services[12]. Additionally, 24%

showed demand for free seminars and skills courses, indicating a growing need for improved financial knowledge and abilities in elderly care. Health and quality of life enhancement were also identified as key concerns.

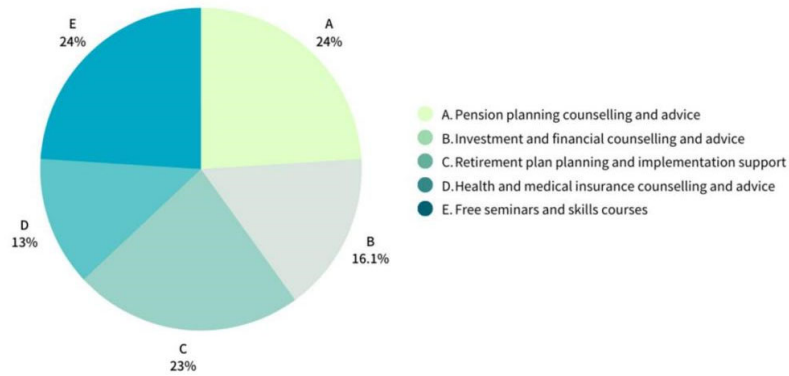


Figure 4. What additional services financial services organisations are expected to provide to meet elderly care needs

4. There are differences in the influence of different channels among respondents. The proportion of those who learnt about the bank's financial services and products through mobile phone apps was the highest at 33%, mainly influenced by the popularity and convenience of the mobile Internet. This is followed by introduction through relatives

and friends, accounting for 20%, indicating that interpersonal relationship plays an important role in recommendation. Financial service providers can conduct targeted publicity and promotional activities based on the characteristics of different channels to better meet the needs of their clients.

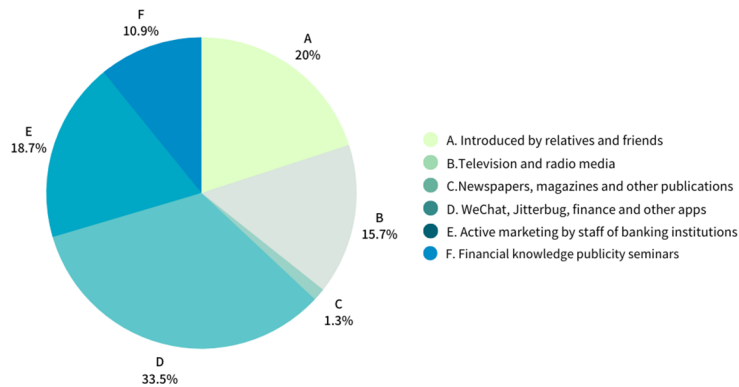


Figure 5. Main channels for understanding the bank's financial services and products

3.4. User Portrait Creation

User profiles were summarized based on interviews and questionnaires. Examples include: User A, highly educated, high income, plans ahead for financial elderly care. User B, newly established family, high demand for education, expectant of children's future. User C, corporate executive with rich management experience and decision-making ability. User D, freelancer with strong self-drive and exploratory spirit, has future plans[13].

4. Results

4.1. Pain points and opportunity points

Through the preliminary interviews and questionnaires, the pain points and opportunity points of users are obtained:

1. Young people are anxious about their future retirement, and begin to understand and contact financial retirement services as early as possible. 30 to 35 years old is the highest proportion of users who begin to contact or understand financial retirement services.

2. Young people are highly receptive to the financial pension industry and are willing to make reserves for their retirement in advance. 65.24% of the respondents believe that it is "relatively necessary" or "very necessary" to make reserves for their retirement in advance from their youth, among which Of these, 21.69% said it was "very necessary". Commercial banks, as fund account providers, are involved

in the whole process of personal pension business, and they need to ensure the accuracy and timeliness of user data, as well as gain insights into customers' needs, make good use of the data, and improve customer experience[14].

3. Personalised services can improve the differentiation of pension financial products. The current pension products in the pension service system are relatively single and homogenised, which cannot meet the financial pension needs of different age groups, which is also a problem among the current financial pension service system.

4.2. Financial elderly care service design strategy model

Aiming at the above user pain points and opportunity points, we can establish the following financial elderly care service design strategy model (see Figure 6) to improve the user experience and satisfaction of financial senior care services, and the main parts are below:

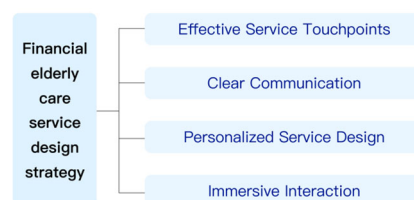


Figure 6. Model of financial elderly care service design strategy

1. Effective Service Touchpoints. To meet the trend of young people using digital services, effective service touchpoints need to be established. These include mobile app end touchpoints, websites, social media, etc., providing 24-hour services. Youth-friendly financial elderly care service apps should be designed for long lead times. Personalised services and VDH should be introduced to tailor financial services and experiences to individual needs of young users. Continuous optimization of these touchpoints is necessary to enhance user experience.

2. Clear Communication. Concise and clear information is essential for young people to reduce confusion about complex financial products and services. Visual elements such as charts and pictures should be used to aid understanding. Information delivery should consider the interactive and participatory preferences of young people, who benefit from financial education games that make learning more engaging and improve financial literacy.

3. Personalized Service Design. Personalized financial pension services are necessary as each user's needs differ. Tailored services such as investment advisors and financial planning should be provided based on consumption habits, investment goals, and risk tolerance. Diverse retirement reserve programs can be designed for different time periods, including short-term, medium-term, and long-term financial products. Asset allocation can also be personalized based on users' risk appetite. VDH can improve service efficiency by obtaining information on user preferences through daily dialogues, enhancing data-driven precision marketing, and conducting accurate user profiling to understand their risk preferences. Continuous optimization of products and services through data analysis enhances customer experience.

4. Immersive Interaction. Provide an interactive image to maintain user adhesion by integrating virtual human interaction into daily behaviors. Users' curiosity drives increased adhesion and motivation to use the product, leading to an immersive experience that adds value. Through immersive interaction in a meta-universe, users can access financial services and pension additional experiences with their preferred image. Effective reward-based feedback

mechanisms, including cash, points, and emotional incentives, enhance user engagement[15].

To sum up, we need to build an all-round and multi-level financial service system to meet the financial retirement needs of users of different age groups. At the same time, we also need to continuously explore and innovate to adapt to the changes and development of the financial market.

5. Case Study

Using the strategy model above, design validation was carried out in the app design.

5.1. Financial Elderly Service System Design

Constructing the touchpoints matrix. When building a financial elderly care service system, defining the touchpoints matrix is necessary. This visual tool depicts all user touchpoints with a product or service. For young people's financial pension services, a comprehensive and targeted touchpoints matrix should consider their needs and behaviors in financial reserves, investments, retirement planning, etc. (See Figure 7).

Stakeholder analysis. In designing the Financial Elderly Care Service System, we considered multiple stakeholders, including users, banks, and government agencies. Users are our main focus, and we aim to provide convenient, safe, and personalized financial services. Financial institutions are key partners who offer a variety of products and services to meet user needs. Government agencies provide policy support and regulatory safeguards to promote the development of financial retirement services.

Service system optimization. To improve the efficiency of financial services and user experience, we have optimized our service system. First, VDH technology has been introduced to provide more intelligent and personalized services. Secondly, data security and privacy protection measures have been strengthened to ensure that users' personal information is fully protected. Finally, the functions and interface design of the app are continuously optimized to enhance the user experience.

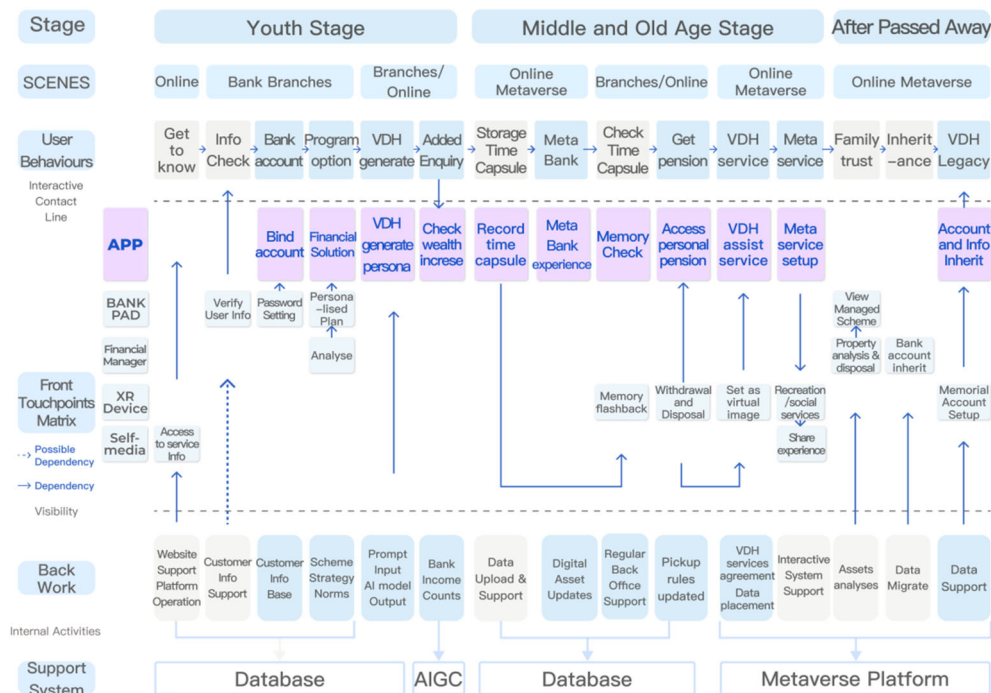


Figure 7. Findings on the shortcomings of current pension finance products

5.2. REME Financial Elderly Care Services Design Orientation

This paper analyzes the participation of VDH in financial elderly services for youth groups, aiming to enrich research on digital people's participation in financial pension services[16]. It explores concerns and needs of youth groups in future pension services, investigates the industry's evolution from traditional to new era and future social environment, and proposes solutions and methods for youth groups using relevant data and research. The paper uses "REME" service design as an example to discuss youth group participation in designing future elderly services, focusing on the following aspects:

1. User-centred. One of the key features of service design is to design for people. The design of service systems and touchpoints should be able to resonate with the users, and the strengths and weaknesses of the products in the market should be understood, so as to optimize the design of the service system in this research.

2. Long-cycle Service System Design. Since the service cycle of this design is from youth to after the user's hundred years, the key needs and pain points of the user change at different times, so the different needs of the user at different stages need to be taken into account in the design process.

Meanwhile digital security and ethical issues in the financial services that digital people are involved in is a concern in this study. The overarching design ethics concept of "ethical design intelligence" needs to be followed in the design (d'Anjou Philippe, 2023).

5.3. REME financial elderly care services key service touchpoints

1. App design. In the service blueprint, mobile phones are the main tool for realizing the youth stage's service aspect. Therefore, a detailed app design is essential as a key touchpoint. The mobile phone app should provide incentive

functions to attract users, such as a value-added tree homepage that displays current pension reserves and daily value-added every time the app is opened, increasing user interest and stickiness. Personalized experiences are also crucial for appealing to the youth group, such as using AIGC technology to provide personalized interfaces[17].

2. Offline bank branches. At the same time, offline bank outlets also serve as a key touch point, stimulating the vitality of offline bank outlets while allowing users to experience the service process more completely. In this design, an experience area is to be set up in offline bank outlets so that users can experience or feel the future scenario when they are old, in order to achieve the purpose of letting users understand more about the necessity of financial retirement planning, and at the same time a 3D scanning area is set up in the bank, which can assist users in generating an image of a digital person based on their personal data.

3. Extended Reality(XR) service design. XR service, as a future mode of service provision, needs to achieve the purpose of allowing users to experience the design of services without leaving home. At the same time, an important function of XR service that embodies humanistic care is that it allows children to interact with their grandparents in the meta-universe when they were young, providing more possibilities at the level of intergenerational inheritance.

5.4. REME App Design and Design Iteration

App Functional Framework Design. For the youth population at this stage, pension services are not their main need at this stage, but the key services provided are the planning of financial pensions, the healthy growth of personal pensions and the need for community building. Therefore, the functional framework of the App was designed based on the main needs of the target users at this stage. The functional framework consists of four main sections, ME, Pension Finance, Meta Universe Bank and HOME. Since the time capsule function is not a major need at the youth stage, it is attached to the Personal Centre section as an additional experience during the user experience[18].

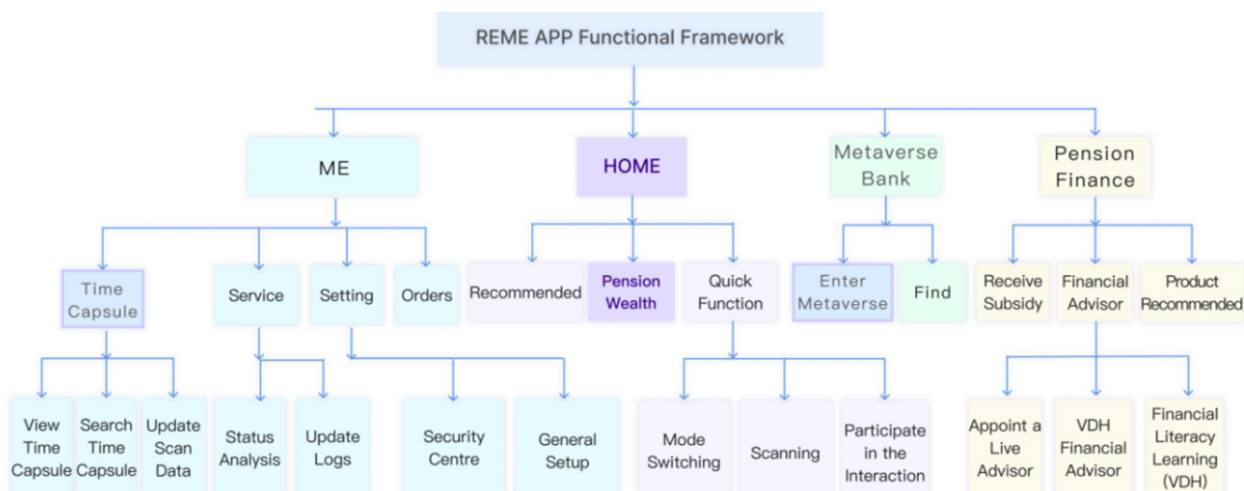


Figure 8. App functional framework.

User Flow Design. By analysing the functional framework of the App and the needs of users at different stages, the user flow at different stages is summarised. In the youth stage, the main user flow is to allow users to enter the service and be able to instantly check their pension reserves to provide users

with a sense of security, while in the stage of entering old age, the main service demand changes to improve the quality of life of users and provide users with more personalised and humanised pension services[19].

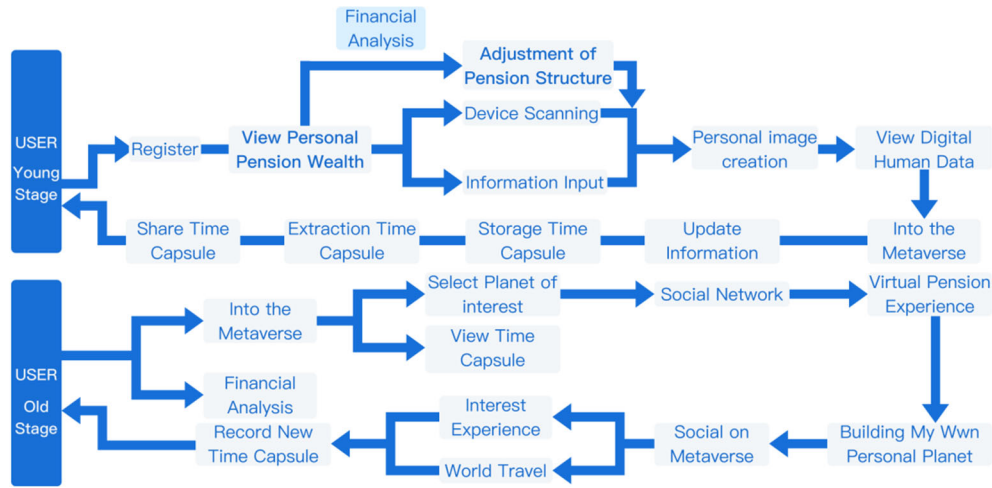


Figure 9. User flow.

App Prototype Design. For the app prototype design, there are various factors to consider, such as simple and beautiful visual design, smooth interaction process, and adding emotional experience process:

Simple and beautiful visual design. Since the research object of this project is not the traditional pension project's old age group but the contemporary youth group, we designed a simpler visual system based on their preferences. Considering the bank's industry qualities of calm restraint and trustworthiness, we incorporated these elements into the visual design. The main color scheme used in this design is blue and white, and the entire visual system is completed in a light anthropomorphic style.



Figure 12. PAD-side interface design.

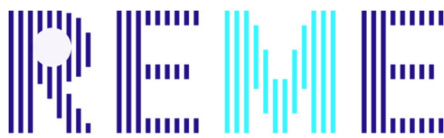


Figure 10. Logo design.

Smooth interaction process. For app, smooth interaction process is also one of the important factors for users to use; through the research of target users, in-depth understanding of user needs, and at the same time, through the bubbles, buttons of different colors and forms of change, instant feedback page, animation, etc., so that the user is more clearly aware of their own interaction state.

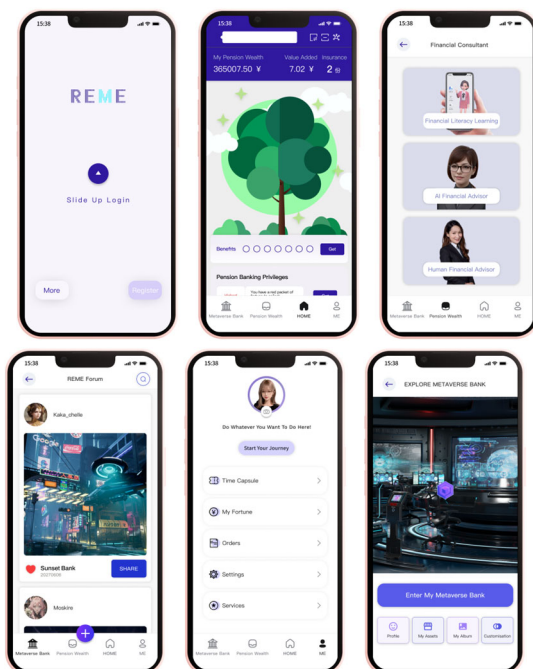


Figure 11. App high fidelity interface design.

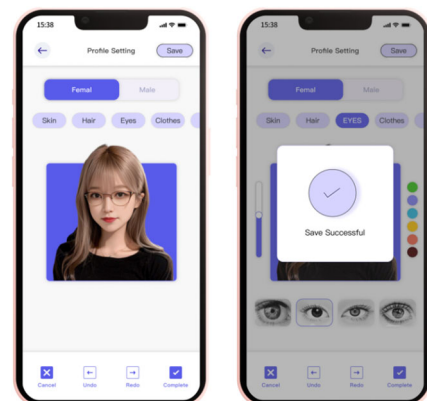


Figure 13. Interaction process of virtual digital person image setting app.

Emotional experience process. Provide motivation to maintain user adhesion. The design will simulate the process of sealing and removing the files, so that users who view the time capsule together press the handprint, from the user's psychological point of view, when the user produces a sense of remembrance and a sense of immersion will lead to an increase in the user's adhesion, thus driving the user's

motivation to use. Leads to the combination of real-life experience, so that users have a continuous emotional experience[20].

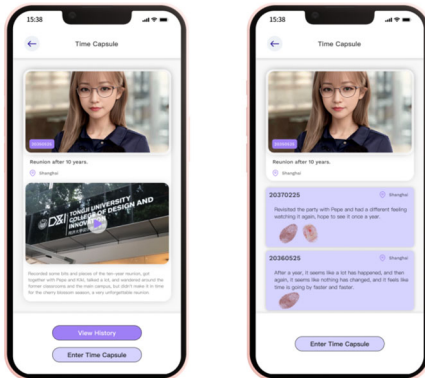


Figure 14. Time Capsule experience interface for users to store their life experiences in the app.

5.5. User Testing and Feedback

To comprehensively understand user needs, we conducted a detailed characterization of the target user group. The main users are aged 22 to 35 years old, with young people in this age range as the primary group. Test users come from various occupations, including employees of enterprises and public institutions, freelancers, etc. They have middle to high incomes, with monthly earnings between 5,000 and 20,000 RMB. Most have a bachelor's degree or higher education, and some possess advanced professional backgrounds.

After completing the design scheme, a user app interaction evaluation test was conducted to assess user acceptance and satisfaction. Five users were tested for one hour each, with an interactable prototype tested in a non-interventionist manner in the same space. Three typical tasks were given: checking personal retirement wealth, consulting a virtual digital person financial advisor, and virtual banking for business. Observations were made of user interactions, problems and suggestions were recorded, and users rated tasks on a five-point scale for improvement in future updates.

During user testing, it was found that some typical tasks could be completed smoothly during user interaction, with an intuitive and easy-to-understand interface design and fast response speed. However, initial operating instructions were inadequate during virtual banking, leading to a trial process for users. Most users were satisfied with the interface design, but some thought the functional layout of some pages could be more compact. Based on this feedback, improvements will be made in subsequent version updates: optimizing interface layout for better space utilization and adding more hints and guidelines in complex operations to enhance user experience.

Overall, this user interaction evaluation test has given us a deeper understanding of our design solutions and provided us with valuable directions for improvement. We will actively take on board users' suggestions and continuously optimise our application to meet users' needs.

Based on user feedback, REME is optimized. This may include optimizing interface design and user experience based on preferences and habits, simplifying the operation process for a more intuitive and easy-to-use app. We will also add social features to meet young people's needs for like-minded connections while preparing for financial retirement, and increase the feature richness of the financial savings section with tools like loan calculators and financial planning. To protect user privacy and financial security, we will enhance

security measures such as adding a virtual digital person data privacy agreement and using encryption technology and double authentication.

6. Discussion

6.1. Innovation Points

Establishing a long-cycle pension service system. Long-cycle financial elderly care services are key to realizing wealth inheritance and pension plans for young group. When designing financial pension services, different investment portfolios and pension schemes need to be considered to meet the needs of different clients, while ensuring security and stability. In addition, scientific risk management strategies need to be developed and effective risk management programs need to be provided to clients.

Include the youth group in the target group of financial pension services. Explore a product and service system geared towards the future retirement preparation stage of contemporary youth. Taking the youth group as an example, we will gain an in-depth understanding of their financial pension service needs and future pension plans, so as to design a financial pension service system suitable for them.

VDH is introduced into the field of financial pension service. Provide new insights into the participation of VDH in pension services through this research. In this study, the VDH data security protocol is introduced into financial pension services, while the bank, as a trust residing body, reduces the insecurity of the customers' misuse of their personal information during the business process, which is of great significance and expands the application of the VDH in the pension services.

6.2. Problems Identified and Future Prospects

There are some other issues that need to be discussed and resolved in this study. In addition to the need to consider the risk management strategies and regulatory mechanisms for financial senior care services, the following issues need to be focused on:

With regard to the discussion of digital person data security protocols, in addition to the need to further strengthen the literature research and technical research, it is also necessary to enhance customers' awareness of digital person data security and protection requirements to ensure that customers' personal information and transaction data are adequately protected from risks such as security threats and data leakage. The digital person data security protocol designed in this topic is only an example made based on the research in this paper, and the specific security protocol still needs a lot of literature endorsement and support and cannot be used directly.

The service system designed in this project is a relatively forward-looking systematic design, in which the app contact link is mainly designed in detail, and the other contacts in the service system still need to be more perfect and detailed design in the future. At the same time, attention should be paid to the optimization of the user experience, and the user-centred idea of the service should be continuously strengthened, so that the users will be more willing to use the service for a long time. In addition, corresponding marketing activities should be carried out for different age groups and demand groups to increase the awareness and promotion effect of the service and expand the social contact surface of the service. In addition, it is necessary for the government, enterprises and all sectors of society to join hands to

strengthen the supervision and regulation of financial elderly care services, so as to further improve the quality and safety of the service.

7. Conclusion

This study establishes a set of financial elderly care service for young people. It is found that there are deficiencies in the current elderly care industry. The system takes into account the process of wealth accumulation of young people in the context of elderly care services. This study firstly advises that young people's future elderly care should be considered to enhance their sense of security; secondly, financial services and elderly care services should be integrated and designed together that financial services should be the basis of elderly care services; finally, the long-cycle financial elderly care service system should concern the changes in the different major needs and pain points of young and old users, which can enhance users' loyalty and allow them to use the system in a long-cycle period.

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