

Design and Research of Smart Elderly Connected Wearable Device System

Simin Shou ^{1, a}

¹College of Design and Architecture, Zhejiang University of Technology, Hangzhou, China;

^a sushu84@qq.com

Abstract. With the increasing aging of the population, helping the elderly to integrate into digital life has become an important part of coping with this trend. The digital quality of life for seniors has improved significantly, however, the adoption rate of smart wearables among seniors is still relatively low. Compared with the diversified and personalized needs of the elderly, there are problems such as inconsistent demand for wearable devices for the elderly. In order to better understand the needs of elderly users for wearable devices, this study adopts the user participation research method, conducts in-depth research on wearable devices for the elderly, and builds a multi-terminal device interconnection system design for elderly users.

Keywords: Elderly users; needs research; systems design.

1. Introduction

In the context of increasingly significant population aging and chronic disease population growth, the research and development of wearable devices is rapid, however, there are still many challenges in the application of smart wearable devices in the elderly population. The low trust of elderly users, psychological barriers, product design, functional use experience need to be strengthened to provide better application and service experience for the elderly group.

This study has carried out in-depth theoretical research and user participation research in the field of wearable devices for the elderly. At the theoretical research level, we have carried out in-depth analysis of wearable devices and the elderly, and summarized the research concept and method of user participation. In the user research phase, we built a user research process for smart wearable devices for the elderly, and summarized the needs insights of elderly users and wearable device design principles. Finally, we preliminarily built the functional architecture of the wearable device system through design practice, and continued to optimize the user experience of the system. These works provide important theoretical and practical references for the design and research of smart wearable products for the elderly, and also provide inspiration for the future development of smart elderly life experience.

2. Literature review

2.1 The elderly and wearable devices

Wearable devices refer to devices that are physically attached to a user's body to monitor some aspect of their behavior, such as their physical activity (number of steps, distance, calories consumed, etc.) and their vital signs (heart rate, blood pressure, etc.) [1]. Wearables enable older adults to be more actively involved in their health, helping them manage multiple chronic diseases and improving their quality of life.

At present, the research on wearable devices for the elderly has been relatively mature, fully considering all aspects of the life of the elderly. It can be roughly divided into four categories: Research on elderly users' cognition and use behavior of wearable devices. Research on the needs of wearable devices for the elderly. Research on hardware equipment for elderly users. Study the factors that influence the adoption of wearable devices among the elderly

2.2 Participatory user research methods for the elderly

The goal of user participation is to allow the beneficiaries and users of design to participate in the design process, so as to create products and services that better meet their real needs and expectations. Older people can be promoted to play an active role throughout the design process by introducing them as co-designers to ensure that their needs and preferences are fully reflected in the final design [2]. User participation usually adopts a variety of methods, such as workshops, interviews, observations, collaborative design, etc., to ensure that the design results can truly meet the needs and expectations of users [3]. Flinn et al. recruited 25 elderly women with hand limitations and conducted participatory design through clay modeling, resulting in 36 bottle cap design concepts to design and make ergonomic bottle caps for people with hand pain or hand limitations [4]. Fang et al. recruited 38 seniors and 16 local service providers to create a "meaningful" community space for the elderly, and conducted an experiential group walk around the community and a drawing exercise so that participants could more clearly indicate their location-based needs[5].

3. Method

This study uses semi-structured interviews to ask the elderly about their multi-dimensional needs for wearable devices through daily activity scenes and wearable devices.

The experiment was conducted between January 17, 2023 and April 13, 2023, and a total of 30 participants were invited to conduct semi-structured interviews, including 20 women and 10 men.

After the interview, the recording was converted into text and the data was analyzed by subject analysis method [6]. The experimental group came together to discuss and identify four main theme categories: health, exercise, social recreation, and home safety. Subsequently, further distinctions are made and sub-themes are formed within each subject category.

4. Result

According to the results of user interviews, there are four demand scenarios for wearable devices for the elderly: health, sports, entertainment, and family. In the health scenario, elderly users need the following functions: daily monitoring and reminder, customized rehabilitation/maintenance plan, disease management, medication reminder and planning, chronic disease management. In the sports scene, the elderly users need the following functions: sports mode, sports guidance, and sports record. In terms of social entertainment and family, elderly users need functions such as family interaction and smart home management.

Based on the previous user needs research results, researchers have proposed three types of elderly user models, namely health pursuers, interest explorers, and safety concerns. In addition, in-depth insights into the needs of elderly users for wearable devices were conducted, and four design principles were summarized, including real-time health and exercise functions, introducing cognitive intervention measures, considering environmental adaptability, and designing software and hardware for aging. These design principles will provide strong support for subsequent system design practices.

5. System design

5.1 Design of multi-terminal interconnection system for wearable devices for elderly users

The design of wearable device system for elderly users is the combination of hardware equipment and software information. From the perspective of the internal system of the product, based on the integration of different device attributes, the empowerment of smart technology, the combination of equipment scenarios, and the connection of internal data, it can provide users with

four sets of complete scene process experience of health management, sports training, disease management, and family management, and carry out product system architecture based on four types of scenarios.

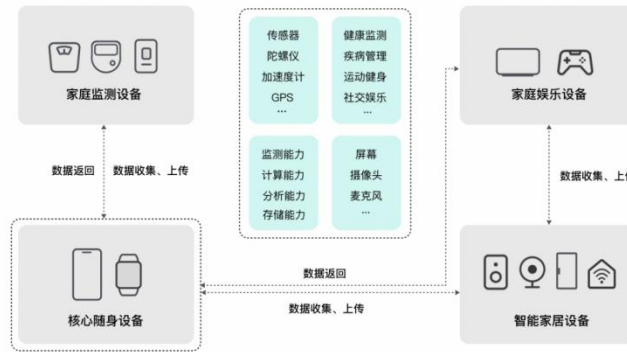


Fig. 1 Multi-terminal interconnected system based on scenarios and device attributes

5.2 Function flow design of wearable device interconnection system for elderly users

From the perspective of the internal system of the product, based on the integration of different device attributes, the empowerment of smart technology, the scenario of combined equipment, and the connection of internal data, it can provide users with four sets of complete scene process experience of health management, sports training, disease management, and family management, and carry out the function flow design of the product system based on four types of scene types.

5.2.1 Smart watch interface design

In the smart watch sports training module, it is divided into three parts: sports mode, sports reminder and sports competition. Users can select exercise modes such as courses and plans, outdoor running, and then further set the exercise, choose whether to turn on the intelligent coach and set the exercise goal. When the exercise starts, the intelligent coach will give warm-up guidance before the exercise, conduct heart rate monitoring and exercise guidance during the exercise, provide stretching guidance after the exercise, and finally display the exercise data in three stages of the entire exercise process.



Fig. 2 Multi-terminal interconnected system based on scenarios and device attributes

5.2.2 Smart watch hardware design

The final product solution includes smartwatch dial, strap, pendant, clip, and hanging. Users can choose different accessories according to their personal preferences and clip the watch to their clothes, bags or belts, providing users with a more flexible and diverse way to wear. To meet the needs of users for flexible wear.



Fig. 3 Smartwatch rendering demonstration

5.2.3 Smart watch hardware design

The mobile app has a more comprehensive functional management system, allowing the elderly to perform detailed settings, view operations, and more on their phones without needing to adjust settings on the smartwatch. The mobile app's functional structure includes: home, health management, disease management, exercise management, home management, and mine.

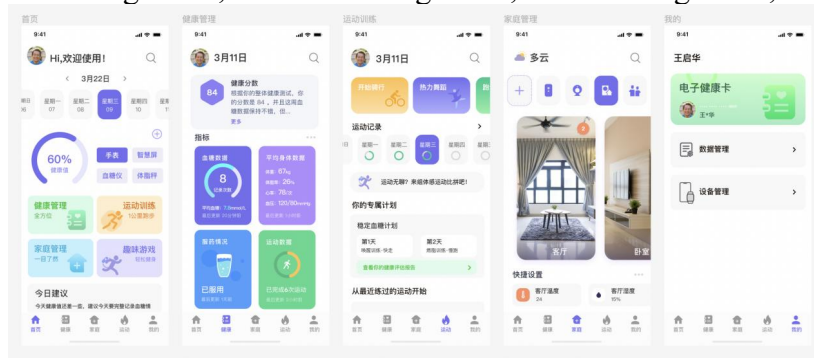


Fig. 4 Mobile App interface design

6. Summary

This study conducted an in-depth interview on the needs of elderly people for research on wearable devices, conducted an insight into the needs of elderly users, produced wearable device design principles, and carried out wearable device system design and evaluation, providing references for the design and research of smart wearable products for the elderly, and also brought inspiration for the future multi-scene and multi-device smart elderly life experience.

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