Highlights in Art and Design
ISSN: 2957-8787 | Vol. 11, No. 2, 2025

Research on User Centered Elderly Remote Medical Interface Design

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Abstract: With the accelerating trend of population aging, telemedicine has become a critical means of improving healthcare accessibility for older adults. Nevertheless, many existing telemedicine platforms exhibit insufficient accessibility and usability in their interface interactions for this population. Guided by the principles of User-Centered Design (UCD), this study examines the behavioral characteristics and perceptual capabilities of older adults. Employing a comprehensive approach that integrates literature review, competitive analysis, and prototype testing, the research systematically identifies pain points and specific needs in elderly users' engagement with telemedicine services. On this basis, a set of optimization strategies is proposed, including simplifying information architecture, adapting visual design to age-related limitations, streamlining interaction processes, and fostering emotional trust. A prototype implementing these strategies was developed and evaluated to verify their effectiveness. The results indicate that user-centered, age-friendly interface design can substantially improve operational efficiency, user satisfaction, and trust among elderly telemedicine users. This study offers both theoretical insights and practical guidance for human–computer interaction design in digital healthcare solutions tailored to the elderly population.

Keywords: Telemedicine; Elderly Users; User-Centered Design; Interface Optimization; User Experience.

1. Introduction

With the accelerated aging of China's population, the number of individuals aged 60 and above has exceeded 280 million [1]. The prevalence of chronic diseases remains high, and the demand for regular medical consultations and remote follow-ups among older adults has grown rapidly. Telemedicine, valued for its efficiency, accessibility, and safety, particularly during the COVID-19 pandemic, has gradually become a mainstream supplementary form of healthcare. However, many elderly users report difficulties in operation, comprehension, and overall usability, which hinder the full realization of telemedicine's potential [2]. Statistics indicate that while China's average life expectancy has increased from 72.0 to 77.3 years, the average healthy life expectancy is only 68.7 years [3].

This study is grounded in the principles of aging-friendliness and usability, aiming to develop telemedicine interface design strategies tailored to elderly users. By examining the behavioral habits and interaction challenges of older adults, the research summarizes optimization principles to improve user experience and enhance digital health literacy. The significance of the study is threefold. First, from the social perspective, it can help alleviate the burden on offline medical services and promote the development of smart healthcare. Second, from the theoretical perspective, it deepens the application of User-Centered Design (UCD) in adapting to specific user groups. Third, from the practical perspective, it provides actionable guidelines for improving the usability of telemedicine platforms.

Accordingly, the study addresses two core research questions.

1)What are the typical interface pain points encountered by elderly users in telemedicine systems?

2)How can an interaction interface be designed in accordance with UCD principles to align with the perceptual and operational characteristics of older adults?

3) Does the optimized design have a measurable impact on operational efficiency and user satisfaction?

2. Journals Reviewed

In recent years, telemedicine has played an important role in alleviating the shortage of medical resources in aging societies and improving the management of chronic diseases. As noted by Lu Tingting (2021) and colleagues, telemedicine, as an extension of family medical practice, not only enables elderly individuals to receive chronic disease diagnosis and treatment, postoperative follow-ups, and rehabilitation guidance at home, but also reduces the burden on hospitals and enhances the accessibility and continuity of medical services [4]. Its development has facilitated a shift from passive consultation to proactive health management. Xiao Juan (2024) suggested that intelligent telemedicine platforms integrating big data and artificial intelligence can support dynamic monitoring, accurate assessment, and intelligent delivery of health data, thereby providing elderly users with personalized and continuous health support [5].

According to recent scientometric analyses, research on elderly telemedicine has shifted from an emphasis on system functionality to a focus on enhancing user experience. Current hotspots include usability, cognitive impairment, and human–machine adaptability. Wildenbos et al. identified three primary concerns among elderly users: clear identification, intuitive navigation, and effective task feedback. Chen Limin reported that elderly individuals often encounter problems such as lengthy operation paths, dispersed information distribution, and inadequate feedback mechanisms in medical interfaces [6].

User-centered design (UCD) emphasizes addressing product experience issues from the perspective of the user, making it particularly suitable for groups with diminished perceptual or cognitive abilities. It integrates user needs,

behavioral characteristics, mental models, and usage contexts throughout all stages of product development. Ma Lin reported that applying UCD to the design of medical record interfaces can improve information acquisition efficiency for elderly users, reduce operational errors, and enhance system fault tolerance and controllability through strategies such as cognitive layering and task decomposition [7]. Within the UCD process, user research, prototype testing, and iterative feedback are essential for achieving a human-centered rather than technology-centered approach. Wu Xinxin applied UCD to the innovative design of mobile medical applications and proposed a strategic model in which design is perceived as a service and the interface as a medium of trust. She emphasized that for elderly-oriented applications, it is important not only to provide a simple and clear interface but also to convey emotional perceptions of safety, warmth, and reliability through elements such as language, color, and information organization [8].

3. Methodology

3.1. Product Analysis Method

The competitive product analysis method is a widely adopted approach in user experience and interface design research. Its purpose is to identify strengths and weaknesses through in-depth comparisons of similar products or services in terms of functionality, interface, interaction, and user feedback, thereby providing a foundation for design optimization. Within the frameworks of Human-Computer Interaction (HCI) and User-Centered Design (UCD), competitive analysis extends beyond the visual dimension to encompass a comprehensive evaluation of information architecture, user flows, interaction logic, and emotional experience.

Table 1. Schematic diagram of user centered competitor analysis dimensions

Analysis Dimension	Examples of Content Elements
Functional structure	Does it support modules such as registration, consultation, prescription, medication purchase, health records, etc.
Interaction process	Whether the operation path is concise and the steps jump naturally
Interface readability	Is the font size, color contrast, and button click area suitable for aging
Universal design for the elderly	Do you provide functions such as "elderly mode", voice assistance, and simplified operation
User guidance and feedback	Are there any step prompts, voice explanations, error tolerant designs, etc.
User Emotion and Trust Building	Whether to display the doctor's profile picture/qualifications, whether to provide strong privacy alerts, etc

The role of competitive analysis in this study can be summarized in three aspects. First, hands-on testing of mainstream platforms, including Ping An Good Doctor, Haodf.com, and JD Health, revealed common issues such as excessive page transitions and lengthy user flows, dense information presentation with insufficient navigation guidance, and the absence of clearly defined entry points for elderly users. In addition, features such as font size adjustment and simplified modes provided valuable references for the age-friendly design approach adopted in this study. Second, the shortcomings of competing products were cross-validated with real user feedback, forming a closed-loop design process that directly informed targeted improvements. For instance, on Haodf.com, the appointment registration process is frequently interrupted due to information overload and the use of overly complex medical terminology. This observation guided the adoption of a design strategy focused on information simplification and a flattened structural hierarchy. Third, the construction of a functional comparison matrix demonstrated that several modules in the study's prototype, including the family assistance entry, voice-guided process navigation, and card-based elderly homepage, were not widely implemented in competing platforms. This finding confirmed both the innovativeness and feasibility of the proposed solution. Moreover, these results are consistent with problems identified in existing literature, such as overly complex processes, specialized terminology, and insufficient feedback mechanisms, thereby providing empirical support for subsequent design iterations.

3.2. User Centered Design Approach

User-Centered Design (UCD) is a design methodology that emphasizes sustained attention to user needs, usage contexts, cognitive abilities, and psychological characteristics throughout the entire design process. It has been widely applied in complex interaction domains such as healthcare, finance, and education, and demonstrates particular suitability for elderly users with relatively diminished cognitive capabilities. As Ma Linhas noted, UCD is not limited to involving users in isolated stages of the process, but requires the continuous integration of the user perspective and feedback mechanisms across user research, design decision-making, prototype evaluation, and iterative optimization, thereby ensuring that the design aligns closely with real-world usage contexts.

Table 2. Optimization Suggestions for Interface Design

Design elements	Suggestions for aging friendly design
Font and layout	Use font size ≥ 18pt, maintain text spacing and good readability
Color and Contrast	Use high contrast color combinations to ensure clear content
Icon Design	Intuitive graphics, combined with textual annotations, avoiding abstract icons
Operation process	Reduce steps, provide "guided" navigation, and place commonly used functions on the homepage
Interaction mode	Encourage voice interaction, button clicking instead of sliding, and increase operational feedback
Emotion design	Use warm tones, personification prompts, and visualized doctor images to establish trust

This study systematically examines elderly-friendly interface design within the domains of Human–Computer

Interaction (HCI) and accessible design. Drawing on functional comparisons obtained from competitive analysis, behavioral insights derived from the UCD framework, and empirical evidence reported in existing literature[9], the study synthesizes these sources to propose optimized interface design recommendations.

The research steps of User-Centered Design (UCD), combined with Ma Lin's framework for healthcare interface design, involve three interdependent and iteratively refined stages [7]. The first stage, User Research and Needs Analysis, aims to understand users' environments, technical capabilities, potential barriers, and behavioral patterns through methods such as structured questionnaires, in-depth interviews, and field observations. In this study, key issues identified among elderly telemedicine users included visual impairments, operational difficulties, incomprehensible medical terminology, and lack of guidance. The second stage, User Modeling and Needs Refinement, involves developing representative personas such as "Proactive Users," "Dependent Caregivers," and "Resistant Users," and distinguishing among functional needs, information structure needs, cognitive interface needs, and trust-building needs. Elderly users' needs were prioritized by integrating the KANO model with UCD principles. The third stage, Interface Design and Prototype Development, is based on analysis results and includes the creation of information architecture diagrams, interaction flowcharts, and design sketches, along with descriptions and characteristic summaries of elderly telemedicine interface design [10]. In accordance with aging-friendly design principles such as the use of large font sizes, high contrast, and voice assistance, mid-fidelity visual prototypes were developed using Modao, covering key functions including the consultation process, prescription medication purchase, and family assistance.

4. Design Practice of User Centered Remote Medical Interface for the Elderly

4.1. User Requirement Analysis

This study, grounded in user-centered design (UCD) principles and supported by a comparative analysis of competing products, identifies key user needs for optimizing remote healthcare interface design. The analysis is organized into three levels: basic visual needs, functional and operational needs, and emotional and trust-related needs, collectively forming a "User Needs Pyramid"[11].

At the basic visual level, elderly users often experience vision deterioration and reduced perceptual abilities, yet most telemedicine platforms lack specialized optimization, leading to difficulties such as poor text or icon legibility and eye strain during tasks like registration, consultations, and medication pickup. Survey data indicate that more than 75% of users reported issues with unclear interface elements, particularly on medication information and doctor selection pages. At the functional and operational level, findings from research and competitive analysis reveal that elderly users frequently face lengthy procedures, excessive page transitions, and insufficient guidance or prompts, which can interrupt operations, cause misunderstandings, and heighten user anxiety. At the emotional and trust level, elderly users express strong concerns about platform safety, credibility, and human-centered care. Interview participants frequently mentioned fears of being scammed or making mistakes and emphasized the importance of authentic doctor identities and transparent, controllable service processes.

4.2. Functional Framework Design

During the UI design process, information architecture serves as the foundational framework for the product's logical structure and cognitive pathways. This is particularly important in healthcare-related and user-specific products, where it plays a central role in determining usability, trustworthiness, and desirability. Previous studies indicate that a clear interface structure can significantly reduce operation anxiety among elderly users while improving task completion efficiency and satisfaction. The functional framework in this study was developed with a user-centered approach, aiming to create an interface that is simple, clear, and low in cognitive load [12]. The remote medical interface structure is organized into four task pathways, as illustrated in Figure 1.

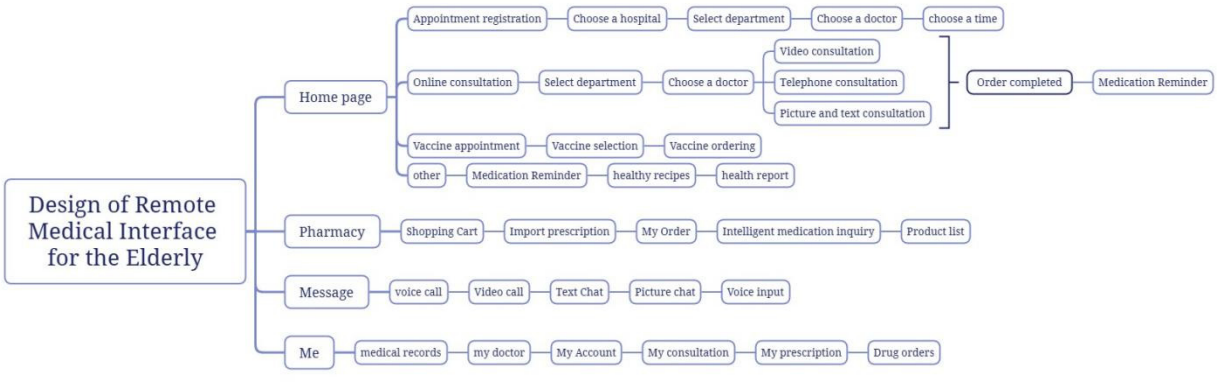

Fig 1. Information architecture for interface design of elderly remote medical care

The homepage of the elderly-oriented telemedicine platform integrates three primary functional modules: Appointment Booking, Online Consultation, and Vaccine Appointment. These are designed to provide one-stop navigation for high-frequency tasks such as seeking medical care, scheduling appointments, and receiving vaccinations. The modules consolidate the most common medical activities of elderly users and employ guided workflows to reduce cognitive barriers, reflecting the principles of User-Centered Design (UCD). Secondary homepage features include Medication Reminders, Healthy Recipes, and Health Reports, which function as optional yet supportive tools for elderly users who actively manage their health. The Pharmacy function addresses common medication-related needs, such

as purchasing and verifying medications, and includes a Prescription Import feature that allows users to add prescriptions manually or import electronic prescriptions after online consultations. Its design adopts a card-based layout with enlarged fonts and medication images to reduce memory load and simplify operation [13]. The Messages function enhances users' sense of control and trust throughout the medical process by supporting multimodal communication in the form of voice, video, and text/image chats, along with visual records to improve comprehension and memory retention. The My module serves as a personal health and account management center, enabling users to access and manage their medical data, personal information, and historical records.

4.3. Interface Visual Design

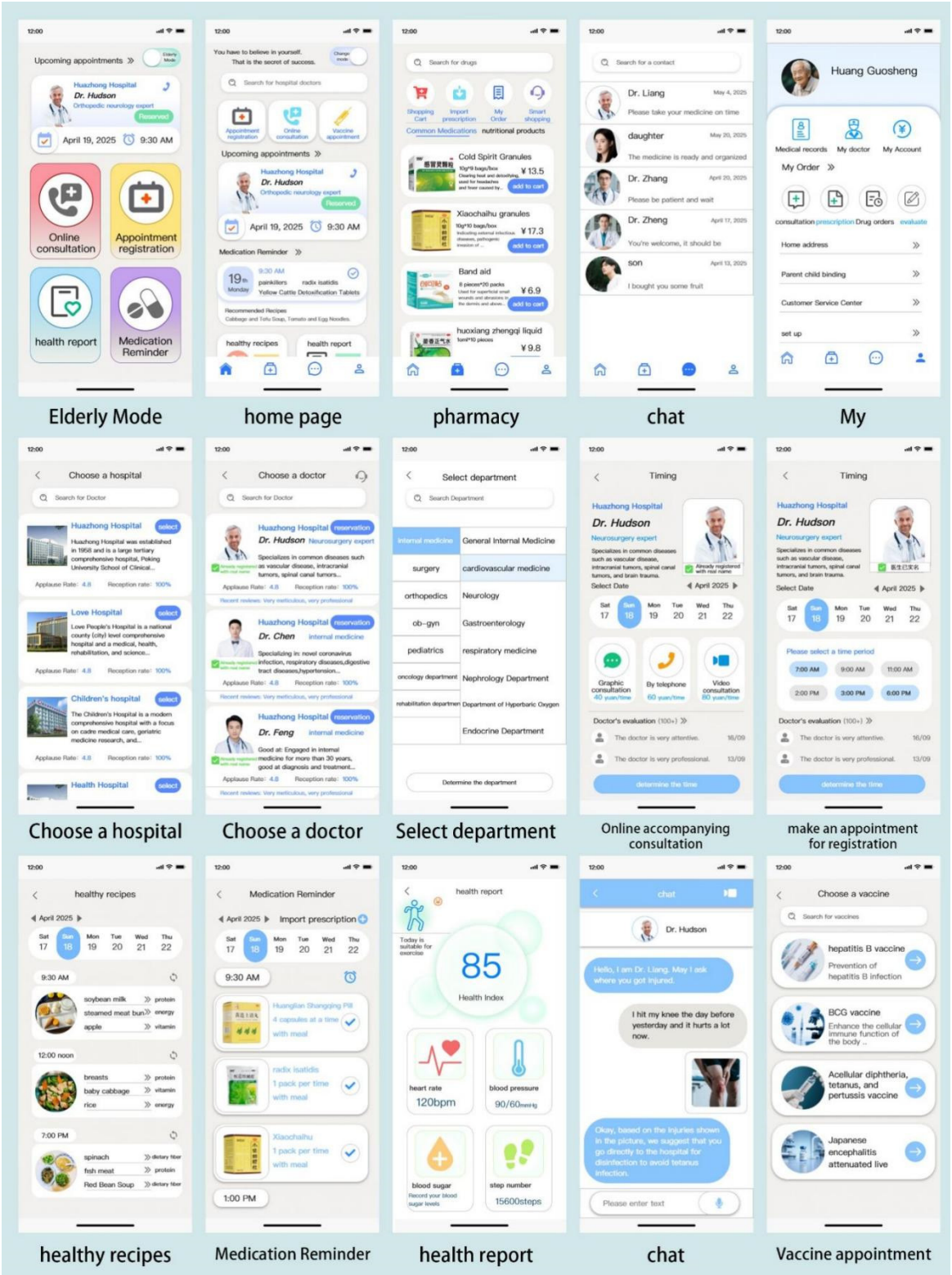

Fig 2. Visual Design of Remote Medical Interface for the Elderly

At the visual level, this study considers the physiological characteristics, cognitive abilities, aesthetic preferences, and operational habits of elderly users [14]. Aging-friendly optimization is implemented in font size, color scheme,

iconography, layout, contrast, and feedback mechanisms to create an interface that is clear to see, easy to recognize, and accurate to operate. For font and text size, an 18 pt sans-serif font is primarily used, with all main menu items, module names, doctor names, and button texts in bold to enhance visibility. Explanatory text is set with appropriate line spacing and left alignment to avoid visual crowding. For the color scheme and contrast, a neutral-warm and white palette is applied to ensure clear differentiation between primary buttons and the background, while all clickable elements are highlighted with saturated color blocks for quick identification. The primary font color is a high-saturation blue, which in design psychology represents composure, calmness, ideals, and trust. In icon and graphic design, highly recognizable icons are paired with concise textual descriptions to address elderly users' potential difficulty in identifying abstract graphics. For high-risk functions such as confirmation and payment, a triple emphasis using color blocks, saturated colors, and supportive text prompts is applied to minimize the risk of misoperation. As noted by Chen Limin, combining text with graphics effectively improves task recognition efficiency in elderly medical interfaces. In the layout design of the aging-friendly remote medical interface, the principle of repetition in design aesthetics is applied to enhance neatness and visual appeal, creating a closer and more approachable user experience. Key sections such as Care Mode, Homepage, Pharmacy, and Select Hospital are presented in a horizontal card layout, enabling smooth swiping with both visual and operational fluidity. Further details are provided in Figure 2.

This study is grounded in the philosophy of User-Centered Design (UCD) and systematically develops an optimized strategy for aging-friendly interface design. It focuses on the behavioral characteristics and perceptual abilities of elderly users when interacting with remote medical platforms, addressing the challenge from four key dimensions: visual recognition, interaction logic, information architecture, and emotional trust [15]. Following a research and design pathway that begins with identifying real-world scenario issues and proceeds to extracting key design insights, the strategy preserves the professionalism and security that are essential for medical platforms while achieving a balance between ease of use and emotional warmth. Collectively, these elements define the core user experience of a user-centered UI system tailored for elderly-oriented remote healthcare platforms.

5. Conclusion

This study centers on the core theme of user-centered interface design for elderly-oriented remote healthcare. Based on comprehensive analyses that include user needs assessment, competitive product evaluation, the User-Centered Design (UCD) process, and interface visual design, it systematically examines the aging-related usability issues in the visual design and information architecture of existing remote medical platforms. The research proposes a series of design and optimization strategies aimed at addressing these challenges. Key findings indicate that the most significant barriers faced by elderly users are low visual readability, complex operational workflows, difficulty understanding icons and graphics, and a lack of trust in the platform and its services. Additionally, the analysis reveals that mainstream remote healthcare products generally lack dedicated entry points or supportive mechanisms specifically designed for elderly users, such as a senior mode or accessibility aids. By constructing an information architecture and interface design grounded in user needs analysis and the UCD process, the study demonstrates that these approaches can significantly improve task completion rates and overall user satisfaction. Furthermore, the integration of family collaboration features and doctor information display mechanisms plays a positive role in enhancing elderly users' trust in the platform and their willingness to engage with its functions.

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Although this study establishes a strong connection between theory and practice, it has certain limitations. The visual design prototypes of the interface cover only a limited range of functions and do not include complex modules such as electronic medical records, video call processes, and payment security mechanisms. The research primarily focuses on visual design and optimization at the interface level, without systematically evaluating technical implementation costs or platform compatibility issues. In addition, due to cultural and regional differences, the study does not address the needs of ethnic minority groups, elderly users in rural areas, or the adaptation of multilingual interfaces. Looking ahead, as telemedicine services become increasingly widespread, usage scenarios are expected to expand from first-tier cities to rural areas, from Mandarin-speaking users to dialect speakers, and to elderly populations across different languages and cultural backgrounds. Meanwhile, smart wearable devices, which serve as key terminals for health management, are gradually becoming more common among elderly users. These trends place higher demands on interface design, suggesting that future research on age-friendly telemedicine interfaces should place greater emphasis on cultural adaptability and device integration.

Acknowledgments

This study was supported by the 2025 Guangdong Technology College Scientific Research Projects "Design of Emotion-Oriented Mobile Healthcare Service Systems Driven by Artificial Intelligence" (2025YBSK039) and "Research on the Construction of a Dynamic Assessment

Model for Blended Learning in Art and Design Majors Empowered by Intelligent Technology" (2025YBSK042); the Guangdong Technology College Higher Education Teaching Reform Project "Teaching Development and Innovation of Art and Design Major Faculty in the 'Internet+' Era" (JXGG2025116); the Guangdong Technology College Enterprise Comprehensive Internship Online Course Project "Practical Training in AI-Enabled Data Visualization Design" (QZZX2025008); and the Guangdong Technology College First-Class Online-Offline Blended Course Project "Infographics and Visualization Design" (YLKC202520).

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