

Exploration of User Experience Design Optimization for the Campus Library Information Management System

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Abstract. As an important bridge connecting library resources and users, the user experience design of the campus library information management system directly affects users' perception of usage. With the development of information technology and the wide application of artificial intelligence technology, the development of libraries in the digital era needs to keep pace with the development of new technologies to further enhance their knowledge service capabilities. For the future campus library information management system, complex information scenarios and personalized knowledge service demands put forward higher interaction design requirements for intelligent applications. This article believes that user-centered intelligent interaction experience lies in fully understanding the intentions of users. With the development of voice recognition, motion recognition, biometrics, and other technologies, the design focus of products and services in intelligent interaction is no longer limited to meeting functional needs, but gradually moves towards providing a more intelligent, continuous, and immersive user experience. Therefore, this study starts from the perspective of user experience design, optimizes the interactive functions of the current library information management system, and explores a new user-oriented framework for campus library interactive services.

Keywords: campus library, information management system, user experience design.

1. Introduction

As a hub of knowledge, libraries on campus have long been committed to providing knowledge services, enhancing user satisfaction, and fulfilling their roles in knowledge dissemination, education, and talent cultivation. However, in the era of continuous technological innovation in information technology, various types of information are growing exponentially. Library and information work not only needs to help users process vast amounts of scattered information, but also provide services such as knowledge management, knowledge application, and knowledge innovation. Currently, most campus libraries have established management information systems, which have played a significant role in improving library service management. However, against the backdrop of rapid growth in knowledge data, there are still deficiencies in the information management systems of campus libraries, such as isolated system functions, unreasonable functional layouts, cumbersome interaction methods, and difficulties in providing personalized reader services, all of which impact user experience. Based on this, this article aims to explore optimization schemes for the user experience design of library information management systems from the perspective of intelligent technology. The goal is to meet users' current needs for more efficient, in-depth, and extensive knowledge acquisition and understanding, while also providing new possibilities for library information management.

2. User experience in the era of intelligent interaction

The concept of user experience emerged in the 1990s, conveying a user-centered product design philosophy.^[1] The systematic definition of this concept can be traced back to cognitive psychologist Don Norman's definition of user experience^[2]. User experience refers to the subjective perception of users towards an objective object, encompassing all aspects that users perceive during the process of using an interface. In a certain scenario, user experience is characterized by its dynamic nature, contextual dependence, and subjectivity. This definition reflects the reality of user experience

evolving from a theoretical concept to a practical level. The International Organization for Standardization (ISO)^[3] has also provided a specific explanation of user experience, defining it as people’s cognitive impressions and responses towards a product, system, or service that they use or are expected to use.

With the development of artificial intelligence (AI) and the Internet of Things (IoT) technologies, intelligent interaction has emerged in an increasing number of use cases. Complex application scenarios and personalized service demands place higher requirements on the design of interactive smart applications. From the perspective of information interaction, big data and intelligent technology are not only transforming the network information environment but also influencing users’ cognitive expressions and driving their interactive needs. This has led to the formation of a user-oriented intelligent interaction system.^[4]

Flow experience, proposed by American psychologist Csikszentmihalyi in the 1970s, refers to the emotional state of an individual when they fully immerse their energy in a certain activity. It is an immersive psychological and emotional feeling and an optimal user experience state that is desired in the interaction design of products and services. Based on the characteristics of flow experience, it is possible to provide clear interface goals in user experience design, balance the relationship between data products and user skills, and provide effective and immediate feedback during product usage to create an immersive user experience environment. Given the connection between flow experience and user experience requirements, product user experience design based on flow can be conducted from the three levels of user, goal, and behavior, as shown in the figure 1.

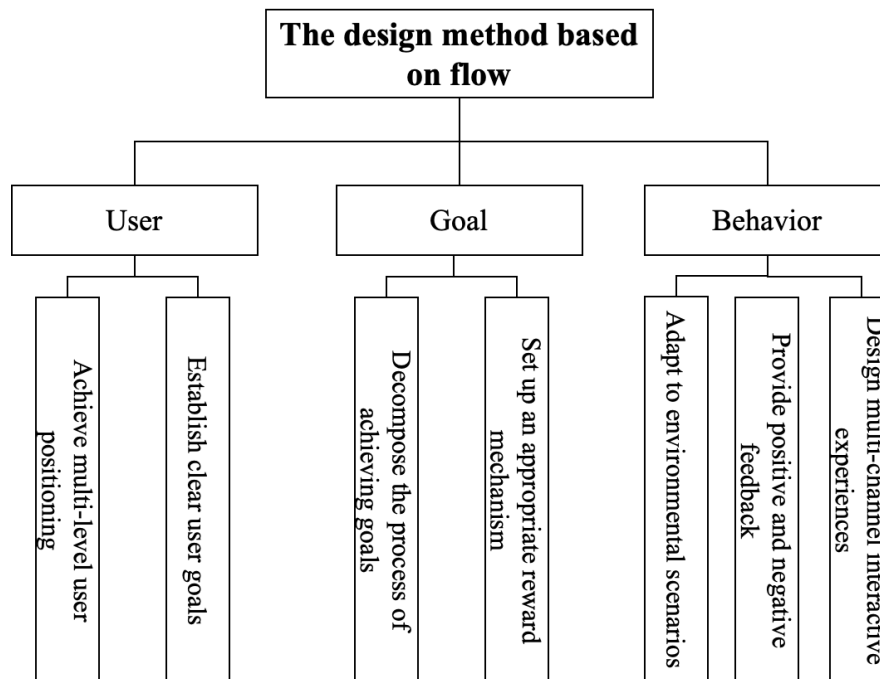


Figure 1. User interaction experience design of data products based on flow

Human-computer interaction refers to the process of information exchange between humans and computers, using a certain dialogue language and a certain interaction method, in order to accomplish specific tasks.^[5] To achieve this process, it is necessary to delve into human cognitive processes, information processing mechanisms, and interactive behavior habits. Based on these studies, more intuitive and habitual interaction systems are designed to bring humans and computers closer together. Therefore, human-computer interaction research has attracted much attention in various fields such as computer science, cognitive science, and information science. With the development of technology, human-computer interaction has gradually shifted from requiring humans to adapt to computers to computers actively adapting to human needs. Correspondingly, the interactive information has evolved from initially strict fixed-format input and output to more flexible input methods that conform to users’ personalized habits.

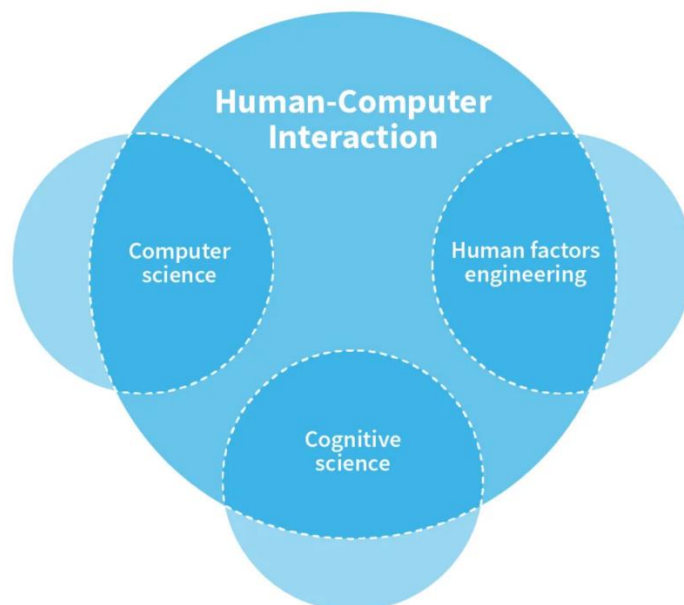


Figure 2. The Multidisciplinary Field of HCI^[6]

3. Main problems existing in user experience of the campus library information management system

3.1. Weak user-oriented intelligent interaction design

In the traditional library physical service scenario, various hardware facilities and book resources are unfamiliar and impersonal. This is reflected in the fact that for first-time users, they will spend a lot of time and energy navigating between different floors, areas, and equipment, and it takes multiple visits to form a relatively preliminary understanding of the library. Meanwhile, in the library service scenario, digital resource users rely more on the use of electronic resources and rarely visit the physical service areas of the library, leading to the idleness of a large number of library collections. Users of library physical resources tend to regard the library as a study room, constantly crowding out other areas of the library, posing challenges to the functional zoning and positioning of the library.

3.2. Low integration efficiency of massive information resources

Library information resources can be divided into internal resources and external resources. Among them, internal resources are selected, purchased, and classified by libraries based on readers' needs and subject characteristics, which are available for readers to borrow and consult in the library. They include various physical and digital resources such as books, periodicals, newspapers, etc. collected, managed, and provided by the library itself. The characteristics of internal resources are organized and structured, and they are managed, maintained, and served by library professionals. External resources mainly refer to books, periodicals, electronic databases, and other resources obtained by libraries from external sources through cooperation or subscription, including academic journal databases, digital books, e-books, professional knowledge databases, digital cultural heritage, historical archives, cooperative collections, as well as academic papers, reports, and datasets. Libraries have accumulated a large amount of internal and external resources, but it is difficult to effectively integrate all of them into the library system.

3.3. Insufficient intelligent construction of information management system

The smart library system is composed of four major elements: resources, tools, space, and core elements. Among the core elements, "readers", "operations", "demands", etc. are the inherent elements of the "library" essence of the smart library and also the key targets for technology

application empowerment. The other three elements have obvious technical attributes. The “intelligence” of the information management system is possible only with the development and application of technologies such as AI, big data, the IoT, and cloud computing. In recent years, AI, represented by ChatGPT, is driving the transformation of libraries towards smart services. AI technology will lead to multiple changes in library scenarios, library resources, librarian management, and services. Currently, the combination of AI and libraries is still in the accelerated integration stage. The user-centered intelligent interaction lies in fully understanding the user’s intentions, integrating user interaction channels such as vision and hearing, and providing support for intelligent service development. This is both an opportunity and a challenge for the current library information management system to upgrade.

4. Optimize the user experience of campus library information management system

4.1. Rebuild the knowledge service system of the smart library

From the perspective of the way of network evolution, the technology of library information management system presents the development of Web1.0 one-way communication to Web2.0 two-way interactive, and gradually expands to Web3.0 user participation, promoting the development of library into a smart library where users interact, share and participate in the construction. Web1.0 is the internet of content, and Web2.0 is the social internet. In this process, the openness and participation mode of the Internet make libraries more dependent on user participation and user construction. Web3.0 library integrates more technical means to lay the architectural foundation for future intelligent services and catalyze the enthusiasm of users to create, including metaverse, blockchain, ChatGPT, situational awareness and other technologies, and the emergence of ChatGPT human-computer interaction accelerates the evolution process.

From the perspective of the needs of user interaction on libraries, the continuous service forms of libraries promote the transformation of library information management to “user” as the core. The traditional library mostly takes “resources” as the center, when relying on Web2.0 technology, library information management gradually presents ubiquitous, convenient, cross-time and space “user” service. In the Web3.0 era, the service mode of library is intelligent service with the integration and interaction of users, resources and space, and the vision of intelligent service means, integrated service methods and satisfactory service experience will be realized

From the perspective of the driving way of content generation, the service content of library mainly experiences the development stage of “PGC-UGC-AIGC” under the Internet. PGC (Professional Generated Content) refers to the content created by professional practitioners and published by official media after professional editing. The corresponding library resources mainly include paper documents, audio and video. User Generated Content (UGC) is a new way of creation and organization of network resources under the environment of Web 2.0, which refers to ordinary non-professional users to display their original content through the Internet platform or provide it to other users. UGC and its potential benefits for users have gradually expanded to the field of libraries, satisfying users' needs for self-realization and self-expression, enhancing users' sense of participation in library construction, and injecting new energy into library information management content. Its resources are generally in digital form.

AIGC (AI-generated Content) refers to the replacement of human beings by AI in content creation. It can customize the style and have unlimited creative inspiration, showing the potential of network content productivity change. The corresponding resources are not only digital resources, but also digital collections, 3D dioramas and so on. AIGC man-machine collaborative digital generation mode breaks the boundary of human, machine and information resources, and accelerates the evolution of library content system.

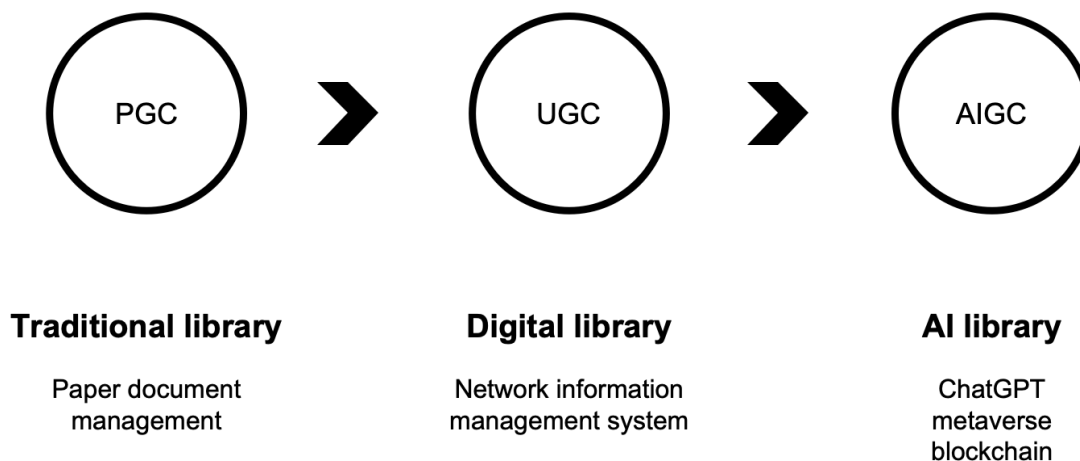


Figure 3. The development of library information management^[7]

4.2. Develop ChatLibrary system to improve user interaction experience

ChatGPT has attracted much attention in library circles since its publication^[8]. It is generally believed that the large language model will have a great impact on the library, which is faced with severe challenges and new opportunities for development. Knowledge service is the core function of library, but due to the diversification and individuation of user needs, the traditional knowledge organization and service methods can no longer meet the needs of users. For example, the traditional manual organization method not only has a heavy workload, but also has low efficiency, limited service mode and weak innovation ability, and cannot adapt to the current development of digitalization, networking and intelligence. The law provides large-scale, heterogeneous and dynamic characteristic resource organization and service in the network environment.

The innovation of ChatLibrary system lies in its intelligent question-and-answer, knowledge recommendation and dialectical fine-grained reading function, which provides users with deeper and wider knowledge services^[9]. ChatLib's conversational knowledge discovery approach constantly refreshes the boundary between knowledge discovery and understanding, making the knowledge exchange process more coherent and dynamic. ChatLib redefines the methods and processes for the storage, organization, discovery and use of library knowledge, making knowledge acquisition and understanding more efficient, in-depth and extensive. It not only enhances the user's sense of experience, but also reshapes the library's information management ability in the depth and breadth of knowledge services.

Table 1. Features of ChatLibrary powered by artificial intelligence^[10]

Feature Dimension	Application Examples	Users	Users' Demand	User interaction experience of ChatLibrary system
Library Scenario	Admission Training	New Users	Understand the distribution of floors and resources, of the library.	Provide interactive guidance, intelligent registration, standardized training, and personalized Q&A for library users.
	Reader services	Reading Enthusiasts	Find target readings	Have 24-hour online real-time interactive dialogue with users; provide users an immersive book experience; Systematically recommend books and other resources based on user profiles.
Library Resources	Literature Search	Researchers	Access the latest academic research papers and resources.	Search the library's internal resource database for journals and academic databases in related fields; Integrate external resources, and recommend authoritative academic databases and academic search engines.
	Interdisciplinary Resource Integration	Interdisciplinary Researchers	Interdisciplinary research requires the support of multidisciplinary resources	Integrate resources from different subject areas within the library, provide interdisciplinary books and journals, and recommend interdisciplinary databases and partner library resources.
Library Management and Services	Management Automation	Library Staff	Simplify daily management	The daily management of library is complicated, tedious and repetitive. The use of generative artificial intelligence technology can deal with most of the daily work of library management and realize the automation of program management.
	Service Extension	Library Staff	Extend service skills	Generative artificial intelligence can provide powerful tools and technical support for library services, which can make library services no longer limited to books and resources, but extend to data processing, intelligent recommendation and other fields.

The application of ChatGPT technology in national libraries around the world is gradually increasing, mainly focusing on automated question and answer service, auxiliary reference consultation and personalized recommendation. For example, libraries in the United States and other countries began to use ChatGPT to provide intelligent customer service and digital resource navigation services, and integrated ChatGPT into multiple service channels of libraries to improve the intelligence and personalized level of services. The cases selected in this paper are as follows:

Table 2. Case Studies of American Libraries^[11]

Location	Library name	Goal	Service content
Washington	University of Washington Libraries	Integrate ChatGPT into the library system	(1) Library staff ChatGPT Training: Assist library staff in quickly searching for documents, such as finding relevant engineering standards, rules, techniques and conditions. (2) Library User ChatGPT Training: Overcome initial writing obstacles, narrow down broad topics, highlight new research areas within that topic, summarize complex concepts or texts, determine keywords for database searches, and help build various types of literature reviews.
Texas	University of Houston Libraries	Generative AI validates and reinforces students' information skills	ChatGPT and Information Literacy: UH librarians see ChatGPT and other generative AI as an opportunity to “emphasize the importance of verifying information and strengthen it as a major part of the research process”. They are collaborating with UH faculty and staff to identify instructional materials that can provide students with guidance on the ethical application of ChatGPT, as part of an iterative process.
Illinois	Northwestern University Libraries	Use AI tools in research	AI Tool Guide: Provide students with continuously updated guidelines on the use of AI tools such as ChatGPT in research. The guide includes sections on generative AI tools, usage examples of ChatGPT and Google Bard, and features the assistance of instructional librarians Michelle Guittar and Jeannette Moss to help students.

4.3. Focus on the optimization of interface layout and interaction design

4.3.1. Interface layout and element optimization

The optimization strategy of user experience design of campus library information management system, especially the optimization of interface layout and elements, is a complex task involving multiple dimensions. First, the interface design should follow the principle of simplicity and intuition, so that users can quickly find the functions they need. The proper layout of function modules prevents the interface from being too crowded or information is scattered, ensuring that users can quickly understand and operate. Throughout the system, a consistent navigation structure and menu layout should be maintained so that users can quickly adapt when switching between different pages. At the same time, provide clear back and forward buttons, easy for users to return to the previous page at any time. Also allow users to personalize themes, recommended books, and query history according to their preferences. This can not only improve user satisfaction, but also make the system more in line with user habits.

In terms of element optimization, on the one hand, it is necessary to ensure that the size of the element is appropriate for the column and row in which it is located, and avoid too large or too small elements affecting the overall layout. At the same time, the spacing between elements should be balanced, neither too crowded nor too sparse, to improve the readability of the interface. On the other hand, all interface elements should be consistent in style, color, and typography to enhance the user's cognitive consistency. Using a uniform font, color, and icon style helps users identify and understand interface elements more quickly. Finally, according to the importance of information and frequency of use, reasonable arrangement of the hierarchy of elements. Important information and features

should be placed in a prominent place on the page, such as the top or center area, to attract the user's attention.

4.3.2. Interaction design and workflow optimization

The improvement of interactive mode of user experience design of campus library information management system is the key link to enhance user satisfaction and efficiency^[12]. Here are some suggested strategies for improving interaction.

The first is to simplify the operation process, redesign the operation process of the user interface, and reduce unnecessary steps and clicks. For example, for commonly used functions, such as book retrieval and borrowing, you can design one-click operations or provide shortcuts that allow users to quickly complete operations. The second is to optimize search and navigation, improve the search function, provide fuzzy search, keyword association and other functions to help users find the required information more quickly. At the same time, the navigation menu and page layout are optimized to make it easy for users to browse and access different functional modules. The third is to provide personalized interaction, based on the user's borrowing history, reading habits and other information, to recommend relevant books, articles or activities for users. In addition, users can be allowed to customize the interface style, font size, etc., according to personal preferences to provide a more personalized interactive experience. The fourth is to enhance feedback and tips, to provide immediate feedback and tips when the user is operating, such as operation success, error tips, etc. This helps users understand the current operating status and correct errors in a timely manner. Fifth, it supports multiple platforms and devices to ensure that the system can run smoothly on different platforms and devices, including computers, tablets and mobile phones. At the same time, the screen size and resolution of different devices are adapted and optimized to ensure that users can get a good interactive experience on different devices. Sixth, the introduction of intelligent assistants: you can consider the introduction of intelligent assistants or chatbots to provide real-time consultation and help for users. Users can interact with intelligent assistants through natural language to quickly get the information they need or solve problems. Seventh, collect user feedback on a regular basis, through questionnaires, user interviews and other ways, regularly collect users' feedback on the way of interaction. Based on user feedback, the interaction design is adjusted and improved in a timely manner to ensure that the system always meets user needs and expectations.

4.3.3. The expansion of library information management function for user demand

(1) Analysis and combing of functional requirements

The optimization of user experience design of campus library information management system and the in-depth analysis and combing of functional requirements include four steps. The first is the user group identification, clear the use of the system objects, such as students, teachers, library administrators, etc., analyze their respective information needs and operation habits. At the same time, through questionnaire survey, interview, observation and other ways to collect users' feedback on the use of the existing system, to understand their pain points, expectations and suggestions.^[13]

The second is the analysis and combing of functional requirements. By combing the basic functions, including book information query, borrowing record management, user information management, book recommendation, etc., these functions are the core of the system and need to ensure stable and efficient operation. Advanced features such as personalized recommendations, intelligent search, data analysis and visualization enhance the user experience and help users access information more efficiently. Auxiliary functions include user feedback, help documents, online customer service, etc. These functions can improve user satisfaction and solve the problems encountered by users in the process of use.

The third is functional prioritization. Prioritize functions based on user needs and business importance. Priority is given to those functions with strong user demand and high business value to ensure that the system can meet the core needs of most users. Attention should be paid to reducing unnecessary operation steps, optimizing interaction design, reducing the learning cost and difficulty of users, providing clear tips and guidance at key nodes to help users successfully complete operations,

but also considering the use of different users' habits and skill levels, providing a variety of operation methods and options.

The fourth is feedback mechanism and continuous improvement. By establishing feedback channels and setting up user feedback entrances, it is convenient for users to raise questions and suggestions at any time. Also collect and analyze user feedback regularly, find problems and deficiencies in the system, adjust and optimize in time, continuously improve and iterate system functions according to user feedback and changes in business requirements, and enhance user experience.

(2) Function optimization and suggestions for new functions

Functional optimization suggestions include improving the speed and accuracy of search: Optimizing the book search function to ensure that users can quickly and accurately find the required book information. We can consider introducing intelligent search technology, such as natural language processing, to improve the intelligence level of search. Simplify the borrowing process: Optimize the borrowing process to reduce unnecessary steps and time. For example, a self-service borrowing system can be introduced to enable users to complete the borrowing and return of books by themselves, improving the efficiency of borrowing. Enhance user personalized experience: Provide users with personalized book recommendations and customized services based on users' borrowing history and preferences. At the same time, it allows users to set personalized interface themes and layouts to enhance user satisfaction and sense of belonging.^[14]

Suggestions for new functions include mobile terminal support: Develop mobile terminal library information management system applications, so that users can query and borrow books anytime and anywhere on their mobile phones. At the same time, the interface design and interactive experience of the mobile terminal are optimized to ensure that users can easily use the system. Social sharing function: Add social sharing function, allowing users to share book information, reading experience, etc., to social media platforms. This can not only increase the interaction and communication between users, but also expand the influence and visibility of the library. Virtual Library Experience: Use virtual reality (VR) or augmented reality (AR) technology to provide users with a virtual library experience. Users can browse books, participate in lectures and activities in the virtual environment, enhancing users' sense of immersion and experience of the library. Data analysis and visualization: Add the data analysis function, collect and analyze the data of users' borrowing behavior, reading habits, etc., and display it to the librarian in the form of charts or visual reports. This helps administrators better understand user needs and behavior patterns, and provides decision support for library operation and management.

In addition, when implementing these optimization and new feature suggestions, on the one hand, it is necessary to fully consider the needs and feedback of users to ensure the practicality and ease of use of functions. It is also necessary to maintain compatibility with the existing system architecture and technology stack, avoid excessive technical changes and cost input, and conduct adequate testing and verification before implementing new functions to ensure the stability and reliability of the functions.

5. Conclusion

To sum up, the rapid development of information technology has brought profound changes to library information management. Artificial intelligence-driven libraries are the inevitable trend of library transformation in the digital era. The library-oriented and single passive service can no longer meet the needs of users, and interaction design needs to be better embedded in library system design. The optimization strategy of user experience design of campus library information management system involves many aspects, including strengthening interactive experience, improving information processing efficiency, optimizing interface design, introducing AI system, meeting individual needs, etc. These strategies help to improve the system's usability, convenience and satisfaction, and bring better user experience.

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