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Research article

Visualization design of health detection products based on human-computer interaction experience in intelligent decision support systems

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Abstract: In order to meet the needs of the human-computer interaction experience of health testing products and improve the decision-making efficiency of intelligent decision support systems, we visualized the design of health testing products. We summarized the design methods for the human-computer interaction experience of health testing products, analyzed health testing data visualization requirements in terms of thematic databases, data visualization diagrams, thematic dashboards and knowledge management systems, and introduced the general process of monitoring information visualization. The visual health testing product information display interface is designed to visualize the testing data in three aspects: information architecture, interaction mode and visual language presentation. The visual intelligent decision support system and the visual interface design are combined for the functional design of the visual intelligent decision support system. The experimental part of the study investigates the effectiveness of the visualized health testing product of the intelligent decision support system, using the questionnaire method and health data measurement method to collect results on the interactivity, convenience, health decision accuracy and product satisfaction of the health monitoring product, with the data presented as a percentage system. The experimental results show that the interactivity, convenience and health decision accuracy of the intelligent decision support visual health monitoring product are higher than those of traditional health monitoring products, with interactivity evaluation results above 85% and high satisfaction with product use, indicating that the product can provide new and innovative design ideas in home healthcare.

Keywords: health testing products; visual design; human-computer interaction experience; intelligent decision support system

1. Introduction

In the context of relative scarcity of social and medical resources, wearable health monitoring products that can promote the development of healthcare products are derivatives of healthcare products in the modern Internet era, and have a certain development space [1]. Portable health monitoring products have the characteristics of real-time, continuous, dynamic monitoring and application in work and daily life. For most people, the use of smartphones can be practiced very well. However, for the elderly, the use of smartphones is still difficult [2]. The demand for real-time health monitoring products is mainly focused on the elderly. Due to the limitations of smartphones, it is not possible to maximize the effectiveness of health monitoring products.

With the intensification of competition in the intelligent health detection product market and the development of artificial intelligence technology, intelligent health recognition and human-computer interaction interface not only have the characteristics of traditional electromechanical products, but also have the characteristics of information products and unique information processing and interaction interfaces [3]. User oriented interactive product design puts user needs first and understands user characteristics and preferences. It improves product design patterns through surveys and interviews, and focuses on target users, so as to effectively understand target users and conduct product design.

Visualization is a theory that utilizes computer graphics and image processing techniques to convert data into graphics or images, which are displayed and interactively processed on the screen [4]. Health testing products contain a large amount of data and require quick mastery of data analysis capabilities. Information visualization can improve the accuracy and efficiency of information acquisition, and excellent visual design can meet people's growing aesthetic needs. Visualization can transform invisible data phenomena into visual graphical symbols and establish connections between complex and inexplicable data, so as to find rules and features. Data design visualization can enhance user interaction experience, and improve product usage efficiency, so as to maximize product performance.

Intelligent decision support systems are the result of close integration between artificial intelligence and decision support systems [5]. Intelligent decision support systems use different artificial intelligence algorithms to better utilize existing data and information, and leverage the advantages of artificial intelligence, so as to solve complex decision problems by simulating decision problems [6]. Data visualization can improve the availability, intuition and practicability of business, and reduce the workload of data analysis process to a certain extent, so as to improve decision-making efficiency. The advantages of intelligent decision support systems are: 1) the technical basis is relatively mature, which is conducive to the practical realization of the system; 2) the rich information resources can be fully utilized [7]; 3) the mathematical and logical way of organizing knowledge provides a solid basis for the realization of the system; 4) the adoption of modularity, good module compatibility, short development cycle and low cost of the system [8]. As a result, intelligent decision support systems have not only become a hot spot for research, but also have a wide range of application prospects. Zhang Jun proposed the structure of "patient robot doctor" and developed a portable robot system for position monitoring, correction and rehabilitation support, mostly including wearable robot devices and consumer electronics, which can be used to help patients recover [9].

We realized the information visualization design of health detection products, and enhanced the product interpersonal interaction experience. The intelligent decision support system was integrated with visual design, which improved the decision-making efficiency and accuracy of the intelligent decision support system. The decision-making results were visualized and the data was presented vividly, which improved the convenience of product use and made health testing products more interactive, convenient and efficient.

2. Human-computer interaction experience of health testing products

2.1. Classification of health testing products

There are various types of intelligent health detection products. With the popularization of digital interfaces, on the one hand, users experience more information in many aspects; on the other hand, the amount of information received and processed is also increasing, which brings some difficulties to users, especially elderly users [10].

We focused on researching intelligent wearable health detection devices in communities or public places, thus providing community users with the ability to measure eight human parameters such as blood pressure, blood oxygen and heart rate. This achieved resident identity recognition, health data consultation, health science popularization, online consultation, etc., thus allowing users to use it independently.

2.2. Human-computer interaction design of health detection products

2.2.1. Principle of product human-computer interaction design

In product design, human-computer interaction refers to the interaction between people and devices. The goal of interaction is to enhance the positive aspects of the user experience, and help users complete tasks more effectively, safely and happily, so as to reduce the negative aspects of the user experience. The interaction between people has become the interaction between interfaces, and interaction is an important component of the human-computer-environment system where the product is located [11]. Human-computer interaction places people at the center of attention, thus emphasizing the application of human factors in technological practice. The human factors in product design mostly include four aspects: research on user physiological and psychological factors, research on environmental factors, research on digital human-computer interface factors, and research on comprehensive factors of human-computer environmental systems.

Product information is provided to users through the human sensory system. After receiving the information, users process it cognitively and perform a series of reaction actions to provide information. In basic health testing service tasks, sensory interaction involves users' perception of physical information, such as the presentation of colors, fonts and digital interfaces. Behavioral interaction is the user's perception of the interface and forms their initial judgment of the interface. Through a series of operational actions, such as touching and pressing buttons, they make decisions to interact with the interface and shape their experiential behavior [12]. These complex interactions create differentiated user experiences.

2.2.2. Product human-computer interaction design interface elements

In human-computer systems, users receive intelligent perception of product information through information display devices, and use their senses to receive information. They operate and control machines through command actions, and consider environmental factors in a specific perception space to achieve predetermined goals. With the development of digital information technology, under the framework of new technologies, traditional display interfaces have evolved into display interfaces that contain multi-channel information such as visual, auditory, and tactile information, and control interfaces have also evolved into touch control, eye movement etc. [13].

According to different information transmission channels, the digital display interface includes three information transmission methods: visual display, auditory display and touch display. As the main channel for receiving and transmitting information, visual channels account for approximately 70%. Hearing is used by humans to receive about 20% of information, while touch, smell and taste only account for 10% [14]. In real life, information is often presented in three-dimensional form, with images, sound effects and physical experiences on interactive interfaces. First, sound effects or signals reach the auditory channel through the ears, while visual information reaches the visual channel through the eyes. Tactile stimulation reaches the tactile pathway through the limbs or body. Each channel processes the received information by integrating the information from all three channels, thus forming a multi-channel interface of audio-visual integration, auditory-tactile integration and visual-tactile integration. The integrated information creates a three-dimensional and unforgettable experience.

1) Visual display

In the actual design of intelligent products, visual display must meet three basic requirements: clearness, clarity and prominence. The main users of health detection products are elderly people, and the overall layout of the interface, the use of fonts, color selection and symbol design should take into account the visual patterns of elderly people to improve their memory ability of the interface. When analyzing the assimilation performance of users, in addition to traditional evaluation methods, eye tracking technology can also be used to obtain eye movement data, such as viewpoint and viewing time, while viewing the interface, thus reflecting the user's interest in the interface and the difficulty of understanding the interface. Electroencephalogram biofeedback technology can collect objective data, such as mental labor during use. Furthermore, it is important to ensure the brightness of the environment and determine the size and position of the screen based on the type of work and usage conditions.

2) Auditory display

The product uses sound to transmit information between the user and the interface, thus guiding the user during use. Its characteristic is fast response and is not affected by lighting conditions. It can quickly attract unnecessary attention from users. There are generally two types: acoustic transmission equipment and voice transmission equipment. Acoustic transmission devices invite or simply remind users to use the system through speakers, buzzers, etc., while voice transmission devices guide users to the next interface reaction through human and machine sounds.

3) Tactile display

Tactile sensation refers to the light touch or stimulation of the human body, which is usually combined with vision and hearing. In human-computer interaction interfaces, tactile information is not affected by external light and sound and has better spatial positioning ability, shorter processing time and faster reaction speed. There are various forms of tactile stimulation, and the most suitable tactile method is vibration tactile. When designing an intelligent health testing interface, the buttons on the touch screen are used for tactile communication. For example, when pressing buttons such as "self-measurement" and "online consultation" on the digital interface by hand, the interface would be triggered to enter a certain state. During the examination process, when the palm of the hand contacts the metal handle of the health examination device, measurement data such as heart rate, blood oxygen content and body temperature are obtained by scanning the electrode. When users measure blood pressure, the vibration caused by the squeezing of the wrist strap of the sphygmomanometer provides the information of blood pressure measurement.

3. Health monitoring data visualization demand evaluation

Data visualization and analysis system includes thematic database, data visualization diagram, thematic dashboard and knowledge management system.

3.1. Theme database

The creation of a thematic database includes two parts: configuring data sources and creating models. The thematic database must support the integration of information from multiple data sources and the integration of visual charts created from multiple data sources into the thematic data analysis page. Conceptually, a data model corresponds to a multidimensional data cube, with key elements including dimensions, metrics, optional expressions and filters. In terms of logical organization, the data model can be represented by a bivariate table structure. The rows of the bivariate table correspond to the combination of all values for each dimension in the model, while the columns of the bivariate table correspond to the measurements or measures in the model. New measures can be constructed by establishing new formulas based on existing measures in the model [15].

3.2. Data visualization chart

The control structure of data visualization diagram includes dimension management, measurement management, diagram type management, diagram component management, filter management and event management.

By selecting dimensions and metrics to be used in the data model, the data to be expressed is configured, and a visualization chart for data analysis is created by selecting appropriate charts for the data. The generated charts can be shared with other users, and users can search and reuse existing charts to improve efficiency [16,17].

The system provides a variety of chart options, including table, key numbers, text cloud, dashboard, percentage chart based on single variable data, bar chart, cross table of overview chart and pie chart, ring chart and area chart of summary chart, funnel chart, radar chart, rectangular tree chart and other charts, as well as multi-layer pie chart, three-dimensional bar chart, three-dimensional area chart and three-dimensional map. The extensive and comprehensive availability of charts extends the functionality of the system, thus providing users with an excellent user experience and meeting their various business needs [18].

3.3. Special dashboard

The thematic data analysis dashboard can combine multiple data visualization maps with thematic links, and provide data administrators and data analysts with a multi-dimensional experience of thematic data analysis, so as to help them make complex analysis decisions.

The data visualization diagram used in the editing page of the thematic data analysis dashboard needs to be managed. The dashboard interaction requirements include link conversion. The specific requirement is to specify one or more of the three screens for clicking on the chart. The meaning of the clicked option is conveyed. The chart is clicked to open another business system page or website and convey the meaning of the clicked option [19].

Dashboard configuration management includes theme configuration management and advanced configuration management. Advanced configuration management includes condition group management, switch information management, embedding management and condition group management dashboard information. Switch information management is used to link dashboard conversions and dashboard filters. Embedding management includes embedding external systems, web pages, images and dynamic titles.

3.4. Knowledge management

The system requires establishing links between unstructured data and mine the potential value of unstructured data. The system requires the provision of key node and path query functions to help users manage knowledge and make decisions and enhance their understanding of knowledge.

Knowledge management is divided into three parts: visual management, graphical structure data management and operational management [20]. The graphic structure data resides in the graphic database, which includes instance structure and concept map data, facilitates knowledge statistics management and facilitates searching for relevant knowledge through key nodes and key paths between knowledge. This enables decision-makers to have a clear understanding of the knowledge structure of the business system, and conduct in-depth research on irrelevant surface knowledge, so as to finally use knowledge graphs for visual analysis [21].

4. Visualization design of health detection products in intelligent decision support systems

4.1. Data visualization process of health detection products

Monitoring information visualization is a comprehensive technology used for data display, data processing and state evaluation. It uses computer graphics, image processing and computer-aided design technology to transform abstract and conventional monitoring data into regular, specific and dynamic charts, images and animations. The implementation process is to use data processing and data mining techniques to convert the original monitoring information into renderable target information. Through interactive operations, the current state, structural environment state and overall structural operation state of structural components are expressed through charts, images and other means, and then dynamically updated in real-time animation playback. This is the abstract knowledge representation process. The general process of monitoring information visualization is shown in Figure 1.

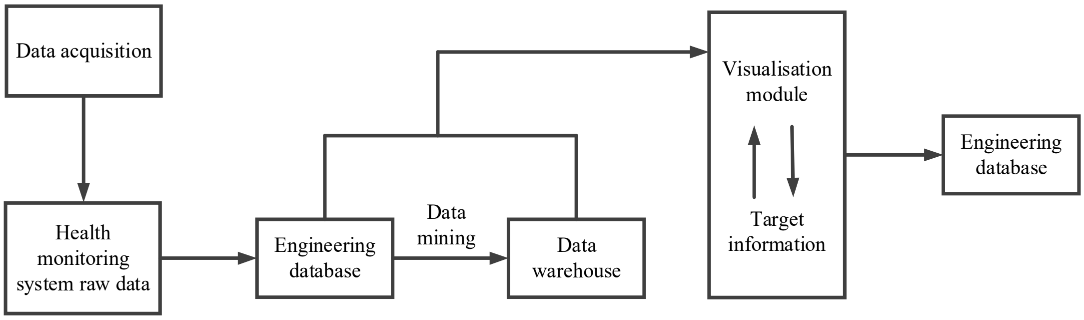

Figure 1. General flow of the design of monitoring information visualization.

4.2. Intelligent decision support system

4.2.1. Characteristics of intelligent decision support systems

Decision making is a process of thinking, which involves formulating problems, analyzing and making decisions. The problem to be solved during decision-making is called a decision-making problem, which is commonly described by the concept of "structure". The degree of structure refers to whether the relationships and laws of a process can be stated or described in clear language. The problems that can be clearly described are called structured problems. Those problems that cannot be clearly described and can only be evaluated through intuition or experience are called unstructured problems. Those problems that fall between the two are called semi structured problems. Therefore, decision-making problems can be divided into three categories: structured, semi structured and unstructured problems.

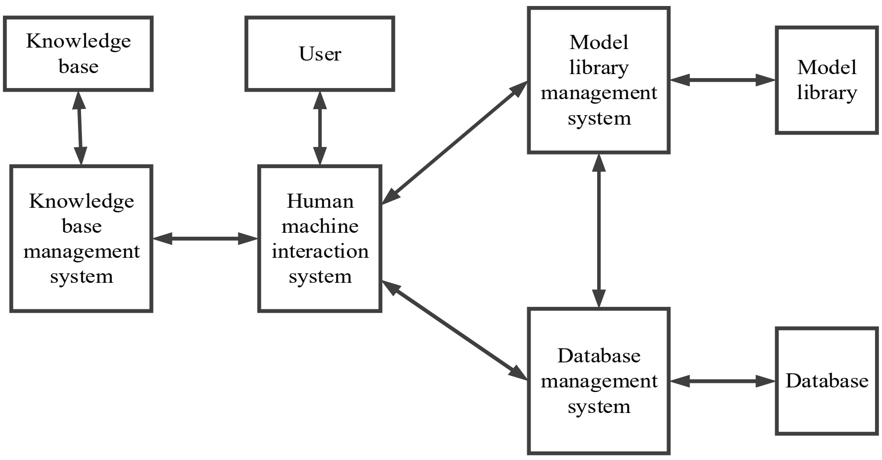

Figure 2. Block diagram of the overall architecture of the intelligent decision support system.

Decision support systems use computers as tools, utilizing decision science and related theories and methods to help decision-makers make scientific decisions in an interactive manner by synthesizing a large amount of data. Intelligent decision support system is a system that combines expert systems and artificial intelligence on the basis of traditional decision support systems. The general structure of an intelligent decision support system is shown in Figure 2.

Intelligent decision support systems have the following characteristics:

1) The intelligent decision support system has a reasoning mechanism that simulates the thinking process of decision makers.

2) The decisions and rulings provided by intelligent decision support systems are decision support tools and cannot replace the reasoning of decision-makers.

3) The intelligent decision support system has a user-friendly and flexible human-computer interface, thus helping users make effective decisions in an interactive manner.

An intelligent decision support system based on data and knowledge from databases and knowledge bases searches for solutions to decision problems based on given logic and provides exclusive thinking mechanisms to assist decision-makers through a user-friendly human-computer interface [22]. In this article, rule-based reasoning was used to calculate user health intelligent decision support.

4.2.2. Rule reasoning

All rules in rule-based reasoning systems are knowledge bases, including knowledge directly related to the work of rule-based thinking systems. Therefore, acquiring knowledge of rule-based thinking systems is very important. Its major sources are as follows: 1) Books, journals, industry standards, rules and guidelines: These text files provide theoretical and reference knowledge for decision-making. 2) Experts: Most of the knowledge gained by experts in solving problems cannot be obtained in writing, but the reasoning and deductive reasoning methods used by experts in analyzing and solving problems can be used as advanced knowledge in the knowledge base, which is a reasoning mechanism to control deductive thinking. 3) Previous examples: Successful problem-solving in the past can provide valuable knowledge for current problems [23].

The main feature of rules is the logical relationship between premises and conclusions, and premises provide evidence for conclusions. Rule reasoning is a thinking process that obtains new facts or information from a rule knowledge base based on known facts. This starts with the premise of each rule. If the premise of the rule is consistent with the existing facts in the decision-making process, the rule needs to undergo new argumentation to draw conclusions and solve the problem.

A large database stores the preliminary facts of the current decision-making problem, as well as the preliminary results of reasoning and new facts. Before reasoning, the system first inputs key decision facts into a complete database. In order to integrate dynamic changes in the database during the demonstration process, new facts need to be added to the database.

The rule knowledge base is the foundation for solving decision problems and storing knowledge rules to solve problems. The rule inference engine is a kind of thinking mechanism, which is composed of a series of programs in the rule reasoning system. It simulates the thinking process of experts in this field, and solves reasoning and decision-making problems, so as to ensure the logical coordination of the whole system. It solves these problems through persuasive methods and strategies based on traditional knowledge, which are the foundation of the entire rule sequence system.

General inference engines use active inference control strategies. When solving decision-making problems, it basically conforms to the normative premise of the knowledge base and the facts of the comprehensive database. Based on specific conditions and reliability requirements, conclusions are drawn, and the reasoning process is as follows:

1) The built-in database is initialized and the original known emergency data is added to the built-

in database.

2) The sequence number of the first scanning rule in the knowledge base is set to 0.

3) If the current analysis rule is not running in the rule library, the prerequisite for the search rule is to match known events in the merged database.

4) If the search in the rule database has not been completed, the search rule number is moved to the next rule and then to 3). When a knowledge base scan is completed and new knowledge is created while analyzing the rule database, it is redirected to 2). Otherwise, the decision-maker must provide other facts. The database is added with new facts, and it is redirected to 2). Otherwise, the reasoning ends.

5) The current search rule is scanned. If the rule output is new, it would be added to the entire database. If the last part of the rule is an action, this action is executed. The rule would be displayed as a trigger rule and written with the trigger rule number. If it is a summative rule, the output of the rule would be completed as the output of the ending inference, otherwise turn to 4).

4.3. Visualization interface design for health testing products

The following discusses how to solve the current problems in the interface design of data analysis visualization products on the premise of visualizing the data.

4.3.1. Establishing a good information architecture—Solving the problem of interface information overload

Information architecture is a key factor affecting the design of product interfaces. It is the basis and guideline for the organization and design of interfaces. The design of the information architecture is a prerequisite for the functionality of the interactive product and the basis for realizing the information transfer of the interactive product. The information architecture of an interactive interface refers to the design of the organization of the information by arranging the information in layers according to the organizational structure, planning out the connections between the various topics and representing them in a visual language. Content serves the information framework, and interface design should not be limited to a pile of cosmetic elements, but should focus on the user experience and emotional design of the product. It is important to understand that the emotional satisfaction a product brings to its users is far more important than its functionality. Therefore, the construction of information and the experience of interaction is crucial to the design of a product.

To solve this problem, it is necessary to build appropriate information structures in the human-computer interaction interface, so that the user can quickly access and process the required information. In the interface, it should try to avoid those distracting redundant information, and put the needed information in the first place. A well-constructed information framework can turn complexity into simplicity and chaos into order. By changing the form in which information is displayed and adopting a reasonable hierarchical distribution, the interface's accessibility is improved, making it easier to understand and thus reducing the communication barrier between users and the product.

4.3.2. Shaping effective interaction patterns—Solving the problem of lack of interactivity in data analysis charts

With the continuous development of mobile terminals, user operations can be completed by touching the screen, and this change in the way information is transmitted has led to a significant change in user interaction habits. The most distinctive feature is the use of finger gestures instead of traditional clicks, forming a new two-way interaction mode of information access. When designing a product's interface, designers must not only pay attention to the color scheme, font choice and size, but also to the human interaction patterns and modes of operation in order to realize the 'design for touch'. Therefore, the most effective way to bring a product to life is to use gestures to meet the needs of the user.

Gesture interaction has the advantage of being flexible and purposeful, but it is relatively unrecognizable and inaccurate, so it is important to set out some basic principles of gesture design to compensate and improve. In order to better form an efficient human-computer interaction model, a gesture-based interaction specification must be built on the basis of a good information system.

Prioritization is designed to allow for more natural user movements rather than simple clicks. When designing for interaction, designers should consider more anthropomorphic and adaptive interaction, which would make it more natural, efficient and fun for the user to use and would also reduce unnecessary learning costs.

According to the ISO ergonomic multi-part standard, the recommended key size is equal to the width of 95% of male knuckles, meaning 22 mm. Therefore, when designing for touch operation, the physical area of the interface should not be smaller than 7–9 mm. The touchable area should normally be at least 7×7 mm^2 and as large as possible at 9×9 mm^2.

An effective interactive language should therefore be fluid and easy to learn. If these touch points are linked together to form an interaction flow, then it is possible to determine whether the product is smooth to use based on this flow. A shorter interaction flow means more efficient use and better fluency. For the product, simplifying the operation as much as possible is more about better operation and more about enabling the user to understand the operation better.

4.3.3. Choosing the right visual language presentation—Solving the lack of graphical optimization for mobiles

Vision controls more than 80% of human behavior, and the eye, as the most important organ of human perception, relies on vision to process external information. Therefore, when people use their vision to perceive the external world, they instinctively use it to optimize images. It is easy for people to psychologically suggest the graphics that match them, to see them as forms that are very common in everyday life, such as parts with symmetry that can easily be perceived as a whole. This puts forward higher requirements for the interface design of data analysis visualization products. It can be designed to maintain the integrity of the image as much as possible, choosing a way that is compatible with the data display on the phone, thus reducing the additional operations the user has to perform in order to view the data.

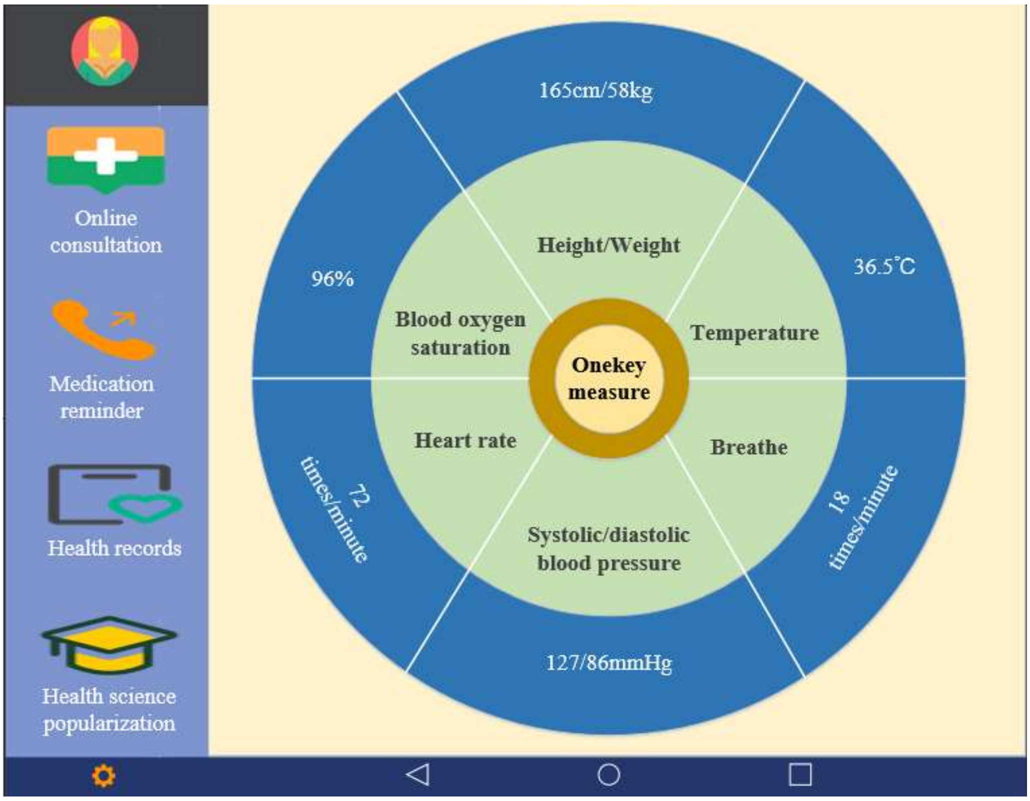

Figure 3. Visual interface for health testing products.

The visualization interface of the health testing product is shown in Figure 3.

With the hot development of interface design in the global design circle, interface design has formed a fairly common design characteristic. A product with a good UI (User Interface) interface design cannot only make the software become personalized and fashionable, but also makes the operation of the software become comfortable, simple and free, fully reflecting the positioning and characteristics of the software. Three kinds of graphical visualization charts used quite a lot in the UI interface are: histogram, pie chart and line chart. Histogram is mostly used to reflect the numerical comparison of data, a pie chart is mostly used to reflect the composition of data and a line chart is usually used to reflect the change trend of data.

On the left side of this interface, there are modules for online consultation, medication reminder, health records and health science popularization. People can enter the corresponding interface by clicking on them. On the left side of the screen is a pie chart. The core of the figure is the one key measure, which corresponds to six modules: height/weight measurement, blood saturation measurement, heart rate measurement, systolic/diastolic blood pressure measurement, respiration measurement and body temperature measurement.

4.4. Functional design of visual intelligent decision support system for health testing products

The visualization intelligent decision support system for health testing products uses database management and visualization technology to visualize changes in user basic data and physiological data. The reasoning mechanism is based on the system knowledge base and database to intelligently generate the decision that supports the results for evaluating the health of users, and provide users with online health detection products.

The requirements of visual intelligent decision support system for health detection products mainly include user basic data management, basic data visualization, user health data change input management, decision logic for evaluating user health status and knowledge base management. The functional design of the visual intelligent decision support system for health testing products is shown in Figure 4.

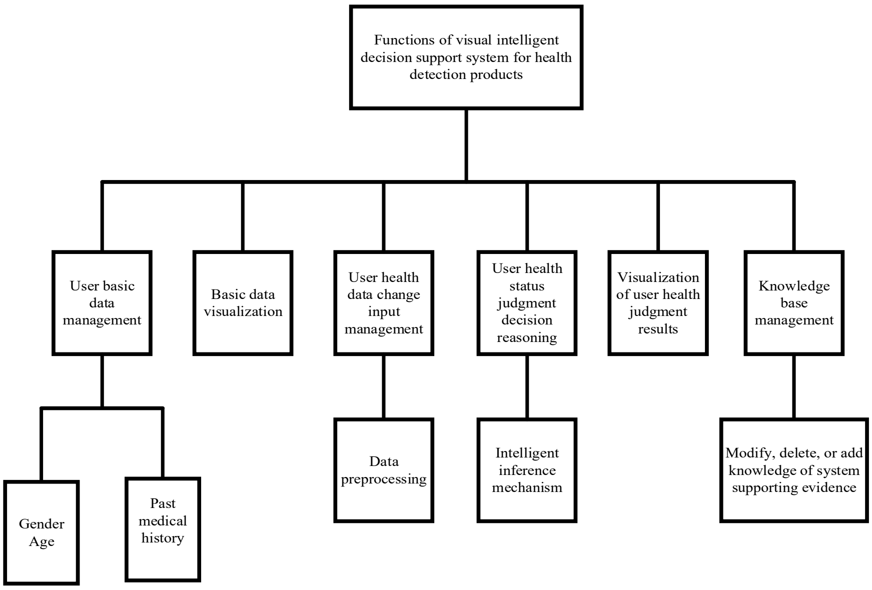

Figure 4. Functions of visual intelligent decision support system for health detection products.

4.4.1. User basic data management

Basic user data mainly includes gender, age, medical history, historical physiological data and other data. Extensive and diverse data is a prerequisite for establishing a scientifically based user health assessment system.

4.4.2 Basic data visualization

Data visualization technology organically integrates all aspects of the user's health information, and accurately expresses it through images and text as required, so that system users can intuitively understand the various aspects of health information and can provide users with visual data management tools.

4.4.3. User health data change input management

Health data change is a decision-making issue for the system. Health information input management is the interface for users to input changed health information into the system. Based on changes in health data, health data change input management performs data preprocessing to eliminate data errors and duplicate data that decision-makers find difficult to capture.

4.4.4. Reasoning of user health status judgment decisions

Reasoning mechanism is the core of the intelligent decision support system, which relates to the performance and efficiency of the whole system. The user health assessment decision is to process and analyze the modified health data after the system confirms the changes in the user's health data. The intelligent reasoning mechanism is used to automatically generate the judgment of the user's health status, and the user can view it in a human-computer interactive manner.

4.4.5. Visualization of user health status judgment results

The visualization of user health assessment results includes visualizing the user health assessment process in various visual forms after determining the user's health status. This enables users to more accurately understand health-related data and visualize and intuitively perceive decisions.

4.4.6. Knowledge base management

A knowledge base is the source of knowledge and experience for intelligent decision support systems that analyze and solve problems, including knowledge used to modify, delete or add system supporting evidence.

5. Evaluation of the effectiveness of visual health detection products in intelligent decision support systems

Twenty people in different age groups between 18–60 years were selected for the study. Twenty of the study participants were users of health testing products and needed to use data analysis products on their mobile phones in their daily work, and had no major physical illnesses. Five people were aged 18–30, 8 people were aged 31–50 and 7 people were aged 51–60. Ten people used smart decision support visual health monitoring products for health monitoring and 10 individuals used a traditional health monitoring product for health monitoring. A questionnaire was used to compare user interaction, convenience and satisfaction with product use when using the products, and the evaluation was carried out on a full scale. Basic user health data was collected using the medical product and compared with the results of the health monitoring product to calculate the accuracy of the health monitoring results and to compare the monitoring results of the 2 health monitoring products.

5.1. Product interactivity

The interactive evaluation results of health monitoring products are shown in Figure 5.

Figure 5(a) shows the interactive evaluation results of intelligent decision support visualization health monitoring products and Figure 5(b) shows the interactive evaluation results of traditional health monitoring products.

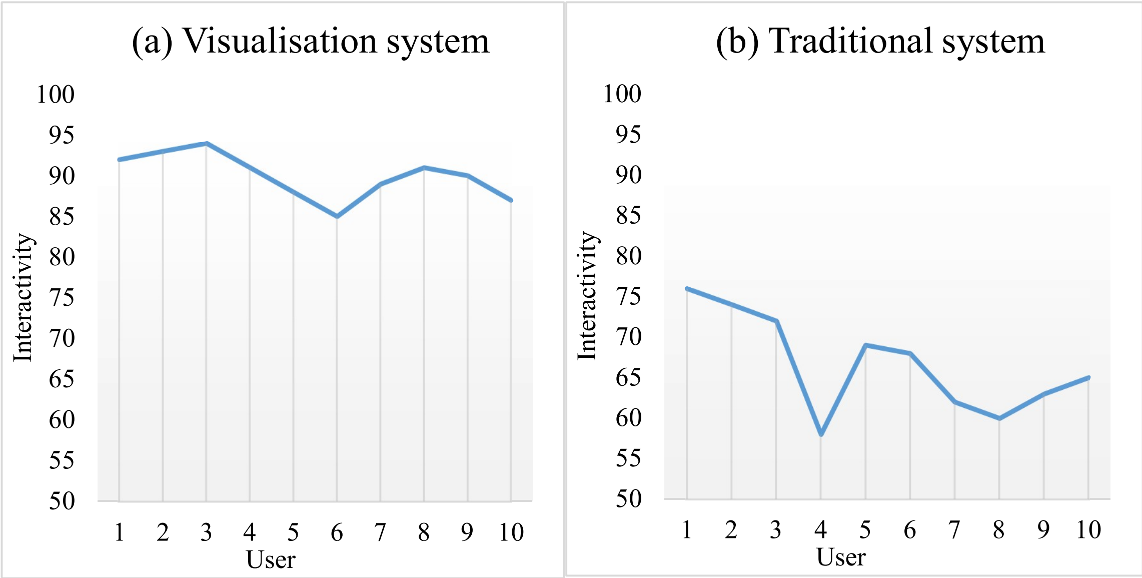

Figure 5. Evaluation results of the interactivity of health monitoring products. (a) Interactivity evaluation of the intelligent decision support visual health monitoring products. (b) Interactivity evaluation of traditional health monitoring products.

The interactive evaluation results of intelligent decision support visualization health monitoring products ranged from 85 to 94, while the interactive evaluation results of traditional health monitoring products ranged from 58 to 76. The interactive evaluation results of intelligent decision support visual health monitoring products were relatively high. The interactive evaluation results were above 85, which was much higher than the interactive evaluation results of traditional health monitoring products.

Intelligent decision support for visual health monitoring products has shifted from a decorative appearance to a user-friendly presentation of user needs. It creates new product designs, and analyzes and designs product functional requirements from the perspective of different users based on their behavioral characteristics and preferences. This product aims to synchronize data with mobile applications, including blood pressure measurement, blood glucose measurement, blood oxygen measurement and Bluetooth or wireless transmission, and improve user interaction during use.

5.2. Product convenience

The convenience evaluation results of health monitoring products are shown in Figure 6.

Figure 6(a) shows the convenience evaluation results of intelligent decision support visualization health monitoring products, and Figure 6(b) shows the convenience evaluation results of traditional health monitoring products.

The convenience evaluation results of intelligent decision support visualization health monitoring products ranged from 80 to 91, while the convenience evaluation results of traditional health monitoring products ranged from 60 to 71. The convenience evaluation results of intelligent decision support visualization health monitoring products were relatively high, which was much higher than the convenience evaluation results of traditional health monitoring products.

Unlike the very practical blood glucose meter and sphygmomanometer in the market, the intelligent decision support visual health monitoring product has complete functions. The monitoring function has been added to the product to track users' emergency situations through infrared radiation. In emergency situations, family members or doctors can be notified as soon as possible. When users view health data every day, the data would be visually displayed, and the digital graphic display makes complex data clear. The data is more convenient for users to view and closer to human cognitive patterns, and users can view their health status more effectively and faster.

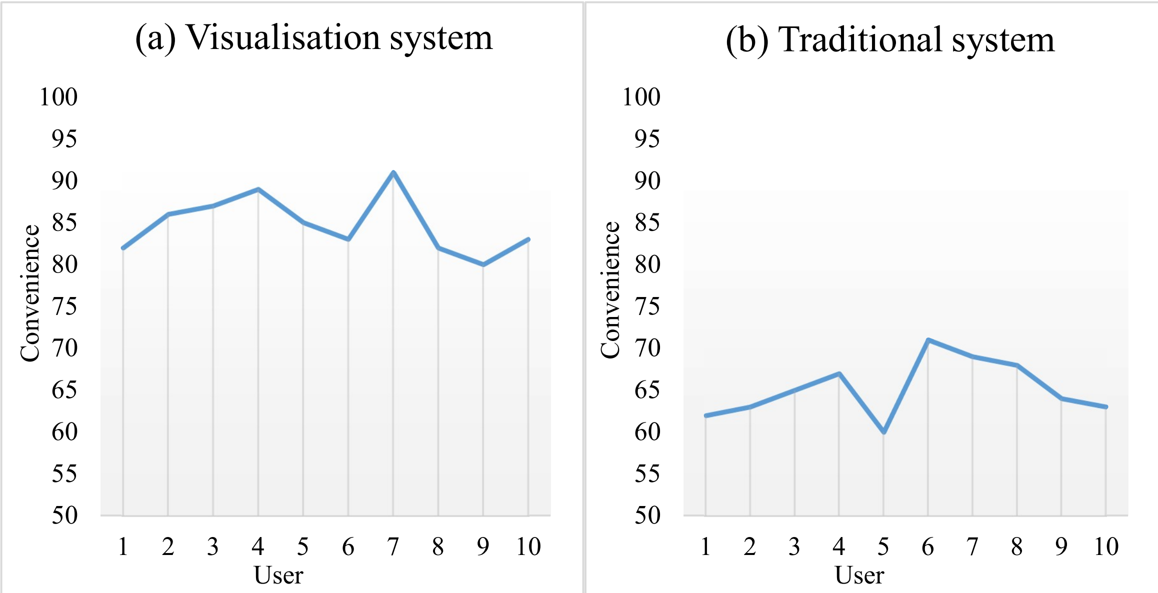

Figure 6. Evaluation of the convenience of health monitoring system products. (a) The convenience of intelligent decision support visual health monitoring products. (b) The convenience of traditional health monitoring products.

5.3. Accuracy of health decision-making

The accuracy of health decision-making in the health monitoring system is shown in Figure 7. Figure 7(a) shows the accuracy of health decision-making in intelligent decision support visualization health monitoring products, and Figure 7(b) shows the accuracy of health decision-making in traditional health monitoring products.

The decision accuracy of intelligent decision support visual health monitoring products ranged from 83.3 to 93.1%. The average accuracy rate of health decision-making was 87.98%, with a high accuracy rate. The decision-making accuracy of traditional health monitoring products ranged from 78.5 to 83.2%, with an average health decision-making accuracy of 81.27%. The accuracy was lower than that of intelligent decision support for visualized health monitoring products.

Intelligent decision support visualized health monitoring products use intelligent decision support systems to analyze the monitored human body data. The intelligent decision support system knowledge base contains a large number of related knowledge rules, which makes decisions on the health status of the body through rule reasoning. Visualized data makes the data more vivid, thus improving the computational efficiency of data analysis. Compared with traditional health monitoring product decision-making systems, the accuracy of health decision-making results is higher.

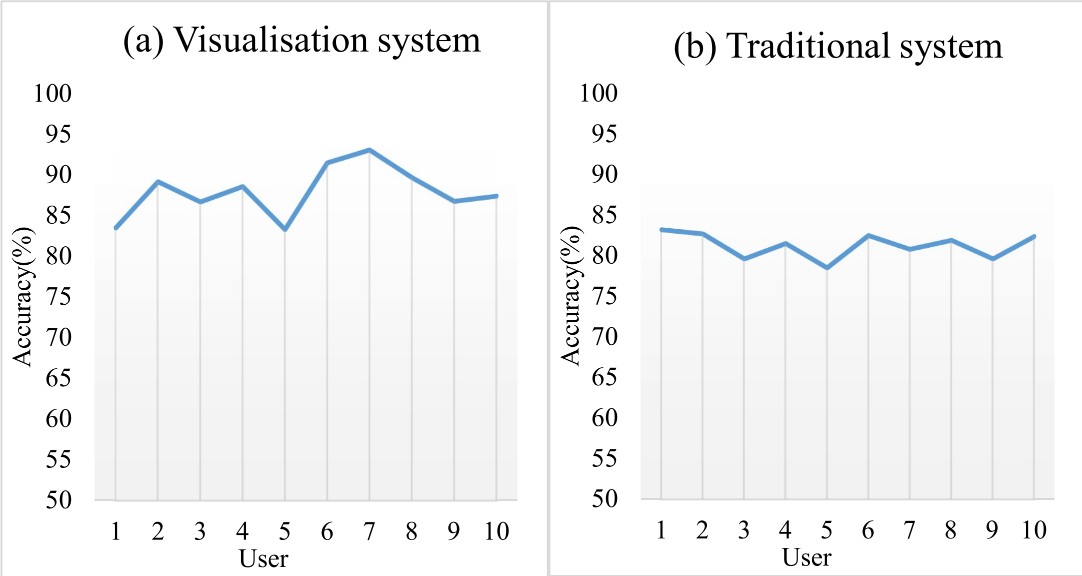

Figure 7. Health monitoring products health decision-making accuracy. (a) Accuracy of intelligent decision support visual health monitoring products. (b) Accuracy of health decision-making in traditional health monitoring products.

5.4. Product use satisfaction

The satisfaction with the use of health monitoring products is shown in Figure 8.

Figure 8(a) shows the satisfaction of using intelligent decision support visualization health monitoring products, and Figure 8(b) shows the satisfaction of using traditional health monitoring products.

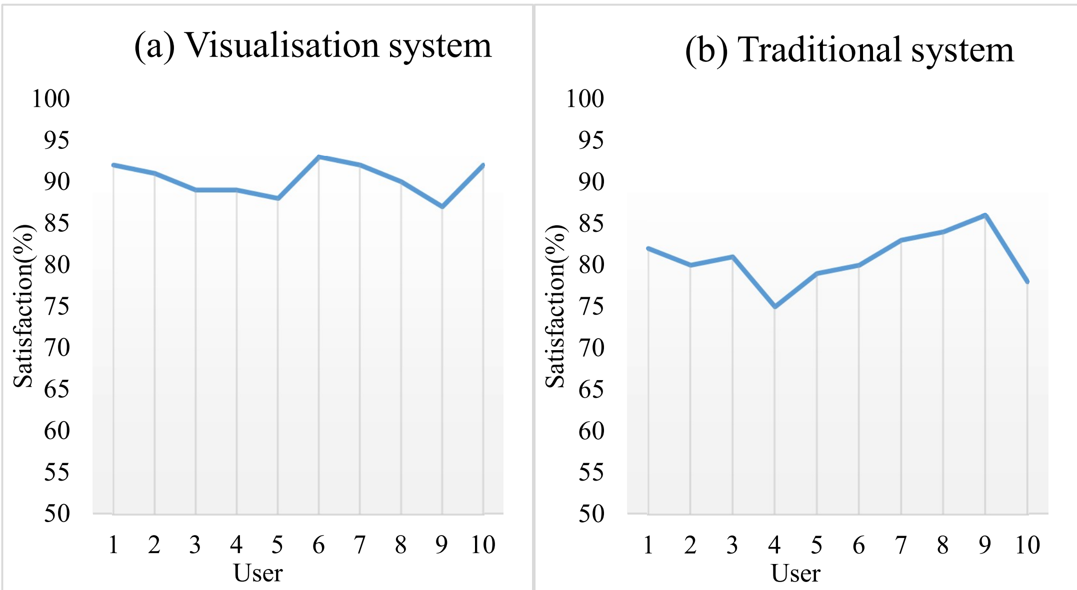

Figure 8. Satisfaction with the use of health monitoring system products. (a) Satisfaction with the use of intelligent decision support visual health monitoring products. (b) Satisfaction with the use of traditional health monitoring products.

The satisfaction with the use of intelligent decision support visual health monitoring products ranged from 87 to 93%, and the satisfaction was relatively high. The satisfaction with the use of traditional health monitoring products ranged from 75 to 86%. Satisfaction was lower than the satisfaction of using intelligent decision support visual health monitoring products.

Intelligent decision support visual health monitoring products have high interactivity, convenient operation and vivid data presentation, and users have a good user experience during the use process. The intelligent decision-making system has high decision-making accuracy and can provide users with professional health diagnosis and scientific guidance, with high user satisfaction.

6. Conclusions

We studied the interaction design of home health monitoring products. Based on the physiological and psychological characteristics of the target users, we designed a visual family health monitoring product combining the living habits and visual characteristics. According to the characteristics of human-computer interaction and data visualization needs of health monitoring products, the design ideas and methods of data visualization of health monitoring products were proposed. Based on the rule reasoning principle of intelligent decision support system, we carried on the functional design of health monitoring product visualization intelligent decision support system, including user basic data management, basic data visualization, user health data change input management and intelligent decision support system based on health detection product visualization. This reduces the effort of the intelligent decision-making process. This paper presented the abstract monitoring data vividly, which improves the interaction and convenience of health testing products, the accuracy and satisfaction of health decision-making. From the perspective of interaction design, we found that the family health monitoring product has the characteristics of comfort, safety, simple operation and comprehensive function, and can meet the needs of users for data analysis products to the greatest extent, which is scientific and humanized. This can break the characteristics of traditional medical products and the monotony of appearance design, and provide help for the interaction design of future family medical products. However, there were still some problems with this study. First, the products in the study were researched, but the research was not comprehensive enough, and there were differences in the reality, so it should be further tested; second, the data of the experimental research subjects was small, and a large number of actual research reports and data analysis were needed before the actual design can be recognized.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors declare there is no conflict of interest.

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