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Design of Sports Training Interactive Interface Based on Human Intelligent Health Monitoring Technology

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Abstract In today's rapidly developing technology, user interfaces are gradually evolving into a multidisciplinary and integrated design science. In the information age, the user interface design of digital products is a key factor determining the user experience of digital products. The current design of sports training interactive interfaces is too complex, and users may need to spend a long time adapting and understanding the operation of the interface, which limits its convenience in use. If a more accurate, easy-to-use, and intuitive interface design can be provided, athletes and sports enthusiasts can monitor their physical health in real-time on the mobile end, and can view training data at any time to effectively improve training effectiveness. This article analyzed the sports training interaction interface under human intelligent health monitoring technology, and analyzed the development process of human intelligent health monitoring technology and introduced the application of health monitoring technology in smart medicine through real-time case analysis. This article also randomly selected a sports training activity center and learned about the athletes' needs for sports training interaction interface design through interviews. Based on questionnaire data, data statistics were conducted to retain improvement suggestions. In the preparation work for the design of the sports training interactive interface, the needs of the personnel of the sports activity center for the interface design were analyzed, and the design of the sports training interactive interface for human intelligent health monitoring technology was explored. After conducting a satisfaction survey on interactive gestures, a total of 104 people were satisfied with the interface interaction gesture design, accounting for 86.7% of the total number. It can be seen that satisfaction has increased after the improvement. This article believed that in the design of sports training interactive interfaces based on human intelligent health monitoring technology, emphasis should be placed on considering the needs of target users and adopting appropriate interface structures to support applications.

Index Terms Physical Training, Interactive Interface, Intelligent Monitoring, Human Health, User Satisfaction

I. Introduction

With the continuous progress of science and technology, people are paying more and more attention to their physical health, and intelligent health monitoring devices have been increasingly applied in sports training [1]. The current design of sports training interactive interfaces is too complex, and users may need to spend a long time adapting and understanding the operation of the interface. Intuitive interface design can enable athletes and sports enthusiasts to monitor their physical health in real-time on the mobile end, improving training effectiveness. Human intelligent health monitoring technology can use various sensors and intelligent devices to monitor physiological indicators such as heart rate, blood oxygen saturation, and respiration of athletes in real-time, and accurately and scientifically evaluate the training situation of athletes [2], [3]. It can also monitor athletes and coaches in real-time and analyze their data, so as to have a more accurate grasp of their physical condition and training results, and adjust training plans and parameters in a timely manner to obtain the best training results.

With the rapid development of computer information technology, various application research on sports training interactive interfaces is receiving increasing attention. Marco Gillies believed that interaction based on human sports may become an important new paradigm in human-computer interaction interface design. However, high-quality and mainstream action interaction requires effective tools and techniques to support designers. A promising method for designing motion interaction interfaces is interactive machine learning, where the design is accomplished through physical execution of actions [4]. Eleonora Mencarini conducted a literature review on human-computer interaction in wearable sports systems, selecting a corpus of 57 papers and analyzing them through the basic theoretical methods of literature review. Five themes were identified in the paper, including different research perspectives, types of sports and athletes, the role of wearable devices in sports, their wearability, and different types of feedback [5]. Long Sha proposed an intelligent human-computer interaction interface that utilized trajectories instead of words to achieve retrieval of specific matches in sports [6]. In order to improve the human-machine interaction and flexibility of rehabilitation training robots, and enhance patients' active participation and user experience, Yang Tao conducted research on the interaction system and aesthetic style of motion training robots based on AD (Automatic Difference) theory and function tailoring method, and proposed a set of interface design and development guidelines suitable for motion training equipment, with users as the center. Moderate adjustments have been made to the high-tech design of motion robots [7]. The above research indicated that interactive interfaces have significant advantages in sports training. However, the existing training data management and evaluation system with a single graphical interface based on windows has brought great inconvenience to users, making it difficult to achieve real-time management and evaluation of training data.

Promoting interactive interfaces based on intelligent health monitoring technology through the use of modern information technology is an important way to improve. H Qian has noticed that some researchers and entrepreneurs have noticed the enormous potential of sports training interactive interfaces in the field of sports, such as smart sports stadiums, smart sportswear, and intelligent health monitoring technology [8]. Liu Dan believed that human physiological parameters are not only important indicators for people to self test their physical health, but also essential medical information for fast-paced life. To meet this daily need, an intelligent human health information monitoring and interaction interface system has been designed, using infrared tubes as heart rate sensors to collect pulse and heart rate information, and finally displaying all information on the interface [9]. The above research indicates that the combination of intelligent health monitoring and interaction interfaces is a hot topic in academic research today. However, there is a lack of specific data validation to determine whether the interaction system can operate normally, reliably, and stably, and whether each functional module can meet the design requirements.

In the interactive interface for sports training health monitoring, personalized training guidance and suggestions can be provided to different athletes based on their physical conditions and needs, thereby helping them develop training plans that are suitable for themselves and improving their training efficiency and effectiveness. In the interactive interface, the physiological parameters and movement data of athletes can be displayed in real-time, and real-time feedback and supervision can be provided to athletes, allowing them to adjust their movements and posture in a timely manner, reduce the risk of injury, and improve the safety and effectiveness of training.

This article studied the design of a sports training interactive interface based on human intelligent health monitoring technology. The article also analyzed the research on human intelligent health monitoring technology from the development process of human intelligent health monitoring technology and common human intelligent health monitoring technologies. After consulting relevant articles, the demand models of target groups such as athletes were analyzed. Preparation work has been carried out from the direction of interactive interface design, the requirements of interactive interface design, the functions and characteristics of interactive interface design, as well as the methods and processes of interactive interface design. The design and implementation of the sports training interactive interface were discussed based on the above content. After discussing the target user's evaluation of interactive gestures on the interface, improvements were made. Through the improved gesture interaction interface, users were satisfied with the sensitivity, reaction speed, and accuracy of the interaction.

II. Evaluation on Human Intelligent Health Monitoring Technology

II. A. Improvement of Human Intelligent Health Monitoring Technology

The health of the human body has always been a concern, and health monitoring technology has also developed with the progress of human society. Through these monitoring technologies, one can have a comprehensive understanding of one's physical health, thereby detecting any abnormalities in the body in the shortest possible time and protecting one's health [10]. The emergence of intelligent health monitoring technology has improved this situation.

Nowadays, small intelligent health monitoring devices are convenient to carry and use, and can comprehensively and clearly reflect various important physiological parameters of the human body, providing scientific and practical solutions for disease prevention and treatment. With the continuous progress of technology, intelligent health monitoring technology has also shown more intelligent and diversified characteristics. The development trends of these technologies mainly include multiple function integration, data intelligence, personalized customization, and the combination of intelligence and medical treatment.

On this basis, this article integrates intelligent health monitoring technology with many other functions such as emotional monitoring, nutritional monitoring, physiological monitoring, etc. With the advancement of sensing technology, more and more information is collected by intelligent devices, and evaluation and analysis are becoming more accurate and intelligent. Intelligent health monitoring devices could provide personalized monitoring solutions for different user needs. In the future, intelligent health monitoring technology could gradually be combined with medical technology, using artificial intelligence to make the diagnostic results of monitoring data more accurate and timely [11].

The development trend of intelligent health monitoring technology is multifaceted, and these technologies could be more widely applied in the future to provide better health protection for people. Figure 1 shows China's per capita consumption level and per capita medical consumption expenditure from 2014 to 2020:

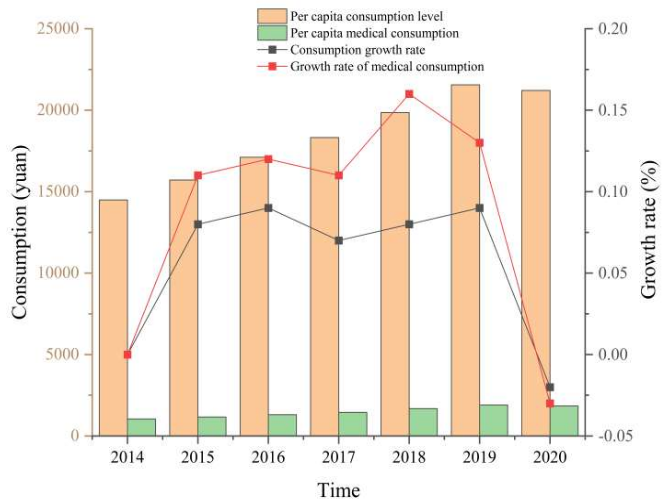

Figure 1: China's per capita consumption level and per capita medical consumption expenditure from 2014 to 2020

The x-axis in Figure 1 represents time; the left y-axis represents consumption; the right y-axis represents growth rate. The legend shows the per capita consumption level and growth rate, as well as the per capita medical consumption and growth rate. From the graph, it can be seen that the per capita consumption level and per capita medical consumption expenditure in China increased year by year from 2014 to 2019, but began to decrease in 2020. Among them, the per capita consumption level in China reached its highest level of 21559 yuan in 2019, and the per capita medical consumption expenditure reached its highest level of 1902 yuan in 2019.

It can be seen that Chinese people are increasingly concerned about their physical condition, and with the continuous development of human intelligent health monitoring technology, the market for smart health app (application) could continue to expand in the future. Therefore, research on the design of interactive interfaces has become very important.

II. B.Human Intelligent Health Monitoring Technology

This article analyzed several common human intelligent health monitoring technologies in daily life and provided a brief analysis of their technical mechanisms, as shown in Figure 2:

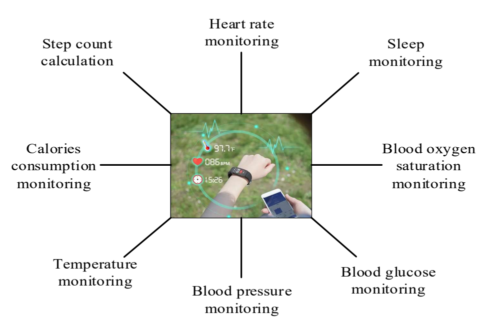

Figure 2: Common human intelligent health monitoring technologies

As shown in Figure 2, human intelligent health monitoring technology includes heart rate monitoring, blood pressure monitoring, sleep monitoring, step calculation, calorie consumption monitoring, temperature monitoring, blood oxygen saturation monitoring, and blood glucose monitoring. Instruments such as smart wristbands, watches, or mattresses monitor sleep status and circulation, and evaluate and improve sleep status. Instruments such as pedometers and smart wristbands record the number of steps taken and the amount of exercise exercised per day to evaluate the level of physical activity. Smart bracelets or mobile apps can calculate and monitor daily calorie intake based on data such as height, weight, and age. Intelligent thermometers, wearable devices, etc., monitor the human body temperature in real time and issue prompts to users to indicate whether there is overheating or overcooling. Pulse oximeters and other instruments measure the patient's blood oxygen saturation to evaluate their respiratory and pulmonary function. The blood glucose meter and other instruments monitor blood glucose, control diabetes patients and control diet.

II. C.Application Cases and Advantage Evaluation

In recent years, intelligent medical technology has received increasing attention and has been widely applied in the field of healthcare to build a more healthy, accurate, and efficient healthcare ecosystem. As a key link, health monitoring technology can help medical personnel monitor the physical condition of patients in real-time, thereby making correct diagnosis and treatment for patients and reducing the occurrence of medical accidents [12].

This article could introduce the application of health monitoring technology in smart healthcare through real-time case analysis. Figure 3 shows the real-time recorded steps in a user's intelligent health monitoring app:

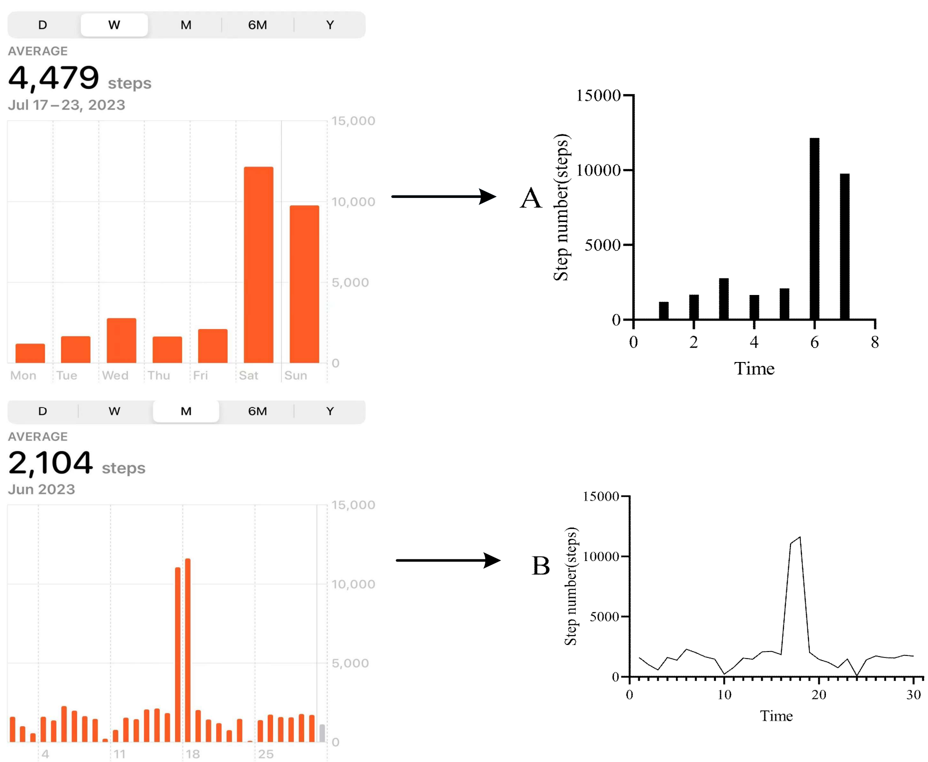

Figure 3: Step count statistics for target users within one week and one month

In Figure 3, the group images A and B obtained from human intelligent health monitoring technology are shown. Figure A shows the steps taken by the target user within a week, while Figure B shows the steps taken by the target user within a month. Among them, the x-axis in Figures A and B represents time, and the y-axis represents the number of steps. From the graph, it can be calculated that the average number of steps taken by the user within a week was 4479. If the average number of steps exceeded on Saturdays and Sundays, it indicated that the user did not engage in too much aerobic exercise on weekdays, while Saturdays and Sundays were rest days when they had time to exercise to maintain physical health. Similarly, the average number of steps taken by the user within a month was 2104, indicating that most of the time it was below this value. Therefore, the intelligent health monitoring application can timely check its own human health status and remind itself to maintain good health by setting certain standards.

The results indicate that using intelligent health monitoring technology to monitor human walking speed is a relatively effective method, which can accurately record daily walking speed and exercise intensity. Sensors can monitor and calculate each step, effectively reducing the error of manual statistics. Intelligent health monitoring technology can monitor the number of walks and movements of the human body in real-time, and provide timely feedback and analysis of human movement. Users can always be aware of their actions and make corresponding adjustments and improvements when necessary. Intelligent human motion monitoring technology can connect and analyze the movement status information of the human body with other body status information. Intelligent health monitoring technology can display step data in a graphical and graphical manner, allowing users to have a more intuitive understanding of their movement status and trends. This can help users maintain exercise to increase their activity levels.

Intelligent health monitoring technology can provide accurate, real-time, and scientifically analyzed data in human step monitoring, helping users better understand and manage their exercise situation, thereby promoting the formation and maintenance of a healthy lifestyle.

III. Requirement Evaluation and User Evaluation

III. A. Evaluation of Athlete Needs

After consulting relevant articles, this article analyzed the demand models of target groups such as athletes, as shown in Figure 4:

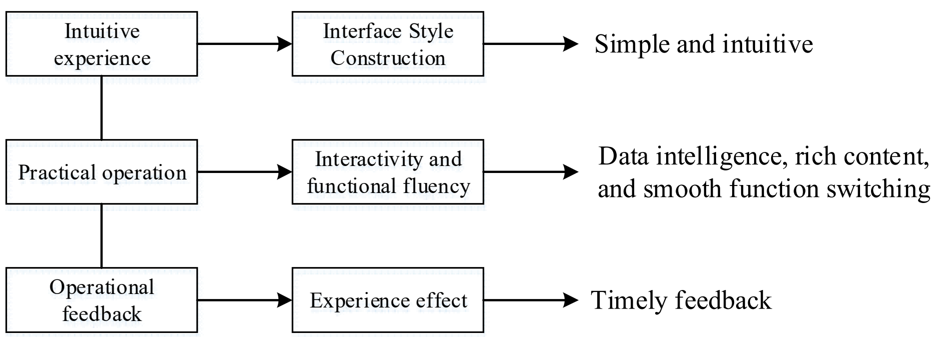

Figure 4: Target group demand model

From Figure 4, it can be seen that the following demand model can be constructed for the health monitoring application interface of target groups such as athletes and sports enthusiasts. Athletes hope that the interface can display their physiological parameters and exercise data in real-time, such as heart rate, blood oxygen saturation, respiratory rate, movement distance, speed, etc., so that they can timely understand their physical condition and training effectiveness. The interface should be able to provide individual training guidance and suggestions for each athlete based on their physical fitness and training objectives, and assist athletes in establishing and managing their own training plans. In the system, athletes can set their own training goals, training plans, and track and record their training progress.

This article believes that in order to help athletes better understand the information they have, the interface can use charts, trend analysis, and other means to visually display relevant data, providing reference for athletes to conduct scientific training and making corresponding decisions. The interface should have friendly human-machine monitoring interaction and be easy to use. On this basis, some scholars have proposed a health monitoring application interface based on virtual reality technology, which provides social interaction functions for athletes to communicate and share with other athletes and coaches in this system [13].

The demand model for health monitoring application interfaces for target groups such as athletes specifically includes the following aspects: real-time monitoring and data display, personalized training guidance, training plan management, data analysis and reporting, user-friendly and easy-to-use user interface, and social interaction functions. The research in this article can provide reference for the design and development of health monitoring interfaces for different populations in the future.

III. A. 1) Training Objectives and Requirements

This article randomly selected a sports training activity center, and after visiting, people can learned about the daily training goals and requirements of athletes. The daily training activities mainly include endurance, strength, speed, agility, and flexibility. In order to collect relevant data, this paper analyzed the training frequency of the center's daily training activities within a certain week, as shown in Table 1:

Table 1: Daily training objectives of athletes

Time	Endurance (number of times)	Strength (number of times)	Speed (number of times)	Agility (number of times)	Flexibility (number of times)
Monday	2	3	2	2	3
Tuesday	3	4	4	2	4
Wednesday	2	3	3	2	4
Thursday	3	3	2	4	3
Friday	4	2	2	3	3
Saturday	4	4	3	3	3
Sunday	4	3	2	2	2

According to Table 1, the focus of this sports training activity was on a total of 12 daily training activities on Monday, with strength and flexibility being the most frequent. On Tuesday, there were a total of 17 daily training activities, with strength, speed, and flexibility being the most frequent. On Wednesday, there were a total of 14 daily training activities, with flexibility being the most frequent. There were a total of 15 daily training activities on Thursday, with agility being the most frequent. There were a total of 14 daily training activities on Friday, with endurance training being the most frequent. There were a total of 17 daily training activities on Saturdays, with endurance and strength training being the most frequent. There were a total of 13 daily training activities on Sunday, with endurance training being the most frequent. It can be seen that the goals of the sports activity center for athlete training were roughly as follows: mainly training flexibility on Mondays and Wednesdays, agility on Thursdays, and endurance on Fridays and Sundays.

III. A. 2) Evaluation of Monitoring Data Requirements

The data during athlete training can be used to evaluate training effectiveness, adjust and optimize training methods, and effectively monitor the health status of athletes [14]. By monitoring its various physiological indicators, it is possible to better understand its physical condition and adaptation. Indicators such as heart rate, blood pressure, muscle soreness, and body temperature can all reflect the physical fitness and recovery status of athletes. By monitoring various indicators, coaches and relevant personnel can have a comprehensive understanding of the physical fitness and training situation of athletes, and thus have a more accurate judgment of their physical condition [15], [16].

III. B. Athlete User Evaluation

This article conducted user research on the multi-identity personnel of the sports activity center mentioned above, and conducted two questionnaire surveys within two days. A total of 105 questionnaires were distributed, and 104 were actually collected. The valid questionnaires were 100. The content of questionnaire 1 mainly focused on the content related to the sports intelligent health monitoring app, while questionnaire 2 mainly focused on the interface design related to the intelligent health monitoring app studied below. Details are shown in Tables 2, 3, 4, and 5:

Table 2: Questionnaire survey 1

Serial number	Option A	Option B	Option C	Option D	Option E
Question 1	59	41	0	0	0
Question 2	11	36	33	14	6
Question 3	32	22	14	23	9
Question 4	15	20	24	27	14
Question 5	47	19	15	9	10
Question 6	20	18	16	11	35
Question 7	83	17	0	0	0
Question 8	40	20	16	14	10
Question 9	35	32	15	11	7
Question 10	33	28	21	11	7
Question 11	17	17	25	25	16

Table 3: Partial datasets for questionnaire survey 1

1	2	3	4	5	6	7	8	9	10	11
A	D	B	D	B	B	A	A	E	D	D
A	C	B	E	A	C	A	A	A	B	C
B	E	A	E	C	A	B	C	A	C	A
B	C	B	B	D	A	A	C	A	C	E
A	B	D	C	E	E	A	D	A	D	C

From Table 2, it can be seen that there were a total of 59 males and 41 females surveyed in this survey, mainly aged between 18 and 24 years old. According to the questionnaire, a total of 68 individuals have had training experience and 23 individuals have never trained. It can be seen that the vast majority of the participants in this survey have had training experience. There was a lot of content related to sports intelligent health monitoring apps in the questionnaire. According to the questionnaire, 47 people stated that they frequently use intelligent health monitoring apps; 19 people stated that they occasionally use them; 15 people stated that they do not use them frequently; 9 people stated that they have never used them before. According to the questionnaire, 33 people expressed that intelligent health monitoring apps have a lot of help for daily sports training, while 28 people believed they have less help. It can be seen that most people in this survey still recommend using intelligent health monitoring apps. Then, this paper would conduct a survey on questionnaire 2.

Table 4: Questionnaire survey 2

Serial number	Option A	Option B	Option C	Option D	Option E
Question 1	53	47	0	0	0
Question 2	11	17	19	24	29
Question 3	21	17	19	20	23
Question 4	51	8	11	17	13
Question 5	33	28	11	21	7
Question 6	20	20	26	24	10
Question 7	18	17	23	27	15
Question 8	33	27	17	12	11
Question 9	73	27	0	0	0
Question 10	16	22	26	24	12
Question 11	17	17	25	25	16

According to Table 4, there were 53 males and 47 females among the surveyed individuals in Questionnaire 2. Most of the questions in this questionnaire were related to the interface design of the intelligent health monitoring app. According to the questionnaire, 11 people reported frequent interface stuttering; 24 people reported no interface stuttering; 29 people reported issues beyond stuttering. 21 people often stay on the heart rate monitoring page; 17 people stay on the blood pressure monitoring page; 19 people stay on the sleep monitoring page; 20 people stay on the step calculation page; 23 people stay on other pages when using related application. The questionnaire showed that more than half of the people unanimously believed that the intelligent health monitoring type of app used needs further improvement in page design, and the beauty of the page is a key choice for many users. Table 5 is a partial dataset of questionnaire survey 2:

Table 5: Partial datasets for questionnaire survey 2

1	2	3	4	5	6	7	8	9	10	11
B	D	C	B	D	E	B	B	B	B	A
B	E	E	A	A	B	A	A	A	C	B
B	A	D	A	A	D	A	A	B	C	C
A	D	E	E	C	C	E	D	A	B	C
A	D	E	C	A	C	B	C	B	B	D

In two surveys conducted on the personnel of the sports center, it was found that users have high expectations for personalized customization of the interface, hoping to customize the layout, color themes, data display methods, etc. of the interface to meet their personal preferences and needs. Users also attach great importance to real-time monitoring and reminder functions. The interface can display physiological parameters and exercise data in real-time, and can provide reminders based on set thresholds to adjust training intensity and methods in a timely manner. Users have high requirements for the friendliness and ease of use of the user interface, hoping that the interface can display information concisely and intuitively, operate conveniently and quickly, and adapt to different devices and operating systems.

This article believes that by conducting research on the health monitoring application interface of target groups such as athletes, people can better understand their needs and preferences, and thus design an application interface that better meets their expectations. This not only improves the user experience, but also meets their needs in health monitoring and training management.

IV. Preparation for the Design of Sports Training Interactive Interface

IV. A. Direction of Interactive Interface Design

This article analyzed a new human-computer interaction method based on the above research. The human-computer interaction method should be easy to learn and use and consistent with the cognitive and behavioral patterns of users, in order to provide better human-computer interaction methods for users. Every element in the interface should be obvious and not for the user to guess. Key features and actions should be emphasized in order to make it easier for users to discover and use, and to minimize the perceived burden and operational complexity of users. In the human-computer interaction of the interface, the user's expectations and habits should be followed to achieve accurate prediction and control of human-computer interaction behavior [17].

IV. B. Requirements for Interactive Interface Design

In today's interface design, human-computer interaction is an important goal. In order to further improve the usability of the network at the design level, designers must fully consider the diverse needs and behavioral characteristics of users, document more accurately, and meet the needs of different users. In the process of analyzing users, it is necessary to combine relevant theories such as psychology, communication science, sociology, etc., in order to analyze and respond to the interface needs of different types of users. This provides a reliable theoretical basis and reference for the analysis and design of interaction systems, so that the designed interaction systems can better adapt to various types of users.

The 100 questionnaires surveyed in the previous section were divided into 5 unequal groups. To view the number of questionnaires related to the requirements for interactive interface design, Table 6 summarizes the requirements for interactive interface design:

Table 6: Requirements for interactive interface design

Group	Reasonable layout	Refine scene	Reduce input	Enhanced interaction	Other
Group 1	4	5	5	5	2
Group 2	5	3	6	3	1
Group 3	4	5	4	4	3
Group 4	5	4	7	6	3
Group 5	2	3	4	6	1
Total (sheets)	20	20	26	24	10

From Table 6, it can be seen that there were 20 questionnaires for users' reasonable interface layout requirements, 20 questionnaires for detailed scenario requirements, 26 questionnaires for reduced input requirements, 24 questionnaires for enhanced interaction requirements, and 10 questionnaires for other requirements. According to the user's needs for interactive interface design, timely modifications can improve user utilization.

IV. C. Data Evaluation of Interactive Interface Design

The user is the owner of the product, and in order to provide the most basic support and assistance for the user's needs, interface design needs to fully understand the goals that the product aims to achieve and the user base of the product [18]. By assisting users in achieving their goals, the design should not only consider whether they accept this result, but also consider issues such as user expectations and the feasibility of possible results. Then, data on the functions and characteristics of interactive interface design in the questionnaire survey should be collected. Based on the data of the functions and characteristics of the interactive interface design, the 100 questionnaires surveyed in the previous section were reclassified into 5 unequal groups, as shown in Table 7:

Table 7: Functions and characteristics of interactive interface design

Group	Complete functions	High user understanding	Simple interface design	Effective user feedback	Other
Group 1	3	2	4	5	3
Group 2	4	4	6	6	2
Group 3	6	5	7	5	2
Group 4	2	3	4	4	5
Group 5	3	3	2	7	3
Total (sheets)	18	17	23	27	15

According to Table 7, there were a total of 18 questionnaires related to fully functional interactive interface design, 17 questionnaires related to high user understanding, 23 questionnaires related to concise interface design, 27 questionnaires related to effective user feedback, and 15 questionnaires related to other functions and features.

IV. D. Method and Process of Interactive Interface Design

A survey shows that interactive interface design was initially developed from web design and graphic design, and later developed into an independent discipline. Nowadays, interaction interface designers are not only responsible for text and images, but also for creating all the elements that users may touch, tap, or type on the screen: all the interactions in the product experience. The paper first comprehensively designed the APP from three aspects: market analysis, competitor analysis, and user analysis, and conducted a detailed analysis of it.

This article summarizes the methods and processes of interactive interface design. Firstly, this paper can start with the large functional modules, then subdivide the small functions, sort out the business processes, user experience processes, etc., sort the importance and timing of the functional modules, and draw a sketch of the software in a wireframe format according to its functional modules, time series, and user experience process. Everyone has their own personality, so the design of the app also has its own characteristics. This article finds a similar app as a reference, and then makes some styles suitable for the group based on the preferences of the target users mentioned above.

V. Design and Implementation of Sports Training Interactive Interface

V. A. Interface Design and Interaction Process

Based on the previous text, this article visually expresses the APP interface from aspects such as architecture, wireframe, navigation, and visual elements. The interface architecture design is the supporting system for the APP interface, and its main service objectives are navigation and information order. By utilizing the logical relationship between the basic functions of the APP, it ensures that users can quickly obtain the information they want. Due to the very small interface of the APP, the design of its interface structure needs to be simple and clear. Currently, the APP interface architecture is mainly divided into hierarchical priority architecture and scope priority architecture, as shown in Figure 5:

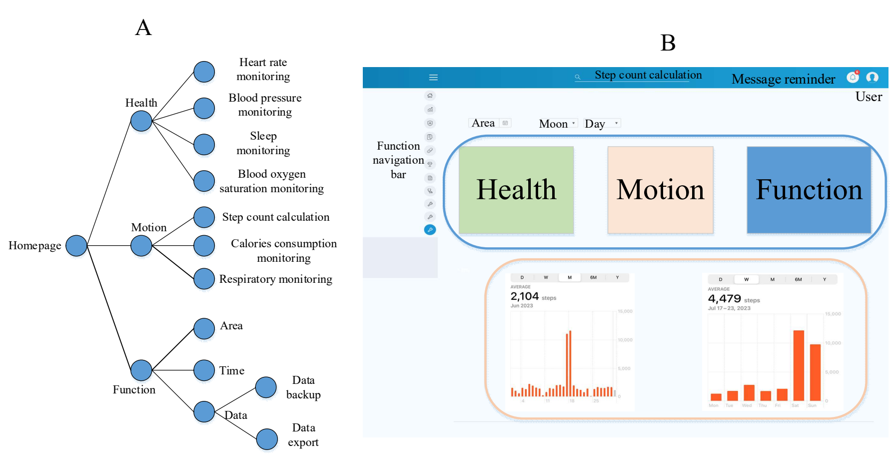

Figure 5: Interface design and interaction process

Figure 5 consists of group diagrams A and B. Figure A is a hierarchical priority architecture, and Figure B presents the interface design and interaction process based on Figure A. By using a hierarchical architecture, users can quickly understand the architecture and main purpose of the interface, as it places emphasis and functionality in a more prominent place. At the same level, the integration of related functions and content enables users to quickly find the necessary information and improve browsing efficiency. A hierarchical architecture can emphasize key features and content, making them easier to discover on the interface, thereby improving the user experience.

At the same time, adopting a hierarchical priority architecture inevitably leads to some problems. If the hierarchical structure is not designed properly, it can lead to information overload on the interface, making it difficult for users to distinguish. If the level is too deep, the user must search for information through multiple buttons, which not only increases the complexity of the user's operation, but also consumes the user's time. A hierarchical architecture requires careful thinking and planning to ensure that its logic is clear, easy to understand, and easy to use. Improper organization and design can cause confusion and poor user experience for users.

Hierarchy first architecture has some obvious advantages in interface design, but it also requires careful consideration and design to avoid potential drawbacks and issues. In practical applications, it is necessary to make reasonable choices and balances based on specific situations and user needs.

V. B. User Evaluation and Improvement of Interface Design

User evaluation and improvement are very important links in interface design. They can help understand user needs and behaviors, identify problems, and propose improvement plans. In the user evaluation and improvement of interface design, this article borrows the fourth question in questionnaire survey 2 above that needs improvement and the eight questions' feelings about the use of the system. The questionnaire data is statistically analyzed, and 100 questionnaires are divided into 5 unequal groups based on the results, as shown in Figure 6:

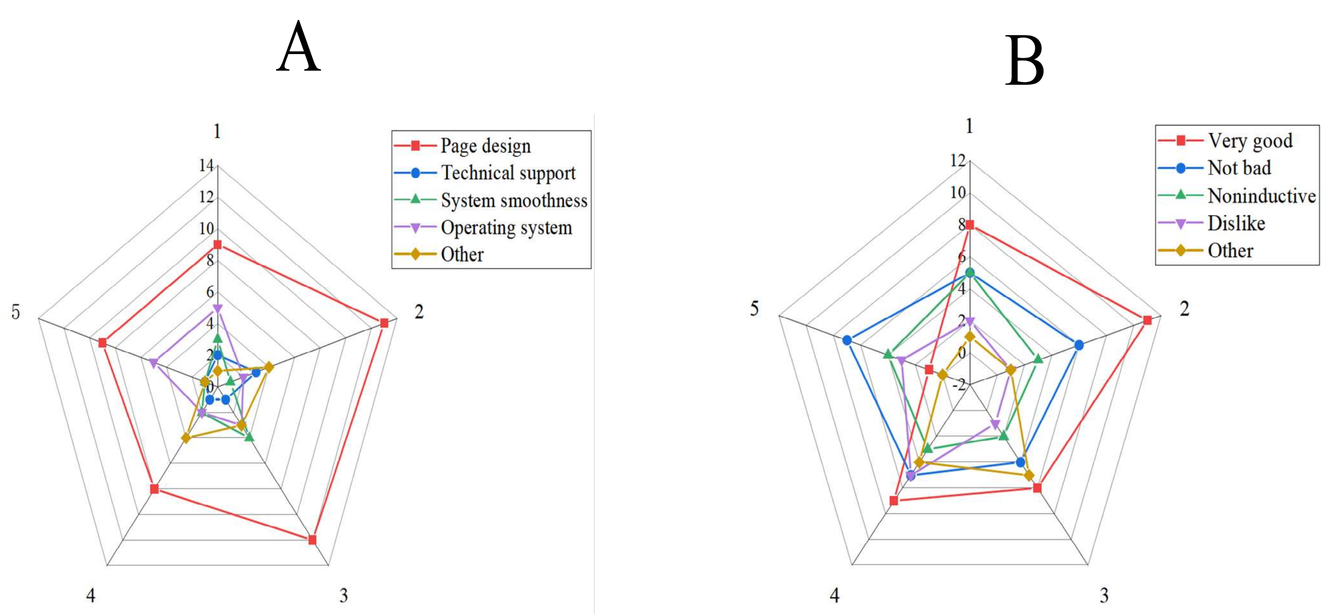

Figure 6: User evaluation and improvement analysis of interface design

Figure 6 consists of two groups of images. The legends in Figure A represent page design, technical support, system smoothness, operating system, and others. The legends in Figure B represent good, decent, neutral, disliked, and others. The outer ring numbers 1-5 represent 5 groups, and the inner ring numbers represent the number of people selected for each option in each group. From the left figure, it can be seen that 51 people believed that the layout of the system page design still needs improvement; 8 people believed that the technical support of the system page still needs improvement; 11 people believed that the system smoothness of the system page design still needs improvement; 17 people believed that the operating system of the system page design still needs improvement; 13 people believed that there are other issues in the system page design that need improvement. From the figure on the right, it can be seen that 33 people think the system's page design has a good user experience, while 27 people think the user experience is still good.

VI. System Evaluation and Experimental Results

At present, there are some plans on the market to perform lag evaluation, but the calculation method values are too discrete and do not have continuity. Therefore, a formula that can evaluate the current lag rate is needed to calculate the score for each lag rate, in order to have a comprehensive evaluation of interface smoothness.

Assuming that the full frame rate of a mobile phone is 60 frames per second, with an average of 16.8ms per frame, the longer the current frame takes, the slower the speed could decrease and eventually approach 0. Therefore, the frame rate range is [0,1], and FPS (Frames Per Second) is:

$$FPS = 16.8 * a / Ft * b \tag{1}$$

Because the user's perception of interface lag is related to frame rate, lag rate fluctuations, etc., the formula for calculating smoothness is to differentiate the interface based on the user's current interface speed, and then use the square of the difference between speed to measure the fluctuation of the interface, as follows [19]:

$$F(x_n) = (a * x_n^t - b * (x_n - avg(x_{n-1}, x_{n-2}, x_{n-3}))^2 + b * avg(F(x_{n-1}, x_{n-2}, x_{n-3})) / (a + b) \tag{2}$$

If the current frame is the fourth consecutive full frame rate, then the current frame smoothness value is restored to 100. a is the weight value of the current frame rate and the value range is [0.1,1]. b is the weight value of the previous frame rate fluctuation and the value range is [1,10]. On the basis of the above algorithms, the smoothness of the sports health monitoring app interface studied in the previous section is analyzed [20]-[23], and the specific results are shown in Figure 7.

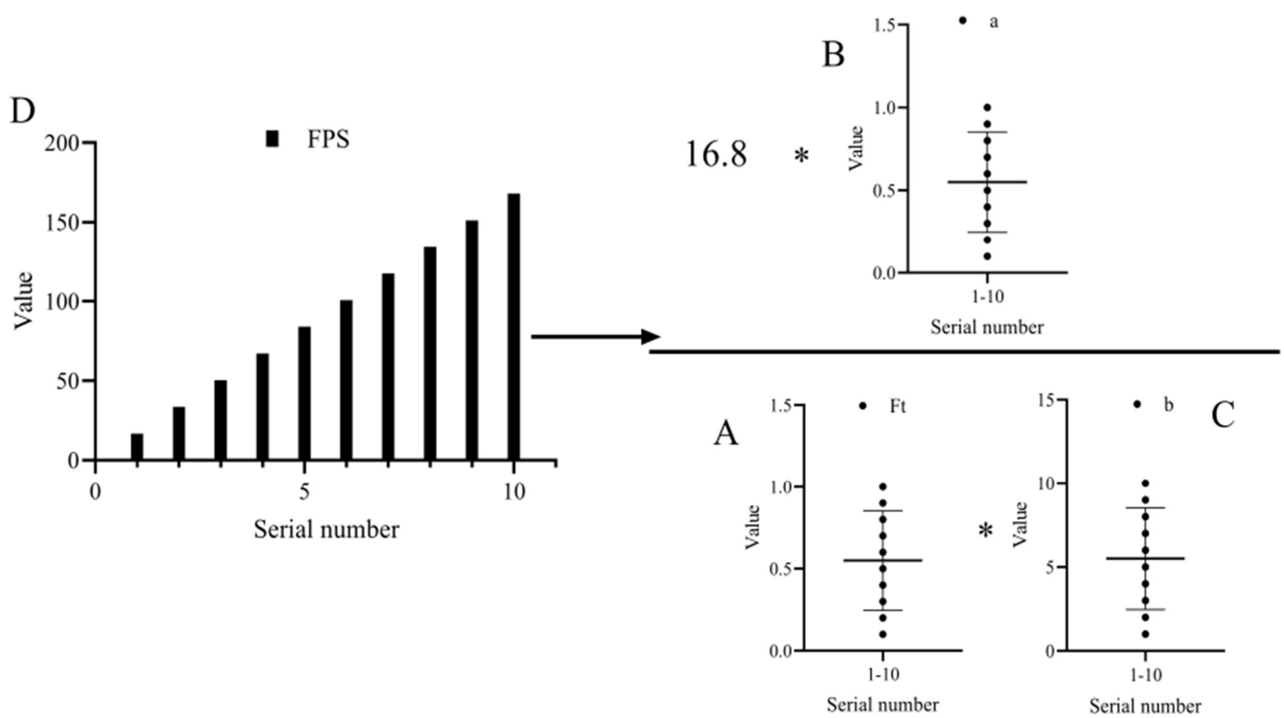

Figure 7: Calculation and statistics of interface smoothness in 10 tests

Figure 7 consists of four group diagrams, A-D. The x-axis represents the test sequence number, and the y-axis represents the value. The legends are Ft, a, b, and FPS, respectively. Figure A represents the value of Ft; Figure B represents the value of a; Figure C represents the value of b. Combining Formula 1, the value of FPS can be obtained. Among them, the value range of Ft was between 0.1 and 1; the value range of a was between 0.1 and 1; the value range of b was between 1 and 10. From the values of FPS, it can be seen that as Ft, a, and b continue to increase, FPS could also continue to increase.

This article believes that gesture data refers to a series of action sequence data obtained through gesture recognition, which has significant application value in fields such as human-computer interaction and computer vision. Each pose on the pose dataset can be described using a time series, and there are corresponding gestures at each time series. There are various ways to collect gesture datasets, using gesture input devices such as Kinect or Leap Motion. Taking the Kinect gesture dataset as an example, it contains a list of gestures that people actually perform in interactive systems, such as raising one hand, closing both hands, and so on. Each gesture has differences in body movement trajectory, speed, finger position, and other aspects, which can be used to identify users' intentions and behaviors, thereby making the system more intelligent. In addition, these posture databases can also be used for motion analysis, posture evaluation, and voice recognition. This article collects a gesture database for the interactive interface of sports training based on human intelligent health monitoring technology, as shown in Figure 8 [24]-[26]:

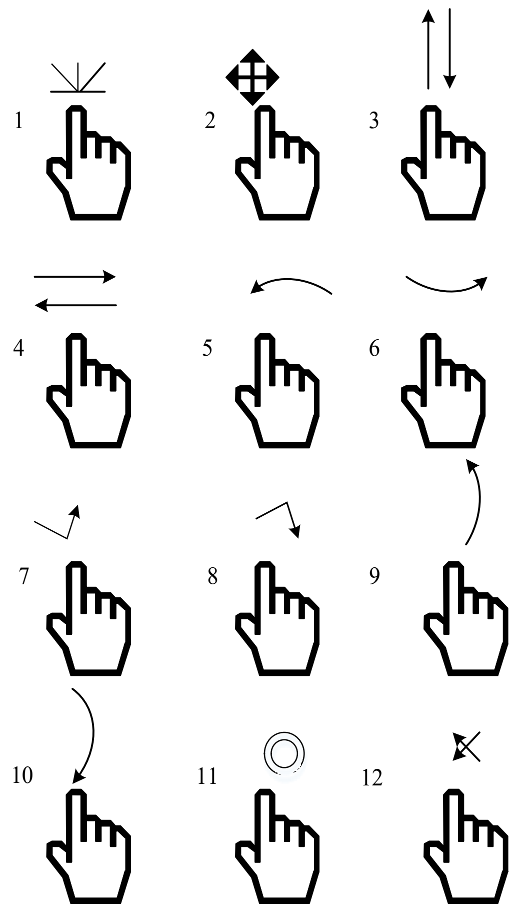

Figure 8: Interface interaction gesture dataset

After logging into the application interface, users can automatically adjust the position of the connection control program through drag and drop according to their application needs and habits. The main function of the application object is health detection. In the interface design, the health functions are arranged vertically in the form of modules, and users can browse through vertical, upward, and sliding postures. The health list can be automatically updated from top to bottom, and by clicking a button, the desired function can be determined to enter this function link [27], [28].

After completing the requirements of the current webpage, the user needs to return to the webpage above to make new actions. At this time, the user can use a horizontal sliding posture from the bottom left to the right to return to the navigation interface [29], [30]. The application function operation settings described in this article execute the interactive posture of the mobile device in an intuitive and unobtrusive manner. Compared with traditional button interaction methods, this article's method utilizes gesture changes to complete all operations. While saving screen area, it also improves on the disadvantage of previous button settings being a click blind spot, thereby improving the applicability, flexibility, and convenience of the operation.

120 application target users were randomly selected and divided into 12 groups of 10 people each. User satisfaction surveys were conducted on the gesture dataset. A user satisfaction survey was conducted on the interface interaction gesture dataset before the improvement, which included users' evaluation of the interface interaction experience and their evaluation based on whether their own needs were met. The evaluation results

were divided into four levels, with A-D representing user satisfaction, relatively satisfied, relatively dissatisfied, and dissatisfied. The results are shown in Table 8.

Table 8: Satisfaction survey on interactive gestures

Content	A	B	C	D	
Gesture number	1	6	1	2	1
	2	5	3	1	1
	3	7	1	1	1
	4	6	1	2	1
	5	5	3	1	1
	6	5	2	1	2
	7	5	3	1	1
	8	6	3	1	0
	9	7	2	1	0
	10	6	1	2	1
	11	6	1	3	0
	12	6	2	1	1

Table 8 divided the gestures in the interface interaction gesture dataset into gesture numbers 1-12 by number. It can be seen that the satisfaction of the target users with interface interaction gestures was good and there was still some room for improvement. Among them, a total of 93 people were satisfied with the interface interaction gesture design (including satisfied and relatively satisfied), accounting for 77.5% of the total number of people. Gesture interaction has strong practicality and universality, with a certain degree of dependence on the interface, and largely relies on several basic single and double finger gestures.

After optimizing the interface interaction gesture dataset, this article compared user satisfaction before and after improving the interface interaction gesture dataset based on satisfaction evaluations of 1-12 gestures in Table 8, as shown in Figure 9:

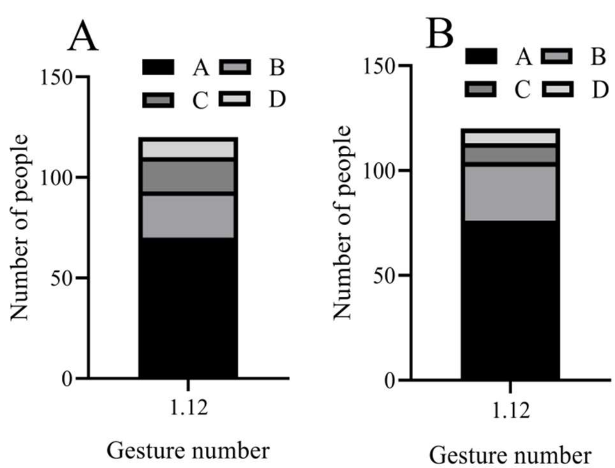

Figure 9: Comparison of user satisfaction before and after improvement

Figure 9 consists of two group diagrams, Figure A and Figure B. The x-axis represents the interface interaction gesture numbers. 1.12 represents 1-12 gestures; the y-axis represents the number of people; the legends represent 4 satisfaction evaluations, A-D. After improving the interface interaction gesture dataset, a total of 104 people were satisfied with the interface interaction gesture design (including satisfied and relatively satisfied), accounting for 86.7% of the total number, indicating an increase in satisfaction after the improvement.

The satisfaction level of users has improved after improving the interactive interface. Users can perform interface operations through simple gesture actions, making the operations more intuitive and natural. By improving the gesture interaction interface, users are satisfied with the sensitivity, reaction speed, and accuracy of the interaction.

VII. Conclusions

This article studied the design of a sports training interactive interface based on human intelligent health monitoring technology, and proposed an effective method to improve the effectiveness of sports training by designing an interactive interface for sports training based on human intelligent health monitoring technology. This study also utilized intelligent sensors to monitor the biological parameters of athletes, such as heart rate, blood pressure, etc., and displayed the data to trainers and athletes through interactive interfaces. Through the interactive interface, trainers can monitor the physical condition of athletes in real-time, and adjust and optimize training plans based on data. At the same time, athletes can also understand their physical state through the interface, better controlling their training intensity and goals. Through experiments, it was found that this interactive interface design can improve the training effectiveness of athletes while reducing the potential risk of injury.

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