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Research Article

Usability Design of Human-Machine Interaction Interface of Child Companion Robot in Wireless Network

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With the core and small-scale family structure, parents and children have less time and opportunities to interact, which leads to the lack of care and emotional companionship for preschool children, which is easy to cause physical and mental disorders. In response to this phenomenon, a series of child care robot products have emerged on the market and have continued to be the focus of attention in the past two years. However, such products are still generally deficient in terms of interaction and content. It is difficult for users to choose and use. This paper takes the design and application of remote parent-child interaction of preschool children's escort machine as the research object. First, it examines the physical, psychological, and behavioral characteristics of escort robots, namely, preschool children. To sum up, the remote parent-child interaction design strategy of children's escort robot products is proposed for the design practice and industry reference of this paper. The experimental results show that the children in the experimental group pay more attention to the main content and off-topic content than the control group, and the attention rate is more than 95%. To a certain extent, it can be said that the games in the system have the ability of parent-child interaction. This paper abandons the traditional research direction of pursuing human-computer interaction between childcare products and high technology. Instead, it studies parent-child emotional interaction, so that the emotional interaction between parents and children is not replaced by technology products but helps parents deepen the relationship with their children. Emotional interaction allows parents to truly accompany their children to grow up.

1. Introduction

With the rapid development of information technology and computer network, great changes have taken place in people's way of life and work. Emerging forms of entertainment and education have sprung up, often through advanced image processing and other technologies. One of the most striking is the emergence of educational games that can cultivate children's interest in learning, which bring great freedom to children's learning process and also increase a certain interest. It also realizes the learning method of "education through fun." A good human-computer interaction design can improve the effectiveness of children's interaction and learning games, increase the affinity of children's learning toys, and effectively improve children's academic performance. However, there are still many deficiencies in the human-computer interface design of children's learning games at this stage. Wireless network control system is a huge and complex control system. It focuses on controlling the system over a wireless network. It is a field that integrates various theories such as communication networks and control theory. It is of high practical value to study the control system under the condition of wireless network.

Many technologically advanced countries in the world are far ahead of us in robot manufacturing technology, robot control technology, wireless communication technology, wireless network control technology, etc. In particular, the technological level of the United States and Japan has always been at the leading level in the world. Foreign scholars have also made many achievements in network control theory. In order to reduce the impact of delay on the network control system, Sheu and Huang designed a receive buffer that can convert the time-varying delay into a fixed delay for delay compensation control [1]. Li and Andrade established discrete models of networked control systems with short delay and probability distribution determined by Markov connections and used stochastic control theory to study system performance and design control systems [2]. Wong et al. analyzed the IP-based networked control system and improved the overall control performance of the control system by compensating for time delay [3].

Robot research in China started relatively late. In the wireless control system, the control signal is encapsulated in a data packet and then sent to the actuator connected to the controlled object through the shared wireless network, and the sensor data of the controlled object are also transmitted back to the controller through the wireless network. Shin et al. built a buffer to receive information, and they converted the original long delay to a short delay, since the reduction constant was not changed, thus forming a switching system that slowed down the speed of maximizing the expansion [4]. The purpose of Peng et al.'s construction of the buffer is to first use the buffer to convert the indeterminate delay into a fixed delay and then perform predictive control. This result can be used for long-delay wireless network control systems [5]. Lao and Wong proposed an improved Ethernet neuron PID controller. The controller can handle the network delay without relying on the accurate mathematical model of the network delay and can obtain good control effect [6].

It is found that most of the products on the market are limited to the functions of smart toys and educational products and lack parent-child interaction functions. In view of the great potential of parent-child emotional interaction, this paper proposes a research perspective on remote parent-child interaction and searches for related research on "parenting robots" through HowNet. There is only one study of companion robots for children with autism. No matter how smart the future AI is, humans will never let it replace the parent-child relationship. Whether it is preschool children or parents, the lack of parent-child emotion is a common problem in the current society. Compared with children's education and games, solving this problem has far-reaching significance. Therefore, it is considered that the topic selection perspective of the remote parent-child interaction research of child escort robots is innovative and meaningful.

2. Usability Design of Human-Computer Interaction Interface of Child Companion Robot in Wireless Network

2.1. Wireless Network Control System. This kind of control system is a kind of distributed system [7]. Due to its characteristics of networking, it uses network lines as data exchange channels for data exchange, which can realize information sharing among multiple nodes. The means of transmitting information is the network. The whole system uses the network to complete the information exchange between the various components of the system (such as actuators, sensors, and controllers) and uses the network to complete resource sharing and remote sharing and detection. Due to the limitations of the traditional wired network, it can no longer satisfy the advanced users who have a relatively large network scale and are very dependent on the network. Choosing a wireless network for communication can avoid complicated line connections like wired networks, greatly reducing the cost of building a system. This not only saves costs but can also satisfy many systems that require flexibility and mobility, expanding the application range of network systems [8].

2.1.1. Wireless Network Control System Structure. The components of the system mainly include wireless communication network, controlled object, and controller [9]. Wireless networks are generally used in remote control information transmission systems using electromagnetic waves, such as networks using radio waves as carrier and physical layers. After the state information output by the control object is collected by the sensor, it is firstly discretized, and then the state information is transmitted to the input end of the controller through the wireless channel. After the controller receives and calculates the information from the wireless network, the wireless network sends the control information calculated by the controller to the controlled object. A zero-order holder processes a discrete signal and divides it into a continuous piecewise function. Use it as an input to a continuous system [10].

2.1.2. Characteristic Analysis of Wireless Network Control System. It can improve system reliability and other benefits. The cost of information transmission for remote control and remote operation is very low. Instead of using analog signals, digital signals are used for transmission over a digital network that digitally interconnects various control devices. It can reduce the intermediate links of information processing equipment to a certain extent, thereby reducing the resources consumed by full control. It can complete process optimization and overall system control from task level, decision management level to field control equipment level [11].

2.1.3. Node Driving Mode on Control System. The driver's position in the system is very important. Generally, when the operating system is installed, the first thing is to install the driver. It is very important to choose the appropriate driving method for each node for the design of wireless network control system. For a system with a small delay, the network load is relatively small and the number of network nodes is relatively small. In this case, when the wireless network control system adopts the event-driven method, the system performance is far superior to the time-driven wireless network control system control performance. Longer delays may occur when the network is heavily congested. Currently, wireless network control systems use this method from time to time. Even if there is packet loss in the measured value, the controller can still take action using the last control quantity entered, thereby turning the packet loss into a long delay [12].

2.2. Process and Analysis of Time Delay in WNCS. Delay includes transmission delay, propagation delay, processing delay, and queuing delay. Generally, transmission delay and propagation delay are the main considerations. Execution delays occur in the actions of controllers, sensors, and actuators. They are represented by $\tau_a$and τ_s, respectively τ_c; the transmission delay includes the information delay from the controller to the actuator and from the sensor to the controller, which are represented by $\tau_{sc}$and τ_{ca}, respectively. The total delay of the wireless control system is expressed as

$$\begin{aligned} \tau &= \tau_s + \tau_{sc} + \tau_c + \tau_{ca} + \tau_a, \\ \tau_k^{sc} &= \tau_k^{cs} + \tau_k^{ss}, \\ \tau_k^{ca} &= \tau_k^{as} - \tau_k^{cf}, \\ \tau_k^{c} &= \tau_k^{cf} - \tau_k^{cs}. \end{aligned} \tag{1}$$

Computer control is controlled according to the specified control algorithm [13, 14]. Therefore, the correctness of the control algorithm directly affects the quality of the control system and even determines the success or failure of the entire system. When the controller executes the control algorithm, as long as the clocks of the nodes in the network are synchronized, it can be obtained by the method of time identification. Therefore, the delay of the wireless network control system can finally be expressed as

$$\tau = \tau_{sc} + \tau_{ca}. \tag{2}$$

The state space can be regarded as a space with state variables as the coordinate axis, so the state of the system can be represented as a vector in this space. Then, the state space expression of the control system is as follows:

$$\begin{cases} x(t) = Ax(t) + Bu(t), \\ y(t) = Cx(t). \end{cases} \tag{3}$$

The principle of motion of the robot is analyzed, and the principle of torque balance is deduced. The steering angle of the robot = the main moment of the right foot - the forced distance of the resistance of the left foot.

$$\begin{aligned} I_v\ddot{\varphi} &= D_r l - D_l l, \\ M\dot{v} &= D_r + D_l. \end{aligned} \tag{4}$$

The torque summarizes all the laws that affect the change of the motion state of the rotating object, and the torque is the physical quantity that changes the motion state of the rotating object. For the feet of the robot, according to the principle of moment balance, the dynamic characteristics of the left and right feet are expressed by the following equations:

$$\tau = \tau_{sc} + \tau_{ca}. \tag{5}$$

Then, the relationship between ϕ, v, θ_ican be obtained:

$$\begin{aligned} I_w r\ddot{\theta}_i + cr\dot{\theta}_i &= kru_i - r^2 D_i, \\ I_w r\left(\ddot{\theta}_r + \ddot{\theta}_l\right) + cr\left(\dot{\theta}_r + \dot{\theta}_l\right) &= kr(u_r + u_l) - r^2(D_r + D_l), \\ 2I_w\dot{v} + 2cv &= kr(u_r + u_l) - r^2(D_r + D_l), \\ \dot{v} &= -\frac{2c}{\left(Mr^2 + 2I_w\right)}v + \frac{kr}{\left(Mr^2 + 2I_w\right)}(u_r + u_l). \\ \ddot{\phi} &= -\frac{2cl^2}{I_v r^2 + 2I_w l^2}\dot{\phi} + \frac{krl}{I_v r^2 + 2I_w l^2}(u_r - u_l). \end{aligned} \tag{6}$$

In WNCS, because the computer is used to process the control quantity, input the control signal, and output the controlled object, the system needs to be discretized before the design. Assuming there is no network latency in the system, we have

$$\begin{aligned} \dot{x}(t) &= Ax(t) + Bu(t), \\ x((k+1)T) &= e^{AT}x(kT) + \int_{kT}^{(k+1)T} e^{A[(k+1)T-s]}Bu(s)\mathrm{d}s. \end{aligned} \tag{7}$$

2.3. Interactive Interface

2.3.1. Human-Computer Interaction and Human-Machine Interface. Human-computer interaction is the study of the interaction between systems and users [15]. A system can be a variety of machines, as well as computerized systems and software. The process is mainly completed by input devices and output devices. The input device converts the operator's thoughts and needs into a language that the computer can recognize, inserts it into the computer CPU, and then transmits the calculation result to the output device through calculation. They can recognize and understand to complete a complete human-computer interaction process. Computers can recognize and differentiate the meaning of human language and sounds through powerful software. Through the analysis and calculation of the kernel computing system, the meaning that the operator wants to express can be better analyzed, and the operator's questions or requirements can be fed back according to the set program. Human-machine Interface is a media and dialog interface for transferring and exchanging information between humans and machines. It is an important part of a computer system and a means for the system to interact and exchange information with users. It is an important part of a computer system, a means for the system to interact and exchange information with users, and can combine the internal form of machine information with humans [16, 17].

2.3.2. Design Principles of Human-Computer Interface Design

(1) Concise Hierarchy Principle. Human-machine interface is a medium and dialog interface for transmitting and exchanging information between people and computers and is an important part of computer systems. Therefore, when

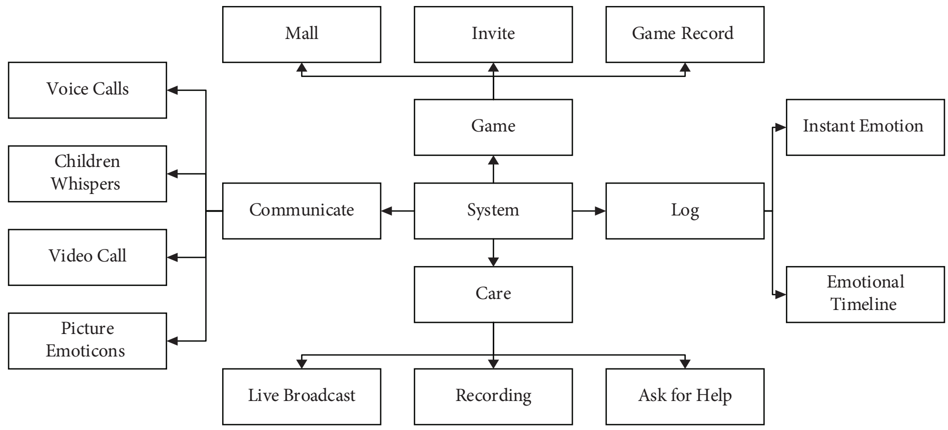

Figure 1: Functional exploded view.

Table 1: Reliability test results.

Category	Index portfolio	Alpha coefficient
Game	Shopping center Invite Game record	0.8627
Log	Instant emotion Emotional timeline	0.8416
Care	Live streaming Record Request for help	0.7663
Communicate with	Voice call Kids whispering Video call Picture expression	0.7552

designing a human-computer interface, the first consideration is to distinguish computer system settings according to the order and urgency of workflow and the relationship from large to small, general to single, and high to low. The levels should be properly arranged. The process of control and design supervision is reduced, and the host-computer dialog interface is more comprehensive and organized, which is convenient for humanization [18].

(2) User-Oriented Design Principles. In the whole process of human-computer interaction interface design, it is necessary to understand and take care of users' usage habits and usage characteristics and put people first [19, 20]. Context awareness, eye tracking, gesture recognition, three-dimensional input, speech recognition, facial expression recognition, handwriting recognition, natural language understanding, etc. are all important problems that need to be solved in user interfaces. In the early stage of design and development, the user's opinions and requirements are continuously solicited and accepted, and then a feasible solution is selected, and secondary development is decided to make the designed interface meet the needs of users.

(3) Interface Consistency Principle. Design requirements must conform to fashion trends, reflect design consistency, and adopt popular design formats. Second, the requirements of the standard must be consistent with applicable international or national standards in order to meet the mandatory minimum standards, that is, the consistency of color, screen, and text throughout the interface.

(4) Functional Principle. According to the user's functional requirements, design different management objects for the same interface, and design multiple projects at the same time [21]. A hierarchical system of information options and dialog boxes is used, depending on the function of the department. The interactive interface makes it easy for users to get started. Users can select common and uncommon functions according to their needs and classify and archive these functions. These are functional options that must be delivered to the customer during the design process.

(5) Frequency Principle. According to the interaction frequency of the dialog box of the management object, draw the hierarchical order of the human-machine interface and the position of the dialog box and increase the frequency of monitoring and accessing the dialog box. According to the user's usage habits and rational thinking, supervise and control to meet the customer's expectations of the product to the greatest extent.

2.4. Functional Requirements of Preschool Children

2.4.1. Physiological Needs of Preschool Children. Physiological needs are a powerful driving force that drives people to carry out various behaviors [22]. When physiological needs are met to a certain extent, people will have the next level of needs. Visual perception in preschoolers includes color perception, which improves as children age. In the design of the companion robot, the colors and styling elements preferred by preschoolers as shown by experimental data should be used. Touch is a way for children to learn about their external environment from the beginning and plays a key role in children's cognitive development.

2.4.2. Psychological Needs of Preschool Children. Psychological needs are a kind of unique human needs [23, 24]. Human needs are divided into two levels: physiological needs and psychological needs. Psychological needs

Table 2: System function test.

Functional module	Function name	Test steps	Test results
Game	Shopping center	Buy product test	Testing successfully
	Invite	Invite players to test	Testing successfully
	Game record	View game record test	Testing successfully
Log	Instant emotion	Instant reading mood test	Testing successfully
	Emotional timeline	Query emotional timeline test	Testing successfully
Care	Live streaming	Can you watch the live test	Testing successfully
	Record	Query record test	Testing successfully
	Request for help	Distress test	Testing successfully
Communicate with	Voice call	Voice call test	Testing successfully
	Kids whispering	Children's riddle test	Testing successfully
	Video call	Video call test	Testing successfully
	Picture expression	Picture expression test	Testing successfully

Table 3: Questionnaire data analysis.

Attributes		Number of people	Percentage
Age	0–2 years old	25	31.6
	3–6 years old	35	44.3
	7–12 years old	19	24.1
Gender	Boy	36	45.6
	Girl	43	54.4
Family status	A parent with a child	27	34.1
	Grandparents taking care of children	50	63.4
	Babysitter taking care of children	2	2.5

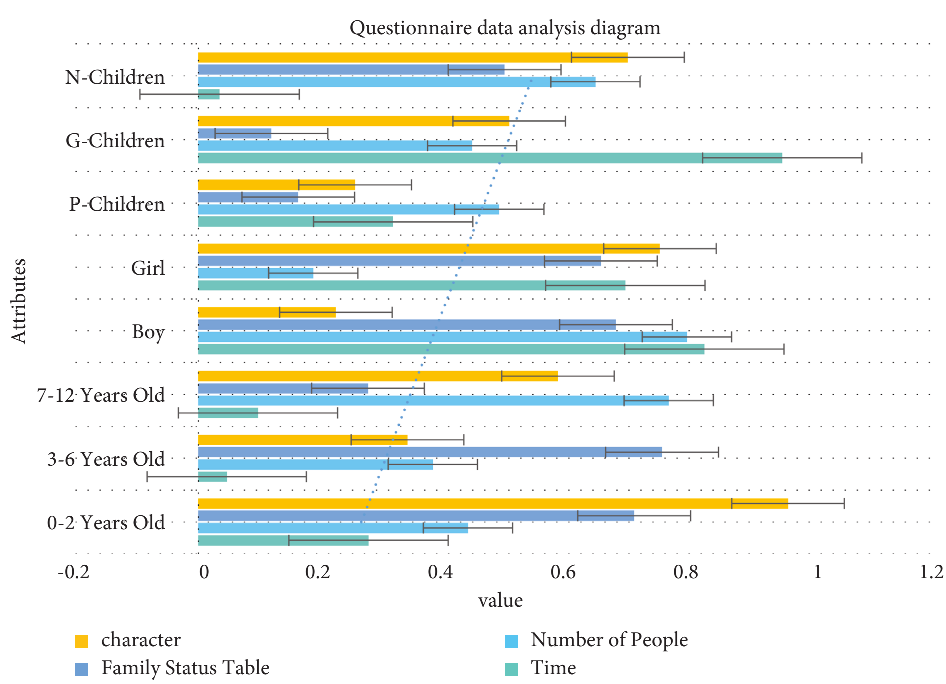

Figure 2: Questionnaire data analysis diagram.

are initially derived from physical needs and then gradually become independent. For example, preschool children are very curious about the unknown things they have never seen and the new things that are constantly changing. Therefore, it is necessary to use the child's curiosity about the unknown to understand the characteristics of children's learning and questioning and to incorporate voice interaction into the design of the robot. Guidance can help children discover

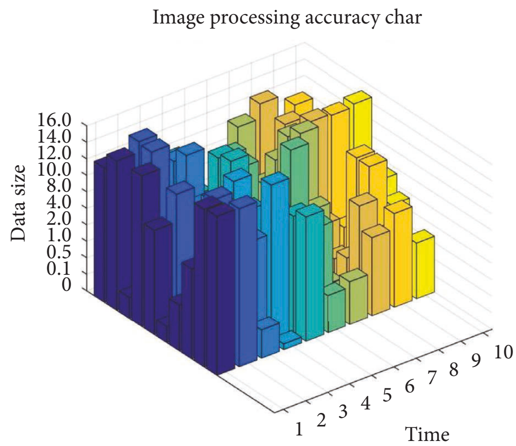

Figure 3: Image processing accuracy map.

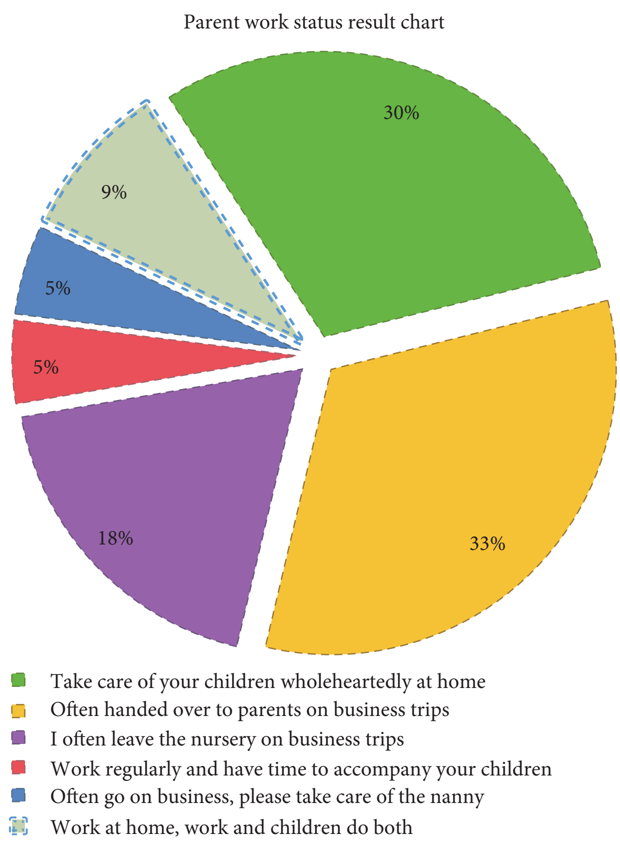

Figure 4: Parent work status result chart.

relationships between things. In response to children's curiosity about changing movements, the interface design uses changing images and rhythmic sounds to attract children's attention.

3. Usability of Human-Machine Interface for Children's Companion Robots

3.1. The Design Process of the Child Companion Robot System. Before designing a system, it is necessary to identify the audience [25]. There are many problems in the process of

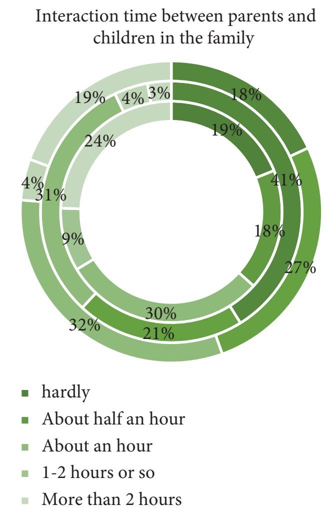

Figure 5: Result graph of parent-child interaction time in the family.

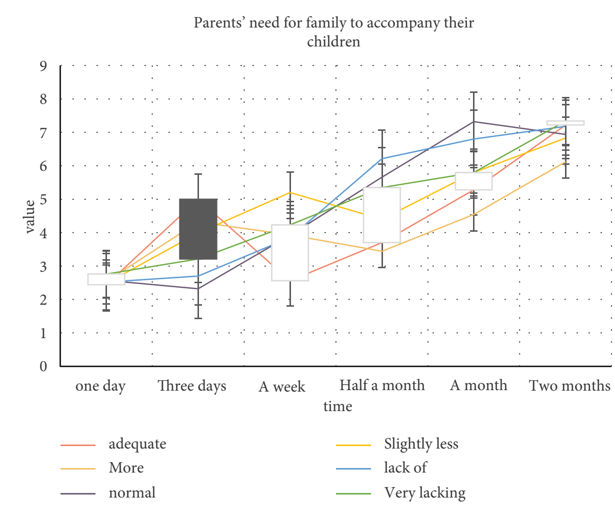

Figure 6: A map of parents' needs for family to accompany their children.

parent-child interaction in today's society. Among them, most of them are busy with work, lack communication with their children, and lack the emotional joy brought by interacting with their parents. Therefore, our system mainly includes children's emotional log function, daily communication function, remote care function, and virtual interactive game function, while for preschool children, the main functions are limited to virtual interactive games and daily communication and early childhood education functions, including various smaller functions [26, 27]. Due to the limitations of preschool children's own cognition, the function of escort cannot be too much and can only meet their basic needs. Too many operation functions can easily lead to misoperation, so the function of child escort should be reserved for reference and should not be overly detailed, as shown in Figure 1.

Table 4: Standardized processing of characteristic data.

Sample serial number	Understand your child's emotions and activities	Talk to children	Play games with children	Walk with the child	No other requirements	Teach a child to do something
1	−0.6776	−0.6411	0.1736	1.9178	−0.3848	−0.5962
2	−0.7014	−0.7048	0.5368	1.7370	−0.3880	−0.6295
3	−0.6465	−0.6438	0.4739	1.8397	−0.3642	−0.6141
4	−0.8523	−0.8657	1.3780	0.9615	0.1147	−0.7533
5	−0.7524	−0.7237	0.8180	1.6722	−0.2849	−0.6791
6	−0.7438	−0.7341	0.6385	1.7827	−0.2274	−0.6609
7	−0.5712	−0.5436	0.1387	1.9857	−0.4264	−0.5432
8	−0.7334	−0.7625	0.7288	1.6483	−0.2781	−0.6341

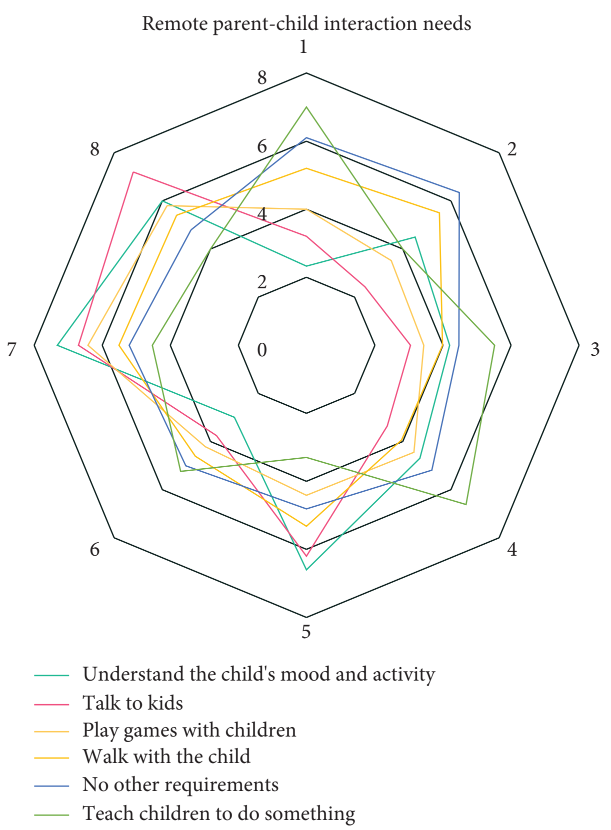

Figure 7: Analysis chart of parents' remote parent-child interaction needs.

3.2. Test Subject. In this experiment, 20 preschool children aged 3–6 were selected for this experiment. These children were accompanied by full-time kindergarten teachers, and their safety was basically guaranteed. We used wearable glasses and X3 eye trackers to collect children's attention while playing, so that we could integrate the data for analysis and consider whether the three play modes meet the usability principles for remote parent-child interaction [28]. The game scene is mainly in the form of a maze map. Parents and children each play roles and play three types of parent-child interactive games on the maze map. Accompanied by the experimenter, 20 preschool children aged 3–6 played simulated interactive games. To a certain extent, whether there is a good experience determines whether preschool children really like and use companion products for a long time. Therefore, a more nuanced human-machine experience is the primary prerequisite for guiding children to use companion robots for remote parent-child interaction [29, 30].

3.3. Experimental Method. The expression of the positive index normalization method is as follows:

$$y_{ij} = \frac{x_{ij} - \min\left\{x_{ij}\right\}}{\max\left\{x_{ij}\right\} - \min\left\{x_{ij}\right\}}. \tag{8}$$

The normalization method for negative exponents is expressed as follows:

$$y_{ij} = \frac{\max\left\{x_{ij}\right\} - x_{ij}}{\max\left\{x_{ij}\right\} - \min\left\{x_{ij}\right\}}. \tag{9}$$

3.4. Statistical Data Processing Methods. In this paper, the well-known SPSS software is used to process the experimental data, the number of experimental data $k$is the number of experimental data, represents the variance of the results adjusted for experimental error. The reliability calculation formula is

$$a = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma^2}\right). \tag{10}$$

4. Experimental Usability of Companion Robot Human-Machine Interface

4.1. Indicator Reliability Test and System Function Test Analysis

4.1.1. Evaluation Index System Based on Index Reliability Test. In this experiment, the alpha coefficient method was used. When α is greater than 0.7, it indicates that the effect of index setting is better. Therefore, we analyze the reliability of each class of objects and divide them into specific different metrics. The results are shown in Table 1.

From the data in Table 1 above, it can be concluded that the effects of various functions on children are less different ($\alpha > 0.7$), all within the acceptable range.

Table 5: Time and focus statistics.

Polygon				Rectangle			
Counting	Average 1	Average 2	Sum	Counting	Average 1	Average 2	And
1	6.00	8.00	14.00	1	178.00	32.00	210.00
2	4.00	3.00	7.00	2	101.00	21.00	122.00
3	8.00	7.00	15.00	3	149.00	19.00	168.00
4	1.00	6.00	7.00	4	246.00	9.00	255.00
5	4.00	7.00	11.00	5	115.00	22.00	137.00
6	10.00	5.00	15.00	6	69.00	31.00	100.00
7	5.00	7.00	12.00	7	140.00	17.00	157.00
8	1.00	9.00	10.00	8	139.00	21.00	160.00
9	15.00	3.00	18.00	9	125.00	19.00	144.00
10	6.00	8.00	14.00	10	176.00	34.00	210.00

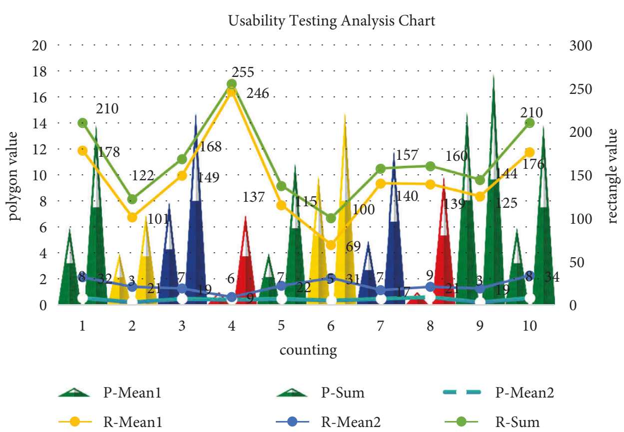

Figure 8: Usability testing analysis chart.

4.1.2. System Function Test Analysis. The system function test mainly includes main functions such as children's emotional log function, daily communication function, remote nursing function, and virtual interactive game function, as shown in Table 2.

As can be seen from Table 2, after analyzing the required functions, the basic design and testing of the system constructed in this paper are relatively successful.

4.2. Questionnaire Test Analysis

4.2.1. Questionnaire Data Analysis. By distributing questionnaires to the local *X* community, a total of 80 parent-child interaction questionnaires for families aged 0–12 were distributed, and 79 valid questionnaires were recovered. The experimental results are shown in Table 3. In addition, we draw a line chart based on the data in Table 3, as shown in Figure 2.

We can conclude that most of these families are grandparents with children at home, and the probability is as high as 63.4%. There are also a very small number of families with better conditions, whose parents do not have much time to hire nanny to take care of them, accounting for 2.5%. The rest are basically parents with children, accounting for 34.1%. Among them, children aged 0–2 accounted for 31.6% of the total, children aged 3–6 accounted for 44.3% of the total, and children aged 7–12 accounted for 24.1% of the total. Observe the child in a natural way, undisturbed, and record the child's behavioral and emotional characteristics along the way. The results will be analyzed later.

According to Table 3, we combine the features extracted by image processing to analyze the immediate emotions of children. The results are shown in Figure 3.

The database is compared and analyzed through image processing technology to obtain and store the children's average feelings, so as to use the function of querying the emotional timeline. As can be seen from Figure 3, the accuracy rate of instant judgment of emotions reached 91.7%, which also shows that the system is very useful.

4.2.2. The Status Quo of Family Parent-Child Interaction Time. As can be seen from Figure 4, about 30% of parents have a relatively stable job and have time to spend with their families and children, and 9% of parents take care of their families at home full time and have enough time to spend with their families. With children, only 66% of households are busy with work and child care. There are some downsides. Among them, 33% of parents gave their children to the elderly because they were busy with work, 18% of parents sent their children to nurseries because of their busy work, and 5% of parents hired nanny to take care of their children because of good family conditions.

As can be seen from Figure 5, more than 75% of parents spend less than an hour with their children on working days, of which only 2.79% spend very little time with their children on working days, and 43.62% spend less time with their children on working days. About 6.9% of parents with their children spend enough time with their children during the workday. From the above two questions, it can be concluded that the time of family parents to accompany their children is extremely scarce at present.

As can be seen from Figure 6, only 7.6% of parents feel that they have enough time to spend with them, while in families with preschool children, the proportion of a parent who is at home full time is as high as 9%. Therefore, it can be calculated that, excluding full-time parents, working parents only account for the lack of companionship. The remaining 87% of parents feel that the time to accompany their children is not enough, and 12.56% of them say that the time to accompany their children is extremely lacking. Therefore, it can be seen that the parents of the current family still have a great demand for the time spent with their children.

4.2.3. Analysis of Parents' Remote Parent-Child Interaction Needs. Here, our method normalizes the extracted feature data. We choose linear scaling transformation, range transformation, and standard sample transformation. These three methods are different. The results are shown in Table 4. We made a radar chart based on this result, as shown in Figure 7.

As can be seen from Figure 7, the main remote interaction needs of children's parents are chatting and playing games with their children, accounting for 60.71%, of which 28.12% are talking to children, and 32.59% are playing games with children, followed by understanding children's emotions and motivation. It can be seen that when parents are away from their children, they focus first on communication and interaction issues, followed by safety issues, and finally education issues.

4.3. Usability and Interesting Test Analysis

4.3.1. Usability Test Analysis. The usability testing of this paper adopts the method of quantitative research using standardized usability questionnaires. Usability questions in the questionnaire are standardized. You just need to change the subject keywords. Common standardized usability questionnaires include overall evaluation questionnaires and experimental results, as shown in Table 5. We made a combined graph based on this result, as shown in Figure 8.

Judging from the validity of the test results, both children and experimenters can participate more actively in such games during the interaction process and generate a certain degree of pleasure. In addition, the number of attention points in the experimental group is much higher than that in the control group, with an average attention rate of over 95%. To a certain extent, it can be said that the games in the system can achieve better attention effects in parent-child interaction, as shown in Figure 8.

5. Conclusion

The design of a successful human-computer interaction interface for children's learning games should not only conform to the development trend of modern technology but also conform to the requirements of children's psychological development. The control of mobile robots in a wireless network environment is very complex. At the same time, due to the comprehensive influence of factors such as changes in network load, randomness of transmitted data, and limited bandwidth resource conditions, the system introduces network delay, which seriously affects the control performance of the entire system. In order to realize the tracking control of the mobile robot in the time-delayed wireless network control system, a solution is proposed in this paper, which has a very positive effect on realizing the stable and fast real-time control of the mobile robot under the wireless network.

In this paper, the two hotspots of wireless sensor network and multi-robot system are deeply studied, and according to the needs of contemporary society, the concept of combining these two hotspots is proposed. The main purpose of this paper is to simulate large-scale wireless sensor networks and study the interaction and communication mechanism between wireless sensor networks and multi-robot systems. Through the effective "communication" and collaboration of each part, the ultimate goal of the research is achieved. The wireless sensor network provides more environmental perception information for the multi-robot system to increase the perception field, and the multi-robot system performs information perception through the wireless sensor network.

For most parents, due to the pressure of life, they cannot give their children time to accompany and care for them. With the popularity of remote parent-child care products, this problem has been better alleviated. It is our responsibility to continuously improve the function and experience of this product, bring better emotional interaction for children and parents, and help children and parents live a happy life. This article focuses on this purpose. Taking emotional human-computer interaction design as an innovation point, further research on remote parent-child interaction design based on children's robots has been carried out, and relevant research results have been obtained.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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