Research on Interactive Children's Teaching Mode Driven by Artificial Intelligence Technology

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Abstract. This paper designs an interactive system of intelligent robots for children's education, which includes interactive desktop devices and interactive robot devices. Teaching and interactive content can be displayed through the display surface of the interactive desktop device. A user manipulates the display surface via gesture manipulation or teaching tools. Interactive desktop devices perform interactive information gathering. A new time series similarity measurement method is given. The display surface and the interactive robotic device provide interactive feedback to the user through sounds, images, and lights. The guidance and interactive operation of the interactive robot on the display surface enhances the effect of the interactive operation. The effectiveness of this method is verified by simulation experiments.

Keywords: Artificial Intelligence, Interactive, Teaching for Children, System Design.

1. Introduction

Children's education takes children as the object, and trains and trains children in moral, intellectual, physical and other aspects. Education is of great significance to promote the social and economic development of China. Minors before puberty are called children or teenagers, and they have extremely high plasticity in thinking, personality, intelligence, body and other aspects. Children's education is a very important foundation in the entire educational undertaking. Providing a good educational and teaching environment for school-age children is of great benefit to children's long-term development in the future. The specific content includes cultivating good study habits early and cultivating a good personality. At present, the education of children is mainly based on lectures by teachers and parents. After investigation, if appropriate interactive links can be added in the teaching process, so that children can give feedback at any time when they are learning, it can significantly improve the efficiency of children's acquisition of knowledge, and it can also be used as the main body of education, such as teachers and parents. Learn about your child's learning status.

With the advancement of technology, the use of robots to carry out interesting and artificial intelligence-based teaching methods has also been gradually proposed. Through big data, the Internet and multi-interaction methods, intelligent robots can bring more fun and fresh learning experience to students, which is also a major direction of the current development of the education industry.

Some researchers suggest establishing an intelligent early childhood education system consisting of teachers and students. The teacher-student terminal can transmit signals to each other, and the teacher-student terminal can control the teacher-student terminal. The teacher can use the interactive all-in-one machine on the teacher's end to display the teaching plan and then transmit it to the student's end. And students can give real-time feedback on the children's smart desk on the student side, so as to achieve the real-time interactive effect of teaching and classroom. Some scholars have proposed an interactive computer system, which can use display components to play comic-like stories, and then cooperate with the teacher to interact with one or more students one-on-one, so that students can interact with the touch screen and mouse, etc. widget to start the response target. Teachers can analyze students' acceptance and learning based on their own observations, or based on the students' operation records they see in the system. Some researchers have proposed a "gamification" learning device and a gamification education system suitable for young children to read. The use of fonts that are easily recognizable by the user is used to enter children's stories to improve children's concentration [1]. Improve the learning and teaching effects of children's stories, allowing users to participate in the

personal stories of video children and allowing users to synchronize with the stories of video children. This paper designs an interactive system of intelligent robots for children's education, which includes interactive desktop devices and interactive robot devices. Teaching and interactive content can be displayed through the display surface of the interactive desktop device. A user manipulates the display surface via gesture manipulation or teaching tools. Interactive desktop devices perform interactive information gathering.

2. Construction of children's virtual reality simulation teaching system platform based on human-computer interaction

2.1. System Architecture

According to the characteristics of multi-person online preschool education system, a modular overall architecture design is carried out. Specifically, it includes two parts, namely the online module and the virtual reality education and teaching business control module. The network online module mainly works on the network information transmission between the server, VR teacher's computer and VR students. The virtual reality education education business control module is divided into four sub-modules, namely: scene loading module, knowledge explanation module, VR interaction module, and answering module. They mainly carry out specific work on the implementation of education and teaching of VR education courses. First of all, the functions of the online module can be improved, and then based on the children's education and teaching content, a syllabus and a virtual reality teaching script can be written according to the standard of class hours, and the system designer and developer based on the requirements in this teaching script, a virtual reality children's education curriculum system will be constructed to realize some functions in the virtual reality education business control module. The children's education system based on multi-person network virtual reality technology adopts a modular design structure (Figure 1 cited in A Haptic Knob as an Innovative User Interface for Visually Impaired).

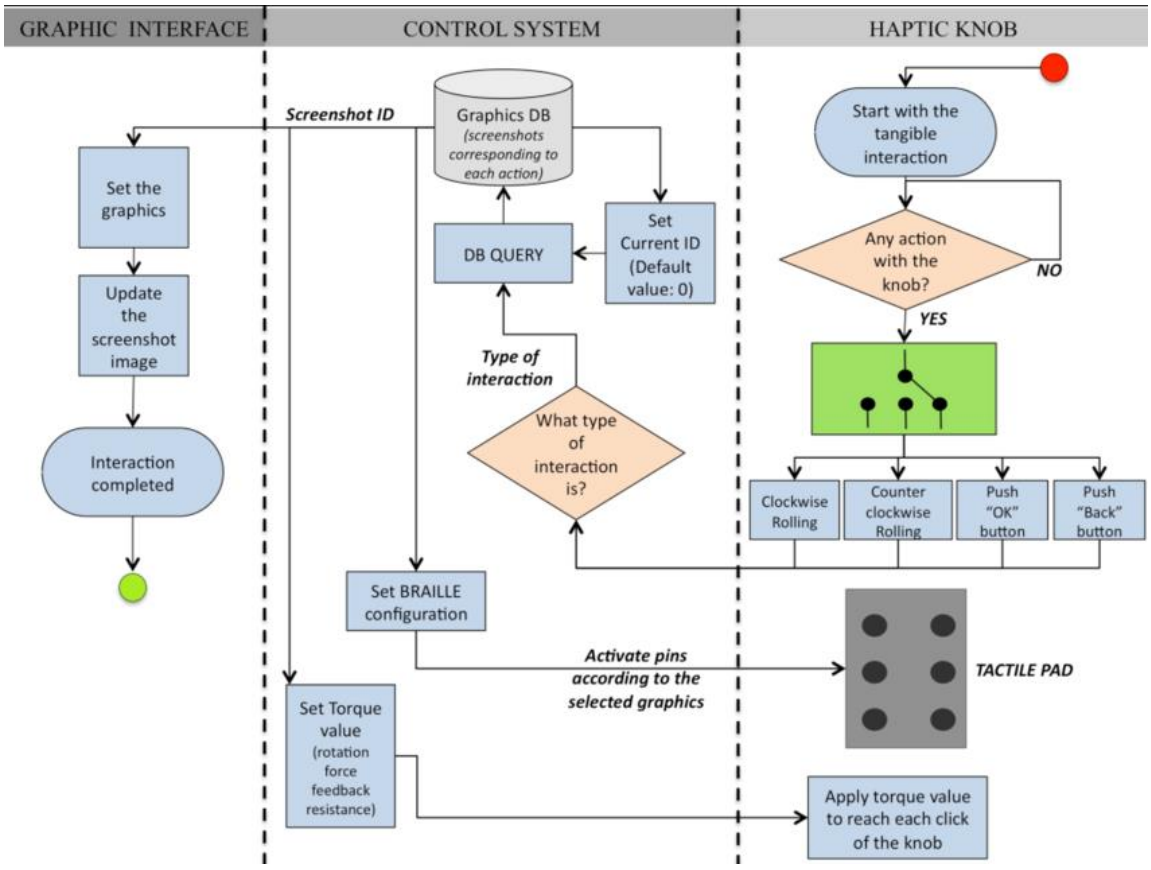


Figure 1. System structure

2.2. Hardware Architecture

The system realizes the command control of information transmission, and realizes the display of teaching content in virtual reality system. After being worn, the data glove can capture gestures and transfer them to the system platform. Gesture recognition is a specific part of interaction in teaching software. It is directly related to the effect of the final teaching software application [2]. Each student must wear a pair of three-dimensional glasses, and students can see the results of a near-reality simulation to realize the interaction of people and objects in virtual reality. The performance of the hardware equipment should be determined according to different course requirements. Hardware equipment is also a carrier of software function realization. Only by designing a stable hardware system can software function be realized more effectively.

2.3. Software design composition

The main systems used in this system are: Division Mockup 2000i2, Rapid VRM, Trackd, Pro/E and so on. The individual software required is constructed according to a subset of the following to enable the conversion between software and hardware systems. Form the following system composition flow chart. In this system, there is an environment of man-machine interaction. Capture an action into a virtual reality teaching platform [3]. The tracked parameters need to carry out an integrated operation and be displayed on the display screen through the internal processing of the system. In this case, various systems of internal control model construction. In the actual design, it is also necessary to show the cooperation of hardware and software in related functions. The computer will run by itself after it is turned on. Finally, various indexes are integrated to meet the teaching requirements.

3. Key technologies

3.1. Three-dimensional Modeling

The establishment of 3D model should be completed based on a system platform [4]. Various types of functions are to be observed. The program running model is established according to the flow chart shown in Figure 2 (the picture is quoted in An ISO/IEC/IEEE21451 Smart Sensor Network for Distributed Measurement of Pavement Structural) Temperature). The implementation of various processes is also based on digital modeling. Connect subsequent transmission ports according to the instructions in information data transmission to avoid data transmission interruption. Different data flows should also be clearly differentiated in the 3D model. In 3D modeling, object_Adapters11.0 software should be combined to realize the function and control of the site. To construct the required 3D scene in real life [5].

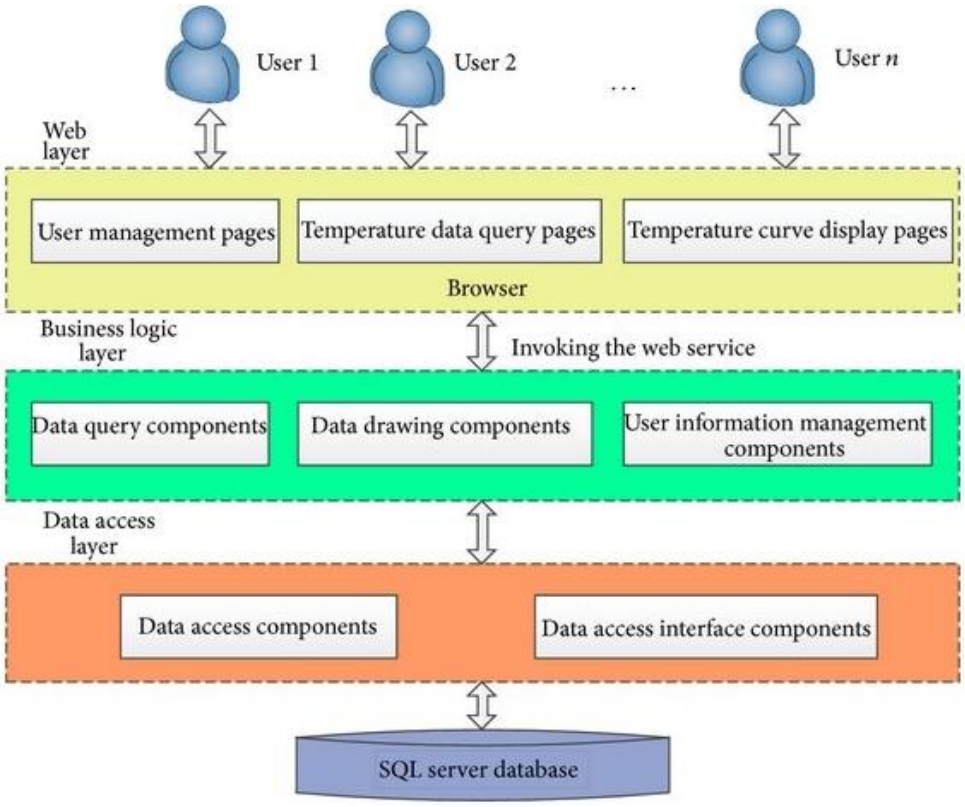


Figure 2. Schematic diagram of logic control

3.2. Action identification and instruction extraction

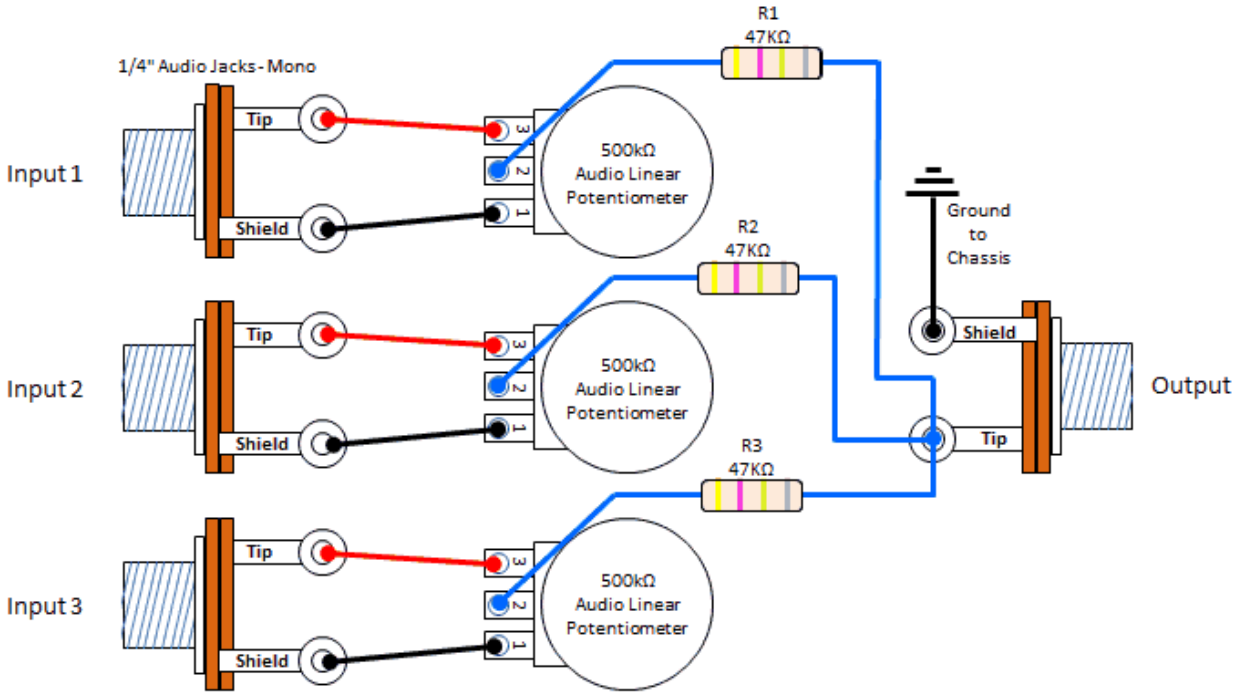


Figure 3. Schematic diagram of single-channel passive stereoscopic display

This paper proposes to construct an educational information base and collect information from the Internet to improve the integrity of the information base. We should pay attention to the security of information acquisition and the security risks in use, and carry out a comprehensive construction of the on-site operation identification instructions. Enable related function modules based on command acquisition. Only in the teaching work can we maximize the use of the internal functions of the system

to complete the relevant instruction construction. The design diagram shown in Figure 3 is a passive 3D schematic display in a channel. In the design of the teaching system platform, the data processing ability of the conversion components should be considered. In order to avoid in the actual operation process due to the lack of execution ability and have a negative impact on the final function [6]. Both action recognition and command acquisition are based on a single channel system, which can more effectively identify data and convert it into the corresponding command indication.

4. Algorithm design

A method for measuring temporal similarity based on dynamic rules is proposed. A nonlinear curve is constructed between the test speech and the template speech sequence. The shorter the curve, the more similar it is. Let $U=\{u_1,u_2,u_3,u_4,u_5,\cdots,u_L\}$ and $G=\{g_1,g_2,g_3,g_4,g_5,\cdots,g_S\}$ be speech sequences of length L and S, respectively. The dynamic time warping algorithm needs to continuously search for a time warping function $D=s(l)$, which maps the time axis of U series nonlinearly to the time axis of G series. Meanwhile, the function s satisfies formula (1):

$$D=\min_{w(l)}\sum_{l=1}^{L}d[U(l),G(s(l))] \tag{1}$$

$d[U(l),G(s(l))]$ is the distance measure between the l data u_l in sequence U and the $D=w(l)$ data g_s in sequence G, and D is the cumulative distance between the two sequences in the case of optimal time warping [7]. In order for the search and match path between two sequences to have practical meaning, the structured function $s(l)$ must satisfy the following three conditions:

Monotonicity: $s(l)\le s(l+1),1\le l\le L-1$;

Boundary property: $s(1)=1,s(L)=S$;

Continuity: $s(l+1)-s(l)\le 1$.

According to the above three conditions, the distance matrix $A_{L\times S}$ of $L\times S$ is formed by the distance of any two points in the two sequences L and S, and the Euclidean distance of any two points A_1,A_2 is calculated using formula (2).

$$D=\sqrt{(x_1-x_2)^2(y_1-y_2)^2} \tag{2}$$

The boundary is to ensure that the search path starts from the bottom left corner of matrix $A_{L\times S}$ (1,1) and ends in the top right corner (L,S). Firstly, we need to find all the pre-order nodes that meet the above three conditions, and then get all the nodes by recursion of equation (3).

$$D(l,s)=d(l,s)+\min\begin{cases}D(l-1,s)\\D(l-1,s-1)\\D(l,s-1)\end{cases} \tag{3}$$

5. Experiment and result analysis

The system uses Vivado2018.1 as the hardware platform and DIGILENTARTY as the development platform of the system. ARTIX-7XC7A35T is used as FPGA chip. A set of devices of the invention supports a MicroBlaze soft kernel. The invention establishes an Embedded platform with MicroBlaze soft core as the control unit in Figure 4 (the picture is quoted in Get Embedded

Microprocessor/FPGA Combo Designs Up and Running Fast with SoMs). The AXI-Lite bus is used and the processor is loaded. A total of 10 templates of effective pronouncing numbers 1-10 were collected in the laboratory environment [8]. The test speech data set was used to collect the effective pronouncing numbers 1-10 for one person in the laboratory environment with the same acquisition Settings. The microprocessor input the processed data into the hardware accelerator in order to verify, and use the UART serial interface to feed back the verification results to the PC.

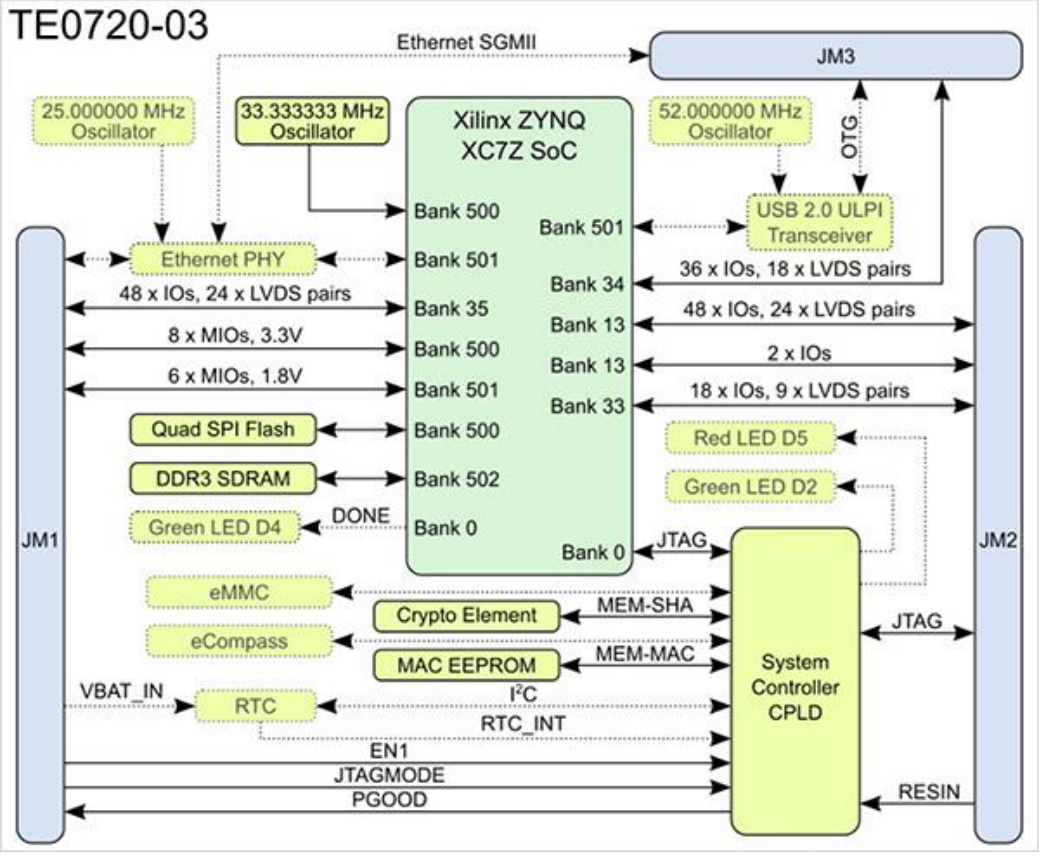


Figure 4. Structure diagram of FPGA embedded verification platform

In order to test the educational effectiveness of the multi-person network virtual reality children's science education system, 40 preschool children aged 5 to 6 were selected to participate in this educational experiment. He divided the children into two groups. Among them, there were 20 people in the observation group. The multi-person network virtual reality children's science popularization system is used for popular science teaching. The control group simply told the children without any assistance. After the completion of the course, the teacher carried out a series of research on each student's understanding of knowledge, learning interest, and class participation in the form of inquiries, and recorded the scoring results of the three items using SPSS26. 0 statistical software for statistical analysis of the data, and the measurement data are represented by the mean ± standard deviation. A t-test was performed between the two groups. $P<0.05$ was considered significant difference. Table 1 lists the results of comparison. The study found that the performance of the observation group was better than that of the control group in terms of knowledge understanding, learning interest, and class participation ($P<0.05$).

Table 1. Experimental results

	observation group	control group	t	P
understanding of knowledge	78±8.5	72.4±10.4	2.271	0.026
interest in learning	85.5±10.28	75.5±10.28	2.125	0.004
class participation	92.5±8.1	82.5±8.4	2.167	0.004

6. Conclusion

The application of multi-person online early childhood teaching system in early childhood teaching has obvious advantages. It is characterized by the use of virtual reality technology, which can break through the limitations of time and space, realize multi-person online teaching, and has strong interactive ability and strong user experience. The actual system test proves that the system improves the efficiency of students absorbing knowledge and improves their enthusiasm for learning. Moreover, it has a certain degree of universality and can be applied to various teaching systems.

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