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Research Article

Design of Multimedia Intelligent Teaching Platform for Preschool Curriculum Based on Edge Computing

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Intelligent teaching platform integrates the respective advantages of network and traditional teaching and makes the teaching content develop in a diversified direction. However, due to the poor response performance of the platform, a multimedia intelligent teaching platform for children's courses based on edge computing is designed. Construct the overall framework of the teaching platform under the edge computing, and get the functions that the platform needs to have. Set the authority and role of administrators, teachers, and children's parents, respectively. Develop Android server and client, determine web server, define main parameters, evaluate the quality of teaching platform, and complete the design of teaching platform. The experimental results show that the platform responds quickly, provides users with good experience effect, and has good application performance.

1. Introduction

The development of early childhood education has attracted great attention. Basic education is the foundation of education, and early childhood education is the foundation of basic education [1]. In order to comprehensively improve the quality of preschool curriculum education, modern educational means should be effectively used to meet the needs of children in their daily life [2, 3]. Modern educational means have been attached great importance to by the majority of early childhood educators. Modern educational means are constantly updated and enriched, which have far-reaching impacts on changing teaching concepts, enriching teaching contents, and optimizing teaching [4, 5]. Today, with the rapid development of scientific and technological information, multimedia has brought great changes to our social life, and its application in the field of education has triggered significant changes. Intelligent multimedia teaching platform has become a new learning way of school education and the second classroom for students to learn and communicate [6]. The rapid and direct interaction of multimedia intelligent teaching platform makes people's communication jump out of the limitation of time and space. People are doing all kinds of attempts, such as online job hunting, online trading, and online education [7]. As the forefront of the new generation of education, kindergartens should also keep pace with the times and let children take the first step on a starting line that closely follows the trend as soon as possible. To make children understand multimedia network and use multimedia network for learning, the most fundamental thing is how to promote their interaction with the "multimedia network education environment," because only in this way can children really feel and appreciate the charm of the network, stimulate more desire for exploration, and develop their own more potential [8, 9]. Therefore, in order to achieve a better effect of early childhood curriculum education, it is necessary to design a multimedia intelligent teaching platform, which can not only meet the needs of teachers' teaching but also facilitate the implementation of home cooperation, home coeducation, and home interaction, so that busy parents can better understand their children's school situation after work, know their children's

shortcomings, and make timely corrections. At the same time, it broadens children's learning vision and promotes children's healthy growth.

With the continuous development and improvement of multimedia technology, the network is more and more widely used in the field of education, and various intelligent teaching platforms also came into being. Reference [10] proposed the development of plasma electronics teaching platform based on colloidal gold color perception. Compared with macrosolids, the color and spectral properties of gold nanoparticles change with size. It is suggested to provide a teaching platform for senior high school students to explain the relationship between the perceived color of colloidal solution and its physicochemical properties. Therefore, based on Mie theory and colorimetry, an open source code is developed to connect the perceived color with the plasma effect. In addition, a group of nanoparticles with different diameters was created to support the theoretical description. The seed-mediated synthesis method used provides sufficient sphericity, which is very important for color matching. The proposed teaching platform is available online and can be linked to outreach activities or practical laboratory courses. In addition, we illustrate the link between nanoscience concepts and real-world examples (such as colored church glass), which can be used to enhance the potential of nanotechnology in other fields, including electronics, optics, and biomedicine, and increase the interdisciplinary nature of teaching platforms. Reference [11] proposed the design of online music teaching platform and interactive design based on cognitive wireless sensor networks. With the development of science and technology in recent years, wireless sensor networks also have many new development directions. Online music learning platform can not only realize various interactions but also meet various needs and behaviors of users. Now, there are many courses suitable for online learning, and students can interact with computers. This paper mainly compares the advantages and disadvantages of various music platforms and selects an open music source platform that can better meet people's needs to build the corresponding environment. The design of music platform mainly adopts B/S architecture and corresponding development framework. The goal is to develop a platform that can teach online. By analyzing the typical algorithms in cognitive sensor networks, the corresponding routing algorithms are used to balance the energy consumption of network nodes. At the same time, the algorithm is optimized, the energy threshold is increased, and the weight of cluster head is changed. It can not only ensure the reasonable distribution of channels but also ensure the balance of energy consumption and make the network more stable. At the same time, based on the existing wireless network algorithms and combined with the energy level, a new routing algorithm is proposed.

Although the above methods have made some progress, the research on early childhood curriculum is insufficient. Therefore, a multimedia intelligent teaching platform for early childhood curriculum based on edge computing has been designed. Edge computing refers to an open platform integrating network, computing, storage, and application core capabilities to provide the nearest service on one side of the object or data source. Its application is initiated at the edge to generate faster network service response and meet the basic needs of multimedia intelligent teaching in real-time business, application intelligence, security, and privacy protection. Edge computing is between physical entities and industrial connections, or at the top of physical entities. Cloud computing, on the other hand, still has access to the history of edge computing. The results show that the designed platform has good application effect.

2. Design of Multimedia Intelligent Teaching Platform for Early Childhood Curriculum Based on Edge Computing

2.1. Overall Framework of Teaching Platform under Edge Computing. For the Internet of Things, breakthroughs in edge computing technology mean that a lot of teaching platform control will be realized by local devices rather than by the cloud, and the processing will be completed in the local edge computing layer [12]. This will greatly improve processing efficiency and reduce the load on the cloud. As it is closer to users, it can also provide faster response for users of the multimedia intelligent teaching platform for early childhood courses and solve their needs at the edge [13, 14]. The overall framework of the teaching platform under edge computing is shown in Figure 1.

It can be seen from Figure 1 that the teaching platform under edge computing must always run through the teaching strategy of strengthening the communication between teachers and students in the design process and make the best use of the existing foundation to build the teaching platform. Teachers do not need to know more about the technical details of the platform and devote all their energy to the multimedia intelligent teaching of children's courses to cultivate children's learning ability [15, 16]. Teachers and parents can interact with each other through the platform.

Based on the overall framework of the teaching platform under the above edge computing, it is analyzed that the platform needs to have the following functions.

2.1.1. Usability. All functions of the platform are required to be easy to use, and an interactive interface is established under edge computing to make the description document easy to understand.

2.1.2. Reliability. It is required that the platform will not be prone to errors under long-time working conditions. The prompt function should be added in the design of the platform, which can meet the requirements of data backup [17, 18].

2.1.3. Security. Ensure that the data in the platform can only be queried by users with permission, and users without permission cannot change the data and record the access.

2.1.4. Scalability. In order to facilitate the continuous updating of technology and follow the pace of innovation, new functions of the platform will be added at any time in

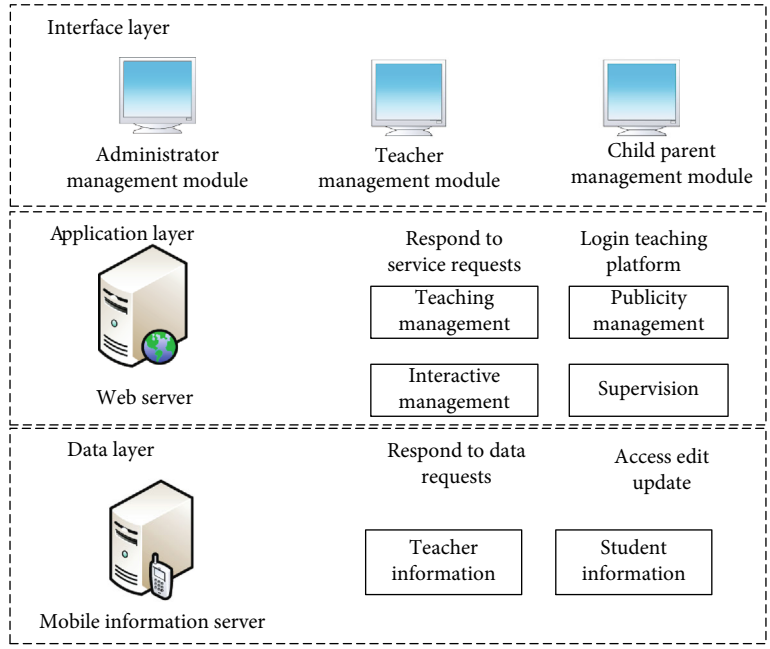

Figure 1: Overall framework of teaching platform under edge computing.

practical application. Therefore, modularize the platform and reserve functional interfaces.

2.1.5. Reusability. Reusability refers to the designed program that can be directly used in subsequent project development. Therefore, the platform uses object-oriented programming and has code reusability.

2.2. Overall Hardware Function Design of Multimedia Intelligent Teaching Platform for Early Childhood Curriculum. The multimedia intelligent teaching platform of preschool curriculum under edge computing mainly includes three types of users: administrators, teachers, and parents. Among them, the overall functions of the platform hardware include platform administrator function, teacher function, and children's parent function. The responsibility of the platform administrator is to maintain the teaching platform and realize the management of curriculum resources [19]. The responsibility of teachers is mainly responsible for teaching related permissions and resources, including teacher information input, online teaching, and performance evaluation [20]. The responsibility of the parents of young children is to have permissions related to classes, including inputting children's information, reading course introduction, course selection, online teaching, homework submission, score test, and query.

2.2.1. Administrator Management Module. In the multimedia intelligent teaching platform designed in this paper, the administrator has all the permissions of the platform, not only to manage the accounts of teachers and children's parents but also to reasonably allocate and manage the platform resources. The functional structure of the administrator is shown in Figure 2.

As can be seen from Figure 2, the account is registered by the administrator. After logging in, the authority of the account of teachers and children's parents can be set. According to the relevant functions of teachers and children's parents, the teaching resources of the platform are divided into homework database, test question database, courseware database, etc. Managers can modify, block, and delete course resources at will and clear the resources that have not been clicked for a period of time.

2.2.2. Teacher Management Module. The account authority of the teacher management module is divided into publishing, modifying introduction, course introduction, uploading courseware, assigning homework, etc. The specific functions are shown in Figure 3 [21].

As shown in Figure 3, when designing the teacher management module, the teacher's account authority and implementation logic are designed in combination with the relevant functional requirements of the course; it also needs to be registered. The administrator verifies the registration information according to the offline information. After verification, the teacher can log in to the platform [22, 23]. The difficulty of teaching resources is divided into five levels. Using the five-point scale can not only facilitate resource management but also realize the scientific division of resource levels. Assuming that b_i represents the difficulty index and the value range is $(-\infty, +\infty)$, but considering the realizability of the algorithm, the value of the difficulty index is controlled at $[-2, +2]$, and it is specified that -2 represents particularly simple, -1 represents simple, 0 represents general, 1 represents difficult, and 2 is very difficult to describe. For the evaluation of resource level, we should not only combine the evaluation results but also refer to the opinions of the teachers.

Multimedia intelligent teaching platform provides support for the development of teaching mode. On this network

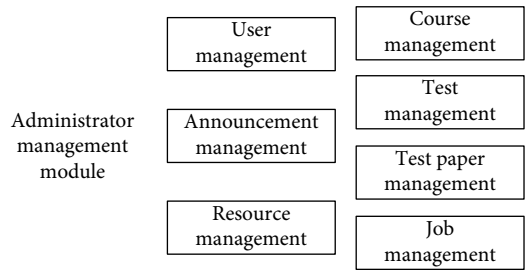

Figure 2: Schematic diagram of administrator management module.

learning platform, teachers make teaching videos or learning courseware before class and upload them to the network learning platform [24]. The vast majority of teachers have the ability to use multimedia intelligent teaching platform and deal with teaching and scientific research problems. It can be said that teachers have mastered the educational thought, educational concept, educational mode, and teaching means of modern educational technology [25]. The information-based education for teachers enables teachers to have the ability of information-based teaching design, the ability to apply network teaching platform, the ability to develop hybrid learning mode, and the ability to design and organize various teaching activities [26, 27]. Teachers have the ability to use multimedia intelligent teaching platform to assist teaching. Teachers not only have the ability to information processing but also can make full use of the teaching platform to search for the required teaching materials, which provides feasibility for the application of learning mode in teaching.

2.2.3. Child Parent Management Module. The main functions of the child parent management module in the multimedia intelligent teaching platform of children's curriculum are shown in Figure 4.

It can be seen from Figure 4 that after logging into the account, parents of young children can view the introduction of teachers and courses, select courses in combination with the introduction, download the selected courseware, and participate in online teaching [28]. In the process of tutoring children, parents can use the online note taking function to record the knowledge points they have not mastered and put forward to teachers in the question and answer session after class, so as to realize the interaction between teachers and parents.

When the parents of young children successfully log in to the platform, due to the large number of teaching resources in the platform, the parents of young children cannot select teaching resources according to the actual ability of young children. Therefore, an adaptive guidance mechanism is designed to meet the needs of parents of young children for personalized counseling. In order to achieve the purpose of adaptive guidance, children need to do pretest when logging in the platform for the first time and test their cognitive ability by showing them the knowledge points of each difficulty level [29, 30]. Suppose the test result is expressed as $(U_1, U_2, \cdots, U_j, \cdots, U_n)$, where U_j is the feedback value of the j test question, and the value is 1 or 0. When $U_j = 1$ represents that the j question is answered correctly and when $U_j = 0$ represents a wrong answer, the relationship between cognitive situation and ability value can be expressed by maximum likelihood estimation.

If all the answer processes of children are independent of each other, it can be considered that the evaluation results of ability value are only related to the cognitive level and the difficulty of questions. Under the above assumptions, the evaluation process of cognitive level can be expressed as

$$U = \left(U_1, U_2, \cdots, U_j, \cdots, U_n\right) \times u. \tag{1}$$

In formula (1), u represents the evaluation coefficient of cognitive level, and formula (1) shows the relationship between children's cognitive level and test results.

Through the design of administrator management module, teacher management module, and children's parent management module, we can improve the network efficiency of multimedia intelligent teaching platform of children's curriculum, improve the utilization of teaching resources, and provide new development ideas for modern education informatization. It has played a role that cannot be ignored, and the requirements for edge computing devices are also increasing. We should constantly improve the hardware platform of edge devices and the software technology in edge devices and improve the reliability and security of multimedia intelligent teaching platform for preschool courses based on edge computing.

2.3. Software Design of Multimedia Intelligent Teaching Platform for Early Childhood Curriculum

2.3.1. Android Server and Client. It is used to exchange data between the client and the server equipped with Android browser, and it is also used to exchange data with the server of Android server. As an important server of multimedia intelligent teaching platform software for children's courses, it also realizes the communication with children's Android server. The communication services are user login verification and information reasoning [31, 32]. After the Android server is connected to the classroom intranet WiFi, access the server and complete the communication according to the customized format data. The communication process between the server and the client is shown in Figure 5.

It can be found from Figure 5 that the framework form of the server is MVC architecture mode, which is divided into three parts, namely, model, view, and control. MVC mode structure mainly includes user input, user feedback, view, and controller [33]. The function of this mode structure is data storage, operation, and content display. When the user operates, this part executes the sending request instruction, and the controller part displays the processing results on the view by expanding the business logic judgment on the received request.

2.3.2. Web Server. Based on edge computing, the web server is constructed by using components such as browser, data block service, and web service. After receiving the HTTP

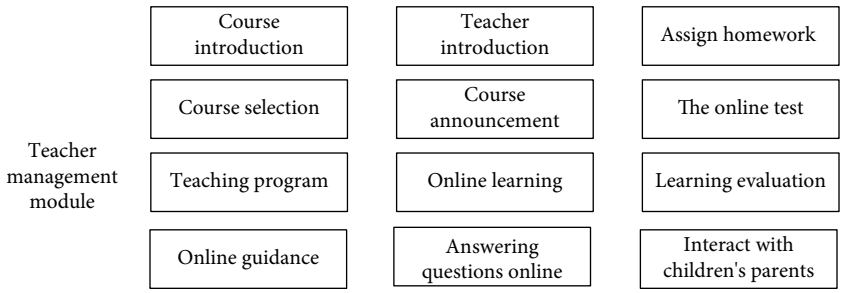

Figure 3: Function diagram of teacher management module.

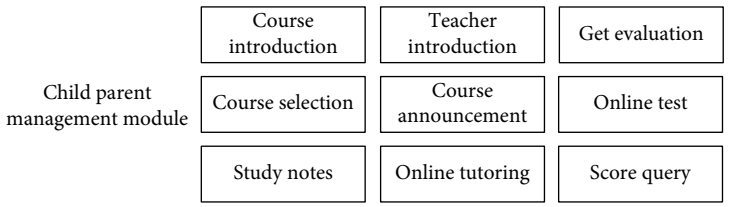

Figure 4: Function diagram of child parent management module.

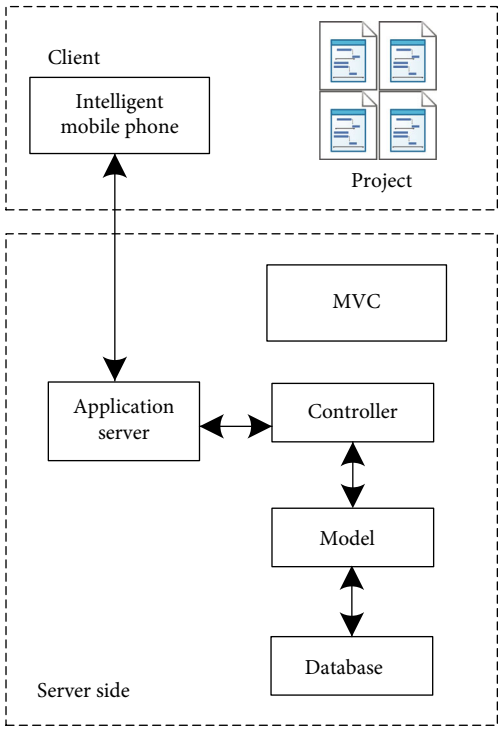

Figure 5: Processing framework between server and client.

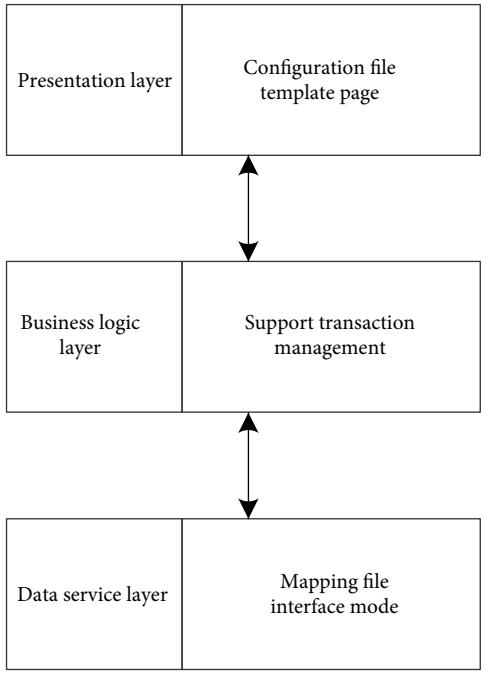

Figure 6: Schematic diagram of integrated SSH framework.

request sent by the browser of administrators, teachers, and children's parents, the web server queries the database. When the browser receives the query result, it will automatically parse the file. The function of the database server is to store data. Its function with web services is access and data access [34, 35].

Integrate the integrated SSH framework composed of spring, struts, and hibernate technology into the web server, and its structure is shown in Figure 6.

In Figure 6, the business logic layer handles business planning, data access, legitimacy verification, and other tasks. After the client connects the layer with components, it completes its interaction with the database. The interactive intranet server and learning extranet server are adopted to form a web server, which provides different functions for different target groups. In order to reduce the storage space and facilitate network communication, the platform uses the multimedia codec framework to automatically convert the video coding uploaded by teachers. Due to the

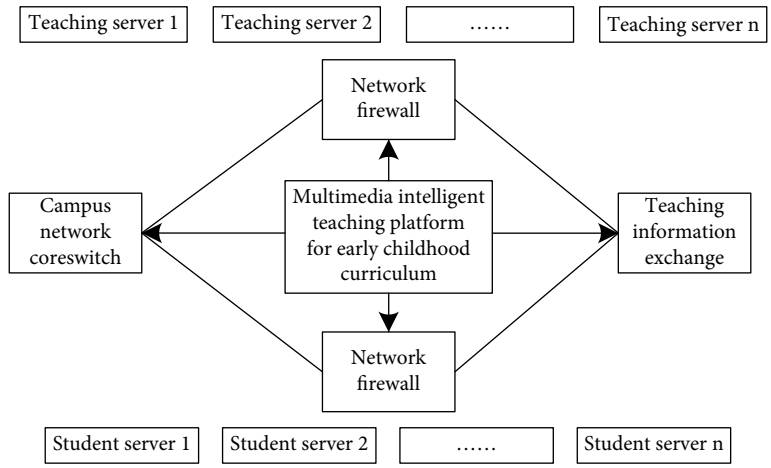

Figure 7: Design of experimental platform.

limitations of the format supported by the framework, format verification is required.

2.3.3. Quality Evaluation of Teaching Platform. Use edge computing to evaluate the quality of multimedia intelligent teaching of early childhood curriculum and further improve the function of teaching platform. The specific operation process is described as follows.

Step 1: Analysis sequence selection. Select the reference sequence and comparison sequence. The former is the data sequence reflecting the behavior characteristics of the teaching platform, and the latter is the data sequence composed of the influencing factors of the platform behavior. The expressions of reference sequence and comparison sequence are as follows:

$$Y_x = (Q_a + Q_b) \times R_n. \tag{2}$$

In formula (2), Q_a and Q_b, respectively, represent the probability of children's correct or wrong answer when their cognitive level is a or b, and R_n represents the feedback value obtained by the teaching platform.

Step 2: Dimensionless processing of variables. Because the data dimensions of the platform factor column may be inconsistent, which increases the difficulty of comparison and affects the accuracy of the results, the dimensionless processing strategy needs to be adopted in the process of grey correlation analysis.

Step 3: Calculation of correlation degree. The correlation coefficient is too scattered, so the average of the correlation coefficients of all reference series and comparison series is used to refer to the correlation degree between series.

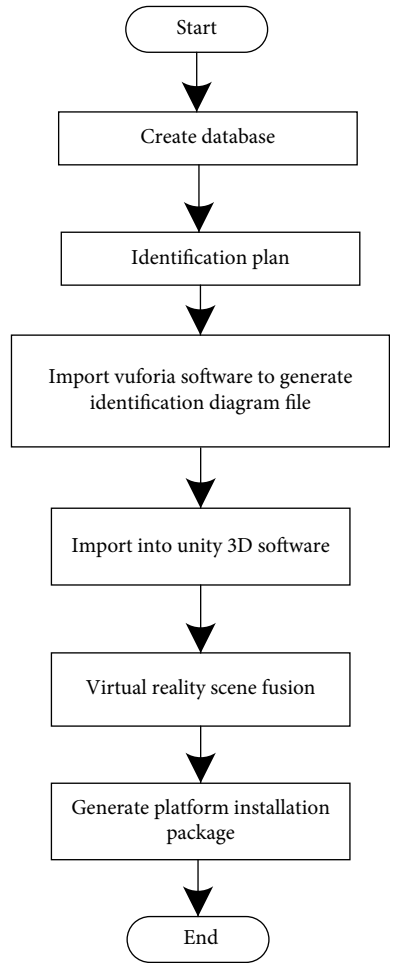

Figure 8: Platform development flow chart.

When edge computing technology is applied to the mobile terminal of multimedia intelligent teaching platform for early childhood courses, virtual information needs to be superimposed on the real scene of mobile terminal users to facilitate accurate interaction in the process of using the software. The least square method of the selected feature points is used to determine the camera position. The position of the random point in the coordinate system in the camera linear model is represented by P, and the projection of the point in the image is

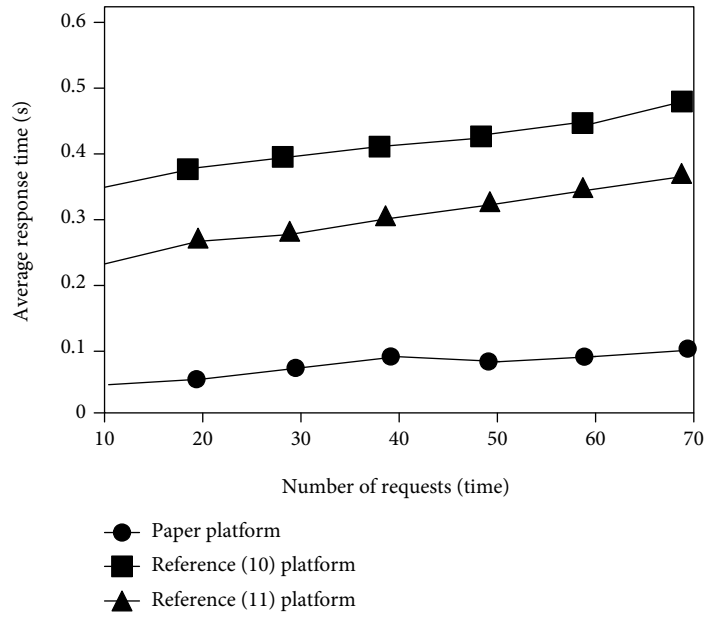

Figure 9: Request response time results of different platforms.

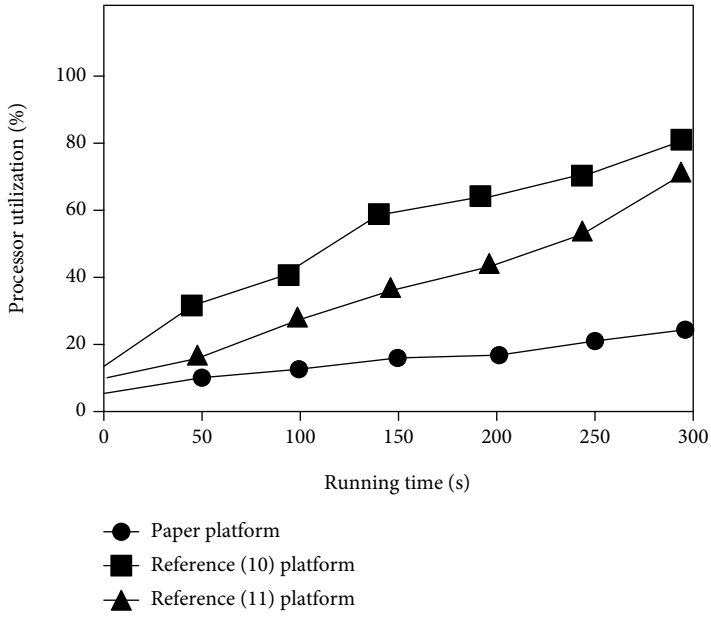

Figure 10: Comparison results of CPU utilization of different platforms.

represented by p. The relationship expression between the two is as follows:

$$P = p \times K \times R_t. \tag{3}$$

In formula (3), K and R_t represent the camera position matrix and camera internal parameter matrix, respectively, to obtain accurate camera attitude estimation results, so as to complete the design of multimedia intelligent teaching platform for early childhood courses based on edge calculation.

3. Experimental Analysis

The designed multimedia intelligent teaching platform of preschool curriculum based on edge computing is an important platform for the application of preschool children. The platform uses edge computing technology to establish a three-dimensional interactive environment with the combination of virtual and real and uses interactive operation to make children experience the mystery of intelligent early education. The platform contains rich and vivid digital symbols and cartoon models. Children can learn interesting knowledge and tap their logical thinking ability and creativity.

Table 1: Statistical results of platform use feeling.

Platform usage experience content	Statistical results	Number of users
Love of platform	Dislike	12
	Like	38
	Like it very much	60
Subjective feeling of using the platform	It has high freshness	24
	The presentation of augmented reality technology is novel	52
	High interactivity	24
Is there a comfortable experience	Easy to operate	75
	Interactive pleasure	23
	Uncomfortable	2
Whether to develop children's good reading habits	Obvious cultivation	78
	Average effect	21
	No effect	1

Unity 3D 2018+vuforia software is selected as the development software of the designed platform. The main running platform of the software is Android mobile terminal. The main target group is school-age children aged 3-9. The platform interface design and story image are original. The designed platform is shown in Figure 7, and the development flow chart of the platform is shown in Figure 8.

According to the platform development flow chart in Figure 8, before designing the platform, it is necessary to fully analyze the platform design requirements and create the database required for platform design. According to the data in the database, the identification map is prefabricated. After identifying the plan in the database, Qualcomm's vuforia platform is selected to make the identification map online. Use unity 3D to add textures and colors to the elements in the scene, and add interesting audio files that match the scene to the scene for the platform runtime to call. Unity 3D can realize the monitoring and interaction of user key functions. It is an important interaction between the virtual world and users in mobile augmented reality technology.

In order to prove the performance of this platform, the platform is deployed according to the curriculum system of a child training institution, and the following test environment is built. Client: operating platform: window10, with 8 GB memory, and 256 g hard disk. Data server: the operating platform is Linux, the memory is 4 GB, and the hard disk is 1 t. Application server: the operating platform is Windows Server 2020, the memory is 64 GB, and the hard disk is 2 T. The platform in this paper, reference [10] platform, and reference [11] platform are used to test the response time, and 70 requests are sent to the three platforms to be tested. The platform response time is shown in Figure 9 [36].

As can be seen from Figure 9, the platform in this paper is outstanding in terms of average response time and can complete the response in the shortest time each time. This is because the function setting of each module of the platform is clear. When teachers or parents send a request, they can get a reply in time, meet the requirements of an interactive platform, and make the communication between students and teachers smoother.

The test tool selects mercury load runner 6.0 to simulate user access. The parameter settings are the same as the actual operating environment. Figure 10 shows the CPU occupancy of the teaching platform.

As can be seen from Figure 10, comparing the congestion status of reference [10] platform and reference [11] platform, the platform in this paper uses Android server-side and client-side development framework, so the increase of CPU occupancy curve is small, providing users with good experience effect.

The feelings of 100 users after using the teaching platform were counted, and the parents of children were selected as the survey objects. The favorite degree of the platform, the subjective feeling of using the platform, whether they have a comfortable experience, and whether they develop children's good reading habits were taken as the statistical topics. The statistical results are shown in Table 1.

It can be seen from the results in Table 1 that children are generally interested in the performance of the multimedia intelligent teaching platform of children's courses based on edge computing. The designed platform can attract children's curiosity and make children continue to experience and use. The designed platform contains rich story content, and the setting of roles and stories is very reasonable, which can effectively cultivate children's good reading habits. Applying edge computing to the multimedia intelligent teaching platform of children's curriculum can enhance children's curiosity, make use of the characteristics of vividness and interactivity, cultivate children's good habits, and assist parents in educating children to cultivate habits.

In conclusion, the edge computing-based multimedia intelligent teaching platform for children's courses has good performance and can respond in a short time with a small increase in CPU usage curve. Users can enjoy better experience effects, fully satisfy children's curiosity, and enable children to continue to use and experience.

4. Conclusions and Prospects

4.1. Conclusions. In recent years, with the comprehensive development and deepening of preschool curriculum education reform, the national economy continues to grow, the construction of teachers continues to strengthen, the level of teachers' educational background and professional ability continues to improve, and the quality and level of preschool education have gradually improved. How to choose and organize the curriculum elements according to the correct guiding ideology and make them have a high degree of internal consistency and how to build a scientific multimedia intelligent teaching platform for early childhood curriculum has become an urgent problem in the current curriculum reform. The conclusions are as follows:

The edge computation-based multimedia intelligent teaching platform for early childhood curriculum has outstanding performance in average response time, which can complete the response in the shortest time every time. The CPU usage curve of the designed platform has a small increase, providing

users with a good experience. Children are generally interested in the performance of the multimedia intelligent teaching platform for children's curriculum based on edge computing. The designed platform can attract children's curiosity and make them continue to experience and use it.

4.2. Prospects. At present, children's online learning has great randomness and is limited by many objective conditions, such as lack of hardware, differences in parents' ideas and consciousness, or children's own ability. Therefore, the key contents of the next research work are as follows:

(1) First of all, it falls on how to help children build online autonomous learning ability. Children with this skill have laid a good foundation as buildings. At the same time, the government should take the lead and the society should participate extensively, expand the number of nonprofit kindergartens, realize the control of market price, and maintain the educational and public welfare nature of preschool education

(2) Although the content of online resources is rich, not all resources are conducive to children's development. How to grasp online learning resources has become one of the difficulties of online teaching. Through children's online learning, it is found that children only pay attention to the interest in images and animation. Therefore, in order to mobilize children's interest in learning, we need to do more research on the secondary development of functions. We hope to realize three-dimensional virtual scenes on the platform and show those things that are difficult for ordinary children on the platform, so as to make the platform more dynamic and increase children's interest in learning, strengthen the professional theoretical learning of preschool education in various ways, and adopt the way of combining theory with practice to transform the theoretical learning into teachers' educational ability. Let teachers understand the core of preschool education reform at present and the meaning of preschool quality education and grasp the content of preschool quality education, so that they can consciously carry out quality education in daily teaching activities

(3) It is hoped that virtual reality scenes will be added to the multimedia intelligent teaching platform of early childhood courses to enhance interest, and the design of the teaching platform will be modified according to the learning evaluation. At the same time, the construction of parents' committee is of great significance to the establishment of school, family, and social education coordination mechanism and the improvement of parents' educational attainment and family education level

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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