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Research Article

Intelligent Campus and English Visual Education System Design Based on Internet of Things

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With the continuous development of the Internet of Things technology, learning and acquiring knowledge through Internet will become an important way for human beings to learn, work, and conduct research. In the field of English language teaching, the cutting-edge research on the Internet of Things-based interactive teaching models is important. The intelligent campus is a new type of campus built aided by advanced techniques such as machine learning and the Internet of Things. In the smart campus, the classroom usually consists of a tangible physical space and an invisible digital space, which can be used to support teaching content through various types of intelligent equipment, promote classroom interaction, and achieve more convenient visualization of educational functions. Based on the initial results of the Internet of Things research, this research establishes a visual education system based on the Internet of Things. At the same time, the Internet of Things is used to study the interactive English teaching mode in order to improve the level of English teaching and thus enhance the technology level of the intelligent campus.

1. Introduction

With the continuous development of the level of technology and the Internet, the era of big data has arrived. At present, in the context of the big data era, the traditional education model has been greatly impacted. To be specific, the new foreign language education, characterised by digital education, is undergoing a huge change in information technology [1, 2]. Also, English language education incorporates social, cultural, and informational aspects and is being transformed by a new model of online interactive foreign language teaching [3–5]. At the same time, information technology has been used in almost all aspects of people's daily lives, and this development of information networks has led to the emergence of the Internet of Things (IoT) technology [6–8].

The concept of the Internet of Things is a network concept that stretches from its customer side to the exchange of information and communication between any two objects. This technology allows real objects to be connected to the Internet by means of information sensing devices such as radio frequency identification [9–11], infrared sensors [12, 13], global positioning systems [14–16], and laser scanners [17, 18], following set rules. By assisting in this way, objects and the Internet can communicate effectively and thus be transformed intelligently. By obtaining information between interconnected objects, the IoT's RFID technology enables more specific, detailed, and comprehensive sensing of object characteristics, making information about interconnected objects more transparent and enabling the capture and interaction of information about interconnected objects anywhere, anytime. The IoT therefore needs to have functional characteristics to capture information about objects accurately, comprehensively, and more sensitively. IoT emerged after the development of modern information technology to a certain stage and is known as the third revolutionary innovation in the information industry. Its essence includes Internet features, identification and communication features, and intelligent features. The major difference between the IoT and the Internet is that the IoT is linked straight to various sensors. In other words, there is no need for people to enter messages, and the IoT can automatically access them and process them. In terms of industrial applications, IoT can achieve efficient and intelligent control and organize large-scale data applications in various industries, such as medicine

[19, 20], geography [21, 22], and economy [23]. In recent years, the promotion of IoT technology for education is on the rise, but due to the limitations of its application mode, it has not yet been applied on a large scale.

Al-Emran et al. proposed a new educational application model based on IoT technology, which takes the sharing of IoT educational resources as a starting point. Specifically, this model can greatly reduce the difficulty and cost of educational applications by developing a repository of resources, thus facilitating the spread of IoT educational applications. [24]. Ramlowat and Pattanayak examined the implications of IoT technology for improving the efficiency of teaching and learning in education, including areas such as computer education, medical education, and distance learning [25]. Suduc et al. argued that IoT can optimize the teaching and learning environment, enrich teaching and learning resources, and improve teaching and learning models [26]. Abbasy and Quesada developed an intelligent electronic learning system based on the IoT that can predict and identify the educational requirements of students based on the study of data obtained from connected objects [27]. Mathews et al. believed that modern education systems should implement an interactive teaching model based on the IoT, as it can greatly improve the quality and efficiency of teaching and learning [28]. In summary, there is a large body of research that focuses on exploring the application and design of the IoT in new educational model environments. This means that the information revolution and technological developments brought about by the IoT have greatly contributed to the development of traditional education models, which facilitates greater access to resources for students and teachers.

The rapid development of IoT technology has led to changes in the design philosophy and functionality of campuses and classrooms. At the same time, the way in which information technology is used in language laboratories is gradually diversifying, and the level of functional applications is also becoming more diverse. In this context, more and more schools are beginning to pay attention to the construction of intelligent campuses as well as classrooms [29]. The use of intelligent classrooms based on IoT for integrated teaching is becoming more mainstream, which can combine teaching media with teaching content according to the needs of teachers. Intelligent classrooms not only have the basic functions of classroom teaching but also include independent learning, online examinations, and recording of high-quality courses. This makes the smart classrooms more challenging to use and maintain than other ordinary classrooms, as it is not enough to keep the electronic equipment working. Based on the IoT environment, English teachers can create an intelligent teaching environment and thus build a networked interactive teaching model for the foreign language classroom. Verbal communication in real life is a blend of multiple information modalities, including sound, text, and image. Human beings acquire information through visual, auditory, tactile, olfactory, and taste senses. In the current Internet environment, as digital technology is not yet well developed, classroom teaching mostly uses relatively separate information transfer methods such as slides, projectors, and videos on the Internet, with forms limited to both visual and auditory aspects. With the application of information transfer technologies such as touch, smell, and taste, the mode of interaction in the virtual world has become closer to a natural and real state. English teaching should fully absorb these advanced technological tools to simulate real language environments and more realistic and concrete communicative behavior. The IoT technology is now commonly used in all areas of working life, and it will bring about a global revolution in the field of English language teaching. IoT technology can provide teachers with an efficient teaching aid and is attempting to develop a professional teaching platform in the field of English language teaching. This paper provides an overview of the application of the IoT in English visualization education, based on the connotations and characteristics of the IoT, with a view to providing a practical basis for a deeper and broader technical and theoretical study of the IoT in the education sector.

2. English Visual Education System Based on IoT

The IoT refers to the identification and management of any object connected to the Internet through information sensing devices. In teaching and learning, smart tags are used to identify objects to be learnt and to adapt learning content to students' behavioral records. This is an extension of the traditional classroom and virtual experiments, enhancing the student experience both spatially and interactively, as students can use their mobile phones to identify QR codes to access relevant extensions from the teaching platform. In terms of teaching and learning management, the IoT technology is used to establish a comprehensive teaching and learning management system and to improve the organization, evaluation, and assessment systems of teachers for students, thus ensuring and monitoring teaching quality. For example, teachers can use the IoT technology to manage students' attendance, assess their learning, and monitor their performance.

The core of IoT is the connection of smart chips to different objects via communication technology and the connection of various devices to the Internet via sensors, thus enabling automated control. The embodiment of the introduction of IoT technology into the teaching field is the intelligent classroom, using radio frequency identification technology and various types of sensors to build an intelligent teaching environment, so that each device in the teaching environment has digital, networked, and intelligent characteristics. As a result, this system can provide smart educational setting by analyzing classroom information in real time and adjusting accordingly.

2.1. Network Management. The network is quite important in the English language teaching classroom, which can link electronic devices together. The internal LAN of the intelligent classroom not only serves the general network needs of the teachers and students but also is responsible for the

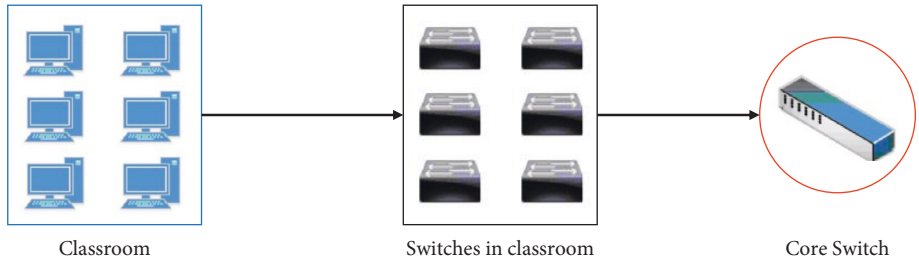

Figure 1: Intelligent classroom network connectivity.

communication of the various sensors and controllers in the laboratory IoT system.

The intelligent classroom network connection is shown in Figure 1. The core part of this network connectivity in the English visual education system is the core switch, which is responsible for the network transmission across the campus. The devices in different classrooms need to be equipped with different network domains and separated by virtual LANs to avoid IP conflicts and virus attacks.

The IoT website is mainly based on the teaching objectives and talent training programs of the school's English language courses. The aim is to use the IoT as a second classroom and to make it a method and mode of teaching foreign languages, so that the English interactive learning website can provide foreign language teaching services for all students in the school and become an IoT foreign language teaching base. In addition, the website can be used to motivate and inspire students to learn a foreign language and create a virtual learning environment for students through a series of online activities and the use of various multimedia courseware. The IoT teaching section is directly included in the foreign language department's homepage, which consists of the following sections: courseware learning, online communication, English forum, and sections such as faculty profile, bulletin board, friendly links, and entertainment. All sections are written in ASP program and the database is AC-CESS, which is powerful, flexible, and easy to use.

2.2. Software Management. For software maintenance, the smart classroom security software is also a must in the software installation sequence. The network firewall must not conflict with the exam software but can be turned on during the week, and some classrooms have introduced virtual desktop management systems in addition to the use of restore cards. When updating software, it is necessary to manually update the software in the software sequence of a mother machine and then use the virtual desktop program to distribute to all terminals of the same type, which is more stable and convenient than the progress of the restore card with the same transmission. The benefits of virtual desktops are that in addition to protecting the data sent down to the system, users can also apply the server to protect multiple system images for different exam and lecture scenarios. In addition, virtual desktops can be set up with different software installation lists, and administrators can view student machines by logging into the server for timely maintenance, as shown in Figure 2.

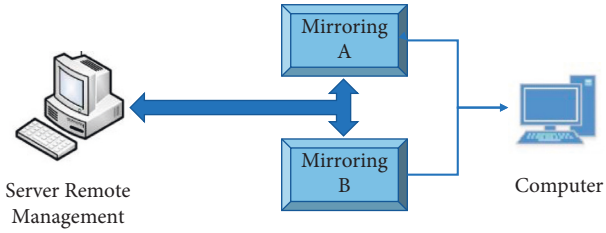

Figure 2: Software management in the intelligent classroom.

Table 1: List of software installations in the intelligent classroom.

Mirroring A	Mirroring B
Microsoft Office	Microsoft Office
Google browser	Exam management software
NewClass English learning system	WeTest testing center
PDF reader	PDF reader

The system is set up with two main types of mirror, the lecture system and the examination system. The lecture system consists mainly of the classroom management software. In general, a classroom management system for a qualified English teacher needs to have the following functions. The first one is to maintain classroom discipline, monitor student behavior, and prevent students from browsing on student computers during lectures that are not related to the course. The second one is a recorder, a function that allows students to be trained in listening, speaking, or translation. The primary elements of this examination system would be the online exam as well as oral exam software. There should not be too much software installed on the student and teacher machines, and there is a need to control the type and amount of software. The list of software installations in the intelligent classroom is shown in Table 1.

The intelligent classroom mainly uses WeTest testing center software, which combines oral and machine examinations in one software program, effectively avoiding the misuse of invigilators. The software is used to assemble examination papers online, generate downloadable packages of papers, and copy them to the teacher's machine. This is then distributed via the invigilation software on the teacher's machine and received by the exam software on the student's machine. This way of running the software is independent of the classroom and the server, with only the data transfer

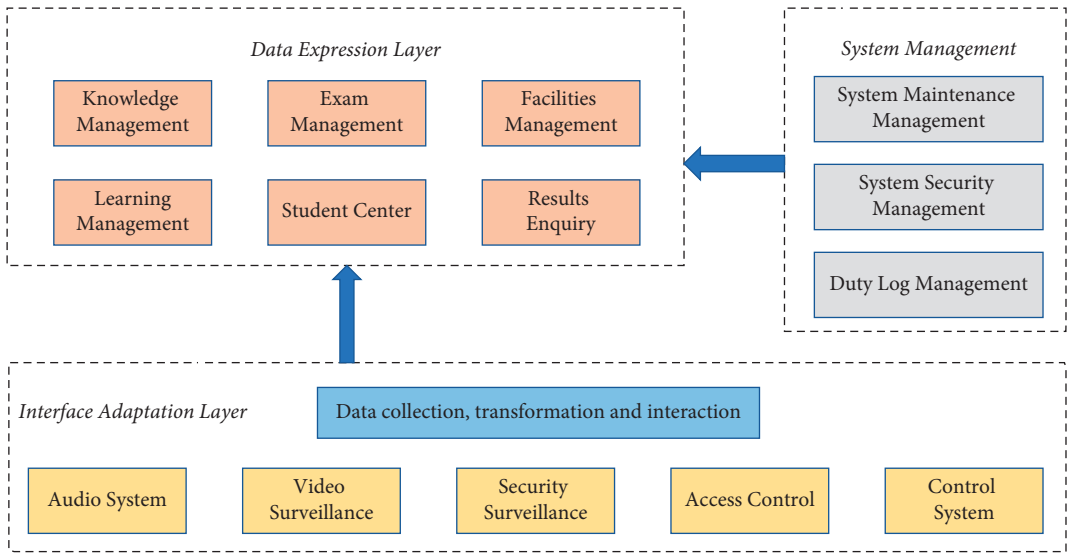

Figure 3: Structure of the software platform.

between the student and teacher machines, making it quicker and easier to prepare for the exam. This mode of machine examination is very convenient for the maintenance work before and during the examination, and after the examination, the technicians can use the marking software to directly export the results of the machine examination, reducing the pressure on the lecturers to mark the papers.

2.3. Software Architecture Design. The architecture of the system proposed in this paper is on the basis of core elements of meeting cross-platform requirements. At the same time, it adopts a plugin and ready-to-use software module configuration approach, split into a data expression level and an interface adaptation level. The overall architecture of this system software platform can be seen in Figure 3.

The communication between the various layers of the platform software is interconnected by a combination of data and message buses to maximize the technical performance and execution efficiency of the system platform software structure. The data bus is responsible for the transmission of non-real-time or large amounts of data, while the message bus is responsible for the transmission of interactive commands and real-time data. At the same time, the plug-and-play configuration of the software modules guarantees the open scalability of the software system platform, so that later access to other devices and network management does not change the overall architecture of the system platform.

2.4. Database Design. The MySQL database is used to store data information within the English visualization system. Since all the information in the MySQL database is contained in a single file, it is also extremely easy to manage and maintain. More critically, a number of procedures could retrieve data from a single database simultaneously. Independent transaction processing in MySQL databases is achieved with database grade ingenuity and common locks. The procedure or thread performing a database write operation has to acquire a unique lock and no other read or write operation will take place, thus ensuring the security of the database.

The database designed for the system developed in this research takes the compatibility with existing databases into consideration. And the database is on the basis of the business process characteristics of school teaching and learning. The most important database tables include user login information, knowledge base information, device information, learning information, exam information, monitoring data records, alarm information records, etc. These tables basically cover all functional modules, fully ensuring the operational independence and future scalability of each module. The relationship between these database tables is shown in Figure 4.

The database table is in the form of key value and stores fields such as modified or not, modified time, modified type, modified status, execution time, current status, and so on. It completes the process of storing the server setting information sent to the web client to take effect and returning the result to the server after it has taken effect. It also stores and manages the content and status of the knowledge base information sent to the server by the web client as required, the location information, etc. and stores the commands and the time of the last message sent in the database.

2.5. Cloud Computing. In addition to teaching English in the classroom, offline training can provide English content that is not available or accessible in the classroom. Cloud computing is a collection of emerging information technologies, such as distributed computing, virtualization, network storage, and load balancing, which support the interconnection of all levels of an organization and facilitate the exchange of resources

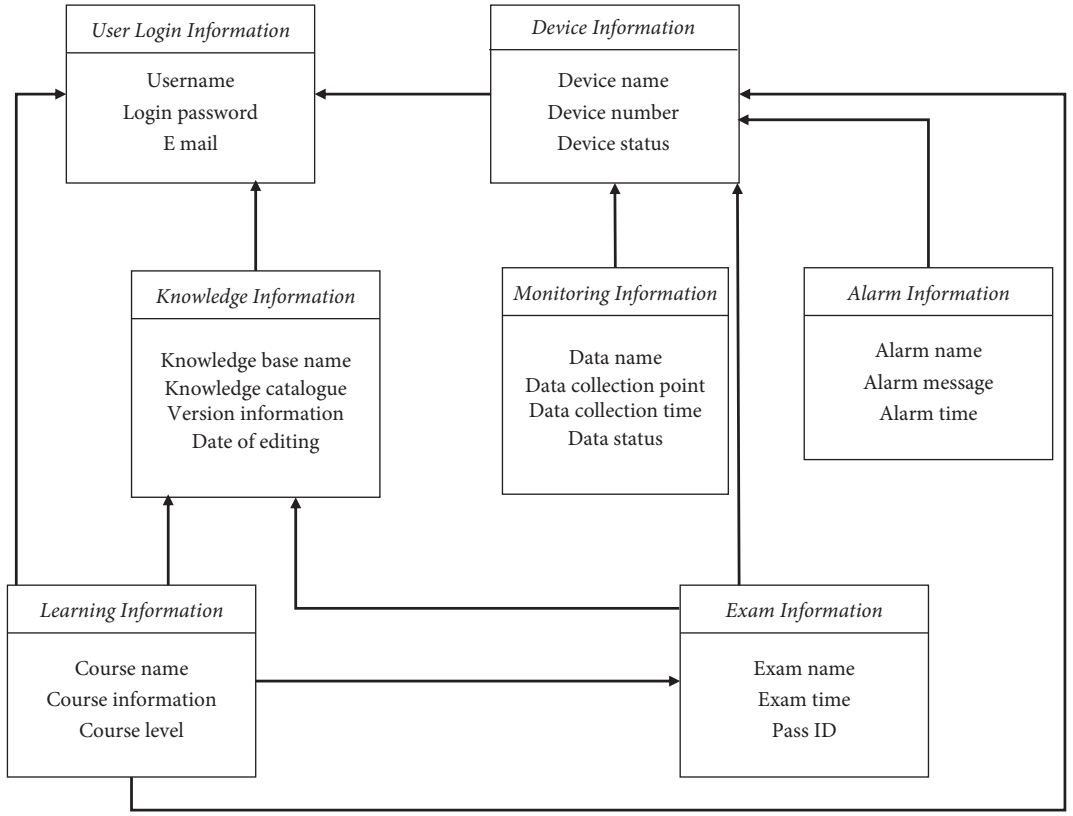

Figure 4: Database table logical relationship diagram.

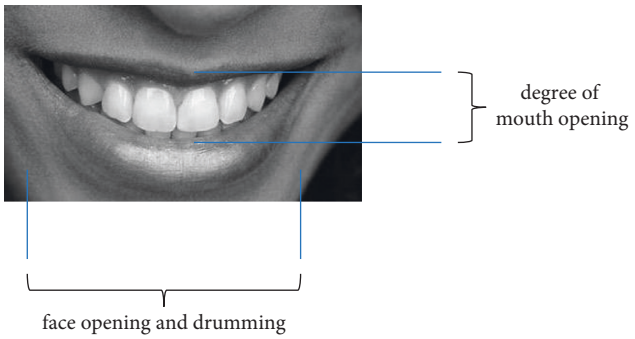

Figure 5: Main parameters of the mouthpiece.

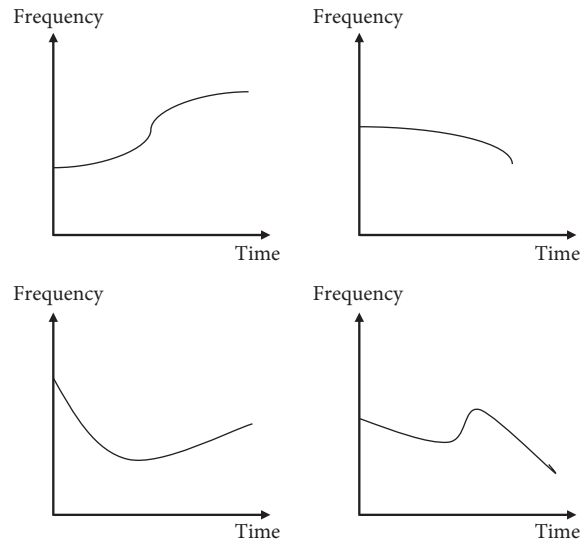

Figure 6: Main technical parameters of English speech sounds.

across platforms. It supports the interconnection of units at all levels of an organization and facilitates the exchange of resources across platforms. The education cloud is a migration of cloud computing technology in the education sector and includes all the hardware and software resources required for education informatization. The platform can store a huge amount of English educational resources, including documents, pictures, videos, audio, courseware, and lectures, and can be regularly updated and replenished. Also, the platform's educational resources are constantly being updated, and the learning resources, time, and difficulty of the content can be adjusted according to the needs of the users. Thus, it can support teachers and students to access effective and quality end-to-end services.

3. Information Acquisition of English Visual Education System

Each language has its own characteristics in terms of articulation, intonation, and frequency. From a physiological and physical point of view, standard English pronunciation is described by the digital recording of cameras and speech. The software can be written to provide a demonstration of

standard English pronunciation and diction, as well as an error correction function for English pronunciation and diction, and the ability to score the learner's learning.

Figure 5 shows the main parameters describing the mouth shape, including the mouth opening width, degree of mouth opening, face opening and drumming, etc. By comparing these parameters, the information of the standard mouth shape figures when pronouncing English is obtained and the corresponding software is written so that it has the function of error correction.

Figure 6 shows the main technical parameters of English speech sounds, which include the main parameters of frequency, intonation, amplitude, and speed of speech, which are used to obtain technical indicators of English speech.

4. Conclusion

The reform of the campus English teaching mode in the IoT environment must have a certain hardware and software foundation, scientific and reasonable teaching principles and evaluation methods, and rich teaching contents. IoT teaching has advantages that no other teaching method can match. It can realize one-to-one, multi-on-one, and non-simultaneous teaching and can also significantly stretch the scope of instruction in the classroom. Therefore, it has been valued and applied by many university teachers.

This study starts from the design of an English visual education system on the basis of IoT. Also, it endeavors to identify popular issues when adopting teaching information technology through researching the present status of the construction of teaching information technology. In addition, the design and implementation of this system is explored from the perspective of the practical needs for running of instructional business processes. Furthermore, an integrated platform for the intelligent system is initially constructed. The completion of the construction of this platform will enable full task of the teaching information reform to be realized, thus furthering the development of education to a high-tech level.

However, due to the constraints of time and conditions, the English visual education system has been studied only on the major procedures. With rapid development of education informatization construction, the continuous innovation of teaching business and the increasing renewal of smart classroom equipment systems have become more and more prominent in the comprehensive consideration of the safety of smart classroom teaching systems.

In addition, the study of technical standards related to intelligent classroom teaching systems and the visualization and application of related equipment systems are the focus of future research. Therefore, there are still very many research areas for intelligent classroom teaching systems.

Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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