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An English Education System Based on the Internet of Things Technology Environment

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Abstract: With the rapid development of China's economy, communication with other countries is becoming more and more extensive. With English as a common language, there is an urgent need for well-rounded and complex talents. In this context, there is a need to focus more on the practical ability of university graduates to use English, and English education reform has emerged. The aim of this paper is to study the design and implementation of an English education system based on the Internet of Things technology environment. The overall functionality of the system is developed and the main modules of the system are established based on the needs of the actual teaching of English. The development techniques used for the system are also briefly introduced. The system is tested for multiple sensor data transfer, and the test results show that the system is able to achieve the expected objectives and real time management.

1. Introduction

The development of global information has provided new ways for education [1-2]. The core of the Internet of Things is to achieve the connection of things to things, embedding various sensing devices into the equipment to be monitored, and monitoring the information collected from the equipment through various wireless and wired networks to quickly feed back and summarise to the central server to achieve real-time management of the equipment status. Based on the real-time monitoring characteristics of the IoT, we can then manage various teaching processes in real time [3-4]. It is new and meaningful to study how to apply various new technologies of the Internet of Things to the English education system to achieve the successful completion of the reform and the ultimate goal of reducing costs and improving the quality of students [5].

With the rapid development of modern technology, virtual reality technology has also been applied to our lives [6]. Hanneke Theelen discusses the application of virtual reality technology in teaching English to higher vocational health professionals. Virtual reality technology is a new technology that has emerged along with information technology. It is a process of creating a virtual environment that allows people to feel five senses. The possibility of using virtual reality technology in English teaching is explored, and constructivism is used to build an authentic language environment so that students can truly experience their native language environment,

increase their interest in learning, and improve teaching effectiveness[7]. With the continuous progress and development of Internet technology, it has gradually become an important part of front-end development technology. Currently, the main technical software for front-end and rich client technology is HTML5, which Kiran Fahd transfers to the client side through the combination of HTML5 and JavaScript software and the processing of the underlying logic. HTML5 has features such as animation, multimedia, and three, which can replace Flash and Silverlight software and improve processing efficiency. Therefore, HTML5 technology was chosen as the implementation of an English language teaching system for universities [8]. Andy Nguyen reviews contemporary developments in e-learning systems in the Internet of Things and cloud computing and provides an outlook on the future of investment in further education. A survey of four higher education institutions in south-eastern Nigeria makes the case for adopting cloud computing technology as the best alternative to organising data warehouses in current social automation. The results suggest that the implementation of technology in schools is critical to student academic achievement, which clearly necessitates digital and technological adaptation and prepares students for opportunities in the emerging new digital world [9].

This paper develops and designs a platform for teaching English based on IoT technology. The system consists of two parts: First, the main user is the English teacher. English teachers use the system IoT technology to diagnose students' classroom situations and to grasp their basic knowledge, guidance, and teaching. The other main user is the student. The practical basis of the student login system. Based on the actual student performance, the system is able to access information about the student's knowledge.

2. Research on English Education System Based on IoT Technology Environment

2.1. Internet of Things Technology

The Internet of Things (IoT) is the third wave in the development of the world's information industry. The Internet of Things is usually a network that enables objects to be connected to objects. Through information devices such as sensors and positioning systems, any object can be connected to the Internet according to certain protocols, with various communications and information exchanges between connected objects, and finally intelligent object management [10-11].

The realisation of the overall concept of the Internet of Things relies on a number of technological inventions, and its key technologies cover the entire information processing process from acquisition, transmission, processing, and storage to application. When the electronic tag of an object is read, various information can be collected in real time and then sent through a series of processes to send data and information to the network in accordance with communication protocols. Finally, the collected data information is processed using intelligent computing technology, and finally the intelligent control of the network object is realized [12-13].

2.2. Overall System Functionality

The English education system designed in this paper is able to collect all kinds of information in the online and offline English classroom in one, helping English teachers to manage the classroom and attracting students to learn to their own. A well-functioning English education system must include the following three major modules:

(1) Student model

The student model system consists of three functional modules: self-management, text learning, and extended learning. The student model is the core of the whole teaching system and is one of the sources of all data. Students learn through this model, which can accurately reflect students' level

and learning ability, etc. It enables the distance learning system to understand the objects taught and automatically adjust teaching strategies and learning syllabus when conducting teaching, and it is a data structure for recording students' situations.

(2) Teacher model

The teacher model system consists of four functional modules: self-management, student management, courseware production, and lecture management. It incorporates knowledge of teaching strategies and lesson structure, selecting questions for the student to answer, monitoring and evaluating his behaviour, and developing appropriate teaching courseware and selecting appropriate remedial materials for the student when he needs them. Remote monitoring in the English Classroom Student Information Collection subsystem can also be used to record student attendance and to observe students in class.

(3) Background support

It is to provide some necessary back-end support functions for student and teacher models. It contains user management module, which mainly completes user verification and control, registered user information, student registration management, teacher registration management, administrator management, etc.; teaching management module, which mainly completes teaching, announcement management, examination information, etc.; teaching knowledge management module, which mainly completes teaching knowledge and the management of formed teaching strategies; The knowledge base management module, which stores all CAI courseware, knowledge elements, etc.; the courseware production support module, which is used to assist teachers to model the production of uniform style multimedia courseware.

3. Design of an English Language Education System Based on the Internet of Things Technology Environment

3.1. Development Environment

The teaching information mining system uses a B/S structure (Browser/Server, browser/server model), with the client running on a Web browser, which can adapt to various platforms, and concentrates the main algorithms and data storage and other functions on the server, simplifying the development, maintenance and use of the system.

The system is developed using the PHP (HypertextPreprocessor) open source scripting language and the server supports PHP version 5.0. The server program is mainly responsible for web page access and display, database operation, and arithmetic program writing, using the relational database system MySql as data storage.

3.2 Hardware Design of the English Classroom Student Information Collection Sub-system

(1) Design of the core control module

The information acquisition subsystem uses the STM32F103RBT6 enhanced microcontroller from ST. The acquisition circuit mainly uses I/O ports, I2C interfaces, and serial ports, so the STM32F103 chip resources are sufficient to meet the design requirements.

The STM32F103 core chip uses a 25MHz external clock source and communicates with the smart camera using the serial port and with the gateway system via the RS485 interface. The STM32F103 uses the on-chip main flash memory boot method, so the pins BOOT0 and BOOT1 are grounded. Light-emitting diode D1 is used as a working indicator. When the system is working normally, the PB9 pin outputs a high level to light up D1.

(2) Design of intelligent camera module

The image acquisition hardware device selected for this design is the "Congmu" series of intelligent cameras developed by Beijing TOPOTEK and equipped with the Android operating system, which has the main functions of optical zoom, portable intelligent algorithm, built-in "face recognition algorithm "and "video-based statistical calculation of the number of people in an indoor space".

Face recognition algorithm:The Conglomerate camera can perform image acquisition, detect a portrait in a picture or a frame of a video stream, and separate the portrait from the background picture, store the portrait into the data storage unit face[i] after determining the portrait; every time a new face is retrieved, a storage variable is created and the time information t[i] when the new face appears is recorded; the next time the course, the face reappears, no new variable is created and only the time information of the appearance is recorded under that variable.

The FaceNet model is a generic system that uses a CNN neural network to map face images into a 128-dimensional Euclidean space. We can determine the similarity of two face images based on the Euclidean distance between the two images. The innovation of FaceNet is to remove the last softmax classification layer from the network structure and use tripleloss as the loss function, which can achieve very good results. Tripleloss loss function is mathematically formulated as shown in Equation 1:

$$T\text{riploss} = \sum_{\text{i}}^{N} [\left\| f(x_i^a) - f(x_i^p) \right\|^2 - \left\| f(x_i^a) - f(x_i^n) + a \right\|]_+ \tag{1}$$

f(xa) represents the feature vector of negative which is a different class from Anchor. The purpose of this formula is to increase the Euclidean distance between f(xa) and f(xn) as much as possible, while decreasing the Euclidean distance between f(xa) and f(xp).

In this paper, softmaxloss+ centerloss is used as the loss function for the training of the face recognition model, as shown in Equation 2.

$$\begin{aligned} \tau &= \tau_s + \lambda \tau_C \\ &= -\sum_{i=1}^{m} \log \frac{e^{W^T_{yi} xi + by_i}}{-\sum_{i=1}^{m} \log \frac{e^{W^T_{yi} xi + by_i}}{\sum_{j=1}^{n} e^{W^T_j xi + bj}}} + \frac{\lambda}{2} \sum_{i=1}^{m} \left\| x_i - c_{yi} \right\|^2 \end{aligned} \tag{2}$$

c denotes the centre of category I and xi denotes the current sample.

Video-based spatial headcount calculation method: This algorithm is based on the HOG feature descriptor of pedestrian detection algorithm, which can count the number of people in a limited indoor space, can count the two-way traffic in the crowd density, people can be effectively calculated in each other blocking situation. In this design, the smart camera uses a video-based headcounting algorithm to find the total number of people N in the classroom.

After the two algorithms mentioned above, the total number of people actually present in the classroom during lesson N and the total number of faces present during lesson M (M is obtained by averaging the number of faces collected three times) can be obtained, together with the number of people present during lesson S, obtained from the teaching system, to obtain the attendance rate N/S (number of people present/number of people present) and the head-up rate M/N (number of faces/number of people present). These data can be output from the serial port interface and passed to the server via the network.

4. Implementation and Research of English Education System Based on IoT Technology Environment

4.1. Implementation of Remote Monitoring

This paper uses object-oriented programming ideas, in order to implement the multiscreen display function, it is necessary to define the class CIPVCDlg. Its main functions are described as follows:

Multi-screen display window design in the region with place 16 PIC controls, ID named ID_VID_WINDOW1,....., ID_VID_WINDOW16. Need to change the property of Type to Bitmap, and then the Image property of IDB_ BITMAP1, IDB_BITMAP1 is a bitmap resource. The system takes a fixed size bitmap as the base and expands its size to get the overall area of the multivideo display window, Mainwin. We can set the length and width of Mainwin to twice the length and width of IDB_BITMAP, after which all video display is carried out on this basis. The remote monitoring effect is shown in Figure 1.

Figure 1: Real time monitoring effect diagram

4.2. Multiple Sensor Data Transfer

We connect a current sensor and a voltage sensor to the sensor interface of the module and set the minimum current amperage and the maximum current amperage for the module to give notification. The current sensors are triggered by connecting them to a high current device, for this test an electric heater was used and the maximum current can be up to 10 amps. The temperature and voltage sensor values are then collected at the same time as the current occurs over the setting. When triggered, the module sends the message "13234218323, 2010090209123312, current rated 9.1A, temperature, 23, voltage 213V". The trigger condition is achieved by the heater voltage being turned on and off.

A summary of the tests is shown in Figure 2.

Table 1: Module testing

Serial number	Trigger times	Total sending time (seconds)	Total receiving time (seconds)	Success rate
1	1	1	2	100%
2	3	1	2	100%
3	5	8	10	100%
4	10	15	17	100%

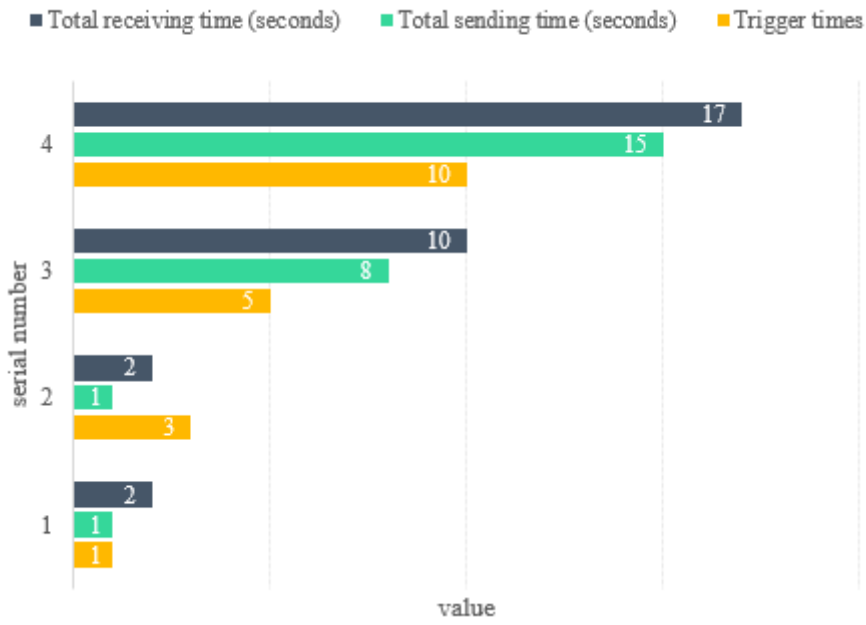

Figure 2: Summary of test results

The result of the whole test is: Pass, as shown in Table 1.

5. Conclusions

This paper introduces the relevant contents of the Internet of Things technology, analyses the implementation of the English education system based on the Internet of Things technology, and puts forward the overall implementation plan of the system. The English education system based on IoT technology designed in this paper is the only teaching aid for basic knowledge according to the characteristics of reducing the consolidation of basic knowledge under the university English teaching reform. In order to make the system more practical and intelligent, the system also needs to assist students to train subjective questions, such as reading, comprehension, translation, and composition, to make the English teaching system more functional, which will be the next step of the work This will be the next step of research.

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