

Retraction

Retracted: Design of Distributed Collection Model of Student Development Information Based on Internet of Things Technology

Security and Communication Networks

Received 26 December 2023; Accepted 26 December 2023; Published 29 December 2023

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] H. Ji, "Design of Distributed Collection Model of Student Development Information Based on Internet of Things Technology," *Security and Communication Networks*, vol. 2021, Article ID 6505359, 10 pages, 2021.

Research Article

Design of Distributed Collection Model of Student Development Information Based on Internet of Things Technology

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Received 25 April 2021; Revised 19 May 2021; Accepted 2 June 2021; Published 9 June 2021

Academic Editor: Chi-Hua Chen

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This paper is aimed at the problem that the process of students' developmental assessment is too comprehensive and the process of data collection is too old. It is very important but the performance of existing methods cannot meet the actual needs. So, this paper puts forward the design of distributed collection model of students' developmental information based on Internet of Things technology, which is based on the hardware design of students' developmental information distributed collection such as RF RC500F chip, TIMSP430 microprocessor, and interface in Internet of Things environment. Experimental results show that the model has less noise interference and strong data transmission ability, has higher collection accuracy of student development information, and can improve the authenticity and comprehensiveness of student development assessment.

1. Introduction

Students' developmental evaluation is a form of evaluation of students' learning in the process of curriculum implementation. It emphasizes the features of comprehensiveness, individuality, objectivity, development, and timeliness. However, the collection of students' development information is full of difficulties; for example, the collection time is too long, and the students' cooperation degree is too low, which results in the limitation of the comprehensiveness of the evaluation; the collection means and process are too old to adapt to the development form of modern information education; the technical problems in the process of students' information retention and mining. Therefore, it is necessary to adopt certain modern technologies [1] to optimize the collection effect of students' development information, for example, in document [2], in order to make use of the learning of augmented reality media to develop the submicroscopic expression ability and the students' classroom research in the fourth semester of the Department of Chemical Education of Bandung University, by measuring the students' activities in the learning process, the completion of the worksheet, and the submicroscopic expression ability after learning, the results obtained from the

completion of the worksheet are classified into very good categories (average score of 86), and the maximum (average score of 94) of the key domain and non-key domain abilities are determined according to the Lewis structure. In addition, the submicroscopic expression ability after learning belongs to very good categories (average score of 81.5) and the maximum (average score of 92) of the key domain and non-key domain abilities are determined according to the Lewis structure. However, the use of the platform is too costly to be practical; literature [3] assesses how to improve the data provided to teachers and administrators, with key features including direct access to data and the provision of average and total scores for individuals, schools, and departments. The results of this study show that the response rate of Evaluate is low compared to paper questionnaires, although the difference is small. Since 2014/15, the response rate of Evaluate has increased every year and the average score has begun to decline, but soon reverted to a level similar to that of paper questionnaires, with significant differences in response rates among schools indicating differences in how assessments are used and disseminated in practice. Students answered and completed more than a third more surveys than did essays. A large number of written comments have been received and are now available for inspection, but the

accuracy of its information collection is low, and the comprehensiveness and individuality of evaluation cannot be guaranteed.

From its inception, the Internet of Things has been hailed as another major innovation in the information industry after the Internet, computer communication network, and mobile network, for example, environmental protection, safety and security, health and safety, commerce and finance, transportation, logistics and distribution, electric power systems, urban communities, education and entertainment, industrial production, agriculture, forestry, animal husbandry, judicial administration, national defense, medical and health care, etc., while the campus network is a relatively independent high-speed network, the number of network users and machines in each school is also very different, only the system of a single machine is difficult to adapt to the steep growth of the network, so it is necessary to use multiple machines to work in parallel, and support scale-up system solutions, where a distributed system is a system that distributes hardware and software components on network computers and communicates and coordinates through messaging [4]. Kong and Ma [5] studied Internet of Things (IoT) technology and elaborated the development status and future challenges of the IoT technology, analyzed the impact of IoT technology on intelligent buildings and intelligent manufacturing, expounded the integrated system framework of intelligent building and building information model (BIM) technology, and proposed the system design of intelligent building and the architecture model of intelligent manufacturing based on the IoT technology. The model verification results show that the intelligent manufacturing model of construction industry can realize the integration of human society and physical system and achieve the purpose of real-time management and control of personnel, machines, equipment, and infrastructure within the whole network. Li [6] studied the problem that the campus data has only been digitized but not informational. They studied a smart campus management system based on the Internet of Things technology. His research used the unified data collection source of face recognition terminal hardware products based on the Internet of Things technology, unified management in the background of the system, and calculated and analyzed the data to obtain valuable campus big data. This study designed and implemented a complete smart campus management system by analyzing the system design principles and design goals. This system was mainly divided into the face recognition terminal hardware and smart campus software system based on the Internet of Things.

It can be seen from the existing research that the distributed system uses network interconnection, message mechanism for communication, and scheduling algorithm for reasonable and efficient allocation of resources to achieve efficient operation of the system. Although the performance of some existing research results has been greatly improved, there is still a lot of room for improvement. Therefore, the technology of Internet of Things and distributed system are introduced into the collection of student development information, and the model of distributed collection is designed based on Internet of Things.

The main contributions of this paper can be described as follows:

- (1) We focus on the important research direction of distributed collection model of student development information. Up to now, this research direction is very important, but the existing research results are relatively few and the performance is not able to meet the requirements. So, therefore, this paper has strong practicability
- (2) This paper puts forward the design of distributed collection model of students' developmental information based on Internet of Things technology, which is based on the hardware design of students' developmental information distributed collection such as RF RC500F chip, TIMSP430 microprocessor, and interface in Internet of Things environment. The experimental results show that the model has less noise interference and strong data transmission ability. Therefore, the proposed method has a better performance.

This article mainly contains six sections. Section 2 presents the method of hardware design of student development information distributed acquisition based on Internet of Things technology. Section 3 proposes the online transmission model of student development information data. Distributed collection model of student development information based on Internet of Things technology will be given in Section 4. The results of the experiment are also presented and analyzed in Section 5. Finally, Section 6 sums up some conclusions and gives some suggestions as the future works.

2. Hardware Design of Student Development Information Distributed Acquisition Based on Internet of Things Technology

In order to ensure the normal operation of the distributed information acquisition model, improve the processing ability of the model, and build the physical basis for the operation of the model program, this paper designs the hardware equipment needed in the operation of the model through the concept of integration with the Internet of Things technology. The hardware equipment mainly includes MF RC500 chip, TIMSP430 microprocessor, and hardware interface, which can effectively improve the efficiency and stability of the operation of the model through the coordination between the equipment. The hardware interface mainly uses the universal serial interface. In addition, there is a power source, which can supply the power for this system.

2.1. MF RC500F RF Chip Hardware Design. The RF chip MF RC500F applied in this paper is a new type of RF chip designed independently according to the principle of 1 MF RC500 RF chip. It can eliminate certain circuit structure under the condition of satisfying the operation and application requirements of the model designed in this paper to

achieve the goal of simplicity and convenience. Its application plays a very important role in developing the operation of the distributed information acquisition model for the students studied in this paper. Its specific structure circuit diagram is shown in Figure 1.

When the model is run and applied to the distributed collection of students' development information, the chip can modulate the data that needs to be sent by TIMSP430 according to the information set sent by the user, obtain a specific wireless signal, and send a specific wireless signal via antenna TX1 to one end of the RF card connected with the Aux pin by wireless connection. The A end of the RF card converts these wireless signals to the related dataset M , and the AUX pin of the chip will also generate the same set of related dataset M , and the chip will verify this set of dataset M , after confirming that the machine has no error processing, sending the radio signal from the RX pin and antenna TX2 to the TIMSP430 micro office in the form of wireless signal [7].

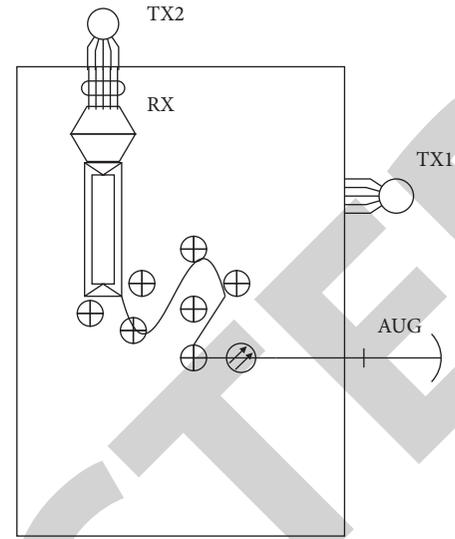


FIGURE 1: Circuit diagram of RF chip MF RC500F.

2.2. TIMSP430 Microprocessor Core Hardware Design. In order to meet the requirements of the rapid integration and encryption security of the model, the TIMSP430 microprocessor in the MSP430 microprocessor family is selected as the main microprocessor of the model. Its main function is to store data, process data, and control flow, and it is also one of the core parts of wireless transmission control in the operation of the distributed collection model of student development information designed in this paper. The TIMSP430 microprocessor is also used as the core to design a kind of TIMSP430 microprocessor hardware equipment. The TIMJTAC debugging module has the functions of program download, simulation, and debugging. The wireless transmission module of the TIMSP430 microprocessor has the functions of receiving and transmitting wireless signals in the form of radio frequency pulse, and its receiving echo has the principle of asymmetry. The serial port module is used for the connection between the computer and the reader. The main function of the power management module is to provide the energy needed for each part in time. The multiplex circuit has the functions of making up the energy error of each part and enhancing the whole life. The TIMSP430 microprocessor is used as the core of the hardware [8]. When the core hardware of the TIMSP430 microprocessor receives the radio signal transmitted by the RF chip through the ZigBeeCC2420 wireless transmission module, the ZigBeeCC2420 wireless transmission module will convert the radio signal into the corresponding storage data N and command data D according to the RF pulse principle and then transmit the storage data N and command data D to the TIMSP430 microprocessor for processing. The TIMSP430 microprocessor plays a core role in the hardware structure. The TIMSP430 microprocessor will first back up and save the storage data N and then issue commands to the JTAC debugging module and the serial port module in turn according to the command data D , complete the tasks of downloading, debugging, and connecting the overall computer information, and ensure the

normal operation of the students' development of the distributed information collection model [9, 10].

In the hardware of the distributed information acquisition model designed in this paper, the specific cooperation between MF RC500F chip hardware and TIMSP430 microprocessor core hardware is shown in Figure 2.

2.3. Hardware Interface Design. The hardware interface designed in this paper uses the way of connecting MF RC500F RF chip hardware and TIMSP430 microprocessor core hardware with the idea of SPI communication. Combining the two, only one SPI interface is used to connect with the serial port of the microprocessor, and through this interface to complete the work of setting and sending and receiving data. In the communication process of RC500F RF chip hardware, TIMSP430 microprocessor core hardware is the host, MF RC500F RF chip hardware is the slave, and MF RC500F RF chip hardware works under the condition of receiving data signal from TIMSP430 microprocessor core hardware. The I/O connection diagram between them is shown in Figure 3.

Integrating Figures 2 and 3, the transmission format of student development information data unit mainly includes head frame, data frame, configuration frame, and command frame. The unit format uses head frame to determine data transmission type, algorithm, analog filter, and data source, command frame to determine the control command of transmission process between online transmission model and different campus models, and configuration frame to determine the utilization of data. The statistics of student development information need to have communication channels and data types; the time of data transmission is determined according to the data frame. All frames have a unified function byte allocation, and the frame header of different frames can display the frame type and time synchronization information. There is no boundary between different frames in the process of data transmission. It unifies the transmission data to the same structured data

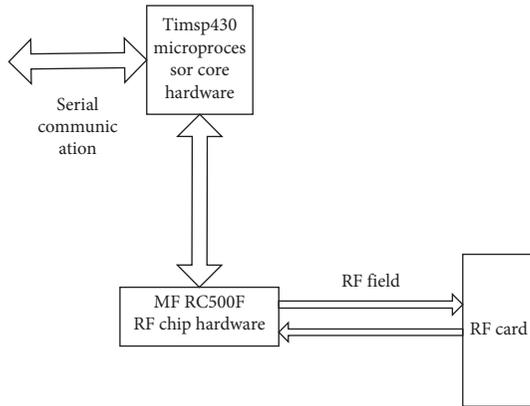


FIGURE 2: Specific coordination relationship between RF chip hardware and microprocessor core hardware.

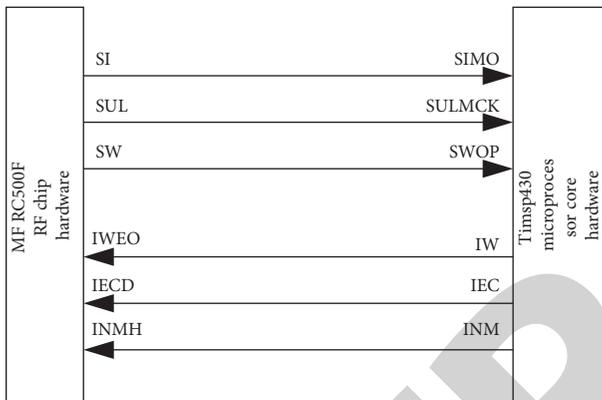


FIGURE 3: I/O connection diagram of MF RC500F RF chip hardware and TIMSP430 microprocessor core hardware.

transmission format, effectively transmits students' development information data, and provides support for subsequent data analysis and application. According to the space-time perspective of information data, this paper studies the efficient data transmission format of student development information.

Using the above data transmission format, the unique code of the data unit frame is ID, the storage quantity of the unique code byte of the data unit is set to 16 bytes, and the related data of the campus IOT equipment is set to 1 byte 024; equipment and time, respectively, indicate the data transmission point and the start time and end time of data transmission; set the byte storage number of data transmission start time and end time to 16, and the byte storage number of start time and end time to 8; use data to represent the transmission information data of specific time and specific transmission point, and the data byte length is 1024000. When the transmission data exceeds the number of queues, the information data is discarded. The frame format diagram is shown in Figure 4.

2.4. Networking Mode. In this paper, we need to consider the distributed networking of the system. In this paper, each terminal implements distributed model data collection and

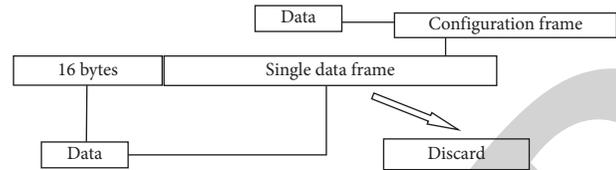


FIGURE 4: Schematic diagram of frame format.

then transfers the collected data to the processing center. Here, the TIMSP430 microprocessor is the processing center. The system mode is shown in Figure 5.

In this figure, we can see that there are many acquisition terminals which can be used to collect the data, and then the collected data can be transmit to the microprocessor which can be used to process these data. The way of data transmission can be wired or wireless.

3. Online Transmission Model of Student Development Information Data

The information and data transmission process between the student development information data online transmission model and other application models of the campus network is the main part of the communication standard. The TCP communication protocol is used as the communication protocol for the connection of the student development information data online transmission model, and the C/S mode is selected to set the management pipeline and data pipeline for the student development information data online transmission [11]. The establishment process of online transmission of student development information data is shown in Figure 6.

In Figure 5, because the real-time communication is not established when the power model is running, rebuilding, or restarting, the communication process of different model operation and transmission models can be divided into different subcommunication processes [12].

3.1. Operation Structure of Online Transmission Model of Student Development Information Data. In order to make the running structure of the model clearer and solve the problem of low software coupling, the idea of "high cohesion and low coupling" is followed in software development, which is convenient for software development and later maintenance [13]. The model runs in four layers.

- (1) User access layer: the login interface of student development information distributed collection model, which provides services for users. It includes two types of users: teacher user and model running administrator. Through the student service interface, teachers enter the power monitoring service, and managers enter the power monitoring service through the distributed collection platform service interface.
- (2) The monitoring layer is the core function layer of the whole model. Users can interact with each other directly through a web browser. Distributed

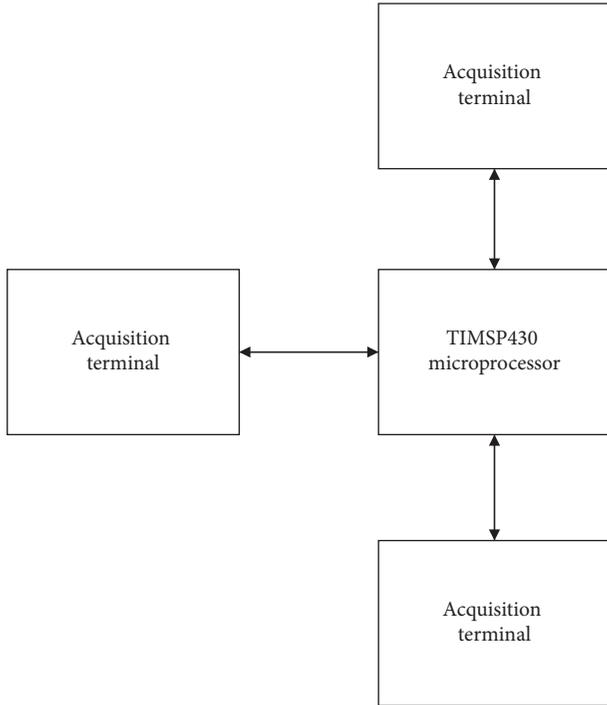


FIGURE 5: System mode.

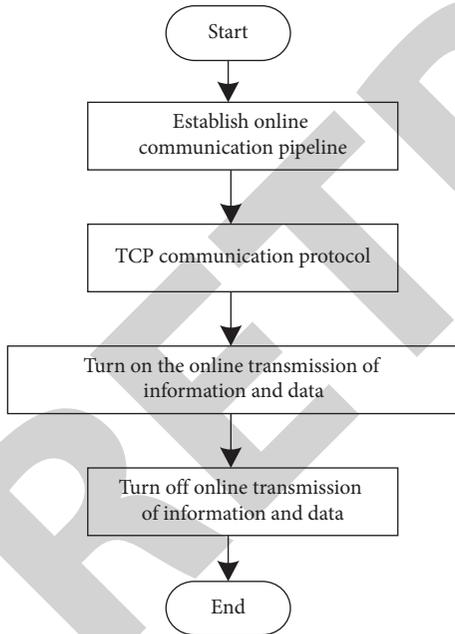


FIGURE 6: Establishment process of online transmission of student development information data.

collection platform services include basic information management of students, comprehensive monitoring of daily information of students, alarm status of abnormal information department, course information, authority management, and other functional modules. Student services mainly include teacher scoring, campus information query, daily status filling, and other functional modules.

(3) Data acquisition layer: it mainly completes the functional requirements of data acquisition tools, is an important technical support for the application layer of model operation, and is also the top priority of the whole student development information distributed acquisition model. It is divided into three modules, among which the communication module mainly realizes the communication with the power black box; the message access module encapsulates the class operation of the power black box; the data acquisition module mainly realizes the initialization and scheduling of various operations in the process of development information collection, which is the most direct data source in the operation of the distributed collection model of student development information [14].

3.2. Spread Spectrum and Transmission Control of Communication Channel. Under the application of the above model, on the basis of extracting the distributed characteristics of the model, through the big data information fusion and carrier modulation method, the distortion modulation in the transmission process of the model is carried out. Select the m -dimensional feature vector to constitute the transmission test statistics of the online transmission model of student development information data, and get the statistical analysis matrix A ; that is, $A = (\varphi_1, \varphi_2, \dots, \varphi_n)$, $m < n$, get the tap interval of M/N , where M and N are integers, the subsequence of the online transmission model of student development information data is X_v , $v = 1, 2, \dots, V$, V is the number of tests, get $x' = \sum_{v=1}^V b'_v x_v$, and carry out the big data fusion and information feature extraction. The fuzzy correlation distribution matrix A of development information data online transmission model can be described by $m \times n$ matrix. For the $n + 1$ moment tap weight vector, the positive distribution set of student development information data online transmission model is obtained, which is represented by s_k^+ :

$$s_k^+ = \sum U + \cos y + \frac{S_t + G}{A}, \quad (1)$$

where s_k^+ is the positive distribution set of student development information data, A is the fuzzy correlation distribution matrix, U is the average, y is the individual, S_t is the information data get at time t , and G is the iterations.

Combined with the channel spread spectrum method, the steady-state error compensation is carried out by reducing the step size μ [11, 12, 15]. The distortion error and standard deviation are as follows:

$$l = s_k^+ + \sum_{s=1} c(s) + a_n(t), \quad (2)$$

$$v = h^y + \sum s + |\theta_0 + \Delta|.$$

Based on the Lorentzian convergence criterion [16, 17], the projection matrix A is established. According to the matrix A , the maximum eigenvalue λ_{\max} is calculated. According to the calculation results, the normalized eigenvector W is obtained:

$$AW = \lambda_{\max} W. \quad (3)$$

The normalization of convenient projection matrix, i.e., the weighted average value of incidence, γ_i , is used to describe the number of incidence degree, i.e., the incidence degree:

$$\gamma_i = \sum_{j=1}^m W_j \times \xi_i(j). \quad (4)$$

The higher the correlation γ_i degree, the higher the possibility of transforming two-dimensional variables into three-dimensional variables through projection matrix, and the stronger the convergence of normalized eigenvectors, which indicates that the online transmission model of student development information that can be obtained in this paper has stable convergence.

4. Distributed Collection Model of Student Development Information Based on Internet of Things Technology

4.1. Accuracy Optimization of Distributed Collection of Student Development Information. The distributed acquisition signal of students' development information is a symmetrical sinc function waveform, and its peak position will not move. Therefore, as long as the peak position is found, the students' development information can be obtained according to the time interval between transmitting and receiving signals. In order to further reduce the acquisition deviation and ensure the accuracy of the acquisition results, this paper uses the exponential function to modify the sinc function to improve the peak searching accuracy

$$S_e(x) = \int_0^x r(t)f(x-t)dt, \quad (5)$$

Among them,

$$r(x) = A \cdot \sin c(Bx), \quad (6)$$

$$f(x) = \begin{cases} \frac{1}{\tau'} e^{(-x/\tau')}, & x \geq 0, \\ 0, & x < 0, \end{cases} \quad (7)$$

$$\tau' = \sqrt{X - \sigma^2}, \quad (8)$$

$$X = W_d^2 g\left(\frac{rw}{lw}\right), \quad (9)$$

$$\sigma = \frac{W_d}{g(rw/lw)}, \quad (10)$$

where $r(x)$ is sinc function, in which t represents integral parameter variable, τ' is correction constant, $f(x)$ is attenuation function, W_d is the full width of peak value, asymmetric variable of left and right half width waveform, and σ is the standard deviation of sinc function.

According to the received echo asymmetry principle of the above hardware design, the correction function is described as follows:

$$f(t) = \begin{cases} \frac{1}{\tau'} e^{(t/\tau')}, & A_L > A_R, \\ \frac{1}{\tau'} e^{(-t/\tau')}, & A_L < A_R. \end{cases} \quad (11)$$

Among them, τ' is the correction constant, and A_L and A_R , respectively, represent the areas of left and right half peaks with τ_B as the echo peak point:

$$\begin{aligned} \sigma &= \Delta\tau_B, \\ W_d &= 2\Delta\tau_B, \end{aligned} \quad (12)$$

where $\Delta\tau_B$ is the bandwidth of the echo -3 dB. By introducing equation (12) into equations (8) to (10), the following relations can be obtained:

$$\tau' = \sqrt{X - \sigma^2} = \sqrt{W_d^2 g\left(\frac{rw}{lw}\right) - \sigma^2} = \sqrt{7}\Delta\tau_B. \quad (13)$$

The key to finding the accurate location of the peak lies in the original peak positioning and peak compensation correction. First of all, a new iterative signal $p(i)$ is obtained by accumulating the echoes of each frame according to the transmission time of the main wave. At the same time, the noise is removed from the signal, and the actual peak and the pseudo peak caused by noise are retained. The signal $c(i)$ is obtained by differential solution of the iterative signal $p(i)$. The point that conforms to the differential signal 0 is all the possible peak points. Setting the slope threshold can remove the false peak. Because the pseudo peak formed by noise also conforms to the condition that $c(i)$ is equal to 0, in order to remove the noise, the signal $c(i)$ needs to be processed by Gaussian filtering, and then the pseudo peak points with small amplitude in the signal are filtered and eliminated by using the critical value of amplitude. After the above steps, we can roughly determine the specific location of the wave crest. Next, the peak point compensation correction is carried out. According to the position of the wave crest, the signal is reconstructed by waveform, and the left half area A_L and the right half area A_R of the wave crest are calculated. At the same time, the size of the two parts is compared, and the two parts of the waveforms are corrected by exponential correction function $f(x)$. The specific operation is as follows: take τ_B as the center, calculate the area of the left and right half waveforms in turn, select the appropriate exponential function, and adopt waveform fitting correction, so as to obtain the corrected peak position τ_p .

4.2. Cost Reduction of Distributed Collection of Student Development Information. For the first mock exam, the daily cost includes operating cost and operation cost. The cost of the distributed collection model of student development information for one day is shown in formula (15)

$$\psi_n(x_n, x_{-n}, S_n) = C_n^e + C_n^g + C_n^{B,in} + C_n^{B,om} - C_n^s. \quad (14)$$

The interactive information between the distributed collection model of student development information and other information collection models is in the non-cooperative game relationship, which can be formed as follows:

$$\min_{x_n, S_n} = \psi_n(x_n, x_{-n}, S_n). \quad (15)$$

Considering the capacity limitation of the whole distributed acquisition platform, the whole distributed acquisition platform needs to meet the following constraints:

$$\begin{cases} S_n^{\min} \leq S_n \leq S_n^{\max}, \\ \text{So } c_n^h \leq S_n, \\ e_{Bn}^{ch} e_{Bn}^{dh} = 0, \\ e_{Bn}^{ch} \leq e_{Bn}^{c, \max}, \\ e_{Bn}^{dh} \leq e_{Bn}^{d, \max}. \end{cases} \quad (16)$$

Hessian matrix is a square matrix mainly composed of the second-order partial derivatives of multivariate functions:

$$\nabla_{x_n}^2(\psi_n) = \begin{bmatrix} \frac{\partial^2 \psi_n}{\partial x_n^1 \partial x_n^1} & \frac{\partial^2 \psi_n}{\partial x_n^1 \partial x_n^2} & \cdots & \frac{\partial^2 \psi_n}{\partial x_n^1 \partial x_n^H} \\ \frac{\partial^2 \psi_n}{\partial x_n^2 \partial x_n^1} & \frac{\partial^2 \psi_n}{\partial x_n^2 \partial x_n^2} & \cdots & \frac{\partial^2 \psi_n}{\partial x_n^2 \partial x_n^H} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\partial^2 \psi_n}{\partial x_n^H \partial x_n^1} & \frac{\partial^2 \psi_n}{\partial x_n^H \partial x_n^2} & \cdots & \frac{\partial^2 \psi_n}{\partial x_n^H \partial x_n^H} \end{bmatrix}. \quad (17)$$

Let $g(x_n)$ be the gradient function of $\psi_n(x_n, x_{-n}, S_n)$:

$$g(x_n) = \begin{bmatrix} \nabla x_n^1 \psi_n \\ \nabla x_n^2 \psi_n \\ \vdots \\ \nabla x_n^N \psi_n \end{bmatrix}. \quad (18)$$

On the basis of the above analysis, the establishment of non-cooperative game relationship and optimal capacity allocation can be transformed into a two-level optimization problem. The outer optimization mainly takes the storage capacity as the decision variable, while the inner optimization takes the user's energy consumption decision as the decision variable. In the following, particle swarm optimization and interior point method are used to solve the model:

- (1) The PSO parameters are defined.
- (2) The initial position and velocity of each particle are initialized.

(3) The IPM algorithm is implemented in the t th iteration.

- (a) Initialize the policy set
- (b) The optimal policy set in current state is obtained by corresponding formula
- (c) Repeat step (b) until the interactive information between the distributed information collection model and other information collection models is no longer changed
- (d) Return the optimal value of fitness function in the current state

(4) Suppose $F_n(p^m(t)) < F_n(p_{\text{pbest}}^m)$, then update $p_{\text{pbest}}^m = p^m(t)$.

Suppose $F_n(p^m(t)) < F_n(p_{\text{gbest}}^m)$, then update $p_{\text{gbest}}^m = p^m(t)$.

Assuming that the current iteration number is $t < T$, the position and velocity of particles are updated by the following formula; otherwise, skip to step (5):

$$\begin{aligned} v^m(t+1) &= \omega v^m + \rho_1 r_1 [p_{\text{pbest}}^m - p^m(t)] + \rho_2 r_2 [p_{\text{gbest}}^m - p^m(t)], \\ p^m(t+1) &= p^m(t) + v^m(t+1). \end{aligned} \quad (19)$$

(5) Output the final results of distributed collection of student development information.

5. Experiments

In order to test the practical application performance of the distributed collection model of students' development information, comparative experiments are carried out. Configuration parameters of test environment are shown in Table 1.

Under the parameter setting shown in Table 1, build the test environment, as shown in Figure 7.

In the test environment setup in Figure 4, the three distributed acquisition is taken as the standard, and the quantitative data of student development status provided in the final work summary report of a school is taken as the data sample, and it is set as the collected dataset of student development information. The model robustness index is measured by the time and power consumption of student development information processing. The processing time and power consumption of the model, literature [2], and document [3] are tested. The comparison results are shown in Table 2.

According to the analysis of Table 2, when the amount of information is the same, the working frequency of this model is higher than that of the comparison method, while the time consumption of student development information processing and the total energy consumption of equipment are lower than those of the method in references [2, 3]. Therefore, the model in this paper is stable and has high adaptability.

Because the application environment of the model is different and the degree of external interference is different, it is necessary to test the information

TABLE 1: Configuration parameters of test environment.

Serial number	Equipment name	Parameter
1	Software server	CentOS 7.3 operating system, Hadoop 5.1 architecture
2	Client	Windows 10 operating system, Google Chrome 67.0 software
3	Hardware server	CPU: Intel Xeon, ES 2680, 2.6 GHz, memory: 128 GB
4	Client	CPU: Intel Core, i5 3320 m, 2.6 GHz, memory: 8 GB
5	Database	MySQL 5.6
6	Server side framework	Play framework 3.1

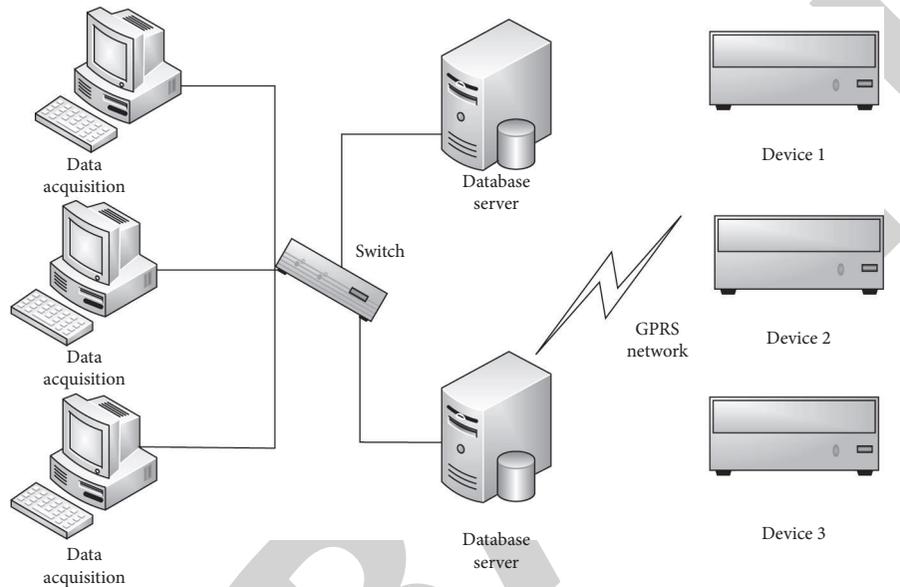


FIGURE 7: Test environment.

TABLE 2: Processing time and power consumption of three methods.

	Methods and indicators	Numerical value
Model of this paper	Working frequency of acquisition equipment/MHz	116
	Student development information processing time/MS	11
	Total power consumption of acquisition equipment/W	1.2
Methods of literature [2]	Working frequency of acquisition equipment/MHz	89
	Student development information processing time/MS	16
	Total power consumption of acquisition device	1.8
Methods of literature [3]	Working frequency of acquisition equipment/MHz	92
	Student development information processing time/MS	16
	Total power consumption of acquisition device	1.5

transmission ability of the model, the method in reference [2], and the method in reference [3] under different noise environments. The comparison results are shown in Table 3.

According to the analysis of Table 3, generally, the number of data transmission frames of the three methods gradually decreases with the increase of noise. The number of data transmission frames of the model in this paper is higher than that of the methods in literature [2] and literature [3], and the reduction amplitude is lower with the increase of noise. When the noise is 200 dB, the number of data transmission frames of the model in this paper is 345 frames/s, which is higher than that of the methods in literature [2] and literature [3], which are 134 frames/s and 278

frames/s, respectively. Therefore, the model in this paper is less affected by noise and has strong data transmission ability.

We test the methods proposed in this paper and compare them with the methods proposed in reference [2] and reference [3] on the application of student development information collection error; comparison results are shown in Figure 8.

According to the results of Figure 8, assuming there are 500 students' development information to be collected, the average collection error of this model has been controlled between 0.4 and 0.6, while the average error of the other two methods fluctuates greatly and has been higher than the model in this paper, which indicates that the model in this

TABLE 3: Data transmission in different noise environments.

Noise (db)	Text model (frame/s)	Reference [2] method (frame/s)	Reference [3] method (frame/s)
20	369	347	362
40	369	344	358
60	369	338	347
80	366	316	362
100	365	318	347
120	369	319	334
140	361	311	326
160	363	178	345
180	368	189	289
200	345	134	278

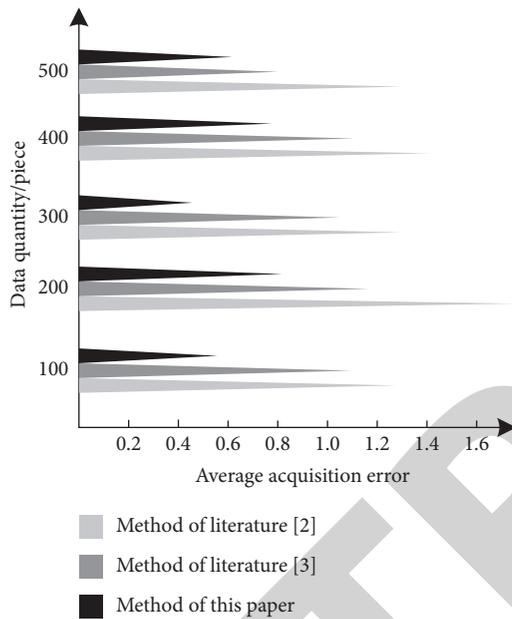


FIGURE 8: Average value of acquisition error.

paper has a higher collection accuracy for students' development information and can be applied in practice.

According to Figure 8, the performance of the average value of acquisition error between the proposed method and the method proposed in literature [2] is up to 43%, while it is 32% for literature [3]. So, we can draw that the proposed method has a better performance.

6. Conclusion

In view of many problems in the process of student development information collection, this paper proposes a distributed collection model design of student development information based on Internet of Things technology, which has significant advantages in collection accuracy and use cost. However, due to the integrity of experimental data sources and uncertainty of model constraints and other related factors, there are two problems to be solved.

- (1) Heterogeneous data sources: the heterogeneous data of this system mainly includes common Internet applications, but it is not comprehensive enough. For

example, WeChat, Netease microblog, and campus internal communication sites are not included in the scope of heterogeneous data collection. Therefore, in the follow-up work, we can expand the scope of collection and increase the accuracy of information management.

- (2) Distributed preprocessing performance: from the test data, we can see that the system has a large room for improvement, which is mainly limited by the I/O capacity of the file server, the single point processing capacity of the control node and the communication overhead. In the follow-up work, we can give priority to improving the I/O capacity of the file server in various ways.

In this paper, we focus on the important research direction of distributed collection model of student development information. Up to now, this research direction is very important, but the existing research results are relatively few and the performance is not able to meet the requirements. In addition, this paper puts forward the design of distributed collection model of students' developmental information based on Internet of Things technology.

According to the experiment, we can see that the performance of the distributed collection model of students' developmental information based on Internet of Things technology is much better than the other two schemes. The strategy proposed in this paper is based on the hardware design of students' developmental information distributed collection such as RF RC500F chip, TIMSP430 microprocessor, and interface in Internet of Things environment. Although the effectiveness of this method has been verified, the time complexity and space complexity of the algorithm need to be improved. In the future research, we need to further improve the performance of the algorithm.

Data Availability

The datasets used and/or analyzed during the current study are available from the author on reasonable request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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