

## *Retraction*

# **Retracted: Application of Edge Computing in Physical Education Teaching Management**

### **Wireless Communications and Mobile Computing**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets 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 own 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] D. Nie and Q. Yuan, "Application of Edge Computing in Physical Education Teaching Management," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 3719469, 8 pages, 2022.

## Research Article

# Application of Edge Computing in Physical Education Teaching Management

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In the traditional teaching mode, teachers have limited time and energy, but the emergence of AI technology-assisted teaching has greatly facilitated students and teachers. They can study and teach anytime and anywhere and can also solve the problem of lack of professional teachers or venues. With the continuous popularization of “Internet + education” technology, the teaching mode has changed, and online courses are gradually accepted by students regardless of time and geographical constraints. This article aims to study the optimization and application of the intelligent scheduling algorithm in the physical education management system based on blockchain technology. This article proposes a combination of Edge Computing technology and intelligent algorithm software and hardware to improve the current difficulties of domestic colleges and universities. The core content of integration, system functions, course scheduling algorithm, database, and other core contents are preliminary designed, hoping to provide ideas for the specific implementation of the college course scheduling system. The experimental results in this paper show that with the support of Edge Computing in solving the CSP problem, the efficiency of various algorithms is relatively high and comparable when the filling rate is less than 90%. However, when the filling rate exceeds 90%, the execution time of the IFS CBS algorithm is relatively longer, but it is generally acceptable. The algorithm and optimization strategy are also implemented, and the performance improvement of the algorithm is compared and analyzed through experiments, which proves the feasibility of the optimization strategy.

## 1. Introduction

Edge computing refers to the use of an open platform that integrates network, computing, storage, and application core capabilities on the side close to the source of objects or data to provide the most end-to-end services nearby. With the progress of society and the continuous popularization and development of computer technology, information has grown exponentially, and people's demand for information digitization is increasing. The information is digitized and then stored in the storage system, replacing paper information to make it easier to store, carry, and view. Therefore, Edge Computing technology is widely used, and it provides convenience for information access, review, and justice. In the school, we have classes every day, and each semester will have a corresponding timetable. However, there are many

courses in the school, and the time conflict is large. If manual scheduling is carried out, there will be many problems and heavy workload. But if we can apply the Edge Computing technology and intelligent algorithms to schedule physical education teaching, then we will save a lot of time and arrange the class schedule without making mistakes [1]. The main characteristics of the arranging activities are as follows: the constraint conditions are many and complicated, and there are multiple solutions. It is a natural combination of time and time (without conflict). The problem of arranging classes has been proved to be an optimal solution, a non-linear mathematical problem with multiple constraints. In college physical education classroom teaching, teachers should change the existing teaching concepts, combine artificial intelligence technology with it, promote practical development, improve the efficiency and quality of teaching

as a whole, and promote students' effective learning and physical and mental health.

Driven by the recent surge in interest in Edge Computing, Biktimirov MR's team recently studied a project model for Edge Computing storage of data. The project elaborated on the configuration and mathematical model of distributed Edge Computing data storage. Edge Computing is used to realize various information technology applications, as well as the needs of Edge Computing derived from its analysis and structural characteristics [2]. For this reason, some scholars have figured out whether Edge Computing technology can be applied to our physical education management system? CERD is an economically profitable shared remote access method that provides paid software for educational facilities. But this method is not suitable for ordinary schools and students, because it has high operation and maintenance costs, which is difficult for ordinary people to afford. Polezhaev P N believes that this architecture reflects the physical and logical structure of CERD and its components. The simulation model describes the simulation scheme and the generation and processing methods of user requests. Two intelligent scheduling algorithms have been implemented in the research: simulated annealing algorithm and genetic algorithm [3–5]. However, because of the cumbersome steps of this algorithm, the writing of the algorithm will become complicated.

Aiming at the problem of data insecurity and low data credibility in the college practical teaching management system, an implementation plan for the college practical teaching management system based on Edge Computing technology is proposed. In this program, technologies and tools such as Geth and Nethereum are used to combine centralization and decentralization, effectively realizing the credible and efficient operation of practical teaching activities in colleges and universities.

## 2. Research and Realization Method of Intelligent Course Scheduling Algorithm in Physical Education Management System Based on Edge Computing

*2.1. Development of Edge Computing.* There are three stages in the development of edge computing, one is edge reasoning, the other is edge training, and the third is edge learning. Broadly speaking, Edge Computing is a new application mode of computer technology such as distributed data storage, point-to-point transmission, consensus mechanism, and encryption algorithm. The current mainstream Edge Computing application development field is shown in Figure 1 [6, 7]:

*2.2. Research on the Algorithm of Intelligent Course Arrangement.* Edge AI is one of the most compelling new areas of AI, designed to allow people to run AI processes without worrying about privacy or slowdowns caused by data transfers. Genetic algorithm is a branch of evolutionary algorithm. The other branches of evolutionary algorithms are the evolutionary strategies proposed by Rechenberg and Schwefel in 1971 and 1975 [8]; the evolutionary programming proposed by Fogel et al. in 1966 [9]; and the

genetic programming proposed by Koza in 1990 [10]. Although there are many types of genetic algorithms, they are all inseparable from five elements: coding; generating initial populations; designing fitness functions and designing crossover and mutation operators; obtaining and screening offspring; and setting calculation parameters. The selection of the fitness function directly affects the convergence speed of the genetic algorithm and whether it can find the optimal solution, because the genetic algorithm basically does not use external information in the evolutionary search.

The traditional GA algorithm is described as follows:

- (1) Generate an initial population; the population after individual coding is  $P(t) = \{x_1, x_2, \dots, x_n\}$ , let  $t = 0$
- (2) Calculate the fitness of each individual in  $P(0)$ ;
- (3) Choose evolved parents
- (4) Generate offspring by crossover and mutation, and calculate the fitness of all offspring
- (5) Select the next generation group  $P(t + 1)$ , let  $t = t + 1$ , go to (3)

The genetic algorithm flow chart is shown in Figure 2:

## 3. System Design and Algorithm Research

*3.1. Software Architecture Design of Edge Computing Attestation System.* In the software engineering design, the modular application program makes each module of the application development focus on the current function without too much consideration of the entire system, which will simplify the development of the entire application [11]. However, modularization requires a good design to reduce the coupling between modules (W. Stevens, G. Myers, 1974). This design designs the software architecture as a three-tier organization, namely the bottom layer of the Ethermint blockchain and the blockchain Interactive SDK and upper application layer [12]. In addition, the storage system of this design uses html and JavaScript as the client language and go as the development language of the back-end server. The Edge Computing will provide two versions of the SDK for the client and server to use. At the same time, the private key used in the Edge Computing signature will be stored in the hands of the user. The server does not do any storage to ensure that the data is not centralized. The transaction initiated by any client will be broadcasted locally after being encrypted with the signature [13]. At the same time, in the development of the application layer, the front-end and back-end separation architecture will be used to construct the application, making each specific function more independent and facilitating software development and subsequent updates [14]. The software architecture design diagram of the Edge Computing certificate system is shown in Figure 3:

*3.2. Research on GA Algorithm in Arranging Courses.* Selection, crossover, and mutation are the three main operation operators of genetic algorithm; they constitute genetic

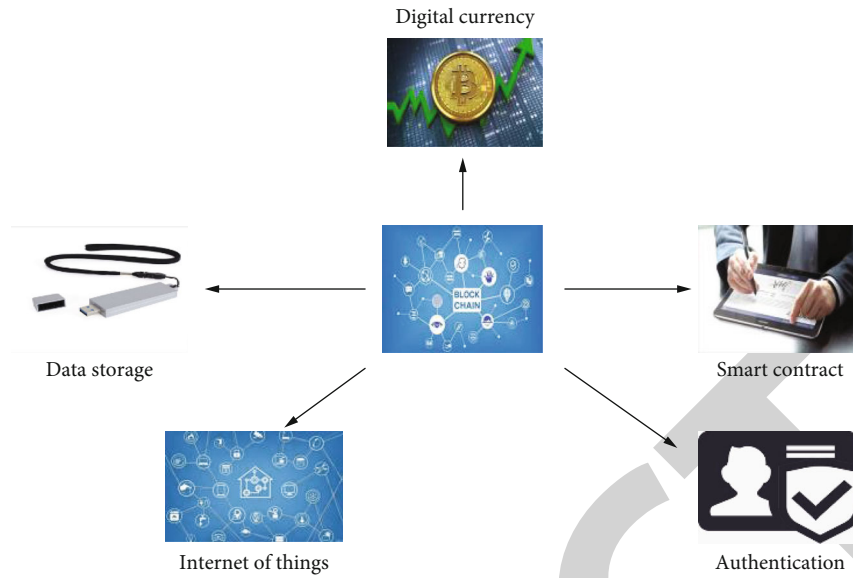


FIGURE 1: Mainstream Edge Computing application development field.

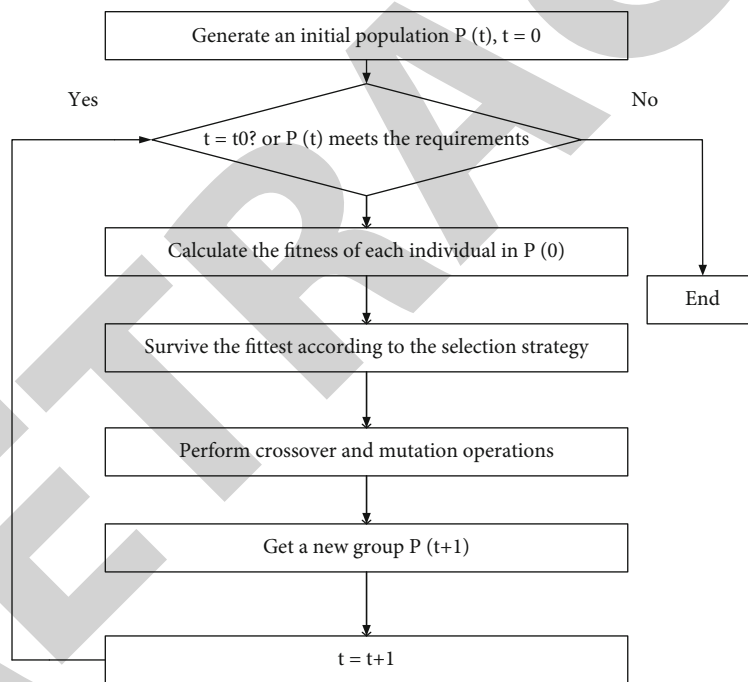


FIGURE 2: Flow chart of genetic algorithm.

operation, which makes genetic algorithm have the characteristics that other methods do not have. The priority list of teaching classes will be categorized according to the following characteristics of the course:

- (1) Constraints, parameters:  $\alpha$ ; strong constraints take precedence over weak constraints
- (2) Course category, parameter:  $\beta$ ; public basic courses have priority over professional courses
- (3) Course nature, parameters:  $\delta$ ; compulsory courses have priority over elective courses

- (4) Teacher gender, parameter:  $\omega$ ; female teachers have priority over male teachers
- (5) Teacher age, parameter:  $\theta$ ; older teachers have priority over younger teachers

Class scheduling priority:

$$Q = \alpha P1 + \beta P2 + \delta P3 + \omega P4 + \theta P5. \quad (1)$$

Genetic algorithm has been widely used in combinatorial optimization, machine learning, signal processing, adaptive

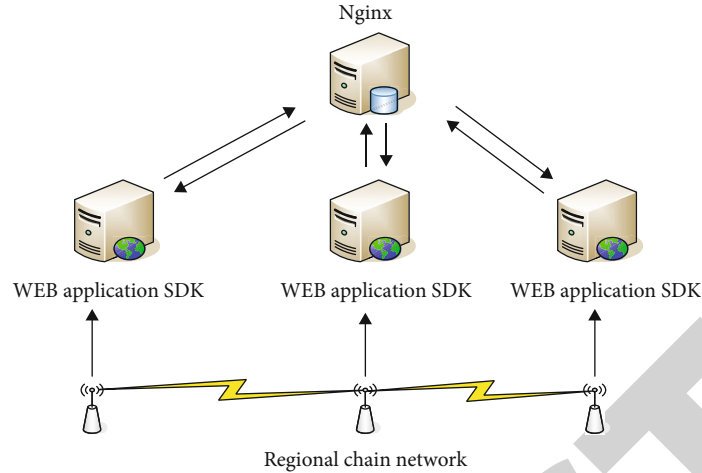


FIGURE 3: Edge Computing storage system software architecture design diagram.

control and artificial life, and other fields. Among the priority classification items, 1, 2, and 3 come from the teaching task table, and 4 and 5 come from the teacher information table. People generally take advantage of the characteristics of priority scheduling objects that are easier to occupy time and space resources to maximize the solution to the problems caused by the constraints. This kind of rapid convergence tends to tend to the local optimal solution for the scheduling solution. For the purpose of solving this problem, genetic algorithm is introduced.

GA coding is the first problem to be solved before using genetic algorithm calculation [15]. As a particularly critical step in the calculation of genetic algorithm, its method directly affects the operation method and algorithm efficiency of other genetic operators such as crossover operator and mutation operator. Regarding the choice of coding, researchers will design coding rules for different applications [16]. Since the course data is not a continuous function, in order to make the encoding and decoding operations simple and easy, this article uses character encoding. The chromosome model for arranging classes is shown in Table 1:

Now suppose that the chromosome is a  $5 \times 10 \times 20$ -bit binary code. The code indicates the arrangement of courses in chronological order. "1" means that it has been arranged, and "0" is the opposite. Taking the course in chart 1 as an example, we can directly write the chromosome code of the class. The solution of the class schedule is a 1000-digit binary number, where the first 10 digits represent the class situation on the 15th and Monday of the first week, 11-20 digits indicate the class situation on the first week and Tuesday, and so on, and the 51-60 digits represent classes on Monday of the second week. It is not difficult to see from the above examples that such coding has the following problems in practical applications [17]:

- (1) The encoding is too long, which reduces the decoding and calculation efficiency
- (2) There are a lot of repeated values in the unit of teaching week

Edge AI means running AI algorithms locally on edge AI computers close to the source of the data the algorithm is processing. In the process of teaching implementation, a course in the same class is often only taught once in a day, and two or more courses can be regarded as an unreasonable lesson scheduling plan. In view of this characteristic of course arrangement, we write all possible course arrangement plans in a day into the course arrangement code comparison table, as shown in Table 2:

At the same time, in order to meet the scheduling needs of special courses, this form allows users to customize the schedule. If  $B = 1100000011$ , it means that the plan B is for a certain course to have classes 1-2 in the morning and 9-10 in the evening.

**3.3. Application of Time Scheduling in Course Arrangement Algorithm.** The scheduling algorithm refers to the resource allocation algorithm specified by the resource allocation strategy of the system. For different systems and system goals, different scheduling algorithms are usually used. Time scheduling problem is a kind of multirestricted resource scheduling combination optimization problem. The departure and arrival schedules of aviation and railway are all related to this [18].

**Definition 1 (Time collection).** In the course of arranging the course, the time interval of the course arrangement is in order, and the time sequence is also clear:

$$I = \{t_1, t_2, t_3 \dots \dots t_n\}. \quad (2)$$

**Definition 2 (Spatial collection).** In the course of arranging classes, it is clear where the class is required when necessary, but there is no certain sequence of class locations:

$$J = \{p_1, p_2, p_3 \dots \dots p_n\}. \quad (3)$$

**Definition 3 (Resource set).** Time set and space set are two dimensions that can generate courses. Therefore, generally speaking, the available range of curriculum arrangement is

TABLE 1: Chromosome model of arrangement course.

(a)													
Class number	Priority	...	...	1	2	3	4	5	...	14	15	16	...
(b)													
	Mon	Tue	Wed	Thu	Fri								
1	1	0	0	0	0								
2	1	0	0	0	0								
3	0	0	0	1	0								
4	0	0	0	1	0								
5	0	0	0	0	0								
6	0	0	0	0	0								
7	0	0	0	0	0								
8	0	0	0	0	0								
9	0	0	0	0	0								
10	0	0	0	0	0								

TABLE 2: Chromosome arranging plan table.

Serial number	Chromosome coding	Binary code
1	0	0000000000
2	1	1100000000
3	2	1110000000
4	3	0011000000
5	4	0111000000
6	5	0000110000
7	6	0000111000
8	7	0000001100
9	8	0000011100
10	9	0000000011
11	A	User-defined coding
12	B	User-defined coding
...	...	...

the Cartesian product of the two sets [19], denoted as

$$K = \{r_1, r_2, r_3, \dots, r_n\}, K = I \times J. \quad (4)$$

The time scheduling problem can be divided into scheduling some events to occur in a specific time and space. In this process, the event is constrained by issues such as resources, time and space, and the nature of the event. Finally, an algorithm is used to make the discharged results meet various constraints.

**3.4. Application of Minimum Disturbance and Optimal Solution in Course Arrangement Algorithm.** The minimum disturbance problem is that the corresponding solution that satisfies the constraints has been found for the class scheduling problem, but the previous constraints have changed, or other constraints have been added, resulting in the original

solution no longer satisfying the constraints, in the generalized minimum disturbance problem definition [20]:

$$\gamma = (K, K', F, \alpha). \quad (5)$$

Among them,  $\kappa, \kappa'$  are two constraint satisfaction problems, where  $\kappa$  is the initial problem and  $\kappa'$  is the problem after the constraint changes.  $F$  is the corresponding relationship between the solutions of the two problems after the change.  $\alpha$  is the initial compatible allocation of the initial problem  $\kappa$ .

In our actual arranging work, what we often want is not the best timetable, but a good enough timetable, as long as it can meet the actual work situation of the school. Usually when we solve the problem of scheduling, we use a four-tuple function to evaluate the quality of the solution [21]:

$$\beta = (W, E, R, T). \quad (6)$$

Disturbance penalty without initial cost:

$$g(\tau) = \sum \{m(v, a, b) | v \in \Pi(\gamma, \beta)\}. \quad (7)$$

The optimization problem of minimum disturbance can be described by the following formula:

$$\lambda = (k, k', F, a, g, \omega_g), \quad (8)$$

where  $k = (W, E, R, T)$  and  $a$  is a (local) initial allocation of  $k$ , which is the maximum compatible allocation [22].

The initial distribution and  $k$  are measured, and the sum of the penalty perturbation changes occurs.

For a MPOP  $\lambda = (k, k', F, a, g, \omega_g)$  and  $\beta' = (V', D', C', f')$ , his solution is a CSP  $(W', E')$ , the (local) maximum compatible distribution  $\theta$  of  $R'$  that makes the objective evaluation function obtain an extreme value or tend to an extreme

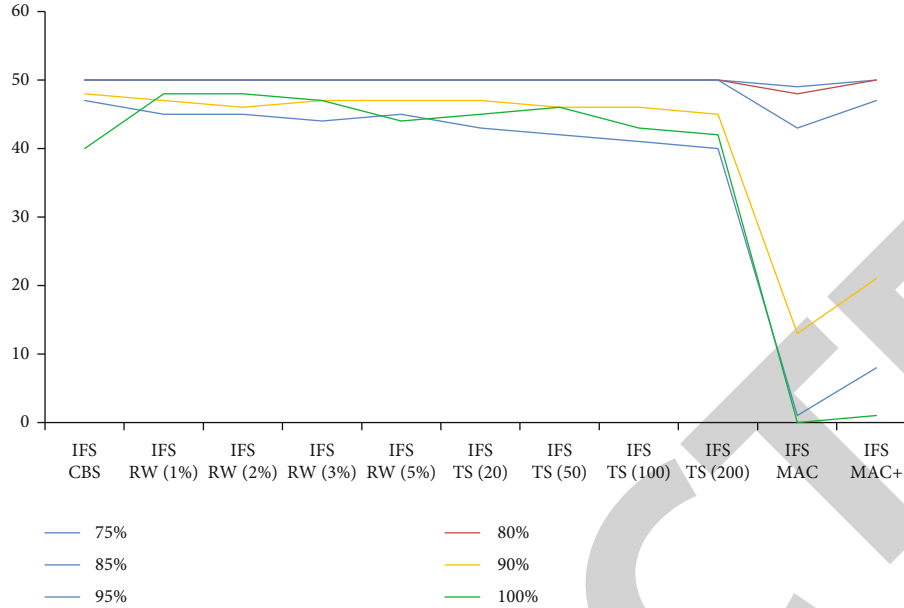


FIGURE 4: Comparison of problem-solving capabilities of various algorithms.

value. In this case, the problem of the minimum perturbation optimal solution is simplified to the optimal solution problem [23–25].

## 4. Experimental Results

**4.1. Comparative Analysis of Scheduling Algorithms.** Every time a subalgorithm is called, the result is also the input parameter. Therefore, if you are not satisfied with the result of automatic course scheduling, you need to delete the unsatisfied schedule plan and proceed from the beginning. After all the algorithm calls are completed, the whole process can regain a new solution to the course. Neither MAC nor FC can solve any problem instances. The variables arranged in the DBT MAC algorithm account for 90.6%, 89.9%, 84.5%, 84.5%, 83.3%, and 81.68% of the total variables, respectively. The filling rates of the corresponding positions are 75%, 80%, 85%, 90%, 95%, and 100%, respectively. Under the overall circumstances, IFS CBS has shown relatively obvious problem-solving ability in solving random two-dimensional constraint problems and random placement problems. In terms of the execution efficiency of solving the CSP problem, when the filling rate is less than 90%, the efficiency of various algorithms is relatively high and comparable, but when the filling rate exceeds 90%, the IFS CBS algorithm execution time is relatively long, but overall it is acceptable [26, 27].

**4.2. Random Placement Experiment Analysis in the Scheduling Algorithm.** Random placement problem is to place randomly generated objects in a space that is greater than or equal to the space size of these objects. This problem is an abstraction of the scheduling problem. There can be the following correspondence: the object is equivalent to the course of the scheduled course, the  $x$ -quadrant is equivalent to the time dimension of the course, and the  $y$ -quadrant is

equivalent to the classroom dimension of the course. When a course requires three lessons to be connected, it is recorded as  $3 \times 1$ .

A total of 50 questions are included in the experiment, and each question contains 200 lectures. These courses can fill 75%, 80%, 85%, and 100% of the entire spatial domain. The situation in the question is as follows: Two-linked classrooms accounted for 80.4% of all courses, three-linked classrooms accounted for 16.6% of all courses, four-linked classrooms accounted for 2.6% of all courses, and six-linked classrooms accounted for 0.4% of all courses [28, 29]. Because the problem is generated by a random algorithm, the higher the fill rate, the more likely it is that there is no solution due to excessive constraints. The ability of various algorithms to solve problems is shown in Figure 4:

## 5. Conclusions

As our country pays more and more attention to education, school teaching arrangements are also facing more challenges. Under the specific conditions of limited teaching resources, how to customize a personalized teaching plan largely depends on the arrangement of the class schedule. The core of the arranging system lies in the arranging algorithm, the degree of adaptation of the algorithm, the operating efficiency, etc., which directly determine the pros and cons of the arranging system. Based on Edge Computing, this article has made certain improvements to the existing physical education management system scheduling problem, effectively integrating the fragmented physical education scheduling record information into a system, and avoiding the tampering of the centralized system possible and high cost of stable operation. At the same time, the introduction of intelligent class scheduling GA algorithm to sort out and integrate the accurate information of class scheduling will make the class information of all teachers in the school

become clearer and clearer, and the class scheduling tasks of the Academic Affairs Office will also become more clear, simple, and efficient. The overall design of the functional modules of the system's deposit business system is carried out. After detailed requirements for the system were carried out, each module was further designed in detail. The main modules include user module, deposit certificate module, announcement module, block information module, and institution evaluation module. This paper proposes related optimization ideas based on GA genetic algorithm and verifies the correctness of the optimization ideas, but there are still shortcomings in work. Although the algorithm has achieved improvements in adaptability and execution efficiency, there are still optimizations. Space, after obtaining a feasible solution, it is necessary to provide the corresponding algorithm to optimize the feasible solution to obtain the optimal solution, so that the discharged courses are more in line with domestic usage habits.

### Data Availability

No data were used to support this study.

### Conflicts of Interest

The authors state that this article has no conflict of interest.

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