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Research article

Design of a control mechanism for the educational management automation system under the Internet of Things environment

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Abstract: Since the entrance of the Internet era, management automation has been an inevitable tendency in many areas. Especially, the great progress of Internet of Things (IoT) in recent years has provided more convenience for basic data integration. This also boosts the development of various management automation systems. In this context, this paper takes physical education as the object, and proposes the design of a control mechanism for educational management automation systems under the IoT environment. First, a description with respect to the overall design, detailed design, and database design is given. In addition, a low-consumption flow table batch update mechanism is studied, which packages and distributes the update rules of all nodes to be updated, in order to reduce the communication consumption between the controller and nodes. The results show that the education management automation of the college gymnasium can be well realized by using the optimization control mechanism. It cannot only make reasonable adjustments to college sports resource data, basic equipment, etc., but also improves the quality of resource management of college physical education courses to ensure that college sports resources can be used in all aspects, and further improves the operating efficiency of the sports management system. The automation technology design of the college sports management system can improve the efficiency of college sports management by more than 20%, so as to ensure the comprehensive development of students in physical education courses and promote the rapid improvement of college management level.

Keywords: optimal control; automation management system; Internet of Things; database design; smart education

1. Introduction

Although intelligent information platforms have been introduced in many universities today, there is still a gap in the annual project of sports day, and many universities still use manual printing of forms to record information, which is redundant and the process is not only inefficient and error-prone but also wastes a lot of resources [1]. With the booming development of 5G technology and mobile internet, the use of digital intelligence technology can better serve students and teachers, and ensure transparency, openness and fairness in the process of holding sports events [2]. Simplifying the workflow, and, thus, increasing the participation of students and teachers in campus events gives the research work of this system a very profound relevance. Today, information technology plays an irreplaceable role in all sectors and fields of our time. Similarly, information management systems are fully utilized in areas of different sizes, natures and types. The university sports hall is an integral part of the teaching infrastructure of higher education institutions, and occupies a very important place in the university infrastructure. Its most basic function is to safeguard the physical and mental health of school students and teachers [3]. At the same time, university sports venues are places for sports teaching, student training, off-campus personnel exercise and enterprises holding competitions. At present, many university sports venues are only open to students, teachers and staff, and if people from outside the university need to borrow sports venues, they must fill in paper application documents, which is a tedious process [4]. To meet the development of the times, it is necessary to increase the usage rate of university sports venues. Therefore, university sports venues need to be reformed and open to social groups, so that they can make the greatest contribution to the school and society [5].

Automation technology design is the most commonly used equipment in the use of college sports management system, and is the application server and database server. According to the actual situation of each college, the number of application servers is 4 and the number of databases is 2. Based on these, some other network hardware devices are also required [6]. Under normal circumstances, in the automation technology design of the college sports management system, the automation platform is usually constructed using a three-layer model, so as to ensure that the internal data management of the system can be realized [7]. At the same time, the automation technology design college sports management system also includes five modules: teaching research management, educational affairs activity management, practical teaching management, teaching basic resource management and teaching quality management [8]. The day-to-day management of university sports venues is complicated, and it requires accurate data recording, timely data updating and a variety of different data statistics. At present, the management of most university stadiums, and many enterprises across the country, is gradually shifting from traditional staff management to advanced information management [9]. Traditional management methods face some insurmountable problems, such as difficulty in management, uncertain real-life conflicts, rental and return of sports equipment, maintenance and inefficient management. However, the information-based management method has advantages, such as high efficiency, low cost and low error rate [10]. As such, it is the trend of the future. The use of information technology to manage sports halls enables the scientific and reasonable allocation of resources in sports halls, and allows students of all school grades to exercise according to their preferences [11]. These advantages can make up for the shortcomings of the traditional information technology system, but how to connect the modern information technology system with the current teaching system and apply it to the current physical education teaching management requires constant analysis and construction of the information technology system, while discovering the shortcomings of information technology teaching management in the process of application and proposing improvements [12].

The main requirements for colleges and universities to automate the design of sports management are manifested in the following aspects: First, the automation technology design of college sports management systems can implement the maintenance of sports equipment [13]. Second, the design of the college sports management system with automation technology can ensure the quality of college sports management, optimize sports management and create a good learning atmosphere for college students. Finally, the use of this system can meet the actual needs of sports management in colleges and universities, so as to better improve the sports management of teachers and students in the school. This is a process of development and adaptation, and the future of information-based education will be directly affected by these problems. The information technology is then integrated into the teaching management of the PE course, which will contribute to the management of PE teaching [14]. The public PE course takes up a large part of the management of PE teaching, and the management of public PE results from teachers and the management of public PE courses, by teaching staff, takes a lot of time and energy. The strength of the invigilation system is one of the influencing factors in determining the teaching tasks and teaching levels. A good invigilation system can effectively ensure the orderly development of teaching work, and enable teaching staff to complete their work tasks efficiently [15]. As the management of college stadiums in the new era presents many shortcomings and defects, this paper puts forward ideas and solutions for improvement and uses Internet technology to design an information-based college stadium management system, absorbing the advantages of past college stadium management, and using information technology to upgrade the existing system in all aspects, meeting the needs of students, teachers and the surrounding residents, and building an efficient modern and intelligent stadium software management system.

2. Related work

The Scottish Government has built a Scottish Sports City based on the needs of the local population for sporting activities and its economic development, hired professional software developers to design and develop a sports stadium website, used information technology to manage the sports city online, published real-time information about the sports stadium on the webpage promptly, allowing more people to use sports resources and carried out the original scale of the expansion, allowing the stadium to be used efficiently, thus increasing the utilization rate of the venue, while the stadium system also facilitates the work of the management staff and improves the efficiency of management work [16]. The control technology associated with controller nodes has been a hot topic of research in the field, including distributed control, security control, and deployment control. To improve the scalability, robustness and availability of the control layer, distributed multi-controller is the current mainstream control layer implementation, which involves some interface, state consistency synchronization and other control technologies [17]. The two main research ideas for security control are security controller design and security module development [18]. As there is little difference between the needs of traditional networks and the IoT for distributed implementation, and security at the control layer, the two original control technologies can be slightly modified or directly applied to the IoT environment [19].

After a series of in-depth analyses, Zhou et al. concluded that, to solve these problems in a meaningful way, a fitness prescription based on an individual's real-life situation is needed, which means that the right amount of exercise is needed to achieve good results [20]. To obtain clear data on the possible effects of insufficient exercise on the human body, Wang et al. used his knowledge of exercise physiology courses and a wide range of equipment to conduct extensive experiments on several test volunteers to obtain clear data on the effects of insufficient exercise on the human body, and, based on this data, Cooper developed the classical aerobic training method [21]. Habibzadeh et al. analyze the physiological characteristics of the "obese" and "elderly" groups by analyzing the impact of health management on the obese elderly group, and formulating corresponding exercise routines [22]. The results of the exercise routines were measured by measuring changes in body composition, physical health indicators and sleep quality to verify the effectiveness of the health management application [23]. Tabassum et al. demonstrated the health-promoting effects of exercise through traditional gong interventions on chronic diseases in the elderly [24]. Song et al. organized health exercises for pregnant women with anxiety. The results of the study showed that appropriate exercise has a facilitating effect on relieving anxiety [25].

With the diversification of teaching levels in universities, the continuous expansion of teaching scale, the construction of multiple campuses, teaching reform and the continuous promotion of informatization campus construction, higher requirements are now put forward for the existing teaching information system, and the enhancement of the performance of the teaching information system and the continuous updating of the system have become urgent problems. However, due to the backwardness of the overall informatization degree, the shortage of funds and the obvious lack of theoretical construction of the system compared with foreign countries, the teaching affairs management system of the university has a large gap with foreign teaching affairs information system in terms of work scope, work quality and work performance.

3. Optimal control technology for automated systems

In multi-intelligence systems, graph theory is widely used as an important theory because the information is transferred between the individual intelligence via a network. The way the network is configured and arranged, and the interrelationships between the nodes are graphically represented by network topology diagrams. The idea of event-triggered sampling and control based on event triggering, stems from an implementation problem, and how we can control continuous-time systems using digital controllers. In order to evaluate the design, it is necessary to construct an evaluation function, including the design variables, that is, the objective of optimization, called the objective function. In the optimization process, the value is continuously improved by changing the design variables, and, finally, the value of x that makes the best or most satisfactory value is obtained. In the construction of the objective function, it should be noted that the objective function must contain all design variables. The objective function is generally represented by the minimum value, that is, if the maximum value of the objective function is to be obtained, it is generally converted into a minimum value problem, so both maximization and minimization can be uniformly expressed as seeking the minimum. The current standard approach is simply to have the digital controller act periodically. Although the idea of non-periodic sampling and control was proposed a long time ago, initially, some scholars believed that periodic sampling and control was the only way to achieve feedback control on digital systems. However, real systems usually cannot acquire samples at a precise operating frequency [26]. As a result, there have been many different criteria and approaches to thinking about acyclic sampling and control, and analyzing stability. For example, acyclic sampling can be modeled as a specific time lag system, and the same system can be modeled as a hybrid system with impulse dynamics. Another option is to derive an input/output relationship to investigate the effect of acyclic sampling on the output, which is common in robust control. Furthermore, the main question of interest is how fast the system needs to be sampled to ensure stability.

However, if we only have one remote sensor, and the sensor data must be transmitted back to the actuator via a wireless channel, this may be impractical, especially if that wireless channel must be shared between other devices. In this case, controlling the behavior of the updates is resource management that must be efficient. Due to the increasing popularity of information-physical systems, particularly in networked systems, the need for inherently tight coupling between physical processes (e.g., sampling, driving, motion) and networked processes (e.g., communication, computation, storage) expresses the need to deploy such systems more effectively by treating things, such as wireless communication or computation, as resources rather than taking them for granted. The idea of event-triggered control is as follows: instead of constantly updating the input u to k(x), use the sampled state $k(x)$ to take it as x_t. The advantage of this is that there is no need to continuously update the input while still ensuring the stability of the equilibrium point. How, then, to determine when the sampled state needs to be updated, the closed-loop system can be expressed as:

$$x = F(x, k(x_t)) \tag{1}$$

In other words, the control signal u(t) is only updated at the discrete-time kt, and the control input is kept constant between events. The aim is to design specific event conditions, so that the closed-loop system still converges to the desired state. With D, V and k satisfying the conditions, V can be designed in the form of:

$$V \geq \nabla V(x)F(x, k(x_t)) - D(x)\|e\| \tag{2}$$

For some function D(x) with non-negative values, where $k(e) = xt - x$, is the error between the sampled state and the actual state? The first term of the derivative in Eq. (2) is negative, while the second term is 0 when the sampled state is the same as the actual value (i.e., e = 0.) To ensure that $V > 0$, a trigger condition can be devised that states that the sampled state should be updated whenever the first and second terms are equal in magnitude. This is designed via a so-called trigger function or event trigger $f(e, p)$, which measures whether a given combination of state x and error e should trigger an event. This condition can be defined as:

$$f(e, p) = d(e) + \hbar(p^2) \tag{3}$$

As the core network entity in the control layer of the software-defined IoT, the control architecture, deployment location and coverage of the controller nodes have an important impact on the control performance of the whole network. In IoT application scenarios, such as smart buildings, smart cities and smart transportation, most research work deploys Software Defined Networking-supported Internet of Things (SDN-IoT) as a support platform in remote cloud servers or edge gateways. Figure 1 shows when the SDN-IoT controller is deployed in an edge gateway of an IoT sub-domain. This single centralized software-defined IoT control architecture performs poorly in terms of link overhead, fault tolerance and hardware complexity, especially when the network size or service load is large; when the SDN-IoT controller is deployed in a remote cloud server, this software-defined IoT control architecture has node control latency, event responsiveness. When the SDN-IoT controller is deployed in the cloud server and edge gateway nodes to form a distributed control architecture, it can improve the overall network control performance, but because the control logic is still located above the gateway, there is limited improvement in the control performance of the IoT device nodes in the sub-domain.

The three metrics in the criterion layer are characterized by ambiguity and uncertainty. In addition, there is no absolute measure of the importance of the evaluation of IoT nodes in many cases. To solve this problem, this paper uses fuzzy measures to describe the degree of interaction between indicators: A fuzzy measure is used instead of one-layer indicator weights, while Coquet fuzzy integrals are introduced as a combination operator for the criterion layer factors to accurately represent the correlation between indicators. For the influence factors in the second-tier indicators, the AHP method was used to determine the respective weight parameters, as they have a high degree of independence [27]. The indicator score values are calculated by the number of devices, services or users corresponding to the IoT nodes.

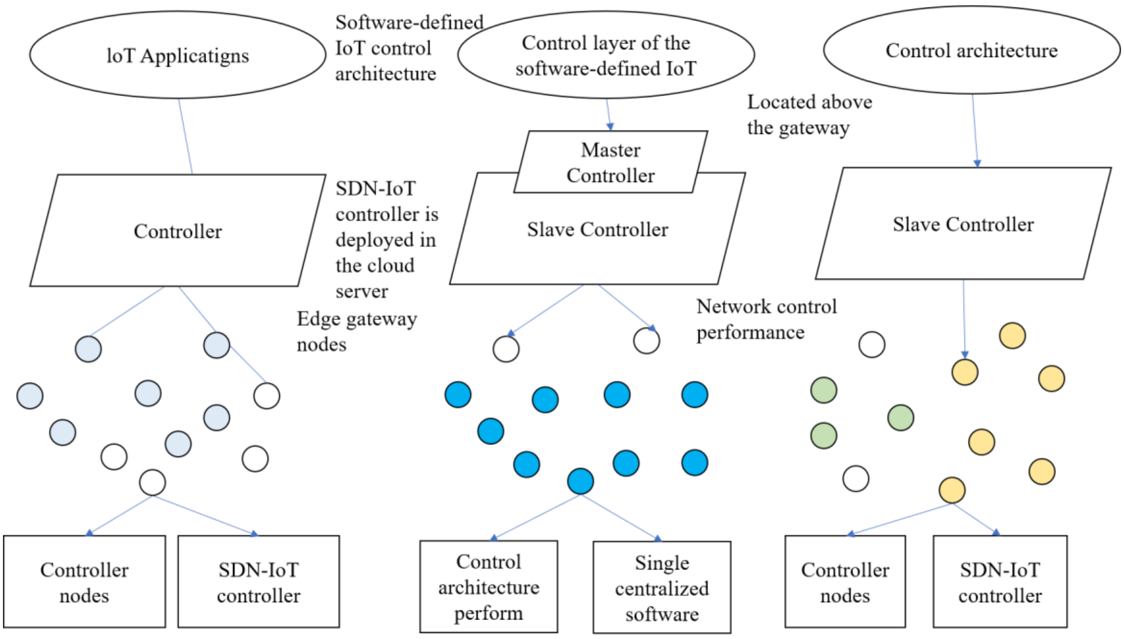

Figure 1. This is the illustration for workflow of the centralized versus hierarchical SDN-IoT network control layer.

After obtaining the judgment matrix, a one-off test is required to avoid conflicting situations due to the ambiguity of the judgment, but when the scale of the assessment is large, this can result in a large computational effort. In this paper, the judgment matrix that does not meet the consistency requirements is processed with the help of the optimal transfer matrix to reduce the computational complexity of consistency verification with the following adjustment:

$$b_{ij}^{'} = e^{\frac{1}{m}\sum_{k=1}^{m} lg\frac{b_i^k}{b_j^k}} \tag{4}$$

The original BPSO algorithm uses a sigmoid function to convert the particle velocity to the probability of the current position, being 1, while the proposed position update method directly sets the position with the maximum velocity to 1 and assigns the other positions to 0. Therefore, this method not only conforms to the original particle position update principle, but also ensures the corresponding constraints.

Automation technology plays an important role in college sports management, and directly affects the efficiency of college sports management. Therefore, all colleges and universities need to actively play the role of automation technology in sports management, and innovate school sports management methods according to automation technology, physical education and other aspects to improve the sports management ability of colleges and universities, and promote the rapid development of colleges and universities. Insufficient local search is an inherent flaw of the original BPSO algorithm, which reduces the possibility of convergence to the optimal solution. Mathematics courses usually expand the axiom department of mathematics, that is, expand the starting point of logical reasoning and increase the basis of logical reasoning. The expanded axiom department is no longer independent and not strict. This reduces the difficulty of mathematical knowledge reasoning, and makes it more possible for the same mathematical conclusion to produce different proofs. People always hope for the stricter and more complete mathematics. The velocity inertia weight, w, in Equation (5) can dynamically adjust the search speed of the particles. When w is large, the particles tend to search for the global optimal solution; when w is small, a more adequate local search will be performed. w is commonly updated by a linear decreasing method, as shown below:

$$w = w(wmin_{max} * T/t)_{max} \tag{5}$$

Often in practice, communication delays may be more complex time-varying delays due to the different environments in which the intelligence is located. Next, we investigate the mean-square bounded consistency of a multi-intelligent system with time-varying communication delays, as shown in Table 1.

Table 1. Multi-objective most-and-good control algorithm.

Input	w_{max}, w_{min},T,t
1	Initialize T, Na, M.Sc.
2	Initialize the particle swarm according to the method in SCPPSO
3	Calculate the fitness of each particle
4	Set archive to xx for the non-dominated solutions of f
5	Guest, best are arbitrary values of archive
6	Update inertia weights using equation (4)
7	Use formula (5) to update the velocity of the jth dimension in the particle
Output	w

When each service starts, it will report its network location to the service discovery center. At the service discovery center, there will be a service registry, which is the core part of service discovery and contains the network address database of all service instances [28]. The service discovery client periodically synchronizes the service registry from the service discovery center and caches it to the client. When a service needs to be requested, the service instance uses the registry to locate the network address of the target service. If the target service has multiple network addresses, a load-balancing algorithm is used to select one of the multiple service instances and issue the request. The impact of unstable resources on other resources is reduced by limiting the number of concurrent threads. This has no loss of thread switching, and no need to pre-allocate the size of the thread pool, as the immediate impact on the resource is a gradual accumulation of thread counts. When the number of threads on a particular resource accumulates to a certain number, new requests for that resource will be rejected. Accumulated threads will continue to accept requests after they have completed their tasks.

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4. Design of the university sports management automation system

The purpose of the functional requirements analysis is to provide a detailed description of the functions that the system needs to meet to facilitate the design and implementation of the system. The system can be divided into two modules: back-end data management and user management. The back-end data management module includes classical prescription management, health assessment test data management and personalized exercise prescription management, and the following requirements analysis is conducted for the user management module and the back-end data management module respectively: According to the different permission levels of the roles in the exercise prescription management system, the roles of administrator, doctor and general user are used to divide the system, and the user becomes a general user after registering for the first time. The doctor user needs to be authorized by the administrator, and can perform classic routine management operations, enter health test information for the user, generate health assessment reports for the user and issue personalized exercise routines. The administrator has a higher level of authority than the doctor, and can add doctor users to the system, as well as view, edit and delete information for all users.

Health management services include self-management, which is driven by internal motivation, and social management, which involves intervention by external forces. Health self-management is the self-correction of bad behavior and lifestyles that occur in everyday life, thus preventing the emergence of health risk factors to improve the health of the organism, with an emphasis on self-management and active participation. The health social management system is designed to maintain health by recommending personalized exercise programs for healthy and sub-healthy people, increasing physical activity time through supervision and monitoring, and developing a lifelong awareness of physical activity. Health social management can help university students to carry out health self-health management more effectively, and health self-health management is the guarantee of health social management, so the two are mutually reinforcing. This paper uses modern technology, such as mobile phones and the Internet, to understand the health status of users, formulate management plans for them and implement measures to monitor and give feedback on the implementation of the plans to help health self-management, thus achieving the purpose of maintaining health status and enhancing health level, as shown in Figure 2.

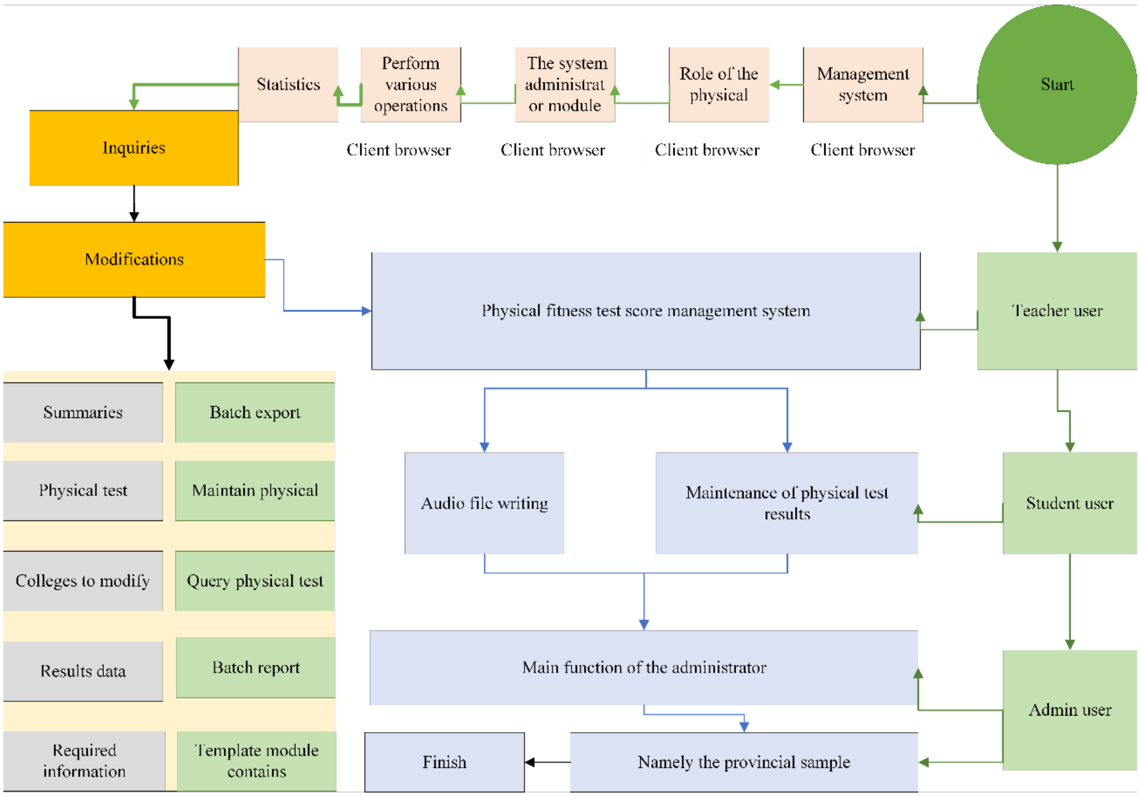

Figure 2. This is the flowchart to illustrate main system function modules.

The health management system is more far-reaching, with the concept of lifelong sport running throughout the health management system. Health self-management is the basis for users to develop health management habits, and the sports health management system designed in this paper provides a practical tool for university students to carry out health self-management. The health management service system can update the content of exercise prescriptions according to the current health status and behavioral habits of users, effectively encouraging them to actively participate in sports, increasing their participation in sports and realizing the transformation from passive to active exercises. In the option recommendation process, for people who are healthy and not interested in sports, sports will be recommended to them based on indicators, such as physical fitness, and by strengthening the sense of achievement in the process of sports and stimulate interest in sports; for people in a sub-healthy state, sports will be recommended to them based on abnormal indicators in the psychological, social and physical health information, and in the process of participating in sports to improve the sub-healthy state [31]. The program is designed to improve the state of health and to stimulate an interest in exercise over and over again.

The main function of the administrator module is the maintenance of physical test results. The system administrator module is the core role of the physical test results management system, and can perform various operations, such as statistics, inquiries, modifications, summaries and batch exports of physical test results. You can maintain physical test results for all colleges, select the colleges to modify, add and query physical test results data, and batch report or batch export the required information. The PE results template module contains 6 sub-modules, namely the provincial sample test student list module, the non-selected student list module, the statistical pass rate list module, the total number of students per teacher list module, the provincial sample test statistics list module and the provincial sample test student results module. After logging into the system, the administrator can view the corresponding PE results templates according to their needs, and can print, export and email the results, which greatly facilitates the teaching and learning process. There are seven sub-modules in the physical test export template module, including the basic class information template module, the environmental test information template module, the physical test result export template module, the basic student information template module, the student source information table module, the Zhejiang Province exempt student information module and the export template module by grade. The administrator can filter and view the various categories of information templates as required, after logging into the system and can export, print or email the required documents, greatly improving the statistical management of PE teaching, as shown in Table 2.

Table 2. Basic student information table.

Field name	Field notes	Field type	Field length	Is it allowed to be empty	Primary key
Stu_xh	Student number	String	64	No	Yes
Stu_xm	Student name	String	64	No	No
Stu_xb	Student sex	String	64	No	Yes
stu_xy	College	String	64	No	Yes
Stu_zymc	Professional title	String	64	No	Yes
Stu_xn	School year	String	64	No	Yes
Stu_xq	Semester	String	64	No	No

The PE teacher allocation module contains three sub-modules, namely the PE teacher allocation fill-in form module, the modified teacher allocation results module and the allocation results from the module. The main interface of the system will automatically display classes that have not been allocated a PE teacher to avoid omissions. The administrator can also modify the allocation filling form, which is highly operable, and the final allocation result of the PE teacher will be displayed in a form that can be queried and called. The main task is to carry out the overall design of the system development, including the design of the functional modules, as well as the database. The database design should be based on the needs of the users of the management system to create a database that meets the needs of the users [32]. A scientific and reasonable database design is an important guarantee for system security and effective system operation. Therefore, the selection of a suitable database for the system, the scientific and effective design of the database, and the correct creation of the database are essential for the implementation of the physical test results management system.

5. Application experiment design

An evolutionary game approach is used between intelligence to determine which cloud controller to connect to. Multiple intelligences may connect to the same cloud controller, which may reduce the utility of the cloud controller, and, thus, increase the price to achieve its higher utility. Therefore, the intelligence can change its connection and switch to another cloud controller. This process can be repeated many times until all the intelligence in the same group can achieve the same utility. Initially, the intelligence is divided into different groups according to their application scenario, and the bits of intelligence in the same group can be connected to different cloud controllers. The bits of intelligence in each group only need to know the decisions of the other bits of intelligence in the same group. Further, for the job information of the respondents, based on the distribution and return of the questionnaires, the number of high-level positions and front-line physical education teachers formed a large proportion, which also indirectly shows that the university physical education faculty is relatively strong. When analyzed in terms of job title, the number of respondents at the professorial level is smaller, while associate professorial level and lecturers occupy the majority share. The interviewees' academic information also further shows their good academic structure, with the percentage of postgraduate students reaching 70.7%, which guarantees the necessary foundation for the application of the Academic Affairs Management Cloud Platform system.

Again, nearly 60% of the interviewees had not received training before using the Sports Academic Management Cloud Platform system, which is a relatively large proportion, and places high demands on the human-computer interaction of the Sports Academic Management Cloud Platform system. Human-computer interaction refers to the process of information exchange between humans and computers, and is also more about ease of use and user-friendliness [33]. Relatively speaking, the human-computer interaction of the PE teaching and management cloud platform system is relatively simple, mainly facing a stable and significantly higher educational background, understanding the same training and learning methods, and having skills highly unified group of physical education teachers, which makes the human-computer interaction of the PE teaching and management cloud platform system abbreviated to analyze the interaction needs of specific functions in the context of a specific user profile, and, thus, mainly requires further exploration among normality, relevance, ease of use and efficiency, as shown in Figure 3.

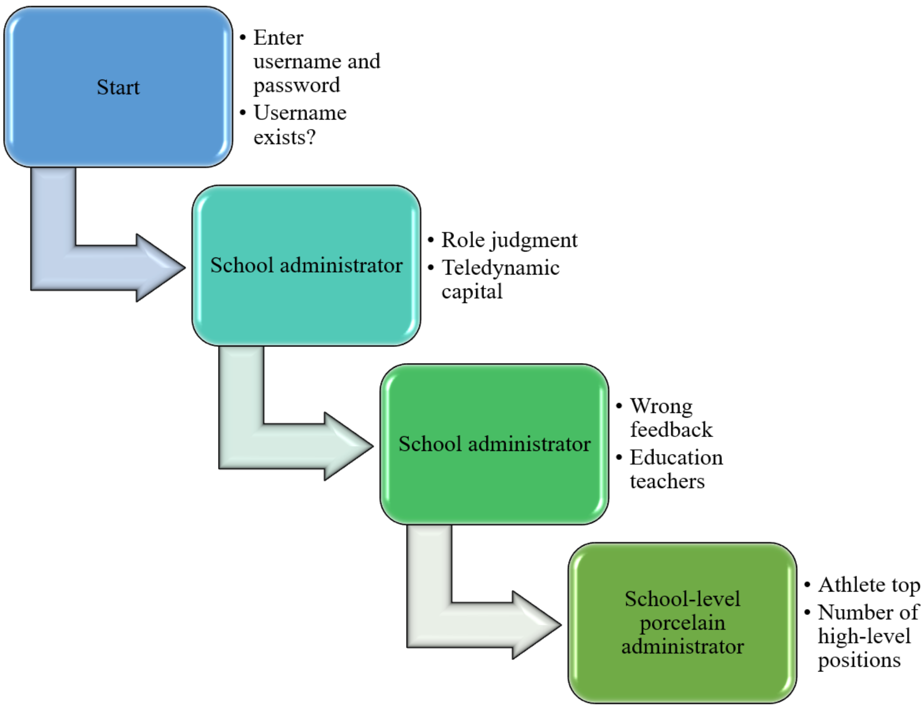

Figure 3. This is the workflow for illustration of experimental steps: check of login information; check of role power; main function demonstration; back-end management.

This physical test performance management system is personalized to the needs of the school, so each functional module in the system is designed to meet the real needs of the user, which requires us to conduct a needs analysis survey and ensure the authenticity and validity of the findings before embarking on the design and development of a management system that can. This will ensure that the development and design of the management system will be appropriate to the task it is intended to accomplish, thus achieving the desired goal of designing and developing a physical test score management system. By analyzing the needs of the three types of users - administrators, teachers and students - the requirements are formulated into design objectives for each functional module and principles that must be kept in mind during the development process. This will allow for a better transmission, storage, management and interaction of physical test results information. The application of information technology in the management of physical tests in colleges and universities makes the management of colleges and universities more intelligent, and is of great significance to the construction of campus informatization.

6. Analysis of results

The testing content of the management system is generally divided into system operation testing, testing of a functional interface implementation and performance testing. The testing process is generally divided into three steps, namely interactive testing, performance testing and regression testing. Interactive testing of all parts of the system is an important step in system testing, as it is used to test the various functional modules of the system, check whether there are faults in each part and find faults in the implementation of system functions as much as possible through interactive testing to ensure that the system can run well. Based on testing the functionality of each module, the whole system is tested using the black-box testing method, and the bugs that occur in the operation of the system are analyzed and improved by performing tests. Finally, regression testing is carried out, i.e., testing of the system after the fault fix has been completed. Regression testing is an effective way to verify that new faults exist in a maintained system, so the system should be regression tested several times during the design and development process. After testing, the system is made to have better stability and continuity. Black-box testing is based on the user's point of view and the correspondence between input and output data. Black-box testing methods can be applied to almost all levels of software functionality, including unit, integration, system and acceptance testing. This is also known as specification-based testing, as black-box testing usually does not require specific knowledge of the application's code, internals and programming, and does not peek into the system's internal architecture or the way it works. The tester knows the functional effects that the program can achieve, but not how it does so. For example, the tester knows that a particular input returns a certain constant output, but does not know how the software produces the output, as shown in Figure 4.

The scheduling phase before each semester of a PE teacher's appointment is a prerequisite to ensure that the teaching of PE runs smoothly. The selection of public PE courses is particularly important, depending on each teacher's area of professional study and expertise, and the College needs to strengthen its management of course resources and teachers' work requirements. The results of the analysis in Figure 4 shows that 82 people think they can meet 66.7%, 41 people think it is an average of 33.3%, and the number of people who do not meet their work needs is 0. In general, people agree that the PE teaching management cloud platform system is put into use and can meet their work needs. The differences in qualifications, job titles, years of experience, working ability and ideological and cultural training of the PE teaching staff can also lead to different considerations when PE teachers choose to teach public PE classes. The time factor is the most important in the selection of PE teachers, accounting for 39.1% and 85.7% of the cases, followed by the personal factor, accounting for 30.4% and 66.7% of the cases, and the venue factor, accounting for 28.3% and 61.9% of the cases. The management of PE teaching is democratized, with the PE teacher as both the object and the subject of management, as shown in Figure 5.

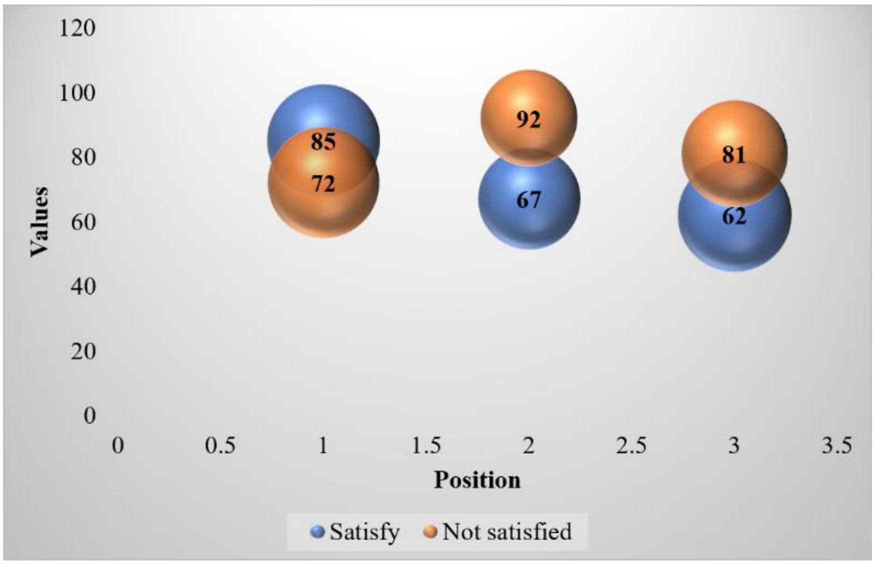

Figure 4. The illustration for whether the system's existing operating modules meet the job requirements.

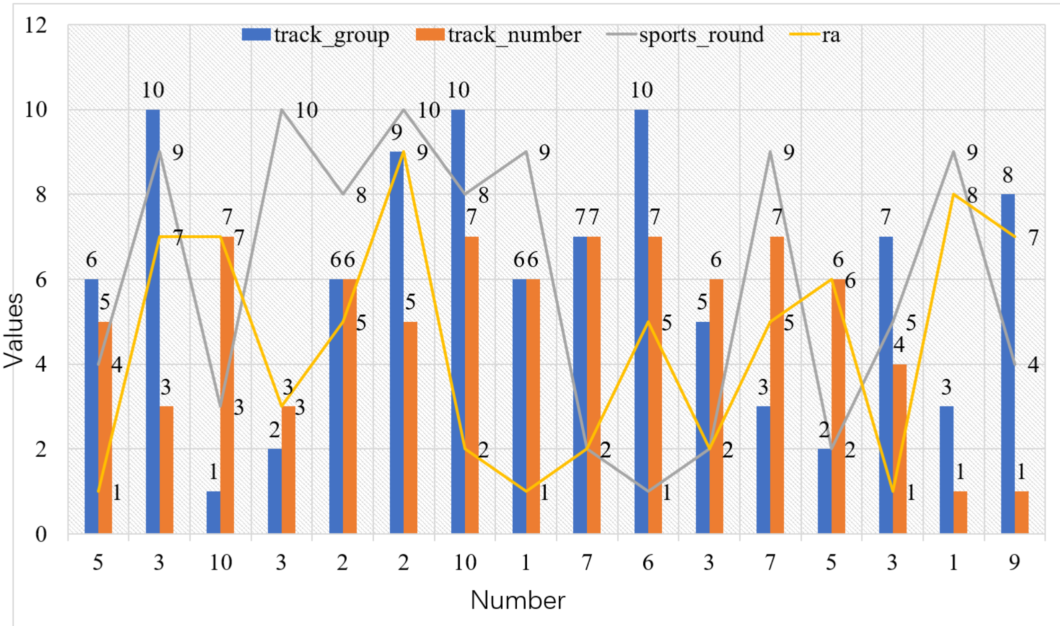

Figure 5. This is the major result of track scheduling.

The above two sets of experiments evaluated the access control performance of Subledger under different parameter configurations, and from the results, the following conclusions can be drawn: Subledger can gain both the security advantages brought by blockchain and ABE, while the time consumption and system complexity they cause to the SDN-IoT network are kept within reasonable limits, especially in complex SLAPP permission management scenarios. In addition, the Subledger's authorization time and access latency increase, approximately, linearly with the number of APIs and SlApps, indicating that the Subledger scales well. The output trajectory curves for all the intelligence are shown in Figure 6, where the output trajectory of the intelligence is shown with the system without perturbation, followed by the output trajectory of the system with perturbation. The stability and consistency performance of the multi-intelligent body system is very similar in both cases, with and without perturbations, noting that the predictive cloud control scheme can actively compensate for the effects of network delays and perturbations generated by bandwidth allocation. Figure 6 represents the output trajectories of the intelligence under random constant value perturbation, cosine perturbation and exponential perturbation, and the outputs of the three bits of intelligence cannot only be consistent over a bounded range, but also track a given reference input signal.

For a multi-intelligent system with restricted communication resources, the bandwidth allocation problem of the system is modeled as a Stackelberg game model, and the evolutionary game among the intelligence and the non-cooperative game among the cloud controllers are realized by a two-stage Stackelberg game approach, and a Stackelberg's Nash equilibrium solution is given. In addition, it is important to allocate bandwidth wisely to make full use of communication resources, which helps to improve network resource utilization and reduce unnecessary wastage of bandwidth. A predictive cloud control problem for MASs with network delays and external perturbations is presented. For multi-intelligent systems with unknown perturbations and time delays, a prediction-based expansive state observer is designed to obtain state estimates and perturbation estimates for each intelligence. Then, a cloud predictive control method is proposed to actively compensate for network delays and external perturbations that are affected by bandwidth allocation. In addition, the cloud control system facilitates the storage and processing of big data, as well as the design and optimization of controllers compared to traditional methods.

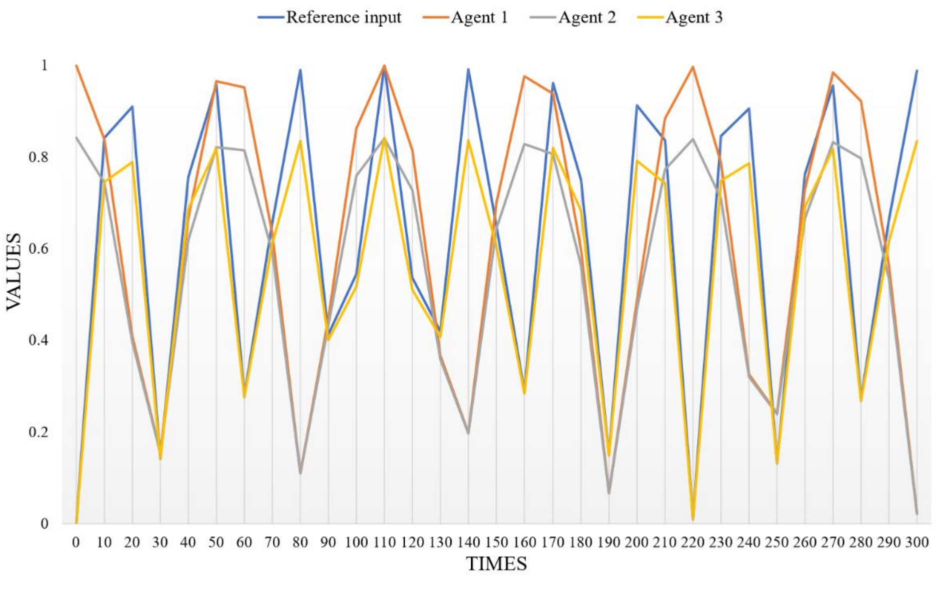

Figure 6. This is the output trajectory of the body system.

7. Conclusion

The use of networked management systems for the management of sports stadiums has become a new trend. Therefore, this paper has designed and developed a college stadium management system, which will hopefully bring convenience to sports management to facilitate better physical exercise for school students, teachers, staff's families and people outside the school. The track scheduling algorithm of the system is then explained in detail. Therefore, in the construction process of the physical education teacher evaluation automation system model, the standardized design of the physical education teacher evaluation automation system is done well, and combined with the application situation, it is pointed out that the physical education teacher evaluation automation system has the characteristics of simplicity and practicality, and also has strong operability. Combining the teaching process at different levels does a good job in the high evaluation of physical education teachers at different levels. It plays an active role in the evaluation of physical education teachers, and realizes the effective evaluation of physical education teachers in various schools. The construction of the comprehensive evaluation index system for physical education teachers, combined with professional skills, is a comprehensive evaluation process for the evaluation of the communication and cooperation ability of the teacher team, and the realization of the teacher's professional development. The establishment of three levels of the evaluation system, are as follow: The establishment of the first level is mainly to do a good job in the overall evaluation of teachers; the second level of evaluation is often combined with the training of teachers' teaching process and professional skills; Evaluation is often the evaluation of specific indicators. The track scheduling module adopts a grouping algorithm based on the evolution of the backpack problem solution, which can solve the problems of low randomness of track scheduling and large gap between players' abilities, and provides the option of automatic grouping and scheduling services, which can reduce the workload of staff. The implementation of the system was carried out based on the previous requirements analysis and design, and all logical functional modules were implemented one by one, thus guaranteeing the usability of the system. Based on the requirements analysis for the exercise prescription system, a basic flow chart was designed for the system, and a reasonable database design was made based on the data to be stored in the system, laying the foundation for the later system implementation. The exercise prescription management system was implemented in conjunction with existing equipment provided by the laboratory and the hospital. The functional interface, back-end interface implementation and system automation deployment were described in detail. Finally, comprehensive functional test cases were designed for the system, and performance tests were carried out to ensure that the system has achieved the functions proposed in the required design, and can run quickly and stably. At the same time, it is noted that the design of such a smart management system still stays in the stage of theoretical analysis and simulation. How to implement it in the real-world environment of big data streams is a problem to be solved. The key point is the development of effective analytical algorithms, and the embedding technique.

Conflict of interest

We declare that there are no conflicts of interest.

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