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Design and Deconstruction of the Intelligent System of College Physical Education in the Era of 5G + Artificial Intelligence

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Abstract: In today's world, the core of competition revolves around the caliber of talent and the nation's capacity for self-driven innovation. Education serves as the foundation for developing skilled individuals and enhancing their abilities. Through robust educational systems, we can elevate the standards and competencies of our workforce, thereby fostering a culture of innovation and progress. At present, people advocate to encourage the holistic growth of students, so it is not only necessary to improve the scientific and cultural aspects, but also the athletic and wellness programs in tertiary institutions. With the continuous promotion and popularization of artificial intelligence technology, it is involved in all levels of society and has yielded positive outcomes. The combination of artificial intelligence technology and the school's sports system is the focus of research. This paper seeks to explore the design of the intelligent framework for college physical education in the era of 5G and artificial intelligence. It is expected to use "5G" and AI technology to change the existing sports framework in higher education institutions, improve the sports literacy of college students, and promote the holistic development of students. In this paper, the cloud-based platform model is used in the college sports management system, which significantly enhances the computing and storage capabilities of the management application platform, making it more suitable for the individual needs of college sports education administrators. In this paper, a multi-agent positioning experiment system is constructed, which provides a practical simulation platform for the theoretical research on multi-agent formation and positioning. This paper studies the management information system based on the B/S (Browser/Server) model to improve the overall level of sports informatization. The experimental findings in this paper indicate that the CPU occupancy rate reaches 44% when the traditional mode runs for 50s, 49% when it runs for 100s, and 35% when the smart sports system runs for 50s, and 42% when it runs for 100s. The smart sports system occupies less CPU during operation, which improves the utilization of resources.

1. Introduction

In the current educational landscape, talent cultivation often prioritizes theoretical knowledge over practical skills, resulting in a significant lack of hands-on experience. This is particularly evident in physical education, which is undervalued at all levels of education, from primary schools to universities. The holistic development of students, which includes physical education, is now recognized as essential. Universities, as key institutions for training highly qualified individuals, must therefore reform their sports programs. Reforming college physical education courses aligns with national policies and enhances practical teaching, strengthening physical education programs and ultimately improving talent quality.

Currently with the ongoing advancement of the social economy, there is an urgent need to deepen the reform of physical education in higher education institutions. Consequently, Liu J identified key issues within the evaluation system of college physical education. He ranked the indicators according to their importance and constructed a scientific evaluation model [1]. To improve the efficiency of interactive physical education, Li B investigated AHP-based evaluation and enhancement of teaching and learning of PE in tertiary institutions. He proposed an overall structural model and an overall functional module model, as well as the implementation of online education and the characteristics of online education, to serve as a basis for the evaluation and construction of online platforms for university PE [2]. To address these challenges, Wang H designed and developed an intelligent learning system based on big data, using a path recommendation algorithm to implement a learning recommendation strategy. He built several models to represent problem domains, such as learning object models, problem models, and relational models, and showed how to apply them to a practical prototype platform for intelligent learning systems in popular settings to demonstrate the usefulness of the proposed model [3]. Wang Q presented the research on an innovative intelligent terminal-based online learning and communication platform for tennis. A control group was set up for experiments on aspects of the design beyond the technology of the online teaching information platform. The findings reveal that online teaching significantly enhances the learning of both skills and theoretical knowledge, with a 20% increase [4]. In a fast-moving global context, smart education is an inclusive notion of inclusive culture and access to a broad range of tertiary level education. It represents advanced technology that enables students to process information and skills more accurately and efficiently. The fundamental problem of smart education is that students are distracted, their learning resources are unreliable, and their academic performance is poor. Zhang Y proposed the use of AI to aid an interactive intelligent educational framework to raise students' academic performance.AI for interactive systems that engage students in learning and enhance healthy environments for student and faculty interaction in higher education. His proposed AIISE is to analyze the learning performance of intelligent education in higher education and provide students with reliable learning materials and feedback systems [5]. Although these theories describe college sports, they are not integrated with artificial intelligence.

Artificial intelligence has relatively advanced technology at present, which is involved in all fields of society, and has achieved certain results. Parkvall S provided an overview of the new radio technologies being developed by 3GPP [6]. These advancements aim to enhance network energy efficiency and utilize spectrum in very high frequency bands. Evaluations indicate that with these technical components, New Radio (NR) can meet the goals set for 5G. AI surveillance programs facilitate early detection by identifying suspicious or positive cases, aiding radiologists in prioritizing their workloads. Thrall J H suggested that artificial intelligence can extract detailed 'radioactive' information from images that are indiscernible to the human eye, offering new and promising methods for image data analysis [7]. Cutting-edge tools from machine learning and artificial intelligence are progressively automating parts of the peer review process, yet there are still numerous areas for further enhancement. Price S has introduced a simplification tool to address this, which also highlights opportunities for improving the peer review process. Especially the view that dissected ideas naturally lead to peer review. Experiments show that the proposed artificial intelligence improvement method makes the automation of the review process smoother and improves work efficiency [8]. Although these theories provide an overview of artificial intelligence, they are less integrated with college sports and are not practical.

Physical education courses are an indispensable part of colleges and universities, and how to improve students' participation is the current problem. According to the experiment, in the original university system, when the system runs for 50s, the memory accounts for 52%; when the system runs for 100s, the memory accounts for 58%. When a smart sports system is implemented, the memory accounts for 43% when the system runs for 50s; when the system runs for 100s, the memory accounts for 46%. It shows that the traditional system has poor resource utilization at runtime, and the intelligent system has solved this problem.

2. Design Methods for Intelligent Systems

The trend of world multi-polarization is becoming more and more obvious, the competition among countries is becoming more and more fierce, and human resources are an important resource to promote social development, so the world attaches great importance to human resources [9]. Human resources include not only brain power, but also physical strength. Human resources need not only competition, but also the cultivation of local human resources. As an important place for human resources training, higher education institutions should teach students not only scientific and cultural literacy and technical competency, but also focus on developing a healthy body and good psychological quality [10-11]. According to the data in recent years, the physical quality of students is declining, which is related to the current display environment and the neglect in physical education courses within higher education institutions[12].

In trying to change the lack of emphasis on physical education, one can design a wise tradition of PE in tertiary institutions, taking into account the needs of students, and set up a reasonable PE curriculum to improve students' motivation in the classroom. As technology advances, the shortcomings of conventional C/S mode apps continue to emerge, and the benefits of the B/S pattern dictate the possibility of replacing the C/S pattern to some extent [13-14]. The B/S model is an enhancement of the C/S model, featuring a three-tier architecture, and each layer has its own tasks. The database server is responsible for accepting the server's request for data manipulation, implementing the data processing, and submitting the operation result to the server [15]. Figure 1 shows the B/S mode model structure:

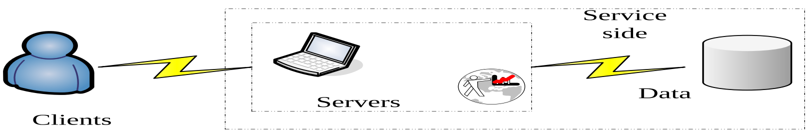

Figure 1: Structure of the B/S model

Competitive sports in informational schools are steadily increasing, but the quality of the curriculum is not guaranteed, especially the sports management system and operation mode of universities, which creates a big gap with the needs of university students and society for sports [16]. All these have brought obstacles to the advancement of university sports [17]. To foster the advancement of college sports, college sport is reformed and the people in charge of college are integrated into the overall system of college education. The first step is to make changes in curriculum management by using an intelligent system to integrate the entire curriculum, design it according to students' current development needs and assess their overall situation. The system's structure is illustrated in Figure 2.

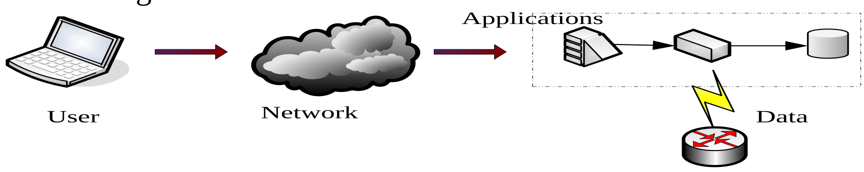

Figure 2: System architecture

With the continuous development of sports, sports facilities also continue to improve. When it comes to professional athlete training, real-time locating and mastering of athlete's physical performance data is critical. Moreover, according to the data, the Asia-Pacific region is the region where sports real-time positioning system is expected to grow the fastest in the next five years, which can also explain the importance of positioning technology in sports. Therefore, to create smart sports in college sports, positioning needs are very important. The structure of the intelligent positioning system is depicted in Figure 3:

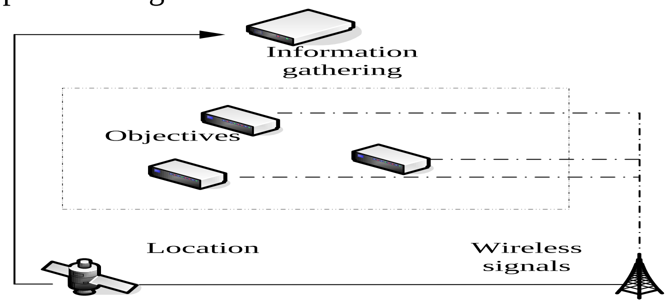

Figure 3: Structure of the intelligent positioning system

$$\beta_a = \frac{2}{h_{max} - h_{min}} \sum max(A_{cv} - A_c) \quad (1)$$

In Formula (1), RR represents the red pixel value of the target, and GG represents the gray value of the target object. Before positioning, it is necessary to collect the relevant information of the target object, and use the coordinate positioning for the moving target. Figure 4 is the basic mode of information collection:

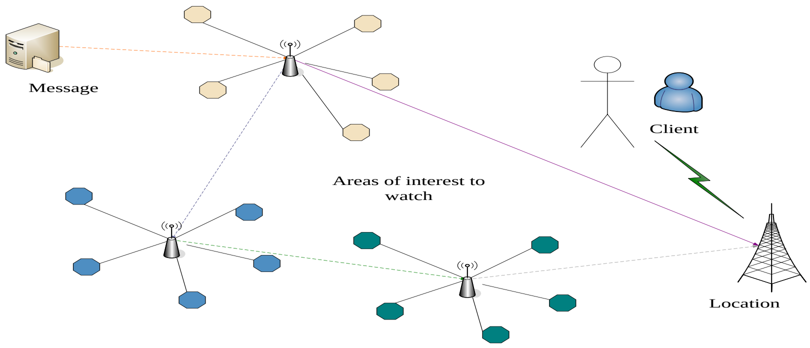

Figure 4: Basic model of information collection

$$\beta_k = \frac{2}{h_{max} - h_{min}} \sum max(K_{cv} - K_c) \quad (2)$$

$$\beta_U = \frac{2}{h_{max} - h_{min}} \sum max(U_{cv} - U_c) \quad (3)$$

The above formula represents the pixel component, U represents the blue pixel value of the target, and h represents the gray value of the target object.

In fact, the model function of color mark identification in color space can be obtained through the above algorithm.

$$\mu_q\big((A,K,U)\big) = |A - A_c| < \beta_a \tag{4}$$

$$\mu_k\big((A,K,U)\big) = |K - K_c| < \beta_k \tag{5}$$

$$\mu_u\big((A,K,U)\big) = |U - U_c| < \beta_u \tag{6}$$

In the above formula, β_a, β_k and β_u represent the thresholds for detecting mobile agents.

In order to make the positioning coordinate value of the agent closer to the center of the agent, after completing the image scanning, save the points that meet the threshold in the array, and then do a weighting to take the average value, which is very close to the coordinates of the center point.

$$\mathrm{Q} = \frac{2}{\mathrm{k}}\sum \mathrm{Q_a} \tag{7}$$

$$\mathrm{W} = \frac{2}{\mathrm{k}}\sum \mathrm{W_a} \tag{8}$$

In the above formula, Q and W represent the horizontal and vertical coordinates of the target object, which are usually in pixels during the calculation process.

$$\binom{Q}{W} = \binom{2(Q - Q_1)3(W - W_3)}{3(Q_2 - Q_1)3(W_2 - W_3)} \tag{9}$$

The above functions represent the coordinates of the coincident points. Its specific situation is shown in Figure 5:

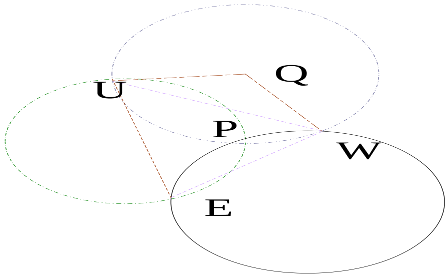

Figure 5: Basic illustration of target overlap

$$Y_a = \int \frac{|\vartheta(\tau)|^2}{\tau} d\tau < \infty \tag{10}$$

In Formula (10), $\vartheta(\tau)$ denotes the Fourier transform, and Y_a denotes the range of values for the Fourier transform. Figure 6 shows the Fourier transform basic mode:

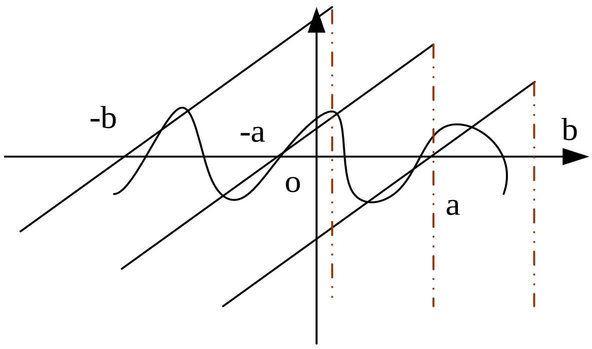

Figure 6: Basic Fourier transform model

$$\vartheta_{f,h}(h) = \frac{2}{\sqrt{k}}\vartheta\left(\frac{h-\epsilon}{k}\right) \tag{11}$$

In Formula (11), $k > 0$, ϑ represent scale factors, and ϵ represent translation factors.

The Kalman filter uses an estimation algorithm to locate the target object and estimate its speed and state.

$$Q_z = R_z Q_{z-1} + T_z \tag{12}$$

$$Y_z = G_z Q_{z-1} + B_z \tag{13}$$

In the above formula, zdenotes the system's state vector, and Y_z denotes the system state observation vector at time z. R_z and G_z representthe state transition matrix and observation matrix of the system, and T_z and B_z represent the normally distributed state and observation noise vector.

$$Q_z = R_{z-1} * Q_z \tag{14}$$

Formula (14) represents the advance forecast value.

$$h = \frac{2}{\sqrt{(1.5\pi)^2 \prod_1^3 \rho a}} \tag{15}$$

Because there will be errors in the calculation. Assuming these errors are independent random variables, the conditional probability function is expressed as in Formula (15).

$$\text{cov}(\varepsilon)Q\left((\breve{\varepsilon} - \varepsilon)(\breve{\varepsilon} - \varepsilon)^u\right) \tag{16}$$

Formula (16) represents the conditional probability density function under parameter conditions.

$$\mu = \sqrt{\frac{2}{5Q}\sum(\breve{a}_h - a_h)^3 + \left(\breve{b}_h - b_h\right)^3 + (\breve{c}_h - c_h)^3} \tag{17}$$

Formula (17) represents the metric of the positioning algorithm and system positioning accuracy, where $1 < h < Q$.

3. Experiments in Teaching Intelligent Systems

B/S architecture is relatively common under today's. Considering the overall complexity and particularity of the system, the B/S structure is also used in the design of the college sports management system. In terms of overall data design, the model part mainly deals with data logic and accesses data in the database. The view is mainly to display the data for the convenience of the user. In the design process, the application service system and the server are completely separated, and the functions of the respective servers are exerted. This approach is conducive to the improvement of the performance of the entire system, and is also conducive to the clarification of computer-level functions and the control and maintenance of the system.

The logical design of the database is to convert the logical model of the real world into the logical model of the corresponding database. The logical design of the database includes the E-R figure design. The database used is relational, and data is stored in tables. Therefore, it is essential to convert the E-R diagram into table format. For this purpose, a data table has been created, as illustrated in Table 1.

In physical education teaching within colleges and universities, students are the central focus main body, and teachers are an important element to guide participation. In the system design, teachers also need to have special modules. The main structure design of the teacher user table is as follows.

Table 1: User information table

Serial number	Field	Type	Keywords	Description
1	Grade	20	Z	Grade
2	Name	11	X	Name
3	Gender	10	X	Gender
4	Date of Birth	date	X	Date of Birth
5	Course	32	X	Course
6	Number	20	X	Number

Table 2: The main structure design of the teacher user table

Category	Keywords	Type	Length
Number	Z	varchar	32
Password	X	varchar	10
Name	X	varchar	11
Phone number	X	varchar	32
E-mail	X	varchar	20

According to the data in Table 2, the teacher's login system is introduced. According to the E-R figure, the teacher data table is the same as the student data table, only the necessary information is retained, and the teacher number is used as the user name to query the teacher's detailed information through the system. The teacher number cannot be changed, so the number cannot be blank during system registration. Passwords are typically set as varchar with a length of 10 characters; names are generally set as varchar with a length of 11 characters, though this can be adjusted. The teacher's phone number is usually set as varchar with a length of 32 characters. This part is the teacher's personal contact information, which can be used to find information in some cases. This system is for teaching purposes. The system adopts the real-name system and does not provide the function of illegally registering users, which can ensure the speciality of the system and improve the security of the system.

In actual sports courses, competition management and project management may be involved. In order to make the expression concise and clear, it needs to be described in the smart sports system, so that the information can be conveyed more accurately.

Table 3: Smart Education Smart System Login Test

ID	Username	Password	Results
1	Error	Incorrect	Prompt error
2	Empty	Correct	Username
3	Change	blank	Re-enter
4	Space	Space	Error message
5	Legal	Correct	Success

According to Table 3, the login test of the smart education intelligent system is carried out. The secure login of the system is the premise of ensuring the connection between users and the database system. When writing tests, people can interchange as well as password and name characters. When the ID is entered wrong and the PIN is also typed wrong, the system will display an error message. When the ID is empty and the PIN is typed wrong, people will be prompted to enter the username. When the ID has been changed, the PIN is empty, and the system will prompt people to re-enter. When both the username and password are empty, the system will display an error message. When the user name is valid and the password is valid, the system will prompt people to log in successfully.

Table 4: Course Selection Test

Name	Nature	Limited number of candidates	Actual number of people	Results
Volleyball	public election	8	5	All selected
Football	public election	15	21	6 not selected
Basketball	Public Election	15	20	5 not selected
Aerobics	Public Election	10	7	Fully selected

According to the data in Table 4, the course selection of the system has been tested. According to the specific circumstances, all the tests in this test are public elective courses, and all students can participate. In the volleyball course, the limit is 8, and the actual number is 5. Because the actual number is less than the limit, all 5 people are selected successfully. In the football course, the limit is 15, and the actual number is 21. Because the actual number is greater than the limit, only 15 people are selected successfully, and the remaining 6 people fail. In the basketball course, the limit is 15, and the actual number is 20. Because the actual number is greater than the limit, only 15 people are selected successfully, and the remaining 5 people fail. In the aerobics course, the limit is 10, and the actual number is 7. Because the actual number is less than the limit, all 7 people are successfully selected for the course.

Physical Education is a compulsory subject in tertiary institutions, especially after quality Education has been emphasized and the all-round development of students has received more attention. Based on this background, the importance attached to physical education classes in tertiary institutions has been increasing. As a crucial hub for talent development, colleges and universities must continuously enhance their teaching strategies and place greater emphasis on the comprehensive development of physical education. Therefore, it is necessary to continuously improve students' interest in sports, improve their physical quality, and constantly improve their comprehensive quality.

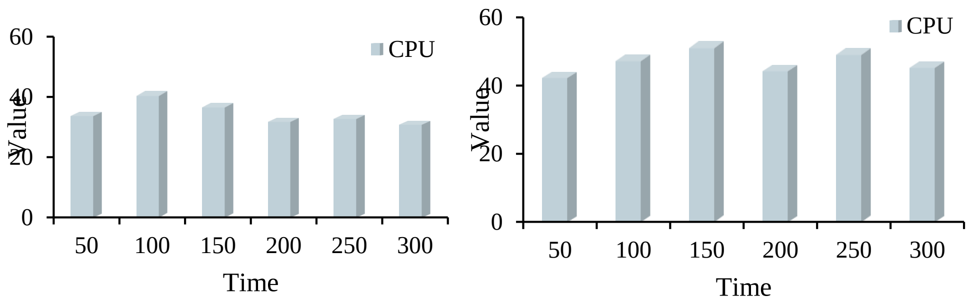

Figure 7: Analysis of system CPU utilization

According to the data in Figure 7, the CPU utilization of the smart sports system is analyzed. According to the actual situation, in the actual operation of the system, the data is relatively large, and the handling and examination of data will occupy a high memory. Therefore, how to use the existing memory in the system is a very important issue. Once the system memory utilization is low, it will bring harm to the running smoothness of the system. Therefore, The CPU utilization of various model systems is examined. For the traditional mode in the college sports system, the CPU usage reaches 44% after 50 seconds and climbs to 49% after 100 seconds, eventually reaching 53% when running for 150s, 46% when running for 200s, 51% when running for 250s, and 47% when running for 300s. Under the traditional mode, the system's CPU consumption is quite high, approaching normal levels upon startup. This suggests that the system's resource efficiency during operation is suboptimal.

When the smart sports system is used, tIn the traditional mode, the system exhibits significant CPU usage, with 35% utilization after 50 seconds, 42% after 100 seconds, and 38% at extended operation. This demonstrates inefficient resource utilization during system runtime running for 150s, 33% when running for 200s, 34% when running for 250s, and 32% when running for 300s. According to this situation, the smart sports system occupies less CPU during operation, which improves the utilization of resources. When the system has a large number of logins, it can also maintain normal operation.

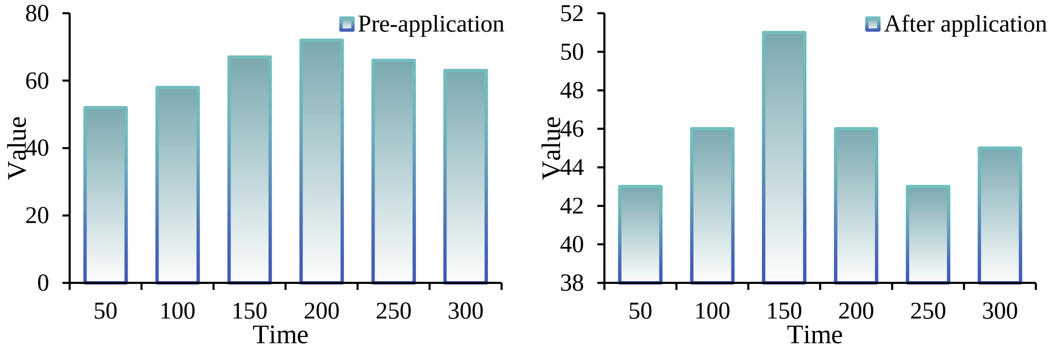

Figure 8: System memory utilization analysis

According to the data in Figure 8, the utilization of system memory is compared and analyzed. Therefore, the use of the internal memory of the system is very critical. According to the experiment, in the original university system, when the system runs for 50s, its memory accounts for 52%. When the system runs for 100s, its memory accounts for 58%; when the system runs for 150s, its memory accounts for 67%; when the system runs for 200s, its memory accounts for 72%. When the system runs for 250s, its memory accounts for 66%; when the system runs for 300s, its memory accounts for 63%. According to the data, in the original system, the amount of memory occupied by the system during operation is very large, especially in the first 200s, the system memory increases with time.

When the smart sports system is used, when the system runs for 50s, its memory accounts for 43%; when the system runs for 100s, its memory accounts for 46%; when the system runs for 150s, its memory accounts for 51%. When the system runs for 200s, its memory accounts for 46%; when the system runs for 250s, its memory accounts for 43%; when the system runs for 300s, its memory accounts for 45%. The intelligent system has a maximum experimental memory of 51%, compared with 72% of the traditional system, its memory usage is greatly reduced. It can be seen that the intelligent system can guarantee the operation effect during operation.

System response time is an important reflection of system performance. The calculation of the system response time should take into account the number of users. In order to understand the time response of the intelligent system, we conducted a comparative analysis under the same load. According to the data in Figure 9, the system response before and after the application of the smart system is analyzed. Firstly, analyzing the traditional system, we observe the following response times with varying loads: at a load of 60, the response time is 2100 ms; at a load of 120, it increases to 2800 ms. When the load reaches 180, the response time becomes 4600 ms; and at a load of 240, it further rises to 7900 ms. This data clearly shows that as the load increases, the system response time also increases, with higher loads resulting in significantly longer response times.

When operating the smart sports system, the recorded response times are: 1800 ms at a load of

60, 2000 ms at a load of 120, 3300 ms at a load of 180, and 5400 ms at a load of 240. This data demonstrates that the smart system significantly reduces response times in comparison to the traditional system, with a slower rate of increase in response times as the load rises.

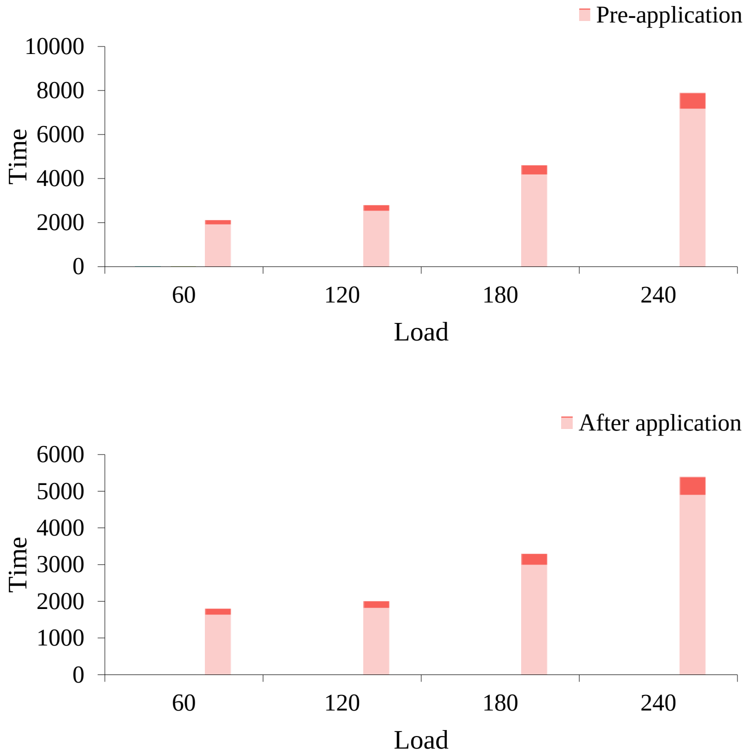

Figure 9: System response time analysis

4. Conclusions

In PE education in tertiary institutions, emphasis should be placed on the comprehensive development of students. Currently, university students' physical fitness is getting lower and lower, which is importantly related to the neglect of PE courses in universities. The aim of this paper is to investigate the development of an intelligent physical education system for higher education institutions in the age of 5G and AI .Through research, it is found that most students have low frequency of sports training and focus on personal interests in leisure activities. Due to the limitations of the material base, most students only participate in sports training in the school. Although this paper has yielded some positive outcomes, but there are still areas for improvement: The role of teachers in guiding the teaching process remains highly prominent. To rely on intelligent systems, it is necessary to have well-established teachers and enough teachers to keep teaching and learning running successfully. This section is not discussed in the article.

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