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Research Article

Efficiency Analysis of Sports Equipment Batch Management Based on Antimetal RFID Tag

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Based on the antimetal RFID tag model, a sports equipment batch management system is established. The establishment process of the model and system is discussed in detail, and the principle of metal-resistant RFID tag is revealed. Then, the antimetal RFID tag sports equipment batch management system is applied to colleges, middle schools, and primary schools, and the use of teachers and students on the efficiency of sports equipment batch management is studied, highlighting the advantages of the management system. In general, the antimetal RFID tag sports equipment batch management system has timeliness, universality, and reliability. It can adapt to the sports equipment management of different schools, improve its management efficiency, and play a positive role in the development of modern school sports.

1. Introduction

Sports equipment is the carrier of sports development. Physical education in colleges must rely on a large number of sports equipment for support, which can achieve better teaching results. In the vigorous development stage of college sports, more teaching projects must be completed with the help of sports equipment. In physical education, colleges should not only provide sports equipment but also manage sports equipment, so as to provide better serve physical education [1, 2].

Sports equipment can be defined as all kinds of equipment used in various sports. Sports equipment is obviously closely related to the sports needs of human beings at all stages. Sports equipment mainly comes from two aspects. On the one hand, it is the evolution of some equipment in people's long-term production labor and social struggle, and on the other hand, it comes from all kinds of equipment formed in people's long-term entertainment [3–5]. For example, some throwing events mainly come from human long-term war practice, and ball games mainly come from human daily entertainment. The origin of different sports equipment is different, and the diversified sources have created the rich and colorful content of sports.

At present, all kinds of equipment can realize intelligent management. Using the system for system management can facilitate the management of equipment in the process of physical education teaching; especially at present, the management of sports equipment is directly related to the improvement of physical education quality [6]. The state pays special attention to the physical education of teenagers, and the sports equipment management system is mainly a comprehensive information service platform created for sports managers. The main purpose is to obtain a series of information of equipment and obtain the use of equipment through specific instructions. The development of the system is conducive to expand the development path of school physical education and promote the modern development of management system [7].

In the management of sports equipment, it mainly aims at the secondment management and return management of sports equipment. In the system business process, users can query the actual situation of their returned equipment through the system. The equipment manager mainly counts the equipment and understands the performance of the equipment and inquires about the use of users' equipment. In the management of sports equipment, the most important thing is to manage the borrowing process and return process, as well as the borrowing approval and management process [8–10].

The functional performance requirements of the sports equipment management system need to ensure beauty and cleanliness. At the same time, it should be convenient, fast, easy to operate, able to enter data, ensure a clear user direction and user group, and facilitate user authentication. For example, the implementation of three algorithm steps can be set. Under Windows OS, to ensure the stable operation and powerful function of the system, it also needs strong fault tolerance, emphasizes the expandability and function of the system, and emphasizes the maintainability, development, and portability of the system [11, 12]. It supports keyboard input and mouse operation, which can realize man-machine interactive processing. At the same time, it can also output relevant sports data in combination with the printer to ensure the stable operation of the system.

On the whole, the sports management department assists with the support of the sports equipment management system, helps the department to have time to perform tasks on the job, and provides good data support for the construction of the sports equipment management department.

Internet of things (IOT) is a project that extends and extends its client to any information exchange and network communication based on Internet applications, which is one of the important components of modern information industry [13]. RFID (radio frequency identification) is not only an automatic identification technology but also a key part of the Internet of things technology, which completes noncontact automatic identification by using radio frequency signals for data and energy transmission. The RFID system generally includes tag and reader, and the tag is used to identify the object. The reader reads the information stored on the tag through radio frequency signal and then completes the identification of the object [14]. Compared with the two-dimensional code technology widely used at present, RFID has the advantages of fast reading rate, long reading distance, large information capacity, and high security performance. In addition, it is supported for fast reading and writing, no need for manual attendance, and no need for manual visualization. Through information sharing in the form of Internet, RFID technology can realize the sharing and tracking of relevant item information all over the world [15–17]. Therefore, it can be said that RFID is the cornerstone of the Internet of things.

RFID technology has a large number of applications and great development prospects in many fields such as commodity management, transportation and production, manufacturing, and commerce [18]. At present, the main applications of RFID include access control, product tracking, logistics management, intelligent shelf, anticounterfeiting security, and medical device management. RFID is the important foundation of Internet plus and Internet of things. Its development needs to keep pace with the rapid development of Internet plus and Internet of things. Although RFID technology is developing rapidly, it is not mature enough [19]. At this stage, there are two main problems: firstly, the cost of labels. Although the cost of ordinary labels is relatively low, for special applications, such as labels applied to metals and specific forms of goods, the cost is high, and a single identification cannot be completed for all goods. Secondly, the tag performance cannot meet the application requirements of specific size and form, which also hinders the popularization of RFID technology [20].

In practical applications, metal objects are common application carriers. According to the antenna theory, the metal object or surface has a great influence on the antenna. When the ordinary tag antenna is pasted on the metal surface, the reading distance becomes shorter or even cannot be read. Metal-resistant RFID tag refers to RFID tag specially designed for metal environment.

At present, there are two main implementation methods of antimetal labels: ordinary labels add additional materials or structures to form antimetal labels and design tag antennas with specific structures and forms. Adding additional materials or structures to ordinary tags to form antimetal tags mainly includes the following methods: adjusting the distance between the tag antenna and the metal surface, adding absorbing materials between the tag antenna and the metal, and adopting structures such as electromagnetic band gap structure EBG and artificial magnetic conductor AMC [21, 22]. These methods mainly study the external environment of the tag, while the metal resistance of the label is realized by changing the external environment of the label. However, this method has many problems in practical application, and its performance and size may not meet the actual needs. The design of tag antenna with specific structure and form mainly includes the design of microstrip antenna and PIFA antenna. These antennas have metal floor, which can effectively reduce the influence of metal surface on them. This way is to study the structural performance of the antenna itself and ignore the influence of the external metal of the tag antenna [23]. Generally, the so-called design of antimetal tag antenna refers to this specially designed tag antenna form.

For the design of antimetal tag antenna, the antimetal performance of tag antenna should be stable, and the performance changes little on metal carriers of different sizes. Reading distance is the most direct performance identification of the tag antenna. The tag needs to have a long recognition distance and a large recognition range, which requires the tag antenna to have high gain and wide lobe width to facilitate the reading of the tag.

Albrecher et al. [24] studied that the input impedance of ordinary tag antenna by the metal environment, which further affected the reading distance of tag antenna, would cause some damage to the management of sports equipment. By studying the influence of metal sports equipment of different sizes on the performance of folded dipole antenna, Rodean and Morar [25] pointed out the influence of the size of metal plate of sports equipment on the width of main lobe of antenna and the influence of the distance between metal plate and antenna on the number of main lobe of antenna and found the management method of metal sports equipment. Bogusaw and Elbieta [26] studied the management of sports equipment under different antennas through the budget of wireless link and obtained the antimetal RFID tag, which was helpful to improve the management efficiency of sports equipment. Based on the above research, Patra et al. [27] summarized and analyzed the influence of metal sports equipment on the impedance, transmission coefficient application, and directivity of tag antenna through simulation and experiment and obtained the best management mode of sports equipment.

Based on the antimetal RFID tag, the optimum parameters of the antenna are obtained by this method, and the influence of impedance data on the properties of metal materials is studied. Then, the optimal number of antimetal RFID antennas is obtained. Through the study of the influence of antenna impedance on metal equipment, the corresponding RFID model is established. Then, for the problems existing in the batch management of sports equipment, the batch management behavior of sports equipment is studied in detail based on the antimetal RFID tag model. The results show that the antimetal RFID tag is helpful to improve the efficiency of batch management of sports equipment, which provides a certain model algorithm and experimental data support for the batch management of sports equipment.

2. Model Establishment Based on Antimetal RFID Tag

Antimetal RFID antenna is mainly composed of three parts: base plate, dielectric substrate, and radiation patch. The radiation patch can be divided into two parts. The first part digs out a rectangular slot, and the second part inserts a metal patch smaller than the rectangular slot in the middle of the rectangular slot and finally forms an annular slot hole.

When the antenna is bent, the electric field of the microstrip line to the ground has a vector in the tangent direction, which can be equivalent to a capacitor connected in series with the antenna, resulting in the shift of the frequency to high frequency. In order to reduce this effect, the metal coverage area of the antenna can be reduced; that is, the value of series capacitance can be reduced by digging out a rectangular slot. However, this method also increases the flow path of the current on the antenna surface, that is, increases the inductance [28]. In order to weaken this effect, insert a metal patch in the middle of the rectangular slot, and the metal patch is coupled at the upper and lower ends to generate reverse current, which reduces the inductance of the patch antenna and causes the effect of frequency rise.

Therefore, when the antenna is bent, the frequency will rise due to the series capacitance, but the phenomenon of the shift of the resonant frequency to the high frequency is slowed down due to the excavation of the rectangular groove, and then the effect of the intermediate metal patch is further used to make the antenna resonant frequency shift very small.

In this design, the antimetal RFID antenna adopts the inductive coupling feed structure, which has the advantages of quickly eliminating interference and collecting signals, and can obtain the required information more accurately, and the inductive coupling matching uses the ring resonator to form the feed structure to provide high inductive impedance and then coupled to the radiator. The size of the ring can adjust the reactance, and the coupling strength between the ring and the radiator can adjust the resistance [29]. So, the method is easier in matching design.

The input impedance at the feed of the feed ring is expressed by equation (1):

$$Z_{\mathrm{in}} = Z_{\mathrm{loop}} + \frac{(2\pi f M)^2}{Z_{\mathrm{rb}}}, \tag{1}$$

where Z_{loop}, M, and Z_{rb} are the input impedance of the feed ring, the mutual inductance between the feed ring and the radiator, and the input impedance of the radiator, respectively. Antenna input impedance is the resistance in the process of antenna input, which reflects the influence of external environment on antenna signal. Based on equation (1), the resistance R_{in} and reactance X_{in} of antenna input impedance can be expressed as equations (2) and (3):

$$R_{\mathrm{in}}(f_0) = \frac{(2\pi f M)^2}{R_{\mathrm{rb}}(f_0)}, \tag{2}$$

$$X_{\mathrm{in}}(f_0) = 2\pi f_0 L_{\mathrm{loop}}, \tag{3}$$

where f_0 is the working frequency of the antenna, which is the speed at which the antenna receives the signal, reflecting the overall working capacity of the antenna. The higher the working frequency of the antenna is, the better the ability of the antenna to receive signals. According to equation (2), the input resistance of the antenna is determined by the mutual inductance between the feed ring and the radiator, and its size can be adjusted by adjusting the size of the feed ring and the distance between the feed ring and the radiator. For the antenna input reactance, due to the size of the feed ring, such as length, width, and height, it will affect the resistance of the reactance. In addition, mutual inductance effect and radiation effect will affect the input reactance of the antenna. Therefore, it is mainly affected by the size of the feed ring, as shown in equation (4):

$$L_{\mathrm{loop}} = 0.4\,(L_L + W_L)\,\ln\left[\frac{2L_L W_L}{s(L_L + W_L)}\right](\mu H), \tag{4}$$

were L_L is the length of the feeder loop, W_L is the width of the feeder loop, and s is the line width of the feeder loop.

For a rectangular radiating patch, after considering the short edge effect, which is caused by the difference and synergy of some energy or information in the rectangular radiation patch, the actual length L of the radiating element is shown in equation (5):

$$L = \frac{c}{2f\sqrt{\varepsilon_{\mathrm{eff}}}} 2\Delta L, \tag{5}$$

where c is the free space wavelength with a value of 3.0×10^8 m/s, $\varepsilon_{\mathrm{eff}}$ is the effective dielectric constant, which is 1.0054, $\triangle L$ is the equivalent radiation gap length, and it can be expressed by equations (6) and (7), respectively:

$$\Delta L = \frac{(\varepsilon_{\mathrm{eff}} + 0.3)((W/h) + 0.264)}{(\varepsilon_{\mathrm{eff}} - 0.258)((W/h) + 0.8)}, \tag{6}$$

$$\varepsilon_{\mathrm{eff}} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{1/2}, \tag{7}$$

where ε_r is the relative permittivity of the medium, h is the thickness of the medium, which refers to the material composition of the antenna, and the thickness of the medium represents the signal receiving ability of the antenna. W is the width of the rectangular patch.

The inductive coupling feeding is used to make the working frequency of the antimetal RFID antenna conjugate with the chip impedance at 915 MHz. At this time, the substrate is$\varepsilon_r = 3.9$, and the dielectric loss tangent tan is $\delta = 0.003$. The thickness h of the medium is 1.5 mm, which meets the low profile requirement of the antimetal RFID antenna. When the antimetal RFID antenna is miniaturized, it not only helps to eliminate the interference of metal substances but also has the advantage of receiving signals quickly. What is more, the width W of the radiation patch is 10 mm, which can meet the miniaturization of the antimetal RFID antenna size.

3. Establishment of the Sports Equipment Batch Management System Based on Antimetal RFID Tags

3.1. System Framework. The sports equipment batch management system based on antimetal RFID tags is designed with an antimetal RFID frame structure. The C language program is used to design the antimetal RFID management mode, which has good openness and can effectively meet the remote needs of users. The system based on the antimetal RFID management mode is divided into three layers: user interface layer, business logic layer, database layer, and system layered structure. The specific system structure diagram is shown in Figure 1.

From this, it can be seen that in the middle layer, the work completed by the system roughly includes three items: setting business development rules, accessing relevant data, and verifying the legality of business and data. In general, there is no direct interaction between the client and the database. The connection between the two depends on the support of the middle layer, and they complete the data interaction task through the intermediary. The middle layer has a large amount of data, and the browser of the client can access and communicate well, so as to generate the database. Under the whole structure of the antimetal RFID management system, the browser is the main standard configuration of the client, the web server adopts the standard configuration of the application program, and the database server performs the work of processing related data.

Based on the antimetal RFID management frame structure, the design of the sports equipment batch management system in this paper includes five levels: (1) the network hardware support layer, which provides a networked communication environment to the system users with the help of the campus network, (2) database server layer, centralized and unified management of sports equipment data recorded in the system, (3) system tool library, including each functional module that the system should have, (4) application layer, calling each functional module to play a role of the self-service borrowing and returning system, and (5) user layer, the system user accesses the application program in the server through the browser.

3.2. System Function Modules. Combined with the current situation of sports equipment management in a school and the overall goal of system design, the sports equipment management system is divided into two major submodules: the front-end functional module and the back-end functional module. Specifically, the front-end module includes three functions of equipment preborrowing, account viewing, and information modification. The back-end module involves two functions of equipment borrowing and returning management and user management. The system function module is showed in Figure 2.

3.3. Database Design. In the design of the whole sports equipment management system, the database design is extremely important. The database collects and processes the data. After analyzing it by software, the transformation of data and signal can be realized, so as to promote the smooth implementation of the antimetal RFID label management system framework. Supported by the application of database technology, the very rich data in the system can be reasonably organized and stored, which reduces the redundancy of the data and realizes the data sharing function to ensure the efficiency and security of data processing.

The function modules in the system are designed with rich data fields and types, and their function is to establish the association of applications in each link of the system. Every business in the system will involve more than (or equal to) one data table, which highlights the importance of table structure design and master-slave table design in the database. Analyzing the system requirements, the categories of database tables should be specifically divided based on different functions. As the basic content of database development, database requirement analysis involves three parts: structure analysis, data definition analysis, and integrity analysis.

There are many types of data analysis, including business data, maintenance data, and user data, which can provide favorable conditions for the organization, management,

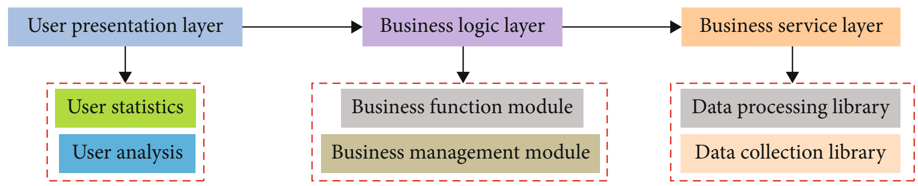

FIGURE 1: Sports equipment batch management system based on antimetal RFID tag.

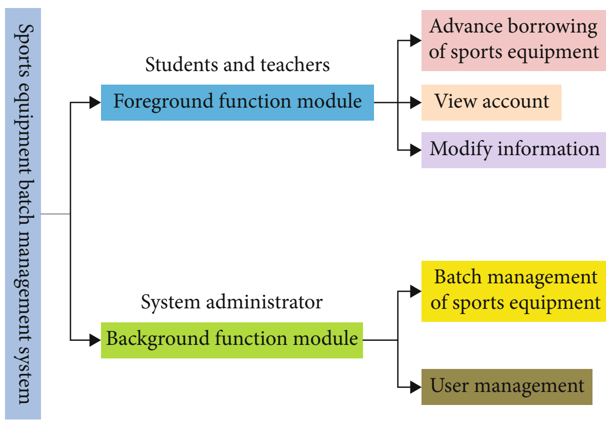

FIGURE 2: Function module of the sports equipment batch management system based on antimetal RFID tag.

and safe storage of system data, ensure the accuracy of the association between tables, and provide strong support for the operation and maintenance of the database.

4. Simulation Results and Analysis

In the antimetal RFID test system, the antenna return loss reflects the signal loss caused by some external reasons in the process of receiving the signal by the antimetal RFID tag. So, the definition of antenna return loss (S_{11}) is shown in equation (8):

$$S_{11} = -20, \tag{8}$$

where Z_{chip} is the chip impedance, and $Z^*{}_{ant}$ is the conjugate of antenna input impedance. The return loss diagram of metal-resistant RFID tag is shown in Figure 3. It can be seen that when in the plane structure, the working frequency of the antenna will have an adverse impact on the return loss rate and show a fluctuating trend. When the working frequency reaches 0.25 Hz, the lowest return loss rate of the antimetal RFID tag is about -20 dB. Then, with the increase of working frequency, the return loss rate increases gradually. In general, the return loss rate of the antenna-resistant to metal RFID tag is comprehensive, and the maximum benefit of the antenna can be well observed.

The power reflection coefficient is expressed as the ratio of the reflected wave power (P_{rfl}) of the tag antenna to the incident wave power (P_{tag}), as shown in equation (9):

$$\frac{P_{rfl}}{P_{tag}} = \left[\frac{Z_{chip} - Z^*_{ant}}{Z_{chip} + Z^*_{ant}}\right]^2. \tag{9}$$

Power transmission coefficient (β) represents the size of the incident wave power transmitted to the label chip, as shown in equation (10):

$$\beta = 1 - \frac{P_{rfl}}{P_{tag}}. \tag{10}$$

The power transmission coefficient can reflect the ability of incoming and outgoing radiation to be accepted by the antimetal RFID tag, and the power reflection coefficient is the ability lost by the antimetal RFID tag. In order to measure the reading performance of metal-resistant RFID tags and facilitate recording the behavior of tags under different bending angles, the maximum reading distance d can be defined for comparison, and the unit is m. The larger the maximum reading distance d, the stronger the reading performance of antimetal RFID tag and the better the acceptance ability of antenna, as shown in equation (11):

$$d_{tag} = \frac{\alpha}{4\pi}\sqrt{\frac{G_r P_{EIRP}}{P_{ir}}}, \tag{11}$$

where P_{EIRP} is the equivalent isotropic power of the transmitter of the reader and here is 3.28 W. P_{ir} is the sensitivity of the tag chip, where the value is -18 dBm. G_r is the simulation of the antimetal RFID tag antenna gain.

Figure 4 shows the variation of power reflection coefficient and power transmission coefficient of antimetal RFID tag antenna with working frequency. It can be seen that with the increase of the operating frequency, the power reflection coefficient of the antimetal RFID tag antenna shows a trend of first increasing and then decreasing. When the frequency is 20 Hz, the value of the power reflection coefficient is the largest. The power transfer coefficient gradually decreases, and at 10 Hz, the power transfer coefficient is close to zero. The above results show that metal substances will not affect the normal use of the antimetal RFID tag antenna, the sensitivity is low, the antenna performance is good, the application range is wide, and it has good application potential.

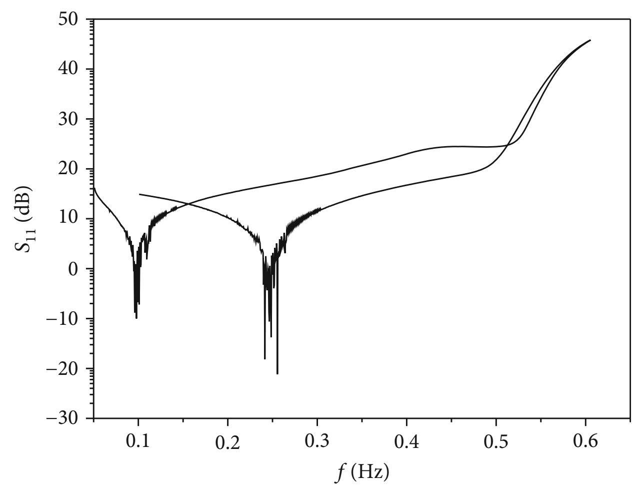

Figure 3: Return loss diagram of metal-resistant RFID tag.

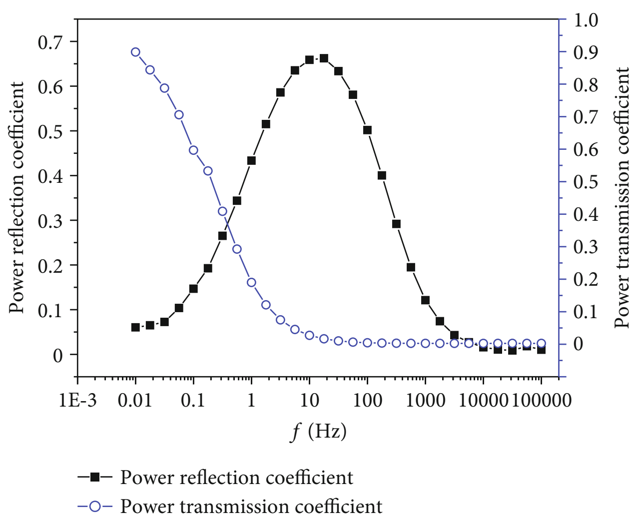

Figure 4: Variation of power reflection coefficient and power transmission coefficient of antimetal RFID tag antenna with working frequency.

5. Application of Antimetal RFID Tag in Batch Management of Sports Equipment

5.1. Application of Antimetal RFID Tag in Batch Management of Sports Equipment. There are two factors in the development of physical exercise activities. In addition to the sports equipment, the sports ground is also a very important factor. Therefore, improving the sports ground and supporting facilities also has a very positive practical significance for improving the application of sports equipment. On the basis of fully understanding the actual situation of the sports ground, managers need to make reasonable arrangements for the limited venues to ensure that the sports ground can fully meet the exercise needs of different people. On this basis, corresponding supporting facilities should be set around the sports ground, so as to effectively improve the utilization rate of the sports ground. In addition, with the increase of the capacity of sports venues, the overall utilization efficiency of sports equipment will be improved accordingly. Antimetal RFID tags can build a management platform. Based on this platform, sports equipment can be managed in batches.

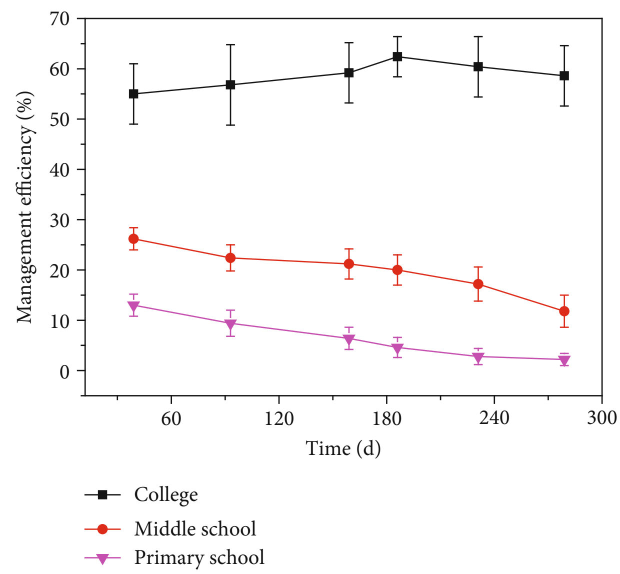

Figure 5: Analysis of batch management of sports equipment based on metal RFID tag between different schools.

According to the management of sports equipment in various schools, this paper discusses the application analysis in colleges, middle schools, and primary schools. Figure 5 is the analysis of batch management of sports equipment based on metal RFID tag between different schools. It can be seen that with the increase of application time, the management efficiency of sports equipment in primary and secondary schools gradually decreases, and the management efficiency of sports equipment in primary schools is the lowest. The management efficiency of sports equipment in colleges shows a gradual upward trend with the increase of application time. The main reason may be that college students have enough time and love sports. Therefore, with the increase of time, the management efficiency of sports equipment increases gradually. For primary and middle school students, their curriculum tasks are heavy, and they can rarely participate in sports; so, the management efficiency of sports equipment is low.

5.2. Application Effect of Antimetal RFID Tag in Batch Management of Sports Equipment. Modern people's pace of life is speeding up, and they also strive to be efficient in the process of participating in physical exercise. Therefore, for some large-scale sports equipment, due to the relatively complex lending procedures and high return difficulty, most people tend to stay away and have low utilization efficiency. In view of this situation, in order to effectively improve the utilization rate of equipment, the relevant responsible personnel of the gymnasium can try to provide some simple equipment for the personnel participating in physical exercise, which can effectively achieve the purpose of exercise on the one hand and effectively improve the overall exercise efficiency of the personnel participating in physical exercise on the other hand. For example, in the exercise of waist strength, large-scale sports equipment was used to achieve the goal of exercise in the past. However, due to the relatively large floor area of these sports equipment, it is difficult to meet people's growing sports needs. In view of this situation, the gymnasium can try to add some simple equipment such as hula hoops and fitness balls. In this way, it can not only effectively meet people's sports needs but also have a very positive practical significance for improving the utilization rate of sports equipment.

Figure 6 shows the utilization rate of different sports equipment among different schools. It can be seen that college students prefer basketball, followed by volleyball and badminton, and finally football. For middle school students, the utilization rate of tennis is the highest, and that of football is the lowest. The use of primary and secondary school students is similar, but also, they prefer volleyball to football. In short, no matter what kind of students, the students do not like football. The above results require that when using the antimetal RFID tag sports equipment batch management system, we should carry out classified management according to the students' hobbies, so as to improve the efficiency of sports equipment batch management and promote the wide application of sports equipment.

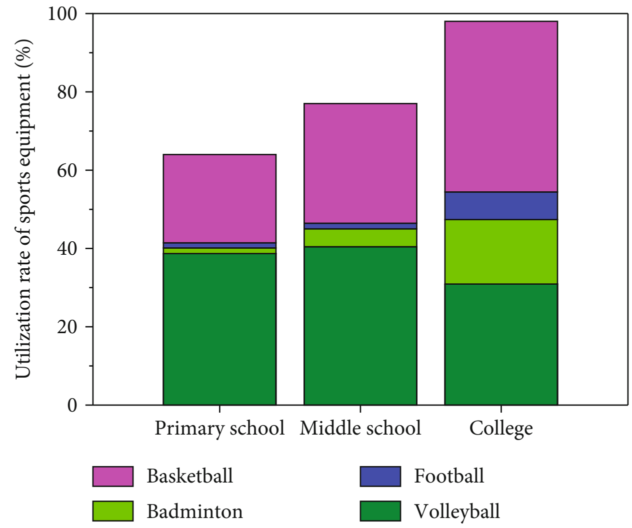

FIGURE 6: Utilization rate of different sports equipment among different schools.

5.3. Satisfaction Analysis of Antimetal RFID Tags between Different Schools in Batch Management of Sports Equipment. In the sports equipment management system, the authority of teachers should be granted the ability of the management system. In the specific design process, teachers can be divided into several types, such as system management teachers, sports equipment management teachers, and sports equipment management responsible teachers. The teacher management system is responsible for system registration and borrowing and returning equipment. This link is the core of managing the main database. The second is the class form. The class form is the statistics of students in each class in the school and the form filled by students in the class taught by teachers. When students in a class need to use sports equipment, they should show personal information data, such as student ID card. After the teacher determines the student identity and class, they can borrow sports equipment uniformly. When the borrower returns the equipment, the administrator changes and records the real situation again. For the return record form, when the teacher or student is returning it, the system can automatically update it and mix and analyze the record form at the same time. The system can also query the students or teachers who have not returned the equipment and even remind the teachers to replace the equipment in time in the process of actual use.

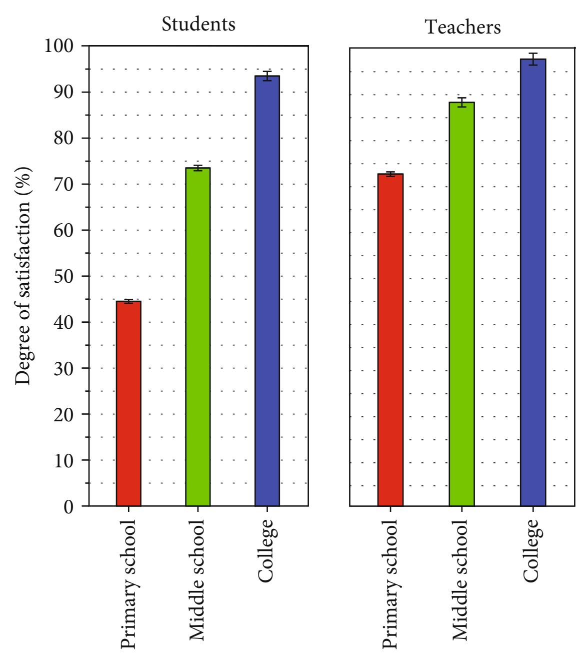

FIGURE 7: Degree of satisfaction of antimetal RFID tags between different schools in batch management of sports equipment.

The degree of satisfaction of antimetal RFID tags between different schools in batch management of sports equipment is shown in Figure 7. It can be seen that for students, college students are the most satisfied with this management system, followed by middle school students, and primary school students are the least satisfied. For teachers, it is consistent with the satisfaction of students; that is, university teachers are most satisfied with the management system, and primary school teachers are the least satisfied. However, it is worth noting that compared with students, the satisfaction of teachers in similar schools is higher than that of students. The main reason may be that college students are adults, have the ability to distinguish right from wrong and autonomous learning, and can well adapt to the management system of sports equipment. However, middle school students are not familiar with this system and have heavy studies; so, their satisfaction with it is low. For primary school students, their autonomous learning ability needs to be strengthened, and they are young; so, it is difficult to adapt to such scientific and technological sports

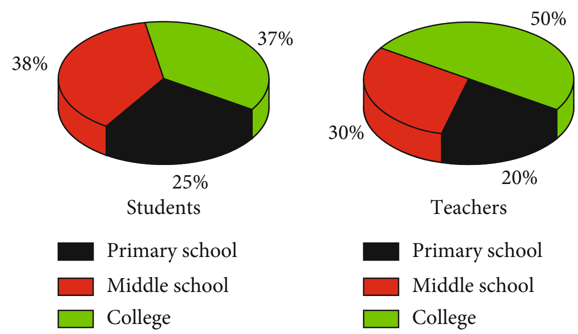

Figure 8: Proportion of satisfaction of teachers and students in batch management of sports equipment in different schools.

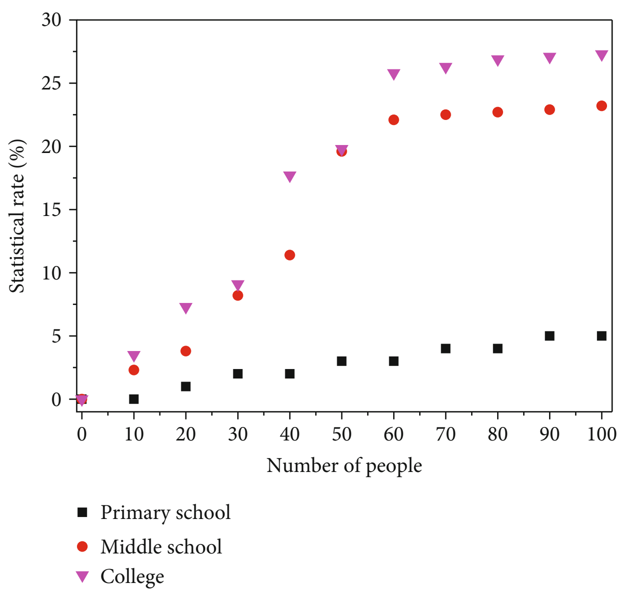

Figure 9: Statistical rate of antimetal RFID tags between different schools in batch management of sports equipment.

equipment management systems. Although teachers can quickly adapt to this management system, due to the different learning ability and cooperation ability among students, the satisfaction of teachers is different. Because teachers are managers of sports equipment and students are users, their different identities lead to different satisfaction.

Figure 8 shows the proportion of satisfaction of teachers and students in batch management of sports equipment in different schools. For students, middle school students account for the largest proportion, followed by college students and finally primary school students, but there is little difference between the three, and the data are very close. For teachers, the proportion of university teachers is the highest, up to 50%, followed by middle school teachers and primary school teachers. In general, the proportion of students' and teachers' satisfaction is different among different schools, which also reflects the applicability and universality of antimetal RFID tags in the batch management of sports equipment.

5.4. Statistical Results of Antimetal RFID Tags between Different Schools in Batch Management of Sports Equipment. Because it is the study of sports equipment management between different schools, in the analysis, we should focus on the differences between different schools, so as to provide experimental support for the popular application of sports equipment. Figure 9 shows the statistical rate of antimetal RFID tags between different schools in batch management of sports equipment. It can be seen that with the increase of the number of students, the statistical rates of primary school students are low, and the statistical rates of middle school students and college students gradually increase and then tend to be stable. The main reason is that middle school students and college students have established a safety guarantee system to correct the problems found in the system, eliminate them in management, and eliminate them in action. We should always adhere to the principle that the expansion of sports facilities is not only the safety of teachers and students but also the safety of students. Form a professional safety management and inspection team to investigate possible hidden dangers and improve the use safety of sports equipment. At the same time, we should also mobilize the majority of students to screen the possible problems, increase the manpower in safety protection, and reduce the possible damage.

6. Conclusion

The sports equipment batch management system based on antimetal RFID tag is mainly to ensure the standardization and rationalization of sports equipment management and effectively improve the batch management efficiency of sports equipment by building an effective management information system. This paper discusses the model establishment process of antimetal RFID tag and analyzes the framework of the sports equipment batch management system based on antimetal RFID tag in detail. Then, apply the antimetal RFID tag sports equipment batch management system to colleges, middle schools, and primary schools, study the application of the batch management system, and realize independent management, which provides some ideas and research methods for building an intelligent modern education environment.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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