Design of Large-scale Sports Event Management System Under the Internet of Things CAD Technology

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Abstract. In the past two decades, China has successively held large-scale comprehensive international sports events such as the Asian Games, the Universidad, and the Olympic Games. The management level of China's sports management departments for events has been greatly improved. Based on this environment, under the guidance of knowledge management theory, this paper systematically explores and researches sports event management. This paper combines CAD technology with the management system of large-scale sports events to enrich and improve the management theory of sports events in our country. This technology combination model will help to promote the scientific, standardized and rational development of future events in my country. Based on the research on knowledge management and event management related theories, this paper systematically sorts out and discusses the traditional event management model. Based on this, this paper further proposes a sports event management mode assisted by CAD technology. This paper further analyzes the operation mechanism and guarantee mechanism of this mode. This paper constructs the evaluation index system of the event management mode. This paper focuses on the knowledge management system and sports event management mode. Based on this, this paper analyzes the purpose, significance of the research object and the theoretical relationship between the two based on CAD technology. Ultimately, this paper argues that the use of CAD technology in large-scale sports events is necessary. This is not only an inevitable choice for sports event management in the era of knowledge economy, but also a key component of the sustainable development of sports events.

Keywords: Internet of things; CAD technology; Large-scale sports events; Event management system.
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1 INTRODUCTION

With people's pursuit of physical health and competitive entertainment, sports events have greatly enriched people's spiritual life. Sports play a very important role in human life in today's society. With the increasingly obvious trend of global integration, Touil et al. [1] believed that the sports events show a diversified development trend. Whether it is a small sporting event, a regional sporting event or a world sporting event, there is a corresponding event management model to match it. Zuhal et al. [2] believed that the types of these sports events include single model, functional model, and joint organization model and so on. With the successful hosting of the Beijing 2008 Olympic Games, China's sports event management practice has developed by leaps and bounds. This incident provides a large number of cases for the study of Chinese sports event management. However, China's domestic research on sports event management contrasts with the extensive practice of the Olympic Games. At present, the management theory of China's domestic sports events cannot well absorb the advanced practices of the Olympic Games.

Since the 1950s, with the rapid development of the global economy and society, people's enthusiasm for participating in sports has continued to increase. People's enthusiasm for sports has driven the vigorous development of the global sports industry. These sports industries include sports lottery industry, sports fitness industry, sports entertainment industry, sports competition industry and so on. Among them, Bakshi et al. [3] believed that the sports competitions have the characteristics of fierce confrontation scenes, unpredictable results, and strong player appeal. Therefore, sports competitions have won the general love and attention of the general public. Based on this, various countries in the world have formed sports competitions of various contents, forms, scales and regions. Among them, some sports competitions take into account differences in the level of political, economic and social development of the venues. Zhao [4] believed that the big sporting events can have a huge impact. Through the management and operation of professional organizations, sports competitions deeply integrate TV, Internet and other media. In the management of sports competitions, commercial enterprises fully participate and provide a lot of financial support. In addition, Bouras et al. [5] believed that the computer technology is also widely used in the management of sports competitions, especially CAD drawing technology has been widely used. The application of this technology makes sports events more and more popular among the people. At the same time, Guevara [6] believed that the large international sports events can boost investment, boost consumption, and improve infrastructure. Sports events can overcome the influence of factors such as political background, racial discrimination and the gap between the rich and the poor.

The management mode and method of sports events has become a hot issue in the study of sports theory. In a globalized environment, the organizers of sports events are usually able to provide a level playing field. Large-scale sports events can attract the participation of countries, regions and cities. Desselle et al. [7] believed that the momentum of competition for sports events in various cities is very strong. China's reform and opening up has been going on for more than 40 years, and China's economic and cultural environment has undergone tremendous changes. Chinese athletes have achieved good results in various large-scale international sports events. China's sports industry is developing rapidly, and more and more large-scale sports events are held in major cities in China. For example, there are various forms such as National Games, Urban Games, National Games and Games of Various Industries. At the same time, China began to try to bid and host international sports events. At present, China is going through the process of rapid urbanization, and large-scale sports events and international sports events have gradually become the choice of Chinese governments at all levels to promote urban development. Large-scale sports events can help enhance the city's image and influence. With the increase of event practice opportunities, Eeva et al. [8] believed that the sports event management experience and event management talents have been cultivated. At the same time, Rebecca et al. [9] believed that the large-scale sports events have also enhanced China's confidence and determination to host the world's top sports events. Shan et al. [10] believed that the Olympic Games is a sporting event

with the most extensive influence, involving the most fields, the most complex participating departments and the largest scale in today's society. At the same time, the Olympic Games is also a huge and complex systematic project.

This article believes that it is necessary for us to extract the guiding theory for the government's management of sports events from the practice of the Beijing Olympic Games. In view of this, this paper thinks that it is necessary to carry out scientific classification and comparative research on the existing sports event management models. On this basis, we need to learn from the advanced nature of the Olympic Games and innovate the existing sports management model. Therefore, combined with the organizational structure theory of management, this paper makes a detailed classification of the sports event management model. In this paper, the management modes of sports events with various types and complex names are divided into flat management mode, vertical management mode and network management mode. This paper further elaborates and analyzes the classification mode of sports events. This paper focuses on the new situation and new problems in modern sports events, and elaborates on the defects of the existing three models. Based on this, this paper further combs and summarizes the CAD technology and the new sports event management mode.

2   RELATED WORK

The CAD technology is constantly updated with the rapid development of computer technology. In the current theoretical research of Chinese academic circles, there are still cases where concepts such as sports competition management, sports events or competitive performances are mixed. The basic theory or partial theory of sports event management in academia is still in a relatively vague state. Sports competition management is an important part of sports events, but not the sports events themselves. Therefore, it is necessary for us to make a brief review of the theoretical research status of sports competition management. The research on sports management in my country mainly focuses on the following aspects. One is the research on the basic theoretical system of sports competition management. The basic theoretical system of sports competition management is the main content of current research on sports competition management. The research focus mainly focuses on the basic concepts of sports competition management, the value and efficacy of competition, the rules of winning, competition methods, competition organization management and competition guarantee. Some scholars have explored and studied the security system of sports competition management, the concept and structure of winning by using the relevant theories of system management. The study further explained the characteristics, operating mechanism, operating conditions and scientific configuration of the sports competition management guarantee system. Some scholars believe that a complete sports competition management theory should be composed of three parts: biological basis, psychological basis and sociological basis. Overall, the management of sports competitions in a broad sense is identified as a practical activity. This kind of activity is a special process with a clear purpose and distinct competitive characteristics. Sports competition has a well-established set of rules. In addition, sports competitions have a set of competition methods and legal basis for deciding the outcome of the competition. In addition, considering that sports competitions have distinct competitive characteristics, the management of sports competitions in a narrow sense is a macroscopic refinement and generalization of the structure and elements of sports. The generalized concept of sports competition management emphasizes the qualitative description of the value and function of sports competition management. This definition has distinct sociological characteristics. The Application Framework of CAD Technology in Large-scale Sports Event Management System is shown in Figure 1.

Judging from the existing research results, the current research in China pays more attention to the competitive characteristics of sports competition management itself. At the same time, the current research also involves the socialized characteristics of sports competition management. In actual research, there is a mixed use of sports competition management and sports events in many documents and government documents. In general, the mainstream view in the academic

circle still does not distinguish sports competition management from sports events. Under the current environment, China's economy and society are facing opportunities for transformation and development, and sports competition management also reflects a series of new changes. This situation also leads to multiple problems in the organization and management of sports events. Some scholars believe that with the deepening of China's economic system reform, China's sports competitions have changed from the original administrative directive plan to a market-oriented operation mode. The operation of sports competitions is realized through marketing activities. This change in competition rules is also an inevitable result of the rapid development of the market economy. There are many main problems facing the development of sports competition management in China. Specifically, the main problems are the serious shortage of competition funds, the prevalence of unhealthy competitions, the low overall quality of professional competitions, the relatively single competition function, and the lack of total competition volume. Some scholars believe that the government's management and organization of sports competitions is the product of the planned economic system. This kind of organizational operation mode can no longer meet the needs of competition development. Some scholars believe that China should not only attach importance to the Olympic Games and the National Games, but also attach importance to the development of professional sports competitions.
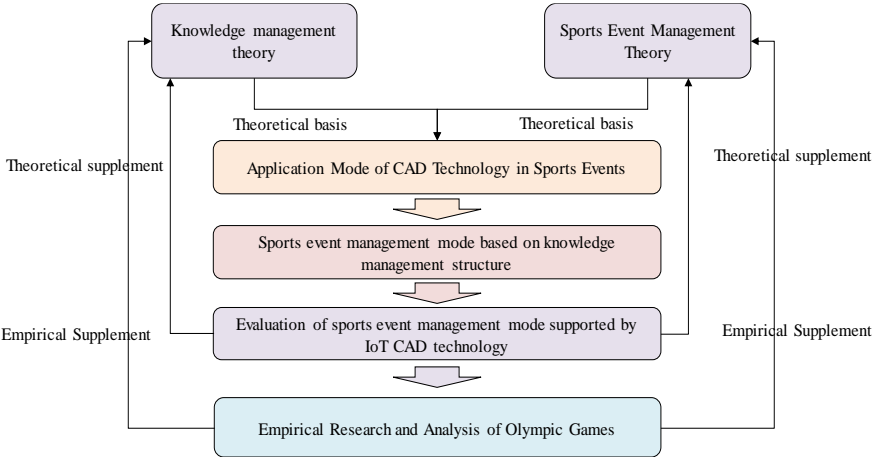

Figure 1: The Application Framework of CAD Technology in Large-scale Sports Event Management System.

3   THE MANAGEMENT MODE OF SPORTS EVENTS BASED ON CAD TECHNOLOGY

3.1   The Flat Management Model of Sports Events

The sports event organizers reflect the implementation of CAD technology by the organizers through the application of CAD technology. The organizer requires the setting of the management system to submit the CAD technical results according to the given template. The event management department provides CAD technical services through various channels. The organizer of the event uses CAD technology to manage the whole process of the competition. This management model not only conforms to international practice, but also highlights the characteristics of the host country. This method applies CAD technology to the management process of sports events. CAD technology has made new contributions to the innovation and inheritance of the management model of sports institutes such as the Olympic Games. During the same period, various sports events held in China have problems such as untimely processing of

data and information. Specifically, there are many problems such as the untimely processing of massive data and information, the unsmooth operation of the organizational management system, and the imbalance of multiple stakeholders. When this article seeks the guiding literature on sports event management theory, it is found that there is not much theoretical research in this area at present. The current research cannot meet the practice activities that are frequently held in various international sports events. Under the general trend of holding sports events in China, China urgently needs to obtain advanced theoretical guidance on sports event management models and methods. This paper uses CAD technology and sports event management theory to conduct empirical research on the application practice of IoT CAD technology in large-scale sports events. This paper further builds the CAD technical model of the event represented by the Olympic Games. This model provides an effective technical solution for the organization and management of sports events. The Structure diagram of sports event management system based on IoT CAD technology is shown in Figure 2.
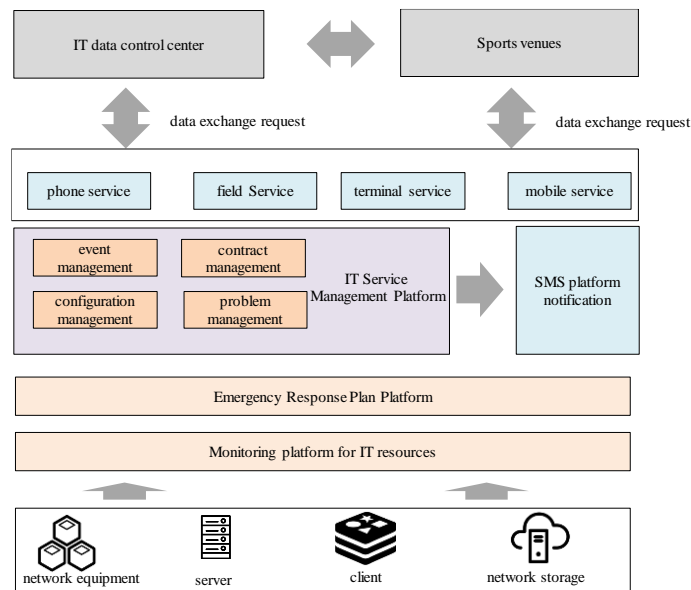
Figure 2: The Structure diagram of sports event management system based on IoT CAD technology.

3.2 The Vertical Management Mode of Sports Events

The sporting event involves a lot of information and knowledge. In addition, each Olympic Games has promoted institutional innovation and the application of new technologies. These new technologies will help organizers to supplement their own abilities and relevant new knowledge. The Beijing Olympic Games emphasizes international standards in the organization and management of sports events. The Olympic Games introduced a new concept and method of CAD technology, which solved the constraints of the diversification of the main body of the event. This technology solves the problems of complex interests of the participants and the sharing of massive information and knowledge. The application of this technology has also formed a large number of valuable knowledge reports and experience summaries. In this sense, the success of the Beijing Olympic Games is largely due to the support of computer CAD technology. In addition, the organization of sporting events is emphasized in order to maximize the role of knowledge in the Olympic Movement. An important move of sports event organizers in the past decade is to highlight the status of CAD technology. Sports event organizers regard CAD technology as an

important supporting technology to ensure the smooth implementation of the Olympic Games in every venue.

3.3 The Network Management Mode of Sports Events

Overall, there are still many problems in the organization and management of current sports competitions. The research of existing scholars shows that the current research content lacks the overall theoretical depth, and lacks the research of specific operational content and technology. The academic community has not yet reached a consensus on the basic concepts of sports event management. From the specific content, on the one hand, the practical work of Chinese sports events is rich in content, on the other hand, the theoretical research on the management of Chinese sports events is still relatively lacking. There are few relevant research results, and there are still large differences between the existing research conclusions. The academic community has not yet clearly understood the basic theoretical issues of event management. Therefore, this paper believes that the management of sports events needs to strengthen the systematic design. Specifically, the detailed design of the system refers to grasping the system management mode as a whole and formulating a series of development norms and standards. The specific content includes the functions, performance, interfaces, user interfaces, auxiliary programs, etc. necessary to realize the system. Systematic design can provide a basis for specific coding work, and help the project leader to arrange and control the entire development process. The systematic design can also provide a reference for the phased and summative quality verification of the project. The organization and management structure diagram of sports events supported by IoT CAD technology is shown in Figure 3.

The system design includes four aspects: system structure, architecture design, interface layer template design and function design of each module. This paper further constructs the structure of the entire IT service management system according to the system functional requirements. Among them, the IT service management system is located inside the management private network. The management system adopts a three-tier architecture design, namely interface layer, business logic layer, data access layer, and public category and entity layer. The interface layer is composed of system interface and control logic. This layer mainly receives user commands, requests and data. After the interface layer collects information, it passes the content to the business layer for processing, and then presents the results. The control logic is responsible for handling the data interaction between the interface and the business layer, as well as some simple data validation. The business logic layer encapsulates the actual business logic, including business-related operations such as data verification, transaction processing, and permission processing. Business logic is the core of the entire application system. The data access layer is used to interact with the database, including operations such as adding, modifying, deleting, and obtaining data. The public class encapsulates some commonly used functional code. The entity class is the data transmission carrier between the various layers. The Design of sports event management system based on IoT CAD technology.

4 THE DESIGN OF SPORTS EVENT MANAGEMENT SYSTEM BASED ON IOT CAD TECHNOLOGY

4.1 The Overall Structure of Sports Event Management System

Data is the heart of the system. Before data is encapsulated, it mainly exists in memory in a fixed format. Data content is transported within the various layers of the system. There are two main ways of presenting business data in IoT CAD technology, including dataset and custom entity. The dataset maps data tables directly into business data objects. This mapping helps machine identification and operation. Existing system frame supports provide this ease of operation. However, this architecture is difficult to intuitively express complex business relationships, and is only suitable for expressing the correspondence between business requirements and data tables.
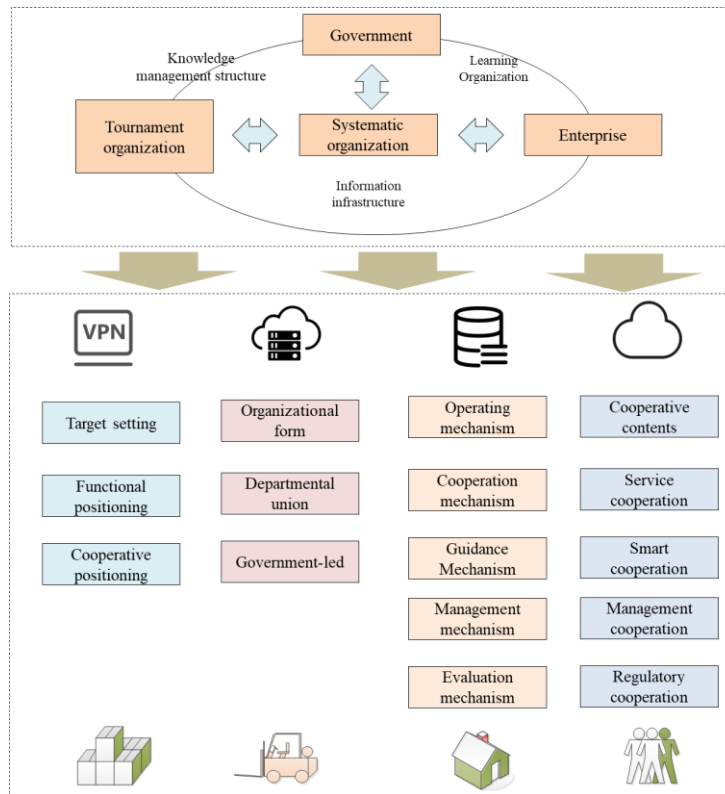
Figure 3: The organization and management structure diagram of sports events supported by IoT CAD technology.

This CAD design framework architecture is suitable for the rapid development of the system. The CAD design framework does not need to write and maintain the code by itself. The CAD design framework does not require system administrators to serialize data. Data is saved in the form of copies, and the system supports data collection storage. The system has a better effect on the control binding support. In addition, the system service provider provides corresponding generation tools and data storage solutions. The disadvantage of this software system is that the presentation of complex data is not intuitive. Data is transferred between layers within the system in DTO mode. The customized business entities in the CAD design framework are classified according to the actual business types. System development adopts object-oriented method for modeling, which is suitable for complex business systems. This mode is suitable for custom data entities, and the system has good performance. In addition, structured code organization facilitates type checking at software compilation time. The data representation is very intuitive and conforms to the actual business operation. The Application of CAD Design Mode in Sports Event Management System is shown in Figure 4. The system uses SQL statements to perform database operations such as data addition, modification, deletion, and query. In addition, the data access layer is an important part of the interaction between CAD business content and data sources. The system provides the data access interface necessary for the business layer, and the logic of the business layer completely depends on the services provided by the data access layer.
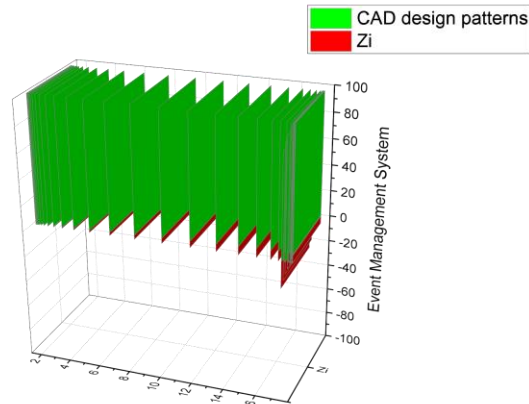
The Application of CAD Design Mode in Sports Event Management System

Figure 4: The Application of CAD Design Mode in Sports Event Management System.

The CAD design service provided by the system is functionally connected to the outside through the interface. The system separates the data access layer, which helps to provide a better data storage strategy. The system update only needs to change the data access layer, without affecting the complex business logic.

4.2   The Overall Architecture Design of the Management System

Specifically, the business logic layer systematically encapsulates the business content. This module includes business-related operations such as data verification, transaction processing, and permission processing, and is the core of the entire application system. The interface layer of the system consists of interface module and control module. The interface module is responsible for receiving commands, requests and data from the user side and passing them to the business layer for processing. The system will display the processing results. The control module is responsible for handling the data interaction between the interface and the business layer, and also provides some simple data validation functions. In general, a large-scale sports event management system needs to meet the following requirements. The first is the functional requirements. The system should try to integrate the reasonable needs of various users on the basis of sufficient research. System construction needs to meet the current and future needs of users. Secondly, the system needs to realize the functional requirements of users. The system needs to be combined with the actual physical environment for performance design. The system construction needs to take into account the efficient and stable operation of the actual production link. Among them, the main indicators considered are system response time. For example, the operation time of the general function of the system should not exceed 3 seconds. The query time of the report class should not exceed 5 seconds, and the system throughput and the number of concurrent users need to be effectively controlled. The effect of CAD technology in sports event management system is shown in Figure 5.

4.3   The Design of Interface Layer Template of Management System

The system needs to meet security requirements. The system should focus on security design, so that outsiders cannot intrude into the system itself. Insider operating systems are required to leave operational traces. System fault tolerance needs to be guaranteed. The system should have the ability to prevent various disasters.
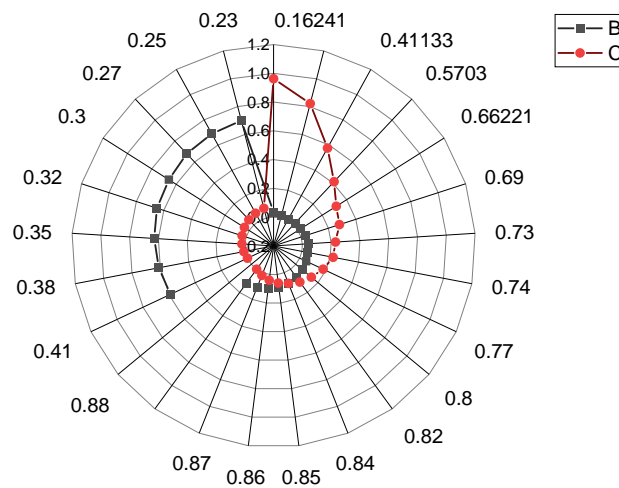
Figure 5: The effect of CAD technology in sports event management system.

When various disasters occur, the system should have remedial or fault-tolerant mechanisms. This mechanism can ensure the regeneration of system functions, thereby ensuring that the time for system troubleshooting is reduced to the shortest possible time. The system keeps its compatibility as far as possible in the design process, so that the system can cope with various business changes as much as possible, and it is convenient for various new business requirements to be added to the system modules. The system needs to meet the maintainability requirements, and various documents should be improved during the design process of the system. Operators only need to read the documentation to become familiar with all operations. System maintainers can understand the system structure and design ideas through the documentation. This mode of operation helps maintainers to quickly understand the entire system. When designing programs, designers need to maintain a good programming style. The design of the system needs to ensure that the structure is clear and the annotations are clear, so that the debugger and tester can quickly locate the error. The Comparison of Combination Channels of CAD Design Method and Sports Event Management is shown in Figure 6.

4.4 The Function Design of Each Module of the Management System

In order to meet the actual needs of customers, the system can provide customers with log-in and maintainable system solutions. The system needs to meet high availability and high stability. The sports event management system is an operation and maintenance system that provides service support for the sports event business department. The system needs to guarantee the sustainability and stability of business processes, and it must have high availability and high stability. The platform must be capable of handling any errors, and the system must provide tools or means to restore service. The security of system applications helps to ensure the security of system personnel's login and operation. Only users who meet the system security requirements can access system business objects and their functions. The user password of the system is encrypted and will not be displayed anywhere in the system in clear text. The system includes complete functional documentation for easy development, training, maintenance, and simplified integration with third-party functions. The system provides a standard Web Service interface, which can be easily integrated with third-party systems. At the same time, the system also helps to maintain its own independence.
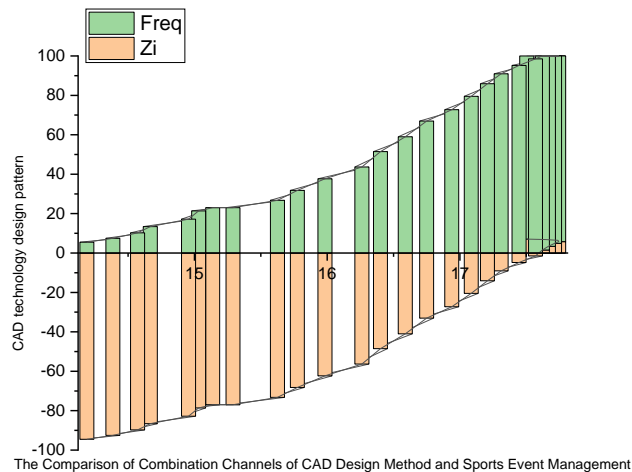
The Comparison of Combination Channels of CAD Design Method and Sports Event Management

Figure 6: The Comparison of Combination Channels of CAD Design Method and Sports Event Management.

The system makes full use of object-oriented design methods and patterns to improve system scalability. This design mode helps to ensure that the system integrates network management systems, desktop management software and third-party monitoring software with the lowest cost and fastest speed.

5 CONCLUSION

At this stage, the national system is still the basic institutional guarantee for the successful holding of large-scale sports events in China. At present, the management level of large-scale sports events in China needs to be improved urgently, and the theory and technology of event management are still relatively backward. The management benefits and experience in the successful holding of sports events are still insufficient, forming a "path dependence" on the national system. In general, the sports event management system needs the support of computer technology. The CAD technology in the Internet of Things environment has a good supporting role for the system development and construction. Generally speaking, the overall requirements for the service management system of sports events are relatively high. The system needs to use CAD technology to support the integration of existing site resources. At the same time, the system IT control center can provide complete consulting services. The system console provides a unique number through the purchaser, and distributes it to the competition system help desk, call center agents and venue technical team in a timely manner according to the service content. The CAD-supported stadium management system should pay attention to the close contact with the stadium technical team, and distribute the relevant service requests to the stadium management personnel in a timely manner.

The operation and management of the IT service center help desk involves many aspects. One is multi-domain support; the system can accept all service requests and events of non-competitive system users. The second is to provide high-quality, professional fault reporting services. The third is that the system needs to receive user service requests and distribute them to the corresponding staff in a timely manner. The fourth is to analyze and process service requests. If the system cannot solve the problem, it needs to be dealt with according to the IT service process. The fifth is to track the processing progress to ensure the time efficiency of the service. The sixth is to carry

out event escalation processing in a timely manner. The system performs reasonable resource scheduling and coordination as needed. The seventh is to conduct user return visits in a timely manner to investigate user satisfaction. At the same time, the system needs to record, archive and count service data.

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REFERENCES

[1]   Touil, N.; Pavlopoulou, A.; Momeni, M.: Evaluation of virtual reality combining music and a hypnosis session to reduce anxiety before hand surgery under axillary plexus block: A prospective study, International Journal of Clinical Practice, 7(22), 2021, 75-88. https://doi.org/10.1111/ijcp.15008

[2]   Zuhal, C.; Cizmeci, S.-F.: The future of quality and accreditation surveys: Digital transformation and artificial intelligence, International Journal for Quality in Health Care, 3(2), 2020, 112-123. https://doi.org/10.1093/intqhc/mzac025

[3]   Bakshi, S.-K.; Lin, S.-R.; Ting, D.: The era of artificial intelligence and virtual reality: transforming surgical education in ophthalmology, The British journal of ophthalmology, 9(12), 2021, 101-112. https://doi.org/10.1136/bjophthalmol-2020-316845

[4]   Zhao, C.: Application of Virtual Reality and Artificial Intelligence Technology in Fitness Clubs, Mathematical Problems in Engineering, 21(20), 2021, 1-11. https://doi.org/10.1155/2021/2446413

[5]   Bouras, M.-A.; Lu, Q.; Zhang, F.: Distributed Ledger Technology for eHealth Identity Privacy: State of The Art and Future Perspective, Sensors, 20(2), 2020, 483-499. https://doi.org/10.3390/s20020483

[6]   Guevara, B.-S.: Virtual Reality-Based Framework to Simulate Control Algorithms for Robotic Assistance and Rehabilitation Tasks through a Standing Wheelchair, Sensors, 2(11), 2021, 21-34. https://doi.org/10.3390/s21155083

[7]   Desselle, M.-R.; Brown, R.-A.; James, A.-R.: Augmented and Virtual Reality in Surgery, Computing in Science and Engineering, 12(88), 2020, 12-18. https://doi.org/10.1109/MCSE.2020.2972822

[8]   Eeva, E.; Pyörälä, Y.; Saana, T.: The art of note taking with mobile devices in medical education, BMC medical education, 7(13), 2019, 67-79. https://doi.org/10.1186/s12909-019-1529-7

[9]   Rebecca, U.; Jane, T.; Calthorpe, F.: Using digital technology for home monitoring, adherence and self-management in cystic fibrosis: a state-of-the-art review, Thorax, 8(12), 2019, 16-23. https://doi.org/10.1136/thoraxjnl-2019-213233

[10]   Shan, R.; Sarkar, S.; Martin, S.-S.: Digital health technology and mobile devices for the management of diabetes mellitus: state of the art, Diabetologia, 62(6), 2019, 8-16. https://doi.org/10.1007/s00125-019-4864-7