



Digital Twin: Health Code Technology in the Large Passenger Flow Management of the Asian Games

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Abstract. Health code, as the integration of individual digital information, the health code promotes the positive transformation of economic and social forms, and the digital twin promotes the digital transformation and promotes the intelligent upgrading. This paper intends to analyze the application of health code technology under the digital twin, discuss the impact of Chinese and foreign sports events, analyze their countermeasures, study the highlights of the early response of the Hangzhou Asian Games Organizing Commission in 2022, and innovate the management countermeasures of the large passenger flow of the 2022 Asian Games in Hangzhou.

Keywords: digital twin · health code technology · Asian Games · large passenger flow

1 Introduction

“Health code”, based on big data technology, can not only track the dynamics of the national epidemic, but also accurately dispatch and distribute resources, becoming a digital means of urban emergency support capacity and management coordination ability. Digital twin is to realize monitoring, prediction, optimization and other functional services and application requirements, driven by multi-dimensional virtual model and fusion data. At the same time, the collection of artificial intelligence, big data, IOT and many other technologies, now copy a digital virtual body in the digital world. In view of this, this paper will discuss the application of health code technology in the Asian Games large passenger flow management, to provide countermeasures and suggestions for the upcoming Hangzhou 2022 Hangzhou Asian Games.

2 Research Review

Due to the impact of the epidemic, more and more scholars are studying the reasons for the shutdown of related sports events to promote the recovery and development of the industry. According to Huang Haiyan, the outbreak of COVID-19 has had a serious impact on the development of major events from the preparation of major events and the

management of the risk of large passenger flow [1]. Fu Mengting's research suggested that in the era of COVID-19, the difficulties faced by large-scale sports events are mainly due to the difficulty of reopening the industry caused by the capital contraction of the sports industry, the low audience participation, and the strict epidemic prevention policies that make the preparation of the sports events more difficult [2]. Xu Xiang found that the suspension or cancellation of sports events due to the epidemic will also change the share price of the event sponsors, hindering the high-quality economic development of the host city or the host country [3]. Take the 2020 Tokyo Olympics, for example, when the postponement and empty matches due to the outbreak caused an economic loss of about 2.4 trillion yen [4].

Due to the uncontrollable factors of the epidemic, the delay or cancellation of the event, which directly affects the training plan of athletes. Numerous studies have shown that the epidemic has impacted athletes in all aspects. Zhang Zhixin and others show that the postponement of the Tokyo Olympic Games will cause an irreversible impact on the athletes' training rhythm and preparation cycle, and the older athletes will also be impacted in their career [5]. In Wu Guodong's opinion, the athletes' preparation training plan will be postponed or cancelled due to the epidemic, which even brings great psychological pressure to them [6]. The results of these studies reveal the negative impact of the epidemic on athletes from different perspectives. Mariella Scerri et al. showed that, without constructive action and support, most athletes experience substantial psychological stress and may stimulate may have mental illness [7].

In short, most of the existing studies illustrate the negative impact of COVID-19 on the large-scale sports event industry from different perspectives, focusing on national sports events. Some of these studies focus on large sports events such as the Olympic Games, but most are prospective studies with retrospective studies accounting for a minority. This paper will focus on the new situation that may emerge in the future, namely, how to better host large-scale sports events under the new epidemic prevention and control policy. This study investigates the recent Tokyo Olympic Games, the Beijing Winter Olympics, and further studies the recent success of the Qatar World Cup, and summarizes the experience, lessons and opportunities of hosting sports events in the face of the epidemic based on facts.

3 Large-Scale Sports Events Held at Home and Abroad Due to the Epidemic Situation

3.1 Tokyo 2020 Olympic Games

The Tokyo Olympics, originally scheduled to open on July 24, will be postponed for about a year as the scope of the new coronavirus infection continues to expand around the world. The Tokyo Olympics is postponed for the first time in history, and it has a great international impact. The World Health Organization announced on the 23rd that the number of confirmed cases of new coronary pneumonia worldwide has exceeded 300,000, and the growth rate of cases has accelerated. Many international organizations have called on the international community to work together to fight the disease, against stigma and other irresponsible behaviors. The Olympic Games is one of the most influential comprehensive sports events in the world. It has particularly important political and

cultural significance. The highly uncertain epidemic situation and the complex content of the Olympic Games make the decision to postpone it more difficult.

Because the risk of the new crown pneumonia epidemic is always high, vaccine research and development has not yet been widely recognized as a substantial advancement, and the postponement of the Olympic Games has increased costs, and some imagination has been added. Harada Munehiko, a researcher in the Japanese sports industry, estimates that the Olympic Games The delay would bring an additional cost of \$6.5 billion. According to international media reports, the overall operating expenses of the Tokyo Olympic Organizing Committee are about 5.6 billion U.S. dollars, and the construction area of urban stadium facilities is about 7 billion U.S. dollars, with a total of 12.6 billion U.S. dollars, a total of more than 25 billion U.S. dollars. In particular, due to the uncertainty of the epidemic situation, the above measures are still under dynamic adjustment, which also brings about the superposition of some delay costs, and will continue to increase the economic pressure on the host country.

In order to control the epidemic at the Olympic Games, the Tokyo Olympic Organizing Committee has formulated multiple epidemic prevention measures. At the same time, it has provided the "Epidemic Response Measures Manual" for everyone involved in the Olympic Games. In view of the fact that a large number of foreign personnel entered my country during the Olympic Games, the Tokyo Olympic Organizing Committee has developed a number of dedicated digital platforms based on the Internet, covering the submission of entry information, approval of activity plans after entering the country, steps to verify nucleic acid test results, etc., by This reduces the risk of entry infection, improves the processing efficiency of entry procedures, and can track entry personnel throughout the process. Major airports in Japan have also implemented physical isolation between Olympic-related inbound personnel and ordinary passengers, further reducing the risk of infection of Olympic personnel at the airport. As far as personnel management is concerned, the Tokyo Olympic Organizing Committee implements "bubble management, etc." All participants participated in the meeting, and all those who participated in the Olympic Games, from entering the Olympic Games to leaving the Olympic Games, are in a specific "bubble" environment, and the local community, try to avoid their contact with the outside world. For those players who unfortunately contracted the new crown, they can participate in the competition again within 6 days of illness and isolation, and when they have 2 consecutive negative nucleic acid tests 24 h apart after isolation.

As far as spectator restrictions are concerned, all events held in Tokyo for the Tokyo Olympics will be empty, and spectator seats will be opened for games in other cities according to local conditions. In addition, the Tokyo Olympic Organizing Committee also set up the post of coordinator for the new crown epidemic to ensure that matters related to the epidemic during the Olympic Games can be carried out smoothly. Although the Tokyo Olympic Organizing Committee has adopted many epidemic prevention measures, the reality is not satisfactory. Many epidemic prevention regulations have not been strictly implemented. Both the Olympic Organizing Committee and the participants have repeatedly been exposed to violations of epidemic prevention regulations. The number of daily confirmed cases in Tokyo has exceeded 4,000 for five consecutive days since the Olympics, reaching a record high of 5,773 on August 13, exceeding the record high of 50 cases on August 5. From this point of view, the Tokyo Olympics accelerated the

spread of the new crown epidemic in Japan, and reached the peak of the epidemic after the Olympics closed.

3.2 CONMEBOL Copa América 2021

The 47th Copa America in Brazil was originally scheduled to be co-hosted by Argentina and Colombia in 2020, but it was postponed for a year due to the pandemic. Due to the political instability in Colombia, coupled with the second wave of the pandemic, which is becoming more and more out of control, Colombia has had to abandon hosting this major competition. There is also a host country, Argentina, and the epidemic situation is not optimistic. As Argentina is in the midst of the worst period since the pandemic, with nearly 40,000 new infections and more than 700 deaths per day, their capitals are Buenos Aires, Santa Fe, Tucumán and Mendoza, Córdoba and other regions that host the Copa America.

The 2020 Copa America has been postponed to June 12 and July 12, 2021 due to the pandemic, just like the time of the European Cup. In terms of epidemic prevention, CONMEBOL has issued a number of health regulations to prevent the spread of the Copa America epidemic. The Copa America allowed 7,000 players to enter the arena except for the final, and the rest of the tournament was not open to fans. After the event, national football associations adjust the rules of the game according to the epidemic prevention and control situation in their countries and the international situation. 24 h before each national team enters Brazil, all accompanying personnel need to upload the nucleic acid test results to the relevant site within 48 h. At the same time, teams are also required to upload their passports and ID cards to the official WeChat platform of the Organization for registration, before they can watch the game at the airport or other public places. When entering Brazil, all national teams are separated from ordinary passengers and delivered to hotels by special bus, after which they must carry out activities in the prescribed area, isolated from the outside world in Brazil. In addition, national teams are required to report the outbreak to the local police. Before each match, all members of the national team and relevant personnel of the Copa America should undergo nucleic acid testing, and if there are positive cases, they should be isolated. Other epidemic prevention regulations include the cancellation of the handshake session, the prohibition of changing jerseys after the game, and the wearing of masks by athletes who do not participate in the competition in the arena.

Since Brazil is the top country in the world in terms of the severity of the epidemic, many Copa America teams have developed stricter epidemic prevention measures in accordance with the CONMEBOL epidemic prevention regulations, thereby minimizing the probability of Brazil contracting the new crown. Outside the competition venue, the epidemic situation in Brazil is still very serious, from June 13 to July 11, Brazil added 2139518 new confirmed cases of new crown, with an average of more than 530,000 diagnoses a week.

3.3 Olympic Winter Games Beijing 2022

The Beijing Winter Olympics was held on February 4, 2022, as scheduled, marking the first time for China to host the Winter Olympic Games. It is of great significance to the epidemic prevention and control and management of sports events.

Combined with the above cases of the Tokyo Olympic Games, the Beijing Olympic Games also implemented the “bubble management”, and set up the entry management software management personnel information, control the number of visitors everywhere and so on. However, based on the situation of the Beijing Winter Olympics, the Beijing Winter Olympics has proposed new guidelines for hosting major sports events in the epidemic. First, a detailed epidemic prevention manual has been compiled, and differentiated epidemic prevention strategies have been adopted for different groups of people. The epidemic prevention manual is further divided into “epidemic prevention manual for athletes and team officials” and “epidemic prevention manual for other stakeholders”. Both of the manuals cover all behaviors that may pose a risk of infection or infection to the activists, including personal protective measures and environmental disinfection measures. Second, use high-tech means to help prevent the epidemic. The third is to achieve full coverage of epidemic prevention work through Internet technology. High-tech include intelligent safety service robots, armpit band-aids, contactless delivery robots, cold chain logistics ultraviolet photocatalytic composite sanitize, bioaerosol new crown monitoring systems in public spaces, unmanned restaurants and so on. Third, during the outbreak of the new crown pneumonia epidemic, through Internet technology and big data analysis, the public will be provided with all-round and multi-channel personalized medical advice, so that the public can receive more comprehensive disease prevention and treatment. Intelligent, digital epidemic prevention tools greatly improve the epidemic prevention efficiency of the Beijing Winter Olympics, reduce unnecessary contact of personnel, make participants’ activities more convenient, and live more comfortably. At the same time, the Beijing Winter Olympics will make full use of Internet of Things technology such as health code plus temperature measurement to improve personal health information code data (see Fig. 1), and control the recovery of the epidemic at low cost and high efficiency, which will be the most effective means to prevent and control the epidemic.

From the results of epidemic prevention, the Beijing Winter Olympics, as a major sports event that has been least affected by the epidemic since the outbreak of the new crown epidemic. Among the first aid support staff for epidemic prevention and control, none of them were infected with the new coronavirus, achieving the goal of “zero infection”. Due to the strict closed-loop management system in Beijing, there are few new cases in areas outside Yanqing and Zhangjiakou.

3.4 FIFA World Cup Qatar 2022

Since the spread of the epidemic, there has been only one mega-event successfully held, the FIFA Club World Cup (referred to as the Club World Cup) held in Qatar. The Qatar World Cup adopted extremely strict epidemic prevention measures under the standards at that time, and there are three points that can be learned:

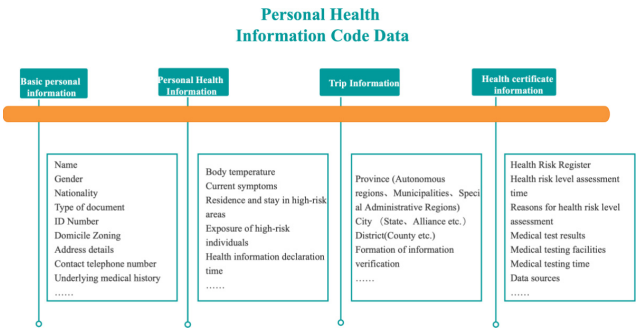


Fig. 1. Data structure of personal information and health code

First, macro overall planning. The epidemic prevention and control of the Qatar World Cup is a complete set of projects, and the first gate of the prevention and control of the event is not the gate of the venue, but the country’s airport customs. Qatar regulates overseas spectators, and Japan has now chosen to ban overseas spectators from attending the tournament, a little different from the current European Championship. The epidemic prevention and control part is mainly managed by the Ministry of Public Health of the Qatari government.

Second, micro-classification management. The Qatar World Cup event involves a wide range of personnel and can be divided into three categories by its nature. The first category of personnel are athletes, referees and team members in the arena; The second category is the on-site spectators and staff who are relatively easy to contact with the first category of personnel, such as the athletes’ village and hotels, training grounds, staff in the competition venue, and staff connecting the three major sectors, such as drivers and security; The third category consists of other staff members who do not need direct contact with category I. During the Qatar World Cup, it is mandatory to present a negative nucleic acid test report within 48 h, so front-line staff need to go to designated testing centers frequently for nucleic acid testing.

Regarding the management of on-site spectators, on-site spectators are required to present a negative nucleic acid test report within 48 h when entering the venue, and the number of stadium personnel admitted is managed as a percentage. The advantage of classified management is that on the one hand, it can relatively maintain the public’s good impression of the event, and more importantly, it can effectively liberate the productivity of the already difficult preparation work and make the preparation work more efficient.

The third is to strengthen communication and manage social emotions. In the prevention and control of the epidemic, there is widespread repression in the emotions of social groups, and any punitive measures can cause direct emotional stimulation to the controlled objects, so it is necessary to comprehensively, comprehensively and efficiently implement communication management, and it is necessary to raise it to the same height as the rule implementation guarantee, in order to effectively control unnecessary public relations crises.

4 Innovation in Epidemic Prevention and Control in the Asian Games

4.1 Docking with Digital Resources, the Asian Games “PASS” Enables Epidemic Management

“Asian Games PASS” is based on “Hangzhou cultural tourism one code pass”, through the link of health code, toll card, ticket code and other kinds of QR code, for users to save the cumbersome to repeatedly find the code. In addition, through the use of big data, artificial intelligence and other technologies, docking with all kinds of digital city resources, to provide audiences with intelligent services from ticket purchase, travel, game watching to accommodation, dining and tourism.

4.2 High Standards of Strict Control, the Implementation of Closed-Loop Management

Before the opening of the Asian Games, a series of championships have been held in the venues of the Hangzhou Asian Games, operating according to the standards of the Asian Games, implementing closed-loop management, and ensuring the medical and health care of the test games with high standards and high quality. During the 2022 Asian Games in Hangzhou, the “point-to-point” closed-loop management should be strictly implemented. At the end of the competition, different classification management measures will be adopted for whether the positive problems are found in each working place and station in the process of closed-loop management.

4.3 Multi-functional Comprehensive Safeguard Measures to Improve the Ability and Level of the Asian Games

The Asian Games will strictly implement the “four-party responsibility”, integrate the closed-loop work and related activities into the regional, county (city) district epidemic prevention and control leading group to implement unified management, and strengthen the territorial guarantee of the venue. Strengthen the coordination and linkage between multiple departments. While formulating targeted prevention and control measures, we will guide the territory according to the epidemic risk and the requirements of “one competition and one policy”, and finally provide funds and materials for prevention and control.

4.4 Attach Importance to Compound Talent Training and Promote the International Communication of the Competition

In terms of sports talent training, there is a certain gap between the development time, development speed and development degree of China’s sports industry and that of developed countries, so the training of compound talents in China is always in the initial stage. Domestic lack of experience in running large-scale sports events, the shortage of digital technical talents, and the weak attraction to domestic and foreign experienced sports events talents. In the era of the rapid development of new media technology, only the

compound talents who master the core technology, are good at reform, and have the ability to integrate resources can meet the construction and demand of sports events, so as to promote the international communication and broadcasting.

5 The Asian Games Large Passenger Flow of Epidemic Prevention and Control in the Future Innovation Management

5.1 Online and Offline Real-Time Dual Monitoring, Continue to Optimize the Asian Games Passenger Flow Management

The content of the Asian games is very wide, the management department make full use of information, big data, the digital regulatory mode into event regulation, innovation and development of “network + video regulation”, accurate forecast passenger flow, strengthen the passenger supervision, tube, understand passenger flow public opinion, realize the Asian games each point of remote real-time supervision. The “Internet + Bright Kitchen stoves” supervision platform has been uniformly connected, and an online system of “Internet + video supervision” has been specially opened on the platform to realize the “online inspection” of epidemic prevention and control measures in various regions. Compared with offline inspection, “online inspection” can not only monitor real-time surveillance, but also the fixed video evidence can be intercepted at any time. For areas where epidemic prevention and control measures have not been taken, on-site inspection and treatment will be carried out, so as to achieve the dual supervision effect of “online and offline”, so that there is “no dead corner” in epidemic prevention and control in Asian Games venues. At the same time, we should pay attention to the construction of information security guarantee system (see Fig. 2). After the end of the event on the day, we should achieve “one analysis per day” and “one countermeasure per day”, and continue to optimize the control measures of the large passenger flow of the 2022 Asian Games in Hangzhou.

5.2 Blockchain + Digital Twin, to Build a Credible Platform for Passenger Flow Management

Blockchain + digital twin, to build a credible platform for passenger flow management. The blockchain encrypts the hash (Hash) algorithm to encrypt the transaction information in a transaction block and compress the information into a hash string composed of numbers and letters. The hash value of the blockchain accurately identifies a block. Any node in the blockchain can obtain the hash value of the block through a simple hash calculation. If the calculated hash value does not change, it means that the information in the blockchain has not been tampered with, so as to ensure the correctness of the transmitted data. Therefore, the tamper-proof nature of the blockchain can provide rigorous and real relevant data for the management of the large passenger flow of the Hangzhou Asian Games, and ensure that the data in the digital twin is real and effective. The uniqueness of blockchain can ensure that the individual digital twin is unique in the management of the large passenger flow of the Asian Games, so that there will be no chaotic situation of one person corresponding to multiple digital twins. Finally, the

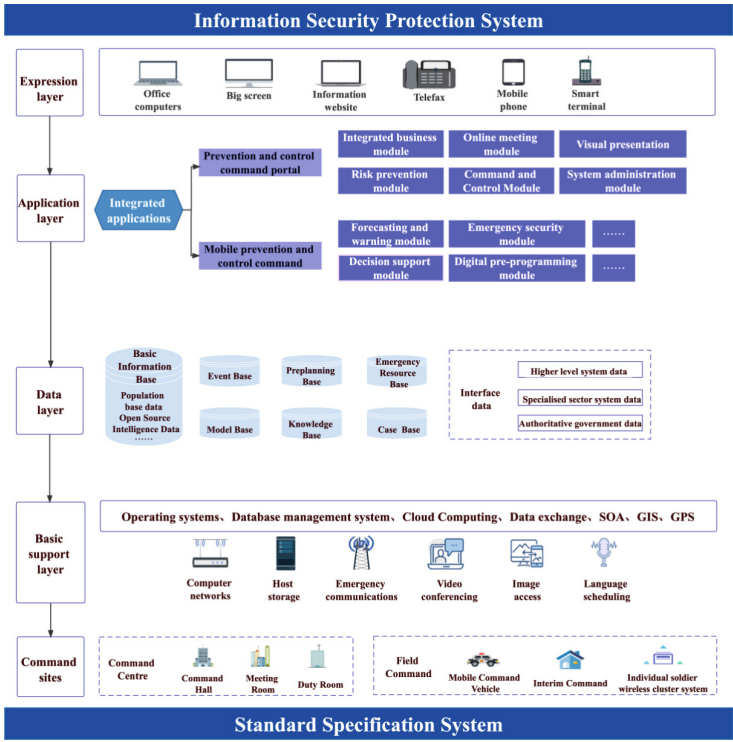


Fig. 2. Information security protection system

asymmetric encryption technology of blockchain can ensure that the privacy of users' health code will not be used by others at will, provide better privacy and security protection for individuals, eliminate users' concerns, and make participants actively cooperate with the epidemic management.

5.3 Improve the Organization and Management of Large Passenger Flow to Maximize the Benefits of the Event

Under the new epidemic prevention and control policy, the research on the management of large passenger flow in the Hangzhou 2022 Asian Games is still lacking, and some participants, employees and audiences have been infected, which will restrict the spectators and will also lose a lot of manpower, material and financial resources. This study will focus on the management of large passenger flow, and actively promote large passenger flow to help the sports economy and drive other industrial chains on the basis of the smooth development of the Hangzhou Asian Games with the help of digital media. The benefits brought by large-scale sports events include many aspects, and under the circumstances of the greater impact of the new crown epidemic, it is necessary to re-evaluate its actual benefits from a new perspective, make up for the gap that existed before the outbreak of the epidemic, and promote the maximization of the benefits of large-scale sports events in China.

5.4 Promote Multi-code Integration and Improve the Level of Digital Public Services

Digital technology has brought about changes in all aspects of economic and social life, and also put forward new topics for the modernization of national governance systems and capabilities. Today, with the rapid development of digital technology, China has gradually entered the “digital society”. Health code is a new requirement for smart city construction at the national strategic level, and it is also one of the important means to promote the development of informatization. Health code is a comprehensive integration of individual digital information, the purpose of which is to maximize the superiority of digital technology, integrate digital technology, a new element with traditional society, and promote the active transformation of economic and social forms. The iterative upgrade of health codes is rooted in the government’s construction of the Internet of Things platform, on the basis of individual people, in ensuring security, personal privacy, integrating social security, health insurance, medical education, etc., communication transportation and other public service information and individual health status information, promoting the development of “multi-code integration”, and promoting the transformation of health codes from social management tools during epidemic prevention and control to digital public service provision tools in the post-epidemic era.

6 Conclusions

In the post-epidemic era, digital twin builds a digital world running in parallel through algorithms, data platforms and artificial intelligence. Artificial intelligence can realize the accurate analysis of big data and realize the efficient matching of service supply and demand. In the context of multi-type digital management application, health code provides a new governance means and digital technology platform for the whole social governance, and provides realistic physical carrier and virtual data space support for the realization of accurate management of epidemic prevention and control of large passenger flow in the Asian Games. Making full use of digital technology to realize the restart of the 2022 Asian Games in Hangzhou is an important window to show the advantages of the national system, the achievements of fighting the epidemic and the comprehensive strength.

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