Research on Integrated Management Platform of Smart Park Based on CIM

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Abstract. At present, the construction of smart cities and smart parks in China has been widely concerned, and the intelligent decision-making in the process of urban planning, design, construction and management is in urgent need of refined, visualized, dynamic and integrated expression of urban entity information. Therefore, this paper studies a technical theory of digital description and expression of cities, namely CIM (City Information Model). Our team independently innovates, develops smart park management platforms. This platform is based on BIM (Building Information Model), GIS, IOT (Internet of Things) and other new generation information technologies. BIM mainly studies parametric information inside buildings, while GIS focuses on external spatial geographic information. IOT Internet of Things technology realizes the transmission and processing between information and data. This platform integrates and upgrades these technologies to build a smart park platform. This paper explores the presentation and current situation of CIM theory and technology under the background of smart city construction, smart park construction and operation and maintenance management.

1. Introduction
With the continuous development of emerging information represented by "great things change wisdom" in recent years and the promotion of COVID-19 outbreak in 2020, the construction of smart cities has gradually attracted more and more attention, which makes it urgent for China to build a smart ecosystem and a smart city. At present, through investigation and study, we know that the intelligent decision-making in the process of urban planning, design, construction and management is very urgent for the refined, visualized, dynamic and integrated expression of urban entity information. Therefore, this paper studies a technical theory of digital description and expression of cities, and independently innovates, integrates and promotes BIM, GIS, IOT and other new technologies, develops a smart park management platform, and puts forward the overall design framework of the smart park platform, "seeing the big from the small", providing solutions for smart cities to realize technology landing, realize the integration of urban planning-construction-management process and intelligent management, improve urban governance level and guarantee people's living standards and quality.

2. The core elements of the smart platform

2.1. BIM technology
Building information modeling (BIM) integrates the effective information in the project into the parametric 3D model and applies it to the planning, investigation, design, construction and operation, so as to realize data sharing and digital intelligent management in the whole life cycle of engineering construction projects[1].
At the initial stage, the information inside the building was input through 3D modeling software and a 3D model was established. People can clearly and intuitively see the solid shape of the building through three-dimensional view observation, so as to meet people's demand for building visualization. In the later stage, BIM cloud platform can be established by BIM 5D of Guanglianda, and all professional models can be integrated, and the integrated models can be associated with each link in the construction process, so as to establish an effective data base for the project, facilitate management and decision-making by managers, and solve a series of problems such as construction delay and high cost caused by construction changes and waste of materials.

However, at present, with the vigorous development of green and intelligent concepts and technologies in China's urban construction, BIM can no longer meet the tasks of data processing and management of a large number of information flows in green ecological urban areas. Therefore, it is necessary to move from BIM building information model to CIM urban intelligence model.

How to form a cloud platform based on BIM technology, combined with IOT, big data and other technologies, so as to realize rapid and efficient analysis of all aspects of information in the city, and then make intelligent response to the needs of people's livelihood, environmental protection, public safety, urban services, etc., which meets the needs of modern people, makes traditional urban management move towards digital intelligent management, and promotes harmonious and sustainable development of the city is our thinking direction.

2.2. GIS technology

2.2.1. Definition and application of GIS. Geographic Information System (GIS) is a comprehensive analysis of space based on computer technology, communication network technology, global satellite navigation and positioning technology, earth observation technology, spatio-temporal big data technology and artificial intelligence technology[2]. A technical system that integrates, stores, manages, calculates, analyzes and describes data distributed in geographic space with the support of computer hardware and software systems. To a certain extent, GIS geographic information system is similar to human brain, which can not only store a large amount of spatial geographic information, but also analyze geographical phenomena in a certain area through various operations such as topological operation of spatial data and joint operation of attribute data, so as to obtain more effective data or solutions to a specific problem. It is convenient for managers to manage and make decisions.

GIS focuses on the application of geospatial information, such as urban brain, which contains urban spatial geographic information and can store, analyze and process data. Its application fields are very broad, including urban geographic information system, public security geographic information system,
environmental geographic information system, resource geographic information system, traffic geographic information system, water conservancy geographic information system, tourism geographic information system, urban fire protection geographic information system and government geographic information system.

Among them, GIS plays a far-reaching role in the field of architecture. Firstly, the UAV is used to survey the construction site, collect the UAV image, and use the existing GIS software in the market to apply 3D modeling. For example, we use SuperMap series software provided by Beijing SuperMap Software to conduct 3D real-life modeling and then import the BIM building information model. In the three-dimensional GIS platform, based on the analysis of terrain and surrounding environment, the functions of large scene analysis and outdoor horizon analysis can be provided for the established three-dimensional model, and slope stability analysis, marginal analysis and shadow rate analysis can be carried out for the existing three-dimensional model in the GIS platform, providing good suggestions for building construction and improvement.

2.2.2. application of GIS technology in smart park. BIM technology is mainly used in the construction industry, but BIM technology is based on the study of the whole life cycle of buildings, focusing on the interior of buildings; GIS is a geographic information system, which is based on macro data analysis outside buildings. They are organically combined above and below the ground, macroscopically and microscopically, and can learn from each other's strengths.

Under the construction of smart city, through the combination of GIS and big data, we can quickly find some illegal buildings and super high-rise buildings in the city on the platform, and use satellite positioning system to quickly determine the location of the buildings, which is convenient for the supervision and supervision of relevant departments. In addition, GIS can use its positioning system to monitor the position of materials in the building construction stage in real time, so as to reduce unnecessary waste of materials and reduce the project cost.

2.3. IOT (internet of things) technology

2.3.1. Definition and structure of IOT

Internet of things (IOT) is a new technology that connects sensors, controllers, machines and personnel by using the new generation of information technology, and can form a platform system that connects things and people with each other. Information is received by sensors, and transmitted to store and analyze, so as to realize effective information management[3].

The overall architecture of Internet of Things (IOT) can be divided into three parts: perception layer, network layer and application layer. Among them, the perception layer is the basic layer of the Internet of Things, which implements information collection and processing, perception recognition and automatic control through cameras, laser scanners and other tools, and connects the network layer and the application layer. In the network layer, Wifi, 5G network, Bluetooth, Zighen and other tools are used to connect various hardware devices to form an interconnected network system to realize information transmission, routing and control. The application layer includes infrastructure middleware such as cloud computing, big data storage, smart construction site, intelligent logistics and various IoT applications, providing information processing capabilities for the Internet of Things.

2.3.2. Application of IOT in CIM platform

- Intelligent management. The data of the smart park is mainly transmitted through communication cables, optical fibers and network equipment terminals, and the data is input through the Internet of Things to ensure the communication and analysis among the data, thus ensuring the operation of the entire CIM smart platform. The collected important information can be publicized through the LED display screen, so that people can know the information they care about anytime and anywhere. At the same time, from the data presented after integration, managers can make decisions quickly and manage the park effectively.
- Park safety. Smart park platform is based on the combination of BIM (Building Information Model), GIS, IOT (Internet of Things) and other new technologies. Integrating the Internet of Things technology with BIM+GIS model, that is, integrating real-time information into the 3D visualization model and reflecting it, can report and display the size and orientation of the flow of people in the park in real time[4]. In addition, the Internet of Things technology can realize intelligent identification, identify various items and facilities, and accurately locate them with the help of BIM+GIS technology, which can provide a quick rescue method in case of danger.

- Construction operation and maintenance management. By integrating the Internet of Things technology and BIM technology, the static data model can be given to external real dynamic information. The integration of Internet of Things technology really makes the model "move", which is no longer a virtual empty shell, and makes the platform realize real operation and maintenance. Information sharing and feedback in real time ensure the consistency and interactivity of BIM delivery in different stages. At the same time, it can also enable urban builders to master the engineering construction data in real time, so as to find some illegal constructions and operations in construction and manage them.

Figure 2. Construction Operation and Maintenance Management Platform
3. The construction of the smart park platform

3.1. Overview of Smart Park Platform
This platform is based on the CIM status of urban model and the development demand of green ecological park. Establish a multi-dimensional intelligent system for the whole process, such as planning, design, construction, operation and maintenance of green ecological park based on CIM concept. With the help of Beijing Super Map Group SuperMap series software, Shanghai Luban developer platform, combined with GIS, BIM and UAV tilt photography technology. Using Java Script front-end development language to establish intelligent application system of campus management, through the mutual integration and sharing of professional information, it can promote the coordinated and efficient operation and maintenance management of various departments in the park more efficiently, and make the park run more safely, efficiently and conveniently.

3.2. Implementation Method of Smart Park Platform
This platform integrates BIM (Building Information Model), GIS, IOT (Internet of Things) and other information technologies for integration and upgrading.

In the early stage, the basic modeling was mainly carried out by a series of softwares such as Revit, and a parametric model with architectural information was established. And get the spatial geographic information through unmanned aerial vehicles and other equipment, and then use GIS related software to add positioning, attributes and other related information to complete the digital operation\[5\]. So as to achieve the integration of micro-information in the building and macro-information in the external space, and get a building model with perfect information. The requirement of building visualization is met, and the information of a single building can be obtained by clicking the model.

Later, the platform is developed. The building environment of the integrated management platform system is based on Beijing SuperMap Software Co., Ltd., and the kernel is completely reconstructed on the CPU architecture based on standard C++ technology, and a set of high-performance cross-platform technology system supporting multiple operating systems and CPU architectures is established. It also supports Huawei Kunpeng, Loongson, Feiteng and other CPUs, domestic operating systems and databases, and has passed the corresponding compatibility tests. Support cross-platform collaborative operation, and support a variety of hardware devices and operating systems. Import and integrate the previous building information model to form the integrated management platform for managers to manage and make decisions.

3.3. Design of Smart Park Platform Based on CIM
The BIM technology integrated by CIM is applied to the single self-management level for fine management, and the advantages of macro analysis and simulation display of GIS technology integrated by CIM are used for coordination and general control at the regional coordination and general control level of the park, and the IOT technology integrated by CIM is used to realize instant and efficient collaborative management. At the same time, a two-level linkage management mode is formed by fully combining the advantages of fine and precise independent management and intensive and efficient regional coordination and general control of the park. The whole architecture of smart park based on CIM can be divided into four parts: perception layer, cloud network layer, platform layer and application layer\[6\].

IntelliSense layer: A large number of sensors and intelligent facilities are deployed in the park, and a cloud service basic platform is set up to monitor the running status of the park and sense the running situation of the park in real time, thus providing hardware basic support for the intelligent control and intelligent service of the park.

Data layer: It consists of a communication network covering the whole campus and a cloud platform supporting the intelligent application of the campus. The extensive and safe transmission of all kinds of information in the campus is completed through optical fiber, 2G/3G/4G/5G, campus Wi-Fi, NB-Io T, etc., and the campus data center is established through edge cloud, public cloud, private cloud and hybrid
cloud, providing hardware basic support for data processing and application system operation in the campus[7].

Platform layer: The platform layer is the core of CIM platform, which plays a connecting role between the preceding and the following. It connects and processes all kinds of data in the south, supports and empowers all kinds of applications in the north, and realizes the convergence of data in the data layer to decision analysis. CIM-based smart park platform layer can be divided into CIM platform, big data platform, AI-enabled platform and unified service platform, with emphasis on CIM's role in multi-source data access, platform basic functions, modeling and model processing, and through the combination with big data platform, AI-enabled platform and unified service platform, the upper application of the park can be empowered together.

Application layer: It covers the comprehensive and integrated application of investment, industry, security, energy consumption, assets and other fields in the park. Compared with the traditional smart park architecture, the smart park based on CIM highlights the integrated application of "regulation-construction-management" and the intelligent operation management (IOC) platform, which can realize the integration of "regulation-construction-management" process and the integration of all services in the park.

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3.4. Technology Integration of Smart Park

3.4.1. Relationship and Integration of BIM and GIS. BIM building information model focuses on the detailed information inside the building and can be accurate to each component inside the building; GIS focuses on geospatial information, and can store and analyze the information. Therefore, BIM+GIS integration technology is actually a combination of parametric information inside the model and macro information outside the model, which is widely used. For example, it can be applied to urban planning and design, environmental simulation, disaster management and many other aspects.

3.4.2. The relationship and integration between IOT and BIM/GIS. BIM+GIS technology is the core and soul of Internet of Things technology, which completely parameterizes and digitalizes buildings and covers all kinds of information of buildings. Using the Internet of Things (IOT) technology, external data is collected and stored through the perception layer; Then, through optical fiber, 2G/3G/4G/5G and other technologies, the data can be transmitted safely, and a cloud data center can be established. The collected valid data can be transmitted to the platform layer in real time and integrated with the existing BIM+GIS model, so that the BIM+GIS model is no longer just an empty shell, but is connected with external real-time data, thus realizing efficient management.

3.5. The essence of CIM platform
BIM is the operation and maintenance management of the whole life cycle of a building. BIM technology completely digitalizes the spatial location of a building, and easily indicates the location of various data inside the building; GIS technology uses geospatial information and urban management planning for spatial comprehensive analysis. BIM+GIS technology is an integrated management of data information to form an information model. However, the Internet of Things technology senses, collects, transmits and monitors external information, and transmits external data in real time. The integrated application of the three realizes the organic combination of virtual information management and physical hardware, and forms CIM smart park platform. The purpose is to form the digital operation of "planning-construction-management" of the park through effective organization, which is beneficial to support specific application and realize timely and efficient intelligent management.

4. Conclusion
In this paper, the three core elements of the smart park operation and maintenance management platform are deeply studied: BIM (Building Information Model), GIS and IOT (Internet of Things). At the same time, this article explores the relationship and integration application between the three. It built the framework of the smart park platform. Analyze the management needs of the project. According to the intensive city construction innovation concept, the independent smart park system is fully incorporate the monomer independent management and intensive intensive advantages in the park area coordinated general control, forming two-level linkage management model.

The operation and maintenance management of smart parks and smart cities is an inevitable trend of intelligent development of cities. The integration of BIM, GIS, IOT, 5G and UAV technologies to realize data information management can greatly improve management efficiency and management quality. However, at present, China's smart cities are still in the initial stage of development, and there are still many aspects that we need to constantly explore and improve, so as to realize the integrated development of smart cities at an early date.

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