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Scheme design of Smart Platform for the Agricultural Science and Technology Park

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Abstract. With the rapid development of the global IoT and various information technologies, the construction of "smart city" has been gradually put on the agenda, and at the same time, the smart management of the National Agricultural Science and Technology Park will also become the key content of smart city construction. This paper proposes a scheme design of smart platform for the agricultural science and technology park, and lists the basic contents of the construction of the smart park. The proposed scheme design of smart platform applies 5G, AI, cloud computing, Internet of Things, mobile Internet and other new ICT technologies to solve the long-term pain points faced by traditional agricultural science and technology parks, including poor service experience, weak comprehensive security, low operational efficiency, high management costs, difficult business innovation, and so on. Because of the construction of the smart park has many contents and a long construction period, this paper discusses the specific design options of smart platform for the agricultural science and technology park. It can provide users with better service perception and help enterprises achieve innovative development through digital transformation. Based on the proposed smart platform, the business subsystem of the agricultural science and technology park is opened horizontally, through data fusion to business integration, to help customers more efficiently and agilely solve business problems that are difficult or even impossible to solve with traditional technical means. The future development and the impact on the life of people.

1. Introduction

The proposal of the smart park is based on the background of the development and construction of smart cities. The development of smart parks must follow the general direction of smart city construction. It is to apply a new generation of information technology to urban development planning, management services, and resource utilization, making the city a new type of city that is more intelligent, efficient, open and inclusive. The construction of smart cities has also become a major trend in global urban development.

As an indispensable part of the construction of smart cities, the construction of smart parks is a concrete manifestation of the country's implementation of informatization strategies [1]. Under the background of the situation for the country vigorously developing strategic emerging industries, the development of agglomeration industries has become an important task for local governments. The park serves as a city to develop local industries and strengthen economic strength. The requirements for transformation and upgrading are also constantly escalating as an important carrier of China. It means that corresponding smart planning is needed to complete the construction of smart parks [2].

In recent years, smart parks are mainly distributed in developed cities along the southeast coast. Depending on the form of parks, there are differences in the composition of the main body and the needs of informationization [3]. The work of the National Agricultural Science and Technology Park



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is an important task proposed by the Party Central Committee. The approved national agricultural science and technology parks are spread all over the country, and they have played an important role in agricultural development.

In order to implement the requirements of the "13th Five-Year" National Science and Technology Innovation Plan and the "13th Five-Year" Agricultural and Rural Science and Technology Innovation Plan, it is necessary to further accelerate the innovation and development of national agricultural science and technology parks. From targeted poverty alleviation to rural revitalization, the national agricultural science and technology park must play an advanced and leading role. The planning and design of the corresponding national agricultural science and technology park smart park should also be carried out simultaneously.

In this paper, a scheme design of smart platform for the agricultural science and technology park is provided and a comprehensive list of the basic contents that need to be constructed in the agricultural smart park. The proposed scheme design of smart platform applies 5G, AI, cloud computing, Internet of Things, mobile Internet and other new ICT technologies to solve the long-term pain points faced by traditional agricultural science and technology parks, including poor service experience, weak comprehensive security, low operational efficiency, high management costs, difficult business innovation, and so on. It can provide users with better service perception and help enterprises achieve innovative development through digital transformation. Based on the proposed smart platform, the business subsystem of the agricultural science and technology park is opened horizontally. Through data fusion to business integration, it helps customers more efficiently and agilely solves business problems that are difficult or even impossible to solve with traditional technical means.

2. Overall Design of Smart Platform

The overall design for building a smart park integrates the application of cutting-edge and latest technologies. It needs to consider the current situation of informatization of agricultural science and technology parks focusing on system construction and business promotion. At the same time, it also takes into account data collection, upload, precipitation and data value mining. The overall construction schemes are mainly divided into construction module division, planning key positioning and implementation process design [4].

The division of smart platform construction modules refers to the division of the overall planning of the smart park into different modules based on the needs of different groups of people, and according to the needs of different units and future development plans. We can also analyze based on a certain situation and design corresponding intelligent functions.

The key positioning of the smart platform planning refers to controlling the key planning content in the overall plan. First, build basic networks in the smart park, including park site network access, integrated network wiring system, and agricultural production Internet of Things private network. Second, integrate application databases and data, such as land resource database, park environment database, settled enterprise database, staff database, vehicle access management database, park security database. Finally, the key smart applications of the park, such as convenient service apps, park card, park environment monitoring platform, property management platform, personnel and vehicle access management platform, energy monitoring platform, and so on.

The overall construction plan of the smart park is developed and constructed in phases according to the urgency of construction. Generally speaking, it can be divided into 4 stages: In the first stage (initial stage), we construct the small-scale basic platform and smart application pilot construction, focusing on the upgrading of basic networks and equipment rooms. In the second stage (improvement), we improve the smart applications around the pilot construction and create corresponding mature applications. In the third stage (expansion), we expand the smart applications of the early development and construction, and tap the depth and broaden the scope to achieve a full range of intelligent services. In the fourth stage (development), the smart park can be continuously upgraded and transformed to comprehensively improve the area Various software and hardware constructions inside. Based on data analysis, it guides the internal decision-making of the park and construct the cockpit.

3. Design Framework of Smart Platform

The design framework of the overall smart platform incorporates the cutting-edge application and latest technologies. It is necessary to comprehensively consider the current situation of the informatization of agricultural science and technology parks and the needs of resource integration. At the same time, it also takes into account data collection, upload, precipitation and data value mining. The overall design framework consists of a basic layer, a data layer, a platform layer, an application layer, a presentation layer and a service layer [5-7], as shown in Figure 1.

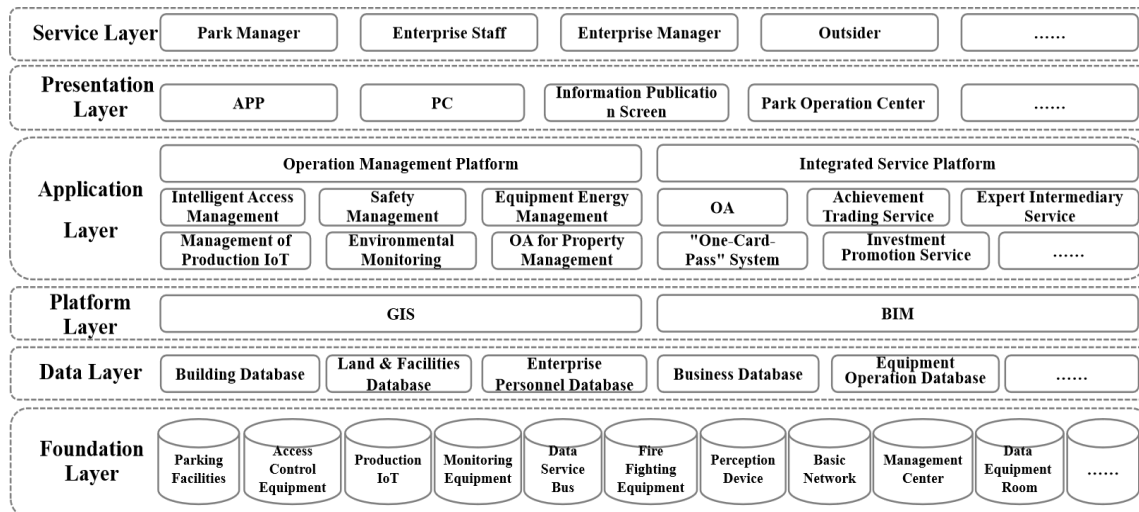


Figure 1. Overall structure of smart platform for the agricultural science and technology park

(1) Basic layer: It is the most basic part of the construction of the smart platform, which mainly includes the facilities and equipment of various application systems, computer rooms, management centers and data service buses. It is used for collection, aggregation and transmission of various data information in the park.

(2) Data layer: It is the core "wealth" of the smart platform, and can classify and store all kinds of data in the agricultural science and technology park. According to the type of data, it can be divided into many types of dynamic databases, such as land and facility information database, building information database, enterprise and personnel information database, ecological environment database, facilities and equipment operation database, business database, *etc.* The data layer can realize the centralized storage, sharing and exchange of various data resources in the park.

(3) Platform layer: As the supporting core of the smart park, it is not only summarizes, processes, analyzes and exchanges data from the lower layer, but also supports different application systems at the upper layer to realize various pre-set intelligent functions. The platform layer is mainly composed of a digital backbone, which is a digital virtualized park based on GIS+BIM.

(4) Application layer: It is equipped with various intelligent applications for daily operation management and service of the agricultural science and technology park. It is mainly divided into operation management applications (such as resource management, equipment and facility management, security management, access management, energy management, collaborative office, *etc.*) and service applications (such as property services, life services park services, *etc.*). The application layer basically meets the various needs of the park in daily operation and management.

(5) Presentation layer: It is mainly the entrance or presentation method of various management and service applications in the agricultural science and technology park. It is the user-oriented presentation side and includes mobile phones, PCs, information release screens, park operation centers, and so on. The presentation layer is the entrance for users to experience various applications.

(6) Service layer: It is the various service objects and users faced by the smart platform for the agricultural science and technology park. It mainly includes enterprise employees, enterprise management, park managers, and outsiders.

4. Construction Content of Smart Platform

The main construction content of smart platform for the agricultural science and technology park includes infrastructure construction, digital backplane construction, operation management platform construction, and comprehensive service platform construction^[8].

4.1. Infrastructure Construction

As the basic work of smart platform construction for the agricultural science and technology park, infrastructure construction is a prerequisite for the realization of various management and service applications in the park. The infrastructure includes various intelligent application systems and equipment, which can be divided into basic network, equipment room, access management, security management, energy management, equipment management, and so on.

The basic network provides channels or links for the collection, transmission, and aggregation of various information (voice, data, video, images, etc.) of business systems and application systems in the smart platform for the agricultural science and technology park. It mainly includes park site network access, network integrated wiring system and special network of agricultural production Internet of Things. The park resident network access and network integrated wiring system are mainly used for traditional wired network access for office buildings and facilities. As the key tasks of basic network construction, the construction of a special network for agricultural production Internet of Things can integrate LoRa, NB-IoT, 2G/3G/4G/5G, Wi-Fi, Zigbee and other methods for hybrid networking. Therefore, we can consider building a low-cost LoRaWAN low-power wide area network for parks with incomplete network coverage of telecom operators [9].

The equipment room is the supporting infrastructure for the weak current informatization in the park. It is mainly used for system equipment installation, data storage, operation management, dispatching and command. It mainly includes the weak electrical room, consumer control center, operation center, data center, and intelligent guide. The construction of the equipment room can be based on the consideration of funds, operation and maintenance talents, security. We usually choose small computer rooms plus third-party cloud computing cloud storage service hosting and self-built computer rooms with complete functions.

Access management is mainly to manage the information of people and vehicles entering and leaving the park. It includes parking management system, access control system, elevator control system, visitor management system and park all-in-one card system.

Security management is mainly to control the safety of people, property, and things in the park to prevent various safety accidents. At the same time, it can quickly detect and deal with security accidents. Security management mainly includes video surveillance system, anti-theft alarm system, intelligent inspection system and public address system [10].

Energy management mainly refers to the centralized and refined management of the park's energy (water, electricity, gas, new energy, etc.) to achieve the goal of green and energy saving in the park. It mainly includes remote meter reading, energy consumption measurement and smart street lights.

Equipment management is mainly to conduct real-time online supervision of all information infrastructure, intelligent application system equipment and other intelligent equipment in the park. It is mainly divided into information basic pipe network, building automation system, production environment Internet of things and intelligent application system equipment integration.

4.2. Digital Backplane Construction

Based on the GIS+BIM system, the digital backplane is a park that builds a virtual space on the smart platform of physical space for the agricultural science and technology park. It can effectively integrate various data for constructing the digital floor of the three-dimensional virtual space, such as spatial geographic information data, building construction data, infrastructure data, pipeline construction data, sensor network data, ecological environment data, economic production data, personnel activity data. The digital backplane becomes the basic data base map for cockpit decision-making, operation management, corporate talent business management, external display and communication, and public services, as shown in Figure 2.

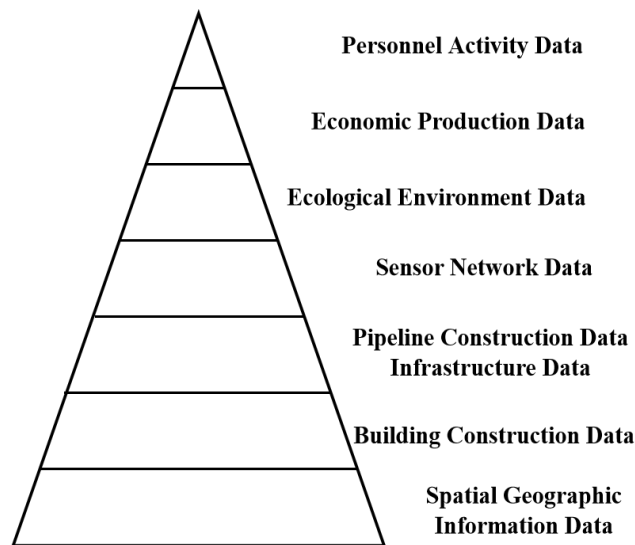


Figure 2. Concept of digital backplane

The scheme design of smart platform for the agricultural science and technology park applies blockchain technology, which is a non-tamperable, full-history, and strongly endorsed distributed storage technology. The digital backplane can use blockchain technology to explore and protect the legitimate rights and interests of data providers, and perform digital confirmation [11-12]. The digital backplane will further enhance the refined management, integration and sharing of basic information in the park, and improve the operation and management and service levels of the park, thereby building the National Agricultural Science and Technology Park into a fully connected digital smart park.

4.3. Operation Management Platform Construction

The operation management platform is responsible for the intelligent operation of the entire smart park. It is mainly composed of sub-platforms such as intelligent access management platform, security integrated management platform, equipment energy management platform, park environment monitoring platform, production IoT integrated management platform, and property collaborative office platform. The production IoT integrated management platform is a platform that integrates sensors that can be shared in the self-built production IoT environment of each settled enterprise to carry out collaborative monitoring. By integrating each intelligent management platform with the property collaborative office platform, the operation management platform can realize unified collection, transmission and storage of basic data of facilities and application systems in the park. It can achieve comprehensive functions such as information collection, data storage, resource sharing and optimized management.

4.4. Comprehensive Service Platform Construction

The comprehensive service platform is a platform that provides various services to the enterprises and people who work and live in the park. It can realize data sharing between different systems and platforms by connecting with the operation management platform and third-party service platform.

For enterprises settled in the park, the comprehensive service platform mainly develops online collaborative office, results transaction services, expert intermediary services, and park environmental data sharing services. For employees of enterprises settled in the park, it mainly carries out property services, living supporting services, park access services, all-in-one card services, and notification announcements. For potential companies, the platform mainly carries out policy introduction and investment promotion. Besides, the comprehensive service platform also provides decision support for optimizing park operation and management services by analyzing the large amount of data accumulated on the platform.

5. Conclusion

The construction of the smart platform for the agricultural science and technology park is carried out in the general environment of smart city construction, which is a further upgrade of the digital park. This paper mainly starts with the analysis of the information needs of the smart platform, taking the national agricultural science and technology park as an example. We propose a scheme design of smart platform for the agricultural science and technology park, which applies 5G, AI, cloud computing, Internet of Things, mobile Internet and other new ICT technologies to solve the long-term pain points faced by traditional agricultural science and technology parks, including poor service experience, weak comprehensive security, low operational efficiency, high management costs, difficult business innovation, and so on. The construction of the smart platform can better meet the operation and development of park enterprises by constantly discovering new demands.

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