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Smart city infrastructure — Development guidelines for information-based system of smart building

CD stage

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Foreword

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This document was prepared by Subcommittee ISO/TC 268/SC 1, *Smart community infrastructures.*

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

As the urban population grows, problems such as resource shortage, environmental pollution, traffic jam, and potential safety hazard are becoming increasingly prominent. In order to solve the problems in the construction and management of cities, the smart city emerges as the times require. As architecture is the most critical component of a city, the informatization construction of a smart building is on the agenda. Smart building is a new model for the sustainable development of cities at home and abroad. Information and communication technologies, such as sensor technology, big data processing technology, AI technology, IoT technology, and new energy technology, are used to sense, analyze and integrate essential information of the core system of city operation to make an intelligent response to various needs, including people's livelihood, environmental protection, public safety, urban service, and industrial and commercial activity.

The informatization construction of a smart building promotes more sophisticated building management, a more harmonious building environment, a more advanced building economy, and a more liveable environment. It leads the application of information technology and enhances the comprehensive social competition of the construction industry while driving the development of the strategic new construction industry, promoting the construction industry to adjust the structure and transform economic development model, and improving the comprehensive competition of the construction industry.

Despite the great significance of the healthy development of intelligent buildings, the norms or standards for smart building information systems are poor.

Therefore, it is necessary to develop smart building information systems guidelines based on strategic planning, design, construction, maintenance, and management.

This standard specifies the technical measures and evaluation methods applicable to smart city infrastructure and intelligent monitoring of buildings, effectively promoting the development of infrastructure and intelligent building and improving the safe and green operation of infrastructure and buildings.

Smart city infrastructure — Development guidelines for information-based system of smart building

1 Scope

This document is mainly applicable to the new and existing information-based system of general public buildings and residential buildings in the infrastructure of smart cities. This document mainly elaborates how the information-based system of smart buildings under the smart city governance requirements promote the perfection of functions of buildings, the liveability of building space and environment, and more effective information delivery and describes the interaction between each level in the system framework and the physical elements inside and outside the building and social activities inside and outside the building to achieve the goals of high efficiency, security, energy-saving, comfort, environmental protection, and sustainability.

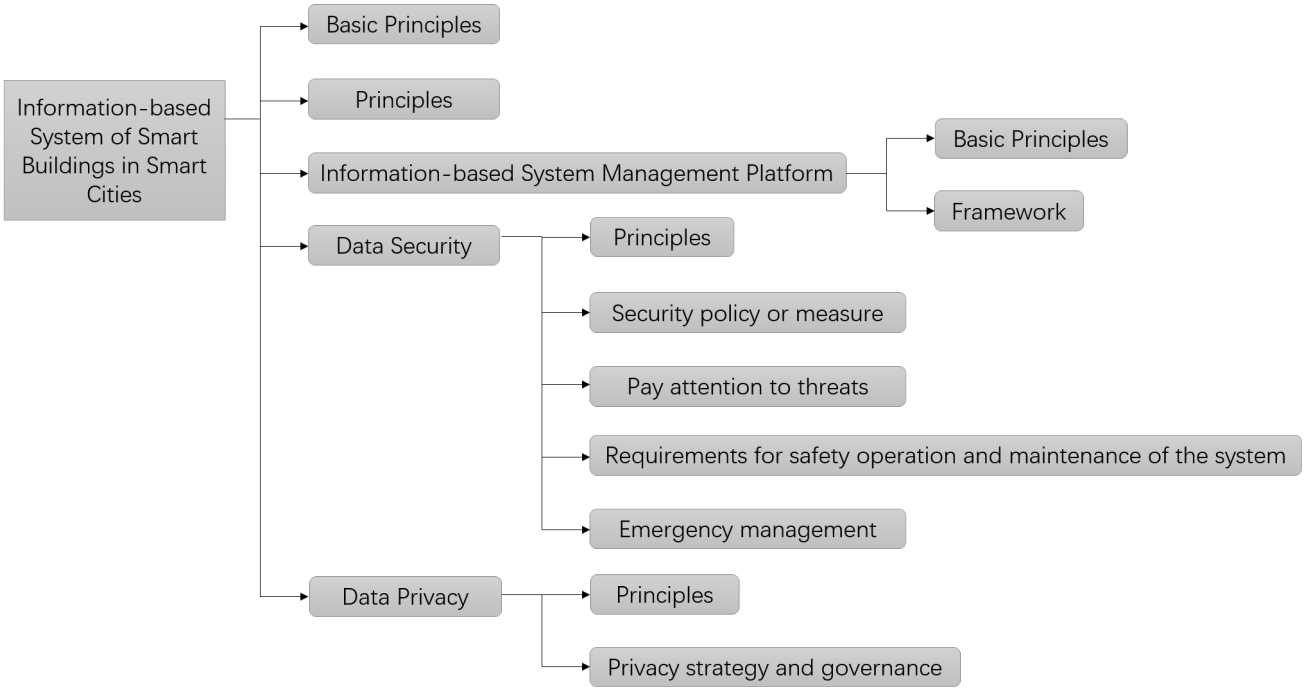


Figure1-Framework of guidelines on Information-based System of Smart Buildings

There are no normative references in this document.

3 Terms and definitions

For this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1

smart microgrid

smart microgrid refers to a microgrid that is equipped with monitoring, control, and protective devices and can realize self-control, protection, management, and self-governance

Note 1 to entry: Microgrid refers to a small power generation and distribution system which can be controlled independently by connecting the electrical load and distributed power. The microgrid can work together with the urban grid or independently.

Note 2 to entry: Smart microgrids can realize economic electricity consumption and environment-friendly intelligent optimization under the premise of guaranteeing reliable electricity consumption.

[SOURCE: IEC TS 62898-1:2017, 3.22]

3.2

lightweight

lightweight of an information-based system of smart buildings refers to the realization of non-destructiveness and fidelity compression under simplification of the complex geometric topology and the entity display process, as well as reduction of dependence and occupation of computing resources.

Note 1 to entry: This reduces the huge data volume of the information-based system of smart buildings, facilitates the information-based system of smart cities and other information-based systems to realize the smooth connection and matching, and provides convenient data interaction and user interaction.

4 Information-based system of smart buildings

4.1 General

The information-based system of smart buildings in smart cities refers to the comprehensive information-based system designed for urban managers, servers, and users of basic urban properties, involving traffic, security, energy, environment, and service. Information monitoring, data collection and analysis, information sharing and guidance, intelligent regulation, and management of the whole smart building can be realized through the interaction between each subsystem of the smart building and the interaction between the subsystem and the information management platform.

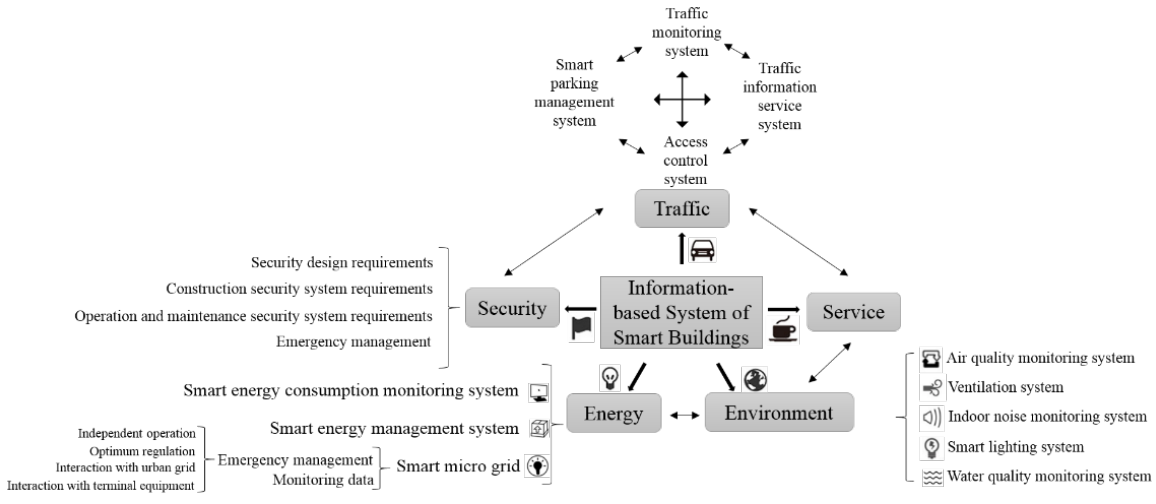
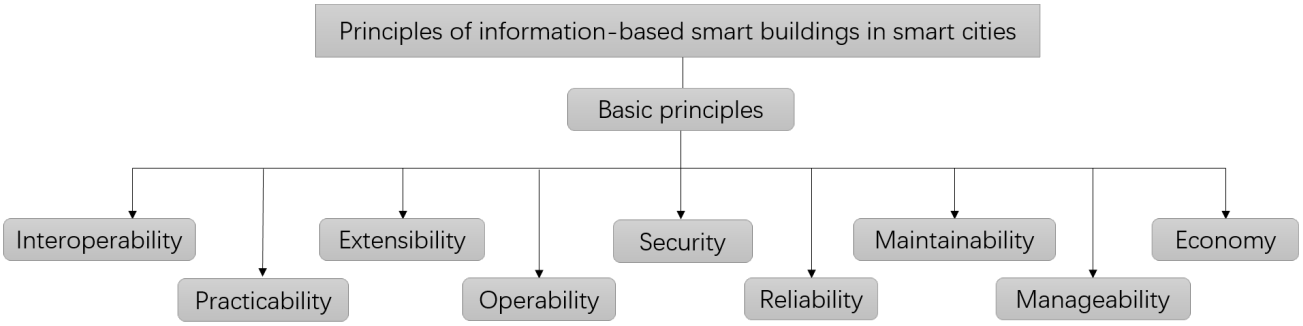


Figure2- Schematic diagram of smart building informatization subsystem and platform interconnection

4.2 Principles of smart building informatization



4.2.1 Basic principles

The information-based system of smart buildings and the information-based system of smart cities are combined in an optimal way to improve the accuracy, effectiveness, and dynamic property of information to improve the security, applicability, durability of buildings and service efficiency of energy, reduce the cost to use and provide an efficient, comfortable and convenient personalized building environment.

4.2.2 Interoperability

4.2.3 Practicability

The information-based system of smart buildings shall apply to the indicator system, data storage, and exchange of the information-based system of smart cities. The system functions shall be set reasonably, system configuration and equipment model selection shall be conducted correctly under the principle of "being practical, overall planning and high concentration."

4.2.4 Extensibility

The modular design shall be applied to the information-based system to meet the needs of scale expansion, functional extension, and upgrading of supporting software and hardware of the system.

4.2.5 Operability

The management software and hardware of the information-based system shall be equipped with a straightforward, concise, and friendly man-machine interface. The operation shall be simple, flexible, easy to study, and convenient to manage and maintain.

4.2.6 Security

Effective security protection measures shall be taken for the information-based system, preventing the system from illegal access, illegal attack, and virus infection. The system shall be equipped with comprehensive security measures, including lightning protection, overload, power outage, electromagnetic interference, and artificial destruction.

4.2.7 Reliability

The information-based system shall adopt mature technologies and reliable equipment. Backup or redundant measures shall apply to critical equipment (redundant and extensible). System software shall have the backup and security maintenance capacities and robust fault tolerance and system recovery capacities.

4.2.8 Maintainability

The information-based system shall equip with self-inspection, fault diagnosis, and fault weakening functions. In case of any fault, the information-based system shall be able to position the fault point quickly, feed it back to the central control platform and recover it timely.

4.2.9 Manageability

Equipment, network, performance, and security inside the information-based system shall be managed and configured conveniently.

4.2.10 Economy

On the premise that the information-based system can meet the user demands, the system shall be simplified as far as possible, and the operation and maintenance costs shall be reduced to achieve the requirements of the one-time investment and the optimized long-term operation and maintenance costs of the system.

5 Basic principles of the information-based system

5.1 General

Construction of the information-based system of smart buildings shall ensure timely, accurate, secure, and efficient data provision, data receiving, data transmission, and data feedback of smart cities so that convenient, secure, and efficient operation and privacy protection of smart buildings and cities can be guaranteed.

5.2 Basic principles

a) The information-based system of smart buildings shall meet the information-based needs of operation and management of buildings and provide support and guarantee for the operation of smart buildings.

b) The information-based system of smart buildings shall realize provision, exchange, sharing, and updating of information or data with smart cities.

c) The information-based system of smart buildings shall guarantee the security and privacy of information or data.

d) The information-based system of smart buildings shall monitor and track the traffic, security, energy, environment, and service of smart buildings and manage them intelligently and dynamically to improve efficiency.

e) Design of the information-based system of smart buildings shall guarantee the integration, coordination, and unification of functions of the whole smart building, subsystems, and equipment and devices.

f) During the construction of the information-based system of smart buildings, it shall be tested and verified to guarantee that it is accurate, effective, stable, and reliable.

6 Information-based system management platform of smart buildings

6.1 Framework overview

a) Smart buildings' information-based system management platform focuses on IoT and gives full play to its ecosystem construction capacity by building a smart building ecosystem.

b) Smart buildings' information-based system management platform can access subsystems and sensors of smart buildings downward and can carry quick deployment of many preferential applications and services. Horizontally, the platform can interconnect various cloud services, meet the demands of different scenes, businesses, and users in digital architectural spaces and realize the interconnection of smart building systems.

6.2 Basic principles

6.2.1 Extensible

After upgrade and extension, system functions meet the current service environment and function demands. After a technical upgrade, the software system and database can be updated typically and

steadily. After the upgrade, the whole system shall be easy to manage, maintain and operate. The system's security, data flow, performance, and other indicators can be monitored in real-time, and the remote fault handling and daily maintenance management shall be supported through technical means.

6.2.2 Robust

Advanced, mature, and practical technologies shall be adopted. The design shall be reasonable, and mature products shall be applied.

6.2.3 Secure

System design and development shall follow the principles of security, confidentiality, and sharing principles. The relationship between data resource sharing and data security confidentiality shall be appropriately handled to realize data sharing under the premise of security and confidentiality. Based on giving full consideration to the security of the server environment and network security, failure of a single point shall be avoided effectively, redundant backup and disaster recovery shall be fully taken into consideration to avoid the occurrence of faults to the maximum and guarantee secure and stable operation of all systems.

6.2.4 Operable

The database console provides the system administrator with an intuitive graphical user interface, enabling the system administrator to control and manage the entire database operating environment centrally.

6.2.5 Maintainable

System analysis and multi-layer design will avoid business chaos and outside interference.

6.2.6 Open

The system shall make full use of open platforms in terms of the architecture, hardware, software, and data exchange protocol, enabling the system to have good interoperability and portability.

6.3 The framework of the information-based system management platform

6.3.1 Physical sensing layer

6.3.1.1 Equipment ledger module

A comprehensive statistical analysis of the equipment maintenance and servicing and maintenance expenses shall be realized in terms of the equipment ledger. The actual situation shall be checked regularly to ensure the consistency of the ledger and the actual situation.

6.3.1.2 Spare product ledger module

Requirements for the spare product ledger module: Ledgers shall be established for spare parts, and products, incoming and outgoing materials shall be recorded seriously, ensuring conformity among the ledger, card, and object. Daily accounts shall be closed daily, and monthly accounts shall be closed monthly.

6.3.2 Core player of the platform

The core layer of the platform shall meet the following requirements:

a) Secondary development can be carried out on the general platform architecture to realize the building of the platform layer of the information-based system of smart buildings, and provide users with management and analysis services of massive smart building data.

b) It can accumulate different system application technologies, knowledge, and experience in smart cities, realize encapsulation, solidification, and reuse. The platform is provided for developers in the form of microservices of the information-based system of smart buildings in the open development system to quickly construct customized smart building application software and forge an integral and open industrial information-based operating system of smart buildings.

6.3.3 Application interaction layer

The basic model of information-based application of smart buildings is to provide business information that supports relevant institutions and their service personnel, including building rental and sales, operation, maintenance, repair, security, and cleaning, to provide convenient information service application for target people in buildings (involving accommodation, office, resident, conference, and shopping) and mainly to provide end-users (enterprises, and individuals) with multi-layer rich data and intuitive and convenient interactive means via the interactive layer.

6.3.3.1 Principle of lightweight data conversion

The lightweight compression conversion process shall meet the demand of the information-based application of smart buildings for the use of modules, mainly including the following four aspects:

a) Compression of multiple data. The lightweight module shall provide a unified data format for data exchange, combination, and assembly to meet the objective demands of the information-based system of smart buildings for multiple suppliers and multiple data platforms.

b) Data carrying. Lightweight data, with the container data format, can meet information-based demands of smart buildings, support accurate marking of accurate data in the lightweight model and provide many data expression modes.

c) Efficient presentation. Lightweight data are generated to reduce the performance and configuration requirements for the display terminal. It shall support a wide range of operating systems and meet the applicability requirement of the independent control system in the information technology application innovation engineering. Delay of data display in the front end shall be significantly reduced according to the response indicators of different business systems.

d) Application interaction. The lightweight model is on the application interaction layer of smart buildings' information-based system management platform framework, including interoperation interaction with other business systems and application interaction with end-users.

6.3.3.2 Fidelity of lightweight data

In application interaction, lightweight data are mainly expressed in environmental scenes, facilities, equipment, landscape objects, etc. It shall meet customers' simulation and fidelity requirements under different business demands and support offline rendering, baking rendering, and real-time rendering of light.

7 Data security

Security of the information-based system of smart buildings means that necessary measures are taken to ensure that data in the system are effectively protected and legally utilized, and the system can guarantee the continued security state.

7.1 Principles

a) Data security of smart buildings' information-based system shall be deemed a whole, and isolated security planning shall be avoided.

b) Proper and overall data security methods with corresponding security measures shall be applied to prevent and destroy the hostile, malicious, fraudulent, criminal, and terrorist actions or activities that threaten smart buildings' information-based systems. Every effort shall be made to protect data confidentiality, integrity, and availability, ensuring that data will not encounter the danger or threat of accidental access and use when possible.

c) For data security, security measures shall be taken by considering the physical condition, network, and personnel involved in smart buildings' information-based systems and the data security of subsystems. Effective and secure data shall be provided for the operation of smart buildings.

d) In order to ensure the overall data security, the security measures used shall consider the physical, network, personnel, and other aspects of smart building informatization, take into account the data security of subsystems and provide effective and safe data for the operation of smart buildings.

e) Security management of data storage shall be considered, scattered data storage shall be adopted, and repeated data storage shall be avoided.

7.2 Security policy or measure

7.2.1 Data security measures

Data security measures shall meet the following requirements:

- Security of data exchange and sharing;
- The reality of exchanged and shared data;
- Data availability, source, and reliability of the information-based system of smart buildings;
- Confidentiality and commercial sensitivity of service data;
- Proper measures for ensuring the integrity of exchanged and shared data;
- Exchange demand and elasticity of shared data;
- Data exchange and sharing interfaces shall be configured with the data access permission.

7.2.2 Data security field

The data security field includes the following aspects:

- Data security of manager;

- Data security of service receiver;
- Data security of service provider and organization;
- Data security connecting to other infrastructure.

7.3 Threats focus

The information-based system of smart buildings shall be able to identify possible security threats, including:

- Possible system interruption or data corruption;
- Possible access of irrelevant personnel to personal data, intellectual property, or sensitive commercial data relating to services of the information-based system of smart buildings;
- Possible damage to physical facilities of the information-based system of smart buildings during use and operation;
- Damage to other buildings or systems beyond the information-based system of smart buildings;
- Damage caused by network, malicious software, and artificial factors;
- Data theft (blackmail, utilization, damage);
- Operational risks (program defects, processing complexity, functional disorder);
- Financial risk.

7.4 Requirements for safe operation and maintenance of the system

a) The information-based system of smart buildings shall carry out real-time security monitoring, monitor and analyze behaviors of users and the system, audit configuration and vulnerabilities of the system, evaluate the integrity of sensitive system and data, and enable the administrator to monitor, control, and estimate the network or the host system effectively.

b) The information-based system of smart buildings shall contain penetration testing and actively analyze any weakness, technical defect, or vulnerability of the system;

c) The information-based system of smart buildings shall carry out risk evaluation before or after the occurrence of risk events to evaluate the possible losses of the information-based system quantitatively;

d) Based on the security risk analysis results of daily monitoring, penetration testing, and risk assessment, the security of the information-based system of smart buildings shall be reinforced by formulating corresponding security strategies for different information systems to improve the target security;

e) The information-based system of smart buildings shall notify necessary information security events and vulnerability information to enhance the safety awareness of personnel.

7.5 Emergency management

Emergency management of the information-based system of smart buildings shall meet the following requirements:

a) Establish an emergency response mechanism, formulate specific technical schemes for data recovery, emergency recovery, and network recovery of the information-based system of smart buildings.

b) Establish the guarantee mechanism of the information-based system of smart buildings at special periods to ensure secure and stable operation of the platform at special periods.

c) In case of any security emergency, the emergency disposal procedure shall be started to carry out quick positioning, analysis, and settlement.

8 Data privacy

Protection of data privacy of the information-based system of smart buildings refers to the process where measures are taken to guarantee that individuals have the right to inquire legally and handle personal data and their data are not publicly disclosed or accessed by others illegally.

8.1 Principles

Data privacy of the information-based system of smart buildings shall meet the following requirements:

- Fairly and legally process data;
- Process data within specific permission and do not process data excessively;
- Ensure the accuracy and timeliness of data;
- Store data within the required period;
- Process data according to laws or rights of individuals as stipulated in-laws, including individuals' right to access;
- Do not transfer personal data to other organizations, countries, or regions without permission.

8.2 Privacy strategy and governance

8.2.1 Data privacy of the service object

The information-based system of smart buildings shall identify and record personal high-risk data. High-risk categories of personal data include:

- Personal sensitive data as stipulated in-laws;
- Bank accounts and other financial information;
- Identifier, such as the national insurance number;
- Personal data relating to vulnerable adults and children;
- Detailed personal data;

- Sensitive data may impose adverse impacts on individuals.

8.2.2 Management team

The information-based system of smart buildings shall ensure that the management team shall be responsible for issuing and maintaining the privacy policies, set a clear framework, and show support for and commitment to the data exchange and sharing of the information-based system of smart buildings. This procedure shall include the compliance of management data protection by laws and regulations.

8.2.3 Notification of privacy management policies

The privacy management policies shall be notified to the following personnel:

- Organizations and personnel that provide services in the information-based system of smart buildings;

- Organizations and personnel involved in the design, construction, implementation, or delivery of the information-based system of smart buildings.

8.2.4 Accountability and responsibilities

Senior management members shall be appointed to take charge of the privacy management and data exchange and sharing of the information-based system of smart buildings. Members shall abide by laws and regulations on data protection and make efforts to display and publicize a good privacy protection practice system.

8.2.5 Data privacy procedure

a) A proper data privacy procedure shall be formulated for the information-based system of smart buildings to meet the following requirements:

- Legally process personal data;

- Process personal data reasonably;

- Process sensitive data by laws or regulations for just reasons.

b) Any individual or organization that provides the system with personal data shall be provided with applicable data exchange and sharing rules where the following information shall be delivered:

- Identity of the data receiver or organization;

- Purpose of data exchange, sharing, or processing;

- The information which may disclose to a third party by exchanging or sharing data;

- Individuals' permission of accessing data when exchanging, sharing, or processing data;

- Whether personal data are transferred to the outside without sufficient protection;

- Detailed information of any technology used for collecting personal data like website;

- Other information.

8.2.6 Privacy procedure

a) The information-based system of smart buildings shall be equipped with a privacy management procedure.

b) The privacy procedure shall guarantee that when the management organization of the information-based system of smart buildings or any third party uses data: the use purpose of data and any restriction for the use of data shall be described in writing; The organization that uses data shall provide a commitment or evidence to prove that it will not violate the policy on the privacy of smart buildings.

c) It shall be guaranteed in the use of data that: data exchange and sharing are legal. Data shall be accessed with personal content. If it is required in accordance with laws that data shall be exchanged and shared with a third party, the agreement on data exchange and sharing shall be guaranteed, and relevant records shall be reserved.

d) The privacy procedure includes the procedure regarding the execution of the privacy right by individuals. Individuals' rights over personal data shall be respected. That is, individuals are entitled to request access to information, disagree with processing, and require investigation of personal data within a time limit.

464 **Appendix A: Typical functional case of an information-based system of smart building**

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Project title	Supporting Construction of Beijing Universal Studio Theme Park (Phase I) Project (2 works including Nuojin Resort Hotel)
Project profile	Universal Nuojin Hotel is located in Beijing Universal Theme Park and Resort, Tongzhou District, Beijing. It is a five-star resort hotel with a total construction area of 47,900 square meters. The information system construction works of the Project mainly includes the following subsystems: 1 Premise Distribution System (PDS): The office building realizes a unified physical platform for the integration of smart building systems, and it selects a flexible star-shaped topology structure to connect voice, data, image, and other equipment. It adopts a star-shaped wiring structure and is divided into three levels. The first level is telecommunications access, the second level is the IT machine room, and the third level is the LV rooms distributed on each floor, including Analog phone, IP phone, office network data, guest network data, information distribution, guest control, TV information interaction (reservation system), wireless AP, security system routing, etc. 2 Video Monitoring System: It adopts an all-digital architecture, which is composed of four parts: front-end video capture equipment, transmission and exchange equipment, management and control equipment, video display, and video storage equipment. Video monitoring system coverage area includes key public areas, such as all entrances and exits, lane entrances, indoor and outdoor lane entrances, lending departments, back-offices, valuables safety boxes, luggage storages, all elevator cars, and elevator lobbies, important machine rooms, and hotel lobbies, guest areas, all-day dining restaurants, Chinese restaurants, multi-functional halls, swimming pools, and SPA rooms, etc. 3 Intruder Alarm System: It is mainly composed of four parts: front-end manual alarm button, transmission equipment, management, and control equipment, and display and recording equipment. The system adopts a bus system structure, and the hand report button is connected to the alarm host through the control bus via the defense zone module of the corresponding area. The alarm points are mainly distributed in the financial office, lending departments, the valuables storage room, the public toilets for the disabled, the special disabled rooms, and part of SPA rooms, with a total of 21 points. 4 Access Control System: As a subsystem of the security system, it is mainly composed of an access controller, a card reader, an electronic door lock, an exit button, a management workstation, and an authorized card issuer. It mainly realizes the functions of identifying, recording, controlling, and managing personnel in and out of areas such as hotel access channels, key computer rooms, financial rooms, rest areas, and unloading areas. 5 Electronic Inspection Management System: It adopts an offline patrol system, and 48 patrol points are designed. Patrol points are

	mainly located in the front room of the stairwell, corridors, halls, main entrances and exits, and important protected parts. The specific installation positions will be adjusted according to the requirements of the hotel security department. The system is mainly composed of a management computer, a patrol stick, a handheld data collector, and a patrol button. 6 Parking Management System: It is located in the outdoor park of the hotel, and it is mainly composed of entrance equipment, exit equipment, exit manual toll station, transmission exchange, image recognition equipment, voice intercom equipment, central management station, etc. The parking management system adopts the vehicle license plate recognition method to implement comprehensive management to the vehicle traffic crossings, such as entry and exit control, monitoring, driving signal instructions, parking signal instructions, parking management, and vehicle anti-theft alarms. 7 Guest Room Control System: There are a total of 400 guest rooms in the Universal Nuojin Hotel. The Project's controllable management system carries out the networking with the hotel front desk management system to achieve networked control, which can intelligently control the lighting, sockets, and air-conditioning of the guest rooms, and simultaneously the purpose of energy saving can be achieved through intelligent control. 8 Intelligent Lighting Control System: The modular distributed bus structure can realize complex scene control and logic control in a specific space and can realize control and management of areas that require intelligent lighting control. The system control module and control panel can be distributed combined with the lighting power distribution system according to different places. 9 Information Network System: It is mainly divided into three independent network systems, namely, office network, passenger network, and equipment network. The office network is used for the access of hotel management software system, information distribution, guest room management system, and other subsystems, and each subsystem is isolated by Vlan; The guest network is used for the access of the hotel guest room Internet access system, interactive TV system, IP telephone system and other subsystems; And the equipment network is mainly used for the access of various intelligent systems, including security equipment access, building control equipment access, and background music system access, etc. 10 Wireless Intercom System: It is mainly used for wireless communication to the hotel security department, engineering department, logistics department, and housekeeping department. The wireless relay equipment is installed in the fire control room on the first floor of Zone A. The main wireless signal coverage areas are all areas inside the hotel (including staircases, basements, equipment rooms), elevator cars, and surrounding areas outside the hotel building. 11 Information Guiding and Release System: It adopts the B/S + C/S structure. That is, the operator of the system can log in to the system through the website browser and carry out operation and

	management. Operators can be assigned to various departments of the hotel, and they have different functional authorities and level authorities. Simultaneously, the administrator will be awarded resource authority to manage different resources, and operators can manage and set the system within their own authority scope only. Operators realize the complete management of the system through the Web server, and they can control the system with no need to install management software or a special PC. 12 Conference System: Construction content only covers a multi-functional hall on the first floor of the hotel, with an area of about 470 square meters. The multi-function hall adopts the layout of flowing seats, which mainly meets the requirements of daily meetings, feasts, other functions, etc. Simultaneously, it meets the external rental requirements for holding product launches and small cultural and entertainment events. 13 Background Music System: It provides the play function of daily background music for the public areas of the hotel 1F, 3F, 6F by the network server of the master control room and local program. Simultaneously it has a strong firefighting cutting function, which can coordinate the firefighting system to play firefighting audio content when the fire alarm is triggered. 14 Building Automation System: It is composed of a working platform, network DDC controller, sensor, actuator, gateway, etc. The system-related wind and water conduits, all kinds of terminal actuating mechanisms installed on water supply and electromechanical drainage equipment (such as electric water valve, electromagnetic valve, etc.), detection sensors (such as temperature sensor, pressure difference sensor, carbon dioxide sensor, etc.) and the power supply of this kind of equipment shall be supplied and installed by an electromechanical general contractor. The subcontractor of low voltage discipline shall take charge of cable laying, connecting, and late commissioning, and the electromechanical contractor shall coordinate the automatic control linkage commissioning of overall electromechanical equipment. 15 UPS Power Supply System: The weak current system of the hotel adopts the UPS centralized power supply system. The UPS power supply is configured in the IT machine room on the B1 floor. The power supply is set up with a 200KVA UPS, and the power storage device can supply power continuously for 0.5 hours. The complete monitoring software can realize local remote monitoring and management of local area networks and wide area networks in the online setting.

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