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Smart community infrastructure — Guidance for the development of smart building information systems

Infrastructures urbaines intelligentes — Lignes directrices pour le développement du système d'information des bâtiments intelligents

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

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Introduction

As the urban population grows, problems such as a shortage of resources, pollution, traffic congestion, and potential safety hazards are becoming increasingly common. In order to solve the problems of urban construction and governance, smart communities are developing. As one of the most critical components in the functioning of a city, the development of smart building information systems has been put on the agenda. A smart building is a new model for the sustainable development of cities, by making intelligent responses to the needs of urban activities through the use of information and communication technology to sense, analyse and integrate the key information of the core system of urban operations.

The development of smart building information systems is an important way to enhance building management and create a liveable built environment. While leading the application of information technology and improving the social comprehensive competitiveness of the construction industry, the development of smart building information systems contributes significantly to the changing industrial structure and industrial economic development.

This document is intended as a reference for government and enterprises, organizations and individuals who are responsible for, or need to develop, smart building information systems. This document helps to provide an important description of the principles for the construction of smart building information systems and the interconnections of sub-systems. Recommendations are proposed for the layers of information systems and data management.

Smart community infrastructure — Guidance for the development of smart building information systems

1 Scope

This document provides guidance for the development of smart building information systems as part of the infrastructure of smart communities. It does not include civil engineering and construction processes.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
data compression
process of encoding, restructuring or otherwise modifying data in order to reduce its size

3.2
fidelity
degree to which a model or simulation reproduces the state and behaviour of a real-world object or the perception of a real-world object, feature, condition, or chosen standard in a measurable or perceivable manner

[SOURCE: ISO 16781:2021, 3.1.4]

3.3
smart building
building that can identify and adapt to both expected and unexpected changes by effective use of data, information and communication technology and which continually improves predictions and action in response to the various needs of building values, urban activities and urban operations

4 Principles

4.1 General principles

Smart building information systems help to achieve security, applicability, durability and energy efficiency of buildings. It can reduce the operational costs and provide an efficient, comfortable, convenient and personalized building environment. The realization of a smart building information system should consider the following four principles:

a) Reliability

A smart building information system should adopt mature technologies and reliable equipment. Backup or redundant measures should apply to critical equipment (with redundant and extensible capacity). System software should have the backup and security maintenance capacities and robust fault tolerance and system recovery capacities.

b) Trustworthiness

A smart building information system should operate using authentic, credible and unmodified data, and not violate intellectual property rights and privacy.

c) Maintainability

A smart building information system should be equipped with self-inspection, fault diagnosis, and fault weakening functions. In case of any fault, the information system will be able to position the fault point quickly, feed it back to the central system and recover it in a timely manner.

d) Security

Effective security protection measures should be taken for smart building information systems, preventing the system from illegal access, illegal attack, and virus infection. The system should be equipped with comprehensive security measures, including lightning protection, overload protection and power outage protection.

4.2 Use cases

Smart building information systems should meet the following use cases:

a) To meet the effective recommendations of the operation and management of buildings and provide support and guarantee for the operations of smart buildings. As an important part of building intelligent systems, it ensures and supports the normal operation of the whole building system.

b) To realize the provision, exchange, sharing, and updating of data with smart communities.

c) To guarantee the security and privacy of data.

d) Smart building information systems can have the capability of monitoring and tracking the mobility, security, energy, environment and smart building services, and support smart decision-making. The system can make a preliminary analysis according to the current collected data and provide reference processing opinions for decision-makers, such as the automatic system prompt "power off" when the circuit is faulty.

e) The design of smart building information systems can ensure the effective interconnection of functions within the system, each subsystem and equipment in smart buildings.

f) The design of smart building information systems can add convenient ways to ensure the timely access to users to authorized buildings, environment, equipment, energy and other information, as well as emergency warning and operation guidance.

g) The design of the smart building information system will consider the interconnection of the building safety and security systems to a city-wide integrated awareness and situational centre (ISAC) for a city-wide emergency response as part of a smart city management system.

5 Information system and subsystems of smart buildings

5.1 Overview

Smart building information systems refers to the comprehensive system designed for city administrators, service providers and citizens. Information monitoring, data collection and analysis, sharing and guidance, intelligent regulation, and management of the whole smart building can be realized through the interaction between each subsystem of the smart buildings.

Internet of things (IoT) information systems for smart buildings can be involved in the rapid deployment of preferential applications and service. Various building information systems are digitized during the construction phase using building information modelling (BIM) software and modelled with the level of detail (LOD) required for future operation and maintenance. IOT sensors will convey all the connected building systems to the BIM model establishing what is called a digital twin platform. In addition, the system 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.

NOTE An example of smart building information systems is contained in Annex A.

5.2 Subsystem interconnection overview

Smart building information systems include multiple subsystems with different functions (e.g. mobility, security, energy, service and environment). The subsystems process the data and realize the information link management of the whole building. See Figure 1.

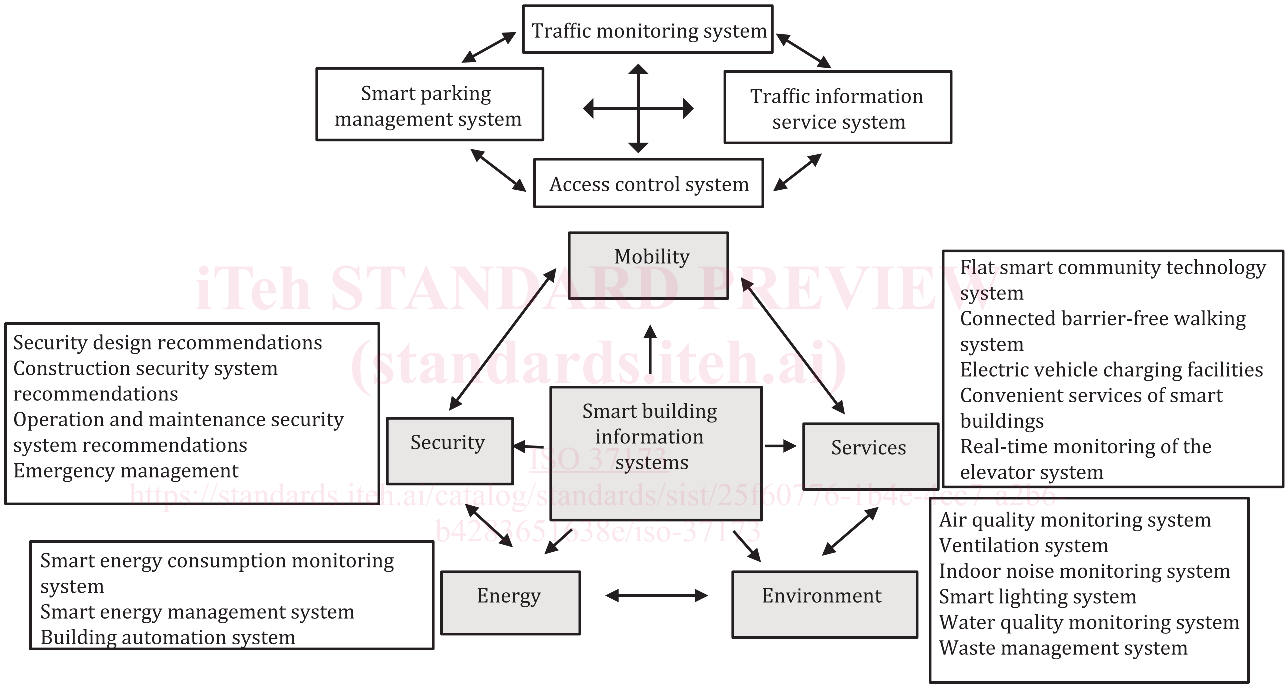

Figure 1 — Overview of the information systems and subsystems of smart buildings

5.3 System recommendations

5.3.1 Extensibility

After upgrade and extension, system functions meet the current service environment demands. Software and databases can be properly and stably updated. The whole system should 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 should be supported through technical means.

5.3.2 Stability

Rational design and advanced, mature, and practical technologies and products should be adopted.

5.3.3 Security

System design and development follow the principles of security, confidentiality and sharing. The relationship between data resource sharing and data security confidentiality should be appropriately handled to realize data sharing under the premise of security and confidentiality. With full consideration of the security of the server environment and network security, failure of a single point should be avoided. Redundant backup and disaster recovery should be fully taken into consideration to prevent the occurrence of faults and ensure secure and stable operation of all systems.

5.3.4 Operability

The database control panel provides the administrator with an intuitive graphical user interface, enabling centralised control and management of the entire database operating environment.

5.3.5 Maintainability

System analysis and multi-layer design can prevent disruptions to business and irrelevant interference.

5.3.6 Compatibility

Good interoperability and portability of the system can be enabled in terms of the architecture, hardware, software and data exchange protocol by making full use of subsystem interconnections.

6 Layers of smart building information systems

6.1 General

The layers of smart building information systems consist of a physical sensing layer, an application layer and an interaction layer (see Figure 2). The creation and maintenance of equipment records allows an evidence-based smart building information operating system to support smart building data management and smart decision-making.

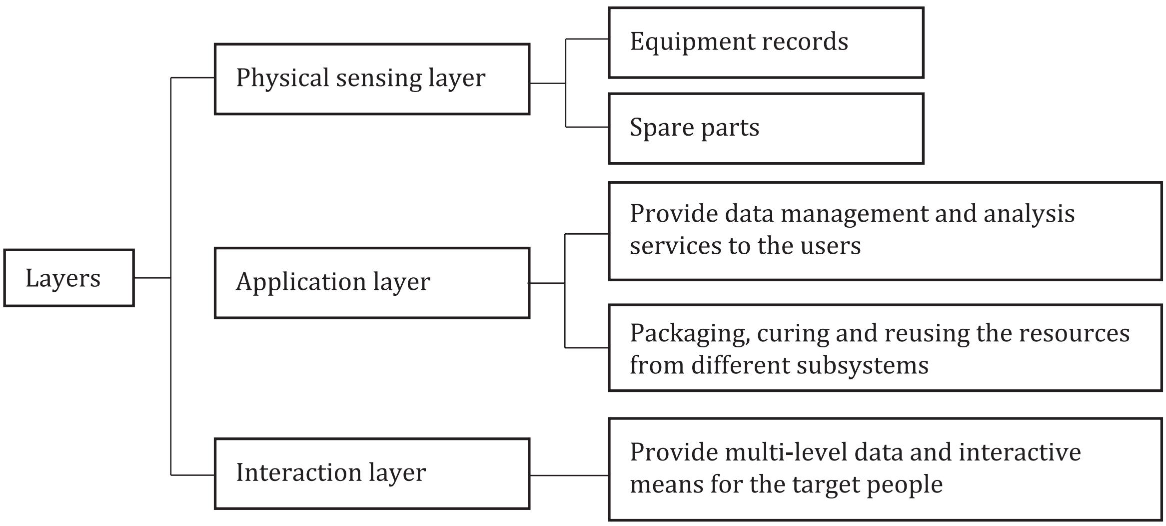

Figure 2 — Layers of smart building information systems

6.2 Physical sensing layer

6.2.1 Equipment records

A comprehensive statistical analysis of the equipment maintenance, service and expenses can be realized in terms of the equipment records. The actual situation should be checked regularly to ensure the consistency of the record with the actual situation.

6.2.2 Spare parts

A record should be established for spare parts. Incoming and outgoing materials should be strictly recorded to ensure conformity among the record, card and object.

6.3 Application layer

The application layer should meet the following:

a) Secondary development can be carried out in the buildings to realize the construction of the application layer and provide data management and analysis services to the users.

b) The application layer meets the functions of packaging, curing and reusing the resources from different subsystems, to quickly build a customized application of smart buildings.

6.4 Interaction layer

The interaction layer of information systems focuses on providing multi-level data and interactive means for the target people. It creates information communication and provides information support to assist information services.

7 Visualization and data compression

7.1 General

Smart buildings can use 3D models as bearers to realize multiple data visualization. Native building models have the characteristics of large volumes, complex structures, with a large number of parts and multiple sources, which are difficult to be displayed away from the computer. In order to achieve the 3D model visualization in different scenarios, it is crucial to compress the data that constitutes the model.

7.2 Fidelity of data compression

In application interaction, data compression is mainly expressed in environmental scenes, facilities, equipment, landscape objects, etc. Data compression should meet the functions of customer simulation and fidelity under different business demands and support offline rendering, render baking, and real-time light rendering.

Smart buildings need to be built based on a 3D model to carry more information. In addition to the 3D model itself, it also includes environmental information, an equipment model, a furniture model, piping information and many other different data. Since these data may come from different 3D models, in order to ensure the availability of the model, the first thing that needs to be ensured is the accuracy in the data compression process.

In evaluating the accuracy of a conversion, the following aspects should be considered:

a) Model appearance. The appearance of the model is the first thing that a user should notice. It is the most intuitive expression of the accuracy of the model.

b) Colour accuracy. The accuracy of colour directly affects the visual effect of the model. The original colour can be fully inherited to achieve quick recognition of the model.