Proceedings of Business and Economic Studies, 2026, Volume 9, Issue 10
https://bbwpublisher.com/journal/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

Application of Building Intelligent Technology in Cruise Ship Interior Outfitting

Guangmei Hai

Jiangsu Maritime Institute, Nanjing 210010, China

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: To systematically review the research progress and application status of building intelligent technology in the field of cruise ship interior outfitting, this paper, on the basis of defining the connotation and extension of building intelligent technology and cruise ship interior outfitting, reviews the application scenarios of intelligent technology from four dimensions: cabin environment, public areas, safety management, and energy management. It summarizes typical application modes such as scenario-based lighting, intelligent cabin control, passenger flow statistics, fire alarm linkage, power monitoring, and air-conditioning optimization. It then analyzes the main current challenges from five aspects: the special marine environment, codes and standards, investment costs, cybersecurity, and interdisciplinary talent. Finally, it looks forward to future development trends from five directions: deep integration, artificial intelligence, personalized customization, green energy conservation, and digital operation and maintenance. The study concludes that the deep integration of building intelligent technology and cruise ship interior outfitting should, on the premise of complying with the SOLAS Convention, cruise ship classification society rules, and cabin comfort standards, coordinate the collaboration of all subsystems through a system integration approach, thereby achieving overall improvement in passenger experience, energy efficiency, and operation and maintenance levels while ensuring safety and reliability.

Keywords: Building intelligent technology; Cruise ship interior outfitting; System integration; Cabin intelligence; Energy management

Online publication: November 16, 2026

1. Introduction

As an important part of the modern tourism industry, the cruise industry has shown a trend of sustained and rapid development in recent years. According to industry reports released by the Cruise Lines International Association (CLIA), the global cruise passenger volume has grown steadily, and the demand for cruise tourism in the Asia-Pacific region, especially the Chinese market, has grown particularly significantly. As the core space directly experienced by passengers, cruise ship interior outfitting not only directly affects passenger comfort and satisfaction, but also increasingly becomes a key element of differentiated competition in cruise products.

At the same time, the rapid development of technologies such as the Internet of Things (IoT), artificial

intelligence, big data, and building information modeling (BIM) has enabled building intelligent technology to gradually evolve from early automatic equipment control into a new technical system centered on system integration and scenario-based services [1]. By systematically integrating building equipment, information communication, and operation management, building intelligent technology has been widely applied in onshore buildings such as commercial complexes, hospitals, and airports. Introducing this technical concept into cruise ship interior outfitting design has important practical significance for improving the functionality, comfort, safety, and energy efficiency of interior spaces.

2. Related concepts and theoretical basis

2.1. Connotation of building intelligent technology

Building intelligent technology refers to a technical system that uses modern communication technology, computer technology, automatic control technology, etc., to comprehensively manage building equipment operation, usage functions, information services, etc. Its core subsystems generally include:

(1) Building Automation System (BAS). Through sensors, actuators, and controllers, it realizes automatic monitoring and coordinated management of HVAC, lighting, water supply and drainage, and other equipment in buildings.

(2) Communication Automation System (CAS). It builds integrated wiring systems and communication networks in buildings to support reliable transmission of voice, data, images, and other information.

(3) Office Automation System (OAS). It provides office automation functions such as information processing, document management, and transaction processing.

(4) System Integration. Through a unified platform and management software, it integrates various subsystems to achieve data sharing and collaborative work.

2.2. Concept and characteristics of cruise ship interior outfitting

Cruise ship interior outfitting refers to all decoration, furnishing, furniture, and functional facilities inside a cruise ship except for the hull structure, power plant, and main electromechanical equipment, covering various spaces such as cabins, public areas, restaurants, theaters, swimming pools, and gyms. Cruise ship interior outfitting has the following notable characteristics:

(1) Spatial particularity. The internal space of a cruise ship is relatively enclosed, and the cabin area is limited. It is necessary to achieve multi-functional integration within limited space, requiring a high degree of design refinement.

(2) Environmental particularity. Cruise ships operate in complex environments and must cope with special conditions such as vibration, humidity, salt spray, and temperature and humidity changes, imposing strict requirements on the durability and reliability of materials and equipment.

(3) Strict regulations. Cruise ships are constrained by the SOLAS Convention, the International Maritime Organization (IMO), and classification society rules. Interior materials, equipment installation, fire escape, etc. are subject to strict mandatory requirements [2].

(4) Passenger experience. As tourism products, passenger comfort and experience are core considerations in design; decoration style, lighting atmosphere, acoustic control, etc. are important design elements.

2.3. Necessity of integration

Applying building intelligent technology to cruise ship interior outfitting has multiple values. First, it can improve passenger experience by creating a comfortable cabin atmosphere through personalized environmental control, intelligent lighting, and background music; second, it can improve energy efficiency. Cruise ship operation consumes huge amounts of energy, and an intelligent energy management system can achieve significant energy savings; third, it can improve safety management by ensuring passenger safety through intelligent monitoring, emergency evacuation, and fire linkage systems; fourth, it can reduce operating costs by improving management efficiency through predictive equipment maintenance and intelligent scheduling. See **Table 1**.

Table 1. Correspondence between major spaces in cruise ship interior outfitting and intelligent requirements

Space category	Main functional areas	Key intelligent requirements	Related subsystems
Cabin Area	Interior cabins, ocean-view cabins, balcony cabins, suites	Environmental comfort, privacy, personalization	HVAC, lighting, cabin control, entertainment
Public Area	Lobby, restaurants, theater, swimming pool, fitness center	Scenario atmosphere, passenger flow guidance, information services	Scenario lighting, BGM, video analytics, information publishing
Safety Area	Escape routes, fire station, monitoring center	Emergency response, alarm linkage, remote monitoring	Fire protection, broadcasting, video surveillance, access control
Back-of-house Area	Engine control room, energy consumption monitoring center	Equipment monitoring, energy management, predictive maintenance	Power monitoring, energy management, equipment operation and maintenance

3. Typical applications of building intelligent technology in cruise ship interior outfitting

3.1. Cabin intelligence

Cabins are the core space of cruise ship interior outfitting and the place where passengers stay for the longest time. The application of building intelligent technology in cabins is mainly reflected in the following aspects:

(1) Environmental control system. Through the system, passengers can adjust cabin temperature, humidity, and fan speed according to personal preferences. It can also automatically learn passengers' usage habits and provide personalized environmental settings. Some high-end cruise ships are also equipped with air quality monitoring and purification functions [3].

(2) Intelligent lighting system. The LED lighting system features adjustable color temperature and brightness, combined with scene presets (such as reading, resting, and entertainment modes), to meet passengers' lighting needs for various activities. The intelligent lighting system can also integrate with sunshades and electric curtains to achieve coordinated control between natural light and artificial illumination [4].

(3) Entertainment information system. Modern cruise cabins are generally equipped with intelligent TV systems that support multiple language interfaces and personalized recommendation services, and integrate functions such as high-definition TV, audio systems, on-demand cinemas, and game entertainment.

(4) Intelligent cabin control. Passengers can control various devices in the room, such as lights, air conditioning, curtains, and music, with just one click through the bedside control panel or the mobile app. Some systems also support voice control, further enhancing the ease of operation.

3.2. Public area intelligence

Cruise ship public areas include the lobby, restaurants, theater, swimming pool, fitness center, etc., and are the main places for passengers to socialize and relax. The application of intelligent technology in public areas is mainly manifested as follows:

(1) Scenario-based lighting control. It automatically adjusts lighting scenes in public areas according to different time periods and activity needs.

(2) Background music system. It not only plays different styles of background music in different public areas, but also automatically adjusts volume and playlist according to time periods and passenger flow.

(3) Passenger flow statistics. It collects real-time passenger density in public areas, provides data support for operational management, and issues warnings when crowded.

(4) Intelligent guidance system. Electronic displays are set up at elevator entrances and passage intersections to provide dynamic information such as itinerary information, activity schedules, and dining recommendations.

3.3. Safety management intelligence

Cruise ship safety is the top priority of operation management. The application of intelligent technology in safety management mainly includes:

(1) Fire alarm system. The system is equipped with intelligent smoke detectors, temperature sensors, and other devices, enabling early detection and rapid alarm of fires, locating the fire location, and triggering the fire extinguishing system and emergency broadcasting devices in coordination.

(2) Video surveillance system. High-definition cameras are deployed in public areas, key passages, machine rooms, etc., combined with AI video analytics technology to achieve intelligent applications such as abnormal behavior detection, face recognition, and abandoned object detection.

(3) Emergency broadcasting and evacuation system. In case of an emergency, the system can generate the most optimal evacuation route based on the location of the fire and the distribution of personnel, and guide passengers to evacuate in an orderly manner through voice and display screens.

(4) Access control management system. By using various authentication methods such as card swiping, passwords, and biometric recognition, intelligent access control is implemented for the crew area and equipment rooms, ensuring the management of access to secure areas.

3.4. Energy management intelligence

The energy consumption of cruise ships is enormous, and energy management is an important field for the application of intelligent technologies. For instance, the power monitoring system can monitor the power consumption of all systems on the ship in real time, analyze the energy consumption distribution, and identify abnormal electricity usage, providing a data basis for energy conservation and optimization; the intelligent air conditioning system automatically optimizes the operating parameters of the air conditioner based on factors such as passenger density, outdoor temperature, and the usage status of the cabin, avoiding energy waste; intelligent technologies can also recover and utilize the residual heat from the ship's diesel engines and the condensation heat from the air conditioning system, achieving efficient conversion and utilization of thermal energy through intelligent control. See **Table 2**.

Table 2. Typical application scenarios and value of building intelligent technology in cruise ship interior outfitting

Application scenario	Core technology	Application value
Intelligent cabin control	IoT, APP/voice control, sensors	Enhances passenger operational convenience and personalized experience
Scenario-based lighting	LED dimming and color tuning, DALI protocol, scene presets	Creates spatial atmosphere and reduces lighting energy consumption
Passenger flow statistics	AI video analytics, passenger flow sensors	Assists operational scheduling and warns of crowding
Fire linkage	Intelligent smoke detection, equipment linkage, BIM integration	Shortens emergency response time and improves safety
Energy monitoring	Power monitoring, HVAC optimization, load forecasting	Reduces cruise ship operating energy consumption and carbon emissions

4. Challenges and development trends

Although the application of intelligent building technology in the interior decoration of cruise ships has a broad prospect, the initial investment for intelligent systems and equipment is relatively high. For cruise ship operating enterprises that pursue cost control, this is an important factor that needs to be weighed. The marine environment has extremely high requirements for the reliability of electronic equipment and systems. Factors such as salt fog, humidity, vibration, and electromagnetic interference may affect the normal operation of intelligent equipment, and specialized intelligent products and solutions suitable for maritime environments need to be developed. Currently, the relevant standards and norms for cruise ship intelligence are not yet complete, lacking unified technical requirements and evaluation systems. Cruise ship intelligence involves multiple fields such as ship engineering, building intelligence, and information technology, and there is a relative shortage of interdisciplinary professionals, which hinders the promotion and application of the technology. The high integration of intelligent systems also brings cybersecurity risks. Once the system is attacked or fails, it may affect the normal operation of the cruise ship and the safety of passengers.

Looking ahead, the application of building intelligent technology in cruise ship interior outfitting will show the following development trends, such as deep integration, artificial intelligence, personalized customization, green energy conservation, and digital maintenance. See **Table 3**.

Table 3. Main challenges and countermeasures for cruise ship interior outfitting intelligence

Challenge type	Specific manifestation	Countermeasures
Economic	High initial investment, long payback period	Phased investment, use energy-saving returns and experience premiums to feed back
Technical	Poor adaptability to marine environment, low equipment reliability	Use marine-grade equipment, strengthen environmental test verification
Standardization	Lack of industry standards, inconsistent interfaces	Promote industry standard formulation, adopt open protocols
Talent	Scarce interdisciplinary talent	Strengthen industry-university-research cooperation, cultivate composite talent
Safety	Cyberattacks, system failures	Strengthen cybersecurity protection, establish redundancy mechanisms

5. Conclusion

The application of building intelligent technology in cruise ship interior outfitting is an interdisciplinary research topic involving architectural design, information technology, ship engineering, human factors engineering, and other fields. By combing and analyzing relevant literature, it can be found that intelligent technology has been initially applied in cruise ship cabins, public areas, safety management, and energy management, and has shown significant application value [5]. At present, the development of cruise ship interior outfitting intelligence faces challenges in economy, technology, standards, talent, safety, and other aspects, which require joint efforts from all industry parties. For cruise ship design enterprises and related researchers, they should closely follow the development trends of intelligent technology, strengthen interdisciplinary cooperation and innovation, promote the implementation and application of intelligent technology in cruise ship interior outfitting, and contribute to enhancing cruise product competitiveness and passenger experience.

Funding

This paper was the research result of the general project "Research on the Application of Intelligent Building Technology in Cruise Ship Interior Design" (Project number: 2025ZKyb071) of Jiangsu Maritime Institute in 2025.

Disclosure statement

The author declares no conflict of interest.

References

[1] Lian Z, Guan W, et al., 2025, Research and Application of Digital Construction Technology for Interior Outfitting Engineering of China's First Large Cruise Ship. Building Construction, 47(12): 1731–1740.

[2] Zhu T, 2026, Innovative Research on Cruise Ship Interior Outfitting Renovation Based on Prefabricated Product Design. Ship Materials and Market, 34(8): 10–12.

[3] Li Z, Wang C, et al., 2020, Intelligent Design and Application of Cruise Ship Living Environment. Ship Science and Technology, 42(10): 65–71.

[4] Tao Z, Yang Y, et al., 2024, Intelligent Dimming Control Scheme for Cruise Ship Cabins. Ship, 208(1): 50–58.

[5] Yan D, 2018, Research on Application of Intelligent Environmental Design in Cruise Ship Living Space, thesis, Harbin Engineering University.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.