

Original Research Article

Collaborative integration and innovation and optimization of cruise liner embedded multimedia entertainment system based on artificial intelligence interaction technology driven by big data*Yangchun Shi^{1,2}**1 School of Cruise & Art Design, Jiangsu Maritime Institute, Nanjing, Jiangsu, 210000, China**2 Faculty of Innovation and Design, City University of Macau, Macao, 999078, China*

Abstract: With the booming development of the cruise industry, passengers' requirements for the cruise ship interior installed multimedia entertainment system are increasingly diversified and personalized. This study focuses on how to realize the collaborative integration and innovative optimization of the multimedia entertainment system installed in cruise ships with the help of big data and artificial intelligence interaction technology. Through in-depth study of relevant cutting-edge technologies and analysis of practical cases, a complete system architecture and optimization strategy are designed to improve the entertainment experience of passengers, enhance the efficiency of cruise operation, and promote the upgrading of the cruise industry towards the direction of intelligence.

Keywords: Big data; Artificial intelligence interaction technology; Cruise liner; Multimedia entertainment system; Collaborative integration

1. Foreword

1.1. Research background

Multimedia entertainment system is the core component of cruise service, which plays a key role in improving passenger satisfaction. However, the traditional cruise multimedia entertainment system has many drawbacks. In terms of function, it is mainly limited to basic film and television broadcasting, music appreciation and simple games, which is difficult to meet the growing diversified entertainment needs of passengers. For example, film broadcast source update lag, unable to provide the latest popular films; music appreciation library is limited, difficult to meet the personalized music preferences of different passengers; game entertainment is mostly traditional stand-alone games, lack of network interaction function, can not meet the social entertainment needs of passengers.

1.2. Purpose of research

This study aims to break through the limitations of traditional cruise ships by using big data and artificial intelligence interactive multimedia entertainment system. Through the in-depth analysis of the massive passenger data, the passenger needs are accurately grasped, and the advanced artificial intelligence interaction technology is combined to realize the intelligent upgrade of the system. To build an efficient collaborative integration scheme, optimize the system architecture, improve the overall performance and user experience of the system, and provide a strong technical support and theoretical basis for the intelligent transformation of the cruise industry.

2. Related technical overview

2.1. Big data technology

Big data technology covers data collection, storage, management, analysis and visualization. In the data collection stage, all kinds of data during the cruise ship operation can be collected through various channels, including passengers' operation records on the entertainment system, consumption behavior data, guest room use data, etc. At the same time, it can also collect cruise equipment operation data, environmental data, etc., to provide rich data support for a comprehensive understanding of the operation status of cruise ships.

In terms of storage and management, distributed file systems (e. g., Hadoop Distributed File System, HDFS) and non-relational databases (such as MongoDB) are able to meet massive, high growth, and diverse data storage requirements. HDFS ensures secure storage and efficient access of data; MongoDB is good at processing unstructured and semi-structured data, facilitating the storage and management of complex passenger data.

In the analysis process, with the help of machine learning algorithms (such as cluster analysis, association rule mining, etc.), valuable information can be mined from massive data. Cluster analysis can classify passengers according to their interests, consumption ability and other dimensions, and provide accurate data support for personalized services. For example, put passengers who like maritime sports into a category and recommend related maritime entertainment projects and peripheral goods for them. Association rule mining can discover potential relationships between data, such as passengers who often watch science fiction movies and are often interested in interstellar themed games, so as to recommend relevant game content for passengers.

2.2. Artificial intelligence interactive technology

Artificial intelligence interaction technology is the key to realize the natural interaction between man and the system. Speech recognition technology, such as the end-to-end speech recognition model based on deep learning, can accurately convert the passengers' speech commands into text information, and the system performs corresponding operations according to the text content, realizing voice search for film and television resources, control of playback progress and other functions. For example, passengers can "play the latest science fiction movie" by voice commands, and the system can quickly search for and play the relevant movie.

Gesture recognition technology captures passengers' gesture movements through the camera, and uses computer vision algorithm to analyze and identify them to realize contactless operation and improve the convenience and interest of interaction. For example, passengers can use simple gestures to flip and zoom, without the remote control or touch screen.

3. Analysis of multimedia entertainment system

3.1. Function and features of the existing system

At present, the function of the multimedia entertainment system in cruise ships mainly focuses on the basic entertainment. The film and television playback function provides a slow source update speed, the content is lack of targeted, unable to meet the needs of different passengers. For example, some popular movies are updated on cruise ships after months in theaters, and recommended films fail to take passengers' personalized preferences into account.

The music library of music appreciation function is limited, and the recommendation algorithm is simple,

making it difficult to recommend songs that meet passengers' personalized music preferences. Most of the game entertainment functions are traditional single-player games, but they lack of network interaction function, which cannot meet the social entertainment needs of passengers.

From the perspective of system characteristics, the hardware equipment of the existing system has limited performance, low display screen resolution, poor sound effect, unable to provide immersive entertainment experience for passengers. For example, when watching a high-definition movie, the picture is blurred and the sound effect is poor, which seriously affects the experience of passengers.

3.2. Existing problems and challenges

In terms of system integration, there is a lack of effective data sharing and coordination mechanism between multimedia entertainment system and other cruise systems (such as room management system, catering reservation system, etc.), which leads to the serious phenomenon of information island and affects the overall operation efficiency of cruise ships.

4. A collaborative integration scheme based on big data and artificial intelligence

4.1. System architecture design

The hierarchical distributed architecture is adopted to ensure the efficient operation and scalability of the system. The lowest data acquisition layer deploys a variety of sensors and intelligent terminals. In the cabin, smart TV not only serves as an entertainment terminal, but also has a built-in behavior analysis sensor, which can record passengers' operation behavior, such as viewing time, channel switching frequency, etc. In public areas, passengers' location information and stay time are collected through Wi-Fi probes, Bluetooth beacons and other devices. The data is transmitted to the data processing layer in real-time flow via a high-speed Ethernet or a wireless 5G network.

The data processing layer uses the Hadoop ecosystem for data storage and analysis. Hadoop The Distributed file system (HDFS) is responsible for the reliable storage of large amounts of data, while the MapReduce framework is used for the parallel processing of large-scale data. For example, MapReduce analyzes the historical data of passengers 'viewing, counts the viewing times and duration of different types of movies, and excavates the passengers' viewing preferences. At the same time, with the help of Spark Streaming and other real-time flow processing frameworks, the real-time collected data is analyzed in real time to capture the real-time needs of passengers. For example, when passengers search for certain movies, they quickly recommend relevant resources.

The AI interaction layer integrates a variety of advanced technologies. The speech recognition module adopts an end-to-end model based on deep learning, such as the speech recognition model of Transformer architecture. The model is trained on a large amount of speech data, can recognize multiple languages and accents, and has real-time noise reduction function to ensure that passenger voice commands can be accurately identified in a noisy environment of a cruise ship. Gesture recognition is based on computer vision technology. The 3D camera is used to capture passengers' gestures, and to extract and classify the movement features through convolutional neural network (CNN), so as to realize various gesture operations such as page turning and zoom. Facial recognition technology uses deep neural networks to accurately identify passengers' facial features for identity authentication and personalized service recommendation.

4.2. Data acquisition and analysis

Data collection covers multi-source channels. In addition to the passenger operation behavior data on the entertainment system, it also includes the cruise ship operation data, such as equipment status, energy consumption data, etc. In the collection of passenger behavior data, encrypted transmission technology is adopted to ensure data security. For example, passengers' login information and consumption records are SSL / TLS during transmission.

The data analysis process is divided into offline analysis and real-time analysis. Offline analysis is mainly used to explore the long-term behavior patterns and preferences of passengers. Through the cluster analysis algorithm, passengers are classified according to their interests and consumption ability. For example, put passengers who like maritime sports into a category and recommend related maritime entertainment projects and peripheral goods for them. Real-time analysis is aimed at passengers' real-time behavior. For example, when a passenger searches for a certain keyword on the entertainment system, the system immediately recommends relevant content through real-time analysis, and records the search behavior for subsequent preference analysis.

4.3. Application of artificial intelligence interactive technology

In terms of voice interaction, in addition to the basic speech command recognition, the voice dialogue function is also realized. Through natural language processing technology, the system is able to understand the complex problems of passengers, such as "recommend a recent highly rated comedy movie" and give accurate responses. At the same time, it supports the voice wake up function, and passengers can start the system through the preset wake up words without manual operation.

Gesture interaction is further optimized to increase the recognition of more complex gestures, such as rotating gestures to adjust the perspective of the 3D model, and kneading gestures to control the progress of video playback. For different scenes, gesture recognition is optimized. For example, in theater scenes, the misrecognition rate is reduced to ensure that the audience will not mistakenly the operation during normal movements.

Facial recognition technology is also used for sentiment analysis, besides authentication. By analyzing the passengers' facial expressions, they can judge their emotional state, such as happiness, sadness, boredom, etc., to adjust the recommended content. For example, when the system detects bored boredom, recommend more attractive entertainment.

5. Innovation optimization strategy

5.1. Personalized service recommendation

The personalized recommendation engine built with the help of deep learning algorithm can deeply analyze the behavioral data of passengers in the multimedia entertainment system, covering the preferences of film and television, music, games and other aspects.

In practice, taking a young passenger as an example, he frequently watched the Marvel superhero movies in the first half of his cruise journey. By analyzing his viewing history, he not only recommended the popular new film Guardians of the Galaxy 3, but also pushed professional film reviews and director interview videos of the film. At the same time, the system recommended the niche high-quality science fiction movie Arrival by referring to the behavior of other passengers with similar viewing preferences. After watching the film, the passenger was

full of praise for the film, broadening his vision.

5.2. Multi-system collaborative optimization

The multimedia entertainment system in the cruise ship is deeply integrated with the room management, catering reservation and other systems. In the guest room scene, when the passengers query the local cuisine through the entertainment system, the guest room management system will send the welcome card containing the information of the recommended restaurant when the passengers return. After the catering reservation system and the entertainment system, the passengers can book the restaurant when watching the food program, and recommend the special dishes according to the past consumption record, which greatly improves the service consistency and convenience.

For example, on a cruise trip, a couple checked information about Japanese sushi in the cabin through the entertainment system. After the room management system obtained this data, the couple returned to the room and sent a welcome card containing the location of the Japanese restaurant on the cruise ship and the introduction of special sushi dishes. After the couple saw the card, they went to the restaurant that night and were pleasantly surprised by the considerate service.

6. System implementation and evaluation

6.1. System implementation steps

In the process of system implementation, the hardware equipment is upgraded and installed first. According to the designed system architecture, high-performance smart TV, 3D cameras, sensors and other equipment will be deployed in the cabin and public areas of cruise ships. At the same time, a stable network infrastructure should be built to ensure that 5G network and high-speed Ethernet can cover all areas of cruise ships and ensure the rapid transmission of data.

Then the software development and deployment of the system. Develop various applications based on big data and artificial intelligence, including data collection and analysis module, artificial intelligence interactive module, and personalized entertainment applications. The developed software system will be deployed to the corresponding server, and conduct strict testing to ensure the stability and compatibility of the software.

In the system integration stage, the multimedia entertainment system is connected with other systems of the cruise ship, such as the guest room management system and the catering reservation system, and the data sharing and collaborative working mechanism is established. The integrated system is comprehensively tested to solve the possible compatibility problems and data interaction problems.

Finally, cruise staff are trained to familiarize them with the operation and maintenance process of the new system. Before the official put into use, conduct a small-scale user test, collect user feedback, and make the final optimization and adjustment of the system.

6.2. Systematic evaluation indicators and methods

To evaluate the performance and effect of the system, a series of evaluation indicators are set. In terms of user experience, passengers's satisfaction with the system was collected through questionnaire survey and user interview, including interface design, interaction mode, personalized recommendation and other aspects. At the same time, the time and frequency of passengers using the entertainment system are recorded as an objective

indicator to measure the user experience.

cruise companies can fully understand the operation effect of the system, timely find problems and carry out targeted optimization, and provide passengers with better cruise entertainment experience.

Project Title: Research on the Development of the Cruise Interior Design Industry Empowered by the Integration of the “Four Chains” from the Perspective of New-Quality Productive Forces

Source of the Project: Jiangsu Education Department

Project Number: 2024SJYB0547

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