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Design of Media Industry's Device Reservation Management System Based on Internet of Things

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Abstract: The rapid development of information technologies such as the Internet, the Internet of Things, and 5G has boosted industries like self-media and short videos, generated technological innovation and work efficiency in various industries, and required higher device-security standard. This paper focuses on device reservation management systems with information gathered from traditional media industries represented by radio and television stations, research institutes, and large laboratories. Based on the technology of Internet of Things, a device reservation management system for the media industry is designed to make management more informaltized, refined and scientized, make the arrangement of devices more efficient, safe, and convenient, and make people management more concise and standardized. It is designed to inspire the inherent creativity and vitality of the media industry, and broadcast the voice of China through updated and upgraded media.

1. Research Background and Methodology

The Internet of Things (IoT) is a network that bases on the Internet, extends from it and expands on it. IoT combines various items with the Internet through sensors or radio frequency identification technology to form a huge network, achieving interconnectivity between people, machines, and items. China's IoT technology has also undergone rapid development [1]. In March 2010, China's *Government Work Report* explicitly stated that the IoT technology would be promoted to the national strategic level. *The 13rd Five Year Plan for the Internet of Things (2016-2020)* and *The Three-year Action Plan For The Internet of Things New Infrastructure Construction (2021-2023)* were released one after another that explicitly indicated that the application of IoT and Big Data should be promoted in a broader expand. In *The Development Plan for Digital Economy during the 14th Five-Year Plan Period* released in March 2022, it was mentioned that the coverage level of the IoT in various fields should be improved, and the IoT access capabilities should be enhanced [2]. In August 2023, the China Internet Network Information Center (CNNIC) released *The 52nd Statistical Report on the Development of China's Internet*. The report showed that up to June 2023, the number of internet users in China had reached 1.079 billion, with an internet popularity rate of

76.4%. The number of mobile internet users in China reached 1.076 billion, and 99.8% internet users used mobile phones [3]. Currently, new technologies such as cloud computing, artificial intelligence, and virtual reality are rapidly developing, providing strong support for media integration. The characteristics of full process media, holographic media, all staff media, and all effect media are gradually coming to manifestation. It is foreseeable that with the application of new technologies such as 5G and IoT, China's public opinion ecology, media landscape, and communication methods will see a more profound revolution.

According to *2022 National Radio and Television Industry Statistical Bulletin* released by National Radio and Television Administration, by the end of 2022, there had been more than 60,000 radio, television and online audiovisual institutions, including 2,527 radio stations and television stations as well as 1,047,500 radio and television employees in China. In the year of 2022, the overall production duration of radio programs and television programs were 7,876,500 hours and 2,852,100 hours.

Through literature review, online questionnaire surveys, telephone surveys, etc, we systematically analyzed media device reservation management system including social media, laboratories and medical institutions such as Fuzhou Radio and Television Station and State Key Laboratory for Conservation and Utilization of Subtropical Agro-Bioresources of Guangxi University, School of Medicine, Zhejiang University , as well as Peking University, Tsinghua University and other 25 high-level universities in China and we found that:

Fuzhou Radio and Television Station has initiated and designed a production equipment management system. "Currently, the production equipment management system has been in operation for a period of time. The system can sufficiently improve the effectiveness of pre-and-post production technical equipment, better control the cost-accounting of pre-and-post production technical equipment, and effectively improve economic benefits and optimize the outcome of equipment utilization. At the same time, staff have explored new ways in the design, construction, and operation of the production equipment management system, enabling the system play a positive role in the high-definition program production of Fuzhou Radio and Television Station." [4] Through analysis, it can be concluded that the production equipment management system of Fuzhou Radio and Television Station only has one operating interface, and the system's permission state is comparatively massive and intricate that varies depending on various permission. There are many management equipment settings, the level is more complex, and the system of main control and sub-control and non-organized network domain control server is adopted, which has high maintenance cost and complex operation.The State Key Laboratory for Conservation and Utilization of Subtropical Agricultural Biological Resources of Guangxi University has introduced an intelligent management system, and after more than one year of popularization and operation, the system is in good condition and the data record is accurate. 80% of the large-scale instruments and equipment have been opened to the public, and the number of teachers and students who have registered to use the instrument platform is 217. It have served 43 on-campus research groups in 7 faculties with a number of 1513 valid appointments. The maximum sharing rate of the equipmentt reached 45%, an increase of 10% over the previous year, and the average number of equipments operation hours also increased by 27% compared to the same period of last year. "[5] Through analysis, it is concluded that the fixed large-scale experimental equipment in the laboratory only requires reservation, and there is no problem of borrowing or monitoring. Moreover, most of the large-scale experimental equipment is embedded in computers and managed based on the control software on the operating system for management. The operating environment is relatively harsh and lacks universality. The App is used to make reservation, which occupies too much users' mobil phone storage. School of Medicine, Zhejiang University has designed an equipment sharing platform management system. "After three years of operation, the annual equipment functional

hours have increased by 2-3 times. There are 6 equipments rank among the top ten hot equipment in around school. ”[6] A conclusion is drawn through analysis that the system still adopts manual approval method, which results in manual errors and a lower work efficiency.

The research on the theme of "Intelligent Reservation" and "Internet of Things Reservation" mainly focuses on management of large-scale equipment in hospitals or laboratories, intelligent garage management and intelligent reservation design for urban planning etc., and lacks the research and design of the reservation management systems for industries dominated by small devices.In terms of equipment reservation methods in the media industry, most institutions complete equipment reservation through oral reservation and communication within the work group, and then complete equipment borrowing and returning through handwritten borrowing and returning orders, and the equipment management system is relatively traditional.

With the increase in the number of devices, there are many drawbacks in this traditional management model: first, it is difficult to supervise in real time, and the users, operation status, and usage of equipment cannot be truly recorded. Once an abnormal situation occurs, it is difficult to be traced back to the source. Second, traditional on-site reservation may make mistakes due to human reasons, or the reservation service cannot be provided during non-working hours, which will affect news reporting. Third, intricate coordination and management work wastes manpower and material resources, and reduces the work efficiency of administrators. It can be seen that the traditional device management mode greatly affects the safe, orderly and efficient development of work.

2. The Thinking Train of Design

According to the research and analysis, the "Media Industry’s Device Reservation Management System based on the Internet of Things" was designed. The system is based on the architecture design of ".NET+C#+ASP.NET MVC+SQL2008R2", and the intelligent device storage and management cabinet uses the architecture design of AFC access control system + SQL SERVER database system + camera sensing system + firewall to realize the comprehensive management of "network access + data gateway + device terminal + background monitoring". The design establishes the process of “use reservation-borrowing operation-problem feedback", and creates personnel management module, device management module, statistics management module, and it is operated on the WeChat. (Figure 1)

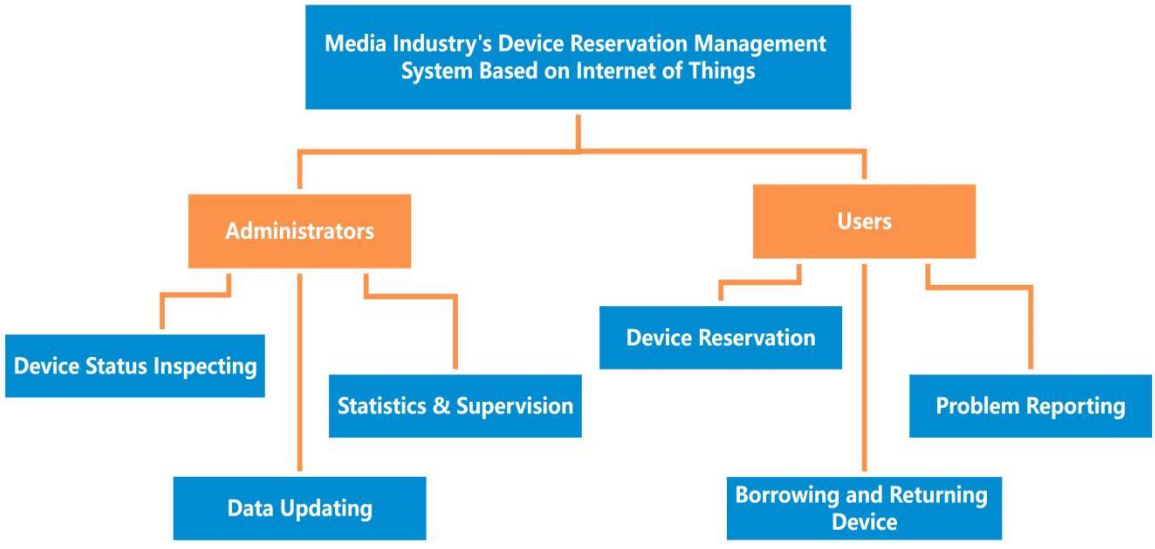

Figure 1: Usage Process and Function Module

2.1 Personnel Management Module

The system is embedded in the existing WeChat official account of the unit (Figure 2) , and the users and administrators are managed at different levels, and real-name login is implemented to ensure the security of the device. All accounts can search for devices by keywords such as device number, name, model, etc. The administrator account can enter new devices, enable deactivate devices, cancel reservations, upload operating procedures, etc. The user account can only apply for the use of the device and fill in the device reservation information and problem feedback.

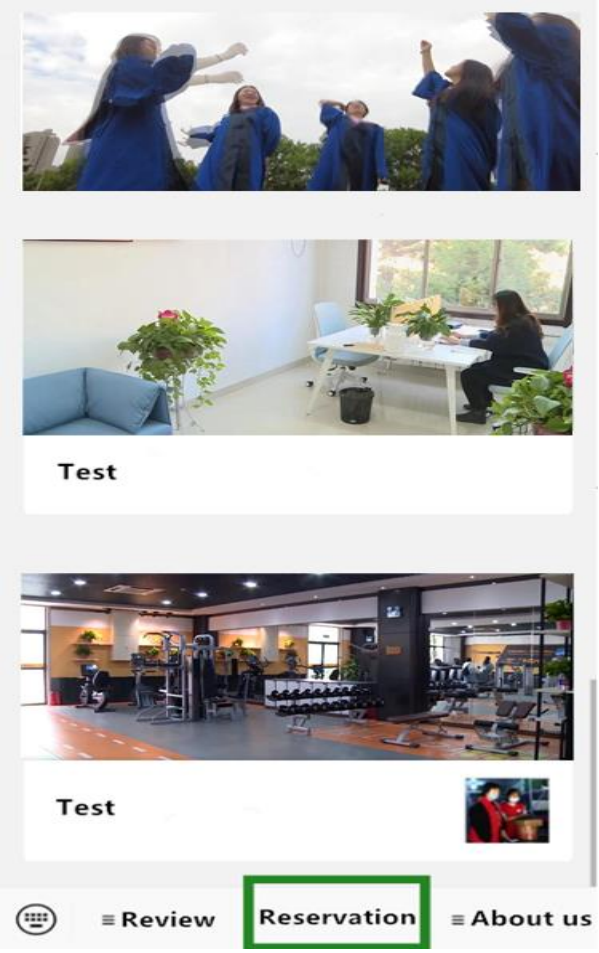

Figure 2: Entrance of Device Reservation Management System

2.2 Device Management Module

2.2.1 Reservation Function

After logging in and selecting the device, you can see the reservation status of the device in the form of a calendar (Figure 3), fill in the borrowing time period, borrower information, and borrowing reason, and complete the reservation without the platform approval. You will receive a successful reservation reminder SMS on your mobile phone and the official account will receive a private message as a remind of a successful reservation. The final reservation status can be checked in the My Reservation column.

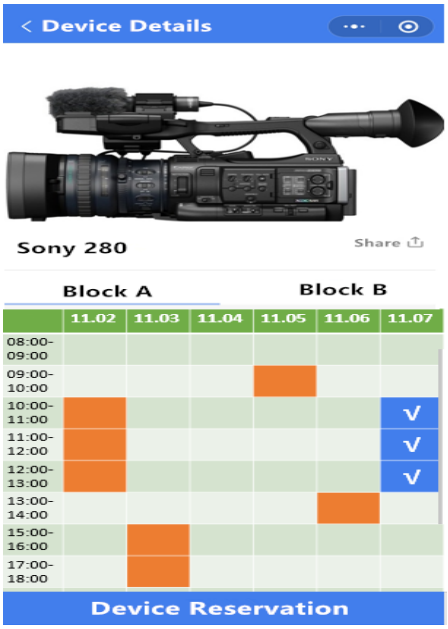

Figure 3: Device Reservation Details

2.2.2 Platform Approval Function

Since the device users are all in stock, the information has been entered into the system in advance, so the administrator do not need to approve it. In case of special circumstances, the administrator can reject the reservation with one click.

2.2.3 Self Pickup Function

We add a QR code to each device. The user can scan the code to open device cabinet with one click, or automatically open the device cabinet through face recognition (Figure 4). By scanning the QR code on the device, users can also obtain the instruction manual and historical usage of the device [7].

Figure 4: Conceptual Design of the Intelligent Device Cabinet

2.2.4 Problem Reporting Function

If there is a problem during use, click Problem Reporting to provide detailed feedback. The device's reservation will be suspended, and opened again after maintenance.

2.2.5 Device Returning Function

When returning the device, it is mandatory to carry out a self-inspection of the device with the popping up reminder. Each item should be mandatorily inspected before returning and then the relevant storage box can be opened with one click through Bluetooth pairing technology and GPS location sensing technology of the mobile phone. The device can only be successfully returned after identification of RFID and NFC sensing technology. Surveillance cameras are installed at the borrowing and returning locations, and the users' operation is restored through video recording. If the device reservation is overdue, you will receive a reminder such as SMS, WeChat reminder, and robot phone [8].

2.2.6 Monitoring Function

Through background program monitoring and video-assisted monitoring, the device's borrowing and returning process is throughly monitored, and recorded in the cloud which can be downloaded regularly. The design could ensure device's safety, and at the same time effectively trace the source and track accountability to prevent the occurrence of non-standard use [9].

2.2.7 Portraying Analysis Function

Through big data capture and analysis of the users' habits, the background generates users' portraits and recommends more relevant devices to them, which helps to improve the users' enthusiasm for creation, and also helps to deepen the understanding and interaction between the employers and employees.

2.3 Statistics Management Module

In the administrator background, detailed data of the operation of the media device reservation management system can be obtained through automatic generation of charts, keyword search, and other methods.

Device Allocation

Analysis: the usage rate of each device, the number of searches, and the comparison with the use of the same device. The Result: as a reference for device procurement for better internal allocation.

The Highly Used Time Period

Analysis: the time period of the highest frequency of borrowing and the frequency of the occurrence of keywords for borrowing reasons. The Result: better allocation and personnel management and increase productivity.

Type of Fault

Analysis: all feedback from problem reporting. The Result: repair or replace faulty device, evaluate related devices and provide reference for later purchasing.

Late Return Personnel

Analysis: late return personnel, number, number of overdue returns by each user, and type of device. The Result: adjust device allocation, improve personnel operation standards and improve management system.

3. Advantage and Innovation

The system which embedded in WeChat official account is simple to operate. It does not occupy mobile phones' storage thus it is not easy to cause user loss comparing to separate client. On the other side, the system costs less with stronger scalability. The operating environment is more secure and the maintenance is less difficult.

The real-time information sharing on the reservation interface can reduce communication delays and make information more transparent, and significantly improve work efficiency compared to one-way borrowing mechnism. By utilizing IoT technology to borrow devices by itself, the system reduces unnecessary human resources and truly achieves intelligent, automated, and self-service functions compared to intricate manual approval steps. When returning the device, the user must perform a self-inspection and pass the relevant verification procedures to ensure the safety of the device. The use of big data to portray users and analyze their usage habits can improve their productivity and innovation.

Organically integrating devices , administrators and users makes a transform from distributed, time-based management to centralized full-time management to optimize the work process. Administrators can obtain the usage status of device, which provides important reference information for mid-term and long-term procurement plans.

4. Social Benefits and Application Prospects

The design can also be applied to the construction of intelligent reservation management system for device, space, and other resources in various industries, striving to achieve the full utilization of human talents and resources, and promoting an efficient working environment through technology. The Market analysis and economic benefit prediction for the huge demand for intelligent intelligent resource management system are as follows:

Personalized customization services can be launched, and different equipment reservation systems can be customized according to the different needs of different industries for resource allocation, management and reservation;

By increasing the extended functions of the equipment reservation system, such as education and training functions, establishing relevant teaching videos in the system, introducing paid consultation of professional talents, building discussion forums, etc., the exposure and usage rate of the platform can be increased, so as to bring considerable economic benefits.

Through the statistics of the administrator's background, the industry equipment management mode can be updated to reduce costs and better manage personnel and equipment;

By constantly updating the Internet of Things technology used in this system, more equipment can be networked for monitoring and deployment, which has broader industry market prospects and higher economic benefits.

5. Conclusion

As a bottom-up open participation platform, social media has great potential for international communication, which not only erases the boundary barriers between interpersonal communication and mass communication, breaks the visual boundary between domestic communication and international communication, but also opens the era of digital globalization characterized by platformization and intelligence. Improving the efficiency of social media international communication is a major theoretical and practical proposition.

Up to now, there are about 1.212 billion WeChat users in the world, and almost all industries are constantly linking up to WeChat offical platform. With the continuous development of the media

industry, with the rapid transformation of traditional media, the media device management reservation system is also undergoing intelligent transformation, and the traditional offline device reservation mode is gradually beginning to transform towards the online intelligent "cloud" model [10].

Timeliness is the life of news, and the rapid development of new media has put forward higher requirements for the speed of news dissemination, which also requires media institutions to update their management modes and upgrade the device management systems, and share China stories through television, broadcast, newspapers, and the Internet.

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