Research on Broadcasting Internet of Things Communication Applications and Development: Postprint

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Abstract

In recent years, with the continuous advancement of national radio and television digitization and the integration of the three networks, the development of broadcast television IoT communication has been thriving. This paper analyzes the current development status of broadcast television IoT communication, investigates its applications, and proposes several measures to promote its development based on the characteristics and advantages of broadcast television networks, aiming to provide assistance for related work and thereby foster the continuous development of the broadcast television industry.

Full Text

Research on Broadcasting Television IoT Communication Applications and Development

Abstract: In recent years, with the continuous advancement of national radio and television digitization and triple-network convergence, broadcasting television IoT communication has been developing vigorously. This paper analyzes the current development status of broadcasting television IoT communication, examines its applications, and proposes several measures to promote its development based on the characteristics and advantages of broadcasting networks. The aim is to provide assistance for related work and thereby facilitate the continuous development of the broadcasting television industry.

Keywords: broadcasting television industry; IoT communication; internet

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With the development of science and technology, the Internet of Things (IoT) has emerged as a product of technological progress. By connecting and interfacing with the internet, IoT has transformed the remote control of objects from fantasy into reality. In recent years, major domestic industries have prioritized IoT development as a key strategic pillar, with various sectors actively pursuing technological innovation. Simultaneously, as national radio and television digitization and triple-network convergence continue to advance, the bidirectional transformation of broadcasting networks has created unlimited opportunities and advantages, ushering the industry into a new era. Moreover, intensifying competition with the three major telecommunications operators constantly demands innovation from broadcasting enterprises, making the application and development of broadcasting television IoT communication particularly crucial. IoT represents a major information technology trend of the emerging era, breaking previous stalemates. On one hand, mutually beneficial integration with broadcasting networks not only promotes broadcasting television construction but also introduces cloud resources through internet integration, combining them with broadcasting network advantages to significantly expand broadcasting services and enrich network capabilities. On the other hand, broadcasting networks possess a massive user base, while IoT market promotion faces certain difficulties; leveraging broadcasting network resources can accelerate IoT adoption and development. After combining broadcasting television with IoT, the integrated system can be applied across various domains such as smart communities, smart homes, and smart healthcare.

1.1 Development History of Broadcasting Television IoT Communication

Broadcasting television refers to a mass media platform that disseminates sound, images, and video to broad audiences. Initially, its development only encompassed propaganda, education, and supervision functions. The world' s first formal radio station was established in 1920, with China beginning wireless broadcasting in 1923 and establishing its first television station in 1958. With continuous technological and social development, the market share and status of broadcasting networks have rapidly declined, gradually forming a triple-network convergence industrial pattern. Therefore, next-generation broadcasting networks should integrate 3D simulation technology, 4K technology, and other innovations to create a convergence point for telecommunications networks, computer networks, and cable television networks, thereby identifying new opportunities and building information service platforms for entertainment, education, culture, and other fields.

1.2 Key Technologies of Broadcasting Television IoT Communication

IoT is a network that achieves intelligent management, automatic identification, and remote monitoring through communication methods, connecting sensor-collected information about object shape, color, and position to the internet. The core technologies supporting IoT include: (1) Radio Frequency Identification (RFID) technology. This non-contact automatic identification technology uses radio frequency signals to automatically identify targets and retrieve relevant data, achieving contactless information transmission. RFID technology is convenient to operate, requires no manual intervention, can identify high-speed moving objects and multiple tags simultaneously, and functions reliably in various harsh environments. (2) Sensor technology. Typically composed of sensitive elements and transducers, sensors convert perceived measured indicators into usable signals according to specific patterns. Embedded intelligent technology, characterized by low power consumption, small size, high-efficiency embedded software, and high reliability, represents an important development trend for sensors. Processors combine hardware and software to form multiple wireless network systems in monitoring areas for real-time detection, perception, and collection of object information, which is then processed and transmitted. Through extensive deployment of sensors and sensor networks, IoT achieves its goal of perceiving the world. (3) Network communication technology. Broadband networks provide robust support for IoT data transmission, with IoT relying on network communication technology for data delivery. The key to IoT communication is M2M (Machine-to-Machine) technology, which enables communication connections between people, machines, and systems. To achieve seamless connectivity, various domain communications can be integrated, such as human-to-machine and mobile network-to-machine communications. (4) Cloud computing. Cloud computing provides efficient computing and storage capabilities for IoT, dynamically deploying, configuring, and canceling services on demand. Through extensive resource sharing, it can construct a distributed resource sharing area. IoT possesses a massive database requiring each object to be associated with its unique identifier for database retrieval. With current IoT development, cloud computing must be introduced to collect, store, process, and analyze the enormous data streams generated by terminals to support decision-making and execution.

2.1 Smart Community Construction

Compared with conventional smart communities, the overall system architecture for connecting internal and external home networks differs, primarily consisting of perception, network, platform, and business layers. Additionally, it requires a home gateway—the digital television set-top box within the household. To achieve status and data collection, processing, and storage from various sensors and interface with the backend broadcasting television IoT cloud platform, the system can provide smart community users with diverse services, completing information transmission and analysis for home life services, community services, and more. System construction adheres to unified technical specifications, frameworks, exchange standards, and application norms to ensure standardization, integrity, advancement, and scalability. Currently, ordinary communities can achieve data docking through simple sensors. By connecting home-level television set-top boxes as home gateways and interfacing with the backend IoT, broadcasting television IoT-based smart communities can provide more comprehensive services to community users through data analysis and sensors.

The perception layer primarily relies on RFID technology, vital sign monitoring equipment, and other data collection components. The network layer mainly achieves data transmission through remote control. The platform layer provides security protection, storage, and privacy functions for community users' personal information databases, handling data processing and analysis tasks as the third platform for implementing smart communities. The business layer serves as the primary display platform and interaction interface between smart communities and users, enabling applications such as community protection, community entertainment, and smart home security. The smart community public service platform allows property management and residents in connected communities to independently download various smart community application services, meeting diverse personalized needs such as home appliance control, home healthcare, and intelligent security.

The smart community application system comprises five components: the smart community public service platform, smart community operation service center, smart community application development and testing platform, smart home gateway, and smart community control center. The public development and testing platform loads developed applications onto the public service platform for user download, providing research, development, and testing services for smart community applications.

2.2 Smart Healthcare

Currently, with the development of medical and health services, Northern Broadcasting has implemented physical examinations and medical services through broadcasting television IoT, bringing conventional healthcare into households and rapidly occupying television screens through smart healthcare. Smart healthcare primarily consists of four components: First, the peripheral measurement section, which mainly collects data including body scales, blood pressure monitors, glucose meters, and body fat analyzers. These devices connect via USB, transmit data primarily through Bluetooth and Wi-Fi, and measurements are completed manually. Second, transmission processing equipment, which requires system architectures including set-top boxes and system servers. System servers evaluate users' health conditions through data analysis. As the foundation of broadcasting television IoT, set-top boxes aim to transmit data and input it into system service stations. Third, through BOSS (Business & Operation Support System), analysis and docking equipment transmits assessment data to users, hospitals, and medical websites to complete binding between mobile user terminals and home health terminals. Fourth, communication connection equipment aims to achieve online medical consultations and hospital reservations through broadcasting network video.

2.3 Smart Charging

Currently, home networks have become a focus of broadcasting television IoT, with television remaining the primary resource for broadcasting network operations. Charging issues have become a critical implementation basis and a hot topic. To achieve smart charging, broadcasting television IoT enables sustainable development through system architecture, such as establishing automatic meter reading systems and highway toll collection systems. The automatic meter reading system operates relatively simply, directly reading various data information. It enables cable television users to pay utility bills—including water, electricity, natural gas, and heating fees—through television and IoT. The highway toll collection system is more complex, utilizing RFID technology to analyze and transmit frontline data, audio, and images through broadcasting broadband networks for summary management, data upload, and ticket issuance, thereby completing the reception of rate tables and charging standards. The toll management system then transmits verified data from the toll center to toll stations through broadcasting broadband networks to complete final charging operations.

2.4 Smart Operation

Smart operation through broadcasting television IoT enables unified monitoring management, user management, and data collection and monitoring for entire television stations. Unified monitoring management monitors all television stations through broadcasting television IoT from aspects such as language, video, and advertising. Unified user management achieves data operations for all television stations through broadcasting television IoT, with management work including data docking and conversion, wireless radio frequency modules, and alarm information processing modules, completing management through data analysis and response. Unified data collection primarily achieves data collection by connecting sensors, the internet, and Wi-Fi through television set-top boxes to enable data transmission and ensure operational stability. Smart operation is accomplished through three components that combine and cooperate with each other.

2.5 Smart Campus and Smart Disaster Prevention

Smart campus utilizes campus sensor networks to provide safety guarantees for campuses, representing an important application of broadcasting television IoT communication that covers campus areas and surrounding regions. The smart school bus system can integrate smart campuses with intelligent transportation through broadcasting television IoT communication, transmitting critical information such as vehicle location to both parents and teachers simultaneously through broadcasting television IoT broadband. Additionally, smart disaster prevention enables broadcasting television IoT to prevent derivative disasters by leveraging time differences and advantages in emergency broadcasting. Through sensors that detect seismic waves in advance, the system can provide early warnings to automatically shut down high-risk facilities such as gas, water, electricity, and nuclear power plants upon receiving signals.

3.1 Development Advantages of Broadcasting Television IoT Communication

As an emerging technology, broadcasting television IoT communication can interconnect tens of thousands of cable television set-top boxes, home gateways, and mobile digital terminals through broadcasting networks to implement smart IoT applications such as interactive video, real-time multimedia communication, and smart homes. Its primary advantages include: First, broadcasting television IoT can implement various smart home and smart community services with relatively complete transmission network coverage, forming an intelligent networked home or community through broadcasting television bidirectional networks that organically integrate related equipment with required platform systems. Second, broadcasting television IoT communication possesses numerous advantages that provide unique prerequisites for future IoT development, such as high transmission rates, high security levels, and abundant fiber resources—capabilities unmatched by other network operators. With a massive cable television user base and high credibility among users, it can provide high-definition programs and 3D channels. By effectively integrating with key IoT technologies, current broadband coverage businesses such as EPON+EOC, EPON+LAN, and CMTS can be better accessed by various IoT platform systems, promoting greater integration and development of IoT services. Currently, broadcasting television IoT communication utilizes digital television set-top box platform systems to enable users to easily achieve various information sharing based on their life needs, closely connecting IoT concepts with people, home appliances, networks, and after-sales systems.

3.2 Challenges Facing Broadcasting Television IoT Communication Development

Currently, satellite live television, various network set-top boxes, and terrestrial wireless digital television competition undoubtedly pose greater challenges to cable television business markets. Other operators offer large-scale regular activities with low fees, basically achieving 20-megabit bandwidth to homes via fiber, while most broadcasting network operators only achieve 8-megabit bandwidth at similar price points, resulting in low renewal rates, significantly reduced new subscribers, and serious loss of existing users. Therefore, broadcasting network reform is urgent. To grow stronger, the industry must continuously seek new breakthroughs, reduce service costs through emerging IoT industries, and enrich existing businesses while expanding new services by providing customized, efficient intelligent services, thereby enhancing comprehensive strength and competitiveness to achieve future operational development goals.

First, with the development of broadcasting television IoT communication, public dependence on and requirements for broadcasting networks will increase, making life more convenient, intelligent, and humanized. The key to broadcasting television business development lies in flexibly utilizing IoT communication technology to support new services. Current challenges include weak overall competitiveness, unclear business models, low-level application requirements, and insufficient resource sharing. Broadcasting television IoT communication development depends on user market demand, with the set-top box being a critical component. However, current set-top boxes' core functions do not integrate high-tech products, still merely converting analog signals to digital signals with relatively simple structures, single services, and 贫乏 content. From a long-term perspective, these terminal products must incorporate sensor and data collection capabilities while retaining basic functions. Only by establishing new business development directions and objectives from user perspectives can terminal equipment diversity needs be satisfied, enabling broadcasting television IoT communication products to develop jointly, promote each other, and complement one another based on market demand.

Second, due to special historical institutional influences, current broadcasting television IoT communication application units across the country operate independently with fragmented operations and varying forms. Some provinces have not even integrated cable television networks into provincial-level networks, let alone municipal-level networks, making a "single national network" impossible. National cable television network integration faces formidable challenges and a long road ahead, requiring the broadcasting television industry to actively explore and respond to break through regional service model constraints in future applications. Additionally, broadcasting television IoT communication currently faces two major issues: On one hand, it lacks theoretical support, and the convergence technology between broadcasting networks and IoT remains immature, limiting the development of related smart applications. Therefore, broadcasting bureaus and governments should attach importance to such issues, organize top scientific and technological talents to continuously improve the technology, and lay foundations for future smart operations. On the other hand, current broadcasting television IoT communication talents have only superficial IoT knowledge while being more proficient in broadcasting networks. Therefore, future development requires collaboration with major universities to cultivate specialized talent to meet industry needs. In the future, to open markets, broadcasting television IoT communication must fundamentally address these problems.

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