Postprint: Applications of IoT Technology in the Broadcasting and Television Industry

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Abstract

The Internet of Things (IoT) primarily involves the full utilization of information sensing facilities to interconnect physical objects in the real world, and the network constituted in this context is referred to as the Internet of Things. All physical objects contained within it are labeled with network-enabled tags and imprinted with information markers to enable sharing and management. This paper first provides an analysis of IoT technology; then elaborates on the key technologies of IoT; and finally discusses its applications in the radio and television broadcasting industry.

Full Text

Abstract

The Internet of Things (IoT) connects physical objects in the real world through comprehensive utilization of information sensing facilities, forming a network where all entities are tagged with network labels and information markers to enable sharing and management. This paper first analyzes IoT technology, then elaborates on its key enabling technologies, and finally explores its applications in the broadcasting and television industry.

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With the progress of the times, IoT technology has achieved significant development. While Western developed countries have conducted in-depth research on IoT and obtained promising results, China' s IoT development remains in

its initial stages. However, China possesses sufficient user foundations and technical conditions, creating substantial room for growth in its IoT industry. In January 2017, the Ministry of Industry and Information Technology released the *IoT 13th Five-Year Plan*, which clarified development goals for the IoT industry during the 13th Five-Year period: improving the technological innovation system, constructing a comprehensive standards system, promoting large-scale IoT applications, perfecting public service systems, and enhancing security capabilities. This paper analyzes the history and current status of IoT development, examines future development directions for broadcasting IoT, and focuses on how the promotion and application of IoT technology—which has greatly facilitated people' s work and lives—can be applied in the broadcasting and television industry.

1.1 Main Concepts

The so-called Internet of Things is essentially an "Internet where things connect to things." In the *IoT White Paper*, the Telecommunication Research Institute of the Ministry of Industry and Information Technology interprets IoT as an extended application of communication networks and the Internet. IoT employs sensing technologies and intelligent equipment to identify and perceive the physical world, then disseminates and shares this information through networks to achieve seamless connectivity between objects and between people and objects, thereby enabling effective management and control of physical reality.

1.2 Main Characteristics

IoT exhibits three fundamental characteristics. First, **comprehensive perception** enables large-scale information acquisition through technical devices such as Radio Frequency Identification (RFID), QR codes, and sensors, capturing diverse information including images, numerical data, and audio-video content. Second, **secure and reliable information transmission** integrates various communication networks with the Internet to ensure accurate delivery of object information, guaranteeing that data collected by sensors can be transmitted unobstructed to wherever it is needed. Third, **intelligent control** utilizes computer technologies such as cloud computing and fuzzy identification to store and analyze massive amounts of information, thereby achieving intelligent control of physical objects.

1.3 Network Architecture

IoT network architecture consists of three primary layers: the perception layer, the network layer, and the application layer. The perception layer uses sensors to collect and transmit object information, achieving goals such as physical world information acquisition and automated control. The network layer primarily handles transmission of identification parameters and controls parameter transmission to complete information delivery and management. The application layer encompasses infrastructure applications and various IoT applications,

representing the deep integration of IoT industrial technologies. By utilizing infrastructure and middleware to provide information processing or computing services, the application layer enables IoT deployment across industrial domains such as intelligent transportation and smart homes.

2.1 Radio Frequency Identification Technology

RFID is an automatic identification technology that employs radio frequency electromagnetic waves for wireless information propagation through spatial coupling to sensors or to objects equipped with RFID tags, facilitating object classification and tracking. When tagged objects approach a microwave antenna, the sensor automatically transmits a microwave query command. The electronic tag attached to the object' s surface receives this command and responds by feeding back its stored parameter information to the microwave antenna. After receiving this information, the microprocessing unit within the sensor treats the identification code in the electronic tag as the object' s characteristic parameter and transmits it to a computer for further processing, thereby enabling object information query and management. This entire identification process requires no manual operation and can identify high-speed moving objects while simultaneously recognizing multiple tags.

2.2 Cloud Computing and Storage Technology

Cloud computing represents a novel computing paradigm that employs distributed storage with redundancy—storing multiple copies of the same data—to enhance reliability. As a core component of IoT, cloud computing plays a crucial role in integrating IoT with the Internet, having evolved through stages including network computing, software services, and utility computing. Its fundamental principle distributes computation across distributed computers rather than local machines. Cloud storage integrates various network storage devices through software to provide unified data processing, utilizing network technologies, cluster applications, and distributed data management systems. Cloud storage is not merely hardware but a complex system comprising multiple components such as public access ports and client interfaces, all centered on storage devices and providing data storage services or access through software.

2.3 Electronic Product Code Technology

In IoT, each entity possesses a dedicated Electronic Product Code (EPC) composed of parameters including version numbers, serial numbers, and domain managers. EPCs on tagged items are identified, transmitted, and queried by upper-layer information systems to create various information services on the Internet. The EPC system comprises system identification codes, product electronic codes, Physical Markup Language (PML), and Object Name Service (ONS). EPC is an emerging technology for tracking and identifying physical objects. In the EPC system, readers only read a single information parameter

from the EPC, which is then used to locate the correct IP address on the Internet and retrieve stored information. Distributed Savant devices use readers to obtain EPC information, which must then be matched with corresponding product information—a service provided by ONS. The Savant system transmits the EPC to ONS, which instructs Savant to query information from the stored item database, thereby linking item information repositories with product information.

3.1 IoT Applications and Advantages in Broadcasting

Cable television networks serve as crucial infrastructure with massive user bases, making significant contributions to broadcast signal coverage. However, current market share has declined due to Internet impact, prompting broadcasting professionals to explore how to reverse this trend by leveraging their extensive user foundation. IoT technology enables cable networks to expand their 业务范围 and enrich content offerings. Simultaneously, as an emerging technology, IoT effectively promotes itself through broadcasting networks' vast customer bases. This mutual integration establishes a solid foundation for broadcasting IoT in smart communities, smart homes, smart city construction, and intelligent operations. Previously, television viewing was a passive, one-way process of receiving external information, but IoT development has transformed audiences into active participants, changing information reception into bidirectional interaction. From early digital set-top boxes to later high-definition versions, IoT applications have provided audiences with rich, diverse services, allowing viewers to select content based on actual needs—such as choosing favorite movies or watching news according to personal interests. This transformation has increased interaction frequency between audiences and programs, changing traditional broadcasting listening and viewing habits and creating a larger development platform for China' s broadcasting industry.

3.2 Development Trends

Broadcasting television represents an important channel for obtaining external information and plays a significant role in daily life. Research indicates that compared with mobile phones and computers, televisions have lower network capabilities. However, with continuous progress and the advancement of triple network convergence strategies, IoT technology will inevitably drive China' s broadcasting industry toward informatization and intelligence, offering optimistic prospects. Using televisions as terminals and networks as the primary transmission channel while establishing corresponding home service standards, the effective integration of IoT technology with digital television value-added services can form an IoT service platform that facilitates daily life and provides audiences with rich programs and services. By applying IoT technology to existing set-top boxes to expand their capabilities, set-top boxes can gain sensing and transmission abilities and connect with users' home appliances. For example, connecting a visual doorbell to the television allows users to see outside

visitors on their TV screen, communicate with them, and even remotely control door opening. In summary, with continuous progress, IoT technology has achieved considerable development and widespread application across various fields in China. For broadcasting and television, IoT applications can enhance social service capabilities, facilitate work and life, and enrich cultural experiences. Therefore, IoT technology holds broad development prospects in the broadcasting industry, driving its evolution toward intelligence and informatization.

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Note: Figure translations are in progress. See original paper for figures.