Digital Television Technology and Set-Top Box Development Discussion Postprint

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Abstract

With the rapid development of social economy in recent years, people's living standards have been significantly improved, leading to very high demands for various forms of entertainment. As a traditional entertainment device, digital television holds significant importance in people's daily lives. The set-top box, as a product, plays a prominent role in digital television, with its application scope becoming increasingly widespread, and it continues to possess strong market influence as well as infinite development potential for the future. With the continuous in-depth development of digital television in our country, software and chip technologies have also achieved significant advancement. The functionality of digital set-top boxes is increasingly enhanced, thereby better satisfying different user needs and providing multi-level services. This paper will focus on the development of digital television and set-top boxes, analyzing and exploring their development and application.

Full Text

Preamble

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Abstract: With the rapid development of social economy in recent years, people's living standards have significantly improved, leading to higher demands for various forms of entertainment. As a traditional entertainment device, digital television holds great significance in people's daily lives. As a product, set-top boxes play a distinct role in digital television, with increasingly widespread application and strong market influence and infinite development potential in the future. As digital television continues to deepen its development in China, software and chip technologies have also made notable progress, enhancing the functionality of digital set-top boxes to better meet users' diverse needs and

provide services at different levels. This paper focuses on the development of digital television and set-top boxes, analyzing and discussing their development and application.

Keywords: digital television technology; set-top box; development analysis
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2. Development Status and Problems of Digital Television Technology and Set-Top Boxes

As a new type of household appliance, digital television primarily extends television functions by converting terrestrial digital signals and other signals into a format that most analog televisions can accept. After this digital signal conversion, viewers can clearly watch digital television programs on analog TVs, which is also very convenient for various educational implementations.

2.1 Development Status of Digital Television Technology and Set-Top Boxes

China's domestic digital television set-top boxes entered a prosperous cycle as early as 2010, characterized by deep development and market structure adjustment. During this phase, digital television set-top boxes experienced rapid growth, with the industry moving toward stability. With the continuous increase in high-definition program sources, cable operators have begun to attach great importance to the development of high-definition two-way set-top boxes. In Shenzhen and other places, operators started large-scale production of high-definition set-top boxes and achieved certain results. Influenced by these regions, operators in other parts of China have also begun to promote local high-definition services.

Future digital television technology will develop toward network television, satellite direct broadcasting, and digital high-definition television. Among these, digital high-definition television offers strong clarity and provides very complete and realistic images, effectively improving the previous situation where digital information provision relied on analog technology. With continuous technological development, high-definition digital television technology is bound to become the mainstream in the near future. Satellite direct broadcasting television primarily uses satellites to transmit television programs. With the continuous progress of science and technology in China, satellite direct broadcasting television has achieved significant development. The notable advantage of satellite television is its high transmission success rate and ability to directly deliver signals to receiving terminals, thereby achieving accurate information transmission. Through satellite utilization, signals can be transmitted promptly and

completely, as traditional information transmission is highly susceptible to interference from natural conditions and other factors, often negatively affecting transmission quality. Satellite utilization minimizes external interference in information transmission and enables real-time delivery of various types of data. In the future development of digital television technology, network television is also an inevitable trend. With the continuous advancement of science and technology in China, network television has become a new form of transmission that has attracted widespread attention.

2.2 Existing Problems in the Development of Digital Television Technology and Set-Top Boxes

The existence of digital television set-top boxes has transformed our existing concept of television, providing the internet with a completely different consumer terminal that is more attractive than mobile phones and other terminals. With the continuous development and widespread adoption of cable digital television, digital television set-top boxes have achieved significant growth. However, their application remains relatively limited, and several problems persist in their development: First, quality issues. Network broadband has a significant impact and constraint on digital television set-top boxes, and coupled with the relatively weak foundation of network development in China, widespread expansion and popularization of digital television set-top boxes will still require considerable time. Second, technical issues. There are not many product varieties, and most manufacturers remain at a conceptual stage in the development of video-on-demand technology. Third, excessive cost. For most users, digital television set-top boxes represent a substantial expense, and for many people, long-term consumption without significant returns is not within their acceptable range. Fourth, service issues. There is a lack of rich information and program resources, and copyright issues pose a challenge for the promotion and application of VOD services. With the gradual establishment of cable television backbone networks, these problems can be alleviated to some extent.

3. Analysis of the Function and Principle of Digital Television Technology and Set-Top Boxes

Digital television set-top boxes consist primarily of two parts: hardware platforms and software systems, which can also be divided into a four-layer structure comprising application software, middleware, low-level software, and hardware platforms. Through the hardware platform, data services and other functions can be well implemented. Set-top boxes mainly include program layers, among others. The cable digital video signal is converted to an intermediate frequency at the output interface, then demodulated using a demodulator. After outputting the TS stream, it is sent to parsing software to effectively achieve digital signal restoration. Digital television set-top boxes and terrestrial digital set-top boxes share the same working principle, with the only difference being the signal transmission medium. Cable digital television set-top boxes primarily use

optical fiber and other technologies, which offer more significant transmission effects compared to other methods. Moreover, their cable modem technology is more mature, which can ensure the effective provision of interactive services for cable digital television set-top boxes and thus offers brighter development prospects.

4.1 Market Direction of Digital Television Technology and Set-Top Boxes

Set-top boxes currently hold a significant position in the market, with increasing market demand and gradual adoption of satellite and other services in households. According to relevant research and predictions, the sales volume of set-top boxes in China will achieve a significant breakthrough and reach a new historical high, bringing substantial profits to set-top box sales. Statistics on previous set-top box sales show that as early as 1998, the number reached 10 million. In the following four years, the quantity doubled, with an average annual growth rate of 30%. To date, set-top boxes still have very large demand and are growing at a rapid pace, with their functions being improved and perfected through usage.

4.2 Key Technologies of Digital Television Technology and Set-Top Boxes

At present, we are in the stage of developing satellite set-top boxes, also known as satellite integrated receiver decoders, with the main difference being the implementation method. Generally, digital satellite receiver set-top boxes do not have an uplink channel and function to decompress video and other data while receiving multiplexed data. In the development and research of set-top boxes, to further improve the system's anti-interference capability, set-top boxes also need to have corresponding channel decoding and error correction capabilities. This study suggests that digital television set-top boxes will likely develop in the following directions: first, implementing Internet broadband service access; second, implementing VOD digital television services. During the completion and implementation of these functions, technologies such as decompression will be involved. Among these, important technologies mainly include demultiplexing and decompression technologies, which have very high requirements during digitization. To better utilize demultiplexing and decompression technologies, it is necessary to use dedicated chips to achieve this goal while providing decision-making methods for the AV–3 standard. For modulating encoded uplink data, interactive VOD applications must be fully considered. Because uplink data has certain limitations, 16QAM and other methods can be implemented during modulation. For DTV, residual variation in demodulation needs to be addressed, and modulation and channel decoding must be implemented in the process. Regarding channel coding technology, there is also downlink data demodulation, as compressed data cannot be directly transmitted over channels.

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