Applied Research on Multiviewers in Broadcast Television Systems (Postprint)

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Abstract

With societal progress and economic development across various regions, analog broadcast television technology is gradually being phased out. The adoption of various emerging technologies has significantly enhanced the overall operational efficiency of broadcast television, with the multi-viewer being an important representative thereof. This study investigates this technology and explores its applications within broadcast television systems.

Full Text

Research on the Application of Multi-screen Splitters in Broadcasting and Television Systems

Abstract: With social progress and regional economic development, analog broadcasting and television technologies are gradually being phased out. The adoption of various emerging technologies has significantly improved the overall operational efficiency of broadcasting systems, with the multi-screen splitter representing one of the most important innovations. This study investigates the application of multi-screen splitters in broadcasting and television systems.

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1.2 Technical Characteristics of Multi-screen Splitters

As society develops, various scientific and technological innovations have found widespread application across industries, including the broadcasting sector where the author works. Audience demands for broadcasting quality have increased substantially, rendering traditional playback models inadequate. Consequently, technological transformation has become imperative. The multi-screen splitter technology was developed against this backdrop. This analysis examines its application in China's broadcasting and television systems, exploring its underlying principles to facilitate broader adoption.

1.2.1 Image Fidelity Image fidelity represents the primary technical metric and core function of multi-screen splitter technology. Key reference parameters include image brightness, clarity, contrast, motion smoothness, and latency—all of which significantly impact viewer experience. For qualified image reproduction, motion video must be smooth; image details must be sufficiently clear without significant smearing or trailing artifacts. Processing delay must fall within a reasonable and acceptable range, generally not exceeding one frame. Furthermore, clarity must be maintained consistently across all image sizes, requiring sufficient coordination. Images should not shift erratically, and transitions from high-resolution larger windows to low-resolution smaller windows must be handled by adequate adaptive filters to preserve fidelity, preventing both blurring and jagged edges[2].

1.2.2 Signal Adaptability and Layout Flexibility With increasing demands for integrated playback capabilities, most broadcast facilities have transitioned to large-scale centralized processing rooms, necessitating greater consideration for signal adaptability and layout flexibility. Multi-screen splitters must accommodate diverse input and output signals while providing highly flexible layout configurations. First, they must recognize various input signal sources, including HD-SDI, SDI, and analog composite video, with input interfaces that allow for convenient expansion. A single input source must be capable of displaying in multiple different windows simultaneously. Second, the system must flexibly adapt to monitors of different resolutions and support multiple output formats. Additionally, layout editing software must provide user-friendly configuration interfaces with sufficient operational convenience and compatibility.

1.2.3 Scalability Given the rapid pace of technological development, sustained progress requires adequate compatibility and future adaptability—what we term scalability. The scalability of multi-screen splitters primarily manifests in expandable system display capacity, achievable through increasing the number of main processing cards or implementing multi-unit networking solutions. Without such expansion capabilities, multi-screen splitters will inevitably become obsolete.

1.2.4 Signal Monitoring Capabilities Signal transmission constitutes the primary function of multi-screen splitters, making signal monitoring a key characteristic. Monitoring capabilities encompass video presence detection, static frame detection, black field detection, excessive brightness detection, and anomaly region detection, including audio signal overload conditions. Additionally, attention must be paid to data cell loss issues.

2. Practical Application of Multi-screen Splitters

Many regions in China have adopted multi-screen splitter technology to enhance broadcasting efficiency. The author's organization began introducing this equipment in 2012, with widespread deployment in recent years. To ensure safe, high-quality broadcasting in the central machine room, the monitoring system employs dozens of LCD displays to create a video wall, transforming it into a multi-screen splitter plus large-screen configuration to display content from various broadcast locations. Each display connects to computer technology, utilizing remote control software installed on computers to handle network monitoring and control issues. Front-end signal sources, wireless transmission mechanisms, five sets of FM radio, and six sets of wireless broadcast programs all employ splitter technology for processing. Monitoring for terrestrial digital television, international standard digital television, and MUDS transmission all utilize multi-screen large-display configurations, achieving excellent broadcast results and enabling timely problem resolution. Based on practical operational experience, the author has identified several critical requirements that this technology must satisfy.

2.1 Flexible and Rational Layout Configuration The author's organization requires six displays for signal source monitoring, with combinations including four-way, six-way, nine-way, sixteen-way, and three-way cyclic display configurations. To more clearly present signal source content, six computer units were installed as auxiliary equipment to optimize signal display and enable independent monitoring of program audio, thereby improving overall service quality and operational efficiency while reducing the likelihood of issues. This represents a crucial improvement. Various wireless transmission primary and backup signals, along with output signals, must employ parallel configuration methods, while other transmission output signals display on the large screen positioned directly in front of operators at a lower elevation, ensuring comfortable viewing that minimizes visual fatigue and enables rapid fault detection and resolution. This design approach merits consideration and adoption.

2.2 Significant Space Savings Traditional broadcasting facilities require substantial physical units for operation. Before the upgrade, the organization's video wall did not efficiently utilize space—some monitors could only display video signals without audio or station identification graphics, while certain signal source monitors frequently displayed black screens, preventing effective interaction and adjustment. Multi-screen splitter implementation resolves these

issues, and with flexible configuration capabilities, significantly reduces physical space requirements, yielding substantial cost savings for overall operations.

2.3 Environmental Protection and Energy Efficiency Multi-screen splitter technology employing large-screen display methods consumes less than half the power of previous systems, according to statistical data. Additionally, environmental adaptability and flat-panel display quality have improved substantially, producing vivid, clear images without flicker or other display issues that could cause eye strain. Previously, various problems were often attributed to insufficient power, leading to frequent voltage increases that caused significant pollution and waste. This technology effectively resolves these issues while reducing operating voltage to meet environmental protection requirements.

2.4 Timely Alarm Functionality In broadcasting operations, any issue requires immediate attention because time represents the most valuable asset. Failure to address problems promptly before they propagate can create significant adverse social impact. In traditional models, problem identification relied entirely on human visual detection, making discovery and resolution time-consuming processes prone to oversight during operator fatigue or distraction, consequently causing negative effects. Multi-screen splitter technology enables continuous automated monitoring based on user requirements. All monitored signals trigger immediate alarms when anomalies occur, with customizable alert methods that substantially improve problem resolution efficiency. Issues can be automatically logged and reported in document format, facilitating management analysis and statistical review to reduce problem occurrence rates and enhance overall system reliability. This capability is critical and essential for meeting user requirements.

2.5 Support for Multi-resolution Simultaneous Broadcasting Contemporary audiences demand increasingly diverse services, prompting manufacturers to develop numerous personalized playback devices, including broadcasting equipment that satisfies various user needs but complicates operations for broadcasters due to differing resolution capabilities across devices. Multi-screen splitters effectively address this challenge by perfectly converting and broadcasting both high and low resolutions, as well as different aspect ratios like 16:9 and 1080P formats, thereby enhancing overall system adaptability.

Multi-screen splitters hold significant importance for the development of China's broadcasting and television industry. Relevant managers must make reasonable adjustments in response to technological progress and user demands to promote continuous improvement and advancement in technical capabilities.

References

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