Design and Implementation of Quzhou Broadcasting All-Media News Live Streaming Platform (Postprint)

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Abstract

This article introduces the design concepts and approach of Quzhou Radio and Television' s all-media news live streaming platform, focusing on the integration of traditional radio and television technology with new media technologies. By connecting the media asset system, news tip system, non-linear editing production network, and other systems, the platform achieves interconnectivity, enhances news timeliness, and fulfills the station' s requirements for news live broadcasting and all-media interaction. Moreover, the transplantation of a 3D virtual system into news reporting revitalizes news programs in both content and form, enhancing visual effects.

Full Text

Preamble

The core function of the all-media news live broadcasting platform is to aggregate news materials from various channels, process them in real time, and broadcast them promptly. Upon completion, this system effectively addresses timeliness issues in municipal radio and television news production. The background large-screen display system connects with the all-media information system to acquire relevant information instantly, diversifying program formats. The broadcasting system interfaces with the media asset library, transforming various materials into valuable digital media assets. In terms of stability, the platform must support 7$\times$24*continuousoperationforbothlivebroadcastingandrecording.Technically*,*lightingfixturesmustmaintai* a color rendering index Ra>90, and illumination levels adjusted according to specific requirements to achieve optimal imaging quality.

2.3 Large Screen System

The studio background large-screen display system implements a multi-screen splicing display system that integrates multi-channel signal input, output display, and control. This system offers both the flexible scheduling functions of a matrix and high-quality multi-screen display effects, while simultaneously achieving high-quality multi-screen and multi-image splicing display capabilities. For this high-definition news studio construction, we required a fully media interactive fusion system, including background large screens, joint screens, studio visual intelligent display scheduling management systems, ultra-high-resolution large-screen packaging display systems, virtual reality graphic packaging systems, and subtitle/graphic packaging systems. According to production needs, the intelligent signal scheduling management system schedules screen content, enabling interaction between hosts and screens, online graphic packaging, and other elements, while providing centralized online control management of screen content playback to meet various presentation formats and daily live/recording requirements for news programs. The multi-screen content system features excellent openness and interoperability, supporting unified control and scheduling for broadcasting, unified production platforms, and unified content management, as well as interconnection among various heterogeneous platforms to achieve efficient communication and application integration with other production subsystems. The graphic online packaging system connects with the internet and non-linear editing networks, with dedicated security devices configured to prevent network attacks and virus damage.

For this construction project, we adopted a main LED screen measuring 2 meters $\times$ 6 meters (12 square meters). The large-screen technical specifications were determined based on shooting distances and high-definition program broadcasting requirements. Specifically, the screen pixel pitch is \$ $2mm, pixeldensity > 250,000 dots/m\hat{}\{2\}$\$, constant current drive, 1/32 scan, corrected brightness of 600 nits, horizontal and vertical viewing angles of 160°, brightness uniformity \$ 95×\$2m LED displays with the same specifications as the main screen. Other control equipment is configured as required.

2.1 Background System

The studio is divided into multiple scenic areas, providing settings for live broadcasting and recording of various channel news programs. Our studio space is designed for 360-degree coverage without dead angles: (1) For current affairs news, we use a dual-anchor setup with a transparent control room background, similar to CCTV' s news broadcast scene. Quzhou News recording and broadcasting employs a 3\$×\$11 meter transparent glass wall to display the control room, enhancing program depth and making current affairs news appear more profound. (2) People' s livelihood news adopts a standing anchor format with large-screen displays, where screen content is controlled from backstage to enrich program content and improve viewability. (3) Economic news and information broadcasting uses a standing anchor format with three computer touch screens,

allowing the host to change content by touching the screens, similarly enriching program content and improving viewability. (4) New media broadcasting employs vertical LED displays to accommodate mobile vertical-screen viewing characteristics, with content also selectable via host touch screens. (5) A standard blue box scenic area is configured to adapt to other program types. (6) The five scenic areas can collaborate and simultaneously serve a single program production. The five major scenic areas maximize the utilization of studio space, enabling camera recording without any dead angles. The various scenic areas integrate seamlessly, presenting grand and aesthetically pleasing visuals that provide audiences with a completely new viewing experience.

2.2 Lighting System

The studio lighting system requires an overall optimized design for lighting suspension, integrated power cabling, DMX512 signal communication control cabling, and fixture dimming systems. The optimization solution must utilize the newest and most advanced domestic products that are reliable, scientifically sound, safe, fully functional, highly expandable, economical, and convenient to use. LED fixtures must feature high color rendering indices and meet studio silence requirements, enabling the studio to fully satisfy current and future high-definition television program field recording and live interview/news broadcasting needs while reserving capacity for future expansion.

In terms of design style, we employ various fixture combinations according to the different requirements of the five scenic areas, with each area' s lighting installed independently. The configuration includes 39 LED panel lights, 8 LED profile spots, 10 LED Fresnel spotlights, and 4 LED chin lights. Additionally, there are 10 LED wall washers and 3 LED soft light boxes, two 72-channel direct patch panels, and two main/backup digital dimming consoles with other related equipment. For stability, the system must meet $7\$\times 24 live/recording requirements for continuous long-term operation. Technically, fixture light sources must maintain a color temperature of 5600K\pm\$200K$, color rendering index Ra>90, and illumination levels determined according to specific needs to achieve optimal imaging results.

2.4 Video and Audio System

The video system comprises five camera channels: four high-definition cameras plus one jib high-definition camera. The system includes three high-definition and two standard-definition video recorders, with input signals selected and provided by a central video matrix. Five recorders are designed for dual recording/playback functionality, with their output signals connected to the switching system. The system configures one high-definition digital character generator and one high-definition online packaging system. The high-definition digital fill and key signals from both machines are distributed simultaneously to the video matrix and switching system after splitting. The system includes two DVI sig-

nal and two VGA signal to high-definition signal (HD-SDI) converters, with one DVI and one VGA signal converted through two DVI converters that can accept sync signals, then distributed through digital video distributors before entering the switching console and video matrix. The other two converted signals enter the matrix directly for use in frame synchronization channels as needed.

The system provides six external signal input channels (4+2 configuration, with at least two reserved channels), all capable of handling complex external signal sources. Two multi-format cross-converters with comprehensive functions—including up/down conversion, frame synchronization, embedding/de-embedding, audio delay correction, and multiple interfaces for high-definition (HD), standard-definition (SD), analog component, and analog composite—are configured as primary external signal processing equipment. The system accesses two K2 broadcast servers (self-provided), using matrix loop-through cross-conversion (including frame synchronization) to achieve flexible allocation of additional channels. Two non-linear editing recording/playback devices are configured and distributed into the system. One high-definition switching console is selected, with high-definition signals (including cascaded signals after synchronization) connectable directly, and standard-definition signals processed through external or built-in up-conversion. To enhance system safety, most input signals to the switching console are connected directly from signal sources (or source distributors), with a small number allocated from the matrix. Program broadcast signals are output directly from the switching console, while signals for other applications are allocated and output via the matrix.

The main signal path routes high-definition digital signals from various sources into the switching console, with standard-definition sources participating in high-definition production through up-conversion. The switching console' s high-definition digital video output passes through emergency switching, embedding, and video distribution amplifiers to broadcasting and recording terminals, while high-definition signals are down-converted to standard-definition for broadcasting and recording terminals. The main and backup switching consoles feature $ $2 M/E processing capabilities with expandable interfaces, with $ $32 high-definition inputs. Each console is configured with one full-function switching control panel. The matrix is configured as a multi-codec high-definition/standard-definition hybrid matrix with a scale of $ 32×$32. All signal sources, PGM signals from the switching console' s second and third-level M/E, PVW signals, PP-level CLEAN signals, some AUX signals, and both high-definition and standard-definition main/backup program output signals are input into the matrix, with panels responsible for switching large-screen signals in the studio and emergency system signal switching.

The audio system design centers on a digital audio mixing console for audio signal processing. Signals from different sources form different timbres due to spectral distribution and harmonic composition, requiring 3-band equalization, gain control, high-pass filtering, and signal mixing. After adjusting various signals, the mixing console merges them into standard left-right channels (stereo)

or 5.1 and 7.1 channel modes. The high-definition studio can accommodate audio systems with 5.1 surround sound compatibility for stereo and mono monitoring and recording. To ensure signal safety, all signals are connected directly to relevant equipment or systems as required.

2.5 Broadcasting System

The broadcasting system represents a critical component of the all-media news live broadcasting platform construction. As file-based workflows throughout the entire station represent the development direction for next-generation television stations, the new studio broadcasting system must consider the necessity of interconnectivity to avoid "production-broadcasting island" phenomena. Due to its high timeliness and operational flexibility, the studio broadcasting system must also incorporate unique broadcasting control modes tailored to the studio environment.

The studio broadcasting system implements two-channel broadcasting tasks, with equipment that must meet live broadcasting requirements, seamlessly connect with mainstream non-linear editing manufacturers' high-definition and standard-definition production networks, enable fast and accurate migration, and achieve control over broadcasting system equipment (video servers, switching consoles, routers, character generators, logo inserters, video recorders, keyers, etc.). Broadcasting system software must control video servers, switching consoles, routers, character generators, and other equipment. The system must enable direct signal distribution within the station, allowing broadcast, website, WeChat, and APP personnel to utilize these materials instantly. The platform integrates broadcast, television, and network operations through a single technical framework, transforming the working relationships among broadcast, television, and network journalists.

2.6 Synchronization and Clock System

We employ a master/slave dual sync generator configuration with automatic switching. The backup sync generator follows the master sync generator' s timing, supporting external reference input with sync lock maintenance functionality, and providing analog black burst sync signals, tri-level sync signals, and WORD CLOCK outputs.

2.7 Intercom System

In the system, we configure various intercom panels and belt packs according to different communication priority levels at each workstation, along with wired and wireless IFB systems for hosts. The design integrates the director, camera operators, and hosts in the studio area; audio, lighting, graphics, playback, and recording personnel in the production area; broadcast workstations, network workstations, and technical maintenance positions into a unified network, combining wired and wireless technologies to achieve effective communication.

2.8 All-Media Information System

In the internet era, program production sources increasingly exhibit three characteristics: (1) abundance—extremely rich information and massive clue resources; (2) speed—rapid information transmission and fast-paced changes; and (3) comprehensiveness—diverse communication channels and multiple publishing formats. In the all-media information system, we capture different sources of clues from multiple channels including web, WeChat, Weibo, hotlines, SMS, and QQ, using text, voice, image, and video formats, standardizing them into uniform formats with images and videos as attachments. After processing through duplicate checking, topic classification, and format verification, these are stored as independent metadata automatically or manually tagged with one or multiple labels. Users can quickly locate desired content and related materials through tags, or precisely search information by topic, category, keywords, or full-text retrieval. Information managers classify all information, transferring valuable clues directly to the clue library while returning non-valuable clues to the original database. Each news clue displays the assigned journalist and selection time, and can track and display real-time status of adopted clues for scoring. All video and audio materials in the news clue library are shareable, and completed news manuscripts from journalists can enter the non-linear editing network and media asset library to achieve interconnectivity.

3. Application Status of the All-Media News Live Broadcasting Platform

After five months of meticulous design and an investment of 20 million RMB, the Quzhou Radio and Television all-media news live broadcasting platform was completed and officially launched during the 2018 Spring Festival. The 400 ㎡ integrated media studio center made its debut, immediately becoming a hot topic among Quzhou citizens and nearly dominating social media feeds. Broadcasting professionals visited continuously, marveling at the excellent image presentation effects that brought audiences a completely new visual feast. The combination of news with virtual 植入 technology gave broadcasting “wings,” making “data move,” “scenes come alive,” and “formats become dynamic,” delivering comprehensive, multi-angle, multi-format, and multi-terminal coverage that was remarkable and brilliant.

The renovated 360 ㎡ integrated media production center features 51 non-linear editing high-definition workstations and three dubbing workstations, ending the fragmented operation of individual program departments. The integrated media production center consolidated five separate standard-definition networks from various television channels and the advertising department into a single station-wide high-definition network, enabling high-definition/standard-definition mixed editing and free material sharing, thereby comprehensively enhancing collective operational capability and the group’ s high-definition program production capacity. Through a cloud computing-based broadcast

production and broadcasting fusion platform, journalists can quickly edit recorded audio, photos, and video from news scenes into complete stories and transmit them to the station for broadcast. Audiences can also watch broadcast video programs, real-time interactive live programs, and on-demand content through multiple terminals including PCs, smartphones, and tablets, as well as via APP, WeChat, and third-party platforms. Through this platform, hosts can engage in online dialogue with audiences anytime, expanding the audience base, enhancing program interactivity and selectivity, and attracting more viewers.

After more than a year of operation, high-definition, interactive, and all-media news programs have enriched audience screen time, providing daily news ingredients for programs including *Quzhou News Broadcast*, *Quzhou Radio News*, and the "Unlimited Quzhou" APP, cooking news feasts in the first instance and continuously improving program ratings. The platform has effectively communicated the Party and government' s voice, highlighted the "Quzhou Courtesy" image in the new era, and promoted Quzhou' s optimal business environment, earning high praise from municipal leaders. The television governance program *Please Review by the People* has attracted over 10 million viewers/listeners, rapidly enhancing the influence and credibility of radio and television media. New media readership has achieved 60 instances of "100,000+" reach, with the "Unlimited Quzhou" APP user base rapidly exceeding 200,000 and the "Quzhou Radio and Television Media"WeChat public account exceeding 300,000 followers. For external promotion, the platform has contributed 205 reports to central-level media (including 27 reports on CCTV *News Broadcast* with 4 headlines), ranking among the top in the province and enhancing Quzhou' s visibility. The platform has also conducted joint live broadcasts with CCTV and Dragon TV for events such as Confucius memorial ceremonies and harvest festivals, achieving simultaneous broadcasting on mobile APPs and websites. Broadcasting organizations from other provinces including Yinchuan in Ningxia and Huangshan in Anhui, as well as 27 radio and television stations within the province, have visited the group to observe the all-media news live broadcasting platform operation. By ensuring recording and broadcasting for these major events, the system has demonstrated stable operation and good working condition, achieving design objectives and delivering excellent social and economic benefits.

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