

Postprint of Overview of Technical Solutions for Manas County Television Station Broadcasting System

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Abstract

This paper provides a scientific exposition from multiple perspectives on the principles, technical solutions, workflows, software modules, and other components of the broadcast system of Manas County Television Station. Compared with other broadcast systems domestically, this system exhibits superior security, advancement, and information resource sharing capabilities. Currently, the system holds a leading position among county-level television stations across Xinjiang.

Full Text

Preamble

Hard disk broadcast control systems have significantly improved operational efficiency while offering enhanced security, advanced capabilities, and information resource sharing. The construction of highly reliable, highly available, fully automated, and intelligent broadcast systems has remained a continuous research focus for television stations. Currently, most broadcasters rely on two critical elements to achieve secure broadcasting: first, building robust, automated, intelligent broadcast systems; and second, establishing new broadcast workflows adapted to file-based production and broadcasting.

It is precisely for these reasons that Manas County Television Station has installed an advanced iChannel2 broadcast system. This paper provides a brief overview of the system's principles and workflow.

1. Product Overview

iChannel2 is a highly integrated broadcast product that combines a video server platform with integrated broadcast software, primarily targeting small

to medium broadcast markets domestically and internationally. It integrates acquisition, import, transcoding, technical review, playlist editing, broadcast, and subtitle functions into a single unit. Without requiring traditional broadcast peripheral equipment, a single server can implement 4-channel HD broadcast solutions, optional 2-channel HD/SD simulcast solutions, or 1-2 channel simple digital/analog broadcast solutions. Compared with equivalent domestic products, iChannel2 better satisfies domestic broadcast requirements for flexibility and security in terms of safety, usability, functionality, and stability, while offering high cost-effectiveness and comprehensive coverage of small broadcast market needs.

2.2 Technical Parameters

All programs in the broadcast system adopt the MPEG2-IBP format. The playlist editing module supports timed broadcast settings; material cutting, copying, pasting, deletion, and undo operations; three search methods including full-word matching, case-sensitive matching, and fuzzy matching; replacement of material content or names with options for single or batch replacement, and upward or downward directional replacement. Content replacement supports retaining original material names or using new names, adopting shorter durations or new material lengths, and preserving or removing subtitles. The system supports subtitle addition to materials with configurable key-on and stop times, and enables invocation of title text, station logos, corner logos, and scrolling text with customizable modifications and effect preview. Additional capabilities include timed material broadcast, visual playlist editing, preview and editing of materials with in/out point setting, duration modification, and alias editing; color marking of materials during editing with keyframe extraction and setting; subtitle keying control for both materials and pass-through signals following timecode; matrix and VTR switching control; material grouping with color marking, group name modification, timed group settings, finite and infinite group looping, and group disbanding; single-material infinite looping; pause settings at first or last frame; material addition via insert, append, or drag-and-drop methods; material insertion with previewable insertion points; a material manager supporting manual import/export, deletion, directory location, column sorting, marker color setting, manager refreshing, and folder creation; time-based material location; and display of total program duration and end time.

5. Broadcast Module

The broadcast module supports material scanning and ingest, “folder generation” for managing materials by channel and type, and database information creation after ingest. It accommodates JPEG, PNG, and BMP image formats, performs decoding verification and loudness control with loudness file generation, and triggers alarms for decoding verification failures, missing loudness material audio, or loudness control file generation errors. The system sup-

ports program review and approval with comment addition and status display, copy/paste/delete subtitle operations, HD/SD mixed broadcast, and HD/SD subtitle mixed broadcast. A single server supports 2-channel HD/SD simulcast and up to 4-channel HD broadcast, with each channel supporting identical or different signal pass-through relay. It supports up/down conversion broadcast via AFD information, cuetone event settings with trigger signal reception for jumping into/out of sub-playlists for insertion, and broadcast monitoring through return window display. Playback controls include broadcast, stop, preroll, pause, skip to next item, and signal pass-through hold. The system supports one-click filler broadcast and automatic filler broadcast, panel locking, sequential broadcast, timed broadcast, and insertion broadcast, as well as image broadcast and timecode track display and adjustment. Additional features include next program first-frame preview, channel subtitle following, self-loading playlists, manual playlist import/export, 1+1 and N+N+M redundancy configurations with primary/backup/tertiary backup support, primary-backup switching and takeover, online playlist editing, signal pass-through broadcast on power failure, IP streaming broadcast, and automatic playlist loading. (Author affiliation: Xinjiang Manas County Radio and Television Station)

2.3.5 Core Functions

The iChannel2 software comprises six primary modules: program acquisition, file import, transcoding, technical review, playlist editing, and broadcast modules.

3. Program Acquisition Module

The acquisition module supports multi-format, multi-channel capture with manual/timed and fixed/variable duration options, batch capture, and preview of captured materials with direct ingest. It provides signal loop-out monitoring, matrix control capture, VTR control capture with advance playback control, timecode transmission delay, simultaneous upload and review with post-capture preview, and automatic upload task saving and resumption.

4. File Import Module

The file import module supports import and pre-import preview/editing from hard disks, DVDs, Blu-ray discs, and P2 cards, with concurrent transcoding settings during import, batch import capabilities, and watch-folder functionality for automatic import.

4.1 Transcoding Module

The transcoding module automatically detects material validity, supports transcoding path and format configuration with multiple format options,

one-click restoration of transcoding defaults, file transcoding through path scanning, and concurrent transcoding during file import.

4.2 Technical Review Module

The technical review module supports material technical review covering parameters such as freeze frames, black fields, macroblocking, color bars, and audio silence. It provides fuzzy search by “material name,” “review status,” and “re-inspection status,” configurable review parameters with template saving, invocation, and deletion. Manual re-inspection supports pause, frame advance/retreat, first/last frame, multi-speed fast forward/rewind, and 1-8 channel monitoring. The re-inspection interface displays material name, file path, duration, review and manual re-inspection status, and review problem markers with navigation options for previous/next/first/last markers. Re-inspection supports playback of entire material segments or problem-marked segments, non-continuous playback with selectable pre/post marker duration for unreviewed materials, and selectable head/tail duration and middle segment count/time for reviewed materials. Decoding verification, loudness control, technical review, and manual re-inspection are all integrated within the material manager.

4.3 Playlist Editing Module

The playlist editing module supports playlist creation, opening, saving, and saving as, with import/export capabilities in plst, excel, and xml formats. Status reminders indicate unapproved, approved, or locked states (post-approval lock prevents editing). It supports advertisement list editing and merging, remote playlist editing and distribution to primary/backup servers, addition of signal pass-through programs with configurable names, input channels, and durations, and audio overlay on pass-through sources. Virtual material placeholders enable playlist editing before material upload, with support for timed broadcast settings, material cutting/copying/pasting/deletion, undo operations, three search methods (full-word, case-sensitive, fuzzy), and replacement of material content or names with directional and batch options. Content replacement supports retaining original names or using new names, adopting shorter or new durations, and preserving or removing subtitles. Subtitle addition supports key-on/stop time configuration, with invocation of title text, station logos, corner logos, and scrolling text customizable with preview. Visual playlist editing includes material preview, in/out point setting, duration modification, alias editing, color marking, and keyframe extraction/setting. Both materials and pass-through signals support timecode-controlled subtitle keying, matrix and VTR switching. Material grouping features include color marking, group name modification, timed group settings, finite/infinite group looping, and group disbanding, with support for single-material infinite looping and pause settings at first/last frame. Materials can be added via insert, append, or drag-and-drop methods, with insertion point preview. The material manager supports manual import/export, deletion, directory location, column sorting, marker color setting, manager re-

freshing, and folder creation, with time-based material location and display of total program duration and end time.

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

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