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Design of Mobile Broadcast Control Management APP for Radio Station Intelligent Broadcast Control Center Auxiliary Management System (Postprint)

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Abstract

Given the current development trends in new media convergence and big data analytics, we can fully leverage the advantages of diversified terminals and big data analytics to develop a mobile data monitoring platform that better assists existing intelligent broadcast control systems, serving as a beneficial supplement to current intelligent broadcast control systems, making possible a mobile broadcast control management platform with mobile monitoring, real-time alerting, and big data analytics capabilities, and enabling the convergence of broadcast control centers with new media. This paper provides a concise exposition of the design philosophy and functional implementation of the proposed platform.

Full Text

Preamble

Title: Radio Intelligent Broadcasting Control Center Auxiliary Management System — Design of a Mobile Broadcast Control Management APP

Abstract: Given current trends in new media convergence and big data analytics, we can leverage the advantages of diversified terminals and large-scale data analysis to develop a mobile monitoring platform that better assists existing intelligent broadcast control systems. Serving as a valuable supplement to current intelligent broadcast control systems, this platform enables mobile monitoring, real-time alarming, and big data analysis functions while facilitating integration between broadcast control centers and new media. This paper concisely elaborates on the design philosophy and functional implementation of this platform.

Keywords: mobile broadcast control management; media convergence; signal monitoring technology; remote monitoring; safe broadcasting

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Currently, intelligent master control systems in radio broadcast control centers have achieved comprehensive signal chain monitoring for broadcast security across all station frequencies. However, the lack of mobile real-time management capabilities means that fault information cannot be transmitted in real time to responsible personnel's receiving terminals when anomalies occur. The auxiliary system described in this paper—a mobile broadcast control management platform—enables mobile real-time monitoring, maximizes the powerful functions of intelligent digital audio monitoring systems, and further improves broadcast security prevention systems.

1. Advantages of the Mobile Broadcast Control Management Platform

[Figure 1: see original paper] Relationship Model Between Mobile Broadcast Control Management APP and Intelligent Broadcast Control System

The mobile broadcast control management platform represents a functional enhancement and extension of the original intelligent digital audio signal monitoring platform, offering several key advantages. First, responsible personnel and technical staff can access real-time alarm and log information, query equipment working status, and identify fault nodes. By analyzing alarm information and related data, they can remotely assist on-site operators in troubleshooting more effectively, efficiently, and accurately, thereby ensuring safe broadcasting. Second, the platform enables quantified assessment of operator workloads. Third, it performs big data statistical analysis on alarm information and work logs, generating analytical reports and graphical illustrations.

2.1 Signal Anomaly Alarm Management Module

This module provides comprehensive alarm functionality through three primary features. (1) It delivers audio transmission equipment alarm notifications via both SMS and APP push messages, with the capability to pre-configure multiple associated recipients for each alarm. (2) It enables real-time querying of audio transmission equipment logs and working status from mobile or PC devices for fault analysis. (3) It monitors diverse anomaly data across both internal and external facilities. Internal monitoring includes: (a) audio signals and operational status of broadcast equipment in live studios; (b) live studio video surveillance queries; (c) real-time status of critical signal transmission equipment in the master control room; and (d) signal status of web streams, slow recording, off-air, and satellite feeds. External monitoring covers return signal status from transmission stations such as FM transmitter sites and satellite earth stations.

2.2 Quantified Duty Work Records

This module implements quantified management of operator activities through three mechanisms. Operators upload photos or signatures to document their work status visually. The platform manages shift handover systems and tracks execution status. It also enables detailed work breakdown, statistical aggregation, and report generation to facilitate performance evaluation.

2.3 Fault Problem Processing Function

The fault processing system offers comprehensive traceability and oversight capabilities. It supports fault information queries, problem tracking, and review of responsible personnel's handling procedures. Leadership can review and approve fault resolution processes, adding comments and confirmations. Historical fault records support fuzzy queries by date, responsible person, or problem content, enabling trend analysis and accountability.

2.4 Big Data Analysis

The platform conducts multi-dimensional big data analysis categorized by alarm type and equipment type, providing intuitive insights into the frequency of similar alarms and equipment failure patterns. This enables quantitative assessment of equipment quality and performance, supporting optimized equipment management strategies.

2.5 Work Scheduling

The system can import duty schedules and register daily shifts, providing clear visibility into personnel adjustments and leave situations. It supports report generation on weekly, monthly, and yearly bases for comprehensive workforce management.

3. Technical Implementation of the Mobile Broadcast Control Management Platform

Implementation Methods: The platform is realized through four integrated approaches: (1) WeChat integration for SMS push and active queries; (2) dedicated mobile APPs for Android and iOS; (3) endpoint data collection; and (4) big data analytics.

System Architecture: Within the broadcast control center, the working status and monitoring signals from studios and critical transmission equipment are already transmitted in real time to dedicated monitoring servers housed in the station's machine room. The solution requires establishing an additional status reception server that receives status information from existing broadcast and transmission equipment monitoring servers. Mobile APPs then query and manage relevant information through this new server, enabling all alarm information and logs visible in the master control room to be accessed anytime via

the APP. This server-data-plus-APP-client/WeChat architecture achieves the goal of real-time broadcast control monitoring.

The logical implementation employs a 4G+WebService approach with three operational modes. (1) **Historical Status Active Query:** When the APP client requests data queries, the server responds accordingly. Authorized personnel can proactively query historical equipment status, work logs, and fault resolution processes, leveraging historical experience for rapid fault diagnosis and performing data analysis including frequency statistics and trend visualization. (2) **Timely Fault Push:** The backend establishes data warehouse rule modeling with alarm mechanisms that filter extraneous data. When thresholds are exceeded, associated personnel receive fault notifications through a dual-insurance mechanism of APP notifications and SMS messages, ensuring all relevant parties receive timely alerts. (3) **Real-Time Interactive Data Exchange:** A backend cloud server is established, with APP clients connecting via Webservice using JSON data format transmission. Through periodic active polling and heartbeat mechanisms to maintain connection integrity, both server and client can exchange data simultaneously whenever monitoring status updates occur or query requests are made, achieving real-time information exchange. [Figure 2: see original paper] illustrates this data exchange methodology.

Data Storage Considerations: Since all status monitoring information is extracted directly from existing broadcast equipment monitoring servers rather than being re-collected, three key storage issues must be addressed. (1) **Offline Client Handling:** If the APP client is offline, how can it receive missed monitoring alarms? The APP can log in via 4G networks to retrieve all information. When real-time alarms are generated for a specific APP that is offline, the system queues these notifications for delivery upon the client's next connection. The monitoring module continuously tracks status changes, repeating this process to ensure APPs receive all relevant alarms, thus resolving temporary offline issues. (2) **Security Safeguards:** How is monitoring information security ensured? For data security and network risk mitigation, the cloud monitoring server and broadcast control center status server employ logical isolation with vendor-customized secure data transmission. Only permitted data is transferred to the monitoring server through secure interfaces. The cloud monitoring server resides in the original secure machine room, maintaining existing security protocols. Public network mapping ports prevent direct external exposure, while APP and WEB access require secure password authentication, restricting access to authorized personnel only and preventing malicious intrusion. (3) **Data Persistence:** How is data stored? Monitoring status data and fault tracking information are stored permanently in the monitoring server database, with images saved in file storage directories on the server. All data and files are retained indefinitely, with regular database backups ensuring long-term availability.

The mobile broadcast control management APP client is specifically designed to address mobile monitoring management needs, achieving the design requirement of comprehensive, full-domain real-time monitoring of data signal transmission

chains. It solves the practical limitation of fixed-location monitoring in broadcast control centers and serves as a valuable supplement to existing intelligent broadcast control systems. This implementation enhances emergency safeguards for safe broadcasting and provides a valuable reference for broadcast technology departments' control system innovations. Such applications can serve as beneficial supplements to equipment monitoring management in duty sections, making safe broadcasting more efficient, reliable, and secure.

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

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