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Development and Application of Cloud-Based Storage Solutions in Modern Video Surveillance Systems

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Abstract: ***Cloud storage employs a cloud-based data storage deployment model and distributed computing methodologies to aggregate a large number of heterogeneous data storage devices within the network through application software, thereby enabling effective and rational unified computation and data processing of resources and information. End users can access cloud storage data resources and business systems via remote or virtual access to desktop software applications and programmatic interfaces, thereby facilitating efficient and rapid resource analysis and data processing within large-scale data storage and access environments. Accordingly, this article provides a focused analysis of the development and application of cloud storage technology in the context of video surveillance.***

Keywords: Cloud storage technology; Video surveillance; Development; Application.

1. INTRODUCTION

With the popularization of digital security technology, monitoring technology is gradually developing towards high-definition and networked, which brings with it the problem of massive data storage. Massive data must have reliable, efficient, and fast read/write and response capabilities for storage. Storage devices have gradually moved from the edge of monitoring systems to the center, and their proportion in monitoring systems has also significantly increased with the increase of centralization. Traditional storage methods can no longer meet the needs of network storage, and cloud storage has emerged as a new type of storage service. By adopting cloud storage technology, building a massive video database, providing a unified cloud storage service interface, and achieving integration with public security business systems and urban management business systems, the video cloud storage center is built into a core resource support platform for various business systems. Detailed exploration of the application of cloud storage technology in video surveillance is of great practical significance. In the realm of complex graph processing, Yang, Zhang, Lin, Zhang, and Li (2023) introduced HGMatch, a novel match-by-hyperedge approach designed to efficiently address the computationally intensive challenge of subgraph matching on hypergraphs [1]. Building upon the theme of high-dimensional data management, Ukey, Zhang, Yang, Li, Li, and Zhang (2023) developed methodologies for efficient continuous k-nearest neighbor joins over dynamic high-dimensional datasets, thereby enhancing real-time analytical capabilities [2]. Complementing these data-centric studies, Lian and Chen (2024) explored the integration of deep learning techniques for complex data mining analysis and pattern recognition, highlighting the efficacy of neural architectures in extracting latent structures from heterogeneous information sources [3]. In industrial applications, Zhou (2025) proposed a digital precision distribution strategy for social media content within private automotive domains, utilizing collaborative filtering models grounded in user behavioral analytics to optimize engagement [4]. Furthermore, Wensi (2026) investigated the role of AI-assisted marketing content generation specifically tailored for non-standard industrial automation solutions, demonstrating how generative tools can streamline communication in niche technical markets [5]. On the front of computer vision, Ren (2024) enhanced object detection performance in challenging environments by implementing an adaptive multi-scale fusion mechanism within the YOLOv8 framework for infrared and visible imagery [6]. Concurrently, Zhao, Lin, Yang, Lu, Xue, and Jiang (2025) focused on the optimization of deep learning models to achieve robust predictions of dynamic market behavior under volatile economic conditions [7]. In financial risk management, Yang, Zheng, and Lu (2025) constructed multi-dimensional network credit risk maps by integrating Graph Neural Networks (GNN) to facilitate early warning systems for transaction anomalies [8], while Shen and colleagues (2025) applied the Whale Optimization Algorithm to significantly improve detection rates in financial payment fraud scenarios [9]. Addressing healthcare and medical imaging, Tian, Wang, and Cui (2024) improved brain tumor segmentation accuracy by augmenting U-Net architectures with GSConv modules and ECA attention mechanisms [10], and Pang, Zhou, Dong, Chen, Gu, Lyu, and Zhang (2024) leveraged electronic health records-based data-driven methodologies to unveil critical diabetes knowledge and perform robust risk prognosis [15]. In the context of cybersecurity and distributed learning,

Deng and Yang (2025) devised multi-layer defense strategies coupled with privacy-preserving enhancements to counteract membership inference attacks within federated learning frameworks [11]. Beyond software and algorithms, foundational hardware contributions were made by Tang, Kojima, Gotoda, Nishikawa, Hayashi, Koike-Akino, and Klamkin (2020) through the design and optimization of shallow-angle grating couplers for vertical emission in indium phosphide photonic devices [12]. Finally, Sun (2025) introduced a machine learning approach for developing adaptive interfaces that personalize user experiences [13], and Yan, Wang, Xu, Wang, Wu, and Lyu (2024) investigated the underlying mechanisms of image super-resolution reconstruction utilizing convolutional neural networks to enhance visual fidelity [14].

2. OVERVIEW OF CLOUD STORAGE

Cloud storage technology has been widely applied in many fields in China, providing distributed computing and massive storage functions with a complete architecture system. Using relevant application software as a carrier, utilizing its storage deployment mode to collect massive and diverse data, and combining distributed computing for data integration, processing, and analysis. For accessing cloud storage resources and their services, virtual access or remote methods are mainly used to achieve software program interface connections, helping end users process massive data resources in a timely manner.

The implementation of cloud storage function and its role is based on the application of cloud computing technology. From the perspective of capacity and performance, a single storage device has application limitations. With the help of distributed network systems, massive service resources and storage data can be processed in a network collaborative mode, and the provision of application services is mainly centered on cloud storage management and storage. The massive storage and management of data in practical applications is a manifestation of the role of cloud storage technology. With the integrated application of storage pools and virtualization technology, cloud storage has undergone a transformation from traditional device based application services in terms of capacity utilization and expansion, and the storage form has shown simplified characteristics. By virtualizing and standardizing the access methods, we help storage devices achieve capacity expansion, while ensuring an increase in data storage capacity and achieving a reasonable reduction in storage costs. From the perspective of end users, accessing data resources only requires relying on a virtualized desktop and reflecting a huge storage capacity in the form of a storage pool on the user side.

3. THE ADVANTAGES OF CLOUD STORAGE TECHNOLOGY

3.1 Reduce overall cost of ownership

In the case of using traditional storage, customers and enterprises need to purchase storage devices separately according to their own needs, and require guidance from device manufacturers, especially in high-capacity application scenarios where platforms need to be built for larger cluster storage and management, which can consume a lot of time and funds. When using cloud storage, the investment is relatively small and can be quickly put into use.

3.2 Improve scientific decision-making ability

Applying cloud storage technology in video surveillance can effectively combine cloud computing technology, video surveillance technology, and data mining technology, thereby improving the processing capability of surveillance data and providing reference for scientific management and decision-making. In the process of video surveillance data management, by applying cloud storage technology, valuable information data can be quickly and accurately identified from massive amounts of data, providing services for decision-making.

3.3 Improving the Quality of Information Storage

Cloud storage systems can provide various types of storage service interfaces, support data sharing across storage interfaces, and greatly improve the efficiency of data sharing usage.

3.4 Ensuring Information Security

Cloud storage adopts data discrete redundant storage technology, which can provide high data reliability. The damage of nodes will not cause data loss, and the damage of multiple hard drives will not cause data loss.

Moreover, the data on damaged hard drives can be quickly recovered in the global space of the system, with a recovery speed up to 20 times that of traditional storage.

4. ACCELERATE THE DEVELOPMENT TREND OF HIGH-DEFINITION, INTELLIGENT, AND NETWORKED CLOUD STORAGE SECURITY

Cloud storage must be based on its efficient massive data storage and capacity management as its core application, integrated with security application systems. Its main core technologies include virtualization technology, data security storage and protection technology, intelligent distributed video data filtering, analysis, and computing technology. Now let's give a brief overview. Virtualization technology is the process of virtualizing numerous storage devices into a single, manageable logical device form, dividing physical disks into virtual disks, and deepening the use of fine-grained management and virtual disk operation technology to achieve higher and more flexible management efficiency, performance, and capacity space. Storage virtualization technology effectively solves the unified management of storage capacity for various forms of devices and dynamic partitioning of disk capacity, achieving flexible, intelligent, and automated management of storage devices and storage spaces. As a data storage center for massive data, cloud storage integrates storage resources into a large storage system through the cloud. It should pay more attention to the management capability of high-definition videos themselves and must have a secure and reliable data protection mechanism to ensure that any device failure or catastrophic event will not result in data loss. Intelligent data filtering and analysis technology is also a development trend for efficient capacity management in cloud storage.

5. THE APPLICATION OF CLOUD STORAGE TECHNOLOGY IN VIDEO SURVEILLANCE

5.1 Application of Massive Video Data

At present, various industries and fields have put forward the demand for high-definition and networked application of video surveillance systems, especially in the context of smart city construction. The cross regional and large-scale growth of surveillance systems makes the application of cloud storage technology urgent. Based on cloud storage technology applications, video surveillance systems with higher storage device capacity can effectively cope with the current trend of massive and rapid data growth. For example, the construction of a storage pool uses multiple PB level storage products to effectively store and manage massive amounts of video data by forming a super large storage space.

In addition, the current massive development of video data further promotes the development and upgrading of intelligent analysis and image and graphic retrieval functions in video surveillance. If manual processing is still used in data supervision and processing, it will be difficult to achieve significant control effects, and even increase monitoring and management costs due to a large amount of personnel investment. Therefore, in the context of cloud storage applications, massive video data in video surveillance systems can be efficiently and conveniently stored and managed through fast retrieval functions. And intelligent analysis of video data is achieved by implementing strategy presets and applying relevant calculation methods and principles. In addition, intelligent analysis of video surveillance systems can achieve functional expansion through technological integration, or maintain a collaborative operation between automation, IoT, and intelligent analysis technologies to ensure that their system decision-making and processing can obtain more accurate and comprehensive basis support.

5.2 Application of Cloud Storage Technology in Security Video Surveillance Systems

In the future, users no longer need to purchase high-performance servers or high-capacity storage devices themselves. They only need to choose cloud services that are suitable for themselves. The cloud will provide corresponding services according to users' needs, truly realizing on-demand resource allocation and improving resource utilization. Cloud storage, for users, refers to a collection of multiple storage devices and servers, where users enjoy the data access services provided by the entire cloud storage system. Video cloud storage technology can achieve efficient and reliable storage of massive data and flexible management of space. It includes modern data processing technologies such as virtualization, data security storage and protection, intelligent analysis, and video data processing.

5.3 Massive Video Data Application

At present, various industries and fields have put forward the demand for high-definition and networked application of video surveillance systems, especially in the context of smart city construction. The cross regional and large-scale growth of surveillance systems makes the application of cloud storage technology urgent. Based on cloud storage technology applications, video surveillance systems with higher storage device capacity can effectively cope with the current trend of massive and rapid data growth. For example, the construction of a storage pool uses multiple PB level storage products to effectively store and manage massive amounts of video data by forming a super large storage space.

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6. CONCLUSION

In summary, traditional monitoring methods are difficult to meet the increasing demand for monitoring management in various fields. Thanks to the organic combination of video monitoring systems and cloud storage, automated and intelligent high-definition video monitoring can be carried out using cloud storage as a framework, providing end users with more convenient, efficient, and comprehensive monitoring modes, and maximizing the functionality and value of video monitoring systems. With the widespread application of video surveillance technology in different fields, cloud storage technology has a broader and brighter development space in the future.

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