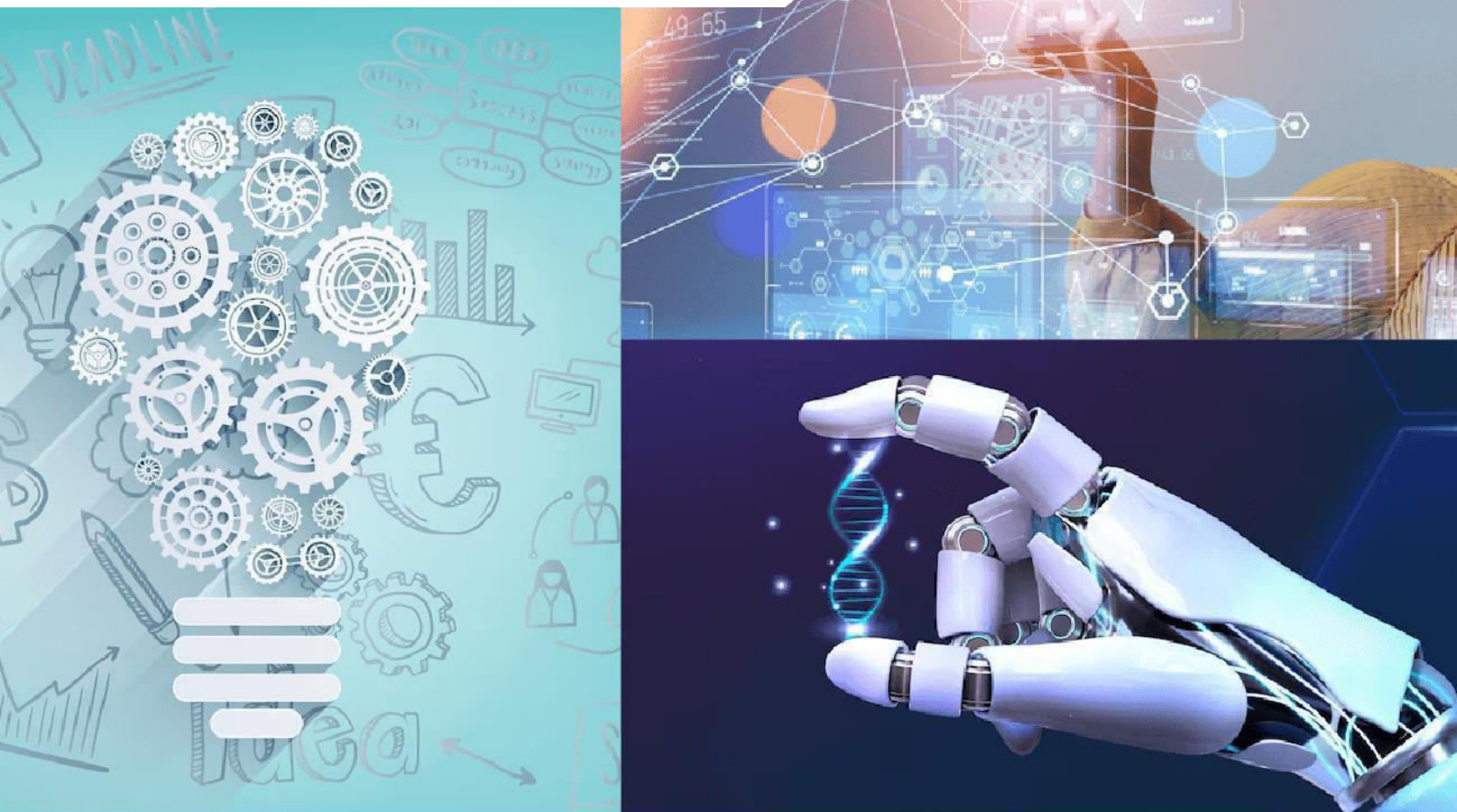




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Advanced Data Deduplication Techniques for Mobile Edge Computing

Dr. B. Ranjitha¹, O. Kavyasri², K. Aashlesh³, N. Shyam⁴

Assistant Professor, Department of CSE, Guru Nanak Institute of Technology, CSE Department, Hyderabad, India¹

Student, Department of CSE, Guru Nanak Institute of Technology, Hyderabad, India^{2,3,4}

ABSTRACT: Mobile Edge Computing (MEC) is an emerging technology that provides low-latency services by storing and processing data near end users through edge servers. However, storing duplicate data on multiple edge servers leads to high storage overhead and reduced storage efficiency. Existing cloud-based deduplication methods are not suitable for MEC environments due to limited storage capacity and latency constraints. In this paper, an efficient data deduplication technique is proposed to reduce redundant data storage and improve storage utilization in edge computing environments. The proposed system detects duplicate files before storing them and balances data distribution across edge servers. The system is implemented using Java, JSP, Servlets, and MySQL technologies. Experimental results show that the proposed approach improves storage efficiency, reduces redundancy, and enhances overall system performance in Mobile Edge Computing environments.

I. INTRODUCTION

Mobile Edge Computing (MEC) is an emerging technology that provides low-latency services by storing and processing data near end users through distributed edge servers. It is widely used in applications such as IoT, virtual reality, real-time navigation, and cloud services where fast data access is required. Compared to traditional cloud computing, MEC reduces network delay and improves system performance by moving storage and computation closer to users.

II. LITERATURE REVIEW

Dinesh Sahu – “Optimizing energy and latency in edge computing through a Boltzmann driven Bayesian framework for adaptive resource scheduling” (2025): This paper proposes an adaptive resource scheduling framework for edge computing systems to reduce energy consumption and latency. The method dynamically allocates resources based on workload and network conditions. Experimental results show improved efficiency and reduced response delay.[1]

K. Swathi – “Secure blockchain integrated deep learning framework for federated risk-adaptive and privacy-preserving IoT edge intelligence sets” (2024): This work presents a blockchain-based deep learning framework for secure and privacy-preserving IoT edge computing. The framework improves secure data sharing and adaptive risk management in distributed environments. Results show enhanced scalability, security, and reliability.[2]

X. Xia – “An online approach for cost-effective data caching in mobile edge computing systems” (2023): This paper introduces OL-MEDC, an online caching strategy for mobile edge computing systems. The approach dynamically makes caching decisions to reduce operational costs and improve data access efficiency. Experimental results show significant improvement over existing caching methods.[3]

III. METHODOLOGY

The proposed system is designed to reduce redundant data storage and improve storage utilization in Mobile Edge Computing environments using efficient data deduplication techniques. Initially, users register and log in to the system securely. After authentication, users can upload files to the edge server. Before storing the uploaded file, the system checks whether the same file already exists in the database. If a duplicate file is detected, the system prevents redundant storage and displays a duplicate alert message. Otherwise, the file is stored successfully in the appropriate edge server.

Disadvantages of existing system:

- Existing cloud-based storage systems produce high latency because data is stored far from end users.
- Duplicate data storage on multiple edge servers increases storage overhead and reduces storage efficiency.

- Traditional deduplication techniques are not suitable for dynamic Mobile Edge Computing environments with limited storage capacity.

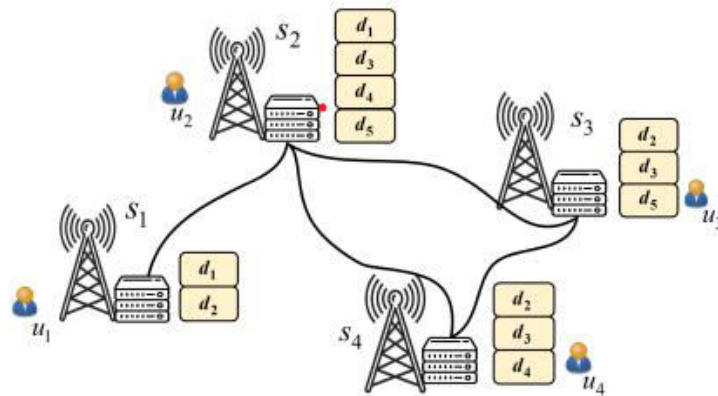
IV. PROPOSED SYSTEM

The proposed system introduces an advanced data deduplication technique for Mobile Edge Computing environments to reduce redundant data storage and improve storage utilization across edge servers. The system detects duplicate files before storing them in the database and prevents unnecessary storage duplication. It also balances data distribution among multiple edge servers to improve system efficiency and reduce server overload. The proposed system is implemented using Java, JSP, Servlets, and MySQL technologies to provide secure file upload, efficient storage management, and low-latency data access in Mobile Edge Computing environments.

Advantages Proposed System Advantages

- Reduces redundant data storage by detecting duplicate files before storing them in edge servers.
- Improves storage utilization and balances data distribution across multiple edge servers efficiently.
- Reduces network overhead and provides low-latency data access in Mobile Edge Computing environments.

V. SYSTEM ARCHITECTURE



The system architecture of the proposed “Advanced Data Deduplication Techniques for Mobile Edge Computing” consists of four major components: User, CSP (Cloud Service Provider), Edge Servers, and Database. Initially, the user registers and logs into the system to upload and search files. The uploaded files are sent to the edge server, where duplicate file detection is performed before storage. If the file already exists, the system prevents redundant storage; otherwise, the file is stored successfully in the database. The CSP manages user requests, approvals, and storage operations across multiple edge servers. The database stores user details, uploaded files, and server information securely. This architecture helps in reducing storage redundancy, improving storage utilization, balancing server load, and providing efficient low-latency data access in Mobile Edge Computing environments.

VI. MODULES

- 1. User Registration and Login Module :** This module allows users to register and securely log in to the system using valid credentials. It provides authentication and secure access to upload and search files in the Mobile Edge Computing environment.
- 2. File Upload Module :** This module enables users to upload files to edge servers through the system. The uploaded files are processed and forwarded for duplicate file verification before storage.
- 3. Duplicate File Detection Module :** This module identifies duplicate files before storing them in the server database. It prevents redundant data storage by comparing uploaded files with existing stored files and improves storage efficiency.
- 4. CSP Approval and Management Module :** This module is managed by the Cloud Service Provider (CSP) to handle user requests, approvals, and storage management across multiple edge servers efficiently.

5. Cloud Server and Database Management Module : This module manages file storage, server details, and database operations. It stores uploaded files securely, balances storage utilization among edge servers, and improves overall system performance in Mobile Edge Computing environments.

VII. IMPLEMENTATION

The proposed Advanced Data Deduplication Techniques for Mobile Edge Computing system is implemented using Java technologies such as JSP, Servlets, JDBC, and MySQL with Eclipse IDE. The system focuses on reducing duplicate data storage, improving storage utilization, and ensuring efficient data management in Edge Storage Systems. It includes modules like User, Cloud Service Provider (CSP), Admin, and Database Management for secure file upload, storage, and retrieval. The implementation improves storage optimization, reduces redundancy, and enhances overall system performance in mobile edge computing environments.

VIII. EXPERIMENTAL RESULTS



Figure. Home Page



Figure. Admin Server Details

**Figure. Admin server files storage details**

V. CONCLUSION

The proposed Advanced Data Deduplication Techniques for Mobile Edge Computing system provides an efficient solution for reducing redundant data storage in Edge Storage Systems (ESS) while maintaining low latency and balanced resource utilization. The proposed Balanced Edge Data Deduplication (BEDD) approach improves storage efficiency by intelligently identifying and eliminating duplicate files across geographically distributed edge servers. Unlike traditional cloud-based deduplication methods, the proposed system is specifically designed for Mobile Edge Computing (MEC) environments, where storage capacity, latency constraints, and data distribution play a crucial role. The implementation demonstrates improved storage utilization, reduced network overhead, enhanced system performance, and better load balancing among edge servers. Therefore, the proposed system offers a scalable, reliable, and cost-effective solution for future MEC applications such as IoT, smart devices, real-time services, and latency-sensitive applications

VI. FUTURE ENHANCEMENT

The proposed Advanced Data Deduplication Techniques for Mobile Edge Computing system can be further enhanced by integrating advanced Machine Learning and Artificial Intelligence techniques to improve duplicate data detection accuracy and intelligent storage management. Future work can focus on implementing real-time dynamic data deduplication, enhanced security mechanisms, and encrypted deduplication methods to provide better data privacy and protection in edge environments. The system can also be extended to support large-scale Edge Storage Systems (ESS) with efficient load balancing and optimized resource allocation among multiple edge servers. In addition, cloud-edge hybrid architectures, blockchain-based security, and energy-efficient storage management techniques can be integrated to improve scalability, reliability, and performance. Future enhancements may also include support for IoT-based smart applications, real-time analytics, and adaptive data caching mechanisms to provide faster response times and better Quality of Service (QoS) in Mobile Edge Computing (MEC) environments.

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