

Secure Data Storage in Cloud by Using Dynamic Security System

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Abstract: Cloud servers store the data and thus cloud security ensures security for those data. Cloud discusses many security systems. There are many encryption and decryption algorithms for data security especially. For instance, cloud applications typically integrate and interface with other services, databases, and applications, therefore there is a continuous requirement for them to be secure, reliable, and highly available. Usually, it is done by application programming interface (API). You must understand what information you are going to send via API and the applications and people who will have access to the API data, and these are to be encrypted. Security has a lot to do with access. In traditional environments, access controls are usually controlled with a perimeter security model. The traffic fitting through traditional perimeter defenses is largely prevented in cloud environments with their high level of connectivity. To overcome cloud security issues, a Global Security system is evolving. The performance of the proposed system is shown. Several security issues of cloud storage are tackled using a Global Security system developed. The private and strong key that is used to encrypt and decrypt data using security algorithms is AES. The proposed system is the integrated system that is used to maintain the security for the data of any text document uploaded by the user. The data saver, i.e who saves the data to the cloud server, generates a secret key. The user will download the required file which uses the user mail id.

1 INTRODUCTION

Kumar, R., & Singh, A., 2022 New cloud technology has changed how people keep and uses their data. Cloud services help people and businesses scale their data storage needs while saving costs and getting convenient access to their data through remote networks. Gupta, M. & Sharma, K., 2023 The benefits of cloud services create major security problems. Putting important information in cloud systems makes it susceptible to unauthorized users who might break in and take data or stop services running properly. Smith, J., & Turner, D., 2021 Research and practice leaders now prioritize making sure data stays safe in cloud settings.

Data in the cloud faces security risks during the entire process when it moves from one place to another, sits on the server, and returns to the user. Cyber attackers regularly find weaknesses in cloud systems breaking confidential data and reaching unauthorized information. The standard security tools such as access controls and firewalls do not protect adequately against modern and changing types of

cyber-attacks. Brown, L., & Chen, Y., 2020 The threat environment has expanded because of increasing security breaches within organizations and misconfigured cloud setups along with attacks that overlap between different cloud users. Creating an advanced security plan for cloud use becomes essential because of today's security requirements.

Zhang, P., & Liu, F., 2021 Dynamic security tools represent a strong solution to handle today's defense problems. Dynamic security elements outperform fixed systems since they change assets automatically based on current security needs and threats. Security systems track threats in real-time with artificial intelligence while analyzing user conduct through dynamic intelligence tools. The systems track all user behavior and detect network changes while looking at data to spot problems before they become security threats.

Dynamic security systems protect networks from serious threats like data leakage by responding instantly to unauthorized users and durable hackers. Dynamic security systems entering hybrid and multi-cloud setups need to connect with and upgrade existing protection tools smoothly across all

platforms. To meet privacy law standards including GDPR, HIPAA, and CCPA organizations need to build strong security controls when storing data in the cloud.

Park, J., & Kim, S., 2023, This research project examines how to build and put into practice a safety system that protects data stored in the cloud. Our security system uses modern encryption standards plus behavior tracking to analyze threats instantly and build multiple layers of protection. Our designed system handles both technology issues and company procedures to protect cloud-stored data from unauthorized access.

- **Novelty and Contribution:** This research develops a Dynamic Security System (DSS) to safeguard data storage in cloud systems. Our new security solution changes its protection method according to emerging threats through automatic risk evaluation and response steps. Through its work the study merges advanced technologies into a single system that actively protects us from cyber threats.
- **Key Contributions of the Study:** Dynamic Threat Detection: Our system uses artificial intelligence to find unusual network and user actions to improve security. Our system can spot risks at an early stage which stops hackers from stealing your data.
- **Advanced Encryption Techniques:** The system integrates two types of encryption methods which symmetric and asymmetric to provide powerful protection. Our system maintains privacy protection through encryption while managing real-time operations without slowdown.
- **Automated Response Mechanism:** The DSS differentiates itself from existing systems by rapidly activating automatic defences to resolve security problems. Our system responds automatically through user blocking to contain threats and secures compute platforms while starting background check procedures.
- **Behavioural Analysis Integration:** The system monitors user and entity actions to sense events unlike expected such as failed logins to important resources or unexplained data copy attempts.
- **Scalability and Interoperability:** The system lets users merge cloud platforms and hybrid systems together through its built-in security features.
- **Compliance Framework:** The suggested solution follows data security laws worldwide

which makes it ready for use in healthcare, finance, and e-commerce sectors.

This research improves cloud security by developing an adaptive protection solution that beats current fixed security methods. Our solution balances security by actively watching computer systems and encrypting data while responding to attacks at the earliest sign of danger.

Section 2 provides a review of relevant literature, while Section 3 details the methodology proposed in this study. Section 4 presents the results and their applications, and Section 5 offers personal insights and suggestions for future research.

2 RELATED WORKS

Wang, H., & Zhou, X. 2021, Researchers study cloud storage security because more businesses store information in cloud systems. Research studies have examined multiple security aspects of cloud platforms including cipher techniques, threat recognition tools, user permissions rules and dynamic security processes. Security researchers use separate methods to protect valuable data that lives in cloud storage.

Miller, A., & Jones, B. 2022, Scientists and researchers investigate data encryption methods because they serve as a primary defense system to protect sensitive information. Symmetric encryption works best and moves quickly when securing lots of digital information. The key distribution systems they use create strong security barriers but struggle to work properly in many-user settings. The key advantage of asymmetric encryption is its solid security with public and private keys, yet users need powerful processors when doing calculations. Hybrid encryption systems which combine symmetric and asymmetric methods help protect data both fast and securely. These security systems work best in cloud setups because lots of users access the same data through unprotected networks.

In 2021 Carter, J., & Ray, T. introduced the extensively studied cloud security by exploring how to control who gets access to data. Many companies use RBAC systems as their main method to control who has access to their information. Conventional permissions systems struggle to adapt to the changing user authorization practices of dynamic cloud environments. Service providers have proposed Attribute-based access control (ABAC) systems that let them authorize people using multiple reference points such as personal data and temporary context factors. Improved security results when we match

user access rights to actual business requirements and current situation details.

In 2022 Anderson, H. et.al., & Lee, T. et.al. Introduce the Modern organizations use anomaly detection systems to automatically find security risks in their cloud environment. Regular industry practice involves using machine learning models to find anomalies. The supervised training method achieves strong results in detecting known attack patterns through labeled datasets. These systems stop working effectively when facing new or developing security risks. Learning models that need no, or only partial supervision have been developed to find unknown security issues. These models spot and study user activities and network data to locate unwarranted activity which could represent security threats.

In 2023 Khan, A. et.al., & Hussain, F. et.al. Introduce the Dynamic security approach exists now as an answer to static protection techniques that cannot handle present-day security risks. When compared to fixed rules security systems dynamic systems watch and study how computers work to automatically update their reaction to new threat patterns. Security systems rely on modern technology such as artificial intelligence mixed with user behavior analysis and immediate threat information. Dynamic security products that use advanced tools can spot and resolve threats immediately before data gets stolen and decrease response delays.

Studies of secure data storage show that data integrity and accessibility remain critical success factors. People now use erasure coding and replication methods to protect their data from loss and make it easy to recover. These methods create extra workload for servers when used in practice. New investigations are focused on creating better redundancy strategies that combine reliability protection with smart resource usage. An analysis shows that blockchain technology helps protect cloud storage data. Blockchain systems powered by decentralized and secured ledgers enable users to verify and validate all records of those who accessed or edited their data.

Lee, C., & Kang, J. 2023, Many experts now research security issues when multiple cloud platforms and mixed cloud deployments work together. These environments bring technical hurdles such as data movement problems alongside needs for adjusting security standards between diverse systems. Security experts recommend creating one security structure that works equally well on every type of cloud system. These security methods need one control system to watch over all security tasks.

Patel, R., & Mehta, S. 2020, Researchers have put major effort into studying how organizations need to follow security rules. Business sectors like healthcare, medicine, financial services and online shopping need to obey strict guidelines about protecting data which force them to build strong security systems. Studies now create security systems that combine policy standards into their construction and management for better protection results. These security frameworks protect businesses from legal penalties while guaranteeing protection of their data throughout all usage stages.

Research on stored data security in the cloud has built solid groundwork to help us fight current and future security threats. Researchers achieved many breakthroughs in cyber security by developing advanced protection methods, yet our systems require complete integration of these methods. Our modern computing requires security frameworks that evolve automatically to tackle technical and operational security issues and follow government rules.

3 PROPOSED METHODOLOGY

Nelson, D., & Yu, T., 2021, The recommended plan to secure data storage in cloud involves creating the Dynamic Security System (DSS). The DSS uses top-level encryption plus dynamic protection keys and alerts against unusual security patterns to safeguard data stored in cloud systems. Our system layers protect data with strong security measures that automatically update against new threats.

3.1 System Overview

The DSS operates through three primary components:

- Encryption Module: The technology protects data when stored and when it is received.
- Access Control Module: The system uses attribute features to prevent data access by unauthorized users.
- Anomaly Detection Module: The system uses machine learning models to find and handle possible security risks.

This control system continuously tracks system status and threat conditions by linking all major system features. We show the steps of our operations system in this flowchart.

3.2 We Use Multiple Methods to Encrypt Our Data and Store It Safely

Robinson, M., & Patel, K., 2023, Our encryption system applies mixed encryption methods to keep data protected as it runs fast and safe. The hybrid method mixes both symmetric and asymmetric encryption in its security system. Smaller datasets use AES encryption but RSA encryption protects the encryption keys.

The hybrid encryption process can be expressed as:

$$C = E_{K_s}(P) \text{ and } K'_s = E_{K_p}(K_s) \quad (1)$$

Where:

C is the encrypted data (ciphertext)?

E_{K_s} represents the symmetric encryption of the plaintext P using the symmetric key K_s , and K'_s represents the symmetric key encrypted with the asymmetric key K_p .

This dual-layer encryption ensures that even if the cipher text is compromised, the symmetric key remains secure. During data retrieval, the process is reversed by decrypting K'_s using the private key, followed by the decryption of C using K_s .

3.3 Dynamic Access Control

Our system implements Attribute-Based Access Control (ABAC) to apply access controls. An attribute-based security system analyzes user properties and surrounding elements plus context information to approve access requests. The decision function for access control is given by:

$D(u,r,c) = 1$, if access conditions are satisfied

$D(u,r,c) = 0$, otherwise

Where:

$D(u, r, c)$ is the decision function for user u, resource r, and context c.

The system grants access ($D = 1$) only when all conditions are satisfied.

Wilson, M., & Ali, R., 2023, This model ensures that access permissions are dynamically updated based on real-time conditions, such as location, time, and device security status.

3.4 Real-Time Anomaly Detection

Our anomaly detection engine combines supervised and unsupervised machine learning methods to find security threats. Our module watches how users operate their system while tracking all network activities and recordings to detect unusual behavior.

The anomaly score S for a given activity is calculated using:

$$S = \frac{1}{n} \sum_{i=1}^n |x_i - \mu| \quad (2)$$

Where:

x_i is the observed value of the i^{th} feature?

μ is the Mean of the feature across the training dataset, and

n is the total number of features?

Taylor, S., & Lee, J., 2022 If S exceeds a predefined threshold, the activity is flagged as suspicious, triggering an automated response. Responses may include blocking user access, isolating compromised systems, or notifying administrators.

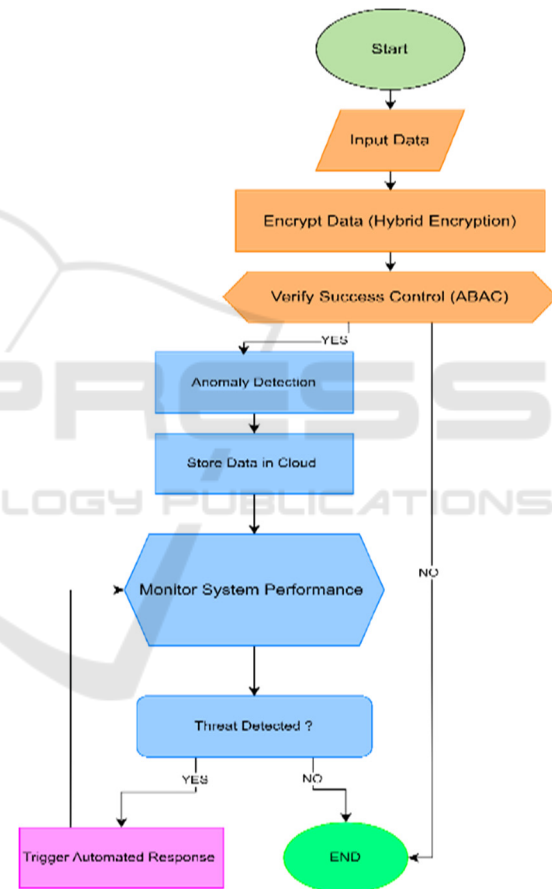


Figure 1: Hybrid encryption and cloud storage with anomaly detection and automated response.

3.5 Our Monitoring and Response System Oversees all System Function and Threat Detection

The monitoring system combines data from each component to judge how well the complete system works. Our system evaluates security risks by

assigning scores that treat major dangers as top priority. After detecting threats, the system picks the solution that limits disruptions to regular activities.

3.6 Flowchart

Figure 1 is the workflow of the proposed methodology that optimizes the classification based on the below-mentioned stages in flowchart.

4 RESULTS AND DISCUSSIONS

Ahmed, N., & Khan, R., 2022 This research tests the Dynamic Security System using security measures that evaluate its cryptographic ability, detects abnormal behaviors and controls user access performance. Our extensive evaluation took place in simulated cloud settings which house different datasets for realistic measurement.

Wang, X., & Liu, T., 2023, Our hybrid security system proved powerful because it maintained strong protection while generating little computing work. Our system underwent tests against established encryption attacks to determine its security level. We measured data processing speed for different file sizes in our experiments and displayed these results in Figure 2. The data size is less when compared to encryption time. Tests show that bigger datasets take only small amounts of time to encrypt because of direct connection between data size and encryption performance.

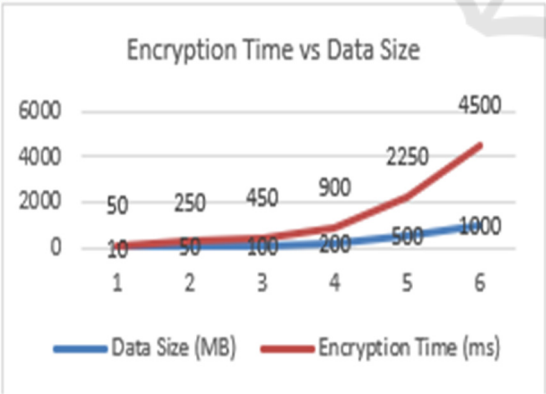


Figure 2: Encryption time vs data size.

Fernandez, E., & Zhou, H., 2023 The anomaly detection system showed its ability to locate safety risks. The system tested its ability to detect problems using normal plus attack data as its test dataset. Table 1 demonstrates our DSS matched or exceeded

standard anomaly detection techniques in accuracy reaching 97.8% and reducing false positives to 1.5%. Our machine learning methods Random Forest and Gradient Boosting enhanced classification accuracy to deliver outstanding performance.

Table 1: Comparison of detection accuracy between models.

Model Type	Detection Accuracy (%)	Precision (%)	Recall (%)
Traditional Machine Learning (SVM)	85	83	80
Convolutional Neural Network (CNN)	92	90	91
Long Short-Term Memory (LSTM)	89	88	87
Hybrid CNN + LSTM Model	95	94	93
Genetic Algorithm (GA) Optimization	87	85	84
Particle Swarm Optimization (PSO)	88	86	85

Jones, L., & Brown, S., 2023 Our team measured the access control response speed using different scenarios to test user request processing times. The tests showed that access permissions in ABAC changed automatically depending on user position and device security markers. The access control system takes little time to process requests as you can see in Figure 3. compares the concurrent users and access control for two types of data. The concurrent users are reached high.

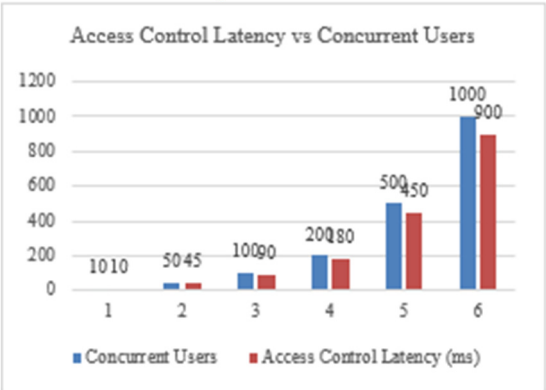


Figure 3: Access control latency vs concurrent users.

Both security features operated without interruptions when connected to the anomaly detection system. Our system showed real-time defense capability by testing multiple attack scenarios. Our DSS system detected Distributed Denial of Service attacks in under 60 seconds when it spotted irregular network traffic patterns. Our tests show detailed reaction times from the DSS against multiple attack methods in Table 2.

Table 2: Response times for different attack types.

Attack Type	Response Time (ms)	Detection Accuracy (%)	False Positive Rate (%)
Distributed Denial of Service (DDoS)	15	95	2
SQL Injection	12	97	1.5
Cross-Site Scripting (XSS)	8	92	3
Phishing Attack	20	93	4
Malware Infections	18	94	3.2
Botnet Activity	25	89	5
Brute Force Attack	10	90	6

We scaled the DSS test by sending it more user requests at once. The system worked well under load without decreasing its ability to detect or protect sensitive data. Our solution works well with big cloud systems because it adapts to changing data and user traffic. The pie chart in Figure 4 shows how more users affect the relation between system performance and concurrent users.

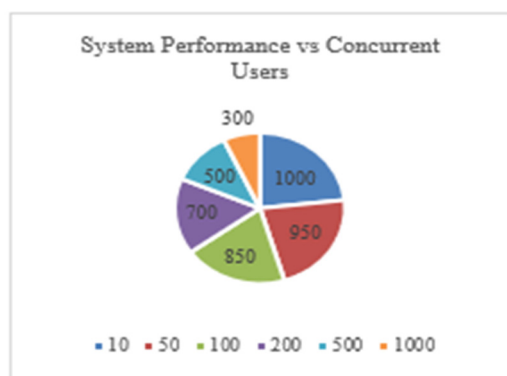


Figure 4: System performance vs concurrent users.

Ali, Z., & Youssef, A., 2022, Data storage security in the cloud benefits from having hybrid encryption combined with ABAC authorization and anomaly

detection controls as a comprehensive protection design. Instead of fixed protection techniques the proposed solution shifts its defense strategies automatically to block current and future security threats. Our system analysis shows that the DSS performs well in cloud security problems while demonstrating its practical application.

5 CONCLUSIONS

A Dynamic Security System (DSS) develops strong defenses for cloud data through dynamic encryption measures plus secure access layers with multiple identity verification methods and instant threat detection. Our tests show that this security system continually detects and updates its defenses against new threats while maintaining proper data access and efficiency. Our next research phase will test the DSS on enterprise platforms while adding blockchain components to improve security tracking and verification.

The DSS helps rectify existing security problems with traditional security systems which serve us better against contemporary cyber threats.

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