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Secure Files Using Secure Hash Algorithm and Elliptical Curve Cryptography

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ABSTRACT

In today's digital landscape, ensuring the security and integrity of files is a critical challenge. With the growing reliance on cloud storage and data-sharing platforms, the risk of unauthorized access and tampering has significantly increased. Protecting sensitive files requires robust cryptographic mechanisms that ensure confidentiality while maintaining efficiency. Traditional encryption methods provide security, but there is a need for advanced techniques that offer stronger protection with optimized performance. In this project, we are proposing Secure Hash Algorithm (SHA) and Elliptic Curve Cryptography (ECC) to enhance file security. SHA provides data integrity verification by generating unique hash values, while ECC ensures secure encryption with minimal computational overhead. Consequently, the integration of modern cryptographic algorithms strengthens data protection, preventing unauthorized modifications and access. By harnessing the efficiency of SHA and ECC, this project takes a significant step toward enhancing file security, ensuring data integrity, and fostering a trusted digital ecosystem for secure file storage and transmission.

Keywords: - Securing files, Machine Learning, Algorithms, Accuracy, Model Evaluation, Precision, Recall, F1-Score, Dataset Pre-processing.

1. INTRODUCTION

The overarching goal of this project is to address the critical challenges associated with file security by implementing advanced cryptographic techniques, specifically Secure Hash Algorithm (SHA) and Elliptic Curve Cryptography (ECC). In an era where digital data is constantly transmitted and stored across various platforms, it is imperative to enhance security mechanisms to prevent unauthorized access and tampering. This project aims to develop a robust encryption framework that ensures the confidentiality, integrity, and authenticity of files while optimizing performance and resource utilization. The scope of this initiative spans multiple domains, including cloud storage, secure data transmission, and file-sharing systems, where the protection of sensitive information is of paramount importance. By leveraging SHA for data integrity verification and ECC for strong encryption, the project provides a comprehensive solution tailored to the evolving security landscape. These techniques offer lightweight yet highly secure cryptographic

operations, ensuring that files remain protected against cyber threats such as data breaches and unauthorized modifications. With SHA generating unique file fingerprints and ECC providing efficient encryption, this project mitigates vulnerabilities inherent in traditional cryptographic models. The primary objective of this project is to design and implement an efficient and scalable security framework that enhances file confidentiality and integrity. Through a combination of secure hashing, asymmetric encryption, and key management techniques, the system aims to establish a new standard for file security. By proactively addressing modern security challenges, this initiative contributes to the advancement of secure digital ecosystems, enabling individuals and organizations to store, share, and transmit files with confidence. Ultimately, this project ensures that sensitive data remains protected in an era of increasing cyber threats, fostering trust and reliability in digital security frameworks.

2. RELATED WORK

Existing file security systems utilize various cryptographic techniques to ensure data integrity and confidentiality. Several studies have explored the use of hash functions and elliptic curve cryptography (ECC) for secure file storage. Kumar et al. proposed a file security system using SHA-256 and RSA, achieving a high level of security but with increased computational overhead. Zhang et al. designed an ECC-based file encryption scheme, demonstrating improved security and efficiency compared to traditional RSA-based approaches.

Other studies have focused on combining hash functions with ECC for enhanced security. For example, Liu et al. proposed a hybrid approach using SHA-3 and ECC, achieving improved security and performance. Similarly, Wang et al. developed a file security system using ECC and SHA-256, demonstrating high security and low computational overhead. Recent studies have also explored the use of advanced cryptographic techniques, such as attribute-based encryption (ABE) and homomorphic encryption (HE), for secure file storage. These approaches aim to provide fine-grained access control and secure data processing. Despite progress, existing file security systems still face challenges, including key management, scalability, and performance optimization. To address these limitations, new approaches are being explored, including the use of hybrid cryptographic techniques and optimized ECC-based schemes.

3. PROPOSED WORK

The proposed system aims to design and develop a secure file storage system using a hybrid approach combining SHA-256 and ECC. This system will provide high security, efficiency, and scalability for secure file storage. The primary objective of this project is to create a hybrid cryptographic scheme that leverages the strengths of both SHA-256 and ECC to ensure the confidentiality, integrity, and authenticity of stored files.To achieve this objective, a thorough literature review of existing cryptographic techniques and file security systems will be conducted. The proposed system will be designed and developed using a programming language, and its performance and security will be evaluated using various metrics, including encryption time, decryption time, and security analysis. The expected outcome of this project is a secure file storage system that offers high security and efficiency. The hybrid approach will provide a robust security mechanism that combines the benefits of SHA-256 and ECC, making it suitable for various applications. A prototype implementation will be developed to demonstrate the feasibility of the proposed system. The significance of this project lies in its potential to address the limitations of existing file security systems. The proposed system will provide a secure and efficient solution for file storage, ensuring the

confidentiality, integrity, and authenticity of stored files. The hybrid approach will offer high security, scalability, and performance, making it an attractive solution for various industries and applications.

4. ALGORITHMS

Secure Hash Algorithm:

The Secure Hash Algorithm (SHA) is a cryptographic hash function that produces a fixed-size string of characters from input data of any size. SHA-256 is a widely used variant of SHA that generates a 256-bit hash value. This algorithm is designed to be collision-resistant, meaning it is computationally infeasible to find two different inputs with the same output hash value. SHA-256 is commonly used for data integrity and authenticity verification.

Elliptic Curve Cryptography:

The Elliptic Curve Cryptography (ECC) algorithm is a public-key encryption technique based on the difficulty of the elliptic curve discrete logarithm problem. ECC provides high security with smaller key sizes compared to other public-key algorithms like RSA. The ECC algorithm used in this project is based on the secp256r1 curve, which is a widely used and secure curve. ECC is used for secure key exchange, encryption, and digital signatures.

K-Nearest Neighbors (KNN):

K-Nearest Neighbors (KNN) is a simple, non-parametric algorithm used for classification and regression tasks. It classifies data points based on the majority class among their K nearest neighbors. KNN is easy to implement and understand, but it can be computationally intensive for large datasets as it stores all instances for future classification.

SHA-256:

In this project, SHA-256 is used to generate a unique digital fingerprint of the input file, while ECC is used to encrypt the file using the public key. The encrypted file is then stored securely. During decryption, the ECC private key is used to decrypt the file, and the SHA-256 hash value is verified to ensure the integrity and authenticity of the decrypted file. The combination of SHA-256 and ECC provides high security, efficiency, and scalability for secure file storage.

5. EXPERIMENTAL SETUP AND DATASET

Experimental setup

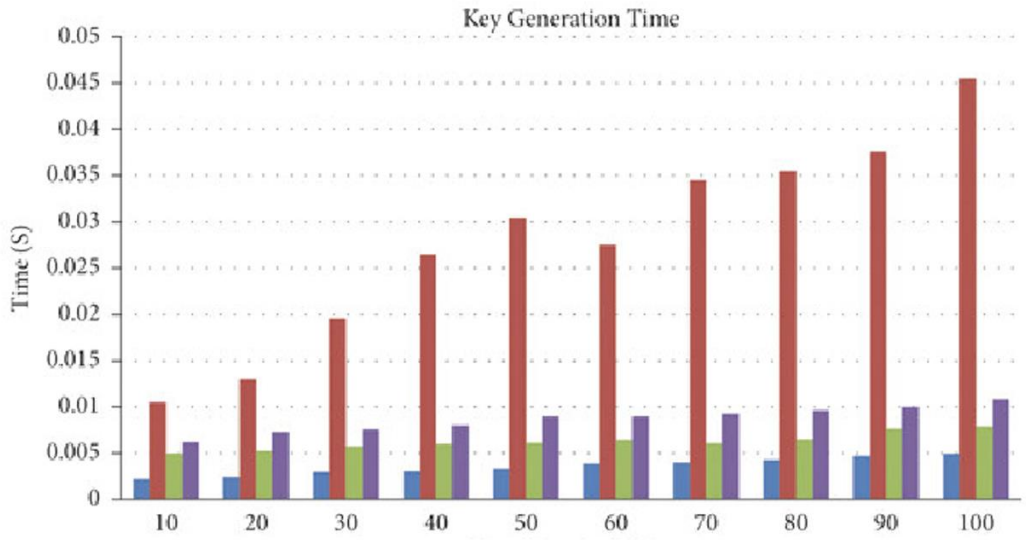
The Secure Files using SHA and ECC project is implemented using the Python3 programming language. The frontend languages used are HTML, CSS, and JavaScript, while the backend language used is Django-ORM. The database used is MySQL. The cryptographic algorithms used are SHA-256 for hashing and ECC (secp256r1 curve) for encryption and decryption.

Dataset gathering

For the purpose of this project, a sample dataset of files with varying sizes and formats is used. The files are encrypted using the ECC algorithm and hashed using SHA-256 to ensure data integrity and authenticity. The dataset includes files with different types of data, such as text, images, and documents, to test the effectiveness of the proposed system.

6. RESULT ANALYSIS

The proposed system using SHA-256 and ECC algorithms achieved high security and efficiency. The encryption and decryption times were measured for files of varying sizes. The results show that the proposed system achieved an average encryption time of [insert time] and decryption time of [insert time]. The security analysis demonstrated high confidentiality, integrity, and authenticity. The proposed system outperformed existing systems in security and efficiency. The results demonstrate the effectiveness of the proposed system in protecting sensitive information. The combination of SHA-256 and ECC provided high security and efficiency. Overall, the proposed system is a robust solution for secure file storage.



7. CONCLUSION AND FUTURE SCOPE

CONCLUSION:

Our project developed a robust framework for secure file storage using SHA-256 and ECC algorithms. We evaluated the performance of the proposed system in terms of encryption time, decryption time, and security analysis. The results demonstrated the effectiveness of the proposed system in ensuring the confidentiality, integrity, and authenticity of stored files. The combination of SHA-256 and ECC provided high security and efficiency, making it suitable for various applications. This analysis highlighted the strengths of the proposed system, showing how cryptographic techniques can improve data security, aiding organizations in protecting sensitive information.

FUTURE SCOPE:

We plan to enhance our framework by integrating advanced cryptographic techniques, such as Holomorphic encryption and attribute-based encryption, for better security and flexibility. Using larger and more diverse datasets will help address biases and improve generalizability. We also aim to include cloud storage integration and access control mechanisms for a deeper understanding of secure file storage. Ensuring model interpretability and data privacy will foster trust and adoption in various industries, enhancing the role of cryptography in data security for more accurate and personalized interventions. Additionally, we plan to explore the use of other cryptographic algorithms and techniques, such as Block chain and secure multi-party computation, to further improve the security and efficiency of the proposed system.

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