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CRYPTOGRAPHY IN CYBER SECURITY

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ABSTRACT

This paper gives complete guidelines for authors submitting papers for the IJESET Journal. This research paper provides a comprehensive review of cryptography, focusing on the principles, applications, challenges, and future prospects of cryptography. Taking a data driven approach, this article explores the role of cryptography in protecting digital information, reviews cryptographic techniques, and discusses the importance of cryptographic techniques in ensuring data security. This essay discusses cryptography, one of the primary techniques for information security, emphasizing both its historical development and contemporary applications. Data includes documents, images, and information necessary to support exploration and visualization. Security has become increasingly important in many industries in recent years. This does not mean that new information should be protected; this. It dates back to World War I and even the days of Caesar, when encryption was used to send data securely between servers.

KEYWORDS

Cryptography, Caesar, Contemporary Applications

1. INTRODUCTION

Originating from the Greek words "kryptos" (meaning "hidden") and "graphein" (meaning "writing"), the name "cryptography" describes the practice of spying on unopened hidden boxes.. It protects data through encryption and allows only authorized parties to decrypt it. Cryptography protects users' privacy, data integrity, identity, and the ability to avoid online conflict.

Encryption is widely used in network security and vice versa. Cryptography protects our digit al assets like physical locks and security. Due to the increase in cybercrime, cryptography is e essential for improving cyber security infrastructure. In other words, we can say that cryptography is the practice of ensuring the security of communication by converting plaintext into ciphertext using encryption algorithms and keys. It is used to protect sensitive data from unauthorised access and ensure data integrity. The two main types of encryption are symmetric key encryption, which uses the same key for both encryption and decryption, and asymmetric key encryption, which uses two keys—public and private—for both operations. Cybersecurity uses for cryptography include digital signatures, protecting sensitive data in military and intelligence operations, and safeguarding online transactions. Key management does, however, still present problems, such as the possibility of quantum computing and human mistake.

2. LITERATURE REVIEW:

Cryptography is a method of protecting the confidentiality of words and data. Abdalbasit Mo hammed Qadir and others explained how it is used at a higher level today, but no one knows how to use it. This is a very old technology still under development. As Susan and colleagues note, hackers are always finding new ways to attack systems and networks, leading to the creation of new courses to prevent

future attacks. Internet and computer security is a rapidly developing field. This security course focuses on algorithms and mathematical concepts such as hashing and encryption. Sandeep Tayal and others discuss how the emergence of social media and the web industry presents major challenges in information security; much information is created and distributed securely over the internet. This is where cryptography and its methods come into play and become very important. This article presents the different methods that networks use to encrypt and protect data transmission. Anjula Gupta and others show how challenging information security is in computing and communication. This article also describes various asymmetric encryption methods used to encrypt and protect data. By N. Varol and colleagues. It is a symmetric encryption technique where the text that has to be encrypted is first transformed into a password that the algorithm is unable to decipher. This is usually applied to audio and text information. Regarding the objectives of cryptography, James L. Massey talks about the two primary objectives that cryptography seeks to fulfil: confidentiality and/or authenticity. Thought of by Callas, J. Discussions are held on subjects such technology privacy support, security, encryption, and regulatory issues pertaining to cryptography and technology anonymity. According to him, the future of cryptography will be determined by how the community utilises it and will rely on current laws, conventions, and regulations, all of which the community desires.

According to him, there are a lot of holes in the research on cryptography that need to be addressed by qualified scientists. Actually, systems that generate strong keys are essential to the future of cryptography because they guarantee that access is granted only to those who possess the correct key and not to others. Lastly, Karas makes the case that societal attitudes towards privacy protection and communication reflect natural law changes brought about by events like the terrorist attacks of September 11, 2001. Cryptography will therefore always be crucial for protecting information, both today and in the future. and Simon's (perhaps theoretical or practical) fairness hypothesis.

Schnell concluded by saying that privacy is bad and that it is incorrect to view anonymity as a form of protection because protection based on covert storage can be challenging. Confidentiality cannot be reclaimed if it is not confidential. Schneier went on to say that the idea behind using encryption technology—which relies on short, easily distributable keys—is to guarantee that the process of encrypting data is secure, transparent, and offers adequate protection. The only way to increase security is to submit to public inspection. Valour, N. et al. Learn how to encrypt a word or phrase using symmetric encryption. The data to be studied in this study is first transformed into an encrypted password that cryptographic techniques are unable to decode.

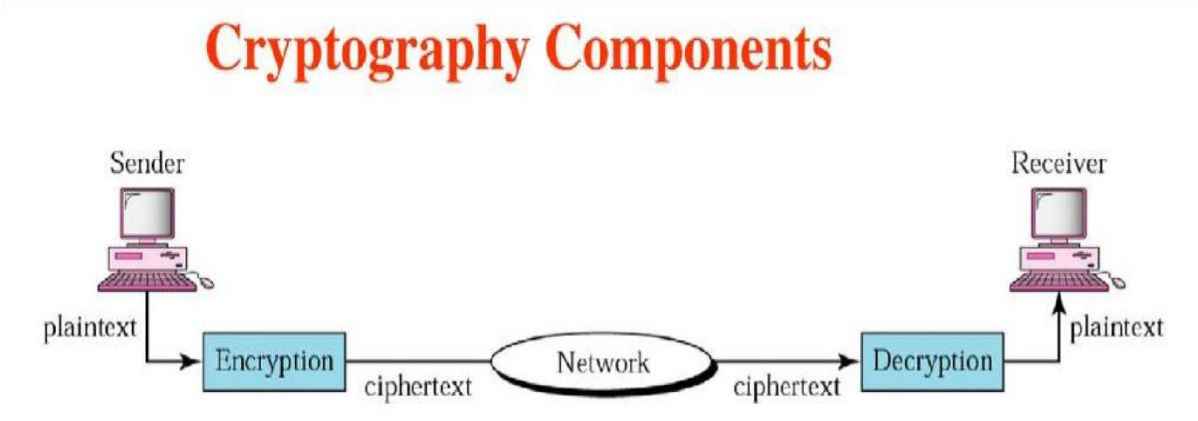

Figure 1 : Overview of Cryptography

https://www.slideserve.com/zeke/cryptography-and-network-security

2.1. COMPONENTS:

A. Plain text: Plain text is used to identify simple words or messages and encrypt results. It is a message in human-readable form. Encryption has plain text that can be read before it is encrypted or

after it is decrypted. For example, Paul wants to send a message to Justin: "Cryptozoology and cyber security are related". Here - about encryption and internet security- text only.

B. Ciphertext: Cipher text is the algorithm's unintelligible output. The cipher text in encryption is encrypted data. The encrypted text is formed, for instance, Ajd672#@91uk l8 *^ 5% uh Bhywu29.

C. Encryption: Data is coded by encryption to prevent unauthorized individuals from accessing it. Encryption transmits hidden messages by using encryption techniques. A component of encryption is the use of keys and encryption algorithms. The encryption procedure is managed by the sender.

D. Decryption: Decryption is used to describe manually decrypting data using a valid code or key. Encryption uses encryption techniques where the addressee receives the original message from the unread text (encrypted text). A component of the decryption process is the decryption key and algorithm. The algorithms used for encryption and decryption are often the same.

E. Key: A key is a parameter or message that specifies the output of an encryption algorithm. .It works privately\and ensures secure communication. For example the sender uses the +3\key (encryption key) to encrypt white text, the result is the encrypted text "Fuswrjudskb". Likewise, if the recipient uses the key-3 (decrypted key) to decrypt the "Fuswrjudskb" file, the resulting plaintext will not be "encrypted.

2.2. DATA SECURITY:

An (unnumbered) acknowledgements section may be inserted if required. The main components used for data security are:

They are as follows:

- **A. Confidentiality:** The sender and recipient must have access to the content of documents marked as confidential.
- **B. Authentication**: Authentication is used to generate personal certificates. This verification process ensures that the data source is correctly identified.
- **C. Method:** Reliability\guaranteed because the content of the data remains unchanged when it reaches the recipient.
- **D. Non-negation:** That which cannot deny something\is called non-negation.
- **E. Access Control:** This will help you define which users can access your files.
- **F. Availability:** This means that only authorized users can use the resource.

2.3. METHODOLOGY:

The study and practice of securing communications in the presence of other parties, or adversaries, is known as cryptography. It is intended to safeguard confidential information from unwanted access and guarantee data integrity when communicating. Techniques for cryptography can be separated into multiple primary categories:

Access and decryption: Using encryption techniques and keys, cryptography transforms plaintext into ciphertext. Afterwards, depending on the type of encryption employed, the ciphertext is either decoded back into plaintext using the same key or a different key.

Encryption methods: Symmetric key encryption and asymmetric key encryption are the two primary forms of encryption. Asymmetric key encryption employs two keys—a public key and a private key—instead of symmetric key encryption, which uses a single key for both encryption and decryption.

Hash function: A mathematical process known as a hash function can transform data of any size into an output size. They are frequently employed to confirm the accuracy of information and make sure it hasn't been fabricated.

Key management: Key management is crucial for maintaining the security of communications in cryptography. Creating, distributing, storing, and destroying keys are all part of key management.

Challenges: Cryptography faces many challenges, including key management, human error, and the threat of quantum computing.

Applications: Cryptography has many applications, including online security, digital signatures, and protecting sensitive information in military and intelligence applications.

Encryption methods involve creating and analyzing processes to prevent malicious third parties from sharing information between two parties. It also includes the study of secure communication

techniques in the presence of adversaries, such as encryption and decryption algorithms, key management, and the use of hash functions to verify data integrity.

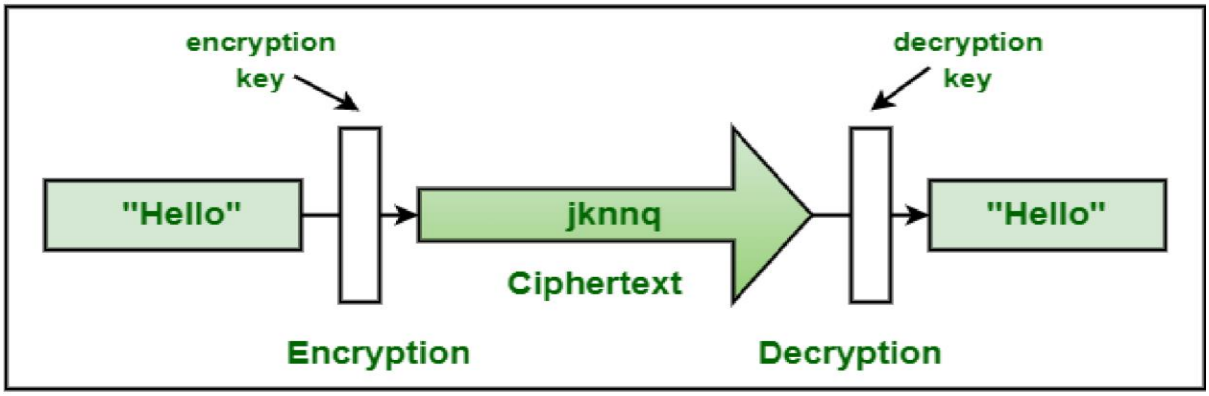

Figure 2: Mechanism of Cryptography
https://medium.com/@tripathyavisarika/should-strong-encryption-be-banned-4b5f3f0b3cee

2.4. MAIN AREAS OF CYBER SECURITY:

Application Security: Any software that users use to carry out their business activities needs to be safeguarded, whether it's developed by IT personnel or by users. All applications have vulnerabilities that an attacker can exploit to compromise the application's user's security.

Information Security: Information Security is a collection of management processes, tools, and policies designed to protect, detect, collect, and respond to digital as well as non-digital information threats.

Email Security: Phishing attacks take advantage of people's personal information to trick them into visiting a website with malware. Message Blocked by Email: Algebra Journal Statistics. External Message Security: Protects and controls external messages, prevents unauthorized access to sensitive information.

Mobile Device Security: Cybercriminals target mobile phones and applications. Users will need to configure mobile devices for network security.

Internet Security: Websites, Internet applications and Internet services.

BLOCKCHAIN CRPTOGRAPHY

A blockchain is a distributed ledger composed of growing lists of items, or blocks, linked securely by cryptographic hashes. With its ability to combine distributed data storage, peer-to-peer transmission, digital encryption, consensus processes, and other computing technologies, blockchain has become one of the most inventive application models.

It has offered a reliable platform for the decentralized, safe sharing of information. Actually, the fundamental components of blockchain technology are digital encryption technologies, which highlights blockchain cryptography.

Assuring the security of user and transaction data is a necessary prerequisite for promoting blockchain's adoption. What role does cryptography play in blockchain, then? The conversation that follows aims to consider the fundamentals of blockchain technology and cryptography as well as various forms of cryptography that are used in blockchain networks.

2.5 THE SIGNIFICANCE OF SECURITY FOR BLOCKCHAIN:

Let's take a moment to consider the blockchain itself before delving into how cryptography functions in it. In essence, it can refer to a distributed database so that it provides immutability, traceability, security, and decentralization. Blockchain presents a new method for multiple users to mutually maintain nodes, replacing the requirement for old methods of maintaining central nodes.

It can therefore assign information supervision to several parties while maintaining the necessary degrees of data quality and reliability. The three different kinds of blockchain platforms are another significant blockchain-related topic. There are three different kinds of blockchain platforms: alliance, private, and public chains. Every node in a public chain might effortlessly join or leave the blockchain based on their own choices. Private blockchains, on the other hand, have requirements that must be met in order for participating nodes to be eligible. The various member organizations run the alliance chain together. Blockchain has been closely linked to the banking sector throughout the years. On the

other hand, it has demonstrated the encouraging possibility of transforming our society's core principles while also bringing value to various industries.
What connection does blockchain have with cryptography, then? Because all user transaction data is stored on the blockchain, it acts as a stand-in for distributed databases. Consequently, it makes sense to conclude that the blockchain has a much greater need for security performance.
There is no single node in blockchain technology because it uses a decentralized, peer-to-peer network paradigm, and nodes are not required to trust one another. Blockchain must therefore preserve transaction integrity while ensuring the necessary security measures for transaction data over unsafe networks. Thus, cryptography becomes a prerequisite for blockchain in order to ensure data consistency and safeguard user privacy and transaction data.

WHAT DOES CRPTOGRAPHY BRING FOR BLOCKCHAIN?

Having a thorough understanding of cryptography is crucial before delving into the specifics of blockchain cryptography. What is the meaning of cryptography? In actuality, encryption is about hidden messages. As a result, techniques for cryptography have been created to provide complete or simulated anonymity.

The primary goals of cryptography's applications are to protect participants and transactions, avoid double spending, and have little impact. There are numerous applications for cryptography. It occasionally aids in preventing certain kinds of network traffic from happening. Nevertheless, it can also be used to analyze shifts in digital assets and tokens.

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Learning blockchain cryptology is challenging. Nonetheless, by considering cryptography's operation, you can comprehend it more thoroughly and with more ease. Use the radio signal on your car radio, for instance, to assist you in hearing announcements. Everyone is free to listen in on the broadcast.
Conversely, as an illustration of radio contact between two soldiers. In order to ensure that only those involved can receive and comprehend the information, communication with this level of protection will be extremely safe and encrypted. Blockchain applications for cryptography can be viewed in the same manner.

In actuality, cryptography is a method for securely communicating with two or more parties. Prior to transmitting the message to the recipient, the sender encrypts it using an algorithm and a key. The original communication will be recovered by the recipient via decryption. What then is the significance of cryptographic research? The encryption key is specifically referenced in the response.

Encryption keys guarantee that transactions, messages, or sensitive data cannot be read by unauthorized readers or recipients. They are crucial instruments for guaranteeing that the intended receiver can only read and process specific messages, valuable data, or transactions. Keys can therefore give data "encryption" qualities.

The majority of blockchain applications, particularly those on open blockchains, do not require the open transmission of encrypted information. Conversely, several forms of encryption are employed by blockchain applications of the next generation to guarantee the security and total anonymity of transaction content. A plethora of new tools with varying

functionalities for using blockchain bitcoin have surfaced throughout time. Among the most well-known instances of these instruments are digital signatures and hashes.

3. CRYPTOGYAPHY AND BLOCKCHAIN IMPLICATIONS WITH DIGITAL SIGNATURES:

To verify the readability of digital messages and documents, digital signatures are simply mathematical methods for creating digital codes. The codes are successfully generated and verified using public-key encryption. Digital signatures ensure that the sender and content specifications are confirmed when a document is delivered electronically.
Before we get deeper into the implications of blockchain and cryptography with digital signatures, let's go over some fundamental security principles. Four essential criteria must be taken into consideration while sending sensitive data online. The four essential qualities are integrity, non-repudiation, authenticity, and confidentiality. In general, encryption techniques like AES can satisfy the need for secrecy. However, digital signatures are superior when it comes to fulfilling the standards of the remaining three qualities—non-repudiation, integrity, and authenticity. Digital signatures and blockchain cryptography mostly rely on two popular encryption methods.

- ***Symmetric-Key Encryption***

The first type of encryption was symmetric-key encryption. Using keys that are similar to one another, symmetric-key encryption aims to encrypt and decode data. Above all, symmetric-key encryption can be applied to a range of information security scenarios, such as encrypted hard drives and secure connections to HTTPS websites. When the same key is used for both encryption and decryption, there are issues with the secure exchange of keys between the sender and the recipient. Symmetric-key encryption is sometimes known as secret-key cryptography.

- ***Asymmetric-Key Encryption***

Asymmetric-key encryption is the second encryption technique that is crucial to the blockchain's cryptography applications. Public-key cryptography, another name for asymmetric key encryption, uses different keys for encryption and decoding. The encryption and decryption keys can be obtained using the public and private keys, respectively.
The key pair is created using asymmetric key cryptography techniques; the private key is kept secret and the public key is shared with the public. It's also known as public-key cryptography, because it makes it possible for two totally anonymous persons to communicate private data.
Public-key cryptography is used in digital signatures, which let users establish who owns their private keys. Interestingly, users can demonstrate their legitimacy without disclosing their private keys.

4. BLOCKCHAIN CRYPTOGRAPHY'S USE OF CRYPTOGRAPHIC HASHING:

When presented correctly, one of the noteworthy aspects of blockchain cryptography is the use of cryptographic as hashing. Cryptographic in hashing is the fundamental component that blockchain technology offers. The most important aspect of the blockchain is its immutability, which is made possible by hashing. Keys are not needed for the cryptographic hashing encryption technique. On the other hand, hashing in cryptography takes an input and applies an algorithm or cypher to extract a hash applied value of a given length. The technique of taking an arbitrary length string as input and giving an output with a predefined length is called hashing. Within blockchain technology, one of the most used hashing functions is the SHA-256 cryptographic hash function. The following list of characteristics indicates why cryptographic hash functions are suitable for use in blockchain applications.
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- Deterministic hash functions are used in cryptography. As a result, the hash function consistently produces an output with the same length regardless of how many times you enter a certain input. Therefore, the outcome would be the same length, or 32 characters in a fixed string that included a mix of letters and integers, regardless of how many characters you entered—three or 200.
  Undoubtedly, the output uniqueness of cryptographic hash algorithms is their second key characteristic. In cryptography, hash functions ensure that no two inputs ever yield the same result. As a result, they might also possess special qualities to prevent collisions.
- The irreversibility property is intimately related to cryptographic hash functions. It is almost impossible to distinguish the original input from the output with the instruments and techniques available today. Their quicker hash computation is another important feature that emphasizes the importance of hash functions in blockchain and cryptography.
- There is a higher likelihood that transactions will be completed faster since hash functions can generate results more quickly.The avalanche effect is a remarkable characteristic of cryptography algorithms. The avalanche effect essentially suggests that even a minor alteration to the input results may result in an entirely different outcome.

The Secure Hash Algorithm (SHA), of which there are many frequently used varieties such as SHA1, SHA256, MD5, and SHA512, is the cryptographic hash function that is most commonly employed.
Every cryptographic hash function serves one of the following purposes:
• The improved SHA algorithm, known as SHA1, was developed by NIST and made available in accordance with the Federal Information Processing Standard, or FIPS. • The Message-Digest method, also referred to as MD5, helps to produce a 128-bit hash result.
• A 256-bit message digest and 32-bit words are used by the SHA256 function to calculate hash values.
• A 512-bit message digest and 64-bit words are used by the SHA512 function to calculate hash values. Thus, it is clear that cryptographic hash functions provide a variety of useful features together with special mathematical advantages. What connection exists, then, between the characteristics of cryptographic hash algorithms and cryptography's function in block chain technology?
Fundamentally, the following benefits are ensured by hash function properties:
1. Having access to records demonstrating who owns specific data without having to reveal the data
2. Guarding against unauthorised transaction modifications
3. Verifying the transaction confirmation without complete block access
4. Reduction of transaction bandwidth
5. Developing riddles for transactional cryptography

5. CONCLUSION

Since everything is online in today's world, security is important. The previous process was easy to deal with therefore, encryption technology is important to protect information and protect our information from unwanted users. The key is only accessible by the sender and the recipient.
Customers can use encryption technology to encrypt data and authenticate different customers. Some encryption technologies are use d in network security to ensure secure communication. Cryptography and network security are used to secure data communications on the Internet. The main goal of security technology is to ensure confidentiality, integrity, availability and no repudiation, and cryptography helps achieve these goals. Encryption algorithms help create security and connectivity for transferring information and data between two organizations. Cryptology is a phenomenon in the world of informatics. As the world becomes technology centred and everything becomes digital, data security and encryption become more important than ever.

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