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Securing Criminal Record Data: Leveraging Blockchain for Effective Database Management

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ABSTRACT

As cities and towns get larger and more urbanized, crime rates tend to rise. Blockchain technology has the potential to replace a system of piled-high criminal records with a network of freely accessible, secure papers that are impenetrable. Data decentralization is made possible via the peer-to-peer network known as blockchain. The immutability of blockchain technology will be used by this system to guarantee data security and integrity. By increasing objectivity and consistency and facilitating third-party monitoring of tamper-evident transactions, this blockchain-based method can lower the danger of corruption and increase the openness and accountability of criminal records. Moreover, law enforcement will be more successful if the appropriate administrative institutions have quick access to valid criminal records.

Keywords: Blockchain, security, criminal records, authentication, decentralization

1. INTRODUCTION

Criminal records play a crucial role in the interrogation and detection of crime. For many years, our country's judicial system has been dealing with securing those criminal records more profoundly in which accessibility becomes easy and security becomes intact. Even for high-level governments, managing and using these data can be a burden. Different state law enforcement agencies have separate databases, which hinders data exchange between various government agencies. A stumbling block is encountered when some states do not bother sending the numbers or sending them long after the volume was released. In addition, long delays in the publication of crime statistics have prevented policymakers from taking appropriate action in the required time. The existence of such multiple databases also increases the cost of its security, so the possibility of illegal modification is gradually growing [1].

Justice is one of the three pillars of any government. In this regard, an information storage system will potentially improve the existing system and meet all the requirements for an efficient judicial system. In this

article, we analysed the possibility of implementing a blockchain-based system to manage citizen's criminal records. Blockchain technology can come into force to solve these problems. A Blockchain is originally a chain of blocks with a growing list of records, called blocks, linked together by cryptography. Each block consists of the cryptographic hash that is the unique identity of that particular block. It also includes timestamps and data to be stored. It is a shared and immutable ledger that facilitates recording data and reducing the risk of data tampering [2].

2. LITERATURE SURVEY

Vaishnavi et al.;[9] proposed a blockchain system that consists of the ideology of one blockchain having one criminal
case. However, this method, in the long run, in a densely populated country where the cases are much higher, makes the entire blockchains of the criminal record a lengthy one and much challenging to operate while in our proposed system, we are generating a single blockchain that contains multiple criminal records making it compact and efficient to carry out an operation. Bhushan et al.; [10] in their paper, discussed the use of transparent blockchain for tracking police complaints. Public blockchains offer more transparency to the system. Still, consensus protocols consume more resources and are not ecofriendly in any way, hence making the system to put in an application much more challenging as it would become costly. The consortium blockchain system is less expensive than the public because it uses fewer resources. However, point to be noted; it is not cheap. Since you are completely changing the system, it would make investments to see the change. However, in the long run, it will benefit you more and save the cost. A. T. Dini et al.;[11] in their paper proposed a system to store citizen criminal records in a decentralized way by using blockchain technology. The key objective of our research paper is to remove the paperwork process involved and make the data get accessed easily by any authority required. Here, the judicial system will be able to gain access to the blockchain whenever needed. It makes the whole judicial system work much more coherently.

3. SYSTEM ANALYSIS

A. EXISTING SYSTEM

The current system for managing criminal records faces numerous challenges in terms of accessibility, security, and integrity. Traditional methods of record-keeping often involve centralized databases that are vulnerable to tampering, corruption, and unauthorized access. These systems are not only susceptible to data breaches but also lack the transparency and accountability necessary for efficient law enforcement. Manual record updates and maintenance procedures are time-consuming, and the risk of errors or intentional manipulation exists. Additionally, the lack of a standardized and secure platform for sharing criminal records among administrative authorities hinders the timely and effective exchange of information crucial for law enforcement agencies. The existing system falls short in adapting to the evolving landscape of urbanization and technological advancements, necessitating a more robust and secure solution for criminal record management.

DISADVANTAGES OF THE EXISTING SYSTEM

Vulnerability to Tampering: Traditional centralized databases are susceptible to tampering and unauthorized access. This vulnerability compromises the integrity of criminal records, allowing for the potential manipulation of data, which can result in inaccuracies and misrepresentation of an individual's criminal history.

Security Concerns: The security of centralized systems is a significant concern. These systems are often targeted by malicious actors seeking to exploit vulnerabilities and gain unauthorized access to sensitive criminal records. Security breaches can lead to the compromise of confidential information and undermine the trustworthiness of the entire system.

Lack of Transparency and Accountability: The current system lacks transparency, making it challenging to trace the origin of changes made to criminal records. This lack of accountability can contribute to a lack of trust in the accuracy and reliability of the information stored in the system, both among law enforcement agencies and the general public.

Inefficient Data Exchange: The manual and bureaucratic processes involved in updating and sharing

criminal records among administrative authorities lead to inefficiencies. Timely access to accurate information is crucial for effective law enforcement, and the existing system's limitations in data exchange can impede investigative processes.

Dependency on Centralized Authorities: The reliance on centralized authorities for record maintenance and updates poses a single point of failure. If the central system experiences technical issues, downtime, or corruption, it can disrupt the entire criminal record management process, causing delays in accessing critical information.

Lack of Adaptability to Technological Advancements: As technology advances, the existing system may struggle to keep pace with modern requirements for efficient and secure data management. Integration with emerging technologies is often challenging, leading to a system that may become outdated and less effective over time.

Limited Accessibility: The current system may not provide easy and secure access to authorized personnel when needed. This limitation can hinder the timely sharing of information among law enforcement agencies, potentially impacting the swift resolution of criminal investigations.

B. PROPOSED SYSTEM

The proposed "Blockchain-Based Criminal Record Database Management" system offers a transformative solution to overcome the limitations of the existing criminal record management systems. By leveraging the power of blockchain technology, the proposed system aims to revolutionize the way criminal records are stored, accessed, and shared.

The key innovation lies in the use of a decentralized, tamper-proof blockchain network. This ensures the immutability of criminal records, eliminating the risk of unauthorized tampering and enhancing data integrity. Each record, once added to the blockchain, becomes a permanent and unchangeable part of the ledger, providing a transparent and auditable history of all transactions.

The peer-to-peer nature of the blockchain facilitates decentralization, reducing the dependency on a single central authority. This not only enhances security but also ensures the system's resilience against potential attacks or system failures. The use of cryptographic techniques further strengthens the security measures, making it highly resistant to unauthorized access.

The proposed system addresses the lack of transparency and accountability in the existing system by enabling a transparent and traceable audit trail of all record modifications. This not only instils confidence in the accuracy of the information but also allows for accountability in case of any discrepancies.

ADVANTAGES OF THE PROPOSED SYSTEM

Immutability and Data Integrity: The use of blockchain ensures the immutability of criminal records. Once recorded, data cannot be altered or tampered with, ensuring the integrity and accuracy of the information. This feature enhances trust in the system and the reliability of criminal records.

Enhanced Security Through Decentralization: The decentralized nature of the blockchain system reduces the vulnerability associated with centralized databases. Distributed across a network of nodes, it becomes significantly more challenging for malicious actors to compromise the system. This enhances the overall security of sensitive criminal record data.

Transparency and Accountability: The transparent and traceable nature of blockchain transactions ensures accountability in the management of criminal records. Any changes or updates to records are visible on the blockchain, providing a clear audit trail. This transparency fosters trust among users and regulatory authorities.

Efficient and Timely Data Exchange: Smart contracts automate the updating and sharing of criminal records, streamlining the process and reducing manual intervention. This automation leads to more efficient and timely exchange of information among law enforcement agencies, enabling quicker responses to criminal investigations.

Adaptability to Technological Advancements: The modular and flexible nature of blockchain technology allows for easy integration with emerging technologies. This adaptability ensures that the system remains relevant and can incorporate future advancements in data management and security, providing a sustainable and forward-looking solution.

4. SYSTEM DESIGN

SYSTEM ARCHITECTURE

Below diagram depicts the whole system architecture.

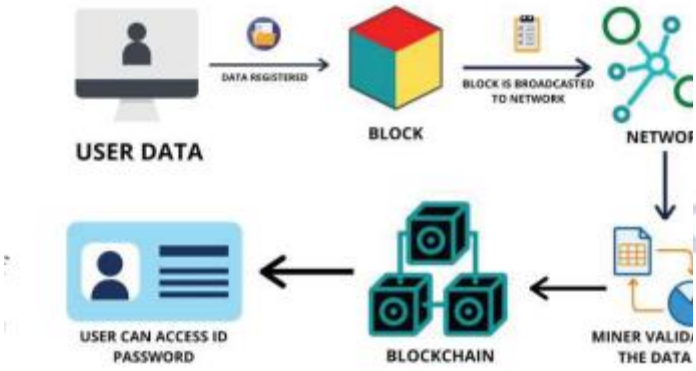

Fig 1. Methodology followed for proposed model

5. SYSTEM IMPLEMENTATION

MODULES

User Authentication and Access Control: This module ensures secure access to the system by implementing robust user authentication mechanisms. Access control features define user roles and permissions, allowing authorized personnel, such as law enforcement officers and administrative authorities, to access specific functionalities based on their roles.

Criminal Record Creation and Updating: The system includes a module for creating and updating criminal records. Authorized users can input new records or update existing ones with relevant information. The immutability of the blockchain ensures that once recorded, the data remains secure and unalterable.

Blockchain Integration and Smart Contracts: The core module involves the integration of blockchain technology, leveraging its decentralized and tamper-proof characteristics. Smart contracts are employed to automate and enforce business logic related to the creation, updating, and sharing of criminal records. These contracts facilitate efficient and secure transactions on the blockchain.

Record Search and Retrieval: This module allows authorized users to search for and retrieve specific criminal records based on criteria such as name, identification number, or incident details. The decentralized nature of the blockchain ensures that the information is easily accessible while maintaining security and integrity.

Audit Trail and Reporting: The system includes an audit trail module that logs all transactions and changes made to criminal records. This transparent and traceable record of activities enhances accountability and provides a basis for comprehensive reporting. Reporting features allow authorized administrators to generate insights into system usage and any modifications made to records.

6. RESULTS AND DISCUSSION

A Merkle tree is one of the most fundamental parts of blockchain technology. It is a mathematical data structure

consisting of hashes of different data blocks that summarize all transactions in one block. The efficient and safe checking of the content helps to ensure consistency and check the information of the data. For example, the Merkle tree will be effective in knowing the status of one particular criminal record. There is no need to download the entire blockchain; we need to ask for vertical proof and a specific branch of a tree to access the data.

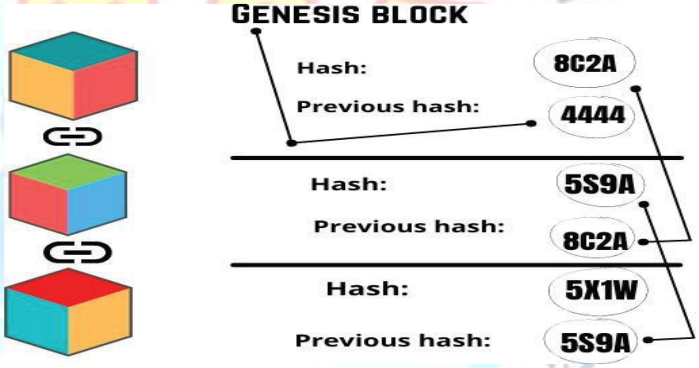

Fig 2. Applying Hash function in Blockchain

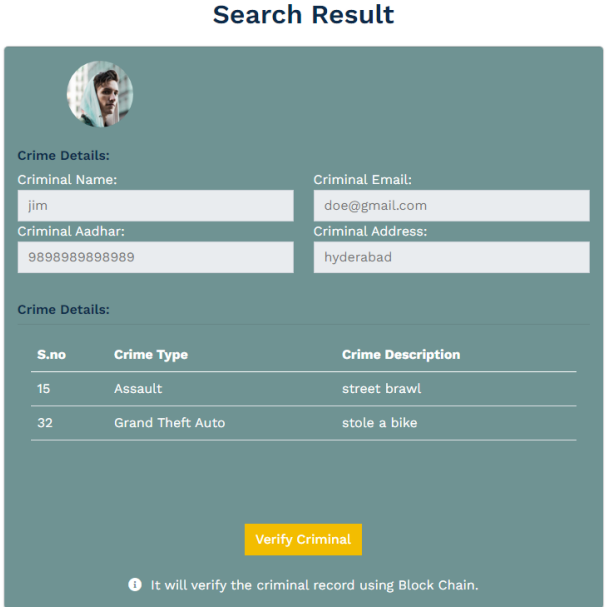

***Fig 3.* Criminal data Checking**

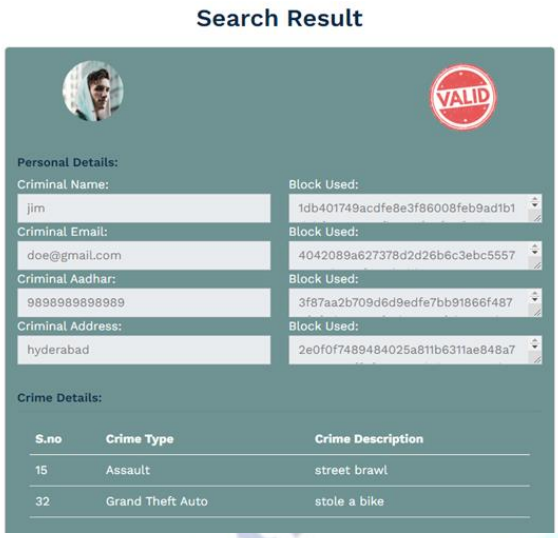

Fig 4. **Verifying The Criminal data**

7. CONCLUSION

Storing data in Local databases can be manipulated; therefore, we proposed an immutable blockchain-based system to maintain a criminal record on a decentralized network. To solve this issue, we have modified our data with digital signature and distributed the data among different entities to maintain data transparency. Easy availability of the information on the network could potentially lead us to generate statistical information which will improve the juridical system, justice actions, and internal processes. Blockchain is an emerging technology and can effectively create more robust control over criminal records if implemented carefully. Technology is just a raw material that alone cannot bring change, but technology processed with creative ideas renders a flourished product for the advancement of society.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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