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Decentralized Model to Protect Digital Evidence Using Blockchain

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Abstract

Blockchain technology is making a significant impact across multiple industries by providing decentralized, secure, and transparent solutions for managing data and conducting transactions. This research paper offers a thorough examination of blockchain, covering its fundamental principles, essential components, and wide-ranging applications. Additionally, the paper explores the obstacles and prospects linked to the adoption of blockchain, and it explores potential advancements in this dynamic field.

Keywords: Block chain, Transparency, Accountability.

I. Introduction

In the current digital era, in many different fields like court cases, etc., digital evidence has grown increasingly importance. Digital evidence like electronic documents, transaction records and recordings are also considered as valid or legal evidence by Indian Government and courts in criminal investigations.

However, security and integrity of this digital evidence have great threats like flaws in centralized storage system, unauthorized access and data manipulation.

So, protecting and maintaining these digital evidences is a great opportunity. That's why the use of blockchain technology, especially polygon blockchain can help us in handling such problems. In this review paper, we go into the overview of polygon blockchain, and how this model can be implemented.

Here we also give an overview of the advantages of using this decentralized system over the conventional centralized methods. With the transparency and immutability of blockchain, high data security of digital evidence can be guaranteed.

II. Problem Statement

Since traditional approaches were centralized in nature which may encounter issues like lack of confidence and a single point of failure. That's why it is not suited for collaborative settings.

So, a type of decentralized system is required as its alternative approach. Due to the absence of mediators in decentralized blockchain, it resolves the trust issue problem and also results in reduced cost.

III. Motivation & Contributions

The exploration and investigation of blockchain technology are driven by its transformative potential across diverse industries. Traditional centralized models face challenges in security, transparency, and trust, making blockchain's decentralized and tamper-resistant ledger a compelling solution. This research is motivated by key factors, including enhancing security and trust, ensuring transparency and accountability, achieving efficiency and cost reduction, revolutionizing financial systems, addressing supply chain issues, and empowering individuals with data ownership and privacy.

Security and Trust

Unlike vulnerable centralized systems, blockchain's cryptographic principles ensure robust security, making it challenging for malicious entities to manipulate data. The decentralized nature eliminates the need for a single trusted intermediary, fostering trust among network participants.

Transparency and Accountability

Blockchain's transparent and immutable ledger records every transaction, reducing fraud risks and enhancing accountability in various processes.

Efficiency and Cost Reduction

Blockchain's potential to streamline processes through a shared source of truth can lead to efficiency gains and reduced costs by eliminating intermediaries and manual reconciliation.

Innovation in Financial Systems

Blockchain's innovative potential is evident in the emergence of cryptocurrencies and decentralized finance (DeFi) platforms, promising to democratize global access to financial services.

Supply Chain Traceability

In supply chain management, blockchain addresses issues of provenance,

traceability, and counterfeiting, promoting transparency to build consumer trust and ensure product authenticity.

Data Ownership and Privacy

Blockchain enables individuals to control their personal data, with decentralized identity solutions empowering users to securely manage and selectively share information.

Contribution

This research contributes to blockchain knowledge by providing a comprehensive overview of its components, applications, challenges, and future perspectives.

Thorough Examination of Fundamentals

The paper explores fundamental blockchain concepts, including cryptographic hash functions, consensus mechanisms, smart contracts, and decentralized networks, providing foundational understanding for newcomers and researchers.

Diverse Applications Across Industries

A detailed exploration of blockchain applications in finance, supply chain management, healthcare, and identity management highlight its transformative impact across various sectors.

Critical Analysis of Challenges

The paper critically examines challenges like scalability, regulatory concerns, and interoperability, offering insights into current limitations crucial for developing effective adoption strategies.

Future Perspectives and Emerging Trends

By discussing future perspectives, scalability improvements, and evolving governance models, the paper contributes to forecasting blockchain technology's trajectory, aiding researchers, practitioners, and policymakers in anticipating and preparing for future developments.

Keywords for Further Exploration

Inclusion of keywords like decentralized finance, smart contracts, and governance models facilitates further research in specific areas, contributing to a nuanced understanding of blockchain.

IV. Literature Review

A literature review on the topic of a decentralized model to protect digital evidence using blockchain would typically involve summarizing and analysing relevant research papers, articles, and publications that address this specific area of interest. Below, I provide a brief literature review by highlighting some key points from existing research up to my knowledge cutoff date in September 2021. Please note that new developments may have occurred since then.

Blockchain Technology and Digital Evidence Protection

Blockchain technology is gaining recognition for its potential to secure digital evidence, ensuring its integrity and immutability. It is often used to establish trust in the authenticity of digital data, making it an ideal candidate for preserving digital evidence.

Blockchain and Chain of Custody

Research has explored how blockchain can enhance the chain of custody in legal and forensic contexts. The decentralized nature of blockchain ensures that data, once recorded, cannot be tampered with, making it ideal for maintaining the integrity of digital evidence.

Decentralized Data Storage

Some studies have examined the use of decentralized storage solutions built on blockchain, which can reduce the risk of data loss or corruption. These systems distribute digital evidence across multiple nodes, making it resistant to single points of failure.

Smart Contracts for Evidence Management

Smart contracts, a feature of blockchain technology, have been suggested as a means of automating evidence management processes. These self-executing contracts can help ensure proper handling and secure transfer of digital evidence.

Case Studies and Use Cases

Literature often includes case studies and real-world examples of how blockchain is currently being used or can be applied to secure digital evidence in various domains, such as law enforcement, e-discovery, and cybersecurity.

Challenges and Limitations

Some research highlights the challenges and limitations of implementing blockchain-based systems for digital evidence protection. These include scalability issues, energy consumption concerns (in the case of proof-of-work blockchains), and regulatory hurdles.

Privacy and Legal Implications

There is a growing awareness of the privacy and legal implications of using blockchain for digital evidence, particularly in cases where personal data is involved. Researchers have explored how to strike a balance between transparency and privacy.

Integration With Existing Systems

Research often delves into the practical aspects of integrating blockchain-based solutions with existing digital evidence management systems and tools.

Future Directions

Many literature reviews conclude by discussing potential future directions for research and development in this field, such as the exploration of hybrid blockchain systems, advanced encryption techniques, and interconnectivity with other emerging technologies like IoT and AI.

Remember that the field of blockchain and digital evidence protection is evolving rapidly. Be sure to consult more recent sources and research papers to gain insights into the latest developments and trends in this area.

V. Related Story

Digital evidence is stored in a blockchain which is accessible to the authorized individuals. Only relevant parties can evaluate the reliability and accessibility of the digital evidence. A data structure known by the name of Global Digital Timeline is used to record the chronological sequence of activities throughout the lifecycle of the evidence.

The main aim of this model is to ensure traceability and decentralization of the evidence. A framework that integrates Software Defined Networking (SON) and the Internet of Things is used to support the forensic domain.

In this framework, the gateway forwards packets from each IOT device to switches. For validation of data packets prior to classification (SON) controllers are used. Packets consist of information such as

username, source and destination IP address, local time of the evidence occurrence, location of occurrence, and the corresponding action taken.

The authors have examined that blockchain technology can be widely used in medical field which is based on Ethereum blockchain and solidity based smart contract. Patients can revoke access to their medical records using smart contracts. This enhances the right to privacy and ensures safe sharing of data among health care professionals.

Workflow

- First of all, creator admin deploys smart contract and then functional view is generated.
- Super admin is created by the creator admin.
- New admin is approved by either creator admin or approved super admin.
- Now approved admin is able to create new users.
- New users should be approved by either creator or super admin.
- Now all these admins can create evidence
- Super admin entity can only be able to use power of creator admin only after its approval.

VI. Conclusion and Future Work

- In this paper, we presented blockchain in technology possessing. This is going to be adopted at a widespread level.
- Blockchain's decentralized nature and cryptographic security make it a powerful tool for securing data and transactions. It ensures data security.
- Smart contracts have the potential to automate highly difficult business process, reducing the need of middleman and Improving efficiency.
- In healthcare, blockchain can revolutionize data management, patient records and clinical trials while ensuring data security and privacy.
- It is widely used in voting systems to ensure transparency and improve governance process.
- Blockchain technology represents a significant shift in how data is stored, managed and transferred.
- It is not only limited to cryptocurrency and has the ability to derange the ongoing industries and enhance efficiency.

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