Date available online: 30-10-2023
Vol. 1, Issue 1(January-June 2023)


# Database Technology for Blockchain

## Opportunities and Challenges in Database Technology for Blockchain

**Ahmed Nasir Khan[1], Muhammad Zunnurain Hussain[2*], Summaira Nosheen[2], Qasim Hussain[1]**

[1] Department of Humanities and Social Sciences, Information Technology University, Lahore, Pakistan
[2] Department of Computer Science Bahria University Lahore Campus Pakistan

[*]Corresponding author: Muhammad Zunnurain Hussain (e-mail: zunnurain.bulc@bahria.edu.pk).

**ABSTRACT:** This report provides an overview of blockchain technology, including its unique properties such as its distributed nature, immutability, and consensus mechanisms. The paper examines the history of blockchain, its cryptographic protocols, smart contracts, and consensus mechanisms, and explores potential use cases in various industries. The authors also compare traditional databases to blockchain technology and propose a common blockchain-based database for intrusion detection systems. The report highlights the potential benefits of this proposed system, including data integrity, security, and fault tolerance. The authors conclude by emphasizing the importance of trust and transparency in blockchain technology, and how it can be applied beyond cryptocurrency to areas such as traceability of medical data, interoperability, and insurance business deals.

**INDEX TERMS:** *blockchain, blockchain technology, privacy, cryptocurrency, bitcoin, decentralization, cryptography, databases*

### I. INTRODUCTION

A blockchain is a digital source which saves data that is completely secured in a decentralized way. The main purpose of Blockchain invention was the power cryptocurrencies. Because of that Blockchain's potential have exceeded far beyond that. A blockchain is also a database where the data that is being stored by it is secured in the form of blocks, and those secured blocks contain a record of multiple transactions. The blocks are linked together in such order that it forms a chain of data making it impossible to interfere with and make changes without even being noticed. This process of Blockchain is accomplished through a process called cryptography (a process of protecting information with the help of coding) and also through distributed consensus mechanisms that guarantees the accuracy of the data to be kept in a blockchain. In blockchain, decentralization means that there is no need for a trusted intermediary transaction verification and also eliminates any sort of single point failure or control. This has created a wide range of new opportunities for a safe and transparent storage and data transfer, containing anything from voting systems and identity verification to supply chain management and business transactions. It is basically a network of different systems both multiplies and distributes a digital ledger of transactions over the entire computer systems network on a blockchain. This article discusses the increase of potential of the blockchain technology and how it has the potential to revolutionize various industries. Then one could mention the central role of databases in data management and storage, and how blockchain is being explored as an alternative or complementary solution. The introduction may also briefly discuss the advantages and limitations of the two technologies as indicated in the literature reviewed. Finally, in the introduction, the main purpose and objectives of the report could be defined, which could be a comprehensive analysis of the similarities, differences and potential synergies between blockchain and database technologies and their applications and challenges.

### II. LITERATURE REVIEW

Other writers have also provided further explanations for the majority of the information about blockchain and how it saves its data. A blockchain, for instance, maintains identical blocks of information throughout its network rather than a single block, as shown by Bambara et al. (2018). As a result, a blockchain cannot be controlled by a single entity and does not exhibit any kind of single point of failure. Data storage via a network eliminates the dangers associated with having data maintained centrally. Blockchain networks do not yet have any centralized points of vulnerability that hackers may readily attack [1]. As was already said, the power of cryptocurrencies was the fundamental motivation for the construction of the Blockchain. However, in addition to cryptocurrencies, blockchain also operates on other platforms. Cryptocurrencies like bitcoin are not equivalent to blocks, but rather successful uses of blockchain, claim Monrat et al. (2019) [2]. Blockchain technology has a lot of benefits and among those benefits, decentralization is one of them (in which data is being stored or processed but in different systems and servers), according to Zheng et al. (2018). "Applications for blockchain exist in a wide variety of industries, including financial services, risk management, the internet of things (IoT), and public and social services." [3]. In order to solve problems with fragmented market systems, such as interoperability, trust, and transparency, blockchain technology can be used in a variety of services, including the traceability of patient and drug data, the support of insurance marketplace transactions between various clients, policyholders, and insurance companies, and many more (see Monrat et al. (2019)) [4]. The essay "Blockchain versus Database: A Critical Analysis" analyses how blockchain technology differs from conventional database architectures. The authors are M. J. M. Chowdhury, A. Colman, M. A. Kabir, J. Han, and P. Sarda (2018, September 5). Identify and contrast the blockchain's distinctive selling advantages with those of conventional databases, such as its decentralization, immutability, and transparency. They also evaluate the

potential benefits and cons of blockchain technology critically, emphasizing that the best solution to employ should be chosen based on the specific requirements and circumstances of a particular use case. The writers talk about how blockchain technology may be useful for supply chain management, digital identification, and data security. They contend that blockchain's decentralized structure may increase security and lower the possibility of data leaks. Blockchain can also make it possible to create private, secure, and unchangeable digital identities. Blockchain may improve transparency and accountability in supply chain management since every transaction is recorded in a shared ledger that all stakeholders can view. The authors do, however, agree that putting blockchain technology into practice presents certain difficulties. Scalability is one of the main problems, since blockchain networks may become sluggish and ineffective as the quantity of users and transactions rises. A further obstacle to adoption is the high energy consumption required by blockchain networks to sustain a decentralized architecture. Finally, the authors provide a thorough examination of the distinctions between blockchain and conventional database systems, emphasizing both systems' potential advantages and disadvantages. They contend that conventional blockchains and databases still have a place in the technological landscape and that the choice of technology should be based on the particular demands and requirements of the use case. [6]. The book" Blockchain Foundations and Operations" is a useful resource for people who want to learn about blockchain technology and its different uses. The book is divided into four sections, each covering different aspects of blockchain technology. The first section provides a preface to blockchain technology and explains how it works. It also covers the benefits and limitations of blockchain technology. The alternate section discusses the different operations of blockchain technology, including cryptocurrencies and smart contracts. The authors explain how these operations work and how they can be used in different diligence. The third section covers the sequestration and security enterprises associated with blockchain technology. The authors bandy the implicit benefits of blockchain technology for sequestration and security, as well as the implicit pitfalls and attacks that could be made against blockchain-grounded systems. The fourth and final section of the book looks at the future of blockchain technology and its implicit impact on different diligence. The authors bandy the ethical considerations associated with developing and enforcing blockchain-grounded systems. Overall, the book provides a comprehensive overview of blockchain technology and its different uses, making it a precious resource for anyone interested in this new technology. The book is written in a clear and accessible style, making it suitable for both specialized andnon- technical compendiums. [8] “The Internet of Things (IoT), which has allowed for the connectivity of billions of devices to the Internet, has made it possible for a sizable network of interconnected devices.” Due to the volume of data that these devices generate, severe storage, security, and privacy issues are raised. Blockchain technology has the power to solve these problems by providing a secure and decentralized platform for data management and storage. An article by Then et al. (2020) discusses the benefits and drawbacks of using blockchain-based databases in the context of the Internet of Things. Following is an introduction to blockchain technology and its core concepts. The authors claim that blockchain technology is a decentralized, distributed ledger system that allows many users to securely and publicly interact and store data. Each data block is added to the blockchain via a consensus mechanism that guarantees the truth and reliability of the data stored there. The authors go on to discuss the challenges of using blockchain-based databases in an IoT environment. One of the biggest challenges is the blockchain technology's ability to grow. The amount of data generated by IoT devices may quickly surpass the capacity of traditional blockchain networks. The authors argue that sharing, or data exchange across many nodes, may help boost the scalability of blockchain-based databases in the IoT environment. The essay also discusses potential applications for blockchain-based databases in an IoT setting. IoT data has the potential to improve privacy and security. The authors assert that the danger of data breaches and assaults is much reduced when data is stored on a decentralized, encrypted blockchain network. explains the benefits and pitfalls of using blockchain-based databases in the IoT space. The authors emphasize the advantages of using blockchain technology to the Internet of Things, including improved data governance, privacy protection, and security. The authors are aware of the scalability and power consumption issues that blockchain networks may run into in the IoT context. According to the general content of the paper, blockchain technology may have an influence on IoT data management. [9] Blockchain technology is a distributed ledger that safeguards the accuracy of the data by storing it in a decentralized, unchangeable manner and tracking transactions. One of the industries that might profit from the usage of blockchain technology is medical imaging. The research by McGee and Wilcox (2020) looks at the core ideas behind blockchain technology and possible uses for it in the field of medical imaging. This report focuses on the potential uses of blockchain technology in the field of medical imaging. The authors provide an explanation of blockchain technology and its guiding principles, emphasizing its decentralized and immutable nature. They explore the advantages of using blockchain technology in medical imaging, such as safe and efficient sharing of medical images among healthcare professionals and secure storage of large volumes of data from multiple sources. The authors also discuss the challenges associated with integrating blockchain technology into medical imaging, including the need for standardization and interoperability across multiple platforms and the high costs of implementation. While acknowledging these challenges, the authors argue that the benefits of using blockchain technology in medical imaging, such as facilitating online medical imaging research and ensuring privacy and security, may outweigh the costs. Overall, this report provides valuable insights into the potential impacts of blockchain technology on the medical imaging industry. [10].

## III. PROBLEM STATEMENT

The problem addressed in this report is the need to clarify the uses and benefits of blockchain technology beyond cryptocurrency, and to explore the differences between conventional databases and blockchain-grounded databases in terms of security, access control, and processing capabilities.

Also, the review identifies the implicit operations of blockchain-grounded databases in colorful diligence, while pressing the challenges that need to be addressed in order to completely realize the benefits of this technology. The work concludes that while blockchain- grounded databases have the eventuality to revise data operation and enhance security, scalability, interoperability, and power consumption, issues still need to be addressed through farther exploration and development.

## IV. METHODOLOGY

The content or material that has been collected for this report paper are from qualitative research articles. Sources such as IEEExplore, Inder science, pdfuni, etc. have been used to explain the content regarding blockchain.

Block chain technology has evolved beyond its initial application in cryptocurrency and is now being applied to various domains, including medical data, interoperability, and insurance business deals. Here are some ways on how the block chain technology can be applied beyond cryptocurrency to areas such as medical data, interoperability, and insurance business deals:

### A. MEDICAL DATA:

Block chain can enhance the security, privacy, and interoperability of medical data. Health records can be securely stored and managed on a block chain, ensuring that sensitive information remains confidential and is only accessible to authorized individuals. Patients can have control over their data and grant access to healthcare providers as needed, facilitating seamless and secure sharing of medical records. This can lead to improved healthcare outcomes and streamlined processes. Block chain can revolutionize the management of medical data by providing a secure and decentralized platform for storing and sharing sensitive health information. McBee and Wilcoxx (2020) discuss how block chain principles and applications are being utilized in medical imaging, ensuring the integrity, security, and accessibility of medical data.

### B. INTEROPERABILITY:

Block chain enables interoperability by providing a standardized and secure way to share data and conduct transactions across various systems. Different entities within a network can access and verify data in a transparent and tamper-proof manner. For instance, in supply chain management, a block chain can be used to track the production, shipment, and delivery of products across multiple parties, ensuring transparency and reducing discrepancies in information. Block chain can enhance interoperability by providing a standardized and decentralized platform for data exchange and integration across various systems. Wang et al. (2021) present a block chain-based privacy-preserving distributed database designed for user behaviors in social networks, illustrating the potential for improving interoperability in a secure and efficient manner.

### C. INSURANCE BUSINESS DEALS:

Block chain can optimize insurance processes by automating and streamlining operations, reducing fraud, and enhancing trust and transparency. Smart contracts, self-executing contracts with the terms of the agreement directly written into code, can automate claims processing, policy management, and underwriting. This can lead to faster and more efficient transactions, reduced administrative costs, and increased trust between insurers and policyholders. Block chain can streamline and secure insurance transactions by providing a transparent and immutable record of agreements and claims. Crossby, Pattanayak, Verma, and Kalyanaraman (2016) discuss how block chain technology extends beyond bitcoin and can be applied to various domains, including insurance, by ensuring transparency and trust in transactions.

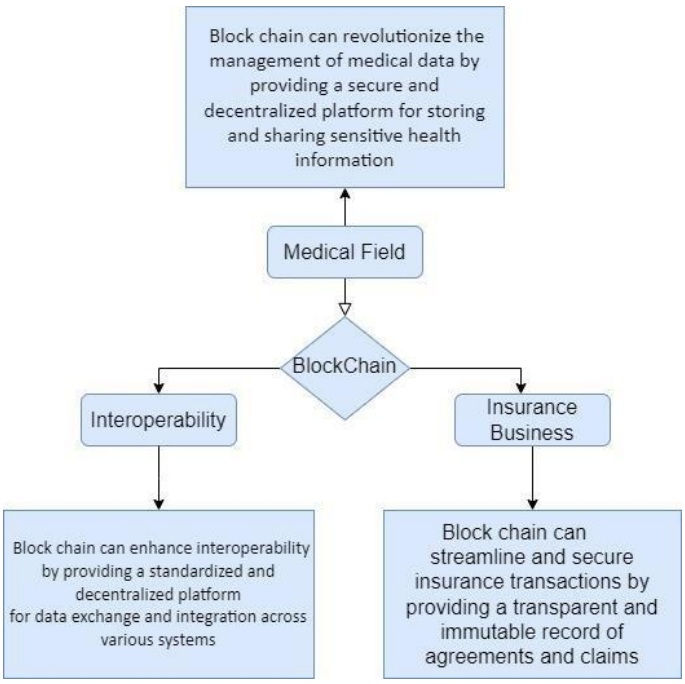


**Figure 1 Use of Blockchain in Medical field, Interoperability and Insurance Business**

As mentioned earlier, both blockchain and database are good but in terms of blockchain, database is also used in their process. Databases such as relational databases, NoSQL databases, etc. are used in other blockchain applications such as traceability of data of a person or anything else. In such databases, software such as PostgreSQL, MySQL servers are used while managing different block chain applications.

## V. RESULTS

If we consider all that we have learned about blockchains so far, we can say that blockchains are quite sophisticated and complex. However, at the bottom line, they are not that complex. They are just like databases but are structurally and functionally different. While databases store data using ‘table’ data structures, blockchains store data in blocks. So, what makes blockchains different from data structures? We can understand this from the picture above which was taken from the blog at Intellipat (Raj, 2023).

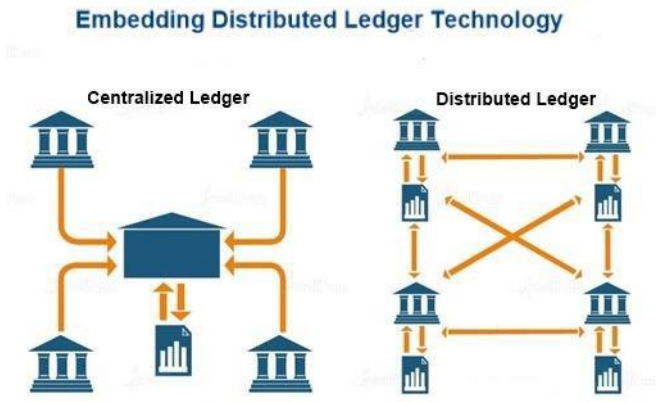


**Figure 2: Structural difference between database and block chain**

In contrast to traditional databases that are centralized, blockchains operate differently by using uniformly sized blocks to store information. Each block includes a hash code from the preceding block, which contributes to its cryptographic security. This additional security mechanism embedded within blockchains makes them extremely resistant to hacking and tampering, setting them apart from databases. It is by the same author which the above- mentioned graph is by databases, like Blockchain, are used to store data, but they do it in the form of tables. Both Blockchain and Database are excellent at securely storing data, but they also have some key distinctions. In a blockchain, each participating node participates in a consensus process to determine whether a certain transaction is genuine or not, according to Chowdhury et al. (2018). The system's nodes all have the same degree of access. Because it democratizes the whole system, this offers a strong platform for fostering trust. While in a typical database, we are forced to depend on a single central figure who manages system access. He also says that when it comes to data confidentiality, databases are preferable to blockchain since they only allow authorized users access, but data in blockchain is exposed to all nodes. On the other hand, blockchain is slower because it takes ten minutes to confirm a transaction (a bitcoin transaction), and multiple transactions may take even longer. This is because databases are specifically designed to handle thousands of transactions in a matter of seconds. However, blockchain is more secure than databases since it only accepts data that 51 percent of mining nodes agree with. As opposed to conventional databases, which safeguard data in a centralized system with access controls defined by the system itself, these databases are susceptible if the system administrator is hacked. [5]. The authors assessed the benefits and drawbacks of each technology, contrasting them in light of aspects including cost, performance, scalability, and security. According to their investigation, even while blockchain offers several distinct benefits, it may not be appropriate for all applications and use scenarios. A full introduction to blockchain technology is given by Al Mamun et al. (2019). The fundamentals of the blockchain are covered in the essay, including its background, architecture, consensus procedures, and security features. The writers also go into how blockchain technology may be used in industries including banking, healthcare, and supply chain management. An explanation of the fundamentals and uses of blockchain technology is given by Bambara et al. (2019). The article addresses the fundamental ideas and elements of the blockchain, such as consensus processes, distributed ledger technology, and smart contracts. The writers also go into how blockchain technology may be used in industries including banking, healthcare, and supply chain management. The foundations and possibilities of blockchain technology in medical imaging are discussed by McGee and Wilcox (2020). The authors talk about how blockchain technology might enhance data security, privacy, and interoperability in the context of medical imaging. Additionally, they provide instances of how blockchain technology has been used to medical imaging applications including data sharing and administration. Based on trait analysis and selection, Che et al. (2018) created a machine learning model to forecast the kinds of membrane proteins. The scientists built their prediction model using a dataset of membrane protein sequences and a few important properties. Their findings demonstrate that their machine learning approach is capable of correctly categorizing membrane proteins. For intrusion detection systems (IDS), Liang and Ma (2021) presented a blockchain-based shared management database platform. The authors have created a platform for lifelong learning that stores and distributes intrusion detection data safely and effectively using blockchain technology. Their findings demonstrate that their system may successfully identify and stop various assaults while preserving the security and privacy of sensitive data.

## VI. DISCUSSION

Article by Chowdhury et al. Compare the advantages and disadvantages of blockchain technology versus conventional database systems. Since blockchain technology provides more security and transparency but may not be appropriate for high-performance and scalable applications, the authors come to the conclusion that the decision between these technologies relies on the unique demands of the application. On the other hand, traditional database systems could be more equipped to swiftly and effectively handle data, but they might also be more susceptible to security breaches. The essay offers crucial details on how well-suited certain technologies are for different applications. [6] Al Mamun et al.'s book Understanding Blockchain Technology: A Comprehensive Introduction, published in 2019, gives a thorough explanation of the technology, including its background, guiding principles, and key elements. Additionally, it covers various blockchain network architectures, their existing and prospective uses, as well as the drawbacks and shortcomings of this technology. The essay is a good starting point for anybody curious in blockchain technology in general. It emphasizes how blockchain technology has the potential to revolutionize several sectors, but it also emphasizes the necessity for ongoing research and development to overcome its problems and constraints. [7] A blockchain-based database can be implemented in an IoT setting, but there are a number of obstacles to overcome, including: B. Scalability, performance, interoperability, and regulatory issues. The authors provide potential solutions to these problems, such as adopting side chains or off-chain techniques to boost scalability and speed. Overall, the essay is appropriate for scholars, practitioners, and policymakers interested in the issue and offers insightful information on the possibilities of

blockchain technology in the IoT ecosystem. [9] The possible use of blockchain technology in the area of medical imaging is covered in the paper "Blockchain Technology: Principles and Application in Medical Imaging" by McGee and Wilcox (2020). The writers provide a summary of blockchain technology and some of its advantages, including improved data security, privacy, and accessibility. The next section of the article discusses particular uses of blockchain technology in medical imaging, including B. safe storage and sharing of medical pictures, management of patient data, and data analysis.

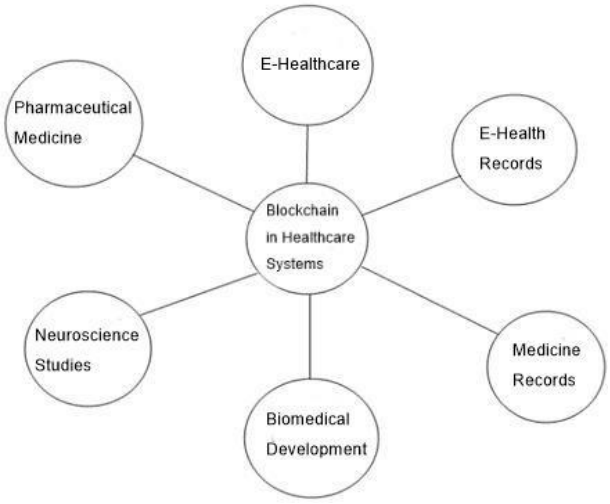


**Figure 3: Use of block chain in healthcare system**

Following chart is a graphical representation of how blockchain in used in other applications. The chart shown explains the usage of blockchain based database in healthcare systems. It tells how blockchain can be used for features like patient and medicine records, E-healthcare, etc. Similarly, besides crypto, blockchain based database are used in other fields or other applications such as in voting systems, in marketing systems, personal identity security, etc.

TABLE I
Use of Block Chain in Other Fields

| Fields | Used Cases |
|---|---|
| Finance | Cross-border payments, remittances, trade finance, smart contracts |
| Healthcare | Electronic health records, supply chain management, clinical trial data management |
| Identity Management | Digital identity verification, secure identity storage, decentralized identity |
| Gaming | In-game asset ownership, secure and transparent item trading |
| Voting | Secure and transparent voting systems, preventing voter fraud |

Following table is another explanation of how blockchain can be used in other kinds of fields. The decentralization, security, and transparency features of blockchain have the potential to transform many aspects of our lives, and we can expect to see many more innovative use cases emerge in the future.

Regulatory concerns and data interoperability are only two examples of possible difficulties in using blockchain technology in medical imaging that the authors address. Overall, the study is pertinent for academics, practitioners, and policymakers interested in the subject and offers insightful information on the possibilities of blockchain technology in the area of medical imaging. The authors contend that while preserving patient confidentiality and data security, blockchain technology may increase the effectiveness and caliber of medical imaging treatments. The paper illustrates how blockchain technology might be used to medical imaging to enhance data security, privacy, and accessibility in plain English. [10] Y. Wang, S. Zhang, X. Wang, & H. Wang's paper from 2021. explains the DEEPEST privacy database, a blockchain-based privacy platform that promises to secure user privacy while gathering and examining data on social network user behavior. The authors outline the DEEPEST system's technical specifications and how it may be used to safely store and analyses user data without jeopardizing that data's privacy. Decentralization, immutability, and transparency are a few advantages of employing blockchain technology in such a system that are also highlighted in the report. Overall, the study is helpful for scholars and practitioners interested in the confluence of blockchain and privacy-enhancing technologies since it sheds light on the privacy-enhancing possibilities of blockchain technology when analyzing social media data. [11]. The paper "Eternity - Integration of database functions into a blockchain" was published in 2018 by Helmer, Roggia, Ioini, and Pahl. describes the creation of the Eternity database management system, which merges database features onto a blockchain. The notion of blockchain and its attributes, including immutability, transparency, and decentralization, are initially introduced by the writers. The drawbacks of conventional database management systems in terms of scalability, security, and dependability are then discussed. By

fusing the benefits of blockchain and conventional databases, the authors suggest Eternity as a remedy for these restrictions. Users may store data, access it, and search it using Eternity while still preserving data security and integrity. The authors describe the fundamental elements of the Eternity architecture, including smart contracts, database interfaces, and consensus methods. The paper also explains Eternity's implementation and gives test results assessing its transaction throughput and query latency performance. The authors demonstrate that Eternity performs better in situations where trust and security are crucial by comparing its performance to that of conventional databases. The essay concludes by presenting a cutting-edge method for managing databases that combines blockchain technology with established databases. By offering a scalable, secure, and dependable data storage and retrieval solution, Eternity has the ability to completely alter the database management environment. [12]. Liang, J., & Ma, M.'s paper "Blockchain-based co- maintained database for DSS: A life learning framework" from 2021. provides a novel method for creating a blockchain-based co-maintained database for intrusion detection systems (IDS). The authors begin by outlining the drawbacks of conventional IDS systems, such as their B. lack of accuracy, scalability, and flexibility. The idea of co- managed databases is then presented, which enables data sharing and learning across various IDS systems. The authors provide a paradigm for lifelong learning that makes use of blockchain technology to build an openly accessible database for IDS systems. The architecture enables IDS systems to input data into a database and gain knowledge from the network's collective intelligence. For the purpose of ensuring the trustworthiness and correctness of the data in the database, the authors additionally provide a reputation-based consensus process. The article includes the elements of the blockchain network, the shared database, and the IDS systems in a full design of the suggested framework. The framework's implementation is also described by the authors, who also give experimental data to assess the framework's effectiveness in terms of accuracy and scalability. The findings demonstrate that the suggested framework performs better in terms of accuracy than conventional DSS and is adaptable to numerous DSS. The essay concludes with a novel use of blockchain technology to create a shared controlled database for IDS systems. IDS systems may exchange and learn from data thanks to the suggested lifetime learning architecture, which enhances accuracy and scalability. By offering an intrusion detection and prevention solution that is more precise and dependable, the framework has the potential to revolutionize the IDS environment. [14] An analysis of how to assess and manage database security in a public cyberattack mitigation organization is provided in the article "Analysis to Assess and Manage Database Security in a Public Cyberattack Mitigation Organization" by Toapanta, S. M., Escalante, O. A., Mafla, L. E., and Arellano,

R. M. (2021). The authors begin by outlining the rise in cyberattacks against government institutions and the need of strong database security management. The authors provide an approach that involves detecting threats and vulnerabilities, evaluating risks, and putting in place security measures for evaluating database security in a public organization. The technique is based on global best practices and standards for information security, including ISO/IEC 27001. The article provides a case study of how the suggested technique was used in a public organization. The authors outline the assessment process, which includes identifying threats and vulnerabilities, evaluating risks, and choosing preventative solutions. The authors also examine the efficacy of security solutions to reduce cyberattacks and offer the assessment findings. In order to avoid cyberattacks, the article summary emphasized the need of efficient database security management in public organizations. The suggested technique offers a methodical way to evaluate and put security policies in place to lessen the risk of intrusions. The case study serves as a helpful manual for public organizations wanting to enhance the security management of their databases and illustrates the practical applicability of the technique. [15].

## VII. CONCLUSION

This essay was produced with the goal of clarifying what blockchain is and how it is used in contexts other than cryptocurrencies. Just a few of the services that can be supported by blockchain technology include the traceability of patient and drug data, resolving interoperability, trust, and transparency issues in fragmented market systems, and supporting insurance marketplace transactions between various clients, policyholders, and insurance companies [4]. This study also examines the differences between conventional databases and blockchains as well as the kinds of databases used in various blockchain applications. Although both Blockchain and Database are quite good at securely keeping data, there are some significant differences between the two. Each blockchain participant node takes part in a consensus process to decide whether a particular transaction is valid or not. Every node in the system has the same level of access. This provides a solid foundation for generating trust since it democratizes the whole system. In contrast, we must depend on a single central authority to control system access in a normal database. When it comes to maintaining data secrecy, databases are preferred over blockchains since they restrict access to authorized users whereas blockchains make data accessible to all nodes. However, since a transaction must be confirmed ten minutes after it is made, and several transactions may take considerably longer, blockchain is slower. Due to their design, databases perform better than other types of systems since they can quickly process thousands of transactions. Blockchain accepts the data if fifty-one percent of mining nodes agree, unlike traditional databases that secure data in a central system where access to the data is restricted by the access control mechanisms that are set by that system, making it vulnerable if the system administrator of that system is compromised. [5]. Having said that, although blockchain technology may be a successful endeavor at the moment, it is still susceptible to hacking just like other databases. As previously mentioned, the security of blockchain is less robust than the security of traditional databases because data in a blockchain database is accessible to all nodes, whereas in a traditional database, data is strictly restricted to the authorized user only so that it can guard against unauthorized sources. Blockchain security, however, is less strong than database security since it is accessible to all nodes. And this reasoning is used in a variety of industries, including marketing and

health care facilities. Although crypto is a component of blockchain, due to blockchain's primary emphasis on crypto, its security is greater than that of other applications. However, by enhancing blockchain security, data protection on other apps may also be enhanced. The conclusion drawn from this is that blockchain-based databases have generated a lot of attention owing to its ability to provide safe and decentralized data storage, making them suited for applications in a variety of industries including banking, health, and IoT. Traditional databases and blockchain-based databases were contrasted, and their advantages and disadvantages were highlighted. Additionally, the potential uses and difficulties of putting into practice blockchain-based databases were looked at. Together, these references imply that blockchain-based databases have the power to revolutionize data management and storage while also enhancing the security and reliability of data transfers. Scalability, interoperability, and power consumption are still issues that need to be resolved and call for more study and development.

## VIII. REFERENCES


[1]. Bambara, J. J., & Allen, P. R. (2018). Blockchain. In A Practical Guide to Developing Business, Law and Technology Solutions (pp. 89-108). McGraw-Hill Professional.

[2]. Monnrat, A. A., Schelén, O., & Andersson, K. (2019). A survey of blockchain from the perspectives of applications, challenges, and opportunities. IEEE Access, 7, 117134-117151.

[3]. Zhenng, Z., Xie, S., Dai, H. N., Chen, W., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. International Journal of Web and Grid Services, 14(4), 352-375.

[4]. Monrat, A. A., Schelén, O., & Andersson, K. (2019). A survey of blockchain from the perspectives of applications, challenges, and opportunities. IEEE Access, 7, 117134-117151.

[5]. Chowdhury, M. J. M., Akter, M., Islam, M. S., Alsadoon, A., Sadiq, A. S., & Fang, X. (2018). Blockchain versus database: A critical analysis. In 2018 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE) (pp. 870-875). IEEE.

[6]. Chowdhury, M. J. M., Colmann, A., Kabir, M. A., Han, J., & Sarda, P. (2018). Blockchain versus Database: A critical analysis. Charles Sturt University Research Output. Retrieved April 14, 2023, from https://researchoutput.csu.edu.au/en/publications/blockchain-versus-database-a-critical-analysis.

[7]. Al Mamun, M. A., Al-Mamun, M. A., Hassan, M. M., & Rahman, M. A. (2019). Understanding Blockchain Technology: A Comprehensive Introduction. Journal of Information Security, 10(3), 129-146. https://doi.org/10.4236/jis.2019.103010

[8]. Bambara, J. J., Allen, P. R., & Kerschbaum, C. (2019). Blockchain: Foundations and Applications. Boca Raton, FL: CRC Press. https://doi.org/10.1201/9780429451049

[9]. Tseng, L., Yao, X., Otoum, S., Zhang, W., & Jiang, X. (2020). Blockchain-based database in an IoT environment: Challenges, opportunities, and analysis. Cluster Computing, 23(4), 2151-2165. https://doi.org/10.1007/s10586-020-03138-7

[10]. McBee, M. P., & Wilcoxx, C. (2020). Blockchain technology: Principles and applications in medical imaging. Journal of Digital Imaging, 33(4), 726-734. https://doi.org/10.1007/s10278-019-00310-3

[11]. Wang, Y., Zhang, S., Wang, X., & Wang, H. (2021). DEPLEST: A blockchain-based privacy-preserving distributed database toward user behaviors in social networks. Future Generation Computer Systems, 115, 455-464. https://doi.org/10.1016/j.future.2020.10.032

[12]. Helmerr, S., Roggiaa, M., Ioini, N.E. and Pahl, C., 2018. EthernityHelmer, S., Roggia, M., Ioini, N. E., & Pahl, C. (2018). EthernityDB – Integrating database functionality into a blockchain. In J. Pokorný, J. Vomlelová, T. Skopal, & W. Abramowicz (Eds.), New Trends in Databases and Information Systems. ADBIS 2018. Communications in Computer and Information Science, Vol. 909 (pp. 65-79). Springer. https://doi.org/10.1007/978-3-030-00063-9_5

[13]. Chen, Z., Liu, J., & Lu, J. (2018). Prediction of membrane protein types based on feature selection and analysis. In Li, C., Li, Y., Wang, L., & Zeng, T. (Eds.), Advanced Data Mining and Applications. ADMA 2018. Lecture Notes in Computer Science, Vol. 11330, pp. 16-27, Springer. https://doi.org/10.1007/978-3-030-03490-5_2 [14]. Liang, J., & Ma, M. (2021). Blockchain-based co- maintained database for IDSs: A lifetime learning framework. Journal of Network and Computer Applications, 186, 103006. doi: 10.1016/j.jnca.2021.103006.

[15]. Toapanta, S. M., Escalante, O. A., Mafla, L. E., & Arellano, R. M. (2021). Analysis for the evaluation and security management of a database in a public organization to mitigate cyber-attacks. International Journal of Advanced Computer Science and Applications, 12(4), 302-311. Doi: 10.14569/IJACSA.2021.0120402.

[16]. Golossova, J., & Rommanovs, A. (2018, September). The advantages and disadvantages of blockchain technology. In 2018 IEEE 6th Workshop on Advances in Information, Electronic and Electrical Engineering (AIEEE) (pp. 1-4). IEEE.

[17]. Raikwar, M., Gligoroski, D., & Velinov, G. (2020). Trends in development of databases and blockchain. In 2020 Seventh International Conference on Software Defined Systems (SDS) (pp. 171-176). IEEE. https://doi.org/10.1109/SDS49278.2020.00035

[18]. Tseng, L., Yao, X., Otoum, S., Zhang, W., & Jiang, X. (2020). Blockchain-based database in an IoT environment: Challenges, opportunities, and analysis. Cluster Computing, 23(4), 2151-2165. https://doi.org/10.1007/s10586-020-03138-7

[19]. Wang, Q., & Su, M. (2020). Integrating blockchain technology into the energy sector: From theory of blockchain to research and application of energy blockchain. ComputerScience Review, 37, 100275. https://doi.org/10.1016/j.cosrev.2020.100275

[20]. Crossby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). Blockchain technology: Beyond bitcoin. Applied Innovation, 2(6-10), 71.

[21]. Ruoti, S., Kaiser, B., Yerukhimovich, A., Clark, J., & Cunningham, R. (2019). Blockchain technology. Communications of the ACM, 63(1), 46–53. https://doi.org/10.1145/3369752