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Block chain-based Database Systems by using WSM Method

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Abstract: *Block chain technology has surfaced as a transformative influence, revolutionizing the verification and recording of transactions across industries. In to traditional data base systems, presenting a novel approach to database management. The objective is to enhance the trust, transparency, and security of data storage and transactions. Research in this field aims to strengthen data protection, reduce the risk of unauthorized access, and prevent data tampering. By providing a transparent and auditable record of transactions, block chain enhances trust among parties. This is particularly important in industries such as finance, where the integrity of transactions is paramount. The Weighted Sum Model (WSM) stands as a straightforward and widely utilized method of multi-criteria decision-making. It operates by multiplying assigned value of each attribute by the weight of importance designated by the decision maker. Subsequently, it entails aggregating these products across all criteria to compute evaluation scores for each alternative parameters considered in this study include Bitcoin, Ethereum, Biance Smart Chain, Hyperledger Fabric, and Corda, evaluated based on criteria such as Transaction Throughput (tps), Security Level (1-10), Energy Efficiency (kWh/tx), and Initial Setup Cost (USD). the term "Weighted Sum Model (WSM)" is correctly spelled, but the term "multi-Criteria" should be "multi-criteria" for proper phrasing. It involves assigning a value to each attribute, determined by the decision maker, which is then multiplied by a specified importance weight Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda. Transaction Throughput (tps), Security Level (1-10) Energy, Efficiency (kWh/tx) and Initial Setup Cost (USD). the ranking for blockchain-based database systems. Binance Smart Chain) got the top rank, whereas faculty strength Bitcoin) has a low ranking.*

Keywords: *MCDM, Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda.*

1. INTRODUCTION

In a typical blockchain configuration, there exist numerous nodes that operate without mutual trust. Despite the potential for some nodes to exhibit Byzantine behaviour, the expectation is that the majority will operate honestly Despite the presence of potentially malicious nodes within the network, block chain nodes can achieve consensus on transactions and their sequencing. The primary aim of blockchain technology is to establish a decentralized environment where transactions and data remain beyond the control of any third party. At its core, blockchain consists of a time-stamped sequence of blocks managed collectively by all participating nodes [1]. These blocks act as containers consolidating transactions and are cryptographically linked: each block is digitally signed and linked to the preceding block by incorporating its hash value. Blockchain operates as a replicated state machine system, where every node maintains identical data. This sets blockchains apart from database systems like H-Store, where data is partitioned or sharded across nodes. Shading helps reduce computational expenses and can potentially accelerate transaction processing. Several recent studies are addressing the challenges of scaling blockchain through the optimization of consensus protocols. However, our comparative study reveals that besides consensus, there are additional performance bottlenecks [2]. Figure 15 illustrates the various stages a transaction must undergo before being considered committed to the blockchain and databases do not necessarily share the same design goals: blockchains are not designed for general data processing This system should seamlessly

integrate blockchain'sinherentresistancetodatamodificationwiththequeryspeedofdistribttted databases, achieving both functionalities simultaneously Blockchain technology has emerged prominently in recent times, with proposed applications spanning various domains such as finance, healthcare, supply chain, online gaming, and social media [3]. However, the limited speed and poor query processing of current blockchain systems limit their usefulness in several sectors. In this section, we address recent developments in the sector and give an overview of blockchain systems and technologies. Blockchain relies on collaboration as its operational engine and functions as a trust less decentralized entity. Researchers that specialize in blockchain networks are now paying more attention to consensus methods, which have been explored thoroughly in the field of distributed systems. Refer to the study for a thorough summary of consensus algorithms designed for blockchain systems [4]. Blockchain operates as a network made up of peers that makes it easier for nodes to send and receive news. Transactions are transmitted over the network via a secure broadcasting protocol. Keeping the network's capability for dissemination of information stable is important since Denial-of-Service (DoS) assaults are common, especially on blockchains that are publicly accessible like Eth and Bitcoin. In the Bitcoin network, for example, larger mining pools may attack smaller pools in order to obtain additional rewards [5]. Over the past decade, blockchain has surged in popularity, serving Safe and unchanging For peer-to-peer transactions Distributed As a ledger. Database systems hold significant importance in storing transactional data within the framework of blockchain. Each database possesses distinct characteristics, and the selection of a database for particular blockchain applications hinges on these specific traits [6]. Blockchain technology emerged in 2009, finding its initial and most renowned application with Bitcoin. It functions as a decentralized database, ensuring data reliability through its unique recording and organization methods Before inclusion in a blockchain, data undergoes rigorous validation processes, making tampering with a blockchain extremely challenging. As a result, records within a blockchain exhibit immutability. This characteristic reduces the opportunity and motivation for fraudulent activities since tampered blocks require the painstaking task of reconstructing the blockchain from the altered point onward. Each block must undergo validation, ensuring the establishment of a permanent audit trail [7]. The primary utilization of blockchain technology is anticipated in the database engine layer, where transactions are aggregated. Nevertheless, it is not feasible to substitute the Accounting Information System (AIS) at the application layer Current discussions regarding blockchain properties largely focus on the database engine, rather than its application in transforming data into useful accounting [8]. Dominant computing power controls validation, Superseding other verification methods. Dominant computing power controls validation, Superseding other verification methods. Therefore, utilizing a public blockchain as a database engine might unexpectedly encourage managerial fraud Furthermore, a blockchain-based Accounting Information System (AIS) is anticipated to adopt a private blockchain model, Professionals who possess recognized expertise are entrusted with managing the technological Aspect of accounting system in computerized environment [9]. The implementation of a stand-alone blockchain in the environment of an Accounting Information System (AIS) for an organization highlights numerous benefits, including the reduction of the risk of financial fraud, cost-effectiveness in auditing, and the prioritization of security measures for financial data. This integration is coupled with legal requirements that mandate compliance with regulations related to financial reporting accuracy, cost reduction, and the ongoing improvement of accounting information through an established system [10]. Blockchain technology is poised to revolutionize the accounting profession, with the anticipation that transactions documented within a blockchain will seamlessly amalgamate into financial statements, enabling automatic verification of their authenticity and accuracy Dominant computing power controls validation, Superseding other verification methods. Therefore, utilizing a public blockchain as a database engine might unexpectedly encourage managerial fraud Blockchain technology offers robust backing for electronic voting systems [11]. Each vote cast by a voter serves as a traceable transaction on the blockchain. Enabling transparent vote tracking. This transparency allows everyone to verify the final tally, thanks to the open audit trail provided by the blockchain, ensuring that no data is tampered with, deleted, or altered without authorization within the blockchain. Blockchain operates as a permissioned protocol overseen by identifiable institutions, establishing a decentralized system for record-keeping [12] This entails the ability to recognize nodes responsible for collectively controlling and updating data, thereby fulfilling the trust objectives of the participants Blockchain technology offers a promising solution for addressing challenges encountered in voting processes and has already demonstrated successful implementation in Bitcoin transaction database systems Blockchain, originating from the entire network, arranges data into blocks that encompass transaction records. Each block serves as a distinctive data structure housing transaction detail on a dedicated blockchain [13]. As blockchain technology continues to evolve, it must adapt to diverse business requirements and facilitate data sharing across enterprise chains. A blockchain comprises the entire network, arranging data

into blocks containing transaction records. Each block serves as a distinct data structure housing transaction detail on a dedicated blockchain The inception of blockchain technology is visionary, representing a notable milestone with far-reaching implications across diverse sectors such as insurance, finance, and public service

Enhancing Supply Chain Management: Blockchain technology holds promise in instilling trust within supply chain management, thereby bolstering manufacturing security and service quality. Initiatives like the BaaS Project, launched by Microsoft and Consensus Microsoft Azure provides Ethereum Blockchain as a Service (BaaS), alongside Consensus, aiming to empower developers and enterprises in creating blockchain-based applications [14]. These offerings facilitate the development of systems that cultivate trust and security within businesses, while also generating revenue for the involved parties.

Testing and Evaluating: Blockchain activities: With the rapid advancement of blockchain technology, there is a growing emphasis on exploring various blockchain activities through multiple research efforts. Researchers are paying attention to investigating different blockchain activities, whether in examining private blockchains or in endorsing other forms, even including the adoption of the Blockchain-based framework, Blockchain Bench [15]. The adoption of private blockchains, endorsed by educators, encompasses the endorsement from all stakeholders, with initial provisions specified in Ethereum-based private blockchains or Fabric. In private blockchains, data approvals are distributed across recognized nodes, ensuring transparency in approved blocks.

Selection Criteria for Testing: Choosing materials for testing should be grounded in their extensive use or adoption within their specific domains. Ethereum stands out as a notable illustration, as it has underpinned one of the most substantial public blockchains since 2014 [16]. Additionally, Ethereum's open-source characteristics make it a favoured option for implementing diverse private blockchains.

Enhanced Security and Reliability: Businesses can leverage blockchain technology to bolster the security and reliability of their operations, especially concerning data reading and writing performance. By integrating blockchain, they can enhance the trustworthiness of their business processes. Conversely, components unrelated to trust and security can accommodate more detailed information and be built using relational databases. Blockchain technology has the potential to enhance trust, security, and decentralization within current business systems and applications [17]. The blockchain database stands out as the pioneering decentralized database system, bridging gaps in decentralized databases. By combining the principles of distributed databases with blockchain features, it inherits the strengths of both systems. A payment mechanism based on blockchain guarantees the reliability of payment procedures., rendering transactions tamper-resistant and non-repudiable. Experimental results validate the feasibility and effectiveness of this method. Traditional blockchain technology has historically struggled with data synchronization due to the requirement for all nodes in the network to synchronize the complete database to uphold consistency [18].

2. MATERIALS AND METHOD

Bitcoin: is the original and most famous digital money, developed in 2009 under the name Satoshi Nakamoto by an unidentified individual or group. It functions as a decentralized digital currency that eliminates the demand for middlemen like banks and permits peer-to-peer transactions.

Ethereum: Ethereum is by ether token decentralized running blockchain is a network, It users transactions carry out, by stocking earn interest on their shares, unusable tokens (NFTs) use and save and trade crypto currencies do, play games,use social media and helps to domore.

Binance Smart Chain (BSC): A distributed ledger technology called Binance Smart Chain, or simply Binance, was developed by well-known cryptocurrency exchange Binance. It seeks to offer cheap and quick interactions for smart contracts including decentralized apps (DApps). Developers may effortlessly migrate their Ethereum-based projects because BSC is friendly with the Ethereum environment and supports the virtual machine called the Ethereum Virtual Machine (EVM). BSC is renowned for its smooth integration with Ethereum Chain, cheap fees, and high transactional throughput.

Hyperledger Fabric: Hyperledger Fabric is an open-source blockchain framework under the Linux Foundation's Hyperledger project. It is designed for enterprise solutions, emphasizing modular architecture, scalability, and privacy. Fabric supports permissioned networks, allowing businesses to have control over access and visibility. It is particularly well-suited for applications requiring confidentiality and fine-grained permissioning, making it a popular choice for various industries, including finance, supply chain, and healthcare.

Corda: Corda is another blockchain platform developed by R3. It is specifically designed for businesses and aims to facilitate secure and private transactions between parties. Corda's unique feature is its focus on enabling direct transactions between participants without the need for a global broadcast. It is suitable for industries like finance, where complex transactions with privacy requirements are common. Corda uses smart contracts called "CorDapps" and emphasizes legal enforceability in its approach.

Transaction Throughput (tps): Transaction Throughput (tps) is a crucial metric in assessing the performance of a system, representing the number of transactions processed per second. A higher throughput indicates a system's ability to handle a larger volume of transactions, which is particularly important in various industries such as finance, blockchain, and networking.

Security Level (1-10): Security Level, rated on a scale from 1 to 10, reflects the robustness and resilience of a system against potential threats and attacks. A higher security level implies a more secure environment, crucial for safeguarding sensitive data and maintaining user trust.

Energy Efficiency (kWh/tx): Energy Efficiency, measured in kilowatt-hours per transaction (kWh/tx), gauges the environmental impact of a system. Lower energy consumption per transaction is desirable, as it not only reduces operational costs but also contributes to sustainability efforts.

Initial Setup Cost (USD): Initial Setup Cost, denoted in USD, represents the upfront investment required to implement a system. Balancing these parameters is essential for designing efficient, secure, and cost-effective solutions in various technological domains.

Method: Weighted Sum Model (WSM), a method for obtaining multiple criteria decisions, is recognized for its simplicity and widespread acceptance. Notably, it operates as an accessible approach in determining various outcomes with ease. However, it presents certain challenges when dealing with uniformity in input quantities, hindering its effectiveness in decision-making processes influenced by diverse factors [19]. The WSM is one of the earliest and most extensively used methods, often considered alongside the Weighted Product Model (WPM), which addresses some of its limitations. In the case of maximization, the optimal alternative satisfies a specific expression, where the Best Alternative WSM Score determined by the sum of actual values for each criterion multiplied by their respective weights. Utilized as a tool for aiding individuals in selecting partners based on Islamic couple criteria, the WSM method is commonly employed in single-dimensional problems. It serves as a means of comparing various factors and alternatives to determine appropriate actions [20]. Renowned for its simplicity in evaluating alternatives based on specific criteria. It offers a viable solution to MCDM problems by assessing the potential value of alternatives while considering relevant criteria. The calculation in WSM requires determining Criteria and relative weighting of alternatives performance values, particularly crucial in decisions based on single-dimensional criteria like the number of students [21]. WSM methodologies provide avenues for achieving optimal solutions in the selection process, particularly regarding the Best Platform (BP). SWARA facilitates the determination of criteria weights, offering clear priorities for Decision Makers (DMs). Meanwhile, WSM numerically ranks potential alternatives to assist DMs in establishing sustainable Enterprise Performance Systems (EPS). The enhanced SWARA involves five sequential phases, and third, alternative ranks are determined using the WSM method, incorporating neuromorphic WSM to rank the alternatives [22]. The outcomes reveal alternative 2 as the optimal choice, while alternative 1 rank lowest among the ten alternatives assessed. The Weighted Sum Method (WSM), and decision-making processes. The weighted sum model (WSM), introduced by Trentepohlia (2000), is employed to assess the optimal collaborative activity for learners, considering their collective learning styles. The weights assigned to various dimensions are determined by 14 instructors [23]. These dimensions and their initial weights are used as input data for the proposed framework. The algorithms in use showcase a capacity to yield a greater quantity of non-dominated solutions compared to WSM. Furthermore, these algorithms demonstrate an ability to generate non-dominated solutions using approximately 0.8% of the CPU time required by WSM [24]. The Weighted Sum Model (WSM) is selected as the Multi-Criteria Decision Analysis (MCDA) method due to its established efficacy in handling and its applicability in scenarios with numerous alternatives relative to Decision criteria. Acts as an adaptive calculation model inspired by biological neural networks, seeking to emulate the fundamental operations of the brain [25].

3. RESULTS AND DICUSSION

TABLE 1. Block chain-based database systems

	Transaction Throughput (tps)	**Security Level (1-10)**	**Energy Efficiency (kWh/tx)**	**Initial Setup Cost (USD)**
Bitcoin	7	9	5	300,000
Ethereum	15	8	7	200,000
Binance Smart Chain	30	9	8	150,000
Hyperledger Fabric	25	9	8	250,000
Corda	20	8	9	180,000

Table 1shows the Block chain-based database systems is using WSM method. Block chain-based database systems in alternative value in Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda and Evaluation value Transaction Throughput (tps), Security Level (1-10), Energy Efficiency (kWh/tx), Initial Setup Cost (USD).

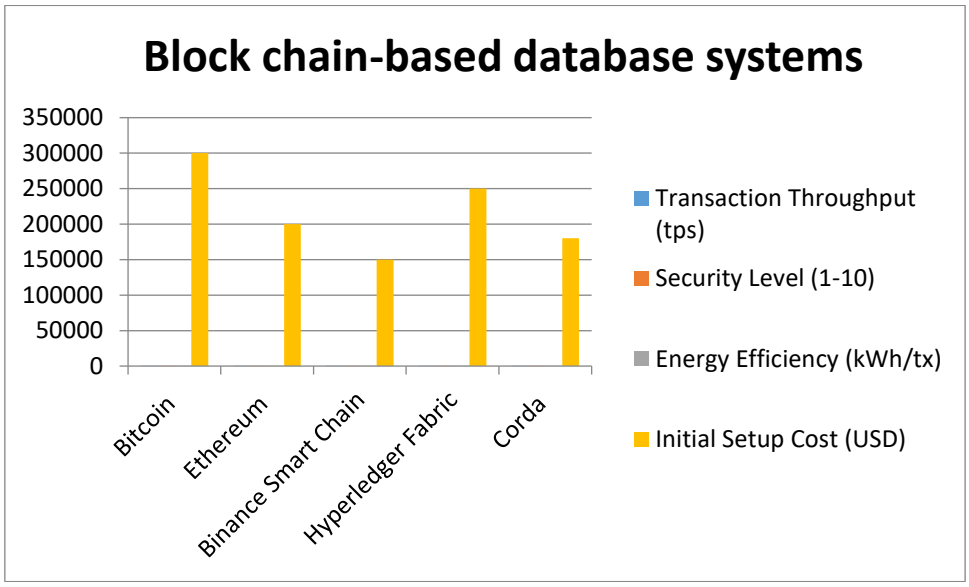

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TABLE 2. Normalized Data

Bitcoin	0.23333	1.00000	0.55556	0.50000
Ethereum	0.50000	0.88889	0.77778	0.75000
Binance Smart Chain	1.00000	1.00000	0.88889	1.00000
Hyperledger Fabric	0.83333	1.00000	0.88889	0.60000
Corda	0.66667	0.88889	1.00000	0.83333

Table 2 shows the Normalized data Block chain-based database systems. Computational time, Simplicity, Mathematical calculations involved, Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda)it is also the Maximum in Normalized value.

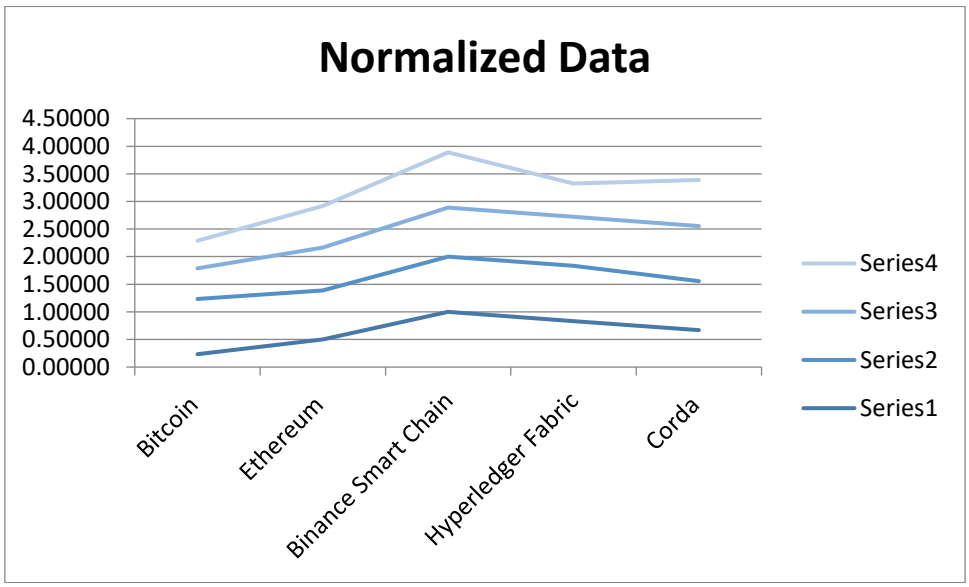

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TABLE 3. Weightages

0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 shows Weightages used for the analysis. We taken same weights for all the parameters for the analysis

TABLE 4. Weighted normalized decision matrix

Bitcoin	0.05833	0.25000	0.13889	0.12500
Ethereum	0.12500	0.22222	0.19444	0.18750
Binance Smart Chain	0.25000	0.25000	0.22222	0.25000
Hyperledger Fabric	0.20833	0.25000	0.22222	0.15000
Corda	0.16667	0.22222	0.25000	0.20833

Table 4 shows the weighted normalized decision matrix for) is Block chain-based database systems in alternative value in Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda and Evaluation value Transaction Throughput (tps), Security Level (1-10), Energy Efficiency (kWh/tx) also Multiple value.

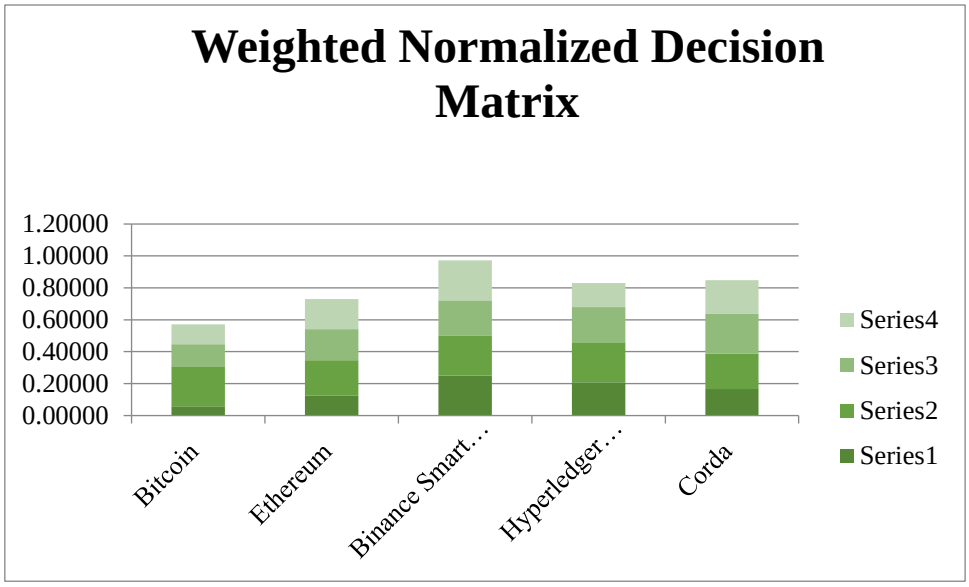

FIGURE 3. Weighted Normalized Decision matrix

Figure 3shows Weighted normalized result matrix for is Block chain-based database systems in alternative value in Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda and Evaluation value Transaction Throughput (tps), Security Level (1-10), Energy Efficiency (kWh/tx) also Multiple value.

TABLE 5. Final Results of Block chain-based database systems

Bitcoin	0.57222	**5**
Ethereum	0.72917	**4**
Binance Smart Chain	0.97222	**1**
Hyperledger Fabric	0.83056	**3**
Corda	0.84722	**2**

Table 5 shows the final result of WSM for blockchain-based database systems. The priority score is calculated using the higher value of Finance Smart Chain and the lower value of Faculty Strength Bitcoin.

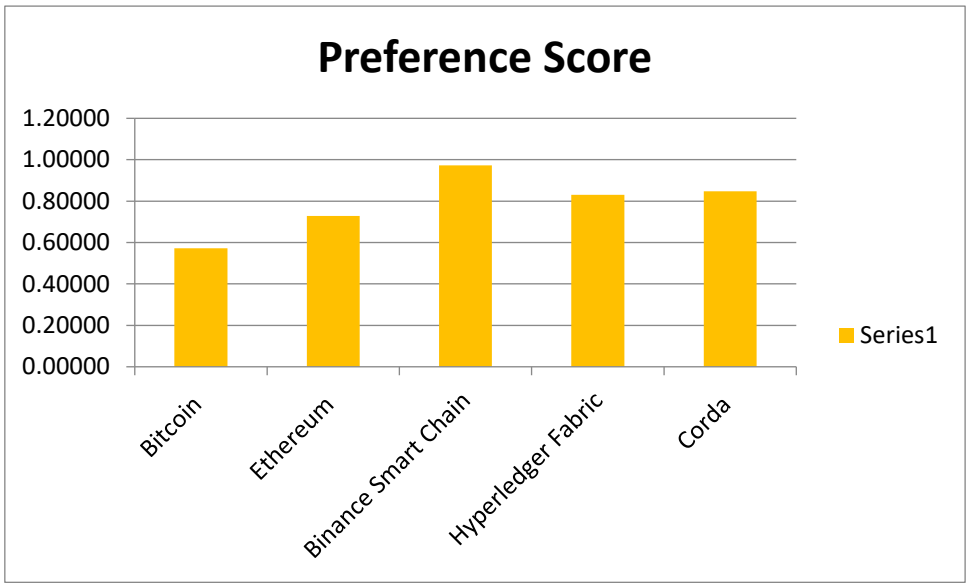

FIGURE 4. Preference Score the.

Figure 4 shows the priority score for Binance Smart Chain, showing the highest value for priority score and author Bitcoin showing the lowest value.

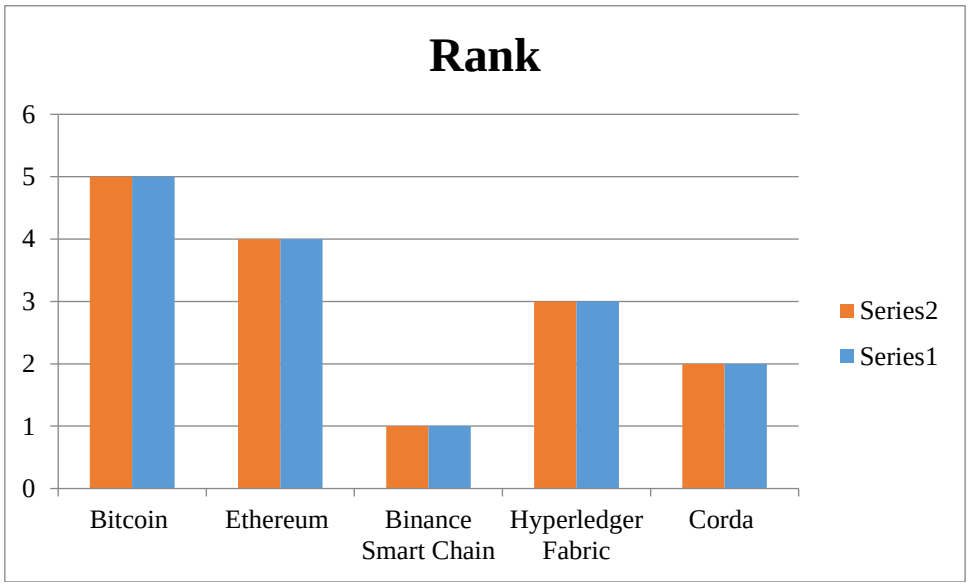

FIGURE 5. Shows the Rank

Figure 5 shows the ranking for blockchain-based database systems. Binance SmartChain) got the top rank, whereas faculty strength Bitcoin) has a low ranking.

4. CONCLUSION

Block chain technology has surfaced as a transformative influence, revolutionizing the verification and recording of transactions across industries. In to traditional data base systems, presenting a novel approach to database management. The objective is to enhance the trust, transparency, and security of data storage and transactions. Research in this field aims to strengthen data protection, reduce the risk of unauthorized access, and prevent data tampering. By providing a transparent and auditable record of transactions, block chain enhances trust among parties This system should seamlessly integrate blockchain's in herentresistance to data modification with the query speed of distribttted databases, achieving both functionalities simultaneously Blockchain technology has emerged prominently in recent times, with proposed applications spanning various domains such as finance, healthcare, supply chain, online gaming, and social media. A distributed ledger technology called Binance Smart Chain, or simply Binance, was developed by well-known cryptocurrency exchange Binance. It seeks to offer cheap and quick interactions for smart contracts including decentralized apps (DApps). Developers may effortlessly migrate their Ethereum-based projects because BSC is friendly with the Ethereum environment and supports the virtual machine called the Ethereum Virtual Machine (EVM). BSC is renowned for its smooth integration with Ethereum Chain, cheap fees, and high transactional throughput. Transaction Throughput (tps) is a crucial metric in assessing the performance of a system, representing the number of transactions processed per second. A higher throughput indicates a system's ability to handle a larger volume of transactions, which is particularly important in various industries such as finance, blockchain, and networking. Security Level, rated on a scale from 1 to 10, reflects the robustness and resilience of a system against potential threats and attacks. A higher security level implies a more secure environment, crucial for safeguarding sensitive data and maintaining user trust. the term "Weighted Sum Model (WSM)" is correctly spelled, but the term "multi-Criteria" should be "multi-criteria" for proper phrasing. It involves assigning a value to each attribute, determined by the decision maker, which is then multiplied by a specified importance weight Bitcoin, Ethereum, Binance Smart Chain, Hyperledger Fabric and Corda. Transaction Throughput (tps), Security Level (1-10) Energy, Efficiency (kWh/tx) and Initial Setup Cost (USD). the ranking for blockchain-based database systems. Binance SmartChain) got the top rank, whereas faculty strength Bitcoin) has a low ranking.

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