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Research Article

Multihoming Big Data Network Using Blockchain-Based Query Optimization Scheme

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In this paper, we have proposed the intimate environment of multiblockchain optimization algorithm using big data inquiry to mend the effectiveness of association query handling among numerous multihoming blockchains by implementing the big data system. This technique adds semantic evidences to the old-styled multiblockchain prototype and constructs a semantic model of multiblockchain that delivers a foundation for linking queries among the various blockchain multihoming system in big data. On the base of this model, distributed databases have index arrangement, and a linking index arrangement is proposed among the numerous blockchains, with several attributes linked to these blockchains employed to improve the efficacy of linking calculation. Besides, the communication cost is d for data communication. On this foundation, a multichain linking enquiry algorithm based on optimization is anticipated to progress the productivity of multiblockchain connection queries. To conclude, two genuine big data community sets of data are used to conduct experiments on. The associating index arrangement among blockchains is unchanging and is equated with the old-styled direct linking inquiry operation. The multiblockchain linking query method of optimization shortens the probe processing procedure. It acquires the query outcomes directly by retrieving the linking index, sinking the local calculating ability, system overhead, and illuminating query efficacy.

1. Introduction

Blockchain can be characterised as a distributed ledger technology for data storage in an encrypted form. It is based on procedures that are intended to connect parties who do not trust one another to team up on various goals that ultimately benefit everyone. The advantages of blockchain technology are that it is open to all, that it stores information in a decentralized way, that it is immune to censors, that it is tamperproof, that it is transparent, efficient, and quicker, and that it eliminates the need for a third party, which lowers the cost. Blockchain technology has a number of drawbacks, including the fact that it cannot be scaled owing to the fixed block size, is energy and time intensive, requires more storage, and is subject to some regulatory restrictions. Blockchain expertise has fascinated the devotion of various industries in recent ages, with the achievement of blockchain schemes such as Hyperledger Fabric and Ethereum designs of blockchain. Multihoming networking technique is employed to reduce ambiguity by involving numerous networks that communicate with a single network activity at the same time and trade the dataset efficiently. Multihoming on the other hand still lacks developmental and research contributions, such as using machine learning and deep learning approaches to help arrange data blocks and point out flaws, as well as a variety of other network delays. A multiparty, interfered, traceable, and cooperatively maintained scattered database, Smart provides a strong safety net. Blockchain networks and [1] promote big data transparency and consistency and yet are broadly applied in health information retention [2], financing, supply chain [3, 4], among information sharing areas [5] and many other arenas. One of the most significant barriers to blockchain implementation has been public acceptance. Medical global records and the absence of a trustworthy third person, according to various research, make it more challenging for regulatory systems to give access, outlining confidentiality as an actual problem. Others have pointed to a lack of governance norms and standards as a potential barrier to blockchain implementation in the healthcare business. A few other studies link a lack of interoperability because of no trust between groups and limited open standards, making a comprehensive exchange of data between healthcare facilities difficult [6]. Only with the advancement of Bitcoin blockchain expertise, more information is dispersed and deposited on various blockchains, resulting in comprehensive and multisetups. However, certain blockchains are isolated, and information bubbles emerge between chains, preventing info from going direct, finding it tough that recovering the info that the treatment is crucial across several chains, i.e., the linking query process of multiple blockchains becomes complex. On the fundamentals of single chain, the existing blockchain scheme only backs multihoming big data inquiry processes. In multiblockchain situations, we study data linking and query handling. Considering the cross-regional arrangement among blockchain, straight data linking operations will create significant local totalling load and linkage transmission that is extremely affecting the linking query efficacy and user practice. Hence, the optimization of multiblockchain linking query processing is crucial. The main goal of this investigation is to optimize a multiblockchain linking inquiry to reduce the rate and response time of the preferred choice. To join the characteristics between chains, the chain linking index (SMMI) or semantic cross-model link indexing is employed; a multichain linking query optimization technique is based on SMMI and is aimed at improving the efficacy of multiblockchain connecting queries.

Taking two medical institutes as a real setup example, both are having diverse blockchains. The conditions connected with “Amy” in the two foundations must be returned if an operator submits a probe “Q [Amy].” Though using the current query expertise, just the required information can be gathered only by exploring Ethereum A, then searching on Chain B, and last integrating the results. This querying method will result in high local totalling load charges as well as network outages. However, the data is being produced, and the system transmission information steadily increases, while the efficacy of the connecting calculation gradually diminishes, resulting in a loss of user competence.

Optimization of multiblockchain linking inquiry to minimize the rate and reaction time to the best possibility is the main objective of this exploration. The following are two major challenges that are faced: (1) weak semantics of the linkages. Although dealings with the blockchain hold multiple characteristics, this has not been wisely conducted in the prevailing multiblockchain context, and there is no semantic explanation for each attribute assessment. Therefore, the association between dealings cannot be recognized, and the linking operation between the blockchain and in the blockchain is not maintained. (2) The linking query efficacy is small. In the chunks on the chain, connections are deposited, with no index among transactions. Speed is significant in terms of query latencies or how long it takes to receive a response to a query. This is especially crucial when there is a lot of data pouring in. Random write access to a database, for example, can severely compromise query speed if transactional guarantees are required. Variety, on the other hand, refers to the amount of effort aimed at integrating and dealing with data that comes from a wide range of sources [7]. Thus, big data inquiries in multihoming need to pass through the whole chain. Due to traversal, the number of random disk reads rises with the substantial time. Since in the cross-qualities of a Trans network setup are enough, blockchains are not linked; therefore, they must be queried singly, and the results must then be aggregated. Because of the high cost of connection establishment, the query efficacy is inadequate.

In the paper, we have suggested the optimization issue based on multiblockchain linking inquiry. Initially, a semantic multiblockchain is designed for the feeble connection to enable multichain linking. Model SMM: by varying the actual data storing architect of the blockchain and the addition of information with a semantic component. Furthermore, because linking queries are ineffective, the multiblockchain architect based on the semantically blockchain model is focused on the semantic blockchain prototype. The chain linking index (SMMI) or semantic cross-model link indexing is being used to join attributes between chains; a multichain linking query optimization technique is based on SMMI and is aimed at increasing the efficacy of multiblockchain connecting requests. Ultimately, experiments are conducted on the genuine community dataset to verify the usefulness of the multichain joint inquiry optimizing procedure.

1.1. Work Done in This Field. It was the cryptocurrency which gave rise to blockchain, but it did not put any concentration on the data management requirements. Bitcoin only facilitates simple inquiries, such as investigation for communications or blocks; it uses a file model for storing data blocks. In this research, the author lengthens Bitcoin by combining a Turing-complete encoding language to facilitate more composite business rationality [8]. Ethereum holds data blocks and sets data in LevelDB [9], and for accessing the information, it uses low-level API’s. Hyperledger Fabric (HF) is innate far ahead to store the information in a database of NoSQL database with type <Key, Value> and communication minimize semantic data. For difficult inquiries, blockchain schemes lack ironic semantics traditionally. In several arenas to withstand novel data maintenance demands in blockchain applications, oscillating between academia and production research has initiated to focus on blockchain and data organization techniques that has supported the use of traditional blockchain knowledge. That is being employed in industry on a vast scale.

SEBDB states that this study has amplified the inquiry ability of the blockchain to itself, but these readings are all grounded on a single chain. Blockchain is a popular study topic at the moment, because it can be used to the greater part of IoT applications [10]. With the extensive usage of blockchain expertise in the management of data, occasionally multiple sections will implement several blockchains for managing data. For managing data, multiple organizations also employed numerous blocks. Data transferring through numerous blockchains is becoming a research hotspot with chain environment a common platform to use. With the several challenges that are faced in the prevailing blockchain system, such as the liberation of blockchain model, data and value communication transfer. Cross-chain expertise is the recognition of several blockchain schemes. A vital technique is meant to intersect and progress scalability [11]. This research is aimed at developing blockchain skills that are suitable for a variety of scenarios, such as community chains like Esperanto, Superledger Chain, and Bitcoin, as well as privatized chains [12]. To review the successes in cross-chain technology, the properties of a substantial percentage of consortium links exist concurrently but also thoroughly. The AC3WN method is designed to use a dispersed instantaneous merge agreement protocol [13]. Data distribution between chains through provisioning specialized care is an example involving cross-chain expertise. Shrestha et al. presented a new blockchain-based platform for user modelling that enables users to communicate data without losing possession and control and apply it to the travel booking sector [14]. The authors [15] suggested a blockchain-based IoT big data authenticity validation technique in this research to prevent any damage of the Third-Party Auditor (TPA), who is responsible for certifying the integrity of Artificial Intelligence of Things (AIoT) data. Another article [16] suggests a multilayer blockchain cyber security strategy to safeguard IoT networks while also making deployment easier.

2. Problem Definition

Definition 1. A multiblockchain paradigm in which $\text{Branches} = \text{BC}_1, \text{BC}_2, \text{BC}_3, \cdots, \text{BC}_i$, where BC_i is a blockchain. An interparadigm with two healthcare blockchains, as depicted in Figure 1, contains chain A and chain B.

Definition 2. Inquiry into cross-linking: $Q = [k\,1, k\,2, k\,\text{chains}]$ is a logical set in the inquiry. The grouping of phrases states the customer's inquiry intent, and each keyword is denoted by k_i $(i = 1, 2, \cdots, n)$. For illustration, if the operator publishes an inquiry $Q = [T_{\text{name}} = \text{X-ray2, AB}]$, it means that all possessions of the radiography division coupled upon that inquiry networks A and B are related, and then, all facts on the blockchain technologies A and B will be reverted.

3. Semantic Multiblockchain Model

Because the current multiblock link scheme information storage lacks semantics, this division plans a semantically multiblock model based (SMM) regarding the existing multichain model to supervise the linking inquiry.

Definition 3 (multimodal blockchain). Contextual network $S = \text{S-Block}_1 + \text{S-Block}_2 + \text{S-Block}_3 + , \cdots , \text{S-Block}_i$ is a syntactic block, which describes the blockchain that supplements semantic information (semantic blockchain, *S*); Figure 2 depicts the chunk assembly of each SMM blockchain.

Definition 4. S-Block is made up of two elements, as indicated in Figure 2, the Blockhead and the S-Block midsection. S-Block is made up of two parts: a head and a body. The unit assembly of an old-style blockchain and the block head is similar. Timestamp (timestamp) and so on are all placed by Blockhead. Merkle's root is built on evidence about connections. To transmit the information content, the stored format of the communication data in the S-Block form is transformed to <keys and column>, and matching sentences are added to each parameter, as illustrated in Figure 2. Extra attribute semantic info and attribute values are included in other forms of communication columns, such as "name = Amy, sex = -women, info = Info_q," whereby the tag is component semantics info and the consistent "Amy" is the variable response.

Definition 5 (semantic transaction). T_s would be the communication's timing, SenID is indeed the communication's initiation, T_{name} is the transaction's category, v_i is the attribute's valuation, and the real parameters are a group of user-defined application-level features. Characteristics attr2 $= vm + 1, \cdots, \text{attrn} = vn - m + 1$, assigned to various attribute categories for diverse products and communication types. Figure 3 shows design of semantics chunks.

4. Indexing Design Linking of Multiblockchain

The SMM paradigm, which is in charge of communication, has semantics in Section 3. Due to the many types of communication characteristics and storage order, which are separated from the database table, the semantic block cannot be directly imaged for assembly operations. Additionally, the unique data is immediately used for linking inquiries. As a result, a higher compute load is produced, as well as latency. An actual indexing should always be recognized to appreciate the optimal linking quest within each trait in column.

4.1. Linking Index for Multiblockchains. A third-part: SMM-based connectivity index in multiblockchains (SMMI) is planned for effective connectivity.

(i) The S-Index is a type of inverted index. An inverted index data structure stores a reference from data to their locations in a record or sequence of records. It helps users navigate from a phrase to a paragraph and also a website link. The inverted index, which includes the index structure as keys, columns> as a design, is used to reduce network data transfer costs and source data count of I/O reads. The important information of the trait named attr is used to generate the index, with the keys being the value of the attribute in the data source's column

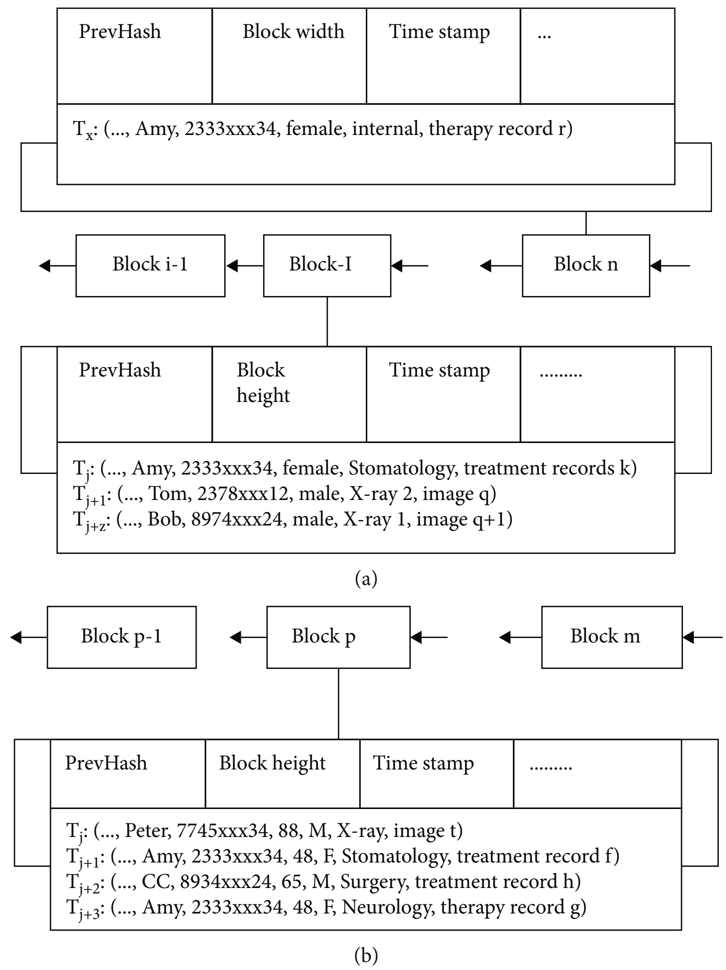


FIGURE 1: Cross-model schematic representation (a, b).

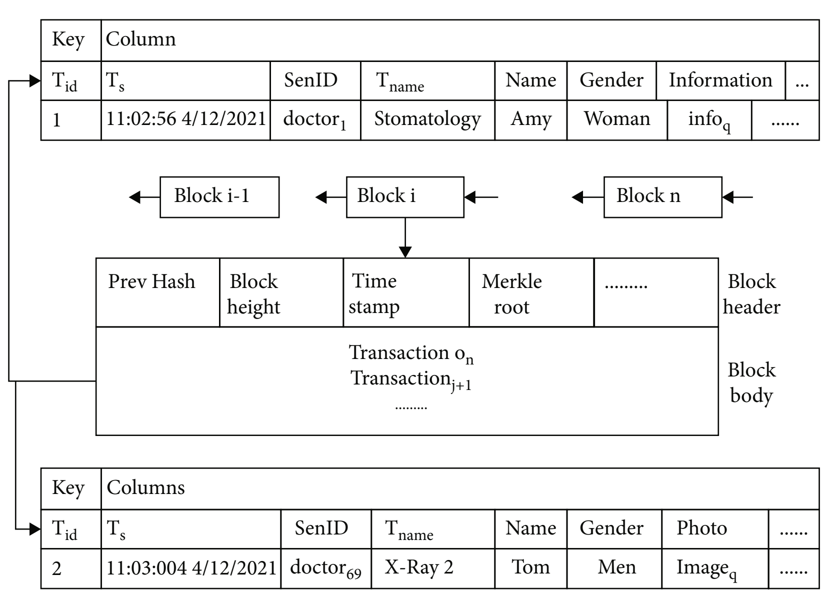


FIGURE 2: Composition of semantic blocks.

Key	Column						
T_{id}	T_s	SenID	T_{name}	Name	Sex	Info	….
1	11:02:56 4/12/2021	Doctor1	Stomatology	Amy	Women	$Info_q$	….
T_{id}	T_s	SenID	T_{name}	Name	Sex	Info	….
2	11:03:00 4/12/2021	Doctor69	X-ray2	Tom	Men	$image_q$	….
T_{id}	T_s	SenID	T_{name}	Name	Sex	Info	….
3	11:20:10 4/12/2021	Doctor69	X-ray2	Bob	Men	$image_{q+1}$	….

Index on T_{Time}

S-inverted index

Key	Column		
T_{name}	T_{id}	Block id	Trans-id
Stomatology	1	i	j
X-ray2	2	i	J+1
	3	i	J+2
Internal	4	n	s

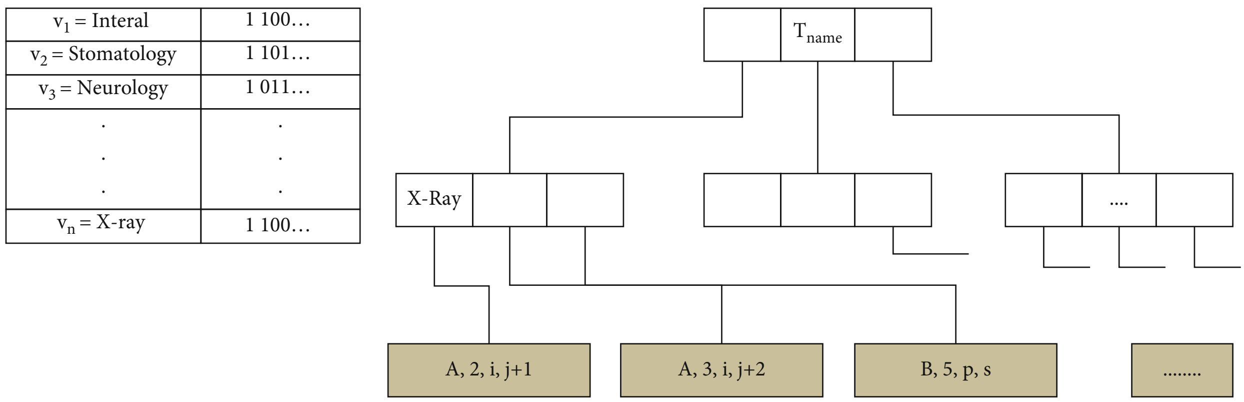
Figure 3: S-inverted index structure.

The valuation of the trait is the crucial component of the index as T_{name}, which is designated as an arrow in the shaped form in diagram 3, the prodigy index as below, where "key = stomatology" is the rate of a basic statistics T_{name} "$T_{id} = 1$" interaction, and the price of the trait is the key of the index as T_{name}, which is designated by arrow in the patterned form in graph 3, the famed index as below, the weight relates to the rate of the trait section as T_{name}. The communication for related recognition including in location of chain is stored in the S-inverted index columns. Consider the box frequency updating of the bitcoin blockchain, where the index case must be retained for a long time and the multichain is scattered across multiple locations. As a result, we wish to create an indexing that is as promising as possible. This approach reduces the index's packing complexity. Furthermore, it may cut the price of data-diffusion interaction and indeed the number of fundamental data I/O interlinking inquiries. The S-inverted index structure is shown in Figure 3.

(ii) For enhancing the effectiveness of linking design in S-Bitmap indexing, we favour the bitmap structure and generate the S-Bitmap key based on the S-inverted key of each blockchain. Bitmap indexes are a sort of database index that uses bitmaps to store information. Bitmap indexes have long been seen to be a suitable fit for columns having a small number of unique entries, either actual or comparative to the volume of records containing information. Any feature (attr) throughout all blockchains is defined by the S-Bitmap indexing. Each trait tr maps to an S-index of bitmap, and indeed the th row of the indexing indicates whether there is any communication between attr as the vth variable per the semantics blockchain

This is illustrated in Figure 4. The theme holdings build the S-Bitmap file over all meanings registered in the blockchain T_{name}'s left expense. Because the initial values in the right hand column throughout the last row are 1, this index can significantly improve the efficiency of linking queries and can directly regulate whether or not the linking requirements are met.

(iii) The S-B+-tree criterion, which is based on the S inversion indicator, is designed to improve inquiry efficacy. The B+-tree is a tree with each point representing a disk block and the corresponding properties. The tree is symmetrical since each leaf will have the same dimensions. An interior node stores a sequence of values and a bunch of pointers. By one, the number of pointers outnumbers the number of keys. The S map indicator will be used to determine yet if the linkage is acknowledged and to quickly obtain detailed information about the communication. S-B+-tree is required for the said creation of the S-B+-tree indexes, which consists of a collection of connected characteristics. The T_{name}-B+-tree indicator is used to discover the leaf nodule with T_{name} = X-ray as well as find the communication position info which thus runs into the network environment



(a) S-Bitmap indication

(b) S-B+-tree indication

Figure 4: Indexing framework based on S-Bitmap and S-B+-tree.

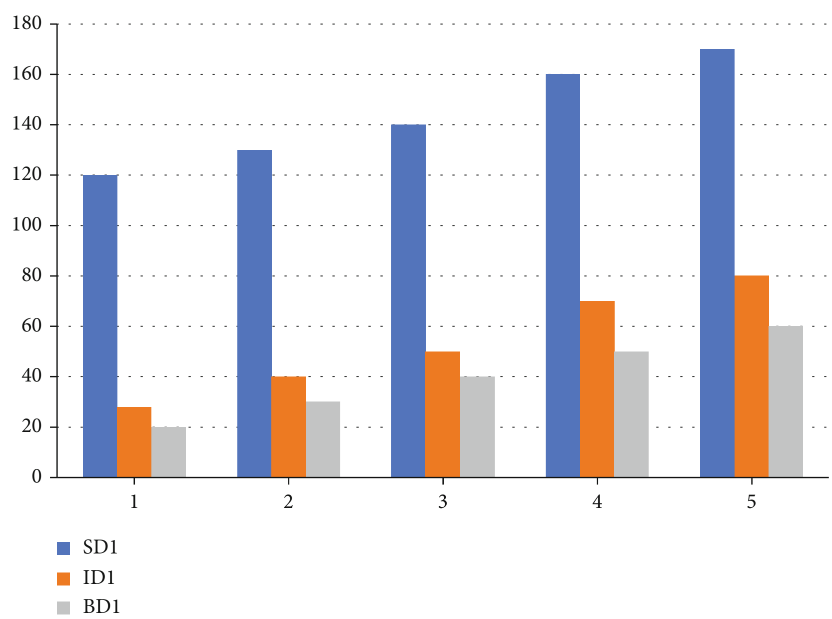


Figure 5: Deviation of link query period in D1 dataset for diverse outcome set.

4.2. SMMI Preservation Strategy

Definition 6. Keep track of indexing record increments and update the indexing information. Tuple in which the semantics label reflects the indexing trait's attr, and the keyword appears to be the trait valuation, Trans-id stands for the transaction volume in the suggestion, and the semantics blockchain has S valuation.

Definition 7. S-inverted indicator fundamentals (attr S-inverted indexing, attr, Block-id) are the indicator data. It keeps track of the file's name (attr S-inverted indexing), semantically the name of a feature that conforms towards the indexing (attr) and refers to a statistical block number (Block-id).

Before using the management plan, one must first construct an incremental record group. The system obtains the information from the previous consent communication and builds an iterative index entry when a fresh round of communication is conducted to obtain an agreement (increment). This step has a linear complexity and is responsible for putting all of the data together. Because of the vast number and variety of iterative records, they are categorized by semantic name (attr), which is an updated attribute, and

Table 1: Disparity of joint inquiry phase for dissimilar consequence sets in D1 dataset.

	SD1	ID1	BD1
Query 1	122	25	20
Query 2	130	40	30
Query 3	140	50	40
Query 4	160	70	50
Query 5	170	80	60

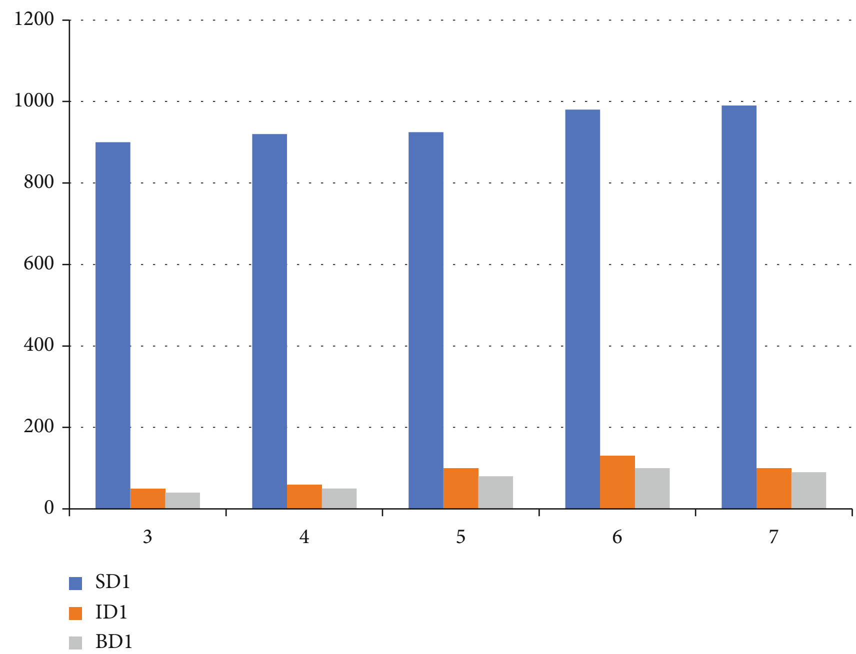


Figure 6: Variation in connection query time in the D2 dataset for various groups of result sets.

incremental info groups (increments). After this, several indexes are modified by attaining the whole record group task. Every index is changed by managing the corresponding task index (attr S-inverted indexing) in relation to the enhanced record set using the semantics trait name (attr). However, if the equivalent indexes do not exist, the adjustment is not immediately written to the S-inverted index. If the problem persists, create new S-inverted index and then modify the assignment. Keep updating the equivalent map of the S-Bit and S-B+-tree index just with the equivalent periods. Finally, implement alterations to the index's essential information (Index-Info). As a response, the distinctive steps listed in the method below, marked as 1, have been used to settle the SMMI indicator.

The SMMI feeding methodology is mentioned in Algorithm 1. Either the first or middle sections of the code attain agreement and successfully create records by increasing internal communication and keeping records in different record groups. Line 3 mentions a duty for feeding the index for the third time in a row. The assignment relating to the incremented range set gets stored in the ready list, according to lines 4 and 5. From line count seven to nine, the activity queue's primary work and searches the S-inverted indexing setting for the said associated S-inverted index. An upgrade is mentioned on lines 10 to 12, and the task will be noted. The additional locality for indexing sustainability here to link index i. Lines in count 14 state that the S-inverted index data has been changed based on the comprehension of the data. Algorithm 1 has O time complexity (n).

Table 2: Deviation of link inquiry period for diverse output sets in D2 dataset.

	SD1	ID1	BD1
Query 3	880	50	45
Query 4	900	60	55
Query 5	910	90	85
Query 6	950	100	98
Query 7	960	110	105

Table 3: Relating query time to the number of links in the D1 dataset.

	SD1	ID1	BD1
Query 2	110	0.6	0.5
Query 3	120	0.7	0.6
Query 4	130	0.7	0.6
Query 5	140	0.8	0.7
Query 6	150	0.9	0.8

5. Experimental Analysis

5.1. Experimental Environment. In our approach, we are implementing the processor i7 of Intel as our hardware setting with a frequency of 2.6 GHz having 16 GB memory for the exploration purpose. We are using Python for implementing models of the blockchain as well as algorithms. To associate real application circumstances, the assessment dataset of Amazon along with the general medication (Medicine) dataset, i.e., 2 dataset investigates, which are denoted as D1 plus D2 datasets. In these criteria, Amazon super market dataset is employed for auxiliary and contrast purpose, whereas the medicinal dataset is employed to authenticate the presentation scenario experiments. There is a uniform dataset distribution in the examination, whereas the distribution of genuine data is in chunks.

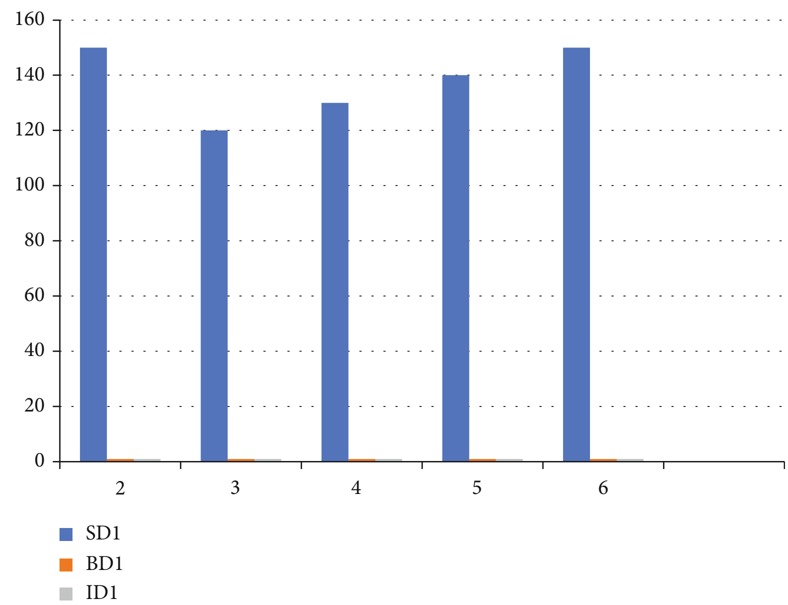


Figure 7: The querying time for a connection in the D1 dataset with varying number of chains.

This research mainly assesses the performance through dual aspects of the planned method: initially, the firmness of the SMMI presented in Division 4 evaluates the index creation time; then, the viability of the indexing construction besides the link algorithm is appraised in the inquiry response time.

5.2. Recital Valuation of Linked Inquiry. For keeping the blockchain intact, we must manage the blockchain's dimension and adjust the number of chains in the blockchain; otherwise, the blockchain's inquiry result set will be used to execute separate investigations upon dualistic sets of data. The shorter link inquiry of the process stage has the following evaluation contrast: (1) no index for all blocks scanning (S-scanning); (2) for linking queries, utilizing the s-reversed index (S-inverted index-I) benchmark algorithm; (3) improve the algorithm by using the S-Bitmap directory and are used to evaluate the query time of three approaches in data collection.

Figure 5 and Table 1 show that in D1, if the number of rows R remains constant over the whole data capacity, the possibility of the inquiry output set changes, as does the time of the join inquiry. Within this trial, the link enquiry has been labeled $Q = [\text{money} = 16.99, \text{AB}]$. The results show that the presentation of the BD1 optimal inquiry strategy is clearly superior to the two other options. The following are the primary causes:

(1) Using the S-B+-tree index, the inquiry communication may be quickly located, eliminating the need to skim the entire blockchain

(2) By means of S-Bitmap index, the join state holds the query deal only. Moreover, ID1 is superior to SD1 since fewer blocks are recited. However, through the outcome set, by increasing the amount, the query reply time rises in the processing of ID1 and SD1, the outcome is decreased due to more involvement of union join procedure, and more communications are delivered from the disk

Figure 6 shows that the number of controller chains on D2 has stayed constant, the quantity of R has varied, and the inquiry period T_q of the said transaction inquiry $Q = [\text{rating} = 6, \text{AB}]$ has been confirmed across specific outcome sets. The results show that its BD2 optimal inquiry technique's presentation is noticeably better than the existing ways, demonstrating the technique's usefulness. The variance of link query period for various effect sets in the D2 dataset is shown in Table 2.

A D2 rating has ten categories for evaluating an attribute, whereas a D1 rating has hundreds of classes for evaluating a monetary element. Because of the properties of the indexing layout, the query presentation difference between indexing S-B+-tree and indexing S-inverted is tiny, while the querying rate of the inquiry variable is minor. On the other hand, the S-B+-tree index will be knowingly better than the S-inverted index in terms of the significant value of the query attributes. Finally, the optimizing algorithm delivers the best results. Table 3 shows the transmission inquiry period for various chain counts.

To evaluate the performance of a large number of blockchains, we must set the result dimensions and maintain the amount and size of blocks per chain while increasing the number of chains C. The query research response time is passed out in D1, where $R = 20$ is fixed, the chain quantity is extended from two to six, and the inquiry $Q = [\text{money} = 16.99, \text{AB}]$ is joined while exploring various chain quantities. Figure 7 depicts the inquiry time (T_q). The results show that as the number of links grows, the length it takes to respond in three ways remains unchanged, because the length it does take to query is primarily influenced by the data structure. As a consequence, the number of communications drawn remains constant, and the inquiry system response is excellent.

6. Conclusion

Blockchain has the ability to radically alter the way big data is managed and studied, with better protection and information quality being just a few of the advantages that this technology has to offer to enterprises. Big data analytics' ability to positively impact corporate operations may become even more enticing. In this study, we propose an optimization problem based on a multiblockchain linking investigation. To enable multichain linking, a semantic multiblockchain is initially built for the weak connection. Model SMM: by altering the blockchain's real data storage design and adding information to a semantic component. Furthermore, because linking inquiries are unsuccessful, the semantic blockchain prototype is the focus of the multiblockchain architect based on the semantic blockchain model. To join the characteristics between chains, the chain linking index (SMMI) or semantic cross-model link indexing is employed; a multichain linking query optimization technique is based on SMMI and is aimed at improving the efficacy of multiblockchain connecting queries. Experiments were performed on two authentic big data community datasets. Blockchain's associated index structure remains constant and is comparable to the old-fashioned direct linking inquiry procedure. Targeting the issue that the prevailing blockchain arrangement only supplies the tasks of data inquiry based on a sole chain, the calculation load is enormous. When performing linking queries between numerous blockchains, the efficacy inquiry is small of a linking query optimization procedure based on the proposed surroundings in a multiblockchain. To accomplish multiblockchain a rapid linking query that is grounded on the multiblockchain prototype with semantics, over the linking index arrangement among multiple blockchains, the linking attribute of numerous blockchains is recognized. The probe processing technique is sped up using the multiblockchain linking query method of optimization. It obtains query results directly by fetching the linking index, sinking the local calculating capability, reducing system overhead, and enlightening the query efficacy. The efficacy of linking calculation is upgraded, and the messaging charges for the transmission of data are minimized. As per the investigational outcomes, the index arrangement shows good stability and declares the impressively improved efficacy on comparing with the old-styled linking query. In the above exploration, we have considered presenting the collection mechanism of the linking attribute and are ensuring the exactness of the inquiry results. We have further studied the simultaneous query approach among multiple blockchains on this foundation.

7. Future Scope

As innovations in this sector evolve, we may expect to see more progress in the big data analytics and blockchain relationship. As technology advances and further breakthroughs arise, more concrete use cases for big data management and data analysis will be developed and analyzed. It will be fascinating to witness how the blockchain intends to revolutionize different organizations while still enhancing data security as more information is collected. One of the industries where blockchain technology and big data could complement each other nicely is healthcare, where patient records are not completely secure. In the healthcare industry, data analysis is critical for tracking patient, treatment, and instrument flow. Inaccurate diagnoses, inappropriate treatment procedures, misplaced test results, and erroneous medications are all possible outcomes of careless handling of patient information in healthcare.

Data Availability

The data shall be made available on request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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