Sustainability of Cryptocurrency in Blockchain Technology for a Banking System in Asian Countries

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Abstract

Objective: The Aim of this paper is to analyze the suitability of digital currencies and blockchain innovation for getting monetary exchanges in Asian nations. A new understanding of money has arisen in the wake of the global economic crisis caused by the subprime mortgage crisis. It is entirely digital money, and all transactions take place across a decentralized network.

Methods: This algorithm-encrypted currency is dependent on a dispersed network called the Blockchain and is said to be tamper-proof, transparent, and inclusive. Exchanges in blockchain innovation are amassed inside the chain of blocks, rather than customary registers, which paginate and consecutively record processes. Since it is replicated over numerous geographical locations all over the world, it is decentralized.

Results: We suggest adding the Proof of Work idea to the SimBlock test system to spread out additional specific measurements roughly the block shape at the blockchain local area, in between one block and some other, to portray the hour of the mining system, and to show the hashing cost made.

Conclusion: The objective is to furnish clients with intensive realities so it will perceive the way the PoW-basically based blockchain network works. Our analysis based on the proof of work (PoW) and Merkle tree model indicates that the sustainability of cryptocurrencies is a significant problem for developing nations. Its practicality presents a variety of challenges, particularly in Asia.

Keywords: Cryptocurrency, Blockchain technology, Banking sector, Asian Countries

Introduction

An innovative wave of disruptive technologies known as "Industry 4.0" has recently emerged in our society and extended across several industries (Hou et al., 2020). Many service sectors, from banking to telecom, are anticipating benefits from Industry 4.0's digital technology

in addition to manufacturing firms (Kohtamäki et al., 2020).The largest part of GDP nowadays in the majority of industrialized countries comes from the service sector. In order to improve the way they conduct business, several service industries are nowputting these technologies to use or testing them. The Industry 4.0 unrest envelops an expansive scope of innovations, including man-made brainpower (AI), the web of things (IoT), distributed computing, 3D printing, blockchain, and digital actual frameworks (CPS). These disruptive technologies' advantages include their capacity for self-improvement, security, and dynamic situational prediction. In the banking sector, cloud computing can assist in fusing consumer knowledge and demands with data for customized services.Security is always a problem in the financial services industry, hence the IoT has been implemented in payment, banking, and insurance activities (Mani & Chouk, 2018).

Blockchain Technology

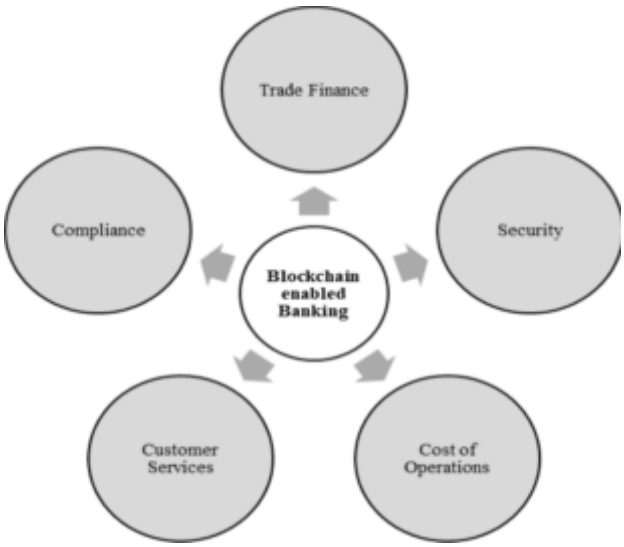
Blockchain is a technological advancement that uses private and public keys to enable cryptographic verification and registration. These electronic marks keep any exchange from being switched, changed, or disavowed, delivering a past filled with permanent, and evident information in a public and once in a while confidential way. It doesn't call for unified control or capacity. It empowers digitalized, secure, and reliable exchanges between the gatherings without the utilization of brokers. The attractive stripe card and ATMs originally showed up during the 1970s. The dematerialization of the monetary framework was the beginning of a grand experience. The digitalization processes have prompted tremendous changes, especially in the monetary associations' financial models.There are several media available nowadays for raising and using funds. These developments have paved the way for advancements in financial transactions like Swift transfers, digital wallets, bank cards, and mobile banking.

Regarding the classification of these media as electronic money, there is some ambiguity. Cryptocurrencies exist in this continuum of many types of electronic currencies, and they do differ from fake money. This perception is incorrect because one of the contemporary manifestations of fiat money is electronic money. Additionally, from a technological standpoint, it is not about money but rather a payment method that enables the mobilization and use of bank money for a variety of operations. The lack of banking among electronic money users should be noted. Instead, In the contractor's bank account, all of their assets are merged, and their only identifiable information is their phone number in the financial system..With the development of cryptocurrencies and their underlying technology, the Blockchain, we are witnessing a new vision of monetary architecture as a result of the economic crisis of 2007–2008. The latter operates without a central control body and is a transparent and secure method for information storage and transfer.

Goal of Blockchain technology

The blockchain serves as a secure database for all users' processes. This innovation's essential objective is to kill the requirement for mediators and help out processes through a circulated network (Zehir and Zehir, 2020). However, there are limitations to the use of blockchain that are unique to developing nations with a lack of internet access and an energy deficit. Therefore, the issue of whether blockchain is usable in Asian nations arises. This essay examines the viability of cryptocurrencies and blockchain technology for protecting banking systems in Asian Countries.Block chain technology cycle of banking sector is shown in Figure 1. .

Figure 1 Blockchain Technology in Banking Sector

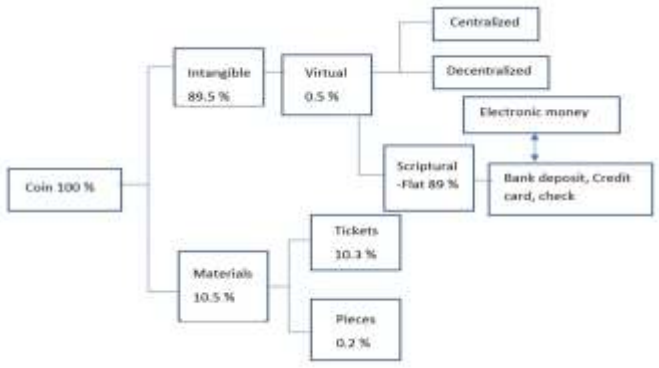


LITERATURE REVIEW

Cryptocurrency Acceptance and Usage

The 4 primary sub-sectors of the bitcoin marketplace are mining, wallets, exchanges, and settlements. Total of 38 countries have cryptocurrency corporations running there. With 32 firms, the USA drives the world's countries concerning undertaking side interest, went with through China with 29 associations and the United Kingdom with sixteen Companies. Past investigation on computerized monetary standards and blockchain age has zeroing in on particular issues alongside blockchain types of progress, fixes for the ongoing age, utilization of blockchain advancement in e-government, Internet of Things-controlled splendid metropolitan networks, cash, and arrangements. Monetary undertaking writing has discussed whether blockchain is an impetus for financial and mechanical development and the manner in which it impacts e-exchange (Friedlmaier et al., 2018). Security, decentralized, straightforward exchanges and the robotization and digitization of internet business processes are of specific significance to the financial area. A dispersed shared network and an open-source blockchain stage are likewise perceived as bringing down obstructions for new businesses to enter the market.

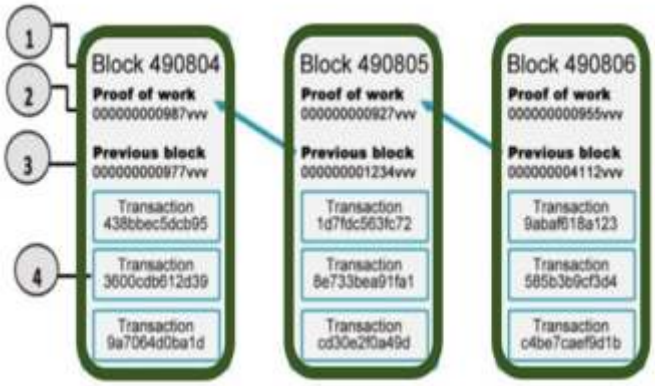
Figure 2 Position of cryptocurrencies in the world of financial instruments



Crypto currency in Blockchain Technology

Blockchain technology, the foundation for crypto-asset transfers, makes it feasible to conduct peer-to-peer transactions in the absence of middlemen. With this approach, we have access to financing without a bank or other reliable third party. The advent of digital currency facilitated for this paradigm shift.Cryptocurrencies refer to alternative Blockchain-based payment systems since they frequently use hashes (Çağlıyangil et al., 2020). Computer scientists devised and mostly maintain this form of money, which is virtual, dematerialized, unregulated, and commonly accepted (developers). It isn't sanctioned delicate, just exists on the web, and is just perceived in virtual networks that observe the guidelines administering its utilization. All things considered, no one is expected to acknowledge it for exchanges. They are exchanged securely over the Internet utilizing cryptography. These are computerized portrayals of fiat esteems that are virtual monetary forms without a bank. They are made utilizing a cryptographic methodology and redid to pass esteem on over the Internet in a public setting while at the same time being totally decentralized and secure. They primarily function in a distributed system, in which all players have complete and simultaneous access to all information. Consensus is used to decide and approve transactions. The place of cryptocurrencies in the present financial system is beginning to take shape.

Figure 3: The Blocks Structure.



Measurement of Cryptocurrency Performance

Existing exact examinations (Bollen et al., 2011) have found evidence for a relationship among web activities and virtual entertainment discusses and monetary execution.For instance, found that Twitter sentiment was an awesome indicator of modifications in last values for the

Dow Jones Industrial Average.In a similar vein, looked into how well editors' activity levels and the number of readers or page views on Wikipedia might indicate how popular a film will be. Their findings show that Wikipedia's collective activity data can be used to forecast box office receipts. Appropriately,investigated the powerful association between sites, client audits, and business value esteem. They additionally differentiated the viability of online entertainment investigation's prescient potential with more conventional web measurements like web traffic and Google look. That's what their discoveries propose, in spite of the fact that web estimations were as yet significant pointers, measures are more powerful indicators of firm resource esteem than customary internet based social measurements. In accordance with this,(Matta et al., 2015), dissected the cost of Bitcoin with data from Google Trends and Twitter's famous points concerning Bitcoin. They discovered strong relationships between theGoogle Trends andcost of Bitcoin information. According to the earlier studies that were examined above, online traffic can be used to forecast the cryptocurrency market. The writing actually needs thorough information on client reception and data stream in the bitcoin business, which could furnish functional data and policymakers with savvy information.

The Applicability of Blockchain and Cryptography in Asian Countries

As exposure to new technologies like cryptocurrencies and blockchain, Singapore has become a significant center in Asia as this digital currency has gained momentum. The Monetary Authority of Singapore (MAS), which has been researching the utilization of appropriated record innovation for clearing and settling installments and protections since late 2016, has built up this picture by its receptiveness to try.

The OpenCerts stage, which utilizes Ethereum savvy agreements to issue and approve advanced endorsements for alumni of provincial instructive establishments, was developed in collaboration with other Singaporean government organizations. Singapore is a well-known and respected nation with favorable tax rules, so it also has other benefits to offer.

In ordering the Payment Services Act 2019, Singapore has taken on a proactive position toward digital currency guideline (PS Act). The PS Act will direct specific digital currency delegates in addition to other things, with an emphasis on shopper security and hostile to tax evasion. When it is active, it will likewise give digital money firms like trades a strong administrative permit and working design. This differences with other Asian countries like China and India, where introductory coin contributions (ICOs) have been banned or where there is a lot of administrative vulnerability.

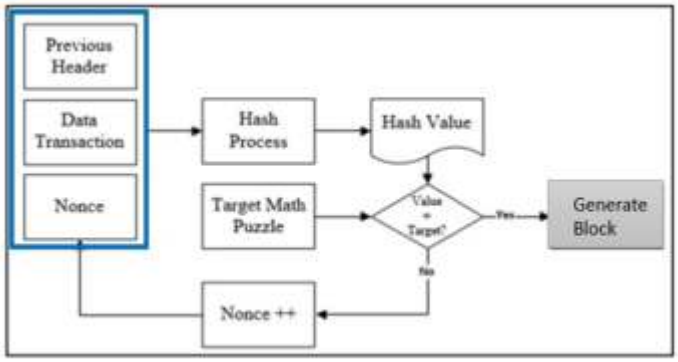
Merchant supporting, buyer reliability bundles, and partnered credits are only a couple of the venture situations that the Indian financial district is effectively trying different things with and researching as far as blockchain age. Blockchain innovation can be a miles quicker, more noteworthy straightforward, and more prominent comfortable way for notable Indian banks (like the Reserve Bank of India (RBI), Yes Bank, Axis Bank, and State Bank of India (SBI)) to serve their clients extra effectively(Andoni et al., 2019). Subsequently, those banks are thinking about implementing it. The State Bank of India, the greatest monetary establishment, was quick to make a blockchain consortium of roughly 10 banks to be utilized in money related exchanges. The monetary establishment's most prominent accomplishment included the utilization of block chain to empower its individuals to trade Know Your Customer (KYC), Combating Anti-Money Laundering (AML), and the Financing of Terrorism (CFT) conditions.

METHODS

Proof of Work (PoW) method

We suggest introducing a new mining method that makes use of the PoW idea in the SimBlock emulator. The block propagation mechanism on the blockchain network is more the emphasis of the SimBlock simulation, as was already mentioned. In this application, mining is done, but only on the basis of a user-identified specified value. A worth that is inside the AVERAGE MINING POWER limit can be set by using the person. The aggregate entered is taken to address a block mining action that ought to run when reliably. Block mining-a proof that the PoW set of rules has been accurately utilized. Figure 4 depicts the mechanism of the mining manner the use of the PoW algorithm.

Figure 4 The mechanism of Mining process.



In the Proof-of-Work (PoW) model, a mathematical challenge must be solved before a block can be added to the blockchain network. Leading-zero counting was the subject of our mathematical exercise.

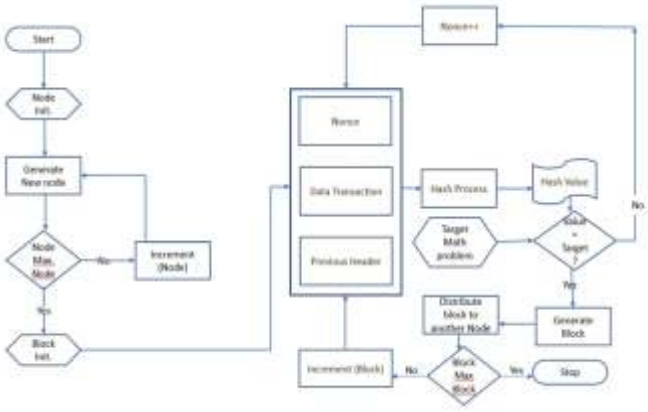
The method involved with counting the quantity of progressive zeros that precede the first nonzero whole number toward the beginning of a word is known as driving zero including. On the off chance that the counter is given n-pieces of information, as the main zero including unit accepts,

$$Lz = Lz_{n-1}Lz_{n-2}Lz_{n-3} \ldots . Lz_0 (1)$$

$\boldsymbol{Lz_{n-1}}$is the main piece (MSB)and its output is $\boldsymbol{log_2 n}$bits of leading-zero count $\boldsymbol{Lz}$M. S.

There must be at least one leading zero in the output of the hashing operation. The modified SimBlock simulator's system flow design is depicted in Figure 5 .

Figure 5 The modified SimBlock simulator's system flow design.



The present records transaction can be altered by using adding more than a few called the salting method with the purpose to achieve a hashing value that fulfills the main-zero circumstance. The continuous data trade can be changed by remembering a number called the salting methodology for request to get a hashing esteem that fulfills the chief zero circumstances.The salting process is expressed by the nonce variable in Figure 5.

In general, the PoW procedure is described as follows:

$$SHA256(T_x + nonce) = target (2)$$

T_x data transaction
" + "the string connect administrator.
Target is the amount of driving zeros to look for.

Experimental Setup

Whole working frameworks that help Java and Gradle can run the SimBlock test system. The SimBlock test system requires Gradle 5.1.1 or later and Java Development Kit (JDK) 1.8.The Oracle virtual machine with six centers and 8 GB of RAM is utilized to do the investigation utilizing the adjusted SimBlock test system. The following are the hardware specifications: Intel Core i7-8750H (eighth era) with memory opening DDR4 with 16 GB, Intel HD 630, 2.2 GHz six-center processor, NVidia GeForce RTX 2070, expandable up to 32 GB, and 500 GB SSD Drive. For working frameworks on virtual PCs, we use Ubuntu 18.04.4 LTS.

a) Algorithm

Some of the currently used programming languages might be modified to comprise the set of rules used to add the Proof of work method to the SimBlock simulator. Coding programs are acquainted with have the option to add the Library bundle, adjust the contemporary style structure, and transfer the fundamental coding program.

b) Evaluation criteria

A comparative experiment will be conducted under identical conditions as the simulator's evaluation criterion. On both the main origin ofSimBlock simulator and the upgraded simulator, we created the equal configuration putting check. We make the assumption that there will be more blocks than nodes because we believe there will be

more transactions in the real world than there are people that participate in mining.We chose to involve gradual digging for hubs and blocks for two emphasess of the test since the scope of hubs mined under assessment addresses 10% of the absolute number of blocks.

The arrangement test situation is displayed in Table 1 for correlation between the first SimBlock test system and the SimBlock test system which is changed.

Table-1: Different Configuration setting assessment standards.

Node	Blocks	Node	Blocks
125	1250	500	1250
	2500		2500
	5000		5000
	10000		10000
250	1250	1000	1250
	2500		2500
	5000		5000
	10000		10000

Merkle's Tree

Each block in the blockchain is made up of a Hashed and coded stack, as can be observed when the structure is studied. The hash function of the previous block is contained in each block and is cryptographically encrypted. These blocks are Merkle Tree-encoded.

Therefore, all of the transactions are placed in Merkle's tree (1978), which hashes the pairs of transactions together. Until one hash is acquired, the operation is repeated. The hashing algorithm used, for instance, in bitcoin is SHA256.

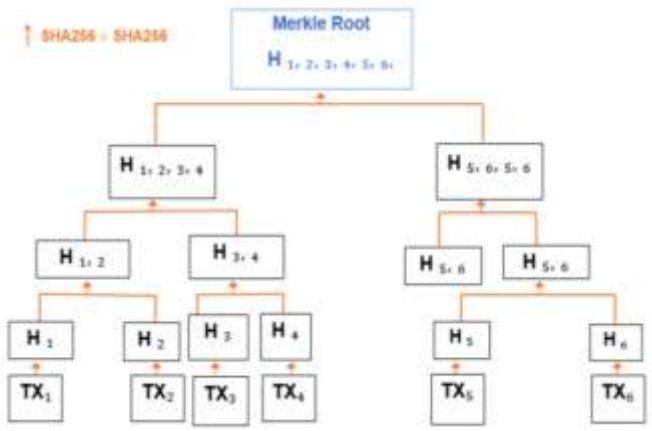
We should utilize the case of a block with 16 exchanges and letter-based distinguishing proof to show Merkle's tree (1978). From A to P, we should. For every one of these, the hash calculation will initially deliver a hash.

The hash of AB will then be made by consolidating the hashes of An and B. From that point forward, we join the hashes of AB and CD to deliver ABCD, etc, until we show up at ABCDEFGHIJKLMNOP. The last hash is the Merkle's root, which will be held in the header of each and every block in the organization.

Evolving one "leaf" (exchange) in the tree without additionally changing the others on the grounds that each "leaf" is reliant upon the others is unimaginable."" Assuming that you attempt to refresh only one exchange, the worldwide hash which was framed by blending at least two free exchanges will be changed. Thus, the hash at the foundation of Merkle's tree (1978) will modify in case of an extortion endeavor.

a) Traditional Merkel Tree Structure

Figure 6 Merkle's Root: adapted from (Merkle, 1978)



A twofold tree structure known as a customary Merkle tree is utilized to hold a few hash values. As a representation, Fig. 6 portrays a five-layer Merkle tree structure. It comprises of a root hub (H4,1) at the best, a bunch of transitional hubs (H3,m, m = 1, 2), a bunch of leaf hubs (Hk, k = 1, 2,..., 8), and a gathering of leaf hubs (H2,j, j = 1, 2, 3, 4). The accompanying representation shows the root hub H4,1 ascertaining process:

Let Di be the ith input data, where I = 1, 2,..., 8 and H(.) is a hash function. The leaf nodes Hi are obtained by encrypting the input data Di with H(.), and they can be calculated by

$$H_i = H(D_i), i = 1, \dots, 8 (3)$$

Leaf nodes Hi provide the material for the subsequent layer, and you can calculate the intermediate nodes by

$$H_{2,i} = H(H_{2,i} - 1, H_{2,i}), i = 1, \dots, 4 (4)$$

Third, we performed the aforementioned procedure once more to create the third layer using

$$H_{3,m} = H\left(H_{2,2m} - 1, H_{2,2m}\right) m = 1, 2 (5)$$

Finally, the root node outcome can be retrieved from

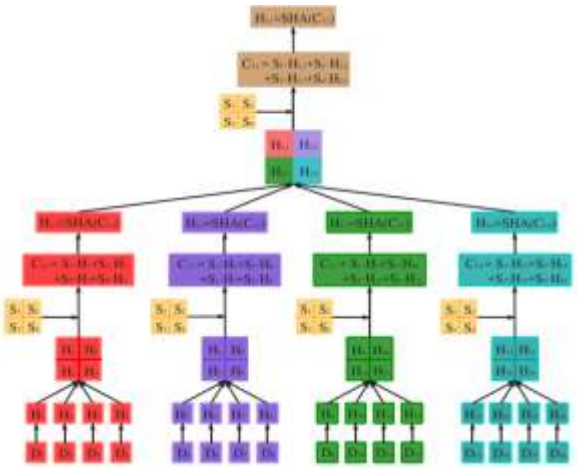
$$H_{4,1} = H(H_{3,1}, H_{3,2}) (6)$$

By and large, the middle of the road hubs store the hash values produced after the items in the two lower-level associated kid hubs, though the leaf hubs regularly store the hash upsides of a specific assortment of information. The last hash worth of the information from the two last go-between hubs is kept in the root hub. Because of the nearby associations in the Merkle tree, in the event that the worth of any leaf hub changes, the worth of the comparing halfway hub will in like manner change. Accordingly, the root hub worth will slowly change. For example, if 〖Data〗 _4 in Figure 6 changes, the middle hubs H_4, H_2,2, and H_3,1 will likewise adjust, and the root hub H_4,1will be altogether unique. Thus, all we want to do to decide if a leaf hub's information has changed is to contrast it with the upsides of the two root hubs of the comparing Merkle tree.

b) Further developed Convolutional layer activity Merkle tree structure

The utilization of convolutional layer activity instead of the ordinary double tree estimation approach, which can diminish the quantity of layers put away and moderate hubs in Merkle trees, is the key distinctive element of the proposed adjusted Merkle tree structure. The enhanced Merkle tree structure that has been presented can also reduce the amount of hash calculations required to produce the root node. We offer the recommended structure with 16 info information as an illustration Figure 7 to additionally explain the construction.

Figure 7 Improved Merkle Tree structure; adapted from(Zhu et al., 2021).



As evident in Figure 7, Di stands for the input data that needs to be stored, with I = 1,..., 16. Stride is 2, t = 1,..., 4, and St is the convolution kernel. In this case, we use the enhanced Merkle tree to encryptDi using the hash method SHA256. We now present the formula for generating encrypted leaf nodes. The input data *Di*, I = 1,..., 16 are first stored in order. If there are fewer input data than 16, the integer 0 is then stored to increase the number to 16. The data *Di*, I = 1,..., 16 is then encrypted using the SHA256 hash function. The encrypted results are then orderedly stored in H_i, I = 1, 2,..., 16. Following the obtaining of the encoded leaf center points, we make the hash root center point, which performs convolution on the leaf center points. H_i, with convolution piece S_t,, t = 1,..., 4 and I = 1, 2,..., 16 The full cycle is given in Algorithm.

Algorithm: The formation of root node, intermediary layers, and convolution operations.
input : Leaf nodes , = 1,… , 16; the convolution kernel
, = 1, … , 4.
output: The intermediate layers and root node with the improved Merkle tree.
1: divide , = 1, …, 16 into 4 parts with the same size.
2: Input the selected convolution kernel , = 1,… , 4.
3:for = 0 to 3 do
for = 1 to 4 do
Do the convolution operation by
2,+1 = ? 4 =1 × 4 +
end
end
4: for = 1 to 4 do
Encrypt the sum 2,, = 1, …, 4 with SHA256 by
2, = 256(2,)
end
5: Store the encoded results in 2,, = 1, … , 4 in order.
6: Obtain the third convolution layer by
3,1 = ? 4 =1 × 2,
7: Encrypt 3,1 with SHA256 by
3,1 = 256(3,1).
8: Store the encoded outcome in 3,1 as the root hub.

The overhauled development of Merkle tree uses just 4 layers, 21 hash errands, and an amount of 37 center points from Algorithm 1 to manage 16 data. The normal Merkle tree improvement, on the other hand, requires 6 layers, 31 hash errands, and 47 center points.

Consequently, appeared differently in relation to the customary development of Merkle tree, the upgraded Merkle tree structure requires less estimation and additional room. For passed on data limit and move using Blockchain advancement, it is uncommonly helpful for enormous data.

RESULTS

The PoW idea technique has been effectively acquainted with the SimBlock test system in this examination. The framework testing method is done as per the laid out guidelines referenced in area 3 to determine the capacities of the refreshed SimBlock test system. The results can be depicted in the accompanying manner:

Blocktime generation

We assessed the age of block times in this framework with those in the ongoing organization, for example, Bitcoin, which makes some block memories of 10 minutes, Ethereum, which makes some block memories of 15 seconds, Dogecoin, which makes some block memories of 60 seconds, and Litecoin, which makes some block memories of 150 seconds. To get the average needed for block-time generation, we performed the experiment ten times using leading zero. Table 2 displays the findings of the experiments that were performed.

Table-2 : Comparison of Block-time generation

Blockchain Networking	**Block-time generation**
Bitcoin	10 min. 0 sec.
Dogecoin	1 min. 0 sec.
Litecoin	2 min. 30 sec.
Ethereum	0 min. 15 sec.
OriginalSimBlock	0 min. 0.112519 sec.
Count of Leading-zero	**Block-time generation**
1 leading 0	0 min. 0.156796 sec.
2 leading 0	0 min. 0.187901 sec.
3 leading 0	0 min. 0.230861 sec.
4 leading 0	0 min. 0.405823 sec.
5 leading 0	0 min. 3.268583 sec.
6 leading 0	0 min. 41.432757 sec.
7 leading 0	3 min. 57.50351 sec.
8 leading 0	5 min. 11.392648 sec.

Output Information

The SimBlock test system's result is saved in a JSON record situated in the result organizer. The results of output comparison from the original and updated SimBlock simulators are displayed in Table 3 for the JSON file.

Table 3 : Comparison Information of JSON file output

Product Information	**SimBlock simulator**	
	Original	**Altered**
Timestamp	yes	yes
Block-type	no	yes
Block-Category	yes	yes
Block-transmission-time	yes	yes
Block-ID	yes	yes
Node-ID	yes	yes
Past Block-Hash-Value	no	yes
Block-Hash-Value	no	yes
Nonce/salt	no	yes

The Block-Category some part of Table 3 contains information on actually creating blocks, including the value of add-block material to display block age and the value of stream block content to show block augmentation in the block chain organization. Block-ID and Node-ID area data is likewise present. As was already explained, the initial SimBlock simulator focuses on displaying how long a block takes to propagate via the blockchain network. Data propagation elements such timestamps, transmission timestamps, reception timestamps, begin node ids, and finish node ids are all included in the Block-Transmission-Time information.

Conclusion

Blockchain technology and the use of cryptography are disruptive technologies that enable significant advancements and significant changes to the financial system. It is decentralized, uncheckable, and open, which brings down exchange intermediation expenses and ensures the soundness of the monetary framework. The totally open system in this register enables all network members to consult the history of entries on a permanent basis. While preserving the economic agents' anonymity, it guarantees complete transaction traceability.

A data set framework called blockchain has indistinguishable information characters. It maintains data across numerous locations (referred to as nodes), is append

only (can add only), immutable (can't altered or trashed),and each of its connected blocks is encryption. Due to its integrity and ability to provide time stamps for cryptographic data transactions, the blockchain is superior to traditional databases in this regard. Developers must verify their application before putting it on the blockchain for this reason.

The nonce values display that the PoW principle is being applied for the duration of the mining process that creates a block. The quantity of leading-zero values which might be focused impacts the mining system' fulfillment price. Because it is going to be extra challenging to generate a hashing cost with extra main zeros than with fewer main zeros, the duration of this operation is unknown. By definitely searching on the Prev-Block value displayed inside the block metadata, a person can determine that a block is connected to the one earlier than it due to the fact the hash value of each block is visible. Users also can choose which blocks are called chain blocks or genesis blocks (the earliest blocks).

From the foregoing, we may conclude that blockchain technology's use of cryptography is a breakthrough that gives Asian countries great promise for protecting their financial systems. Be that as it may, there are different difficulties to its utilization, including those connected with the openness of the web, the ephemerality of advanced cash, the framework's control, yet in particular, energy limitations and natural impacts. Despite these unquestionable benefits, there are many sustainability constraints with blockchain.

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