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Research Article

A Comparative study about pi in various ancient civilization and it's present scenario

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Abstract— Presently, blockchain-powered cryptocurrency has gained widespread recognition. Bitcoin stands out as one of the most valuable and sought-after digital currencies. However, Bitcoin's accessibility is limited across various platforms, and its user-friendliness leaves much to be desired. Nonetheless, a new user-friendly cryptocurrency is on the horizon. Pi Coin aims to cater to a broader audience, potentially revolutionizing the future cryptocurrency landscape. While Bitcoin has already established its demand in the crypto sphere, Pi Coin is generating considerable buzz as it prepares for launch. This paper will explore the projected value of Pi Coin based on the timeline of Bitcoin's development.

Keywords- Blockchain, cryptocurrency, Bitocoin, Pi Network

1. Introduction

In the current era, numerous cryptocurrencies are emerging based on blockchain technology. Bitcoin remains a prominent figure in the realm of cryptocurrencies, despite encountering numerous obstacles. Despite its volatility, Bitcoin's valuation has soared, albeit fluctuating over time, a well-known fact. However, accessibility to Bitcoin remains limited for many individuals, posing significant challenges in acquiring it. In response to this, Pi Network or Pi Coin has been developed by a select group of individuals, some of whom are graduates of Stamford or hold PhDs. The primary aim behind its creation is to democratize access to cryptocurrency. Mining operations for Pi Coin are already underway, although it has yet to enter the market. Nevertheless, preparations are underway, taking into account various factors such as Bitcoin's future currency rates and the potential scale of the Pi Network, in order to prepare a comprehensive pap.

Cyptocurrency represents a decentralized form of digital payment, functioning independently of traditional banking institutions. It enables global peer-to-peer transactions, removing the necessity for physical currency. Transactions are logged on a transparent public ledger and securely stored in digital wallets. The term "Cryptocurrency" derives from its encryption-based transaction validation, ensuring privacy and security. Bitcoin, founded in 2009, stands as the foremost cryptocurrency, celebrated for its widespread acceptance and impact. Beyond facilitating transactions, cryptocurrency trading has sparked substantial interest, with speculators frequently impacting price variations.

2. History and uses of pi in different ancient civilization

Mathematics spans a vast array of topics, incorporating constants and formulas gleaned from diverse civilizations. Pi, a cornerstone of mathematics, occupies a central role. Defined as the ratio of a circle's circumference to its diameter, Pi is a fundamental constant with far-reaching implications. Its value, approximately 3.14159, remains consistent across circles of all sizes, making it indispensable in geometry, trigonometry, calculus, and beyond. Pi's significance extends beyond its numerical value; it symbolizes the beauty and universality of mathematical principles across cultures and epochs.

The concept of Pi has roots in various ancient civilizations, yet in modern times, many people are unaware of its origins. For those curious about the history of Pi and its roots, several civilizations lay claim to having determined its value long before. In this article, we delve into the knowledge that ancient civilizations possessed regarding the ratio of a circle's circumference to its diameter. From the ancient Egyptians' approximation of Pi around 2560 BC, evident in the construction of the Great Pyramid of Giza, to the Babylonians' understanding of Pi as early as 1900 BC, recorded in the Babylonian clay tablet Plimpton 322, the journey of Pi spans millennia and across cultures. The ancient Greeks further refined the concept, with Archimedes famously approximating Pi using polygons in the 3rd century BC. Even in India, the concept of Pi appeared in the Sulba

Sutras, ancient Vedic texts dating back to the 8th century BC. These civilizations, among others, contributed to the understanding and approximation of Pi, leaving behind a legacy of mathematical prowess that continues to inspire curiosity and admiration today.

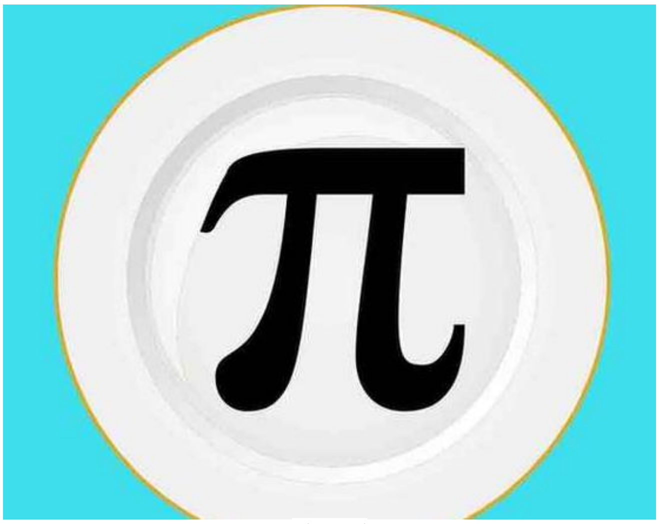

Fig.1. Pi

3. Development of pi in modern mathematics

Certainly! Pi, a fundamental constant in mathematics, plays a crucial role in various mathematical calculations, including those related to area, volume, and numerous other mathematical disciplines. The value of Pi as we know it today is the culmination of centuries of efforts by ancient civilizations striving to determine its precise value. Let's explore the historical journey of Pi across different cultures:

3.1 Babylonian: In the 17th Century BC, the Babylonians demonstrated advanced mathematical information, as evidenced by their intricate tables detailing fractions, squares, cube roots, linear and quadratic equations, and algebraic forms. They estimated the value of Pi to be 3.125, commendable achievement considering their numerical system was based on 60.

3.2. Egyptian: The Egyptians, like their Babylonian counterparts, were adept mathematicians. Evidence of their estimation of Pi dates back to around 1650 B.C., recorded in the Rhind Papyrus. Their calculated value was 3.1605, slightly higher than the modern value of 3.14.

3.3. Hebrew: The Hebrews recorded specifications of the Temple of Solomon, including a description of a brass casting with a ratio of diameter to circumference valued at 3. While not precise, this demonstrates a close approximation to the value of Pi.

3.4. Greek: Renowned for their advancements in mathematics, the Greeks excelled in geometric studies. In the 3rd Century BC, Archimedes of Syracuse provided a theoretical calculation of Pi, yielding a value of 3.1418, remarkably close to the modern approximation.

3.5. Chinese: Chinese Mathematics, rooted in a 10-based, place value system, made significant strides in calculating Pi. Liu Hiu and Zu Chongzhi, in 2000 BC and 3rd Century AD respectively, calculated Pi to several decimal places.

3.6. Persian: During the Middle Ages, Muhammad Al-Khwarizmi, known for his contributions to algebra and the Hindu numbering system, calculated Pi to four decimal places in the 9th Century AD. Jamshid al-Kashi later in the 15th Century AD calculated 2 π to 16 decimal places.

Through the endeavours of these ancient civilizations, the value of Pi was gradually refined, laying the foundation for its enduring importance in mathematics.

4. BITCOIN

4.1 The Fundamentals of bitcoin

Bitcoin, conceptualized by the enigmatic figure Satoshi Nakamoto, aimed to address significant challenges in digital currency, notably the problem of double-spending. Though Nakamoto's true identity remains elusive, it's known that he remained involved until 2010.Nakamoto's proposal cantered on a peer-to-peer distributed timestamp server system, providing computational proof of transactions arranged chronologically. In this system, a digital signature chain defines each Bitcoin, ensuring uniqueness. Transactions consist of prior hashed signatures and the recipient's public key, with the sender's private key used for signing. Verification of transactions utilizes the recipient's public key, typically stored in a wallet accessible via software, hardware, or the internet.

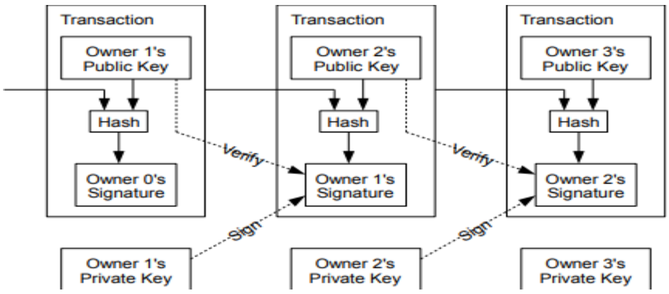

Fig.2. Illustrates a coin piece transformed into a Merkle tree through hashed transactions.

The Bitcoin ledger operates as a state transition system, maintaining ownership status of all bitcoins and facilitating state changes through transactions. If the sender possesses sufficient bitcoins, the state transition function generates changes for both sender and recipient; otherwise, it generates an error.

4.2 Transactions of bitcoin

Within the Bitcoin blockchain, each transaction is uniquely identified by a hash value. These transactions consist of inputs and outputs. An important feature of the blockchain is that each output can only be used once as an input, effectively preventing the double-spending problem. Outputs are categorized as Unspent Transaction Outputs (UTXOs) if they haven't been referenced before, and as Spent Transaction

Outputs (STOs) if they have been used. Transactions can include multiple inputs, allowing for the aggregation of smaller amounts of coins, while outputs direct funds to recipients or return them to the sender.

The entire transaction history and ownership records of Bitcoin are stored on the distributed ledger. Every node in the peer-to-peer network maintains a copy of this ledger. When a user initiates a transfer, they publicly declare the transaction, and the network verifies its accuracy. However, there are risks of attempts to subvert the system, such as double-spending, where a user tries to spend the same currency twice. Additionally, a single user may create multiple identities to validate their original purpose, leading to what is known as a Sybil attack.

4.3 Block chain and proof of work

In the Bitcoin system, these challenges are addressed, or at least mitigated, by requiring a proof-of-work from each validating node. To establish their legitimacy within the network, nodes must complete a series of complex calculations. The system maintains its integrity by ensuring that the combined computational power of honest nodes exceeds that of any potential attacker.

A hash is generated from a set of transactions, the hash of the previous block, and a nonce. A timestamp server hashes a block and broadcasts it, demonstrating that the data within the block existed at the time of hashing. This server also ensures that the block's timestamp is later than the previous block's and less than two hours into the future. This process creates a chain of hashes, forming what is known as a blockchain. The blockchain's ability to trace transactions back to any point in time is a fundamental aspect.

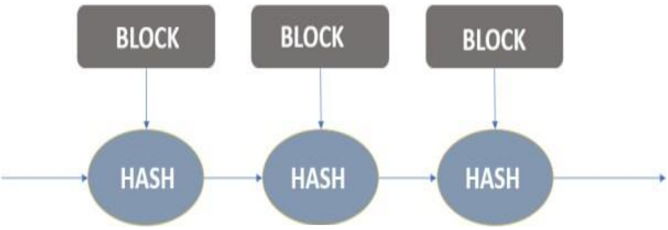

Fig.3. Theblockchainconspire

Bitcoin utilizes a proof-of-work hashing algorithm akin to Hashcash and relies on the SHA-256 hash function. This proof-of-work entails adjusting a nonce within the block until a value is generated with the desired number of leading zero bits in the block's hash. Once set, altering it becomes practically infeasible without recalculating the nonce. Any malicious alteration by an attacker would result in incorrect hashes for all subsequent blocks. The system operates under the principle that the longest chain with the most consensus within the network is deemed valid. Consequently, an attacker seeking to modify a block would require substantial computational power to outpace the majority of honest nodes, leading to a race condition.

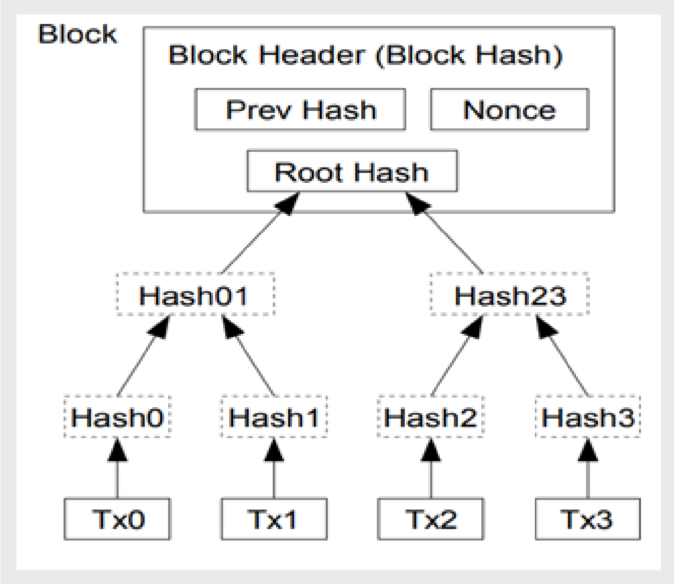

Fig.4. Bitcoin block with hashed transactions into a Merkle Tree

Transactions within a block are hashed using a Merkle tree structure. This tree comprises numerous leaf nodes, each rooted in a hash of its respective subtree. A Bitcoin block is represented as a Merkle tree of transaction hashes. The Merkle tree is vital for long-term maintenance, as any error within it would impact the entire chain. To conserve storage space on nodes, necessary for retaining the blockchain, maintenance is often performed. Bitcoin introduced Simplified Payment Verification (SPV), which mandates nodes to store only the block headers of the longest chain rather than the complete transaction history.

4.4 Bitcoin mining and bitcoin network

Bitcoin mining is a crucial process within the Bitcoin network, serving to both validate transactions and introduce new currency into circulation. Each block within the blockchain begins with a Coinbase transaction, generating new coins that belong to the block's creator. This serves as an incentive for nodes to participate in the validation process, as they have a vested interest in maintaining the integrity of the system.

The Bitcoin protocol targets the production of one block every 10 minutes, adjusting the difficulty of block generation to accommodate the increasing computational power of computers over time. As new transactions occur, they are disseminated to all nodes in the network. Each node gathers transactions into a block and then seeks proof-of-work before broadcasting the block to the network.

For a block to be considered valid by the network, all transactions within it must be valid and unspent. Once accepted, the blockchain continues by appending the hash of the previously added blocks. In addition to the block creation incentive, nodes are rewarded with bitcoins for validating transactions through mining.

The initial block reward was set at 50 coins (50 BTC) and halves after every 210,000 blocks. This halving will continue until the reward drops below one Satoshi, the smallest unit of Bitcoin. Occasionally, multiple nodes may broadcast the same block nearly simultaneously, resulting in a fork and network inconsistency. However, the network resolves this by adhering to the longest chain, thereby establishing consensus and rendering chains resulting from forks invalid.

4.5 The issue of bitcoin's scalability

Bitcoin's scalability challenge stems from its 1MB block size limit, which severely restricts the number of transactions the network can handle. With this limit, Bitcoin can process fewer than seven transactions per second, a far cry from the tens of thousands processed by Visa during peak times and the hundreds of millions on an average day. Achieving Visa-level throughput on Bitcoin would require an enormous increase in block size, resulting in a staggering amount of data storage – almost 400TB per year.

This scalability issue threatens the decentralized nature of Bitcoin, as it could lead to centralization by favoring nodes with significant storage capabilities. To address this, various strategies have been proposed, often resulting in soft and hard forks. Soft forks are backward-compatible modifications that allow old software to recognize new blocks, while hard forks introduce new rules, making old software incompatible.

These forks represent ongoing efforts within the Bitcoin community to find solutions that balance scalability with decentralization, ensuring the network's long-term viability and utility.

4.6 Lightning and SegWit

Segregated Witness (SegWit) stands out as a proposed solution to Bitcoin's scalability challenge, primarily addressing the issue of transaction malleability. This vulnerability arises because the transaction signature doesn't cover all transaction data, leaving room for manipulation by malicious nodes, which can alter the transaction and invalidate its hash.

SegWit introduces significant improvements by allowing for a maximum block size of 4MB and adding a second layer on top of the main network. This segregation of signature data from other transaction data lays the groundwork for implementing the Lightning Network, a second-layer protocol aimed at facilitating faster and cheaper transactions. Notably, SegWit was successfully activated on block 481,824, marking a milestone for Bitcoin's evolution on August 24th, 2017.

4.7 BTS Gold and Cache

As Bitcoin's popularity surged, the network struggled to keep pace with the increasing transaction volume, resulting in significant delays lasting days for confirmations. To address this issue, a hard fork of Bitcoin occurred on August 1st, 2017, leading to the creation of Bitcoin Cash (BCH) at block 478,558. This fork saw the block size increase to 8MB, resulting in expedited confirmation times and aiming to alleviate the congestion issues experienced on the original Bitcoin network.

Another notable hard fork, Bitcoin Gold (BTG), took place on October 24th, 2017, at block 491,407. Similar to Bitcoin Cash, holders of Bitcoin at the time of the fork received an equivalent amount of Bitcoin Gold. The motivation behind this fork stemmed from Bitcoin's original mining process, which heavily favored ASIC devices over CPUs. Bitcoin Gold aimed to level the playing field by implementing the Equihash algorithm, which requires significant memory resources and is better suited for mining using graphics processors.

In contrast to Bitcoin's mining difficulty adjustment every 2016 blocks, Bitcoin Gold dynamically adjusts its mining difficulty with every newly mined block, ensuring a more responsive and adaptable mining environment. These forks represent efforts within the cryptocurrency community to address scalability and decentralization concerns while exploring different mining algorithms and transaction throughput solutions.

5. Pi Network

5.1 Pi Introduction

Pi (π) was conceived with the aim of democratizing access to cryptocurrencies by enabling anyone to mine them using readily available technology, such as a smartphone. This project achieves its objective by employing a variant of the Federated Byzantine Agreement (FBA), originally developed by researchers of the Stellar blockchain. Unlike proof of work and various forms of proof of stake, which rely on a single miner or validator becoming the "leader" by presenting a block for consensus, this consensus mechanism operates differently.

Instead of selecting a leader, consensus is reached through nodes gaining ascent on a specific block via a series of votes conducted through message exchange. Byzantine Fault Tolerance (BFT), implemented in several blockchains like Ripple, Hyper ledger Fabric, and Zilliqa, is a well-known form of algorithm utilizing such a method to achieve consensus. However, one criticism of BFT consensus models, in general, is their potential for centralization, as the system architect determines the voting majority at the outset.

This feature empowers nodes to independently determine whether or not to trust other nodes, thus avoiding reliance on a central authority. Pi's consensus process is notably energy-efficient due to the minimal energy consumption involved in the voting communications, particularly when contrasted with proof of work systems.

5.2 Pi (π) Mining

By installing the Pi Network app on their smartphones, users can engage in Pi mining. They can then participate in the Pi consensus through one of four avenues:

a. Pioneers: These are app users who consistently verify their presence each time they log in. Their role is to enhance the accessibility of the Pi Network. Currently, they can only send and receive Test-Pi on the Pi Testnet using their Pi wallets.

b. Contributors: Users who contribute to and maintain an updated list of pioneers they know and trust. Contributors play a crucial role in developing the global trust graph necessary for Pi's consensus.

c. Ambassadors: Pi network users who actively introduce others to the platform.

d. Nodes: Pioneers and contributors who additionally run the Pi node software on a desktop or laptop computer. Pi Nodes are responsible for executing the consensus algorithm of the blockchain, utilizing the trust graph compiled from trusted pioneers provided by mobile contributors.

Participants may assume multiple roles, and they receive newly minted Pi on a daily basis based on their participation and contribution.

As of now, the value of Pi is officially stated as zero. However, the Pi team believes that its value can be realized through the development of utilities for the cryptocurrency, where individuals use Pi to conduct transactions for goods and services on a global scale. These transactions will ultimately support and underpin the value of Pi.

5.3 PI(π)KYC&SECURITY

Pi employs a Know Your Customer (KYC) procedure to bolster the network's integrity. To transfer Pi onto the Pi Mininet blockchain, users are required to provide a copy of their identification. This measure prevents abuse of the system, such as creating multiple accounts, running bots, or engaging in farming activities. Pi is also on track to become one of the first and largest verified networks.

The KYC process and data are currently safeguarded by a trusted third-party vendor. In accordance with its privacy policy, the company pledges to keep user data secure and refrain from selling or otherwise exploiting it.

5.4 A Streamlined Presentation to Stellar Agreement Convention

The Pi network employs a unique approach to achieving consensus, relying on the Stellar Consensus Protocol (SCP) and an algorithm called Federated Byzantine Agreement (FBA). Unlike traditional blockchain networks that consume significant energy, SCP and FBA minimize energy consumption by facilitating communication and agreement among nodes without the need for mining. Instead of a centralized voting mechanism, FBA allows each node to form its own "majority cuts," establishing decentralized quorums. This decentralized approach enables new nodes to join the network without central approval, as they demonstrate trust relationships with existing nodes. SCP, a form of FBA, ensures the security of the shared ledger by having nodes endorse each other's trustworthiness. Nodes create quorums based on the majority cuts of their trusted nodes, and transactions are only accepted if a portion of nodes in the quorum agree. This distributed consensus mechanism enhances security while minimizing energy consumption, making SCP and FBA attractive alternatives to traditional blockchain consensus algorithms.

6. Future consent – pi network on the basis of bitcoin

Back in 2017, Cryptocurrency was far from being a mainstream topic, and the general public was not accustomed to dealing with it. During that period, only a handful of individuals engaged in storing or mining bitcoin. At that time, the price of bitcoin hovered around 2.3 dollars. It wasn't until April 2017 that bitcoin surpassed the 100 USD mark. Notably, bitcoin had been launched in 2010, and it took seven years to reach the 100-dollar milestone. The market cap on March 4 was 25 billion, which skyrocketed to over 100 billion by October 20, 2017. Moving forward to 2022, the price of bitcoin stands at approximately 40,000 USD.

In the early days of cryptocurrency, back in 2010, it wasn't as widely known or accessible to the general populace due to the lack of technological infrastructure. However, over the course of a decade, bitcoin gradually gained traction and amassed a user base. In contrast, Pi coin presents a promising opportunity to achieve substantial value post-launch. With a user base of 29 million already, Pi coin boasts a more user-friendly mechanism. Unlike bitcoin, which requires specialized mining equipment, Pi coins can be mined using regular smartphones. The predicted market cap of Pi Coin is an impressive figure, and there are currently no declared limitations by the Pi Leader's organization. It is envisioned that Pi Coin could potentially become a mainstream currency in the foreseeable future, aided by its straightforward pool tools and accessibility for everyday users.

Considering these factors, it is conceivable that Pi Coin could have a significant impact on the cryptocurrency landscape.

7. Conclusion and Future Scope

While Bitcoin has undeniably risen to prominence as a widely recognized cryptocurrency, the Pi Network endeavors to democratize access to cryptocurrency for individuals of all backgrounds and expertise levels. This paper outlines the key features of Bitcoin, the Pi Network, and forecasts regarding the Pi Network's future value in relation to Bitcoin.

In comparing the two, Bitcoin has surmounted significant challenges and accrued substantial value. Conversely, the Pi Network has already attracted 29 million users and continues to expand its audience. Currently, Pi has mined 889,865,486 coins, suggesting its potential to establish itself as a user-friendly cryptocurrency.

There's absolutely no doubt that ancient civilizations' understanding of pi paved the way for today's precise calculations. Through the Middle Ages to the Modern Era, significant developments unfolded in determining its exact value. Thanks to the concerted efforts of Americans and Europeans, the precise value of pi used in contemporary calculations has been established and refined.

Here's a more conversational take on the future scope of cryptocurrency:

A. Finance and Banking: Picture a world where sending money to your friend across the globe is as easy as sending a text message, and you don't have to wait for days or pay hefty fees. Cryptocurrencies could make this a reality by offering faster and cheaper ways to handle financial transactions, making traditional banking systems rethink their approach.

B. Technology and Innovation: Think beyond just buying and selling coins. Cryptocurrency is like the tip of the iceberg; underneath lies blockchain technology, a digital ledger with endless possibilities. From securing medical records to tracking products in a supply chain, the future could see blockchain transforming various industries, making processes more transparent and efficient.

C. Investments and Asset Management: Imagine having a diverse investment portfolio that includes not just stocks and bonds but also digital assets like cryptocurrencies. As more people embrace digital currencies, traditional investors might jump on the bandwagon, leading to the development of new financial products and services tailored for the digital age.

D. Regulatory Environment: Governments are scratching their heads trying to figure out how to regulate this new digital frontier. As cryptocurrencies become more mainstream, expect to see clearer rules and regulations to protect consumers while still fostering innovation in the industry. This could give traditional investors the confidence they need to dip their toes into the crypto waters.

E. Global Trade and Commerce: Forget about dealing with multiple currencies and waiting days for international transactions to clear. Cryptocurrencies could streamline global trade by offering a universal medium of exchange that transcends borders and reduces friction in cross-border transactions. This could open up new opportunities for businesses to expand globally and reach untapped markets.

F. Decentralized Finance (DeFi): Picture a world where you don't need banks to take out a loan or invest your savings. That's the promise of decentralized finance or DeFi. With smart contracts and blockchain technology, you could lend, borrow, trade, and even create complex financial products without relying on traditional financial institutions. The future of finance could be decentralized, putting power back into the hands of the people.

G. Privacy and Security: In a world where data breaches and identity theft are all too common, privacy-focused cryptocurrencies offer a beacon of hope. By using advanced encryption techniques and decentralized networks, these cryptocurrencies aim to protect your identity and keep your financial transactions private. As concerns about data privacy grow, expect to see more emphasis on privacy-preserving technologies in the cryptocurrency space.

H. Environmental Sustainability: One of the biggest criticisms of cryptocurrencies is their environmental impact, especially with energy-intensive mining operations. However, the future could see a shift towards more sustainable mining practices and energy-efficient consensus mechanisms. From solar-powered mining rigs to carbon-neutral blockchain networks, efforts are underway to make cryptocurrencies greener and more environmentally friendly.

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Data Availability
The data utilized in this research stems from a diverse array of research papers, each offering valuable insights that contribute to our understanding of the topic. Through our comprehensive review of literature and online sources, we have amassed substantial knowledge and identified potential directions for future exploration. This study also discusses future scope and applications, leveraging mathematical methodology to uncover new possibilities

Conflict of Interest
All the authors declare that they do not have any conflict of interest.

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Authors' Contributions

- First Author:

- Conducted literature review and gathered necessary results to support the proof.
- Drafted the manuscript.
- Incorporated feedback and corrections from both guide teachers.

- Second Author:

- Reviewed and edited the manuscript for clarity, coherence, and accuracy.
- Provided feedback and revisions to improve the quality of the manuscript.

- Third Author:

- Provided approval for the research direction.
- Offered necessary corrections and guidance on results.

- All Authors:

- Participated in the review and editing process of the manuscript and approved the final version of the manuscript for submission.

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