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Research Article

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The Role of Blockchain in Cryptocurrency and Information Technology

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Abstract

Cryptocurrency is an attribute derived from blockchain that serves the sole purpose of money exchange, similar to Bitcoin. Cryptocurrency can have major benefits but it could push the limits if it would be used for money laundering and terrorist finances since there is an absence of intermediate checks to ensure the transaction integrity and no one comes to know the identity of people who've made the transaction. This paper touches upon the meaning and definition of blockchain and cryptocurrency, a comparison of bitcoin and Ethereum, smart contracts, mining, advantages and drawbacks of cryptocurrency, properties of blockchain, a study (the bulk of bitcoins handled by the USA, and how google stops showcasing advertisements of bitcoin and cryptocurrency), proposed suggestion and scope for future study.

Keywords: Central banks; Blockchain; Cryptocurrency; Federal reserve; Consensus algorithm; Proof of work; Information Technology; Smart contract.

1. Introduction

There are assumptions to the cryptocurrency that if all money goes paperless there is no money left in the market, even though using blockchain can ensure the security of transactions but what if somebody from the dark web takes control over all money which is in the form of cryptocurrency.[1] Technically the federal reserve gold will have no value, one would see money inflation globally as the US dollar has the highest monetary value, and various sectors may lead to shutdown, causing the worldwide economy to suffer.

1.1 Blockchain

Blockchain is the result of RPOW (Reusable Proof of Work), which was introduced in 2004, Such system intakes HASHCASH-based proof of work and end results into RSA-signed tokens, which are transferable between one entity to another entity. Blockchain is an online public ledger that holds the logs, entries, and records of online transactions. Blockchain is a key foundation stone for cryptocurrencies. In this technology, the integrity of cryptocurrency is maintained by encryption, validation, and storing the entries of the transaction once and for all. It holds time-stamping-based records that are immutable, to ensure when an entry is logged. Imagine a typical scenario where you go out to a store to buy something, hand over your card to the store cashier, cashier swipes the card into the card swipe machine, one enters OTP, the transaction is sent to the financial institutions who authenticates the transaction, debits card holder's account and store's account is credited with the money. That's how a transaction gets completed.[2] This is hectic and expensive too because the bank charges an amount of money as part of processing fees. On the other hand, the point of sale is a bad idea due to recent emerging cases of card fraud using POS machines. This might cause a loss of lots of money to the retailer and the wholesaler. Blockchain provides a digital platform for distributed computing to ensure the smooth working of cryptocurrencies such as bitcoin, which was popular amongst all.[3] Each block of data in a blockchain is chained using cryptography so that all block consists of some sort of link to establish a relation among them.

Blockchain is not a centralized system, instead, it is distributed where information is open to everyone. Anything that is built using blockchain is transparent and everyone holds the liability for the action they perform. Unlike any other transaction system, blockchain carries no additional transaction charges. It's a way of passing some data from one entity to another entity (entity is a person) in a safe environment. As reflected in Fig. 1, If one wants to perform a transaction, a block has to be created, this block is verified amongst thousands of distributed computers and later on, this verified block is added to the chain, which is stored across the internet. Such a mechanism ensures that one single entity cannot add up an invalid block in a chain. This is not simply creating a block instead we create a distinct record with a distinct history. So, if one wants to prove a particular record false, it's impossible because that's how the system is designed. When one makes a single move, it's been recorded at each step. If a new block has been added to the blockchain, the

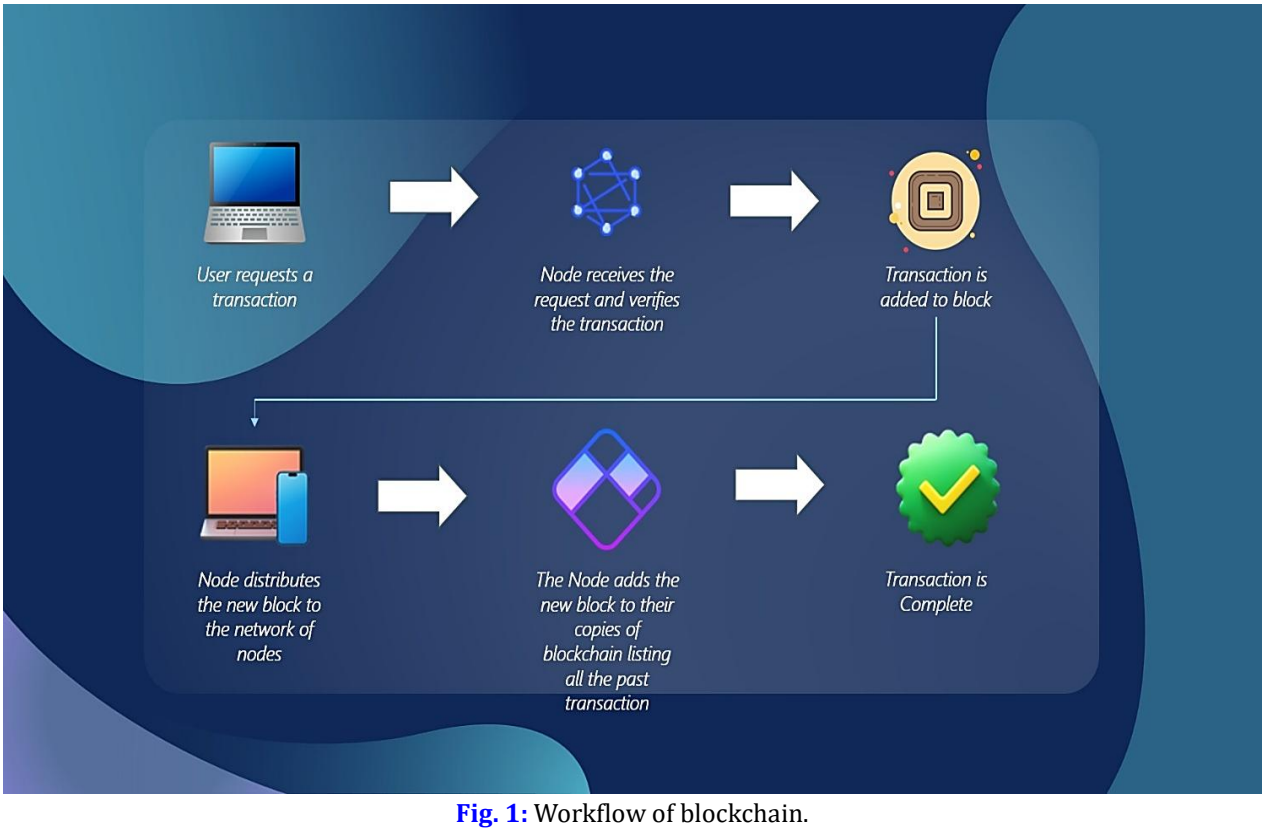


Fig. 1: Workflow of blockchain.

newly added block is first linked to the previous existing block. This type of linking from block to block ensures that the chain is never disconnected or discontinued and each block is always recorded permanently. So, when somebody wants to alter a transaction that occurred in the past is a difficult job, as all the previous blocks should be altered firstly.

1.1 Cryptocurrency

A form of Digital money created with the help of a technology that controls its the creation and protects the transactions ensuring that the details of the users are hidden from everyone else. Cryptography is a computer-based technology used for phrases such as security, authenticity, and more. Currency refers to a particular form of money that has some monetary value which is currently in use. A cryptocurrency is a form of digital money that is designed for quicker and cheaper than that of what issued by regulatory government bodies. So now, one doesn't have to rely on regulatory government bodies for money, instead, one can create their own money, send or receive, and make the payments at the store. To prevent financial fraud and manipulations in cryptocurrency, the below functions are performed by each user–

- Record the transaction simultaneously
- Verify own transaction
- Verify transactions of the rest of the users

All of these cryptocurrency transactions are recorded in a book, which in terms of financial institutions can be termed a "ledger". This ledger is accessible and open to everyone so that verification of transactions comes in handy with ease. In other words, one can say that all these records of the transaction are public records.

Every currency has its issuing and governing body. For example, the rupee is governed by the Reserve Bank of India, and the US dollar is governed by the Federal Bank of the USA. These kinds of systems determine how much cash is available and how much cash will be required shortly determining the economy's wellness. Reprinting more currency can lead to inflation and deflation of currency value and impact an economy as well. Such risks can't be afforded because they can impact all the sectors of the economy and can affect net GDP as well.[4] However, cryptocurrency is all different in this case. There is not a single entity that determines the amount of cryptocurrency required shortly or for creating denominations for cryptocurrency. Everyone knows the present supply of cryptocurrency and how much will be required shortly. There was no intention to invent a new currency when Satoshi Nakamoto created Bitcoin.[5]

1.2 Bitcoin

Avery's first form of digital cash or money is ever known to have been invented by an unknown or a group of people later so-called to be Satoshi Nakamoto as its founder. Bitcoin Doesn't require any sort of financial institution involvement in its transaction system since it's a form of money with uniqueness into itself. All the transaction in Bitcoin occurs in between people or someone's banks as Anonymous, having said that no banks are involved along with middlemen.[6] Every single transaction you make is being recorded and every single person gets hold of it, so do we use "Blockchain" to define that term, which tells us how everything is connected point to point.[7] The data on the blockchain is available to everyone and is public, and this data is being saved on multiple computers worldwide. Since so many copies of data are being maintained at the same point of time, it's impossible to forge the transaction and banking-related data is safe, because altering or tempering the data overall computers of networks is next to impossible.[8] Every single person protects their bitcoins using digital wallets. In a technical word, A wallet is software, so whenever you want to access it, use a key. Such keys consist of long sting including symbols, letters, and numbers.

Just like one uses a particular technology for the cloud, in such cases, it would be AWS (Amazon Web Services). Similarly, in the case of cryptocurrency, we use bitcoin. There are multiple options available such as Ethereum, Litecoin, Ripple, and so on. Over recent years, Bitcoin has become very popular amongst all cryptocurrencies. There are a few places where Bitcoin is accepted as a mode of payment like Reeds Jewellers of the USA. Even though many other brands such as Dell, Microsoft accepts bitcoins as a mode of payment.[9] Over the recent years, Bitcoin has received hype as in China price of Bitcoin was boosted to around US dollar 1200. The estimated price of bitcoin is around the US dollar 15000 approximately.[10]

Table 1: A comparison between Bitcoin and Ethereum

Bitcoin	Ethereum
The average block time is 10 minutes.	The average block time is 12 seconds.
Around a sum of 66.67% or more bitcoins are mined already.	The mining has not reached even 50% mark.
In Bitcoin, if a block is mined then the reward is 12.5 bitcoin.	In Ethereum, if a block is mined then the reward is 5 ether. .
Proof of work is determined using ASIC which is centralized.	Proof of work is determined using Ethash which is a memory-hard hashing algorithm.

There were exceptions made to the bitcoin that its value will be degraded and the people who've invested in bitcoin will burst out of anger. Eventually, prices of bitcoins went down when some rumors started floating around as "Chinese government is going to shut down usage of bitcoin". Later on, bitcoin recovered after some time when the rumor was proved to be a false alarm.[11] The detailed comparison between Bitcoin and Ethereum is discussed in the Table. 1, which discusses the major differences between them.

2. Literature review

Various studies explored the application, advantages, and hurdles of Blockchain. Zhang *et al.* identified major hurdles in the adoption of blockchain in finance which highlighted security and regulatory concerns.[11] Treleaven *et al.* provided an initial exploration of blockchain's role in financial services which emphasizes its potential for decentralization and transparency.[12] Ren *et al.* examined the intersection of sustainable finance and blockchain providing a research agenda for future exploration.[13] Casey *et al.* described blockchain as a catalyst for change in financial systems, emphasizing its ability to enhance trust and efficiency.[14] Kowalski *et al.* analyzed the impact of blockchain on trade finance, particularly in improving trust relationships.[15] Furthermore, Tian *et al.* explored blockchain-based tokenization for financing infrastructure projects, showcasing its potential in asset management.[16] Du *et al.* discussed blockchain-enabled supply chain finance innovations, demonstrating enhanced transaction security.[17] It further emphasized blockchain adoption in supply chain finance, discussing its implications for financial efficiency. Osmani *et al.* conducted a cost-benefit analysis of blockchain in banking, identifying significant cost reductions and efficiency improvements.[17] Chen and Bellavitis explored DeFi's rise, discussing its role in decentralizing financial systems.[18] Anoop and Goldston examined the transition from DeFi to hybrid finance, analyzing case studies such as Acala.[19] It reviewed blockchain-powered DeFi, emphasizing its transformative impact on traditional finance. Karim *et al.* explored blockchain applications beyond digital currencies,[20] while Guo and Liang conducted a critical review of blockchain applications in banking.[21] Yadav *et al.* discussed blockchain's role in cost-saving measures within banking.[22]

2.1 Smart contract

Two entities agree upon doing business and exchange money for the same. Requirements are set by both parties for a contract to meet on a date, the smart contract becomes active when the delivery of purchase is completed. The contract is deactivated when the requirement doesn't match. Say, for example, Jack wants 5 bitcoins from Jacob and Jacob wants 5000 USD dollars. Both parties agree to deposit cash and bitcoins on 5th January 2020 into their account which is linked with the smart contract they've agreed upon. On 5th January, it will be checked that both Jack and Jacob fulfilled their promises as per the smart contract or not. If the promises are not fulfilled then coins and money, will be returned to their source of origin. Both parties are responsible for their action and the contract is publicly available and no changes can be made to that. Anyone who violates the contract is dealt with for their actions and one can be made accountable for their actions.

2.2 Mining

It is a computation phenomenon, in which information is recorded and verified on a digital record-keeping system, commonly known as the blockchain. People perform mining in return for money. In other words, when a computer completes the mining, they are eligible to earn rewards in the form of digital money.

Only one block can be created at any point in time to ensure blockchain works smoothly. To determine it there are several ways as discussed below -

- Proof of work is the most common mode; in order to solve math problems, we would require computers to work on it. The very first computer to solve the math problem gets the opportunity to discover new blocks and the information is recorded on the blockchain. For each transaction, the reward is offered which consists of digital money with transaction fees paid.
- Proof of stake is another mining technique, there is software that determines who is going to create a block to record the information. In other words, it's said to be a lottery-based system, in which no computer competes to win the chance. One would not be able to create new coins using this technique. Using this technique only allows collecting fees for verification and recording of the transaction.
- Every single month a sum of around 1,100 cryptocurrencies is created.

3. Advantage of cryptocurrency

- **Low Transaction Fee:** Anyone can send or receive money without being worried about transaction charges since there is no involvement of a middleman. There is a minimal amount of money charged for a transaction, but it is very little.
- **Trustless:** One can easily see the transaction in the system, when and how money is sent, received, and verified, and such transactions are recorded on multiple systems.

Anonymous: All the transactions are made by an unknown person in terms of cryptocurrency. No one

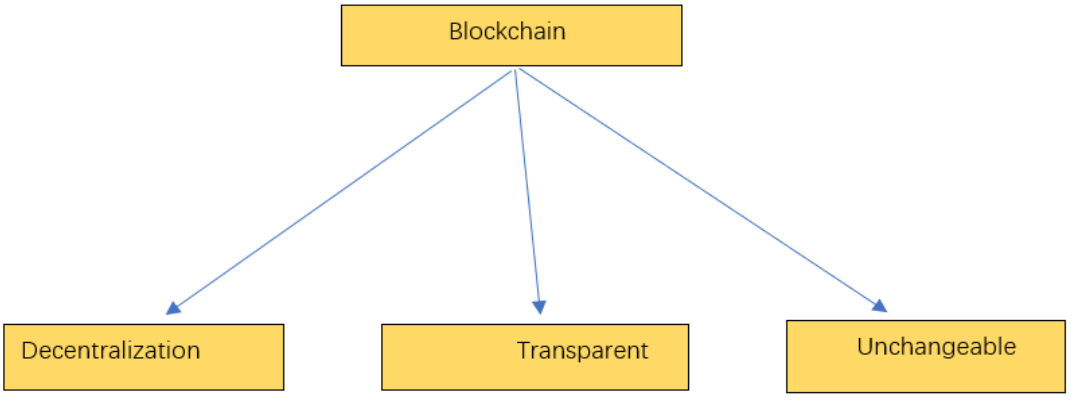


Fig. 3: Properties of blockchain.

can track a person who has made a transaction using cryptocurrency with their real-world identity. In other words, the User's privacy is governed by cryptocurrency.

- **Fast:** Transaction occurs in real-time and confirmation is granted within a fraction of a minute.

4. Properties of blockchain

4.1 Decentralization

Before the arrival of Bitcoin as a cryptocurrency, everything used to lie on centralized service. It's just like legacy DBMS where all of your data is kept on a centralized database and you've to interact with that database every single time, whenever you require some intel. Remember the Client-server model, that's the best fit in this case as reflected in Fig. 2.

- When you search for something with the help of a search engine, your HTTP request is sent to the web server using a web browser.
- The web server finds the corresponding web page as part of The HTTP request and results are sent back to the client machine in the form of an HTTP response.
- The Problem is data is being located on a centralized machine, in case of halting, all operations are affected.
- No one will be able to access the centralized located database.
- If data is modified accidentally, all the data on the blockchain will be impacted and the outcomes will be worse than one could have expected.

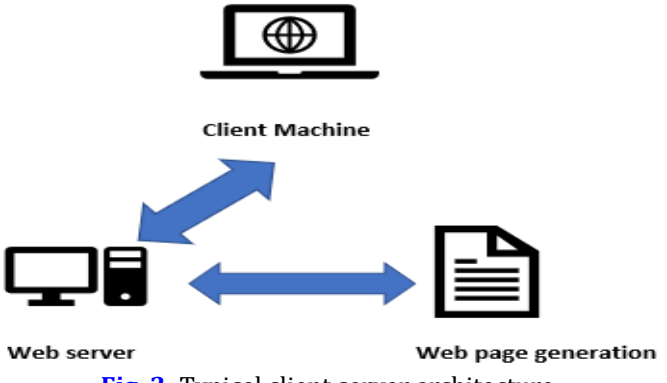


Fig. 2: Typical client server architecture.

As mentioned in Fig. 3 decentralized sets you free from being worried about information. You get to see your information is stored on multiple computers over the network. Interaction with another entity can be done without the help of anyone. This was the main idea behind the implementation of Bitcoin. You and only you are in charge of your account and of your money too.

4.2 Transparent

A person's identity is always hidden using cryptography. In this, all the identity names will start with Hexadecimal values a form of binary numbers with cryptography that makes it hard to understand the name of the sender and receiver. In the transaction history, If I've sent money to my friend's account his name will appear as highlighted in the address. The amount of Either sent is 18.75 is also highlighted in the below snapshot. Fig. 4 is the snapshot of ETHERIUM (another type of cryptocurrency). So, we can see that a person's real identity is secured and its public identity can be seen. Such a level of Transparent system never existed in a financial institution. All you need to know is the public address of a person, and bingo, now you can all the transactions, keeping in mind cryptography made the rest of the details hidden from everyone else. Using such a concept one can integrate the whole supply chain management system.

4.3 Unchangeable

Data added on Blockchain can never be tempered. This can add up to a valuable key to their core system. Blockchain uses a cryptographic hash Function. This means no matter how long the string length is the output will be always in the fixed length. A hashing algorithm SHA -256 used by Bitcoin gets you the output of a fixed length.

5. Study on how google stops showcasing advertisements of bitcoin and cryptocurrency

The widely known cryptocurrency Bitcoin was founded using blockchain, in which every block is hashed cryptographically. This makes the record immutable and

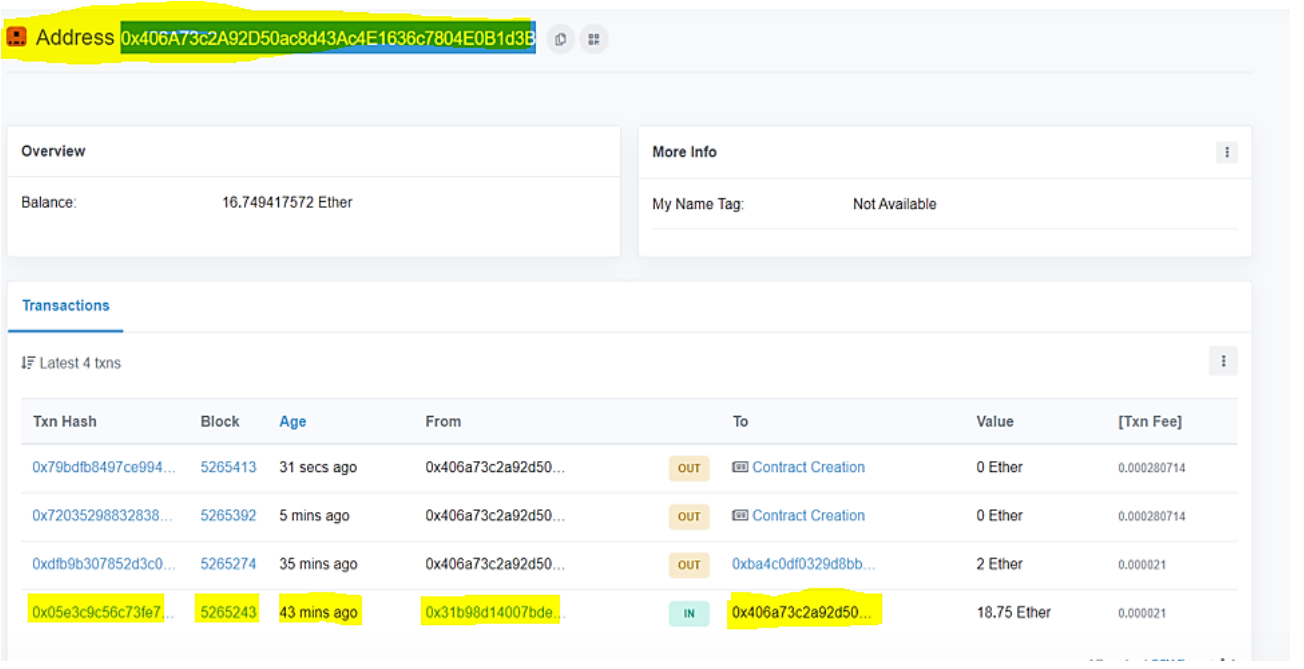


Fig. 4: Transaction state in ETHERIUM (Digital currency).

tamper-proof proof which has led to the application of secured and decentralized data storage. Bitcoin employs a peer-to-peer network method in which nodes operate independently to validate and certify transactions, which solves the problem of a single point of failure. The immutable and tamper-proof nature inspires applications across distributed computing. Hedge funds and retail investors purchase bitcoin to diversify their investments instead of stocks and bonds. Social media platform X or Reddit utilizes the Bitcoin Lightning Network to receive tips from fans across the world. Cryptocurrencies always facing lots of heat from the rest of the world including Google. The online search engine removed advertisements of cryptocurrencies (bitcoin) in 2018 summer, leaving everyone in shock, which costs bitcoin a lot in terms of reduced monetary value. This was done to reduce scam cases related to cryptocurrencies. Though Google allowed the advertisements on the search engine at the end of 2018 September. The situation became worse on 24th December 2019 when Google started the purge against videos posted on YouTube, aiming to remove cryptocurrency and bitcoin videos. The videos listed for reasons such as harmful or dangerous are being removed from YouTube. In a few cases, YouTubers' channels were terminated once and for all. Few YouTube channels such as CoinTelegraph or CNBC manage to save themselves from this purge. This purge is a big blow to the cryptocurrency industry.

6. A study on the bulk of Bitcoins handled by the USA

As per the study, the USA is the only country to hold the largest amounts of bitcoins. These bitcoins are being sold into public auctions under the deep observation of US Marshal services and the Department of Justice. As per fact, Bitcoins worth around US dollar 1 billion have been under the custody of US law. To ensure the sale of cryptocurrencies legally and correctly, US Marshal services are responsible. The sale of bitcoins conducted by marshal services during the time window between June 2014 – and November 2015 was US dollar 379 per token. Tim Draper who is an American venture capital investor has purchased 30,000 coins worth 18.5 million US dollars approx. As per the current price of bitcoin, its net value is 300 million US dollars and it's a good return on investment if we think of 2.5 years. Manhattan local authorities have captured the accuses of kidnapping and Burglary, who converted Ethereum into Bitcoin to sell the loot. all the bitcoins that are or were under the possession of the US government, all those records can be found on the Forfeiture.gov website. There is a difference between the online report publication date and the seized date of bitcoins. The government cannot trace bitcoin owners because they cannot establish a relationship between the owner of the cryptocurrency. During the window of June 2014 – November 2015, in the 4 auctions, Marshal's sold Silk Road bitcoins which were estimated for an average price of 379 dollars.

7. Proposed suggestions

Blockchain guarantees security via a distributed form of data availability over peer-to-peer networks. To ensure full security of the technology being used, background checks are to be made on the transacting party to ensure no fraud case. As in blockchain, we use a consensus Algorithm to ensure common agreement of almost all entities before performing a transaction. This describes a proof of work On the other hand, identities to be verified for those entities who are making the transactions.

Granting privacy to the user is a good thing, but what if a user whose intentions are not good when it comes to the use of technology. If the same very cryptocurrency is used for terrorist funding or someone attempts to use it to demolish the economy worldwide by replacing cryptocurrency with paper-based currency. In such cases, outcomes will differ. Cryptocurrency implementation using blockchain requires serious security improvements such as wallets. Attacks from hackers on wallets can be prevented by using key encryption and categorizing funds into General storage and daily use. Using this one can ensure that not the entire fund is lost in case of theft. When a cryptocurrency exchange is made, the exchange should implement multi-signature security. Investment in cryptocurrency includes higher risk, one must calculate the risk before investing in the cryptocurrency.

8. Scope for future study

The use of cryptocurrency can differ based on the intentions for which it is being used. A currency is traceable, but this doesn't apply to cryptocurrency. People stealing Taxes from the government can easily make a fool out of them by using such currency because real-world identity is unknown. Various countries reserve banks have instructed the government to ban the use of cryptocurrency, as inflation and economic factors are indirectly associated with it. The technologies following the footsteps of decentralization have grown bigger and bigger with time. Cryptocurrency has grown along with blockchain and it continues to do so. Various companies, in particular, have been spending money on blockchain to improve their security and other features. Blockchain can lead to the potential discovery of various new technologies.

9. Conclusion

Cryptocurrency is not everyone's cup of tea. Until today, very few people know about cryptocurrency and it's not very popular since it's a new technology. Since values of cryptocurrencies are higher in terms of monetary value, eventually they do require a bulk of the money, including risk. In other words, not suitable for all in one. Hackers can steal cryptocurrency if we talk about Bitcoin, the transaction can be delayed which is highly volatile. They can steal credentials related to cryptocurrency wallets. We Cannot guard it in terms of 100% security just like no algorithm exists which is 100% efficient. Though there are pros and cons for everything, however, there is a limit to be set on cryptocurrency investments and few other cryptocurrency financial institutes are required to be setup so to ensure transparency and faith stored in the investors or customers. Setting up the financial institutions will provide better and smoother efficiency, ready to track transaction system for the government, so as to stop appreciation of the myths related to cryptocurrency.

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Data Availability Statement

The datasets generated and/or analyzed during the current study that support the findings are available from the corresponding author upon reasonable request.

Conflict of Interest

There is no conflict of interest.

Artificial Intelligence (AI) Use Disclosure

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI. All technical content, experimental implementation, results, and interpretations were independently developed and verified by the authors.

Supporting Information

Not applicable.

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