European Journal of
Health Sciences
(EJHS)

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European Journal of Health Sciences
ISSN 2520-4645 (online)
Vol.8, Issue 2, pp 32 - 49, 2023

www.ajpojournals.org

A Review of Challenges of Block Chain with COVID-19: A Review Paper

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Article History

Received: 02nd Mar 2023

Received in Revised Form: 19th Mar 2023

Accepted on: 21th Mar 2023

Abstract

COV-19 has a negative impact on human life and several sectors, particularly the health, financial, and tourism sectors. Such circumstances led to the concept of new forms of life that people have had to adapt to lessen the spread of disease by taking preventive precautions as recommended by governments and international organizations such as the WHO. As a result, authorities and technical associations must take advantage of the current technological advancements to overcome the challenges posed by these circumstances. Blockchain (BC) technology has been identified as a platform for cryptocurrency globally. However, BC technology has the wonderful ability to facilitate the transition from a centralized, low-trust transaction ledger to a decentralized, high-trust ledger held by multiple verifying nodes. Due to its distributed nature and protection, BC can be used in various fields other than cryptocurrency. BC plays an important role in improving and maintaining the privacy, security, and integrity of data. This paper aims to discuss the background of the BC technology and its applications in combating the COV-19 crisis. Also investigated existing BC methods in specific applications and analyze the effectiveness of their outcomes. Furthermore, the most recent BC-based research proposals for combating the COV-19 pandemic are reviewed.

Keywords: *Block chain architecture, COVID-19, traceability, decentralization, integrity, transparently.*

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1.0 INTRODUCTION

The living pattern of the world changed in the 2020 first quarter as a result of the pandemic, of COV-19 which affected 166 million people and more than three million deaths by month of May 2021 [1]. To lessen infection rate, protect lives, and stop it spreading, states had to enforce bans and isolate people [2]. As a result, major challenges arose, requiring authorities, technology titans, and governing bodies to find quick solutions. The main issue that was faced by countries was figuring out the new learning mechanism, which was the change to e-learning [3]. Furthermore, the COV-19 also had severe impact of the health sector, and it confronted several challenges, involving retaining a constant supply of medicines and medical apparatus [4] and providing patient care. Data tracing applications based on tracing of Bluetooth proximity or tracing of geolocation functionality have been used in most countries and health sectors [5]. It has several benefits, including the ability to track COV-19 cases, know where they are, share data, and track patients' status by remotely [6].

These applications lack privacy and reliability, making it easier to access the data of a patient. As a result, authorities and technical organizations should get benefit of current advancements of technology to meet these challenges. The Internet of Things (IoT), Machine Learning (ML), Artificial intelligence (AI), and BC are examples of technologies that can be used to develop plans for handling the epidemic [7] because the BC can maintain confidentiality and integrity, BC-based data-tracking applications can replace applications that rely on Bluetooth affinity. This paper discusses the role of BC in managing and combating the COV-19 crisis. The sector of health is one of the most disturbed by the COV-19, and BC techniques has characteristics that facilitate it to transform different regions [6], such as sector of health. According to much research BC is also a crucial knowledge in the fight against COV-19 [7][8][9], this technology can be utilized to enhance the protection of health records while also protecting the privacy of patients.

1.1 Structure of the Paper

The paper organized in following order: section 3 Motivation and contribution section 4 background of BC, section 5 BC Structure, section 6 literature review and comparison of BC researches in COV-19 pandemic and discuss their solution, and section 7 conclusion with main findings and remarks as shown in the Fig. 1.

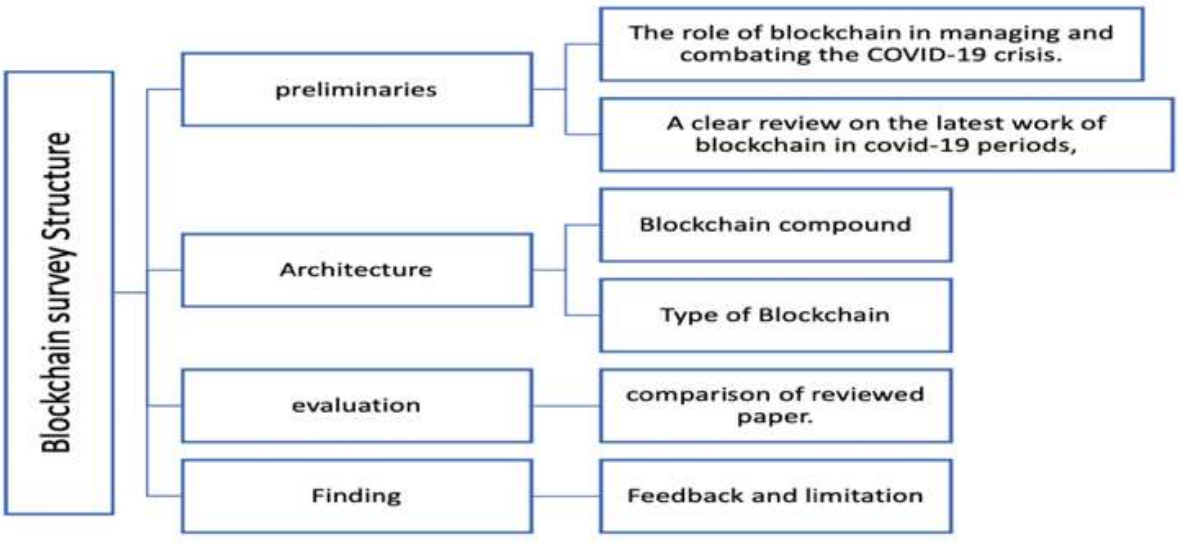

Fig 1: Structure of the Paper

Table 1: Comparison of recent block chain survey article with this survey paper

Topic	Details of Topic	Addressed in Previous Survey Papers	Addressed in this Article
Preliminaries	Preliminaries concepts related to understand BC	[13][14][15][16][17][18] [19]	✓
Evolution	BC 1.0 (cryptocurrency), BC 2.0 (smart contracts), BC 3.0 (blockchain Application)		✓
	Types of BC (public, consortium, private, hybrid)	[13][18][2][38]	✓
Architecture (Components and working)	BC 1.0(cryptocurrency)	[27][28][33]	✓
	BC 2.0 (smart contracts)	[21][22][26][29][30][31] [32][34] [35][36][37]	✓
	BC 3.0 (BC Application)	[20] [23] [25]	✓
Development framework	Application development framework	[19]-[38]	✓

1.2 Motivation and Contributions

There is no evidence that all states around the world are experiencing from this pandemic, emotionally, physically, and economically, [2], and all government must be conscious to minimize the risk that arises due to this disease latest development. Many research discussed the BC in this pandemic, such as implementations, techniques and methods and based on that our paper make a clear review on the latest work of BC in COV-19 periods, which will help to use and deal with BC on future. This paper analyzes many papers on this perspective and make a clear explanation about the methods and experiment, also an evaluation and comparison is made to extract the limitation on BC technology.

The major contributions of this research work are:

1) To study the existing methods of BC in general.
2) To compare many of related work of BC based on COV-19.
3) To analyze and assess the effectiveness of their result.

1.3 Background

David Chaum proposed the initial BC-like set of rules in 1982 with the help of his dissertation [10]. W Scott Stornetta and Stuart Haber extended on this theory in 1991, explaining the process of designing a cryptographically secured chain of blocks with non-damage able timestamps. Satoshi Nakamoto, on the other part, popularized BC in 2008. He improved the design by timestamping every block with hash cash-like techniques instead of trusting on a central power

or "trusted parties." These improvements were so innovative that they have developed the basis of current cryptocurrencies.

A BC is a distributed database that is distributed amongst nodes of computer network [12]. it performs as a database, that stores the information in a digitized structure, and is popular for their viral role in providing transaction's safe and distributed record in cryptocurrency structures like Bitcoin. A BC's revolution is that it guarantees the reliability and protection of a data record without the need of third party, which is why it is known as decentralized technology [7].

1.4 BC Structure

A structural and functional unit are represented by each block in this technique. A block contains the data, as well as the hashed value of that block and the previous block's hashed value. Like In a chain, these blocks are connected [13]. As depicted in Fig 2.

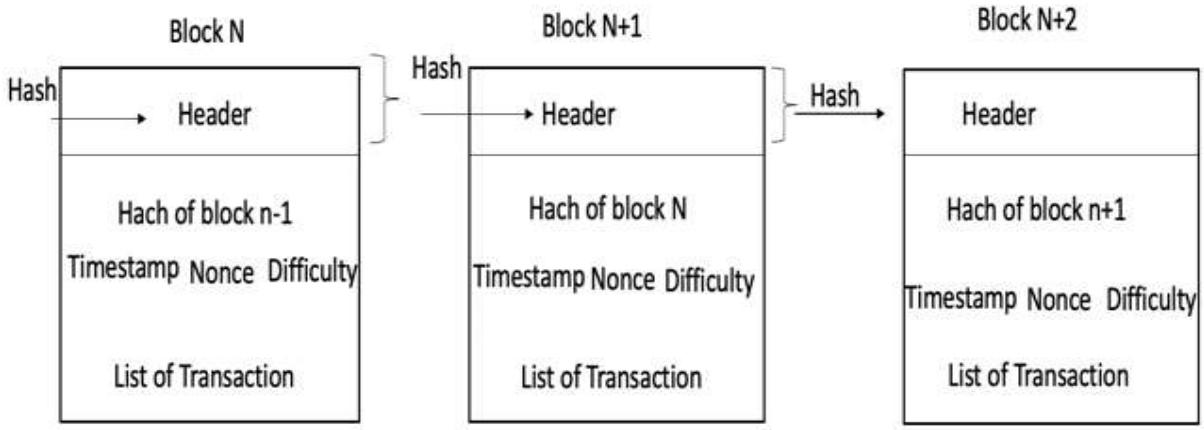

Fig 2: Linked blocks [13]

1) Each block contains digital information, which is data. Each block has information about transactions.

2) Each block also includes its own unique identifier and that of the previous block's identifier.

3) These identifiers are referred to as "hashes". Therefore, each block includes its hash and the previous block's hash.

4) The blocks are distributed freely and are very secure. Thus, modifying the blocks of the BC will be very difficult.

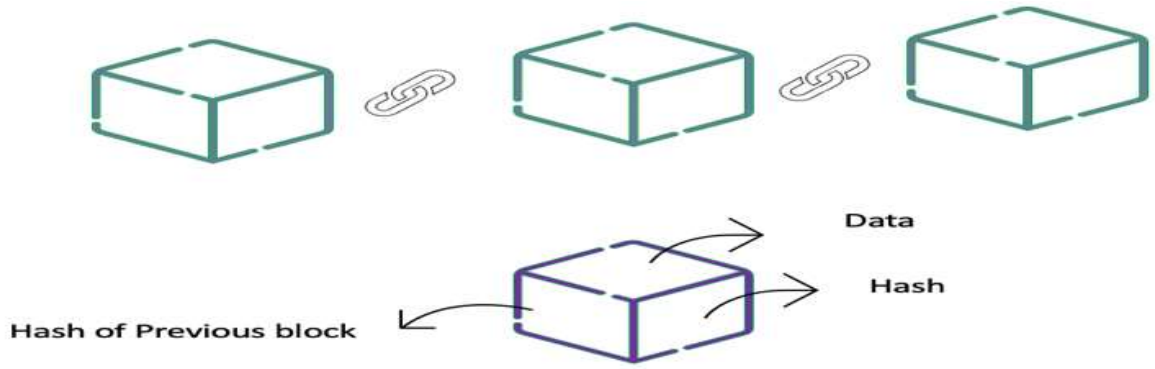

Fig 3: BC [14]

The block of genesis, having no parent block, is referred as BC's first block [14]. As shown in Fig 3, the BC's structure is based on a header and body of block, each of which contains a list of transactions. Version number, prior hash of block, timestamp, Merkle root, difficulty target, and nonce are among the fields in the header of block [15]. Furthermore, Merkle tree generates a single digest using safe hash procedures, such as the SHA-256 [16]. The purpose of this digest is to cover the integrity of origin evidence. The data of a block cannot be altered retroactively devoid of impacting all successive blocks, which demands main compromise on network [17]. In other words, BC is resilient to data composition variations. Algorithms ensure the BC's compromise system. It guarantees that all nodes in the network can verify a new block. We divide BC into 4 categories-based accessibility of data: private, public, hybrid, and consortium BCs. In a public BC, all has approach to the whole thing noted in the chain.

1.4.1 Types of Blockchain

Many types are used in BC such as [13] [18]

1) Public BC: The transaction can be read and submitted on this type of BC.

2) Private BC: Only one group or all affiliates inside the same unit can participate in a private BC. The transaction can be read and submitted in this type of BC.

3) Community/Consortium BC: A consortium of organizations can submit transactions and read transaction data using this type of BC.

4) Hybrid BC: A new type in which BC (private, public, or hybrid) can be utilized. Private, or community / association) can be utilized to assist transactions.

The BC enables a BC platform for configuration in a variety of modes and to accept transactions in a variety of ways [2].

1.4.2 BC Evolution

1.4.2.1 BC 1.0 (Cryptocurrency)

Cryptocurrencies are the first and most obvious application of distributed ledger technology (DLT), which has been implemented. The most well-known example in this segment is Bitcoin, which allows the implementation of financial operations based on BC or DLT (often used synonymously for the sake of simplicity). It serves as a form of electronic money, a digital payment system, and is sometimes referred to as the "Internet of Money."[19]

1.4.2.2 BC 2.0: Smart Contracts

Small computer programs called Smart Contracts that "live" in the BC are the novel main idea. They are independently operating programs of computer that carry out preset situations, such as the facilitation, verification, or enforcement of contract performance, automatically. The BC's ability to prevent Smart Contract tampering or hacking is a significant benefit of this technology. To overcome the moral hazard issue, smart contracts enable transparent contract definition while reducing the cost of verification, execution, arbitration, and fraud prevention [20]

1.4.2.3 BC 3.0

There is general agreement among experts that BC 3.0 has a wider range of trades it can include. This indicates that BC 3.0 has functions outside of the fields of finance and economics. This generation of BCs faces several challenges, including sustainability, scalability, cost-effectiveness, increased decentralization, and enhanced security. Healthcare, cybersecurity, supply chain, and production are some examples of these applications. [21]

2.0 RELATED WORK

Many researches have been done to combat COV-19 based on BC. A number of researches [23-26] were collected that focused on data sharing, integrity [28-29], traceability [30-39], and artificial intelligence [40-44], see Fig.4.

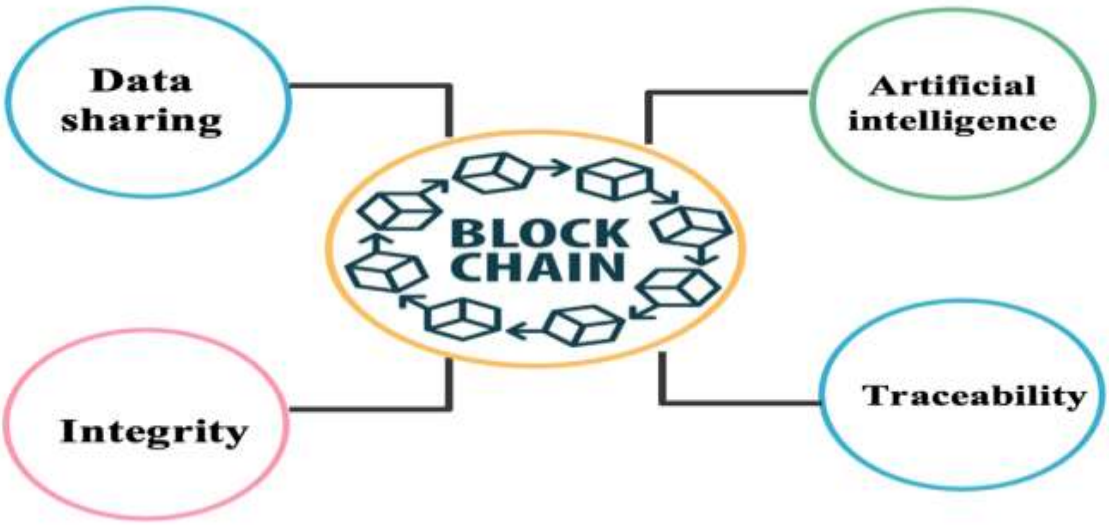

Fig 4: BC with various approaches

2.1 Data Sharing

In this study [23] the researchers proposed a Signature Algorithm called Diagonal Digital (DDSA) with the Hash Tire of Merkle Patricia (MPHT) that is a clever EHR distribution architecture that uses BC to accelerate reliable sharing of medical record among various patients and doctors. The active products clarify that our sketch permits a functioning explanation for truthful interaction of data on the cloud while storing careful records of medical in inequality to close threats. This project fully works within the data framework and can be merged in a secure method in IoT-based healthcare technology. In the proposed reliable data distribution sketch for smart applications of medical, the size of bilinear and exponential matching actions in the path of decoding is ineradicably symmetric to the snarl of the access control method.

The sketch rating, having the security implementation, also offers the maximum achievement amplifying in light-loading rules of access, the least latency of network, communication retard, and least loss average, with unusual security and features of data, in contrast to the current record-sharing sketches. Tentatively, the network execution of the frequent divide build was hardened during the tailored operation that gashed the costs on replicas cataloging and communicating. The results clarify that the expected structure has unsettled protection legislation and network legislation. The investigational results show that our sketch can transfer intelligent medical implementations with a safe and safe medical data partnership as well as fine-grind arrival monitoring. There are some critical concerns that need to be processed before comprehensive implementation. Furthermore, it is important to pay attention to the human side that might be trapped in the use of any digital framework.

This paper also used [24] a BC-based medical data-distribution architecture which is called GlobeChain to minimize technical issues and field the burst files. Their model was built to introduce a dependable collective data commutation service that could be useful in other medical services. Their suggested architecture explains an efficient procedure to link the state-limited BC networks and create a unified GlobeChain endorsed network of BC.

Other researchers suggested [25] an Ethereum BC-based resolution for controlling data about COV-19 vaccines' division and consignment. They implemented smart contracts to automatize the COV-19 vaccine traces while saving data privacy, clarity, protection, and responsibility. They combine the Ethereum BC with storage of off-chain, and this will help to manage the unimportant and huge data. After analyzing the results, they found that the cost and security are better compared with other solutions that are non- BC-based. The cost is low, and the security is strong against possible attacks, so this will save smart contracts.

Furthermore in [26] used a solution based on distributed BC-based to robotize pass on supply chain procedures for the COV-19 medical tool and approve data commutation to all participants involved in their garbage management in a way that is reliable and perceptible. They join the Ethereum BC with the distributed space of interplanetary file systems (IPFS). They build algorithms to identify intercommunication laws respecting COV-19 waste administration and costs to be assessed on the users in case of infraction. They offered a system architecture along with its full execution specifics. Then, they examine the result of the suggested idea using charge analysis to see if it is reasonable. They presented the protection study to confirm the obligation of the canny contracts.

This research also focused on data sharing [27], the utilized BC-based medical research to support stage based on a platform that can offer effective and safe information sharing against COV-19. They built a chain that includes nodes that are hospitals and medical research institutions. This helps with data sharing and consensus for all nodes. Next, doctors, patients, and researchers will be confirmed in different institutes. Also, doctors and scientists must have a Fabric Certificate Authority. After that, doctors transmit CEMRs to the chain of partnership, and scientists can get CEMRs from this research projects chain. The results for their experiments met an acceptable performance requirement. So, this will promote medical research into COV-19.

2.2 Integrity

In [28] suggested BiiMED: a BC framework for improving data transmission and reliability concerning electronic health records (EHR-sharing). Their explanation includes an access organization method enabling the interchange of EHRs between various medical distributors and a distributed Third-Party Trusted Auditor to certify data validity. BiiMED offered a solution emplaced in a case of the intelligent contract on the Ethereum Testnet. BiiMED enables partnerships in EHR between healthcare distributors. They analyzed their work by testing these points: Turing-complete procedure, scalability over huge populaces of patients, user symmetry and verification, constitutional transfer at the lower level, and cost-activity. This study determines a foundation for further investigation into vibrant information interoperability and reliability investigation in a totally distributed medium.

BC technology can be a quick, inexpensive, and effective solution along with Integrity [29]. BC can replace every means Authentication of the data as it ensures the source and persistence of the data at the same time as it is approved. There are many cases of BC technology such as the case of "Spike chaining" which means eliminating the time allocated to validate data before they are employed which greatly reduces the time, and thus turn into public and overseen by third parties. The realization of private BCs where the holder can create their own regulations and dimensions without losing the properties of legitimacy and immutableness assured by third parties. These components exhibit that a public database secure by a BC can easily be created today and that the only hurdle is in the desire or ability to make it in a good way.

2.3 Traceability

Another area of interest in this paper was traceability on BC. They introduced [30] a new BC-based frame for forming confidence on the authorization carrier. Also, they seek to abolish vaccination amnesty certificates. Their suggested from goal is addressing the challenges related to trackability, and traceability of the information that is ingrained in the immunity authorization. This way will confirm the assurance on the certificate holder which all important insurance connected to COV-19 immunization have been lawfully followed and observed with. Their suggested system was built to track the root of the COV-19 license authentication and observe the vaccine procedure stem at each step of its production and its related sequence of distribution. The system can show the chain of information which a confirmer can take from an owner of an Immunity Certificate by QR/barcode format. This code can show the data begin with its production to the final certificate holder.

Research by [31] suggested a BC-built framework which investigates the capability of operating peer-to-peer, decentralized space, and time stamping benefits of BC to create a novel method for confirming and discovering the unknown spread cases of the COV-19 virus. By using a new design for Applications of P2P-Mobile, people can forecast the risk in public regions. The basic goal of this research is to help discover the infection. Their framework includes four elements, which are: BC, P2P-Mobile Application, Disease Verifier Subsystem, and System of Mass-Investigation. BC helps to guarantee health data security and privacy.

Also, the researchers focused on tracking the data and proposed a BC-based resolution that [32] includes re-encryption agents, self-sovereign uniqueness, and a decentralized repository, for example file systems based on interplanetary (IPFS). Their idea is to develop a digitized medical passport (DMP) and authorization of immunity for COV-19 test-takers. They Ethereum BC-based code introduced intelligent contracts and tested them strongly to assert a digital medical identification to facilitate test-takers that gives a quick, dependable reply to straightaway from the appropriate medical experts. This decreases the medical facilities response time. Their proposed system has the potential to minimize the infectious spread in common and COV-19 in specific. [33] added a BC-based combined digital twins' architecture for distributed pandemic forewarning to clash with COV-19 and any upcoming infection. This is important because it is essential to achieve real-time exchange of information and assay across different members. Their proposed framework combined some innovative techniques such as BC, digital twins, and AI. They discussed the solution of decentralized paramedic notification to battle COV-19 outbreaks.

Besides that, the researches proposed [35] a BC, allowing intelligence of edge for IoMT in fielding the COV-19 disaster. They first reviewed IoMT, intelligence of edge, and BC in processing the COV-19 diseases. Then they offered a structure of BC-empowered intelligence of edge for IoMT and introduced some information about the chances of combining BC and edge intelligence. They next introduced resolutions to COV-19 delivered by BC-empowered intelligence of edge that included: (A) observing and following the COV-19 pandemic root, (B) tracking the chain of supply of medicines that are injectable and COV-19 medicine, and (C) telecare and faraway healthcare favors.

[36] Used the BC's emerging technologies to construct smart contracts for the COV-19 pandemic, a prototype of healthcare application was offered for the COV-19 virus as a universal epidemic because health applications needed transparency, trust, security, and huge space to build unchallengeable and reachable online data of medical, that is unable to be created by using traditional methods. The system is assessed using only illusive data to examine the function and the result of the scheme after each generated transaction. The goal is to use the BC instead of

normal applications of database to realize privacy, immutability, and security. Using BC offers a substantial and effective way to build the COV-19 virus application for security and tracking the users 'records without being interrupted, that is, completed on the IBM platform that is open-source. The results of the concluded implementations and situations showed productive and proper outputs that applied every process and function on every block this exists in the chain of any patient, and upcoming entries will be added to the history of user except changing the prior records. This work can be used to entail all people globally on the BC cloud. So, it will be like a certain sign anywhere while moving.

Also, this study [37] an online automatic platform that can casually gather the indicators required from expected patients and offer a quick finding. Because of its invisibility and data unlikability, the proposed platform protects users' privacy in case of both invisibility and data unlink ability, while also presenting 90% accuracy of detection by finding the coughing signals. The concept was inspired by an automated online method that allows for collection of symptoms remotely from presumed patients, precise and rapid diagnostics, and sharing of information among different bodies within the system of healthcare. This method expresses low complexity and takes 14 minutes for any individual out of 500 of group to realize its trial outcome. Furthermore, the requirements of space for a user and healthcare unit are 0.52 and 0.6 MB, correspondingly. Future additions to the suggested platform will reflect the existence of nodes such as hospitals, users, and smart contract.

Protection and confidentiality concerns [38] in the platform of medical cloud are more important and must be prioritized. To address issues, a secure and confidential COV-19 information sharing is presented based on encryption method of ciphertext policy attributes. A BC-empowered method to protection and confidentiality schemes with perceptible and direct invalidation for COV-19 records, this system performs the BC for regular uniqueness. The BC is utilized to authenticate all public keys, invalidation lists storage.

Moreover, BC technology (BT) [39] was used to solve many problems and can play an important role to track the Corona virus spread with easily and recognize who are the patients at high risk for this disease more than the others, and these technologies are highly efficient in controlling real time infection. BT is referred to as a digital database containing information which can be utilized and shared simultaneously within a vast distributed network available to all people. It has numerous techniques such as 3D scanning biosensors, and the multi-agent scheme that can be profitably employed to identify infected cases. BC technology also can effectively trace a patient's condition and provide real-time required data about the affected areas; this technique is also useful to track the people movement in a certain area. Some of the BC instances of the COV-19 virus are Hashlog, VeChain, PHBC, and HyperChain. There are many applications of BC technology in the COV-19 such as control of disease and tracking, strengthening the supply of things for medical fields during this disaster, enhancing transparency while treating infected patients, and to improve the recovery of patients.

2.4 Artificial Intelligence

Recently BC is used with artificial intelligence techniques. Researchers suggested [40] building an artificial intelligence (AI) model to apply to BC. This model works to classify the cases of the COV-19 patients to make them easier to store and use to make good decisions. The Artificial Neural Network (ANN) algorithms are selected to split the patient's cases into possibly COV-19 confirmed cases and possibly COV-19 negative cases depending on the impersonal and CT-scan reports. Based on the protocol of Interplanetary File System (IPFS), which is enough to be a solution of cost-effectiveness, they store data in a BC. They did some analysis of the execution of different AI-based models, assuming certain metrics, for instance, loss curve, accuracy, etc.

They test the storage efficiency, and security of their model MedBlock, which exceeds other recent systems.

Also, in [41] a BC-based COV-19 finding method (BCovX) for rapid and responsible examination of COV-19 and applied it to images of chest X-Ray (CXR). For rapid and exact detection of COV-19 employing CXR, BCovX contains a Convolutional NN (CNN) algorithm, to identify a patient who be identified for COV-19 remotely. CNNs succeed in classifying medical images in different ways. The authors used BCovX to provide dependable and secure information access and to transform it in BC working BC and smart contracts (SC). To crack challenges related to information space and its related cost, they used the protocol of InterPlanetary File System (IPFS) to save medical information. In addition, they introduced a real-time improvement of SC in the Solidity language to control the transaction process between the infected person and the doctor. Then they implement and deploy it using the Remix Integrated Development Environment (IDE). They found good performance when evaluating their model BCovX with classical schemes, particularly in storage cost, bandwidth requirements, and accuracy.

Herein, [42] suggested a BC-based architecture that saves patients' facelessness during the tracing process of their contacts using Bluetooth-implemented smartphones. They developed a smartphone application to collaborate with the suggested BC architecture that traces the whole community using Bluetooth. Also, it saves the acquired information across the cloud so that it can be made available to health branch managers and government offices to achieve convenient comfort. Their framework assists people to achieve their frequent business and everyday actions with a composed method that saves them from infected and exposed people. Users can check the condition of each analysis by using a smartphone application, and then they will know if they are infected or not. Their proposed system, Adaptive Neuro-Fuzzy Interference System (ANFIS) applied based on K-Nearest Neighbor (KNN), gave a very interesting result with a 95.9% accuracy score.

Moreover, [43] the system was developed based on Deep NN (DNN) analysis and applied in healthcare, particularly the COV-19 epidemic. They supported their study by using smart contract operations to extract features from data. They mentioned that the BC will be applicable to using it in the future to analyze diseases. The suggested approach introduces analysis of different illnesses. It is also highly applicable to lead physicians in adding suitable medicine and saving people's lives. They used Python to integrate huge amounts of data to use it in the diagnosis process. Their suggested approach introduces the integrity and accuracy of data transportation.

According to latest research [40-44], BC could perform a tactical part in future healthcare: specifically with AI methods to enhance COV-19-safe practice for clinical field. The main conceptions by [40] is to conduct A Threats, Weaknesses, Strengths, Opportunities (TWSO) analysis of the COV-19 infection to highlight the benefits and drawbacks of its adoption.

Table 2: Comparison of recent blockchain survey article with this survey paper

Ref	Application	Country	Used Techniques
[23]	IoT-based healthcare systems	SA	DDSA MPHT BC
[24]	GlobeChain	-	BC network
[25]	Khalifa University of Science and Technology under Award CIRA-2019-001	United Arab Emirates	BC GPS REMIX
[26]	Ethereum BC + (IPFS)	United Arab Emirates	Remix IDE environment BC
[27]	Efficient and Privacy-Preserving Medical Research Support Platform Against COV-19: A BC -Based Approach	China	BC CEMRs
[28]	(BiiMED) BC technology for healthcare	Qatar	BC
[29]	Spike chaining	US	BC
[30]	Novel BC -based system for establishing trust on the certificate bearer and to eradicate vaccination immunity certificate fraud	Saudi Arabia	BC QR/barcode format
[31]	P2P-Mobile Application	Egypt	Mobile - SMS- Internet
[32]	Ethereum BC + (IPFS)+DMP	United Arab Emirates	Remix IDE environment BC
[33]	BC +MCPS	SA, Yemen and Ireland	BC
[34]	Bychain	China	Bluetooth 5.0. CPU BC
[35]	BC- empowered Edge Intelligence	-	Edge intelligence BC (IoMT)
[36]	BC	United Arab Emirates	(ACK) BC
[37]	BC -Enabled Online Diagnostic Platform of Suspected Patients of COV-19	-	BC
[38]	BC for Data Sharing for COV-19 Medical Records	China	(CSP) BC SMS
[39]	Hashlog, VeChain, PHBC, and HyperChain	-	BC
[40]	MedBlock	Canada	ANN BC
[41]	BCovX	London	CNN BC
[42]	IoMT	-	ANFIS Bluetooth BC KNN
[43]	BC	India	DNN BC
[44]	Electronic health records (EHR)	-	BC

Table 3: Comparison of recent block chain survey article with this survey paper

Authors	Limitation	
[23]	Researchers mentioned that some critical issues needed to be addressed prior to the event, but they did not go into detail	
[24]	No clear time analysis.	
[25]	GDPR and Data Privacy	1-The public block chain platforms face data privacy. Assurance challenges since all transactions and data are publicly available on the ledger, thus affecting the privacy of user data.
		2-The public BC platforms face data privacy. Assurance challenges since all transactions and data are publicly available on the ledger, thus affecting the privacy of user data.
	Regulations Integrating	BC-based methods with legacy are exceptionally tricky. Also, the lack of awareness, regulation, governance, understanding, and developers' support are some problems needs to be considered for future.
	Vulnerabilities and Attacks on Smart Contracts	Normal functioning of SC can be affected by Bugs and defenselessness.
	Throughput and Latency	The Ethereum platform transaction latency is fully dependable on the fees of transaction and whole time of convergence of the applied consensus methods, including stake and work proof.
	Interoperability	Their scheme is universal and can be altered for any platform while applying little effort due to the publicly availability of the code.
	Scalability	The fee of traction and time of response can be affected due to increases in BC rate of transaction
	On-chain and off-chain governance the BC	It is regulated and run by various groups, including, node operators, core developers, BC teams and token holders.
[26]	They didn't introduce analysis of time or storage.	
[27]	1-The size of storage increases in proportion to the submitted number of test requests.	
	2- This method expresses low complexity and takes 14 minutes for any individual out of 500 of group to realize its trial outcome.	
[28]	The execution costs of SC deployed on the BC are expensive.	
[29]	The problem is with the willingness or capacity to construct it.	

[30]	Their model introduced many benefits, such as protection, confidentiality, trust, trustworthiness, and data space cost challenges.
[31]	Having constancy in their solution can be a double-edged sword because any human mistake will be forever stored, and it cannot be modified. The public Ethereum BC uses Work Proof consensus algorithms that offer scalability challenges.
[32]	There is no clear description of the time of data analysis during different volumes of streaming data.
[33]	1- Data protection, uniqueness privacy and implementation efficacy issues are the most important subjects of the digitized contract tracking methods. 2-These issues need examination, although the connection tracing applications. 3- There are several engineering notes related to their suggested research, e.g., the computers that stores user data may be completed quickly when the observers are dimly deployed.
[34]	1- The role of applied intelligence in improving the perfection of digital contact tracing has a challenge to offer a unified favor to get the accuracy of distance measurement at the edge. 2-Offloading: offloading decisions must suit various metrics at various levels. Energy efficiency is an essential aspect at the device level. BC Scalability: Although immutableness, improved protection, and distribution of BC are advantages, different current BC systems are grieving from weak scalability, displaying low transactional output and elevated latency.
[35]	There is no clear analysis of delay and throughput
[36]	1- Amount of uploading CEMRs into conventional databases is somewhat greater than that of medical fields.
[37]	2- They depend on full revocation, but some need to be partial with fine-gained restrictions.
[38]	It consumes a huge energy due to the need of a powerful hardware for each transaction. Moreover, Scalability due to time need to validate and authorize a transaction. Complexity of BC and necessity of widespread network of users, privacy protection
[39]	The difficulty lies in the eagerness and ability to build it.
[40]	Challenge they didn't implant Ethereum 2.0 for verification of scalability problems of public BC
[41]	All societies can access people's data, so it is challenging to confirm to the public that their information will stay safe and not be used for any other goals after the COV-19 pandemic ends.
[42]	They mentioned improvements without identifying how or where they would be added.
[43]	Each case produces high weights of transactions and as it increases, this is a challenge to handle in memory. Also, BC itself faces scalability challenges.

[44]	Due to the immutability of the BC, this property can act as a restriction when the modification of a transaction. Moreover, the high cost of management and data storage it is also generating temporary Conflicts in the BC.

3.0 MAIN FINDING

The integration of BC with the healthcare working model has gained traction in this COVID-19 age. Numerous researchers are aiming to incorporate the beneficial qualities of a BC network into the functioning models of healthcare sectors and to track the COVID-19 vaccination. We have reviewed and summarized the recent literature required to combat this situation. The main parts involved contact tracing, data sharing, data exchange services, managing data for COVID-19 vaccines' distribution and delivery, automating forward supply chain processes for COVID-19 medical equipment, data security, data authenticity, and traceability.

The key three promising qualities of BC, which are decentralization, transparency, and immutability, have enabled its successful amalgamation. By reviewing the existing literature, we find that the current centralized systems on which these healthcare models are based are very vulnerable to unwanted attacks, resulting in inescapable repercussions such as compromising individuals' privacy and identification. BC's major support is efficient, quick, and secure data sharing across many stakeholders for better decision-making. In addition, BC aids in the authorization and verification of the application's stakeholders in order to maintain the integrity of the data transferred over the network.

Numerous researchers throughout the world are striving to identify ways to employ BC technology to tackle COVID-19, although some proposed BC-based techniques, such as GlobeChain [24], BiiMED [28], Bychain [34], MedBlock [40], and BCovX [41], have been simulated.

4.0 CONCLUSION

People's daily lives have been affected by COV-19. As a result, administrations and technological organizations have had to use recent advancements of technology to meet the challenges caused by these conditions. The role of BC in addressing the COV-19 crisis was debated in this paper. It also featured some of the most up-to-date BC-based research proposals for reducing the COV-19 pandemic and categorized them based on their purposes. Finally, this paper reviews the challenges and limitations of BC. As a result, it is clear that most papers lacked elaboration on time analysis and evaluation, so that in future work, people can focus more on analyzing the time of BC not only in this pandemic but also in any other serious disease that we may be fighting.

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