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# A SYSTEMATIC REVIEW OF BLOCKCHAIN BASED ON COVID-19 PANDEMIC

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Abstract: This research contains a review of the scholarly literature on the blockchain-based COVID-19 epidemic. Beginning in the year 2020, a coronavirus outbreak was generated by a brand-new virus known as SARS-CoV2. COVID-19's sudden outbreak and uncontrolled global spread highlight the current healthcare system's limitations in treating emergencies in public health quickly. In these circumstances, Blockchain and artificial intelligence are good instances of cutting-edge technologies potential strategies for regulating coronavirus epidemics. The 'World Health Organization estimates that the number of illnesses and deaths associated with this outbreak will continue to rise, posing an increasing threat to people's lives and, as a result, to nations' economies. The absence of a clear mechanism for detecting unidentified infected cases and COVID-19 risk projections viral infection is the most important concern that the majority of governments are now experiencing. The viability of employing decentralized blockchain memory, peer-to-peer, and representation of the data to check and detect fraudulent activity unknown COVID-19 virus-infected patients is investigated in this study. While tracking epidemics, blockchain can help fight pandemics by detecting outbreaks early, maintaining a dependable medical supply chain while respecting user privacy. AI provides insightful ways for characterizing the symptoms of coronavirus infection and facilitating the development of vaccines and medicines. Inspired by these, the research examines the application of blockchain and artificial intelligence to address the rapidly developing literature on coronavirus pandemic support (COVID-19). The proposed system is supposed to have a functional infrastructure that can support states, health agencies, and residents

## Index Terms - COVID-19, SARS-CoV2, Blockchain, Artificial Intelligence, WHO

### I. INTRODUCTION

The Coronavirus outbreak (COVID-19) that began at the end of 2019 poses a major hazard to people all over the world. The confirmed cause of Severe Acute Respiratory Syndrome cases in the Wuhan new coronavirus ailment 2019 patients is SARS-Cov-2, which outnumbers SARS-CoV-1. (1), (2), (6). As of August 20, 2021, there are currently +209,876,613 certified cases and +4,400,284 demises globally as the success of the epidemic of COVID-19 as mentioned in Figure 1.



Figure 1:-COVID-19 global report

According to the World Health Organization, Coronaviruses are a wide family of viruses with varying degrees of severity. The WHO has established institutions such as the Society in a globalized society, the World Health Organization guarantees that diverse governments work together on global health issues.

The virus's propagation is wreaking havoc on the global economy, causing massive disruptions in supply chain management, industry, insurance, agriculture, transportation, and tourism are all being pressured by governments and business owners around the world to shut down operations. The world economy is predicted to develop slowly since 2009 due to the coronavirus outbreak, Organisation for Economic Cooperation and Development [5]. As the number of instances grows, numerous countries around the world are taking action are enforcing strict lockdowns and curfews, maintaining social isolation, and allowing people to work from home to prevent the virus from spreading.

As the deadly coronavirus spreads over the world, every effort is being made to assist sufferers and prevent the virus from spreading further. As governments tackle the problem, technology-enabled solutions will help address the global health crisis. In response to the coronavirus crisis, there will be answers to the applications of advanced technologies such as blockchain.

While blockchain can help fight pandemics by detecting outbreaks early, speeding up drug delivery, and safeguarding user's

privacy while they are being treated. It can also be utilized to provide intelligent solutions for recognizing and treating symptoms produced by the coronavirus.

## **II. BLOCKCHAIN TECHNOLOGY**

Satoshi Nakamoto, the anonymous creator of Bitcoin, about a decade ago, illustrated how to tackle this problem, blockchain technology, and a dispensed point-to-point connected framework can be used. Transaction problems and avoid double jeopardy (4), (9). Bitcoin transactions are sorted and organized into blocks of a certain size that all have the same timestamp. The network miners' nodes are in charge of linking the blocks over time, creating a blockchain with each block including the previous block's hash [13, 25]. As a result, a safe and auditable database of all transactions is included in the blockchain framework.

Connecting to the blockchain network, stocking an up-to-date ledger, listening to transactions, valid transactions are forwarded to the network, noticing newly closed blocks, validating newly closed blocks - confirms transactions, and creating and transferring a blockchain node's primary task is to create new blocks [24].

Blockchain applications and transactions can be operating decentralized with the same level of determination [12-21]. Transparency, robustness, auditability, and security are all of the key features of blockchain architecture and design Blockchain is a ledger that is distributed that is arranged into a list of blocks in order, with committed blocks remaining unmodified.

Beyond cryptocurrencies, blockchain is employed in a variety of applications, with smart contracts playing a key part. As a result, interest in blockchain technology is growing. Researchers and developers are already familiar with the new technology's potential and are researching various applications in many fields. Three generations of blockchain can be recognized based on the target user [4]:

- Blockchain 1.0 is a set of programs that allow users to conduct digital bitcoin transfers.
- Blockchain 2.0 Smart Contracts are a type of contract that can be used in a variety of ways are set to go outside the boundaries of cryptocurrency transfers
- Blockchain 3.0 Government, health, science, and the Internet of Things are just a handful of the technologies that are outside the two preceding editions.

The assessments concentrate on the blockchains' security challenges, as well as its promise to promote stability and decentralization across service systems and peer-to-peer networks. The consensus protocol, the hazards of SCs, the size and bandwidth of the blockchain, and other technical factors such as Reliability, traceability, and flexibility are all technical components of blockchain design.

Without the requirement for a trusted authority, a dispersed peer-to-peer connection blockchain allows non-trusted individuals to connect frequently. As shown in Figure 2, blockchain is a collection of interconnected systems that bring unique features to infrastructure [4]. At the most basic level, they have peer-to-peer signed transactions. These are agreements between two parties that can entail the physical or digital handover of assets, as well as the completion of a task. The agreement is signed by at least one partner and circulated to neighbors. The term "node" refers to any entity that connects to the blockchain. Full nodes, on the other hand, check all of the blockchain rules. These nodes are in charge of classifying transactions into blocks and assessing whether or not they are valid and should be maintained on the blockchain.



Figure 2:- An overview of blockchain architecture

As a result, nodes must reach a consensus that must be recorded in the transaction blockchain to prevent corrupted branches and distortions. The goal of the second consensus layer is to do this. Due to the many types of blockchains, various consensus mechanisms exist. Proof of Work (PoW) is the most well-known. To ensure authentication and verification, PoW must solve a complex computing process such as identifying hashes with certain patterns. Proof of Stake (PoS) methods distribute stock blocks proportionately among mineworkers with current wealth, rather than among mineworkers with comparable hash rates, or mining power. In this way, selection prevents the best and preventing the network's wealthiest partner from dominating it Because of the huge reduction in energy usage and greater scalability, several blockchains, including Ethereum, are making the switch to PoS.

The next layer, compute interface, offers more functionality for blockchain. The blockchain architecture will eventually be expanded by the Governance layer to permit global social interactions. As a result, blockchain governance is concerned with how these various players collaborate to produce, keep, and modify the inputs that make up a blockchain.

In the existing research, blockchain systems are categorized in a variety of ways [10]. These groups are created based on network management and permissions as

- Permissionless public blockchain. As a new user or as a node miner, anybody could join. Transactions and contracts can be carried out by all stakeholders.
- Private Blockchain networks with permissions can avoid the need for expensive PoW algorithms. Instead, it can employ a wider range of disengagement-based consensus techniques.
- Federal blockchain is a project that brings public and private blockchains together.

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Table 1 [4] highlights the important aspects of each blockchain network in terms of efficiency, privacy, and consensus procedures.

| Property                             | Public                        | Private                            | Federated                           |
|--------------------------------------|-------------------------------|------------------------------------|-------------------------------------|
| Consensus<br>Mechanism               | Costly PoW All miners         | Light PoW Centralised organisation | • Light PoW<br>• Leader node set    |
| Identity<br>Anonymity                | (Pseudo) Anonymous Malicious? | Identified users Trusted           | Identified users Trusted            |
| Protocol Efficiency &<br>Consumption | Low efficiency High energy    | High efficiency Low energy         | High efficiency Low energy          |
| Immutability                         | Almost impossible             | Collusion attacks                  | Collusion attacks                   |
| Ownership &<br>Management            | Public Permissionless         | Centralised Permissioned whitelist | Semi-Centralised Permissioned nodes |
| Transaction Approval                 | Order of minutes              | Order of milliseconds              | • Order of milliseconds             |

Table 1: Blockchain network classification and main characteristics.

#### **III. HEALTHCARE**

Due to its ability to connect disparate systems and improve the quality of electronic healthcare records, blockchain technology has significant potential in the need for a more patient-centered approach to healthcare systems (EHR).

Due to its multiple applications, blockchain technology is becoming increasingly essential in the healthcare industry. Public health care administration, health care records, automated health claim judgments, Patient portals access, individual clinical data exchange, user-centered medical research, pharmaceutical forgery, new treatment, and targeted therapies are only a few examples of application areas [8]. Lost data findings, endpoint flipping, data scavenging, selective clinical trial publication, and patient informed consent can all benefit from the implementation of blockchain technology and SCs in particular. A patient's short medical history, medical record, data, forecasts, and any other type of information about a patient's symptoms and clinical progress throughout therapy are all included in an EHR.

A blockchain-based EHR system can be thought of as a protocol that uses clients to acquire and preserve their medical protection of private information confidentiality and privacy. Using a blockchain-based EHR system has a lot of benefits: Documents are preserved in a scattered format that can be easily verified by non-affiliated provider companies, and the central or owner of data that has been corrupted or breached is identified. Data is updated and provided regularly, and data from a variety of sources are merged into a single uniform data collection.

To manage medical data, pre-authorize payments, resolve insurance claims, and undertake more complicated transactions and records, a more efficient and secure system is required in the healthcare industry [10]. Electronic medical records are currently housed in data centers, with only hospital and care provider networks having access to them. Information centralized in this manner is prone to security breaches and can be costly to maintain. To address this, the Blockchain records each patient's complete medical history, offering a safe way for recording and maintaining a comprehensive medical history including control of the patient, doctors, regulators, hospitals, and insurers. This ensures preventive measures for storing medical history; Patient's complete medical history for resolution of reducing insurance claims and using physicians for accurate drug recommendations.

Changing health-care services to allow for a more patient-centered approach. By providing patients ownership over their medical records, blockchain-based healthcare systems can improve the security and integrity of patient data. These systems can also integrate patient data by allowing medical records to be transferred between different healthcare organizations. In health care, it's critical to keep track of patients' medical information. This information is extremely sensitive, making it a prime target for attackers. It's critical to keep all sensitive information safe. Another component is data control, which will help the patient be properly managed. As a result, sharing and accessing patients' healthcare data is another use case that could benefit from current technologies. Blockchain technology is extremely resistant to attacks and failures, but it also provides a variety of access control options. As a result, the blockchain is an excellent platform for healthcare data.

#### IV. COVID-19

Around the end of December 2019, so many cases of pneumonia with an uncertain origin were reported in Wuhan, China [6] [7]. The disease-causing agent was first identified as 2019-nCoV, SARS-CoV-2 was the name given to a novel coronavirus. Coronavirus ailment 2019 is a respiratory infection that has swiftly transmitted from human to human, producing massive epidemics around the world and generating significant morbidity and mortality. The WHO declared the COVID-19 spread as the world's sixth public health emergency of concern on January 30, 2020 [23, 26, 27]. The World Health Organization states COVID-19 a contagion on March 11, 2020[7]. Governments focused on health systems and the global financial system as they balanced defense, clinical care, and economic concerns. In the past few decades, the coronavirus has been responsible for large-scale contagious such as Middle East Respiratory Syndrome (MERS) and SARS.

'COVID-19' is a severe public health issue that has produced a large global outbreak. The WHO reported that more than 209,876,613 confirmed cases have been recorded in 217 nations, regions, or territories as of August 20, 2021, as illustrated in figure 3 [28]. It is transmitted from human to human by droplet or direct contact, although investigating the possibility of fecesoral transmission and the average incubation period for infection is estimated to be 6.4 days. It spreads far more when aerosolized. Fever is the most frequent cause of COVID-19, followed by a cough. Officials in charge of public health must keep a close eye on the situation because the more knowledge they have about this rare virus and the crisis it has spawned, the prominent prepared they will be to deal with.



### Figure 3:- COVID-19 Global Situation

According to a genetic study, bats are a natural reservoir for coronaviruses [22]. A small percentage of patients' condition worsens 5-10 days after beginning, Acute Respiratory Distress Syndrome (ARDS) and other organ problems are common incidence consequences. Patients over 60, as well as those with concomitant conditions including cardiovascular ailment, pulmonary ailment, or cancer, are at a higher risk of serious complications and demise. Children, on the other hand, have a moderate clinical course.

COVID-19 assays are being developed to allow for quick testing at the point of care.COVID-19 is now being managed with a focus on symptom support, care, and therapy, including infection control and on-demand ventilator support. Patients with suspected symptomatic or mild illness should see a doctor. Self-isolation for COVID-19 is suggested for two weeks after exposure. Patients with more severe illnesses are hospitalized for treatment [11]. Preliminary reports have prompted the clinical use of hydroxychloroquine in some hospitalized patients. As a result, health workers, governments, and the general public must act together to prevent the disease from spreading globally.

### V. RESEARCH METHODOLOGY

This research will use the qualitative analysis of data to gauge the applicability of Blockchain technology and AI in the healthcare industry.

#### 5.1 Blockchain Platform for Covid-19

Recently, several technologies have been increasingly introduced to predict 'COVID-19' growth and spread worldwide. By allowing info to be acquired and disseminated while maintaining data protection, blockchain technology can help improve data security management in the healthcare industry.

Here's a look at how COVID-19-infected instances may be detected automatically, how blockchain technology can help, and how individuals and authorities can check infection prediction in real-time. Blockchain is a "decentralization" technology by definition, which means that data is shared across participants, stores, and websites rather than being stored on a single server. As a result, anyone with the appropriate permissions can access health data stored on the blockchain transparently and securely. Data saved in a blockchain is never lost, making it easy to track. Many data-driven industries, including health care, have been recommended to be deactivated using this new technology.

In the aftermath of the COVID-19 crisis, it's critical to consider how to employ blockchain as an emerging technology that assures health data confidentiality and privacy while simultaneously offering the right instruments for treatment plans, scanning, testing, treatment, and infection prevention. Manage patient and public information; adequate personal security measures have been applied as needed.

The construction of the COVID-19 blockchain platform would improve registry sharing interoperability among healthcare partners, safeguard patient privacy and security, and offer crucial information to them fairly and effectively. Most importantly, it has the potential to improve global health worker cooperation.

Accessing a patient's record may result in delayed exercise and patient care. Insufficient document management and, in one of the worst scenarios, misinterpretation can arise as a result of this. By building a network in which trustworthy information is easily accessible, digitizing records using a blockchain helps mitigate these problems.

With remarkable performance in the privacy of health information, safe data management, and open medical data storage, blockchain has proven beneficial in healthcare and biological applications. As a result, it is conceivable to use it to solve healthcare challenges relating to the coronavirus outbreak.

This investigation reveals a COVID-19 blockchain platform that can utilize a revolutionary technique to combat COVID-19 ailment outbreaks by instinctively detecting unfamiliar viruses and predicting the epidemic's primary risk. In real-world communities, point-to-point blockchain, time-stamping, and distributed recording can aid in infection detection, COVID-19 viral treatment protocol, and risk prediction.

### 5.2 Consensus Mechanism

Blockchain is a sophisticated, open ledger that keeps track of internet transactions. It contains an innovative record conveyance and consensus process that eliminates all go-between risks. Cryptographic money is one of the most well-known blockchain applications. Bitcoin has shown to be an effective alternative monetary component in emerging markets. Blockchain innovation has demonstrated flexibility as of late prompting its consolidation in a wide scope of uses including biomedical and social insurance frameworks.

Bitcoin's key consensus approach for transaction management is the PoW algorithm [9]. For the first time, Nodes with substantial computational power can participate in the mining process and compete to check the block. In exchange for their efforts, the winner will receive a set sum of coins. Mining is a hashing competition centered on the calculation of a block, which comprises unconfirmed transactions, random nodes, and a reference to the prior block's code. It is required that the hash result match the predetermined value. A minor is broadcast to the newly formed block network once it reaches the required value. Other peers check it and, if it's correct, send it throughout the network.

The PoS consensus process is based on a peer's assets or a share of a peer-controlled network value. The chance of choosing a peer to confirm a new block is proportional to its value. In practice, this is accomplished by investing a preset percentage of the company's assets. It purchases a node ticket. The winner is chosen in a pseudo-random method from a group of ticketed peers. In this situation, competition is not based on peer computational power, resulting in lower energy use than in PoW. However, such a strategy is comparable to that of a shareholder corporation, in which the wealthy have a competitive edge. It

works because a peer network is unlikely to attack. After all, it would be attacking its qualities in this situation.

#### 5.3 Blockchain and Artificial Intelligence

The devastating coronavirus ailment is growing fast an increasing loss of life and transmission rate revealed in high salary nations as opposed to in low pay nations [3]. The overburdened human services frameworks and poor malady observation frameworks in asset constrained settings may battle to adapt to this COVID-19 flare-up and this requires a custom-made key reaction for these settings. In this research, researchers suggest a simple COVID-19 and other upcoming infectious disease self-testing and trail services based on blockchain and artificial intelligence. The suggested approach, if well organized and implemented, may be able to control COVID-19 transmissions and fatalities that are associated, especially in areas where access to research facilities is limited.

As per new research, creating and deploying point-of-care (POC) tests for detection in the case of a COVID-19 incident can help prevent the disease's transmission and lower healthcare costs. To allow sufferers in isolation who have been exposed to COVID-19 to self-test, POC diagnostics are regularly included with Blockchain and artificial intelligence (AI) technology are examples of early health innovations. Mobile-connected node diagnostics and self-testing have been victoriously deployed in a resource-constrained setting. However, there is only a sprinkling of evidence that blockchain and artificial intelligence may be utilized to treat certain ailments. Given COVID-19's age, signs of exhaustion With We advocate for the fast development and implementation of low-cost blockchain and AI-coupled mHealth connected self-testing and identify innovative in resourceconstrained contexts, under strategic priorities.

The blockchain and AI system will aid incident response teams by notifying them of all or any completed tests, and also the number of significant medical reports, and guaranteeing that each positive case is brought to a quarantine facility for treatment and monitoring. Individuals who have been thoroughly screened will be monitored utilizing the mobile device's built-in Geographic Information System. To ensure proper outbreak surveillance and control, this methodology will be linked to a local and international database.

This technology's AI component will allow the collection of patient data, the patient's geographic location, clinical data sets from federated blockchain platforms: test results, security, analysis, and filtering, as well as a degree of confidence and agility. We ensure secure and immutable data sets with the help of this well-designed integrated technology platform, enabling the collection of high facts and the extraction of incisive insights.

From many views, blockchain and artificial intelligence are prepared to provide viable answers to the coronavirus outbreak. Blockchain is widely utilized to aid in the fight against coronavirus pandemics, having demonstrated its worth in a variety of real-world applications. A conceivable use is epidemic tracking, in which blockchain is frequently used around the world to use a blockchain network installed on inhabitants' mobile devices to monitor the growth of the Coronavirus. The ability of blockchain to preserve user privacy, which enables coronavirus tracking and early epidemic diagnosis while preventing data exposure, is described below as one of the most essential elements of blockchain. Furthermore, blockchain can help with outbreak and treatment management by speeding up medicine studies and transparently and universally collecting and recording all fundraising campaigns and payments.

On the other hand, AI can help in a variety of ways in the fight against the coronavirus crisis. By assessing the combined information of environmental conditions, access to healthcare, and hence how it is distributed, AI is commonly used to determine viruses and anticipate how they will grow. As a result, AI can detect coronavirus inside isolated epidemics of the disease and assist in determining the virus's characteristics. Pneumonia, severe acute respiratory syndrome, and failure of the kidneys are all possible signs of the coronavirus. Furthermore, using AI to determine the link between emerging coronaviruses and similar viruses like SARS could assist speed up the development of a replacement vaccine. AI technology will eventually be able to establish an automatic pattern or link between therapies described in medical data and patient outcomes. These models can help establish clinical recommendations for future coronavirus epidemics by quickly identifying treatment alternatives.

Blockchain and artificial intelligence are thought to have a significant impact on pandemic management and, as a result, therapy dissemination. There are currently no comprehensive assessments or studies in the literature on the implementation of blockchain and AI in the struggle over coronavirus. As a result, based on the most recent research findings and rapidly-growing academia, this article will present an in-depth examination of the applications and use cases of blockchain and AI technologies in the context of the coronavirus rife. To this goal, our poll offers the following contributions: Identify a variety of specialized applications for solving coronavirus-related concerns detected employing these technologies. A thorough investigation and discussion of several real-world scenarios will be used to illustrate the potentials of blockchain and AI in particular.

#### VI. CONCLUSION

COVID-19 has spread throughout the world, causing alarm among the general population and healthcare staff. However, little is known about this unusual virus. Antiviral therapy and immunization are now being evaluated and developed as a viable options. What can be done now is to actively deploy infection control measures to prevent SARSCoV-2 from spreading from person to person. The more this unique virus and its related epidemics are studied, the more prepared public health officials will be to respond.

The major goal of this research was to see how likely it was to develop a unique method for validating and detecting unknown coronavirus infections (COVID-19). This method develops a blockchain architecture that might be used to help governments and health authorities hunt down unknown sick people and coronavirus (COVID-19) sites, and even some measure and predicts the development of risks. This framework is expected to serve as a foundation for governments, health agencies, and individual citizens in making vital decisions.

This inquiry looks at the usage of blockchain and artificial intelligence (AI) to tackle coronavirus affliction. The study initially presented a hypothetical architecture for using blockchain and artificial intelligence to combat the coronavirus issue. The crucial function of blockchain in pandemic mitigation has been thoroughly studied, Outbreak tracking, user privacy protection, safe day-to-day operations, medical supply chain, and donor tracking are just some of the features

available. AI has been employed to address the COVID-19 issue in addition to contagious estimating, coronavirus detection, coronavirus analytics, treatment development, and prediction of future coronavirus-like illnesses.

According to this framework, time stamping, modular design, peer-to-peer networking, real-time computing, and modular design are all there are numerous pros to blockchain technology. The mass of the research uses blockchain technology in healthcare to propose an entirely new framework, design, or model.

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