

Revealing the Demonstration of Blockchain and Implementing Scope in COVID-19 Outbreak

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Abstract

Blockchain is gaining attention since its development due to its features like immutability, transparency, decentralization. It can also be used as decentralized storage. Blockchain offers a wide range of digital services both in financial and non-financial sectors. In this paper, we discuss the basic concepts and terminologies associated with blockchain and discuss the application areas both in financial and non-financial sectors such as Digital voting, Digital identity, Education, etc. and discuss the existing framework in these areas, also the progress and challenges of global acquisition. The main highlight of this paper is COVID-19 and we discussed existing solutions to fight the COVID-19 pandemic by using such technology. This survey paper will be helpful for a data scientist as well as researchers to explore in the area COVID-19.

Keywords: Blockchain, COVID-19, Coronavirus, Decentralized, Bitcoin, P2P Networks.

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1. Introduction

With the advancement of lifestyle, the technology is increasing parallelly day by day and blockchain is one of the most recent technologies, which grabs fascination from the past 2-3 years due to its decentralized architecture. Blockchain was developed by a group of people or an anonymous person under the name Satoshi Nakamoto in 2009 [1-2]. Firstly, this was only used for cryptocurrency like Bitcoin but then due to its advanced features like immutability, distributed, and transparency makes it more functional to use. This technology solves the double-spending problem that occurs in the current transaction system [3]. It is defined as a chain of blocks; each block holds a set of transaction records like a conventional public ledger. This grows ceaselessly when new blocks are attached to it [4]. When a new transaction occurs the groups of people called miners verifies the transaction by solving hash function and appends the block to the chain.

The Blockchain is maintained by all the nodes in a Peer-to-Peer (P2P) system and called as distributed append-only ledger. It does not require a mediator or third force and nodes decided the appending blocks [5]. Blockchain is categorized into two categories named public blockchain and private blockchain. The Public chain is that blockchain in which anyone can join or leave; Bitcoin and Ethereum are some examples of Public Blockchain. Private Blockchain is the one in which a specific person or group can add it and relates it to an organization or company. Hyperledger Fabric is an example of a private Blockchain [5]. Blockchain-related applications are arising and covering numerous areas including Digital voting, Education, Solid Waste Management, Agriculture, Internet of Things (IoT), and so on. In this paper, we cover up the whole working concepts of blockchain, terminologies, applications, Resultant, and constraints as well.

This paper gives the focal mastery of blockchain technology and its existing framework in various application areas. It gives the idea of ongoing pandemic COVID-19 and how we can relate blockchain technology to COVID-19 to

2.3. Working Principles behind Blockchain and Tools used

Blockchain is a decentralized and distributed ledger for the peer-to-peer network. The working mechanism is followed as: Suppose a new transaction is issued, it will broadcast to all P2P networks then a network of nodes or miners verifies the transaction by solving computationally high hash function or follows some other consensus algorithm based on the approach used. Once the transaction is corroborated, the transaction becomes a chunk of a new block for the ledger then this current block is added to the existing blockchain and then the transaction succeeds. There are many platforms used for Blockchain development like Ethereum, Hyperledger Fabric, R3 Corda, Ripple, and so on. [9] The most used platform is Ethereum; it is a blockchain platform which is open source and highly vital that forms the station for the other applications to be developed. The programming language supported by Ethereum is Solidity. It uses the Proof of Work (PoW) consensus algorithm and approachable to all. Hyperledger Fabric is open-source permission or private blockchain platform used for running smart contracts.

3. Applications

The technological outcome of blockchain within various domains seems illimitable, and it's a thrilling prospect for technical fields.

Blockchain implementation moves far beyond cryptocurrency and Bitcoin with its potential to generate extra transparency and impartiality while also economizing businesses time and capital, the technology influence a variety of sectors in ways that range from how contracts are enforced to making government perform their tasks more effectively.

Its applications are not limited to the described applications only as it contains an exhaustive list of applications in which some are to be found or some find but not noticed yet.

For perceiving the contribution of Blockchain in various fields we can classify the applications of blockchain into two main broad sectors i.e. Financial and non-financial sectors.

The application of blockchain in the financial sector is further divided into two main categories which can be shown as per figure1.

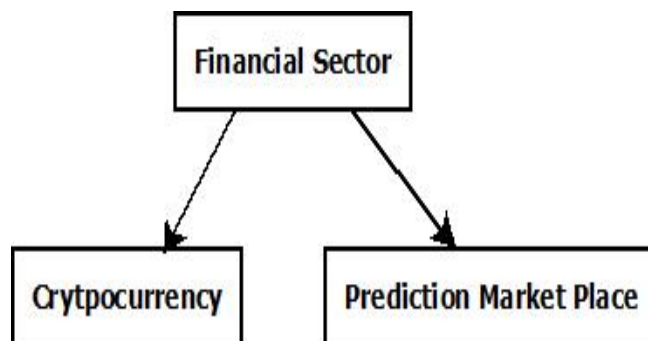


Figure 1. Categorization of the Financial Sector

A cryptocurrency is a digital exchange such as US Dollar, which is encrypted through various techniques to verify the funds' transfer and to control the financial units. Blockchain is the one that enables the extant of cryptocurrency.

Blockchain technology includes many profits such as a reduced number of intermediaries and censorship-resistance. On the other hand, when blockchain technology was proposed then initially it was implemented only in the financial sector but due to its advanced features like decentralization and transparency, it grabs attention in the non-financial sector as well.

Application of Blockchain technology in the non-financial sector contains a wide and incessant range of areas, which includes Healthcare, Education, IoT, Business and Industry, Governance, Data Management, Privacy and Security. These areas are further divided into various categories which can be shown as per figure2.

signed by the originator, that provides private access to institution, company, or individual, and resource URL is attached to each record so that e-copy of the record can be seen. Qin Liu [11] proposes the Education- Industry cooperative system that uses Hyperledger Fabric to deploy blockchain it tracks all the negative and positive records of the students on campus behavior to build healthy credit ecology. So, that company or industry can decide suitable employees for its organization according to credits. Students with high credit may get good incentives. It also stores all academic records, skills, and demand for Industry recruitment so that student and industry choose their demands or choice precisely and effectively. It provides a way for universities and industries to share information transparently. KRISTJAN KO.I. [12], proposed a higher education credit platform based on blockchain globally called EduCTX which is rooted in proof of concept and the open-source Ark blockchain platform. Academic records are managed and controlled by ECTX tokens and stored over the P2P network where the users are students and organizations. Presently, the ECTS (European Credit Transfer and Accumulation System) grading system is used but could be extended to other grading systems. There are various challenges associated with blockchain in education such as complex systems, immutability, and technical issues. [13]

3.2. Smart Cities

A city is a smart city if it provides an easy and luxurious lifestyle and solves all urban problems like water sanitation, pollution, etc. Many technologies are working to upgrade or implementing smart city concepts and blockchain is one of them. Blockchain can be applied to smart cities due to its features like transparency, decentralization, etc. Various frameworks are used in smart cities through blockchain, they are as follows:-

Simona Ibba [14] proposes CitySense, a system to manage the environmental conditions based on blockchain that monitors environment quality in an urban area to manage and promote awareness of city health and SCRUM methodology used. The sensors will sense the surroundings and compute the phenomena of interest and obtain pertinent data and process the information encountered.

Kamanashis Biswas [15] proposes a framework for security based on blockchain for smart cities so that secure communication of data can take place and provides scalability, reliability among all devices that can communicate on the same platform in a distributed environment; this framework can be extended to investigate interoperability and scalability of different platforms.

Regio A. Michelin [16] proposed a blockchain-based framework to provide a secure and private communication model for vehicles called Speedy Chain. The main issue with this scalability, access level for different entities and to store the transaction externally.

There are problems [17] associated with the use cases of blockchain in smart cities such as Security, Storage, throughput, etc.

3.3. Solid Waste Management

Solid waste is a global issue; the amount of solid waste is increasing day by day that has both social and economic impacts. Solid waste management is a way how to manage or procedure to recycle or reuse the solid waste in a systematic manner. Solid waste management can be implemented through blockchain. Various tools or platforms that are already working on the blockchain that helps in solid waste management are Plastic bank, Swacch Coin, Recereum. Various frameworks are issued in Solid waste Management through blockchain, they are as follows:-

Parth Jatinkumar Shah [18] introduces a stochastic optimization model to improve waste collection operations as the waste collection is uncertain due to different collection and mix of solid waste. This model is split into two models, the first model defines the quantity of waste that is to be collected or transferred to units and the second model defines the quantity or amount of waste that is to be collected from these units and then send to recover units. The model can be further extended by considering other decision parameters like the number of vehicles used, route of the vehicle, etc.

A.S.L. França [19] proposed the model for improving solid waste management techniques in small municipalities using blockchain. It followed the system that is working in Brazil to handle solid waste and implementing it with blockchain to make transparency. The system works as low household income people collect waste from various and sell it to the municipality company in return for green coins and make the use of those green coins to earn their livelihood. The municipality in return sells the collected waste to the company for recycling. David Zhang [20] proposed the model for incentivizing the use of rural waste through blockchain and use smart bins. This framework follows the approach as waste is collected from rural people and transported to energy plant and digital coupons are given as reward that in turn can be used for purchasing or exchanging fertilizers or other resources.

3.4. Digital Voting

As fraud and corruption in voting increases, it leads to digital voting. Bringing blockchain technology to digital voting comes with benefits like transparency. Various frameworks are issued in Digital Voting through blockchain, they are as follows:-

Ahmed Ben Ayed [21] proposes a voting system which is conceptually secured in which user will log in to the voting system using his/her unique Id provided by the government and cast a vote of his/her choice after that encrypted information will be stored in a block that contains the user name and identification number. The problem with the

associated with blockchain in health care such as scalability, speed, interoperability, privacy as no proper standards are followed that lead to open research all [35]. Hua Wang [42] proposes a framework for sleep stage classification using the edge strength of the visibility graph technique from EEG signals.

Wang H. [43] discusses how to apply the privacy and security of Big Data in Healthcare or EHD and discusses the various techniques and open challenges considering. E-health cloud privacy-preserving approaches are categorized into cryptographic and non- cryptographic approaches.

Muhammad Ashad Kabir [44] uses Facebook as a medium for identifying major depression among users by considering all factors that contribute to depression such as temporal process, emotional process, linguistic style, and all by using various Machine Learning algorithms.

P. Vimalachandran [45] proposes a model to resolve the issue of unauthorized access for the PCEHR (Personally Controlled Electronic Health Record) system called “Log-in-pair” in which the only superuser give access to all the other users. This model uses both RBAC and PBAC access model principles.

Shekha Chenthara [46] discusses the existing cryptographic and non-cryptographic e-health cloud preserving mechanisms to secure privacy and also discusses the various issues and opportunities for advanced research related to secure EHR.

3.9. Real Estate

Real estate can be a land or property or building. The problem with the current real estate system is transparency, not accessible to all, high fees, lack of liquidity, pricing commitments, etc. These issues can be handled by blockchain by providing transparency, not any intermediate, less costly, and accessible to all. Blockchain came up with the concept of smart contracts and tokens.

Ioannis Karamitsos [36] gives an overview of Blockchain as a disruptive technology in the real estate industry using smart contracts. The main issue with blockchain in real estate is the ability to collect reliable data.

4. COVID-19

COVID-19 is an infected disease caused by a newly discovered virus called coronavirus. In humans, respiratory infections are caused by many coronaviruses that range from the common cold to Severe Acute Respiratory Syndrome (SARS). COVID-19 affects the lower respiratory tract and upper respiratory tract and caused by a coronavirus called SARS-CoV-2. The first case of COVID-19 patient was found in late November 2019 in Wuhan, China and till December 31 China has 41 confirmed cases. China reported to WHO on 31 December 2019 in the WHO country office in China and on 30 January it is declared as Public Health

Emergency of International Concern [37]. COVID-19 is declared as a pandemic by WHO on 11-03-2020.

The first case outside China was found in Thailand in January 2020. In India, the first case of COVID-19 was found on 30 January 2020 in Kerala. Till May 1, 2020, India has 35,043 cases out of which 1,154 death cases and 9,068 recovered cases at the same time over the world there are 33,08,772 cases out of which 2,34,133 death cases and 10,042,993 recovered cases. The symptoms of this disease are runny nose, dry cough, sneezing, fever, and tiredness as per the guidelines given by WHO. Symptoms to show on an average take 5-6 days and can take up to 14 days.

The main prevention is social distancing, washing off hands regularly, or uses masks or hand sanitizer. The person who has a history of any disease like diabetes, cancer, lung disease, heart disease, high blood pressure, or old people or children(because of the weak immune system) they are more prone to COVID-19 disease. It spreads by touching the infected person, or the droplets generated by infected person release in airdropped on the floor or surface, by touching or inhaling it. There is no evidence yet is given that animals can be infected from this deadly virus or not. According to guidelines given by WHO, ICMR the symptoms and preventions of COVID-19 can be summarized in below mentioned tabular form:-

Table 1. COVID-19 Symptoms and Preventions

Symptoms	Prevention
<u>Usual Symptoms:</u> <ul style="list-style-type: none"> • Dry Cough • Fever or cold • Tiredness 	<ul style="list-style-type: none"> • Use alcohol-based rub sanitizer or soap and water wash off your hands regularly. • Maintain social distancing, at least 1-meter distance be maintained from a person who is coughing and sneezing. • Stay quarantine if you feel unwell. • Quit smoking and intake of other tobacco as it weakens the lung and immune system. • Cover your mouth with hanky or elbow while coughing and sneezing. • Do not touch your mouth, nose, and eyes.
<u>Rare Symptoms:</u> <ul style="list-style-type: none"> • Body pain and aches • Nasal Congestion • Sore Throat • Diarrhoea • Conjunctivitis • Headache • Loss of taste or smell • A rash on the skin, or discoloration of fingers or toes • Bluish lips or face 	
<u>Serious Symptoms:</u> <ul style="list-style-type: none"> • Shortness of breath • Chest Pain • Loss of Movement 	

The other way to stay safe is to be updated and be alerted about the fake news and stay away from hotspot areas, and

if any of the symptoms arise immediately contact to the nearby health care center. There are various initiatives taken by the Indian government they can be pointed as follows [38]:-

- Hon'ble PM Modi announced Janta curfew on 22 March 2020 after its successful completion he announced the first phase of lockdown from 25 March 2020 to 14 April 2020 and the second phase from 15 April 2020 to 3 May 2020 and third phase of lockdown starts from 04 May 2020 to 17 May 2020.
- Free food and fuel are provided to 800 million poor people.
- COVID-19 health workers will get an insurance cover of 50 lakh.
- India invites and opens the sovereign bond market to overseas investors.
- Advance PF withdrawal schemes are provided under the COVID-19 outbreak in which employers can withdraw 75% of both employee and employer share or 3-month salary depends upon which is less.
- Various reduction schemes have been given by RBI about various loans to deal with the economic crisis.
- The government proposed an app named Aarogya Setu which informs about coronavirus symptoms, prevention, and nearby cases by using location and help to fight against COVID-19.

Presently, 200 laboratories are approved by ICMR (Indian Council of Medical Research) [39] for COVID-19 testing in India. The COVID-19 testing strategy in India can be described as follow:-

- The individuals who have come from outside India.
- The laboratories workers that come in direct contact with infected cases. All health care workers.
- Patients who are suffering from fever, cold, or shortness of breath.
- The people who contacted the infected person between 5 to 14 days of infection.

Till 28 April 2020 7, 16,733 samples have been tested in India. There are two types of COVID-19 testing performed in India RT-PCR and Antibody test. RT-PC (reverse transcription-polymerase chain reaction) works on DNA and it is very expensive and takes much time to find results whereas the Antibody test takes the samples from Blood, Finger prick, Serum, and comparatively cheap and gives results within 15 minutes. RT-PCR is performed in early symptoms cases i.e. less than 7 days whereas the Antibody test is to perform on 7-14 days cases under strict medical supervision. Antibody tests are not allowed in private labs. Various researches are taking place to deal with this pandemic. In this phase, blockchain technology can also be

helpful and comes to rescue. Mohamed Torky [40] proposed an innovative approach to deal with COVID-19 through blockchain. This system helps to detect the unknown infected person using a pattern recognition system. The framework consists of four main components which are Infection Verifier Subsystem, a Blockchain platform, P2P-Mobile Application, and Mass-Surveillance System. The first component i.e. Infection Verifier Subsystem represents or creates or verifies infected patterns and infection instances. The second component, blockchain, is used as a distributed or decentralized database to store all related information about COVID-19 infected cases.

The third component P2P- Mobile Application is used by all citizens or authorities for getting information about the prediction of infected cases and statistics. The last component i.e. Mass – Surveillance System is a system to monitor to whom an infected person has contacted and which place he has gone or going with the help of tracking motions.

Mipasa is a distributed ledger technology that is built to convey data about COVID-19 pandemic in collaboration with WHO and other technical firms.

Civitas, a blockchain-based tracking app was developed on 06-04-2020 by a Canada-based company called Emerge to assist local authorities in many nations. Donghwi Park [41] discusses how the blockchain can be helped to deal with the COVID-19 pandemic. Firstly, blockchain can be used as reporting or data storing systems that store all medical reports of infected people so that they cannot be destroyed or hacked. Secondly, Blockchain can provide a transparent mechanism for the donation that is done to help the needy or raise funds for medical equipment needed. Thirdly, blockchain can save us from false information regarding COVID-19 symptoms or prevention. Lastly, blockchain can reduce the risk of face-to-face contact as all diagnosis reports are stored online.

In this paper, want to represent some ideas for enhancing and exploring the use of blockchain in this epidemic situation, which are as follows:-

- i. To deal with COVID-19 pandemic Hon'ble PM Modi announced an initiative called PM Care fund (Prime Minister's Citizen Assistance and Relief in Emergency Situations Fund) on 28 March 2020 so that people or organization can donate to help needy people and can fight against with this deadly virus but the painful reality is that many fraudsters create fake accounts on the name of the PM care fund to make frauds and plunder people. Almost 4000 fraud portals have been found till 1 May 2020. One fraudster has been caught by Delhi police who has accounts from Jharkhand and Bengal. Delhi people get to know about this account through social media. Due to lockdown and work from home, there is a lack of official standards by which cyber security measures are not efficient as needed and hackers try actively to hack

the PM Care Fund. We can prevent this by spreading awareness of online scams and threats. We can also solve this issue by using Blockchain technology due to its features like immutability, transparency, and decentralization; we can implement PM Care Funds using Blockchain as Blockchain is less prone to hacks or attacks due to its decentralized nature and usage of the highly computed cryptographic algorithm.

- ii. Due to COVID-19 pandemic the entire country is locked down or home arrest but due to urgency of works various professionals are allowed to travel or move to work such as Bank Employees, Food and medical suppliers, Health workers, etc. To validate these professionals an E-pass (Electronic pass) is issued or approved by the state government so that no other individual can travel at the same time in case of any emergency or urgency individuals can obtain their E-pass. E-pass contains the individual name, the purpose of travel, phone number, address, validity, etc. There are various attacks taking place or people are creating fake e-pass to travel. As one case took place in Beed in Maharashtra, one person was arrested for creating fake passes on mobile phones and selling it to others. Another case happened in Baghpur district, fake e-pass is created by employees of the Public Facilitation Center and youth working in a Medical agency in exchange for Rs500 through the computer by scanning Drug Inspector signature and seal. We can solve these types of issues by implementing Blockchain in E-pass generation as it creates transparency likewise the role of Blockchain in Digital Identity Management. The individual can obtain their E-pass by obeying the following procedure:-
 - Visit the official website of the State or Union Territory.
 - Select the 'apply e-pass' tab and fill the personal details correctly.
 - Upload the supporting documents.
 - After this, a confirmation message will be sent to your contact number and have to carry this e-pass in printed or e-copy to travel.
- iii. As per the news, India rejects the testing kits supplied by China because kits are faulty and not gives accurate results (as per doctor's advice) whereas China criticized India's decisions by saying that it is unfair and irresponsible to label China products as faulty. The testing kits have to be

validated by European regulator include those by one Singapore-based firm Sensing Self Ltd, CTK Biotech Inc and two US-based firms BioMedomics, and at least five China-based firms like Getein Biotech, Hangzhou Biotest Biotech Co Ltd and Beijing Tigsun Diagnostics Co Ltd. Blockchain can be used in validating testing kits by storing each record of the kit and by whom it was certified or if any error occurred or not. Each testing kit has its associated batch number that can be used to identify each kit. This transparency can only be given by blockchain.

COVID-19 pandemic is the greatest global challenge after World War II, the world is fighting against this deadly virus actively, and each contribution matters. Hence, above listed 3 ideas can be the building blocks in the use of Blockchain and these ideas can be the next step to fight against coronavirus.

5. Conclusion and Future Scope

We have uncovered the core concept of blockchain technology as well as some noteworthy attributes. After defining the basic principle behind the technology and tools used such as Ethereum and Hyperledger Fabric in public and private blockchain respectively. We presented the non-restrictive list of blockchain applications that ranges from financial to non-financial sectors. Non-Financial sectors include various areas such as Healthcare, Education, Real Estate, etc. This paper highlights the ongoing COVID-19 outbreak that affects globally. Furthermore, various works can be done in the future which is as follows : (i) Overcome from issues and challenges that are described above in various areas of applications in blockchain technology.

(ii) Points described to deal with COVID-19 using blockchain technology can be implemented or can be taken into consideration. (iii) Apart from COVID-19, we can implement this technology in various medical obstacles for validating their procedures, applications, and tools as well to increase their reliability. (iv) More areas apart from the medical field like electronic products manufacturing industry and automobile industry can also use this technology for gaining reliability by validating their manufactured parts. Moreover, we indexed some glitch, challenges, reluctance, and problems that would hinder blockchain development and summarized some existing approaches for unriddling these problems some possible future paths are also proposed. On the other hand, we visualize the blockchain technology going through gradual acceptance due to the peril associated but we can't deny the openness, borderless and permitless nature of blockchain technology which allocates nonpartisan access to masses for their network built with it at the same this technology does

not set any confine for the utilizer and it has potential to amend the definition of computing.

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