Using Blockchain Technology to Detect Unknown Cases of COVID-19

By Varun Pereira

***Abstract*:** Due to global COVID-19 crisis, a new and effective system needs to be quickly implemented and mitigate the risks and growth of the virus [13]. Consequently, a new framework based of blockchain technology, aims to detect unknown infected cases, potentially saving millions of lives as well as the drained healthcare systems and governments in economic decline.

Keywords: *COVID-19, blockchain, framework, infected cases*

INTRODUCTION

Around the world, almost a million people have lost their lives due to COVID-19. More than 21 million have recovered, and greater than 31 million cases have been diagnosed. [5] In many countries the virus sees no sign of slowing down, especially in third world countries. The healthcare systems are being overburdened, governments are overwhelmed, and economy is in decline, [12] which causes a great deal of harm to citizens mental and physical health and their financial and social wellbeing. The biggest problem that government's face from COVID-19 are the lack of proper systems to detect unknown infected [4] cases and predicts the risk of infection. In response to this crisis, the introduction of a new system which is a framework based on blockchain technology, aims to detect new infections in public spaces and clusters of people via the P2P-Mobile Application. [19] This encompasses four integrating components:

1. Blockchain Platform
2. Infection Verifier Subsystem
3. P2P-Mobile Application
4. Mass-Surveillance System

BLOCKCHAIN

To realise the value that the Blockchain Based COVID-19 System brings to minimize the risk of COVID-19, we first need to understand the basics of blockchain technology.

What is Blockchain?

Originally formed to allow digital currencies, blockchain is a data structure, where chunks of data are shared in a peer-to-peer (P2P) network [14]. The system is designed to validate transactions. Each 'block' of data is composed of a transaction (can carry any information the user requires) and a hash (a unique value which links it to the previous block, forming the 'chain'). [9]

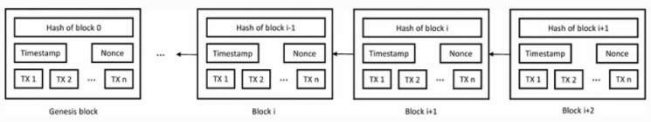


Figure 1: Example of a blockchain [20]

Why is it Secure?

If an existing block's data is modified, all the previous blocks' content will also be modified, as the blocks are chained by previous hashes, making the system immutable [1]. This P2P network makes the data in the blocks, very safe from corruption and cheating. Interacting parties do not need to trust each other.[17] Another reason which makes blockchain trustworthy, is the lack of a central authority, instead opting for trusted mediators which makes faster interactions between parties. Cryptography is incorporated in blockchain, establishing high security withing networks.[10]

Different Applications of Blockchain

Although the digital currency Bitcoin, is the most famous example, blockchain is used in various applications including business, healthcare and government services. [6] For example, blockchain is already in use in hospitals for medical supply chain management, ensuring quality of medical resources. Its also used in sharing medical records and cash transfer services. It can even be used to detect new cases of COVID-19.

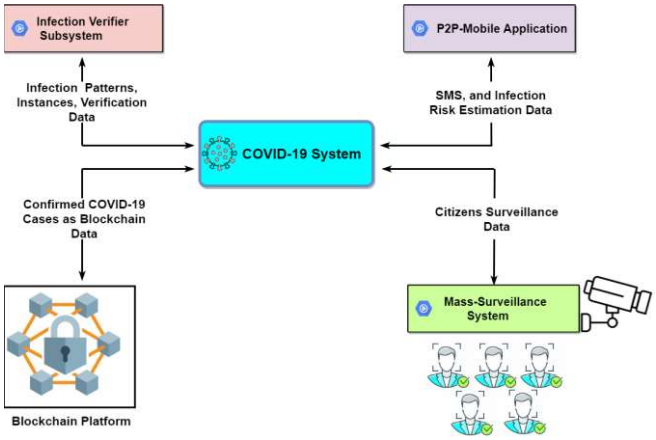
PROPOSING A NEW BLOCKCHAIN FRAMEWORK TO MINIMISE COVID-19 RISKS

Existing Frameworks That Can Manage Sensitive Data In The Blockchain

Several techniques are already in use to predict the global spread of COVID-19. This includes the Adaptive Neuro-Fuzzy Inference system (ANFIS) which integrates abstract logic and connected networks in real time, to predict future COVID-19 growth. [7] These kinds of techniques also heavily used modification of algorithms to forecast the cure of new cases, confirmed cases, deaths, and recoveries. The problem with these types of systems, is that they did not provide any solutions to automatically detect infected cases, and they wouldn't work properly without relying upon the predictions of infection risks by authority figures in real time.[8] Not to mention the lack of precise time stamping with real time processing, a decentralized storage, and an integrated peer to peer system. Thus, the proposed blockchain framework, would not only be more efficient and have more

accurate data, but the data would also be safer from corruption which is widespread in many countries. [19]

Proposed Blockchain Framework to Minimise COVID-19 Risks



As can be seen in Figure 1, the Blockchain Based COVID-19 System encompasses four integrating subsystems:

1. Blockchain Platform
2. Infection Verifier Subsystem
3. P2P-Mobile Application
4. Mass-Surveillance System

Figure 2: Architectural Model of the proposed COVID-19 System: A Proposed Model [19]

As the Infection Verifier, P2P-Mobile Application and Mass-Surveillance System, do not themselves utilize blockchain technology, as they rely on the Blockchain platform for those purposes, only the Blockchain Platform subsystem will be discussed in detail. [19]

Subsystem: Infection Verifier

The Infection Verifier's job to virtually create, verify and represent the infection cases and infection patterns. [19]

Subsystem: P2P-Mobile Application

This mobile app can used by anyone regardless of their status, from ordinary citizens to those with authority. The app's job is to graphic represent relevant data related to results of infection risk estimates, statistics, data forecast and infected cases detection. This is established by the P2P interaction between authorities and citizens. [19]

Subsystem: Mass-Surveillance

This is an intricate surveillance system of ordinary people, which will track the interaction between people and the motion tracking of specific people for detecting people and places of a confirmed COVID-19 case contact. [19]

SUBSYSTEM: BLOCKCHAIN PLATFORM

Blockchain Platform's Role:

The Blockchain Platform's job is to create and maintain a decentralised repository, which is made of a sequence of real-time digital blocks that will store relevant data related to confirmed COVID-19 cases. The P2P design can detect the unknown infected cases automatically, through discrete communication between the blockchain and P2P mobile app, whenever a new block is added to the blockchain. [19]

Blockchain Platform's Design:

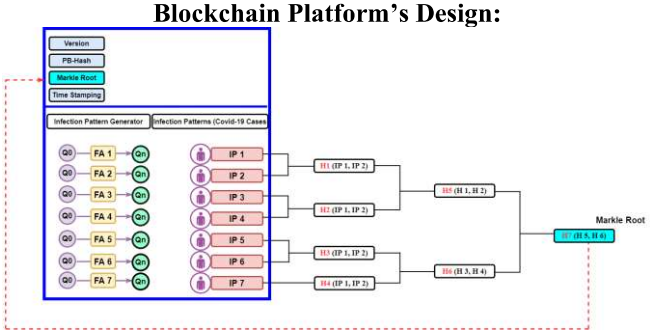


Figure 3: A proposed block design for processing Confirmed COVID-19 Cases: A Proposed Model [19]

Block Header:

1. Block version: contains confirmed and likely infected cases
2. Hash of Previous block: 256-bit hash to establish connection between previous blocks
3. Merkle Root: creates a unique fingerprint and hashes pairs of infection patterns via hash tree
4. Block Hash: code that gived a block its unique identity
5. Time Stamp: real time stamp which guarantees block integrity and traceability

Block Body:

1. Pattern of Infected Cases: confirmed cases are digitized and stored in the following component:
2. Generator of Infected Cases Pattern: sends data with the other 3 subsystems [19]

Block Mining:

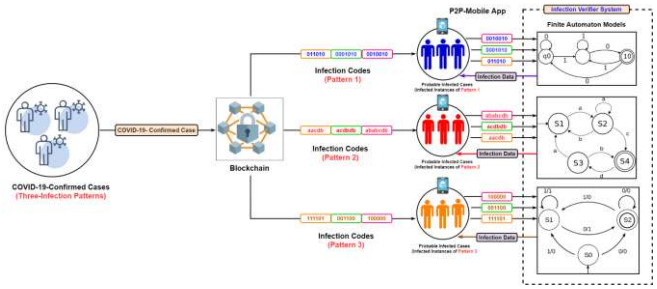


Figure 4: A proposed models for identifying probable infected cases based triple connections between Blokchain, P2P mobile Applications, and Infection Verifier system: A proposed Model [19]

Advantages of this Blockchain Framework

1. Peer to peer Communication and Decentralised Design: works through citizens use of the P2P mobile app, and there is no need for authority roles.[15]
2. Time Stamping and Real-time Tracing: guarantees block integrity and done in real time so no waiting period [2]
3. High Speed and Efficiency: transactions process much quicker than traditional methods

4. Integrity: a block's data on cases of COVID-19 can't be modified
5. Traceability: Using hash any block or group of cases can be located
6. Security: As a hash is assigned to each block, and immutability is preserved

Disadvantages of this Blockchain Framework

1. High Cost: a lot of resources required to implement
2. Large Storage: becomes an issue since it's a global issue, and problem worsens over time [3]
3. Difficult to modify data: Once a case is detected, its extremely hard to redo it
4. High Power use: there are more energy efficient options available
5. New Technique: As this is a new system, there are likely to be many challenges faced than using standard methods.[11]

CONCLUSION

Overall, it is evident that if implemented, this new Blockchain Based COVID-19 System, is highly likely to reduce the stress and load of the healthcare, business and government sectors as well as millions of citizens, by detecting unknown infected cases and places of COVID-19, and predicting future risks automatically. [19]

ACKNOWLEDGMENT

Thank you to the very skilled and knowledgeable tutors who taught me a lot about blockchain, for which this assignment would not have been possible!

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