IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, May 2022
Impact Factor: 6.252

Covid -19 Digital Medical Passport using Blockchain Technology

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Abstract: *COVID-19 has emerged as a highly infectious illness that has had a worldwide effect, resulting in a significant number of infections and fatalities. Testing is critical to a successful response to this pandemic because it helps detect illnesses and therefore attenuate (isolate/cure) them. We will look at this issue and contribution in this study by providing a block chain-based solution that includes self-sovereign identity and decentralized storage. For COVID-19 test takers, our solution includes digital medical passports and immunity certificates. We will demonstrate smart contracts based on the block chain and implemented in Python to preserve a digital medical identity for test-takers, allowing for a quick and trustworthy response from the appropriate medical authorities. We will use immutable trustworthy block chain to decrease medical facility response times, relieve the dissemination of incorrect information, and stop the transmission of illness via digital medical passports.*

Keywords: Digital medical passports, Immunity certificates, Block chain, Elliptic Curve Digital Signature Algorithm (ECDSA).

I. INTRODUCTION

The coronavirus (COVID-19) outbreak in late 2019 comprises a serious threat around the world. The severity of the epidemic was so huge that the World Health Organization (WHO) was compelled to declare it as a pandemic within a month of its wide-scale expansion. The virus spread causes the global economic shock with the massive interruptions of many sectors such as supply chain, industry, insurance, agriculture, transport, and tourism, forcing governments and owners to shut stop operations on a worldwide scale. Coronavirus-2019 (COVID-19) has had unprecedented impact on human life across the world. Being highly contagious, this disease has affected a significant proportion of the world population with a very large number of infections and deaths. With stringent countermeasures, such as lockdown adopted by governments across the world, COVID-19 has not only affected human health but has also caused a significant negative impact on the global economy.

Since the first case was diagnosed in Wuhan, China in late 2019, coronavirus disease 2019 (COVID-19) has spread globally at an unprecedented rate, and was declared a pandemic by the WHO on March 11, 2020 [1]. The fatality rate of COVID-19 is 2% – 5%, and the virus has caused many deaths worldwide as it is highly infectious. [2] In addition to COVID-19, a number of other novel infectious diseases have recently been encountered, such as severe acute respiratory syndrome in 2004, novel influenza in 2009, and Middle East respiratory syndrome in 2015, and this is expected to continue in future. Block chain is a recently developed technology that allows transaction designers to make transactions directly through peer-to-peer (P2P) networks, without intermediary organizations, and to store transaction data in a distributed ledger. Because block chain stores data from several individuals simultaneously, in order to amend the data, it is necessary to simultaneously modify the data divided between the individuals. This makes it almost impossible to forge or manipulate the data and ensure their reliability and transparency. The data stored in a block chain are not erased, and so can be easily tracked. In addition, because the participation of intermediaries is minimized, savings in both financial and temporal expenses can be made. There have been attempts to use block chain in various industries, including finance,

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place and date of birth, citizenship, and visa stamps. Meanwhile, different countries are looking at ways to make passport management more efficient. The current passport system has a number of problems, including:

1) Theft of identity
2) Extensive application period
3) Difficulty of the recovery process
5) When data is kept in a central database, the risk of personal information being stolen is always there.

The digital revolution has swept the globe. While we all appreciate the convenience of having everything at our fingertips, it is not without faults. In the digital age, one of the main problems that must be addressed is privacy. However, by using digital passports, many fraudulent actions may be curtailed, and privacy concerns can be minimized. Many nations have already signed Memorandums of Understanding (MoUs) to conduct in-depth research and study on block chain technology and how it may be utilized to create an app that meets the need for a digital passport.

II. PROBLEM DEFINITION

To propose a cutting-edge block chain-based method for establishing trust and preventing fraud. Our system, in particular, makes advantage of programmable smart contracts to do function calls and create events that alert participants to medical information, test changes, and needs.

III. LITERATURE SURVEY

[1] Min Cheol Chang & Donghwi Park (2020) et al., In this paper author states that We examined how blockchain can improve upon the shortcomings of the current system and thus help people during the current COVID-19 pandemic or in the event of other infectious diseases in future. Author further said we anticipate that blockchain technology will be able to play a greater role in future during actual infectious disease outbreaks.

[2] Vinay Chamola, Vikas Hassija, Vatsal Gupta and Mohsen Guizani (2020) et al., The unprecedented outbreak of the 2019 novel coronavirus, termed as COVID-19 by the World Health Organization (WHO), has placed numerous governments around the world in a precarious position. The impact of the COVID-19 outbreak, earlier witnessed by the citizens of China alone, has now become a matter of grave concern for virtually every country in the world. The scarcity of resources to endure the COVID-19 outbreak combined with the fear of overburdened healthcare systems has forced a majority of these countries into a state of partial or complete lockdown. The number of laboratory confirmed coronavirus cases has been increasing at an alarming rate throughout the world, with reportedly more than 2.2 million confirmed cases as on 20 April 2020. Adding to these woes, numerous false reports, misinformation, and unsolicited fears in regards to coronavirus, is being circulated regularly since the outbreak of the COVID-19. In response to such acts, we draw on various reliable sources to present a detailed review of all the major aspects associated with the COVID-19 pandemic. In addition to the direct health implications associated with the outbreak of COVID-19, this study highlights its impact on the global economy. In drawing things to a close, we explore the use of technologies such as the Internet of Things (IoT), Unmanned Aerial Vehicles (UAVs), blockchain, Artificial Intelligence (AI), and 5G, among others, to help mitigate the impact of COVID-19 outbreak.

[3] Samen Anjum Arani1, Md. Rashed Ibn Nawab*,2, Md. Tanvir Rahman3, Moniruz Zaman4 (2020) et al., In this paper author mentioned that, the primary goal of our experiment is to develop a framework which can utilize the features of permissioned blockchain and maintain the fully controlled sharing of confidential health record to exhibit the health status and COVID-19 history of a patient using a mobile QR code based solution. So, the administrative team of any public place can be aware of the health condition of any people who are using this platform to prevent the unaware and hidden contagion of COVID-19. This article is the first of its kind to propose such a method to aid in solving this crisis. In our experiment, we have shown that Hyperledger Fabric as a base technology along with a robust user registration algorithm and data accessibility can solve the problem under consideration with a minimal health record of the patient. The proposed architecture also offers the patient more control over the health record, where the healthcare service provider assures the authenticity of the data, and the intrinsic feature of the blockchain technology makes it immutable.

[4] Jos´e L. Hern´andez-Ramos, Georgios Karopoulos, Dimitris Geneiatakis, Tania Martin, Georgios Kambourakis, and Igor Nai Fovino, (2021) et al., This work propose a scalable, blockchain-based platform for the secure sharing of COVID-19 or other disease vaccination certificates. As an indicative use case, we simulate a large-scale deployment by considering

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the countries of the European Union. The proposed platform is evaluated through extensive simulations in terms of computing resource usage, network response time and bandwidth. Based on the results, the proposed scheme shows satisfactory performance across all major evaluation criteria, suggesting that it can set the pace for real implementations. Vis-`a-vis the related work, the proposed platform is novel, especially through the prism of a large-scale, full-fledged implementation and its assessment.

[5] Sofia Maria Dima1, Alexandros Hasikos2, Stylianos Kampakis3, Theodosis Mourouzis4, and Andreas Papageorgiou5 (2021) et al., In this article author present Hygiea, an end-to-end blockchain-based solution for the Covid-19 pandemic. Hygiea has two main objectives. The first is to allow governments to issue Covid-19 related certificates to citizens that can be verified by designated verifiers to ensure safer workplaces. The second is to provide the necessary tools to experts and decision makers to better understand the impact of the pandemic through statistical models built on top of the data collected by the platform. This work covers all steps of the certificate issuance, verification and revocation cycles with well-defined roles for all stakeholders. Author also proposes a governance model that is implemented via smart contracts ensuring security, transparency and auditability. Finally, author proposes techniques for deriving statistical models that can be used by decision makers.

IV. PROBLEM DEFINATION

Passport must be assist for prevention of the COVID-19 virus by properly maintaining the patient health status.

- Patient information must be from trusted source
- To keep the patient record distributed, Secure and decentralized is also challenging

V. PROPOSED SYSTEM APPROACH

We propose a cutting-edge block chain-based method for establishing trust and preventing fraud. Our system, in particular, makes advantage of programmable smart contracts to do function calls and create events that alert participants to medical information, test changes, and needs.

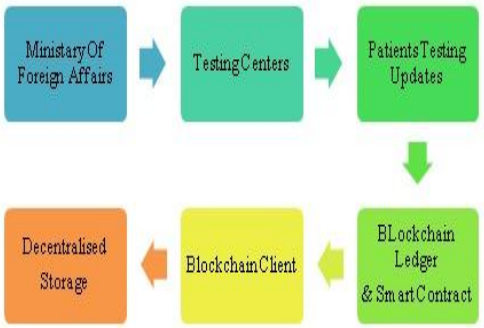

Figure 1: System Architecture of Proposed System

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Digital Signature Algorithm using Elliptic Curves

The Elliptic Curve Digital Signature Algorithm (ECDSA) is a Digital Signature Algorithm (DSA) that utilizes elliptic curve cryptography keys to generate signatures (ECC). It's a very efficient public key cryptography-based equation (PKC). ECDSA is utilized in a variety of security systems, is popular in encrypted messaging applications, and is the foundation of Bit coin security (Bitcoin "addresses" serve as public keys). ECDSA is also used to encrypt connections between web browsers and online applications using Transport Layer Security (TLS), the successor to Secure Sockets Layer (SSL). The encrypted connection of an HTTPS website is established via signed certificates utilizing ECDSA, as indicated by a picture of a physical padlock in the browser.

ECDSA has the advantage of providing a better level of security with lower key lengths than another popular method, RSA. ECDSA utilizes less computer resources than RSA, a less secure competing equation, which improves its ROI even further.

VI. CONCLUTION

This research presents design, development, and evaluation of a block chain-based solution for digital health passports with immunity certificates. The proposed system helps in mitigating the spread of infectious diseases in general and the COVID-19 disease in particular. The presented smart contracts that rely on negligible on-chain storage and leverage on-chain events and notifications. The proposed ECDSA treats generating point as private key, which ultimately revolutionize the whole algorithm and improves the security and execution speed of the algorithm.

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