PATIENT FACING SYSTEMS

Optimizing the Implementation of COVID-19 "Immunity Certificates" Using Blockchain

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In an effort to lift the social distancing measures, some countries including Chile, Germany, the UK and others have suggested the use of COVID-19 "immunity passports" or "immunity certificates" or "immunity licenses" i.e. document that certify an individual has been infected and is immune to coronavirus disease 2019 [1]. Individuals with immunity certificates could be exempt from physical restrictions and could return to work, school and other daily activities. However, there are various practical and legal challenges [2–4] in adequate implementation of "immunity certificates." The use of immunity licenses would create a restriction on who can and cannot participate in social and work-related activities and this would encourage forgery and incentivize people to seek infection. Herein, we propose a blockchain technology [5, 6] to combat two challenges while using immunity certificates, falsification of information and people seeking out for COVID-19 infection.

Citizens register on a government run blockchain which would maintain and verify the COVID 19 related data. Testing facilities and hospitals are also required to be on the blockchain network so that all the reports are automatically uploaded on the distributed ledger and cannot be modified later. When an individual takes the COVID-19 antibody test, the details are kept confidential using smart contracts. Smart contracts swap the public key of the individual with an anonymous key which is received by health care workers. Once the sample is tested, the smart contract is able to tag the anonymous key with the actual public key of the individual. If the

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test confirms that the person has developed antibodies to SARS-CoV-2, a token is issued in the account of that person with expiry date according to the expected age of antibodies. This means that the tokens can be verified only until a particular time frame. This blockchain takes biometric authentication as a private key so as to prevent people using each other's blockchain account. Since every person's data is encrypted with their biometrics, privacy and anonymity is maintained. This system cannot be used to extract any information of the individual but only to verify the claims of a person. Another advantage is the ease of verification, since it is a public digital ledger run by the government, it provides quick and trusted verification across borders. Just like bitcoin, everyone can see how much a particular wallet owns, the person just needs to prove the ownership of that wallet. This can be achieved simply by sending a message from your account to the person who is verifying the claim. It could be made more robust if the laboratory and hospital devices are IoT (Internet of things) enabled so that they are able to work directly with the blockchain without any human intervention. Smart contracts make it extremely easy to verify if any of the devices have been tempered with or not.

Contact tracing also becomes convenient when phone devices are connected to this blockchain through person's account. The smart contract generates a unique key for each person pair. Whenever they come in contact with each other, it adds the transaction which is tagged with geo-location and time-stamp. Any government/healthcare official will be able to only verify if the person came in contact with a COVID-19 patient or not. This blockchain system would incentivize the individuals to come in contact with those who have certificates of immunity to COVID 19 rather than seeking for infection.

Utilizing blockchain can mitigate the falsification of test reports and encourage people to come in contact with individuals having immunity-based licenses rather than actively seeking for COVID 19 infection. This blockchain based system also offers an opportunity to prioritize individuals for antibody testing via contact tracing. However, the major concern while

implementing this blockchain system is that there is currently not enough evidence that people with antibodies are protected from having a second COVID 19 infection [7, 8]. Thus, contact with individuals possessing immunity certificates might increase the risk of infection. There exists a challenge of social division between the licensed and unlicensed people [9]. Therefore, in conclusion, we believe that the above mentioned blockchain system would mitigate some of the challenges existing with the current implementation of "immunity certificates" or "immunity licenses."

Compliance with Ethical Standards

Conflict of Interest   The authors declare no conflicts of interest.

Ethical Approval   This article does not contain any studies with human participants or animal performed by any of the authors.

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