A Novel Smart Healthcare Design, Simulation, and Implementation Using Healthcare 4.0 Processes.

ABSTRACT

Blockchain technology is found to have its applicability in almost every domain because of its advantages such as crypto-security, transparency, immutability, decentralized data network. In present times, a smart healthcare system with a blockchain data network and healthcare 4.0 processes provides transparency, easy and faster accessibility, security, efficiency, etc. Healthcare 4.0 trends include industry 4.0 processes such as the internet of things (IoT), industrial IoT (IoT), cognitive computing, artificial intelligence, cloud computing, fog computing, edge computing, etc. The goal of this work is to design a smart healthcare system and it is found to be possible through integration and interoperability of Blockchain 3.0 and Healthcare 4.0 in consideration with healthcare ground-realities. Here, healthcare 4.0 processes used for data accessibility are targeted to be validated through statistical simulation-optimization methods and algorithms. The blockchain is implemented in the Ethereum network, and with associated programming languages, tools, and techniques such as solidity, web3.js, Athena, etc. Further, this work prepares a comparative and comprehensive survey of state-of-the-art blockchain-based smart healthcare systems. The comprehensive survey includes methodology, applications, requirements, outcomes, future directions, etc.

A list of groups, organizations, and enterprises are prepared that are working in electronic health records (EHR), electronic medical records (EMR) or electronic personal records (EPR) mainly, and a comparative analysis is drawn concerning adopting the blockchain technology in their processes. This work has explored optimization algorithms applicable to Healthcare 4.0 trends and improves the performance of block chain based decentralized applications for the smart healthcare system. Further, smart contracts and their designs are prepared for the proposed system to expedite the trust-building and payment systems. This work has considered simulation and implementation to validate the proposed approach. Simulation results show that the Gas value required (indicating block size and expenditure) lies within current Ethereum network Gas limits. The proposed system is active because block utilization lies above 80%. Automated smart contract execution is below 20 seconds. A good number (average 3 per simulation time) is generated in the network that indicates a health competition. Although there is error observed in simulation and implementation that lies between 0.55% and 4.24%, these errors are not affecting overall system performance because simulated and actual (taken in state-of-the-art) data variations are negligible.