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Blockchain Grounded Electronic Record for Healthcare Monitoring System

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Abstract---The introductory conception of using Blockchain database in order to manage and maintain electronic health records of the case used for covering the health and to give better services and to store and save the data pertaining to the patient health and to make it public to the sphere experts it's veritably important that the data has to be stored in a secured database, so that only the authorize druggies can have the access to the same. So, in order to safe guard the data and to maintain sequestration of the data it's always recommended to have a database which can not be shifted. So, the significance of blockchain is vital to store the data safely. Principally, blockchain is a distributed database where data is participated among the bumps in a network. This database stores information in the electronically digital form. This particular database is more popular to store data pertaining to cryptocurrency systems. Blockchain will help us in furnishing complete security of the records stored and will help in generating trust factor. Further over the blockchain also provides dedication of the data stored. Data structure of blockchain and the other databases is the key for furnishing security and sequestration of the data. Blockchain makes use of blocks which stores information in it. Blocks can store information with some limit on the storehouse capacity and after the block is fully filled up, it'll also store information in the coming block by creating a link to the former block. Typically database stores data in the form of tables, but in case of blockchain the data is stored in the form of blocks (gobbets of data) and are connected with all the blocks. Because of the structure of the data stored in blockchain it becomes nearly unsolvable for anyone to hack it or manipulate the data stored. Every block created will have a timestamp associated with it when these blocks are added in chain.

Keywords--- Blockchain, E-Records, Data warehouse, Cryptography.

Introduction

In order to store and save the data pertaining to the case's health and to make it public to the sphere experts it's veritably important that the data has to be stored in a secured database, so that only the authorized druggies can have the access to the same.

So, in order to safeguard the data and to maintain sequestration of the data it's always recommended to have a database which can not be shifted. So, the significance of blockchain is vital to store the data safely. [3]
Principally, blockchain is a distributed database where data is participated among the bumps in a network. This database stores information in the electronically digital form.

This particular database is further popular to store data pertaining to cryptocurrency systems. Blockchain will help us in furnishing complete security of the records stored and will help in generating trust factor. Further over the blockchain also provides dedication of the data stored. Data structure of blockchain and the other databases is the key for furnishing security and sequestration of the data. [6]

Blockchain makes use of blocks which stores information in it. Blocks can store information with some limit on the storehouse capacity and after the block is fully filled up, it'll also store information in the coming block by creating a link to the former block. Typically databases stores data in the form of tables, but in case of blockchain the data is stored in the form of blocks (gobbets of data) and are connected with all the blocks. Because of the structure of the data stored in blockchain it becomes nearly insolvable for anyone to hack it or manipulate the data stored. Every block created will have a timestamp associated with it when these blocks are added in chain. [12]

It's veritably important important for any person to know the details pertaining to the health and also to maintain the records pertaining to the same. As the data pertaining to the person is related with health is becomes important to guard it and to see that the same is used by the concerned people in order to give needed services.

The work performed is to make use of ethereum blockchain to store the data in the form of blocks in chain and to help the authorities concerned to have access to the important and vital data of the case. When the data pertaining to the case is stored using blockchain it becomes safe and inflexible. So, in order to maintain the health- related data pertaining to the case's blockchain database is used. [18]

Summary of the research paper

System to store the data on the blockchain database can be by using the hash function to induce a number to the record to be stored, also we need to store the number generated by using hash function on the blockchain, by placing all the data pertaining to it in a train system which can be of distributed nature.

When we store the data using a blockchain database the advantage we get is it'll break problems related to the storehouse, which typically happens in centralized storehouse systems. This will also help in reducing access time to pierce the data from blockchain databases.

In order to have access to the data stored on the database we can have a trait grounded medium to decipher the data stored electronically in translated form. With this we can ensure complete sequestration and security for the data stored. [28]

Blockchain database is analogous to the distributed tally system we had in earlier days. The data when stored using a blockchain database can be participated and stored in the bumps over a network, rather than storing it on a centralized database. It's a distributed and participating type of database which is different from the normal database in terms of storehouse medium. [22]

Features of Blockchain to mention are

In this Blockchain database whenever new data is to be added it'll be stored only in a new block in the chain. When the block with certain capacity is filled up also the data is stored in another new block with a link handed to the former block. Data type isn't the constraint for storing data on a database. It's like the tally system used in maintaining the accounts. No single stoner can have a control on this database so data stored is inflexible.

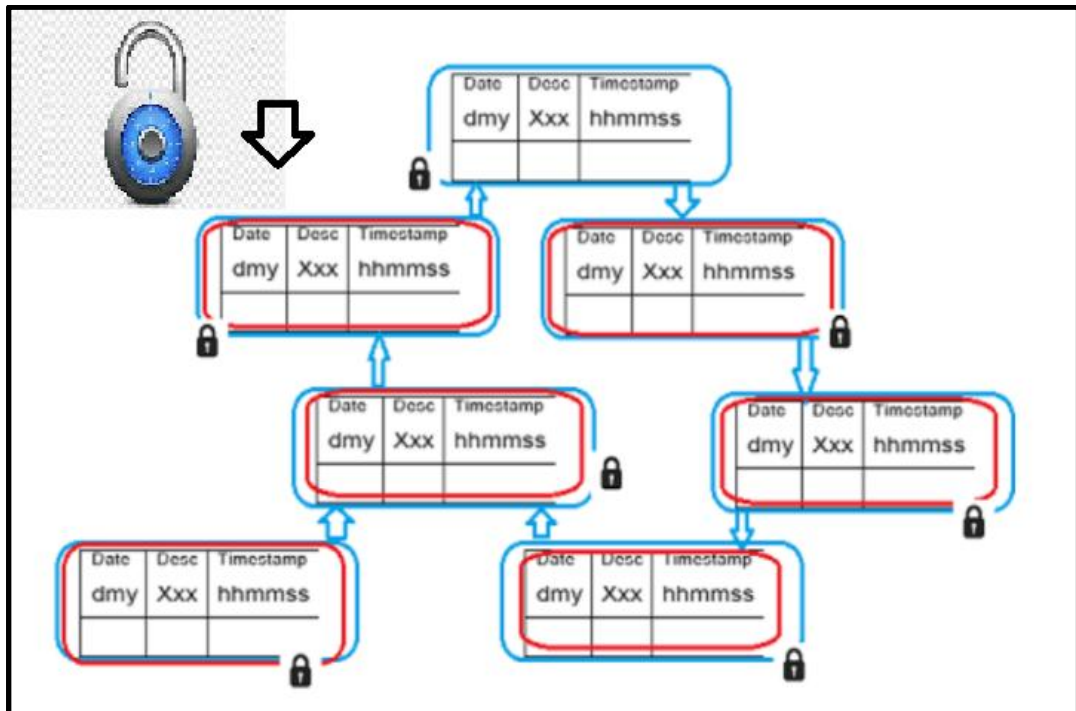


Figure 1: Data Store in Digital ledger / Record

As shown in figure 1 The data is stored in the blockchain in the form of a tally which is digitized and decentralized. Whenever the block is added it updates in every knot which are principally translated and the proprietor of the block only can decipher the information using public-private-crucial brace. Every block is associated with the timestamp. This will help in securing the electronic health records. Al the records will get streamlined at a time and each of them will associate with the timestamp, which makes it veritably delicate to manipulate or modify. Therefore, making the complete structure as inflexible. [8][9]

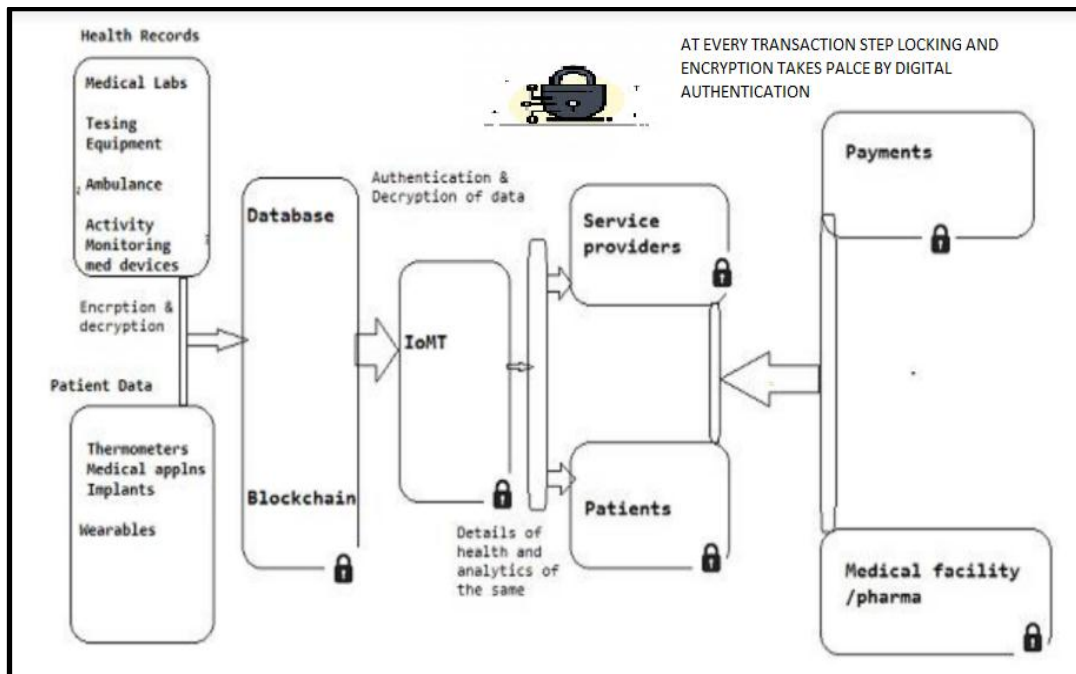


Figure 2(a): Data Flow at respective steps with encryption and key generation

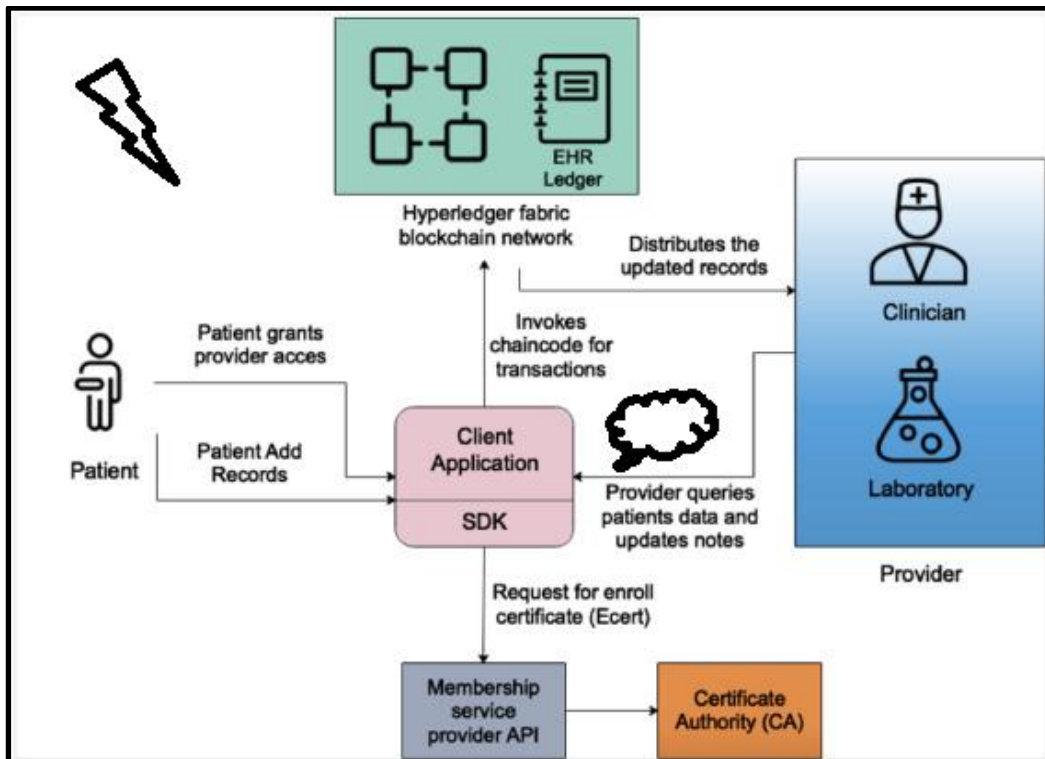


Figure 2 (b): Data Flow at respective steps (Graphically Structure)

Figure 2(a)& (b) In this the inflow of data is shown from the stoner to the separate sphere experts, as shown the data is captured at the stoner position (patient position) by making use of colorful detectors, bias connected and also the data is translated by making use of mincing fashion and also the data is uploaded on the database using the conception of blockchain, where the data is stored in the form of blocks and also the new blocks are created and added to the chain. [17]

The data is also made available to the different stake holders for furnishing colorful services including the services related to drugstore, testing in medical labs, opinion and transferring tradition to the medical units including the use of service providers for making the needed payments. Internet of medical effects used to see that all the data analytics related to the health of the case is handed to the service providers and the cases. [8]

Detailed description of the research paper

As the data stored using blockchain databases are inflexible which means they can not be altered/ modified, nor can be destroyed. DLT- Distributed Ledger technology is the other name for Blockchain.

Blockchain database provides translucency because of the decentralized nature of the chain. Deals can be viewed in a real time mode by any stoner using his own knot or can make use of explorers of blockchain. As every knot gets streamlined with the new block whenever it's added to the chain. We can fluently shadow

blocks in chains. [21] All the data stored in the blockchain is fully translated, which will allow only the proprietor of the block to decipher it by making use of the conception of public private-crucial brace. This installation or the point will make blockchain fully unknown while maintaining translucency.

Blockchain provides security for the data by storing the data in the form of blocks which are stored in linearly chronological order in a decentralized manner. Whenever new data is to be streamlined/ stored it'll be by creating a new block which will get eventually added to the end of the chain. [11]

Once the new block is added to the end of the chain, it becomes delicate to go back and to perform any revision or streamlining on the data unless the druggies involved in the network and maturity of them have to make a policy. Each block has its own hash value generated by using a hash function and also has a timestamp. Mincing is where a find function is used in order to produce or induce a group of letters and figures for the information present in the digital form. [7]

It's veritably important that the data pertaining to the case, which can be called as electronic records, has to be maintained safely by furnishing complete security and sequestration. Else, every chance that the information can be manipulated will produce huge problems for the experts to diagnose or to find the root cause of the problem.

Another advantage is that the case data is all time available irrespective of the position and time, which makes it easier for the experts to timely give results for the problem the case is suffering with. Typically databases store data in the form of tables, but in the case of blockchain the data is stored in the form of blocks (gobbets of data) and are connected with all the blocks.

Because of the structure of the data stored in blockchain it becomes nearly insolvable for anyone to hack it or manipulate the data stored. Every block created will have a timestamp associated with it when these blocks are added in chain.[41] It's veritably important for any person to know the details pertaining to the health and also to maintain the records pertaining to the same. As the data pertaining to the person is related with health is becomes important to guard it and to see that the same is used by the concerned people in order to give needed services.

The work performed is to make use of ethereum blockchain to store the data in the form of blocks in chain and to help the authorities concerned to have access to the important and vital data of the case. When the data pertaining to the case is stored using blockchain it becomes safe and inflexible. So, in order to maintain the health- related data pertaining to the case's blockchain database is used. [39]

Advantages

- Blockchain database is used because this database or the data stored in this database is inflexible.

- Framework is used which helps to perform encryption and decryption of data before the data
- is stored and penetrated by multiple druggies.
- Data is stored using a data structure which helps to maintain data by using the timestamp.
- Health records are stored in a decentralized database using blockchain so as to make it easier to pierce and to give timely services.
- Data stored is made public where by anyone who's authorize can use it anytime every
- time by using the public-private-crucial brace.
- Mathematical function is used in order to induce a hash number which will be the
- combination of rudiments and figures which makes it delicate for anyone to decipher it.

Conclusion

In our research paper we state that the Complex algorithm used for generation of the identification number for the block of data stored in the chain. Installation is handled where the data from the case can be captured using colorful devices like the wearables and so. Service provider conception is added to the frame whereby the task of making the payment and to make them secure is also taken care of. Hash value generated by the making use of the data which is of arbitrary length, When the number generated is of fixed length and lower in size we can relate as a contraction function.

References

- [1] S. Khezr, M. Moniruzzaman, A. Yassine, R. Benlamri, Blockchain technology in healthcare: a comprehensive review and directions for future research, *Appl. Sci.* 9 (9) (2019) 1736.
- [2] T. Kumar, V. Ramani, I. Ahmad, A. Braeken, E. Harjula, M. Ylianttila, Blockchain utilisation in healthcare: key requirements and challenges, in: *In2018 IEEE 20th International Conference on E-Health Networking, Applications and Services (Healthcom)*, IEEE, 2018 Sep 17, pp. 1–7.
- [3] G. Moona, M. Jewariya, R. Sharma, Relevance of dimensional metrology in manufacturing industries, *MAPAN* 34 (2019) 97–104, <https://doi.org/10.1007/s12647-018-0291-3>.
- [4] M.H. Kassab, J. DeFranco, T. Malas, Giuseppe Destefanis Laplante, V.V. Neto, Exploring research in Blockchain for healthcare and a roadmap for the future, *IEEE Trans. Emerg. Top. Comput.* (2019), 1–1.
- [5] B. Shen, J. Guo, Y. Yang, MedChain: efficient healthcare data sharing via Blockchain, *Appl. Sci.* 9 (6) (2019) 1207.
- [6] U. Chelladurai, S. Pandian, A novel blockchain based electronic health record automation system for healthcare, *J. Ambient Intell. Humanized Comput.* (2021).
- [7] P. Zhang, D.C. Schmidt, J. White, G. Lenz, Blockchain technology use cases in healthcare, in: *Advances in Computers*, vol. 111, Elsevier, 2018 Jan 1, pp. 1–41.

- [8] I. Yaqoob, K. Salah, R. Jayaraman, Y. Al-Hammadi, Blockchain for healthcare data management: opportunities, challenges, and future recommendations, *Neural Comput. Appl.* (2021 Jan 7) 1–6.
- [9] X. Liang, J. Zhao, S. Shetty, J. Liu, D. Li, Integrating blockchain for data sharing and collaboration in mobile healthcare applications, in: 2017, IEEE 28th Annual International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC), IEEE, 2017 Oct 8, pp. 1–5.
- [10] A. Varshney, N. Garg, K.S. Nagla, et al., Challenges in sensors technology for industry 4.0 for futuristic metrological applications, *MAPAN* 36 (2021) 215–226, <https://doi.org/10.1007/s12647-021-00453-1>.
- [11] T. McGhin, K.K. Choo, C.Z. Liu, D. He, Blockchain in healthcare applications: research challenges and opportunities, *J. Netw. Comput. Appl.* 135 (2019 Jun 1) 62–75.
- [12] X. Yue, H. Wang, D. Jin, M. Li, W. Jiang, Healthcare data gateways: found healthcare intelligence on Blockchain with novel privacy risk control, *J. Med. Syst.* 40 (10) (2016 Oct) 1–8.
- [13] M. Holbl, M. Kompara, A. Kami, € salic, L. Nemec Zlatolas, A systematic review of the use of Blockchain in healthcare, *Symmetry* 10 (10) (2018 Oct) 470.
- [14] A. Farouk, A. Alahmadi, S. Ghose, A. Mashatan, Blockchain platform for industrial healthcare: vision and future opportunities, *Comput. Commun.* 154 (2020 Mar 15) 223–235.
- [15] A. Ekblaw, A. Azaria, J.D. Halamka, A. Lippman, A Case Study for Blockchain in Healthcare: "MedRec" prototype for electronic health records and medical research data, in: *InProceedings of IEEE Open & Big Data Conference*, vol. 13, 2016 Aug 13, p. 13.
- [16] V. Dhillon, D. Metcalf, M. Hooper, Blockchain in healthcare, in: *Blockchainenabled Applications*, Apress, Berkeley, CA, 2021, pp. 201–220.
- [17] D.V. Dimitrov, Blockchain applications for healthcare data management, *Healthcare informatics research* 25 (1) (2019 Jan) 51.
- [18] M. Mettler, Blockchain technology in healthcare: the revolution starts here, in: *In2016 IEEE 18th International Conference on E-Health Networking, Applications and Services (Healthcom)*, IEEE, 2016 Sep 14, pp. 1–3.
- [19] J. Chanchaichujit, A. Tan, F. Meng, S. Eaimkhong, Blockchain technology in healthcare, in: *healthcare 4.0*, Palgrave Pivot, Singapore, 2019, pp. 37–62.
- [20] G. Tripathi, M.A. Ahad, S. Paiva, S2HS-A Blockchain-based approach for smart healthcare system, in: *Healthcare*, vol. 8, Elsevier, 2020 Mar 1, p. 100391. No. 1.
- [21] R. Gupta, S. Tanwar, S. Tyagi, N. Kumar, M.S. Obaidat, B. Sadoun, Habits:lockchain-based telesurgery framework for healthcare 4.0, in: *In2019 International Conference on Computer, Information and Telecommunication Systems (CITS)*, IEEE, 2019 Aug 28, pp. 1–5.
- [22] G. Srivastava, R.M. Parizi, A. Dehghantanha, The future of blockchain technology in healthcare internet of things security, *Blockchain Cybersecurity, Trust and Privacy* (2020) 161–184.
- [23] M. Bhavin, S. Tanwar, N. Sharma, S. Tyagi, N. Kumar, Blockchain and quantum blind signature-based hybrid scheme for healthcare 5.0 applications, *Journal of Information Security and Applications* 56 (2021 Feb 1) 102673.

- [24] G. Rathee, A. Sharma, H. Saini, R. Kumar, R. Iqbal, A hybrid framework for multimedia data processing in IoT-healthcare using blockchain technology, *Multimed. Tool. Appl.* (2019 Jun 3) 1–23.
- [25] E. Chukwu, L. Garg, A systematic review of Blockchain in healthcare: frameworks, prototypes, and implementations, *IEEE Access* 8 (2020 Jan 28) 21196–21214.
- [26] B. Houtan, A.S. Hafid, D. Makrakis, A survey on blockchain-based self-sovereign patient identity in healthcare, *IEEE Access* 8 (2020 May 12) 90478–90494.
- [27] A. Rejeb, L. Bell, Potentials of blockchain for healthcare: case of Tunisia, *World Scientific News* 136 (2019) 173–193.
- [28] E.M. Abou-Nassar, A.M. Ilyasu, P.M. El-Kafrawy, O.Y. Song, A.K. Bashir, A.A. Abd El-Latif, DITrust chain: towards blockchain-based trust models for sustainable healthcare IoT systems, *IEEE Access* 8 (2020 Jun 2) 111223–111238.
- [29] K. Paranjape, M. Parker, D. Houlding, J. Car, Implementation considerations for Blockchain in healthcare institutions, *Blockchain in Healthcare Today* 2 (2019 Jul 9) 10–30953.
- [30] T. Le Nguyen, Blockchain in healthcare: a new technology benefit for both patients and doctors, in: *In2018 Portland International Conference on Management of Engineering and Technology (PICMET)*, IEEE, 2018 Aug 19, pp. 1–6.
- [31] R. Kumar, N. Marchang, R. Tripathi, Distributed off-chain storage of patient diagnostic reports in healthcare system using IPFS and Blockchain, in: *In2020 International Conference on COMMunication Systems & NETWORKS (COMSNETS)*, IEEE, 2020 Jan 7, pp. 1–5.
- [32] M. Javaid, A. Haleem, R. Vaishya, S. Bahl, R. Suman, A. Vaish, Industry 4.0 technologies and their applications in fighting COVID-19 pandemic, *Diabetes & Metabolic Syndrome: Clin. Res. Rev.* 14 (4) (2020 Jul 1) 419–422.
- [33] L. Bell, W.J. Buchanan, J. Cameron, O. Lo, Applications of blockchain within healthcare, *Blockchain in healthcare today* 1 (8) (2018 Jul 9).
- [34] K. Miyachi, T.K. Mackey, hOCBS: a privacy-preserving blockchain framework for healthcare data leveraging an on-chain and off-chain system design, *Inf. Process. Manag.* 58 (3) (2021 May 1) 102535.
- [35] C. Esposito, A. De Santis, G. Tortora, H. Chang, K.K. Choo, Blockchain: a panacea for healthcare cloud-based data security and privacy? *IEEE Cloud Computing* 5 (1) (2018 Mar 28) 31–37.
- [36] K.A. Clauson, E.A. Breeden, C. Davidson, T.K. Mackey, Leveraging blockchain technology to enhance supply chain management in healthcare: an exploration of challenges and opportunities in the health supply chain, *Blockchain in healthcare today* 1 (3) (2018 Apr 11) 1–2.
- [37] I.A. Omar, R. Jayaraman, M.S. Debe, K. Salah, I. Yaqoob, M. Omar, Automating procurement contracts in the healthcare supply chain using blockchain smart contracts, *IEEE Access* 9 (2021 Feb 26) 37397–37409.
- [38] K. Yaeger, M. Martini, J. Rasouli, A. Costa, Emerging blockchain technology solutions for modern healthcare infrastructure, *Journal of Scientific Innovation in Medicine* 2 (1) (2019 Jan 24).
- [39] M.Z. Bhuiyan, A. Zaman, T. Wang, G. Wang, H. Tao, M.M. Hassan, Blockchain and big data to transform healthcare, *Proceedings of the*

- International Conference on Data Processing and Applications (2018 May 12) 62–68.
- [40] P. Pandey, R. Litoriya, Securing and authenticating healthcare records through blockchain technology, *Cryptologia* 44 (4) (2020 Jul 3) 341–356.
 - [41] R. Abujamra, D. Randall, Blockchain applications in healthcare and the opportunities and the advancements due to the new information technology framework, in: *Advances in Computers*, vol. 115, Elsevier, 2019 Jan 1, pp. 141–154.