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Healthcare Management System using Blockchain with ML Integration

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Abstract: Today, every industry has access to a vast amount of data, and with the development of technology, it is now possible to offer answers to a wide range of issues. This project will use machine learning and blockchain technology to offer answers to issues with healthcare data management. With the aid of machine learning, it is feasible to extract only the pertinent data from the data. Using trained algorithms, this is done. The trustworthiness of data exchange becomes a challenge after this data has been stored. Blockchain can be used in this situation. Blockchain technology's consensus ensures that data is authentic and transactions are secure. By putting the patient at the heart of healthcare administration, blockchain technology has the ability to improve it.

Keywords: Electronic Health Records (EHR), Machine Learning, Blockchain Technology, Medical data sharing.

I. INTRODUCTION

Blockchain is a distributed ledger technology that can be used to create secure, transparent, and tamper-proof healthcare management systems. A healthcare management system based on the blockchain can securely manage and store health information such as electronic health records, patient information, medical histories, and clinical trial data.

One of the key benefits of using blockchain technology in healthcare management systems is that it can enhance the security and privacy of health data. Because blockchain is a decentralized and transparent system, it eliminates the need for intermediaries, such as third-party data aggregators and clearinghouses, that are typically used to manage health data. This helps to prevent data breaches and protect the confidentiality of patient data.

Another advantage of using blockchain in healthcare management systems is that it can help to streamline administrative processes, reduce costs, and improve efficiency. For example, blockchain technology can be used to automate claims processing, manage drug supply chains, and track medical devices, among other applications.

Healthcare management systems based on blockchain technology can provide significant benefits in terms of security, privacy, efficiency, and cost savings. As the healthcare industry continues to evolve, it is likely that we will see more widespread adoption of blockchain-based healthcare management systems in the years to come.

II. PROBLEM STATEMENT

Studying physiological data, environmental influences, and genetic factors allow practitioners to diagnose diseases early and effectively. Machine learning allows us to build models that associate a broad range of variables with a disease. And blockchain has a wide range of applications and uses in healthcare. Using ML extracting data & blockchain secure transfer of patient medical records, manages the medicine supply chain, and helps healthcare researchers unlock genetic code. Blockchain will provide numerical security by public and private key encryption to the patient's level as the foundation of a new generation of health information sharing. This technology promises to treat patient records, infringement prevention, interoperability improvement, rationalization of procedures, medication and prescription control, and medical and supply chain monitoring. Blockchain in healthcare is seen with a tremendous performance in the future. That's why we are utilizing blockchain innovation to fathom security-related issues.

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III. RELATED WORK

Blockchain Technology has gone far beyond Bitcoins. Healthcare is one of its application areas. The proposed system was based on the bitcoins approach was meeting information customers' needs and protecting patients' privacy [5]. In this proposal, if the information customer needs to see the record of the patient then they have to pay the fee with bitcoins. The disadvantage of this is a misuse of patient records and paying fees every time makes it difficult in terms of cost. The research took a turn from Public Blockchain Networks to Private Blockchain Networks. In healthcare, many parties have to access the same information [6]. Gem Health Network was launched which was based on

Ethereum Blockchain Technology. With this infrastructure, the information can be shared among different entities. The latest treatment information is available to prevent the use of outdated information in a transparent way [6]. It also shows previous interactions between the patent and all physicians. Another research in this field was by Estonia's digital health infrastructure which was created to help insurance companies to check all the medical treatments of patients. The Counterfeit Medicines Project based on Hyperledger Technology was based on drug counterfeiting [5]. The drug produced was a timestamp and added to the blockchain which cannot be altered [7]. This also helps in detecting the ownership transfer thereby protecting against fraud [7].

Each transaction performed in a block of the network is validated through a process based on the consensus distributed across all nodes (that is, the devices/users connected to the net). Blockchain technology belongs to the larger category of Distributed Ledger technologies, whose functioning is based primarily on a register structured in blocks linked in a network; each transaction performed in a block of the network is validated through a process based on the consensus distributed across all nodes (that is, the devices/users The transactions are the outcomes of the operations that take place among the network's subjects. The concept of blockchain comes from the fact that each block keeps a reference to the previous one using a cryptographic method. Blockchain is not stored on a centralized server like typical online services, but rather on network devices (computers) called nodes, each of which has a copy of the entire blockchain.

Furthermore, two important elements of this type of technology should be highlighted for our analysis: (i) decentralization of consensus and (ii) decentralization of ledgers. The existence of trustworthiness among the individuals participating in any form of transaction and the presence of a central authority may no longer be necessary due to the decentralization of consensus[10][11]. Similarly to the second point, the replication and storage of different copies of different blockchains across network nodes ensure greater system security and equity among users, who can access the same information at the same time, and thus the traceability and immutability of the validated transactions contained in the blocks. As a result, blockchain is a peer-to-peer network in which all network users can trust the system without having to trust one another.

IV. OUR PROPOSED MODEL

We have combined blockchain technology with machine learning algorithms in our suggested approach to give a better security-related solution. By utilizing machine learning, we introduce new capabilities that can serve as the foundation for subsequent implementations of this idea. While Blockchain technology exploits the decentralization of data to offer great security, machine learning is founded on the idea that data should be centrally managed. We attempted to project our model in this paper, showing how we may apply both of them for this specific application.

4.1 System Architecture

The Patient healthcare data is secured using a Blockchain network through which transactions between the patient and the authorized doctor are made as shown in fig.1. The functionality of Blockchain ends here. A new set of patient healthcare data is then fed to the trained model which first filters the data and discards all the personal details and information, then this data is further categorized by diseases. The role of Machine Learning terminates here. This dataset from a hospital can be transferred to other hospitals by using e-mails or by uploading the data set from each hospital on a cloud-based storage system that can be accessed by hospitals and researchers. This sharing of data is very important because the data for each hospital would be completely different. The biggest advantage of using Machine Learning algorithms is to make healthcare data accessible to researchers and doctors for study purposes. Thus, using this model can provide dual advantages with Blockchain providing the necessary security of the healthcare record by allowing secure transactions between the doctor and patient, while the filtered data can be used by researchers and doctors because this

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data need not be secured as it is deprived of all personal information. This data is entirely built to be used for reference purposes.

A distributed and decentralized method of managing and storing medical data is offered by the medical blockchain. With this strategy, the information island created by conventional medical information systems is broken, allowing individuals to focus on their own medical information that is dispersed across many healthcare facilities. Patient renounces all rights to their own private medical information. Before others can access the pertinent medical data about the patient, they must submit a request and obtain the necessary permission. Also, the patient has the right to revoke their consent at any moment. Security of data storage is a key feature of the medical blockchain. Three perspectives—public information, data generation, and data reception—are considered in the analysis of medical data storage security.

The medical blockchain offers a decentralized and distributed method to Blocks containing public information about medical data, such as the store address, the hash value, and the authorization of the data. This open data is accessible but cannot be altered. The patient's record and signature are used to encrypt the patient's public key, and the hash value is signed using hash algorithms to process data produced by medical institutions.



Fig.1. System Architecture

4.2 Implementation of Blockchain

The initial portion of this model's dual blockchain architecture, which was created using Hyperledger Fabric, provides access to health data. The second component of the framework runs all applications and provides all services using Ethereum. Medical data is extremely private and sensitive, so a closed blockchain like Hyperledger Fabric aids in maintaining the necessary secrecy. Public blockchains and permissioned blockchains are the two main categories of

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blockchains. This can be understood by using the example of a user who wants to sell a book to someone at a discount but does not want to disclose this to the wider public. In this case, the seller can utilize permissioned Blockchain to keep the public from learning about the offer. This design makes use of two encryptions method on a Blockchain with permissions. This is crucial in situations where it's necessary to switch the doctor in charge, therefore using Blockchain will make the information transfer simple and secure.

There will be no more data leaks likely in this transaction procedure, and international information transactions can be more cost-effective than the traditional methods to accomplish the same.

A trained model with a test is posted to the blockchain network when a patient asks a straightforward question about their health; the model can forecast epidemics and offer advice to physicians. Natural Language Processing can be used to identify a condition and suggest treatments. On the basis of the patient's symptoms, the trained model can provide professionals with clinical recommendations. In order to predict epidemics, the model has been trained. The algorithm can forecast an outbreak and provide recommendations to the doctor, for instance, if a patient gets a test and the data are uploaded to the blockchain network. The medical blockchain system shares resources, like medical health data, through consensus-based, industry-standard protocols and peer-to-peer propagation techniques. According to the patient's desires, the doctor will decide whether to anonymously share the medical record with the general public for research purposes. The doctor will make a standard match based on the patient's disease type, age, work type, and other factors and add it to the shared centre of the private network if the patient chooses to share.

4.3 Implementation of Machine Learning

Building a new machine-learning model involves two steps. Adding the dataset and modifying the model weights in order to improve model accuracy is the first stage. The second phase involves evaluating the machine learning model's accuracy on distinct or fresh datasets in order to validate it and avoid overfitting.

An excessively fitted model performs well on a given dataset but performs poorly when generating hypotheses for a particular situation. Figure 5 illustrates the machine learning process used in our suggested model.

Once a machine learning model has been trained via supervised learning, it can be used to perform a variety of tasks on the untrained dataset, including prediction and classification.

To preserve patient privacy, the "Bag of Words" technique is used in the proposed model to extract only the necessary dataset while ignoring additional information such as the patient's name, age, address, and other personal information.

The dataset is given, and supervised learning creates a mathematical model of it that includes input and output information. Regression and classification are two applications of supervised learning.



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The security of health data can be improved by combining blockchain with machine learning. Combining the two of them is a rather difficult undertaking. There hasn't been much progress made in this area.

In this study, datasets from different sources, including MedLine, were used to train the machine learning algorithm using supervised learning. To reduce the dimensionality of the data, we will use the "bag of words" algorithm, which will only use the dataset's essential components for the machine learning model's training.

Transactions between the patient and the authorized doctor are made utilizing a blockchain network that secures the patient's healthcare data. Here, Blockchain's functioning comes to an end.

The trained model is then given a fresh collection of patient healthcare data, which it filters to remove all the identifying information and then further organizes by diseases. Here, machine learning's function comes to an end.

The development of 5-G networks and quicker-than-ever data transfer capabilities will promote the adoption of Blockchain, Machine Learning, and other data-based approaches in a variety of industries, including healthcare. Blockchain offers considerable improvements in the management of patient health records as this new technological ecosystem takes shape.

The accuracy of wearable health tracking devices is constantly being improved, and if the data from these devices could produce more accurate and reliable results, there would be a better chance of integrating them with health records to provide more information and to securely share some of these medical data with authorized doctors without actually seeing them.

V. CONCLUSION

There are innovative applications of Blockchain in healthcare due to inherent encryption and decentralization. It enhances the security of patients' electronic medical records, promotes the monetization of health information, improves interoperability among healthcare organizations, and helps combat counterfeit medicines. Different healthcare fields can change with Blockchain technology; in areas like healthcare, digital agreements allowed by intelligent contracts constitute one of Blockchain's most critical applications. It will not be wrong to say that the Blockchain-based Health care model is the future in the healthcare sector and has the potential to change the way healthcare records are managed and secured. The ideas based on implementing Blockchain and Machine Learning are not much explored. Our paper proposes a unique healthcare model which is still in its infant stage but can surely form a base for many more healthcare models to come. There is further scope of improvising this idea by implementing Artificial Intelligence (AI), the Internet of things (IoT), and much more available technology to develop a more comprehensive healthcare model in the future.

REFERENCES

- Chen, Y.; Ding, S.; Xu, Z.; Zheng, H.; Yang, S. "Blockchain-Based Medical Records Secure Storage and Medical Service Framework", Journal of Medical Systems, vol.43, no. 5, 2018.
- [2]. Francisca Adoma Acheampong, Big Data, Machine Learning and the BlockChain Technology: An Overview, International Journal of Computer Applications (0975 8887) Volume 180 No.20, March 2018.
- [3]. Freya Sheer Hardwick, Apostolos Gioulis, Raja Naeem Akram, and Konstantinos Markantonakis, E-Voting with Blockchain: An E-Voting Protocol with Decentralisation and Voter Privacy.
- [4]. Nakamoto, S., et al.: Bitcoin: A Peer-to-peer Electronic Cash System (2008)
- [5]. Pinyaphat Tasatanattakool and Chian Techapanupreeda, "Blockchain: Challenges and Applications"
- [6]. G. Prisco (2016, April), The Blockchain for Healthcare: Gem Launches Gem Health Network With Philips Blockchain Lab, [Online]. Available: https://bitcoinmagazine.com/articles/theblockchain-for-heathcaregemlaunches-gem-health-networkwith-philips-blockchain-lab-1461674938
- [7]. O. Williams-Grut (2016, March), Estonia is using the technology behind bitcoin to secure 1 million health records, [Online]. Available: http://www.businessinsider.com/guardtime-estonian-healthrecordsindustrial-blockchain-bitcoin-2016-3?r=UK&IR=T
- [8]. Jamison, D.T. Disease Control Priorities, 3rd edition: improving health and reducing poverty. The Lancet 2018, 391, e11–e14.



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- [9]. Zarzaur, B.; Stahl, C.C.; Greenberg, J.A.; Savage, S.A.; Minter, R.M. Blueprint for Restructuring a Department of Surgery in Concert With the Health Care System During a Pandemic: The University of Wisconsin Experience. JAMA surgery 2020.
- [10]. He Warned of Coronavirus. Here's What He Told Us Before He Died. The New York Times. https://www.nytimes.com/2020/0 2/07/world/asia/Li-Wenliang-china-coronavirus.html. (Accessed on 10/28/2021).
- [11]. Wendelboe, A.M.; Miller, A.; Drevets, D.A.; Salinas, L.; Miller, E.J.; Jackson, D.; Chou, A.F.; Raines, J. Tabletop exercise to prepare institutions of higher education for an outbreak of COVID-19. Journal of emergency management 2020, 18 2, 183–184.