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SECURE HEALTHCARE APPLICATION FOR DISEASE PREDICTION IN FOG COMPUTING USING BLOCKCHAIN

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ABSTRACT

Fog computing is a cutting-edge computing model that provides highly scalable, latency-aware services to end users who are dispersed geographically. Due to information being quickly analyzed and stored nearby data sources on local fog nodes, it is more secure than cloud computing. The growth of Block chain (BC) technology in recent years has been extraordinary, extremely disruptive, and expanding. BT's open platform stresses data protection and anonymity. It also guarantees data is protected and valid through the consensus process. BC is mainly used in money-related exchanges; now it will be used in many domains, including healthcare; The SHA512 algorithm is used in this work to provide effective Blockchain-based safe healthcare services for disease prediction in fog computing. Cardiovascular illnesses and diabetes are taken into account for prediction. The patient's health data is initially gathered from fog nodes and kept on a block chain. Patient health records were the initial target of the innovative rule-based grouping technique. Finally, utilizing feature selection based on an adaptive neuro-fuzzy inference system, diabetes and cardiovascular illnesses are predicted (FS-ANFIS).On data from actual healthcare settings, a thorough experiment and analysis were done to gauge how well the planned task performed. The performance of the rule-based clustering is examined using purity and NMI metrics, while the performance of the predictions is examined using accuracy. The findings of the experiment demonstrate that the suggested work accurately predicts the sickness. Compared to previous neural network techniques, the proposed work has a prediction accuracy of more than 81 percent.

1. INTRODUCTION

The act of taking necessary medical procedure to improve a person' well-being is a Health Care. Traditional IT health care systems have tribulations like cost, location, continuous monitoring, applications, administrative burdens, processing delays and accuracies. Many healthcare applications have been implemented by using different IT infrastructures .Available IT, health care solution works very well for non-invasive healthcare. In non-invasive application, the medical devices are mounted on the body and they keep on generating organ health related data. This data is captured and interpreted by the devices using various processing and method and accordingly the actions are taken to maintain the patient's health. But there are some critical health care applications which need parametric information like Electrocardiography(ECG), Electromyography (EMG), blood pressure, glucose level sensing, Blood Pressure monitoring, Oxygen sensing, rehabilitation, medication and blood temperature. Based on the data recorded IT support systems will aid in taking decisions about health. But in any case if decision for such critical health care are delayed by one or the other means, then it results in catastrophic situations. If deployed health care systems are not giving responses on time sensitive basis, then SOQ is compromised. In proposed work we intend to improvise the existing IT based health are application in SOQ approach. Long-term technological developments offer considerable opportunities for biomedical innovation and cost reductions, but they also present a barrier to the integration of developing technologies into medical therapy. A significant amount of work is focused on smart healthcare to address traditional healthcare limits and meet rising premium healthcare expectations. With conventional healthcare, biosensors, smart healthcare could be designed and developed as a spectrum of devices, tools, software, facilities, and organizations.

1.1Cloud Computing in Healthcare

Cloud Computing is the internet based computing, meant to provide any sort of computing on demand. The two models which make cloud accessible and feasible to end users are service model and deployment models. Cloud can be deployed as a private, public, hybrid and a community cloud where "as" service models refers to

Infrastructure as a Service (IaaS): It provides access to resources like virtual storage, virtual machine and physical machine etc.

Platform as a Service (PaaS): It provides runtime environment for application, development and deployment tools.

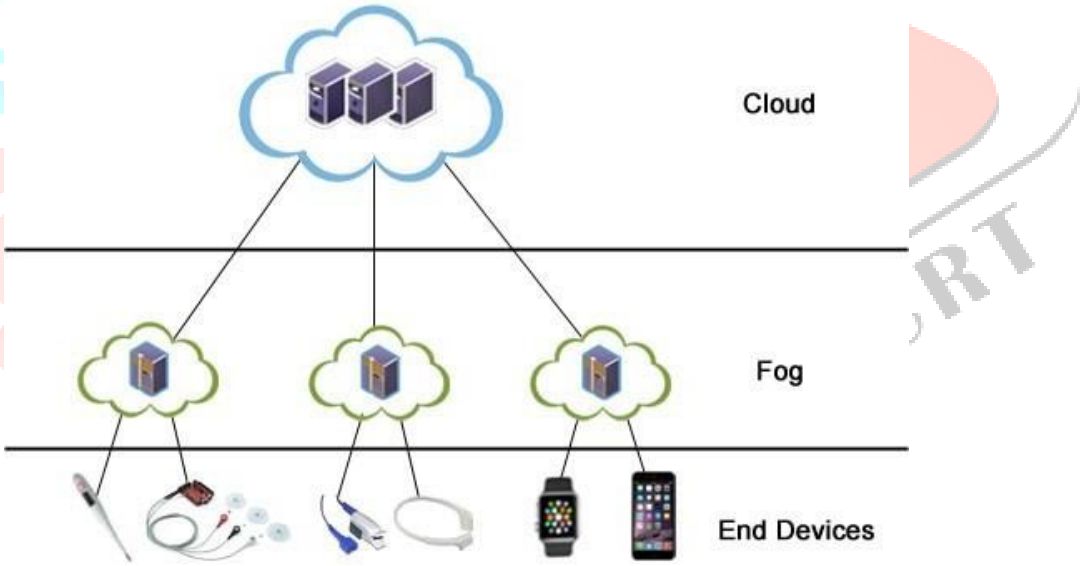
Software as a Service (SaaS): It provides use of different software as a service.

2Fog Computing

It's a distributed computing platform that brings the cloud infrastructure of the network to the network's edge. It helps with data centre and end-user processing, networking, and storage operations and configurations. In both cloud and edge applications, fog computing refers to software specifications that operate between sensors and the cloud, such as smart access points, routers, or advanced fog devices. Fog computing combines agility, processing power, networking protocols, interface flexibility, cloud convergence, and distributed data analytics to satisfy the needs of applications that demand low latency and a vast geographical footprint. The term "fog computing" was invented by Cisco. Fog computing, according to the Open Fog Consortium, is "a horizontal system-level architecture that distributes processing, storage, and communication."

1.2.1 Fog Computing in Health care

Fog Computing, popularly known as Edge computing is then overly paradigm/architecture that provides limited computing storing and network services at the end user devices at user's edge. Simple Fog Computing architecture.



1.2.1 Fog Computing Architecture

The implanted Fog Computing extends the Cloud Computing paradigm to the edge of end users and it is able to perform storage, processing and data forwarding Fog Node/serverisatlayer-2. What ever data gets forwarded by end devices will be first received by Fog Node. This node keeps on processing the data an disable to take actions and also it forwards the filtrated data to the cloud for future use and analysis. It has characteristics [1] like

- **Adjacent Physical Location:** Fog devices are near the user end, and hence they can process the user data with less delay and can be made custom in user's need context. They can use protocols of WLAN too.

- **Support for on-line analytics:** Due to limited capability of processing and storing, Fog devices are connected to cloud servers where they can have on demand real time analytics of live data streams.

- **Service is provided by smart but not powerful devices:** As the Fog Node has limited storing and processing power, it cannot do big data analytics because of its limited processing power and storage, but it can have real time decision making on certain conditions, when it occurs.

- **Supports for various communication networks:** when different sensors connect to internet different protocols are involved. Some of the supported protocols are Bluetooth, Zig bee, WLAN, WiFi,2g/3G/4G,WiMaxandsoon.

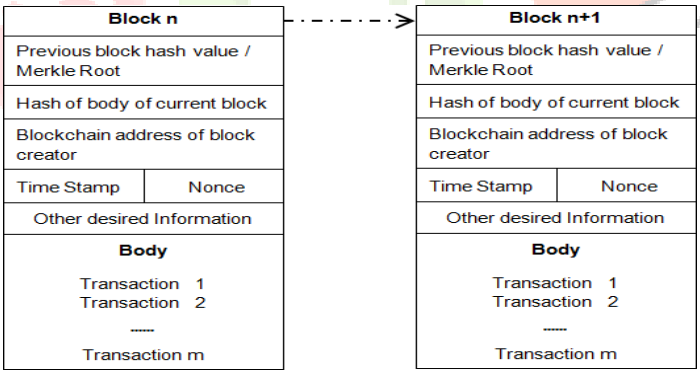
- **Distributed Computing:** Fog Nodes can communicate to other fogs. And cloud sees the environment as a collection of different fogs, i.e., the whole computation needed by user is available via distributed Fogs.

Fog Computing does note laminate the Cloud Computing but of course it will reduce the Cloud traffic at a greater extent and also to access and store historical data, the Cloud Computing is only the option for any applications.

1.3 BLOCKCHAIN

Block chain is a cutting-edge technology and a digital wallet that keeps account of all network transactions and events, and whose integrity is assured by a peer-to-peer computing network rather than a centralized body, removing the risk of a single central point. It's made up of structured documents organized in a block structure, with transaction batches and previous key hashes included.

FIGURE:1.4 BLOCK CHAIN

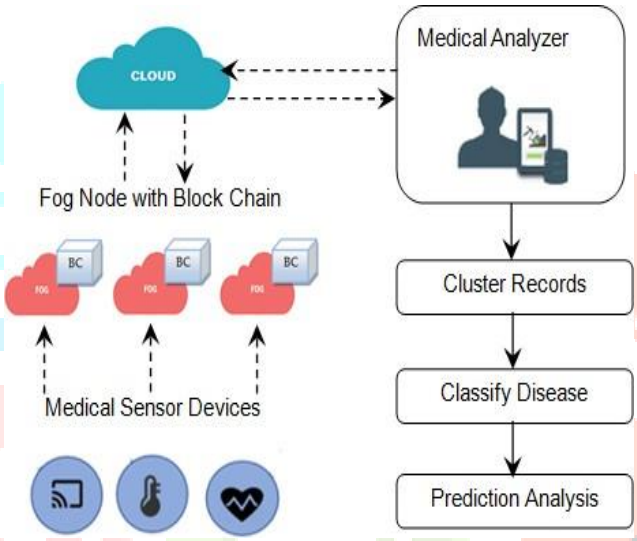


The data on the Block chain network is unchallengeable because each block is chronologically linked. In a block chain network, any user has individual access rights to allow transactions that are amended throughout the framework, which is known as the consensus protocol. A block chain employee the SHA256 hash for transaction insertion. The National Security Agency (NSA) develops that, which is 64 characters long. All transactions are recorded in a block chain network without altering or manipulating the public ledger; both transfers are distributed to various users across the network to transfer and update data; a block chain network may be duplicated to a different venue, such as within the same ability or healthcare distribution network, or as part of a regional or global data exchange system. The data structure of the Block chain is a hierarchical set of blocks, as depicted in Figure 3. Blocks are connected in the form of a tuple with the current block's header storing values such the previous block's hash, Block chain address, and so on.

Every block is made up of two parts: a header and a body. Block number, previous block hash value to maintain chain stability, current block body hash to ensure transaction data integrity, timestamp, nonce, block chain block creator address, and other requested detail are all included in the header. One or more transactions can be found in the block bodies.

1.4 MODEL OF THE SYSTEM

The proposed system model and notations employed in this model are explained in this section. The IoT medical sensors are employed in this concept to collect patient health data. These data are collected by fog nodes and sent to a medical analyzer for analysis and prediction of disease. The system model is depicted in Figure 4. It consists of five different entities. Figure:1.4 model of the system



A. SENSOR DEVICES FOR MEDICAL APPLICATIONS

Sensor devices, whether wearable systems or embedded sensors, can track a variety of human health characteristics. Because of their limited computational and storage capacities, these devices capture a variety of health-related data and transfer it to fog nodes that will be well-managed.

B. NODE OF FOG

It's a basic fog computing platform that can be a network computer that maintains underlying devices with processing resources, dedicated servers, or computational servers. It captures data from medical sensor equipment and saves it in a Block chain-based distributed ledger.

C. BLOCKCHAIN

It's a cooperative network that keeps track of patient health and activity data. Without authorization, no one can access the network. This is made up of a chain of blocks, each of which contains the preceding hash block, status user health.

D. CLOUD

It's utilized for storing things. It holds encrypted patient health information, which can be accessed by an authenticated medical analyst for further processing.

PROPOSED SYSTEM

The following are steps for data study:

- To ensure safe and effective data storage and sharing, a semi-centralized Block chain-based digital healthcare network for the protection and sharing of patient data is introduced.
- The diabetes and cardiac disease patient records are grouped using a rule-based clustering technique.
- Using Feature selection based ANFIS, diabetes and cardiac disease are predicted after this clustering.
- Finally, the model is developed to assess the proposed work's performance.

CONCLUSION

The usage of Block chain in the present healthcare system is critical. It can lead to automated processes for gathering and verifying data, correcting and aggregating information from various sources that are undeniable, resistant to manipulation, and offering protected data with reduced cybercrime risks and system redundancy. In fog computing, this study provides efficient Block chain-based secure healthcare services for disease prediction. Diabetes and cardiovascular illnesses are taken into account while making predictions. In comparison to other methods, the proposed work efficiently clusters and predicts disease. Security and privacy for accessing patient medical data, as well as a hybrid clustering and classification algorithm could be introduced in the future to improve the prediction results' performance. In the current healthcare system, the use of Block chain plays a crucial role. It can result in automated processes for collecting and verifying data, correcting and aggregating information from different resources that are indisputable, defiant to manipulation and providing protected data, with condensed cybercrime chances and which also supports disseminated information, with system redundancy. This work proposes efficient Block chain-based secure healthcare services for disease prediction in fog computing. Diabetes and cardio diseases are considered for prediction. The proposed work efficiently clusters and predicts the disease compared to other methods. In the future, the security and privacy for accessing patient medical data and some hybrid clustering and classification model can be added to enhance the performance of the prediction results.