Smart Healthcare System Using Blockchain Technology

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Abstract- Today's healthcare data is fragmented and not properly kept in one place. However, some records aren't even made digital, which makes research uncertain. Mutually the number of dubious medications on the market and the volume of false insurance claims are rising. Additionally, patients are demanding an infrastructure that offers them the majority of the controls as they become more aware of all the factors and increasingly demanding of patient-centric models. In this research, a blockchain-established intelligent healthcare system is explored that would be able to give real-time data access in a transparent, traceable, and reliable way. Several industries, including finance, manufacturing, e-commerce, education, etc., have been altered by the Blockchain, and it is now entering the healthcare sector. The Blockchain is a distributed technology built on a network of peer-to-peer computers that are not governed by a single central authority. Blocks are the units used to represent data on the blockchain network. Therefore, the advancement of society through healthy and effective healthcare can benefit from systems like blockchain technology.

Keywords:- *Smart System, Healthcare System, Blockchain Technology*

1 Introduction

Healthcare is one of the most critical sectors that need the integration of advanced technologies. Smart healthcare is being made possible by IoT-enabled sensors, electronic health record (E.H.R.) storage, improved data processing algorithms, and metaheuristic optimization techniques. The recent growth of telemedicine and e-healthcare systems has demonstrated the importance and necessity of these developments in the healthcare industry during a pandemic. Although telemedicine and smart healthcare are not the answers to all health-related difficulties, they can be utilized to treat many health conditions without requiring patients and doctors to go about it physically. The telemedicine method will aid in easing overcrowding in both private and public hospitals. A patient who lives in a rural area can access these telemedicine platforms to receive health consultations from various prominent hospitals and top physicians worldwide [1].

With technological progress sweeping the globe, intelligent healthcare, as well as biomedical innovation, have got every time been a most important worry that must be advanced in each way. The patients' support with appropriate nutrition and care is of the utmost significance, along with improving the structure, trust, process, and effectiveness of health care services. People are more reluctant to seek personal healthcare till serious suffering manifests, as the world has observed today. Such behavior is frequently viewed as a portion of over-engagement with the tuned lifestyle framework and customary hectic living. Consequently, the situation would be far additional suitable as well as a simple discussion could be completed on the patient at the proper time as well as within a protected period if a scheme is designed in such a method it actions or notices characteristic irregularities in the health set of a human as well as can statement to the chosen individual health care manager of the somebody. The range of communication among remote methods connected to the internet for data as well as access transfer has increased as a result of ongoing improvements in the Internet of Things (IoT). Therefore, from the education sector to supply chain management, IoT transformed and disrupted practically every worldwide industry. IoT has also performed admirably in the healthcare industry, simplifying diagnostic procedures and effectively monitoring patient

activity. Additionally, the main benefit of IoT that we are concentrating on is that it permits patient monitoring even during inactive hours, which can be quite challenging to perform in the traditional system. Additionally, isolated access to the data and ongoing laboratory analysis reveals a wide range of opportunities for quicker diagnosis and effective treatment.

A number of research studies have underlined blockchain technology's potential for the healthcare ecosystem, and it has newly surfaced as a critical tool in the sector's digital revolution. It is prepared to change how conventional medical institutions and companies have operated in the healthcare industry for many years. Blockchain technology and information and communication technologies (I.C.T.s) are essential for decentralizing and digitizing healthcare facilities. They deliver a cutting-edge, digital healthcare environment to customers and service providers. The areas of patient data contact as well as control, allegations as well as expenses administration, medical IoT protection, as well as research data management, and blockchain applications for healthcare data management can be advantageous for patients, doctors, and healthcare organizations. Healthcare management involves a variety of procedures, such as controlling investments, personnel, patients, official problems, logistics, inventories, etc. Medical systems occasionally include tedious projects linked to patient care that might be represented as a sequence of provisional stages. These are meant to decrease risk, job phases, and overhead for hospitals as well as additional healthcare service benefactors while raising internal controls, compliance, productivity, and efficiency. Multiple medical workflows are defined in this study for various healthcare management application domains. exchange of information and verification for financial transparency and audits. In these applications, medical information is understood, monitored, and controlled through real-time changes to a decentralized, encrypted blockchain ledger. Additionally, it makes it easier for healthcare organizations to prevent illegal access to private data [2].

The technology recently seized control of all access, transactions, and storage management with the introduction of Blockchain. Additionally, blockchain has demonstrated significant capability as well as hold through a range of industries, including retail, resource chain management, finance, and healthcare. The privacy and security of the data is the main problem in healthcare because so many stakeholders frequently use it to pursue their own interests. For instance, one of the parties involved in giving a particular facility to the patient is an insurance provider, who frequently needs access to the patient's data in order to properly evaluate it and design the services. However, it is frequently observed that the firms change the data and leak it. Therefore, this system is a Bonafede solution to safeguard the data from exploitation and uphold a clear sense of trust among the various stakeholders [3].

2 Literature Review

Many researchers have previously worked on blockchain-based healthcare systems. Some of their works are highlighted in this section such as for better-organized management of transactions that Medical Sensors and Devices carry out [4] represented an IOT Model grounded on Blockchain. The MQTT protocol-based architecture that has been proposed can serve as the main connector for attaching the biosensors to the IoT stage. Additionally, the structural design included the Planetary File System (I.P.F.S.), which can filter out state information or block changes when specific operations remain affixed to the blocks to minimize deduplication of the stored operations.

An interactive environment in relation to a healthcare system run by I.O.T. was proposed by [5]. The core of the suggested architecture is reproductive data point absorption from smart wearables and biosensors, followed by some conclusive feedback and simple patient remedies.

In order to provide patients with quicker and more appropriate recommendations, (Badiganti et al., 2022) recommended an intelligent hospital method that integrates sensor effectiveness with human reaction suggestions. The suggestion promotes the practice of RFID, W.S.N., as well as smart vestures, which function in concert over a single platform to carry out specific tasks like intelligently sensing the patient's environment, allocating the patient to a specific ward in accordance with the

doctor's placement requirements, monitoring the patient's movement, and reporting investigation based on the data the system has planned, post-information has remained to upload by the instruments.

In this research [6], made it possible for a Healthcare Information Allocation scheme that is superior to the current organization by permitting the pseudonymity of privatizing the identity of the workers whose information is existing community as well as used by the Medicinal Research Middles. The labor likewise developed the idea of an agreement procedure, "Proof of Interoperability," which enable organizations to set up the system in a way that would facilitate transactions that were smoother and more effective, based solely on the Interoperability of the numerous bulges on the network. A three-level architecture was also proposed by the author, consisting of a Web Platform for patients to upload their health data and maintain an admittance organization system, a Mist Middleware for maintaining data retrieved after the Web Platform by means of REST API services, and a Smart Contract for execution the required registering of fresher blocks and supporting the general agreement of the Vertices across the Blockchain.

A Parallel Healthcare System built on a Blockchain network and based on the A.C.P. Approach is advanced by [7] . The framework illustrates the use of a Similar Healthcare Scheme based on the actual healing expertise as well as the involvement of doctors as well as patients, then the use of an Artificial Intelligence scheme that selects the execution of Virtual Doctors as well as Virtual Patients to go through as well as define a Similar method in dictating the action that must be provided by doctors to the patients. The computational experiments section, which makes use of the scientific relevance as well as expertise of the other four segments to establish the basic clinical as well as investigational technique to be applied to the patients, is the second component of the ACP strategy. The third section allows the parallel operation of the software-defined healthcare system and the real healthcare system by regulating the communication among real doctors and simulated doctors. The central tenet of the parallel system is that the patients will be the subjects of computational experiments conducted by artificial or software-defined doctors founded on the topographies that have remained nursed into the scheme; the outcomes that the Reproduction. Doctors will ensure that their work is effective and further validate it. A Blockchain Network comprising a group of doctors, hospitals, patients, healthcare associations, as well as medical researchers was also added to the Complete Healthcare System. This network can be utilized for data review and sharing.

The numerous blockchain designs in the current environment were covered by researchers in their paper [8]. They discussed the fundamentals of all blockchains and how to preserve, validate, and store data using them in the healthcare industry. Additionally, the consortium blockchain was identified as the method for storing healthcare data that worked primarily out of the box. Blockchains with access control granted to the node owner and the miners are considered acceptable consortium blockchains. Additionally, the consensus theory of the majority of stakeholders or blockchain network nodes underlies how the consortium blockchain operates.

A cutting-edge blockchain design was put up by researchers [9] aimed at the scheme controlling e-health care schemes. The growth of an interoperable and flexible networking system for the proper as well as efficient distribution of health care information among various shareholders was the work's main concern. Furthermore, the cutting-edge blockchain architecture adheres to the major auditing approach used by stakeholders like insurance firms, hospitals, as well as doctors to determine the reliability as well as the validity of a recording that has been published on the network.

Researchers [10] created a condition look after blockchain that satisfied the secrecy law made possible by HIPAA by controlling the information that contained patient demographic as well as cultural information. The experiment also demonstrated a blockchain network's generative architecture, which consists of 3 different types of networks: an urgent care network, a referral network, as well as a primary care medical doctor system.

For remote places where connectivity is a major challenge, the authors established and created an innovative approach for health monitoring and supporting the fundamental application of

telemedicine technology. A portable technology for sensing patients in remote regions was created as a result of the effort. The system includes a pulsation oximeter, an ECG, and an EMG. The scheme as well as the ability to operate together connected and off modes allows the small-scale information packages after the radars to be saved in a resident record before being transferred to the medical experts while they are online or on the road, depending on what is most practical at the time. The system also considered how doctors might practice using a multi-channel architecture, where they might take over patients' situations from Remotely Sensed Centers.

To share data and work together with the Blockchain Architecture, the authors incorporated a Blockchain Network. The system outlined in the paper generally aimed to provide interoperability between a number of entities, including patients, doctors, healthcare suppliers, as well as health assurance firms, in the distribution as well as the cooperation of health data. The patient's wearable gadget is attached to a network or cloud database that houses all of the patient's data. A significant amount of data enters storage every day, thus the work suggests grouping the data into batches and storing them in a Merkle tree-created design for effective and seamless information handling. In order to obtain services or insurance estimates, the patient may share information with healthcare providers and insurance firms. The system at work out was designed to be user-centric, with the patient having sole discretion over whether or not to share their data. When it comes to health investigation as well as the conservation of individual medical information, where data security, as well as secrecy, are major concerns, this kind of technology can be quite useful.

Most of the approaches have been used while employing and constructing several smart as well as intelligent frameworks like machine learning approaches [11-21,37], Fuzzy Inference systems [22-25], Particle Swarm Optimization (PSO) [26], Fusion based approaches [27- 32] ,cloud computing [33-36], transfer learning [38] and MapReduce that may provide assistance in designing emerging solutions for the rising challenges in designing smart cloud-based monitoring management systems.

Most of researchers have tried to improve the health care of patients using machine learning techniques [38,40-45,52-53] empowered with blockchain technologies [48-60-63], cloud computing [46,51,56-58],Internet of things [54,55-59],smart cities [39,47,49-50]but still it needs motivation for the future directions to improve the healthcare system.

3 Proposed Methodology

Healthcare is one of the many areas where blockchain is being used to provide innovative solutions. It can be used in the healthcare industry to communicate and maintain patient data among clinicians, medical facilities, and diagnostic laboratories. Apps built on the blockchain can precisely identify severe mistakes in the medical sector, including ones that could be fatal. It can therefore improve the effectiveness, security, and transparency of sharing medical data in the healthcare industry. While collecting knowledge and improving the analysis of medical information, this cutting-edge technology may be useful to medical facilities. In this study, machine learning is utilized to make wise decisions and protect healthcare records using blockchain technology. This allows for real-time disease prediction. Blockchain is essential for controlling fraud in clinical trials and enhancing the effectiveness of healthcare data. It can provide a distinctive data storage pattern at the greatest level of security and lessen the concern about data tampering in healthcare.

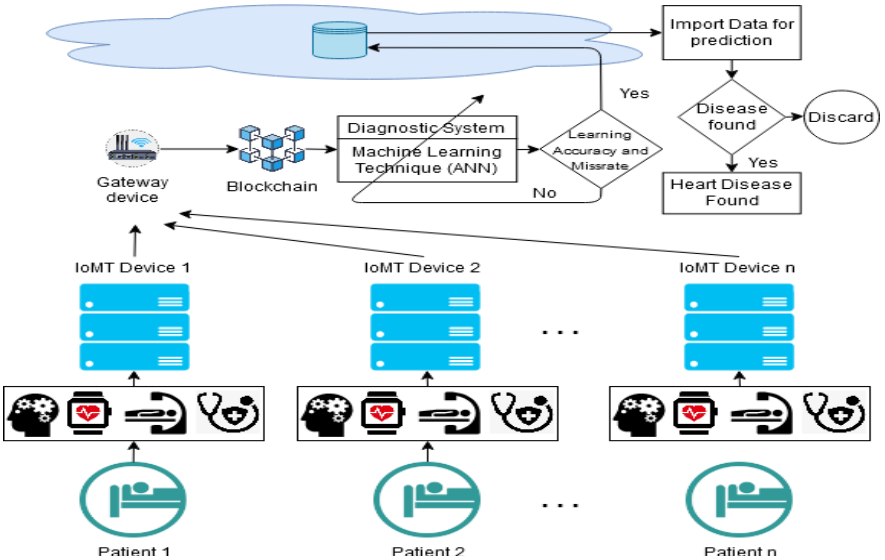

Figure 1: Proposed Methodology

Figure 1 shows the methodology of this proposed research work. It is described that the patient healthcare data is sensed through the digital medical devices via IoMT and forwarded to the gateway device. The gateway device collects data through IoMT devices and is passed to the blockchain layer. In the health service, the blockchain layer is utilized to store and share patient data amongst hospitals, diagnostic labs, drug companies, and doctors. Public blockchains can precisely detect serious errors, including potentially deadly ones, in the medical industry. After Blockchain, the data is forwarded to the diagnostic system, where a machine learning-based ANN approach is applied to diagnose the disease and test whether the learning criteria are met. In the case of No, the diagnostic system process is retrained, whereas in the case of Yes, the trained outcome will be stored on the cloud. After this process, the oriented development will be imported from the cloud for diagnosing purposes, checking whether the disease is found or not. The process will be discarded in the case of No, whereas in the case of Yes, the message will be displayed that the disease is found.

4 Limitations and Future Recommendations

IoMT has been adopted in different applications and provides additional support for the healthcare system, such as patient monitoring. Today's healthcare data is fragmented and not properly kept in one place. The proposed model can overcome these smart healthcare systems in this research using blockchain technology. In the future, Blockchain technology may potentially …. progressively facilitate financial transfers between healthcare facilities and patients, particularly for small payments. Therefore, such systems as blockchain technology can be careful substantial in uplifting civilization with proper and well-organized healthcare.

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