Blockchain based Online ECG Monitroing for Patients using IoT

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***Abstract*— In the Blockchain network, the key terms such as Privacy and security are important and challenges in the Internet of Things. In this paper, we proposed a new Internet of Things layered Blockchain network: all real time data is stored with the privacy and security process and layered identification. The proposed projects deal with cloud supported Internet of Things systems and are implemented and executed. Nowadays there is growth in advancement for real time application in health care industry over the past years. The proposed solution in this paper is a new blockchain- based architecture with Internet of Things for the designing of an e-health monitoring system. The aim of this paper is to use a health kit that can store suitable data online to understand the situation of patients in present conditions by using the concept of Internet of Things and blockchain technology. The digitalized data are stored as e-health records with advanced technology. In recent years, the Blockchain and IoT bring more advancement in the healthcare industry. There is a major challenge in accessibility of getting real time data provided by sensors for any patient in critical condition in our blockchain based application. The proposed system aims to exchange health information on a block chain platform to build an online health care system. In our project, the blockchain network which consists of patient health data usually collected from multiple sensors for which represent the status of present patient condition in all aspect. We are transferring the data securely by using a proxy re-encryption scheme from patients. After encryption, the system stored all Internets of Things data in cloud storage. There is a smart contracts method for accessing data by patients with network administrators so that they can avoid the involvement of third parties. The third party data requester or real time patients with smart contract can view their all data records in our blockchain network and get their pharmacy data at any time. For secure data logging and processing, the IoT processing and transactions of data are recorded into blockchain networks. By using cryptographic hash functions, this proposed system provides high security and flexibility for storing and processing data.**

Keywords — IoT; Blockchain; Hash algorithm; ECG, Raspberry-Pi

I. INTRODUCTION

The Internet of Things (IoT) is an emerging technology which has great technical, social, and economic significance. Current predictions for the impact of IoT are very impressive. Because the implementation of IoT technologies is rapidly increasing, it must be included in all application processes including communication, E-health monitoring, Networking and business development. The blockchain and IoT based network provides a hyper connectivity concept in which each individual can access a network for communicating with each other from remote locations effectively. The Raspberry PI kit with several health related sensors are connected largely by advancement of Information and Communication Technology (ICT). Our proposed system provides data security, collects online data, and provides necessary support through network activities. Fatal diseases are increased in recent days even though several health facilities available in society. So Patients are need to face these fatal disease in nowadays and visit different hospitals for treatment regularly and not care about their health records and no source option for keep and track the record properly every time. As a result, patients can get medical prescriptions based on providing online data in blockchain networks in an uneven manner and also data is secured in networks for supporting patients. Each task assigned for getting patient data through IoT within the time and provides solutions based on data by network are done by this blockchain network. The functionality of storing, securing and retrieving online health data is important task and exchanging of health record data between blockchain networks is major challenges in health care industry. The patient cannot retrieve data from network anywhere anytime. The usage of IoT applications provides rapid growth of wearable IoT technologies and also gives flexibility and accessibility for patients to retrieve their needs through the network. Thus the proposed project facilitates the collection of E-health data, integration, and harmonization by using Blockchain and IoT technology. These capabilities are amplified by the ability of DLT to overcome the weaknesses and vulnerabilities of today's client/server cloud IoT models, such as security, privacy, and traceability, by providing a shared data, Encrypted process for security, and peer-to-peer networks based database ledger.

II. RELATED WORK

Nowadays, Blockchain technology based storing data is done by several research people. The security of storing data related to hospital information is mostly done by Blockchain technology. In past years, the hospital data of each person was stored in private copy files in systems and files. The real-time processing of online health data is more critical and makes several issues on storing real time data. Data for medical drugs, Biomedical application based online data, analyzing data related to brain, spinal cord, nerve cell, electronic data based on diagnostic, Electronic health records, activities based on health data related tasks are needed in online health data applications. MedRec is one of the applications which include the blockchain based application to solve the problem such as flexibility in storing online data, continuous ability to send and receive data among the interconnected networks, access in retrieving medical data, etc. The storing online data from health monitoring systems through blockchain is done by MedRec. In the Decentralized Medication Management System (DMMS), a hospital assistant monitors patients in physical mode and writes a details or prescription based on data obtained from physical mode. But there is no security provided for stored data and patients are not able to retrieve their hospital data at any time. There is a need for all medical stake records under security control which includes confidentiality, availability and privacy. That's why our project details a blockchain based network to maintain automated electronic health records for monitoring patients. Under blockchain technology Health monitoring systems provides fast communication with encrypted stored data and precision to be integrated, and health monitored stored data can be accessed by patients at any time. And also, our network provides the working condition of network with sensor owner and they give access to third party person who join in our network for retrieve their health record for their medical treatment. Our network which manage sharing data with security like encryption process, providing data for patients at any time, handling data transaction. Blockchain ensures network participants to engage directly with doctors with secure data transactions. The distributed ledger of blockchain provides the data owners to monitor the data transfer among network participants.

III. PROPOSED WORK

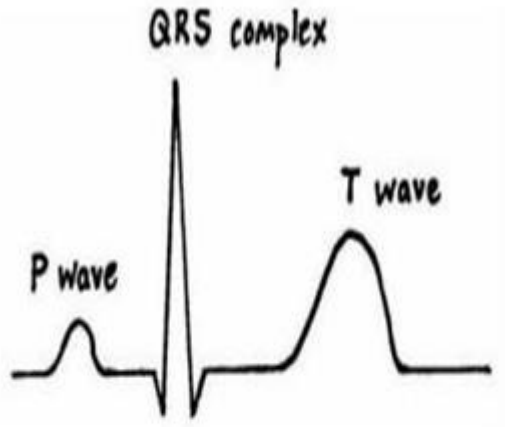


Fig.1 Electrocardiogram (ECG) Signal

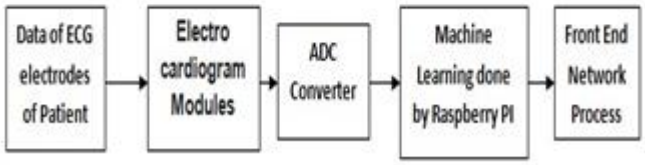


Fig : Block Diagram of ECG based Health Monitoring System

The above figure shows the basic block diagram of ECG based proposed health monitoring system in which each step consists of different integrated technology which provides fast online communication, accuracy in data transaction. The proposed model consists of several layers includes measuring real time data in application layer, blockchain technology based service layer, Encryption and Decryption based cloud network layer and IoT based physical layer. The IoT layer consists of communication link, data storage and measuring real time data from health monitoring devices. This project work provides facilities for patients to utilize technology for power handling their health data, storage, retrieves their data at any time from our blockchain database. The main importance of node in blockchain network provide independentcomputer which have capability to record online health data, share fom one person to another person with permision from authorities and synchronize transaction in corresponding networks.

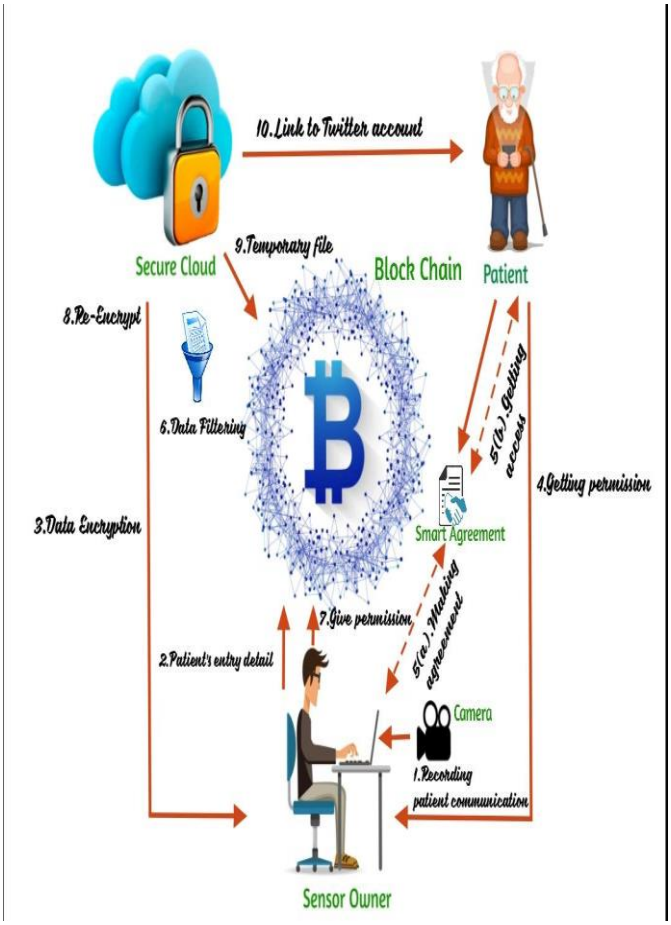


Fig: Proposed Architecture

The real time health records are accompanied and shared are kept in network by the distributed ledger technology. Every patient can share their online health records throughout blockchain network and can be accessed by patients and their corresponding doctors can access the corresponding data at any time. The distributed ledger technology can store all patients' data and secured all sensors information by encryption process. In our project work, the health monitoring sensors such as Electrocardiogram sensor, Electromyography sensor, Sphygmomanometer, Body Heat temperature sensor and some other sensors for measuring data of patients needs such as reading heart rate, reveal nerve dysfunction, muscle dysfunction, measuring blood pressure etc.

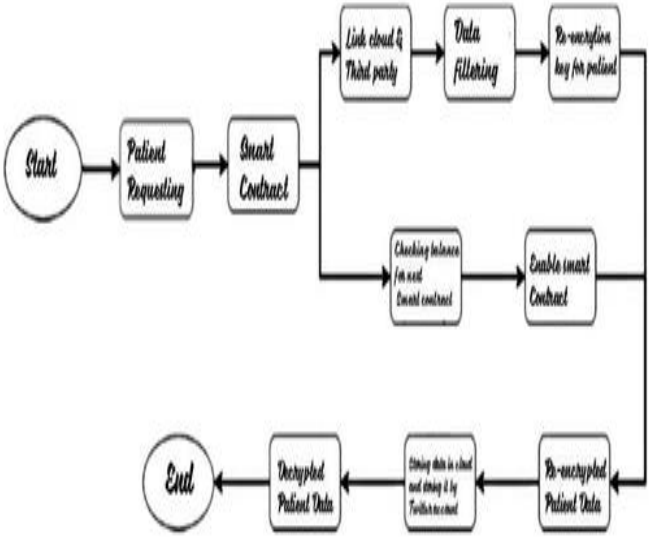
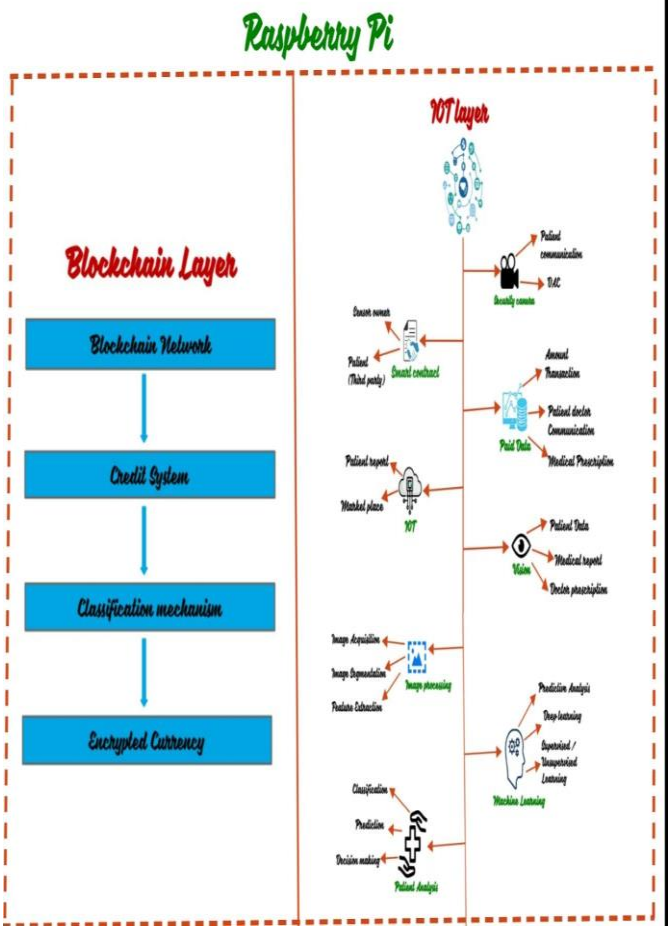


Fig: Flowchart for Patient's Data Re-Encryption

Every time the blockchain network updates the real time data of each patient and shares full health report of Patients in encrypted form in blockchain network. This project consists of four stages such as log creation stage, patient- accessing permission stage for updating real time health records, data sharing stage and viewership stage. The data which is required to submit in an online network to be ensured by the system for its correctness.



The data transaction identifier helps the users get solutions for their needs by providing facilities in networks. In the proposed work, blockchain network is used as a main part of health monitoring data. The smart contracts in blockchain are designed and implemented by the proposed system.

IV. EXPERIMENT AND RESULTS

The mainframe of health monitoring application of the proposed work is categorized into two frames: one is front-end window and another one is back-end window. In our proposed system, the implementation and experimental work are carried out by Raspberry PI and memory and online cloud network. The Python version 3.8.4 is used as software for our proposed system. The Python IDLE is used for creating several blocks and algorithm for hashing function to encrypt and decrypt the data for security for each block, creating a chain loop of blocks with index and online data are stored in database cloud server with cryptography. Front-end GUI implementation is developed with HTML and PHP. The application of the front end GUI contains information to get / write from users such as user login with smart contract, upload records of online health data and view the prescription for given records.

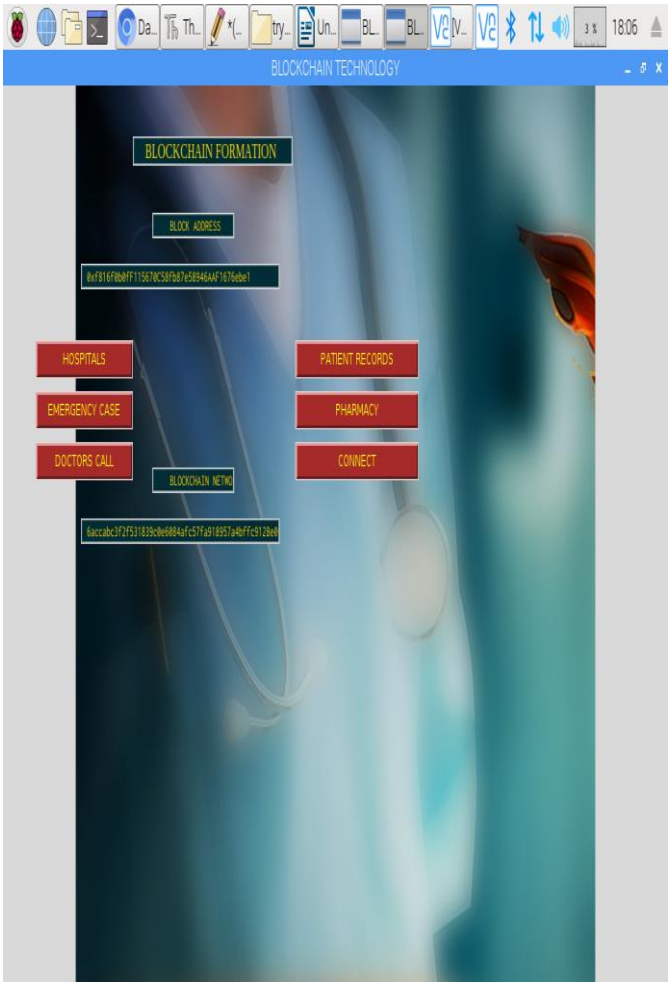


Fig : Patient entering network after smart contract

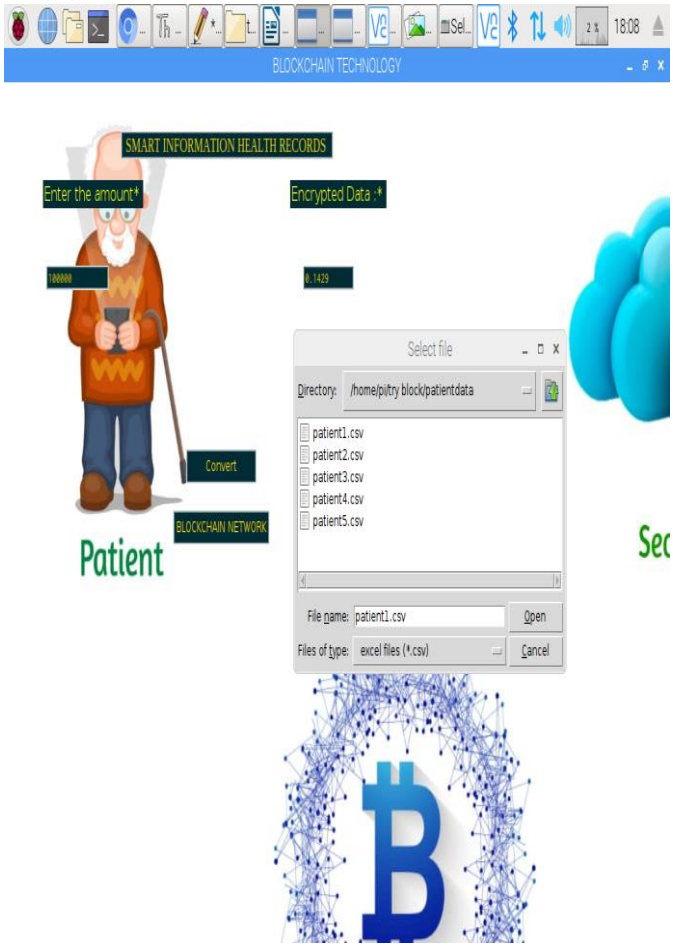


Fig: Patient's can access Prescripton file at any time

Fig: Doctors can monitor the sensor value through ThingSpeak

The performance of the proposed main frame block chain with smart contracts has been evaluated by conducting a rigorous experiment part. Initially the login process was formatted and described as follows. All patients must enter through a smart contract of the proposed system to have this login process. The registration page for patient dashboard and doctor dashboard have been created as described. The complete data of each patient is stored through an online interface. Once the patient does complete the login and registration entry, then the proposed system allows the patient to enter the network by proper authentication with patientID, and allows the patient to enter several data samples for testing the environment. The sensor owner provides a smart contract with patient for entering blockchain network, the patientID exists. When they paid amount as per smart contract for every visit to Doctor for their treatment, the patient have access to enter into network and they have access to enter their health records and retrieve their prescription as per health record from concern Doctors.

PERFORMANCE EVALUATION

The process of checking utility of resources, CPU and memory for a particular time period of a proposed block chain system is called Resource utilization. The time period for measuring success by the amount of time requesting a contract to take place and receiving response from the network framework is called Contact response time. The ratio of measuring success by valid transactions committed by a network for a particular time period is known as System throughput. The time taken for processing data transactions in a blockchain network is called latency.

CONCLUSION

The online patient data transfer through blockchain network has done its potential to keep patient health data record management in a safe, encryption process and secure cloud service. In our proposed system, the complete project provides the safety, security and flexibility for health monitoring patient records of the proposed with blockchain network management. Our network allows patients to operate devices for displaying their records and get proper treatment through blockchain networks. The network provided to achieve efficiency, flexibility, security and access data in any time for patients. The several patients' data can be monitored at same time for providing proper treatment to patients in an effective way. The throughput and performance of the system can be improved in our proposed system and also Hash function for data security provides good communication and transaction between patient and networks with less resource usage

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