# Improving Data Security in Healthcare Systems using Block chain technology

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***Abstract:*** *The health care services industry is always showing signs of change and supporting new advancements. One of the predominant requirements in today's health care systems is to protect the patient's medical report against potential attackers. Hence, it is basic to have secure information so that the authenticated people only have to obtain their medical report. Block chain technology is one of the upcoming research fields with various advances especially for the purpose of securing documents or reports. The proposed system utilizes block chain technology which has a distributed approach to grant security in accessing the medical report of a patient.*

*Keywords:*** Block chain, Healthcare, Medicine, SHA**

## 1. INTRODUCTION

The rapid revolution in digitalization brings various improvements in almost all the fields. It also impacts the healthcare by generation of massive electronic documents about patients. Hence data protection becomes a crucial concept for healthcare which is achieved using the upcoming technology called Block chain. The block chain technology is responsible for storing and distributing data with data privacy, security and integrity in healthcare. Block chain technology has attracted considerable attention from industry as well as academics over the past few years. A block chain technology is identified as a distributed ledger technology for peer-to-peer network digital data transactions that may be publicly or privately distributed to all users, allowing any type of data to be stored in a reliable and verifiable way. With the progress in electronic health-related data, cloud health care data storage and patient data, privacy protection regulations, new opportunities are opening for health data management, as well as for patients convenience to access and share their health immensely valuable to any data-driven organization, especially in healthcare where block chain technology has the potential to resolve these critical issues in a robust and effective way. Healthcare and medical data sharing is one of the major and important steps to improve the quality of healthcare providers and also to make healthcare system to be smarter [1].

There is no option for managing multi-institutional life time medical records in Electronic Health Records (EHRs). The data of the patients were available across various organizations and thus the patient's health data are placed in a scattered manner. Due to this reason, the patients can lose easy access to their past data. Record maintenance can prove quite challenging to initiate as patients are rarely encouraged and seldom enabled to review their full records. Interoperability challenges between different provider and hospital system pose additional barriers to effective data sharing. Health records are fragmented and there is no coordination of data management and exchange of data which results in non-cohesive data provision to the patients. The data providers and also the patients may face significant difficulties while data retrieving and sharing and also encourage health information blocking [2].

## 2. MOTIVATION

The conventional method of maintaining medical data records are paper-based and it is complicated to keep track in order according to patient's health status. Also the results may have some errors which lead to providing maltreatment to patients. With the power of information technology these errors can be avoided by the introduction of EHRs. Electronic accesses to health records enable physician practices to significantly improve quality of treatment. EHRs assist for better disease management that plays a significant role for increased levels of preventive care. The digital records also enable to integrate with various service providers of patients and increase collaborative effort. Thus EHRs gain better role among healthcare community. Block chain technology rise today is used to secure, share and store HER data within and across various medical institutions. Using this technology we can provide personal data privacy, data sharing and patient enrolment in a better secure manner [1].

There are a number of technologies and application frameworks for supporting healthcare data such as MedRec, a record management system is proposed to handle EHRs using Block chain technology. MedRec manages authentication, confidentiality, accountability and data sharing while handling sensitive information [2]. The authors tried to make MedRec as an interoperability layer that can be build using open standards. Emerging technologies in healthcare is discussed in [3]. A systematic review of research in the application of block chain technology in healthcare is studied in [4]. The clinical applications of Artificial Intelligence is studied in [5], the work [6] explains how far Healthcare analytics aids in reduce the cost of treatment, predict outbreaks of epidemics, avoid preventable diseases and improve quality of life. But it is not confirmed the data using in those techniques are secure. Block chain technology has the potential to address these challenges. More research is still needed to better understand and utilizing the block chain technology in healthcare.

## 3. SYSTEM DESIGN AND METHODOLOGY USED

The entire system must follow the workflow as mentioned in the Figure 1. There are three different roles for the entire system namely: i) admin, ii) doctor, and iii) patient. The authentication of accessing the medical records is different for every role.
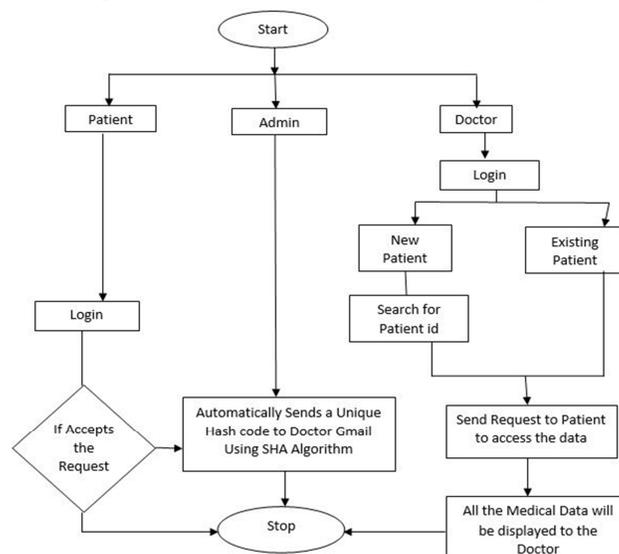


**Figure 1. Flow diagram of Health care data security using Block chain Technology**

### 3.1. Admin

The main task of Admin is to enter the data in the form of blocks. After every patient consulting to the doctor, all the medical data are again updated to the respected blocks. The other main job for the admin is to send a unique hash code to the doctor's mail ID using SHA algorithm.

### 3.2. Doctor

The doctor can approach patient in two ways. Every patient has one unique number. If the patient is new one then doctor will search for patient directory by using patient number then he will send request to the patient. If the patient accepts the request then all medical data will be displayed to the doctor. Then the doctor will analyze the medical data and diagnose the patient.

### 3.3. Patient

The patient has his or her own username, password and patient identification number. To know his or her details, he or she can enter into the system using authenticated username and password. If the doctor sends a request to see all the encrypted data of the medical reports regarding patient then the patient will accept the request of the doctor. After patient's acceptance a unique hash code will be send to the doctors mail ID to give access to the patient medical data.

### 3.4. User Registration

The registration step is unique for every role. Every person has their unique password and username.By using their username and password they can login to their portal. Register as user by providing first name, last name, user name and password, etc.After registration and login user can access their medical data.

### 3.5. Healthcare data

Patient healthcare data like height, weight, blood pressure, temperature, heart beat rate, disease symptoms will be given as input. The patient data entered will be encrypted and saved into the system. For encryption, block chain crypto system algorithm is used.

### 3.6. Block chain crypto system algorithm

Each patient data will be encrypted using block chain algorithm based on cryptographic technique. For this purpose, SHA algorithm is used which is based on the hash function of MD4. Cryptographic hash algorithm produces unique and irreversible hashes.The larger the number of possible hashes, the smaller the chance that two values will create the same hash. The data set given into SHA function will result in a hexadecimal string of alphanumerical characters 40 digits long. Encrypted data from the system is shown to appropriate doctor and patient with decrypted format. Every time a unique hash value is generated by using SHA algorithm. Hence the data is more secured due to this property of hash value generation. The process and implementation of SHA are explained by following steps:
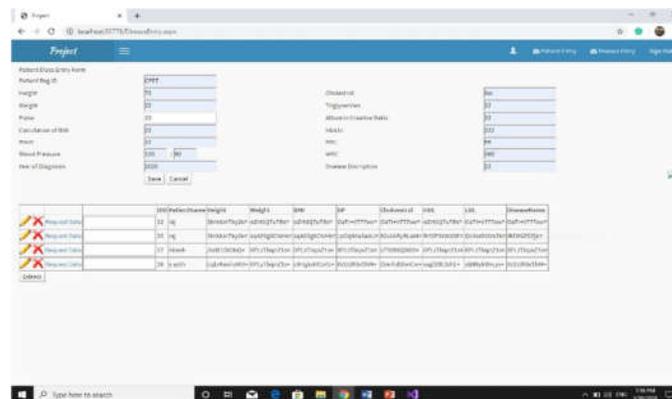
Step1: Algorithm takes the input text and splits into an array of the characters ASCII codes.
Step2: It converts ASCII codes into binary.
Step3: Zeros are padded to the each bit until they are 8 bit long and join them together.
Step4: The binary message are padded with zero until its length is 512 mod 448.
Step5: Take binary 8-bit ASCII code array from step 3 and get its length in binary.
Step6: Zeros are padded until it is 64 characters.
Step7: Append to your previously created binary message from step 4.
Step8: The message is broken into an array of chunks of 512 characters.
Step9: The chunk is again broken into sub-array of sixteen 32-bit words.
Step10: By looping all sub-arrays extend each array to 80 words using bitwise operations.
Step11: Initialize some variables.
Step12: By looping through each chunk do bitwise operations and variables reassignment.
Step13: The resulting variables are converted to hexadecimal values.
Step14: The hash value is obtained by appending hexadecimal values together.

A sample example of hash code generated is F5963E5E-A321-49C8-B53A-A657506FA9F5. The input for the hash code is patient data in the form of text. Using the above 14 steps, it is converted into 40 alphanumerical characters. Any kind of input can be accepted whether it can be text or image or numbers.

## 4. SYSTEM OBSERVATION

The first step is that the doctor has to register in the system using username and password. To access patients' data, the corresponding doctor has to enter into the system using authenticated username and password.

Patient health care data like height, weight, blood pressure, and temperature and heart beat rate are tested and saved into the Database. After saving all the medical data, they are encrypted using advanced encryption standard. If any new disease has to enter then doctor can click on the disease entry field and he can add the new disease.



**Figure 2. Medical data of the Patient**

The doctor after login, he has two scenarios. If the patient is existing patient then he will request the medical data of the patient by clicking on the request button. The doctor request is send to the corresponding patient. If the patient is new patient then doctor will search in the other patient directory using patient id and sends the request to the patient. If the patient accept the request of doctor then automatically an alphanumerical hash code will send to the Doctors Gmail.
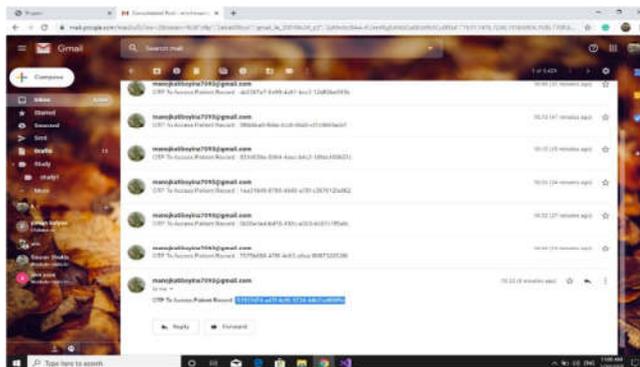
**Figure 3. Generation of Unique hash code**

After the unique hash code sent to the doctor's mail, he or she can copy the hash code and paste it in the requested data field and then all the encrypted medical data will be decrypted and then it is visible to the doctor. He or she can analyze all the medical data and diagnose the patient disease.
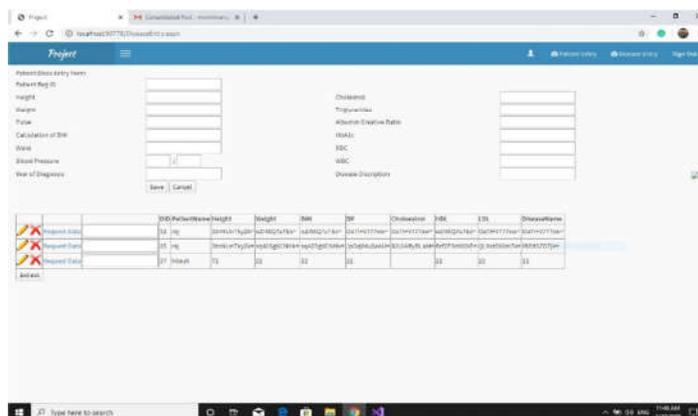


**Figure 4. Decrypted data of the Patient**

# 5. CONCLUSION

Block chain is relatively a new technology which is in its nascent stage. Its huge success in the form of Bit coin has certainly raised the bar of expectations. This work gives an implementation of securing medical health record and it can also be used for integrating the same to different healthcare institutions. In coming years it is possible to visualize block chain disrupting the healthcare industry and with that there will be boost in the healthcare app development using the block chain technology and it is sure that block chain will make healthcare sector swift and secure than ever in the coming future.

# REFERENCES

[1] *SeyednimaKhezr, MdMoniruzzaman, AbdulsalamYassine, RachidBenlamri, Blockchain Technology in Healthcare: A Comprehensive Review and Directions for Future Research,Applied Sciences, 9, 1736, 2019.*

[2] *Ariel Ekblaw, Asaph Azaria, John D. Halamka, MD, Andrew Lippman, A Case Study for Block chain in Healthcare: "MedRec" prototype for electronic health records and medical research data, IEEE Conference on Open & Big Data 2016.*

[3] *Matthew N.O.Sadiku, YogitaP.Akhare and SarhanM.Musa, Emerging Technologies in Healthcare: A Tutorial, International Journal of Advances in Scientific Research and Engineering, vol.5, Issue.7, July 2019.*

[4] *Cornelius C.Agbo, QusayH.Mahmoud, J.MikaelEklund, Blockchain Technology in Healthcare: A Systematic Review, MDPI Healthcare, April 2019.*

[5] *Jeff Mason, Andra Morrison, Sarah Visintini, An Overview of Clinical Applications of Artificial Intelligence. Ottawa: CADTH; Sep 2018 (CADTH issues in emerging health technologies; issues 174).*

[6] *Swarna Latha Garapati, Dr.Sridevi Garapati, Application of Big Data Analytics: An Innovation in Health Care, International Journal of Computational Intelligence Research, vol.14, No.1, 2018.*