

HealthStack- A Decentralized medical record storage Application

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Abstract— The aim of this study is to design and develop a blockchain-based web app called HealthStack to maintain accurate and complete medical records of patients, to help doctors to fetch previous medical history of the patients, to assist user to find out the disease he or she is suffering from and much more. For medical services, secure data storage is one of major concern for people. This problem can be resolved by developing an app using a blockchain technology having the features of decentralization and verifiability. Development of this app doesn't involve any kind of dependency on third-party.

Keywords— *Blockchain, Decentralized, Disease prediction Health IT, Medical records.*

I. INTRODUCTION

Health Information Technology (Health IT) is a broad term that describes the technology and infrastructure used to record, analyze and share a patient's health data. Various technologies include health record systems, including personal, paper and electronic; personal health devices, including smart devices and applications; and finally, to share and discuss information to communities. Some of these techniques can tell if a patient needs to take a diet, and most of the time Golo's diet is what they need to do or take a gynecological pill for gynecology, as most men do.

Health IT helps in providing better care to patients and achieves health equity. It supports patient data recording to improve healthcare delivery and allows analysis of this information for health services and government agencies. It further improves healthcare delivery, improves patient safety, reduces medical errors, and strengthens interaction between patients and health care providers.

It has been found that there is a need for reliable and inexpensive medical record software in low- and middle-income countries (LMIC). Health IT use in medical clinics not only improves the quality of health care, provides accurate patient records, but also enables clinicians to better understand the patient's medical history. With an extensive patient history, physicians are empowered to treat diseases and prevent excessive use of drugs that can be fatal. Without a medical record, the physician has to rely on the patient's memory, leading to a false medical history due to memory, complex drug names, and diseases that affect the patient's memory.

This motivates us to design and develop Health Stack app. And the objective of this paper is to have a secure ledger for storing sensitive medical information on a blockchain server that provides critical data analysis, such as a specific area, age and gender, such as a common disease, which can

be used for the development of any country. This ensures that any patient's medical, treatment, medication and vaccine records are tied to his Aadhaar card so that previous reports no longer need to be stored. Any physician and his family member can access this crucial information. Personal details & Medical history of a patient will be stored through Block chain to ensure Security and decentralization. Data Analysis can be employed to get the overall health condition of citizens of the country. A doctor can access his patient account after scanning his Aadhaar card through his phone and can update or add a medical prescription along with his reports. This will help other doctors and his family member to track the medical history of the patient. This application will have following two interfaces,

1. User Interface

User Interface is used by Patients. They can scan their Aadhaar card to check their medical history, search medicines according to symptoms they are having, chat with bots to ask any health-related questions and to see prescription given by any doctor.

Here are some of the features that are available in the user interface

1.1 Chat with Expert a Chatbot build using Machine Learning Algorithm is integrated on the landing page itself. So, if the user is having any type of confusion or want to ask about the disease he is suffering from, he can ask by typing the symptoms. Along with this he will be shown the medicines and Diet he should take.

1.2 Scan Aadhaar Card Any user can scan Aadhaar card of his own or any family member to check the medical history of the person, the disease he is or was suffering from, the treatment he has gone through and what are drugs & vaccines he has intake.

2. Professional Interface

The professional interface is used by doctors. After registering on the application doctor can scan the Aadhaar of any of his patient and see his

medical history, previous treatment records, previous drugs & vaccines records and add new prescriptions or treatment record.

2.1 Registration to access the application as "Doctor", a person needs to fill a registration form where he will be asked about his details, qualification, area of interest, year of experience, and license number and some identity cards. Once these details are filled, the doctor can access his interface.

2.2 Scan & Add Doctor can access his patient record after scanning his Aadhaar card and then can view or add new prescription, his treatment information, and drugs and vaccines records.

The remaining sections of this paper are arranged as follows: in "Technology used" section, different technologies used for the development of this app are explained.

II. RELATED WORK

Health IT is generally observed as solution so as to improve healthcare sector [1–3]. It has augmented accessibility of medical data to aid medical research and healthcare management [4–8]. Large number of peoples including students, researchers, and entrepreneurs are working to bring blockchain in health sector, and specifically in retrieval of health records from a unique identity.

Blockchain technology is considered as a shared decentralized ledger for recording the transactions. It is employed to record events as products from its beginning to the present state in an unmodifiable log [9–11]. Decentralization, verifiability, and immutability are essential features of blockchain that are required in the medical and healthcare industry. The applications of Blockchain have gained the attention of research institutions around the world. Health bank is an international innovator in digital health, and energetically involved in tapping into blockchain such as smart contracts [12]. For enterprise blockchain solutions, Gem Health is one of the established providers which is partnered with Philips Blockchain Lab to have blockchain technology to address the trade-off between patient centric care and operational

efficiency by creating a healthcare ecosystem connected to universal data infrastructure [13]. The effective utilization of blockchain technology in healthcare are increasing so as to benefit population health and medical records.

Further, various research studies have been identified that highlight application of blockchain in healthcare sector. In this industry, the ongoing researches in the blockchain technology includes medical information protection, medical data storage and sharing, medical data application, forecast analysis, etc. The study [14] discussed the goals and benefits of blockchain technologies in healthcare. The study [15] introduced a blockchain-based application whose architecture supports the patients to manage, and share their own data securely but also enabled untrusted third parties to process medical and health data while ensuring patient privacy through introducing secure multifactor computing. The study [16] introduced OPAL/Enigma encryption platform that is based upon the blockchain technology so as to create a secure environment for storing and analyzing medical data. Few research studies have also been found that are based on blockchain technology for storing and managing patient medical records [17-20]. The study [21] provided a blockchain-based method to share the patient's data. The study [22] also employed blockchain network technology to generate an interinstitutional medical health prediction model.

III. FEASIBILITY STUDY

A. *Implementation & Technical Feasibility*

As per now, the government is focusing on Linking every detail of a person with his Aadhaar card. Such as linking his bank account, pan card, Mobile number, Gas Connection, Property Record. Thus, we aim to link his Medical reports to his Aadhaar card to create a unique identity of any person.

This will help a lot to a patient or his family member, tracking his medical, treatment & drugs and vaccine history. Also, reduce dependency on Hard copy or papers. Use of machine learning will help any user to find out what disease he is having and its proper treatment without going to doctor

and spending time and money. The project will help mankind and Government and thus this will be feasible to implement.

Talking about Technical Feasibility, we are not using any rocket science, it is just the use of some popular and tested technology in an innovative manner and thus we guarantee 100% feasibility of the project.

Reference

B. *Need & Significance*

As discussed above, we need a unique identity of a person, so that all of his details such as personal, financial and even Medical details can be tracked. We need this project to provide secure ledger to store sensitive medical information on the blockchain server also providing crucial data analysis like most common disease in particular area, age group, gender which can be useful for the development of any country.

We also need to ensure that medical, treatment, drugs & Vaccines record of any patient is linked with his Aadhaar card so that he didn't need to store his previous reports anymore. And any doctor or his family member can access this crucial information.

IV. BRIEF OVERVIEW OF TECHNOLOGIES USED

This is a Block chain based web application built to enhance the healthcare industry.

Node JS is used as a Backend Language to retrieve and update data. It is a platform built on Chrome's JavaScript runtime for easily building fast and scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.

Machine learning algorithm (Regression Model) is used to predict the diseases a patient is having by his symptoms and also suggest medicines and treatment accordingly. Regression analysis is a form of predictive modelling

technique which investigates the relationship between a **dependent** (target) and **independent variable** (s) (predictor). This technique is used for forecasting, time series modelling and finding the causal effect relationship between the variables. For example, relationship between rash driving and number of road accidents by a driver is best studied through regression. Linear Regression, Logistic Regression, Polynomial Regression, Stepwise Regression, Ridge Regression, Lasso Regression, Elastic Net Regression are different type of regressions models.

Blockchain is used to store and mining the data and increase the security of the database through decentralization. A blockchain, as the name implies, is a chain of digital “blocks” that contain records of transactions. Each block is connected to all the blocks before and after it. This makes it difficult to tamper with a single record because a hacker would need to change the block containing that record as well as those linked to it to avoid detection. This alone might not seem like much of a deterrence, but blockchain has some other inherent characteristics that provide additional means of security.

Angular JS is used to make the frontend of the application mobile responsive and interactive, and also to support Scan feature. AngularJS is a structural framework for dynamic web apps. It lets you use HTML as your template language and lets you extend HTML's syntax to express your application's components clearly and succinctly. AngularJS's data binding and dependency injection eliminate much of the code you would otherwise have to write. The impedance mismatch between dynamic applications and static documents is often solved with: a **library** - a collection of functions which are useful when writing web apps. Your code is in charge and it calls into the library when it sees fit. E.g., jQuery. **frameworks** - a particular implementation of a web application, where your code fills in the details. The framework is in charge and it calls

into your code when it needs something app specific. E.g., durandal, ember, etc. AngularJS takes another approach. It attempts to minimize the impedance mismatch between document centric HTML and what an application needs by creating new HTML constructs. AngularJS teaches the browser new syntax through a construct we call *directives*. Examples include:

- Data binding, as in `{{}}`.
- DOM control structures for repeating, showing and hiding DOM fragments.
- Support for forms and form validation.
- Attaching new behavior to DOM elements, such as DOM event handling.
- Grouping of HTML into reusable components.\

AngularJS is what HTML would have been, had it been designed for applications. HTML is a great declarative language for static documents.

V. EXPERIMENTATIONS AND RESULTS

The architecture of the medical blockchain is shown in Fig. 1. Medical institutions, patients and third-party agencies (such as medical information service platform, medical insurance company, etc.) are three main types of transaction bodies in the medical blockchain.

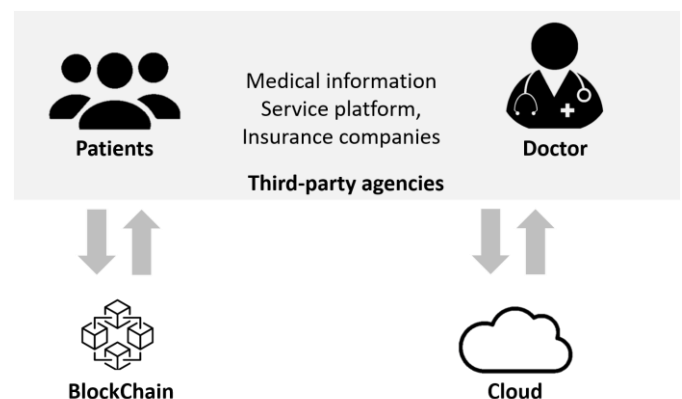


Figure 1: The architecture of Medical blockchain

The below code snippet shows the algorithm we are using to store the medical records of a patient.

```

Blockchain.prototype.createNewBlock = function (nonce, previousBlockHash,
hash) {
    const newBlock = {
        index: this.chain.length + 1,
        timestamp: Date.now(),
        transactions: this.pendingTransactions,
        nonce: nonce,
        hash: hash,
        previousBlockHash: previousBlockHash
    };
    this.pendingTransactions = [];
    this.chain.push(newBlock);
    return newBlock;
}

Blockchain.prototype.getLastBlock = function () {
    return this.chain[this.chain.length - 1]
}

Blockchain.prototype.createNewTransaction = function (age, symptoms,
disease, treatment, location, weight, url, amount, sender, receiver) {
    const newTransaction = {
        amount: amount,
        sender: sender,
        receiver: receiver,
        age: age,
        symptoms: symptoms,
        disease: disease,
        treatment: treatment,
        location: location,
        weight: weight,
        url: url
    };
    return newTransaction;
}

```

VI. CONCLUSION

Personal details & medical history of a patient will be stored through block chain to ensure security and decentralization. A doctor can access his patient account after scanning his Aadhaar card through his phone and can update or add a medical prescription along with his reports. This ensures that any patient's medical, treatment, medication, and vaccine records are tied to his Aadhaar card so that not only security and privacy can be achieved but also previous reports would be digitally available for long-run in life. This also overcomes the problem of medical data of the patients being dispersed in various medical institutions. Thus, we can conclude that this model can create a revolutionary change in Health-tech sector. In near future, blockchain based medical networks can be established with the aim of associating various medical institutions.

VII. REFERENCES

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