

Block chain Based Implementation of Electronic Medical Health Record

B. Narendra Kumar Rao, B. Bhaskar Kumar Rao, Vellingiri J

Abstract: *Electronic medical records (EMRs) square measure vital, sensitive personal data in aid, and wish to be often shared between peers. Blockchain Technology facilitates a shared, immutable and history of all the transactions creating software of trust, responsibility and transparency. This provides a novel chance to implement a secure and reliable EMR knowledge management and sharing, system victimization. In this paper, we gift our views on blockchain primarily based aid knowledge management, specially, for EMR knowledge sharing between aid suppliers and for analysis studies. we have a tendency to propose a framework for managing EMR knowledge for cancer patient care. together with an Hospital, we have a tendency to enforced our framework in an exceedingly image that ensures privacy, security, convenience, and fine-grained access management over EMR knowledge. The planned paper will considerably scale back the turnaround for EMR sharing, improve higher cognitive process for medical aid, and scale back the value. Confidentiality in health industry refers to the "obligation of professionals", World Health Organization can have access to patient records or exchange information to carry that data in confidence. Managing electronic health data presents distinctive challenges for restrictive compliance, for moral concerns and ultimately for quality of care. As the meaningful use of Electronic Health record system expands from the health devices, its aiding organizations grow. All World Health Organization work with health data—health information processing and management professionals, doctors, researchers, business directors have responsibility to accept that data. And as patients, we've privacy rights with relevancy our own health data Associate in Nursing an expectation that our data be control in confidence and guarded. Confidentiality of patient medical records is of utmost importance. Access to patient medical records in hospital software package ought to be with the treating/admitting practitioner and therefore the team. Access to medical records mustn't lean to everybody within the hospital network. one in all the thanks to address this confidentiality issue is "Blockchain Technology". Victimization digital signatures on Blockchain-based knowledge permits access for multiple folks may regulate the provision and maintain the security of health records. Additionally, a community of individuals, together with stakeholders of health care industry, might be a part of the Blockchain, can reduce fraud in payments.*

I. INTRODUCTION

Electronic restorative statistics (EMRs) are basic but very responsive to innate information for finding and treat human services, which have to be as often as viable disseminated and shared amongst pals, as an example, medicinal services suppliers, insurance agencies, drug stores, analysts, sufferers families, amongst others. This represents a noteworthy take a look at on preserving a patient's medicinal history splendid. Putting away and sharing records among various elements,

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Dr. B. Narendra Kumar Rao, Professor, Chairman Board of Studies in Department of Computer Science and Coordinator, IQAC at Sree Vidyanikethan Engineering College.

Mr. B. Bhaskar Kumar Rao, Assistant Professor from Department of IT, Sree Vidyanikethan Engineering College, A. Rangampet.

Dr. Vellingiri J, Associate Professor in Sree Vidyanikethan Engineering College, Tirupathi, Andhra Pradesh.

preserving up get admission to control through various assents just entangle the technique of a patient's treatment. A affected person, experiencing a real sickness, as an instance, malignant increase, or HIV, wishes to preserve up the lengthy history of the remedy procedure and submit-remedy recovery and checking. Approaching a complete history might be crucial for his remedy: as an example, knowing the conveyed radiation quantities or research facility consequences is crucial for proceeding with the treatment.

A patient may visit diverse restorative institutions for a meeting, or might be exchanged starting with one clinical medical institution then onto the next. As in step with the legislation, a affected person is given a without delay over his well being records and may set tips and breaking factors on who can take a gander at and get his well-being records. On the off danger that a affected person desires to percentage his medical facts for the examination functions, or exchange them beginning with one clinical health facility then onto the following, he is probably required to sign an assent that determines what sort of statistics may be shared, the facts approximately the beneficiary, and the duration amid which the facts can be gotten to by means of the beneficiary. This might be very hard to facilitate, mainly whilst a patient is transferring to any other metropolis, district, or state and won't recognize in advance of time the parental parent or clinic where he'll get care in a while.

Regardless of whether or not the assent is given, the manner closer to replacing the statistics is tedious, especially if sending them through put up. Sending the patients' statistics via e mail over the Internet isn't always taken into consideration in many medical clinics as this will pressure security risk while the patient's medicinal offerings records are in transit. Environments for well-being statistics trade (HIE, as an example, Common Well Health Alliance intend to guarantee that the statistics shape persistent electronic wellness record are effectively, proficiently and precisely shared across the state in US. This suggests as soon as suppliers receives an entrance to the affected person's well-being data it's far tough to make certain that a patient could get autonomous feelings from diverse medicinal offerings suppliers. In addition, such biological groups don't cope with the pre-requisites within the occasion of changing statistics starting with one nation then onto the next.

II. STATEMENT OF THE PROBLEM

Confidentiality of patient medical records:

- How to supply security and police investigation for patient medical health records?
- Providing security to patient medical records is utmost vital, however clinicians/physicians will access the stored



data in a very secured method.

OBJECTIVES

- The main objective is to produce confidentiality to patient medical records victimization “Blockchain Technology”.
- Patient information secrecy or confidentiality is one amongst the foremost necessary pillars of drugs.
- Protecting the personal details of a patient isn't simply a matter of ethical respect, it's essential to bond trust between the doctor and also the patient.

SCOPE

- Ready access to a lot of all-inclusive, updated patient info, quick, reliable and secure information.
- Streamlining of clinical data and powerful tool that take care, supporting multi-disciplinary team operations.
- Online call support tools, access to top care and quicker access to consultant doctor opinions and identification.
- Reduced patient info management, paper-work, duplication and other forms – less time spent finding unidentified notes, x-rays, admission or discharge information.

III. LITERATURE SURVEY

This work is based on providing security and privacy through cryptography based access control to store data in the cloud and encryption through attributes. The generic public key encryption (PKE) based techniques use high key management mechanism, or require encrypting a file using different users keys of different sets for using fine-grained access control. To enhance the scalability during the encryption schemes like ABE can be used. ABE information is encrypted under a based on a set of properties that different users who have proper keys can use and decrypt it. Thus it makes encryption and management of key efficient compared to others.

Interoperability in care has historically been targeted around knowledge between business entities, as an example, completely several hospital systems. However, there is a trend push towards patient-driven ability, during which health knowledge exchange is patient-driven. Patient-centered approach introduces new challenges and necessities for technology, privacy, security, incentives, and governance that has got to be taken up in this sort of knowledge sharing to succeed at a large scale. In this work, we look at applying blockchain technology for facilitating this transition through 5 mechanisms: (1) digital access rules, (2) knowledge aggregation, (3) knowledge liquidity, (4) patient identity, and (5) knowledge immutability. We have a tendency to verify barriers of blockchain-enabled patient-driven ability, specifically clinical knowledge deal volume, privacy and security, patient engagement, and incentives. We have a tendency to conclude by noting that whereas patient-driving ability is an exciting trend in care, given these challenges, it is required to be verified as to how blockchain will facilitate the change from hospital-centric to patient-centric information knowledge sharing. [1]

Physicians have a different relationship with the electronic health record (EHR). On the one hand, doctors apprehend they cannot offer the most effective attainable treatment while not them. And on the opposite, today's EHR systems are cumbersome, gawky and slow physicians down. Indeed, there is a lot of to like and far to hate concerning today's EHRs, aboard a spread of the way to handle the issues they produce. One resolution might belong block chain, the technology presently powering the cryptocurrency Bitcoin.[2]

In the summer of 2016, a hacker named “the dark overlord” scarf over 650,000 medical records from the databases of 3 separate attention establishments. The hacker wasn't solely marketing the records for many thousands of bucks on-line, however may be extorting the establishments by hard cash to forestall more attacks and distribution of records. The worth of those medical records is 10 to sixty times larger than a master card range on the black market, because the info on the records is also wont to pull alternative forms of fraud, like filing dishonest tax returns, creating these records a primary target for malicious hackers [3].

Block chain Technology is that the advance info technology in medical sector that require secure knowledge sharing among connected parties within the network. The work factors have impacts on electronic case history Blockchain technology adoption. On-line form was improved by taking from literature with performance perspective, trust, and risk ideas. On-line survey sent to patients and medical personnel. The feedback respondents were 149. The analysis results showed that the foremost important issue poignant the acceptance is getting done with performance expectation which incorporates the popularity of technological edges and relative blessings. Trust issue has impact on acceptance and low risk having positive impact on the Blockchain technology[4].

Electronic medical records (EMRs) are crucial however sensitive non-public data for designation and treatment in aid, that has to be usually distributed and pooled among peers like aid suppliers, insurance firms, pharmacies, researchers, patient's families' et al. This poses a serious challenge in maintaining a patient's case history up-to-date. Storing and sharing knowledge between varied entities, maintaining a right to use management through varied consents solely obscures the method of a patient's treatment. A patient, afflicted with a significant medical condition like cancer, or HIV, must sustain an extended history of the treatment procedure and post-treatment rehabilitation and observance. Having access to a patient's complete history is also essential for his treatment as an example, knowing the delivered radiation doses or laboratory results is critical for continued the treat is necessary for continuing the treat.[5]

Related work:

Recently many authors examined the thought of mistreatment clever agents in ambient to produce ability. Some authors explored blockchain technology have a theoretical approach we tend to did some proposing ways to enhance quality and security in EHRs mistreatment. We tend to found a number of references discussing real implementations of EHRs over blockchain since block chain could be a comparatively new technological development. Cyph MD

managed by an Australian startup used Ethereum for development. We couldn't notice more details regarding to suppose that it's within the terribly initial stage of development. Ethereum is associate degree Running System that pretense to produce armour based mostly in blockchain as associate degree Running System feature. It offers a standard ledger and permits secure key governance and verification operations of Gem OS area unit offer chains and EHRs. Ethereum is validation-of-concept that utilizes blockchain as intermediate to the health information. The epitome known as Med-Rec, brings medical research and aid stakeholders to the "mine" within the loop and, as a bequest for data mining, it produces access to collective health care information. The authors state that a property and assuring peer-to-peer network is designed simply by supply massive information, so as to empower researchers where patients and suppliers.

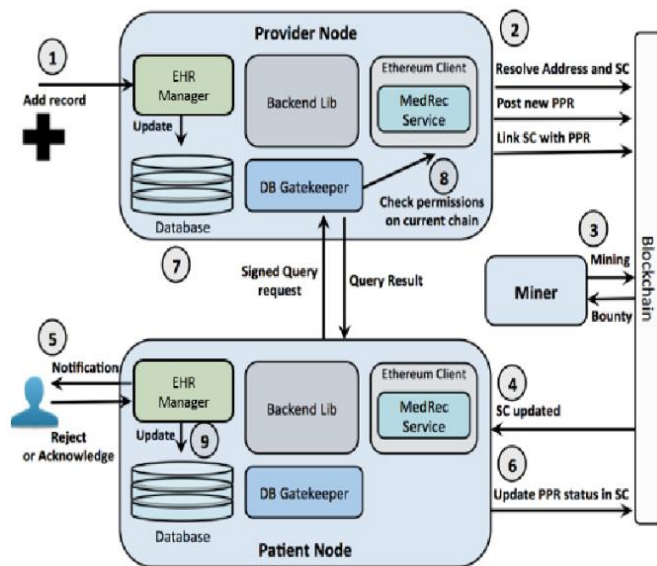


Fig 1: MedRec- Architecture

Privacy levels and anonymization:

However aggregate information must be affordable to certified organizations in governance of public health and medical care, e.g. in monitoring and preventing the transfer of epidemics and encryption layer should be included with the result to meet the variety of privacy concerns. Exceptionally access to private data must also be regarded for those situations where a patient is not active or responsive. These exceptions require the participation of mediating third party organizations or other care providers, which should register save and direct the exceptions as well as details and the conditions that demand exceptional access to personal and private information. Data should be made available only to parties in charge of public medical care. In this scenario, data canonization is a form of information sanitization, whose aim is privacy protection. It is the method of encrypting privately notifiable information from data sets so that the citizens to whom the data validations remain anonymous. Some times, canonization still has a challenge of negative social results. Corresponding challenges must be clearly represented to patients before subscription to any information governance system.

Ethical issues:

Health knowledge management paves a way to boost the standard of lifetime of voters. Any ways, these chances produce some moral risks [Mann et al. 2016]. Support the anatomy of the chances for using health care connected knowledge,

Floridi and Taddeo [Floridi and Taddeo 2016] printed 3 directions of moral queries associated with data: the ethics of information, the ethics of algorithms, and therefore the ethics of practices.

1. Ethics that relates to data possession, transparency, and security. It's the ability to rectify problems associated with blurred line that partitions what ought to be open knowledge and what mustn't.
2. Ethics of the algorithms states to pre-defined behavior of the program or intelligent agent so as to minimize, example is wrong selections or fortuitous exposure of data.
3. Ethics of practices mentions to however info is employed, in step with skilled moral tenets that, as an example, is to establish respect for Human Rights and therefore the got to reduce adverse outcomes like malicious utilization of data.

Data ethical dilemmas:

The regard for patient autonomy is nearly uncontroversial. There are some things wherever patients might not have the correct to determine that methods they want to bear, or that information they want to own exposed. Typically there is a public interest in individual or self information, which might increase a problem regarding over-ruling individual patient rights for advantage of a grouping. As an example, that we tend to take into account the regional management of infectious diseases like TB, it is vital to trace the matching and relevance of cases at an individual level, nevertheless of non-public consent provision by patients. In emergency cases, a patient might not be ready to create autonomous decisions and health care professionals ought to be ready to request over-ruling of individual rights to protect the lifetime of patients.

Algorithmic ethical dilemmas:

Let us imagine a situation wherever a patient desperately desires a bone marrow donation and a worldwide EHR governance system is in a position to spot a possible donor, however the system cannot disclose the identity of that particular donor. The quandary bestowed here stays within the call between making an attempt to avoid wasting the life and respect the individual rights. To boot, percept that, during the same situation, the system will be any of a proprietary supply or open supply. The opaqueness of procedures utilized to unravel the quandary clearly is a problem it ought to be discovered, withal, that the difficulty here isn't most regarding the access permission and therefore the power to change ASCII text file as was common, we tend to perceive that open supply computer code is regarding so it's regarding and therefore the validation of these methods.

Practices related ethical dilemmas:

During any health care appointment, each patients and medical professionals will act incorrectly, in an exceedingly non-sincere or amateurish approach. for instance, a patient will provides a incor-

rect data throughout a health care appointment owing to health illiteracy, misinterpretations or privacy reasons; a doctor will disregard the facet results of a drugs as a result of he has an interest in improving a selected whole of medication. A privacy governance system, supported name may have a positive result in these styles of misbehavior. For instance, a doctor might imagine doubly before endeavor a procedure that may be audited and cause difference of opinion. As a disadvantage, if malpractice could leave a trace, some of the patients could favor to self medicate themselves, which can have negative results for the standard of care.

Openness:

To develop a totally localized system needs belief on many parts, like third party establishments, agents and therefore the data network alone. Here, we tend to state that elementary to achieve the required level of trust within the system often outlined as a stress on clearness and free, unrestricted access to data and data, still as cooperative or cooperative management and decision making instead of a central authority. Openness for mentioned to be the other of secrecy. a minimum of four totally different aspects of openness helpful in an exceedingly world EHR and also are gift in blockchain technology: the open or free package, open ethical standards, open kind of data, and open mode of innovation. We tend to show every of those aspects within the next paras.

- Despite the system design incorporated in an exceedingly world EHR, this technique will get pleasure from the inclusion of open supply package to confirm that data is processed in trustworthy ways in which.
- Similar arguments regarding auditability and certification additionally apply to the adoption of open standards to cypher, exchange and transfer data. Additionally, to use open standards is inherently vital to the system integration.
- Open information isn't needed within the specific system pro-posed, as we've got sensitive information moving across a loop of peers. However, the open information is fascinating as a supply of data to grasp network dynamics. For instance, it should be wont to add a social facet within the system, i.e., sanctioning agents to permit or refuse data the utilisation of data to an establishment counting on its name or its public perceived belief. In different words, though open information isn't a main feature within the system, and this will be however a strong tool for up its coming releases.

A general Architecture for Open architecture for EHR based on blockchain:

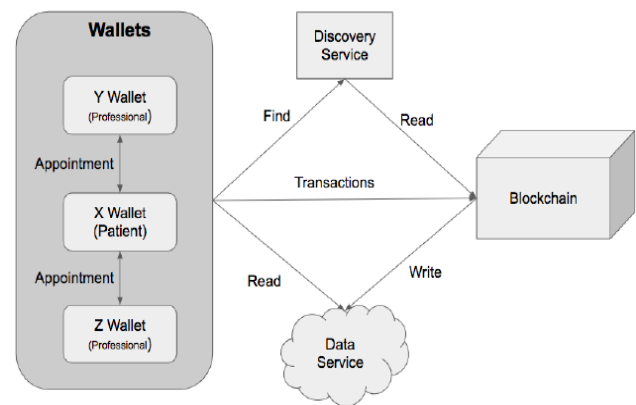


Fig 2: Open architecture for HER

Description on components:

Blockchain: A distributed ledger can execute smart contract. They record references for health transactions like examination, appointment and medications. It is described in cryptocurrency system. In block of a privacy layer, it contains a pointer to health information of patient. If a patient X is observed by doctor in a hospital Y, then a transaction is appended to Y as if transaction is accessible to information of X.

Data Service: It can store necessary information about health records. They can be implemented using cloud services like Dropbox, Google Drive etc....

Wallets: It has the capability to store user's private and public keys. Email and other credentials are stored with the wallet. It serves as an interface to access the entire system.

Discovery Service: Non-mandatory and other credentials are stored in discovery service. Information stored in Blockchain is indexed using this. This is capable of listing all the services offered to patient X in the listing format. NOSQL can be used for implementing this.

Services offered by ledger includes the following: Storing a transaction, Accessing and processing requests and Registration of all transactions for which access is granted.

Transactions: It is the basic unit of information stored in the system as per the above architecture. The following are the transaction types:

A New transaction creates an entry in the ledger. It contains transitive closures, timestamp information of transaction, link, public profile etc...

Request Access is the record entry listing the request to access the content of patient record X and also lists for those who were granted access.

Notification, these are special information stored along with a transaction.

Smart contracts: It is a program stored in the blockchain and run on virtual system. They actually manage transactions.

Scenarios of usage:

The blockchain saves the historic interactions between the patients and health care

agents, beside connections to the EHRs that has careful descriptions of every of the interactions. A hash of the case history is additionally keep within the block, there-

fore the movement of the data will be simply validated. If a patient A meets a health care agent C, the agent ought to have the acceptable software package, the Way to get health knowledge from the blockchain. The skilled C will request for the knowledge from A and raise the proper to browse the info. The user A should expressly authorize the usage. During this scenario, new transactions area unit produced within the blockchain, for every file is made a dealing authorizing C to own use to it file. Note that C will opt for, supported the information content keep to own access to specific files. As an example, C will request access solely to the files relevant to this medical appointment. In essence, every patient will have their own billfold instance, whose way of behavior will be known in line with rules set and attached by the patient. as an example, the patients ought to be ready to specify the way of behavior of the billfold just in the case they're not responding and imperative care should be provided. Further rules will be created, as an example, the procurator. Another vital situation happens once C requests the access directly from B. Again, a brand new dealing should be registered, giving access to C those data that is not broken within the knowledge service of B. See the content of A was derived, that the billfold of A should be notified regarding this type of dealing. More to be usable from the info, e.g. to respect the management of epidemics and also the un fold of contaminated diseases. In fact, this design will be simply improved to support totally various levels of privacy. One can be enforced by reading the transaction's information. The information is employed to give guidance to professionals regarding the information of some hint regarding health conditions. As an example, suppose by reading the information, it's doable to notice many requests for exams to validate the designation of dengue fever. The users and establishments don't seem to be known, however it's a relevant indicator of population health. On the far side of reading open knowledge within the blockchain, it's straightforward to increase the design to implement new kinds of transactions to supply an improved read of the population health. Finally, it's vital to notice that by victimization the design projected during this article doesn't forestall that health establishments still use their EHR systems. With the arithmetic mean, each systems ought to be used till all bequest systems can be custom-made.

Considerations about implementation:

As we've mentioned already, the ledger element may be enforced victimization the Ethereum and its good contract resolution. The Wallets may have a phone version enforced, for instance, victimization golem platform. A case ought to be developed taking under consideration the challenges of exposing of private information and will reduce such prospects for information storage, we must always provide interfaces for the foremost widespread cloud services. Google platform provides a programming opportunity referred to as Google Apps Script (GAS) that will help the mixing between wallets and also the information repository (Google Drive, during this case). The best production of the invention service is, sporadically, analyses the block-chain and update the indexes. The information of this service may be a document based No SQL implementation, like Mongo DB. Apart from the invention service ought to be supported net services path to produce interoperability. so as to reduce one cause of failure, the invention service ought to be duplicated and every case ought to have the references for over

one instance of invention service. Google Apps Script (GAS) provides the mixing of wallets and also the information repository (Google Drive, during this case). The best way of presenting the invention service is, sporadically, analyses the blockchain and intern update the indexes. The information of this service may be a documentation based No SQL implementation, like Mongo DB. Besides, the invention service ought to be supported net services interfaces to produce interoperability. So as to avoid one purpose of failure, the invention service ought to be replicated and every case ought to have references for over one instance of inventory service.

Open questions about Proof of Work and economic ecosystem:

The verification of labor in a very blockchain facilitates a sign of the responsible of a network node. In the Bitcoin, it's the number of process power time spent. In this context, the active involvement within the network ought to be identified by the amount of the new transactions that were done recently. At this time, that a node is gift on the network is also another parameter; the more is that this time, a lot of reliable ought to be the node. There are many open questions on the economic strength of the system. 1st of all, what's the worth of non-public medical knowledge the system will, as an example, scale back the amount of medical exams and improve health care appointments quality. However, WHO pays for it and the way abundant C can pay to possess use to a health data might these values be changing. Answering to these questions is vital to outline rules of the system. Another question is that the utilization rate of the system agent. At the primary moment, the system bootstrap, a world EHR looks to be sensible for medical patients and professionals. Except for the hospitals and massive medical health care establishments, that already kept the management of an oversized quantity of Medicare knowledge, the system may be taken as a challenge for a well be organized and most profitable business case model. As a result of in our model customers are the house owners of health care knowledge, This implies that they have to have management of respective non-public keys. This might gift a risk, as users WHO don't seem to be leading to knowledge loss or, even worse, knowledge compromise. To perceive these queries, it's mandatory to verify the system with original patients and caregiver.

Future Work:

For longer term we have a tendency to decide to introduce a practical prototype of the projected design, shown in Section five. This marginal implementation ought to embrace an easy mobile billfold given in automaton [Elenkov 2014] and therefore the contracts victimization Ethereum framework [Wood 2014]. Our aims, besides the design verification, Is to judge by trial and error the quantity of transactions that are supported by the blockchain. Another side to be validated is that the capability of Ethereum management framework to precise complicated pc models that are must for the introduction of realsensible contracts within the health care domain.

EXISTINGSYSTEM:

Electronic medical records area unit important however sensitive non-public info for

diagnosing and treatment in attention, which require to be oftentimes distributed and shared among peers like attention suppliers, insurance corporations, pharmacies, researchers, patients, their family, among others. This poses a significant challenge on a patient's case history update. Storing and sharing information between entities for maintaining access management through varied consents solely complicate the method of a patient's treatment. They bestowed the design of a attention information entrance application for straightforward and secure management and sharing of medical information between totally different entities which will use patient information. However, the system has not been implemented nor tested however.

DISADVANTAGES:

- Less efficiency
- Decision creating is a smaller amount

PROPOSED SYSTEM

A framework for administering and EMR sharing information for cancer patient care. In collaboration with a Hospital, a framework is enforced during a paradigm that ensures privacy, security, availability, and fine-grained access management over EMR information. The proposed work will considerably cut back the turnaround for EMR sharing, improve deciding for treatment, and cut back the value. This provides a novel chance to design and implement a secure, trustable EMR information management and sharing system victimization using blockchain.

ADVANTAGES:

- More efficiency
- Improve deciding
- Less time consuming

RECORD STRUCTURE

Here The user gets registered with some basic details and his profile is created where he can upload his previous records and can describe his problem here the tests and there is are added for heart disease the user will get tests and based on those results the treatment will be given the data owner provides access only for specific information. If data user wants to view his previous records or other information which is not provided by data owner he needs to gain access again from the data owner these information is stored in the blockchain where one cannot edit or change the information.

Table 1: New User Registration and Login

New user registration:

Data owner

Data field	Data type	Size
username	Varchar(40)	100
password	Varchar(20)	100
Usertype		
Contact no	int	100
Email id	Varchar(40)	100
Address	Varchar(50)	100

Login:

Data field	datatype	size
username	Varchar(40)	100
password	Varchar(40)	100
User type		

Table 2: User Profile Creation, Problem selection and Heart Disease classification

User profile creation:

Data field	Datatype	Size
Name	Varchar(40)	100
Access control		
Problem description		100

Problem(select):

Eye sight	Blood pressure	Mental health	Cold and flu	diabetes	Infectious diseases	Heart disease	Oral health	X rays/ reports	Blood tests	Discharge information
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Heart disease:

ECG / holter monitoring	Echo cardiogram	Stress test	CT scan	MRI scan
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Table 3: Treatment, Report and Access

Treatment

Treatment:

Life style changes	Medications	Medical procedures/surgery

Report

Results	Time period	Discharge information

Access:

Data owner name	problem	Access given data	Requested data

Table 4: View profile, User login data, user Profile data

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View profile

Person name	Access control	Problem description	status
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logout

Data user login

Data field	datatype	size
username	Varchar(40)	100
password	Varchar(60)	100

Data user profile

Data owner name	problem	Data files	Request data	Access given files

Table 5: View Medical Profile, Data Owner status

View medical profile

Person name	Access control	Problem description	status
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Data owner status

Data owner	problem	report	Results/prescriptions	Discharge information

logout

APPLICATIONS

Asset management: Traditional trade processes with quality management is risky, expensive, particularly once it involves cross border transactions. The ledger of blockchain reduces the error by records encryption.

Payments: The international payment sector is error prone pricey and receptive cash. It takes days if not longer for cash to flow across the globe. The blockchain is already providing solutions with remission firms like abra, bitsPark.

Your car/smart phone: primitive types of sensible property exist, your car-key for AN in-stance is probably outfitted with AN immobilizer, where will solely be active once you sort the correct protocol on the key your sensible phone will solely activates once you sort within the right pin code each work on cryptography to safeguard your possession.

Smart appliances: A sensible appliances that connects to the web and offers additional data and management than before. A code connected to your appliance is joined to the web and provide you with a warning once your cookies are prepared or if your laundry has stopped encrypting these appliances on the blockchain protects your possession and allows transferability.

Blockchain healthcare: personal health records is hold on and encoded on blockchain which might grant access to solely specific individual the ledger too, can be used for general health care management, supervising medicine, testing results.

Blockchain music: key issues within the music business are possession rights, royalty, distribution, transparency. The blockchain and sensible contract will circuit this downside by making comprehensive info of music.

Blockchain identity: some firms WHO we tend to purchase from sell our identity details to advertisers who send you their blockchain block this by making protected datum whenever you write solely the data that you simply need relevant folks to understand at bound times.

LIMITATIONS

Complexity: it's created cryptography additional thought however the extremely specialized business is chack jam-packed with jargon.

Network size: Blockchain don't seem to be most proof against unhealthy actors they're anti-fragile, that is they answer attacks and grow stronger. This needs an oversized network of users.

Human error: If blockchain is employed of information bovine spongiform encephalitis the knowledge is employed into the information base is of prime quality the information keep within the blockchain isn't inherently trustworthy thus events must record accurately on the primary place.

Unavoidably security flaw: If over half the computers square measure functioning on nodes to serve the network to inform a lie and the lie can become the reality this can be known as fifty-one attack.

Storage constraints: knowledge storage imposes an enormous price on a suburbanized network wherever each full node has got to store additional and additional knowledge into eternity. As a result, storage remains an enormous hurdle for realistic application that gets engineered on the blockchain.

Privacy: Just in case of public blockchains, transactions on blockchains may seem personal since it's circuitously tied to your identity. However since they're recorded on public ledger, transactional patterns is determined and it's attainable to link your identity to the address.

Redundancy: This isn't regarding the performance of a private node, however the full quantity of computation that a blockchain needs. Whereas centralized databases method transactions once (or twice), during a blockchain they have to be processed severally by each node within the network. Thus heaps additional work is being in deep trouble a similar consequence.

ANALYSIS

Maintenance of patient medical records is one of the key challenges that arises in our current world. For this problem, there came several solutions. Electronic Health Records Confidentiality can also be done with the help of Block-Chain Technology. Hence, we use Ethereum to implement Block chain Technology to maintain confidentiality of patient medical records. Record structure has been designed for the same. It helps to know how the data can be accessed by physicians and patients. Blockchain technology is a



better way to provide medical record to make secure where it is also known as distributed ledger technology, where it requires no third party to organize, maintain, and manage data in the records. Ethereum is a decentralized platform software platform that has functionality like smart contract and distributed applications to be built without any downtime, error, fraud or third party interference. It possesses smart contract functionality, it is a computer code where we can write what kind of operations we want to perform. Web page is designed based on the record structure where the code is written for index page, registration. Data owner, data user and their profiles, problem description. Block Creation is done. Keys are generated and we will insert and store knowledge within the Ethereum block chain and execute the code. We will talk about how to keep up a permanent and easy document, which video display units every one of the occasions took place over the device, may want to improve and inspire the administration of restorative records.

IV. SYSTEM DESIGN

UML DIAGRAMS:

UML represents Unified Modeling Language. UML is an institutionalized universally showing dialect in the subject of program designing.

The goal is for UML to become a regular dialect for design of item in PC programming. In its gift frame UML is contained two noteworthy components: a Meta-show and documentation. Later on, a few type of method or system can also likewise be brought to; or related with, UML.

The Unified Modeling Language is a popular dialect for indicating, Visualization, Constructing and archiving the curios of programming framework, and for business demonstration and different non-programming frameworks.

The UML discusses on accumulation of first-rate building practices which have are useful in the demonstration of full-size and complicated frameworks.

The UML is a essential piece of creating gadgets located programming and the product development method. The UML makes use of commonly graphical documentations to for programming platforms or systems.

USE CASE DIAGRAM:

A use case diagram (UML) is a behavioral diagram defined and created from a Use-case analysis. Its purpose is to represent a graphical overview of the functionality provided by a system in terms of actors and any dependencies. The main purpose of a use case diagram is to show how system functions are performed for which actor. Roles of the actors in the system can be depicted as below.

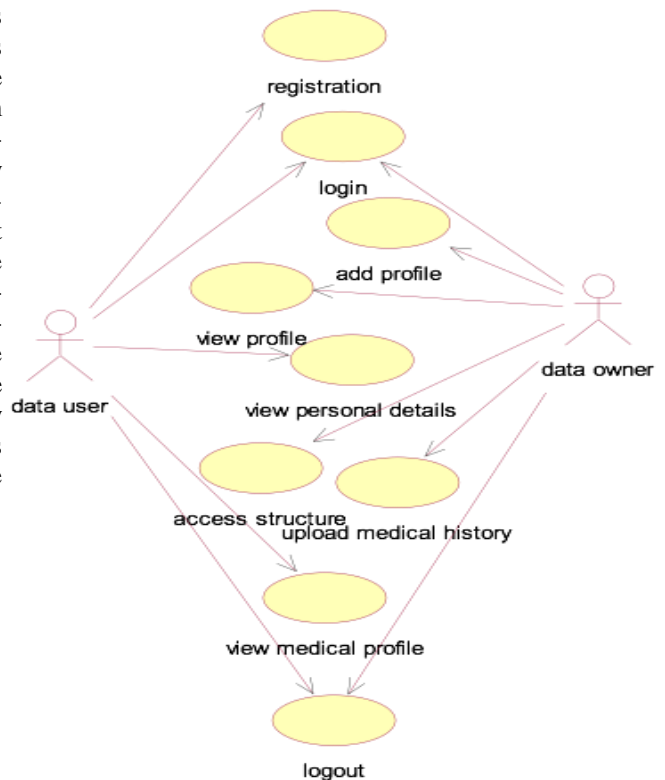


Fig 3: Use case Diagram

CLASS DIAGRAM:

A class diagram in UML is a static structure diagram for describing the structure of a system. It shows the system's classes, their attributes, methods, and the relationships among them. It explains class information.

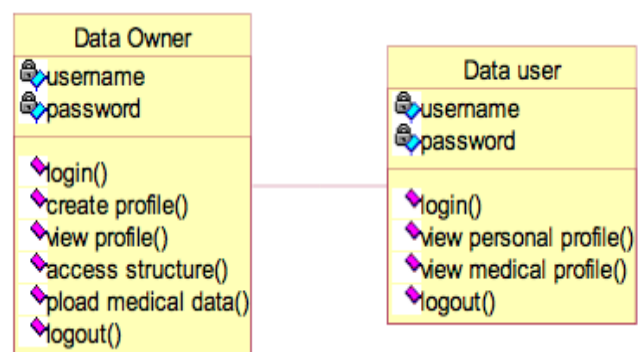


Fig 4: Sequence Diagram

A sequence diagram in Unified Modeling Language is a type of interaction diagram and are also called event diagrams, event scenarios, and timing diagrams.

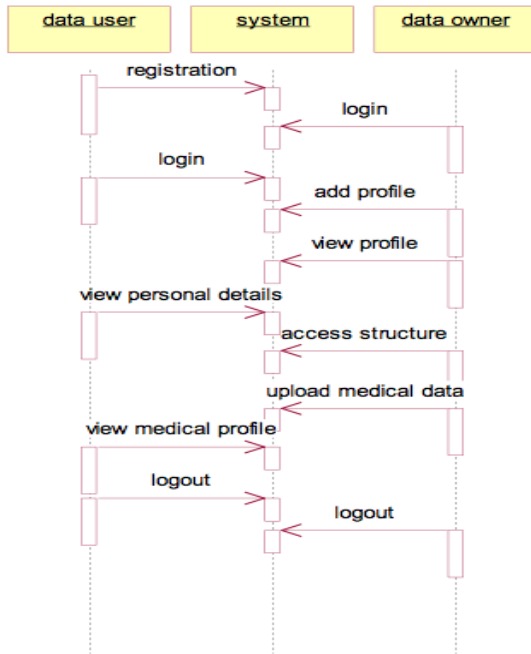


Fig 5: Collaboration Diagram

V. COLLABORATION DIAGRAM:

In collaboration diagram the call sequence of methods is represented by numbering technique as shown below. The number indicates the way in which the methods are called after one another. Same management system is used for describing the collaboration diagram.

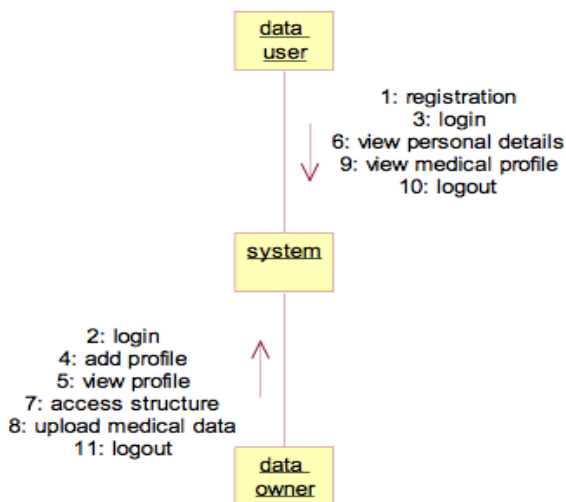


Fig 6: Activity Diagram

VI. ACTIVITY DIAGRAM:

Activity diagrams are the representations of workflow in form of step-wise activities. In Unified Modeling Language, the activity diagrams are used to present the business and operating step-wise workflows of individual system component or items in a system. Flow of control can be seen in activity diagrams.

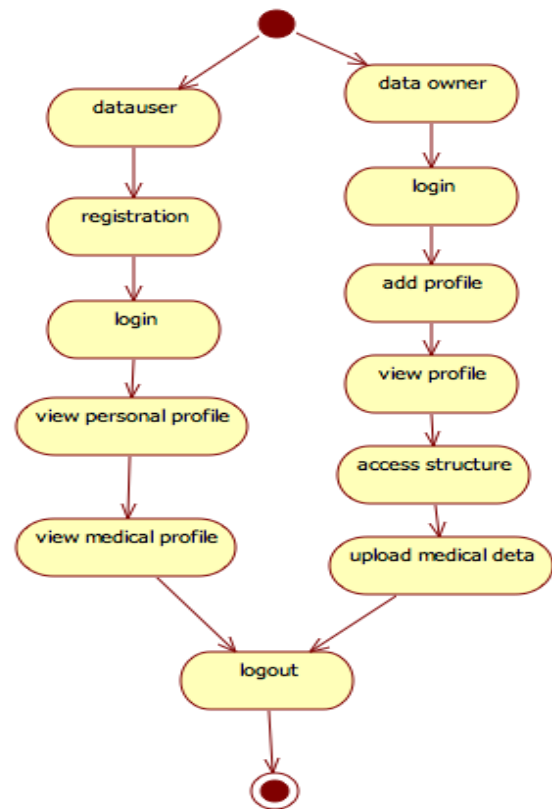


Fig 7: Component Diagram

COMPONENT DIAGRAM:

Component diagrams are majorly used to explain the artifacts of any system that are physical in nature. Artifacts may be anything like executables, file and libraries. The objective of this diagram is different. During the phase of implementation of an application, the component diagrams are used. But this diagrams are designed in advance for visualization of the details regarding implementation. At the very beginning, the system uses different UML diagrams for designing and once the artifacts are actually ready, then to get an actual idea on implementation, we use component diagrams.

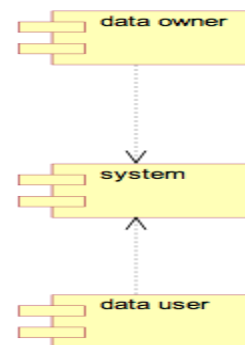


Fig 8: Deployment Diagram

DEPLOYMENT DIAGRAM:

Deployment diagram describes the deployment view of a system. A deployment diagram consists of nodes where physical hardware is used for deploying the application.



Fig 9: Deployment Diagram

Implementation

Blockchain technology is an effective way to provide security to the medical records where it is also known as distributed ledger technology, where it requires no third party to organize, maintain, manage data in the records the implementation is done in the following steps.

1. Building a record structure and how patients and physicians can access the data.

Here patients information must be kept secured and how data users can access the data is also important the structure is built how data is inserted and how data is retrieved. Here, the structure is built with two users data owner and data user and how there profile creations and problem description for data owner and tests, results, other information is added and how the data owner can access that information is built.

2. Installation of Ethereum

Ethereum is a decentralized platform software platform that has functionality like smart contract and distributed applications to be built without any downtime, error, fraud or third party interference. It possess smart contract functionality, it is a computer code where we can write what kind of operations we want to perform and also errors can be easily identified it can be installed from the official ethereum platform with an windows/mac version and geth is installed which is a multipurpose command line tool which serves as a ethereum full node in blockchain. Ethereum is better than other block chain platforms because here user can create whatever operations he wants to perform with this ethereum functionality and errors are also easily identified.

3. Webpage:

Is designed based on the record structure where the code is written for index page, registration. Dataowner, data user, and their profiles, problem description. Here data owner will not provide access to everything stored in the block chain he provides only specific and required information for data user. If data user wants to view more information from

the data owner he needs to gain access again from the data owner. This is why it is more secure this can be written using smart contract functionality.

4. Block creation:

After the installation of ethereum we should run commands on cmd using ethereum path. Here the account is created and some password is given this password is used in the smart contract code where the data is to be stored using this password and path. After giving password a address is generated where using this public is generated with algorithms like ECDSA and sha1. Without this address and keys no one can access or change the information present in the blockchain. It is difficult to generate the address and keys because it is generated using cryptographic algorithms which is highly difficult to generate keys. After the address generation a command is given to run the ethereum server `*geth --identity nodes --no discover --networkid 13 --port 60303 --maxpeers 10 --lightkdf --cache 16 --syncmode "fast" --rpc -rpccorsdomain "*" --datadir "C:\ETH\data-private"--etherbase "0x32a75a74b19f59a96d42270ce3df027d86d88122" --minerthreads 1 --mine*`.

Using the above command, the ethereum will setup to take request and to store data In that command the address is given which is generated using personal account after server is setup we can run code. The server will run as in the below picture

Fig 10: Server Setup process

After server is setup we are able to run sensible contract code to insert and store knowledge within the blockchain wherever the non-public key's generated exploitation public key and address that is generated higher than this key's used for knowledge insertion by the knowledge [the info] [the in-

Block chain Based Implementation of Electronic Medical Health Record

formation owner and public key's used for data retrieval.

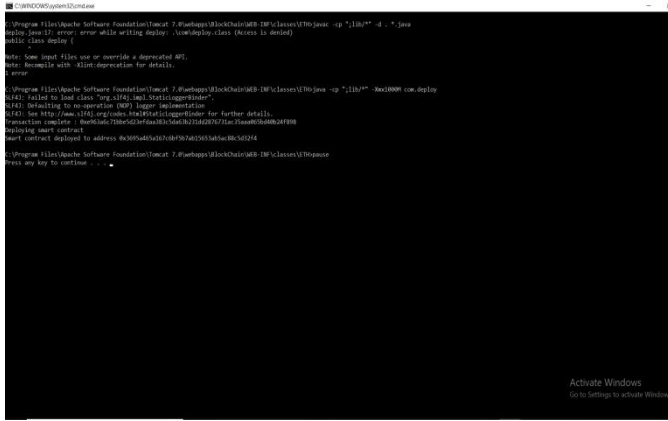


Fig 11: Information Retrieval

After the keys generation we will insert and store knowledge within the ethereum blockchain and execute the code.

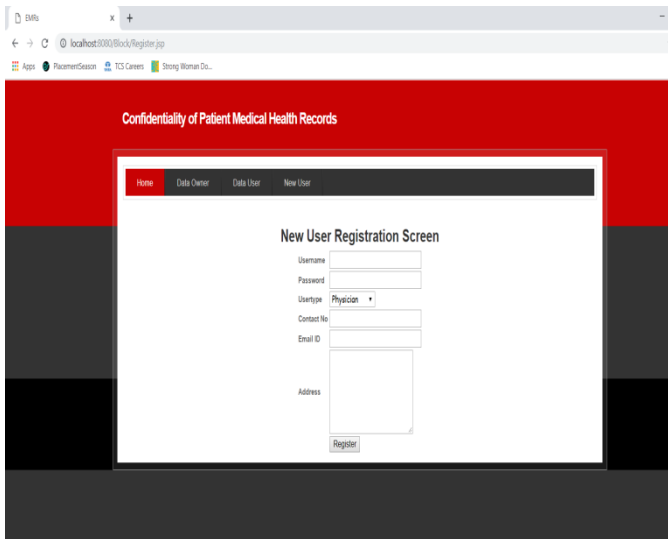


Fig 12: New User Registration Form

VII. SYSTEM REQUIREMENTS

H/W System Configuration:-

- Processor I3/Intel Processor
- RAM 4GB (min)
- Hard Disk 160GB
- Key Board Standard Windows Keyboard
- Mouse Two or Three Button Mouse
- Monitor SVGA

S/W System Configuration:-

- Operating System Windows 7/8/10
- Application Server Tomcat 7.0
- Front End HTML, JSP
- Scripts JavaScript.
- Server side Script Java Server Pages.
- Database My SQL 6.0

PHYSICAL MODEL

In this model there is unit information owner and information user Data owner enters and transfer the infor-

mation that is hold on within the blockchain through good contracts and personal key Data user will access information provided by the information owner and might use it or update it by employing a non-public key, here information user cannot amendment or edit the information [the info] the information solely data owner has access to try and do that.

A Sample structure can be considered as below for futuristic implementation:

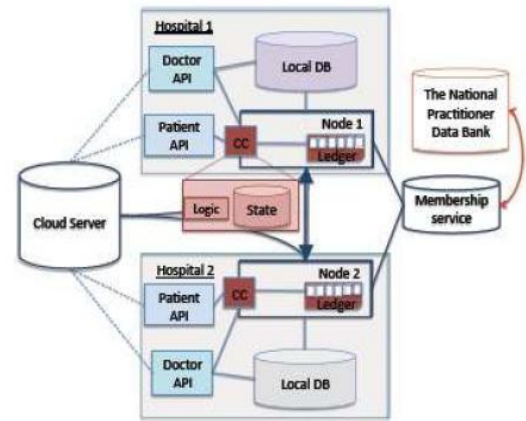


Fig 13: Structure of Futuristic Implementation -1

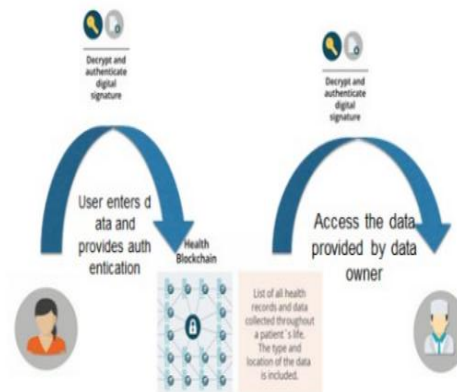


Fig 14: Structure of Futuristic Implementation -2

MATHEMATICAL MODEL

- Here during this blockchain technology ethereum uses ECDSA(Ecliptic curve digital signature algorithm) for keys generation.
- Public key: public secret is generated victimization non-public key with elliptical curve multiplication.
- $K = k * G$, wherever k is that the non-public key, G could be a constant purpose known as the generator purpose, K is that the ensuing public key, and $*$ is that the special elliptic curve “multiplication” operator.

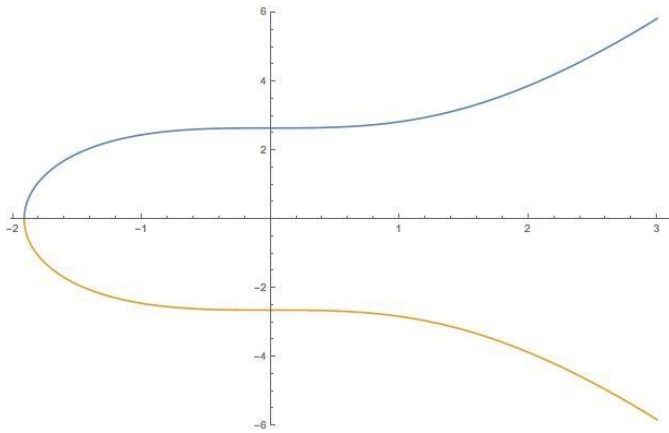


Fig 15: Mathematical Model

- Elliptic curve addition is outlined specified given 2 points P1 and P2 on the elliptic curve, there's a 3rd purpose P3 = P1 + P2, conjointly on the elliptic curve. M may be a massive prime.

Select a random number d within the interval [1, n-1].

Compute alphabetic character = refugee.

- choose a random or pseudo random number k within the interval [1, n-1].
- cypherK = x1, y1 associate degreed r = x1 mod n (where x1 is considered an number be-tween zero and q1). If r = zero then return to step one.
- cypher k -1 mod n.
- cypher s = k -1 mod n, wherever h is that the Secure Hash algorithmic program (SHA-1). If s = 0, then return to step one.
- The signature for the message m is that the set of integers (r, s).

ALGORITHM EXPLANATION

SHA-1 algorithm:

- SHA was designed by authority in one993 revised as SHA 1 in 1995, initialize pamessage therefore its length is 448 mod 512
- append a 64-bit length price to message
- Initialize 5-word (160-bit) buffer (A,B,C,D,E) to (67452301,efcdab89,98badcfe,10325476,c3d2e1f0)
- process message in 16-word (512-bit) chunks:
- Expand sixteen words into eighty words by combining & shifting
- Use four rounds of twenty bit operations on message block & Buffer
- Add output to input to make new buffer price
- Output hash price is that the final buffer price
- each spherical has twenty steps that replaces
- the five buffer words thus
- (A,B,C,D,E)
- $<-(E+f(t,B,C,D)+(A<<5)+Wt+Kt), A, (B<<30), C, D)$
- a,b,c,d talk over with the four words of the buffer
- t is that the step variety ,f(t,B,C,D) is nonlinear perform for spherical

- Wt comes from the message block
- Kt may be a constant worth derived from sin

SHA1 Compression Function

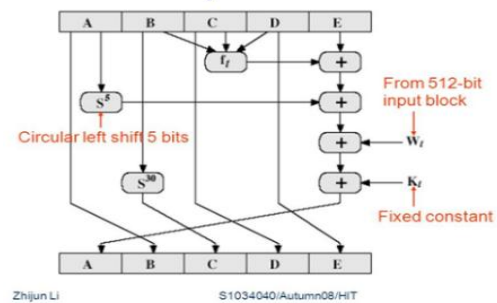


Fig 16: Compression Function

RESULT AND PERFORMANCE EVALUATION

After running higher than command we'll get address of that ac-count.

```
Command Prompt - geth --dev console
INFO [02-15:16:15:49.483] Loaded most recent local header
INFO [02-15:16:15:49.488] Loaded most recent local full block
INFO [02-15:16:15:49.492] Loaded most recent local fast block
INFO [02-15:16:15:49.526] New local node record
INFO [02-15:16:15:49.527] Stored checkpoint snapshot to disk
INFO [02-15:16:15:49.529] started whisper v.6.0
INFO [02-15:16:15:49.545] Started P2P networking
a9dea6b2f0127.0.0.1:50829?discport=0"
INFO [02-15:16:15:49.586] IPC endpoint opened
INFO [02-15:16:15:49.591] Transaction pool price threshold updated
INFO [02-15:16:15:49.608] Transaction pool price threshold updated
INFO [02-15:16:15:49.611] Etherbase automatically configured
INFO [02-15:16:15:49.615] Sealing paused, waiting for transactions
INFO [02-15:16:15:49.643] Commit new mining work
Welcome to the Geth JavaScript console!

instance: Geth/v1.8.22-stable-7fa3509e/windows-amd64/go1.11.5
coinbase: 0xbaf5d7888d9b6365a22ce41d7c15c74c9e1dc59
at block: 0 (Thu, 01 Jan 1970 05:30:00 IST)
datadir:
modules: admin:1.0 clique:1.0 debug:1.0 eth:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 shi

> 2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:device:
2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:device:
2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:device:
INFO [02-15:16:15:51.824] Mapped network port
proto=tcp extport=50829

> personal.newAccount("rajesh_account")
"0x5945ac16205b4425901a388650d0a94f90d29873"
```

Fig 17: Results and Performance Evaluation

The server is started now we can proceed to execution

```
Command Prompt - geth --dev console
INFO [02-15:16:15:51.824] Mapped network port
proto=tcp extport=50829

> personal.newAccount("rajesh_account")
"0x5945ac16205b4425901a388650d0a94f90d29873"
```

Fig 18: Server Ready and Proceed to execution

After running on top of command we'll get address of that account.

```

Command Prompt - geth --dev console
INFO [02-15]16:15:49.4831 Loaded most recent local header      number=0 hash=0252a5
INFO [02-15]16:15:49.4881 Loaded most recent local full block  number=0 hash=0252a5
INFO [02-15]16:15:49.4921 Loaded most recent local fast block  number=0 hash=0252a5
INFO [02-15]16:15:49.5261 New local node record              seq=1 id=f436a2b7de57
INFO [02-15]16:15:49.5271 Stored checkpoint snapshot to disk   number=0 hash=0252a5
INFO [02-15]16:15:49.5231 started whisper v.6.0
INFO [02-15]16:15:49.5451 Started P2P networking              self="enode://da7b954a9dea6b2f0127.0.0.1:30329?discport=0"
INFO [02-15]16:15:49.5861 IPC endpoint opened          url=\\\\.\\pipe\\geth
INFO [02-15]16:15:49.5911 Transaction pool price threshold updated price=1000000000
INFO [02-15]16:15:49.6081 Transaction pool price threshold updated price=1
INFO [02-15]16:15:49.6111 Etherbase automatically configured address=0xBAF5D7888D9
INFO [02-15]16:15:49.6151 Sealing paused, waiting for transactions
INFO [02-15]16:15:49.6431 Commit new mining work          number=1 sealhash=05c
Welcome to the Geth JavaScript console!

instance: Geth/v1.8.22-stable-7fa3509e/windows-amd64/go1.11.5
coinbase: 0xbaf5d7888d9b6365a22ce41d7c15c374c9e1dc59
at block: 0 (Thu, 01 Jan 1970 05:30:00 IST)
datadir:
modules: admin:1.0 clique:1.0 debug:1.0 eth:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0

> 2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:de
2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:devi
2019/02/15 16:15:51 ssdp: got unexpected search target result "urn:schemas-upnp-org:devi
INFO [02-15]16:15:51.8241 Mapped network port                  proto=tcp extport=508
> personal.newAccount('rajesh_account')
"0x5945ac16205b4425901a388658d0a94f90d29873"

```

Fig 19: Address of theaccount

VIII. SYSTEM STUDY

FEASIBILITY STUDY

The practical implementation of the project is analyzed during this part and business proposal is place forth with a really general arrange for the project and a few value estimates. Throughout system analysis the practical study of the projected system is to be dispensed. This can be to confirm that the projected system isn't a burden to the corporate. For practical analysis, some understanding of the foremost necessities for the system is crucial.

Three main considerations involved in the feasibility analysis are

- ◆ ECONOMICAL FEASIBILITY
- ◆ TECHNICAL FEASIBILITY
- ◆ SOCIAL FEASIBILITY
- ◆ ECONOMICAL FEASIBILITY

This study is disbursed to examine the economic impact that the system can wear the organization. The number of fund that the corporate will pour into the analysis and development of the system is restricted. The expenditures should be even. Therefore the developed system also at intervals the budget and this was achieved as a result of most of the technologies used area unit freely out there. Solely the custom-built product had to be purchased.

TECHNICAL FEASIBILITY

This study is allotted to see the technical practicality, that is, the technical needs of the system. Any system developed should not have a high demand on the available technical resources. This may result in high demands on the obtainable technical resources. The developed system should have a modest demand, as solely marginal or null changes square measure needed for implementing this method.

SOCIAL FEASIBILITY

The facet of study is to observe the extent of system acceptance by the user. This includes the method of training the user to use the system efficiently and effective-

ly. The user should not feel vulnerable by the system, instead should settle for it as a necessity. The extent of acceptance by the users depends on the strategies that are used to train the user regarding the system and create awareness on it. His level of confidence should be raised so that he is ready to take up defects associated with the system, as he's the ultimate user of the system.

MODULES

There are two Modules

1. DATA OWNER
2. DATA USER

DATA OWNER: In this module information owner will login with valid credentials. Once login information owner will produce profile and consider profile and access structure and transfer the medical record and at last logout.

DATA USER: data user will at the start register with her/him details. And information user login with valid credentials. Once login information user will read personal profile and think about the medical profile then finally logout.

INPUT DESIGN

The input coming up with is that the link between the entropy system and therefore the user. It includes the developing stipulation and operation for knowledge preparation and people steps area unit necessary to place dealing knowledge in to a usable kind for process is achieved by inspecting the pc to browse knowledge from a written or written document or it will occur by having mass keying the info directly into the system. The planning of input focuses on controller the number of input needed, dominant the wrongdoing, avoiding delay, avoiding duplicate steps and keeping the method person. The input is meant in such how in order that it provides security and remainder of use with retentive the secrecy. Input Design considered the following things:

- What information ought to run as input?
- However the information need to be organized or coded?
- The dialog to guide the operational personnel in providing input.
- Methods for making ready input validations and steps to follow once error occur.

OBJECTIVES

1. Input vogue is a strategy of adjusting where a user-oriented description of the input is fed into a computer-based system. This style is primary to avoid errors within the given input method and shows the right direction of management for obtaining correct information from the processed system.
2. Achieved by making use of screens for the information entry to handle large volume of knowledge. The goal of planning input is to make knowledge entry easier and free from er-

rors. The info entry screen is designed in such the way that everyone manipulates or enters the information. It additionally provides record viewing facilities.

3. Once the info is entered it'll check for its validity. Knowledge is often entered through screen input method. Acceptable messages are given as required so that the user won't be in surprise. Therefore the target of input method is to make associate degree input layout that's simple to follow

OUTPUT DESIGN

A quality output is one that is essential to meet the needs of the end user and showcases the knowledge. In a given system results of a process are sent to the users and also to other system through outputs.

1. Planning pc output is for proceeding in a well thought out manner; the correct output should be improved whereas making certain that every output part is meant so the system will use it effectively. Once analysis is done on pc output, they must establish the precise output that's required to satisfy the requirement.
 2. Choose ways for representing data.
 3. Produce document, report, or alternative formats that contain data created by the system.
- The output data system must satisfy one or more of the subsequent objectives.

- ❖ Convey past data of activities, current standing or projections of the future.
- ❖ Warn for signal vital events, opportunities and problems.
- ❖ Trigger associate in supportive action.
- ❖ Confirm associate in supportive action.

IX. CONCLUSION

In this paper, we proposed situations of blockchain innovation utility in numerous social insurance settings: critical attention, restorative data inquire about, and associated wellness. We talked about how keeping up a permanent and easy document, which video display units every one of the occasions took place over the device, may want to improve and inspire the administration of restorative records. In view of the compels diagnosed with the social insurance placing, we defended the decision of the permissioned block chain innovation for the use of the proposed situations. We likewise exhibited a layout of the gadget for the unique wishes if there must be an occurrence of radiation oncology data sharing and accomplished a version that guarantees safety, security, accessibility, and best-grained get entry to electricity over exceedingly sensitive patients' information. As a characteristic of destiny paintings, we might need to develop the structure of a affected person record and its metadata, utilizing the semantics of social insurance facts, consisting of the chance of sharing radiology pictures, which is substantially more tough. Since we work in a joint effort with a health facility, we intend to test our framework with the facts of the real sufferers. Our long haul objective is to investigate exclusive situations proposed in the paper, for example, associated wellbeing

and therapeutic data check out and apply them via and by to upgrade the prevailing medicinal services records the board. A end-to-end futuristic work can include the following:

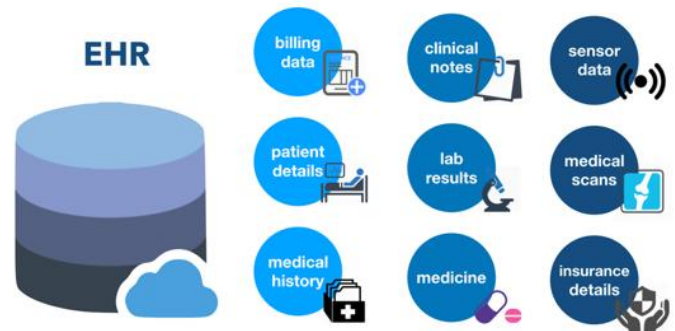


Fig 20: Electronic Health Record (EHR) Systems & Deep Learning

Using Deep Learning can help in the following clinical predictions by doctor: Medical codes, clinical notes, Time-series data, Medical scans, etc..

Medical Codes: It comprises of lab values, information about patient etc... Likely hood of disease can be predicted by storing demographic information about the patient in the EHR. Heart failures can be detected from this information about patients.

Clinical notes: This is unstructured data representing large volume of information about health of the patient. They include doctors' notes, medical procedures during investigations. Deep Learning techniques associated with CNN and RNN can be used to predict onset of diseases.

Time-Series data: They are obtained through sensors placed around patients to monitor the health condition from time-to-time. CNN can be used to process time-series specific inputs obtained from the diseased.

Medical Scans: Medical scans provide valuable data from which there can be valuable conclusions resulting in providing valuable conclusions. CNN can be used to process such information.

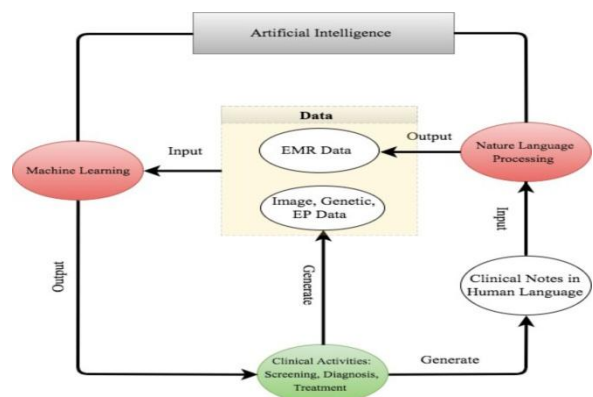


Fig 21: Electronic Health Record (EHR) Flow diagram

Screen shots



Block chain Based Implementation of Electronic Medical Health Record



Fig 22: Screen shot -1



Fig 23: Screen shot -2

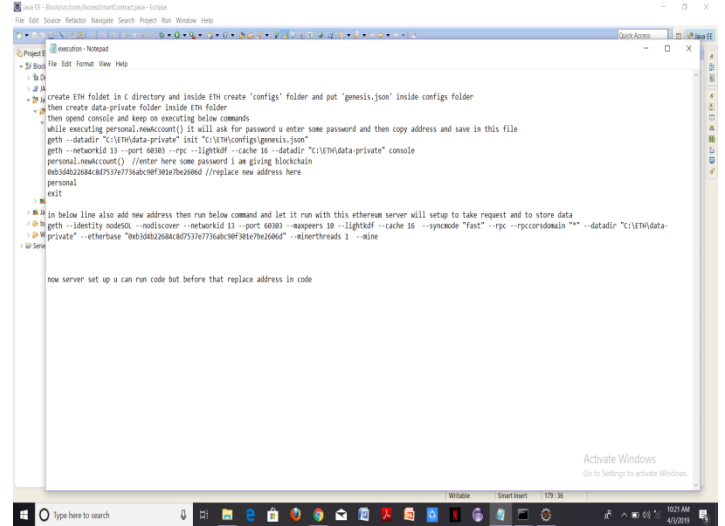


Fig 23: Screen shot -3

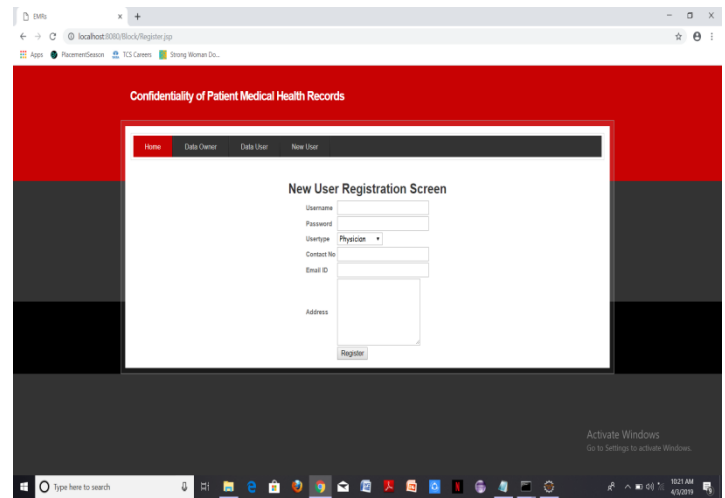


Fig 24: Screen shot -4

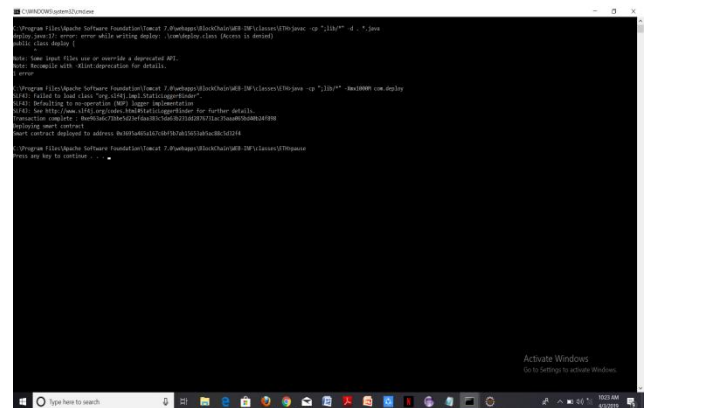


Fig 25: Screen shot -5

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AUTHORS PROFILE



Dr. B. Narendra Kumar Rao, obtained Bachelor Degree in Computer Science and Engineering from University of Madras, M.Tech in Computer Science from JNTU, Anantapur, Ph.D. from JNTUH, Hyderabad. He has more than 18 years of experience in Area of Computer Science and Engineering which includes four years of Industrial Experience and Twelve years of Teaching Experience. Research interests include Software

Engineering, Deep Learning and Embedded Systems. Currently he is working as Professor, Chairman Board of Studies in Department of Computer Science and Coordinator, IQAC at Sree Vidyanikethan Engineering College



Mr. B. Bhaskar Kumar Rao is an Assistant Professor from Department of IT, Sree Vidyanikethan Engineering College, A. Rangampet. He has done his M. Tech in Department of CSE from SRM University, Chennai and B.E from Sree Vidyanikethan Engineering College, A. Rangampet. His area of research includes Software Engineering, computer vision related approaches.



Dr. Vellingiri J working as Associate Professor in Sree Vidyanikethan Engineering College, Tirupathi, Andhra Pradesh. He has completed Ph.D. in Computer Science and Engineering from Anna University, Chennai in 2012 and he completed Master of Engineering in Computer Science and Engineering from Anna University, Chennai from 2006. His area of research includes Data analytics and Artificial Intelligence.

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