

**Seminar Title**

**BLOCKCHAIN**

**TECHNOLOGY**

**Submitted To**:

Prof.Mohamed Minhaj

**Submitted By**: Group 6

Aman Sharma -19126

Manguirish - 19138

Monica P.M - 19150

Suhas M.S - 19174

Riddhi Patsa - 19162

|  |  |  |
| --- | --- | --- |
| **SL.NO** | **CONTRIBUTION** | **STUDENT NAME** |
| 1 | Introduction to Blockchain and the working | Aman Sharma |
| 2 | Implementation of the given topic | Manguirish |
| 3 | Advantages and uses of Blockchain | Monica P M |
| 4 | Implementation of blockchain in health care | Suhas M S |
| 5 | Challenges and Conclusion | Riddhi Patsa |

Contents

[INTRODUCTION 1](#_Toc19544129)

[WORKING OF BLOCK CHAIN 1](#_Toc19544130)

[IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY 3](#_Toc19544134)

[Implementation in Health care 4](#_Toc19544135)

[ADVANTAGES OF BLOCK CHAIN 5](#_Toc19544136)

[USES OF BLOCKCHAIN IN HEALTH CARE: 6](#_Toc19544137)

[CHALLENGES 8](#_Toc19544138)

[Interoperability & integration with the legacy systems 9](#_Toc19544139)

[Adoption and incentives for participation 9](#_Toc19544140)

[Uncertain cost of operation 9](#_Toc19544141)

[Regulation 10](#_Toc19544142)

[Governance 10](#_Toc19544143)

[Scaling 11](#_Toc19544144)

[CONCLUSION 11](#_Toc19544145)

**REFERENCES**

# 

# **INTRODUCTION**

The Block Chain is an incorruptible virtual ledger of economic transactions that may be programmed to document now not simply monetary transactions but clearly everything of value. In different word a blockchain is a time-stamped collection of immutable report of information this is controlled by means of cluster of computer systems now not owned by using any single entity. Each of those blocks of facts (i.E. Block) are secured and bound to every other the use of cryptographic ideas. The blockchain community has no crucial authority — it's miles the very definition of a democratized device. Since it is a shared and immutable ledger, the information in it is open for everybody and absolutely everyone to look. Hence, anything that is built at the blockchain is through its very nature transparent and each person concerned is accountable for their movements. Blockchains will alternate the manner inventory exchanges paintings, loans are bundled, and insurances shrunk. They will get rid of financial institution debts and practically all services presented with the aid of banks.

The blockchain is a ingenious way of passing information from A to B in a fully automated and secure way. One birthday party to a transaction initiates the manner by growing a block. This block is established by means of thousands, possibly hundreds of thousands of computer systems distributed around the net. The established block is introduced to a chain, that is stored throughout the internet, creating no longer just a completely unique record, however a unique document with a unique history.

**WORKING OF BLOCK CHAIN**

The blockchain is maintained by a peer-to-peer network. The network is a collection of nodes which are interconnected to one another. Nodes are individual computers which take in input and performs a function on them and gives the output. When a new transaction or an edit to an existing transaction comes in to a blockchain, generally a majority of the nodes within a blockchain implementation must execute algorithms to evaluate and verify the history of the individual blockchain block that is proposed. If a majority of the nodes come to a consensus that the history and signature is valid, the new block of transactions is accepted into the ledger and a new block is added to the chain of transactions. If a majority does not concede to the addition or modification of the ledger entry, it is denied and not added to the chain.

Information held on a blockchain exists as a shared and restored database. This is a way of using the network that has benefits. The blockchain database isn’t stored in any single location, which means the records it keeps are truly public and easily verifiable. No centralized version of this information exists for a hacker to corrupt. Hosted by millions of computers simultaneously, its data is accessible to anyone on the internet. The three main supporting systems of block chain are:

1. **Decentralization**

In a centralized entity we have all the data stored and we have to interact solely with this entity to get whatever information you required. The client-server model can be a best example of centralized entity where when we send a query to the server it gets back at us with the relevant information. But this has many vulnerabilities like all the data is stored in one spot which makes them easy target spots for potential hackers, and if the centralized system were to go through a software upgrade, it would halt the entire system. But in case of a decentralized entity the information is not stored by one single entity rather everyone in the network owns the information. If we want to interact with our friend then it can be done directly without going through a third party.

1. **Transparency**

The person’s real identity is secure. A person’s identity is hidden via complex cryptography and represented only by their public address. This level of transparency has never existed before within a financial system. It adds that extra, and much needed, level of accountability which is required by some of these biggest institutions.

1. **Immutability**

Immutability, in the context of the blockchain, means that if once something has been entered into the blockchain, it cannot be tampered with. This property of blockchain is because of cryptographic hash function. The blockchain is a linked list which contains data and a hash pointer which points to its previous block, which creates the chain. A hash pointer contains the hash of the data inside the previous block. This one small property is what makes blockchains amazingly reliable. There will be drastic change in the hash of the previous blocks if any changes are made in a particular block. So there will be a complete change in the whole chain and this makes blockchain more reliable and immutable. In the **financial** world the applications are more obvious and the revolutionary changes more imminent. Blockchains will change the way stock exchanges work, loans are bundled, and insurances contracted. They will eliminate bank accounts and practically all services offered by banks. Almost **every financial institution will go bankrupt** or be forced to change fundamentally, once the advantages of a safe ledger without transaction fees is widely understood and implemented.

## Dark Gray CubeCell TowerRequest for transaction Block creation User Block is broadcasted to other nodes

## CheckmarkDocumentDark Gray CubeUser network

## Certification of transaction block Block is added to chain Transaction is executed

# 

# **IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY**

There are four stages in implementing blockchain technology.

These stages are:

1. Identification of a blockchain use case.
2. Proof of concept.
3. Field trial.
4. Full volume roll out.
5. **Identification of a blockchain use case**

The first step in implementing blockchain technology is to identify a use case, which is a system analysis methodology used to identify, clarify and organize the system requirements. It involves determining if blockchain technology would be appropriate in the particular circumstance. While the technology has numerous applications, there are situations where it will be most suitable. In other situations, it may be unnecessary. For example, where an immutable record of transactions is needed or there is need to eliminate a third-party intermediary, blockchain technology would be appropriate. Generally, a use case is made up of several possible sequences of interactions a system and users in a certain environment and for a particular goal.

1. **Proof of Concept (POC)**

The Proof of concept is documented evidence that a proposed application of blockchain technology will be successful. Developing a proof of concept can help you identify potential technical and logistical issues that may interfere with the implementation of blockchain technology. It provides an opportunity for your organization to solicit internal feedback about the proposed use of the technology. This can reduce exposure to unnecessary risk and provide an opportunity to stakeholders to assess design choices in the early stages of the system development cycle. A proof of concept plan should demonstrate how the implementation of blockchain technology will support your organization goals.

1. **Field Trial**

Once it is known that the organization can implement blockchain technology profitably and with minimal flaws, a field trial should be conducted. This involves piloting the blockchain project. If the organization has several branches, one could start with one or two branches to test the viability of the technology. If it’s a single branch organization, you could have phase one where you implement the technology on a small scale for a particular time period. This leaves room for reverting to the previous system should the blockchain based system prove unprofitable.

1. **Full Volume Roll out**

One can implement blockchain technology fully after the trial is successful. All technical flaws must be addressed that could affect full roll out. Additionally, ensure that there are adequately trained staff as well as appropriate hardware and software capabilities that will handle the blockchain based system once implemented it in full.

## Implementation in Health care

#### For medical and healthcare providers, the blockchain offers outstanding opportunities for storing an enormous amount of records, performing pre-authorization payments, and processing complex transactions. Implementing blockchain technology will help healthcare industries maximize the effectiveness of their doctors, while at the same time minimizing the repetitive data-entry and recovery activities that limit the doctors. Blockchain can find itself applicable in hosting, securing, and sharing new medical research. Conducted on a regular basis and results are published across the entire year, without decentralized ledgers it is [challenging for doctors](http://www.diagnosticsworldnews.com/2017/09/07/the-return-of-individual-research-results-through-the-eyes-of-clinicians-researchers-participants.aspx) to keep up with emerging new drugs on the market and information about techniques that have been proven to be successful at treating various ailments.

Few implementations are as follows

* Supply chain probity
* Drug development & Medical Research
* Data / Cybersecurity and healthcare IoT
* Claims & Billing management
* Ambulance and Emergency response

**[MedRec](https://medrec.media.mit.edu/technical/)** is one prototype that implements blockchain for keeping and managing electronic health records and medical research data. It enables secure immediate access to patients’ records by other medical programs which avoids waste of time due to bureaucracy and procedure duplication. In case of emergency, this is a life saver. In addition, upon patient’s permission, it anonymously gives access to a medical record for research purposes and medical breakthroughs. In case of emergency, this is a life-saver. In addition, upon patient’s permission, it gives access to medical records for research purposes and medical breakthroughs. MedRec is developed and supported by MIT Media Lab and a grant from Robert Wood Johnson Foundation.

# **ADVANTAGES OF BLOCK CHAIN**

Though blockchain is a new idea, but its worth and significance proved this technology best in a very short time. These are the key advantages which are mentioned below-

1. **No fraud issues:** It is an open source ledger, every transaction will be made public and there will be no chance of fraud taking place. The worthiness of this technology will be constantly monitored by miners who keep track of all transactions.
2. **No Government Interference:** There is no control of Government and financial institutions on virtual currencies that are based on blockchain technology. Devaluation of various currencies is happened by government interference sometimes and the good example of it is latest Zimbabwean Dollar. When Governments interfere too much with the currencies, this leads to inflation or hyperinflation by degrading or printing too much currency in short time. As blockchain is decentralized online ledger, so it is impossible for government to interfere and take any action on cryptocurrencies.
3. **Instant Transactions:** Virtual currencies that are based on blockchain offer transactions that are 10x faster than usual bank ones. For example, if a transaction made for a person who has different bank accounts then it will take minimum 2 days for transaction but blockchain transactions will be usually completed in just few minutes.
4. **Improved Financial Efficiency:** Blockchain technology make transactions directly to end user without involving any 3rd parties. So it enhances the financial efficiency in every nation and people will be less dependent on financial institutions or banks. It will not only save a lot of money for people and also other related expenses with utilizing banks.
5. **No technical Failures:** Blockchain data is stored in thousands of devices on a distributed network of nodes, so the system and the data are highly resistant to technical failures and malicious attack. Each network node is able to replicate and store a copy of the database. So that there is no failure issues, a single node going offline does not affect the availability or security of the network.
6. **Empowered users:** Users are in control of all their information and transactions.
7. **Ecosystem simplification:** With all transactions being added to a single ledger, it reduces the clutter and complications of multiple ledger.
8. **Stability:** Blocks are unlikely to reverse, so that once data has been registered, then it is difficult to remove or change it. So this makes blockchain a great technology for storing financial records or any other data where an audit trial is required because every change is tracked and permanently recorded on a distributed and public ledger.

# **Uses of Blockchain in Health Care:**

The blockchain era has already begun. The fast progress in development of new and efficient healthcare record systems, wearable devices, and medical examination systems implementing artificial intelligence, cryptography will become an important part of the way hospitals work. There are, however, a few improvements still needed for seamless blockchain adoption across the entire medical industry. According to Hyperledger’s survey, 42.9% of healthcare organizations suppose that the interoperability of electronic health records will help for faster blockchain implementation; with 28.6% of respondents ready to use this technology in care settings today.

Blockchain in healthcare examples include the following usage issues: So the below mentioned are some of the factors examples which are included in health car and lets see all the examples with a brief explanation and also the solution using blockchain.

* Drug traceability.
* Data security in clinical trials.
* Patient Data Management.

**Problem: Drug Traceability**

One of the most serious problems in pharmacology is drug counterfeit. According to the Health Research Funding Organization (HRFO), approximately 10%-30% of drugs in developing countries are fake. US businesses lose up to $200 billion annually because of drug counterfeiting; however, the main reason is not in counterfeiting itself, but, rather, that these drugs provide different effects than their traditional medicinal counterparts. They may not help patients at all, or may even be harmful and dangerous to a person’s health.

**Blockchain-Based Solution**

As all transactions in blockchain are times tamped and immutable, Detection is easy for fraudulent drug dealers. There are two blockchain types: private and public. Trustworthy healthcare blockchain companies have to register their products in the private system to ensure authenticity and the high quality of their medicines. Private blockchains are moderated by central entities, and the fact that a specific producer or distributor has access to the so-called drug blockchain is proof of drug authenticity. This is where blockchain transparency comes in useful. Once a drug is produced and moves from the manufacturer to retailer, the operational data is recorded on the blockchain. It makes it easy to verify the drug, and determine all chain links at any time.

**Problem: Data Security in Clinical Trials**

Clinical trials are used to determine the effectiveness of particular medicines which cure specific diseases. These tests can either prove or disprove an offered hypothesis. During clinical trials, researchers obtain and record a great deal of information concerning statistics, test results, quality reports, etc. Each scientist is responsible for specific research, making it difficult to control everyone. Those data can then be easily modified or hidden in order to change the whole outcome of the research performed. Criminals are interested in recording the results that are beneficial for them, even if the data does not coincide with the reality.

**Blockchain-Based Solution**

This technology allows users to prove the authenticity of any document registered in the system. It provides proof-of-existence by adding data in the form of the transaction and validating the information by all system nodes. As mentioned above, blockchain records immutable data. This characteristic will allow for the storage of results from clinical trials in a secure way, making it impossible to modify data. Two doctors from Cambridge University conducted a 2016 study to see how blockchain can provide proof-of existence for clinical trials. They found that comparing a unique data code, which is set by the system, with the original makes it possible to verify whether the data of clinical trials has been modified, thanks to the inner SHA256 calculator which generates a unique hash every time a modification is made to the data.

**Problem: Patient Data Management**

Patient data privacy is strictly regulated by the Health Insurance Portability and Accountability Act (HIPAA), and requires PHI to be totally secure. There is, however, another problem related to PHI: sometimes, patients need to share their medical records with third parties (e.g. with pharmacies when they need to buy specific medicines). So, how can blockchain help protect data while providing partial access at the same time?

**Blockchain-Based Solution**

The Blockchain creates a hash for each PHI block, together with a patient ID. Using an API, covered entities can receive the necessary information without revealing a patient’s identity. In the same way, a patient can decide whom to provide with access and whether this access will be either full or partial. Furthermore, a patient can set specific third parties that would have to give their permission for sharing the PHI, if the patient is not sure in what he or she is doing.

Blockchain has a tremendous potential of use in different industries, including healthcare. This technology has already become widespread in the financial sector, but medical organizations still hesitate to implement it into their IT systems. This does not mean, however, that there are no healthcare companies currently using blockchain. Below, you will find a short list of start ups that have made this technology the base of their operational structure.

Blockchain healthcare start ups:

· Guardtime (a blockchain-based system for securing patient healthcare records);

· Gem Health (an initiative that promotes blockchain-based collaboration in healthcare);

· Cyph (a platform for building secure digital identities and ensuring protected communication between healthcare providers);

· MedRec (a blockchain-based system for securing medical records management); and,

· Blockchain Health (a blockchain-based system for medical research management).

Blockchain is an effective technology that can help prevent data breaches in the healthcare industry. It is a secure and reliable method of recording, storing, and sharing sensitive data. Caregivers will definitely benefit from implementing this technology, while remaining HIPAA compliant with this method of trustworthy digital protection.

# **CHALLENGES**

As blockchain has extreme potential for the improvement and value addition to the healthcare system and many companies have started using it for speciﬁc purposes but still there are various challenges present to be taken care of before block chain came in the mainstream. Some of the issues related to block chain are for example:

## 

## Interoperability & integration with the legacy systems

Healthcare facilities has a huge number of technologies, machines, and equipment and people, all these come together to cater the current needs in the facilities. There are possibilities for improvements, blockchain technology is providing a promise to fill the gap of these possibilities. Still, the blockchain technology would be just one technique, though a very important one. The blockchain technology must to be integrate with existing systems, but this integration is going to be very challenging because of the reasons like interoperability. The healthcare facility has large numbers of tools and device which make it even more difﬁcult. All releted parties and stakeholders must come together to make the effective use of blockchain technology in healthcare. Some of the issues like infrastructure building will still be there, regardless of the blockchain. Another important part of this challenge relates to the of healthcare staff, those people may be needed to be trained on use of this technology if the blockchain technology would ever enter into the healthcare facility.

## Adoption and incentives for participation

Adoption of this technology in healthcare facility would require the co-ordination and co-operation of various parties. These parties can be the hospital staff, device manufacturers, etc. some changes in each of these parties current behaviour would be required, it would be very natural for these stakeholders to expect some incentive in order to participate in the change. For managing these expectations a new business models should be identified that will able to give the fair incentives to all these stakeholders. The incentive must takes in consideration the costs and efforts in adopting the new blockchain based technologies, along with all other underlying changes in the operational model that the deployed solution entails. For example the solution for blockchain based patient data management. In this scenario, a fair incentive should be employed in business model that could get patient’s, device manufacture’s, backend IT solution provider’s, hospital’s, etc acceptance.

As the technology is still in evolution , it would be some time before proven robust incentive models are aplenty. Meanwhile, any associated risk of a particular incentive model must be carefully assessed and quantiﬁed.

## Uncertain cost of operation

While blockchain has promising highlights, for example, no need of focal specialist (and consequently no main issue of disappointment), transparency and generally quick settlement of exchanges, the expense of working blockchain frameworks are not yet known. Today, a signiﬁcant measure of resources in healthcare is being spent on work force, time, and money to build and oversee the current conventional data system and information exchange. In addition, there is an overhead of persistently updating the system, investigating issues, performing backup, stressing over hacks and information ruptures.

The blockchain-based HIE framework could be mare effective and more efﬁcient contrasted with the traditional HIE framework. This, for instance, could come because of the upgraded security by structure. In any case, the general expense elements associated with a blockchain technology based healthcare services must be vigorously evaluated in a given business and operational model of a healthcare organisation.

**Regulation**

A solution in the healthcare facility needs to hold fast to a different arrangement of guidelines as the patient's well being and even life is at stake, directly or indirectly. Further, as it concerns health data, the worries in regards to data security are also the highest . The blockchain technology being a new technological solution that is being embraced among the early users ,one of the difficulties stay on how the solution on top of blockchain technology conform to existing guidelines and measures. While existing HIE frameworks have different years to evolve towards meeting the regulatory requirements, the blockchain technology may be still in the advancement stage to ﬁnd the sweet arrival spot inside the healthcare space where it can likewise satisfactorily stick to set healthcare guidelines. To accomplish this, , a number of pilot deployments and rigorous test and validation of the underlying technological pieces must be considered by the solution providers. The prerequisites to cling to guidelines could likewise be a catalyst for further innovative headways in the blockchain technology.

The requirements from newly enforced General Data Protection Rule (GDPR) is one of the cases which is leading discussion and thoughts on how blockchain technology could further evolve to comply with set regulations.

## Governance

The basic premise of the distributed nature of blockchain helps to bring parties into a trusted transaction scheme, without the need of centralized authorities. However, if we see how a healthcare organizations works , there could be various different operational models. In some operational models of blockchain based solutions, it may be crucial to have a stakeholder to assume the role of a regulator to govern the overall operation. This governing model may, for example, be required to meet the regulatory requirements. It is not yet clear that how such a governance structure can be managed in a system with multiple different parties. This aspect of governance will have a tie-in with the intended incentive schemes. However, as the adoption of new blockchain based solutions will surely evolve in the healthcare facility, we would see various solutions also to the requirements of governance.

## Scaling

Not only in healthcare but any in any industry, the underlying blockchain network must have scalability for successful application of any blockchain-based solutions. At least in the early phase, various solutions in healthcare will use the semi-permissioned blockchains which are scalable and have high transaction throughput at the cost of decentralization. Still , there will be a need for public blockchains for communication among permissioned blockchain networks. And also , a blockchain-enabled global HIE can only be possible with highly scalable public blockchains. In current form, public blockchain networks like Bitcoin and Ethereum are not fast and cheap enough to host any decentralized applications on a large scale. However, there have been several ongoing scaling efforts such as lightning network, state channels, plasma chains, sharding, zk-snarks, etc. and some of them are already being adopted in practice. In the future, it is likely that the public blockchains will be fast and cheap enough for their mass adoption.

# CONCLUSION

Blockchain technology has the potential to solve numerous problems associated with the healthcare industry today. As a trust mediator, it can enable novel healthcare solutions; and as an incentive machine, it can enable novel business models which may lead to a new dynamic among various healthcare stakeholders like patients and providers. For example, a patient-centric healthcare model and a global HIE might be realized by virtue of blockchain enabled decentralized trust and incentive structures. Likewise, blockchain based decentralized network or services may minimize vendor lock-in problems in healthcare. We reviewed some usage of blockchain like as healthcare data management, supply chain management in the healthcare industry, billing management, analytics, etc. The applications range from moon-shot projects trying to create a whole decentralized health care system to applications like as data provenance, counterfeit drugs identiﬁcation, consent management, etc.

Despite the huge potential of blockchain technology and an immense amount of interest around it, we found that its influence on healthcare is minimal and is still in the early days. Most of the blockchain based healthcare solutions are still in the form of new concepts represented by whitepapers, models, or only a very small number of working products with a limited user base. However, the ﬁeld is growing rapidly; we anticipate a signiﬁcant positive impact of blockchain in healthcare in the recent future. Challenges such as interoperability, integration with the existing systems, uncertainty in cost , regulatory compliance, and scaling have to be successfully undertook to help blockchain make its spot in the healthcare industry.

**REFERENCES**

[1] <https://www.idc.com/research/viewtoc.jsp?containerId=US41114417>

[2] <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/public-sector/us-blockchain-opportunities-for-health-care.pdf>

[3] <http://compare-trials.org/>

[4] <https://public.dhe.ibm.com/common/ssi/ecm/gb/en/gbe03790usen/GBE03790USEN.PDF>

[5] <https://www.nytimes.com/2017/07/13/us/politics/health-care-fraud.html>

[6] <https://cryptobriefing.com/healthcare-industry-blockchain-technology/>