iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** IV **Month of publication:** April 2022

DOI: https://doi.org/10.22214/ijraset.2022.41486

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

An Effective Health Information Exchange Using Blockchain Technology

Prof. Chandini S B[1], Arpith Kagalkar[2], Bhumika Dhayanidi[3], Gunashree S[4]
[1, 2, 3, 4]*Department of Information Science & Engineering, Vidyavardhaka College of Engineering, Mysuru, Karnataka*

Abstract: ***There is a tremendous difficulty in sharing information between organizations. The similarity is compromised because of heterogeneous information, and an impediment to information understanding happens because of the utilization of medical care wording.***
Assuming design and semantics are to have concurred; however, security and information consistency concerns remain. Centralized information stores are an alluring focus for cybercrime, and patient record that is being shared and seen reliably in an organization is an enormous issue. Blockchain is a circulated record innovation applied to a great extent in the monetary area.
This guarantees the honesty of exchanges without outsider approval. Its elements of decentralized exchange approval, information provenance, information sharing, and information incorporation are ideal for the requirements of health information exchange.
Keywords: EHR, HIE, Blockchain, SHA Algorithm, AES Rijndael Algorithm

I. INTRODUCTION

The electronic health record (EHR) could be a digital record that firmly records data a few patients and makes it accessible to users in period of time.

Health data Exchange refers to the method of act patients' aid statistics between aid patients and aid professionals. There has been attention on health-statistics exchange as a major tool for providing wonderful and economical treatment, and several other policy approaches are accustomed strengthen competencies during this space. Health data exchange (HIE) delivers vital advantages to patients by up aid quality and expediting coordinated treatment.

HIE's have evolved into 3 differing types, every providing a novel approach to health data access. Direct Exchange: Health care professionals will safely share patient information with alternative physicians through a directed exchange. The info is transmitted over the web in a very dependable and secure encrypted manner.

Directed exchange is employed to transmit quality-measurement results to the agency and vaccination data to public health agencies. Query-based Exchange: Through the query-based exchange, physicians could ask for and retrieve precise health data on a patient from whichever acceptable clinical sources are accessible.

This kind of rush is most usually utilized by suppliers to convey unlooked-for treatment, like in associate degree emergency circumstance or once a patient goes into labor whereas move. Consumer-Mediated Exchange: Patients will access their own medical data firmly and simply on-line. This enables for the patient to participate in their own care and will increase satisfaction and accuracy. Through this utilization of rush, customers will higher manage their own health care, not like those who could use on-line banking to manage their finances.

A. Blockchain

Blockchain technology may be a framework that maintains public group action information, conjointly known as blocks, in various databases, mentioned as the "chain," in an extremely large network connected by peer-to-peer nodes. Blockchain, also known as Distributed Ledger Technology (DLT), employs decentralization and cryptographic hashing to create an immutable and visual history of any digital asset. Kind of storage is usually mentioned as a "digital ledger."

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

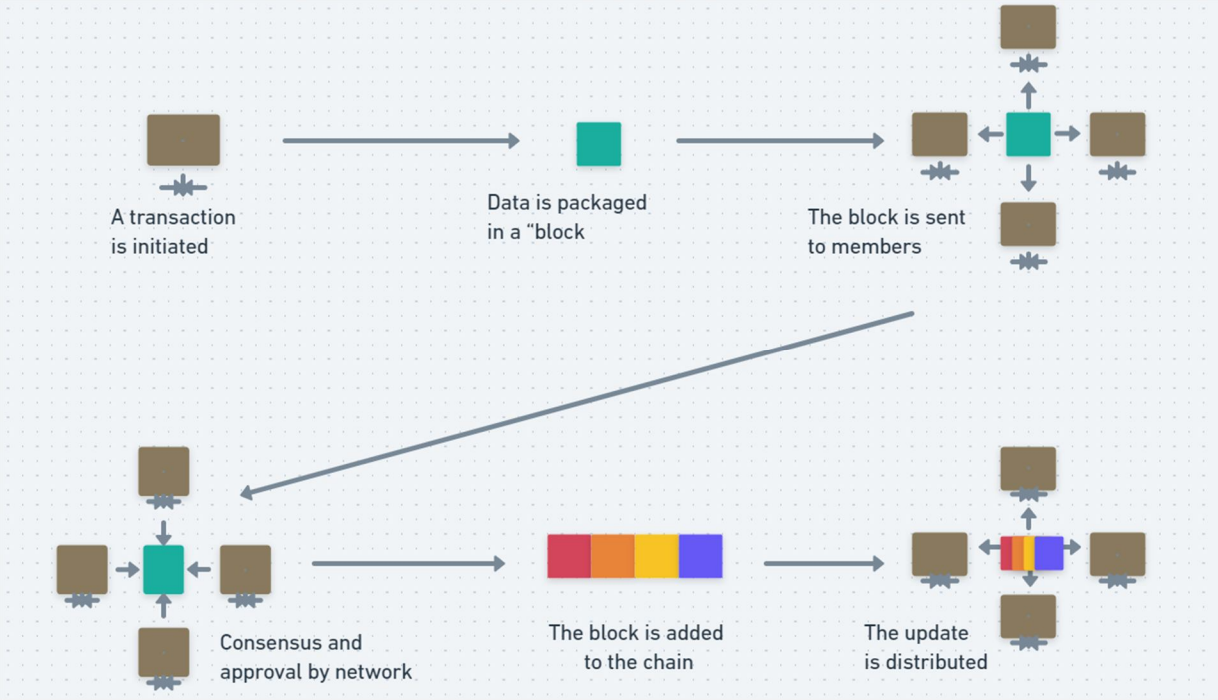


Fig 1. Blockchain Work

Each blockchain contains bound data like the hash of this block and also the preceding block. The information contained within a block varies depending on the type of blockchain. For instance, the Bitcoin blockchain records group action details like the sender and receiver, as well as the amount of bitcoin. A blockchain conjointly contains a hash that is analogous to a fingerprint in that it identifies a block and every one of its contents and is often distinctive. Once a blockchain is created, its hash is computed, and sterilization of one thing within the block can cause the hash to alter. Once anyone desires to spot changes to the blocks, the fingerprint of the block changes, and it's no longer an equivalent block. The third part, at intervals every block, is the hash of the preceding block, primarily making a series of blocks.

Blockchain stands to revolutionize the manner in which we have a tendency to move with one another. The first reason is the way it tracks and stores knowledge. A blockchain stores data in batches known as blocks that are coupled together in a written record fashion to make an eternal line. Metaphorically, a series of blocks If you create an amendment to the information, "the knowledge," or "the knowledge" recorded during a specific block, you do not rewrite it. Instead, that amendment is held on during a new block showing that X amendment to Y at a specific date and time. That is because blockchain relies on a centuries-old technique of a general money ledger. It is a non-destructive exercise thanks to tracking knowledge changes over time.

Like the adulthood ledger technique, which was originally a book rather than an info file held on an easy system, the blockchain was designed to be decentralized and distributed across an oversized network of computers. This dispersal of information of knowledge reduces the flexibility for data meddling and results in the world as the second issue that distinguishes blockchain: The second reason is it fosters trust in the knowledge. Before a block is added to the chain, some things have got to happen. First, a cryptologic puzzle should be resolved. This will make a block. The PC that solves the puzzle shares the answer with all or any of the other computers on the network. This can be known as proof of labor. The network can then verify this proof of labor and, if correct, the block can add further to the chain. The mix of those advanced math puzzles and verification by several computers makes sure that we are able to trust every single block on the chain. As a result of the network's trust building for the world, we have a tendency to currently have the chance to move directly with our knowledge in real time. Which brings the world to the third reason blockchain technology is such a game changer: The third reason is that there aren't a lot of middlemen. Current leave we do not show the other person our money or business records after doing business with each other. Instead, we have a tendency to accept trustworthy intermediaries, like banks or attorneys, to look at our records and keep that data confidential. These intermediates build trust between the parties and are ready to verify.

Some blockchains are utterly public and hospitable for everybody to look at and access. Others are preparing to select a group of authorized users, such as your company, a group of banks, or a group of government agencies. And there are hybrid public and non-public blockchains. In some cases, those with non-public access will see all the information that the public will only see alternatives to. In others, everybody will see all the knowledge, the info, or the information. However, just some folks will have access to feature new data. It may enable everybody to look at property records, but it may also reverse its prerogative to update them. It's the mix of these factors that disperse "of knowledge," "of knowledge," and "of information," building trust within the knowledge and permitting the world to move directly with each other and therefore the data that provides Blockchain Technology has the potential to underpin several of the ways that we have a tendency to move with one another. However, much like the increase of the web, technology can bring with it every kind of advanced policy query around government, law, security, and social science. Here at the centre for international governance innovation, we have a tendency to obtain to bring trust analysis, which will equip policy manufacturers with the knowledge they have to advance blockchain innovations, enabling social science to flourish in this new digital economy.

B. SHA Algorithm

In simple words, hashing implies taking an input of any length and producing an output of a defined length. In the context of cryptocurrencies, such as Bitcoin, transactions are accepted as input and then processed through a hashing algorithm that provides an output of a predetermined length. Regardless of how large or little your input is, the result will always be 256 bits long. This is crucial when dealing with big amounts of data and transactions because instead of remembering a significant quantity of input data, you can remember the cryptographic hash. Hash Function is a subclass of Hash Function that is perfect for cryptography. Cryptographic hash functions must satisfy six qualities in order to be considered secure.

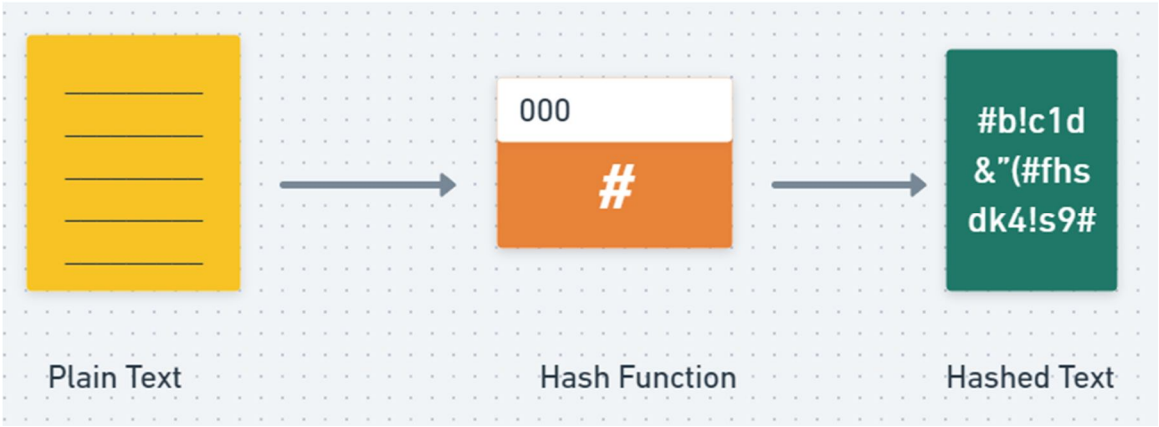


Fig 2. SHA Algorithm

C. AES Rijndael Algorithm

AES stands for an advanced Encryption Algorithm, one of the most secure encryption standards; waking this algorithm requires computational powers that far exceed the capabilities of modern computers every day AES and show the security of millions of Internet transactions, billions of wireless transactions as, well as countless files stored on the disc as the semantic cypher it uses the same secret code of 128, 192 or 256 bits of the encryption and the decryption is a safe and reliable way.

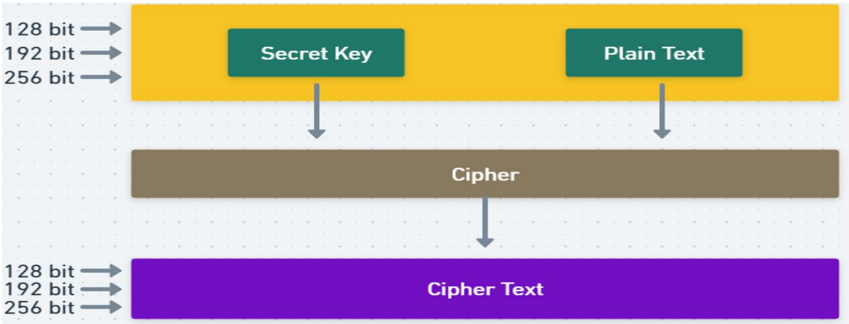


Fig 3. AES Rijndael Algorithm

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

II. CHALLENGES FACED IN HIE

Patient information privacy: Lack of clarity for rule variances across digital HIEs will cause some privacy and compliance considerations, particularly once patient data is being transmitted across state lines. Strict EHR standards will usually overcome this issue.

Patient ID matching: Providers might realize it troublesome to match patients with the health records and exchange data once multiple patients living within the same space conjointly share a birthdate or name. Making a separate symbol will facilitate resolving this downside.

Incomplete records: Some HIEs with centralized depositories contain outline (continuity of care) documents solely, which may skip vital context and compromise patient treatment in emergency situations. Mandating vital data to be enclosed will bypass this risk.

Insufficiency in Standards: Lack of standards in digital health data exchange will cause some privacy considerations. Hence, data changed digitally should adhere to some standards to be utilized in EHRs.

Lack of Clarity on necessities and Variations in Rules: Exchanging health data in alternative states is troublesome because of the variation in privacy rules. Moreover, suppliers square measure finding it troublesome to suit the state laws once exchanging patient's health data with the supplier in alternative states.

Difficult to Match Patients to Their Health Records: It is troublesome to match patients to their health records once exchanging health data. Suppliers square measure finding it troublesome to match patients with the health records and exchange data, because of the presence of many patients with constant name, birth year, and living within the same space. Hence, there's a necessity for an associated symbol which will match patients with their health records.

Cost of Health data Exchange: Covering value, the value the price of health data exchange is troublesome because it includes numerous prices like getting and implementation cost, price to participate in native or state speed organization, and dealings fees for exchanging data by vendors. Moreover, typically extra price comes up together with establishing an associate interface for health data exchange.

Contains solely outline Document: Some health data exchanges solely contain an outline document, which will even be brought up as a continuity of care document. Because of the generic nature of the document, it typically misses vital data on the patient's health that will be vital to supply the proper treatment.

Patient Consent: Authorization by the patient is one amongst the largest challenges in health data exchange, as authorization is very important to exchange health information through numerous technology and care platforms. It should conjointly cause legal risks if the health data of the patient is shared while not the patient's authorization.

Rising Competition: Competition amongst health data exchange suppliers is intense. Organizations square measure probably to still contend for the patient and on sharing data. Consistent with the report from Harvard grad school, sharing health data is the biggest concern amongst care suppliers, and it's specified it obstructed health data exchange development.

A 2017 shortlist survey found that eighty-seven % of adult shoppers were unwilling to let on all their medical data in this autumn 2016. Digital health data being shared on the far side a consumer's medico and hospital was a prime cited worry. Over fifty-seven % {– further that they were skeptical of potential edges to bound technologies being used by a hospital, physician, or subsidiary supplier. Eighty-nine % of these surveyed declared that they in reality withheld data from their supplier in 2016. Of these people, ninety-three % admitted it absolutely was thanks to considerations over personal monetary data security. Physicians changing into are getting have become} more and more weak with the number {of information of knowledge of information} becoming out there through data sharing though, which may cause supplier burden and in impact, less effective patient care. Reduced information sharing barriers in current HIPAA laws might facilitate scale back that burden, consistent with the Anneke Hospital Association (AHA). Limiting patient information sharing for "health care operations" will impact quality assessment and improvement activities, like outcome's analysis, AHA explained during a 2017 letter to the House ways in which and means that Health committee.

"The challenge that strict regulative prohibition poses within the integrated care setting is that patients often don't have a relationship with all the suppliers amongst whom data ought to be coordinated," AHA wrote. "A clinically integrated setting and every of its collaborating suppliers should concentrate on and be in control of all patients."

The CMS' Patients Over work initiative conjointly hopes to assist scale back body burden and medico burnout. Having a cooperative method for evaluating and streamlining laws to reduce regulatory burden, increase potency, and improve the beneficiary expertise can profit suppliers and patients, consistent with CMS.

"As we tend to concerning mention cite point out refer name remark quote observe bring up point out say state regulative problems in burden one issue we've detected about over and another time around several communities is that the problems around medical records and ability," CMS Administrator Seema Verma explained at the 2017 ONC Annual Meeting. "Many of our suppliers refer to the system that they're operating with and say it absolutely was not designed for them in terms of delivering care to their patients. It's a lot suited to an asking system."

Having all care stakeholders concerned are going to be key to reducing body burden, up ability, and strengthening health information exchange choices. This can even be necessary in making a care system that focuses on value-based care and making certain that patients square measure place 1st.

Additionally, specializing in care information security wants will reassure patients that their information can stay protected, even within the health information exchange method. Organizations ought to conjointly stay current on the most recent federal regulatory changes that might impact however data is used and disclosed.

III. COMPARATIVE STUDY

Title	Author	Year	Description	Methodology	Result	Limitations
A Blockchain-Based Approach to Health Information Exchange Networks	Kevin Peterson, Rammohan Deeduvanu, Pradip Kanjamala and Kelly Boles	2016	To describe an approach to effectively and securely share healthcare information within a data-sharing network	Blockchain mining	The cross-institutional sharing of health care information with the potential to considerably increases the analysis and clinical effectiveness	Limitations of blockchain-based approach is lack of awareness & key management [1]
ASHP national survey of pharmacy practice in hospital settings: Prescribing and transcribing	Craig A. Pedersen, Philip J. Schneider, and Douglas J. Scheckelhoff	2013	It focuses on practices and technologies for managing and improving the medication-use system and the role that pharmacists play in this effort	Survey sample and Questionnaire development	Pharmacists still expand their role in rising the prescribing of medicines in each the hospital and patient settings	Outdated data & costs a lot, inconsistency & inefficiency [2]
Improving Clinical Data Integrity by using Data Adjudication Techniques for Data Received through a Health Information Exchange (HIE)	Pallavi Ranade-Kharkar, Susan E. Pollock, Darren K. Mann	2014	It addresses the issue of data integrity for HIE data inbound into an organization	HIE data adjudicator	Presented potential for external data to be seamlessly integrated into an organization's EHR and clinical processes	The effort to establish a working exchange faced administrative and logistical delays. The accuracy of patient identity matching algorithms and processes[3]
Applying Blockchain Technology for Health Information Exchange and Persistent Monitoring for Clinical Trials	Yan Zhuang, Lincoln Sheets, Zonyin Shae, Jeffrey J. P. Tsai, Chi-Ren Shyu	2018	A private blockchain to simulate scenarios in HIE	Smart Contract, Blockchain, RPC server	The use of an autonomous validation approach for hotfoot and clinical trials without the involvement of a third party	No integration of data analysis of smart contract[4]

Blockchain distributed ledger technologies for biomedical and health care applications	Tsung-Ting Kuo, Hyeon-Eui Kim,and Lucila Ohno-Machado	2017	To introduce blockchain technologies, including their benefits, pitfalls, and the latest applications, to the healthcare domains	bitcoin-blockchain: hash-chain timestamping and proof-of-work algorithm	introduced Bitcoin and blockchain technology that underpins, that permits decentralized management, associate degree changeless audit path, information root, robustness and security	Transparency & scalability[5]
Choosing Wisely Clinical Decision Support Adherence and Associated Inpatient Outcomes	Andrew M. Heekin, John Kontor, Harry C. Sax, Michelle S. Keller,Anne Wellington,Scott Weingarten	2018	To determine whether CDS is correlated with improved patient clinical outcomes	Study population and Data Sources	When comparing adherent and non-adherent interactions, the overall encounter cost increased by 7.3 percent	Strict inclusion criterion limits our understanding of the clinical impact that patients with partially adherent episodes may have experienced [6]
Usage and Effect of Health Information Exchange	Robert S. Rudin,Aneesa Motala,Caroline L. Goldzweig,MSHS; and Paul G. Shekelle	2014	systematically review and evaluate evidence of the use and effect of HIE on clinical care	Data extraction, Quality assessment and data analysis	Assess and evaluate evidence of the usage and impact of HIE on clinical treatment on a systematic basis	Publication bias, possible selective reporting of outcomes. A dearth of reporting on context and implementation processes [7]
Stimulating the Adoption of Health Information Technology	David Blumenthal	2009	Improving health and healthcare through the use of HIT	Blockchain technology	Encourage the development and use of electronic health records and health information technologies	Inconsistency & inefficiency [8]
Comparison of blockchain platforms: a systematic review and healthcare examples	Tsung-Ting Kuo, Hugo Zavaleta Rojas and Lucila Ohno-Machado	2019	It provides a reference for the selection of a suitable blockchain platform and compare blockchain platforms using a systematic review method	PRISMA, distributed ledger technology	Using a systematic review method, assess distinguished blockchain platforms and provides a reference for choosing an associate degree an applicable blockchain platform	Restricted data and information & not included the minor technical features[9]

Table 1: Comparative Study

IV. PROPOSED SYSTEM

To use the one-of-a-kind innovative ability of blockchain for patient-driven HIE, we have carried out a blockchain system, SHA algorithm and AES Rijndael algorithm with different clinicians. A framework director from every medical care office will make a touchpoint for every quiet visit after the EHR is prepared and input the essential connected data for future interaction. Patients give clinicians consent to get their information by adding clinicians to the "permitted list". Clinicians can choose records through the touchpoints in the wake of being conceded admittance to a patient's records. The ensuing trade of information among the distant medical services offices will incorporate information encryption and utilization of the blockchain framework to send and recover decoding keys. We propose a framework to foster an application that will assist with getting the patient clinical information.

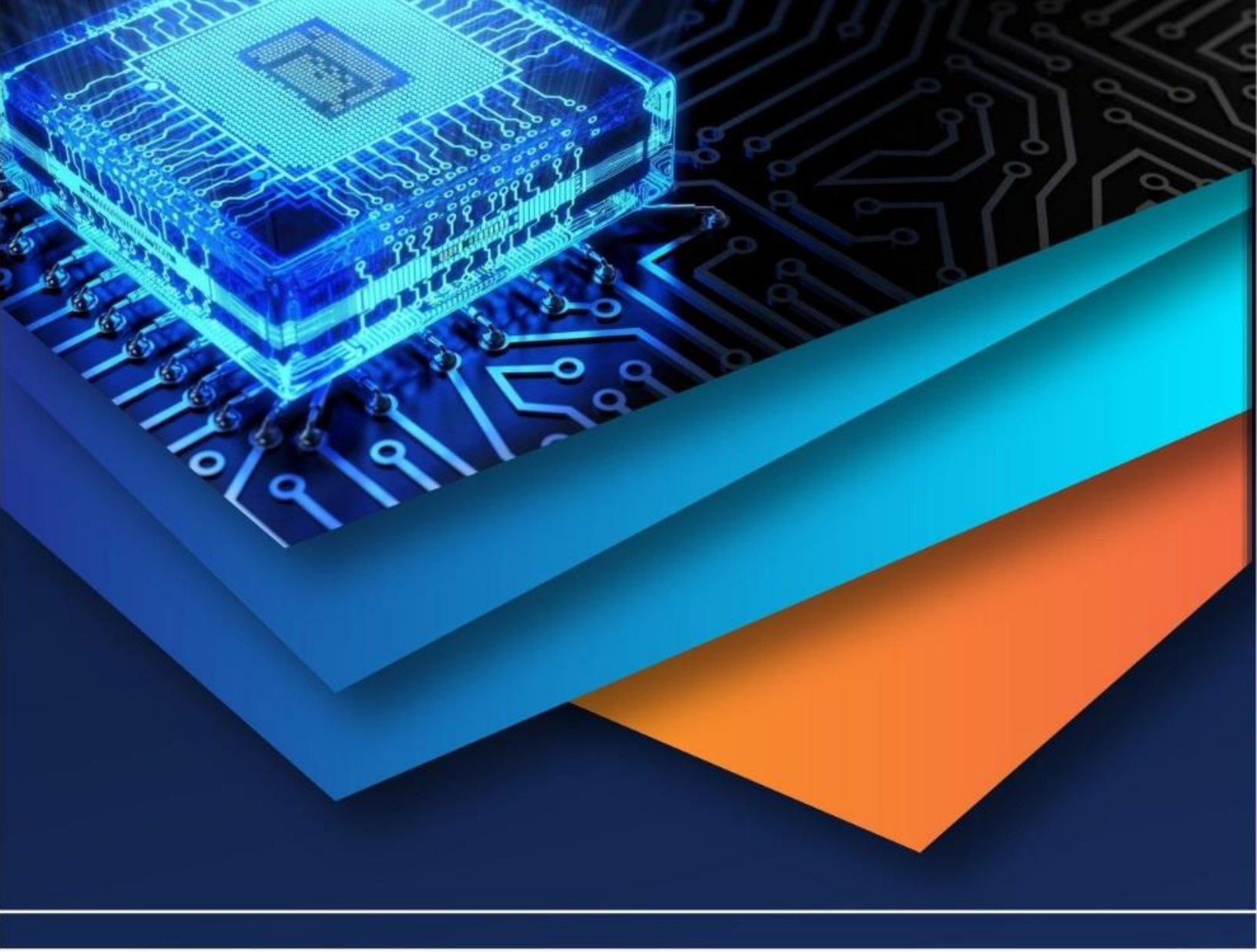
The patient subtleties and treatment information are put away in the data set. Each patient treatment subtlety is scrambled by utilizing SHA algorithm, AES Rijndael algorithm, using blockchain idea and put away in a database. To view patient treatment details, Doctor/clinicians demand and Access key is produced and notice is sent to the Doctor/clinicians Email ID. When the Access key is confirmed, they can see the patient's treatment subtleties by decoding the information. This empowers protection and security and keeps from outsider access.

V. CONCLUSION

To provide data security for efficient data transmission without posing any security or privacy risks in the healthcare field. It also facilitates data access from the various healthcare professionals. A possible solution to problems faced by health information exchange can be found by using the blockchain technology's characteristic property of being "unhackable." A blockchain paradigm that protects data security and privacy, ensures data provenance, and gives patients complete ownership over their medical information.

REFERENCES

[1] K. Peterson, R. Deeduvanu, P. Kanjamala, and K. Boles, "A blockchain-based approach to health information exchange networks," in Proc. NIST Workshop Blockchain Healthcare, 2016, vol. 1, pp. 1-10.
[2] C. A. Pedersen, P. J. Schneider, and J. P. Santell, "ASHP national survey of pharmacy practice in hospital settings: prescribing and transcribing—2001," American Journal of Health-System Pharmacy, vol. 58, no. 23, pp. 2251-2266, 2001.
[3] P. Ranade-Kharkar, S. E. Pollock, D. K. Mann, and S. N. Thornton, "Improving clinical data integrity by using data adjudication techniques for data received through a Health Information Exchange (HIE)," in AMIA Annual Symposium Proceedings, 2014, vol. 2014: American Medical Informatics Association, p. 1894.
[4] Y. Zhuang, L. Sheets, Z. Shae, J. J. P. Tsai, and C. R. Shyu, "Applying Blockchain Technology for Health Information Exchange and Persistent Monitoring for Clinical Trials," in Annual Symposium proceedings.vol. 2018, pp. 1167-75, 2018.
[5] T.-T. Kuo, H.-E. Kim, and L. Ohno-Machado, "Blockchain distributed ledger technologies for biomedical and health care applications," Journal of the American Medical Informatics Association, vol. 24, no. 6, pp. 1211-1220,2017.
[6] A. M. Heekin, J. Kontor, H. C. Sax, M. S. Keller, A. Wellington, and S. Weingarten, "Choosing Wisely clinical decision support adherence and associated in patient outcomes," The American journal of managed care, vol. 24, no. 8, p. 361, 2018.
[7] R. S. Rudin, A. Motala, C. L. Goldzweig, and P. G. Shekelle, "Usage and effect of health information exchange: a systematic review," Annals of internal medicine, vol. 161, no. 11, pp. 803-811, 2014.
[8] D. Blumenthal, "Stimulating the adoption of health information technology," New England journal of medicine, vol. 360, no. 15, pp. 1477-1479, 2009.
[9] T.-T. Kuo, H. Zavaleta Rojas, and L. Ohno-Machado, "Comparison of blockchain platforms: a systematic review and healthcare examples," Journal of the American Medical Informatics Association, vol. 26, no. 5, pp. 462-478, 2019.
[10] S. Simon, J. S. Evans, A. Benjamin, D. Delano, and D. Bates, "Patients' attitudes toward electronic health information exchange: qualitative study," Journal of medical Internet research, vol. 11, no. 3, p. e30, 2009.
[11] P. Zhang, D. C. Schmidt, J. White, and G. Lenz, "Blockchain technology use cases in healthcare," in Advances in Computers, vol. 111: Elsevier, 2018, pp. 1-41.
[12] V. Patel, "A framework for secure and decentralized sharing of medical imaging data via blockchain consensus," Health informatics journal, p. 1460458218769699, 2018.
[13] M. M. Goldstein, A. L. Rein, M. M. Heesters, P. P. Hughes, B. Williams, and S. A. Weinstein, "Data segmentation in electronic health information exchange: policy considerations and analysis," 2010.
[14] Jan Walker, Eric Pan, Douglas Johnston, Julia Adler-Milstein, et al. "The value of health care information exchange and interoperability". Health Affairs, 24: W5, 2005.
[15] J. J. Cimino, M. E. Frisse, J. Halamka, L. Sweeney, and W. Yasnoff, "Consumer-mediated health information exchanges: The 2012 ACMI debate," Journal of biomedical informatics, vol. 48, pp. 5-15, 2014.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY