

Transforming Industrial Operations with Blockchain: The Healthcare Application Health-Chain

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Abstract: - Globally, effective application of cloud technology, mobile, social media, analytics, and IoT (Internet of Things), has resulted in new creative products, tight consumer interactions, and enhanced corporate operations. Block-chain technology is reshaping the digital landscape by offering a fresh perspective on efficiency, system security and resilience. Despite its initial popularity as a foundation for digital money, Block-chain is much more than that. It offers a safe way to conduct any form of product or service trade. Growing laws, cybercrime, and fraud are impeding industrial progress even while trusted connections are becoming more and more crucial for growth. To overcome these obstacles, Block-chain will enable more flexible better customer interactions, cloud technology, value chains, quicker product developments, and quicker IoT and integration. Further Block-chain reduces the charge of commerce by providing a reliable bond that is handled devoid of outside interference from parties that might not directly provide value. It is now feasible to create engagements, smart contracts, and agreements with solid cyber-security components built in. In order to show and illustrate the usage of Block-chain technology across numerous industrial applications, this research attempts to build the framework for that. The IBM Block-chain project is used to define and develop the healthcare application Health-chain. The ideas may be used to a variety of trades, including as manufacturing, banking, and government, where scalability, safety, and efficiency are needed.

Keywords—Block-chain Technology; Bitcoin; Cloud computing; Control Systems; Cyber-security; Dev-Ops; IBM; Cybercrime; Health-chain; Internet of things.

I. INTRODUCTION

A ledger or database that is dispersed or exchanged across nodes in a computer network is known as a prevent-chain. A block-chain functions similarly to a relational database that stores data physically in electronic format. In digital currency platforms like Bitcoin, in which they maintain a safe and centralised capture of actions, digital currencies are recognised for playing a crucial role. The uniqueness of block

chains is that it generates confidence without the requirement for an impartial third party yet still ensuring the accuracy and security of the information being transmitted.

The way information works together between a traditional collection of data and the blockchain differs significantly as shown in figure 1. A blockchain gathers data in collections called blocks of data, which hold collections of data. When an block's storage capacity reaches its limit, it is closed and linked to the previous full blocks, forming a chain that holds data known as the distributed ledger. When a freshly added block is finished, all the additional information that comes after it is gathered into a recently organised block and added into the existing chain of events.

Bitcoin frequently uses the distributed ledger technology known as Block-chain. Everyone on the network has access to the public ledger where the transfer's specifics are kept. Bitcoin was first presented to the public by Satoshi Nakamoto in 2008 when he published the article "Bitcoin: A P2P Electronic Cash System." [1] Despite the expansion, there are still many of uncertainties regarding the mainstream use of Bitcoin. However, the use of the fundamental structure outside of the financial sector has drawn attention.

As the corpus of knowledge expands, Block-chain will develop in a variety of sectors. This study illustrates the various use cases that researchers are aiming to exploit, such as smart contracts, supply chains, and healthcare [2, 21]. (SHI). According to EminGünSirer, an associate professor of computer science at Cornell, "The IoT might be a huge application domain where consumers want to interface with the objects directly without the need of middlemen. Although there isn't a killer app yet, it will probably have Block-chain transparency [3]. The security, privacy, and scalability of Block-chain are the current study focuses. In his article "Might Block-chain Outlive Bitcoin?" from April 2016, Mr. Hurlburt discusses the need for ethical and operational requirements, remarking that stringent criteria, including

acceptable behavioral guidelines, must be laid down before Block-chains become a mainstream alternative for existing transaction databases [1, 22].

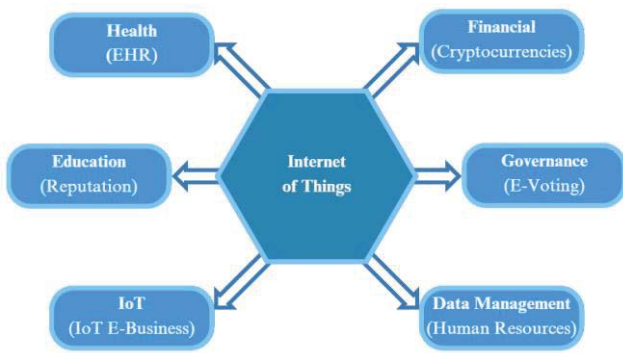


Fig. 1. Application of Blockchain in The System.

There is potential for Block-chain technology to be applied to applications in cognitive computing, [4] Internet of Things, supply chains, and healthcare as shown in figure 2. The article examines Block-chain technology's potential from a cybersecurity standpoint [5, 23]. The professional duty of Block-chain technology will next be discussed. Then, Health Chain is introduced, which uses Block-chain technology to enable security, scalability, and efficiency in applications for the healthcare sector. A description of how Block-chain is altering the world appears at the paper's end.

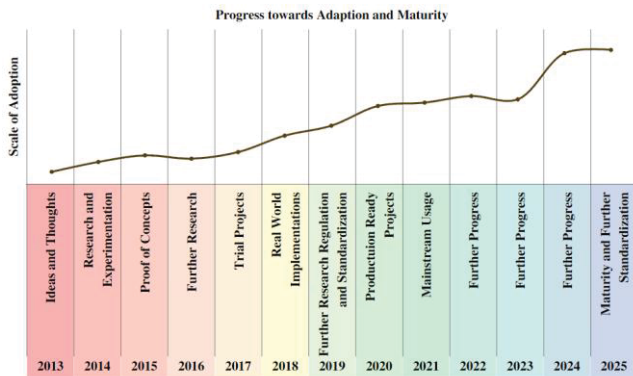


Fig. 2. Growth of Blockchain in Recent Years

II. LITERATURE REVIEW

A. Cyber Security

Cryptography is the process of protecting hardware, software, computer systems, mobile devices, automatic networks, and the information they contain against malicious attacks. Both data and money present obstacles, according to comments made during the 2013 VSAE Annual Conference [6]. Data can sometimes be more precious than currency. For keeping your belongings, you've got two options: a bank or beneath a bed (a premise solutions and a cloud service). Whose security is the tightest? The bank is able to pay for more strict safety precautions such foot-thick concrete walls in the storage facilities, along with an investigation team made up of security experts and a few workers to stay up to date on new crime techniques and develop and put into practise counterstrategies.

The service made it easier to monitor who has permission to use cloud applications, check them for vulnerabilities, and impose access restrictions by combining safeguards to managing information and big data tools. Safety monitoring and assessment of vulnerabilities are not complete without limiting software and task access, checking programmed for bugs, and safeguarding data. Through the help of the platform, we can quickly add client authentication and one-sign-on functionality to web and mobile apps, send method-based approval points of relationship to support the rapid development of numerous authentication, assess web and mobile apps for vulnerabilities, and strengthen protection and managerial consistency efforts by reviewing use before organisation. By doing this, you may be able to identify problems, provide states, and reach agreements.

Data concealment, exploration, audit, along with the built-in confidentiality and security capabilities of big material and material management services will all be used by the platform approach to safeguard the data. After that, the security API may be connected to APIs for IoT (Internet of Things), development and operations, Cloud The integration process, mobile devices, and business analysis using the API approach (figure 3). The task had the option to reuse huge, prescribed procedures and examples to guarantee the outcome of the data framework and the undertaking's life cycle beginning to end.

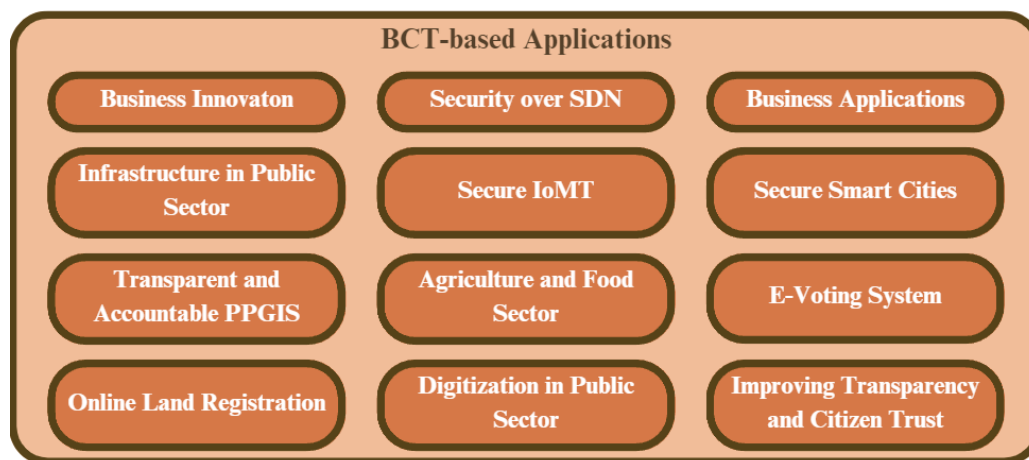


Fig. 3. BCT Based Application

B. Professional Responsibility

Goals and techniques in software-enabled goods, processes, and services have altered overnight with the shift from analogue to digital technology. Through the use of sensors, processing chips, actuators, and improved power sources, public infrastructures are becoming more sophisticated. The digitization of air quality, buildings, transportation, water purity, materials, and the environment is being completely transformed by software, hardware, and networks. Although technology will develop, the moral, ethical, and technical requirements of professionals only increase. Operator error is a common suspect in post-accident

root-cause analysis because human error nearly always occurs at some point in the sequence of events. One finds that social and professional engineering failures are obvious when examining the big engineering tragedies. Every human error is generally accompanied by a series of administrative and organizational choices that raise the chance of the error [7].

Professionals' first responsibility should be ensuring the safety, security, health, and welfare of the general population. Software and System engineers were not previously required to adhere to the basic requirements.

TABLE I TYPES OF BLOCKCHAIN IN TRANSACTION PROTOCOL IN SUPPLYCHAIN

BLOCKCHAIN NAME	CONSENSUS PROTOCOL	TRANSACTIONS PER SECOND (TPS)	TRANSACTION CONFIRMATION TIME (TCT)	SUPPLY CHAIN SUITABILITY
Bitcoin (BTC)	PoW	3-7	25 min	Expensive, low bandwidth (TPS), high TCT.
Ethereum (ETH)	PoW	15-20	2 min	Expensive with viable, for commercial deployment TCT
Ripple (XRP)	RCPA	1.500	4 S	High bandwidth, low cost and high TCT
Bitcoin Cash (BCH)	PoW	60	60 min	Expensive and not suitable for real-time
Litecoin (LTC)	PoW	56	30 min	Expensive, not well suited for real-time
EOS(EOS)	DPoS	millions	6 min	Inexpensive, high throughput, low TCT
Cardano (ADA)	PoS	5-7	3-5 min	Inexpensive, moderate throughput, low TCT
Stellar (XLM)	PoS	1000	2-5 S	Inexpensive, high throughput, low TCT
NEO (NEO)	DBFT	10.000	15-20 S	Inexpensive, high throughput, low TCT
Monero (XMR)	DAG(Tangle)	4	30 min	Inexpensive, low TPS, low TCT
Tether (USDT)	Various Consensus mechanisms	Ethereum-based token	15-30 S	Inexpensive with moderate TPS and low TCT.
NEM (XEM)	Pol	4000	1-2 min	Inexpensive with moderate TPS and low TCT.

Like their peers, software engineers can now obtain their licence from the National Society of Professional Engineers. An individual must first be licenced in order to practise in a certain occupation or profession that is regulated by the government and to use the terms "licenced" or "allowed to practise" in relation to such practise. Practice statutes include regulations for practitioners to get licences, often based on criteria including education, testing, experience, and moral character. Westinghouse explicitly said that it didn't do a specialized survey to decide the security capability, basic qualities, and acknowledgment processes for an economically open variant of limited component examination device of ANSYS. It was discovered that Ultra Electronics had mishandled the third-party-software Lab View in compliance with published guidelines and instructions.

As a result of these and other occurrences, the professional responsibility of not just control system software but also analysis and support software that may have an influence on nuclear system operation has been increased. Even the nascent Block-chain technology relies on qualified engineers to guide and control its development. As Block-chain technology develops, significant power industry shifts are anticipated to occur. Block-chain is considerably more than merely the foundation for digital currency, despite the fact that Bitcoin first made it well-known.

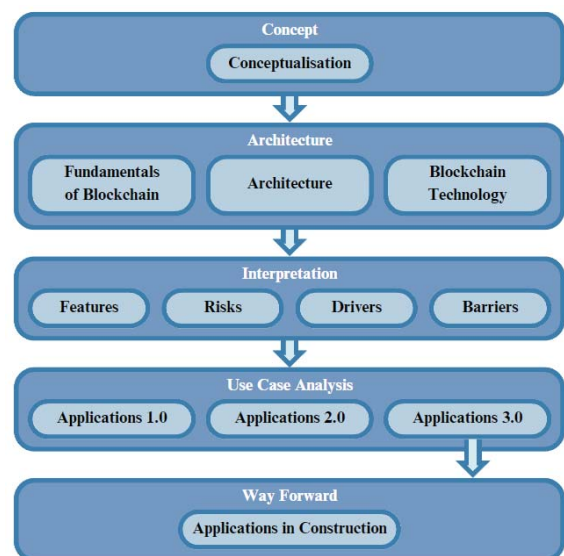


Fig. 4. Architecture of the System

It offers a secure means of exchanging any good, service, money, or information and has the power to build new global networks and introduce fresh business strategies for producers and energy providers (figure 4). The professional

engineering protocol and the aims of the Block-chain protocol continue to have striking parallels, showing that the concepts behind both were not novel and might even be more well-matched with established organizations than was formerly thought.

It makes sense that the minimum level of care for professional software engineering licensure would apply to Block-chain technology. Licensing bestows responsibility and accountability on people who design, operate, and manage digital systems and privacy data, with a focus on safeguarding the public's health, wealth, safety, and security.

III. BLOCKCHAIN IN HEALTHCARE

According to the HIP&AA's privacy rules, "Secured Healthcare Info" (SHI) includes any individually identifiable health information—including demography and genetic data—that is shared or stored in any way or media [8], [9]. The HIP&AA confidentiality legislation establishes SHI (Secured Health Information) confidentiality guidelines and offers individuals the ability to regulate their private data. Even though the adoption of cloud-based technology for the creation of HIP&AA-compliant files has boosted the security of the information and decreased HIP&AA offences, the mitigation provided of dispersed records on the web will not be sufficient to address the problem of privacy violates for medical payees and providers. Which makes the situation more severe [10]. Clinical adheres to have profited greatly from the design of mobile applications and software, but hacks may still happen and SHI (Secured Medical Info) may have been stolen [11] even the typical cryptography and login settings required by HIP&AA for an included company. In an age of effective medicine, the demand for safe use as well as incorporation of novel innovations with the availability of SHI (Secured Health Info) is of the highest significance as shown in figure 5. In the present study, a use case for the blockchain system is considered to address the aforementioned challenge of integrating modern technology into the existing HIP&AA compliant infrastructure while supporting exceptional patient treatment and ease of use.

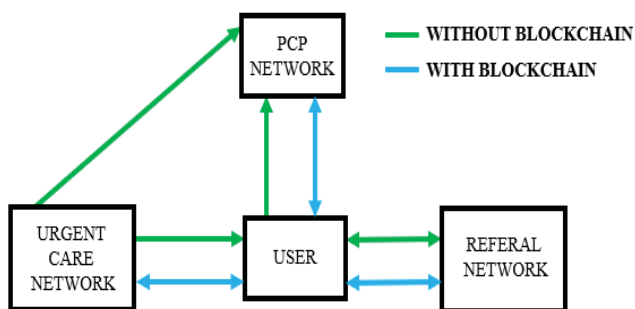


Fig. 5. Secured Health Information (SHI) Is Now in Its Lifespan on Networks Used by Healthcare Providers

By invoking a transaction, the patient can provide the physician access to the asset (SHI Record). The transaction is not finished until Consensus is reached. All SHI (Secured Health Information) adjustments are seen to chain participants with the necessary permissions. The resilience, security, privacy, and validity of SHI (Secured Health Information) are continuously ensured by the usage of tried-and-true decentralised [12] cryptocurrency and Block-chain technology. The three-tier concept of the HealthChain platform is put into practise as a private Block-chain network

on IBM Block-chain and made accessible through Bluemix. Users communicate with the HealthChain through the web page interface at the top layer of the architecture. On the intermediate layer, a web page is hosted by a NodeJs server that is in responsible of interacting with the HyperLedger fabric and chain code. [13]

The most current and complete version of the patient's PHI is now easier to get thanks to this solution, which also improves the standard for security and resilience.

The user interface for the HealthChain system and provides background information on the establishment of Block-chain peers on the IBM cloud. HealthChain drove by Block-chain is fundamentally upgraded by the particular plan of Hyperledger texture, which offers privacy, versatility, and security in wellbeing informatics. Brilliant agreements are utilized in the permissioned organization to ensure appropriate approval and characterized privileges. HealthChain has the PBFT agreement [14-25] calculation, it lessens the computational intricacy expected by conventional answers for encode PHI moves between medical care network suppliers as well as cell phones inside networks while as yet giving a constant, trustworthy help in a nonconcurrent climate.

IV. CONCLUSION

Data innovation has turned into a basic headway in pretty much every area. The paper guarantees that by empowering secure trust structures, empowering speedy worth chain creation, and coordinating all the more intimately with different advances like distributed computing and IoT, Block-chain can essentially change how associations and applications are digitalized. By fostering an application in light of cloud called Health Chain, the scientists have shown their capacity to utilize proficient designing norms, a DevOps way to deal with iterative turn of events and the board, and the coordination of digital protection, circulated registering, and blockchain innovation. We believe that HealthChain is only one of numerous models that exhibit the expected force of Block-chain innovation.

By effectively using mobile, IoT (Internet of Things), social networks, statistical analysis, and cloud technologies to develop models for superior judgements, the sector is aiming to increase productivity, generate new inventive goods, and enhance consumer relationships internationally. Block-chain innovation will make the supply and demand chains more flexible, accelerate creation of goods, improve customer interactions, and hasten the melding between cloud and Internet of Things (IoT) technologies. The extremely efficient built-in security features of the digital ledger enable instantaneous agreements, assignments, and collaborations.

REFERENCES

- [1]. S. Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," www.Bitcoin.Org, p. 9, 2008.
- [2]. S. Sargolzaei, B. Amaba, M. Abdelghani, and A. Sargolzaei, "Cloudbased Smart Health-care Platform to tackle Chronic Disease," vol. 4863, no. August, pp. 30–32, 2016.
- [3]. S. Underwood, "Blockchain beyond bitcoin," *Commun. ACM*, vol. 59, no. 11, pp. 15–17, 2016.
- [4]. G. Hurlburt, "Might the Blockchain," no. April, pp. 12–16, 2016.
- [5]. B. Libert, M. Beck, and J. Wind, "How blockchain technology will disrupt financial services firms," *Knowledge@Wharton*, pp. 2–7, 2016.
- [6]. G. Engaged, J. Tobe, G. Your, C. Computing, C. Dellorso, E. Apps, E. Reggie, R. Coughlan, and M. S. Fernandes, "Annual Conference –May

- 6-7, 2013 –Kingsmill Resort ‘ The Value of Values: Linking Strategy and Decision Making ’ – 2013 Annual Conference Educational Sessions,” 2013.
- [7]. Rawal, B. S., Manogaran, G., &Poongodi, M. (Eds.). (2022). Implementing and Leveraging Blockchain Programming. Springer.
- [8]. U. S. D. of H. and H. Services, “Standards for privacy of individually identifiable health information; proposed rule,,” Fed. Regist., vol. 64, no. 212, p. 59917, 1999.
- [9]. Centers for Medicare and Medicaid Services, “Security Standards: Technical Safeguards,” HIPAA Secur. Ser., vol. 2, pp. 1–17, 2007.
- [10]. M. Modahl, “Tablets set to change medical practice,” Quantia MD, 2011.
- [11]. C. L. Ventola, “Mobile devices and apps for health care professionals: uses and benefits,” Pharm. Ther., vol. 39, no. 5, p. 356, 2014.
- [12]. L. Luu, D.-H. Chu, H. Olickel, P. Saxena, and A. Hobor, “Making smart contracts smarter,” in Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security, 2016, pp. 254–269.
- [13]. K. Delmolino, M. Arnett, A. E. Kosba, A. Miller, and E. Shi, “Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab,,” IACR Cryptol. ePrint Arch., vol. 2015, p. 460, 2015.
- [14]. M. Castro and B. Liskov, “Practical Byzantine fault tolerance,,” in OSDI, 1999, vol. 99, pp. 173–186.
- [15]. Desa, M.B.M., Nasir, N.B.C.M., Jasni, M.A.B., Yusof, Y.B., Nordin, M.N. (2022). ISIS Uses A Social Influence Techniques To Induce Individuals To Become Terrorist Sympathizers: A Review. Journal of Pharmaceutical Negative Results, 2022, 13, pp. 5622–5630.
- [16]. Kadir, M.A.B.A., Muhammad, A.B., Yusoff, M.Z.B.M., Hassan, M.H., Nordin, M.N. The Relationship Between Learning Style AndJawi Writing Skills Among Primary School Student. Journal of Pharmaceutical Negative Results, 2022, 13, pp. 5524–5534.
- [17]. Sriram, V. P., Sujith, A. V. L. N., Bharti, A., Jena, S. K., Sharma, D. K., & Naved, M. (2023). A Critical Analysis of Machine Learning’s Function in Changing the Social and Business Ecosystem. In Proceedings of Second International Conference in Mechanical and Energy Technology (pp. 341-350). Springer, Singapore.
- [18]. Omar, S.A., Latif, M.S.A., Bujang, S., ...Musa, P.I.P., Nordin, M.N. (2022). Determination of Uruf Rate of Gold Jewelry In The State of Sarawak. Journal of Pharmaceutical Negative Results, 2022, 13, pp. 5607–5612.
- [19]. Rani, M.A.M., Jasmi, Z.S., Abbas, M.S., Nordin, M.N., Musa, P.I.P. (2023). Empowering The Competitiveness Of Asnaf Rural Zakat Entrepreneurs Policy: National Development Aspirations 2030. Journal of Pharmaceutical Negative Results, 2022, 13, pp. 5613–5621.
- [20]. Rani, M.A.M., MohdArif, M.I.A., Adenan, F., Nordin, M.N., Izham, S.S. (2022). Contemporary Research In Islamic Philanthropy: An Analysis of The Needs And Directions of The Field of Waqf. Journal of Pharmaceutical Negative Results, 2022, 13, pp. 5805–5813.
- [21]. Shilpa Choudhary, Lokesh Sharma, Awanish Kumar Kaushik, Arpana Mishra, “Novel approach to reduce the replication of information and to increase the reliability of end-to-end data transmission in WSN”, 2019 2nd International Conference on Intelligent Communication and Computational Techniques (ICCT), IEEE, 2019, pp. 83-86.
- [22]. Eliyas, Sherin, and P. Ranjana. "Gamification: Is E-next Learning’s Big Thing."
- [23]. Kumar, M. S., &Iyapparaja, M. (2021). Fog and edge computing simulators systems: research challenges and an overview. International Journal of System of Systems Engineering, 11(3-4), 202-223.
- [24]. Tareq Ahran, Arman Sargolzaei, Saman Sargolzaei, Jeff Daniels, and Ben Amaba "Blockchain Technology Innovations"2017 IEEE Technology & Engineering Management Conference (TEMSCON)
- [25]. Tareq Ahran; Arman Sargolzaei; Saman Sargolzaei; Jeff Daniels; Ben Amaba "Blockchain technology innovations"2017 IEEE Technology & Engineering Management Conference (TEMSCON)