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DRUG SAFETY USING BLOCKCHAIN TECHNIQUE

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Abstract: The escalation of occupational stress and the concomitant reduction in personal leisure time have contributed to an increased reliance on medications and drugs. These pharmaceuticals serve as pivotal resources for preserving human life, especially in critical medical situations. To ensure a consistent and high-quality supply of medications, regular monitoring is imperative. Despite the multitude of medications stocked in stores, instances of theft, expiration, or misplacement are prevalent, often driven by personal avarice. In order to avert such circumstances and safeguard patient lives, the implementation of a Drug and Medicine Monitoring Model is recommended. This model leverages RFID and IoT technology to meticulously monitor the inventory of drugs and medicines within the store. Through the deployment of this system, pharmacists or hospitals gain comprehensive insights into the availability, quality, location, and safety of medications and drugs.

I. INTRODUCTION

Ensuring the safety and authenticity of pharmaceuticals is a critical problem in the constantly changing pharmaceutical market. The pharmaceutical supply chain has grown more complex with the growth of globalization, requiring multiple parties and a maze of transactions. Significant obstacles have also emerged as a result of this complexity, which has also encouraged innovation and accessibility. The industry is nevertheless beset by issues such as counterfeit medications, inferior quality, non-compliance with regulations, and inefficiencies in supply chain management. To tackle these obstacles, a solution that is as complex as the problem is required. Blockchain technology is a ground-breaking invention that has transformed a wide range of sectors globally, going beyond its cryptocurrency roots.

Blockchain fundamentally serves as a distributed and decentralized ledger system designed to securely, transparently, and irrevocably document transactions. Each individual transaction is stored within a "block," and these blocks are interconnected to form a continuous chain. Blockchain is unique because of its cryptographic structure, which makes sure that once data is entered, it cannot be changed without the network's members agreeing. This technology, which provides unmatched transparency, security, and efficiency, is radically changing the way industries function.

The safety of drugs is a major public health concern. Millions of people experience dangerous medication responses each year, some of which are lethal. Blockchain technology offers a transparent and safe means of tracking the creation, production, and distribution of drugs, which has the potential to completely transform medication safety. Distributed ledger technology, or blockchain, enables safe, open, and unchangeable transactions. Although its most well-known use is in cryptocurrency powering, it has a wide range of other possible uses, including in the medical field

II LITERATURE REVIEW

A blockchain-enabled drug safety surveillance system using smart contracts - Smart contracts automate the process of collecting, analyzing, and reporting drug related data, ensuring data integrity and preventing unauthorized access. The block chain‘s distributed ledger provides a tamper-proof and traceable record of drug-related events, enabling seamless auditability. Smart contracts enable selective sharing of drug data with authorized parties, protecting patient privacy while facilitating data access for research and analysis.

A blockchain-based platform for drug safety monitoring and counterfeiting prevention- The blockchain network serves as a secure and tamper-proof ledger to record drug transactions throughout the supply chain. This transparent and immutable record enables tracing the movement of drugs from manufacturers to patients, facilitating the identification of counterfeit drugs. The drug safety monitoring system leverages the blockchain's data integrity and traceability to collect and analyze data on drug safety incidents. This system continuously monitors drug-related events, enabling the detection of potential safety issues and prompt corrective actions.

A blockchain-based system for drug safety management- Blockchain technology has emerged as a promising solution for enhancing drug safety management by introducing a decentralized, transparent, and tamper-proof system for tracking drug movement, monitoring adverse drug reactions (ADRs), and ensuring drug authenticity. By leveraging blockchain's immutable ledger, drug manufacturers, healthcare providers, and regulatory bodies can seamlessly share and verify drug information, enabling real-time insights into drug safety and efficacy. This can lead to faster identification and mitigation of potential drug safety issues, improved patient outcomes, and greater trust in the pharmaceutical industry.

Blockchain technology in the pharmaceutical industry- Blockchain technology is revolutionizing the pharmaceutical industry by enhancing supply chain transparency, combating counterfeit drugs, streamlining clinical trials, and fostering data-driven decision-making. Its decentralized and immutable nature enables secure and tamper-proof tracking of drugs from manufacturing to patient delivery, ensuring authenticity and preventing counterfeiting. Blockchain also facilitates seamless data sharing among stakeholders, promoting collaboration and improving clinical trial efficiency. Furthermore, it empowers patients with greater control over their health data, contributing to personalized medicine and improved patient outcomes.

On blockchain and its integration with IoT. Challenges and opportunities- Examining the integration of blockchain and the Internet of Things (IoT) presents a rich landscape of challenges and opportunities. In a literature review, you could delve into issues like scalability, data privacy, and consensus mechanisms in the context of combining blockchain and IoT. Exploring how blockchain enhances security and trust in IoT ecosystems could be a focal point, as well as investigating potential applications and industry use cases. Identifying gaps in the existing research and proposing avenues for future exploration would contribute to the comprehensive understanding of this evolving intersection.

Exploring IOT Application Using Raspberry Pi-Provide a brief overview of the Internet of Things (IoT) and its significance in various domains. Examine literature discussing the use of Raspberry Pi as a versatile and costeffective platform for IoT applications. Explore studies on communication protocols employed in IoT applications with Raspberry Pi, such as MQTT or CoAP, and their implications. Investigate how Raspberry Pi interfaces with various sensors to collect and process data for IoT applications Analyze literature on security challenges and solutions when deploying Raspberry Pi-based IoT systems, including data encryption and device authentication

Towards a definition of the Internet of Things (IOT)- Examine early definitions and conceptualizations of IoT to understand its evolution over time and the key milestones in its development.Explore literature discussing the defining characteristics of IoT, such as connectivity, interoperability, sensing capabilities, and the integration of physical and digital environments. Investigate existing frameworks and models proposed in the literature that aim to structure the understanding of IoT. Analyze their components and the perspectives they bring to defining IoT. Summarize research on diverse

IoT applications across industries, highlighting how different scholars conceptualize IoT based on its practical implementations.

III METHODOLOGY

A multifaceted strategy that incorporates blockchain technology into several phases of the pharmaceutical supply chain is used in the methodology for guaranteeing drug safety utilizing blockchain approaches. First, a suitable blockchain platform must be chosen, taking into account aspects like security, scalability, and consensus procedures. Well-known platforms with a lot of traction and adaptability, like Ethereum, Hyperledger, or Quorum, are frequently picked. The medicine production process is connected with the blockchain network after the platform is chosen. A distinct digital identifier is provided to each batch of pharmaceutical products and is kept on the blockchain.

Blockchain technology is utilized in the distribution phase to provide an unchangeable ledger that tracks the flow of medications from producers to distributors and wholesalers, and ultimately to pharmacies or medical facilities. Every transaction is safely documented on the blockchain, including ownership transfers, location changes, and timestamps. Because of this transparency, all parties involved can track the movement of narcotics in real time, making it possible to quickly spot any irregularities or questionable activity. Additionally, anticounterfeiting methods like distinct RFID tags or QR codes can be connected to the blockchain, enabling customers to use a smartphone app to scan the codes and confirm the legitimacy of the medications they buy.

Private or consortium blockchains, where only approved players, such as pharmaceutical companies, regulatory bodies, and healthcare providers, have access to the blockchain network, can be used to improve regulatory compliance and data security. While preserving the privacy of sensitive data, this regulated access makes it possible for reliable parties to share information effectively. Furthermore, data kept on the blockchain is secured by the use of cryptographic techniques like hashing and encryption, which make it nearly hard for unauthorized parties to tamper with the data.

The blockchain network's integrity is regularly audited and monitored, guaranteeing that the system will always be safe from tampering and manipulation. The blockchain infrastructure is subjected to ongoing testing and validation procedures in order to find and fix any vulnerabilities or possible sources of failure. In addition, continuous cooperation with industry standards groups and regulatory bodies is necessary to synchronize the blockchain's deployment with current laws and industry standards in the pharmaceutical industry.

A blockchain platform must be chosen, smart contracts and unique digital identifiers must be integrated into the manufacturing and distribution processes, anti-counterfeiting measures must be put in place, private or consortium blockchains must be used for secure data sharing, and strict security measures, such as cryptography and frequent audits, must be followed. Adopting an all-encompassing strategy would enable the pharmaceutical sector to use blockchain technology to transform drug safety procedures, improving patient safety and regulatory compliance while guaranteeing the integrity, authenticity, and traceability of pharmaceutical products.

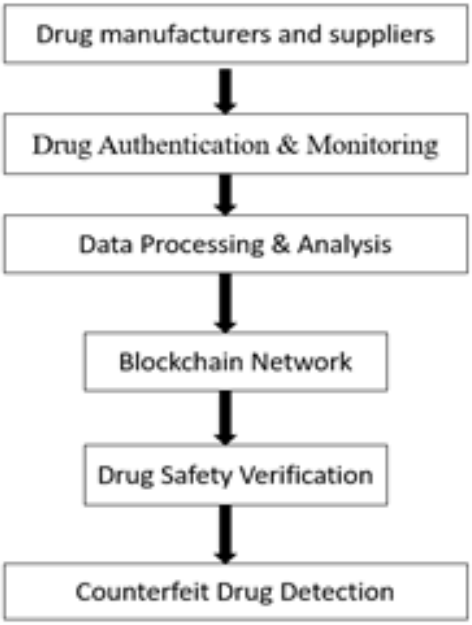

Figure: 1 Flowchart of the Proposed Methodology

IV RESULTS AND DISCUSSION

Data about medicine manufacture, delivery, and authentication can be gathered using NodeMCU. To ensure the quality and legitimacy of pharmaceuticals during transportation, NodeMCU can be linked with sensors to monitor variables like temperature, humidity, and location. A blockchain network can be accessed by NodeMCU in order to safely record and validate transactions pertaining to drugs. NodeMCU may communicate with blockchain nodes via bespoke protocols or APIs in order to send and receive data, hence guaranteeing the transparency and integrity of the medication supply chain.

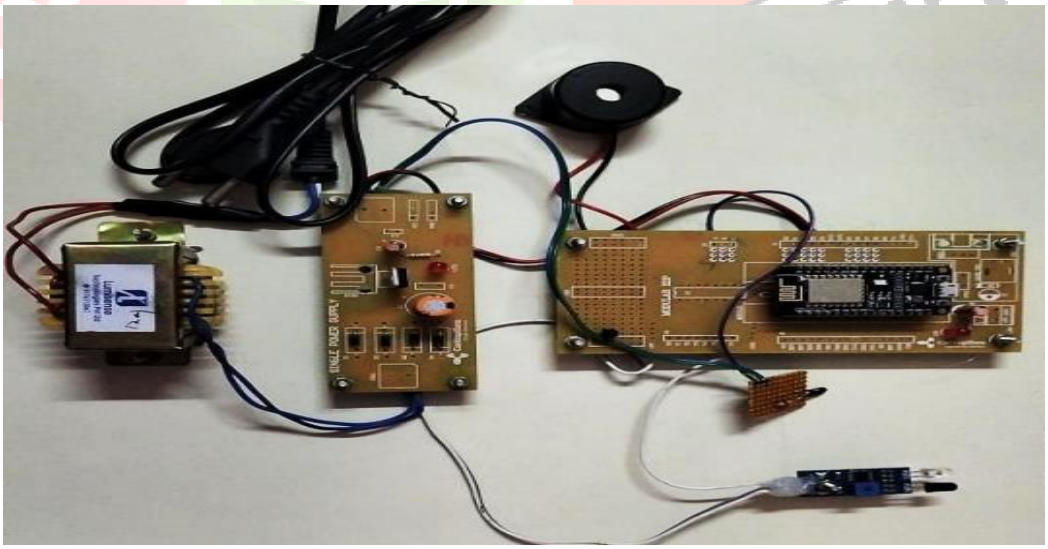

Figure: 2 Hardware Setup of Proposed Methodology

On blockchain platforms like Ethereum, NodeMCU may carry out smart contracts, allowing the automated execution of predetermined rules and circumstances. Smart contracts, for example, have the ability to automatically initiate warnings or take appropriate action in response to predetermined circumstances, like temperature variations or unlawful access to drug shipments.

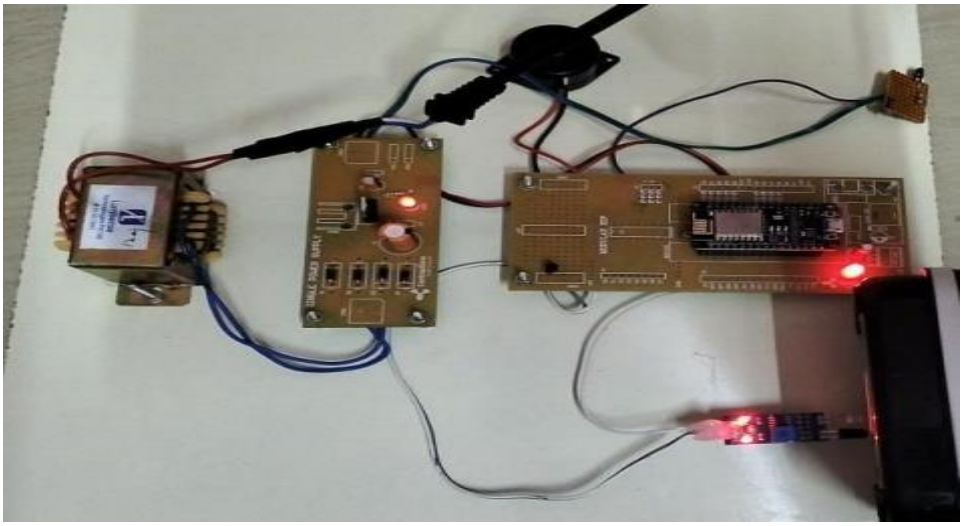

Figure: 3 Working of Proposed Methodology

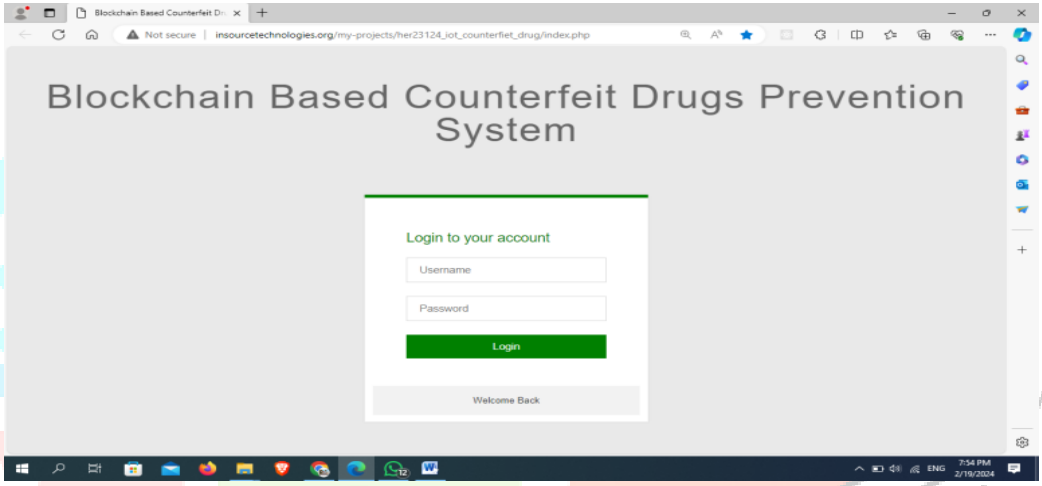

Figure: 4 Login page

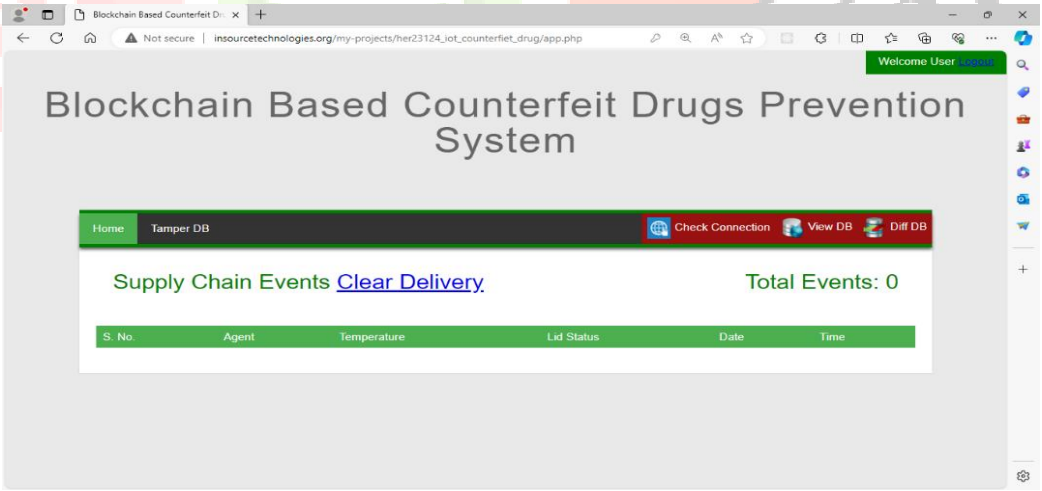

Figure: 5 User-interface

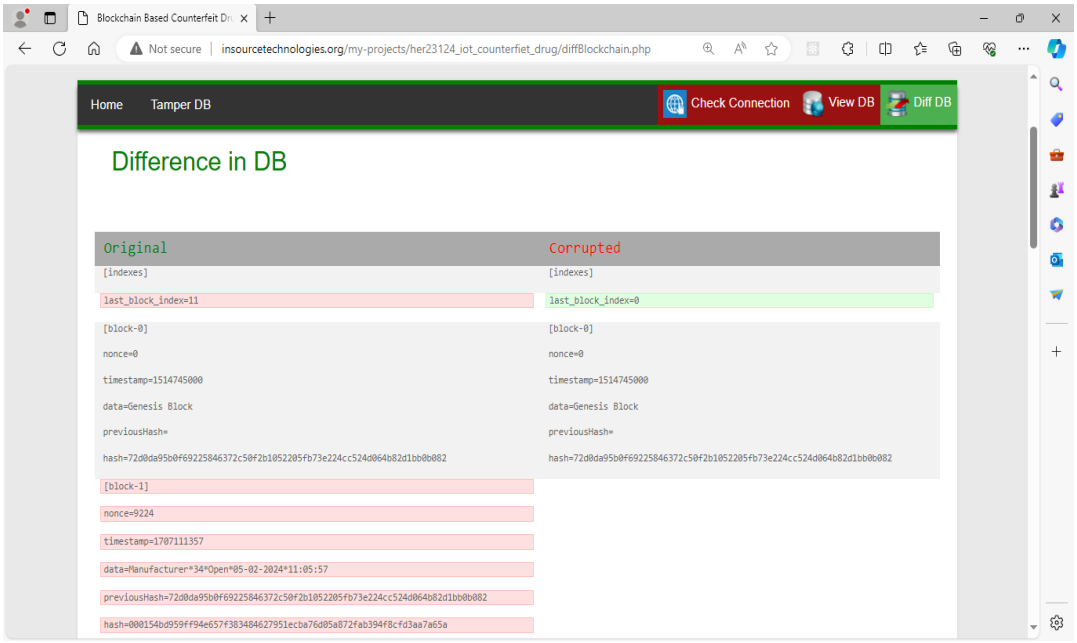

Figure: 6 Modified database

V CONCLUSION

Blockchain technology is a significant advancement in the pharmaceutical industry, as it ensures the safety of medications. Blockchain's decentralization, transparency, and immutability address numerous essential aspects of drug safety, leading to improved efficiency, enhanced traceability, and ultimately, safer pharmaceutical products for consumers. Blockchain technology possesses the capability to establish a transparent and secure network that interconnects all facets of the pharmaceutical supply chain, encompassing producers, distributors, and retailers. As a result of this interconnectedness, pharmaceutical products can be monitored and tracked in real-time, ensuring that every step of the supply chain is traceable and resistant to any attempts of tampering. Furthermore, this transparency not only aids in the fight against counterfeit drugs but also expedites recalls and reduces the sale of hazardous or expired pharmaceuticals. The usage of blockchain technology enhances the protection and reliability of data.

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Biography

Dr. L. Malathi, She received her Ph.D. in the field of VLSI under Faculty of Information and Communication Engineering (ICE) from Anna University, Chennai in the year 2023. She received her M.E. degree in Applied Electronics in the year 2008. She received her B.E. degree in Electronics and Communication Engineering in the year 2005. Currently she is working as Assistant Professor (Sr. Gr.) in Department of Electronics and Communication Engineering at Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu, India. She is having 15 years of teaching experience. She has presented and published papers in various National and International Conferences, Journals and patents. Her field of interest is VLSI, Digital Signal Processing and Embedded Systems. She acted as resource person in seminar and workshop, session chair and reviewer in conferences. She is a lifetime member of professional bodies such as ISTE, IAENG and ACM.

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REFERENCES

[1] K. H. Berge, K. R. Dillon, K. M. Sikkink, T. K. Taylor, and W. L. Lanier, __Diversion of drugs within health care facilities, a multiple-victim crime: Patterns of diversion, scope, consequences, detection, and prevention,‘‘ Mayo Clinic Proc., vol. 87, no. 7, pp. 674–682, Jul. 2012.

[2] Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle: From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence.: First edition (2014).

[3] Roberto Minerva, Abyi Biru, Domenico Rotondi, ―Towards a definition of the Internet of Things (IoT),‖: Revision 1: IEEE, Telecom Italia S.p.A. 2015 w

[4] Harshada Chaudhari: ―Raspberry Pi Technology: A Review,‖ International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 3, (2015).

[5] Cheah Wai Zhao, Jayanand Jegatheesan and Son Chee Loon: ―Exploring IOT Application Using Raspberry Pi‖: International Journal of Computer Networks and Applications, volume 2, issue 1 (2015).

[6] P. W. Brummond, D. F. Chen, W. W. Churchill, J. S. Clark, K. R. Dillon, D. Dumitru, L. Eschenbacher, T. Fera, C. R. Fortier, K. K. Gullickson, and K. Jurakovich, __ASHP guidelines on preventing diversion of controlled substances,‘‘ Amer. J. Health-Syst. Pharmacy, vol. 74, pp. 325–348, Mar. 2017.

[7] Y. Huang, T. Wu, and Y. Long, "Blockchain technology in the pharmaceutical industry: a systematic review", PMC, vol. 55, no. 4, pp. e39566-e39566, 2018.

[8] P. Plotnikov and O. Kuznetsova, "Security of blockchain-based solutions for pharmaceutical supply chain management", Advances in Science and Technology, vol. 13, no. 2, pp. 103-110, 2018.

[9] R. Shigemura, G. Gonçalves, F. Oliveira, L. Coura, E. Júnior, L. Dias, A. Cunha, P. Tasinaffo, and J. Marques, __Wibx: Making smart contracts even smarter,‘‘ in Proc. Workshop Artif. Intell. Appl. Finance (WAIAF), 2019,

[10] T. McGhin, K.-K. R. Choo, C. Z. Liu, and D. He, ―Blockchain in healthcare applications: research challenges and opportunities,‖ Journal of Network and Computer Applications, vol. 135, pp. 62–75, 2019.

[11] A. Reyna, C. Martín, J. Chen, E. Soler, and M. Díaz, ―On blockchain and its integration with IoT. Challenges and opportunities,‖ Future Generation Computer Systems, vol. 88, pp. 173–190, 2019.

[12] D. Sinclair, N. Shahriar, and P. Zhang, "Blockchain technology in the pharmaceutical industry", NCBI, vol. 14, no. 10, pp. e0220841, 2019.

[13] Xie, K., Zhang, J., & Zheng, Y,"Blockchain technology for drug traceability and counterfeiting prevention in the pharmaceutical supply chain", In IEEE Access, vol. 7, no. 1, pp. 3235-3246,2019.

[14] R. Balani, M. Choudhary, and A. K. Kar, "A blockchain-secured pharmaceutical distribution system to fight counterfeiting," PMC, vol. 48, no. 12, pp. e22607, 2020.