International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

Supply Chain Tracing and Anti-Counterfeiting with Distributed Ledger Technology

Ms. Swati Bula Patil[1], Dr. Snehal Rahul Rathi[2], Mr. Ganesh C. Shelke[3], Mrs. Shalini Vaibhav Wankhede[4], Dr. Manohar K. Kodmelwar[5], Mr. Kishor Renukadas Pathak[6], Ms. Komal M. Birare[7]

[1]Assistant Professor at Department of Information Technology,
Vishwakarma Institute of Information Technology, Pune, India
swati.patil@viit.ac.in

[2]Assistant Professor at Department of Computer Engineering,
Vishwakarma Institute of Information Technology, Pune, India
snehal.rathi@viit.ac.in

[3]Assistant Professor at Department of Information Technology,
Vishwakarma Institute of Information Technology, Pune, India
ganesh.shelke@viit.ac.in

[4]Assistant Professor at Department of Information Technology,
Vishwakarma Institute of Information Technology, Pune, India
shalini.wankhede@viit.ac.in

[5]Assistant Professor at Department of Information Technology,
Vishwakarma Institute of Information Technology, Pune, India
manohar.kodmelwar @viit.ac.in

[6]Assistant Professor at Department of Information Technology,
Vishwakarma Institute of Information Technology, Pune, India
kishor.pathak@viit.ac.in

[7]Assistant Professor at Department of Information Technology.
Vishwakarma Institute of Information Technology, Pune, India
komal.birare@viit.ac.in

Abstract — In recent times, there has been a rampant proliferation of counterfeit products that has left a trail of devastation in the manufacturing sectors. The repercussions of this extend to companies, impacting their brand reputation, revenue streams and overall profitability. Industries like agriculture, banking, electronics, and high-value deliveries uses the emergence of blockchain technology as a powerful tool to discern between authentic and counterfeit items. Its potential as a means to curtail the influx of fake products in the market is substantial. Blockchain technology, at its core, operates as a decentralized and distributed digital ledger system, meticulously recording transactions within interconnected blocks across multiple databases. The inherent security of this technology ensures the immutability of these blocks, rendering them invulnerable to alteration or hacking. By leveraging blockchain technology, consumers can independently verify the authenticity of a product, eliminating the need for reliance on third-party intermediaries. Incorporating recent technological advancements, the utilization of Quick Response (QR) codes offers a robust approach to combat the proliferation of counterfeit goods. The integration of blockchain technology with QR codes serves as a means to uphold the integrity of products. This innovative system securely stores product details and unique codes in the form of blocks, where QR codes play a pivotal role in collecting and matching these unique codes with entries in the blockchain database. If the QR code matches with entries in the database, the user receives a confirmation of the product's authenticity; otherwise, an alert is triggered, signaling the presence of a counterfeit product.

Keywords — supply chain, counterfeit products, blockchain, smart contract, distributed ledger.

I. INTRODUCTION

Blockchain technology is a robust data storage system that presents formidable obstacles to tampering, hacking or fraudulent manipulation. The vast expanse of the supply chain encompasses an extensive array of goods, creating a pressing need to validate the authenticity of products. Among those most severely affected by counterfeit or spurious merchandise are the manufacturers, who endure substantial hardships and significant losses. The adoption of blockchain technology offers a potent solution for discerning the legitimacy of products, effectively countering the scourge of counterfeiting. Blockchain based technology boasts enhanced security measures, ensuring the establishment of an immutable transaction history for each product once it becomes part of the network. This construct allows for the comprehensive documentation of all transactions pertaining

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

to the product and its current owner, with these records meticulously archived within blocks of a ledger in the blockchain. Incorporating this proposed system involves assigning a unique QR code and a corresponding token to each product, empowering end-users to acquire comprehensive information about the item by simply scanning the code. This innovative approach allows for the straightforward determination of a product's authenticity, presenting a potent defense against the persistently looming risks of counterfeiting and duplication. When any global technological advancement or product development takes shape, the specter of risks such as counterfeiting and replication invariably looms, poised to cast a shadow over an organization's reputation, financial well-being, and the welfareof its clientele.

A. Distributed Ledger Technology

Distributed Ledger Technology (DLT) is a digital record-keeping system designed for secure, transparent, and decentralized transaction recording. It functions by linking individual data blocks using encryption, and a network of computers collectively manages the distributed database.

Once a data block is incorporated into the chain, it becomes immutable and resistant to alteration or deletion. Each data block stores a compilation of various transactions, rendering the DLT impervious to tampering and indisputable.

DLT finds its most notable application in cryptocurrencies like Bitcoin, where it serves as the foundation for recording and validating transactions. However, its potential utility extends to a multitude of other areas, including supply chain management, electoral systems, and digital identity verification.

B. Self-Executing Contracts

Self-Executing Contracts, often referred to as smart contracts, are computer programs designed to automatically enforce the terms of a contract when predefined conditions are met. These contracts are self-sustaining, as they encode the agreement's specifics into lines of code. Smart contracts are packages that execute precisely as they are set up with the aid of their creators.

There are several applications for smart contracts, including supply chain management, real estate transactions, and digital identity verification.

Blockchain based smart contracts facilitate secure and transparent execution without the necessity of intermediaries or trusted third parties. They are engineered to reduce human intervention by automating the execution of contractual agreements. Smart contracts have a diverse range of applications, from managing supply chains and property transfers to handling financial transactions. Smart contracts has multiple applications like supply chain management, agriculture, pharmaceutical and identity verification. It helps in increasing transparency and to automate complicated procedures. For instance, a smart contract could automate the property transfer process, ensuring that transactions are secure and transparent while consistently upholding the contract's stipulations.

II. LITERATURE REVIEW

The research paper, titled “A Blockchain-Based Approach for Drug Traceability in Healthcare Supply Chain”,Healthcare supply chains are complex networks that go across numerous organizational and geographic boundaries,providing critical backbone to services vital for everyday life.It combines blockchain technology and machine learning to improve transparency, security, and efficiency. Blockchain technology creates a tamper-proof ledger that records drug transactions from production to distribution, ensuring authenticity and traceability.The smart contract gives a secure, immutable history of transactions to all stakeholders and ensures data provenance.We present the system architecture that govern the working principles of our proposed solution. We perform testing and validation,and present cost and security analysis of the system to evaluate its effectiveness to enhance traceability within pharmaceutical supply chains. This approach streamlines supply chain operations, reduce manual processes, and improves drug traceability. The paper validates its effectiveness through simulations and real-world case studies[1]. It also discusses potential future integration, including IoT. In summary, the paper offers a comprehensive solution that leverages blockchain and machine learning to transform pharmaceutical supply chain management. It addresses issues such as service redundancy, poor coordination, and lack of transparency. Counterfeiting remains a significant challenge, and while methods like RFID tags and Artificial Intelligence have been explored, they have limitations, including the vulnerability of QR codes and the computational demands of AI. [20]

Supply chain management is a core corporate activity responsible for moving commodities and services between different stakeholders [2]. The solution proposed here enhances counterfeit product detection through Blockchain technology. Blockchain provides secure, transparent tracking of genuine products throughout the supply chain. It's a decentralized system, enabling multiple parties to access data simultaneously, ensuring data security and immutability. This paper introduces "PharmaChain," a novel system addressing key issues in pharmaceutical supply chain management, including counterfeit drugs, inefficiencies, and transparency. To tackle these challenges, it suggests

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

integrating blockchain technology. Blockchain acts as a transparent, immutable ledger, recording the pharmaceutical product journey from origin to distribution, ensuring authenticity verification. Its decentralized nature allows concurrent data access and its robust security resists unauthorized data tampering.

The utilization of blockchain technology holds significant relevance across a range of domains, spanning from finance, healthcare, education, data management, privacy, and security. Additionally, the versatility of blockchain technology is expanding its horizons into the telecom and cybersecurity sectors, as highlighted by researcher. Agriculture supply chain (ASC) is crucial for the practitioners in the ASC to discover the enablers of the BT adoption and apprehend how they are linked with every different problems. The relationship between the enablers will help the ASC practitioners to convince the organizations to adopt BT in their supply chains to provide solution of sustainability issue.[3]

In a globalized world, counterfeit goods have proliferated across industries. This research introduces a Blockchain based DApp to identify counterfeit products in the supply chain. The system leverages Blockchain immutable and secure data storage, managing product ownership transfers. Consumers can verify product distribution and ownership by scanning a QR code generated by the DApp, linking each product to Blockchain for an unalterable supply chain record. This paper addresses the rising issue of counterfeit products in supply chains, enhancing security,privacy risks and authenticity verification through Blockchain technology.[4]

Trust between stakeholders, transparency, and efficiency at every stage of the supply chain are just a few of the obstacles and challenges that come with maintaining a good supply chain[5]. However, it's important to acknowledge that countering the sale and distribution of counterfeit pharmaceuticals, both in physical and online realms, necessitates the integration of complementary technologies like machine learning.In this paper, authors has proposed and develop a revolutionary drug supply chain management and recommendation system (DSCMR) based on blockchain and machine learning.N-gram, They have performed number of tests to evaluate the effectiveness and usefulness of our suggested solution.[22].

Blockchain significantly improves supply chain traceability, enabling rapid identification and recall of specific drug batches in safety concerns or recalls.A decentralized hyper ledger fabric system called PharmaChain makes use of interoperability, accountability, and confidentiality. With the use of smart contracts, this system offers on-chain and off-chain storage for safe, quick transactions. [6]

Supply chain management often grapples with challenges like service redundancy, poor coordination, and standardization issues due to transparency deficiencies. The widespread problem of product counterfeiting, challenging to detect visually, affects brand reputation.The purpose of this paper is to develop a comprehensive framework for block chain adoption in the supply chain by identifying the enablers and empirically evaluating their inter dependencies and impact on adoption. Various methods have been explored to combat counterfeiting, including RFID, AI, and QR code systems. However, these methods have limitations, such as QR code replication and AI's computational demands. To combat counterfeit products, this project utilizes Blockchain to track the entire supply chain history, enhancing transparency and security. It offers a robust solution to counterfeiting issues faced by legitimate businesses. [7]

The researchers Maher A.N. Agi a, Ashish Kumar Jha, revealed that the perceived simplicity and effectiveness of blockchain technology remain largely unaffected by concerns related to insecurity and discomfort. The behavioral intention to embrace this technology is notably influenced by perceived efficacy, individual attitudes, and the perceived ability to control one's behavior. This finding has crucial implications for supply chain professionals who perceive blockchain as a means to maximize supply chain efficiency with minimal effort [8].

Within this study, a classification framework is introduced, focusing on critical stages of data sourcing, capture, integration, and analysis. Various traceability solutions, ranging from RFID and NFC technologies to biometric systems, databases, web services, and IoT technologies, are meticulously examined. Additionally, the concept of smart factories is explored, along with the challenges posed by data analysis. This comprehensive paper offers a significant contribution to the body of knowledge addressing product supply chain counterfeiting, serving as a valuable tool for researchers and practitioners in this field [9].

A thorough examination and categorization of traceability methods designed to detect product supply chain counterfeiting are meticulously presented by the authors. The categorization is subdivided into six distinct categories, encompassing physical, RFID based, barcode based, smartphone-based, holographic-based, and blockchain-based approaches. The paper delves into specific solutions, such as 2D codes, RFID, Near-Field Communication (NFC), and biometric technologies, while also exploring a spectrum of integration techniques, including databases, web services, and IoT technologies. Furthermore, the challenges associated

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

with data analysis are thoroughly addressed, alongside proposed methodologies for overcoming these hurdles. This scholarly contribution significantly advances the discourse on product supply chain counterfeiting[10].

In a world marked by globalization and technological advancements, the proliferation of counterfeit goods has reached unprecedented levels across various industries, including food, pharmaceuticals, and luxury items. This paper introduces a decentralized Blockchain based application system (DApp) as a solution to detect and combat counterfeit products within the supply chain. Blockchain technology's inherent immutability and security make it the foundation of this project, ensuring the secure transfer of product ownership.

Consumers can verify product distribution and ownership information by scanning Quick Response (QR) codes generated by the DApp, which are linked to the Blockchain. This innovative ownership tracking system is reshaping traditional supply chain management. Importantly, this approach eliminates administrative costs and streamlines complex procedures. One noteworthy aspect is the remarkably low cost associated with enrolling each product in this model. This cost-efficiency can significantly benefit large chain stores [11].

The pharmaceutical supply chain currently suffers from a lack of transparency and an increasing prevalence of counterfeit drugs, with approximately 10.5% of medicines in lower and middle-income countries being counterfeit, posing significant public health risks. To tackle these issues, in this paper, researchers has proposed a blockchain based model to monitor pharmaceutical flow while minimizing counterfeit drug risks. Blockchain technology is chosen for its immutability and tracking capabilities. Manufacturers can upload product information for approval by relevant authorities. Hospitals and pharmacies can request approved drugs based on their needs, and patients can make requests within the blockchain network, directing them to the nearest hospital or pharmacy for medication collection. This blockchain-based solution addresses pharmaceutical supply chain challenges, especially counterfeit drugs, enhancing transparency and benefiting patients.[12]

Managing the medicine supply chain is complex, impacting transparency, data traceability, and issues like counterfeiting, illegal imports, and inefficiency. A Cloud-based Blockchain powered system architecture is proposed to address these challenges. It offers solutions for pharmaceutical material traceability, secure data storage, data privacy, and quality assurance. This research introduces a Cloud-based Blockchain-powered system to enhance pharmaceutical supply chain transparency, tackle counterfeiting and inefficiencies, and promote safety and cost reduction, with experimental results validating its efficiency for the pharmaceutical industry.[13]

Here, authors has been designed and developed software program connector to join an Ethereum like blockchain with the enterprises' records structures to enable groups to share records with
their companions with exceptional stages of visibility and to take a look at statistics authenticity, integrity and invariability over time via the blockchain, for this reason constructing trust. outcomes indicates how blockchain technological know-how is a convenient instrument to overcome collaboration and have faith problems in a furnish chain,
to decrease the terrible penalties of facts asymmetry over the echelons of a furnish chain however additionally to discourage corporations from any misconduct [14]

Here researchers has give analytical review, of blockchain based supply chain lookup, the benefits, issues, and challenges in the blockchain-supply-chain paradigm. They had given different industrial applications of this technology [15,18]

In the paper [16], authors has proposed a for detecting faux drug treatments by using block chain technology. The gadget tracks the whole life cycle of a drug, from manufacturing to distribution, and continues a decentralized ledger that files every transaction. This method allows stakeholders to affirm the authenticity of tablets in real-time, making sure that solely proper drugs reach patients.

The paper titled "Smart Contract Applications within Blockchain Technology: A Systematic Mapping Study" conducts a comprehensive systematic mapping study of smart contract applications within the realm of blockchain technology. As an outcome, the most widely discussed problems and solutions in the literature are related to the security and privacy of blockchain and the programming of smart contracts [17].

Counterfeiting is a growing concern globally, jeopardizing consumer safety and brand reputation. This paper proposes a blockchain based system for secure and transparent fake product identification. Each product is assigned a unique identifier during manufacturing, with its transaction history recorded on the block chain. Block chain's decentralized nature ensures data authenticity and security, making tampering nearly impossible. This approach is particularly beneficial in industries like luxury goods, pharmaceuticals, and electronics, where product quality and safety are paramount. The research implements a decentralized fake product identification system using the Ethereum block chain and the Etherscan API for easy

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

product authenticity checks. In summary, block chain-based fake product identification can enhance product safety, reduce counterfeiting, improve supply chain efficiency, and build consumer trust in products and brands.[19]

III METHODOLOGY AND PROPOSED SYSYTEM

The counterfeit goods market is growing rapidly due to the vast array of products available online. Therefore, it is crucial to detect false items, and this is achieved through the use of Distributed Ledger Technology and Smart Contracts. The comprehensive system architecture overview is depicted in Figure 1.

In this method, the manufacturer will be the guardian of the blockchain network who will be managing and initializing the network and its operations. Whenever manufacture creates new product for shipment or any it is his responsibility to add the product details on blockchain, to facilitate this operation we have add Product function in smart contract. This function uses keccak256 algorithm to generate a unique code from provided product name as shown in Figure 2.

Once the unique id for the product is generated the block is mined with this detailed i.e adding product details to distributed ledger as shown in Figure 3 and publishing it to all the members of network and now our frontend application can fabricate an QR code with unique id received from smart contract.This QR code now can be attached with product in terms of any medium. Figure 4 shows Contract Transaction details.
When the product is transported to warehouse partner, they both have to update the status of product in journey with the help of events only. No one in the network has authority to alter the data so we are using Boolean only to track the status and once Boolean are set there's no way to go back which prevents members from attempting any frauds.

As product reaches to end consumer without any hurdles they are now enabled to scan QR tagged with product with the help of mobile application which will query the blockchain network whether the product is genuine or not? If the product is not claimed yet it means It is genuine and can be purchased. When consumer purchases the product, he has to redeem the product and an event will be triggered to set the is Sold flag to true as shown in Figure 5. The event will be published to whole network and if someone tries to attempt to clone the product and QR they won't be able to claim product as its flag is already set to true and can't be changed cause of immutability.

A Aims and Objectives

This issue of this false and cloned goods, products is rapidly increasing day by day. This occurs due to loopholes and absence of decentralized tracking mechanism which build trust between partners. So to encounter this issue it is mandatory to design a mechanism or framework which can build the trust in supply chain and identify the culprit. It should enable all the participants to go through product journey without intervention from any third-party entity. Hence, we have proposed this simple distributed ledger-based mechanism which can provide insights at every checkpoint in supply chain.

B Goals

- Implement a distributed Ledger based supply chain mechanism to improve transparency.

- Make every member in supply chain as an equal participant in network.

- Enable end consumers to validate and purchased product's confidently.

- Fabricate the event-based mechanism to minimize the efforts to tracing and maximize efficiency.

C Actors and Roles

a)Manufacture / Network Admin:

The administrator creates a initialized Genesis block and Ledger, serves as the guardian as a Network, as depicted in Figure 1. They have the authority to add or remove Contributor in network, produce reports, mines block i.e. adding information of products and its identity on blockchain.

b)Partners:

Warehouse Partner and Transportation Partner as just contributor who are supposed to update current status and locations of products and Inventory as shown in Figure 1.

c)Consumers:

Consumer can be individual who can use the system for checking product's authenticity and update the status if they purchased product. (Figure 2).

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
Article Received: *06 July 2023* ***Revised:*** *28 August 2023* ***Accepted:*** *16 September 2023*

d)Design and Architecture Diagrams

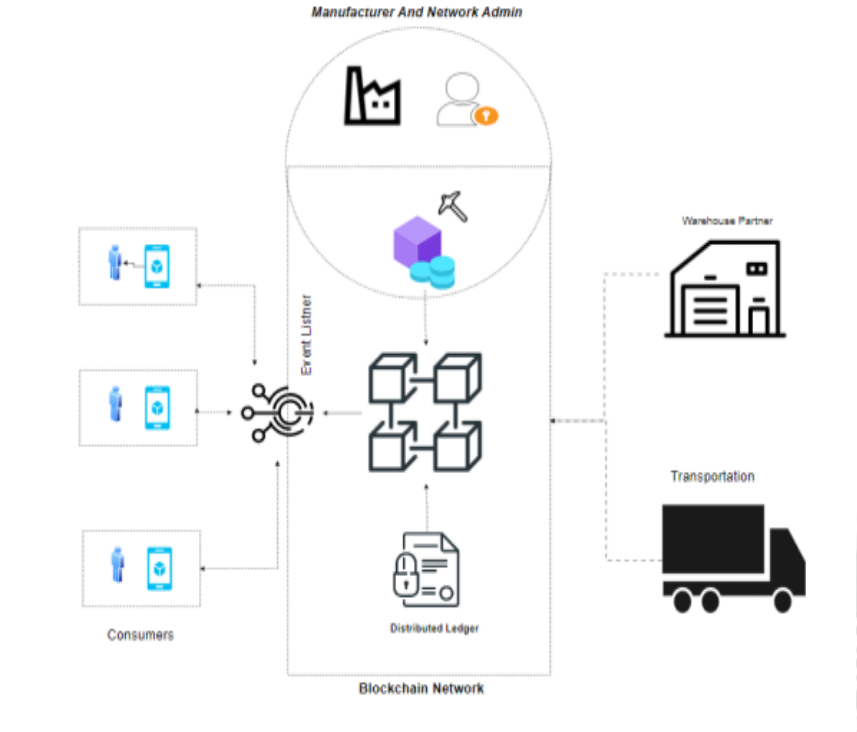

Fig 1. Architectural Overview

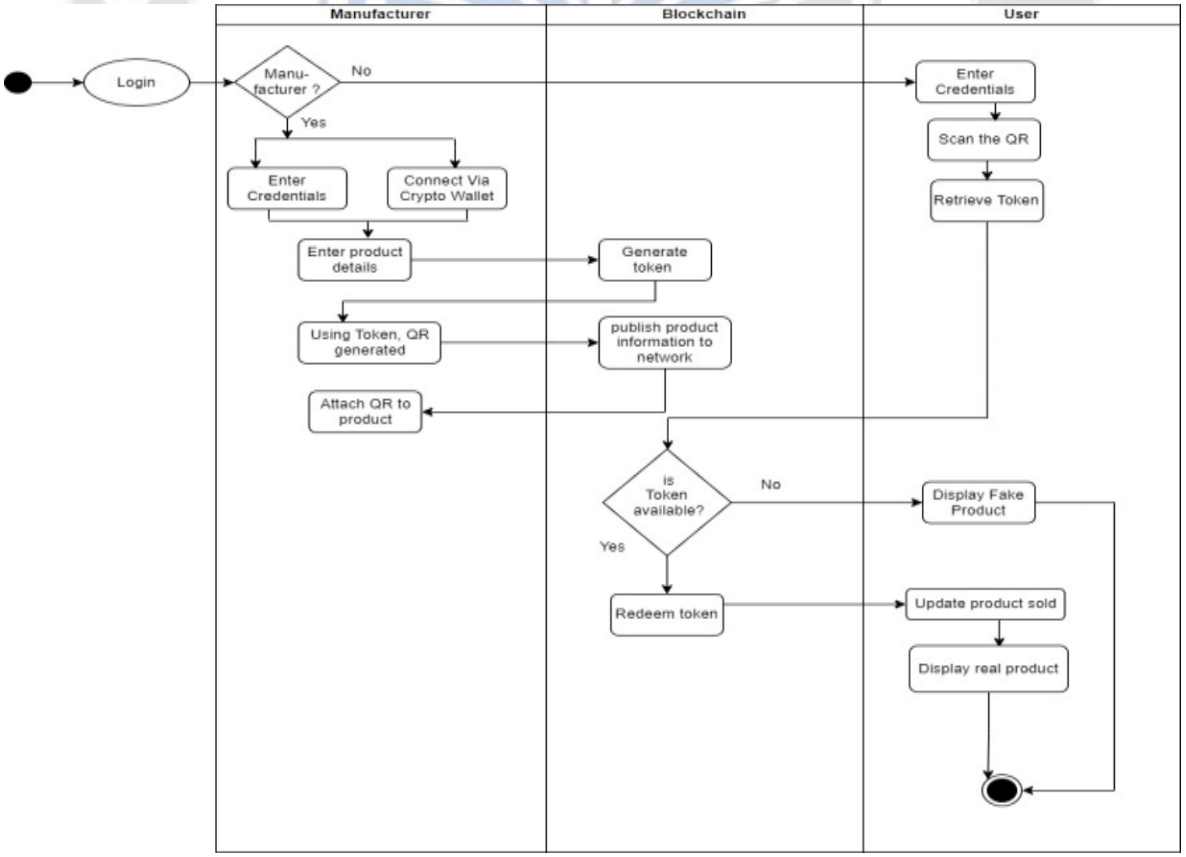

Fig 2. Activity Diagram

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
Article Received: *06 July 2023* ***Revised:*** *28 August 2023* ***Accepted:*** *16 September 2023*

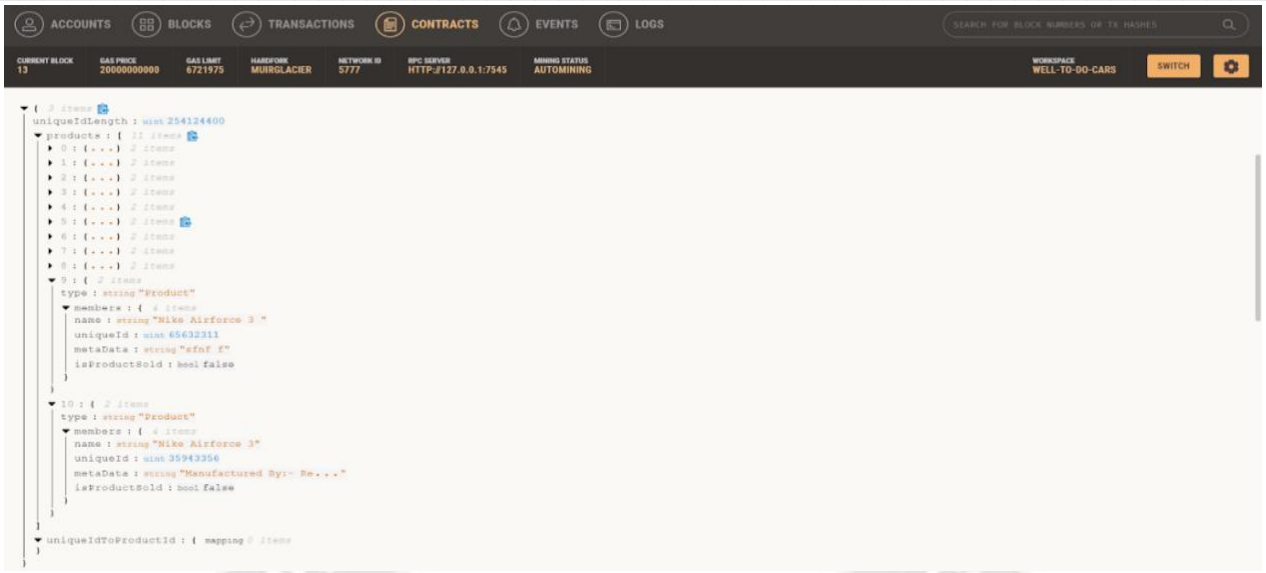

Fig 3. Contract Storage / Ledger

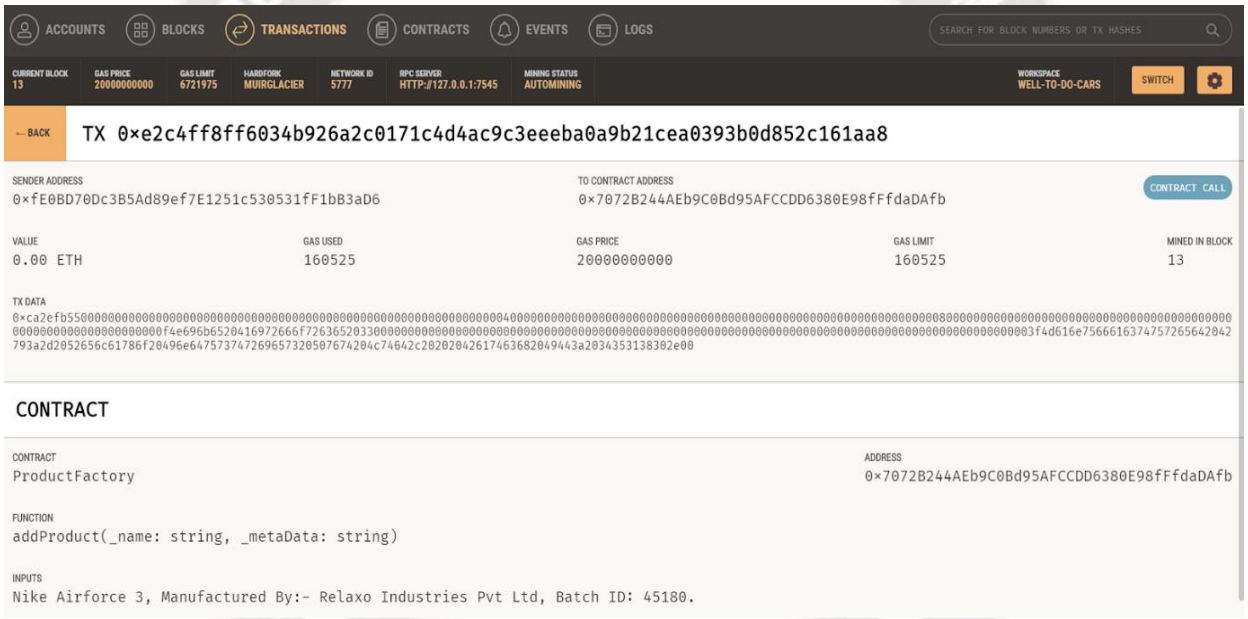

Fig 4. Contract Transaction Details

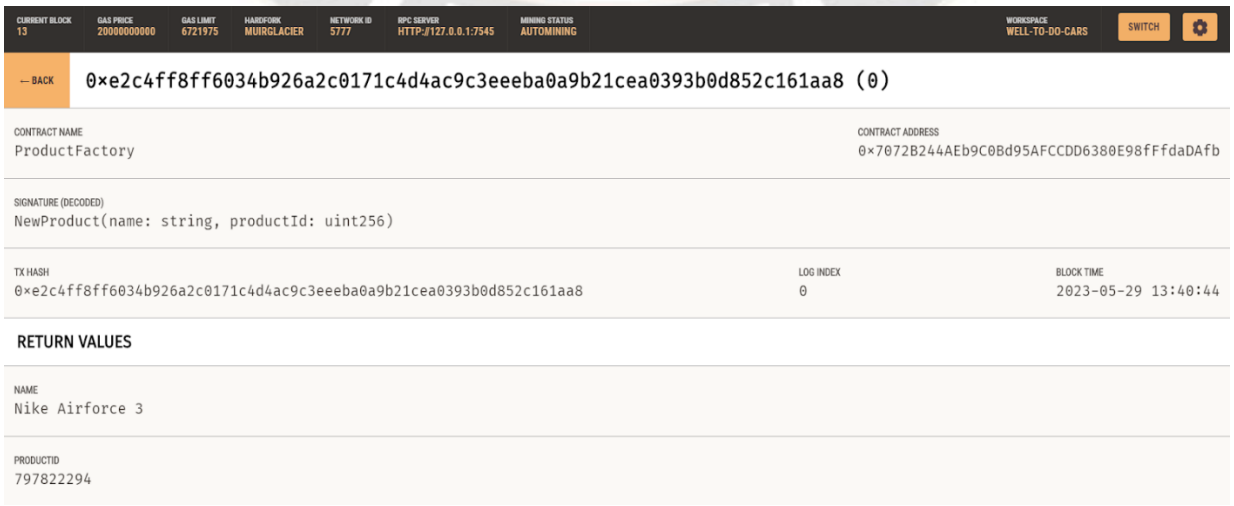

Fig 5. Emitted Contract Event

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 11s
DOI: https://doi.org/10.17762/ijritcc.v11i11s.8301
***Article Received:** 06 July 2023 **Revised:** 28 August 2023 **Accepted:** 16 September 2023*

IV CONCLUSION

In an era marked by a pervasive challenge of counterfeit products infiltrating global markets, the role of blockchain technology in addressing this issue has emerged as a beacon of hope. This paper has explored the application of blockchain, in conjunction with a Flutter-based mobile application for QR code scanning, as a robust solution for counterfeit product detection and product authenticity verification. The overarching goal of this research has been to devise a practical and secure system that empowers consumers to confidently differentiate genuine products from counterfeits while enhancing supply chain transparency and integrity.The adoption of blockchain technology in the context of counterfeit product detection offers several noteworthy advantages. Firstly, the decentralized nature of blockchain ensures that local suppliers or malicious actors cannot interfere with product verification processes. This feature alone serves as a formidable deterrent to counterfeiters. Additionally, the immutability and transparency inherent to blockchain technology provide a tamper-resistant and reliable ledger of product information, making it virtually impossible to manipulate or falsify product data.The Flutter-based mobile application leverages the ubiquity of smartphones to empower consumers with the ability to scan QR codes and instantly verify the authenticity of products. This user-friendly interface bridges the gap between consumers and the blockchain, making it accessible and convenient for individuals to make informed purchasing decisions. Furthermore, the incorporation of machine learning algorithms and artificial intelligence into the application can enhance its accuracy and efficiency in detecting counterfeit products.The research has also highlighted the broader implications of blockchain-based counterfeit product detection. It extends beyond mere consumer empowerment, as it equips manufacturers and regulatory authorities with tools to trace the source of counterfeit products. By tracking the product's journey through the supply chain and identifying the point of entry for counterfeit goods, stakeholders can take proactive measures to safeguard brand reputation and protect consumers.In practical implementation, the project employed the Ethereum blockchain, known for its security and flexibility, to develop the infrastructure for counterfeit product identification. The utilization of the Flutter framework for mobile application development ensured cross-platform compatibility and user-friendly functionality.The successful implementation of the system, as demonstrated in our experiments, showcases its efficiency and usability. While blockchain technology, particularly on permission less networks like Ethereum, can sometimes exhibit higher lateness and lower throughput, these limitations are inherent to the network's design. Future iterations of the system may explore the use of more tailored blockchain frameworks to optimize performance further. Looking forward, the potential applications of blockchain-based counterfeit product detection extend well beyond its initial scope. Industries such as luxury goods, pharmaceuticals, and electronics stand to benefit significantly from the enhanced product safety, reduced counterfeiting, and improved supply chain efficiency that this technology offers. Moreover, the development of machine learning and IoT based authentication systems can further fortify the security and efficacy of counterfeit detection in supply chains.In conclusion, this research represents a significant stride toward combating counterfeit products through blockchain technology and a user-friendly Flutter-based application for QR code scanning. The synergy between these technologies not only empowers consumers but also strengthens supply chain integrity and brand protection. As the global market grapples with counterfeit product challenges, this system stands as a beacon of hope for achieving authenticity and transparency in a world crowded with counterfeits.

REFERENCES

[1] Ahmad Musamih 1 , Khaled Salah 2 , (Senior Member, Ieee), Raja Jayaraman 1 , Junaid Arshad 3 , Mazin Debe 2 , Yousof Al-hammadi 2 , And Samer Ellahham ,"A Blockchain-based Approach For Drug Traceability In Healthcare Supply Chain", Digital Object Identifier 10.1109/Access.2021.3049920

[2] Udit Agarwal 1 , Vinay Rishiwal 1 , (Senior Member, Ieee), Sudeep Tanwar 2 , (Senior Member, Ieee), Rashmi Chaudhary 3 , (Member, Ieee), Gulshan Sharma4 , Pitshou N. Bokoro 4 , And Ravi Sharma 5 ,"Blockchain Technology For Secure Supply Chain Management: A Comprehensive Review", Digital Object Identifier 10.1109/Access.2022.3194319

[3] Sachin S. Kamble, Angappa Gunasekaran, Rohit Sharma, "Modeling the blockchain enabled traceability in agriculture supply chain", International Journal of Information Management, Volume 52, June 2020, 101967

[4] N. Anjum and P. Dutta, "Identifying Counterfeit Products using Blockchain Technology in Supply Chain System," 2022 16th International Conference on Ubiquitous Information Management and Communication (IMCOM), Seoul, Korea, Republic of, 2022, pp. 1-5, doi: 10.1109/IMCOM53663.2022.9721789.

[5] Dhruman Gohil, Shivangi Viral Thakker, "Blockchain-integrated technologies for solving supply chain challenges", Modern Supply Chain Research and Applications, 24 May 2021, ISSN: 2631-3871

[6] Sarmistha Sarna Gomasta a, Aditi Dhali a, Tahlil Tahlil b, Md. Musfique Anwar a, A.B. M Shawkat Ali c, "PharmaChain: Blockchain-based drug supply chain

provenance verification system", Volume 9, Issue 7, July 2023, e17957

[7] Kunal Wasnik, Isha Sondawle, Rushikesh Wani, and Namita Pulgam, "Detection of Counterfeit Products using Blockchain", ITM Web of Conferences 44, 03015 (2022) ICACC-2022

[8] Sukhmeet Singh, Nitin Sharma. (2023). Image Based Analysis for Bone Marrow Cancer Detection using Soft Computing Techniques: A Review. International Journal of Intelligent Systems and Applications in Engineering, 11(4s), 602–610. Retrieved from https://ijisae.org/index.php/IJISAE/article/view/2737

[9] Maher A.N. Agi, Ashish Kumar Jha, "Blockchain technology in the supply chain: An integrated theoretical perspective of organizational adoption", International Journal of Production Economics, Volume247, May 2022, 108458

[10] Vincenzo Varriale, Antonello Cammarano , Francesca Michelino and Mauro Caputo,"Sustainable Supply Chains with Blockchain, IoT and RFID:A Simulation on Order Management,Sustainability 2021, 13, 6372. https://doi.org/10.3390/su13116372

[11] GHAITH KHALIL , (Member, IEEE), ROBIN DOSS, AND MORSHED CHOWDHURY , (Member, IEEE),"A New Novel RFID-Based Anti-Counterfeiting Scheme for Retail Environments,Digital Object Identifier 10.1109/ACCESS.2020.2979264

[12] Dr. Anasica S, Mrs. Sweta Batra. (2020). Analysing the Factors Involved In Risk Management in a Business. International Journal of New Practices in Management and Engineering, 9(03), 05 - 10. https://doi.org/10.17762/ijnpme.v9i03.89.

[13] Nafisa Anjum, Pramit Dutta, "Identifying Counterfeit Products using Blockchain Technology in Supply Chain System", arXiv:2206.08565v1 [cs.CR] 17 Jun 2022

[14] Abhinav Sanghi, Aayush, Ashutosh Katakwar, Anshul Arora, Network Adi, "Detecting Fake Drugs using Blockchain", International Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277- 3878 (Online), Volume-10 Issue-1, May 2021

[15] Vinodhini Mani, M. Prakash, and Wen Cheng Lai, "Cloud-based blockchain technology to identify counterfeits", J Cloud Comput (Heidelb). 2022; 11(1): 67. Published online 2022 Oct 20. doi: 10.1186/s13677-022-00341-2

[16] Longo Francesco, Nicoletti Letizia, Padovano Antonio, d'Atri Gianfranco, and Marco Forte, "Blockchain- enabled supply chain: An experimental study." Computers & Industrial Engineering, Volume 136, October 2019.

[17] Shuchih E. Chang, Yichian Chen, "When Blockchain Meets Supply Chain: A Systematic Literature Review on Current Development and Potential Applications", IEEE Access, Volume 8, March 2020.

[18] Anurag Upadhyay, Anshuman Bhargava, J Sathish Kumar, "Investigating to detect the fake medicines using blockchain technology", https://doi.org/10.21203/rs.3.rs-3003120/v1

[19] Macrinici Daniel, Cartofeanu Cristian, Shang Gao, "Smart contract applications within blockchain technology: A systematic mapping study." Telematics and Informatics, Volume 35, Issue 8, December 2018.

[20] Ming K.Lim, Li Yan, Wang Chao, Ming Tseng, "A literature review of blockchain technology applications in supply chains: A comprehensive analysis of themes, methodologies and industries." Computers & Industrial Engineering, Volume 154, April 2021, 107133.

[21] Jang Bahadur Saini, D. . (2022). Pre-Processing Based Wavelets Neural Network for Removing Artifacts in EEG Data. Research Journal of Computer Systems and Engineering, 3(1), 43–47. Retrieved from https://technicaljournals.org/RJCSE/index.php/journal/article/view/40.

[22] Tushar Suryawanshi, Swapnil Jadhav, Subeg Singh Kapoor, Prof. Sonali Shinkar, "Fake Product Identification System Using Blockchain", © 2023 IJCRT | Volume 11, Issue 5 May 2023 | ISSN: 2320-2882

[23] Kunal Wasnik1,⇤, Isha Sondawle1, Rushikesh Wani1, and Namita Pulgam1,"Detection of Counterfeit Products using Blockchain",ITM Web of Conferences 44, 03015 (2022), https://doi.org/10.1051/itmconf/20224

[24] Reza Soltani 1 , Marzia Zaman 2 , Rohit Joshi 3 and Srinivas Sampalli 1,Distributed Ledger Technologies and Their Applications:A Review,,Appl. Sci. 2022, 12, 7898. https://doi.org/ 10.3390/app12157898

[25] Khizar Abbas , Muhammad Afaq, Talha Ahmed Khan and Wang-Cheol Song ,"A Blockchain and Machine Learning-Based Drug Supply Chain Management and Recommendation,Electronics 2020, 9, 852; doi:10.3390/electronics9050852