Supply Chain For Pharma Network Using Blockchain & QR Code Technology

[1]Pravin R. Pachorkar, [2]Mayuri M. Pagar, [3]Khagendra C. Patil, [4]Shaurya R. Gangurde, [5]Shreyas R. Nagare

Guru Gobind Singh College of Engineering and Research Centre
Nashik, Maharashtra, India.

Abstract- **Blockchain technology has wider scope in the financial tech fields, pharmacies and food industries. Blockchain technology is decentralised distributed ledger that provides the transparency, immutability and reliability in the network. In this project, we are integrating the Blockchain technology with pharma supply chain process for reliable supply chain process. It records all the information in the form of smart contract from manufacturer to the customer.**

In the field of finance, blockchain technology was recently developed to offer a secure, consensus-based, and irreversible environment. In certain contexts, trust and transparency are essential, and blockchain arrives to save the day. Pharmaceutical information must be transmitted. data to multiple parties with accuracy. Like prescription medications, Blockchain technology makes it possible to see and track supply chains, providing Producers with comprehensive information to consumers. Nowadays, big manufacturers collect and handle data, and pharmacies misuse their centrally located systems. A lot Current strategies and techniques make pharmaceutical data to be maintained and grouped between the tending provider and other parties involved.

In the traditional supply chain process stakeholders cannot trust each other because there is no any trustworthy document verified by them but, in Blockchain the data can be stored by mining a block by number of miners so there is the transparency between the stakeholders.

Keywords: **Blockchain Technology, smart contract, Pharma supply chain , Visibility, Transparency.**

INTRODUCTION

Blockchain technology is a decentralized and distributed ledger system that securely records and verifies transactions across a network of computers. It relies on cryptographic principles to ensure data integrity and immutability, making it resistant to tampering and fraud. With its transparent and trustless nature, blockchain eliminates the need for intermediaries, fostering efficiency and enhancing security in various industries, including finance, supply chain, and healthcare. To address the urgent issues facing the pharmaceutical sector, we suggest creating a cutting-edge supply chain management system built on blockchain technology. With its creative approach, the pharmaceutical industry has long been beset by serious problems like black marketing, fake medications, and a lack of transparency. The system makes use of the immutability, decentralization, and transparency that are inherent to blockchain technology to guarantee an unbroken and impenetrable record of a medicine's journey from the manufacturer to the final consumer. The project's integration of smart contracts reduces the possibility of counterfeit medications and improves the integrity of the pharmaceutical supply chain by automating verification procedures. By facilitating real-time tracking and fostering transparency among stakeholders, the implementation of this state-of-the-art system offers a comprehensive and resilient response to the many challenges that the pharmaceutical industry faces.

LITERATURE SURVEY

• Kaushal Shah, Shivrajsinh Rana, Neel Solanki: Blockchain-based Pharmaceutical Drug Supply Chain Management System, In this paper, a overview of the blockchain technology is given and examines and evaluates the most noteworthy and current studies that have used blockchain technology in pharma supply chain network.Here, they use solidity, concurrent algorithms, smart contracts, and supply chain transparency to create a software solution for security and transparency.[1]

• Dr. Aarti Dandavate, Krupa Savsani, Tejas Pisal, Rutuja Pandule, Hema Nagandla: Cryptopharmacy-Blockchain Based Pharmacy Supply Chain, The paper proposes a clever blockchain-based anti-counterfeit medication supply chain system. In this paper consensus algorithm , proof of authority, SHA algorithm, PKI algorithm is used.All product transferring records are permanently registered in an immutable ledger by the system through the use of smart contracts and product registration and transfer. This makes it possible to track products and allows customers to contribute to maintaining information flows. Because of the system's decentralized features, there is less chance of data manipulation. [2]

• Corrine Sim , Haisheng Zhang and Marianne Louise Chang: Improving End - to - End Traceability and Pharma Supply Chain Resilience Using Blockchain, In this paper, Hyperledger fabric is used for implementing better end-to-end traceability using blockchain technology. Hyperledger Fabric features automatically executable smart contracts, which are business logic algorithms that are mutually agreed upon by all network participants and are intended for use in enterprise applications across various industries. Every party will endorse every transaction in accordance with an elaborate endorsement policy that has been pre-established. It looks at the benefits of end-to-end traceability for businesses and the changes it makes, like strengthening supply chains and thwarting counterfeit goods. [3]

• Prof.R Nageswar Rao, Surekha Adiki: A Conceptual Framework for Sustainable Supply Chain Practices for the Pharmaceutical Industry, In order to better understand how pharmaceutical companies develop supply chain models for system-level transformation toward sustainability, this paper will offer a conceptual model. Research methodologies were applied in the construction of this framework for content analysis. The framework connects sustainability and sustainability. Its main goal is to investigate the relationship between the three dimensions and supply chain functions of the supply chain, namely, problems with the economy, society, and environment. [4]

• Ilhaam A. Omar, Raja Jayaraman, Mazin S. Debe , Haya R. Hasan ,Khaled Salah And Mohammad Omar: Supply Chain Inventory Sharing Using Ethereum Blockchain and Smart Contracts, In this paper, they present a blockchain-based inventory sharing strategy that links suppliers and retailers through private Ethereum networks and smart contracts. This method boosts supply chain transaction security, trust, and transparency by fusing blockchain technology with decentralized storage. In order to improve trust between participating entities, we present a generalized mechanism for secure information sharing that includes extensive algorithms to capture supply chain stakeholder interactions. The Remix IDE was used to create and verify the smart contract. The solution shows how a blockchain-based strategy lowers inefficiencies, is affordable, commercially feasible, and enhances information connectivity among supply chain participants in a reliable and secure manner. [5]

• Hesham Magd, Mohammad Sultan Ahmad Ansari and Saurav Negi: Impact of Blockchain Technology on Operations and Supply Chain Management Performance, This paper focuses on investigating the connections between supply chain management, operations, and blockchain technology, as well as the effects of blockchain on supply chain management, logistics, and operations performance.   according to the study, supply chain managers and operations can benefit from using blockchain technology in their daily operations in a number of ways, including faster response times, safe and secure data, proper visibility across nodes, transparent transactions, and increased trust among supply chain members. [6]

• Atul Kumar Singh, V.R. Prasath Kumar: Smart Contracts and Supply Chain Management Using Blockchain, The aim of this paper is to examine the potential of blockchain technology in relation to smart contract and supply chain management applications in the building industry. Cost overruns are typically ascribed to the slow progress of contractual obstacles or the inefficiency of procurement procedures for equipment and materials. Information and material flow One of the main responsibilities of construction companies is management. The industry is frequently criticized for taking too long to recognize the changes it requires and for being deemed prepared for the disruption due to the complexity of the work and the overwhelming amount

of rules, regulations, standards, and checks Consistency issues with regard to work principles continue to be a major concern. [7]

• Qingyun Zhu, Mahtab Kouhizadeh: Blockchain Technology, Supply Chain Information, and Strategic Product Deletion Management, The proposed system will lessen the risk of a product being discontinued, optimize supply chain operations, and improve stakeholder trust and transparency generally. The main goal is to create a reliable system that gives all parties involved real-time visibility into the production, distribution, and final product deletion phases of the supply chain. By preventing unauthorized changes and boosting trust among supply chain network participants, the use of blockchain ensures data integrity. A key component of strategic product deletion is the safe and effective removal of particular products from the market for a variety of reasons, including recalls, end-of-life concerns, or problems with regulatory compliance. [8]

AIM & OBJECTIVES
• To achieve transparency in supply chain
• To achieve optimization with the profit
• To increase Production and customer satisfaction
• To increased shipping predictability and accuracy

APPLICATION:
• Batch Verification: The system allows suppliers to upload verified batch documents on the blockchain. This application ensures the authenticity and integrity of the medicine batches throughout the supply chain.
• Medicine Validation: Consumers can use the system to validate the authenticity of medicine strips by scanning QR codes. This application enables consumers to verify the legitimacy of the medicine they purchase, thereby reducing the risk of counterfeit drugs.
• Counterfeit Detection and Reporting: The system empowers consumers to report suspected counterfeit drugs, enhancing the overall safety of the pharmaceutical
Industry. By integrating real-time verification and reporting mechanisms, the system encourages users to actively participate in detecting and preventing counterfeit products.
• Document Management: The system provides a secure and transparent platform for manufacturers to upload and share batch documents. Distributors, retailers, and consumers can access these documents to ensure they have accurate and complete information about the medicines they handle or purchase.
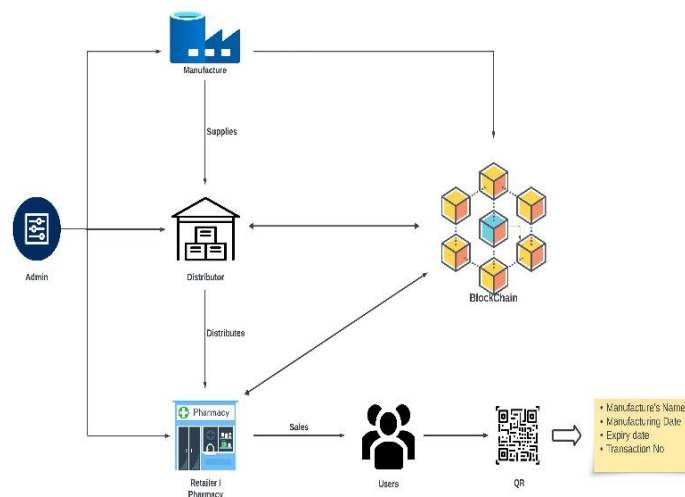
SYSTEM ARCHITECTURE

Fig -1: System Architecture Diagram

ADVANTAGES
• Increses Collaboration between manufacturer, distributors and regulators
• It help in reducing the time for managing the supply chain
• It prevents security threat and data breaches
• Brokers can be removed from the supply chain

FUNCTIONAL & NON-FUNCTIONAL REQUIREMENTS

Nonfunctional Requirements

1. **Ensure the Service Is On-Demand** : The system should be available 24/7 to support global pharmaceutical supply chain operations. Define acceptable downtime for maintenance and updates.

2. **Usability**: The user interface should be intuitive and user-friendly to facilitate easy interaction for all stakeholders in the supply chain. Provide training and documentation to support users in adopting the system.

3. **Auditability**: The system should maintain a comprehensive audit trail of all transactions and changes made within the blockchain. Facilitate traceability for compliance and dispute resolution purposes.

4. **Cost**: Define and control the total cost of ownership, including development, maintenance, and operational costs.

5. **Compliance**: The system should comply with relevant industry standards and regulatory requirements for pharmaceutical supply chain management. Regularly update the system to adhere to changes in regulations.

Functional Requirements:

1. **User Management**: User management is a fundamental component of the system. It involves the registration, authentication, and management of different types of users, including Manufacturer, Distributor, Retailer and customer.

2. **Product Traceability**: The system should enable end-to-end traceability of pharmaceutical products from manufacturer to distributor, to retailer, and finally to the end consumer. Each product unit should be uniquely identified with a tamper-resistant identifier linked to the blockchain.

3. **Supplier Management**: Registration and verification of suppliers on the blockchain to ensure the legitimacy and reliability of the supply chain partners. Smart contracts to automate and enforce compliance with predefined quality standards and regulatory requirements.

4. **Real-time Monitoring**: Real-time monitoring of the movement of pharmaceutical products through the supply chain.

5. **Smart Contracts for Transactions**: Implementation of smart contracts to automate and secure transactions between supply chain participants. Automated payment processing, order fulfillment, and contract execution based on predefined business rules.

SYSTEM REQUIREMENTS

Software Used:

• Windows 7 or above • Vscode • Python • Django
• Css/HTML

Hardware Used:

• AMD/Intel i3 Processor or above Processor
• 4GB RAM for application development
• 150 GB or above Hard Disk

CONCLUSION

In traditional system there exists improper traceability system for the pharmaceutical industry supply chain and hence counterfeit drugs are increasing and it is hard to track them. This project focused on the need of a blockchain equipped supply chain system in the pharmaceutical industry. This application of blockchain leads to transparency by guaranteeing both tracing and tracking thus preventing the supply chain from counterfeit drugs and also reaching the consumer. Unique ID was generated for each product which was used to create a Quick response (QR) code. QR code was identified as a practical and cost-effective method. Also, consumer feedback was considered which was used for further analysis and rating the actors of the supply chain.

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