2024 International Conference on Intelligent Systems and Advanced Applications (ICISAA)
Pune, India. Oct 25 - 26, 2024

Blockchain-Based Supply Chain Tracking System

Prof. Vilas Rathod
Department of Polytechnic,MIT WPU
Pune,India
vilas.rathod@mitwpu.edu.in

Atharva Deshmukh
Department of Polytechnic,MIT WPU
Pune,India
atharvd13@gmail.com

Rudolph Smith
Department of Polytechnic,MIT WPU
Pune,India
rudy16102005@gmail.com

Swara Shah
Department of Polytechnic,MIT WPU
Pune,India
swarakshah05@gmail.com

Jai Umadi
Department of Polytechnic,MIT WPU
Pune,India
jaiumadi31@gmail.com

2024 International Conference on Intelligent Systems and Advanced Applications (ICISAA) | 979-8-3315-3994-8/24/$31.00 ©2024 IEEE | DOI: 10.1109/ICISAA62385.2024.10829186

***Abstract*—With the introduction of a unique blockchain-based solution, this project addresses enduring problems with traditional supply chains, such as counterfeiting, inefficiencies, and trust-related difficulties. A decentralized blockchain ledger serves as the foundation for our supply chain tracking system, guaranteeing safe and open documentation and validation of the complete product route. Every step, from production to delivery, is recorded as unchangeable blocks. The integration of smart contracts serves to further automate vital procedures, such as quality checks, payments, and product verification; this fosters confidence and considerably reduces the likelihood of fraudulent activity. In addition, our system makes real-time tracking and traceability possible, giving interested parties the capacity to carefully follow the location and present condition of their product through the supply chain. This project not only signals an important change in the supply chain management but it also creates a more transparent and reliable environment for all involved parties by strengthening security measures and increasing accountability. By merging automated procedures with the openness and security of blockchain, this approach not only solves the current issues but also creates the foundation of a reliable and effective supply chain ecosystem.**

Keywords—Blockchain-based solution, blockchain ledger, Supply chain tracking system, Effective supply chain ecosystem, Transparent and reliable environment, Product verification

I. INTRODUCTION

The integration of blockchain technology and smart contracts represents a fundamental transformation in supply chain management, addressing enduring challenges related to trust, inefficiency, and counterfeit goods within traditional supply networks. By harnessing the decentralized and immutable characteristics of blockchain, alongside the automation capabilities of smart contracts, this pioneering concept establishes a robust framework for meticulously documenting and verifying every aspect of a product's lifecycle, from its inception to distribution. At its core, the system utilizes blockchain technology to securely record each phase of the product's journey as immutable blocks, ensuring the transparency and data integrity. Smart contracts and programmable, self-executing protocols deployed on the blockchain can automate key processes such as payments, quality assurance, and verification, reducing human intervention and risk impacts such as errors or fraud. This automated enforcement of predefined conditions fosters greater confidence and trust among consumers, reinforcing the integrity of the supply chain ecosystem. The real-time monitoring and traceability capabilities provided by this integrated approach empower stakeholders with prompt access to relevant information regarding product origins and statuses. Such transparency not only facilitates improved collaboration and decision-making but it also acts as a powerful barrier against illicit activities, further strengthening the system's resilience against fraud and malpractice. Ultimately, the fusion of the blockchain technology and the smart contracts creates a supply chain ecosystem characterized by heightened efficiency, reduced fraud risks, and enhanced levels of transparency and trust. This innovative convergence represents a significant advancement in supply chain management trials, ushering in a new age of reliability and security in the global movement of goods and services.

Recent advances in blockchain technology show the potential to solve these problems due to its unique features such as immutability, transparency and distribution. Although proof-of-concept studies and research on blockchain-based supply chain management (SCM) for logistics exist, the following topics are still not fully understood. This article aims to provide a comprehensive review of the opportunities, emerging trends and principles for the development of blockchain-based supply chain management (SCM). As we examine potential solutions, we identify and discuss four key challenges related to capacity building, production, access control, and data storage.[6]

II. LITERATURE SURVEY

[1] Blockchain allows decentralized bookkeeping, seen in Bitcoin to prevent double-spending. Blocks hold multiple transactions, with participants using consensus protocols like Proof-of-Work, Proof-of-Stake, and Byzantine Fault Tolerance for secure construction.

[2] The TrustChain Framework proposes a three-tiered trust management system integrating blockchain for supply chain integrity and traceability. It addresses data authenticity challenges, introduces a novel reputation model, and evaluates implementation using Hyperledger Fabric

[3] Blockchain ensures backup, prominence, and transparency, fostering trust in pharmaceuticals. Its transformative potential reshapes trust dynamics, particularly in industries like pharmaceuticals, by providing essential information for easy tracking and awareness.

[4] Improved supply chain efficiency with enhanced traceability, real-time data access, and streamlined processes. Reduced waste through optimized inventory management and logistics. Heightened cybersecurity and trust with decentralized, cryptographic record-keeping

[5] Decentralized network with cryptography and consensus for secure transactions. Ensures integrity for anonymous participants. Immutable data enhances transparency. Blockchain fosters openness, reducing fraud and enhancing stakeholder trust.

[6] Blockchain's immutability, transparency and decentralization fit SCM. This paper examines technical hurdles in blockchain-based SCM, focusing on scalability, throughput, access control, and data retrieval, proposing solutions and highlighting blockchain innovation.

[7] The supply chain uses a permissioned blockchain with stakeholders like suppliers and factories for control. Regulatory authorities enhance transparency. Stakeholders upload data for consumer confidence and regulatory compliance, improving services.

[8]The paper explores integrating blockchain in leather industry logistics for efficiency and transparency. It suggests Ethereum smart contracts to enhance trust, and RFID for improved tracking and security of leather goods.

[9] The paper examines how blockchain can boost trust in pharmaceutical supply chains. It proposes a system involving manufacturers, distributors, users, IPFS, and smart contracts to upgrade supply chain management and tackles challenges like counterfeiting.

[10] Blockchain is depicted as a chain of encrypted blocks, each with transaction data, a timestamp along with a hash of the preceding block. It highlights blockchain's potential to transform e-commerce and enhance supply chain management.

[11] The paper examines improving traceability and transparency in industrial supply chains via blockchain. It cites Bitcoin's genesis by Satoshi Nakamoto amid bank trust issues and Ethereum's role in decentralized applications. Challenges in supply chains, including tracking and security, are discussed

[12] A product authentication system employing Ethereum and smart contracts was developed. Participants, including farm inspectors, harvesters, exporters, importers, and processors, update batch details. QR codes offer access to transaction history, ensuring authentication and transparency throughout the supply chain, enhancing trust and reliability for stakeholders and consumers alike.

[13] The paper delves into leveraging blockchain for sustainability and efficiency in the dairy supply chain. It highlights opportunities like enhanced traceability, transparency, and challenges such as data standardization and adoption barriers.

[14] The research proposes blockchain technology to alleviate supply chain challenges, including information asymmetry and the double marginalization problem. It ensures secure data sharing, enhancing coordination and visibility. Challenges include developing efficient incentives and addressing scalability issues.

III. EXISTING SYSTEM

Disadvantages of the existing system:

- Visibility: Shipment tracking visualness has turned into a critical element, but their lack can create challenges and risk demanding shipping agencies. Poor merchandise visibility can negatively impact supply chain and logistics operations.
- Invalid source: With a centralized system of all supply chain details for manufacturers and supplier companies, there is a huge likelihood that data will be manipulated for the benefit of the manufacturer, potentially leading to erroneous results for customers.
- Losing reputation: As specified earlier, centralization can lead to fake authentication and approach, where hackers and middlemen can modify data and affect the honor of the company.[12]

IV. PROPOSED SYSTEM

In traditional food supply chain management, the authority can modify data, and several middlemen oversee the delivery process, which reduces system reliability and performance. Companies that have management system websites and databases sometimes add QR codes, which customers can scan to obtain end-product details. However, there is also a problem here, as the database itself can be efficiently mutated or hacked by the company. To add another layer of security, we propose a system that inserts product details into a blockchain-assigned ledger at each step of delivery. From raw materials to packaged products, every bit of information is updated in the blockchain. Anyone can scan the QR code provided by our system and access the current product details. The advantages of the proposed system include improved transparency, immutable records, increased data security, efficient traceability, customer empowerment, and streamlined processes:

- Decentralization: It is one of the best aspects of Blockchain technology. Blockchain systems are completely decentralized rather than stored in one place. Everyone has access to the transaction which was made to update the chain with information. This can have a certain authenticity and it is impossible to manipulate.
- Trust: Supply chain members can trust the data they identify. The modified data of the history of transactions is stored on the blockchain, so they are decentralized and immutable. In opposition, classical data repository structures in supply chains often require each link in the chain to maintain its own record, and conflict arises when records are inconsistent.
- Transparency: All the history of the updated data on the blockchain is automatically stored in a transaction recording website like Ethscan. This website is accessible to all and so our system fosters transparency. All participants in the supply chain may benefit from end-to-end tracking as information is updated to a blockchain ledger at every step of the product cycle. Conflicts and human-made errors may be settled more quickly than with conventional supply chain methods.
- Efficiency: The product life cycle is tracked at all steps, making it easy to identify where nonconformances (such as product defects or product shortages) occur in the supply chain. All data is collected at every stage of the SC and is accessible to all members of the SC [12]

V. RESEARCH GAP

A. Current challenges

Supply Chain Management (SCM) includes the nascent integration of blockchain technology, which despite its novelty, faces several constraints and barriers to widespread adoption. Both scholars and industry practitioners often underestimate the transformative potential of blockchain in disrupting conventional business models. While numerous studies explore supply chain coordination under risk aversion, there remains a notable absence of research examining the interplay between supply chain risk aversion and blockchain technology. Current applications of blockchain in supply chain management mainly focus on tracking and credit issues, as well as the pursuit of privacy.

Despite the widespread availability of Radio Frequency Identification technology (RFID), many warehouses still rely heavily on manual paper-work processes in critical operations, indicating a gap between technological availability and acceptance. Misconceptions about blockchain, including its perceived transient nature, coupled with a reluctance to invest in the absence of standardized industrial processes, further hinder its adoption among corporate executives. Convincing key stakeholders of blockchain's benefits is essential for its successful incorporation into traditional supply chain industries, necessitating broad consensus and alignment of interests.

The accuracy of data entry poses a significant challenge at the interface of technological and non-technological factors. Given blockchain's immutable and transparent nature, data integrity is paramount, as erroneous entries cannot be easily rectified. If inaccurate data from a supply chain partner is stored in a blockchain system, adopting blockchain technology could be harmful. Thus, while blockchain's immutability ensures data integrity, it does not guarantee data quality, highlighting the need for robust data management practices in supply chain operations. [9]

B. Why is Blockchain needed in the Supply chain?

The incorporation of blockchain technology into the supply chain system enhances the distinguishability, security, and transparency of web infrastructure through its unique set of attributes. These include features such as a concurrent algorithm, on-chain resources, smart contracts, diverse specifications, a decentralized system, and storage methods. The presence of blockchain presents significant opportunities for revolutionizing supply chain operations, including facilitating supply chain inclusion, transforming business processes, and bolstering security measures. With blockchain technology, there is increased efficiency in identifying problematic items promptly and removing them from the supply chain, whether they are defective, mishandled during storage, or counterfeit.[9] The concept of "legitimacy" in relation to blockchain denotes the widespread acknowledgement and recognition of blockchain technology as trustworthy, robust, and highly efficient solution applicable across diverse industries and use cases. This recognition underscores blockchain's reliability and efficiency in addressing a broad spectrum of industry challenges and facilitating innovative applications.[13]

VI. BACKGROUND

A. Block Chain

Blockchain technology represents a groundbreaking innovation in decentralized bookkeeping, with its foundational application exemplified by Bitcoin. The essence of blockchain lies in its sequential arrangement of blocks, each containing numerous transactions. Participants in the network maintain local copies of the blockchain, collaborating to establish the next block through a consensus protocol.

Various methods are employed for constructing blockchains, including Proof of Stake, Proof of Work and BFT (Byzantine Fault Tolerance). In proof of work, participants compete to solve complex tasks, and the first person to complete gets the right to add the next block. Conversely, Proof-of-Stake allocates block-producing rights based on participants' stake accumulations. Meanwhile, Byzantine Fault Tolerance protocols enable immediate determination of the next block through consensus among all participants.

Blockchain's salient features encompass public accessibility, immutability, and resilience. Public accessibility ensures that all information stored within the blockchain is openly available to all network participants. Immutability is guaranteed through cryptographic mechanisms, rendering it exceedingly difficult to alter or delete data once it has been added to the blockchain. Furthermore, blockchain's resilience stems from the fact that each participant retains a complete copy of the blockchain, mitigating the risk of single points of failure affecting data availability.

This trifecta of attributes imbues blockchain with unparalleled reliability and trustworthiness. Its transparency fosters accountability and trust among network participants, while its immutable nature ensures data integrity and security. Moreover, blockchain's distributed architecture enhances system robustness, safeguarding against potential disruptions or tampering.

In essence, blockchain's transformative potential lies in its ability to revolutionize data management paradigms, offering a decentralized, secure, and resilient framework that underpins a myriad of applications across diverse domains.[1]

Blockchain is a database that uses connections and blocks to store information. A block contains new data that is appended and connected to earlier data. Blocks are linked together and have limitations on storage to create a "Blockchain." Stuart Haber and W. Scott Stornetta began researching blockchain in 1991 with the aim of protecting real-time transactions. Blockchain technology (BC) is based on blocks, which are distinguished by distinct hash values.[4] Blockchain is a tamper-proof, decentralized, secure ledger where transactions are recorded in connected blocks. It uses consensus processes and encryption to provide security, traceability, and transparency. Every block is immutable because it contains distinct data that is replicated throughout the network. [8] Blockchain technology comprises an expanding sequence of data referred to as blocks, which are interconnected and encrypted.Each block usually contains an immutable record of transactions as well as the time and cryptographic hash code of the previous block. The diagram below shows the blockchain concept proposed by Nakamoto (2008). Distributed ledger technology (DLT), also known as blockchain, provides a way to store transactions and events on

a decentralized ledger. It ensures the efficiency, marketing, distribution, security and transparency of business information.[10]

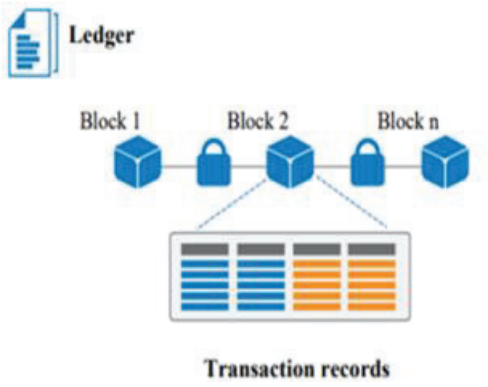

Fig. 1. How a blockchain works

An alternative method for building trustless, privacy-preserving reputation systems focuses on anonymously rating assets to safeguard consumer privacy. However, lacking performance analysis makes it challenging to assess the effectiveness of token generation in producing separate ratings from transactions. Also, in case of unfair ratings, some rates would be disadvantaged as there is no direct link between a transaction and a rater which eventually can be exploited by malicious users.[2]

B. *Problem of Supply Chain*

In supply chains marked by short product cycles and lengthy production lead times, accurate demand forecasting proves daunting, risking either excess capacity or product scarcity. Decentralized setups exacerbate capacity risk due to inadequate sharing mechanisms. Contract manufacturers pre-emptively secure capacity, risking overcapacity in high-demand scenarios while facing downside risk if demand falls short. Collaborative strategies like flexible manufacturing and data-driven forecasting are crucial for agility. Clear contractual agreements can evenly distribute risks among partners. Effective communication is pivotal for navigating these complexities, ensuring timely responses to dynamic market shifts and optimizing supply chain performance.[14].

C. *Benefits of Blockchain for Supply Chains*

Francisco and Swanson evaluated the benefits of blockchain technology in improving supply chain management. (2018), who have highlighted the system's traceability and transparency capabilities. Through a variety of use cases, their research demonstrates how blockchain may successfully increase productivity, traceability, and waste reduction within food supply chains. Furthermore, as stated by Kshetri (2018) and Ying et al. (2018), blockchain may promote trust and strengthen cybersecurity, which emphasizes its importance in supply chain management.[4]

D. *Supply-chain transparency*

To meet stakeholder expectations in terms of quality, compliance, and social, environmental, and economic performance, supply chain traceability requires collecting and analyzing custody, transformational, and environmental data on material flows. Hastig and Sodhi talk about the expected effects of blockchain technology and what's needed to put traceability systems in place that work and meet corporate goals. Different industries face different stakeholder expectations and challenges. This study takes a different tack than it usually does when operationalizing traceability.[4]

TABLE I. BLOCKCHAIN CONSTRUCTION METHOD

Blockchain Type	***Construction Method***
Public Blockchain	• Proof-of-work • Proof-of-stake
Permissioned BlockChain	• Proof-of-work • Proof-of-stake • Byzantine fault tolerance

E. *Decentralization*

It eliminates the need for central approval of transactions, unlike traditional methods, by enabling direct interaction among users. This supports equality of network partners who jointly use changes, manage data, and own the balance of historical data. Authorized users can collect and access product data across the entire supply chain, from raw materials to customers and clients. End users gain access to comprehensive product information, including authenticity and origins, while manufacturers can monitor supplier quality. Trust in the decentralized supply chain is established and upheld through blockchain consensus algorithms like Proof of Work (PoW), which require transaction verification by other users.[11]

VII. REVIEW OF SUPPLY CHAIN AND COUNTERFIT TRUST ISSUES

"Blockchain-based supply chain tracking system" is a solution to the ongoing problems caused by fraud and trust issues in the complex environment of supply chain management. The system introduces a revolutionary system designed to change the way business is done by leveraging the transformative power of blockchain technology. At the core of its effectiveness is the implementation of an immutable ledger, a foundational feature of blockchain, ensuring that once information is documented, it becomes impervious to tampering or manipulation. This inherent immutability acts as a powerful barrier against counterfeiting activities, instilling a new level of integrity in the supply chain data.

The transparency afforded by blockchain's centralized architecture is another pivotal aspect of this system's ability to combat trust issues. Through centralization, all participants in the supply chain gain unfettered access to a shared repository of information, engendering a communal sense of transparency and accountability. This transparency not only discourages fraudulent practices but also establishes a mechanism for swift identification and rectification of any anomalies, fostering a culture of trust between stakeholders.

Moreover, the incorporation of smart contracts within the blockchain framework elevates the system's resilience against fraudulent transactions. These self-executing contracts automate essential procedures like quality assessments and payments, cutting down on intermediaries and reducing the risk of human errors or misconduct. Real-time tracking, another unique feature of the system, is that it provides continuous and detailed visibility into the location and status of the product at all levels of the supply chain. This not only improves operational efficiency, but also allows stakeholders to check the accuracy of products in a timely manner, thereby increasing trust throughout the supply chain.

The centralized architecture also extends to product traceability, as each product is intricately linked to a unique identifier stored securely on the blockchain. This association ensures that products can be traced with unwavering accuracy from their beginning to their final destination. The centralized and transparent attributes of the system collaboratively create an environment The risk of counterfeit products infiltrating the supply chain is reduced, increasing participants' trust and confidence.

In addition to these technological advancements, the system places a premium on data security through the implementation of robust cryptographic techniques. This not only safeguards sensitive supply chain information but also establishes a formidable barrier against unauthorized access, fortifying the overall integrity of the system.

In summary, the “Blockchain-based supply chain tracking system” represents an integrated and revolutionary way to reduce long-standing fraud and trust issues in the supply chain. Through the amalgamation of immutable ledgers, centralized transparency, smart contracts, real-time tracking, and enhanced traceability, this system pioneers a new era of supply chain management characterized by unparalleled transparency, security and trustworthiness.

VIII. METHODOLOGY

A. Characterstics of BlockChain

Before a transaction is included in a block in a blockchain network, it is first validated and endorsed by the network. By using cryptographic hashing, each block is given a unique hash value. It also includes hash values from the previous block, creating a sequential connection. Immutability guarantees no data can be altered once it is uploaded to the network, improving security. Consequently, the qualities of immutability, trust, openness, transparency, and security set blockchain systems apart. Transparency has become essential for controlling the flow of materials and information in supply chains, thanks to blockchain technology. Blockchain promotes trust, openness, immutability, and security among supply chain stakeholders by facilitating efficient data collection, storage, and administration. This increased transparency helps to reduce fraud.[5]

Predicting demand has become difficult due to short product lifecycles and extended delivery times. As a result, supply chains are prone to overcapacity due to lack of demand or supply shortage due to scarcity. Lack of effective capital in separate distributions increases the costs associated with risk management. In order to deliver on time, contract manufacturers must be able to place pre-orders with OEMs. In this type of work, subcontracting companies and initial products face the risk of increasing capacity if customer demand exceeds expectations. However, if the customer's demand is not sufficient, only contracted companies have a discount risk.[15]

B. System Model

The supply chain involves stakeholders such as manufacturers, raw materials, warehouses, shipping companies and retailers, creating a collaborative network and managing blockchain permissions. Regulators also have the right to participate and expand this blockchain network. Our system prioritizes permissioned blockchains over public blockchains to prevent access to nodes operated by unauthorized parties. Each stakeholder can contribute to a group of blockchain nodes, thus creating a large network. Stakeholders upload product information to the blockchain for several reasons. Firstly, transparent product information strengthens consumer confidence. Secondly, interconnected information enhances supply chain management efficiency. Lastly, blockchain-recorded product information better meets regulatory requirements. However, the blockchain system can only ensure that stored information remains untampered. If a stakeholder submits inaccurate records, the blockchain provides immutable and lasting evidence of the errors. End consumers benefit from supply chain services and can query product tracking information via the blockchain. [7].

C. System Design

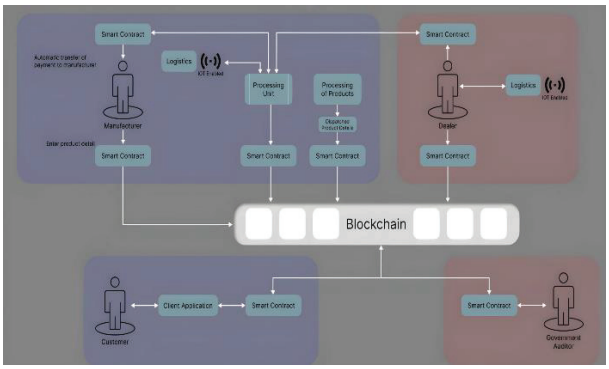

Fig. 2. System Architechture

After establishing the requirements, the system architecture was planned. This involved the creation of separate HTML pages for consumers and suppliers, each equipped with appropriate forms and elements for interacting with the system. The design prioritized responsiveness and user-friendliness, incorporating clear instructions and well-defined input

D. Backend Devleopment

The system's backend was constructed utilizing the Python programming language and the Flask framework. This entailed the implementation of classes for Block and Blockchain to oversee the blockchain data structure. Endpoints were established to manage requests about retrieving blockchain data, adding new orders, and updating order statuses. Robust data validation and error-handling mechanisms were integrated to uphold data integrity and facilitate the seamless operation of the system

E. FrontEnd Development

At the same time, the system's user interface was developed employing HTML, CSS, and JavaScript. Specific pages were created for consumers and suppliers, each customized to accommodate their roles. JavaScript was employed to manage form submissions and retrieve data from the backend.

F. Testing and Debugging

During the development phase, rigorous debugging and testing procedures were implemented to detect and address any problems or errors within the system. Comprehensive tests were conducted on both frontend and backend components to guarantee smooth integration and optimal functionality across various browsers and devices

G. Deployment and Maintaincence

Upon the completion of development and testing, the system was deployed on a local server for demonstration and additional testing. Sustained monitoring and maintenance remain crucial to uphold the system's reliability and performance over the long term.

IX. BLOCKCHAIN-BASED GOVERNANCE

The integration of blockchain's inherent characteristics forms a resilient backup system for verifying the credibility of the chain's proof. Centralisation within the blockchain network establishes a transparent medium, facilitating smooth recording and sharing of data and information transfers. This centralization ensures that all participants in the chain have equal access to the recorded data, promoting transparency and accountability within the network. As each participant queries the records within the blockchain, the distributed nature of the system guarantees transparency and consistency across the network, as noted by Yang (2019). This means that every participant has access to the same set of information, eliminating discrepancies and promoting trust among stakeholders. Transparency within the blockchain ecosystem validates the presence of open, explicit and dependable sources of stored data. This transparency enables all entities involved to benefit from credible peer-to-peer systems with consistently stored transactions. By providing a tamper-proof and immutable ledger, blockchain technology ensures that the integrity of the data remains intact, further enhancing trust and reliability. In traditional centralized systems, reliance on a single authority for record-keeping can lead to vulnerabilities such as data manipulation or fraud.

However, the decentralized nature of blockchain disperses this responsibility across a network of nodes, reducing the risk of malicious activities. Each transaction is cryptographically linked to previous transactions, creating an unchangeable audit trail that requires consensus from the network to alter. Furthermore, employing smart contracts improves the transparency and effectiveness of transactions within the blockchain network. These self-executing agreements automatically uphold pre-established terms, removing the necessity for intermediaries and diminishing the likelihood of human mistakes or tampering. By amalgamating centralization, transparency, and smart contracts, blockchain technology provides the foundation for building trust and transparency in a wide range of applications, including financial transactions, supply chain management and decentralized applications. As the technology continues to evolve, its potential to revolutionize industries by promoting trust, transparency, and efficiency remains significant. [3]

X. RESULTS

1) Step 1 :

User provides necessary details for placing an order and then the User submits the order details for processing.

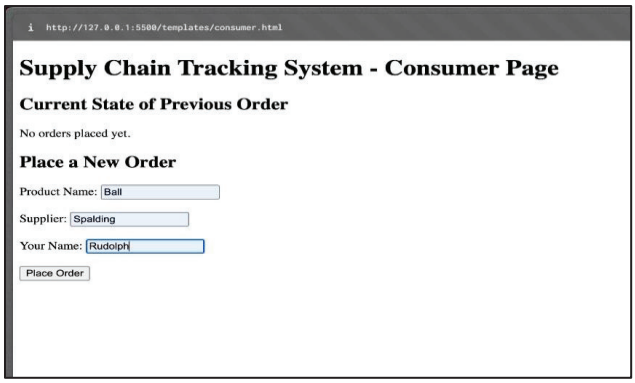

Fig. 3. User Places Order

2) Step 2 :

Supplier acknowledges the receipt of the order and then Order details are automatically recorded into a block within the Blockchain.

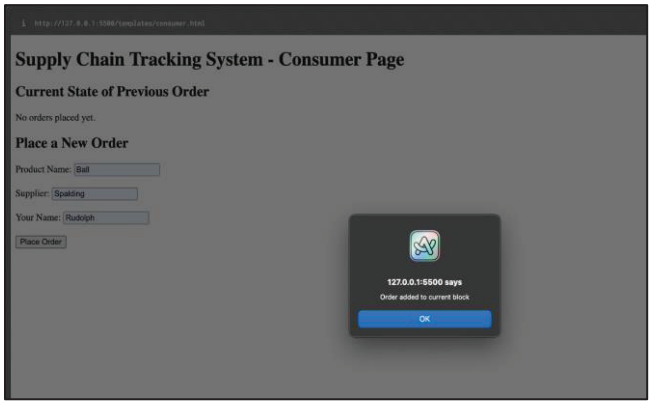

Fig. 4. Order Confirmed

3) Step 3:

Supplier updates the order status after manufacturing and the Updated order status is automatically written into the Blockchain.

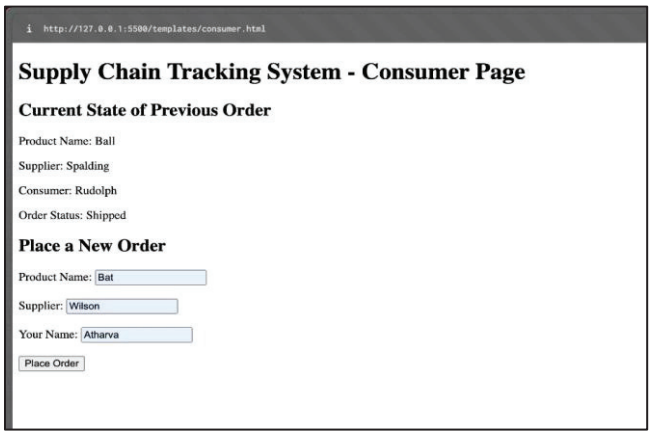

Fig. 5. Supplier Updating Order

4) Step 4:

The consumer page reflects the updated order status.

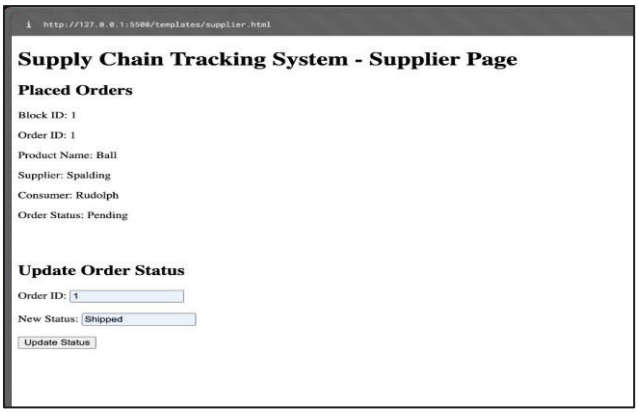

Fig. 6. Latest Status of Order

XI. CONCLUSION

In conclusion, the Supply Chain Tracking System project has effectively met the crucial demand for efficient and transparent supply chain management. Through systematic requirement analysis, meticulous development, and rigorous testing, the system delivers robust functionalities for consumers and suppliers alike. Leveraging blockchain technology guarantees secure and immutable data storage, thereby boosting trust and reliability across the supply chain process. The system's intuitive interfaces and seamless data flow empower users to expedite order placement, monitor order status, and ensure timely updates. Overall, this project represents a significant stride towards enhancing supply chain efficiency and transparency. It stands as a pivotal milestone in various industries, where operational effectiveness is paramount. By embracing innovative technologies and addressing key challenges, this system sets a precedent for improved supply chain practices, fostering greater trust and efficiency across the board.

REFERENCES

[1] L. Xu, L. Chen, Z. Gao, Y. Chang, E. Iakovou and W. Shi, "Binding the Physical and Cyber Worlds: A Blockchain Approach for Cargo Supply Chain Security Enhancement," 2018 IEEE International Symposium on Technologies for Homeland Security (HST), Woburn, MA, USA, 2018, pp. 1-5, doi: 10.1109/THS.2018.8574184.

[2] S. Malik, V. Dedeoglu, S. S. Kanhere and R. Jurdak, "TrustChain: Trust Management in Blockchain and IoT Supported Supply Chains," 2019 IEEE International Conference on Blockchain (Blockchain), Atlanta, GA, USA, 2019, pp. 184-193, doi: 10.1109/Blockchain.2019.00032.

[3] V. Ahmadi, S. Benjelloun, M. El Kik, T. Sharma, H. Chi and W. Zhou, "Drug Governance: IoT-based Blockchain Implementation in the Pharmaceutical Supply Chain," 2020 Sixth International Conference on Mobile And Secure Services (MobiSecServ), Miami Beach, FL, USA, 2020, pp. 1-8, doi: 10.1109/MobiSecServ48690.2020.9042950.

[4] A. R. Rao, M. Saxena, K. H. Krishna, A. R. J, B. Pravallika and A. Dutt, "Secured Traceability System Using Block Chain Technology in Supply Chain Management," 2023 10th IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON), Gautam Buddha Nagar, India, 2023, pp. 532-535, doi: 10.1109/UPCON59197.2023.10434517.

[5] R. Perera, K. R. Nawurunnage, S. Chathuranga, R. Wickramarachchi and A. Withanaarachchi, "Role of Blockchain Technology in ERP Systems for a Transparent Supply Chain: A Systematic Review of Literature," 2023 3rd International Conference on Advanced Research in Computing (ICARC), Belihuloya, Sri Lanka, 2023, pp. 232-237, doi: 10.1109/ICARC57651.2023.10145618.

[6] H. Wu et al., "Data Management in Supply Chain Using Blockchain: Challenges and a Case Study," 2019 28th International Conference on Computer Communication and Networks (ICCCN), Valencia, Spain, 2019, pp. 1-8, doi: 10.1109/ICCCN.2019.8846964.

[7] H. Wu, S. Jiang and J. Cao, "High-Efficiency Blockchain-Based Supply Chain Traceability," in IEEE Transactions on Intelligent Transportation Systems, vol. 24, no. 4, pp. 3748-3758, April 2023, doi: 10.1109/TITS.2022.3205445.

[8] N. N. Ahamed and R. Vignesh, "Logistics and Supply Chain Management in Leather Industry Using Blockchain," 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2023, pp. 137-142, doi: 10.1109/ICACCS57279.2023.10112883.

[9] K. Shah, S. Rana, N. Solanki, V. Desai, D. Prajapati and U. Vasita, "Blockchain-based Pharmaceutical Drug Supply Chain Management System," 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), Maldives, Maldives, 2022, pp. 1-6, doi: 10.1109/ICECCME55909.2022.9987875.

[10] N. Verma and P. Kulkarni, "Impact of Blockchain Technology on E-Commerce," 2023 International Conference on Innovative Data Communication Technologies and Application (ICIDCA), Uttarakhand, India, 2023, pp. 668-672, doi: 10.1109/ICIDCA56705.2023.10100222.

[11] A. Kaushik and N. Jain, "An Approach For Improving Transparency And Traceability of Industrial Supply Chain With Block chain Technology," 2021 6th International Conference on Innovative Technology in Intelligent System and Industrial Applications (CITISIA), Sydney, Australia, 2021, pp. 1-6, doi: 10.1109/CITISIA53721.2021.9719941.

[12] N. A. Bosunia, J. Araf Prity, J. J. Jabin, M. Hasan, M. R. Ahmmad Rashid and R. Amin Tuhin, "An Application of Decentralized Product Authentication System for Supply Chain Management Using Blockchain Technology," 2023 26th International Conference on Computer and Information Technology (ICCIT), Cox's Bazar, Bangladesh, 2023, pp. 1-6, doi: 10.1109/ICCIT60459.2023.10441094.

[13] B. M. El Amine and S. -T. Lamia, "Blockchain Adoption for a Sustainable Agricultural Supply Chain: Opportunities and Challenges for the Dairy Industry," 2023 International Conference on Decision Aid Sciences and Applications (DASA), Annaba, Algeria, 2023, pp. 331-336, doi: 10.1109/DASA59624.2023.10286692.

[14] M. Nakasumi, "Information Sharing for Supply Chain Management Based on Block Chain Technology," 2017 IEEE 19th Conference on Business Informatics (CBI), Thessaloniki, Greece, 2017, pp. 140-149, doi: 10.1109/CBI.2017.56