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Secure Online Product Recommendation System Utilizing Blockchain with SHA-256 Hash Generation

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***Abstract*—Blockchain-based product tracking creates anirreversible and permanent ledger of a product's whole lifespan, from conception to final delivery, revolutionizing supply chain management. This technique creates a transparent and safe system for tracking and validating product information all the way through the manufacturing process by utilizing blockchain technology. Manufacturers and distributors can ensure transparency and authenticity at every level of the supply chain by using blockchain technology to trace every step-in detail. Because blockchain is unchangeable and tamper-proof, it is the perfect tool for preventing fake goods and guaranteeing product integrity. Blockchain lowers the risk of fraud and manipulation by recording every movement and transaction in the supply chain in a decentralized, transparent manner. Consumer trust is strengthened by this increased degree of responsibility and openness, which also protects the authenticity and quality of products. Customers feel more confident when blockchain technology is used since they can be sure of the origin and caliber of the goods they buy. Improved traceability and transparency empower customers to make knowledgeable decisions and protect themselves from the dangers of fake goods. Additionally, blockchain strengthens brand loyalty and integrity by creating a marketplace that is transparent and trusting, protecting companies from the negative impacts of counterfeiting.**

***Index Terms*—Blockchain technology, consumer trust, traceability, product integrity, origin verification, brand loyalty, supply chain management, transparency, authenticity, tamper-proof, fraud prevention,decentralization, and prevention of counterfeiting.**

I. INTRODUCTION

The spread of fake products has become a widespread and complex issue affecting players in many different industries in today's globalized economy. This article explores the negative impactsthat counterfeit goods have on producers, customers, and brand integrity and explains how the application of blockchain technology offers a revolutionary wayto address this urgent problem. Since counterfeit goods are frequently indistinguishable from authentic ones, they seriously jeopardize customer happiness and safety. These illegal items regularly find their way into the supply chain, compromising the genuine producers' quality requirements. Furthermore, the wide availability of fake goods damages the reputation of legitimate brands by undermining customer confidence and costing themmoney through revenue diversion. In light of this, the emergence of blockchain technology portends a viable strategy for battling fake goods globally. Through the utilization of blockchain ledgers' irreversible and transparent properties, companies may create an exhaustive documentation of a product's progression from

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manufacturing to finalization. By ensuring the validity and integrity of every product, this tamper-proof ledger reduces the possibility of counterfeit goods into the supply chain. Customers feel more confident when blockchain technology is used since they can be sure of the origin and caliber of the goods they buy. Improved traceability and transparency empower customers to make knowledgeable decisions andprotect themselves from the dangers of fake goods. Additionally, blockchain strengthens brand loyalty and integrity by creating a marketplace that is transparent and trusting, protecting companies fromthe negative impacts of counterfeiting.

II. LITERATURE REVIEW

[1] The drug recommendation system and the drug supply chain system. With outstanding outcomes, the system has used blockchain technology and machine learning algorithms to the healthcare industry.[2] a precise taxonomy to characterize the current blockchain-based RS frameworks in relation to several elements such as the problems related to security and privacy, the features and operational principle, the potential influence of blockchain technology, and the different kinds of blockchain- based RSs and applications.[3] In a SC made up of contributors, one used online platform, and one supplier, this study defines the selling of used goods using an online platform. While the provider offers new products directly to customers, the contributor consigns their used goods through the site.[4] To beimplemented in Ethereum Base, the technique is logically derived. Starting from the product's development until its consumption, the solution offers a visible view of the data.[5] in this investigation. The blockchain's intelligent multilayer sharding network architecture. Our major addition to this study article is proposed at the beginning of the publication. Next, the author developed a brand-new localized cryptosystem and demonstrated its resilience to collusion, cryptography, and ciphertext attacks.[6] This article explores the possible use of blockchain technology in marketing and suggests six areas for future investigation. It draws attention to blockchain's potential to remove intermediaries from marketplaces, promoting direct consumer-brand interaction and boosting transparency and trust.[7] This paper suggests a blockchain-based approach tocommodity tracing that makes use of smart contracts to log transactions and guarantee the legitimacy of products. Customers can access the network through it, and an issue resolution procedure is included for the purpose of validating agreements. Security evaluations show resilience toassaults and data manipulation.[8] By categorizing five research streams—Blockchain and Electronic Commerce, Marketing, Data, Data Analytics, and Blockchain— and highlighting important literature characteristics, this study makes a substantial contribution to the field of blockchain-marketing integration research.[9] This study explained how the Blockchain is used as a tool to handle access control and how the suggested model is an extension of decentralized online social networks.[10]This analysis focused on the industry, employing an eligibility technique derived from online sources of firms. By doing this, the authors can providethe current state of the BCT application landscape inmarketing in a clear and understandable manner.[11] This approach suggests optimizing agricultural product transactions with blockchain technology. By using smart contracts to provide automation, security, and transparency, it streamlines the process from farm to customer. All parties engaged in the agricultural supply chain benefit from transactions that are more effective, transparent, and dependable thanks to the use of blockchain technology.[12] The Internet of Things (IoT), a network of linked devices and sensors that tracks the food supply chain from manufacture to consumption, is used to track food items back to people. Real-time data collection is made possible by this network, improving the food supply chain's traceability and transparency.[13] Blockchain technology is used to create an unchangeable, transparent database of woodtransactions, therefore preventing illicit wood logging. Ensuring accountability and transparency across the supply chain poses a challenge to the cover-up of illicit forestry operations.[14] Fruit and vegetable quality management and traceability are improved with a dual storage system that integrates blockchain technology. By redundantly storing product data in both blockchain and conventional systems, it guarantees dependability. This strategy increases consumer confidence and makes supply chain management more effective.[15] The aim of this project is to track pharmaceutical items by creating a mobile application using blockchain technology. By allowing users to confirm the provenance and validity of medications, the program improves supply chain security and transparency while also guaranteeing patient safety and regulatory compliance.[16] In order to increase supply chain management efficiency, the paper presents a revolutionary blockchain-based information management architecture. By utilizing blockchain technology, items can be tracked securely and transparently, which minimises delays, lowers mistakes, and increases stakeholder trust. The goal of this strategy is to raise operational performance and supply chain efficiency. [17] Encrypted keyword search activities are efficiently enabled by the proposed Dynamic Symmetric Searchable Encryption (SSE) technique. It ensures privacy protection by supporting encryption- preserving, dynamic, and secure search functions. This invention satisfies the need for safe and effective keyword retrieval in a variety of applications.[18] decentralized model built on

blockchain to improve data integrity; the proposed methods perform better. These techniques, which make use of blockchain technology, guarantee safe and un hackable data transfer and storage. Since blockchain is decentralized, it is transparent, dependable, and resilient, which makes it a useful tool for preserving data integrity in a variety of applications.[19] The first fairness-based transaction packing technique for IoT systems with permissioned blockchain is introduced by AIR- PACK. This creative method shortens the time it takes to generate blocks. FAIR-PACK priorities fairness, which increases the efficiency of transaction processing and guarantees that all participants have equal access to blockchain resources.[20] work definition With Bloom Filters, the proposed Chameleon inverted (Chameleoninv) index provides a flexible way to accommodate various kinds of queries. This index structure's versatility and adaptability may be further increased by simply extending it to incorporate other indexes. The index maintains efficiency and scalability while optimizing query performance with theincorporation of Bloom Filter.

III. Proposed Methodology

A. Algorithm

SHA -256 one of the most important steps in guaranteeing the security, integrity, and immutability of data stored on the blockchain is the SHA-256 hash creation process in blockchain technology. Input data is subjected to the SHA-256 cryptographic technique, which yields a distinct hash value that functions as a digital fingerprint. After that, the hash value is safely added to the blockchain, serving as an impenetrable record of all transactions and blocks. A differing hash value would indicate any effort to modify the data and notify the network of possible manipulation. Given the circumstances, SHA-256 hash creation is essential to preserving the openness and reliability of blockchain networks since it offers a strong method for data protection and validation.

B. Architecture

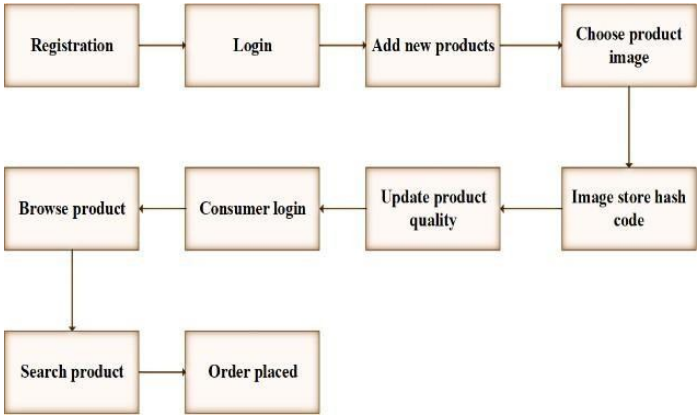

FIG 1. Proposed work architecture

The Architecture (FIG 1) shows how to handle customer contact and product registration on a digital platform. Registration is the first step that takes users to the Login Screen. From there, users have the option to Add New Products or Consumer Login. The Ordered Placed Screen and Browse Products features are accessible through the Consumer Login interface. The former directs consumers to the Search Product Screen, making it easier for them to explore products. The Add New Products option, however, offers additional options like Update Product Quality and Choose Product Image. If the latter is chosen, users are sent to the Image Store Hash Code step, which concludes the Architecture series of steps.

C. Registration and Login

Users' first point of entry into a digital platform is the "Registration and Login" procedure. The "Registration" phase is when users fill out the details needed to create an account. Usually, this data consists of specifics like a name, password, and email address. Additional procedures, including confirming email addresses or accepting terms and conditions, could be required throughout the registration process. Users who have registered are sent to the "Login Screen," where they enter their login information to get access to the site. Usually, this entails providing their login and password or email address that they have registered. As a gatekeeper, the login page makes sure that only users who have registered may utilize the platform's features.

D. Adding New Product and Choose Product

Adding new (FIG 2) product listings to a digital platform is possible for administrators or merchantsthrough the Add New Product and Choose Product procedure. Authorized users can add a new product to the platform's inventory at the "Add New Product" phase, which is where it all starts. Usually, this entails entering comprehensive details about the product, including its name, description, category, cost, and any applicable features or specs. Users choose an acceptable image to represent the newly added product in the "Choose Product" phase after entering the product data. The product is represented visually by this image, which is shown on the platform's interface next to its description. Users have the option to choose a picture from a preset collection or upload one from their device.

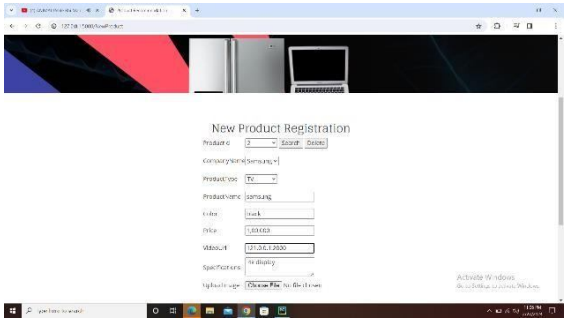

FIG 2. Product Registration

E. Image Store Hash Code

Users must complete the registration and login process in order to use the features of the digital platform. Then, authorized individuals, suchadministrators, or sellers, may select the right picture for each product and add new goods to the platform'sinventory. The selected product picture is then subjected to SHA-256 cryptographic hashing, producing a distinct hash code. After then, the hash code is safely kept on the blockchain to guarantee its legitimacy and immutability. By utilising cryptographic methods and blockchain technology, the process of storing product images is made more secure and transparent, giving consumers more faith in the platform's legitimacy.

F. Update Product Quality

For the purpose of to use the web-based platform's capabilities, users must first register and log in. Theplatform's inventory may be expanded by authorized users, who can also choose a picture for each product. The selected product picture is then subjected to SHA-256 cryptographic hashing, producing a distinct hash code that is safely saved on the blockchain. After then, customers may update the quality of the product by entering or changing details and attributes pertaining to its features. By ensuring openness and integrity in product listings, this step improves user experience overall and builds customer trust.

G. Product Browsing

After being redirected, consumers can explore goodson the consumer dashboard. (FIG 3) Users maybrowse the platform's inventory, search for certain products, and filter products according to different criteria by utilising the product browsing capability. To make well-informed purchase selections, users may browse comprehensive product information, including pictures, descriptions, and pricing. This feature makes shopping more enjoyable by enabling consumers to easily find and assess a wide selection of items. Furthermore, supplying clear and comprehensive product information promotes consumer connections and confidence.

H. Search and Order Placed

The search and order procedure uses the SHA-256 algorithm to guarantee data confidentiality and integrity during the transaction. The software safelyaccesses pertinent data from the blockchain—whichhas been hashed using the SHA-256 algorithm— when a user does a product search. To ensure the validity of data and prevent manipulation, this cryptographic hashing approach creates a distinct and irreversible digital fingerprint for every item of data, including product information and transaction records. The software uses SHA-256 hashing to generate a tamper-proof record of the transaction details when the user puts an order, which are securely recorded on the blockchain. By ensuring the transaction data's transparency and immutability,this method boosts

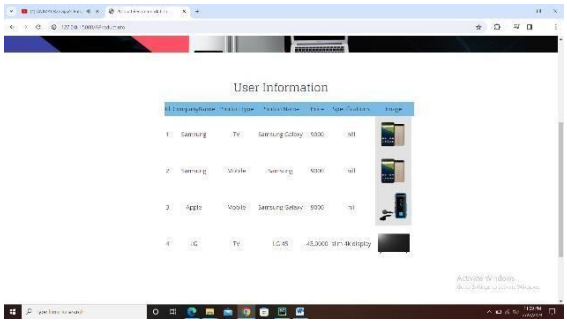

FIG 3. Product Listing

security and confidence within the blockchain network. Given the circumstances, the integration of SHA-256 hashing with searchand order features in blockchain technology guarantees a reliable and safe experience for customers conducting business on the platform.

IV. Objective

The article examines how blockchain technology is revolutionising supply chain management, with a focus on product tracking. It emphasizes how the immutable ledger system introduced by blockchain transforms the conventional supply chain. Manufacturers and distributors may use blockchain technology to guarantee accountability and transparency throughout the manufacturing process, allowing for precise product quality and origin certification. Additionally, by protecting data integrity and transparency, blockchain lessens the dangers related to counterfeit goods, which in turn builds customer trust. Customers gain from more openness as they can base their purchases on accurate and verified product information. Furthermore, by creating a transparent and trust- based economy, blockchain enhances brand loyalty and integrity.

V. Experimental Setup

In the experimental configuration, a web-based application with database capability is created using HTML, CSS, and SQL within the PyCharm platform. Web pages are structured using HTML, components are styled using CSS, and backend database interactions are handled via SQL. The integrated development environment (IDE) fordeveloping, debugging, and executing code is calledPyCharm. This configuration makes it possible to create dynamic web applications with database integration and aesthetically pleasing interfaces, which speeds up the development and testing process.

VI. Result and Discussion

The experiment demonstrated the effectiveness of aSHA-256 hash generation and blockchain-powered product recommendation system. Blockchain technology ensures the integrity and privacy of data,enabling the successful provision of transparent andsecure recommendations. By adding SHA-256 hashgeneration, security measures were strengthened, and sensitive user data was protected from manipulationor unwanted access. The conversation that followedbrought to light how blockchain technology might improve online recommendation systems, especially in terms of enhancing user privacy and trust. Blockchain offers a solid foundation for safe recommendation systems by decentralizing data storage and utilizing cryptographic techniques.Furthermore, the addition of SHA-256 hash generation strengthened security even more, making it difficult for malevolent actors to tamper with recommendation data. The experiment's overall findings highlight the critical role that user trust andprivacy play in online shopping experiences, and they also indicate that blockchain-based solutions have a great deal of promise to address these issues and improve users' overall e-commerce experiences.

The supply chain process is represented by the graph (FIG 4), which outlines the evolution of traceability and transparency at each stage, including conception, manufacturing, distribution, and delivery. Every dot on the graph denotes a distinct phase, signifying the degree of traceability and transparency attained. When the product is still in the conception stage, for example, the graph might indicate strong product origin monitoring and documentation due to its high degree of traceability and transparency. The traceability and transparency levels may fluctuate as the process moves forward tomanufacturing and distribution, due to factors like data accuracy and information sharing practices. The graph may show a return to prominent levels oftraceability and

Graph:

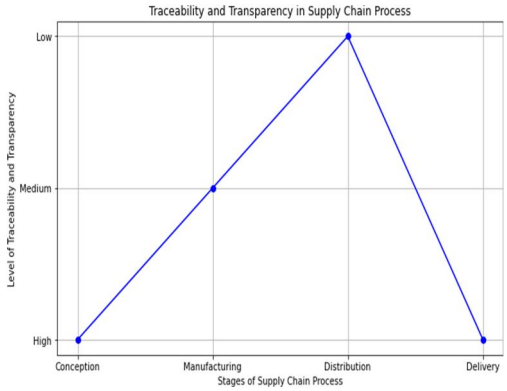

Fig 4. Traceability and Transparency in theSupply Chain Process: An Evolution

transparency at the delivery stage, signifying the strict measures put in place to guarantee the authenticity and integrity of the product during the last stage of delivery to customers.

VII. Conclusion and Feature Work

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