DApp FOR FAKE PRODUCT DETECTION

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***Abstract*— Businesses and consumers throughout the world are extremely concerned about the rise of counterfeit goods. We suggest creating a secure blockchain-based management system that can spot fake goods to address this issue. Our strategy entails building a local Ethereum blockchain with ganache CLI and integrating it with an Android programme. With a distinct blockchain address for each entity, transactions will be transparently and immutably recorded. We want to develop a safe and reliable system that can successfully identify and stop the sale of counterfeit goods by utilising the power of blockchain technology.**

***Keywords*—Blockchain; Traceability; Counterfeit products; Security.**

Introduction

Blockchain tracks the record of transactions made in cryptocurrency across several computers that are linked in a peer-to-peer network. In addition to its use in cryptocurrency systems, blockchains have gained attention for their potential to revolutionize other industries that rely on secure and transparent record-keeping. For example, supply chain management can benefit from the use of blockchain technology to provide a tamper-proof and transparent record of the movement of goods. This would allow for greater traceability and accountability, reducing the risk of counterfeit products and increasing consumer confidence. Another key advantage of using a blockchain is the increased security it provides, because the blocks are connected in a chronological chain, altering or tampering with any one block would require changing all subsequent blocks in the chain, making it virtually impossible to manipulate the data without detection. This makes blockchains ideal for storing sensitive information, such as financial records or personal identity data.

Overall, the use of blockchain technology has the potential to transform the way we store and share information, increasing security, transparency, and trust in a variety of industries. Smart contracts are a powerful tool that leverages blockchain technology to automate and enforce agreements between parties without the need for intermediaries. They provide several advantages over traditional contracts, including increased efficiency, transparency, and security. By running on a blockchain, smart contracts are tamper-proof and cannot be altered once they are executed, ensuring the integrity of the agreement. Furthermore, smart contracts can be designed to execute automatically when certain conditions are met, reducing the need for human intervention and increasing the speed of execution. This makes them ideal for time-sensitive applications such as supply chain management or financial transactions.

Overall, the combination of blockchain technology and smart contracts provides a powerful tool for creating secure, efficient, and transparent agreements between parties, with a wide range of potential applications across industries.

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I. LITERATURE SURVEY

The literature survey on fake product detection using blockchain technology highlights the growing interest in this area and the potential of blockchain technology to combat counterfeiting. Various approaches have been proposed to improve the detection of counterfeit products using blockchain technology, such as tracking the supply chain history of products and using QR code or barcode scanning to link the product details with the blockchain. These approaches provide a simple and effective way for consumers to verify the authenticity of products and prevent financial loss for businesses. However, it is worth noting that there is currently no system in India to identify fake goods, indicating a need for further research and implementation of blockchain-based solutions for detecting and preventing counterfeit products. By leveraging the potential of blockchain technology in combination with other technologies such as NFC, businesses can protect their brand reputation and revenue while ensuring consumer safety, making it a promising area for future research and development

II. PROBLEM DEFINITION

Counterfeiting is a problem that affects multiple industries and has a significant impact on the global economy. The production and trafficking of counterfeit goods often involve organized crime and money laundering, leading to a range of negative social and economic consequences. Consumers are also at risk, as counterfeit products may contain harmful substances or lack the quality standards of genuine products. This poses a significant health and safety threat to consumers and can lead to financial loss for legitimate producers. Moreover, counterfeiting damages the reputation of legitimate brands, leading to a loss of consumer trust and revenue. It is a complex problem that requires effective solutions to protect consumers, legitimate businesses, and society as a whole. By using technologies such as blockchain to track and verify the authenticity of products, businesses can prevent counterfeiting and protect their brand reputation and revenue. It is essential to address this problem to ensure a healthy and sustainable economy and protect the safety and well-being of consumers.

III. RELATED WORK

As an Android application for the detection of bogus goods, we present a blockchain-based false product detection system. The suggested system makes sure that phoney goods are identified in daily life. The suggested system is made up of three primary components: an Android application for the consumer or user, an Android application for the manufacturer or business, and a cloud or database. The Manufacturers or corporate side application is the first application, where we must first register. We have some alternatives when logging in to the application after registration. One choice is to include a product where the maker can add information about the product.

Another choice is to display the order so that they may view the specifics of the clients' orders and then choose whether or not to accept them. The manufacturer can also observe whether or not the product was delivered. The Customer application is a second application that requires in-app registration before allowing users to log in with an ID and password. Customers can choose to view products in this application, where they can view information about the products such as name, total amount, price, and manufacturer information. By entering the product's amount there, we may product book the product. We may view orders using the show my order feature in this application. Here, we can see the product details, including name, amount, date, and time of production, price, and whether the product has been delivered or not. This programme has a QR code scanner that we may use to determine whether a product is legitimate or phoney by scanning its QR code.

Another choice is a blockchain, which shows the name of the generated block, the quantity of the product, the generated hash value, and if the product is corrupted or not. Customer login is required for this project's application. He logs on and enters the information necessary to order and reserve the merchandise. The maker may be shown the product's order. The producer creates the specific QR code for the product after accepting the order. After a product order is saved on the network, a hash code for that product is created, making it easy to keep track of the product's transaction. A QR code is created for a specific product in the proposed system. Consumers can use a customer application or the QR code reader app on their smartphone to scan the QR code that is printed on a product or package. Following scanning, we learn whether the goods is genuine or not.

To monitor the goods along the supply chain, the Blockchain system ultimately stores these product specifics along with a history of transactions. The Firebase Cloud Database contains all of the product information, including block name and hash value.

IV. REQUIREMENT SPECIFICATIONS

A. ANDROID STUDIO

Built on IntelliJ IDEA software and created specifically for Android development, Android Studio is the recognized integrated development environment (IDE) for Google's Android operating system. On Windows, macOS, and Linux-based operating systems, it can be downloaded. The current stable version offers the following features:

- A scalable build system based on Gradle.
- A powerful and quick emulator.
- Wizards that use templates to construct typical Android designs and components.
- A powerful layout designer that enables UI component dragging and dropping.

B. PYTHON IDLE

Python comes with an interactive development environment called Python IDLE (Integrated Development and Learning Environment). For programmers and beginners, it offers a straightforward and practical means of creating and running Python code. Python IDLE has certain important features, including, Python IDLE's syntax highlighting feature makes it simpler to read and comprehend your code by drawing attention to different parts of it, including keywords, strings, and comments. Python IDLE offers auto-completion, which suggests the following word or character you might want to input based on what you've already typed. Debugging: Python IDLE gives you the ability to place breakpoints in your code and run it line-by-line to help you find and correct bugs. An integrated shell is provided by Python IDLE, allowing you to enter and execute Python code as well as access the variables and functions it defines. Code templates are available in Python IDLE, which you can use to jump right into a number of tasks including building a new module or class. Multiple operating system support: Python IDLE is compatible with Windows, macOS, and Linux, making it available to developers and students using a variety of platforms.

C. GANACHE CLIs

Developers can run a personal Ethereum blockchain network locally on their computer for testing and development

purposes using the command-line interface application called Ganache CLI. The Truffle toolkit, which offers a variety of tools for developing and deploying smart contracts on the Ethereum network, includes Ganache CLI.
Among Ganache CLI's standout characteristics are:
Simple installation: Ganache CLI may be launched with a single terminal command and installed via npm.
Local blockchain network: Ganache CLI builds a local blockchain network that is pre-populated with fictitious ether and has a configurable number of accounts. This enables developers to test their smart contracts in a secure setting.
Ganache CLI is quick and deterministic, making it simple for developers to reproduce and troubleshoot problems with their smart contracts.
An integrated interface is offered by Ganache CLI, allowing programmers to communicate with their blockchain network and test their smart contracts.
Blockchain visualisation is made possible by Ganache CLI, which gives developers a visual depiction of the blockchain network that makes it simple to examine and comprehend the network's transactions and blocks.
Options that can be customised: Ganache CLI offers a variety of settings that may be customised, including gas restrictions and block times, enabling developers to simulate various scenarios and evaluate the robustness of their smart contracts.

D. ANACONDA

For scientific computing and data science, a well-liked open-source distribution of Python and R is called Anaconda. It comes with more than 1,500 pre-installed data science tools and libraries, including TensorFlow, Pandas, Scikit-learn, Matplotlib, and NumPy. Known as Anaconda Navigator, this graphical user interface (GUI) from Anaconda makes it simple for users to manage their projects and packages. Moreover, it includes the Anaconda Prompt command-line interface (CLI), which may be used to execute Python and R code.
Anaconda's major characteristics include:
Conda, a package manager provided by Anaconda, makes it simple for users to install, update, and manage packages and dependencies.
Cross-platform: Because Anaconda runs on Windows, macOS, and Linux, developers and researchers using various operating systems can use it.
Jupyter Notebook: Jupyter Notebook, a web-based interactive environment for generating and sharing documents with live code, equations, visualisations, and narrative text, is included with Anaconda.
Virtual environments: The isolated Python or R environments known as virtual environments, which can have their own packages and dependencies, can be created and managed by users using Anaconda.
Collaboration: Anaconda offers a cloud-based platform for teamwork called Anaconda Team Edition that enables groups to manage environments, exchange notebooks, and work together on projects.

E. VISUAL STUDIO CODE

Microsoft created Visual Studio Code (VS Code), a free and open-source coding editor. It is intended to be a portable yet effective tool for developing and debugging, and it supports a variety of frameworks and programming languages. The following are some of Visual Studio Code's important features: Code completion and syntax highlighting are two features that VS Code offers. Depending on the context of your code, it might also suggest code completions. VS Code offers a built-in debugger that supports a variety of programming languages and enables you to step through your code, set breakpoints, and inspect variables and call stacks. Extensions: VS Code offers a robust ecosystem of add-ons that bring new features including support for other programming languages, tool integrations, and themes. Integrated terminal: The integrated terminal in VS Code enables you to execute scripts and commands on the command line without leaving the editor. Git integration: VS Code includes tools for viewing differences, resolving conflicts, and committing changes as well as built-in support for Git version control. Snippets: VS Code enables you to create customised code snippets that can be quickly added, saving time and lowering the likelihood of types. Various operating systems: VS Code is available to developers on a variety of operating systems because it operates on Windows, macOS, and Linux.

V. SYSTEM IMPLEMENTATION

A. PROPOSED FRAMEWORK

The proposed framework is that of a smartphone application that can spot fake items. The new technology uses a smartphone software that can determine if a product is real or fraudulent and allows users to verify a product's authenticity using their phones. When a consumer uses a smartphone to scan an optical tag on a product, the 2D tag is compared to the manufacturer's database. Two of the most expensive crimes in the world today—product counterfeiting and the creation of false digital identities could be eliminated.
Blockchain-based management (BCBM) system has the potential to combat counterfeiting by identifying and removing counterfeit products from the supply chain. By utilizing blockchain technology, the system can track the supply chain history of products and verify their authenticity, making it difficult for counterfeiters to produce fake products.
The BCBM system can also use smart contracts to automate the verification process, ensuring that only genuine products are allowed to move through the supply chain. This can help businesses protect their brand reputation and revenue while ensuring consumer safety.
Moreover, the BCBM system can provide a transparent and immutable record of the supply chain, making it easier to identify and eliminate counterfeit products. By using this system, businesses can gain insights into their supply chain and identify areas where counterfeit products are most likely to enter the supply chain. Overall, the proposed BCBM system has the potential to revolutionize the way businesses combat counterfeiting by providing a secure and transparent supply

chain management system that can prevent the production and distribution of counterfeit products.

A. METHODOLOGY

In Fig 1. of the proposed architecture, the system uses a barcode reader to detect counterfeit products. The barcode of each product is linked to the blockchain system so that when a consumer scans the barcode using their smartphone, the system can verify the authenticity of the product and notify the consumer whether it is genuine or fake.

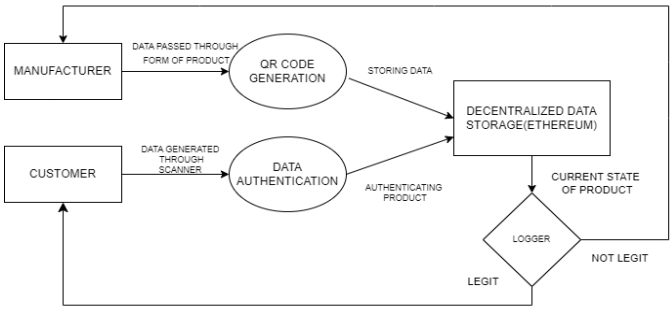

Fig 1: Work flow of proposed work

This provides an easy and accessible way for consumers to verify the authenticity of a product and avoid purchasing counterfeit products that may pose a health or safety risk. The use of blockchain technology ensures that the information is secure and tamper-proof, providing an additional layer of protection against counterfeit products. The system can also provide real-time information on the location of counterfeit products, allowing businesses to take swift action to remove them from the supply chain. By using this system, businesses can protect their brand reputation and revenue while ensuring consumer safety and confidence in their products. The use of a barcode reader tied to a blockchain system is a promising solution to combat counterfeiting and improve supply chain management.

B. SYSTEM ARCHITECTURE

In Fig 2. of the system architecture, the customer is required to register or login to the app before scanning the QR code of the product. Once the authentication process is completed, a unique code from the customer is compared against the entries in the blockchain database. If the code matches, the system sends a notification to the customer that the product is genuine.

If the code does not match, the system prompts the customer to provide information about where they purchased the product. This information can be used to identify the manufacturer of the counterfeit product and take necessary action to remove them from the supply chain. By requiring customers to register or login, the system can track the authenticity of products and ensure that only genuine products are being sold. This can help businesses protect their brand reputation and revenue while ensuring consumer safety.

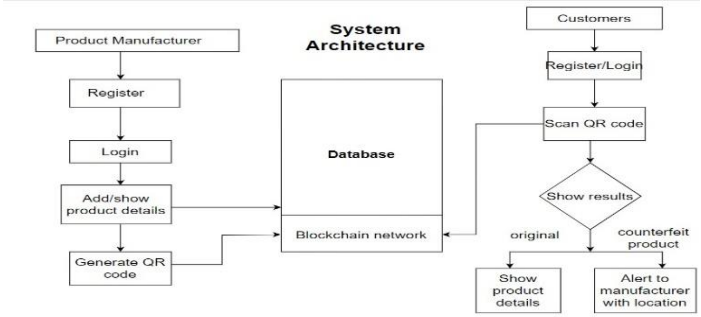

Fig 2: System Architecture

Thus, the use of QR codes and blockchain technology provides an effective solution to combat counterfeiting and improve supply chain management. By engaging customers in the authentication process, the system creates a more transparent and secure supply chain that benefits everyone involved.

VI. MODULES AND DESCRIPTIONS

A. CUSTOMER

In order to establish the customer's identification on the platform, registration with basic information and a blockchain public key entails creating an account on the platform and supplying basic information like name, contact information, and a distinctive identifier, such as a blockchain public key. With their login information, such as a username and password, customers can access the platform's features and functionalities after registering with the platform. Scanning QR codes and comparing them to blockchain QR codes A consumer can scan a QR code on a product they are interested in purchasing using their smartphone or another scanning device. The system then compares the product's QR code to the blockchain QR code to ensure that it is authentic.

Get product details: The customer is given information about the product, including its name, price, quantity, and any other pertinent details, once the QR code and blockchain QR code have been matched.

Verify whether the product is authentic or not: The consumer can verify whether the product is authentic or not using the data provided by the system. A secure and impenetrable record of the product's history is provided by the blockchain technology, which guarantees the accuracy of the product information.

Find out the product's specifics to determine whether it is a fake: When a consumer learns that a product is a fake, the system gives them information about the product, including the manufacturer's name and any other pertinent characteristics that can aid in making an informed choice.

Logout: The customer can log out of the system after finishing their chores to protect the security of their account.

B. MANUFACTURER

Creating an account on the platform and registering with basic information such as firm name, contact information, and a distinctive identifier, such as a blockchain public key, to establish the manufacturer's identity on the platform are the steps involved in registration.
Logging in with credentials: After registering, the manufacturer can access the platform's features and functionalities by entering their credentials, such as a username and password, into the system.
Provide the following information about the product: name, price, quantity, etc. The system allows the producer to add new products to their inventory while specifying information about those products such as name, price, quantity, and any other pertinent facts.
Product information can be accessed by customers by scanning a special QR code that the manufacturer creates and stores in IPFS. This allows customers to see the product's details and confirm its validity. To guarantee its confidentiality and immutability, the QR code is kept on the IPFS.
See further product information: The manufacturer has access to the product information they've entered into the system, including the QR codes linked to each item.
Logout: To protect the security of their account, the manufacturer can log out of the system whenever they have finished their tasks.

C. QR (QUICK RESPONSE) CODE

A barcode is a label with data on the object to which it is attached. Consumers can use QR codes as a counterfeit prevention tool to determine whether a product is genuine or not.

D. SMARTPHONE

Customers can use smartphones as effective instruments to confirm the legitimacy of the goods they are considering buying. One approach to accomplish this is to scan the product using the smartphone's QR code scanning capability. When purchasing items like luxury goods or electronics, which are frequently imitated, this can be extremely useful. Customers can get details about the item and its maker by scanning the QR code. They can use this information to confirm that the product is real and not a fake using this information. For instance, they can ensure that the product is legitimate and that the relevant accreditations and quality standards are there. Customers can use their smartphones to protest to the real maker if they do come across a phoney product. You can accomplish this by visiting the manufacturer's website or getting in touch with their customer care division. You can assist stop others from falling for the same con by reporting fake goods. In general, smartphones are a crucial tool for customers who want to safeguard themselves from fake goods. They may quickly and easily check the authenticity of products and take action if they discover any fakes by using the QR code scanner tool.

VII. MECHANISMS FOR DETECTING COUNTERFEIT PRODUCTS THROUGH MOBILE APP

A. PRODUCT LABELS

A product's marks are distinctively recognisable concealed elements like pictures, a message, labels, DNA identifiers, or any other type of distinctive identification that cannot be duplicated. When applied to products, these markings can be useful for product verification using an RFID reader in a mobile app at different stages of a product life cycle. A failed authentication attempt may directly inform the brand of the contents and country of origin of the package or item. After that, the brand can take the necessary action against the seller or store, whether it is an online or physical store.

B. MARKS ON PACKAGES

Similar to product markings, package markings are integrated into the packing material for your goods, saving you the expense of applying these marks to goods during production.
They function similarly to product markings and can assist brands in locating the sources of fake goods.

C. AUTOMATIC ANALYSIS REVIEW

Businesses can effectively acquire useful insights into customer sentiment and feedback through automated review analysis through innovative partnerships with independent online marketplaces like Amazon. Businesses can use data from these marketplaces to discover possible problems or areas for improvement by learning more about the sellers and products that have received duplicate evaluations.

Using a mobile app with an algorithm to help brands analyse customer evaluations that contain their brand name together with phrases like "fake," "counterfeit," "cheap," etc. is one technique to carry out automatic review analysis. This system can evaluate customer reviews and spot patterns and trends in customer sentiment using natural language processing techniques.

VIII. TECHNOLOGIES FOR IDENTIFYING COUNTERFEIT PRODUCTS

A. SMARTPHONE APPS

At many points along the supply chain, a smartphone app can greatly speed up product authentication. A consumer's app can enable them to easily verify an item's authenticity after purchase and submit a return request with a justification. Users of smartphone applications can also post pictures of potential fakes they may have purchased from a shop to a map tied to a locator. These details might be used by brands to warn other customers about fake products in particular areas. By adding authentication methods at the distributor and

supplier end, apps can also enable brand owners to detect, trace, and prevent counterfeiters from selling counterfeit goods.

B. RADIO FREQUENCY IDENTIFICATIONS (RFID)

In order to identify and track individuals or objects, radio waves are used in radio frequency identification (RFID) technology. An RFID reader and an RFID tag are the two essential parts of an RFID system. The tag reacts with its specific identification information once the reader sends out a radio signal that is picked up by the tag. Active and passive RFID tags are available. Whereas passive tags rely on the energy from the reader's signal to relay their information, active tags have their own power source and can send a signal across a greater distance. Inventory management, supply chain management, asset tracking, access control, and security are just a few of the many uses for RFID technology. For instance, RFID readers can be positioned throughout a warehouse and RFID tags can be applied to every item to track the movement of the objects. This enhances inventory management accuracy and lessens the chance of theft or loss. Some potential drawbacks of RFID technology include worries about security and privacy. There is a chance that private or sensitive information could be accessed without authorization because RFID tags can be read remotely. However, these hazards can be reduced with encryption and other security measures.

C. AN ELECTRONIC ECOSYSTEM

You can go a long way in spreading consumer knowledge of your goods and services by having an online presence. It aids in creating a recognisable brand image that enables customers to spot authentic goods at a glance and detect fakes. Users can report the presence of a fraudulent commodity by adopting a more prominent digital profile, such as having a website with online sales capability. Having a continuous messaging system in place to let digital marketplace platforms know about your brand's requirements can also assist the big digital marketplace companies in adding sellers of phoney goods to their blacklist and taking action against them.

IX. CHALLENGES AND LIMITATIONS

A. CHALLENGES

1) One of the main problems for authentic products is counterfeiting. It will result in a loss of revenue and harm the company's reputation.

2) On occasion, it is discovered that suppliers receive payment from websites that advertise their goods in order to offer discounts and boost the worth of the goods through fictitious reviews.

3) Customers are unable to discern between genuine and counterfeit goods due to a lack of understanding about these products.

4) The supply chain can be complex and involve multiple parties, making it difficult to track and verify the authenticity of products at each stage.

5) The cost of implementing authentication technologies such as RFID or blockchain can be a barrier for small businesses or those with limited resources.

6) The authentication technologies used may require specialized skills or knowledge to implement and maintain, which can be a challenge for companies without in-house expertise or the resources to hire external experts.

7) There may be regulatory challenges, such as compliance with laws and regulations related to data privacy, security, and product labelling.

8) The use of authentication technologies can also raise ethical considerations, such as the potential impact on individual privacy and the risk of exclusion for those who cannot access or afford the necessary technology.

B. LIMITATIONS

The blockchain-based bogus product detection systems now in use have a number of drawbacks. These systems' reliance on barcode or QR code scanning, which is simple for imitators to duplicate, is one drawback. Another drawback of the system is that it necessitates the consent of all parties engaged in the supply chain, which may not always be possible. Furthermore, these systems might not be able to identify complex counterfeit goods that are challenging to distinguish from real goods. Limited range: RFID readers have a limited range, which means that tags may not be detected if they are too far away from the reader. Environmental factors: RFID tags may not function properly in certain environments, such as areas with high levels of interference or metal. Compatibility issues: Different RFID technologies may not be compatible with each other, making it difficult to integrate them into existing systems. Cost: The cost of implementing RFID or barcode scanning technologies can be prohibitive for small businesses or those with limited resources. Maintenance: RFID systems require regular maintenance and calibration to ensure accurate readings, which can be time-consuming and costly. Security concerns: RFID tags can be hacked or cloned, which can compromise the security of the system and lead to unauthorized access or data theft. Privacy concerns: The use of authentication technologies like RFID can raise privacy concerns, as they can be used to track the movement of individuals or goods. This may be a particular concern in sensitive industries like healthcare or defence. Last but not least, the deployment of these systems may call for substantial infrastructure investments that may be beyond the means of small firms or underdeveloped nations. Therefore, despite the

fact that blockchain-based fake goods detection systems present a promising approach to stop counterfeiting, there are still issues that need to be fixed.

X. CONCLUSION

In conclusion, the problem of counterfeit goods is a severe one that has an effect on governments, businesses, and consumers. It compromises the reliability of the supply chain, harms the reputation of the brand, and may even put consumers' health and safety at danger. This problem can be solved by using authentication technologies like RFID, blockchain, and QR codes, which offer a safe and transparent means to confirm the legitimacy of goods. These technologies do, however, have drawbacks and can necessitate hefty infrastructure and skill investments. In order to effectively combat counterfeiting and ensure the safety and integrity of the global supply chain, it is crucial for businesses and regulators to carefully weigh the possible advantages and disadvantages of these technologies. Also, it's critical to educate consumers about the dangers and repercussions of buying fake items. Many customers could be ignorant of the possible risks linked to phoney items, such as subpar or even hazardous components. Consumer decision-making can be aided by education and outreach programmes, which can also serve to decrease the demand for fake goods. Along with authentication technology, it's critical to enhance supply chain management procedures and foster stakeholder participation. This can involve putting in place reliable traceability systems, carrying out routine audits and inspections, and disseminating knowledge and best practises throughout the supply chain. Businesses and governments can better protect customers, preserve brand integrity, and combat the expanding problem of counterfeit goods by collaborating and utilising the newest technologies and best practises.

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