A Blockchain-Based Fake Product Identification System

[1]Suryawanshi Varsha Netaji, [2]Sujata Gaikwad
[1,2]College of Engineering Osmanabad
[1]varshansuryawanshi95@gmail.com, [2]sujatagaikwad414@gmail.com

Abstract: People all over the world are at risk of buying fake things because they often don't check to see if they are real. An acceptable solution to this issue is the blockchain technology that is increasingly gaining popularity due to its ability to instill confidence among parties that distrust each other. To fight the sale of counterfeit products, this paper proposes the use of blockchain technology where the manufacturers can securely store authentic product serial numbers into a distributed registry. By using the given serial numbers, customers would have a lower risk of falling victims of counterfeit schemes by verifying products before purchasing them. It is the blockchain technology that the environment of transactions is trusted as nobody can tamper with the transactions and ensure data integrity. The approach minimizes the reliance on intermediaries and enhances the security by automating checking the procedure according to predefined criteria, with the help of the smart contract functionality of Ethereum. Besides eliminating the risk of counterfeit products, this innovative implementation of blockchain technology provides the customer with an added confidence regarding the authenticity of the transactions.

"Index Terms: blockchain, counterfeit".

1. INTRODUCTION

Counterfeiters are a global and sophisticated issue in the current market and threat to consumer safety, brand integrity and undermined trust of online purchasing. Having the definition of being low-quality imitations of original goods, counterfeits are meant to look like high-quality items, but at one-tenth of the price, which leaves the urge to save. The differentiation between genuine products and calfe ones has become very challenging as the quality of the counterfeit products has grown to reach a stage where they are almost similar to the original products. the global trade in counterfeit goods has been steadily growing and at present, it takes up 3.3% of the global trade as per the "Organization of Economic Co-operation and Development (OECD)" [1]. Besides depriving legitimate companies of their profits, this flourishing illicit trade poses a threat to the health of consumers particularly in such sectors as medicine and cosmetics.

Online sellers are increasing their campaign to curb the increasing menace of fake products and guard the interests of clients. It is important to note that e-Amazon, a huge online store, has started projects like Project Zero, which uses machine learning to find and get rid of fake listings on its website [2]. An enormous amount of time and money is spent by Amazon to protect its customers from fake goods and make sure that its marketplace is honest. Despite all these measures, the proliferation of fake products in the world market continues to undermine the competitiveness of true brands and contributes to the development of consumer mistrust.

A large proportion of the population in the European union has unwillingly purchased goods that they believed were genuine because of counterfeiting [3]. With the turnover of disappointed customers to online shopping, this is not only a cause of lack of consumer confidence but also a threat to the existence of the real brands which are just going out of business. Moreover, the uncontrolled distribution of counterfeit products not only diminish the profits of honest businesses, but also facilitate the successful competitive situation when the fake companies gain at the cost of the legitimate manufacturers.

In light of these problems, a robust and reliable mechanism of validating the goods and restoring the customers confidence in internet transactions is strongly demanded. One of the solutions that appear promising is the blockchain technology which offers a decentralized source of trust that would help the customers to quickly verify the authenticity of products. Stakeholders can mitigate the risks of counterfeitable actions through the inherent applications of the blockchain, such as agreement, provenance, immutability, and finality, to set up a system of product information that is both open and hard to get to.

There are a lot of things that can be learned about how fake goods affect customer trust and brand integrity in the digital age from this introduction. This paper tries to explain how the concept of blockchain technology can be used effectively to fight counterfeit products through a review of the market patterns, legislations, and technological developments. This paper will inform consumers, businesses, and governments about how to minimize the risks of counterfeit products and create a safer and more trustful marketplace by discussing the benefits and challenges of blockchain-based verification tools.

2. LITERATURE SURVEY

Given that counterfeit goods have become a common and an increasing menace in the global economy, much research and development has been undertaken in an effort to put to a stop this criminal act. Critical review of the literature indicates that this is a complex environment comprising of the technological, social and economic factors of scrutinizing and averting counterfeit products.

The scope and scale of the fake commodities trade is elaborated by OECD that also points out the substantial and increasing influence of the trade within the world trade [1]. In the finding of the study, they find that 3.3 percent of international trade encompasses the counterfeit products and therefore there is an immense need that effective interventions are implemented in an effort to address this issue. It is a pioneering report that lays the how big fake goods are and how they affect the world economy is what gave them life.

Because fake goods are becoming more common, online shops are working harder to stop people from selling fake goods and protect customers' interests. Segran (2021) is a critical assessment of the programs created by Amazon, one of which is Project Zero, which utilizes the ML algorithm to identify and eliminate fake items in its market [2]. These efforts have not eliminated the problems yet, which casts the efficiency of the existing measures in preventing the spread of counterfeited goods in the market into a new perspective.

This perception and experience of the consumers play a critical role in the debate concerning the topic of counterfeit goods. As TFL (2021) says, over ten percent of consumers in the European Union already purchased a fake product in the wrong way, which is why the problem becomes a widespread one and affects the consumer confidence and trust [3]. The disclosures also reveal the need to know customer preferences and behaviour as an effort to come up with effective anti-counterfeiting policies.

The blockchain technology has established to be an encouraging method of product authentication and counterfeiting throughout several sectors. The study by Hedaoo et al. (2021) provides a comprehensive examination of blockchain-based systems for detecting counterfeit products and emphasizes the importance of distributed ledger technology in establishing a transparent and incorruptible record of product provenance [6]. These solutions are meant to improve the trust and transparency of supply chains by using the blockchain decentralized structure scheme as well as the cryptography scheme that will reduce the risk of counterfeits.

Gupta et al. (2021) introduce a product identification system using Ethereum to solve the problem of counterfeit in the form of an anti-counterfeiting system to automatize the process of product authentication [7]. It is an innovative approach that capitalizes on the Ethereum blockchain and programmability and security properties to make sure that the products are real and their Integrity of the supply chain. In their study, Šandi et al. (2018) examine the potential applications of smart tags. in the wine industry as a brand protection option and prevent counterfeiting, and the opportunities which the blockchain-based solutions provide in terms of stopping fraudulent activities [8].

The blockchain technology has special capabilities in identifying and tracking of counterfeit products within the supply chain management. Prathipa et al. (2020) present a blockchain scheme of supply chain management that enables one to identify the presence of counterfeit products in the supply chain by tracing and verifying the products using distributed ledger technology [9]. That is why blockchain is a more viable choice to enhance the accountability and transparency as it provides an inalterable record of product transactions and ownership that minimizes the presence of counterfeit products.

Kumar and Tripathi (2019) comment on the opportunities of the traceability of the supply chain of counterfeit medications relying on blockchain and underline the significance of safe and transparent data management to facilitate the integrity of pharmaceutical products [10]. Blockchain based traceability systems can be used to assist the stakeholders to verify the authenticity of the medicines source, thus reducing chances of fake medicines being released in the market.

Generally, the literature review demonstrates the multifaceted nature of the issue of fake products and the quantity of different approaches that is being debated to resolve the problem. Various sectors are uniting their efforts to ensure that they are counterfeits and that the consumers will not suffer due to lack of technology and regulation. Interdisciplinary collaboration and sharing of knowledge in the future will be essential in developing overall strategies that can be used to effectively deal with this global challenge.

3. METHODOLOGY

a) Proposed Work:

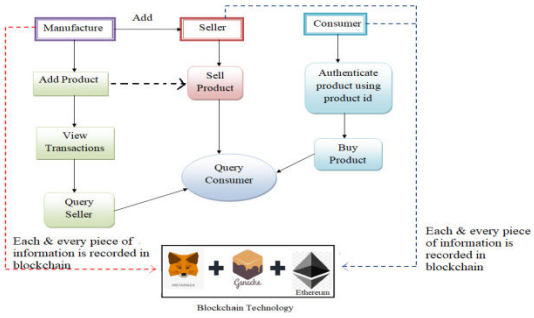
The proposed anti-counterfeiting system based on blockchain integrates the benefits of automation, transparency, and decentralization in order to address the limitations of the existing ones.

Besides proactively involving supply chain stakeholders and letting the customer make informed purchasing decisions, it is a good solution in preventing sale of fake products.

Blockchain follows the transactions in an open and secure way just like digital registry. We store information on product provenance, provenance, and verification using it. Instead of having all the information at a single location, blockchain stores the information in form of blocks of data each with a unique code called a hash.

It is quite difficult that the counterfeiters can imitate or reuse the identifiers of the products because of using unique serial numbers that are developed by manufacturers and are stored in the blockchain.

b) System Architecture:



"Fig 1 Proposed Architecture"

The system architecture utilizes blockchain technology to facilitate a decentralized ecosystem consisting of buyers, merchants, and manufacturers. Manufacturers evaluate transactions, incorporate product details, and inquire of the parties. Sellers assist in selling products even as customers authenticate products, transact, and contact relevant parties. All actions and data are safely recorded by the blockchain and ensure the transparency, impossibility of changes, and traceability of the supply chain. The architecture encourages trust and confidence between all the stakeholders since it allows easy interaction, verification, and exchange of true commodities with the use of smart contracts and cryptographic operations.

c) Modules:

We have followed the Manufacturer, Seller and Consumer modules to complete this project. These modules are outlined as follows:

i) Manufacturer Modules

Manufacturer Login: Manufacturers can regulate their activities in the site by signing in using safe credentials.

Add Seller: The manufacturers also make their products easily distributable by increasing the number of approved merchants.

Add Product: The system will enable the manufacturers to post their goods and give detailed information about them including the validity of the product.

View Transactions: Under this tool, the producers can view and track transactions involving the products thereby providing them with useful

information regarding the sales and distribution of products.

Query Seller: Manufacturers have the option to engage their authorized vendors in questioning them to seek more information about their distribution and performance.

Query Customer: It allows manufacturers to seek customer feedback, who have used their products about their experiences, perhaps to promote their products.

ii) Seller Modules

Seller Login: To handle their product sales and dealings, the sellers can safely utilise the system.

Sell Product: Through specification and authenticity of the products, sellers are able to show their products in the market and give customers the opportunity to purchase them. Before that, they are forced to purchase the products of the producers.

"Query Consumer: Sellers can access information concerning" customer who have purchased their products and they can utilize this information to manage relationships with customers or as a marketing tool.

iii) Consumer Modules

Consumer Signup & Login: The customers can engage the platform through the option of registering or logging in safely.

Authenticate Product: Customers are in a position to use the system before purchasing their products to ensure that they are getting what they are buying.

Buy Product: Customers can use the platform to safely window shop through the available products, buy and complete a purchase.

"Query Consumer: This feature allows their customers to consult their own transaction history".

d) "Blockchain Integration":

Blockchain is a ledger of product information, and it maintains an in-depth and transparent record, which can never be altered. This includes data concerning the production of a product, distribution, and other important features of a product on its entire lifecycle. This ensures reliability and validity of the data recorded which promotes transparency and trust in the past of the product.

It is possible through blockchain to verify products in a secure manner. Using a product history traced and tracked on the blockchain registry, the stakeholders can determine the authenticity of the product by a customer, producer, and the authorities. Due to this transparency, reliable authentication becomes possible, which is crucial in ensuring authentic goods and prevention of counterfeits.

Due to the decentralization characteristic of the blockchain technology, information is distributed across a host of nodes, eliminating the possibility of having a central authority. This is a better organization of the security of the system because the risks of fraud and data manipulation are reduced drastically. It is a robust and unbreakable platform as it eliminates the possibility of having one point of failure.

Using pre-established commands, e.g., updating the status of the product and initiating verification, smart

contracts make the process more productive and create trust in monitoring and determining a product.

The agreement procedures and the level of transparency of blockchain ensure that all users of the network access the same information and can trust it. This trust is the key to preventing counterfeit products and improving supply chain visibility. It also ensures that all will be able to trust the information kept in the blockchain ledger, and cooperation.

e) Ganache:

A user-friendly application to monitor the activity in the Ethereum blockchain is Ganache. It simplifies the process of tracking accounts, transactions, and smart contracts, thus any person, regardless of his or her deep knowledge in blockchain, could use it. Ganache is beneficial in debugging and ensures accuracy of transactions as it provides detailed information of the transactions including the sender, receiver, amounts, gas used, and success. It also tracks the operation and deployment of smart contracts to ascertain their proper operation and deployment. This transparency makes the processes of monitoring and verification easier.

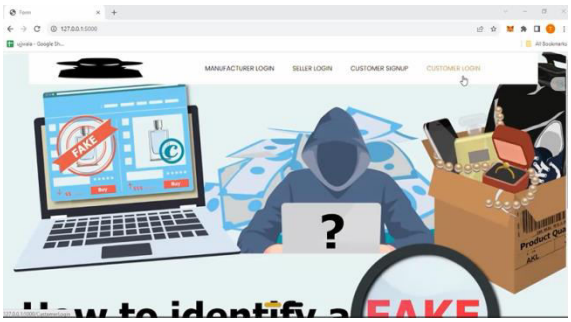
With the help of Ganache, we are able to examine each block of the Ethereum blockchain comprehensively. We can ascertain the timestamp of when a specific block was appended, the transactions executed within that block, and the amount of gas (computational power) expended. Also, ganache allows retrieval of data in blocks that were saved which provides developers with access to and analysis of specific block data.

f) Metamask:

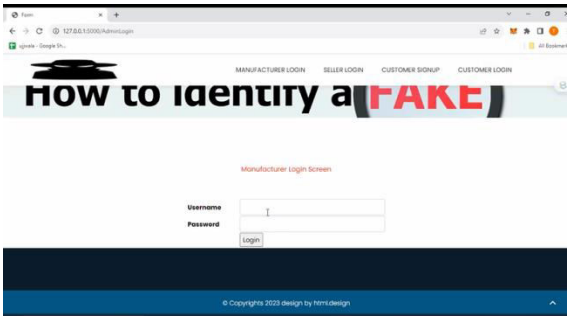
Metamask is an extension of a browser and an Ethereum wallet. It enables the connection with blockchain applications simplifying the process of managing cryptocurrencies and providing direct access to DApps.

Metamask also facilitates transparency by showing the deduction of ETH in the form of fees, and this ensures that there is security in Ethereum transactions. This transparency ensures accuracy and security, and veracity of financial transactions in the system.

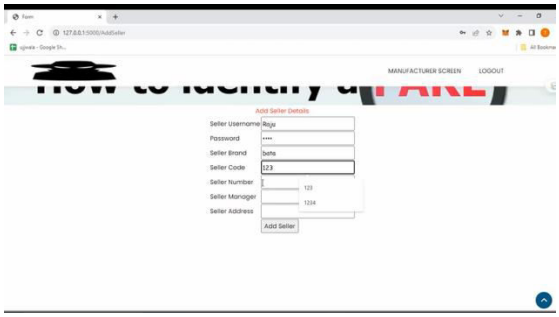
4. EXPERIMENTAL RESULTS



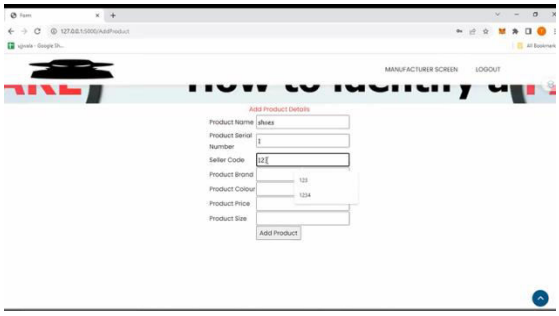
"Fig 2 Main Page"



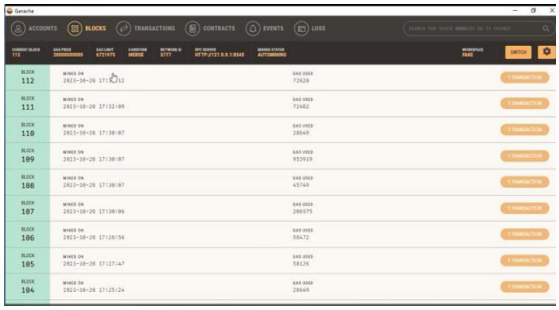
"Fig 3 Manufacturer Login Screen"



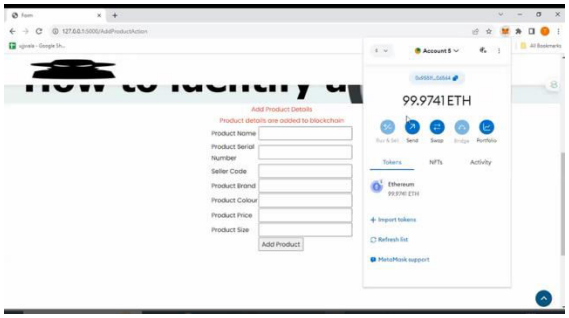
"Fig 4 Add Seller Details Screen"



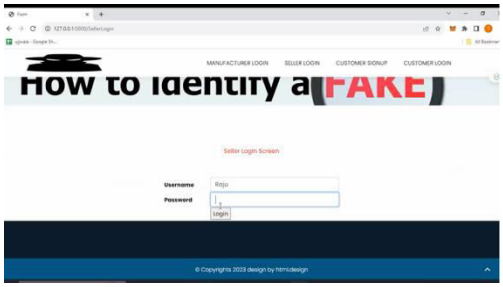
"Fig 5 Add Product Details Screen"



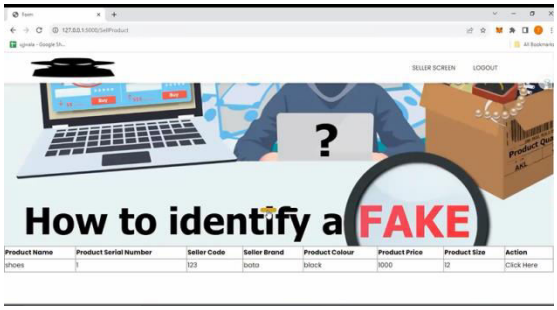
"Fig 6 Ganache Screen"



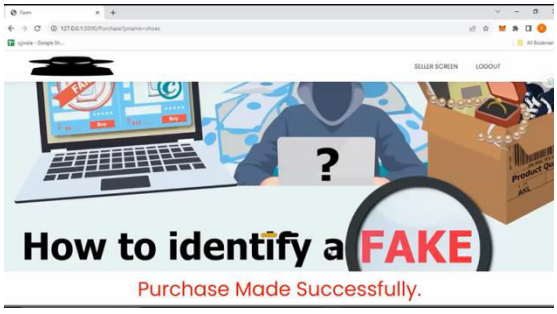
"Fig 7 Metamask Screen"



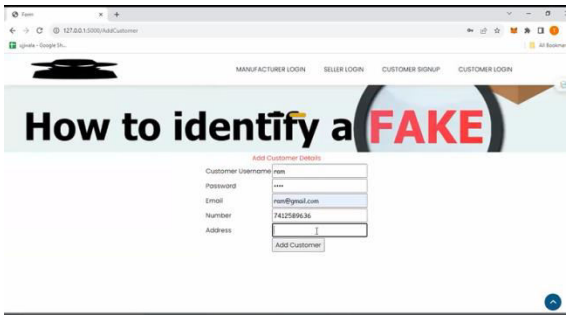
"Fig 8 Seller Login Screen"



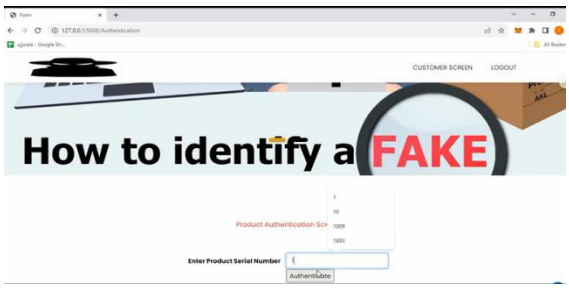
"Fig 9 Product Purchase Screen"



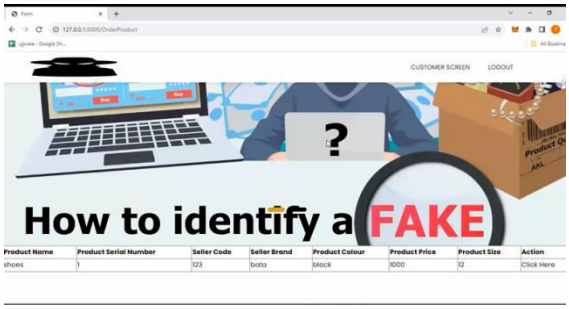
"Fig 10 Purchase Successful Screen"



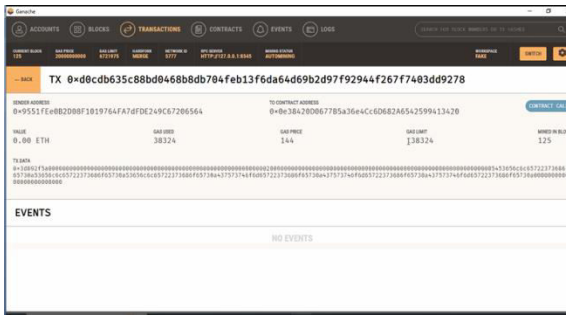
"Fig 11 Customer Signup Screen"



"Fig 12 Product Authentication Screen"



"Fig 13 Output Screen"



"Fig 14 Ganache Screen"

5. CONCLUSION

In conclusion, blockchain technology is applied in the project to help customers distinguish between counterfeit and real goods, which motivates them to be confident in their purchases. This action has been successful in fighting fake goods by integrating blockchain in supply chains to improve transparency and reliability of industries. The stakeholders cooperate with the idea of encouraging the adoption of standardized blockchain integration protocols to improve the effect of anti-counterfeiting. Customer convenience easiness facilitates the customers to make sure that they are purchasing a genuine commodity during the limited time frame and this makes them more confident about doing business at a frequent rate. Finally, reducing the effects of counterfeit goods and the risks they pose, the initiative will become a significant protection of the markets and purchasers and underscoring the advantages of its assistance in the future.

6. FUTURE SCOPE

The possibility of the system changing the way industries such as pharmaceuticals, electronics and luxury goods are conducted is beyond what it has first succeeded in the market. Integration will make supply chain efficient, as it will be connected with the latest technology such as IoT devices that will provide an opportunity to track and monitor in real-time. Furthermore, ML and AI can be utilized to enhance the precision of pattern analysis and detection of the presence of counterfeit. It is the product of this multidimensional approach which has not only reduced duplication but also contributed to the efficient innovation and development of many industries as well as making the world a safer and more open place.

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