



A Survey on Counterfeit Product Identification Using Blockchain

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Abstract: Supply chain management frequently faced issues such as service redundancy, poor coordination between several departments, and lack of standardization as a result of the lack of transparency. Product counterfeiting is something which is very common now-a-days and it's almost impossible to detect a counterfeit product just by looking at it. Counterfeiters cause significant challenges for legitimate firms, yet far too many people have no idea of the entire amount of counterfeit items' influence on brands. There are several methods devised in the past to get away with this problem of product counterfeiting. The most popular methods are using RFID tags, Artificial Intelligence, QR code based systems, etc. But each of them had few disadvantages such as the QR code can be copied from a genuine product and placed on a fake product, artificial intelligence uses CNN and machine learning which needs heavy computational power and so on. The idea of this project is to improve detection of fake products by tracking its supply chain history. This is achieved with Blockchain technology which ensures the identification and traceability of real products throughout the supply chain. Blockchain based system, makes everything decentralized that may be accessed by several parties at the same time. One of its main advantages is that the recorded data is difficult to change without the consent of all parties concerned which makes the data extremely secure and protect from all vulnerabilities. This paper presents system designed using blockchain technology for detection of counterfeit products.

Key words: Block Chain, QR Code, E-commerce, RFID.

1.INTRODUCTION

The manufacturing as well as marketing of counterfeit or duplicate products and goods leads to consequential financial, health and safety threat to end users. It also has adverse effect on the economic growth of original manufacturers and businesses through revenue loss, product defamation, downtime, replacement expenses, forcing many brands to spend money on fighting counterfeits, trust among business partners can also be at risk, stealing sales etc. To overcome and stop these crucial effects of counterfeiting, a blockchain based system is used in identification of original products and also detects duplicate products to ensure the identification of original goods. In this project, with massive emerging trends in wireless technology, QR (Quick Response) codes and barcodes provides a technique to cut down the practice of counterfeiting the products. The fake products are identified using camera scanner, where QR or barcode of the product or goods is linked to a blockchain to store product details and guaranteed unique code of each product stored as blocks in the database. If the code in product matches, the notification will be sent to the customer indicating the authenticity of the product and else if it does not match the code in database, a notification will be sent to customer indicating that product is fake or counterfeited and notification is also sent to manufacturer about the place of purchase if customer accepts the request made by the application. This approach to cut down counterfeit ensures that consumers won't completely rely on merchants to determine if products are original or forged.

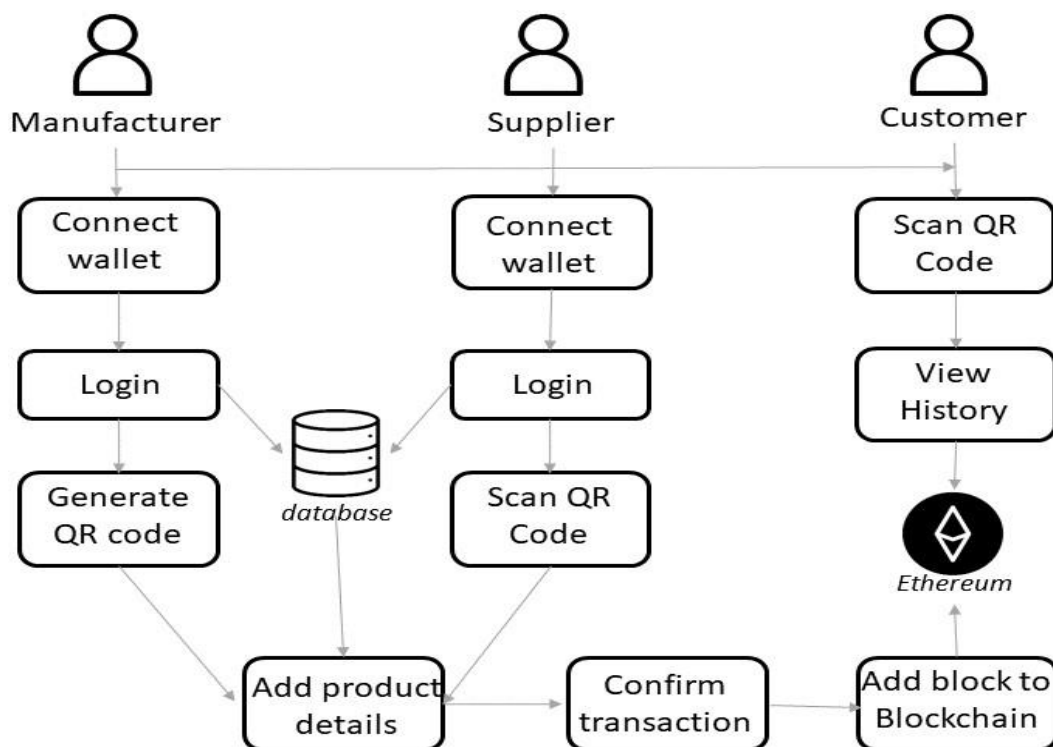
The global development of the product or branded product always comes with risk factors such as counterfeiting and duplication of product which in turn can affect the company name, reputation, revenue and customer satisfaction. The trading and marketing of counterfeit products is growing at high rates. It affects adversely on the sales, reputation, and profits of the companies and also do poses a fatal threat for the unsuspecting buyers. In order to ensure the identification and traceability of fake goods or products throughout the supply chain and to overcome this phenomenon, a fully functional blockchain system is proposed. Companies need to pay very low

transaction fees and they don't need to worry about the possibility of delivering counterfeit products to end-users. Because of fake products builder, original manufacturers face the biggest problems and huge losses in sense of brand damage as well as revenue loss. To find the originality of the product a functional blockchain technology can be used. Blockchain is a chained arrangement of recorded information that makes it difficult or impossible to modify or hack the framework. Once the product is stored on the network, hash code is generated for that product and it is possible to maintain all transaction records of the product as well as its current owner as a chain created for that product transactions. It will store all the transaction records as blocks in the blockchain. In the proposed system we are assigning a QR code or barcode generated for a particular product created by manufacturer along with all the details of the product. The end customer can scan that QR code to get all information about that product. After scanning the QR code or barcode on the product, the user can identify whether the product is real or fake.

Blockchain is an arrangement of recording information that makes it troublesome or hard to change, hack, or cheat the framework. A blockchain is essentially a computerized record of transactions that is duplicated and distributed across the entire network of PC systems on the blockchain. Each block in the chain contains multiple transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participant's record. The decentralized database managed by the number of participants is known as Distributed Ledger Technology (DLT). Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash.

Blockchain technology helps to solve the problem of counterfeiting a product. Blockchain technology is more secure. Once the product is stored on the network hash code is generated of that product and it is possible to maintain all transaction records of the product and its current owner as a chain will be created for that product transactions. All the transaction records will be stored in the form of blocks in the blockchain. In the proposed system we are assigning a generated QR code to a particular product and the end customer can scan that QR code to get all information about that product. After scanning the QR code we can identify that the product is real or fake.

Figure 1: Trial and error, but successfully adding a block is rewarded in Ethereum



2. METHODS OF DETECTION

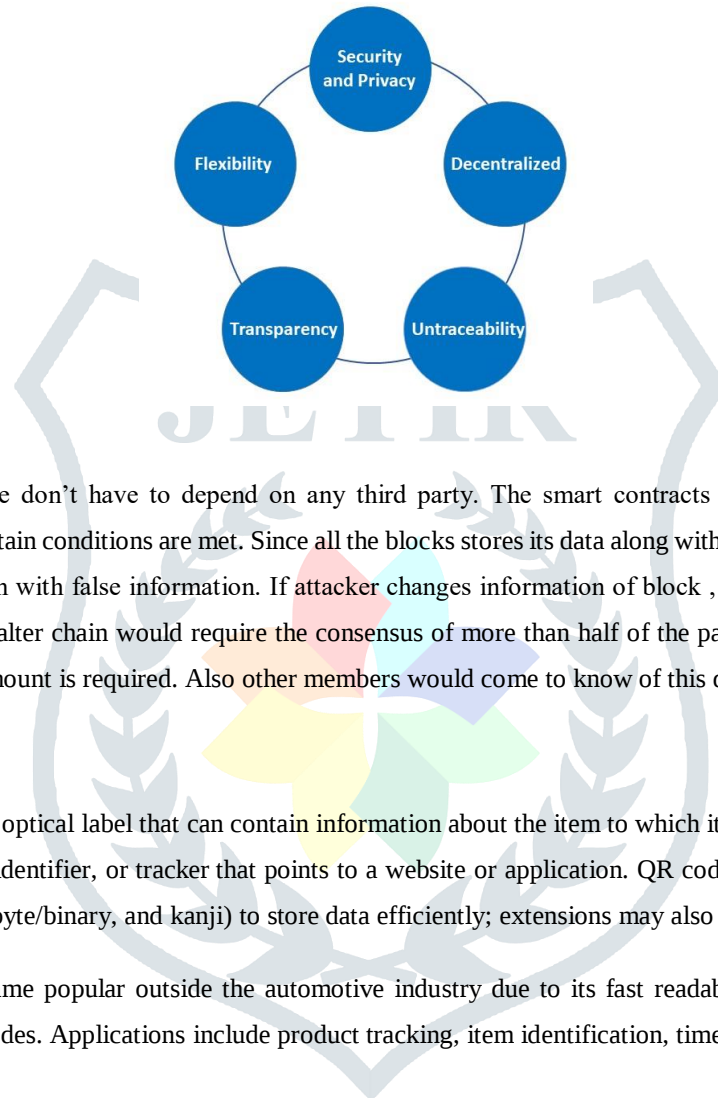
Block Chain

Block Chain When a new transaction is entered, it is then transmitted in a network of peer-to-peer computers scattered across the world. The network of computers then solve the equations to confirm the validity of the transaction. They are called miners. Once confirmed

to be legitimate transactions, they are clustered together into blocks. The miner then receives an award as a proof of work. These blocks are then chained together creating a long history of all transactions that are permanent.

Blockchain is collection blocks that are linked together which stores information. Each block has a timestamp, transaction data and hash of its own and hash of previous block, so it is difficult to tamper with data. Blockchain is a decentralized system. It ensures that every new block added to the blockchain is the one and only true version that is agreed upon by all nodes in the Blockchain. It refers to the collective maintenance of a technical solution that maintains a continuous record file as a reliable database through decentralization.

Figure 2: Features of Blockchain



Blockchain increases trust as we don't have to depend on any third party. The smart contracts which are basically programs on blockchain are run only when certain conditions are met. Since all the blocks stores its data along with hash of previous block it becomes difficult to modify the blockchain with false information. If attacker changes information of block, its hash also change but the hash of next block remains same. To alter chain would require the consensus of more than half of the participants which is unlikely, since lots of resources and financial amount is required. Also other members would come to know of this drastic change.

QR Code

A barcode is a machine-readable optical label that can contain information about the item to which it is attached. In practice, QR codes often contain data for a locator, identifier, or tracker that points to a website or application. QR codes use four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to store data efficiently; extensions may also be used.

The quick response system became popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard UPC barcodes. Applications include product tracking, item identification, time tracking, document management, and general marketing.

A QR code consists of black squares arranged in a square grid on a white background, including some fiducial markers, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image.

QR codes are now used in a much broader context, including both commercial tracking applications and convenience-oriented applications aimed at mobile-phone users (termed mobile tagging). QR codes may be used to display text to the user, to open a webpage on the user's device, to add a vCard contact to the user's device, to open a Uniform Resource Identifier (URI), to connect to a wireless network, or to compose an email or text message. There are a great many QR code generators available as software or as online tools that are either free, or require a paid subscription. The QR code has become one of the most-used types of two-dimensional code.

RFID

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods.

Passive tags are powered by energy from the RFID reader's interrogating radio waves. Active tags are powered by a battery and thus can be read at a greater range from the RFID reader, up to hundreds of meters.

Unlike a barcode, the tag does not need to be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of automatic identification and data capture (AIDC).

RFID tags are used in many industries. For example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line, RFID-tagged pharmaceuticals can be tracked through warehouses, and implanting RFID microchips in livestock and pets enables positive identification of animals. Tags can also be used in shops to expedite checkout, and to prevent theft by customers and employees.

Since RFID tags can be attached to physical money, clothing, and possessions, or implanted in animals and people, the possibility of reading personally-linked information without consent has raised serious privacy concerns. These concerns resulted in standard specifications development addressing privacy and security issues.

E- commerce

E-commerce (electronic commerce) is the activity of electronically buying or selling of products on online services or over the Internet. E-commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. E-commerce is in turn driven by the technological advances of the semiconductor industry, and is the largest sector of the electronics industry.

E-commerce typically uses the web for at least a part of a transaction's life cycle although it may also use other technologies such as e-mail. Typical e-commerce transactions include the purchase of products (such as books from Amazon) or services (such as music downloads in the form of digital distribution such as iTunes Store). There are three areas of e-commerce: online retailing, electronic markets, and online auctions. E-commerce is supported by electronic business. The existence value of e-commerce is to allow consumers to shop online and pay online through the Internet, saving the time and space of customers and enterprises, greatly improving transaction efficiency, especially for busy office workers, but also saving a lot of valuable time

3. Survey Papers

In this section, A Survey of Counterfeit Product Detection by Prabhu Shankar, R. Jayavadeivel. Counterfeit products are growing exponentially with the enormous amount of online and black-market. So, there is a strong need to address the challenges of detecting counterfeit products and designing appropriate technology to improve detection accuracy. This is one of the active research areas to be explored in the current world. This paper discusses various techniques for identifying counterfeit products.

Smart Tags for Brand protection and anti-counterfeiting in the wine industry by Steven, Marko. This paper describes a brand protection and anticounterfeiting solution for the wine industry based on smart tags and Cloud-enabled technologies. The main idea behind smart tags is to utilize quick response codes and functional inks supported by the Cloud system and two-way communication between the winemaker and end-user.

A Blockchain-based Supply Chain Quality Management Framework by Si Chen, Rui Shi. In this paper, we propose a blockchain-based framework. This framework will provide a theoretical basis for intelligent quality management of the supply chain based on blockchain

technology. Furthermore, it provides a foundation to develop theories about information resource management in distributed, virtual organizations.

The survey focused on understanding the sources of counterfeits, impact on the society. There exist various systems of fake product detection, which use Artificial Intelligence, QR codes, Machine Learning and Blockchain. The methods discussed by Shaik included the use of providing product with public and private keys as QR code, the app used to scan the QR should have cryptographic functionality to decrypt the QR code. The manufacturer is also supposed to run server to accept request and match the buyers name, and items code. The scanning app should have cryptographic functionality to decrypt ciphertext of the item code encoded in the QR code [9]. Benatia and Baudry et.al explains traceability-CPS based architecture for supply chain management consists of several layers that interact to form a traceability-CPS. Also, the proposed architecture allows supply chain monitoring and data analytic to enhance product. Safety and quality.

The proposed algorithm consist on computing the most frequent item sets in the product transaction database. This item sets are then used as genuine product trajectories and can serve in detecting abnormal product behavior [10]. Khalil and Doss et.al comes up with the solution of using RFID based system to reduce counterfeiting. This system allows consumers to query in-store the tag attached to an item to verify its legitimacy. RFID-based anti-counterfeiting and anti-theft schemes are suitable for large scale implementation in retail environments. The proposed scheme is lightweight and suitable for implementation using low-cost passive RFID tags. Tran and Hong's anti-counterfeiting protocol are used. This system is immune to DOS attacks [11]. Habib and Sardar et.al gives explanation on SCM trends. They are examined in their work process that executives' difficulties and transaction issues are problems featured in the SCM. Hence proposed a solution, SCM by considering the blockchain as a technological feature for solving them. Primary method for structuring new models should find the transaction process at a plan level [12].

4. CONCLUSION

Blockchain is a decentralized system, therefore the local suppliers cannot interfere with the checking or counterfeiting of the product in the proposed system. Manufacturers and Suppliers can use the system to store product details in Blockchain which offers certain properties such as tamper resistance, data consistency and confidentiality that assure the security and privacy of the data on the network. The customer views the product supply chain history and verifies if the product is genuine. Customers can be sure about the integrity of goods they purchase. The proposed system can effectively lower the rate of counterfeiting of branded goods and provide the companies with an easier approach to provide consumers with the confidence that they will not purchase counterfeit goods. This system will help to build trust and good bonding between manufacturer and customer and in deed it will help in improving economy and reducing corruption. Further system can be extended to avoid frauds done in banking, healthcare, voting system, online shopping and so on. At the time of customer purchasing the product after the QR scan in supply chain history, if the last location is not matched with the purchase location, the customer will know that the product is not genuine.

REFERENCES

- [1] ASPA, The state of counterfeiting in india 2021, https://www.aspaglobal.com/pre_upload/nation/1623216858-4730baa0efdb83aba174859af0a3a6a5-Report (2021)
- [2] Y. Lu, Journal of Management Analytics 5, 1 (2018)
- [3] F. Casino, T.K. Dasaklis, C. Patsakis, Telematics Informatics 36, 55 (2019)
- [4] M. Peck, IEEE Spectrum 54, 26 (2017)
- [5] S. Idrees, M. Nowostawski, R. Jameel, A. Mourya, Electronics 10, 951 (2021)

- [6] Zignuts Technolab, How blockchain architecture works? basic understanding of blockchain and its architecture., <https://www.zignuts.com/blogs/how-blockchain-architecture-works-basicunderstanding-of-blockchain-and-its-architecture/> (2022)
- [7] J. Ma, S.Y. Lin, X. Chen, H.M. Sun, Y.C. Chen, H. Wang, IEEE Access 8, 77642 (2020)
- [8] M.J.L.I.N.M. J.M. Bohli, N. Gruschka, IEEE 10, 9 (2013)
- [9] C. Shaik, Computer Science & Engineering: An International Journal (CSEIJ) 11 (2021)
- [10] M.A. Benatia, D. Baudry, A. Louis, Journal of Ambient Intelligence and Humanized Computing pp. 1–10 (2020)
- [11] G. Khalil, R. Doss, M. Chowdhury, IEEE Access 8, 47952 (2020)
- [12] M.A. Habib, M.B. Sardar, S. Jabbar, C.N. Faisal, N. Mahmood, M. Ahmad, Blockchain-based supply chain for the automation of transaction process:
- [13] Case study based validation, in 2020 International Conference on Engineering and Emerging Technologies (ICEET) (IEEE, 2020), pp. 1–7
- [14] E. Daoud, D. Vu, H. Nguyen, M. Gaedke, Improving Fake Product Detection Using Ai-Based Technology, in 18th International Conference e-Society (2020)
- [15] S. Chen, R. Shi, Z. Ren, J. Yan, Y. Shi, J. Zhang, A blockchain-based supply chain quality management framework, in 2017 IEEE 14th International Conference on e-Business Engineering (ICEBE) (IEEE,2017), pp. 172–176

