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SYSTEM FOR DETECTING FAUX PRODUCTS

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Abstract **- As a disruptive technology, blockchain technology has the potential to eliminate the problem of product counterfeiting in supply chains. A blockchain-based platform, on the other hand, charges legal producers and retailers an operational fee for product tracking and authentication. We use enterprise profit-driven analytical models based on Stackelberg equilibrium theory in this work to demonstrate the benefits of blockchain-supported e-commerce platforms in combating product counterfeiting. We evaluate the profitability of all actors in two separate supply chains, traditional and blockchain-supported, to determine the true benefits of blockchain technology. Manufacturers, merchants, and customers do not necessarily benefit from the use of blockchain technology, according to the findings. When a genuine company's manufacturing costs are sufficiently high, however, blockchain technology allows the manufacturer to make more money. Furthermore, in a price-sensitive market, a retailer is more likely to trade on a blockchain-supported e-commerce platform if the retailer's qualification in the platform is lower than in a traditional supply chain and the counterfeit manufacturer's manufacturing cost in the platform is higher than in a traditional supply chain.**

Keywords **– Blockchain, Distributed ledger, Distribution chain, Goods.**

I. INTRODUCTION

Many industries, such as luxury handbags, perfumes, pharmaceutical products, and automobile components, are rife with counterfeit goods. According to the International Chamber of Commerce in Geneva, the global annual sale of counterfeit goods is worth USD 650 billion. In addition to costing legitimate businesses a lot of money, counterfeit products put people's lives in danger, such as by employing low-quality auto parts, medicines without active ingredients, and toys with hazardous substances. Radio-frequency identification, barcode scanning, and mobile technology have all been presented as solutions to the product counterfeiting problem. These systems, on the other hand, are largely centralised and rely on trusted servers, which are subject to cyberattacks such as replay and man-in-the-middle attacks. The best contender for overcoming these threats has emerged as blockchain technology. It has the ability to create a tranparent, trustworthy, and secure supply chain that prevents the counterfeiting of products.

A blockchain records product information in perpetuity and cannot be changed, destroyed, or manipulated. A blockchain is a decentralised public record that allows retailers to view and verify past product information. Because of the transparency of the blockchain-based e-commerce network, a store can instantly determine whether their goods are qualified, preventing counterfeit products from entering the supply chain. Because blockchain technology assures traceability and transparency, it can create a secure trading environment for supply-chain businesses, making it an appealing solution to a variety of supply-chain issues. Previous research and real-world instances have demonstrated that blockchain-based e-commerce systems can be utilised to combat counterfeiting. However, just a few research have developed models to assess the true impact of blockchain on supply chain entities. For product traceability and verification, blockchain-supported platforms charge genuine manufacturers and retailers an operating fee, which means that adopting the blockchain raises the costs of legitimate businesses. Legitimate businesses lose money as a result of counterfeit products in a typical supply chain. Firms pay an operating charge in a blockchain-based supply chain. Because the true impact of blockchain on supply chain organisations is unknown, this article aims to address the following three questions in order to assess the technology and provide some light on researchers and practitioners.

We merged a platform with blockchain technology to address the problem of counterfeit products. Unlike a typical supply chain, a blockchain-based e-commerce platform can

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accurately record the entire process of raw-material gathering, goods production, and shipping; as a result, an unlawful manufacturer has no way of delivering inferior items to a retailer.

II. OBJECTIVE

The goal of this project is to use the Hyperledger fabric framework's Blockchain architecture to record product ownership on the Blockchain. Consumers do not need to totally rely on trusted third parties to safely know the source of the acquired product because of Blockchain's traceability and transparency qualities, as well as the assurance that each record on the Blockchain cannot be falsified. Small businesses and new businesses can use the proposed phoney product identification application system in this research to supply real products to their customers and create confidence. To establish secure and memorable anti-counterfeit authentication, they will only need to pay a relatively low cost for operation costs.

III. LITERATURE SURVEY

Si Chen et al. [1] implemented A Blockchain-based Supply Chain Quality Management Framework (2017).They suggest an ethereum - based framework in this paper. This guideline, based on the blockchain age, provides a theoretical foundation for high-quality supply chain operations. It also serves as a framework for the development of theories regarding the administration of information resources in decentralised, internet-based groupings.

Prabhu Shankar, R. Jayavadivel. [2] wrote A Survey of Counterfeit Product Detection (2019). In this paper, they discuss counterfeit goods, which are on the rise due to the vast volume of online and black-market activity. As a result, there may be a great desire to address the issues of counterfeit goods detection and to develop effective technology to improve detection outcomes. These are only a few of the current research subjects being investigated today. The tactics for detecting counterfeit items are discussed in this study.

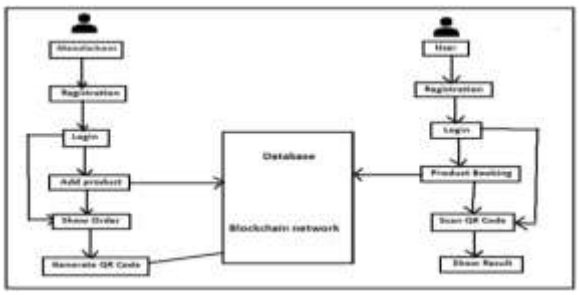

Figure 1. Counterfeit Product Detection Workflow Diagram

Oleh Prokipchuk et al. [3] organized an Intelligent System for Checking the Authenticity of Goods Based on Blockchain Technology (2021). This paper covers the importance of fake goods identification devices and the various ways that may be employed to combat them. The gadget provides a preferred template for product makers to follow in order to obtain access to a stable blockchain ecosystem and produce a product with realistic value.

Shovon Paul et al. [4] developed a Fake News Detection in social media the usage of Blockchain (2019). This paper explains how, at times, false information is more appealing than true information. Humans appear to be imperfect as a result. How can we utilise blockchain to debate how to avoid fake news on social media, taking advantage of the benefits of Blockchain's peer-to-peer network requirements?

Abhinav Sanghi et al. [5] advanced Detecting Fake Drugs using Blockchain (2021). This paper's authors mentioned If people use counterfeit pharmaceuticals, they risk major health problems and even death. As a result, they developed a blockchain capability for preventing medicine counterfeiting and facilitating pharmaceutical mobility within the blockchain network.

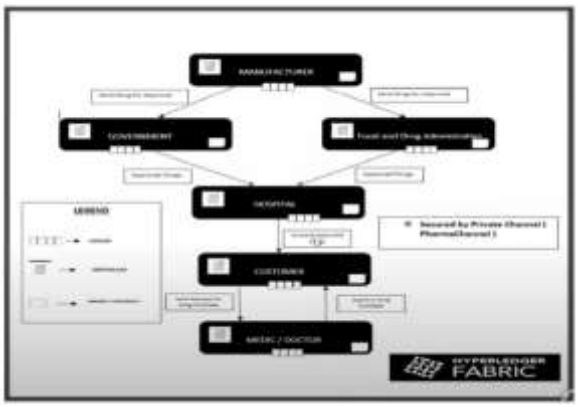

Figure 2. Architecture of detecting fake drugs using Blockchain

Yang et al. [6] Proposed a protocol for election that's based on decentralized approach i.e., blockchain-generation. Their system eliminates the need for a committee to rely on votes. They created a cryptographic system that ensures that no one can decode the votes, but that each of us can verify the votes' legitimacy.

Taner Dursun et al. [7] presents Blockchain Technology for Supply Chain Management(2021). This paper's authors give an outline of how blockchain technology is being used in the supply chain. Blockchain technology can be used to produce a permanent, easily shared, and completely transparent record of a product's path through its supply chain. A tiny factory, which is a proposed use case for

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blockchain technology in automotive manufacturing, was also presented.

Fabio Della Valleand Miquel Oliver[8] came up with Blockchain-Based Information Management for SupplyChain Data-Platforms(2021). The authors of this study looked at how well public blockchains and logistics and supply chain processes work together.

Ya-Jun Cai et al. [9] proposed a Platform Supported Supply Chain Operations in the Blockchain Era: Supply Contracting and Moral Hazards (2021). When a retailer has a reason to overclaim the markdown sponsor's amount, the authors demonstrate how a moral hazard problem arises. According to the authors, the moral hazard dilemma results in a loss for the producer, an immoral gain for the retailer, and no impact on the platform or consumers.

Jing Yang et al. [10] Public and private blockchain in construction business process and information integration(2020). The authors of this study evaluate the possibility of employing both public and private blockchain technologies in the construction industry using two industrial scenarios. This report also goes through the process, benefits, and challenges of integrating private and public blockchain technologies in the construction business.

IV. PROPOSED SYSTEM

The proposed system employs the Hyperledger architecture as the backend Blockchain operating system, with chaincode serving as the high-level programming language for smart contract creation. We have nodes in the Hyperledger fabric. The nodes form a network by communicating with one another. There are some programmes, though, that are run by the blockchain itself. They're made up of chaincode. The chaincode is in charge of the ledger and state data, as well as transaction execution. As transactions are carried out on it as operations, Chaincode receives the most attention. Transactions, on the other hand, require endorsement to be valid. Transactions can only be committed once they have been endorsed.
The below figure 3 illustrates the working of the proposed system, there are three users implemented in the system the Manufacturer module, seller module and the customer module. Each manufacturer can add a new product. The customers will buy that product form the seller. After purchasing that product, the customer can check the information about that product whether it came from a genuine manufacturer or not.

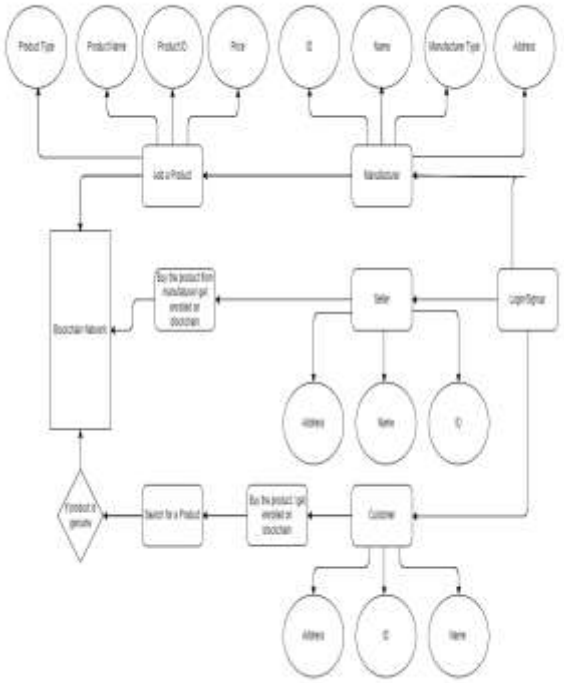

Figure 3. Basic Workflow of the system

SOFTWARE REQUIREMENTS:
A. Programming languages: -
C#
HTML
CSS
Bootstrap
B. Database: -
SQL Server
C. Framework: -
Entity Framework
ASP.NET MVC

V. WORKING OF THE SYSTEM

The technique for detecting fake products is based on Blockchain. Manufacturers can use this system to record relevant information about product sales in Blockchain, which is available to consumers, in this application. The total amount of sales that the seller can make and the number of products that the seller has now left are both visible to users. The user can use this system's functionalities to undertake vendor-side verification right away. The Manufacturer Role, the Seller Role, and the Consumer Role are the three roles that make up a fake product identification system based on Blockchain.

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4.1.1 Manufacturer Role: The seller's functions include adding new seller's addresses to contracts, increasing the number of products a seller may sell, and getting information on sellers to get the most up-to-date sales status. FIGURE 7. Our system's design aim from the consumer's perspective. FIGURE 8: Our system's basic model. It is possible to enquire about the product that the seller sold to the customer and see if it has been exchanged or if the product's status has been validated using the customer's public key certificate.

4.1.2 Seller Role: The seller can encrypt the verification information with a private key using the system's features, and the consumer can use the seller's public key to verify if the vendor is who he claims to be. Following the purchase and sale, the seller enters the purchaser's address in the contract so that the manufacturer can obtain the data. The vendor has access to information about his products, including sales lists and the amount of stock he has left.

4.1.3 Consumer Role: The consumer can utilise the system's functionalities to encrypt the verification information with a private key, and the seller can use the consumer's public key to check if the seller is who he claims to be. The seller specifies the purchaser's address in the contract for the manufacturer to acquire the information after buying and selling. The vendor has access to information about his products, such as sales lists and remaining stock quantities.
The manufacturer is in charge of pushing seller information to the contract, such as the quantity of products the seller can sell and the seller's address, under this design. After obtaining the manufacturer's approval, the seller can get a set of recording rights for the products he can sell under the contract. When a customer buys a product, the seller adds the customer's address to the contract in order to finalise the transaction. Consumers can utilise the system to find out if the seller is in the contract and if there are any unsold products available for trade. Following the purchase, the consumer will furnish the manufacturer with the information that the product wishes to mail, which will be encrypted using the consumer's personal information. The encrypted data is delivered to the manufacturer, who will decrypt it using the consumer's public key. If the information matches the information provided by the consumer, the producer will send the product to the customer and the transaction will be completed.

Login Process: The user must choose which account to log into before creating a connection to the system. The user's accounts are linked to Geth accounts, and after Geth is started, the user can select an account that is likewise tied to the serial number of Geth's account list. After that, the user must enter the Keystore file, which is an encrypted file containing the private key. Finally, the user can enter the contract address and save the basic information by clicking the save button.

Public Information of Contract: The information about sellers is totally public with the objective of information transparency. This system has data search functions for chain codes, which can provide a seller list, a customer list, all seller information, and the amount of products left for each seller.

Adding New Sellers and Products Number: Manufacturers can manage seller information in our system, including adding new seller addresses and limiting the quantity of items that can be sold by a single seller. The smart contract's programme will first verify that the function setter is the manufacturer. If everything is okay, the programme will create a seller structure and set the maximum number of products that can be sold by the seller; this number can be changed later.

Recording the consumer on Smart Contracts: When the seller and consumer have completed their transaction, the seller will add the customer's address to the smart contract. In the seller structure, each seller has a product structure, and the seller will enter the consumer addresses into the product owner field. Furthermore, the seller's product owner field access rights can only be specified by the seller.

Product Verification: One of the most crucial parts of our system is product verification. Users in our system can use the unique ID of the product they purchased to see if it's in the blockchain. The user can then confirm that the goods is authentic and that it came from the correct source.

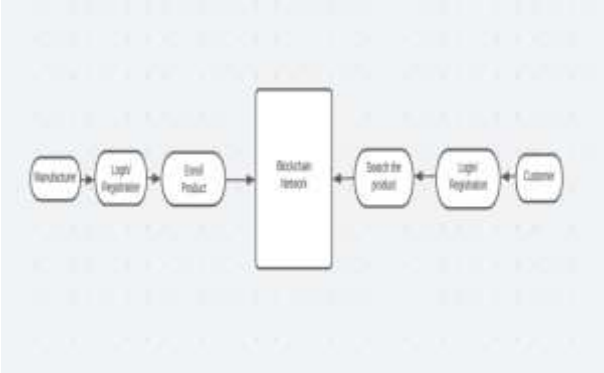

Figure 4. Basic Architecture of verifying the product

VI. METHODOLOGY

The suggested system is in charge of preserving product details, keeping track of the current owner and manufacturer, and creating time stamps for each operation.

The project will be built using the.NET Core MVC framework. The user will be able to engage with the

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blockchain. And the User's information will be saved on SQL Server. The user must choose which account to log in with before connecting to the system. Users can create accounts as a manufacturer, a seller, or a buyer. Each account will be assigned a distinct ID. The user must first register on the app by providing all of the required information. Finally, by clicking the save button, the user can enter the contract address and save the fundamental information.

The Hyperledger fabric framework will be used to implement the blockchain. The user will be able to save data in the form of blocks on the blockchain. The data will be hashed and then added to the block, with a new block being added to the blockchain after each transaction. The producer has complete control over the information about the product under this system. The manufacturers will oversee entering product information and storing it on the blockchain. Data will be hashed and stored in the form of blocks on the blockchain.

Product verification is the most important part of our system. When clients visit the suggested website, they can use this feature. Users will have access to a page on the website where they may search for products and view details by entering the product's unique id. Users in this system can look up a product's unique ID to see if it's on the blockchain. The user can then see the product's details, including if it came from a legitimate source, and decide whether or not to buy it.

VII. RESULTS

The app is built using the.NET Core MVC framework. The user will be able to engage with the blockchain. And the User's information will be saved on SQL Server. The user must choose which account to log in with before connecting to the system. A user's account can be either a Seller or a Buyer. Each account will be assigned a distinct ID. The user must first register on the app by providing all of the required information. Finally, by selecting the save button, the user can enter product specifics and save the basic information. Buyers will be able to purchase things directly from the ecommerce website's Home Page.

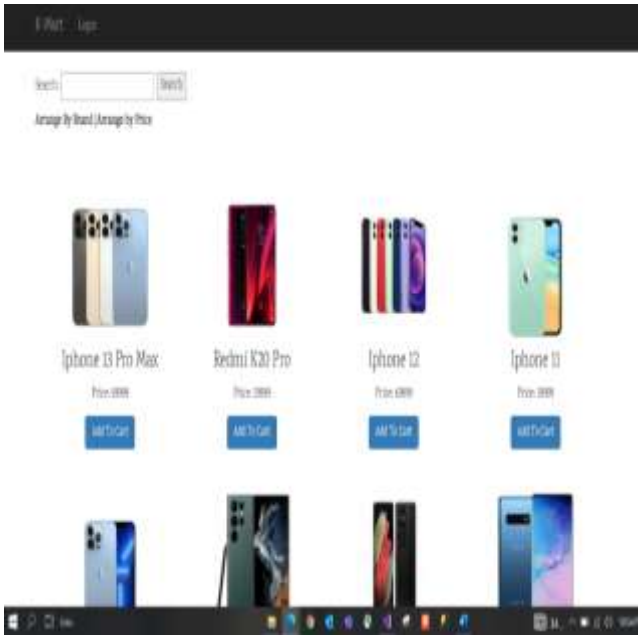

Figure 5. Home page of the web application

The above **figure 5** shows the home page view of the web application when there is no user logged into the web application

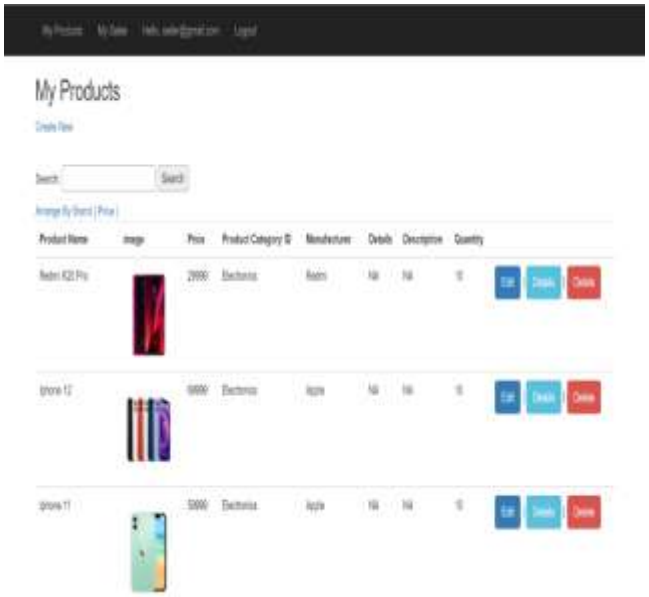

Figure 6. Product list in the web application

The above **figure 6** shows the view of the web application when a user is logged in as a seller and viewing the product list

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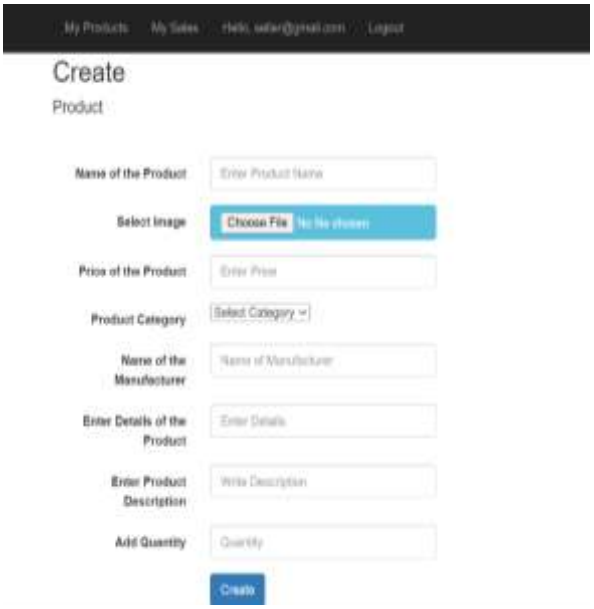

Figure 7. UI for creation of a product

The above **figure 7** is the view of the web application at the time of creation of a new product.

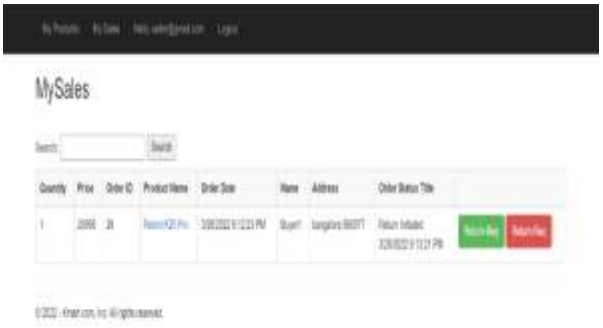

Figure 8. Sales List for the Seller Account

The above **figure 8** shows the list of the sales of a particular seller.

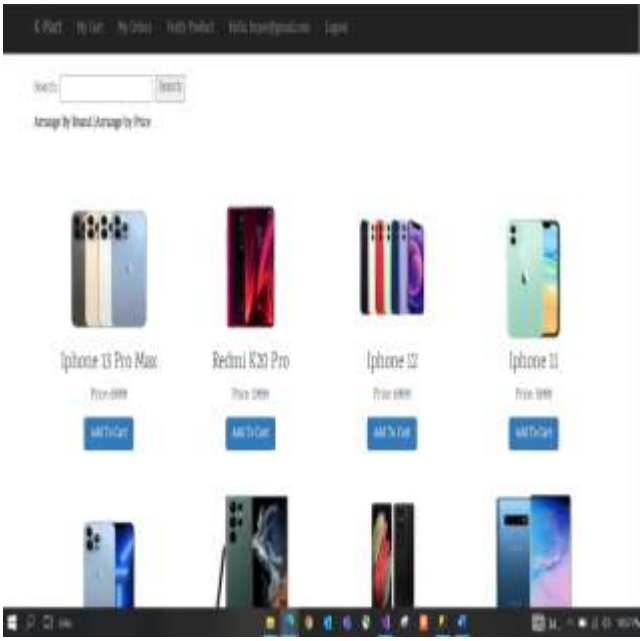

Figure 9. Home page for Buyer User

The **figure 9** shows the view of the home page of the Buyer user in the web application

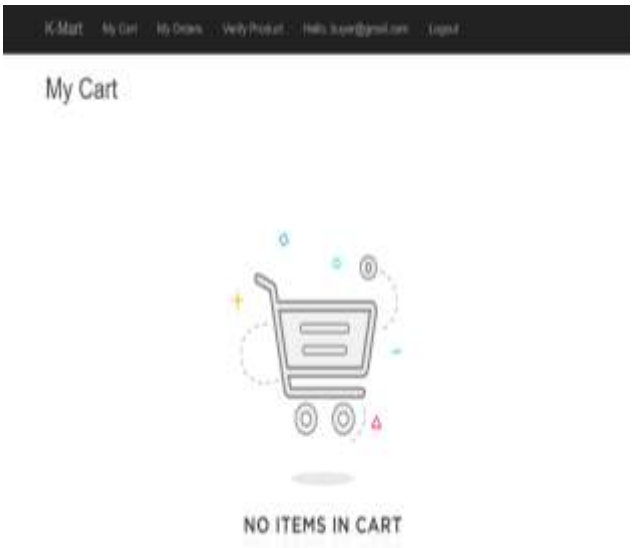

Figure 10. Empty Cart

The above **figure 10** shows the view of the cart when cart is empty.

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Figure 11. List of the orders

In **figure 11** the web application is showing the list of the orders for the buyer.

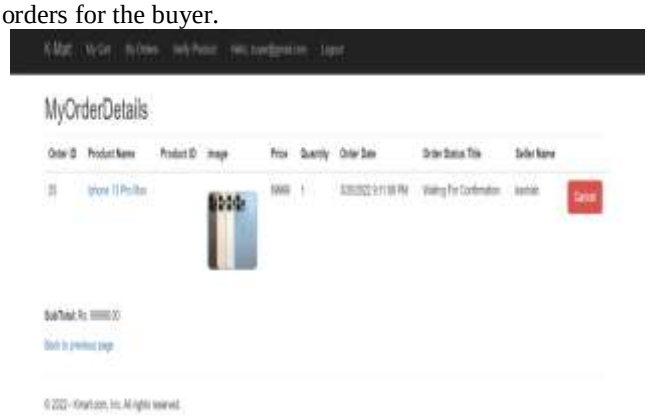

Figure 12. Detailed view of the orders

The figure 12 displays a list of the orders placed by a buyer user. The **figure 12** is a much more detailed view of the order as compared to the **figure 11**.

Figure 13. View of the orders after it has been delivered

Once the order gets delivered the buyer will be able to see the product id in the web application. As the **figure 13** is showing the id of the product to the user.

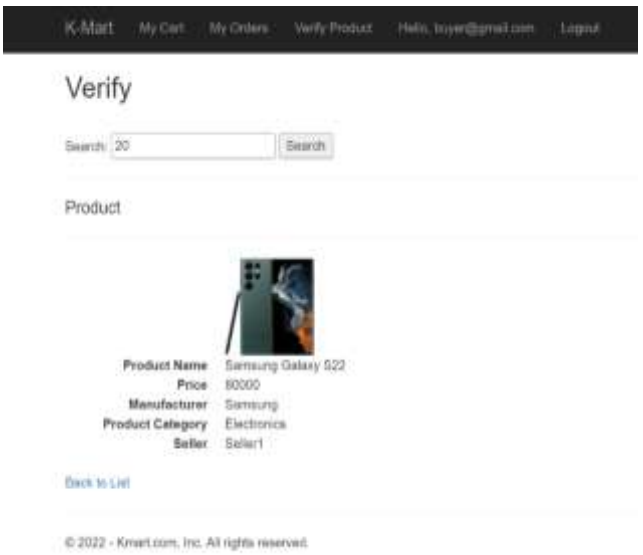

Figure 14. verifying the genuine product

After obtaining the Id the user can search about the product with the help of that id. As shown in **figure 14** the user searches for a product which turn out to be genuine.

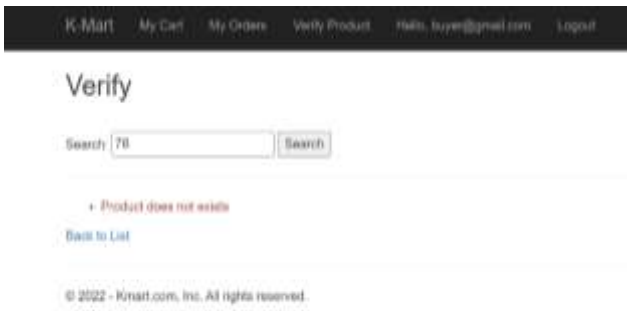

Figure 15. Verifying if the product is not genuine

In **figure 15** the output of a product is shown when it is not genuine. The website will not find the result for that order and will declare that the order does not exists.

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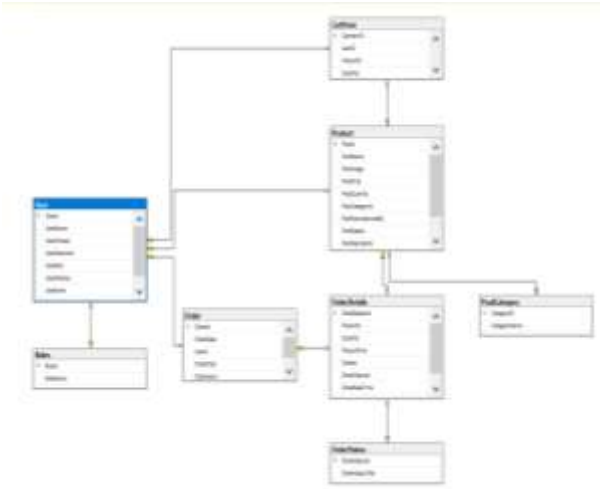

Figure 16. Database Diagram

The **figure 16** is a database diagram which shows that the Database design and the relationship between all the tables. The tables have been normalized according to the third normal form or 3NF.

VIII. CONCLUSION

The proposed method could be extremely useful in keeping track of things and who currently owns them. This Blockchain Ledger can track items without the usage of a centralized controlling server, in addition to detecting tampering, cloning, and tag replication threats. The cost of running a distributed utility on the Hyperledger fabric blockchain is proportional to its code simplicity. This method is expected to be cost-effective. Goods manufacturers can use the programme to keep statistical data on item sales and purchases in Blockchain, which is open to the public. Due to the simplicity of the code and the absence of documentation, customers who use this system to acquire products can expect the distributed programme to have additional intake. I'd like to thank the authors for the excellent works for their contributions.

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