A Custom Blockchain Approach for Identification of Fake Product in Supply Chain Management of E-Commerce Portals

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ABSTRACT

Fake products create a huge negative impact in the market for both buyers and sellers. The sellers fails to deliver the product as per the consumers expectations and the consumers starts to doubt the quality and standards of the company which ultimately results in the negative marketing of the brand whose fake products are being circulated in the market. The most critical part about counterfeit products is that it can be harmful for the consumers. Since, the fake or counterfeit products are not restricted to any particular sector in the market therefore it has become important for us to detect these products and find a way to keep them out of the market. These products can be dangerous if we consider very dominating sectors of market like pharmaceutical and food supplies. To tackle such problems, we need to maintain a data, which is easily accessible to consumers where they can verify the details about the products and build a level of trust regarding the product authenticity. As we all know that no product is safe from counterfeiting due to the continuous growth in counterfeit products in the supply chain. It is degrading company's name and their profit; it also affects the customer, for example if this counterfeiting is done in pharmaceutical field, then it will directly affect the customer's health. To counter this problem, the research work has been proposed but not perfected. In this proposed approach, we will be using Blockchain technology to find genuineness of the product. Blockchain technology is generally a ledger system, which holds all the data of the transactions that take place on it. The unique thing about this technology is that the ledger that we mentioned here is a distributed ledger across a peer-to-peer network. Also, we propose a system where we store product's detail and its ownership status on architecture provided by Ethereum. We will be using QR code, which will be scanned by customer such that he/she will be able to find out the details of the product as manufacturing details, current owner etc. and will be able to determine whether the product is fake or real.

Keywords: Fake products, QR code, Blockchain Technology, Ethereum, Distributed Ledger

I. INTRODUCTION

Blockchain is a decentralized and distributed ledger that contains the records of transaction and maintains it over a peer-to-peer network. The idea of Blockchain was first suggested by Satoshi Nakamoto in his whitepaper "Bitcoin: A Peer-to-Peer Electronic Cash System [2]" which came out in 2009 where he gave the concept of crypto currency or we can say a digital cash system. The Blockchain is termed as decentralized as there is no centralized authority or a central database that manages the Blockchain [5]. There is a peer-to-peer network where we have multiple nodes connected in a network such that the data is distributed over the network and there is no central server with all the information. Since the network is distributed and there is no single source for its operation therefore it becomes really difficult to hack or gain access of the Blockchain. As the name suggests, Blockchain is a chain of blocks. All the information that is available on the Blockchain is stored in the form of blocks. The blocks contain various information about the transaction records or the data, the hash of previous block in the Blockchain, timestamp, its own hash code and some other values like nonce. All these values together are secured cryptographically [3] through strong hashing algorithms like SHA-256 [4]. Since the data in block is secured through such hashing algorithms, even a minor change or attempt of data manipulation get detected very easily because even a small change in the data completely changes the hash value of that block and this leads to case of miss match values since the next blocks uses the hash value of previous blocks. This feature helps Blockchain to maintain immutability and makes it difficult to temper the data of the Blockchain. Whenever a user requests a transaction on Blockchain, the requested transaction is passed to the P2P network where it is broadcasted to the nodes on the network [16]. After this, the validators on the network validate the transaction and user status. This is done using some known algorithms.

The verified transaction can contain information of crypto currencies, contracts or other information. After successful verification the transaction is combined with other transaction records and a new block of data is formed. The new block is then added to the Blockchain and the copy of Blockchain for each node on the network is updated. C. Smart Contracts Smart contracts [6][7] are programs that are stored on Ethereum Blockchain which runs when the predetermined conditions are met [8]. These smart contracts basically replaces the involvement of third-party members or any intermediary from any kind of traditional contract works or agreements so that the outcome is instant and time loss is negligible. Also, the workflow is automated and hence the process gets simpler. When the actions made by smart contracts are completed, it updates the Blockchain with the transaction record [9]. Once the transactions are recorded on Blockchain, they cannot be changed. Since smart contracts are collection of programs which specified conditions, they can be used for various actions like making transactions, renting a house or issuing tickets, etc.

II. RELATED WORK

Ma et al. [27] proposed a fully anti-product forgery system to implement a Blockchain architecture provided by Ethereum to record product ownership on the Blockchain. By using this technology's transparency properties, and the guarantee that each record cannot be faked on the Blockchain, the end-users do not require to completely depend upon trusted third parties to carefully know the origin of the bought product.

Small and medium-sized organizations can make use of this anti-product forgery application that will bring down the fees which they need to pay to monitor the authenticity of the products and by this system the authors of this paper aim to solve the issue of brand anti-counterfeiting certification and providing the small salespersons an opportunity to validate the

source of each component of their product [24, 34]. Using the completely revealed smart contract details, anyone can simply verify the genuine source of the business and can even serve as proof for the end users' purchase of goods. For retailers, it is possible to prove whether they provide legitimate products by using this anti-counterfeit Blockchain system. So by using this approach the users of this system will be benefited in a manner as firstly, they will have to pay a low transaction fee, and secondly, they need not be concerned about acquiring a fake product

S. Uhlmann [39] explores the chances to lower down the fake products using the Blockchain technology and his thesis also shows that the counterfeiting of products cannot be brought down only by the use of technology but people do require to maximize their general awareness and they should start challenging the caught counterfeited products legally in court, and must be having an inviolable packaging of the products as well in order to assure of its safety. In this thesis, the issues and results of counterfeiting were acknowledged and different Blockchain technologies and deployment models are discussed and analyzed to achieve the goal of reduction in the counterfeited products in the market. The authors believe that alone Blockchain cannot bring down the fake products in the market but it can be useful when combined with some other trending technologies of today's world like using Internet of Things(IoT) devices where each transaction of a product is saved, and this can allow proper transparency along with data security.

The combination of the IoT and Blockchain technology might empower utilization on the ways to reduce counterfeits. we have observed in this paper that no such model is proposed which could effectively lower down the counterfeits, instead only ideas were provided as future work for the combination of Blockchain with IoT to prevent product counterfeiting.

Chang and Chen. [20] contribute to the understanding of the Blockchain applications in supply chain management and comes up with a plan for these applications from the viewpoint of the literature analysis. The reason for using the Systematic Literature Review(SLR) is to demonstrate a general summary of the recent research by performing a systematic analysis of the extent of literature. This study is an add-on to the understanding of Blockchain applications in the supply chain domain by finding different research topics and paths for future researches in a similar domain. The primary objective of this paper is to give a structured review of extant studies to get a clearer understanding of the applications of such technologies. The future works in Blockchain technology can include certain technical problems like scalability, the inter-working of the Blockchain, and also the security issues in Blockchain, and Song et al. [36] worked upon the improvement of the operations and the supply chain functions and this paper primarily focuses on the effect that Blockchain will make upon the supply chain to make advancements in the transparency, the detectability, and accessibility of the flow of products alongside the supply chain containing the manufacturers and end-users. This study has researched the present applications used in the industries to monitor and trace the supply chain operations in industries and it also talked about its future work for further industrial applications. The LoRaWAN based solution can be also applied in supply chain andsmart factory [25, 30, 40]. A good number of Information and Communication Technology(ICT) based Supply Chain traceability solutions are been implemented for the welfare of the industry as well as for the society, and also the supply chain detectability means an overall better environmental feasibility. This paper did not provide a fair amount of ideas or any adequate number of suggestions or any proposed solution model for their current work and did not contribute much even for future works but it was primarily based upon the improvement of the supply chain features using the Blockchain applications.

III.METHODOLOGY OF PROPOSED APPROACH

In proposed system, the web application is made for the vendor side where the vendor is going to fill in the details of the product to be delivered to the client. In the application, we deployed it on the Apache Tomcat server and implemented in J2EE using servlets and JSPs. The vendor will login into the web portal using the login credentials after which he is redirected to a page where the product to be dispatched, is registered for delivery. The QR code is generated using the third-party library named ZXing (Zebra Crossing). It is a popular API that allows us to process with QR code. With the help of the library, we can easily generate and read the QR code. Once the product is registered, we generate the QR code for that product which will be unique for that product. The QR code contains the hash value generated by using SHA-256 algorithm and the hash is generated using the unique credentials of the product to be delivered.

The data of the product to be delivered is then combined in the form of String and that data is stored as the Block in the Blockchain. The application makes use of XAMPP which has the ability to serve web pages on the World Wide Web and to provide support for creating and manipulating databases in SQL. The proposed system makes use of SQL server to create the database and to store the Login data into it. The Blockchain model is created using the Java's List data structure that provides the facility to maintain the ordered collection. It contains the index-based methods to insert, update, delete and search the elements. Each Block in Blockchain is consisting of the one product's data, the SHA-256 hash of the previous block and the hash of the current block. The hash of the previous block plays an important role in maintaining the validity of the Blockchain.

IV.WORKFLOW

When the delivery details of the product are filled and stored in Blockchain, at the same time the cryptographic hash of the details is generated and is manifested in the QR code which is generated and is shown on product in the form of label.

When the QR code is scanned with the QR code scanner of the smartphone, the request is sent to the server to cross verify the scanned hash with the hash stored in the Blockchain.

If the hash is found in the Blockchain, the product is considered as original otherwise fake. The Entire approach is divided into 3 modules:

- User Interface Design
- Database Design
- Creation of Custom Blockchain
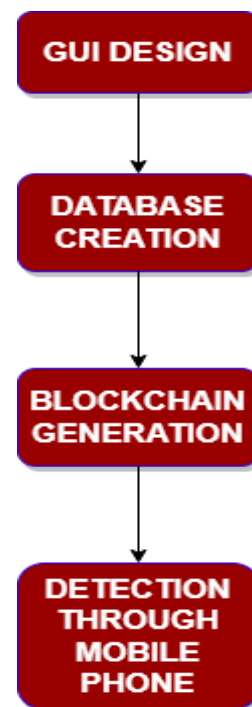- Detection of Result through smartphone
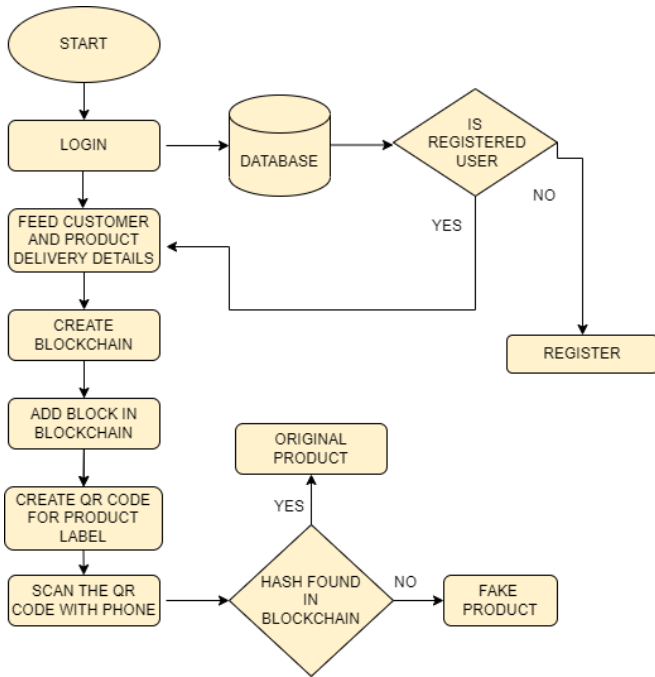

Figure .1 Modular Flow of the proposed approach
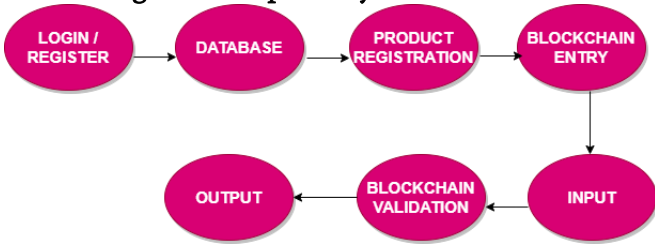
Figure .2 Proposed System Flowchart

Figure 3. Proposed System Data Flow Diagram

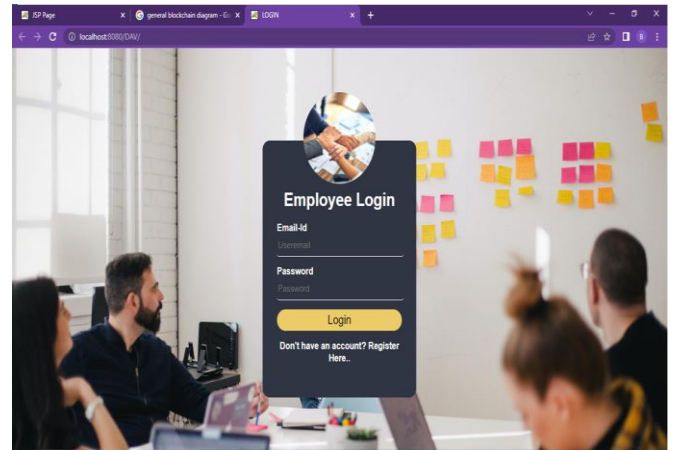## V. SYSTEM REQUIREMENTS

Hardware Requirements
- Hard Disk : 80 GB
- RAM : 4 GB
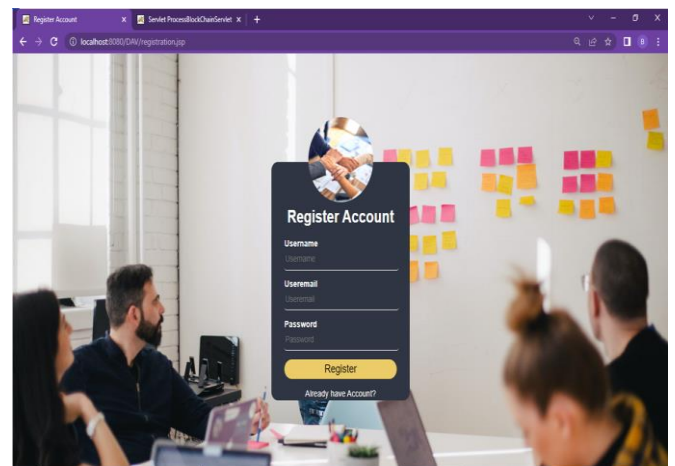- Processor : Intel Core i3 and above

Software Requirements
- Technology Used : J2EE
- Tools : JDK 1.8 or above, Netbeans 8.1
- Operating System: Windows 10 or above
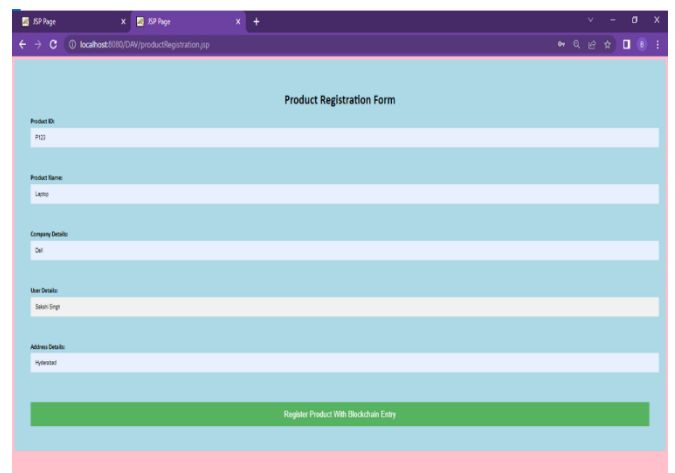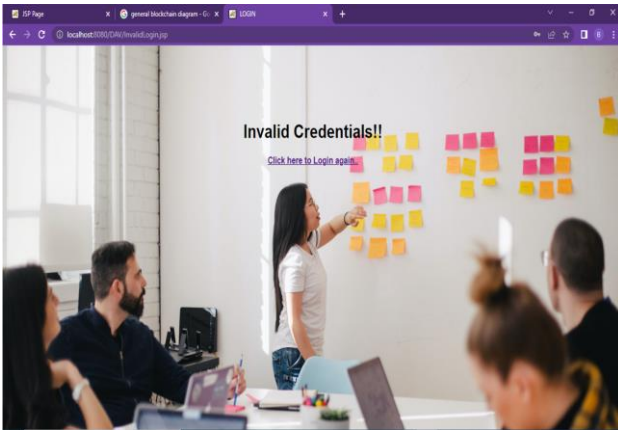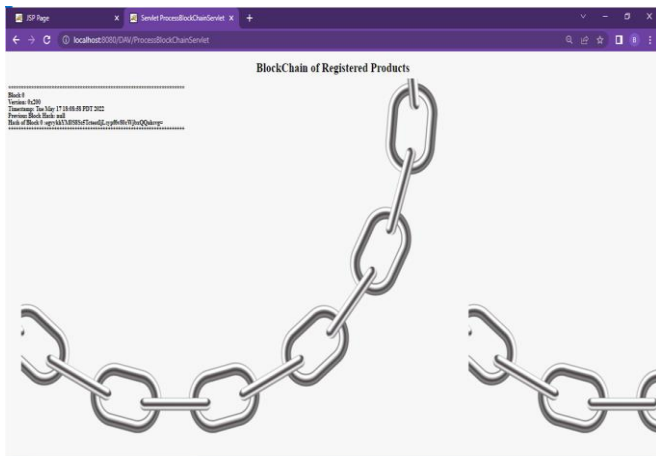
VI. SAMPLE SNAPSHOTS OF WORK

Screen 1: Login Form

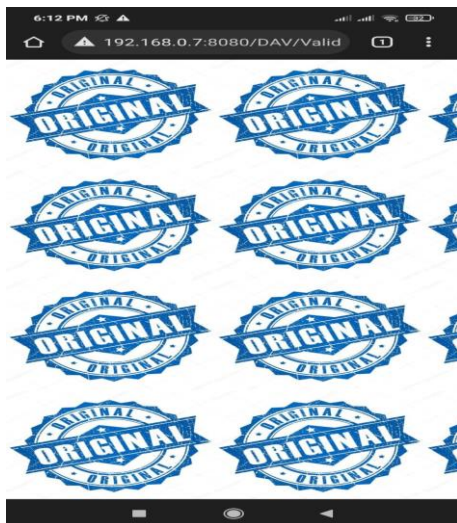
Screen 2: New User Registration Form

Screen 3: Product Registration Form

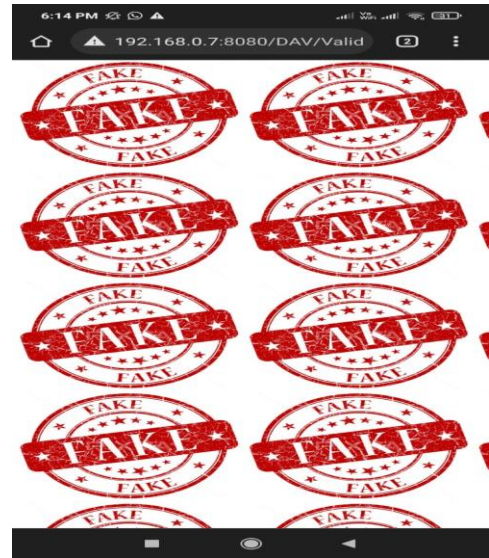**Screen 4: Invalid Credentials Page**

Screen 5: Blockchain of Registered Products

Screen 6: Server Response in Smartphone for Genuine Product

Screen 7: Server Response in Smartphone for Fake Product

VII. APPLICATIONS AND CONCLUSION

Applications

- The main motto of the proposed work is to avoid the delivery of the Fake products to the end users.

- This will not only maintain the faith of the customers on the manufacturer's product but also will worth their hard earned money.

- The proposed application can be used in all types of supply chains for all type of deliverable products.

- This will also helps the Nation's economy by the sincere payment of taxation which otherwise is avoided in case of fake products.

VII. Conclusion

Following important conclusions can be made from our results.

- The application is effective in the detection of fake products because all the delivery details are stored in the Blockchain which cannot be altered and for which the unique QR code is generated and pasted on the products.

- As the QR codes are being validated directly from the vendor's site and hence no scope of false positives is there and thus assurance of the receipt of original products is achieved.

- Ethereum or Hyperledger Fabric Blockchain platforms are avoided here because of limited number of nodes participation and to reduce load on server.

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