TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Kathmandu Engineering College

Department of Computer Engineering

Major Project Final Report

On

A BLOCKCHAIN BASED ANTI-FAKE PRODUCT SYSTEM

[Code No: CT755]

By:

Aakash Pandey - 39351

Kapur Mahatara - 39383

Lokesh Pandit - 39386

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Kathmandu, Nepal

April 2023

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INSTITUTE OF ENGINEERING

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A BLOCKCHAIN BASED ANTI-FAKE PRODUCT SYSTEM

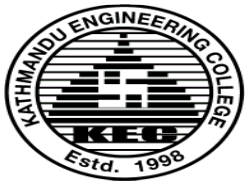
[Code No: CT 755]

PROJECT REPORT SUBMITTED TO

THE DEPARTMENT OF COMPUTER ENGINEERING

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE

BACHELOR OF ENGINEERING



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CERTIFICATE

The undersigned certify that they have read and recommended to the Department of Computer Engineering, a major project work entitled "A Blockchain Based Anti-Fake Product System" submitted by Aakash Pandey-39351, Kapur Mahatara-39383, and Lokesh Pandit-39386 and Mandipa Thapa-39387 in partial fulfillment of the requirements for the degree of Bachelor of Engineering.

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We are also thankful to all our friends and seniors for the assistance they provided during this report. We hope all their help and support can result in a project that all of us can be proud of and can inherit many new skills in the field of programming. Finally, we would like to express our sincere gratitude towards everyone who helped us directly or indirectly to finalize this report.

ABSTRACT

Product faking is something which is quite common nowadays and it's almost impossible to detect a counterfeit product just by looking at it. Fake products 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 fake products. In recent years, Blockchain has received increasing attention and numerous applications have emerged from this technology. Any application using Blockchain technology as the base architecture ensures that the contents of its data are tamper-proof. This project uses the decentralized Blockchain technology approach to ensure that consumers do not fully rely on the merchants to determine if products are genuine. This project describes a decentralized Blockchain system with products anti-fake, in that way manufacturers can use this system to provide genuine products without having to manage direct-operated stores, which can significantly reduce the cost of product quality assurance.

Keywords—*Blockchain, Fake Product, Decentralize, Ethereum.*

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LIST OF ABBREVIATIONS

AI: Artificial Intelligence

CSS: Cascading Style Sheet

EVM: Ethereum Virtual Machine

HTML: Hypertext Markup Language

JS: JavaScript

RFID: Radio Frequency Identification

CHAPTER 1. INTRODUCTION

1.1. BACKGROUND THEORY

Fake products create a huge negative impact on the market for both buyers and sellers. Retailers are failing to deliver the product as expected by the consumer and consumers are beginning to question the quality and standards of the company leading to poor marketing of a product whose counterfeit/fake products are being distributed in the market. The most important part about fake products is that they can be dangerous for consumers. As such, counterfeit or fake products are not limited to any field of the market, so it is especially important for us to identify these products and find a way to keep them out of the market. These products can be dangerous when we consider the dominant market sectors such as medicines and food. To address such issues, we need to keep data accessible to consumers where they can verify information about products and build a level of trust about product authenticity. As we all know, no product is safe from counterfeiting due to the continued growth of fake products in the supply chain. It tarnishes the company's reputation and profitability, and affects the consumer; for example, if these frauds are committed in the medical field, then it will directly affect the client's health. To address this problem, research work has been suggested but has not yet completed. In this project, we will be using block chain technology to determine product integrity.

Blockchain technology is usually a ledger program that stores all transaction data in which it occurs. The unique thing about this technology is that the textbook we are talking about here is a book that is distributed across a peer-to-peer network. The most successful mitigation measures for overcoming misleading counterfeit risk in global supply chains include network transparency, cost control and pre-supply evaluation approaches, and supplier relationship management. The purpose of this project is therefore to launch an anti-counterfeiting system using Blockchain technology and to provide the end user with the provider's power to track a product supply chain in a secure environment. In an overview of the proposed system, it is aimed to solve the problem of brand counterfeiting and provide the chance to the customer, vendors, and suppliers to check the integrity of the product. In this project, we propose a system where we store product information and ownership status in the facility provided by Ethereum and use a smart contract to update the product owner when the product is sold. We will be using unique product details

that will help the customer find product details such as production details, current owner etc., and customers will be able to see and buy genuine products only.

1.2. PROBLEM STATEMENT

The situational problems that exist with the conventional way of fake product detection system are:

1.2.1. Decreasing Trust on Online-Shopping

Despite the considerable work on anti-fake systems, forging and duplication frequently accompany the global enhancement of a product or innovation, mostly on online platforms. Hence, online shopping isn't at the stake of decreasing, but many must think twice before adding some products to his/her cart.

1.2.2. Decreasing Market of Genuine Companies

The reputation of the company and the well-being of the customer is forging's a result affecting both; product makers are facing severe hardships. Hence, many unauthentic companies are using the fake products in the name of genuine companies and hence decreasing the market of those reputed companies, at least to some scale.

1.2.3. Forging in Medical Section

Counterfeit products range from high-end medical needs to business-to-business products such as machines, chemicals, to common consumer products such as pharmaceuticals. In fact, any IP-protected product can be counterfeited. Some counterfeit products, such as pharmaceuticals, are of low quality, and thus create significant health and safety threats.

1.3. OBJECTIVES

The increment in the fake products brought the idea for this project. The objectives of our project are:

1. To design Anti-Fake Product System using Blockchain.
2. To accept and store only the genuine product details in the blockchain database.

1.4. SCOPE AND APPLICATIONS

Using this website, one can identify the real product and companies can easily reach new customers. It promotes economic growth of businesses. It gives the customer an easy and instant way of checking the authenticity of any product of their interest just by using our website. Customers don't need to bother about wasting their time on fake products, as our system only shows real products. So, our system can be used:

1. To provide security service to the clients by offering data to client.
2. To help the end-user or customers to cross-check and identify the genuineness of the product by using the webpage.
3. To maintain all transaction records of the product in a decentralized manner.
4. Since, Blockchain is a secure technology, which means that any block cannot be tampered with or hacked. By leveraging this technology, customers or users don't need to depend on third-party users to check the authenticity of their products.
5. It brings trust and reduces fake products for consumers which creates anti-fake environment right from supply to demand.

CHAPTER 2. LITERATURE REVIEW

2.1. A Survey of Counterfeit Product Detection by Prabhu Shankar, R. Jayavadivel.

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 [3].

2.2. Smart Tags for Brand protection and anti-counterfeiting in the wine industry by Steven, Marko.

This paper describes a brand protection and anti-counterfeiting 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 [2].

2.3. A Blockchain-based Supply Chain Quality Management Framework by Si Chen, Rui Shi.

This paper proposes 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 [1].

2.4. AI Based Fake Product Detection System

The paper entitled ‘IMPROVING FAKE PRODUCT DETECTION USING AI- BASED TECHNOLOGY’ describes how an Ai based system can be used to reduce fake products where we do not require any special device to verify the authenticity of the product. Machine learning uses the data set and training data provided to generate the outcome whether the product is

genuine or not. It analyses the logos, or the information captured by the end user through their device and verifies it with the data available. After detection the server returns the result to end user to make further decision [4].

2.5. RFID Anti-Counterfeiting

The paper entitled 'RFID Anti-Counterfeiting for Retailing Systems' describes how we can use RFID counterfeit system. In this system the author proposes a system consisting of two protocols. The first one is tag authentication protocol which allows users to authenticate the product without revealing their valuable information and the other one is data correction protocol which ensures the correctness of the tag status [5].

2.6. Blockchain against Data Tampering

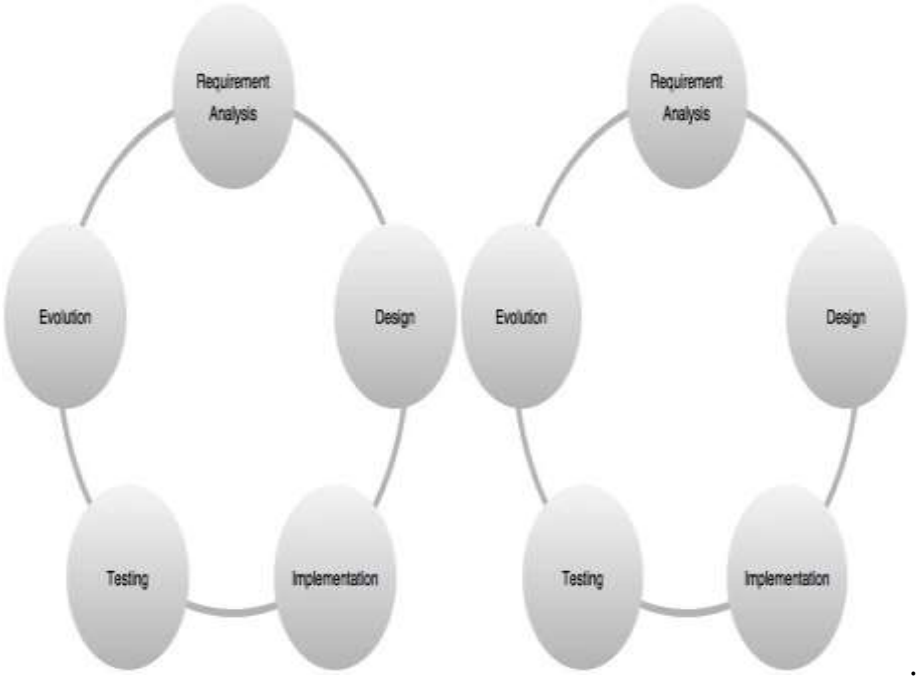
In blockchain, we store the hashes of files - metadata and its hash, the transactions between users, who the data belongs to, who is storing the data, which other parties are involved during the replication and storage process and access control data. Encryptions with Asymmetric keys paired and shared secrets; we will implement a layer of security and restriction. Using such an approach, one can be sure that one's data is safe and not accessible and readable by undesirable parties [6].

CHAPTER 3. METHODOLOGY

3.1. PROCESS MODEL

3.1.1. AGILE SOFTWARE DEVELOPMENT

Making huge and dynamic system using traditional approach such as waterfall model of software development cost more time and workforce. Therefore, to meet the requirements of the system with more flexibility and timely deliveries, we have chosen Scrum methodology under the Agile Development method.



...Iteration NO. N

Figure 3.1.1.Agile Methodology Process Model

Agile software development is an umbrella term for a set of frameworks and practices based on the values and principles expressed in the Manifesto for Agile Software Development and the 12 Principles behind it. According to the agile principles enunciated in the agile manifesto,

motivated and empowered software developers –relying on technical excellence and simple designs –create business value by delivering working software to users at regular short intervals. These principles have spawned several practices that are believed to deliver greater value to customers. At the core of these practices is the idea of self-organizing teams whose members are not only collocated but also work at a pace that sustains their creativity and productivity. The principles encourage practices that accommodate changes in requirements at any stage of the development process. Furthermore, end users are actively involved in the development process, facilitating feedback and reflection that can lead to more satisfying outcomes.

The agile software development model is being used as this development model ensures and promotes teamwork, collaboration, and progress adaptability with the combined iterative increments. The problem with the current financial system was analyzed. In the first phase, the deposit flow of tokens will be implemented. Then after thorough testing, borrow, redeem, and repay flow will be subsequently added followed by testing of each part. These will be followed by liquidation and yield farming rewards. The discussion, case study, coding, testing, and review will be conducted for every feature in an iterative manner without any farsighted plans in order to focus on every small aspect before the deployment.

3.2. SYSTEM BLOCK DIAGRAM

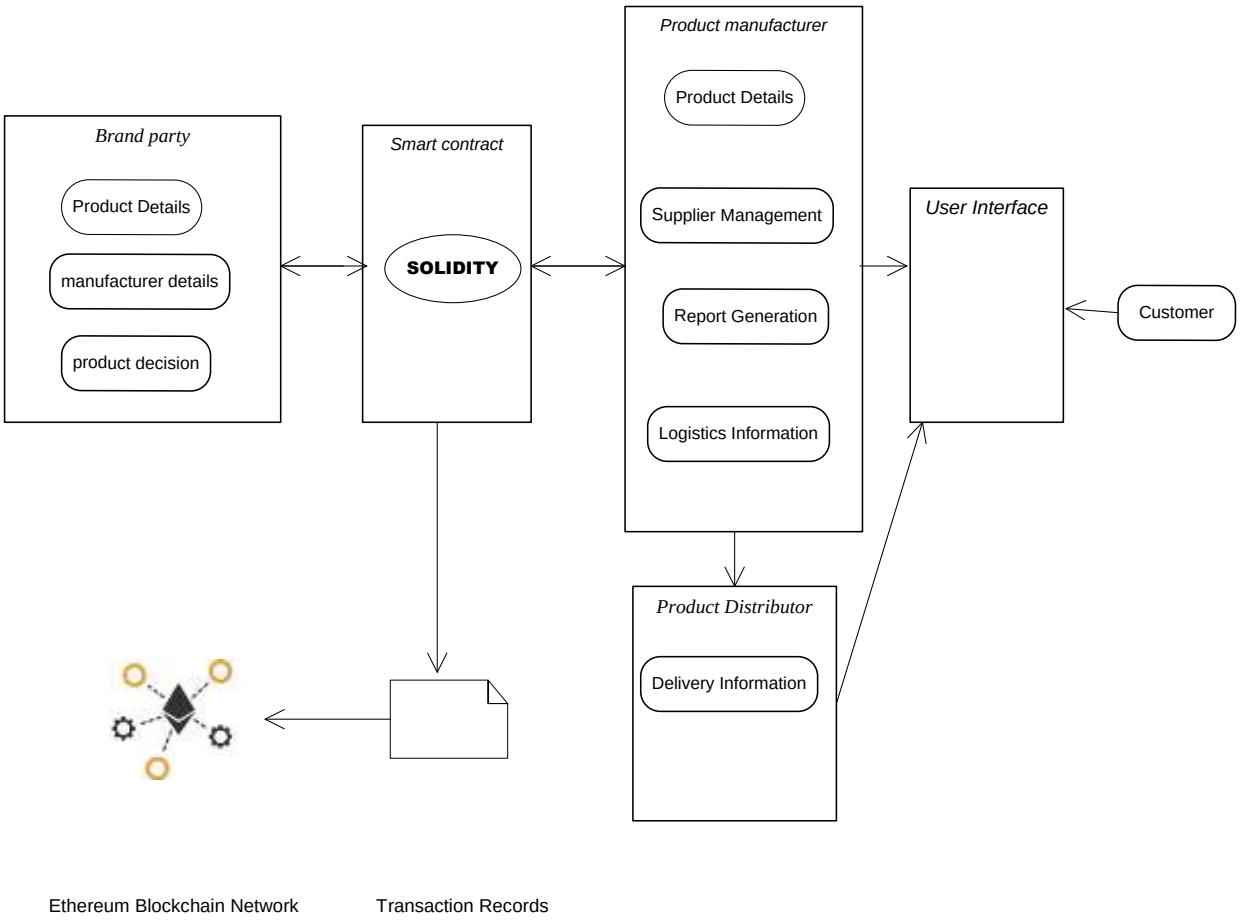


Figure 3.2. System Block Diagram

This is the overall architecture of our proposed system. It is composed of four parts: The Brand Party Roles, Product Manufacturer Roles, and Product Delivery Roles and The Customer roles. -

Brand Party (BP) Role: The Brand Party is responsible for the design of the new product, reviewing whether the product manufacturer has produced a product that meets the standards, and controlling the eligibility of the product to be marketed. BP can accept or reject the design of the product forwarded by the product manufacturer.

Product Manufacturer (PM) Role: The manufacturer will receive the transactions made in the smart contract by the Brand Party. The manufacturer will get the features to add/modify product details. The smart contract will be separate for each supplier and all the transactions made by the manufacturer will directly update the smart contract. There is a two-way communication between the Brand Party and Product Manufacturer.

Product Distributor (PD) Role: The Product Distributor receives the product approved by the Brand Party and is unknown about the products rejected by Brand Party. The role of Product Distributor is to deliver the products to the customers.

Consumer (CO) Role: In the customer's part, the consumer proceeds to the UI to see only the valid, original, and anti-fake products. The customer can see whether the seller's stock hasn't been yet sold out. The consumers can obtain individual purchase records and product status in their product. The customer can order the product and product status.

3.3. ACTIVITY DIAGRAM

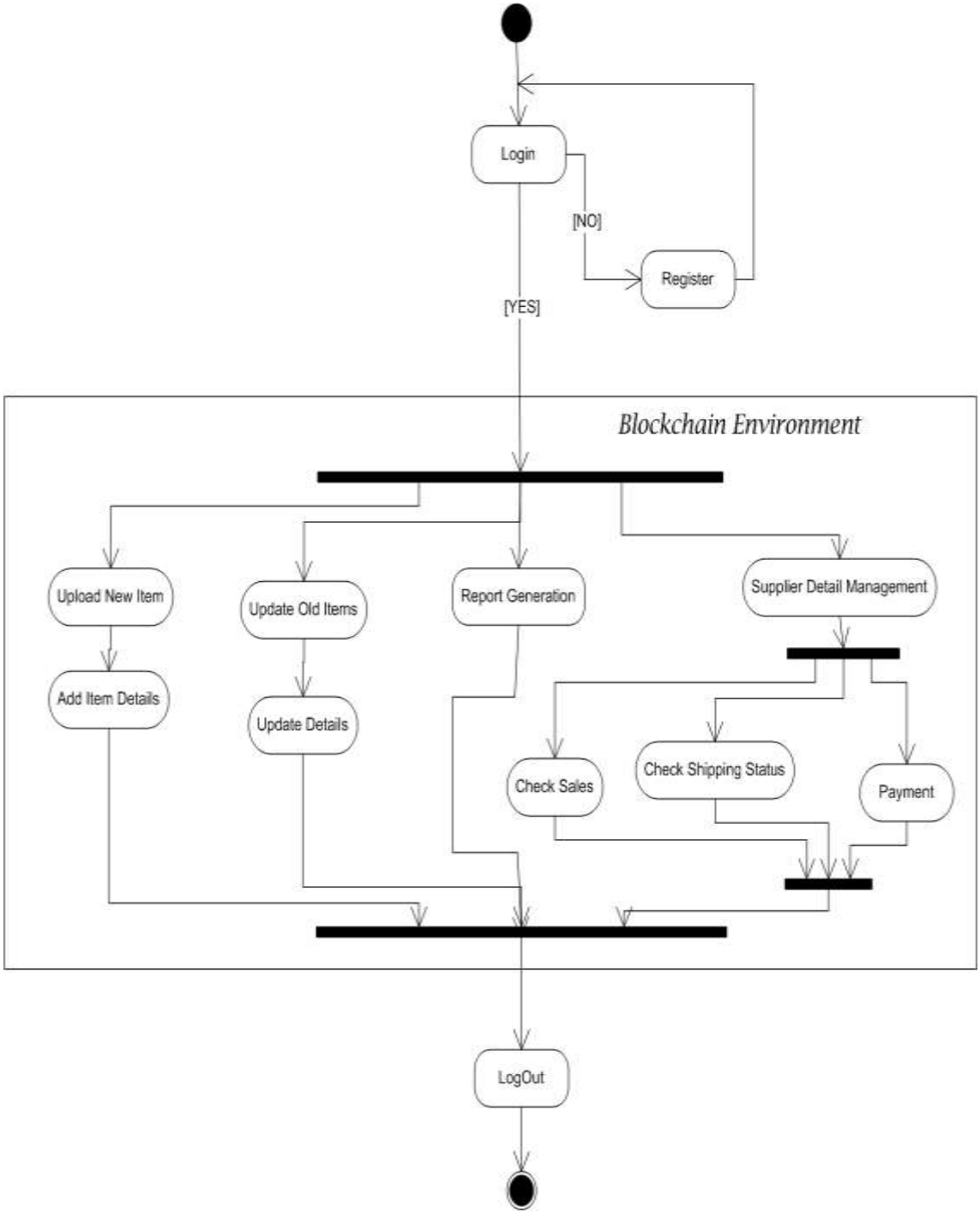


Figure 3.3.1.Product Manufacturer Flow

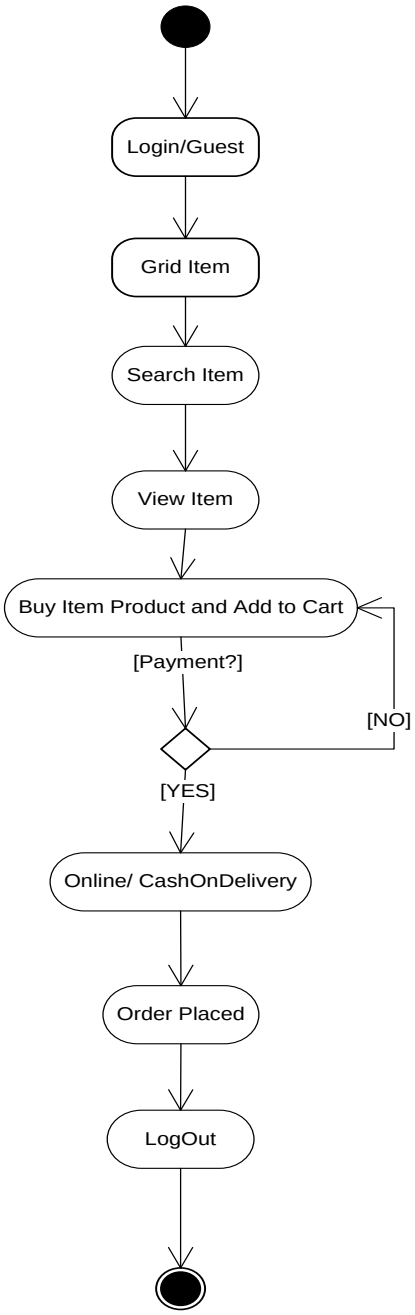


Figure 3.3.2. Customer Flow

3.4. DATA FLOW DIAGRAM (DFD)

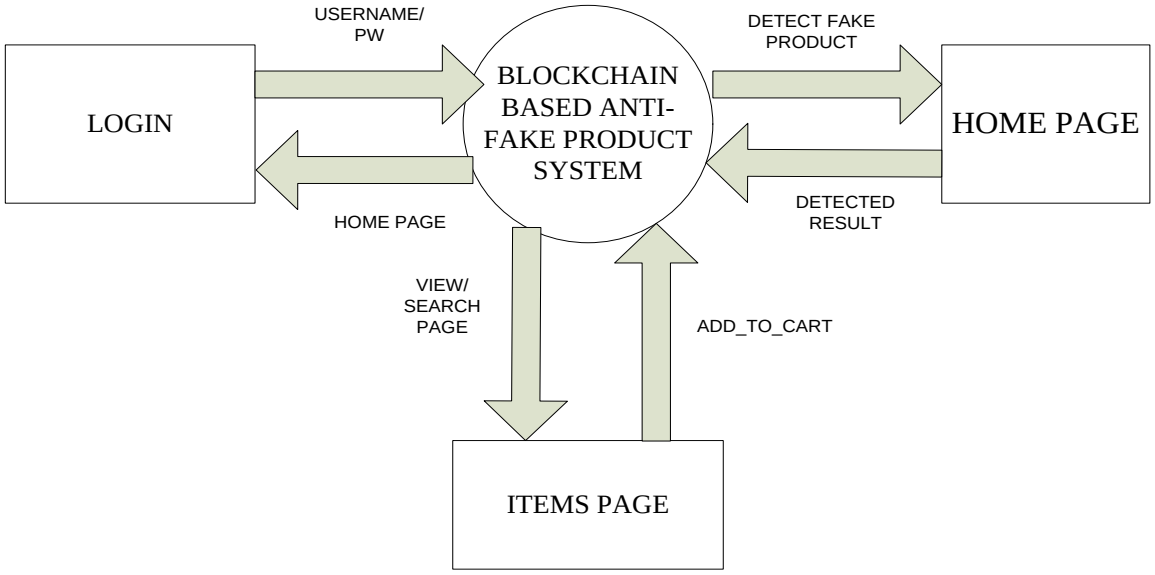


Figure 3.4.1. DFD Level 0

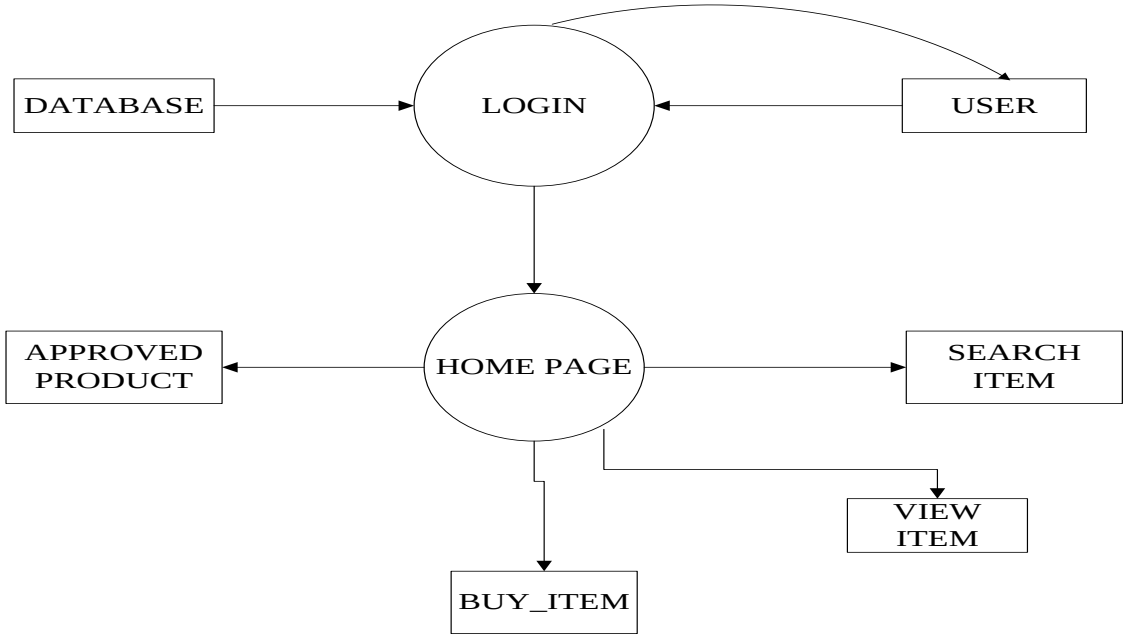


Figure 3.4.2. DFD Level 1

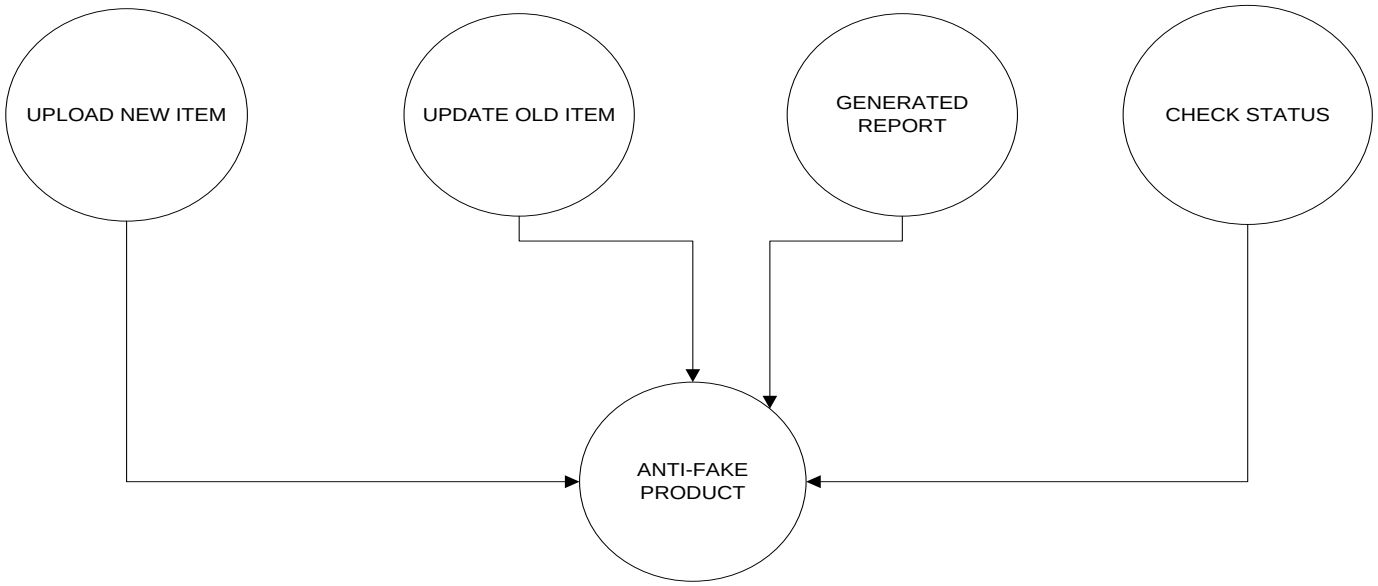


Figure 3.4.3. DFD Level 2

3.5 USE CASE DIAGRAM (UML)

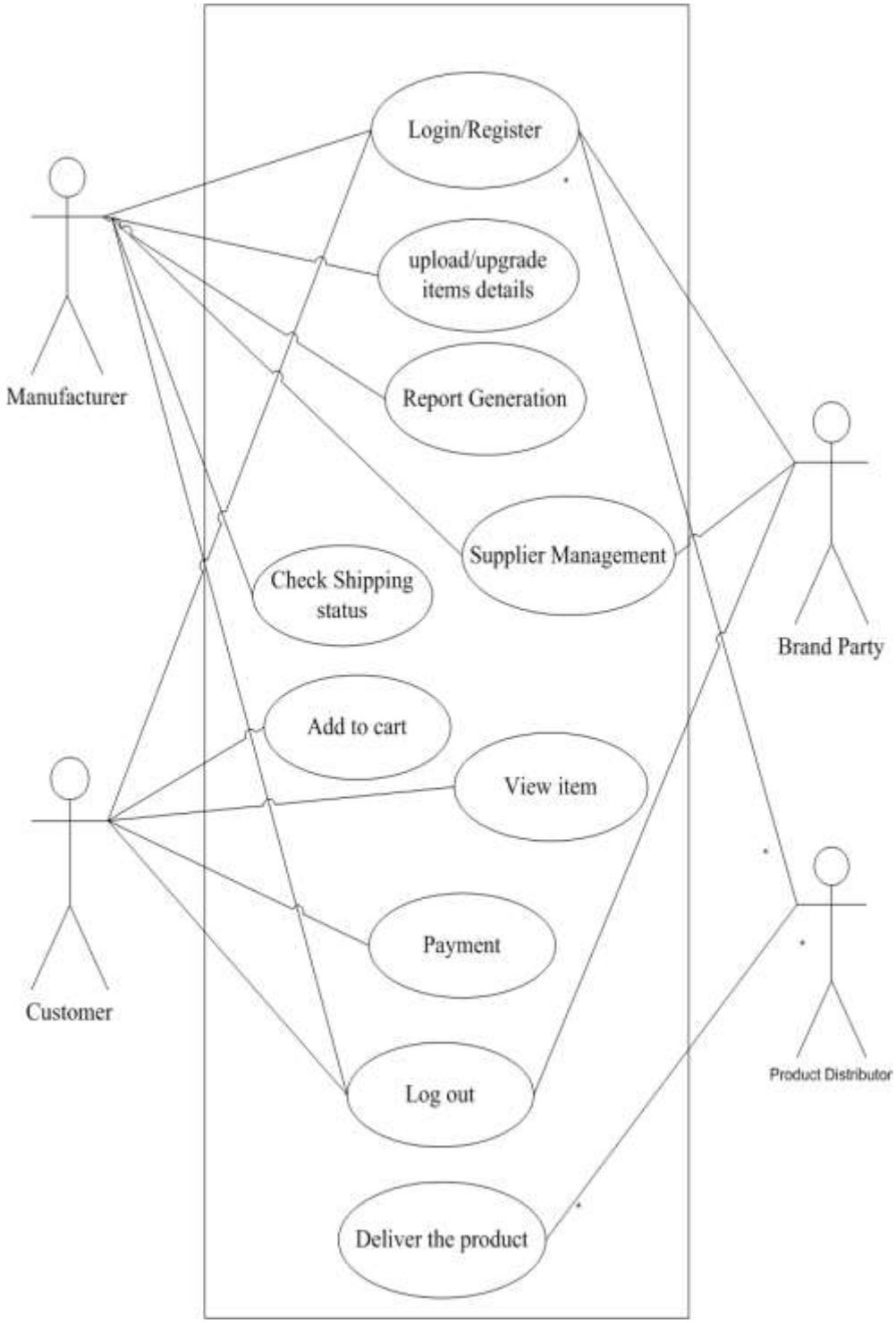


Figure 3.5. Use Case Diagram

3.6. SEQUENCE DIAGRAM

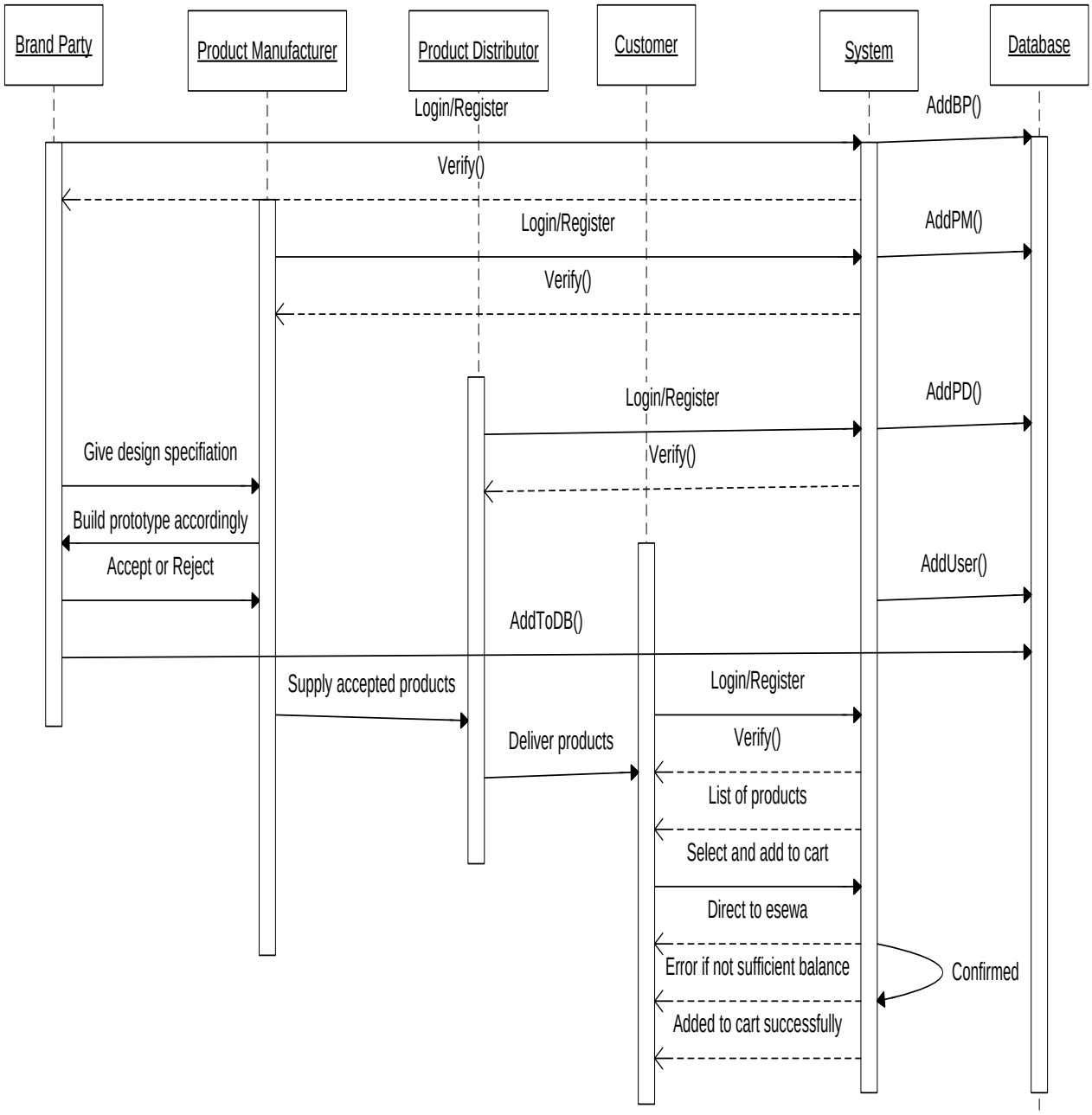


Figure 3.6. Sequence Diagram

3.7. TOOLS USED

1. **Solidity EVM**: Solidity is a programming language used to write smart contracts for the Ethereum blockchain. The Ethereum Virtual Machine (EVM) is a virtual machine that executes these smart contracts on the Ethereum network. We used Ethereum as the back end Blockchain operating system and used its proprietary programming language Solidity as the high-level programming language for writing smart contracts.
2. **MetaMask Wallet:** MetaMask acts as a bridge between users and the Ethereum network, enabling users to interact with decentralized applications (dApps) and websites that are built on the Ethereum blockchain. With MetaMask, users can access Ethereum-based dApps and perform transactions without the need to run a full Ethereum node. MetaMask Wallet was installed on a browser which would interact with ethereum blockchain, to allow accessing ethereum wallet through a browser. Accounts from ganache was imported into the metamask.
3. **Ganache**: Ganache is a personal blockchain for Ethereum development that allows developers to test their smart contracts and decentralized applications (dApps) in a local environment. It is a part of the Truffle Suite, which is a set of tools and frameworks for Ethereum development. We used it for some test ethers.
4. **NodeJS and web3.js**: NodeJS is a popular server-side JavaScript runtime environment, while web3.js is a JavaScript library used to interact with Ethereum blockchain nodes. NodeJS is commonly used in the development of backend systems for web applications. By using web3.js with NodeJS, developers can create server-side applications that interact with the Ethereum network. This is useful for building decentralized applications that require server-side functionality, such as managing user accounts or handling complex business logic.

   Web3.js provides a way to interact with an Ethereum node using JavaScript, allowing developers to create decentralized applications (dApps) on the Ethereum network. It provides a set of APIs for developers to interact with the Ethereum network, such as sending transactions, querying data from smart contracts, and subscribing to events.Web3.js is available as a npm package, which can be installed in a NodeJS project using the npm package manager.

5. **HTML and CSS**: The frontend of our web app was implemented using standard HTML and CSS script.
6. **ReactJS**: ReactJS, commonly referred to as React, is a JavaScript library used for building user interfaces (UIs) for web applications. React allows developers to build complex UIs using a component-based architecture, where each component is a modular piece of the UI that can be re-used and composed to create larger, more complex components. We used ReactJS as a scripting language because of its ability to create dynamic and interactive UIs with minimal code.
7. **MongoDB**: MongoDB stores data in flexible, schema-less JSON-like documents called BSON (Binary JSON) documents. This allows developers to store and manage data in a more natural and flexible way, without the need to define a fixed schema upfront. MongoDB database was used for storing brand party, product manufacturer, product distributor and customer details.

CHAPTER 4. EPILOGUE

4.1. RESULTS AND CONCLUSION:

Hence, we created a blockchain-based Anti-Fake product system to address the challenges of product verification and supply chain management. The system is composed of four roles that work together to ensure the authenticity of products and improve supply chain efficiency. Overall, the designed system aimed to provide a secure and efficient way of managing the supply chain while ensuring product authenticity. The use of blockchain technology provides an immutable and transparent record of the product's journey from the manufacturer to the end consumer. By providing greater transparency and trust in the supply chain, the system has the potential to reduce fraud, increase consumer confidence, and improve overall supply chain efficiency.

To combat the proliferation of counterfeit products, protect the rights of consumers, and maintain the huge consumer market for products, we built a blockchain based Anti-Fake system for traceable products.

4.2. FUTURE ENHANCEMENT:

- AI and machine learning algorithms could be used to analyze data on the blockchain and identify patterns that may indicate counterfeit products. This could include analyzing product characteristics, transaction data, and other factors to detect anomalies that may indicate counterfeit activity.
- Collaboration with government agencies to ensure compliance with regulations and prevent counterfeit products from entering the market.

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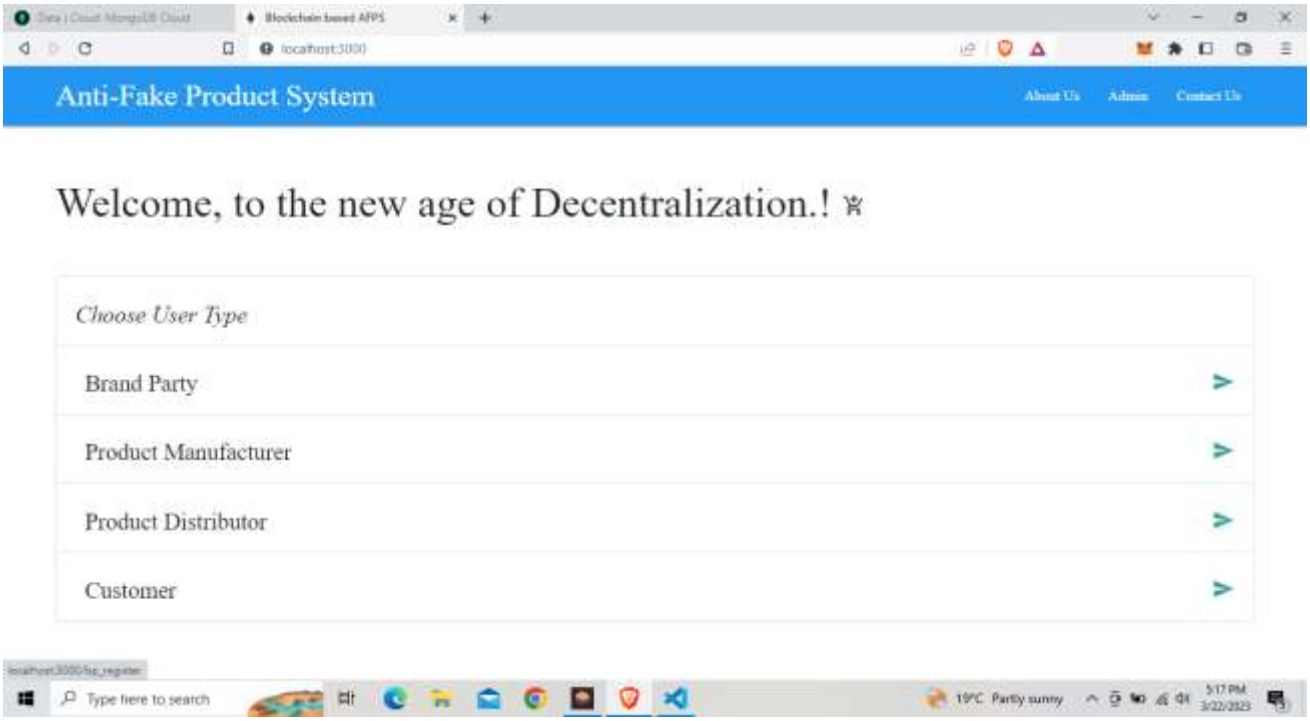
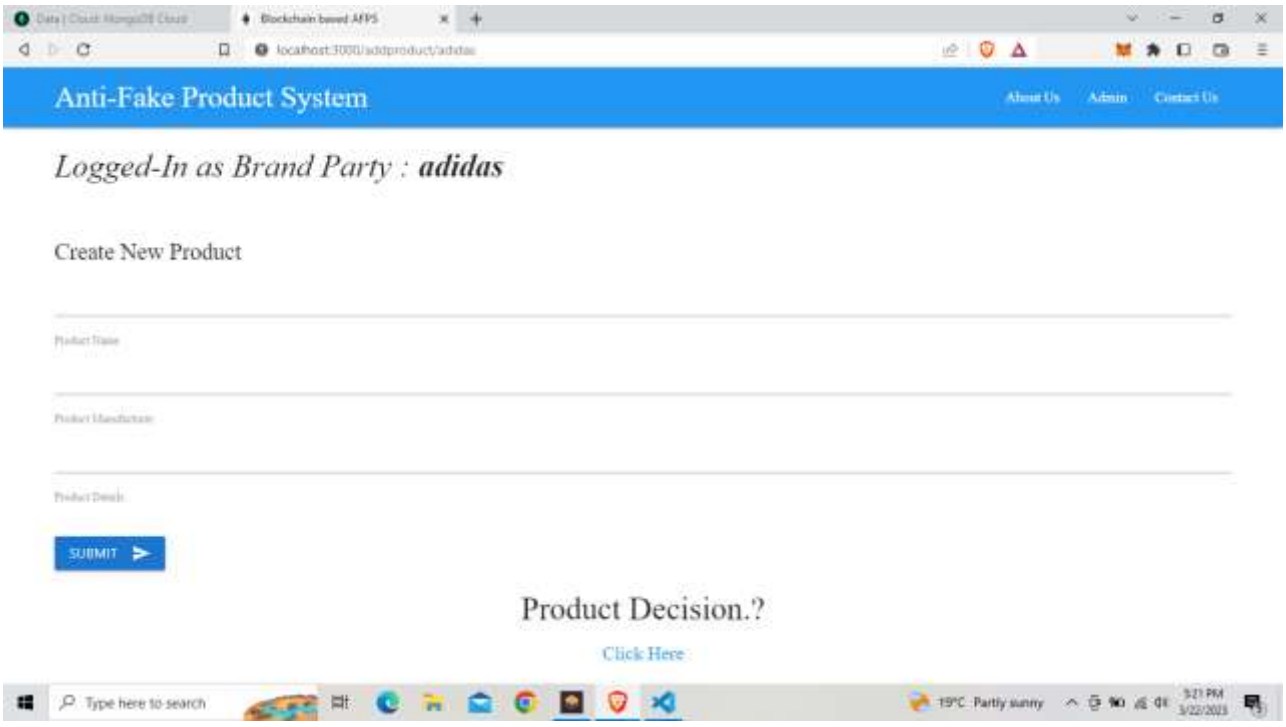
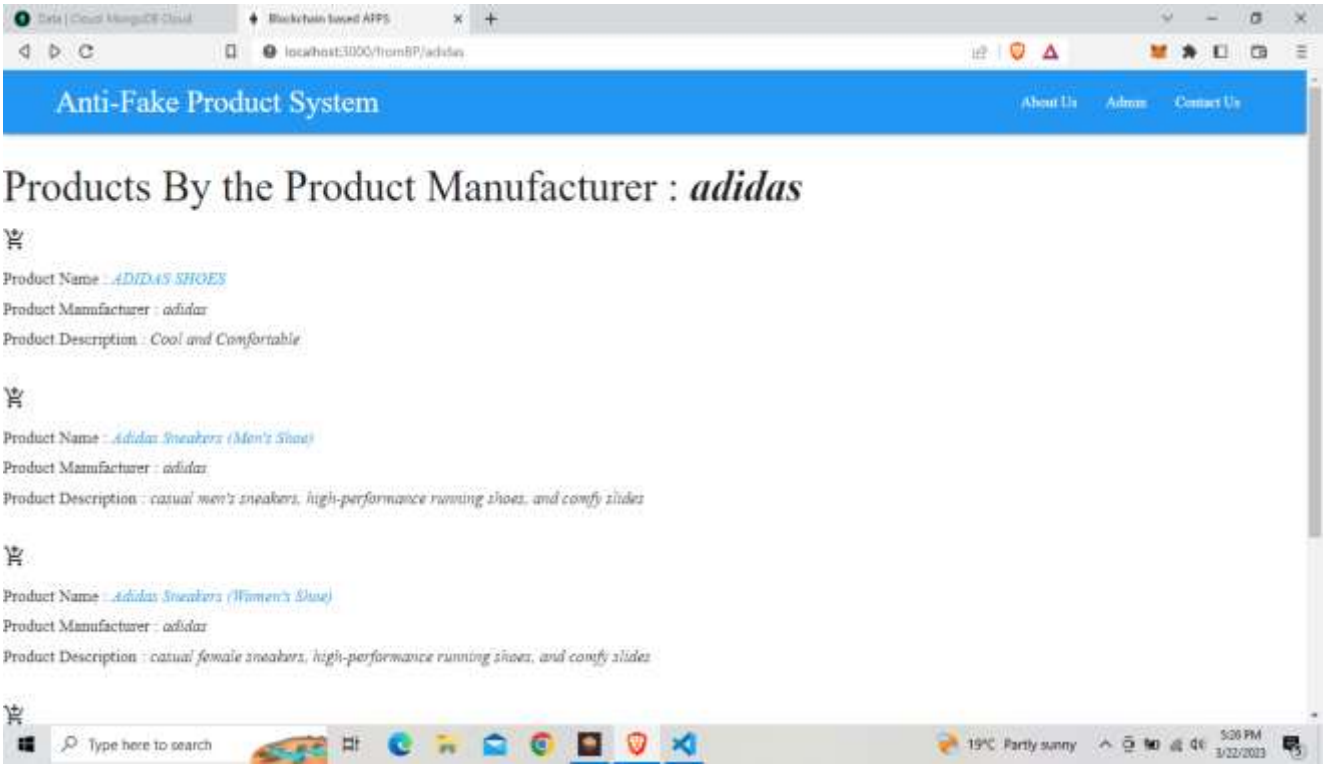
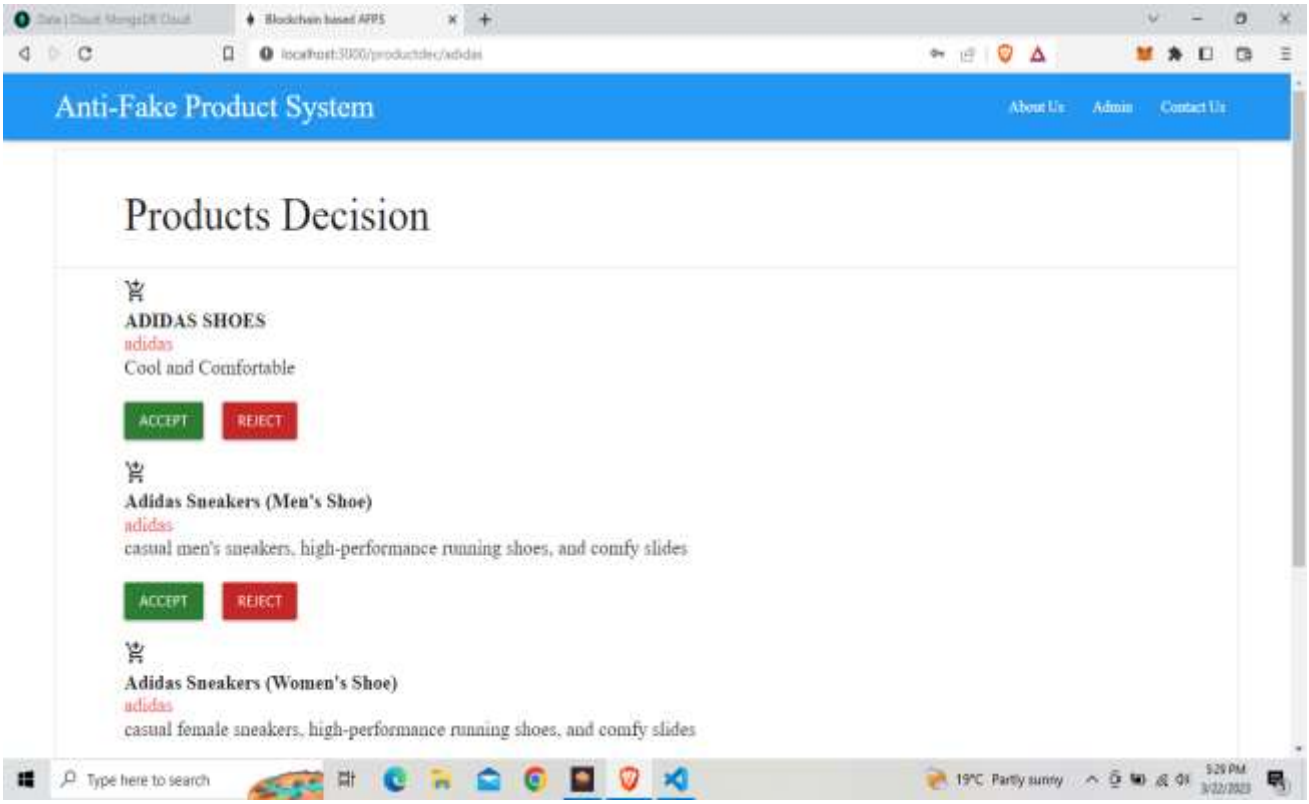
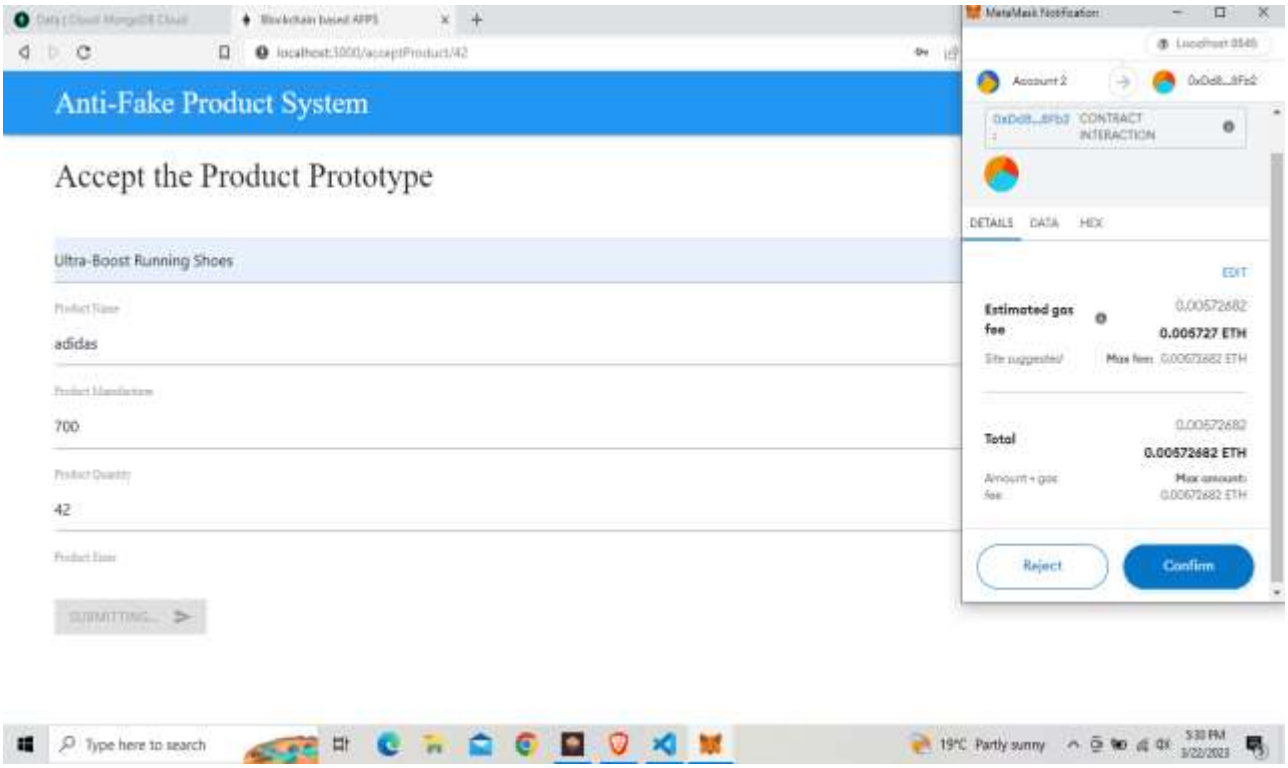
SCREENSHOT

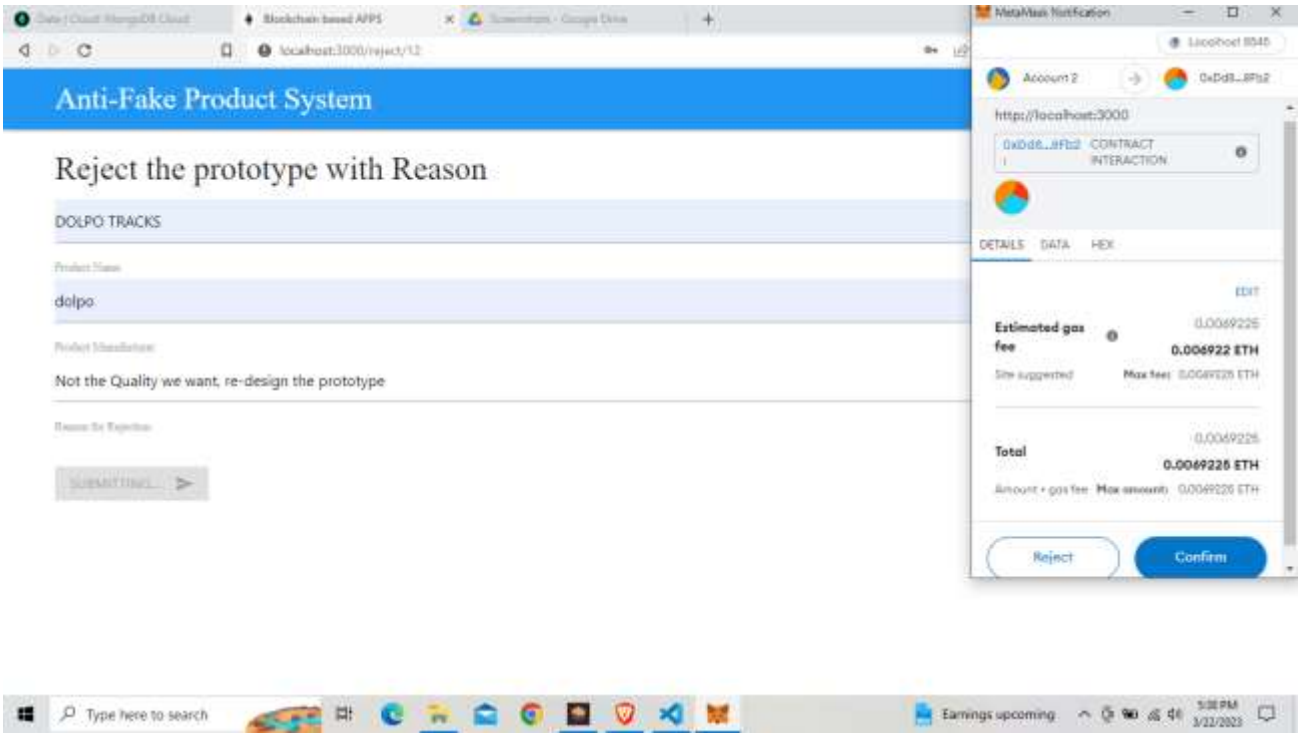

Anti-Fake Product System
About Us
Admin
Contact Us
Welcome, to the new age of Decentralization.!
Choose User Type
Brand Party
Product Manufacturer
Product Distributor
Customer

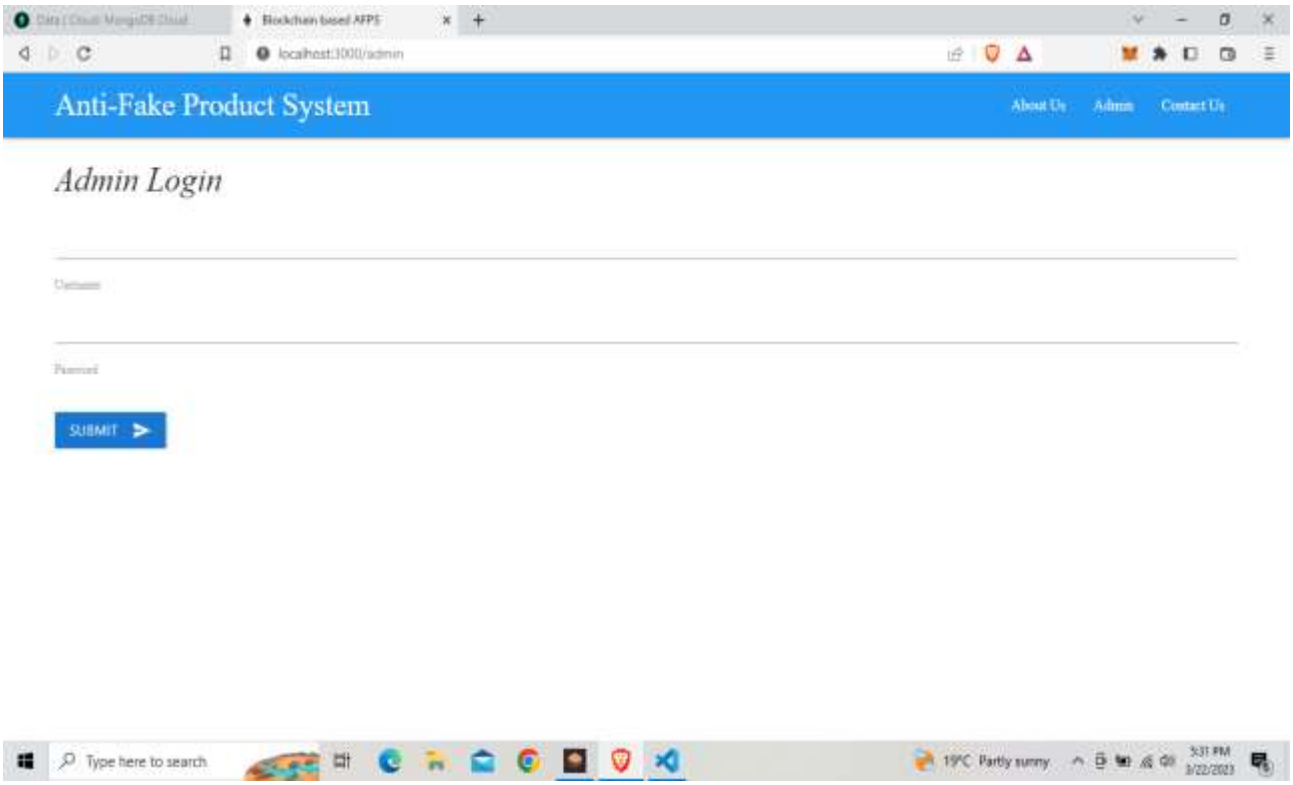

Anti-Fake Product System
About Us
Admin
Contact Us
Logged-In as Brand Party : adidas
Create New Product
SUBMIT
Product Decision.?
Click Here

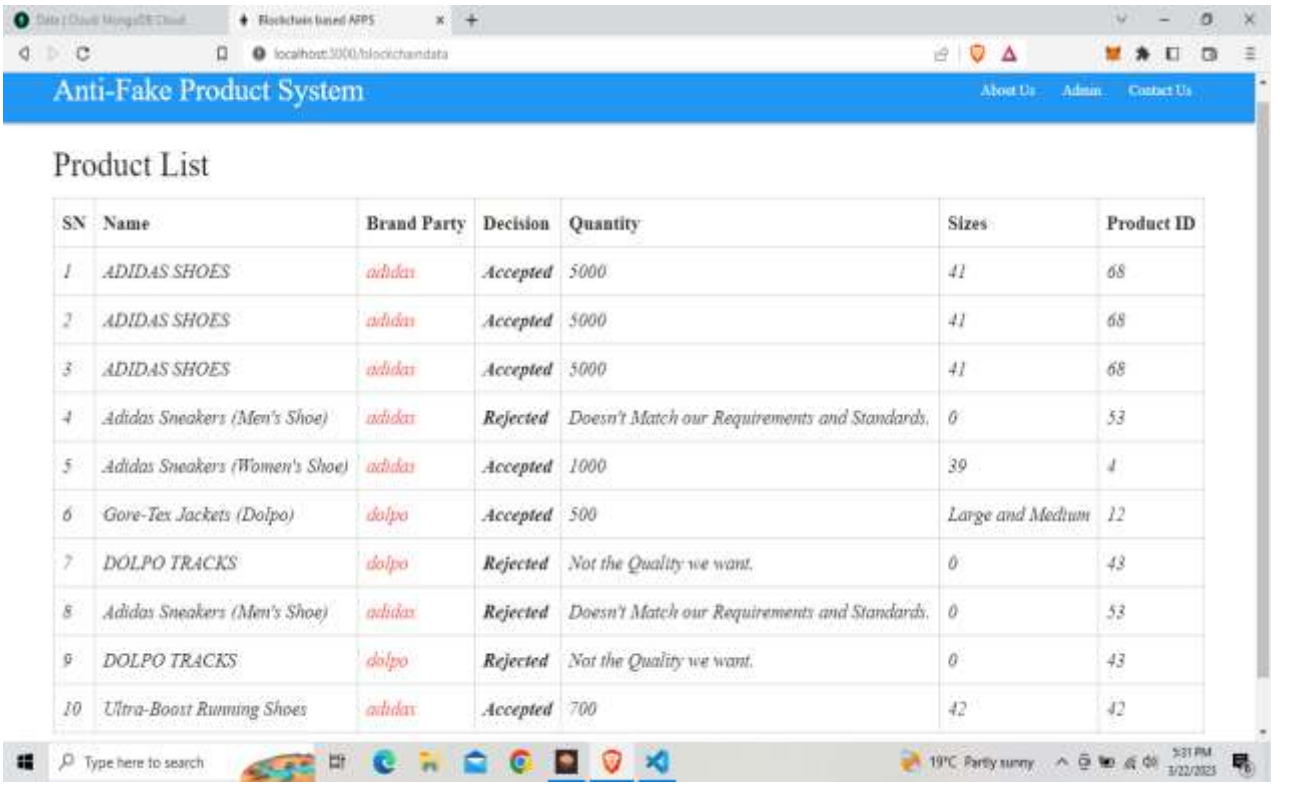

Anti-Fake Product System
About Us
Admin
Contact Us
Products By the Product Manufacturer : adidas
Product Name : ADIDAS SHOES
Product Manufacturer : adidas
Product Description : Cool and Comfortable
Product Name : Adidas Sneakers (Men's Shoe)
Product Manufacturer : adidas
Product Description : casual men's sneakers, high-performance running shoes, and comfy slides
Product Name : Adidas Sneakers (Women's Shoe)
Product Manufacturer : adidas
Product Description : casual female sneakers, high-performance running shoes, and comfy slides


Anti-Fake Product System
About Us
Admin
Contact Us
Products Decision
ADIDAS SHOES
adidas
Cool and Comfortable
ACCEPT
REJECT
Adidas Sneakers (Men's Shoe)
adidas
casual men's sneakers, high-performance running shoes, and comfy slides
ACCEPT
REJECT
Adidas Sneakers (Women's Shoe)
adidas
casual female sneakers, high-performance running shoes, and comfy slides

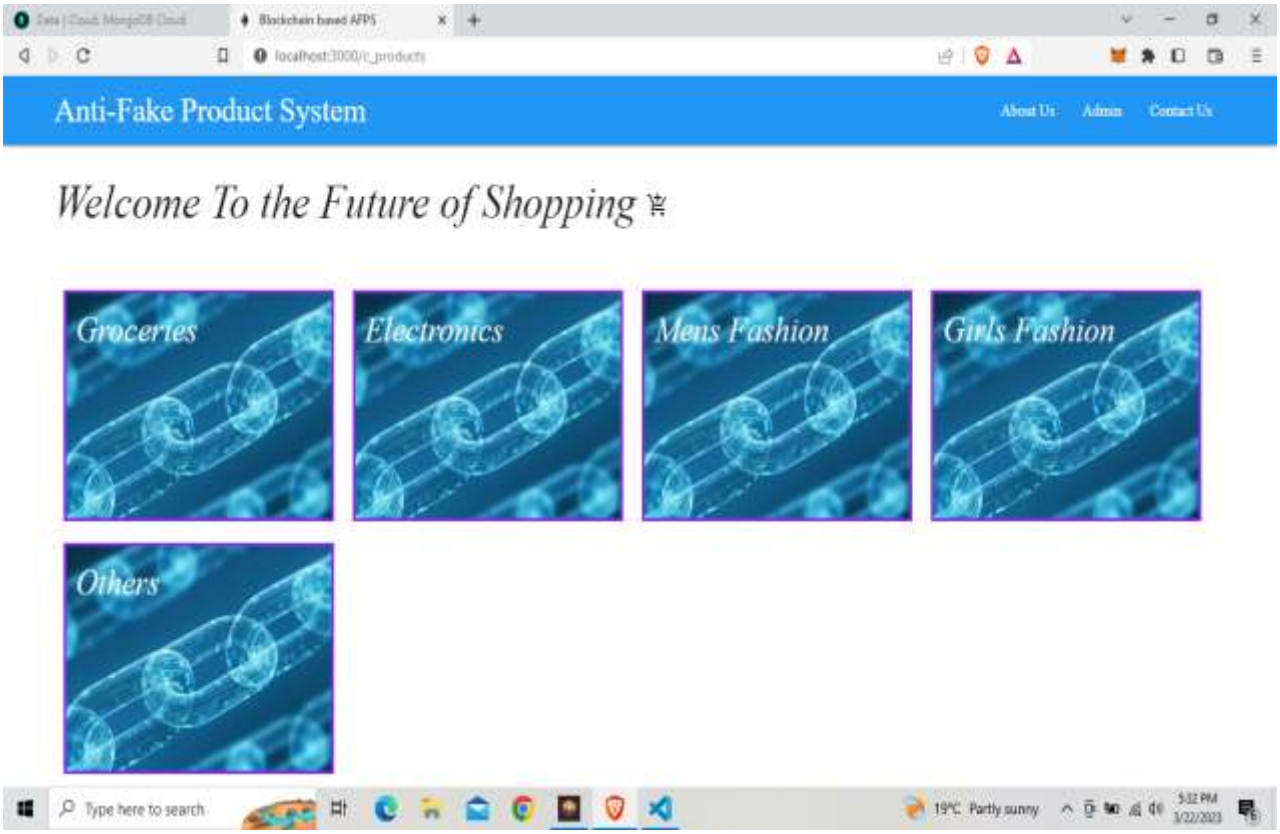

Anti-Fake Product System
Accept the Product Prototype
Ultra-Boost Running Shoes
adidas
700
42
Estimated gas fee
0.005727 ETH
Total
0.00572682 ETH
Reject
Confirm


Anti-Fake Product System
Reject the prototype with Reason
DOLPO TRACKS
dolpo
Not the Quality we want, re-design the prototype
Estimated gas fee
0.006922 ETH
Total
0.0069225 ETH
Reject
Confirm





SN	Name	Brand Party	Decision	Quantity	Sizes	Product ID
1	ADIDAS SHOES	adidas	Accepted	5000	41	68
2	ADIDAS SHOES	adidas	Accepted	5000	41	68
3	ADIDAS SHOES	adidas	Accepted	5000	41	68
4	Adidas Sneakers (Men's Shoe)	adidas	Rejected	Doesn't Match our Requirements and Standards.	0	53
5	Adidas Sneakers (Women's Shoe)	adidas	Accepted	1000	39	4
6	Gore-Tex Jackets (Dolpo)	dolpo	Accepted	500	Large and Medium	12
7	DOLPO TRACKS	dolpo	Rejected	Not the Quality we want.	0	43
8	Adidas Sneakers (Men's Shoe)	adidas	Rejected	Doesn't Match our Requirements and Standards.	0	53
9	DOLPO TRACKS	dolpo	Rejected	Not the Quality we want.	0	43
10	Ultra-Boost Running Shoes	adidas	Accepted	700	42	42


Blockchain based AFPS
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Mens Fashion
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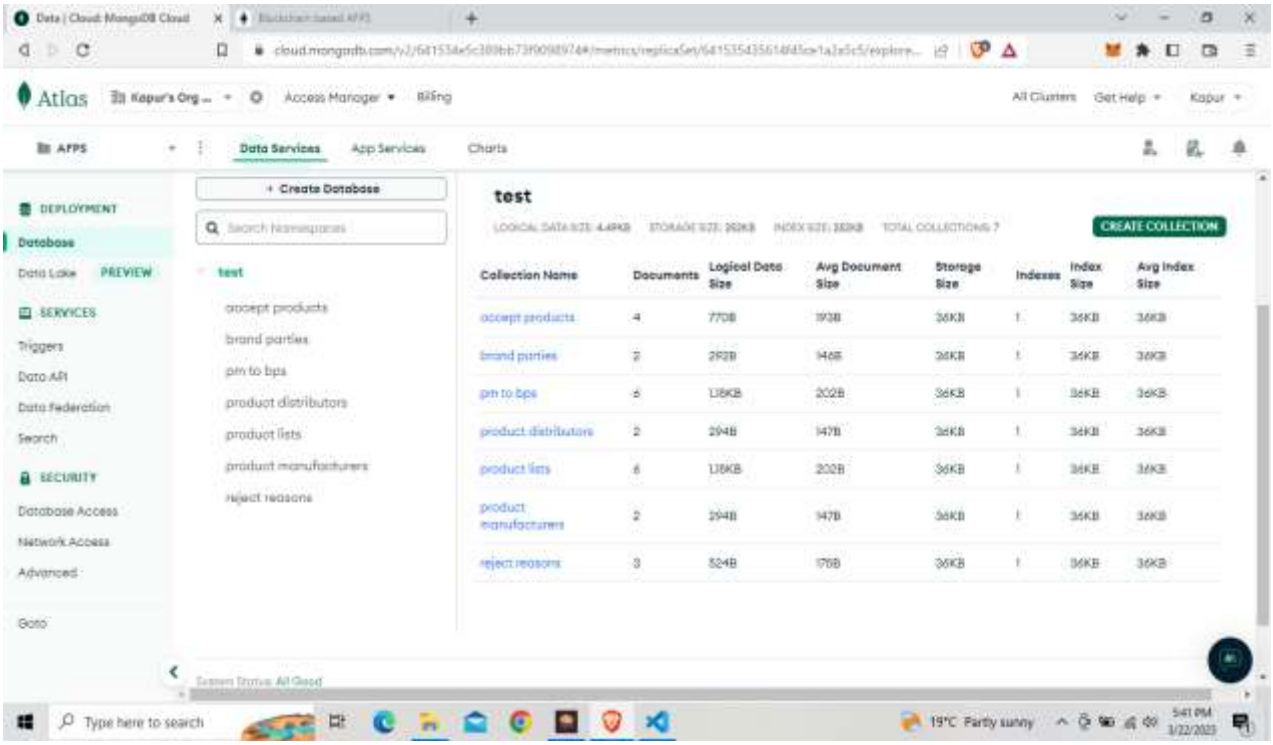
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product distributors
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