

DEVELOPING E-COMMERCE APPLICATIONS WITH BLOCKCHAIN TECHNOLOGY

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ABSTRACT

To address this issue, we are migrating the e-commerce application to blockchain, which will maintain data at multiple nodes/servers and allow customers to access data from other operational nodes in the event that one node goes down. Previously, all customer and product details were stored and managed in a single centralized server. If this server crashed due to excessive requests or if it was hacked, services would not be available to other customers. Another benefit of blockchain technology is that it has built-in support for data encryption and is immutable, meaning that data cannot be changed by unauthorized users. Blockchain stores data as blocks or transactions and assigns a unique hash code to each block. Before storing new records, Blockchain verifies the hash code of previous blocks; if all nodes in the block verify the block successfully, the data is considered secure. In order to carry out this project, we used Truffle with Blockchain Ethereum to store E-commerce data. Since Blockchain is unable to store images, we are storing product images inside IPFS (interplanetary file storage) servers. These servers store images and provide a hash code that allows us to retrieve the images from IPFS.

Key Words: E-commerce, Blockchain, Ethereum, Smart Contract, Web 3.js, Decentralized

1. INTRODUCTION

Globally, e-commerce is one of the most significant industries. In order to handle massive volumes of data and additional services, e-commerce platforms need a lot of processing power and storage. Although the sector is currently operating at a higher level, there is always room for improvement, and blockchain technology makes this feasible. Blockchain technology can improve data handling efficiency for e-commerce companies. Within a blockchain network, the platforms can organically store data about customers, goods, orders, delivery, manufacturers, sellers, and a plethora of other topics. The e-commerce industry benefits from additional security layers thanks to the well-known security properties of blockchain. Peer-to-peer trade is encouraged and intermediaries are reduced. Numerous more features are included, such as expedited transactions, a decrease in chargeback fraud, the ability to verify user evaluations, and customized product offerings. Blockchain ensures end-to-end product tracking for

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customers through traceability. In the end, customers may verify the authenticity of the goods and follow their orders in real-time.

2.LITERATURE SURVEY AND RELATED WORK

A literature survey for a blockchain-based e-commerce online application project in Python should include research papers, articles, and books related to blockchain technology, e-commerce, and relevant Python libraries. Here are some key areas to focus on:

1. ***Blockchain Technology:***

- Understand the fundamentals of blockchain technology, its history, and its applications.
- Explore consensus mechanisms (e.g., Proof of Work, Proof of Stake) and their impact on blockchain security and scalability.
- Review research papers on blockchain scalability solutions like sharding, sidechains, and layer 2 solutions.

2. ***Smart Contracts:***

- Study smart contracts and their role in blockchain-based applications.
- Research different smart contract platforms (e.g., Ethereum, Binance Smart Chain) and their programming languages (Solidity for Ethereum).
- Examine best practices for secure smart contract development.

3. ***E-commerce and Blockchain:***

- Look for papers discussing the integration of blockchain in e-commerce, including supply chain management, product provenance, and fraud prevention.
- Investigate case studies of real-world blockchain-based e-commerce applications.

4. ***Python Libraries and Frameworks:***

- Identify Python libraries and frameworks suitable for blockchain development (e.g., Web3.py for Ethereum, Binance Smart Chain Python SDK).
- Learn about web development frameworks like Django or Flask for building the e-commerce frontend and backend.

5. ***Security and Privacy:***

- Research blockchain security vulnerabilities and countermeasures.
- Explore privacy-enhancing technologies like zero-knowledge proofs (e.g., zk-SNARKs) for protecting user data.

6. ***Payment and Cryptocurrencies:***

- Understand cryptocurrency basics and their role in e-commerce transactions.
- Investigate Python libraries for handling cryptocurrency payments.

7. ***Decentralized Identity:***

- Explore decentralized identity solutions on blockchain (e.g., Self-Sovereign Identity).
- Understand how they can enhance user authentication and data protection in e-commerce.

8. ***Regulatory and Legal Considerations:***

- Review legal and regulatory aspects of blockchain and cryptocurrency use in e-commerce.
- Consider tax implications and compliance requirements.

9. ***Scalability and Performance:*** - Examine research on blockchain scalability solutions to ensure your application can handle a large number of transactions.

10. ***User Experience and Design:***

- Look for articles on designing user-friendly blockchain-based applications for e-commerce.

- Explore user adoption challenges and strategies.

Compile summaries of the most relevant literature and use it as a foundation for your project's design and development. Additionally, stay updated with the latest research developments in these areas, as blockchain and e-commerce are rapidly evolving fields.

3. EXISTING SYSTEM

In existing E-commerce application all customers and product details will be stored and managed in single centralized server and if this server crashed due to too many requests and or if server is hacked then services will not be available to other customers and to overcome from this problem we are migrating E-commerce application to Blockchain which will maintain data at multiple nodes/servers and if one node down then customers can get data from other working nodes.

Disadvantages:

Less security.

4. PROPOSED SYSTEM

Advantage of Blockchain has inbuilt support for data encryption and immutable (data cannot be alter by unauthorized users) and it will consider each data as block/transaction and associate each block storage with unique hash code and before storing new records Blockchain will verify hash code of previous blocks and if all nodes blocks verification successful then data is consider as secured.

To implement this project we have used Blockchain Ethereum with Truffle to store E-commerce data and Blockchain cannot store images so we are storing products images inside IPFS (interplanetary file storage) server and this server will store image and returned hash code of stored image and by giving that hash code we can retrieve images from IPFS.

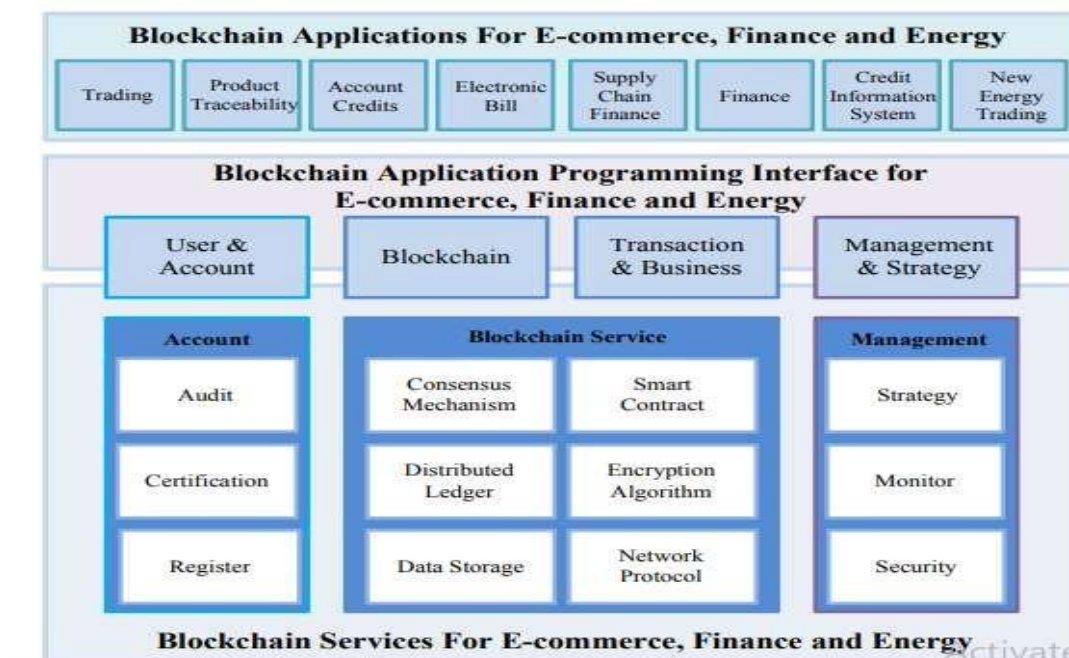


FIG 1- SYSTEM ARCHITECTURE

5.METHODOLOGIES

MODULE

SYSTEM MODULES

Building a blockchain-based e-commerce online application involves several key modules to ensure its functionality and security. Here are some essential system modules for such an application:

1. ***User Management :*** This module handles user registration, login, and profile management. It should integrate robust authentication and authorization mechanisms to protect user data.
2. ***Product Catalog:*** This module manages the listing of products or services available for purchase. It includes product descriptions, prices, images, and categories.
3. ***Shopping Cart:*** Users can add products to their shopping cart, review the contents, and proceed to checkout. This module should also calculate the total cost, apply discounts if necessary, and handle inventory updates.
4. ***Order Management:*** This module tracks and manages orders from placement to delivery. It includes order processing, payment verification, and order status updates.
5. ***Payment Integration:*** Integrating a secure payment gateway is crucial. It should support cryptocurrencies if you want to leverage blockchain technology, as well as traditional payment methods like credit cards or digital wallets.
6. ***Blockchain Integration:*** This is the heart of your application. It includes modules for smart contract development and execution. Ethereum and other blockchain platforms provide tools for building decentralized applications (dApps).
7. ***Inventory Management:*** Keep track of product availability, restocking, and inventory levels. This module is vital for ensuring that products are not oversold or out of stock.
8. ***Shipping and Logistics:*** Handle shipping options, address validation, and tracking information. Integration with logistics services and APIs can help automate this process.
9. ***Reviews and Ratings:*** Allow users to leave reviews and ratings for products. This module can build trust among users and help with product selection.
10. ***Customer Support:*** Provide a way for users to contact customer support, whether through live chat, email, or a ticketing system. Timely support is essential for customer satisfaction.
11. ***Security and Compliance:*** Implement robust security measures to protect user data and transactions. Ensure compliance with relevant data protection and e-commerce regulations.
12. ***Analytics and Reporting:*** Collect and analyze user and sales data to gain insights into customer behavior and improve your application.
13. ***Search and Filters:*** Enhance the user experience with search functionality and filters to help users find products quickly.
14. ***Admin Panel:*** Create a backend admin panel for managing products, orders, users, and monitoring the overall health of the application.
15. ***Notifications:*** Implement notifications for order updates, promotions, and other relevant information. This can be done through email, SMS, or in-app notifications.
16. ***Blockchain Wallet Integration:*** If your application involves cryptocurrency payments, users should have wallets to store and manage their digital assets securely.
17. ***Scalability and Performance:*** Design your application architecture for scalability to handle increased traffic and ensure optimal performance.
18. ***Testing and Quality Assurance:*** Develop a robust testing strategy to identify and fix bugs

and vulnerabilities throughout the development process.

19. *Maintenance and Updates: Plan for regular maintenance, bug fixes, and updates to keep your application secure and up to date with the latest technologies.

20. Legal and Compliance: Ensure your application complies with all relevant laws and regulations, especially regarding e-commerce, blockchain, and data protection.

Remember that developing a blockchain-based e-commerce application is a complex task that requires expertise in both e-commerce and blockchain technologies. Consider collaborating with experienced developers or consulting firms specializing in these areas to ensure a successful project.

6. RESULTS AND DISCUSSION SCREEN SHOTS

We can interact with the Blockchain by using Solidity code so we need to create solidity function for signup users, add products and book orders and then this solidity has to deploy on Ethereum Blockchain and by using WEB3 python package we can call this solidity contract. Below is the solidity code



In above screen click on 'Browse Products' link to get list of products

7. CONCLUSION

In conclusion, there are a lot of benefits for both customers and sellers in terms of security, transparency, and trust when using an online e-commerce platform built on blockchain. This platform lowers the risk of fraud by using blockchain technology to guarantee transactions are tamper-proof and unchangeable. Furthermore, smart contracts provide safe and automated payment procedures, which increase productivity. But as technology advances, it's critical to take consumer acceptance and scalability issues into account. All things considered, blockchain-based e-commerce has a lot of potential to completely transform online buying, but its effective adoption in the always shifting digital environment will depend on smart planning and adaptability.

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