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E-Commerce Product Management and Shopping Portal

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Abstract- In this paper, we designed and developed an e-commerce system a future-friendly E-Commerce Product Management and Shopping Portal utilizing the latest technologies, including the MERN stack (MongoDB, Express, React, and Node.js), Vision AI, and Blockchain to make the system work more efficiently work and user experience are presented. The suggested system will receive a dual-interface construction that will serve both administrators and end users with specific features. In our case, the admin portal was developed to efficiently manage product management operations. It is possible to easily add new items, modify products and organize them in one place. Moreover, Vision AI was applied to automate the process of analyzing photos in order to extract information regarding the properties of products including color, type, and category. At the same time, inventory management is implemented, which allows for real-time updates on the stock of products and alerts concerning the shortage of items. Apart from that, admins have an opportunity to control customers' orders, change the status of these orders and analyze sales reports to make decisions based on them. As for the end-users of the website, they can easily browse products, look for them, put them into the cart and buy goods using the provided checkout page. To increase trust, Blockchain was applied for the purposes of ensuring users about the security of transactions. Specifically, once users complete their orders, their data will be securely stored and not be available for any further modifications by other users. The described technologies help create an efficient and convenient system.

Keywords: Vision AI, E-Commerce, Blockchain, MERN Stack, Product Management, Inventory, Security, Order Tracking.

I. INTRODUCTION

Currently, e-commerce plays an important role in retailing since many people prefer online shopping because of its convenience. However, current e-commerce systems suffer from several disadvantages, which include inefficient inventory management, order processing delay, and opaque transactions. In our project, we sought to resolve the mentioned issues through the development of an E-Commerce Product Management and Shopping Portal, utilizing such technology as Vision AI and Blockchain. In the proposed system, the management of products becomes more convenient for the administrator. With the help of Vision AI, the system can automatically identify important product features such as color, type, and category from images. This reduces manual work and minimizes errors. It also improves inventory management by providing real-time stock updates and low-stock alerts. Administrators can also manage orders, update their status, and generate reports, which helps in better decision-making. For users, the platform provides a smooth and simple shopping experience. They can browse products, add items to their cart, and complete purchases through a secure checkout process. To ensure data security and transparency, Blockchain technology is used. All transaction details, including orders and payments, are stored securely and cannot be modified. This helps in building trust among users. Overall, the system provides a reliable, secure, and efficient solution to improve existing e-commerce platforms.

A. Motivation

This project was mainly motivated by the problems we observed in existing e-commerce systems, such as inefficient product management, lack of proper security, and low transparency. Many platforms still depend on manual processes, which often lead to errors, time consumption, and poor handling of inventory. Also, users sometimes hesitate to trust online transactions due to security concerns. To overcome these issues, we decided to develop a

system by combining technologies like Vision AI and Blockchain. Vision AI helps in automating product-related tasks and reduces manual effort, while Blockchain improves security and transparency in transactions. Our main goal is to make the system more efficient for administrators and at the same time build trust and confidence among users.

B. Objective

This project is about designing an efficient e-commerce Product Management and Shopping Portal. This design is intended to increase productivity and user satisfaction. Vision AI technology assists in detecting product features from images, which saves manpower in managing products, thereby reducing the burden on the system and increasing accuracy. The system also aims to implement efficient inventory management by tracking the stock levels in real-time and alerting. We intend to provide secure and transparent transactions through the implementation of Blockchain technology, which leaves behind a history of orders and funds that cannot be manipulated. Furthermore, the system ensures an excellent shopping experience for end- users, including searching, adding to the cart, and payment.

II. LITERATURE SURVEY

Regarding the development of e-commerce recently many scientists have concentrated on developing product management systems and their performance to make them more efficient, user friendly and secure [1]. Early studies primarily concentrated on building basic e-commerce websites using web technologies, with features such as product listing, cart management, and online purchasing. Although these systems enabled online transactions, they lacked advanced functionalities such as intelligent product management and secure data handling. With the increase in the number of users, products increased, issues like poor inventory tracking, manual data entry errors, and inefficient order processing became more prominent [2]. To overcome these issues, researchers have recently explored advanced web technologies such as the MERN stack [3]. These technologies help in building a scalable and flexible platform for developing dynamic e- commerce applications. MongoDB supports efficient handling of large datasets, React enables interactive user interfaces, and Node.js with Express ensures efficient server-side processing. These changes have improved system performance, real-time updates, and user experience [4]. Another important area of research is the application of Artificial Intelligence in e- commerce systems. Vision AI, in particular, has become popular because it can process product images and automatically extract features such as color, type, and category. Studies show that image-based recognition reduces manual data entry and improves the accuracy and consistency of product information [5].

Additionally, AI-based recommendation systems help users find products based on their preferences and browsing behavior. Security and trust are also critical concerns in e-commerce platforms, leading to the adoption of Blockchain technology. Traditional systems store transaction data in centralized databases, which are not very secure and can be manipulated [6]. In contrast, Blockchain provides a decentralized and immutable ledger, ensuring that transaction records cannot be altered. Research indicates that Blockchain integration enhances transparency, prevents fraud, and increases user trust [7]. Furthermore, studies emphasize the value of efficient inventory management and order tracking systems. Features like automated stock control, real-time notifications, and low-stock alerts improve operational efficiency. Order tracking systems provide real-time updates to users, enhancing customer satisfaction.

Reports and analysis tools also support better decision-making for administrators [8]. From the research, it is clear that integrating modern web technologies, AI along with Blockchain can significantly improve e-commerce systems [9]. However, most existing solutions implement these technologies independently. We focused on integrate these components into a unified platform, providing a comprehensive solution for product management, user experience, and transaction security [10]. The researchers have presented a new way of implementing product management which would ensure improved sales in the e-commerce

environment. Unlike the traditional ways where the products are managed depending on their category and stocks, the proposed technique incorporates customer analysis as well as their purchasing history and sales trends.

The system can be utilized in helping to highlight the popular products, adjusting the price, and increasing product visibility by relying on data analysis. In this regard, it is possible to claim that the discussed study reveals that sales-based approach is effective for making e- commerce platforms more efficient and successful [11]. Have talked about how e-business services affect the management of the product in today's digitized environment. This paper suggests that the digital services like digital platforms, customer services, and analytics provide support to organizations in the management of the product. This helps the organization get information about their customer, monitor performance, and take timely decisions regarding the same. In addition, this paper suggests that the e- business tools help the organization maintain better communication with their customer base and offer customized services [12]. Examined the important elements that would make the online shopping experience pleasant for users.

According to their findings, website design, ease of use, speedy loading, and secure payment system are some of the essential components of user-friendly e-commerce platforms. Product description and the simplicity of the checkout process are other crucial aspects that should be considered. These elements not only help companies gain more customers but also encourage them to purchase from the same platform in the future. In this way, businesses can ensure success by designing the appropriate e-commerce websites [13]. Described the development of an e-commerce website with the usage of MERN stack. Their study explains the benefits of this framework, which consists of MongoDB, React, Node.js, and Express.js. In particular, the authors point out that React contributes to the improvement of the user interface. At the same time, Node.js and Express.js facilitate effective server-side programming.

Moreover, thanks to MongoDB, it becomes possible to store information related to products and users in a flexible way. Overall, the chosen technological stack proves to be a great choice for building e-commerce websites [14]. Examined the application of GPT-4 technology in enhancing product search within online retail platforms. The article discusses how the use of sophisticated language models helps in comprehending the search query and delivering precise outcomes for product searches. Using artificial intelligence, the system will be able to interpret the intentions behind the search and recommend suitable products based on the user's input. Additionally, it is worth noting that the technique helps in enhancing the user experience as it improves the speed of searching while personalizing the process [15].

III. METHODOLOGY

The methodology of the suggested e-commerce system is organized logically and utilizes contemporary technologies to make it efficient, automated, and secure. Initially, the system undertakes the task of data collection and preprocessing, where products' data and images are uploaded by the system administrator. Such images are analyzing using the Vision AI module, which is capable of automatically detecting image features such as color and product type and category, thereby ensuring correct classification of products. Subsequently, the processed data is saved in the system's database using the MERN stack to facilitate proper handling and updating of data.

The inventory management module constantly monitors the stock level and sends alerts about products running out of stock. Consequently, stock levels for each product will be kept at a high level. In the transaction phase, buyers interact with the system through its functions like product listing, cart, and checkout process. Once the order is made and completed, all the data related to the order and payments are securely stored using Blockchain technology to guarantee that this information cannot be accessed by third parties. The order management and reporting modules are integral components of the system; thus, administrators can

track orders and gain relevant insights from their transactions.

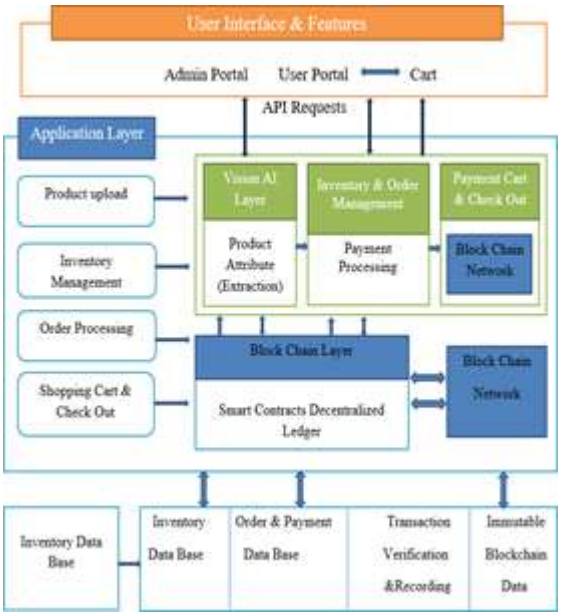

Figure 1: Architecture of e-commerce product management and shopping portal

The architecture of our e-commerce Product Management and Shopping Portal is designed using multiple layers to ensure smooth functioning and secure transactions as shown in figure 1. This architecture consists of two main layers:

- Admin Portal, where admin can manage products and
- User Portal, where users can perform shopping operations. In Application Layer, some crucial functionalities such as product upload, inventory management, order generation, and payment are performed. Vision AI Layer can be used for automatically recognizing attributes such as color, product, and category of the product to increase the accuracy level of the system. To secure the transaction, a Blockchain Layer is used for storing the transaction record securely in a decentralized way using smart contracts. Product-related data, order data, and transaction data are all stored in databases to efficiently manage information.

A. Proposed System

The proposed product is an e-commerce Product management system and a shopping portal that is set to break the constraints of the conventional online shopping sites since it incorporates modern technologies like the MERN stack, Vision AI, and Blockchain. The platform is developed by taking into consideration the two different interfaces that cater to administrators as well as regular users. Firstly, on the administrator's end, it is easier for them to add, edit, or delete products. Since Vision AI is integrated within the application, the products' characteristics like colors, types, and categories can be identified from images. Furthermore, the system will provide them with inventory management services that help them keep track of products' stocks. This helps them maintain stock at a suitable level. Moreover, they can manage customers' orders, change their status if necessary, and generate useful reports based on those orders. Lastly, on the other hand, regular customers have an efficient and convenient interface. They can view products, search, add them to the cart, and purchase them securely. Additionally, since the system incorporates Blockchain technology, it records all transactions such as orders and payments made. Overall, the system is quite reliable and secure due to Blockchain.

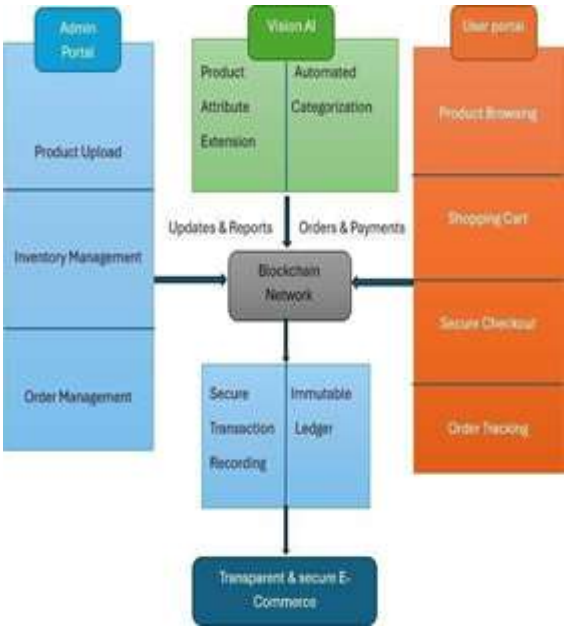

Figure 2: Work flow of the proposed e-commerce system.

As discussed earlier, the proposed system will be providing a holistic way of conducting e-commerce through the use of Product Management and Shopping Portal that combines the functionalities for both Administrators and users by incorporating new innovations such as vision AI and blockchain. Figure 2 depicts the process of the suggested method. Using the Admin portal allows efficient conduct of activities associated with uploading products, inventory management and processing orders. One key importance of using vision AI is its capability of generating automatic features such as color, type, and category of items contained within an image, and doing an automated classification, which eliminates the need for manuals. Through blockchain network, there is high level of security associated with transactions and immutability of data ledgers containing the record of transactions and payment details. Through the User portal, customers can browse, purchase products, do secure checkout, and monitor orders in real time. The main objective is to provide a clear, reliable, and safe e- commerce experience.

B. Blockchain Integration

The incorporation of the Blockchain technology in the proposed e-commerce system is an important factor in offering protection in terms of safety, immutability, and transparency of the transaction process. In the proposed e-commerce system, Blockchain technology is used to record all transaction-related data such as order information and payments in a secure manner. As Blockchain functions in a decentralized manner, the information recorded cannot be altered or accessed unless permitted. Thus, the possibility of abuse is reduced, and the trust among the system users and administrators can be increased. Furthermore, smart contracts will be used to ensure that all necessary conditions have been met prior to completing each transaction. After recording the details of each transaction, it is not possible to alter them. Therefore, a reliable record of all activities carried out within the system can be maintained.

C. SHA256 Algorithm

SHA stands for Secure Hash Algorithm. It is one way of ensuring data security using cryptography. The SHA algorithm involves taking any input data and converting it into a unique fixed size output data called hash. A slight alteration in the input data will result in a totally different hash. It begins by buffering the message to achieve length that is a multiple of some fixed block size (e.g. 512 bits in case of SHA-256). This message is then processed in blocks where a block passes through a sequence of operations which included bitwise shifts, logical operations (AND, OR, XOR), modular additions and mixing of data. These are all repeated and then a final hash is obtained. SHA-256 such will produce a 256 bit hash of any message input which will provide a distinctive finger print of the information. This hash is customarily stored as hexadecimal string given in equation 1.

$$Hi = Hi - 1 + (Hi{-}2, Hi{-}1) + Wi \qquad (1)$$

Where:

- The new hash value at a single iteration is denoted by Hi and the message schedule (a sequence of values based on the message block) is denoted by Wi. The function f is an implementation of logical operations and bitwise shifts.

D. Secure Transactions Stocking

In our project is premised we implemented the Blockchain technology that will store and save the data about the transactions to ensure the level of transparency and impossibility. The Blockchain contains information regarding the logs of the transactions e.g. order data, payment data, consumer data (hashed to protect their privacy) and product data e.g. product ID, quantity and price of the product. After the confirmation of a transaction, all the details pertaining to the transaction are stored in a block and the block is then stored in the decentralized ledger. Cryptography helps to encrypt the data and it is impossible to modify such data. Each and every transaction is under a consensus mechanism (proof-of- work or proof-of-stake) and the legitimate transactions are only appended. The processes are also ensured by automating the usage

of smart contracts and, therefore, guarantees the security of the process. Our system can ensure the safe and transparent of history of transactions (auditable) and make sure the information cannot be manipulated by other individuals without the authorization to do so by storing this information on a Blockchain.

A. Modules and Implementation

1. Admin Module:

- **Login:** Admins can securely log in to access the portal.
- **Manage Products:** Admins can add, update, or delete products and upload product images. With the help of Vision AI, the system automatically identifies features like color, type, and category from the images.
- **Manage Orders:** Admins can view customer orders, update their status, and also dispatch or cancel orders when needed.
- **Inventory Control:** Admins can monitor stock levels, update them when required, and receive alerts when stock is low.
- **View Reports:** Admins can check sales reports and analyze which products are performing well.
- **Logout:** Admins can safely log out of the system.

User Module:

- **Registration/Login:** Users can create an account and log in securely.
- **Browse Products:** Users can explore different products available on the platform.
- **Order:** Users can select products and add them to their cart.
- **Checkout Process:** After selecting items, users can proceed to checkout by entering shipping details and completing payment.
- **Order Confirmation:** Once the payment is successful, users receive confirmation of their order.
- **Order Tracking:** Users can track their orders in real time.
- **Logout:** Users can log out of their account securely.

IV. RESULTS

The proposed technique primarily concentrates on making the e-commerce system more efficient and effective in terms of its operations. It uses modern technology and data analysis techniques to control products and make the system more user-friendly. It helps in delivering precise results quickly and makes decisions based on factual information.

1) Admin dashboard

Admins can securely log in to access the portal through only admin credentials as shown in fig.3

2) User Login

User can login to the portal through user login. If there is no account in the portal, user can able to register securely with required details as shown in fig.4

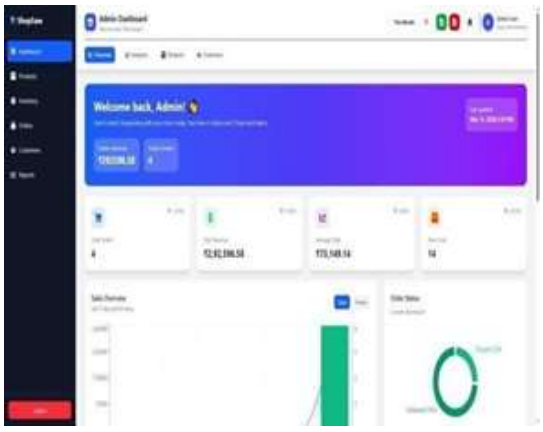

Figure 3: Admin Dashboard

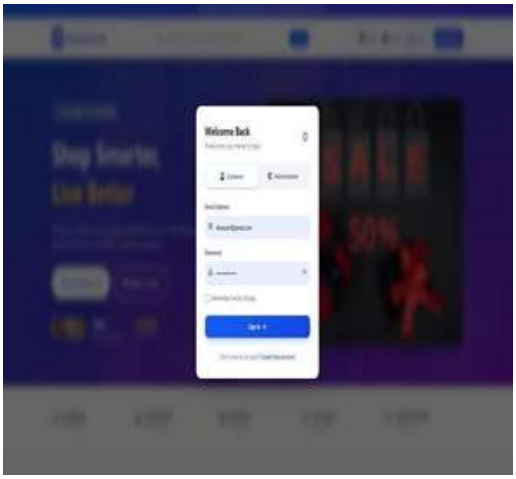

Figure 4: User Login functionality

Manage Products

Admins can add, update, or delete products and upload product images. With the help of Vision AI, the system automatically identifies features like color, type, and category from the images. Admins can monitor stock levels, update them when required, and receive alerts when stock is low as shown in fig.5.

Manage Orders

Admins can view customer orders, update their status, and also dispatch or cancel orders when needed as shown in fig.6

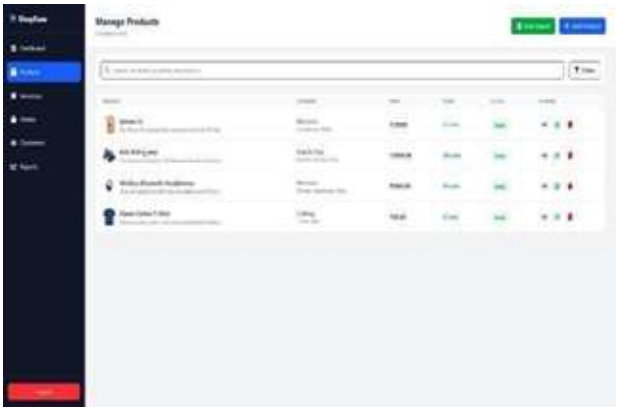

Figure 5: Manage Products functionality.

Figure 6: Manage Orders functionality.

Browse Products

Users can explore different products available on the platform as shown in fig.7

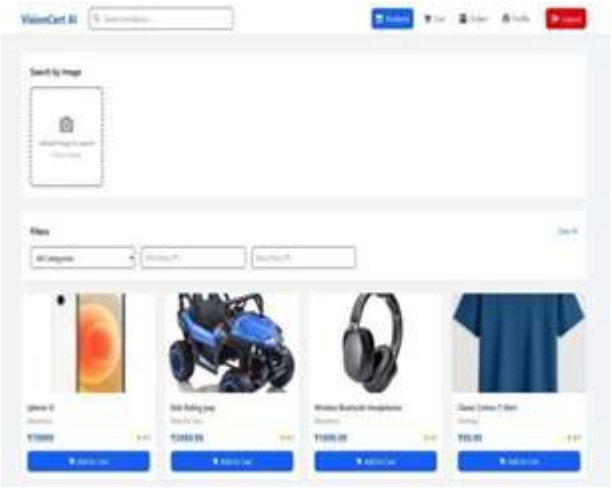

Figure 7: Browsing of products with Vision AI functionality.

V. DISCUSSIONS

Our system showed visible improvements in efficiency, security, and user satisfaction in terms of experience through the integration of technologies Vision AI and Blockchain. First of all, Vision AI makes possible an automated identification of such product attributes as colour, type, and category by images. Such approach minimizes both effort and number of errors, leading to improved accuracy and efficient inventory control. Blockchain enhances the security of transactions through the storage of orders and payment details in a safe and immutable environment. Once transaction information gets saved into blockchain, it is impossible to alter it. It allows one to maintain integrity and increase user confidence.

Additionally, the use of smart contracts ensures that transactions will be processed in a right way and automatically. In the terms of functionality provided for the admin, there are some benefits such as the ability to monitor inventory in real time and receive low-stock notifications. The feature of orders management makes the process more convenient. As for the reporting and analytics functionality, it

allows one to get useful insights into the process of sale. From the user perspective, the proposed system offers a convenient way of shopping online, including browsing, managing the cart, making payments, and tracking orders.

VI. CONCLUSION

In the process of developing our Project, we have successfully created an e-commerce Product Management and Shopping Portal using various technologies such as Vision AI, Blockchain, and MERN stack for solving various issues in currently used systems. Product Management becomes easier since our system is able to automatically recognize products' characteristics, thus eliminating the need for tedious manual work. At the same time, transaction security increases due to the use of Blockchain technology in which all data cannot be modified. Moreover, our system allows us to efficiently manage inventories, orders, and provide user-friendly interfaces.

Future Scope

The system can achieve better performance through implementation of advanced technological solutions which enhance its operational capabilities and improve user satisfaction. Artificial Intelligence-based recommendation systems can be added to provide personalized product suggestions and increase customer satisfaction. Advanced data analytics helps businesses better understand user behavior and support informed decision- making. The system can also incorporate Augmented Reality (AR) to enable users to see products before they buy them which works well for fashion and home decor industries. Blockchain technology improvements will boost transaction speeds because they create better systems for achieving consensus which increases scalability. The security of transactions will improve through machine learning-based fraud detection system implementation. The platform will become more accessible to international users when it expands its support for different languages and currencies.

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