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Smart Reselling: Leveraging MERN Stack and AI for Intelligent Bidding in E-Commerce

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Abstract: *Digital reselling marketplace expansion has brought a radical change in e-commerce, however issues like failed transactions, security and safety risks, spam, and ineffective interactions between buyers and sellers remain a concern. In this context, this paper offers an appropriate approach to dealing with this problems informing the introduction of Bid2Buy, a smart bidding system that combines the MERN stack and artificial intelligence technologies to further streamline the process of reselling. Such a system ensures security, transparency and completion of transactions by abstracting the buyer-seller interaction through a time-bound digital bidding system whereby buyers submit their bids within stated timeframes, subject to a minimum bid condition at which point the bid is guaranteed financial security. The product is offered to the highest bidder at the end of the auction; thereby protecting fair competition among members and reducing delays in the transaction. Christened the intelligent persuasive recommendation system, this additional system utilizes machine learning and AI to recommend bid options most appropriate for the users and help sellers set initial monitors. Computer vision technology is also included in the system to scan through images of the products and descriptions to enhance picture equity. Bid2Buy not only optimizes the process of reselling by providing embedded payment mechanisms and comprehensive verification procedures but also maintaining security and reliability features for all users. This paper explores the architecture, implementation, and benefits of using the MERN stack alongside AI technologies in transforming digital marketplaces into more efficient, secure, and user-friendly platforms.*

Keywords: Intelligent Bidding, MERN Stack, Machine Learning (ML), Deep Learning (DL), Computer Vision, Product Verification, Real-time Transactions, Transaction Security, Buyer-Seller Interaction, AI Recommendations, Dynamic Pricing, Fraud Prevention, Payment Integrity, Firebase Integration, Bidding Algorithm, Platform Trust, Secure Payment

Gateways, Product Authentication, Personalized User Experience

I. INTRODUCTION

In the last few years, online reselling has been booming allowing buyers to enjoy lower product prices and avail sellers to larger markets. However, despite this boom, many problems still exist in these platforms, for instance, user's problems such as unfinished payments, anonymity, spamming, non-efficient buyer-seller relations among others. Such challenges fail to allow existing e-commerce websites to operate smoothly and effectively scale up which ultimately affects the user and trust's sentiment.

This paper aims to propose a solution to these problems by proposing the Bid2Buy platform which is a digital reselling platform of the new generation that utilizes the capabilities of the MERN stack (MongoDB, Express.js, React, Node.js) as well as incorporates modern AI technologies such as ML, DL, and computer vision. Bid2Buy presents an innovative intelligent time- constrained bidding system which abstracts the buyer-seller relation and ensures that the deals are completed, security is enhanced and enhances the marketplace experience.

In a digital auction that has a time limit, bidders bid by meeting a starting minimum estimate, and the highest bidder wins the product at the end of the auction. Such a mechanism makes sure that all transactions are safe and complete as

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well. Furthermore, Bid2Buy uses an AI based recommendation system that helps buyers to identify relevant bidding opportunities and sellers pricing their products at the rational benchmark for the opening bid. At the same time, in order to increase the trustworthiness of the listings, the computer vision technique is also applied to provide an assurance as to the truthfulness of the product descriptions and its photographs.

This paper addresses and demonstrates how the MERN stack and AI technologies can be used in the architecture, implementation and anticipated advantages of the creation of a more intelligent, reliable and less cumbersome reselling marketplace. Bid2Buy is introduced with the intention of providing an innovative framework to the existing problems that persist in online reselling as well as to the growing debate about the impact of AI and other new technologies on the functioning of ecommerce websites.

II. LITRATURE SURVEY

In the 2022 paper "Artificial Intelligence for Smart Bidding," Pratyush Shandilya, Laura Murphy, and Fernando Perales look into the role of AI in improving digital marketing efforts with a particular focus on optimizing search advertisement smart bidding. With the fast pace of industries shifting towards digital, the conventional way of conducting business is no longer a sustainable model forcing companies to rely more on online channels to remain competitive. This change, in turn, opens up an opportunity for intelligent marketing approaches. The authors pay attention to one of such marketing strategies – AI, focusing mainly on the contextual multi-armed bandit algorithm, which is an efficient and affordable way to tackle problems associated with bidding strategies optimization. It increases the capacity of the advertisers' advertisers to successfully win auctions and earn more advertisement revenue. Consequently, through AI, it is possible to automate and optimize the bidding process to ensure that the right target audience is reached at the right time, thus enhancing efficiency and achieving better results in the practicable e-commerce environment. The paper discusses how automated decision-making as one of the AI tools can play a great deal in improving cost efficiency relative to digital advertising. These authors combine their backgrounds in AI, business transformation, and digital marketing to explain how AI can enhance advertising strategies.[10]

Yin and Han (2021), in their work "Dynamic Pricing Model of E-Commerce Platforms Based on Deep Reinforcement Learning," deal with dynamic pricing models of e-commerce platforms operating on American markets. The authors are particularly concerned with integration of DRL techniques for the most appropriate pricing decision making in a real time basis amid changes in demand, competitors' prices and customer's actions. They present several Econometrics models to describe the possible directions for dynamic pricing due to market changes, therefore, profit maximization by the companies' wheeler dealers without dishonoring the customers' inclinations. The paper also analyzes different pricing models with their advantages and disadvantages in terms of application to the e-commerce industry. This modelling is however not appropriate in other industries close to e-commerce, because the authors of these models designed them specifically for e-commerce platforms. Nevertheless, the paper convincingly argues the use of deep reinforcement learning for pricing mechanisms in e-commerce business strategies.[2]

III. SYSTEM ARCHITECTURE

Bid2Buy's architecture is built around the MERN stack (MongoDB, Express, React and Node.js) while Firebase is applied to store data and authentication purposes. In one user's account, the system facilitates both sales or purchases of products allowing the user to switch from buying to selling or both in a seamless manner.

Frontend (React.js): The front-end of the application has been structured utilizing React.js enabling a dynamic and interactive user interface. React helps to update and manage states of a number of components best. Such components include search results, listings of various products, and certain interactions(bids)

Backend (Node.js + Express.js): For the server-side logic, Node.js is the language used and Express.js is the framework adopted to implement the server logic for web applications and HTTP requests. The backend performs user login, updates users about their bidding rules and deadlines, sends signals whenever a new auction is created, and channels calls from the AI services to the front end.

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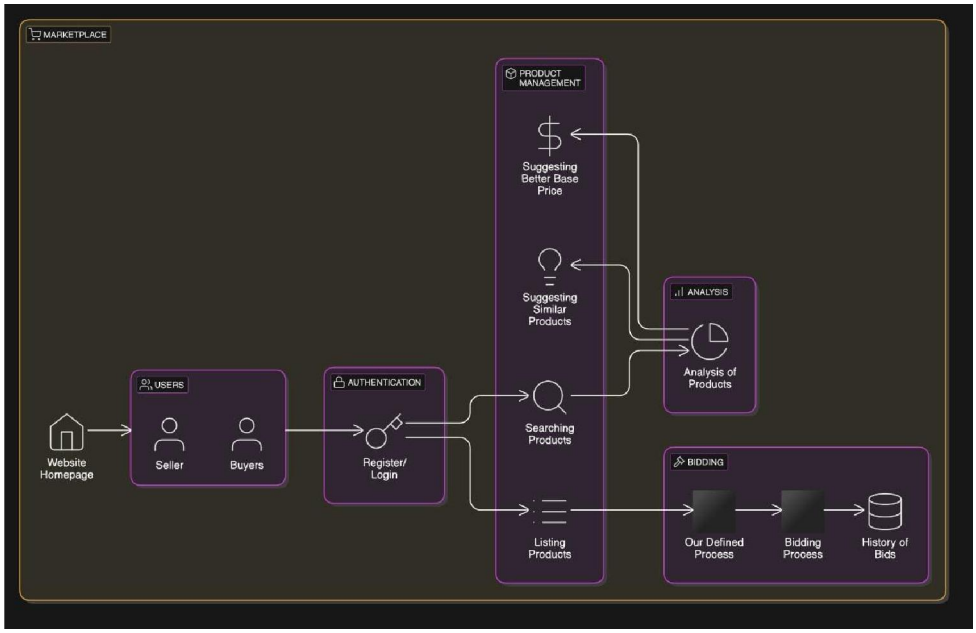

Database (Firebase): As the minor database that was used, Firebase enables storage of user data such as profiles, products available for purchase and even bought products. Firebase was also selected for its real time embedding capabilities enabling users to see live up to minute developments of the products, changes in products, bids and advertisements.

A. AI and Computer Vision Integration:

Bid2Buy uses artificial intelligence to optimize the precision and productivity of the platform. AI is used in the following directions.

Intelligent Recommendation System: Machine learning strategies study the behavior of users on the site, their previous purchases, and preferences regarding suitable products and the bidding opportunities in potential sales. Such an approach enables buyers to easily get the products of their choice and enables sellers to determine the base bids to be made on their products according to the market trends and participation of the target audience.[17]

B. Product Verification with Computer Vision:

This approach employs computer vision as a verification technique for images and videos of the products uploaded by the sellers. This verified method ensures that what is described is what is shown as a visual image in the auction thus increasing legitimacy in the bought products. If the images used to describe the product are not in accordance with the images description, then, the item is flagged to be vetted so that any chance of listing false represented items for sale is eliminated.

C. Security and Transaction Integrity:

To reduce fraud and provide security to the transactions Bid2Buy provides many security features.

Authentication and Authorization: All user authentication and authorization is done safely and securely through the use of Firebase, which allows regions to be controlled to specific users (i.e. sites Authentication and Authorization where users are able to place a bid or sell).

Bid Integrity: The system also includes a feature that restricts users from placing bids unless the user has already deposited a 50% balance.

Transaction completion: Through the abstraction of the buyer and seller, Bid2Buy minimizes the completion of transactions by providing that all transactions are conducted through the platform. This reduces the chances of completion oriented transactions turning out to be fraudulent.

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IV. BIDDING PROCESS

Bidding process works in Bid2Buy is that users make a bid on product within the specified time limit. The purpose of such a process is to provide security and fairness to any buyer or seller

Listing the product: To list the product, a seller needs to upload any image or video related to the product and write its description. Further AI-based tools verify this information in order to ensure the correctness of the list.

- Product Verification: Products are put on auction after verification with a minimum price and timeline for the auction. Sellers indicate the beginning and ending for the auction.
- Product Bidding: Potential buyers offer the selling price for the product. The system makes sure that most buyers have sixty percent of the maximum bid on their accounts.
- Product Pats Received: The person who had made highest bid for the product when bidding period expires obtains the product. The bidding algorithm used is capable of determining who won the bid by estimating the highest price using the Python language.[9]

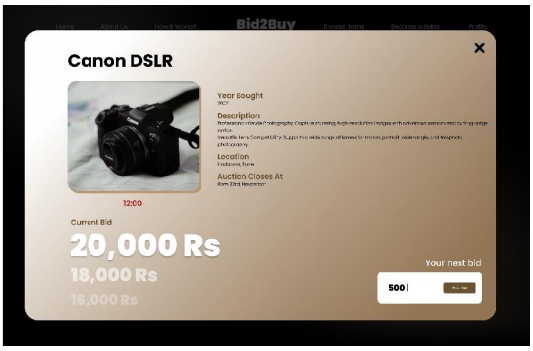

Figure 4.1 Bidding Panel

Transaction Completion: As soon as the auctions finish, the item goes to the utmost bidder where in turn, the owner collects the payment. Even though the gateway for payments is developing as well, the system is already well positioned to accommodate secure transactions as are provided by other commercial online payment facilities.

V. IMPLEMETATION AND RESULTS

Using the MERN stack (MongoDB, Express.js, React.js, Node.js) and Firebase, Bid2Buy can operate in transactions in real time and authenticate its users.

- Frontend (React.js): The interface is active and lets the user effortlessly browse any product, list a product, participate in bidding, or login to interact with the application.
- Backend (Node.js + Express.js): C++ has been actively working on the server-side logic which comprises user management, event rules, auction, etc. Additionally, Firebase is used for real-time updates.

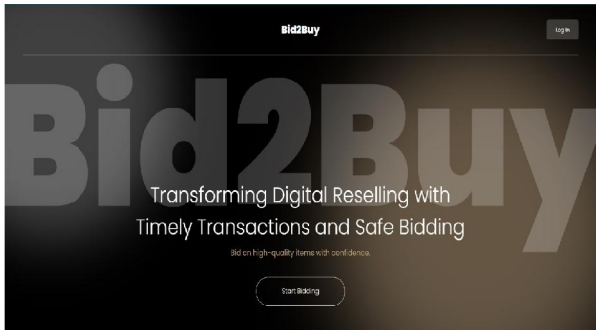

Figure 5.1 Landing Page

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- Firebase: It was applied to store user-related data and also update users on the ongoing bids and new bids placed which happened in real time with interaction with buyers and sellers.
- Bidding Algorithm: The Python Bidding system guarantees that users do not make a bid below 50% of initial and whenever any person outbids the best bid at that time before the closing of the auction, that becomes the highest bid.[7]
- AI Integration: Machine learning can be very useful as particular products can be recommended to users and the sellers can be assisted with choosing their first bid. There is also a computer vision check on whether the photographs and their descriptions are correct for the products.

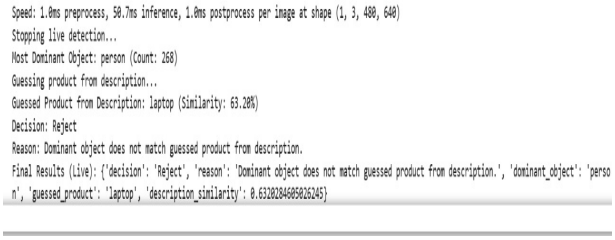

Figure 5.2

- Accuracy of Product Verification: The computer vision based AI technology has already shown its effectiveness on verifying whether what's shown in the images of the products is matching the text on the products. Wrong listings were not only verified in several test cases; they were also prevented from getting onboard the market.[7] This feature enabled the users to be confident in the platform more.[13]
- User Experience: The user experience was further improved by the seamless transitions in the buying and selling processes, AI recommendations and updates during the bidding process.The real-time changes in the bids and the deadlines for the auction process were stirred up and kept the interest of the users. The platform allowed both buyers and sellers to operate the system without any bewilderment thanks to its layout.

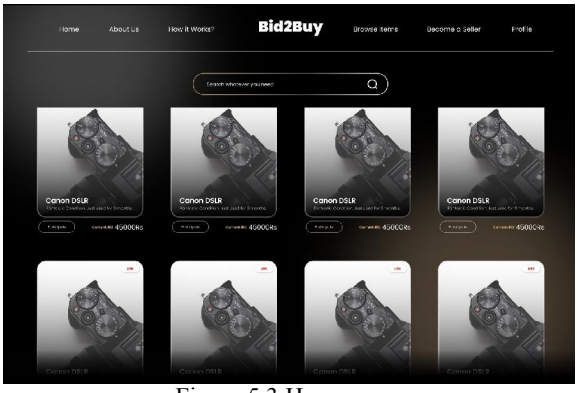

Figure 5.3 Home page

VI. DISCUSSION

The evolution of Bid2Buy marks an important step forward in addressing important problems in the area of digital reselling and e-commerce. Utilizing the MERN stack together with AI technologies such as ML, DL, and computer vision, Bid2Buy seeks to enhance transaction security, improve user experience, and alleviate the problems of security, fraud and inefficiency in interactions of buyers and sellers. This section will focus on the efficiency and perspectives of the system, which are based on the implementation results, as well as the integration of AI, bidding algorithms, and the architecture embedded in Bid2Buy.

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A. Addressing E-commerce Challenges with Intelligent Bidding:

A significant pain point of the present online reselling platforms is the absence of a detailed and workable bidding mechanism which is not available on other present platforms. The existing platforms suffer from abandoned transactions, late payments and scams thus making users lose confidence. [14]

Bid2Buy tackles these challenges by implementing a time-sensitive, AI-controlled bidding platform that allows all sales to be made in a quick and safe manner. As a way of reducing the negative impacts of non-transactionable bids, including adding consistency to the entire bidding procedure, a rule is enforced whereby a bidder must deposit a minimum of 50% of the highest bid price into their account before making a bid. In addition, the time constrain on the auction coupled with the fact that buyers and sellers never interact also creates credibility and ensures that the bidding process is carried out objectively.

B. Leveraging AI for Personalization and Product Verification

The recommendation system based on machine learning algorithms is an important component for Bid2Buy which makes it unique as it offers focused experiences to the users. From past activities, preferences and locations visited by the user, the system provides necessary information that further increase the chances of that particular user winning. The AI integrates buyers' behavior and industry standards in setting the appropriate opening prices for the sellers. This is a crucial advantage of the system, especially in a hyper-competitive environment where sellers need to be able to enforce prices that are closely related to the demand and therefore have higher chances of selling.[4]

Alongside recommendations, Bid2Buy also utilizes the computer vision to validate product images and descriptions uploaded by the sellers. This guarantees that the product on sale is what it is described as, hence reducing the chances of products being listed fraudulently. As the results of the implementation show, the system is good at detecting differences that may exist between a product image and description, hence avoiding the uploading of misleading images and descriptions. This enhances the facets of trust for both buyers as well as sellers since the platform guarantees the authenticity.

C. Real-time Transactions and Seamless User Experience

Users can purchase and sell any objects from around the world using the auction bidding and striking features provided by the platform in real-time. Bid2Buy leverages Firebase technology which provides absolute synchronization between users and seamless connection statistics updates at all times. Information about a user is kept in Firebase databases, along with updates about product availability, current bids, and auction progress in real time so that the most relevant information is in front of users all the time. This feature is extremely important in the field of e-commerce where the main features of the platform are instant transactions and real time auctioning. Furthermore, placing users in an up to date information scenario, Bid2Buy allows the users to bid and follow up on their auctions thus enhancing the experience of the users.[11][15]

Presenting the final feature will be the frontend built on React.js. The platform allows users to switch between buying and selling mode easily, browse through the available products and check the bids on particular products. It also has a responsive Design, allowing different users on different devices with different screens to have an optimal experience. Additionally, there are AI driven recommendations in the platform and seamless movement through the various functions of the site, which are all powerful in enhancing the usability of the platform, so that buyers and sellers alike do not get confused in using the system.

D. Ensuring Security and Transaction Integrity

A very important feature of Brokerage B2B is the issue of security regarding the fact that transactions are carried out without any problems and fraud is kept at bay. In order to carry out the Platform lets users register and sign in securely and FireBase has been used as the backend to which only registered users have access and they are able to enter the auctions. The bidding procedures have also the provisions of 50% deposits, which cater for the fact that bidders will be able to pay for the bids that they have placed. This in turn minimizes the chances of non completion of transactions.

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There is still active development underway for the payment gateway integration, however, the platform is already built to focus on secure transactions in readiness to payment systems which will even strengthen its security infrastructure. Once these systems are in place, they will further advance the dependability of the platform and minimize the threats associated with payment fraud.[15]

VII. FUTURE SCOPE

The intelligent bidding system and the use of AI on the platform are great features that make Bid2Buy offer a unique way of solving the challenges of online reselling, however there are some other features that are yet to be added and improved. As the platform progresses, focusing on expanding the scope of the project to include a payment gateway, delivery systems and enhanced communication after the sale will make the platform more efficient and user friendly. In this part of the report, the challenges faced by Bid2Buy so far are outlined, and ways of improving the existing project prototype as well as extending the functionality of the new system are provided.

A. Payment Gateway Integration:

The integration of a reliable payment gateway remains one of the most important next steps for Bid2Buy. Although the system is currently set up to enable bid payments, once direct payment transactions through the platform are enabled, it would facilitate the whole transaction process. Bid2Buy would be able to utilize Stripe or PayPal or even cryptocurrency payment options to ensure that buyers and sellers have no issues completing transactions because they do not have to go through other channels. Also, the implementation of escrow services could also increase the trust levels of the buyers and sellers since the funds will only be released once transaction conditions are met.

B. Delivery and Shipping Management.

A third area that has not received much attention in relation to online reselling is how products will be delivered or other logistics that come at the end of an auction. At the moment, Bid2Buy is not responsible for the sale of goods and therefore does not have a post-sale management system. Having a dispatch or delivery management system is useful in order to close the e-commerce loop. In the future, embedding timely fulfilment and delivery tracking capabilities may involve prospects for collaboration with third-party logistics integrating such features within the site. This will not only benefit the users but also increase the confidence level of the site since buyers will know the exact status of the shipment and when to expect delivery.[18]

Further, the site could allow users to select between a number of different delivery methods and speeds including economy and express whereas the buyers' urgency will determine their choice of shipping options. For automatic global fulfilment, enabling simple tools that will allow sellers to specify their shipping fees, target delivery areas or offer local delivery could enhance the customer experience.

C. Post-Sale Customer Support and Point of Contact.

In looking at how Bid2Buy handles sales for the presents, there's a need to also establish contact on issues after the sale. Once a product has been successfully bid on, messaging interfaces can be created for the seller and buyer whereby questions concerning payment problems, delivery or product condition may be raised to facilitate resolution. Moreover, the support feature could be developed specifically for the use of users who participate in violence or are still coping with challenges within the system.

Likewise, the eventual introduction of a system of reviews and ratings by buyers and sellers can be envisaged. This would enable users to post comments about their experiences in the marketplace helping develop trust and improve transparency in the community. When allowing for feedback on products and services, Bid2Buy gives a chance to draft an area that fosters good practices for the sellers and would raise the credibility of the platform as a whole.

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D. Higher Levels of Automation and Greater.

Personalization with New AI Features As of now, the only application of AI by Bid2Buy is in product recommendation and image recognition. almost all the areas of AI integration into the operations of the platform are open for move. For instance, How do models make accurate predictions about what etiquette needs to be displayed for different users when placing bids? If answered and implemented, it will allow the system to suggest optimal bid amounts and times tailored to the user's profile, budget, and current market conditions. This would alleviate overall decision making for both buyers and sellers and in turn create more streamlined deals.

Moreover, such optimized pricing could also be a result of real time updating of factors, such as, availability of stock units and prices for competitors that could, in turn, be deployed to rule other features within the B2B platform. These characteristics would enable retailers offer attractive prices and prices that respond to market requirements while offering a suitable environment for making bids to buyers.

E. Blockchain for Transaction Transparency.

As a possible future development, Bid2Buy might consider the application of the blockchain system to promote the transparency and security of its transactions. Bids and transactions, for example, can all be stored on a distributed ledger if using the blockchain. This makes it impossible to change anything without verification, and anyone can confirm it. Offering such an assurance would boost the level of confidence the users have in the platform since it is guaranteed that every act is secured and captured permanently. Moreover, this technology could be exploited to create secure digital contracts and grow the availability of security for buyers and sellers in the event of a conflict or fraud'obligation breach.[16]

VIII. CONCLUSION

It is a fact that the emergence of social commerce and associated reselling platforms over the years has afforded numerous buyers and sellers with a platform to do business, but it has also restated important issues surrounding transactional safety, experience, and trust. In this research, we demonstrated Bid2Buy, which is considered a prospective digital reselling market with built in features using the MERN stack that includes MongoDB, Express JS, React JS and Node JS, as well as the most recent advances in AI technologies such as machine learning, deep learning, and computer vision.

Bid2Buy outlines an intelligent bidding feature that is time-sensitive while providing ample back and forth communication with the buyers and sellers within a secure transaction setting that originates from efficient bidding processes. The discontinued AI recommendation engine assists in native searching for needed biddings, as well as helps sellers to set optimal prices for their goods. Additionally, these aspects are recognized through the use of modern computer vision methods and hence enable the platform ensure the credibility of the product offerings and reduce fraud.

Bid2Buy enhances the bidding in the e-commerce site by combining real-time bidding using Firebase with a well-balanced and secure backend enabling users (sellers and buyers) to have a good experience. The built-in systems of the site such as the 50% deposit which users have to pay to place a bid and the non-physical interaction between the buyer and the seller provide for easier completion of processes where minimal chances of transaction failure and fraud exist.

In conclusion, Bid2Buy can be considered as an innovative approach to solving some of the existing weaknesses such as Transaction Cost Economics and Transaction Risk Facets in the contemporary e-commerce platforms. With the application of the MERN stack in the research, it was shown that intelligent bidding systems and enhanced transaction integrity would result in better and more efficient transactions in a private and safe digital platform.With the capacity of the application to integrate different features, such as secure payment methods, well-organized delivery systems, and other automated processes, the user experience will be enhanced greatly, and Bid2Buy is poised to remain a key player in intelligent reselling, effectively defining the evolution of the global market in the future.

The success of Bid2Buy sets a precedent for how e-commerce platforms can embrace new technologies to build more intelligent, transparent, and user-centric marketplaces, driving both operational efficiency and trust in digital transactions.

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