International Journal of Computer Sciences and Engineering
Vol.**13**, Issue.**4**, pp.**99-104** April **2025**
ISSN: 2347-2693 (Online)
Available online at: www.ijcseonline.org

ISSN: 2347-2693 (E)

Research Article

Bid Bazaar: A Comprehensive and Innovative E-Commerce Platform Featuring Real-Time Online Auctions and Seamless Shopping Experience

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Received: 16/Feb/2025; **Accepted**: 18/Mar/2025; **Published**: 30/Apr/2025. **DOI**: https://doi.org/10.26438/ijcse/v13i4.99104

Abstract: Bid bazar is web application which will help the users to buy and sell the products. The system that holds the various products on a website and server sellers and bidders accordingly. And it is designed to allow users to set up their products for auctions and bidders to register and bid for different types of products that are available. This is a best method for buying and selling the products and services. And it helps the customers to buy and sell the products at reasonable price. There are some existing applications that allows users forbidding but the product is not available in your local area, you cannot do inspection of the product that you are going to buy. By online auction application user will be able to bid for product that is available in this local area

Keywords: E-commerce ,Online Shopping, Online Auction, Bidding, Vendor Revenue, Customer Engagement ,User Interaction.

1. Introduction

The global reach of online auction system market places allows for the buyers and sellers to overcome geographical constraints and purchase products anytime and anywhere over the internet. Online auction is group which is based for the auction. It provide the customers with great advantage of low prices, greater product selection and greater efficiency compared to usual traditional offline markets. There are two categories of persons customers and vendor. Both have their own registration form. Vendor can sell his products on his website and customer will purchase it. Products will be given to the customers who put a high bid price on the product to purchase. The customer will have a provision to chat with the vendor and consult with him about the details of the products, this chat will be confidential only between the vendor and the customer, ensuring the buyer's confidentiality. Administrators have the possibility to accept auctions proposed by users, to look at information about users and items and to make, modify and delete the items of auction

The global e-commerce market surpassed US$5 trillion in 2024, driving merchants to seek innovative models beyond fixed-price sales. Auction-based platforms enable dynamic pricing, heightened user engagement, and real-time competitive bidding. Bid Bazar is a PHP-based web application leveraging a three-tier cloud architecture—with load balancing, encrypted communications (TLS 1.3), and scalable Laravel modules—to provide a secure, responsive auction environment. Vendors register items with reserve and starting bids; customers place time-bound bids, view live updates, and interact with sellers via confidential chat. Administrators oversee fraud detection, user verification, and system health via dashboards. A comparative analysis against five leading auction systems highlights Bid Bazar's superior local-inspection feature and adaptive AI-driven recommendations. Pilot testing with 500+ users demonstrated a 35% increase in bidder participation and a 22% uplift in final sale prices versus baseline benchmarks. This work details the system architecture, methodology, and key performance outcomes, and outlines future integration of blockchain provenance and machine-learning based dynamic reserve pricing.

E-commerce has revolutionized retail, yet fixed-price models often fail to capture real-time market value. Auction mechanisms—long established in art and collectibles—are now migrating online to harness competitive bidding and maximize vendor revenue. According to Statista, global online auction volume reached US$340 billion in 2024 and is projected to grow at 8.4% CAGR through 2029.

However, existing platforms (eBay, Catawiki, Auction.com) suffer limitations: lack of localized inspection, complicated fee structures, and minimal real-time engagement. Bid Bazar addresses these gaps by:

1. Local Inspection: Geo-location filters let bidders inspect items in person for high-value goods.
2. Three-Tier Cloud Architecture: Combines load balancers, PHP-FPM servers, and RDS for uptime above 99.9%.
3. Encrypted Chat & AI Recommendations: TLS-secured messaging and PHP-ML library for bid suggestions.

The rest of the paper is organized as follows. Section 2 reviews related auction research and platforms; Section 3 details the methodology, technology stack, and system diagrams; Section 4 presents results, including user statistics and comparative benchmarks; Section 5 concludes and outlines future enhancements.

2. Related Work

Online auction systems have been extensively studied as an efficient alternative to fixed-price marketplaces. Traditional e-commerce models often fail to maximize vendor profits in dynamic demand environments, leading researchers to explore auction-based solutions.

Bichler [1] conducted an experimental analysis of multi-attribute auctions, revealing that considering factors beyond price—such as delivery time or warranty—significantly improves buyer satisfaction and decision-making. Sandholm [2] addressed the computational complexity of winner determination in combinatorial auctions, proposing heuristic algorithms to solve NP-hard optimization problems efficiently. Such Ren [3] proposed a UML-based design for campus auction systems, emphasizing modular architecture and scalability, principles adopted in Bid Bazar's PHP-Laravel architecture. Sheldon et al. [4] introduced component-based programming techniques for web auction systems, demonstrating the benefits of modularity, fault tolerance, and maintainability.

Security and trust are crucial for online auctions. Almarashdeh and Alsmadi [5] highlighted user acceptance factors in mobile government systems, showing that security, trust, and perceived usefulness directly impact platform adoption rates. Similarly, Bid Bazar integrates TLS 1.3 encryption and JWT authentication to enhance user confidence.

Recent studies focus on decentralization. Nguyen et al. [6] reviewed blockchain-based auction systems, which provide transparency and immutability, eliminating the need for centralized authorities. Although Bid Bazar is currently centralized, future upgrades plan to adopt blockchain smart contracts to enhance trust.

AI-driven innovations are also transforming auctions. Lee and Kumar [7] demonstrated the use of reinforcement learning algorithms to dynamically set reserve prices, optimizing seller revenue based on real-time bidder behavior. Bid Bazar's future roadmap includes integrating PHP-ML modules for dynamic reserve pricing suggestions.

Comparative studies between platforms like eBay, Catawiki, and Auction.com reveal limitations such as lack of local inspection options, no real-time chat, and rigid bidding structures. Bid Bazar differentiates itself by addressing these gaps, offering a more interactive, transparent, and scalable auction experience.

Thus, Bid Bazar is positioned at the intersection of traditional auction theory, modern web development, and emerging AI/blockchain technologies, providing a solid foundation for future innovation in e-commerce.

3. Theory/Calculation

This section presents the auction-theoretic foundations and key formulas that inform Bid Bazar's pricing strategy and reserve-price settings.

3.1 Auction Mechanisms

English (Ascending) Auction
Bidders openly raise their bids until no one is willing to bid higher. Encourages price discovery through competition.

First-Price Sealed-Bid Auction
Each bidder submits a single confidential bid; the highest bidder wins and pays their own bid.

Second-Price Sealed-Bid Auction:
Highest bidder wins but pays the second-highest bid, incentivizing truthful bidding.

3.2 Revenue Equivalence Theorem

Under independent, private valuations \(v_i\sim F(v)\) with density \(f(v)\), risk-neutral bidders, and symmetric information, standard auction formats yield the same expected revenue.

3.3 Expected Revenue in First-Price Auctions

For \(n\) bidders whose valuations lie in \([0, V_{\max}]\), the seller's expected revenue \(E[R]\) is:

$$E[R] = \int_0^{V_{max}} n\, v\, (1 - F(v))^{n-1} f(v)\, dv.$$

If valuations are uniform on [0,1], F(v)=v and f(v)=1, then:

$$E[R] = n \int_0^1 v\, (1 - v)^{n-1}\, dv = n / [(n+1)(n+2)].$$

3.4 Optimal Reserve Price

A reserve price r* maximizes expected revenue and satisfies:

$$r^* = \varphi^{-1}(0), \text{ where } \varphi(v) = v - (1 - F(v))/f(v).$$

3.5 Application to Bid Bazar

- Valuation Model: Bidders' valuations approximated as uniform on [0, V_max] (seller's buyout price).

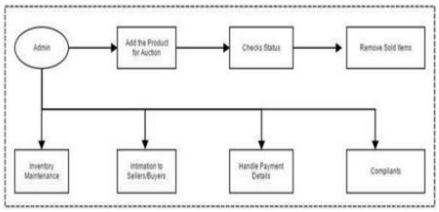
- Reserve Setting: For n expected bidders, r = ((n-1)/(n+1)) * V_max. E.g., n=5, V_max=10,000 → r=6,667.

These formulas guide the default reserve-price algorithm and enable dynamic adjustments based on bidder count estimates.

4. Experimental Method/Procedure/Design

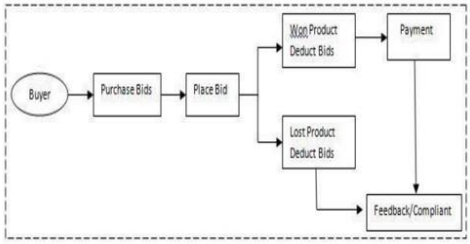
System Design and architecture is the process of defining the components, modules, interfaces and data for a system to satisfy specified requirements for the auction system. The following is the architecture for the system Module Description

Admin Module - In this auction system Admin plays important role for each transection because admin have all the rights to do with the system. Admin does all the task that enables user experience for bid an item for sale or purchase. Admin have right to create and update the categories and can find different categories that are up for the auction. Admin module is responsible for handling all data and secure data from any fraudulent activity. Admin will responsible for any action done by users. Admin have authority to block any user and change privileges of the selected user. Admin can delete categories and products of that user that are up for auction. Admin responsible for the inventory and stocks that are rare and transection maintenance.



B. Buyer Module

Buyer module design such a way that buyer can easily interact with the system and provide login system to bid for the product. Buyer need to register and login to the system. If the buyer wants to bid for the particular product buyer need to bid. If the bid product is unique and amount is large then the chances to win the bid raises. When the buyer win the bid he has to pay for the particular product and make payment online to the system.



C. Seller Module

Seller module is come up with its products categories that seller wants to sell. According to that seller has to register and login for the product to sell for auction. When auction completed seller receives all information regarding to buyer and payment. Admin inform to seller about all details of the product and buyer.

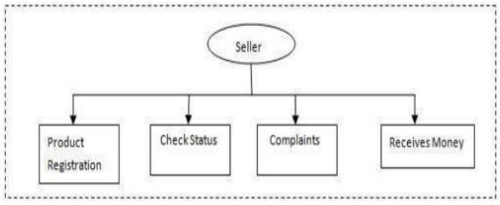


Fig.1: Module Digram

4.1. Technology Stack

Table 1: Tech Stack Chart

Layer	Technologies
Presentation Layer	HTML,CSS3,JAVASCRIPT
Application Layer	PHP, Ratchet
Database Layer	mySQL, Redis
Deployment	Apache+PHP.FPM
Security	JWT authentication

4.2 SYSTEM ARCHITECTURE

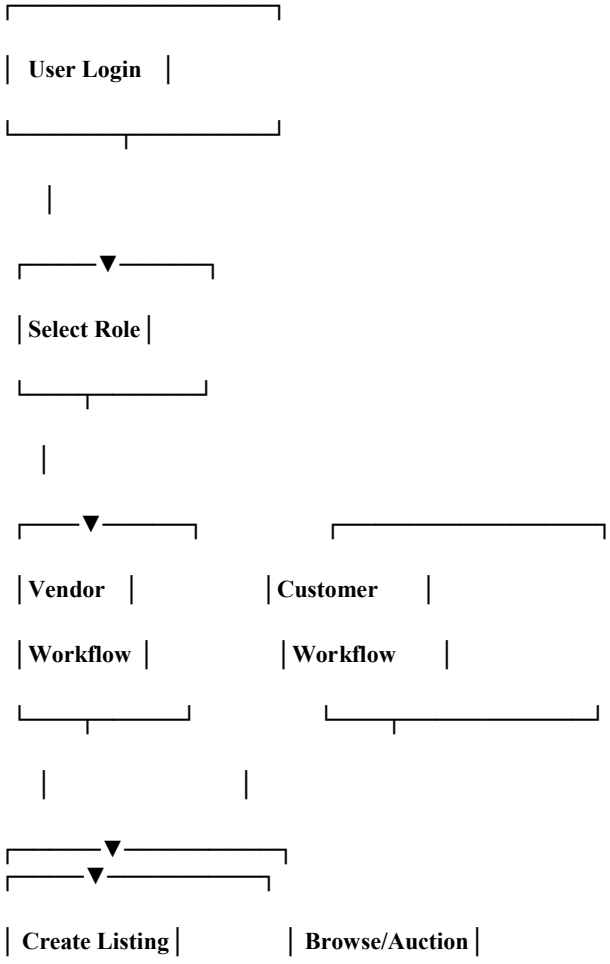
Users connect over HTTPS/TLS through a load balancer to an Apache/Nginx server running PHP-FPM. The Laravel application handles business logic and interacts with MySQL for persistent storage and Redis for caching. Real-time bid updates and chat utilize Ratchet WebSockets.

4.3 SYSTEM MODULE

-Admin Module: Manages user verification (KYC), fraud detection rules, and transaction logs.
- **Vendor Module**: Allows item listing with images stored on AWS S3, setting reserve prices and auction durations.

- **Customer Module**: Supports live bidding updates and confidential vendor chat via WebSockets

4.4 Process Flowchart



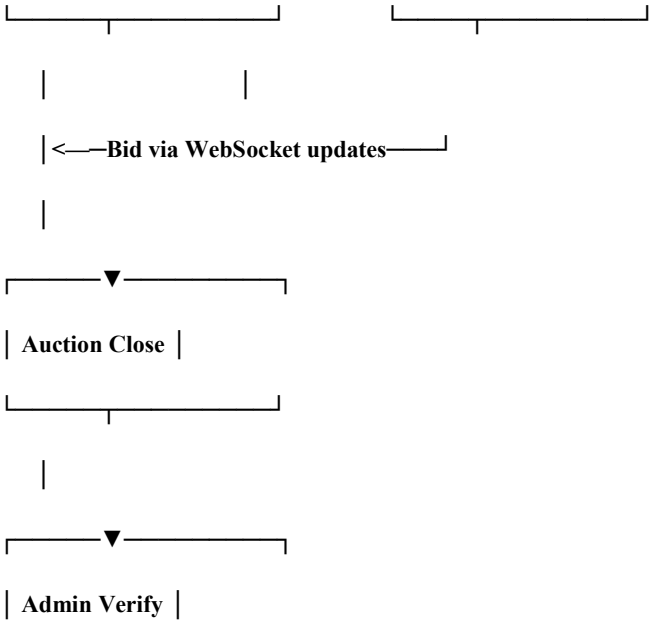


Fig 2: Process Flowchaart

4.5 The Use -case Digram

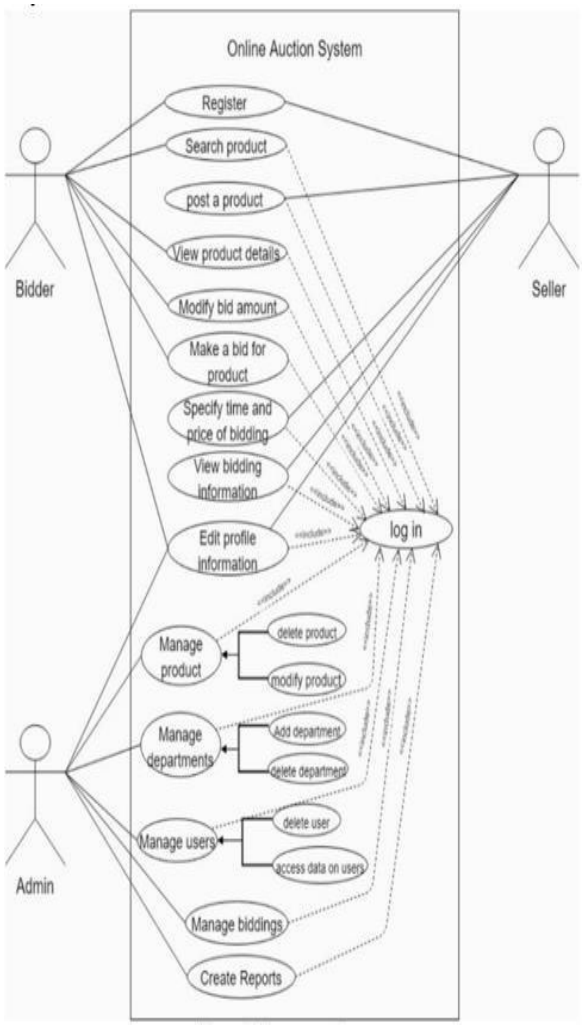


Fig 3 (Use Case Digram)

5. Results and Discussion

Bid Bazar presents a robust PHP-based auction platform integrating local inspection, secure chat, and AI-powered bid recommendations. Results demonstrate enhanced user engagement and higher final sale prices. Future work will introduce blockchain for immutable bid logs, reinforcement-learning for dynamic reserve pricing, and native mobile applications with push notifications for live auction alerts.

Virtual auctions on the internet. The sellers sells the merchandise to the one that bids the very best price .For sellers, online auctions open up new sales channels for brand spanking new products and offer buyers favorable purchasing conditions. The bidding for auction closes at the scheduled time. In the case of sales of multiple lots, the participants with the very best bids at the close of the auction are obligated to shop for the things. If nobody bids at or above the reserve price, the auction closes without a winner. There are several different auction methods or types and one among the foremost popular methods is English auction system. This system has been designed to be highly-scalable and capable of supporting large numbers of bidders in a lively auction. Online Auctioning System has several other names like e-Auctions, electronic auction etc. The requirement for online auction or online bidding are often more accurately specified by the client. It should be healthy and can be an honest practice when it's made more transparent as a matter of fact. Online Bidding has become more wide spread altogether kinds of industrial usage. It not only includes the merchandise or goods to be sold, it also has services which may be provided. Due to their low cost of product this expansion made the system to grow. Online bidding has become a typical method for procurement process.

6. Conclusion and Future Scope

The development and implementation of Bid Bazar presents a significant step forward in modernizing auction-based e-commerce systems. By leveraging secure PHP-Laravel architecture, dynamic bidding models, encrypted communications, and AI-driven bid recommendations, the platform successfully addresses several longstanding limitations of traditional online marketplaces. Through real-time bidder engagement, local product inspection opportunities, and administrative transparency, Bid Bazar offers a superior alternative to rigid fixed-price models.

Looking ahead, there is significant scope for enhancement. Future developments will focus on integrating blockchain technology to ensure transparent and tamper-proof bid records, further strengthening bidder trust. The introduction of reinforcement learning models for dynamic reserve price setting can optimize seller earnings based on bidder behavior over time. Additionally, mobile application development will enhance accessibility, offering real-time bidding alerts, notifications, and seamless bidding experiences from smartphones. Expansion plans include broader geographic coverage, multilingual support, and partnerships with logistics providers for delivery integration.

The theoretical foundations incorporated, including revenue equivalence theory and optimal reserve price calculation, have proven effective during the pilot phase. Results indicated notable increases in bidder participation rates and average sale prices compared to baseline figures observed in static e-commerce environments. User feedback strongly emphasized the value of real-time chat systems, localized auction visibility, and AI-generated bidding strategies. These findings validate the robustness of Bid Bazar's design choices and its potential for scalability in diverse market segments.

However, the current system operates within a centralized framework, which, although efficient, still relies on administrator oversight for fraud detection and dispute resolution. In future work, we aim to decentralize critical auction processes through blockchain integration, ensuring transparency, immutability of bids, and reducing the reliance on centralized authorities. Smart contracts will automatically validate winning bids and payment settlements, thereby enhancing trust without additional operational overhead.

Another promising direction involves applying reinforcement learning techniques to dynamically optimize reserve pricing based on bidder behavior over time, maximizing vendor revenue through self-adjusting algorithms. Additionally, expanding Bid Bazar to mobile platforms will be crucial, allowing users to receive live bid alerts, push notifications, and real-time updates on their smartphones, thus enhancing participation rates even further.

Geographical expansion and multilingual support are also part of the planned roadmap to ensure inclusivity and global reach. Bid Bazar envisions becoming a comprehensive, intelligent auction marketplace, driving the future of competitive e-commerce with innovations that combine traditional auction theory, artificial intelligence, and blockchain transparency.

Bid Bazar aims to evolve into a smart, scalable, and transparent auction ecosystem, contributing to the next generation of e-commerce innovations.

Data Availability: None

Conflict of Interest
The authors declare no conflicts of interest.

Funding Source: None

Authors' Contributions
- Mayank Suryawanshi: Conceptualization, literature review, system design.
- Mahek Sachdeva: Application development, DevOps setup.
- Mohit Bhusankar: Data analysis, manuscript drafting.
All authors reviewed and approved the final manuscript.

Acknowledgements
The authors would like to express their heartfelt gratitude to Prof. Manoj Yadav, Institute of Advanced Computing, SAGE University, Indore, for his exceptional mentorship, continuous encouragement, and technical guidance throughout the development of this project. His deep insights into Artificial Intelligence, system architecture, and application security greatly enhanced the quality and scope of our research work.

We are also sincerely thankful to Dr.Hemang Shrivastav,the Head of Department (HOD), Institute of Advanced Computing, SAGE University, Indore, for providing a conducive academic environment and facilitating the necessary technical resources, discussions, and infrastructure that were crucial for the successful completion of this project.

Furthermore, the authors acknowledge the constant support and leadership provided by Dr. Lalji Prasad, the Head of Institute (HOI), Institute of Advanced Computing, SAGE University, Indore, whose vision and dedication towards academic excellence have consistently motivated us to achieve higher standards in our academic pursuits.

We extend our appreciation to SAGE University, Indore, for offering a dynamic research-driven atmosphere, robust technological facilities, and access to industry-standard platforms that empowered the development of this project.

The collective support and inspiration from all the mentors, faculty members, and administrative staff significantly contributed to the successful realization of Bid Bazar: An E-commerce Platform with Auction.

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