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Design and Development of An Online Auction System

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Abstract
Inventory The Online Auction System (OAS), named Bidify, was developed to address inefficiencies in existing online auction platforms by enhancing user experience, security, and transparency. This study aims to evaluate Bidify by gathering and analyzing feedback from the users. The methodology involved usability testing with a sample of 32 students who provided quantitative data through surveys and questionnaires. The results indicate that Bidify offers a user-friendly interface and robust functionality, effectively reducing fraudulent activities and enhancing the bidding process. However, areas needing improvement were identified, such as error handling, advanced notification features, and additional security measures. The study concludes that continuous user feedback and iterative development are essential for the system's success. Bidify has the potential to set a new standard in online auction platforms by providing a secure, reliable, and user-centric experience. This improved platform will benefit both buyers and sellers in the online marketplace, offering a more transparent and efficient auction process. By addressing prevalent issues and incorporating user suggestions, Bidify demonstrates significant promise for revolutionizing online auctions.

Keywords: *online auction system, bidding, online marketplace.*

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I. INTRODUCTION

In recent years, the electronic marketplace has expanded dramatically in terms of convenience, size, and value. It is projected that this trend will accelerate in future years. As a result of the constantly expanding internet environment, customers can easily access the things that they purchase in the traditional market through online auction platforms. Online auctions are a major component of the electronic marketplace, which uses electronic commerce techniques (Aldaej et al., 2019).

Auction means Latin work, which implies growth. The auction process involves bidding, purchasing, and giving services. (Sharma, 2020). An online auction is a service that enables auctioneers or consumers to sell or bid on items over the Internet. Bidders can consider and study the transaction before bidding because it is only displayed for a few days. The absence of geographical or temporal constraints has boosted the number of bids received. Online auctions are both cheaper and less expensive than traditional auctions. Both buyers and sellers will benefit from this arrangement. Sellers gain access to a larger pool of clients and can provide more access and services at a lower cost (Wen & Wong, 2021).

Virtual auctions on the internet. The seller sells their item to the highest bidder. Online auctions provide sellers with new sales channels for new products and give favorable purchasing conditions to buyers. Bidding for auctions ends at the scheduled time. When selling several lots, the highest bidders at the end of the auction must purchase the items. If nobody bids at or over the current bid, the auction ends without a winner. Online auctioning systems are often known as e-auctions or electronic auctions (Shirode et al., 2021). Auctions are classified into several categories, including English, Vickrey, Dutch, double, and so on. The English auction is the most common sort of auction. An English auction is known as an ascending price auction. To win, bidders must outbid each other, pushing the price higher. The winner is the bidder who pays the highest price at the end of the auction (Trevathan et al., 2009).

Users frequently specify more precisely the requirements for an online auction or bidding. It should be a healthy and honest practice if it is made more transparent. Online bidding has become more widespread in all types of industrial applications. It covers not only the merchandise or goods to be sold, but also the services that may be offered. Because of the low cost of the product, this expansion allowed the system to grow. Online bidding has become a common method for the procurement process (Shirode et al., 2021).

Words like "system" are frequently used in daily speech, online forums, and scholarly publications. A system is characterised as a unit made up of entities, parts, or constituents that are linked together to facilitate the flow of information, matter, and energy towards the fulfilment of an objective in the form of optimal

circumstances. A system is, broadly speaking, a group of items that are connected to one another. The systems may be conceptual, physical, or a combination of the two (Online Auction, 2022). The system has a three-tier architecture: a relational database that stores information about items, users, and auctions; an application server that handles business logic; and a front-end interface with a web browser for user interaction. The database is not directly accessible, but administrators can make changes without connecting to it (Shirode et al., 2021).

II. LITERATURE REVIEW

This chapter primarily focusses on the common gathering of information and essential resources from all sources involving the internet, as opposed to online auction platforms. This study will focus on current internet auction searches and examine the actions of eBay.com, the world's most popular online auction platform. (Asong, 2016)

According to Asong (2016), a Literature Review is the condition, impression, and important evaluation of a body of literature relating to a study topic or problem. This form of study provides users with various perspectives on the topic area, including how alternative methodologies were approved in the SDLC (Software Development Life Cycle), the approach to testing, how venture actions were planned, and much more. This research endeavor additionally studied articles and journals on the internet addressing the subject topic and grew into application software produced for an online auction website.

Online commercial activity through web-based auctions began in 1995. Pierre Omidyar created eBay in September 1995, initially named AuctionWeb, marking the first website connecting online sellers and buyers. In just a year, it transitioned from a hobby to a thriving business, generating $7.2 million in sales. In 1997, AuctionWeb rebranded as eBay. In 1998, eBay went public with an IPO at $18 per share, which quickly surged to $53.50 per share on NASDAQ (Wiredelta, 2022).

When eBay founder Pierre Omidyar auctioned off a damaged laser pointer on his website in September 1995, he sparked a business uprising. Economists have long advocated auctions for their ability to realize prices, but the main obstacle to their widespread usage was the cost of assembling bidders. Internet auctions solve this critical issue. Three years later, in 1998, eBay's gross fourth quarter merchandise volume totaled $307 million. Total sales for the fourth quarter of 2005, ten years after eBay's founding, were $12 billion. In 2008, eBay boasted that if it was a traditional retailer, it would be the sixth largest (by sales volume) in the United States; nevertheless, in the third quarter of 2008, it experienced negative growth for the first time in its existence. EBay is now available in 29 countries, offering anything from Cold Mountain (the book, DVD, and mountain) to marbles (Asong, 2016).

eBay, being a prominent international e-commerce platform, presents a multitude of benefits for sellers. eBay boasts a substantial user base of 168 million active individuals during the third quarter of 2017, offering a wide-ranging platform for product promotion. This affords sellers the opportunity to gain significant visibility among a large and engaged audience actively searching for various commodities. Successful transactions on eBay can serve as a potential avenue for cultivating client loyalty and encouraging repeat purchases by redirecting purchasers to your online business. The platform's adaptability facilitates the commercialization of a diverse range of products and services, accommodating several specialized markets. Nevertheless, the process of navigating eBay has several problems. Sellers are obligated to comply with the rules and policies enforced by the platform, which restrict their influence over certain features, such as return policies. The imposition of seller fees is a significant disadvantage that can have a detrimental effect on profitability, especially for products characterized by narrow profit margins. Moreover, the highly competitive environment on eBay, fueled by a vast number of engaged users, necessitates the implementation of strategic differentiation in order to effectively distinguish oneself from competitors. Although eBay provides a substantial platform for sellers, it is crucial for sellers to carefully consider the advantages and disadvantages associated with the platform's regulations, charges, and competitive environment (Cannon, 2020).

EBid, founded in 1998, is a British online marketplace that bears a resemblance to eBay. It maintains a strong presence in the realm of online auction sites, consistently ranking among the top players. EBid attracts an average of 8 million monthly visitors, with a daily traffic volume of around 60,000 users. Over the course of a year, it records an impressive average of 15 million unique visits. Currently, eBid hosts a substantial inventory, with more than 3.8 million active listings available. The platform offers a diverse range of up to 12,000 categories for both auctions and fixed-price listings. The estimated total value of the eBid website is around 6 billion USD.

EBid presents both advantages and disadvantages for users. Firstly, eBid is lauded for its user-friendly interface and consistent rules and regulations, simplifying the process of maintaining a store on the platform. It also boasts high ratings for its customer support and service, setting it apart in its category. Additionally, eBid offers a seller-friendly fee structure, with no listing fees and a 3 percent cap on the Final Value Fee (FVF) per transaction. Conversely, the drawbacks of eBid include its lower volume of traffic and activity, resulting in longer listing durations and potentially slower sales. Listings on eBid tend to take more time to complete on average. Furthermore, despite being an online auction site, users on eBid often favor the "buy it now" option over participating in bidding wars, which are less common on the platform. To maximize the value of their inventory, sellers might find it more effective to set their starting price as their desired sale price from the beginning (Slade, 2023).

Listia was founded in 2009, operates as an online auction platform that bears similarities to eBay. However, Listia distinguishes itself by using a credit-based system instead of real currency. Users trade items using these credits; when they sell items, they earn credits, and when they buy items, they spend their credits. Each user begins with an initial allocation of 500 credits, allowing them to obtain items without incurring any costs. If users require more credits, they have the option to either purchase them or complete offers to earn additional credits. Listia offers free membership and allows users to list items and place bids without any associated fees (Avery, 2020).

Listia provides a one-of-a-kind online auction experience, replete with its own set of benefits and downsides. One of its distinguishing aspects is its credit-based system, which offers a separate trade environment in which players can barter products for credits rather than traditional currency. Furthermore, Listia encourages active participation by allowing users to earn credits through activities such as item sales, auction participation, and referrals (Weebly, n.d.). Listia, on the other hand, has some limits. For example, it may have a smaller user base than major e-commerce platforms, resulting in fewer available consumers and sellers. The credit system may also be restrictive for some users, and there may be a learning curve involved in accessing the platform (Haan, 2023).

III. METHODOLOGY

The methodology that used to develop this project is the waterfall model (Figure 1).

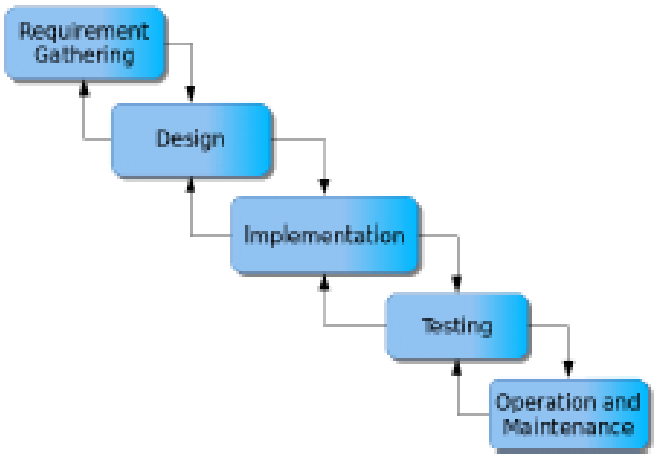


Figure 1: Waterfall Model

The waterfall model is a prominent software engineering and product development method to the software development lifecycle (SDLC). The waterfall model employs a logical succession of SDLC processes for a project, analogous to how water pours over a cliff's edge. It establishes different endpoints or objectives for each stage of growth. After they have been completed, the endpoints or goals cannot be revisited (Lutkevich & Lewis, 2022).

Comprehensive data collection will be conducted during the first phase of the Waterfall Model to understand the requirements and expectations of the stakeholders. Engaging with potential customers, sellers, and administrators to collect insights about the features and functionalities required for a robust and user-friendly online auction system is part of this process. Feedback on user experience expectations, navigation preferences, and the overall appearance and feel of the platform will be solicited. This phase's major result will be a detailed requirements paper explaining the specific needs and preferences uncovered during data collecting.

The system design phase will focus on establishing a blueprint for the online auction system based on the criteria received. This includes creating architecture, user interfaces, and workflows that are in line with the project's goals. The system design will prioritise fluid navigation, clear instructions, and an intuitive interface in order to achieve the goal of producing a robust, reliable, and user-friendly system. To provide a visual depiction of the system's structure, detailed mock-ups and prototypes will be created. This phase's major outputs will be system architecture diagrams, interface mock-ups, and a complete design document.

The system development phase will begin after the design is complete. Based on the specifications established in the design phase, this is where the real coding and implementation of the online auction system will take place. Encryption, authentication, and fraud detection techniques will be systematically included into the development process to achieve the security and privacy goals. The emphasis will be on laying a solid foundation for the system. This phase's deliverables will comprise the created system, source code, and an early prototype of the online auction platform.

Following the completion of the development phase, the system will be thoroughly evaluated to ensure that it achieves the set objectives. Functional testing will be performed to ensure smooth navigation and clear instructions, as well as security testing to evaluate the effectiveness of encryption, authentication, and fraud detection measures. The system's features related to equal chances, real-time updates, and bid history will be extensively reviewed in order to achieve the transparency goal in the bidding process. This phase's deliverables will include a detailed testing report noting areas of strength and improvement.

The Waterfall Model's final phase is incorporating comments from the evaluation phase to make necessary modifications. This iterative process allows for feature refinement, security advancements, and modifications to ensure fair opportunities in the bidding process. The system will be fine-tuned in response to user comments and testing results, with the goal of addressing any discovered flaws and optimizing overall functionality. The final version of the online auction system, incorporating the changes achieved during the improvement stage, will be the main deliverable from this phase.

IV IMPLEMENTATION

Table below show the lists of all use case or functional requirements for Online Auction System (OAS).

Table 1: Functional Requirements

Use Case	Descriptions
Register Account	This use case allow user to register account. The required input for this use case includes username, password, first name, last name, birth date, gender, phone number, address and email. System will save all the information into database and user registered account successfully.
Login	This use case allow user to login to the system. The required input for this use case includes username and password. System will validate the username and password. If username and password are valid, user will successfully login. Else, user will not allowed to login.
Forget Password	This use case used when user forget their password. The required input for this use case includes username, email and a new password. System will validate user's username and email, if correct, system will allow user to create a new password. Else, system will reject the request to change password.
Logout	This use case allow user to logout from the system. System requires user to click "Logout".
Search Item	This use case allow user to search item in the system. System requires user to input the item name to search a particular item. System shall display the possible item.
View Item	This use case allow user to view the ongoing listed item information. System requires user to click on the desired item. System shall display the item information like item name, picture, description, seller name, starting bid, current bid, and bid time left.
Place bid	This use case allow user to place bid on an item. The required input for this use case is the bid amount. If the bid amount higher than current bid, the bid will be successful. Else, the bid is unsuccessful.
Manage Watchlist	This use case allow user to manage their watchlist. User shall click on "Watchlist". System will display all items in watchlist.

Withdraw from Auction	This use case allow user to withdraw from an auction. User is required to click "Withdraw from Auction". System will set the previous bid price of the item as current bid.
Remove from Watchlist	This use case used allow user to remove item from their watchlist. User required to select the item and click "Remove".
Add to Watchlist	This use case allow user to add item into their watchlist. System requires user to click on an ongoing listed item then click "Add to Watchlist".
Create Auction	This use case allow user to sell item by creating an auction. The required input for this use case is item name, picture, description, category, starting bid, start time and end time. System will display the auction on the main page.
Modify Auction	This use case allow user to modify their created auction information. User is required to click "Modify" and edit the auction information. System shall save and display the latest auction information.
Delete Auction	This use case allow user to delete their created auction. User required to click "Delete".
Cart	This use case allow user to view their cart. User is required to click on the cart icon. System shall display the won item in cart.
Checkout	This use case allow user to checkout won item in cart. User shall select the item and click "Checkout". System will display the item information and buyer address.
Make Payment	This use case allow user to make payment on checked out item. User shall click "Make Payment". System will redirect the payment process to the third-party service.
To Receive List	This use case allow user to view item in "To Receive" list. User shall click on "To Receive". System will display all items in "To Receive" list.
Rating and Comment	This use case allow buyer to give ratings and comments to seller. System requires user to input the rating and comment in the field. System will display the rating and comment in seller's profile.
To Delivery List	This use case allow user to view item in "To Delivery" list. User shall click on "To Delivery". System will display all items in "To Delivery" list.
Change Item State	This use case allow seller to change the item state in delivery process. System requires user to click on "Item State" to change the item state. System shall display the item state to buyer.
Modify Profile	This use case allow user to edit their personal information. User is required to click "Edit Profile" and edit the personal information like username, first name, last name, gender birth date, address, address, phone number and email. System shall save and display the latest personal information.
Change Password	This use case allow user to change their account password. User is required to click "Change Password" then input the old password and create a new password. System will validate the old password. If it is valid, the new password will replace the old password.
View Profile	This use case used allow user to view profile. User required to click the profile icon. System will display profile information.
Report	This use case allow user make report to the system. System requires user to click "Report" then enter the report category, title and content.
Automated Customer Service	This use case allow system to have an automated reply customer service. The required input for this use case is some specific keywords. User will get certain reply based on the keyword.
Manage Report	This use case allow admin to manage the report submit by user of the system. Admin shall click on "Manage Report" to view the report list.
View Report	This use case allow admin to view the report. Admin required to click on a report to view its content. System shall display the report title, category and content.
Delete Report	This use case allow admin to delete selected report. Admin is required to select report then click "Delete". System will remove the report from the list.
Search Report	This use case used allow admin to search report based on their category. The required input for this use case is admin has to select the report category and click "Search".
Manage User	This use case allow admin to manage user of the system. System requires user to click "Manage User" to view the user list.
View User Details	This use case allow admin to view user's personal information. Admin required to click on a user to view their personal information. System shall display the user's personal information.
Delete User	This use case allow admin to delete user in the system. Admin is required to click "Delete User" to delete their account. System will remove the user from the list.
Remove User from Auction	This use case allow admin to remove bidder from an ongoing auction. Admin shall select a bidder from the bidder list and click "Remove from Auction". System will remove bidder from the list.

The class diagram (Figure 2) below shows the structural elements of an online auction system. The primary classes are User, Bidder, Seller, Auction and Admin, and it displays the attributes and operations of the application.

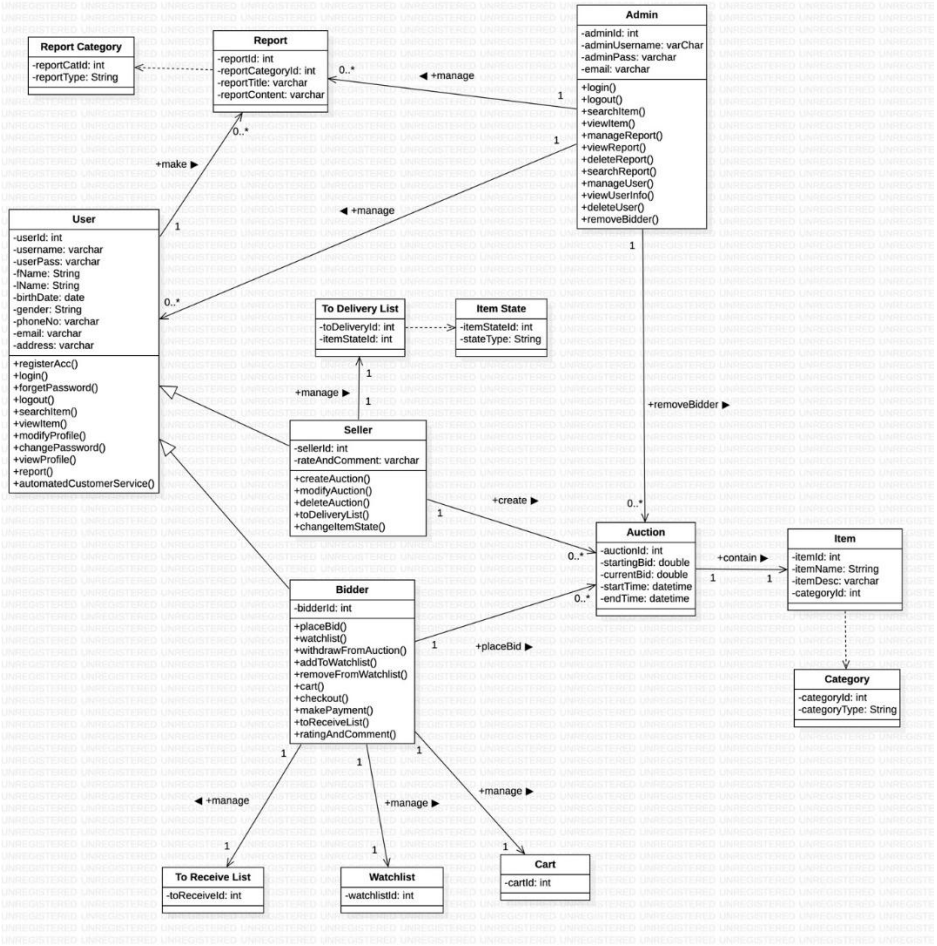
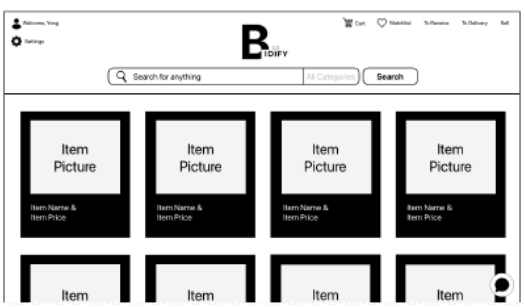
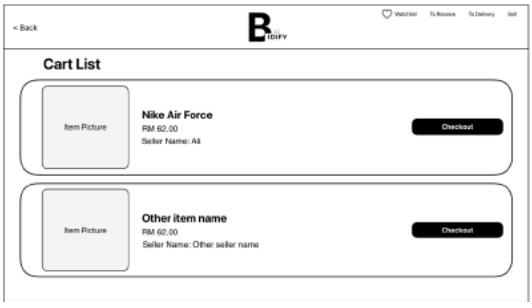


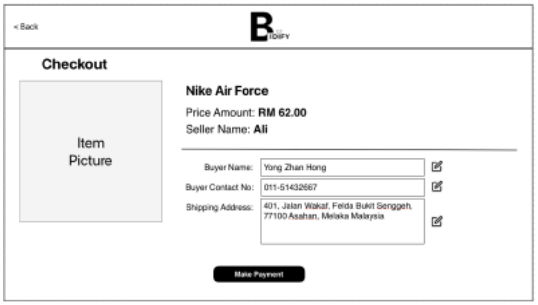
Figure 2: Class Diagram

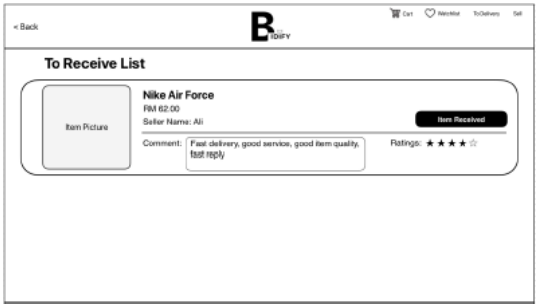
Prototype Development

From the requirements acquired, a prototype of the inventory management mobile app was created. Software prototyping is the practice of displaying software requirements in real-time so that user feedback based on their interaction with the prototype can be received. The primary integrated development environment (IDE) tool was Flutter, while JomHosting served as the web hosting company for databases and data storage. Screenshots of the prototype's interface are shown below:









IV. ANALYSIS AND RESULT

Online Auction System seeks to address these challenges by providing a reliable and trustworthy system that improves the auction experience for both buyers and sellers. Depending on the existing situation, a few methods and flows can be applied to design such a system. The system will include a few main requirements, such as registration and login, profile management, password changing, viewing the count of all active auctions, product details, entering bids, viewing bid status, and adding, updating, deleting, and viewing an auction for their product.

There are various methods for evaluating a system. However, in this situation, the optimum method for evaluating the Online Auction System (OAS) is quantitative. The quantitative methodology focuses on statistical analysis. The quantitative technique requires each respondent to answer a set of questions. Surveys and questionnaires are the most used tools to collect quantitative information. With the availability of incredibly strong online survey technologies, a growing majority of academics are using web-based survey collection for quantitative research. As one might expect, quantitative research is typically less expensive than qualitative research, however, this is not always true. When selecting a collection methodology, it is crucial to consider the system's objectives.

In this situation, usability testing has been selected as an appropriate evaluation technique for the Online Auction System (OAS). It focuses on how users may learn and apply the system to achieve their goals. It also indicates how satisfied users are with the process. Usability is the quality of a user's interaction with systems like websites, software, gadgets, or applications. Usability refers to how properly the Online Auction System (OAS) operates. It is critical to recognise that usability is more than just one aspect of a product, system, or user interface. We use various variables to determine the appropriate assessment, including:

- Usability: To evaluate how user-friendly the system is to navigate and interact with.
- User Acceptance Testing (UAT): To determine whether the web-based system satisfies the needs and expectations of the users.
- Error Handling and Recovery Testing: Assess the system's ability to handle errors and bounce back from failures.

The objectives of this evaluation are threefold. First, it aims to gather feedback from the users regarding the development of the Online Auction System, Bidify. This feedback will provide valuable insights into user

experiences and satisfaction levels. Second, the evaluation seeks to analyze the users' judgments of the system development based on specific criteria, such as usability, security, and functionality. This analysis will help determine how well the system meets user needs and expectations. Lastly, the evaluation aims to identify the strengths and weaknesses of the system, as well as recommended improvements. By understanding these aspects, the development team can make informed decisions to enhance Bidify, ensuring it provides a secure, reliable, and user-friendly auction platform for all users.

The respondents were asked to get involved in the study. This online survey had 32 participants. Every respondent must answer questions about demographics, how the system is used, how simple it is to use, and how it is developed. Initially, respondents were shown how the system operated. Then, based on what they observed and learned about the system being demonstrated, they will use a Google Form to respond to the related questions.

Certain materials were used to evaluate the Online Auction System (OAS). Evaluation questionnaires are highly helpful in identifying factors that contribute to system success or failure. The importance of a questionnaire can have a major impact on how a system works. An evaluation questionnaire, similar to a survey questionnaire, gathers and records important information from a large number of people. This information is required for a system to operate properly and meet its objectives. The Online Auction System (OAS) was evaluated using Google Forms, which is commonly used to create surveys efficiently and easily by providing online questions that users may respond to evaluate the system. As a result, it can be used to gather a wide range of information quickly and easily. Google forms enable us to ask a wide range of questions, including those with brief responses, paragraphs, multiple choice options, verification boxes, pull-down menus, linear scales, and grids with many possibilities.

Google Form is used to collect feedback on our system. The questionnaire was divided into three parts. In the first part, we obtained demographic data from respondents. In the second part, we collected data from respondents about their opinion of our overall system based on certain criteria. This was done by using a Likert scale ranging from "Strongly Disagree" to "Strongly Agree," where 1 indicating "Strongly Disagree," 2 indicating "Disagree," 3 indicating "Neutral," 4 indicating "Agree," and 5 indicating "Strongly Agree." In the third part, we requested respondents to provide feedback on our system by answering brief questions. The charts below display the results and findings obtained through this evaluation method.

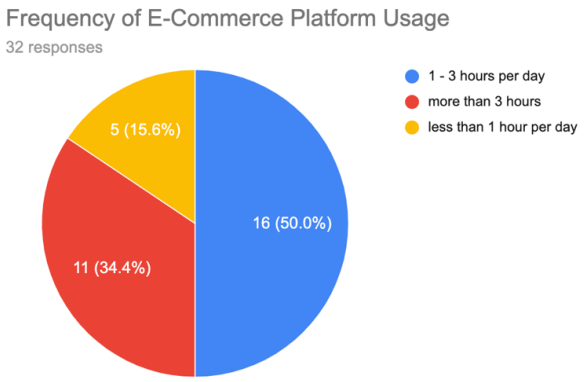


Figure 3: Frequency of E-Commerce Platform Usage

Based on the analysis of the sample data gathered from 32 respondents, the highest frequency of ecommerce platform usage is 1 to 3 hours per day (50%). The next highest is more than 3 hours (34.4%), followed by the lowest is less than 1 hour per day (15.6%).

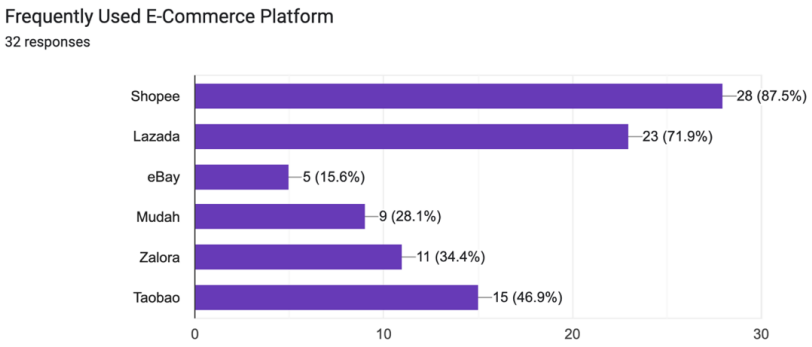


Figure 4: Frequently Used E-Commerce Platform

Figure 4 show the analysis of the sample data gathered from 32 respondents, The platform Shopee is the most frequently used, with 28 respondents (87.5%) indicating it as their preferred choice. Following closely, Lazada is also highly favored, used by 23 respondents (71.9%). Taobao and Zalora are moderately popular, with 15 (46.9%) and 11 respondents (34.4%) using them, respectively. Mudah is used by 9 respondents, representing 28.1% of the participants. The least frequently used platform is eBay, with only 5 respondents (15.6%) reporting its use.

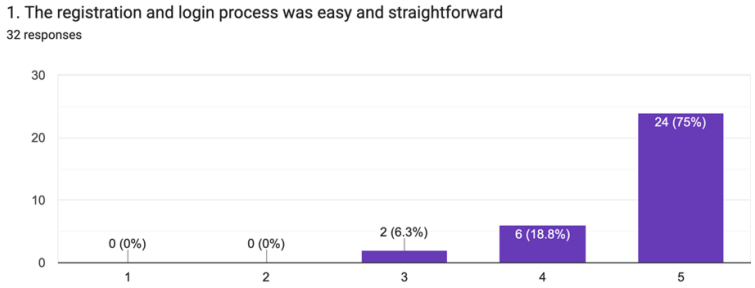


Figure 5: Login Process

Based on the above figure, the majority of respondents strongly agree that the registration and login process was easy and straightforward. This means that the respondents agree that the registration and login process was not complicated.

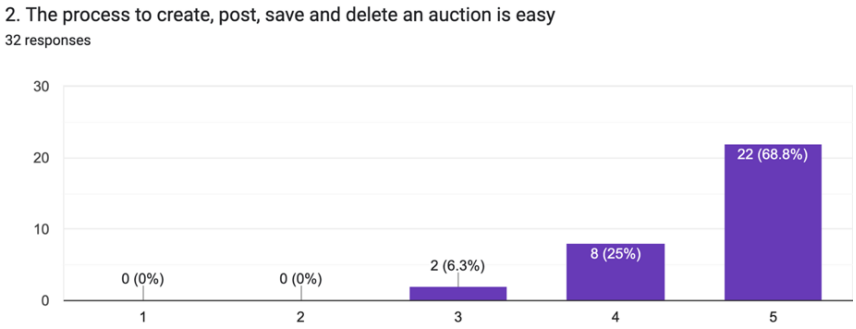


Figure 6: Create Process

Based on Figure 6 above, the majority of respondents strongly agree that the process to create, post, save and delete an auction is easy. Online Auction System systems may provide a simple procedure to let seller create and manage their auction. This can help save user's time to sell their item by using this website.

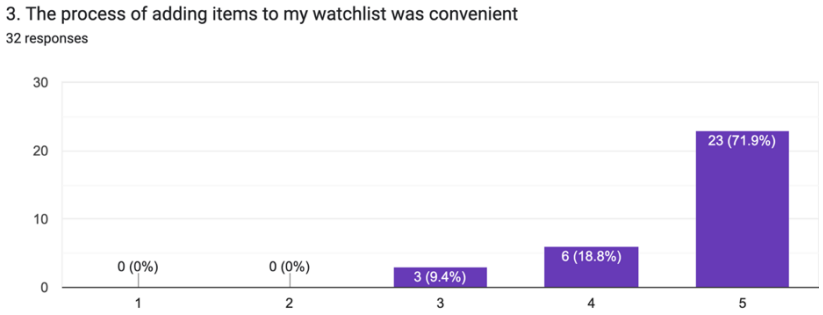


Figure 7: Add Process

Based on the figure above, the majority of respondents strongly agree that the add to watchlist function was convenient for them. Add to watchlist function was created to let user able to save their favorite item into watchlist so that they just need to click on the watchlist icon to view the items.

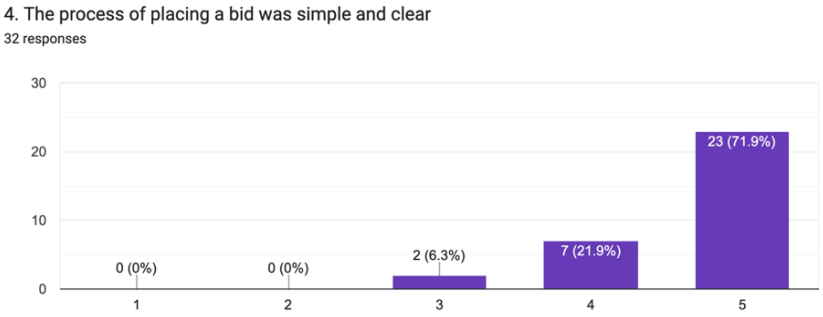


Figure 8: Bid Process

Based on Figure 8 above, the majority of respondents strongly agree that the process of placing bid was simple and clear. The place bid function is the main function in OAS. Respondents clearly knew the process to place a bid on their desired item.

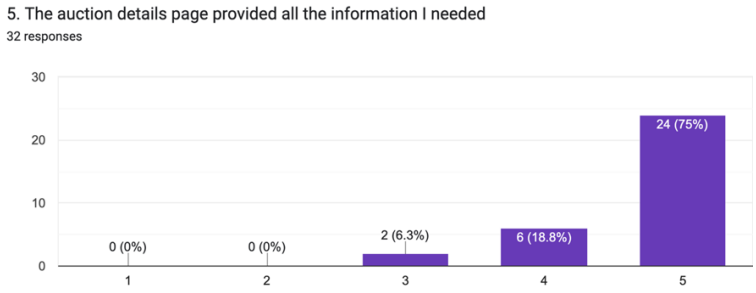


Figure 9: Auction Details

Based on the figure above, the majority of respondents strongly agree that the auction details page has provided all the information they need. Respondents will be able to see the item information like item name, description, price and so on in the auction details page. This statistic shows that the auction details page has fully provided auction information.

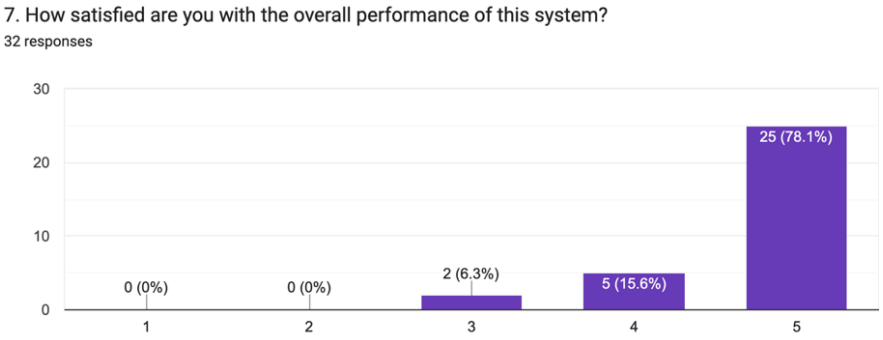


Figure 10: Performance

Based on the figure above, the majority of respondents agree that the system's overall performance is satisfactory. These statistics imply that respondents are generally satisfied when using OAS.

VI. CONCLUSION

The evaluation of the Online Auction System (OAS) developed for users revealed substantial insights into its performance and user satisfaction. The system, named Bidify, was well-received for its user-friendly interface and robust security measures. Most respondents highlighted the ease of use, intuitive navigation, and real-time bidding capabilities as significant advantages, demonstrating Bidify's readiness for broader implementation.

This study identified both strengths and areas for improvement. The system's advanced security protocols were praised for effectively reducing fraudulent activities, which is a common concern in existing online auction platforms. Additionally, the transparent bidding process and comprehensive user interface contributed to a positive user experience. However, the evaluation also pointed out areas that require enhancement. Suggestions included the integration of a chat function to facilitate communication between buyers and sellers, as well as improved notification and alert features to keep users informed about auction status and updates.

These enhancements, informed by user feedback, are crucial for continuous system improvement. Implementing these suggestions will not only address user concerns but also align the system with contemporary needs and expectations. Furthermore, the evaluation underscored the importance of regular updates and user training to ensure that the platform remains relevant and user-friendly.

Overall, the findings underscore the potential of Bidify to offer a more secure, efficient, and user-friendly online auction experience. By addressing prevalent issues such as fraud and lack of transparency, and by incorporating user feedback to refine its features, Bidify sets a new standard in online auction systems. The system's successfully indicates its viability for broader application, suggesting that it can significantly improve the online auction landscape. Moving forward, continued user engagement and iterative development will be essential to maintaining Bidify's effectiveness and ensuring it meets the evolving demands of the online marketplace.

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