ONLINE AUCTION WEBSITE FOR CHARITY FUNDRAISING IN SUPPORT OF UTAR HOSPITAL

BY

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A REPORT

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It is hereby certified that Tee Jian Wei (ID No: 22ACB00692) has completed this final year project entitled "Online Auction Website for Charity Fundraising in Support of Utar Hospital" under the supervision of Ts Dr Phan Koo Yuen (Supervisor) from the Department of Computer Science, Faculty of Information and Communication Technology.

I understand that University will upload softcopy of my final year project in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

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(*TEE JIAN WEI*)

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Signature : 

Name : TEE JIAN WEI

Date : 24 JUNE 2024

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ABSTRACT

This project, titled "Enhancing Charitable Fundraising for UTAR Hospital through an Online Auction Platform," seeks to provide sustainable financial support to UTAR Hospital, an educational and community healthcare institution facing financial constraints. By creating an online auction platform dedicated to charitable fundraising, the project offers a convenient and transparent means for individuals and organizations to contribute to the hospital's mission. The platform offers enhanced accessibility and convenience, enabling donors to participate from anywhere, breaking geographical barriers. It provides an innovative way for the public to contribute to the construction of UTAR Hospital by participating in auction events to bid on unique items and provide funds, as well as by donating items to launch new auction events. The fact that everything is done online addresses the inefficiencies and lack of transparency in traditional fundraising methods, streamlining the process and ensuring full disclosure of auction data, financial information, and fund allocation details to build trust among donors. Motivated by compassion and a commitment to improving healthcare access, the project's contributions include enhanced accessibility and convenience, transparency and accountability, and the potential for sustainable support, ultimately empowering UTAR Hospital to continue its vital role in medical education and healthcare provision.

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β	beta
Ω	Ohm (resistance)

LIST OF ABBREVIATIONS

UTAR	University Tunku Abdul Rahman
UH	UTAR Hospital
TCM	Traditional Chinese Medicine
SDLC	System Development Life Cycle
HTML	Hyper Text Markup Language
CSS	Cascading Style Sheets
SQL	Structured Query Language
JWT	JSON Web Token
UTAR	University Tunku Abdul Rahman
UH	UTAR Hospital

CHAPTER 1 Introduction

In this chapter, we will delve into the problem statement and motivation, outline the project scope, elucidate the project objectives, highlight the contributions made, and provide relevant background information. This comprehensive exploration aims to establish a clear foundation for understanding the context, significance, and goals of this project.

1.1 Problem Statement and Motivation

UTAR Hospital requires a sustainable source of funding to continue offering quality medical services and contributing to medical education. [1] Traditional fundraising methods, such as charity events and activities, may yield limited results and require significant effort for preparation, including decorating event locations, managing human resources, and promoting the events. Therefore, there is a need for a more efficient and accessible approach. With this online auction platform, numerous resources, costs, and time can be saved because all charity activities are conducted online, allowing participants to complete transactions with just a few clicks from the comfort of their homes.

Moreover, potential donors often seek transparency and accountability when contributing to charitable causes. However, in many online auction platforms, auctioneers are often reluctant to share their auction data, primarily due to privacy concerns. While the primary objective of this project is to raise funds for charitable causes, concerns regarding where the fund goes, and the responsible sharing of information have been prioritized. There is a lack of standardized practices and guidelines for maintaining transparency in the collection, storage, and dissemination of data, including donor information, transaction records, and fund allocation details. This lack of transparency can undermine trust among donors, deter potential contributors, and potentially hinder the effectiveness of charitable fundraising efforts. To safeguard against potential financial fraud and ensure accountability, the initiative has been taken to make all aspects of the platform open to the public. This commitment extends to the following areas:

- **Fund Distribution**: Full transparency is maintained in how funds are allocated to charitable causes. Every step of the fund distribution process will be visible to the public, allowing donors to see the direct impact of their contributions.
- **Auction Data**: All auction-related data, including item listings, bidding history, and final sale prices, will be accessible to the public. This openness ensures that the auction process remains fair and trustworthy.
- **Transaction Data**: Transparency extends to financial transactions as well. Transaction records, including payment details and expenses, will be available for scrutiny, reinforcing financial integrity.
- **Donor and Bidder Contributions**: The names (or organization names) of donors and winning bidders will be displayed. This visibility not only acknowledges their contributions but also promotes a sense of community among users.

By adopting this comprehensive approach to transparency, this project aims to create a secure and trustworthy environment that encourages participation, deters fraudulent activities, and ultimately supports the charitable mission. The belief is that openness is a fundamental element of building a robust and ethical online auction platform for charitable fundraising.

1.2 Objectives

The first objective of this project is to offer the public an additional and flexible way to donate to UTAR Hospital, not just through monetary contributions but also by donating valuable items to launch new auction events. This approach sets our online auction apart from traditional charity events, as it opens up more opportunities for individuals to contribute in ways that align with their preferences and resources. By allowing people to donate items such as limited-edition goods, antiques, or collectibles, we can attract a broader audience that may not be inclined to give money but is eager to support the cause through their personal belongings. This strategy caters to a diverse group of potential donors, ensuring that the platform appeals not only to those who can provide financial support but also to those who have valuable items to contribute. In turn, this wider participation increases the likelihood of raising more funds through the auction, as both financial and item donations contribute toward the hospital's goals. Overall, this dual donation model enhances inclusivity, broadens our target audience,

and has the potential to significantly increase the overall contributions made in support of UTAR Hospital.

The second objective of this project Is to create a non-competitive and welcoming environment for all participants. In traditional auctions, bidders often compete directly against one another, striving to win an item by offering the highest bid. This competitive dynamic can sometimes lead to emotional bidding, where participants lose sight of their financial limits and place bids beyond their means. Such pressure can be discouraging for some individuals and may deter them from participating in future auctions. To mitigate this risk, our project adopts a silent auction format, which provides a more relaxed and thoughtful experience. In a silent auction, bidders are unaware of the bids placed by others until the event overs. This allows each participant to focus on their own decision-making process, carefully evaluating their financial capacity without the influence of other bids. By removing the immediate competition and fostering a more private bidding environment, we hope to encourage broader participation, ensuring that bidders feel comfortable and in control throughout the process. Ultimately, this format promotes a sense of fairness and inclusivity, making the auction more appealing to a wider audience.

For our final objective, we aim to provide a comprehensive dashboard that visualizes key data related to the auction and donation activities. This dashboard will display a range of important metrics, including total collected funds, total utilized funds, funds collected by month, trending auction items, average bid amounts, and more. By offering such detailed insights, we aim to increase donor confidence, as they will have a clear understanding of how their contributions are being used and managed. Transparency is crucial in any charitable effort, and by making this information readily accessible, we can help prevent issues such as embezzlement and corruption, ensuring that all funds are allocated responsibly and ethically.

In addition to fostering trust, the dashboard will also serve as a valuable tool for stakeholders, enabling them to analyse website activity and identify trends in fund collection. For instance, by monitoring the most popular auction items, donors can adjust their contributions to include items from categories that are in high demand, potentially boosting overall funds raised. Furthermore, tracking user engagement and donation patterns over time will help stakeholders make informed decisions to optimize

auction strategies, ensuring the platform remains efficient and responsive to the community's needs. Ultimately, this transparent and data-driven approach will not only enhance trust but also support more effective decision-making for ongoing and future fundraising efforts.

1.3 Project Scope and Direction

This project develops an auction website with financial transparency by publishing all the details of how collected funds are used. Upon completion of this project, a fully functional online auction website will be established. Users will have the dual capability of acting as donors, contributing items, and participating as bidders, thereby contributing funds simultaneously. The website will encompass a range of features, including item submission, auction listings, a bidding system, real-time updates, a secure payment gateway, user profiles, an administrative dashboard, and comprehensive charity information.

Additionally, the platform includes an admin management system to supervise user accounts and the items being auctioned. Access to this management system will be restricted to authorized personnel only. The administration, through this system, will transparently publish all charity-related information and details of fund distribution to the public. Robust authentication and authorization mechanisms will be implemented to safeguard against fraud and unauthorized access, ensuring the security of the entire platform. In this website, the chosen auction type is a blind auction. Bidders will not know the bids of other participants until the deadline has passed. This allows bidders to bid at their own pace without feeling pressured. Additionally, blind auctions encourage bidders to maximize their offers, potentially maximizing charity fundraising.

1.4 Contributions

The three main contributions of this project are as follows:

- **Enhanced Accessibility and Convenience**

  The implementation of this online auction platform significantly improves the accessibility and convenience of charitable giving. Donors can participate from the comfort of their homes, breaking down geographical barriers and facilitating involvement for a diverse range of individuals. This increased accessibility democratizes philanthropy, enabling more people to contribute to UTAR Hospital's

mission. The website will be user-friendly, designed to minimize any frustration, particularly for senior citizens.

- **Transparency and Accountability**

This project's dedication to accountability and transparency is a key contribution. By making all aspects of the platform open to the public, including auction data, donor information, and fund allocation details, it addresses a common concern among donors. This transparency not only fosters trust but also guarantees the efficient and intended use of funds.

- **Sustainable Support for UTAR Hospital**

The most significant contribution of this project is its potential to provide sustainable support for UTAR Hospital. In an era where traditional fundraising methods may yield limited results, this project offers a promising avenue to generate ongoing financial resources. Sustainable funding is essential for the hospital to continue offering quality medical services and advancing medical education.

1.5 Report Organization

This report is organized into seven chapters: Chapter 1 – Introduction, Chapter 2 – Literature Review, Chapter 3 – System Methodology, Chapter 4 – System Design, Chapter 5 – System Implementation, Chapter 6 – System Testing and Discussion, and Chapter 7 – Conclusion.

The first chapter introduces the project by covering the problem statement and motivation, project scope and direction, project objectives, project contributions, and the organization of the report. In Chapter 2, we review several existing online auction websites, comparing their features and analyzing their strengths and weaknesses. This comparative analysis helps us incorporate their advantages into our own system while avoiding their mistakes. Chapter 3 focuses on the overall system methodology, outlining the systematic approach used to develop the system efficiently. Chapter 4 delves into the specifics of the system design, detailing how user requirements are translated into a technical blueprint. Chapter 5 covers the implementation phase, explaining the steps taken to realize the system design in practice. Chapter 6 discusses the results using various system testing methodologies to ensure the website is working correctly. Finally, Chapter 7 concludes the report with a summary of the findings and recommendations for future work.

CHAPTER 2 Literature Review

This section describes some existing online auction systems with their strengths and weaknesses.

2.1 Existing Online Auction Systems

2.1.1 eAuction

The slogan of eAuction is “Malaysia’s Biggest Online Auction.” [2] This website exclusively lists vehicle auctions and does not include other categories of items.

Figure 2.1.1.0 Main Page of eAuction

First, users need to register an account before performing any bidding.

Figure 2.1.1.1 eAuction register interface

Figure 2.1.1.2 Purchase GMART Credit interface

Afterward, users are required to deposit their credit through online payment or cash. They need RM750 for motorcycles and RM1600 for cars and other vehicles.

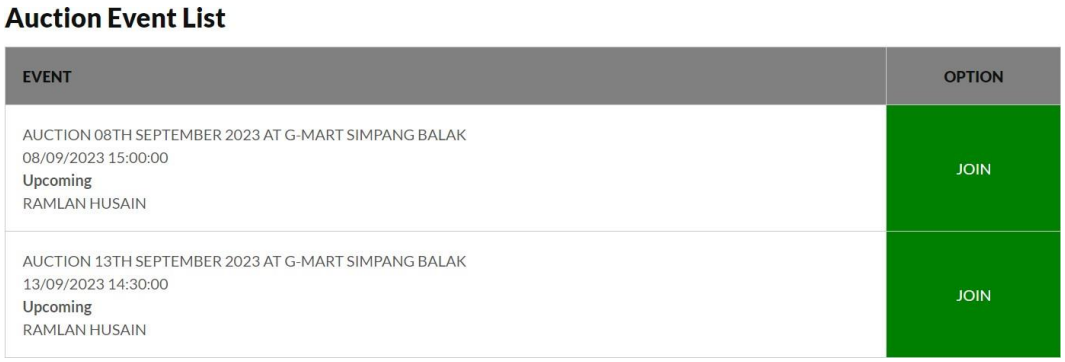


Figure 2.1.1.3 Auction Event List interface

Users can select any event they wish to join. After clicking 'join,' they need to read all terms and conditions and then proceed.

Figure 2.1.1.4 Auction room interface

Users need to click the 'Bid' button for bidding. The increment for motorcycles is RM100 per bid, and for cars and other items, it's RM200 per bid. When the price goes above RM100k, the increment will change to RM500 per bid.

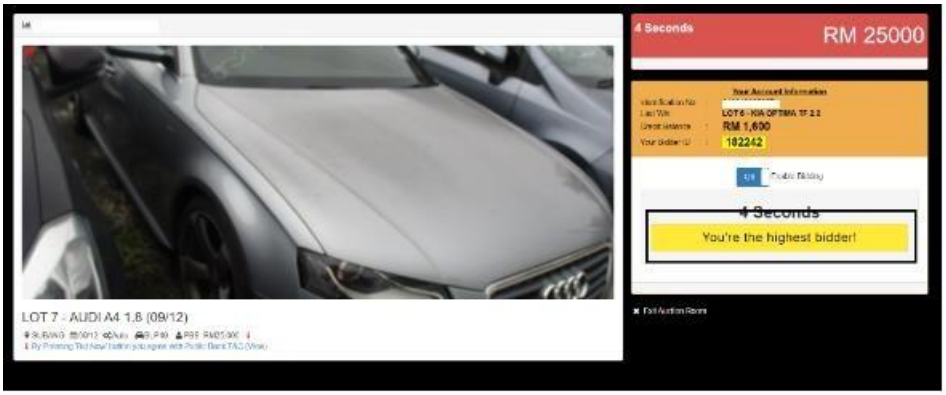


Figure 2.1.1.5 Highest bid interface

If the user is the highest bidder, the 'highest bid' will appear at the bottom.

2.1.1.1 Strengths

1. Cool interface.
2. User-friendly navigation, suitable for first-time users.

2.1.1.2 Weaknesses

1. Users have only 30 seconds to decide whether to bid on the item. If the user does not press the bid button, the current item will move to the next item in the list.
2. Items (vehicles) are randomly displayed; users cannot choose their preferences.
3. Only future events are displayed; no access to previous event history.
4. Limited support for item types, exclusively focused on vehicles.

2.1.2 Kuala Lumpur Online Auction

Unlike the previous website, Kuala Lumpur Online Auction platform offers a wide range of item categories for bidders. [3]

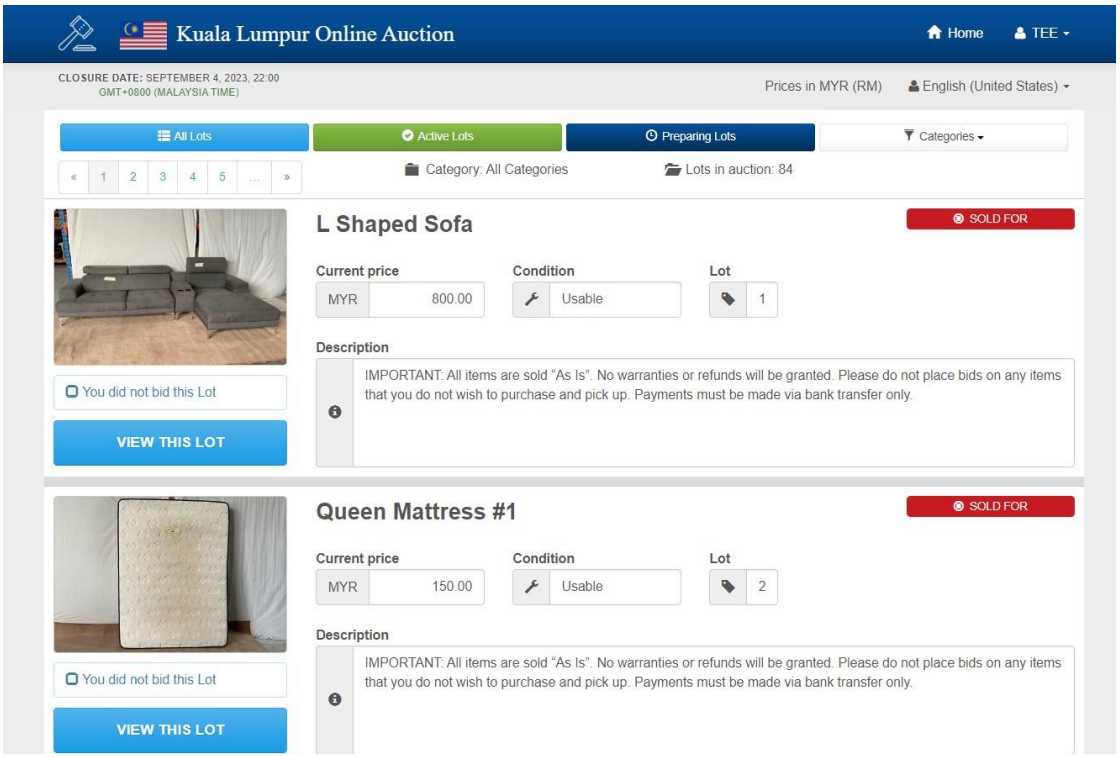


Figure 2.1.2.1 Main Interface of Kuala Lumpur Online Auction

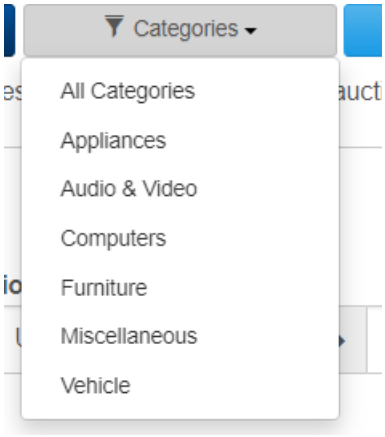


Figure 2.1.2.2 Categories of item list

More detailed information of an item will be displayed after users click on the 'View this lot' button, which includes the item condition (repairable, usable), bid information (minimum and maximum increase of the bid price) and current price.

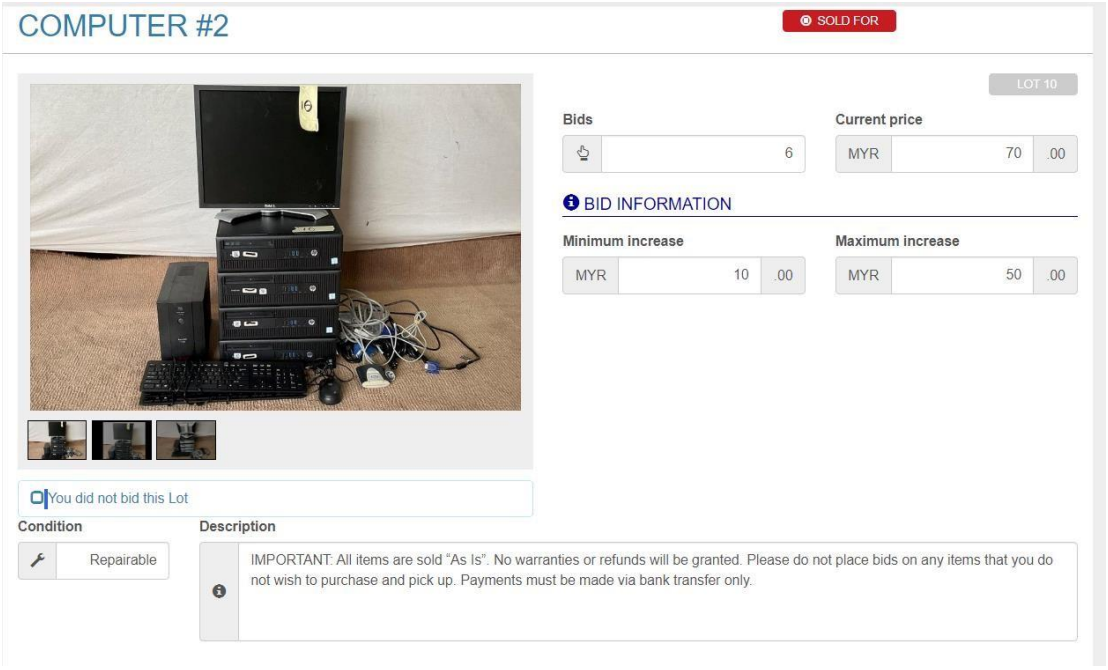


Figure 2.1.2.3 More detailed information of the item

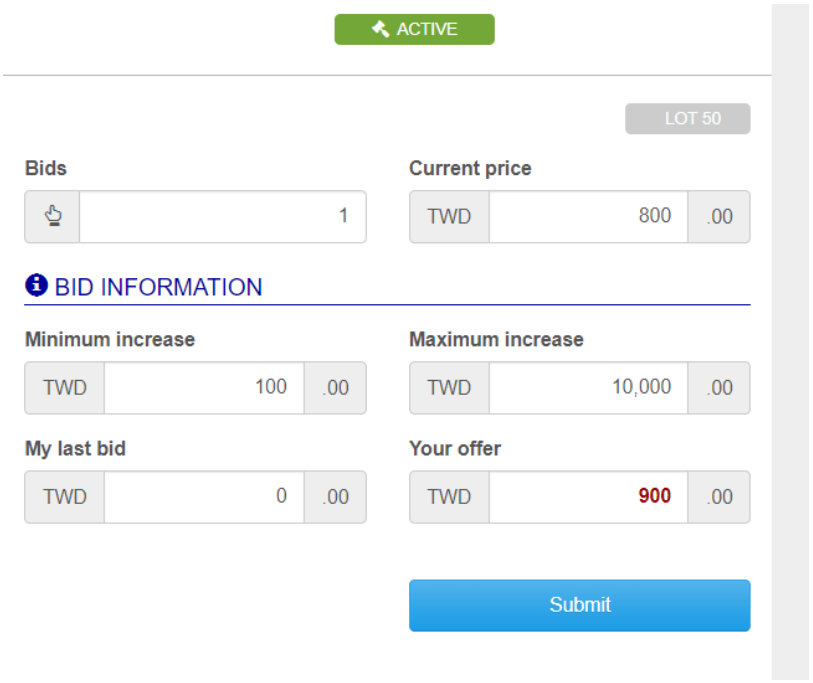


Figure 2.1.2.4 Bidding interface

Users can enter their offer price and click the 'Submit' button to place a bid on an item. The winner is required to make the payment through online banking and collect the item from the warehouse. Items will not be delivered to the winner. If the winner fails to make the payment within the specified time limit, the next highest bidder will be declared the winner.

2.1.2.1 Strengths

1. Offers a wide range of auction items.
2. Provides detailed information about the items.

2.1.2.2 Weaknesses

1. Confusing navigation, not user-friendly.
2. Most displayed item listings are inactive and cannot be bid on.
3. The interface is too monotonous, lacking visual appeal and variety.
4. Past events have not been displayed.

2.1.3 Ehsan Auctioneers

The Ehsan Auctioneers website conducts auction sales for judicial or court orders, land offices, financial institutions, insurance companies, liquidators, developers, and individual property owners. [4]

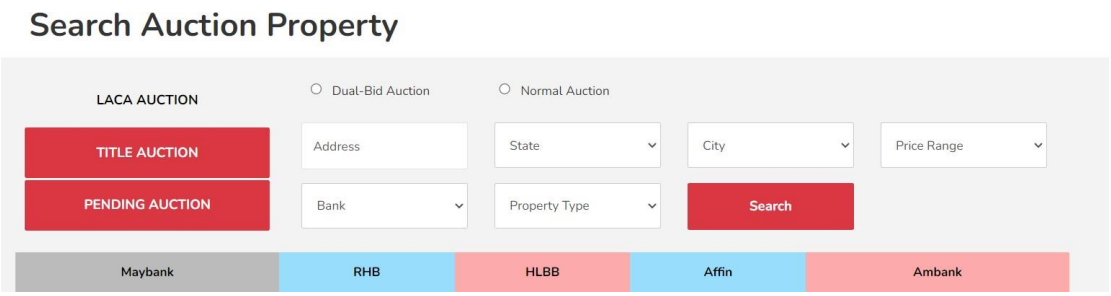


Figure 2.1.3.1 Advance searching interface

Compared to other auction websites, Ehsan Auctioneers offers more advanced search functionality. Users can search for auction items based on address, state, city, price range, bank, property type, and whether it's a dual-bid or normal auction.

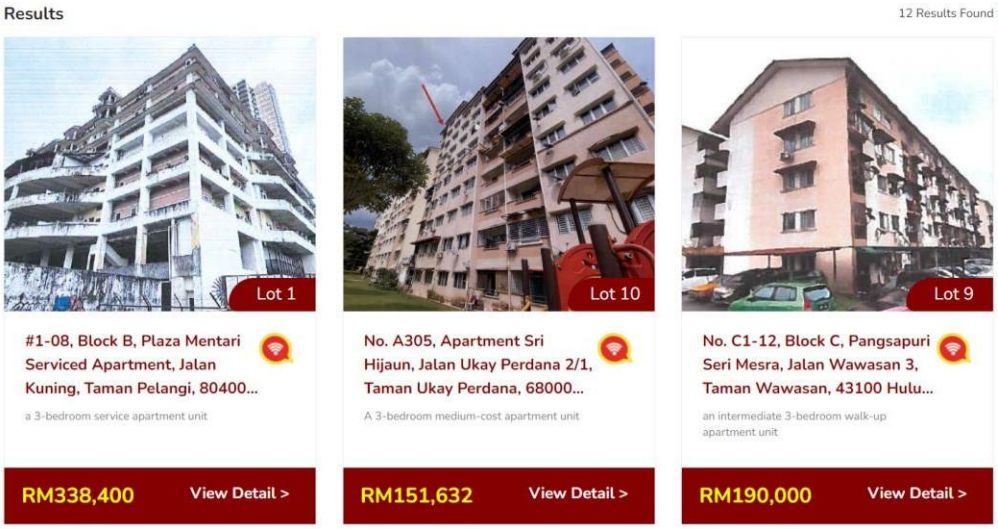


Figure 2.1.3.2 Property List Page

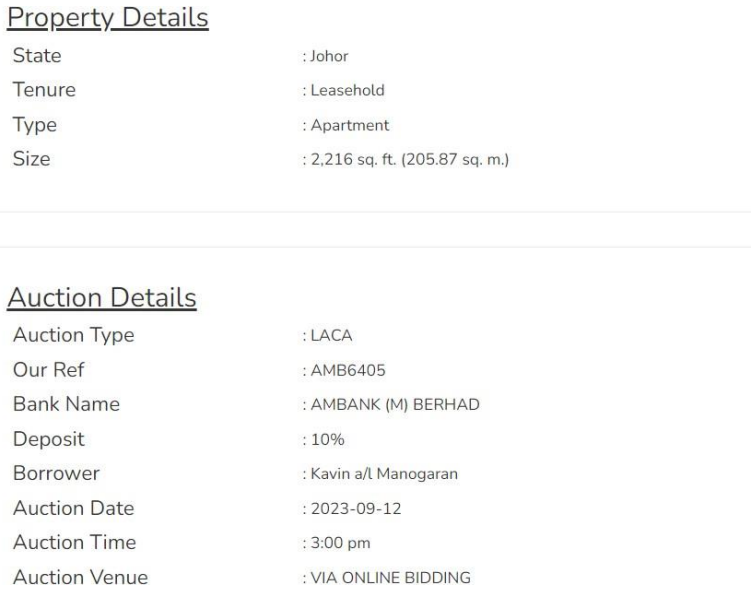


Figure 2.1.3.3 Details Information Page

Users can access more detailed information about a property of interest by clicking on 'View Details.' On the details page, users can review the property's state, tenure, type, size, and all auction-related information.

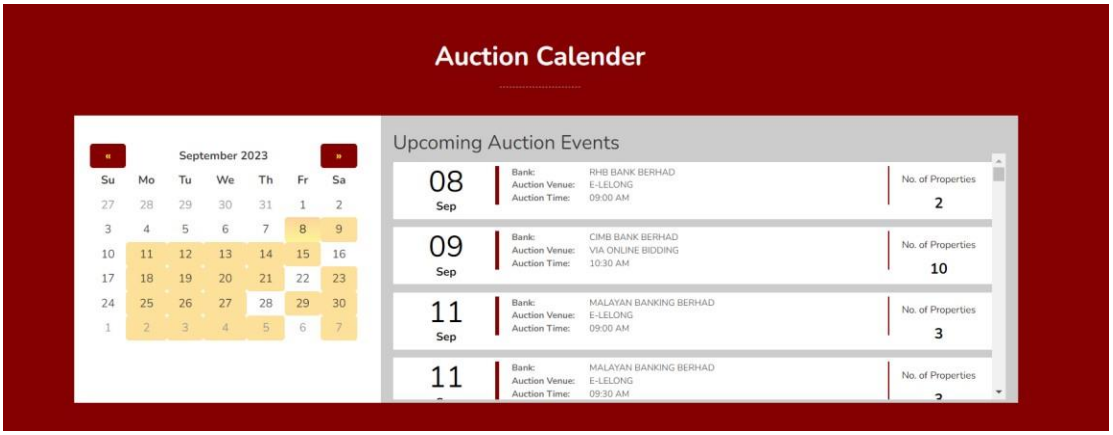


Figure 2.1.3.4 Auction Calendar

Users can access information about all upcoming events on the auction calendar. Details such as the bank involved, auction venue, and auction time are listed, offering significant convenience to users.

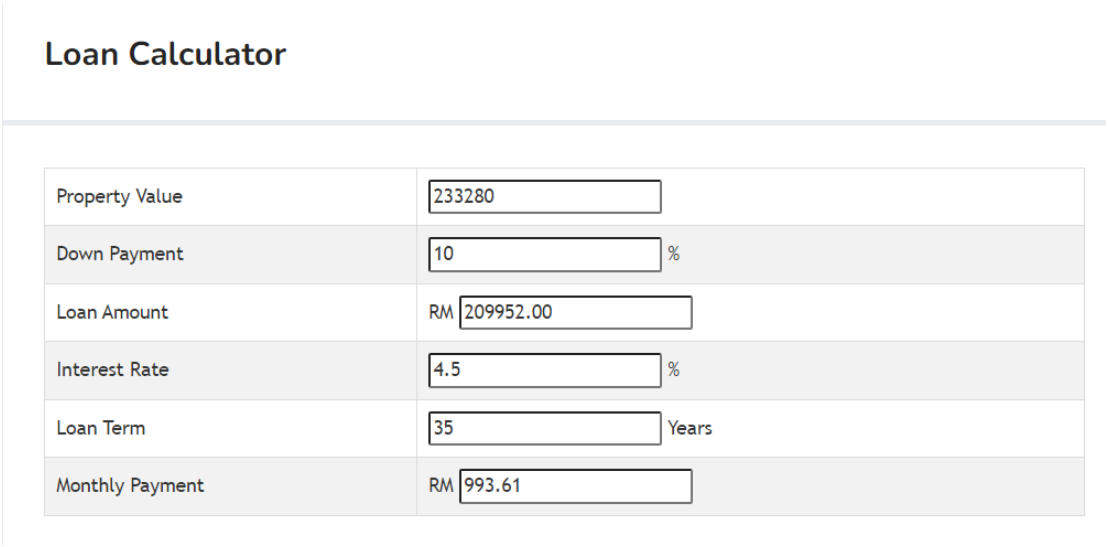


Figure 2.1.3.5 Loan Calculator

The website also offers a loan calculator for users to calculate their monthly payments and loan terms in years.

2.1.3.1 Strengths

1. Comfortable interface.
2. Advanced search functionality, which can save users' search time.

3. Easy navigation and user-friendly interface.
4. Provides additional functionality, such as a loan calculator for user convenience.

2.1.3.2 Weaknesses

1. Past events cannot be tracked.

2.1.4 BidNow

Figure 2.1.4.1 BidNow item categories

BidNow provides a wide range of item listings, including property, land, small gadgets, concerts, e-Charity, home appliances, kitchen appliances, art pieces, watches, games & consoles, phones & tablets, sports, and tech & computer. BidNow offers the most extensive variety of categories compared to other auction websites. [5]

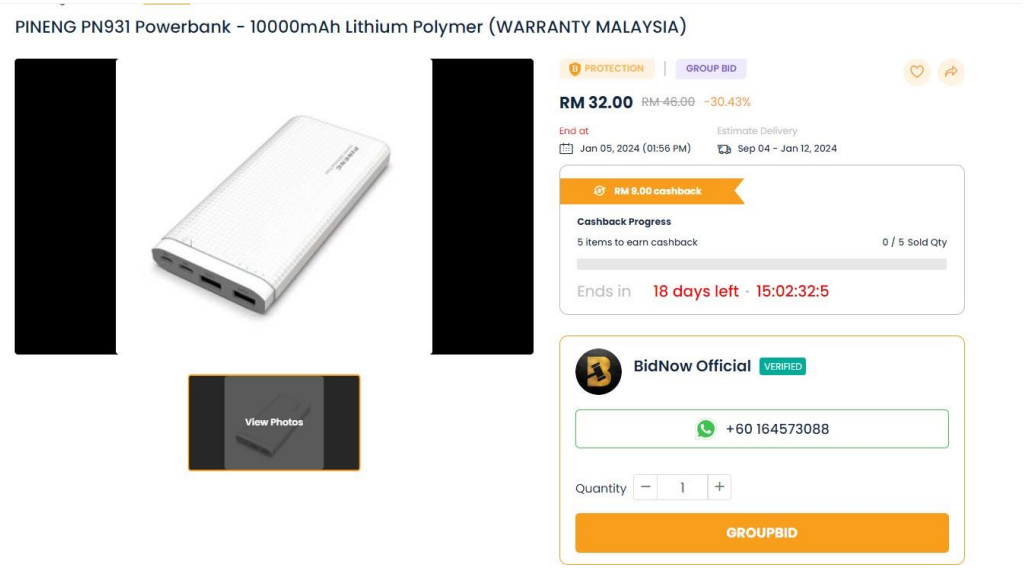


Figure 2.1.4.2 Item details page

In the item details page, there is a countdown clock that indicates the remaining time and the remaining available quantity of the item. If the item is verified by the official, it will display the ‘VERIFIED’ tag to inform users that it is an authentic product. Users can contact the donors/sellers by the phone number provided.

2.1.4.1 Strengths

1. Users can contact sellers/donors.
2. Users can identify authentic products through the ‘VERIFIED’ tag.

2.1.4.2 Weaknesses

1. Past events cannot be tracked.

2.1.5 Best2Bid

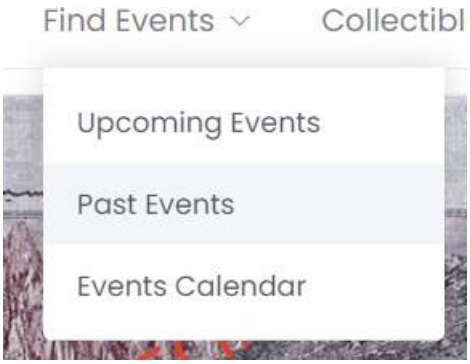


Figure 2.1.5.1 Events categories

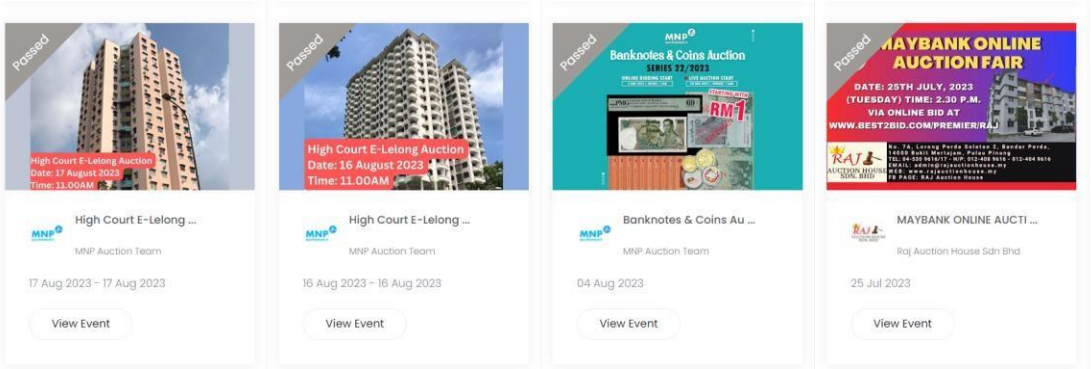


Figure 2.1.5.2 Past events

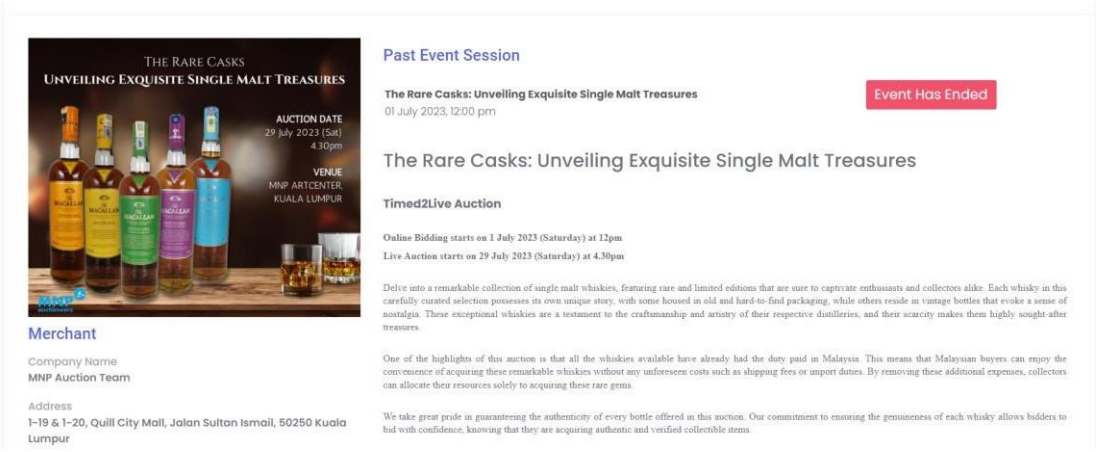


Figure 2.1.5.3 Details of past events

Unlike previous online auction websites, best2bid provides past events for users to track. However, the details of past events are limited; the information about winners, sellers/donors, and the transaction amount is not shown. [6]

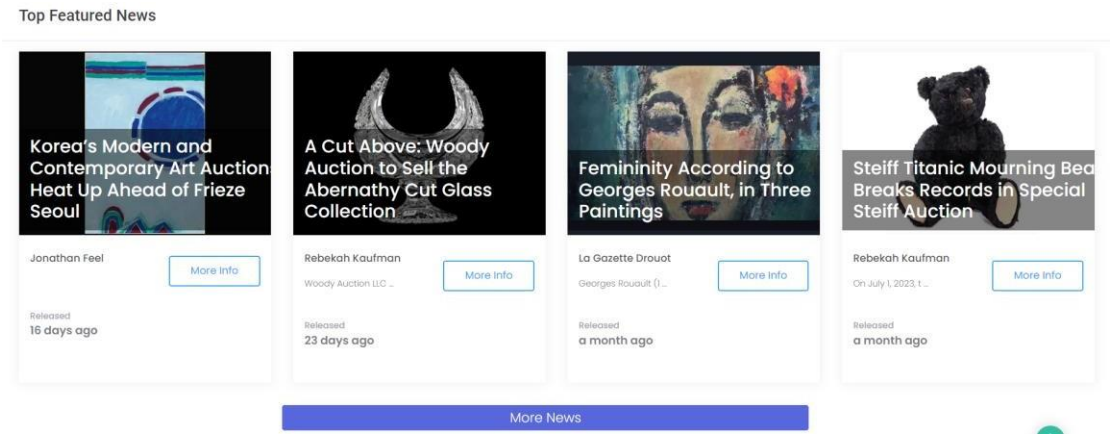


Figure 2.1.5.4 Top Featured News

In addition to detailed item listings, Best2Bid offers a wealth of top-featured news articles. These articles delve into the fascinating history and origin stories of the auction items, providing valuable context and insights for users who are not only interested in bidding but also love discovering the unique backgrounds of these items.

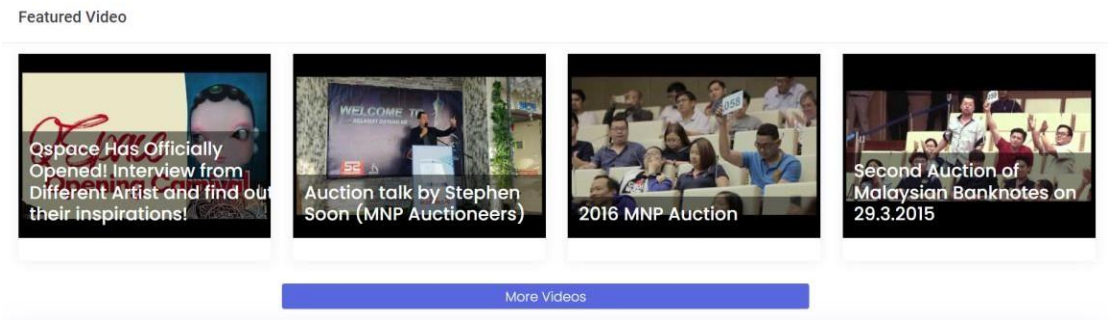


Figure 2.1.5.5 Featured Video

Best2Bid also offers featured videos for users. These videos include interviews with different artists, allowing viewers to discover their inspirations. This provides bidders with a better understanding of the art items they are bidding on.

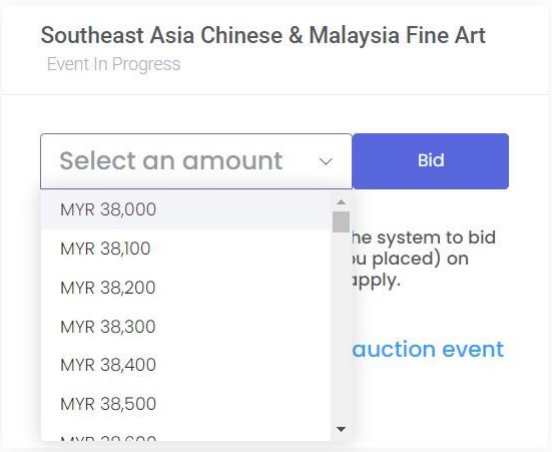


Figure 2.1.5.6 Bid interface

Users can select an amount and click on the 'bid' button to bid an item. Placing an absentee bid allows the system to bid incrementally on behalf of the user, up to the amount the user has placed.

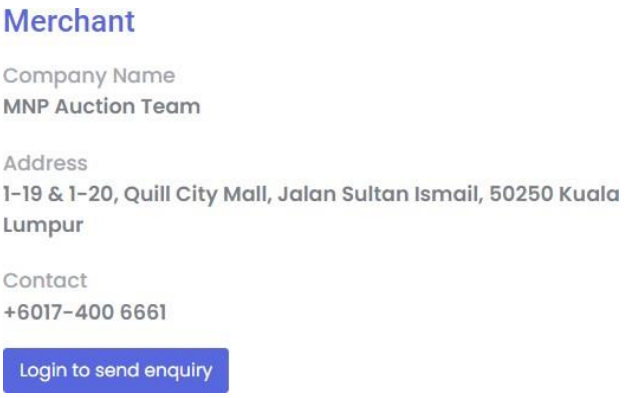


Figure 2.1.5.7 Details of Merchant

The details of the merchant, including the company name, address, and contact number, are shown.

2.1.5.1 Strengths

1. Provides featured videos and articles that offer more details about the auction event and items.
2. Users can review past events.
3. More merchant information is available.

2.1.5.2 Weaknesses

1. Limited information is available about past events.

2.1.6 Summary

Existing online auction systems have been reviewed in this chapter. The strengths and weaknesses of the systems are discovered and discussed. Table 1.0 provides an overview of the strengths, weaknesses, and a comparison of the online auctions.

Table 1.0 overview of the strengths, weaknesses, and a comparison of online auctions.

	EAuction	Kuala Lumpur Online Auction	Ehsan Auctioneers	BidNow	Best2Bid
UI design	Attractive interface	Monotonous UI design	Colorful design	Informative and user friendly	Informative and simple design
Display of past events	No	No	No	No	Yes
Display of current highest bid	No	Yes	No	Yes	Yes
Additional features	No	No	Loan calculator	VERIFIED tag for authentic products	Featured videos and articles
Support for Multiple Categories	No	Yes	No	Yes	No

2.2 Impact Charity Status on Auction Events

Research has shown that charity auctions attract a higher number of bidders and result in higher bids compared to regular auctions, indicating that the charity status of these events significantly boosts participation and revenue outcomes. Charity status specifically increases the likelihood of a sale by 46% and raises the number of bidders by 111% [7]. Additional research indicates that during charity auctions, the likelihood of a sale increases by 55%, and the second-highest bid rises by 103% [8]. Depending

on the type of auction, these events generate varying revenue; in fundraising efforts, all-pay auctions often outperform winner-pay auctions, especially when there is bidder asymmetry [9]. By strategically managing auction mechanisms, a charity can maximize revenue through portfolio diversification, aligning with its preferred level of risk [10].

2.3 Data Transparency in Charity Events

Building trust among donors in charity events requires transparency in the utilization of collected funds. A study explores the impact of transparency and accountability on donor behaviour when nonprofit organizations (NFPs) disclose fraud. The findings indicate that when NFPs disclose fraud, such as asset diversion, there is a notable decrease in donor contributions. This response highlights the importance of transparency in donor decision-making, as donors are sensitive to issues of trust and integrity within the organizations they support. The study emphasizes that transparency about the fraud and efforts taken to recover from it are essential for maintaining public trust. By providing detailed disclosures and demonstrating accountability, nonprofits can mitigate the negative impact on donor contributions, helping to preserve the support needed for their missions [11].

In addition to financial transparency, operational and impact transparency are critical in charity events. Sharing detailed insights into the organization's processes, mission, and daily operations through operational transparency fosters trust by showcasing the utilization and management of funds. Impact transparency focuses on illustrating the concrete outcomes of donor contributions, providing evidence of the difference made by their support. Both forms of transparency are essential for fostering donor confidence and engagement. Transparency not only addresses issues of trust and integrity but also strengthens donor relationships by showcasing the effectiveness and accountability of nonprofit organizations. Such practices are crucial for maintaining donor support and ensuring the long-term success of charitable endeavours [12].

2.4 The Role of Data Visualization Tools in Enhancing Decision-Making

Tools for data visualization are essential for transforming complex datasets into easily understood visual representations, thereby enhancing comprehension and decision-making across various sectors. These tools enable effective data analysis by allowing users to quickly identify trends, patterns, and anomalies. In artificial

intelligence, visualization aids in data preparation, feature engineering, and model evaluation, with techniques like PCA (Principal Component Analysis) and t-SNE (t-Distributed Stochastic Neighbour Embedding) improving model performance. Explainable AI techniques such as LIME (Local Interpretable Model-agnostic Explanations) and SHAP (Shapley Additive exPlanations) further enhance transparency by using visuals to make model decisions more understandable [13]. Business intelligence tools like Tableau and Power BI convert raw data into actionable insights, enabling organizations to make informed decisions [14]. However, challenges such as the need for complex computational resources and user interpretation still persist.

This is particularly relevant for nonprofit organizations (NFPs), as data utilization is increasingly necessary for making well-informed decisions. Salesforce's 2021 Nonprofit Trends Report categorizes only 22% of companies as having high digital maturity, and 76% of nonprofit respondents reported lacking a data strategy [15]. Although visualization tools are widely available, studies show that many of them lack flexibility and user engagement, especially in decision-making processes at all stages. Increasing the adaptability of these tools and exploring new visualization frameworks could enhance their effectiveness [17]. Additionally, converting information into visual formats leverages quick cognitive pathways, enabling faster comprehension than textual or audio information [18].

2.5 Gaps and Opportunities

While existing online auction systems provide robust features for real-time bidding, they primarily cater to a competitive environment where the highest bidder wins. This model may not be well-suited for charitable events, where the focus is on community engagement and participation rather than purely on competition. According to Newberry's study, increased competition can drive down prices due to market thinning, which may not align with the goal of maximizing donations for charitable causes [19]. Therefore, there is an opportunity to develop auction systems that balance competitive

bidding with community-oriented features, encouraging participation while still generating substantial funds for charity.

Another gap identified is in the area of transparency. Harris et al. emphasize the importance of transparency and accountability in building and maintaining donor trust, especially when it comes to the handling of funds and fraud disclosures [11]. Current online auction systems may not adequately address these concerns, leading to potential trust issues among donors. This presents an opportunity to integrate features that enhance transparency, such as real-time updates on fund allocation and detailed reporting on the use of proceeds.

Lastly, the use of data visualization tools in online auctions offers untapped potential. While these tools can significantly enhance the user experience by providing clear insights into bidding trends and fund utilization, current systems often lack the flexibility and user interaction necessary to support decision-making across all stages. By incorporating more advanced and interactive data visualization tools, online auction platforms can better inform and engage users, making the auction experience more transparent and intuitive. This could lead to higher participation rates and increased satisfaction among both donors and bidders, ultimately benefiting the charitable causes these auctions support.

CHAPTER 3 System Methodology/Approach

3.1 Proposed Approach

The method used in this project is the traditional SDLC approach that consists of 5 main stages, which are planning, analysis, design, implementation, and maintenance. The reason for using the SDLC method is that the website is less likely to undergo frequent changes. Development takes longer due to the critical real-time requirements for auction events and the stringent security requirements of the payment function, which must be error-free.

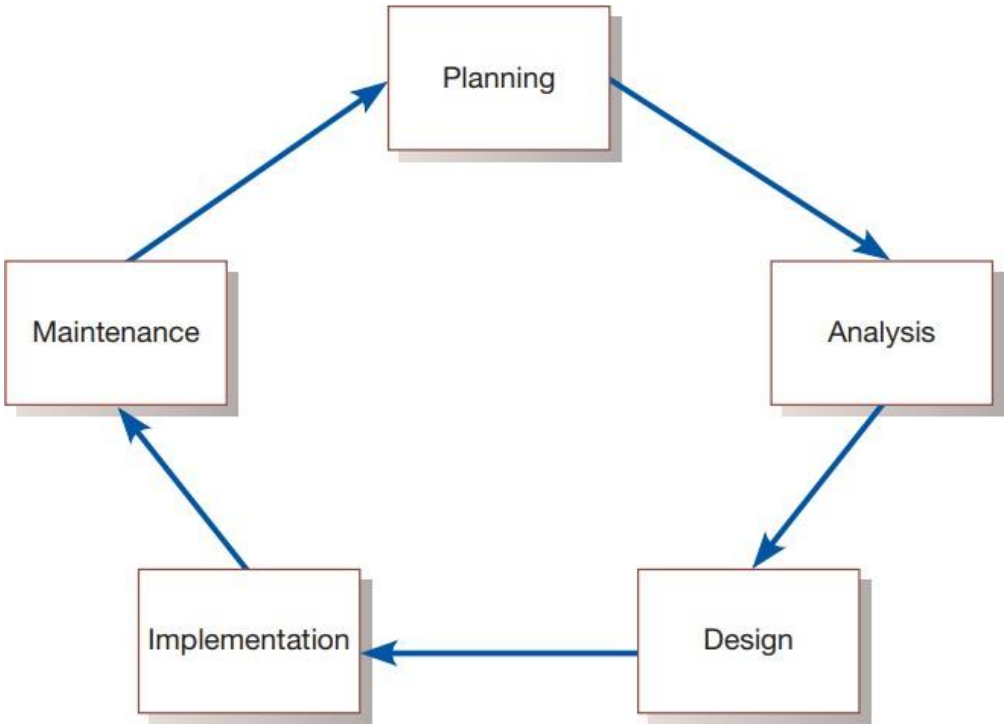


Figure 3.1 Systems development life cycle

3.1.1 Planning Phase

In the initial planning stage, the need for this system was identified: to create a platform that facilitates contributions to UTAR Hospital. The primary goal of this project is to provide the public with an accessible platform where they can contribute not only funds but also items for auction. From UTAR Hospital's perspective, this platform offers a new avenue for fundraising. Once UTAR Hospital is fully operational, it can offer affordable medical services to the public, thereby contributing back to the community in a meaningful way.

To build such a platform, meticulous planning is essential. The platform must be equipped with key functionalities, including bidding, item listings, a chat room, and most importantly, a dashboard. To encourage widespread participation, transparency is crucial. The dashboard should display comprehensive statistics, such as the total funds collected and detailed information on how those funds are being utilized. This level of transparency will help build trust among potential contributors, especially in light of the declining public confidence in charity events due to past corruption and embezzlement scandals.

Additionally, the Power BI dashboard includes key metrics such as the most popular categories of items, monthly fund collections, monthly donated items, and the average bidding amount. These statistics empower stakeholders—such as UTAR Hospital's management, donors, and potential contributors—to make more informed decisions. By analyzing these trends, the hospital can better understand donor behavior, optimize fundraising strategies, and ensure that the platform meets the needs of both the contributors and the organization.

Furthermore, the platform needs to be both robust and interactive. Achieving this requires selecting the right tools and technologies. For the front-end, HTML, CSS, JavaScript, and Vue.js are recommended to ensure an engaging and user-friendly experience. On the backend, Java is a solid choice due to its robustness and widespread

use in the industry. With these well-defined plans in place, we can now proceed to the next phase: detailed analysis.

3.1.2 Analysis Phase

As we move into the analysis phase, our goal is to thoroughly understand the project requirements, identify potential challenges, and establish a clear roadmap for implementation. The primary objective of the project is to develop an interactive and transparent platform that enables public contributions to UTAR Hospital, both in monetary form and through item donations for bidding. To achieve this, the platform must include several key functionalities: a user-friendly interface for bidding and item listing, a chat room for real-time communication, and a robust dashboard that provides detailed insights into the fundraising efforts.

The dashboard, powered by Power BI" sho'ld offer real-time data on various metrics, such as the most popular item categories, funds collected on a monthly basis, donated items by month, and average bidding amounts. This data is crucial for stakeholders, including the hospital's management, donors, and potential contributors, as it facilitates informed decision-making and strategic planning.

There are two primary groups of users in this project. The first group consists of the primary stakeholders, including UTAR Hospital's management, who will use the platform to enhance fundraising efforts and ensure transparency. The second group includes donors and contributors, whose trust and continued participation are essential for the platform's success.

In terms of risk assessment, several potential risks must be addressed during this phase. First and foremost, ensuring the security and privacy of user data is critical. Any breach could severely damage the hospital's reputation and undermine public trust. To mitigate this risk, we will implement the MD5 encryption algorithm before storing users' sensitive data in the database. Additionally, robust authentication mechanisms will be put in place to ensure that each user can only access authorized pages.

3.1.3 Design Phase

Moving on to the design stage, the visual aspects of the website are carefully outlined. To align with the theme and branding of UTAR Hospital, a color scheme featuring blue and green is chosen as the primary palette. These colors not only reflect the hospital's identity but also evoke a sense of calm and trust, which are essential qualities for a healthcare-related platform.

To enhance the website's appeal and user engagement, various emojis and icons are incorporated into the design. These elements are sourced from https://emojipedia.org/, ensuring that they are both visually consistent and universally recognizable. The strategic use of emojis and icons adds a modern, friendly touch to the user interface, making the platform more relatable and easier to navigate.

When designing the interface of the Power BI dashboard, it is essential to ensure that each column is appropriately sized to fit within a single page. The columns should not be too large, as this would make the statistics page more cumbersome for users to browse. A well-proportioned layout is critical to creating a user-friendly and intuitive experience, allowing users to easily view and analyze the data without excessive scrolling or adjusting their view.

There is a dedicated page that displays all the items users have bid on or donated. These items are organized into categories based on their current status: 'To Pay,' 'Pending,' 'Completed,' and 'To Receive.' This categorization ensures that users can easily track the progress of their transactions and stay informed about the next steps they need to take.

3.1.4 Implementation Phase

As the project transitioned to the implementation stage, the actual development of the system began. The designs and architecture crafted during the design and analysis phases were put into action. First, a new Spring Initializer project was created using IntelliJ IDEA, an Integrated Development Environment (IDE). The project structure

consists of five main directories: ‘model,’ ‘config,’ ‘controller,’ ‘mapper,’ and ‘service.’

The ‘config’ directory is particularly important as it contains various configuration files critical to the system’s functionality. These include the WebSocket configuration for enabling real-time online chatting, MailConfig for managing the sending of emails, MinioConfig for handling the uploading of images to a Minio server, and GlobalWebMvcConfig for configuring global settings related to web development, such as view resolvers, resource handlers, and cross-origin resource sharing (CORS) settings.

The ‘model’ directory contains all the entities that correspond to the tables in the MySQL database. Each entity is equipped with its own set of properties that map directly to the columns in the respective database tables. These entities serve as the backbone of the application’s data layer, allowing seamless interaction between the application and the database. All the entities implement the Serializable interface, which is crucial for enabling the conversion of these objects into a byte stream. This capability is essential for various operations, such as caching, session management, and transmitting objects between different layers of the application. By implementing the Serializable interface, the application ensures that these objects can be easily stored, transferred, and restored, thereby enhancing the system’s flexibility and performance.

The remaining three directories— ‘controller,’ ‘service,’ and ‘mapper’—are interconnected and play a crucial role in the application’s functionality. The classes in the ‘controller’ directory are responsible for handling incoming requests from the front end. These controllers listen for user actions, such as form submissions or page navigation, and act as intermediaries between the user interface and the backend logic.

When a request is received, the controller processes it and delegates the necessary operations to the appropriate service classes. The service layer, represented by the classes in the ‘service’ directory, contains the business logic of the application. This layer handles complex operations, such as data validation and transaction management. It ensures that the application behaves correctly according to the requirements before any changes are made to the data.

The service classes, in turn, rely on the ‘mapper’ directory to interact with the database. The ‘mapper’ classes are responsible for executing SQL queries and updating the database with the processed data. They use Object-Relational Mapping (ORM) techniques to map Java objects to database tables, allowing for seamless data persistence and retrieval. By extending the classes in the ‘mapper’ directory, the service layer can efficiently manage database operations, ensuring that all data-related tasks are handled accurately and efficiently.

Lastly, on the front-end side, to implement the user interface theme planned during the design phase, we utilized free and open-source frameworks, specifically Bulma and ElementUI. To connect the front end to the back end, an Axios instance was set up for making HTTP requests, with integrated request and response interceptors to handle authentication and error management. The request interceptor attaches a Bearer token to the headers if available, ensuring secure API interactions. The response interceptor processes the backend’s response, displaying error messages or prompting the user to re-login if authentication issues arise. This setup enhances the application’s security, user interaction, and overall robustness.

3.1.5 Testing Phase

In the final phase of the methodology, it is essential to verify that the system functions as intended. This involves employing four key software testing methods: unit testing, integration testing, system testing, and security testing. The comprehensive testing process and results are detailed in Chapter 6, “System Testing and Discussion.”

Unit Testing focuses on validating individual components to ensure each functions as expected in isolation. In this method, we have verified that the system correctly determines the highest bid among multiple bids, validated user credentials accurately, sent properly formatted messages to auction winners, and ensured the function responsible for listing auction items displays item details correctly.

Integration testing examines the interactions between different modules of the software to ensure they work together seamlessly. In this phase, we conducted tests on payment

processing and order confirmation. We verified that when a payment is processed, the system updates the auction item status and sends a confirmation email to the winning bidder. This involved checking the integration between the payment module, email module, and item module. Additionally, we tested to confirm that placing a bid updates both the auction item and the user's account balance. Another integration test conducted ensured that donated items are correctly added to the auction listing and displayed with accurate details on the website.

System Testing evaluates the complete and integrated application to ensure it meets all requirements and functions correctly in a full environment. A thorough test of the entire auction process is conducted, including user registration, login, item browsing, bid placement, receipt of auction notifications, payment processing, and report generation on fund usage. This involves simulating the entire user journey to confirm that all features work together as expected in a real-world scenario.

Security Testing identifies vulnerabilities, threats, and risks to ensure the system is protected against potential attacks and unauthorized access. Initial testing involves checking for SQL injection vulnerabilities to ensure input fields, such as bid forms and registration forms, are secure. Following this, authentication and authorization testing ensures that only authorized users can access specific features, such as allowing only winners to view payment details and only donors to edit item details. Additionally, it is verified that all sensitive data, including user passwords, is encrypted both during transmission and in storage.

These testing methodologies ensure that the auction website for charity fundraising is reliable, functional, and user-friendly, thereby supporting the success of the fundraising initiative for UTAR Hospital.

3.2 Development Tools

The development of this project is categorized into two distinct parts: the front-end site and the back-end site. The technologies involved in the front-end site include HTML, CSS, JavaScript, as well as framework such as Bulma. On the back-end side, the technologies include the MySQL database, the Java programming language, and related

frameworks such as Spring, MyBatis, and Spring Boot. The development tool used is Intellij IDEA version 2022.1.4.

3.2.1 Hardware specifications

Table 3.1 Specifications of laptop

Description	Specifications
Model	Acer Nitro 5
Processor	Intel Core i5-12450H
Operating System	Windows 11
Memory	24GB DDR4 RAM
Storage	512GB

3.2.2 Software specifications

Table 3.2 Specifications of software

Description	Specifications
Front-end	HTML, CSS, JavaScript, Vuejs, Bulma, ElementUI
Back-end	Java, Spring, Spring Boot, MyBatis
Database	MySQL
Development tool	IntelliJ Idea, Visual Studio Code

3.3 Timeline

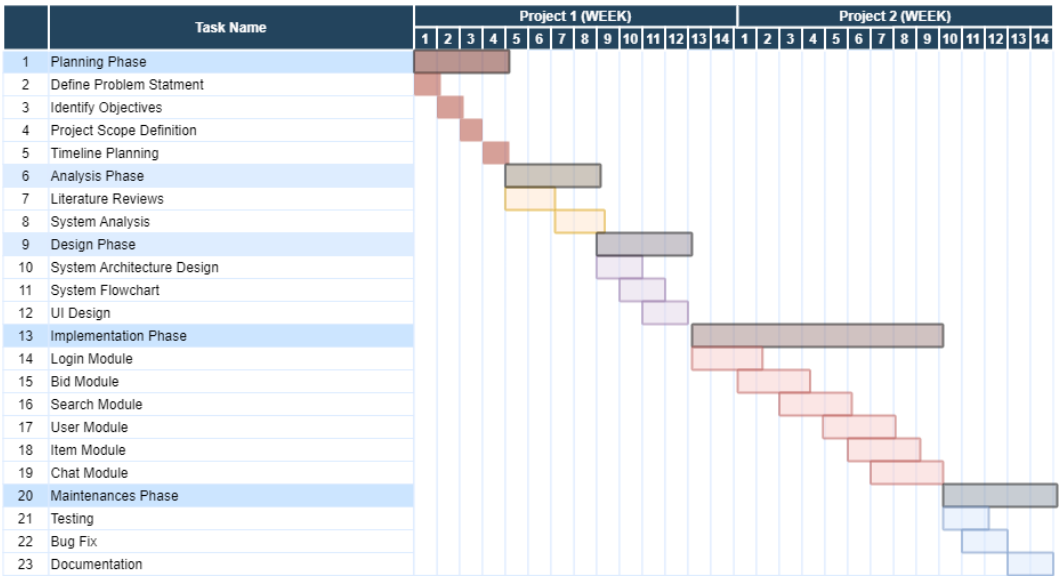


Figure 3.3 Timeline diagram

CHAPTER 4 System Design

4.1 System Flowchart

This section provides the process for both donor and bidder in sequential order.

4.1.1 Donor Process Flowchart

The figure below illustrates the typical workflow for a donor. After registering and logging in, a donor can initiate a new auction event by donating an item. This involves uploading the item's details, such as its name, categories, description, end date, and images. Once the auction concludes and the item's end date passes, the donor is responsible for delivering the item to the auction winner.

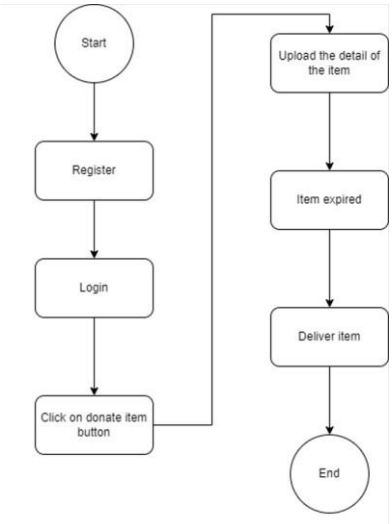


Figure 4.1.1 Donor process flowchart

4.1.2 Bidder Process Flowchart

This diagram illustrates the workflow for a bidder. A bidder can browse the list of available items on the main page. If they find an item of interest, they can place a bid on it and have the option to update their bid amount before the auction ends. After the event concludes, if the bidder wins the auction, they can proceed with the payment process and wait to receive the item from the donor.

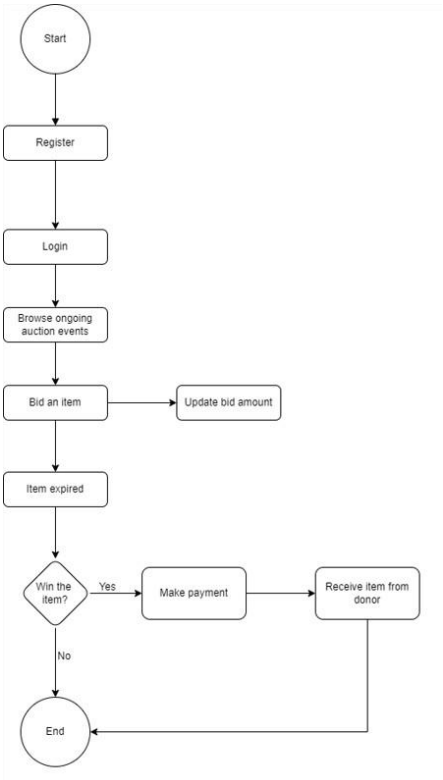


Figure 4.1.2 Bidder process flowchart

4.2 System Design Diagram

This section provides an overview of the database, functional module, and system interactions through various diagrams, including use case diagrams, an activity diagram, and a system architecture diagram. The system architecture diagram provides a blueprint of the system, the use case diagrams depict the functional requirements from the perspectives of both administrators and users, and the activity diagram showcases the workflow of the system.

4.2.1 System Architecture Diagram

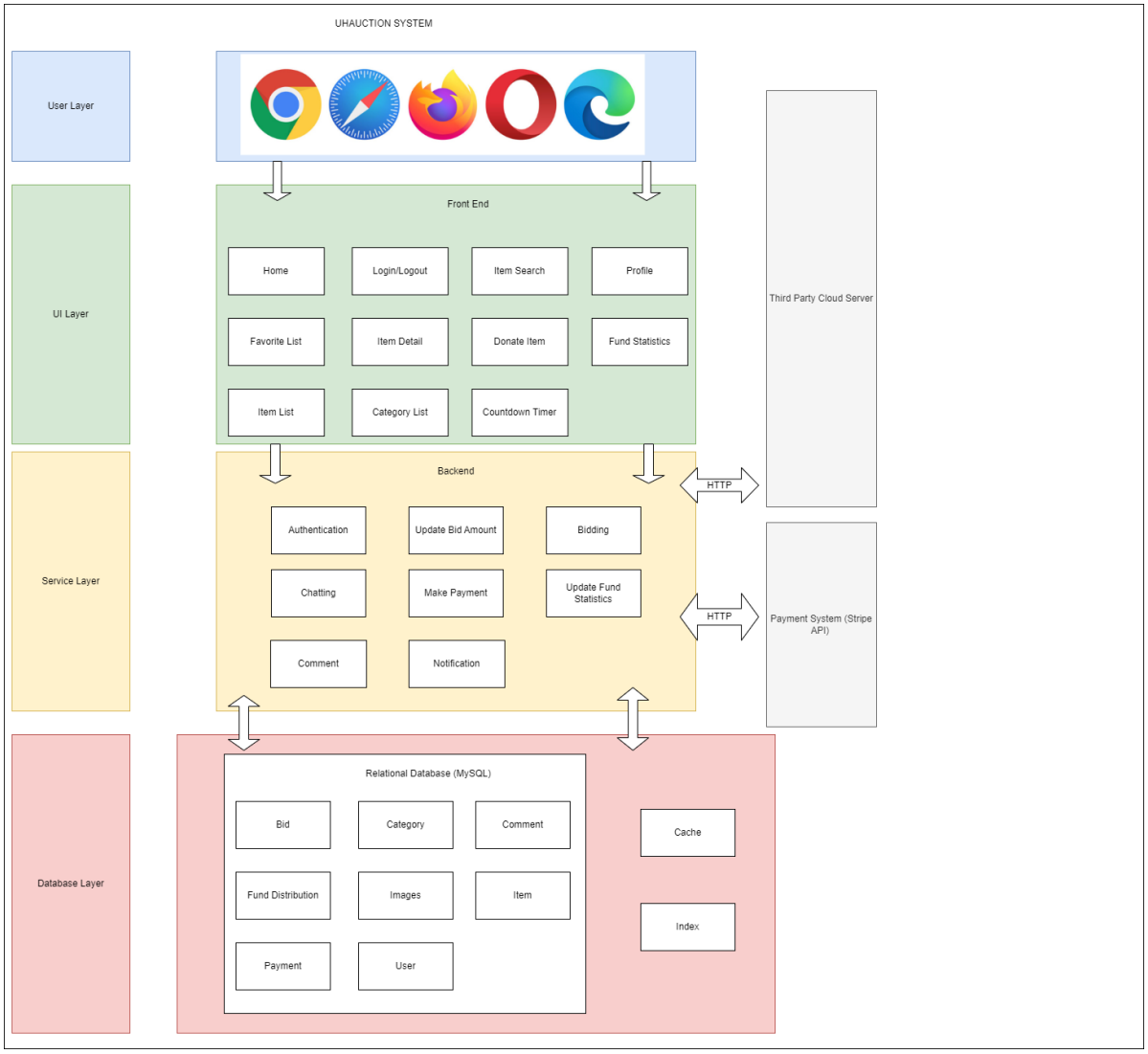


Figure 4.2.1 System Architecture Diagram

Layer	**Description**
User Layer	This layer represents the client-side interaction with the system through various web browsers. Users access the auction system via these browsers.
UI Layer	This layer contains the user interface components that users interact with directly.

Service Layer	This layer contains the server-side logic and functionality of the system.
Database Layer	This layer stores all the data used by the auction system.

4.2.2 Use Case Diagram and Description

The use case diagram and some of the important functions of the use case description are provided in this section.

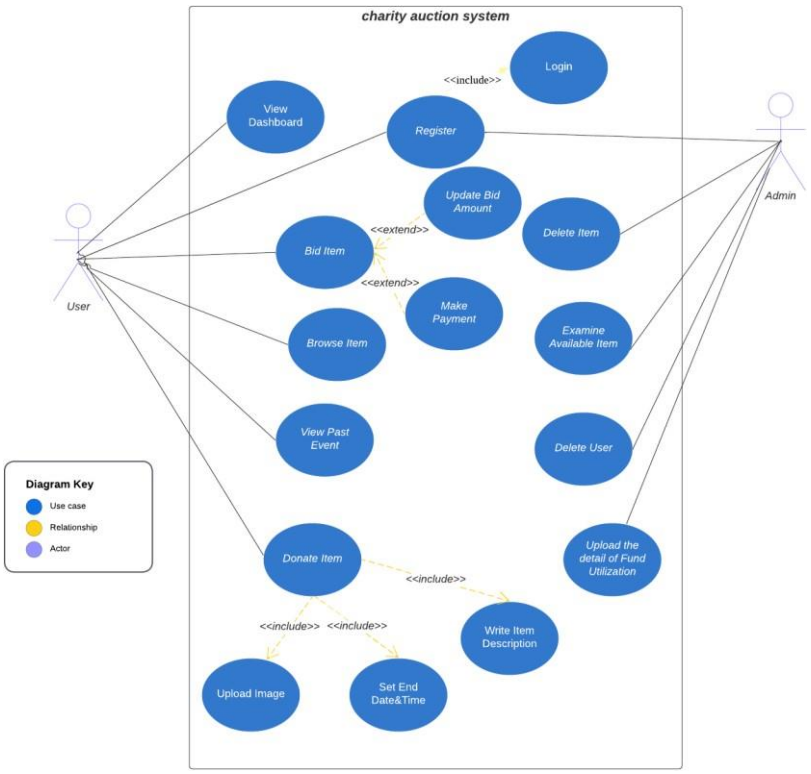


Figure 4.2.2 Use Case Diagram

Use Case Id	001
Use Case Name	Bid Item
Brief Description	A user can place bid on the interested items
Actor	Registered user
Preconditions	- The user must be logged into their account. - The item must be active and open for bidding.
Basic Flows	1. The user logs into their account.

	2. The user can browse the item lists, search for items, or filter by categories to find their desired product. 3. The user clicks on the item they are interested in to view more details or place a bid. 4. The user enters the amount of the bid in the input text box. 5. The user will receive a notification if they are the winner after the item's deadline is over.
Alternate Flows	- If the user attempts to place a bid before logging in, the system will prompt them to log in before proceeding. - If the item's deadline is over, the system will prompt indicating that the bidding is no longer available.
Postconditions	The user's bid is stored in the system database.

Use Case Id	002
Use Case Name	View Past Event
Brief Description	A user can view the past bidding events
Actor	Registered user
Preconditions	- The user must be logged into their account. - The time duration of the bidding activity for the item is over. - At least one bid has been placed on the item.
Basic Flows	1. The user logs into their account. 2. The user clicks on the "View past events" button, and a list of all past events is displayed. 3. The user clicks on the item they are interested in to view the history of the bids. 4. The information includes the winner's name and bidding price.
Alternate Flows	- If the user attempts to view the bidding history before logging in, the system will prompt them to log in before proceeding. - If there are no bids placed on the item, the system will prompt that no bidding history is available.
Use Case Id	003
Use Case Name	Add Item to Favorite List
Brief Description	A user can add interested items to their favorite list.
Actor	Registered user
Preconditions	- The user must be logged into their account. - The item must be active and open for bidding.
Basic Flows	1. The user logs into their account.

	2. The user can browse the item lists, search for items, or filter by categories to find their desired product. 3. The user adds the interested item to their favorite list. 4. The user can check their favorite list by clicking the 'Favorite List' button.
Alternate Flows	- If the user attempts to add an item before logging in, the system will prompt them to log in before proceeding. - If the item is already in the user's favorite list, the system displays a message indicating that the item is already in the list.
Postconditions	The user can manage their favorite list such as removing items and placing bids on the items.

Use Case Id	004
Use Case Name	Update Bid
Brief Description	A user can update the amount of their previous bid.
Actor	Registered user
Preconditions	- The user must be logged into their account. - The item must be active and open for bidding. - The user must have placed a bid on the item before.
Basic Flows	1. The user logs into their account. 2. The user can browse the item lists, search for items, or filter by categories to find their desired product. 3. The user clicks on the target item that they want to update. 4. The user edits the amount of the bid in the input text box.
Alternate Flows	- If the user attempts to edit a bid before logging in, the system will prompt them to log in before proceeding. - If the item's deadline is over, the system will prompt indicating that the bidding is no longer available.
Postconditions	The user's bid is updated in the system database.
Use Case Id	005
Use Case Name	Donate Item
Brief Description	A user can create, edit, and delete a new auction listing
Actor	Registered user
Preconditions	- The user must be logged into their account. - The user has permission to create, edit and delete an auction listing

Basic Flows	1. The user logs into their account. 2. The user accesses the "Donate Item" section. 3. To donate a new auction item: a. Click the "Create New Auction" button. b. Enter the details of the item such as title, description, duration of the auction and images. d. Confirms the details and submits the new auction listing. 4. To update an existing auction listing: a. Locates the target auction listing in the list of active auctions. b. Clicks the "Edit Auction" button. c. Updates changes to the listing details, such as editing the item description or shortening the duration of the auction. d. Confirms the changes and updates the auction listing. 5. To delete an existing auction listing: a. Locates the target auction listing in the list of active auctions. b. Clicks the "Delete Auction" button. c. Confirms the deletion of the auction item. 6. The user can monitor auction activity and receives notifications about new bids. 7. Once the auction ends, the user select can review the winner who has the highest bid and arranges for payment and item delivery.
Alternate Flows	- If the user attempts to donate an item before logging in, the system will prompt them to log in before proceeding.
Postconditions	Auction listings are stored in the system database

Use Case Id	006
Use Case Name	Make payment
Brief Description	A user who wins an item can make a payment with the bid amount
Actor	Registered user who wins an item
Preconditions	- The user must be logged into their account.

	- The time duration of the bidding activity for the item is over. - The user has the highest bid amount
Basic Flows	1. The user clicks on the 'Pay' button. 2. The user will be redirected to the payment page. 3. The user can choose the payment method and fill in the payment details. 4. The user submits the payment.
Alternate Flows	- If the user is not the winner, the 'Pay' button will not appear. - If the user cancels the payment, they will be redirected to the home page.
Postconditions	- Store the payment details in the database

Use Case Id	007
Use Case Name	Administer Auctions
Brief Description	An admin can manage the auction on the website
Actor	Administrator
Preconditions	- The administrator must be logged into their account. - The administrator must have the permissions to manage the website
Basic Flows	1. The admin logs into their account. 2. The admin navigates to the "manage auction" section. 3. The admin can view the details of current active and pending auction. 4. If the admin found any inappropriate item, they can remove it. 5. The admin can refund to the bidder for any damages or losses incurred. 6. The admin can generate reports on the past auction activity and how the fund is distributed.
Alternate Flows	- If the admin identifies any issues on the website, they may report to the technical team.
Postconditions	The admin maintains accurate records of fund distribution

6.1.2 Activity Diagram

The activity begins with a donor submitting an item by filling out a form with the item's details. At the same time, the total number of donated items on the dashboard will be updated. After that, bidders can browse the item list and place bids on the items they are interested in. The winning bidder will then proceed to make the payment for the

amount they bid, and the total funds collected on the dashboard will be updated in real time. Finally, the donor will deliver the item, and the bidder will wait to receive it.

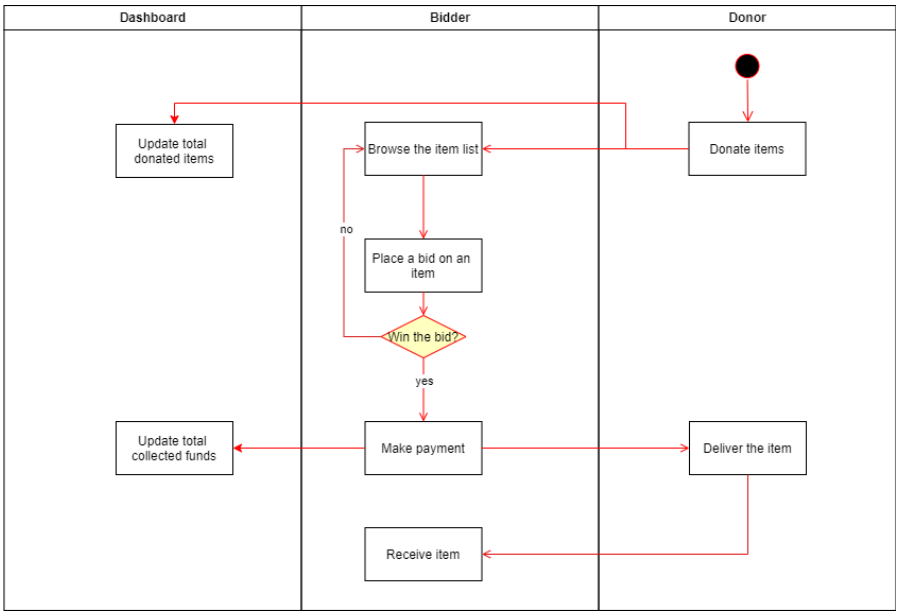


Figure 4.2.3 Activity Diagram

4.3 Module Description

This online auction platform consists of five modules: admin module, user module, search and filter module, item module, and bid module. All the diagrams and descriptions are provided in the following section.

4.3.1 Admin module

The administrator holds the highest privilege on the platform and plays a crucial role in maintaining the website. Admins can block users involved in fraudulent activities and remove inappropriate items from auctions. They also have the right to add new product categories and publish fund distributions on the website.

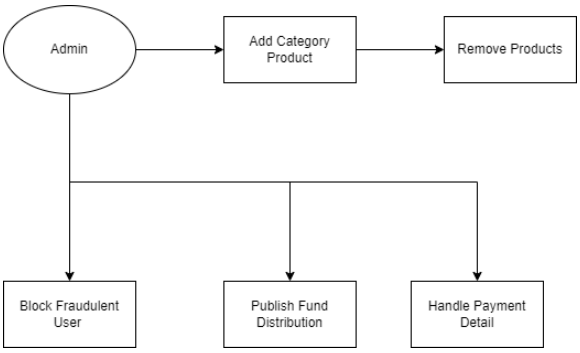


Figure 4.3.1 Admin module diagram

4.3.2 User Module

In the user module, individuals can register an account and log in to the website. Users have the option to participate as either bidder, providing funds to UTAR Hospital, or as donors, donating items for auction. Hence, every registered user has the opportunity to act as both a bidder and a donor simultaneously. When a user wins a bid after the auction event has concluded, the payment button will appear and redirect the user to the payment page. Once the winner completes the payment, the donor can proceed to deliver the item.

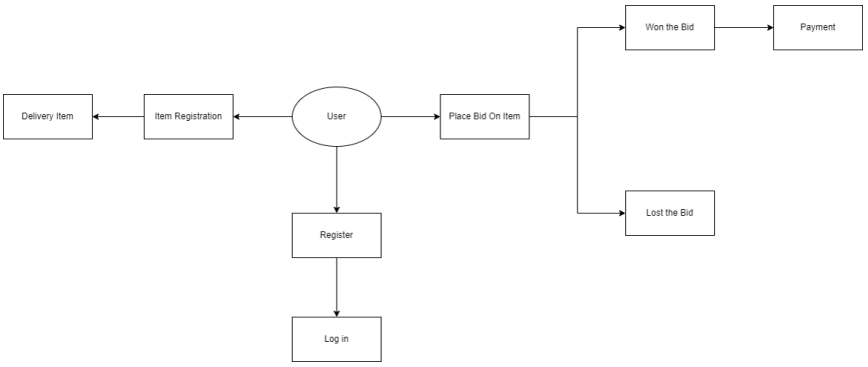


Figure 4.3.2 User module diagram

4.3.3 Item Module

To donate an item, the donor needs to provide the event end date, a description of the product, category tags, and images of the product. All these details can be set by the donor on the donation page. Additionally, the donor has the option to edit or delete existing items after they have been submitted. Furthermore, users can leave comments on the item page to provide feedback or ask questions.

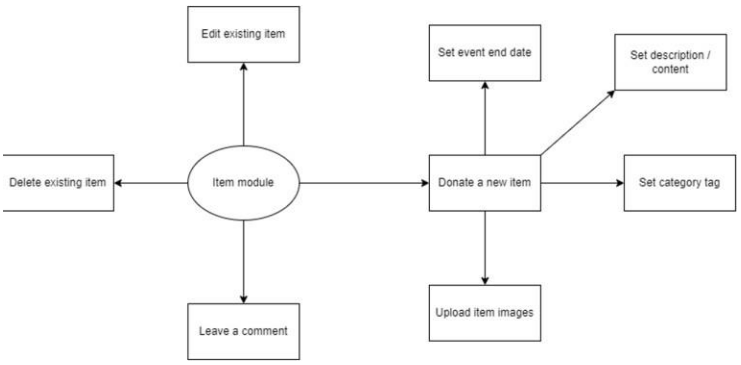


Figure 4.3.3 Item module diagram

4.3.4 Search Module

In the search module, users can enter keywords of the item they wish to find in the input text box to filter the results. These keywords are then sent to the backend, where SQL statements are executed to retrieve relevant results based on the user's input.

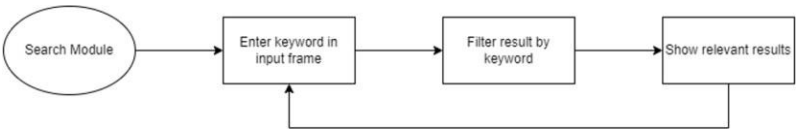


Figure 4.3.4 Search module diagram

4.3.5 Bid Module

In the bid module, users can place bids on any item they find interesting. Even after submitting a bid, users retain the option to edit the bid amount if they wish. The number of people who have placed bids on a particular item will be displayed on the item's detail page, providing transparency and insight into the level of interest. Once the auction event has expired, the item will be moved to the past event list, and the winner along with their bid amount will be prominently displayed, allowing users to view the outcome of the auction.

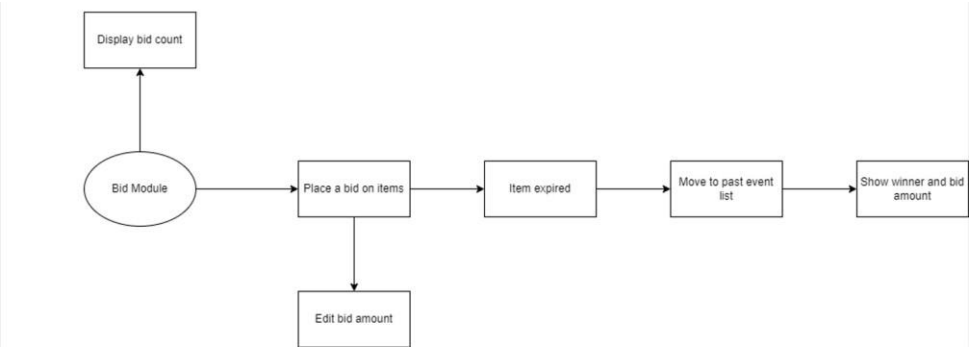


Figure 4.3.5 Bid module diagram

CHAPTER 5 System Implementation

5.1 Hardware setup

This section outlines the necessary hardware components required to support the online auction website. The system is hosted on local servers, with storage and network configurations designed to ensure reliable performance and scalability.

5.1.1 Server Hardware

The core of the system runs on a local server that handles the website's backend processes, including user management, auction handling, and database queries. The server specifications are as follows.

Description	Specifications
Model	Acer Nitro 5
Processor	Intel Core i5-12450H
Operating System	Windows 11
Memory	24GB DDR4 RAM
Storage	512GB

5.1.2 Database server

The MySQL database server requires dedicated resources for smooth operation and handling multiple concurrent user requests. The setup includes:

Description	Specifications
Processor	Intel Core i5-12450H
Memory	24GB DDR4 RAM
Storage	512GB
Backup System	1TB HDD for weekly backups

5.1.3 Storage system

For image and file storage, MinIO is deployed as the object storage service. This requires an additional storage setup:

Description	Specifications
Storage capacity	2TB HDD for file storage
Connection	1 Gbps network connection for file upload/download speeds
Backup System	1TB HDD for weekly backups

5.2 Software setup

5.2.1 Project structure

The first step in developing the online auction system is to create a new project using IntelliJ IDEA for the backend part and Visual Studio for the frontend part. The project will have three main directories: model, view, and controller. This is because the MVC (Model-View-Controller) design pattern is utilized in this project. The files under each directory are as follows:

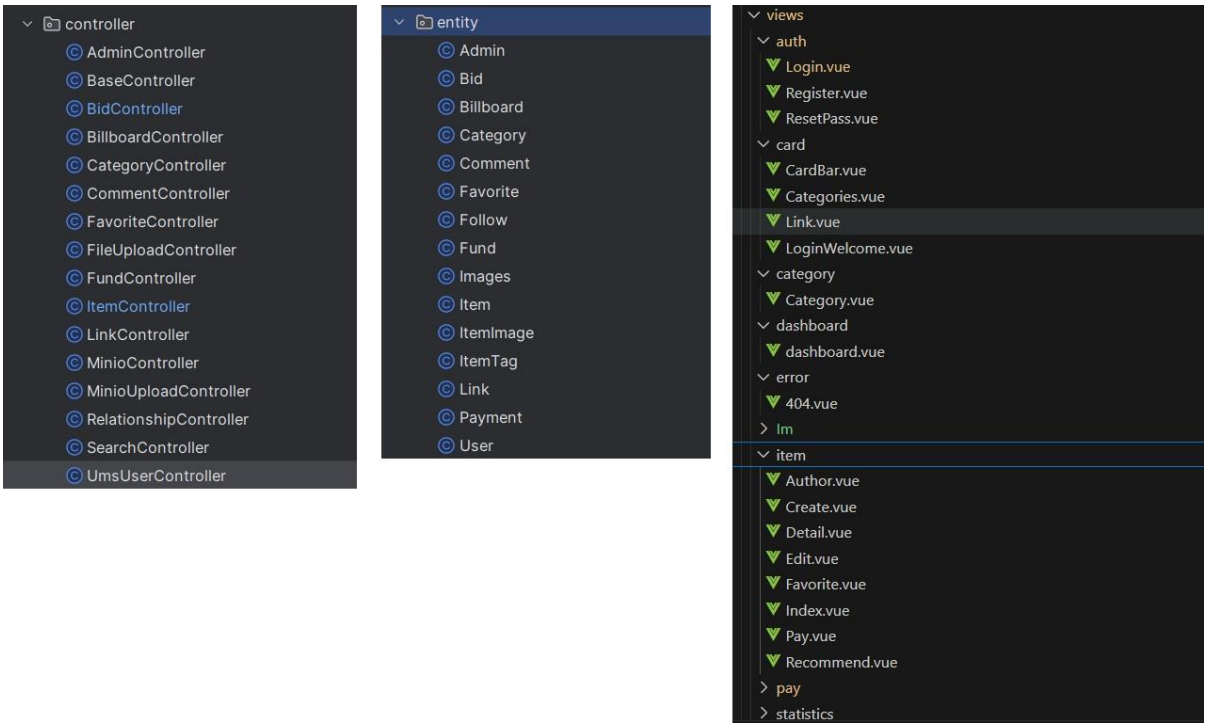
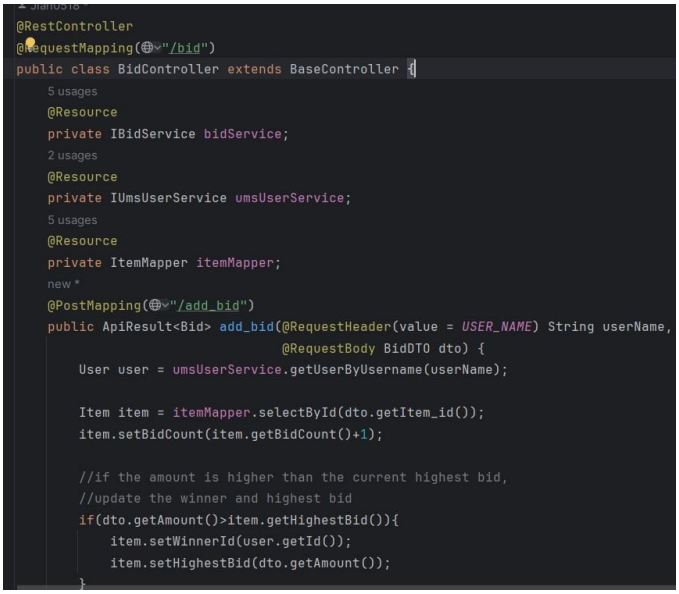


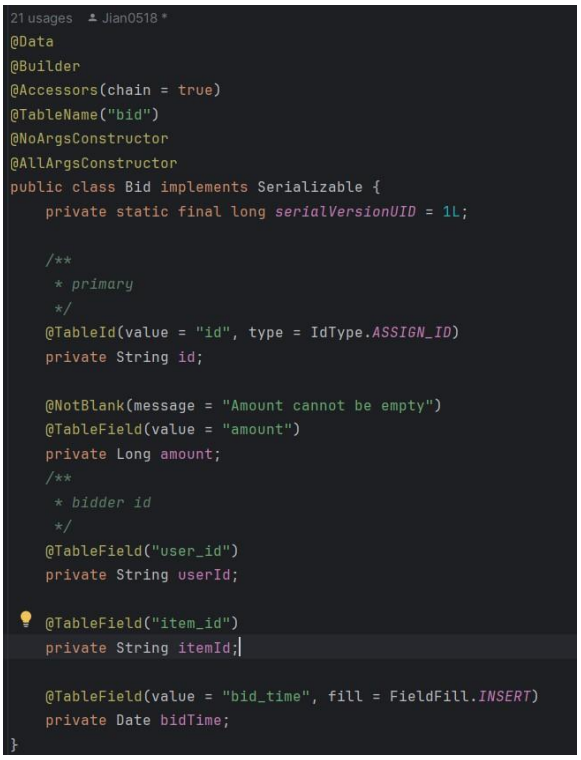
Figure 3.3.1.1 Project structure

When a user sends a request from the client side, the controller layer contacts the model layer to retrieve or update data stored in the database. Next, the model layer returns the result to the controller layer. The controller layer then delivers the response to the view layer to display the results for users.



```java
@RestController
@RequestMapping("/bid")
public class BidController extends BaseController {
    5 usages
    @Resource
    private IBidService bidService;
    2 usages
    @Resource
    private IUmsUserService umsUserService;
    5 usages
    @Resource
    private ItemMapper itemMapper;
    new *
    @PostMapping("/add_bid")
    public ApiResult<Bid> add_bid(@RequestHeader(value = USER_NAME) String userName,
                                  @RequestBody BidDTO dto) {
        User user = umsUserService.getUserByUsername(userName);

        Item item = itemMapper.selectById(dto.getItem_id());
        item.setBidCount(item.getBidCount()+1);

        //if the amount is higher than the current highest bid,
        //update the winner and highest bid
        if(dto.getAmount()>item.getHighestBid()){
            item.setWinnerId(user.getId());
            item.setHighestBid(dto.getAmount());
        }
```

Figure 3.3.1.2 Code snippet of controller layer



```java
21 usages  Jian0518 *
@Data
@Builder
@Accessors(chain = true)
@TableName("bid")
@NoArgsConstructor
@AllArgsConstructor
public class Bid implements Serializable {
    private static final long serialVersionUID = 1L;

    /**
     * primary
     */
    @TableId(value = "id", type = IdType.ASSIGN_ID)
    private String id;

    @NotBlank(message = "Amount cannot be empty")
    @TableField(value = "amount")
    private Long amount;
    /**
     * bidder id
     */
    @TableField("user_id")
    private String userId;

    @TableField("item_id")
    private String itemId;

    @TableField(value = "bid_time", fill = FieldFill.INSERT)
    private Date bidTime;
}
```

Figure 3.3.1.3 Code snippet of Model layer

```
<template>
  <div class="columns">
    <!--item detail-->
    <div class="column is-three-quarters">
      <!--item name-->
      <el-card class="box-card" shadow="never">
        <div slot="header" class="has-text-centered">
          <p class="is-size-5 has-text-weight-bold">{{ topic.title }}</p>

          <!-- Countdown Timer -->
          <div
            class="countdown-timer has-text-danger is-size-5 mt-3"
            :style="{ fontWeight: 'bold' }"
          >
            Ends In: {{ countdownTimer }}
          </div>

          <div class="has-text-grey is-size-7 mt-3">
            <span>{{
              dayjs(topic.createTime).format("YYYY/MM/DD HH:mm:ss")
            }}</span>

            <el-divider direction="vertical" />
            <span>Donor: {{ topicUser.alias }}</span>
```

Figure 3.3.1.4 Code snippet of View layer

5.2.2 Dependency Management

The application uses Maven for managing external libraries and dependencies. The dependencies are listed in the pom.xml file.

5.2.2.1 Spring Boot Starters

The Spring Boot Starters dependencies include the Core Spring Boot dependency for setting up a basic application, Spring MVC for building web applications, a template engine for rendering views, testing tools such as Junit, and email sending capabilities.

```
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter</artifactId>
</dependency>
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-web</artifactId>
</dependency>
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-thymeleaf</artifactId>
</dependency>
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-mail</artifactId>
</dependency>
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-websocket</artifactId>
</dependency>
```

5.2.2.2 Database and ORM

For the database and ORM dependencies, it includes the MySQL JDBC driver for connecting to MySQL databases and a starter for integrating MyBatis-Plus, an ORM framework that simplifies database access.

```
<!-mysql→
<dependency>
    <groupId>mysql</groupId>
    <artifactId>mysql-connector-java</artifactId>
    <scope>runtime</scope>
</dependency>
<!-mybatis-plus→
<dependency>
    <groupId>com.baomidou</groupId>
    <artifactId>mybatis-plus-boot-starter</artifactId>
    <version>${mybatis-plus.version}</version>
</dependency>
```

5.2.2.3 Google API integration

Used for interacting with Google's APIs, including Oauth and Gmail services.

```
<dependency>
    <groupId>com.google.api-client</groupId>
    <artifactId>google-api-client</artifactId>
    <version>2.0.0</version>
</dependency>
<dependency>
    <groupId>com.google.oauth-client</groupId>
    <artifactId>google-oauth-client-jetty</artifactId>
    <version>1.34.1</version>
</dependency>
<dependency>
    <groupId>com.google.apis</groupId>
    <artifactId>google-api-services-gmail</artifactId>
    <version>v1-rev20220404-2.0.0</version>
</dependency>
```

5.2.2.4 JSON Processing

The dependencies include high-performance JSON processor by Alibaba and a Google library for JSON serialization and deserialization.

```
<dependency>
    <groupId>com.alibaba</groupId>
    <artifactId>fastjson</artifactId>
    <version>${fastjson.version}</version>
</dependency>
<dependency>
    <groupId>com.google.code.gson</groupId>
    <artifactId>gson</artifactId>
    <version>2.10.1</version>
</dependency>
```

5.2.2.5 Web and HTTP

The dependencies in this section include HTTP client for network communication and Apache's HTTP client for making HTTP requests.

```
<dependency>
    <groupId>com.squareup.okhttp3</groupId>
    <artifactId>okhttp</artifactId>
    <version>4.8.1</version>
</dependency>
<dependency>
    <groupId>org.apache.httpcomponents</groupId>
    <artifactId>httpclient</artifactId>
    <version>4.5.13</version>
</dependency>
```

5.2.3 Setup MinIO server for image upload

When a user wishes to donate an item, they need to upload images of the item. Therefore, an object storage server is required. The MinIO server is well-suited to our needs because it is open-source and can store unstructured data such as photos, videos, and container images. Initially, we can download the MinIO server from https://min.io/download, tailored to our operating system. Next, we can start the server by executing the command '.\minio.exe server C:\minio –console-address :9001' in the command prompt system. At this stage, the MinIO server will run at the 'http://localhost:9000' address. Upon logging in, we can create a new bucket to store the uploaded images.

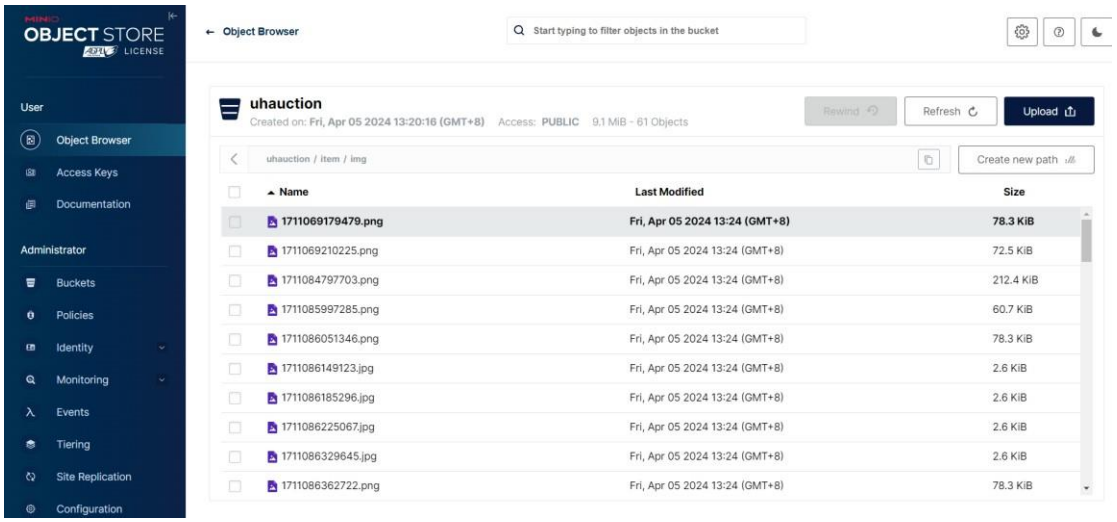


Figure 3.3.2.1 MinIO console

After completing the setup, we can proceed to integrate MinIO with our project to handle image uploads using the SDK provided by MinIO. The first step involves adding the MinIO dependency to our pom.xml file.

```xml
<dependency>
    <groupId>io.minio</groupId>
    <artifactId>minio</artifactId>
    <version>8.3.0</version>
</dependency>
```

Figure 3.3.2.2 Dependency of MinIO

Now, we can design a MinIO controller to provide a RESTful endpoint for retrieving image files stored in a MinIO bucket and serving them to clients upon request.

```java
Jian0518 *
@Controller
public class MinioController {
    @Value("uhauction")
    private String bucketName;
    @Autowired
    private MinioClient minioClient;

    Jian0518 *
    @GetMapping("/uhauction/item/img/{fileName:.+}")
    public ResponseEntity<byte[]> getImage(@PathVariable String fileName) throws Exception {
        InputStream stream = minioClient.getObject(
                GetObjectArgs.builder()
                        .bucket(bucketName)
                        .object( name: "item/img/"+fileName)
                        .build()
        );

        byte[] bytes = IOUtils.toByteArray(stream);

        HttpHeaders headers = new HttpHeaders();
        headers.setContentType(MediaType.IMAGE_JPEG);

        return new ResponseEntity<>(bytes, headers, HttpStatus.OK);
    }

}
```

Figure 3.3.2.3 Code snippet of Minio Controller

5.2.4 JWT for Authentication and Authorization

To ensure secure communication between the client and the server, we need to incorporate an open standard for securely transmitting information between parties into our project. This standard is known as JSON Web Token (JWT), commonly used for authorization purposes. Once a user logs in, each subsequent request will include a JWT, enabling access to routes, services, and resources permitted by that token.

```
3 usages  Jian0518 *
public class JwtAuthenticationFilter extends OncePerRequestFilter {
    1 usage
    private static final PathMatcher pathMatcher = new AntPathMatcher();

    no usages  Jian0518 *
    @Override
    protected void doFilterInternal(HttpServletRequest request, HttpServletResponse response, FilterChain filterChain) throws

        try {
            if(isProtectedUrl(request)) {
                if(!request.getMethod().equals("OPTIONS"))
                    request = JwtUtil.validateTokenAndAddUserIdToHeader(request);
            }
        } catch (Exception e) {
            response.sendError(HttpServletResponse.SC_UNAUTHORIZED, e.getMessage());
            return;
        }
        filterChain.doFilter(request, response);
    }
```

Figure 3.3.3.1 Code snippet of JWT 1

The doFilterInternal method is where the actual filtering logic happens. It intercepts incoming HTTP requests, checks if they are for protected URLs, and if so, validates the JWT token attached to the request and adds the user ID to the request header. It then continues the filter chain for further processing.

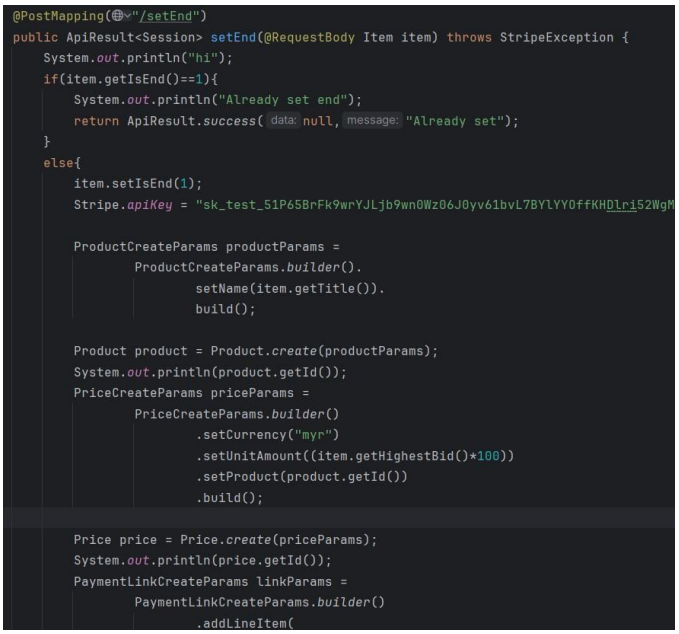
```
1 usage  Jian0518 *
private boolean isProtectedUrl(HttpServletRequest request) {
    List<String> protectedPaths = new ArrayList<~>();
    protectedPaths.add("/admin/login/status");
    protectedPaths.add("/ums/user/info");
    protectedPaths.add("/ums/user/update");
    protectedPaths.add("/item/create");
    protectedPaths.add("/item/pay");
    protectedPaths.add("/item/setEnd");
    protectedPaths.add("/item/update");
    protectedPaths.add("/item/delete/*");
    protectedPaths.add("/fund/update");
    protectedPaths.add("/fund/add");
    protectedPaths.add("/comment/add_comment");
    protectedPaths.add("/relationship/subscribe/*");
    protectedPaths.add("/relationship/unsubscribe/*");
    protectedPaths.add("/relationship/validate/*");
    protectedPaths.add("/bid/add_bid");
    protectedPaths.add("/bid/update_bid");
    protectedPaths.add("/uhauction/item/img/*");

    boolean bFind = false;
    for( String passedPath : protectedPaths ) {
        bFind = pathMatcher.match(passedPath, request.getServletPath());
        if( bFind ) {
            break;
        }
    }
    return bFind;
}
```

Figure 3.3.3.2 Code snippet of JWT 2

The `isProtectedUrl` method checks if the requested URL is in a list of protected paths. If it is, the method returns true, indicating that JWT authentication should be applied. Overall, this filter ensures that requests to certain URLs are authenticated using JWT tokens before allowing access to the protected resources. If authentication fails, an unauthorized response is sent back to the client.

5.2.5 Integrate with Stripe API for Payment function.

After a bidder wins an item, they need to proceed with the payment. In this project, the Stripe Payment API is integrated with the auction website. Stripe provides comprehensive documentation and robust SDKs (Software Development Kits) for various programming languages and adheres to strict security standards to protect sensitive payment information. First, we need to sign up for a Stripe account at https://stripe.com and complete the required information. After that, we can log in to the Stripe Dashboard and navigate to the Developers section to access API keys. With the provided API keys, we can now integrate the Stripe payment into our website.



```
@PostMapping("/setEnd")
public ApiResult<Session> setEnd(@RequestBody Item item) throws StripeException {
    System.out.println("hi");
    if(item.getIsEnd()==1){
        System.out.println("Already set end");
        return ApiResult.success( data: null, message: "Already set");
    }
    else{
        item.setIsEnd(1);
        Stripe.apiKey = "sk_test_51P65BrFk9wrYJLjb9wn0Wz06J0yv61bvL7BYlYYOffKHDlri52WgM

        ProductCreateParams productParams =
                ProductCreateParams.builder().
                        setName(item.getTitle()).
                        build();

        Product product = Product.create(productParams);
        System.out.println(product.getId());
        PriceCreateParams priceParams =
                PriceCreateParams.builder()
                        .setCurrency("myr")
                        .setUnitAmount((item.getHighestBid()*100))
                        .setProduct(product.getId())
                        .build();

        Price price = Price.create(priceParams);
        System.out.println(price.getId());
        PaymentLinkCreateParams linkParams =
                PaymentLinkCreateParams.builder()
                        .addLineItem(
```

```
                                        .setPrice(price.getId())
                                        .setQuantity(1L)
                                        .build()
                        )
                        .build();

        PaymentLink paymentLink = PaymentLink.create(linkParams);
        System.out.println(paymentLink.getUrl());
        item.setPayLink(paymentLink.getUrl());
        iItemService.updateById(item);


        SessionCreateParams params =
                SessionCreateParams.builder()
                        .setMode(SessionCreateParams.Mode.PAYMENT)
                        .setSuccessUrl("http://localhost:8080/#/pay/success")
                        .addLineItem(
                                SessionCreateParams.LineItem.builder()
                                        .setQuantity(1L)
                                        .setPrice(price.getId())
                                        .build())
                        .build();
        Session session = Session.create(params);

        return ApiResult.success(session, message: "Set Expire Success");
    }
```

Figure 3.3.4.1 Code snippet of Stripe Payment Integration

In the provided code, the method interacts with the Stripe API to create a product, price, payment link, and payment session. Subsequently, the payment link is stored in the database along with the corresponding item for future retrieval.

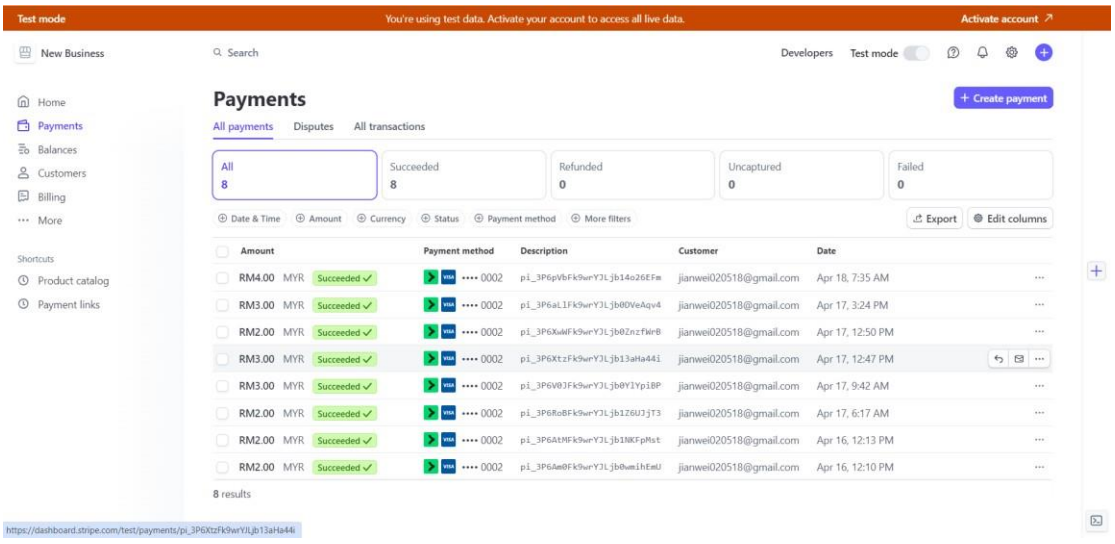


Figure 3.3.4.2 Stripe Dashboard

5.2.6 Google Gmail Setup

After an auction event has ended, we need to notify the winner. This can be accomplished by sending an email to the winner using Gmail. To enable this functionality, we first need to create an app password specifically for this project. An app password is a 16-digit code that allows a less secure app or device to access your Google Account securely. You can generate an app password by visiting Google's App Passwords page. Once the app password is generated, it should be added to the configuration in the application-dev.yaml file as follows:

```
spring:
  mail:
    host: smtp.gmail.com
    port: 587
    username: jianwei020518@gmail.com
    password: porz nwcj mimh ttfa
    properties:
      mail:
        smtp:
          auth: true
          starttls:
            enable: true
```

The following dependencies need to be added to the pom.xml file to integrate Gmail services into our program. These dependencies include libraries for Google API client support, Oauth authentication, and HTTP client capabilities, which are essential for accessing Gmail's functionalities and securely communicating with Google's servers.:

```
<dependency>
    <groupId>com.google.api-client</groupId>
    <artifactId>google-api-client</artifactId>
    <version>2.0.0</version>
</dependency>
<dependency>
    <groupId>com.google.oauth-client</groupId>
    <artifactId>google-oauth-client-jetty</artifactId>
    <version>1.34.1</version>
</dependency>
<dependency>
    <groupId>com.google.apis</groupId>
    <artifactId>google-api-services-gmail</artifactId>
    <version>v1-rev20220404-2.0.0</version>
</dependency>
```

Next, an EmailService class is created under the Service directory. This class is responsible for handling all email-related functionalities, such as composing, sending, and managing email notifications. It interacts with the Gmail API to send emails to auction winners and other users as needed, ensuring that all email operations are handled efficiently and securely.

```
@Service
public class EmailService {

    @Autowired
    private JavaMailSender mailSender;

    no usages  Jian0518
    public void sendSimpleEmail(String to, String subject, String text) {
        SimpleMailMessage message = new SimpleMailMessage();
        message.setTo(to);
        message.setSubject(subject);
        message.setText(text);

        mailSender.send(message);
    }

    1 usage  Jian0518
    public void sendEmailWithImage(String to, String subject, String text, String imagePath) throws Exception {
        MimeMessage mimeMessage = mailSender.createMimeMessage();

        MimeMessageHelper helper = new MimeMessageHelper(mimeMessage,  multipart: true);
        helper.setTo(to);
        helper.setSubject(subject);
        helper.setText( text: "<html><body>" + text + "<br><img src='cid:image'></body></html>",  html: true);

        UrlResource image = new UrlResource(imagePath);
        helper.addInline( contentId: "image", image);

        mailSender.send(mimeMessage);
    }
```

We can now create a @PostMapping method to send an email to the user when a request is received from the front end:

```
@PostMapping("/sendMail")
public ApiResult<String> sendMail(@RequestBody Item item) throws
Exception {

    User user = umsUserService.getById(item.getWinnerId());
    String toEmailAddress = user.getEmail();
    String subject = "Congratulations! You are the winner";
    String text = "Dear " + user.getAlias() +
",<br><br>Congratulations! You have won the auction for the item: "
            + item.getTitle() + ".<br><br>Best regards,<br>Your
Auction Team";
    String imagePath = "http://localhost:9000/uhauction/item/img/" +
item.getCover();


emailService.sendEmailWithImage(toEmailAddress,subject,text,imagePath
);
    item.setIsNotify(1);
```

```
    iItemService.updateById(item);

    return ApiResult.success("Email sent successfully!");
}
```

5.3 Website Interface and Key Features

5.3.1 Home Page

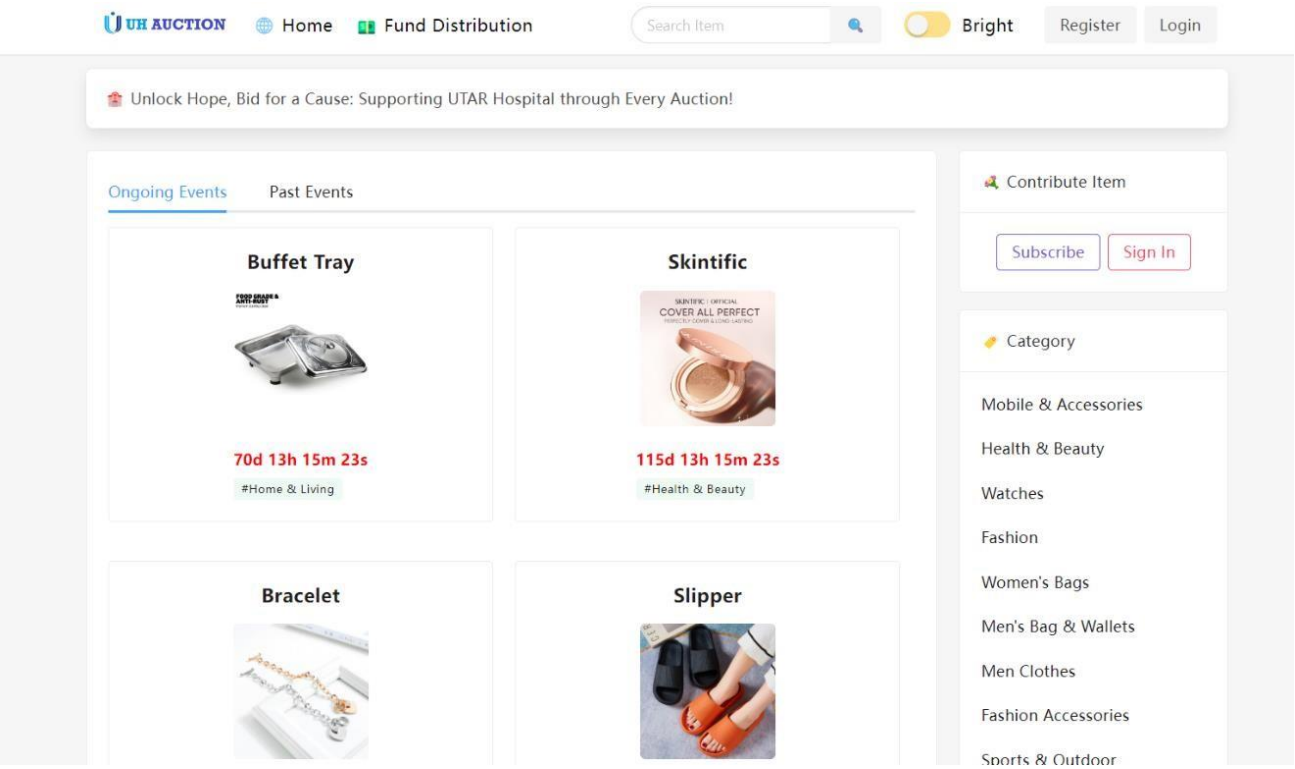


Figure 5.3.1 Home page

On the home page, users will find a list of items currently being auctioned, accompanied by a countdown timer. To view past auction items, users can simply click on the 'Past Events' tab. Additionally, users can register an account or log in by clicking the 'Register' or 'Login' buttons, respectively.

If users wish to search for a specific item, they can enter keywords into the search bar and click the magnifying glass icon. Alternatively, if they prefer to browse items by category, they can click on the category tags located in the right-hand sidebar.

5.3.2 Register / Login Page

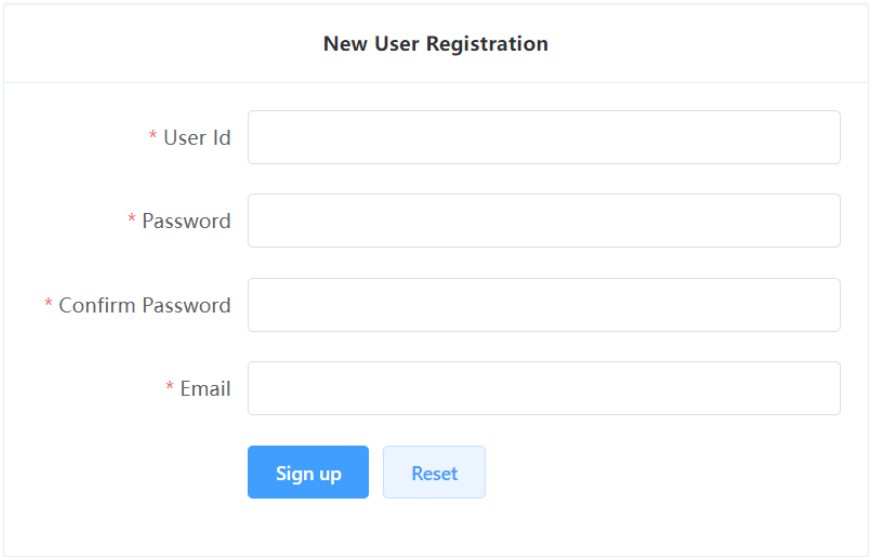


Figure 5.3.2.1 Register page

A new user must fill in details such as user ID, password, and email to register an account.

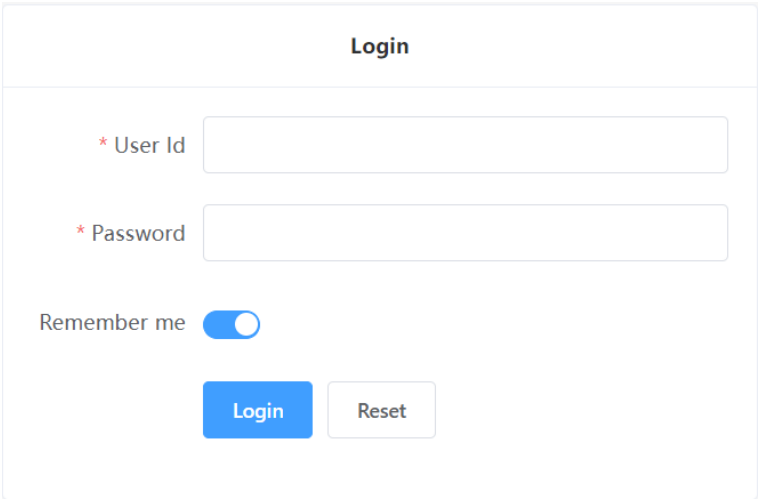


Figure 5.3.2.2 Login page

After successfully registering, they can proceed to log in using their ID and password.

5.3.3 Item Detail Page

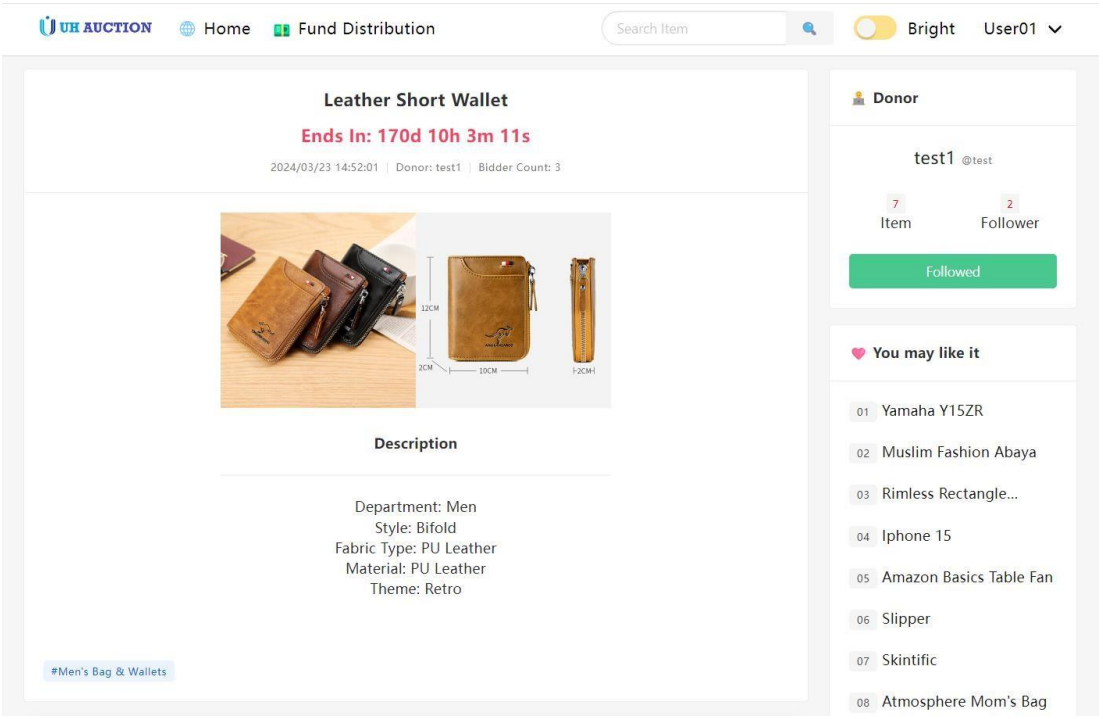


Figure 5.3.3.1 Item Detail page

When users click on an item from the main page, they will be redirected to the item detail page. In this page, the description and detail of the item will be provided. User can see who the donor is and how many people has bided on this item.

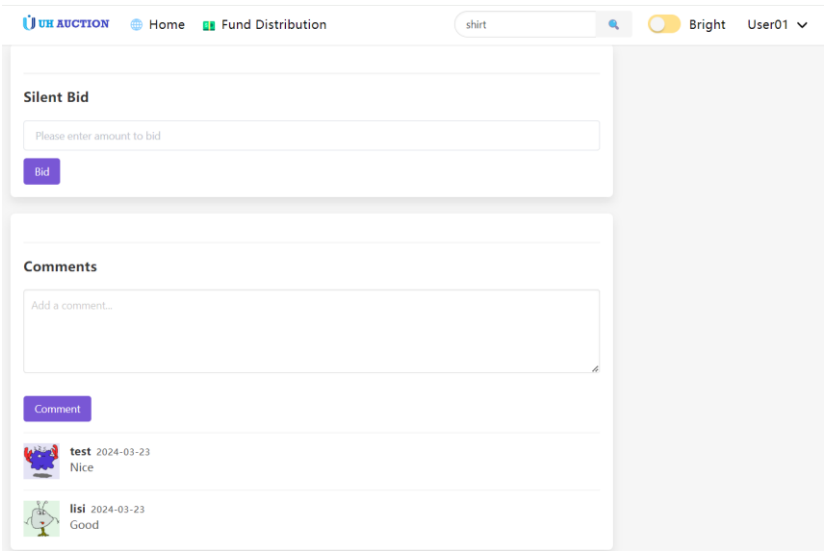


Figure 5.3.3.2 Bid and Comment section

Additionally, users can place a bid on an item by entering an amount in the input textbox. Below the bid section is the comment section, where users can view other people's comments and leave their own. Since the website employs a silent auction format, users can only see the winner and the winning bid amount after the item has expired. The image below provides an example of an expired item with the winner displayed. If the user is the winner, a 'Pay' button will appear to redirect them to the payment page.

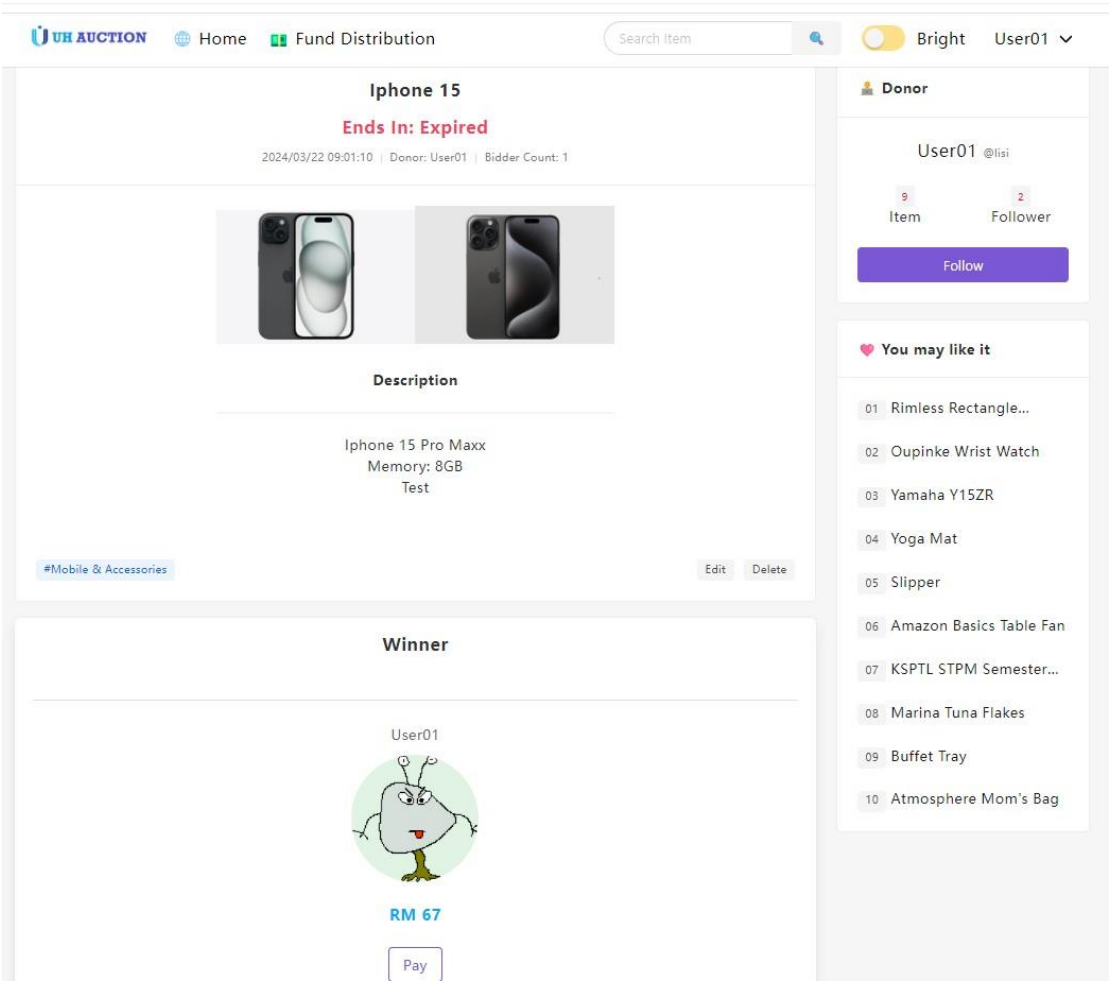


Figure 5.3.3.3 Winner section

5.3.4 Favorite Item Page

Users can add items they are interested in to their favorite items page to review them in the future. By clicking the ‘Add to Favorites’ button, they can save the item to their favorite list.

Figure 5.3.4.1 Add to Favorites

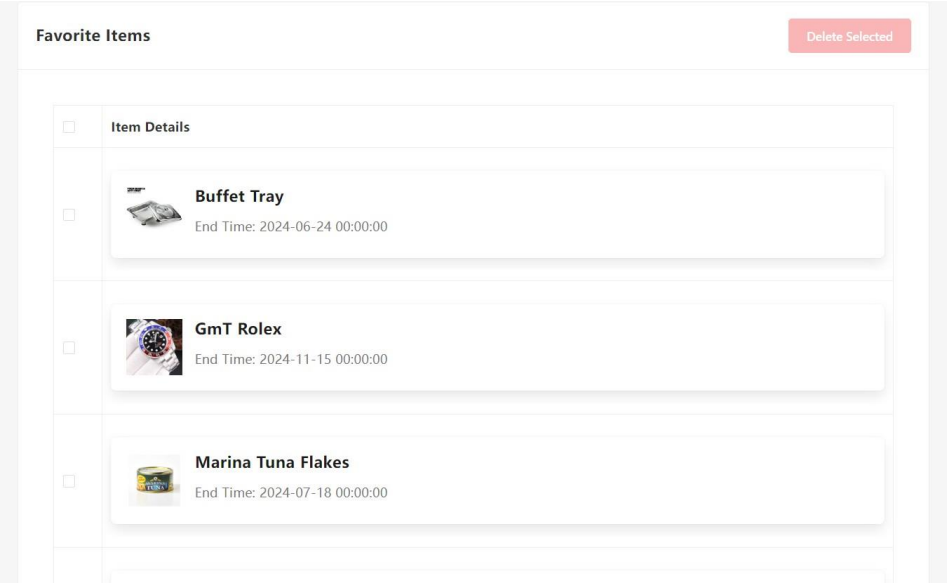


Figure 5.3.4.2 Favorite Item Page

5.3.5 Search and Filter

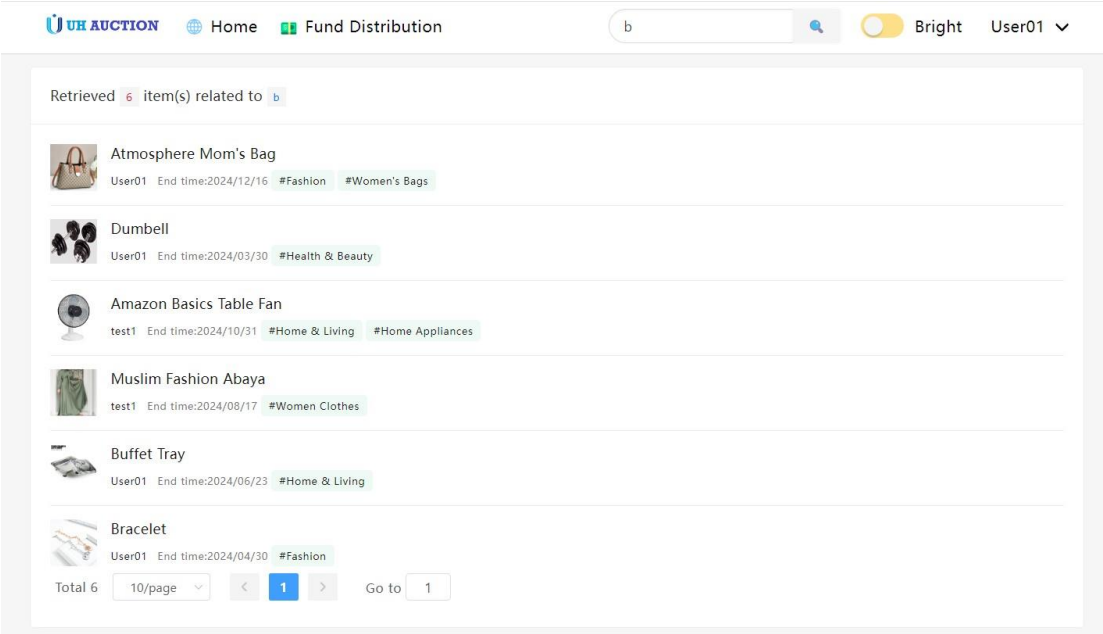


Figure 5.3.5 Search and filter section

Users can search for items based on keywords by entering the keyword into the input textbox and clicking the magnifying glass icon. The implementation details of the search function are as follows:

```
<select id="searchByKey" resultMap="itemVO">
    SELECT t.id,t.title,t.donor_id,t.bid_count,t.cover,
    t.comments,t.view,t.collects,t.top,t.essence,
    t.create_time,t.end_time,t.modify_time,
    u.username,u.alias,u.avatar
    FROM item t
    LEFT JOIN ums_user u
    ON t.donor_id = u.id
    <where>
        <if test="keyword!=null">
            and t.title like CONCAT('%','${keyword}')
            or t.title like CONCAT('${keyword}','%')
            or t.title like CONCAT('%','${keyword}','%')
            or t.title = #{keyword}
        </if>
    </where>
    order by t.view desc, t.create_time desc
</select>
```

5.3.6 My Donated Items Page

Users can check their donated items by clicking the ‘My Items’ button. On this page, users can see all their items categorized by their progress, such as items to be delivered, pending items, and completed items, by switching the tab pane.

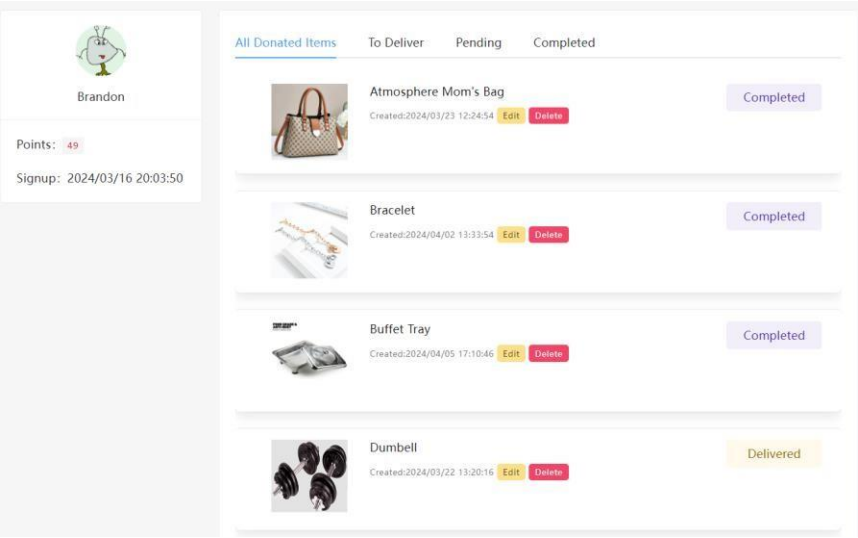


Figure 5.3.6 My Items Page

5.3.7 My Bid Item Page

Users can check if they have won an item on the ‘My Bids’ page. All items are categorized as ‘To Pay,’ ‘To Receive,’ ‘Pending,’ ‘Completed,’ and ‘Lost.’ On the left side of the page, users can check the balance of their ‘UH Wallet’ and choose to top up their balance by clicking the ‘Add Funds’ button.

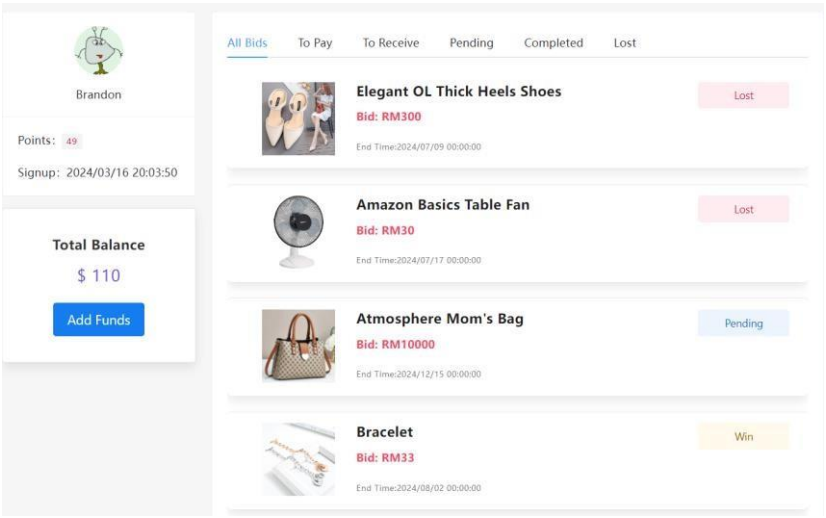


Figure 5.3.7 Bid Item Page

5.3.8 Payment Page

Users have two options to pay for their won items: credit card or UH Wallet. If they choose to pay with UH Wallet, the amount will be deducted directly from their wallet balance. Alternatively, they can choose to pay with a credit card, which will redirect them to the Stripe API payment.

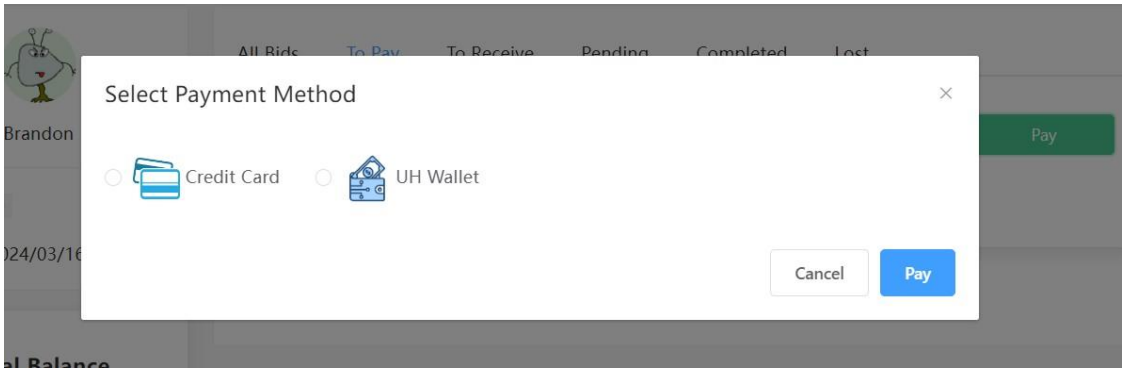


Figure 5.3.8.1 Payment Options

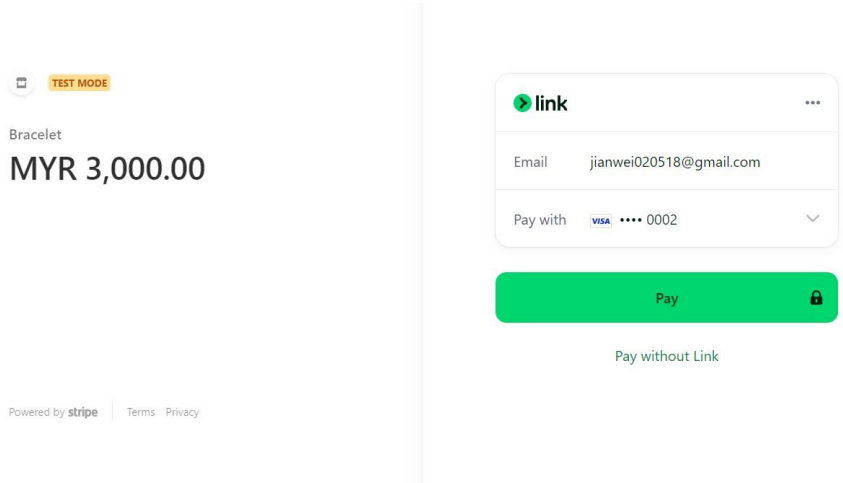


Figure 5.3.8.2 Stripe API Payment Page

5.3.9 Dashboard Page

The most important feature of this website is the webpage that displays comprehensive statistics on how the funds are used for UTAR Hospital. All details regarding the allocation and utilization of funds at UTAR Hospital should be open and accessible to the public to ensure transparency and trust. Users can easily access this page by clicking the 'Dashboard' link in the header. This page contains a variety of summarized data, including:

1. **Funds Collected by Month**: A visual representation of the total funds collected each month, helping users understand the financial progress over time.

2. **Distribution of Funds Utilization**: Detailed charts and graphs showing how the collected funds are allocated across different departments and projects within the hospital.
3. **Top Donor Ranking**: A list ranking the top donors by their contribution amounts, acknowledging their generosity.
4. **Top Bidder Ranking**: A similar ranking for the top bidders in auctions, showcasing their active participation.

By providing these insights, the website aims to maintain a high level of accountability and encourage continued support from the community.

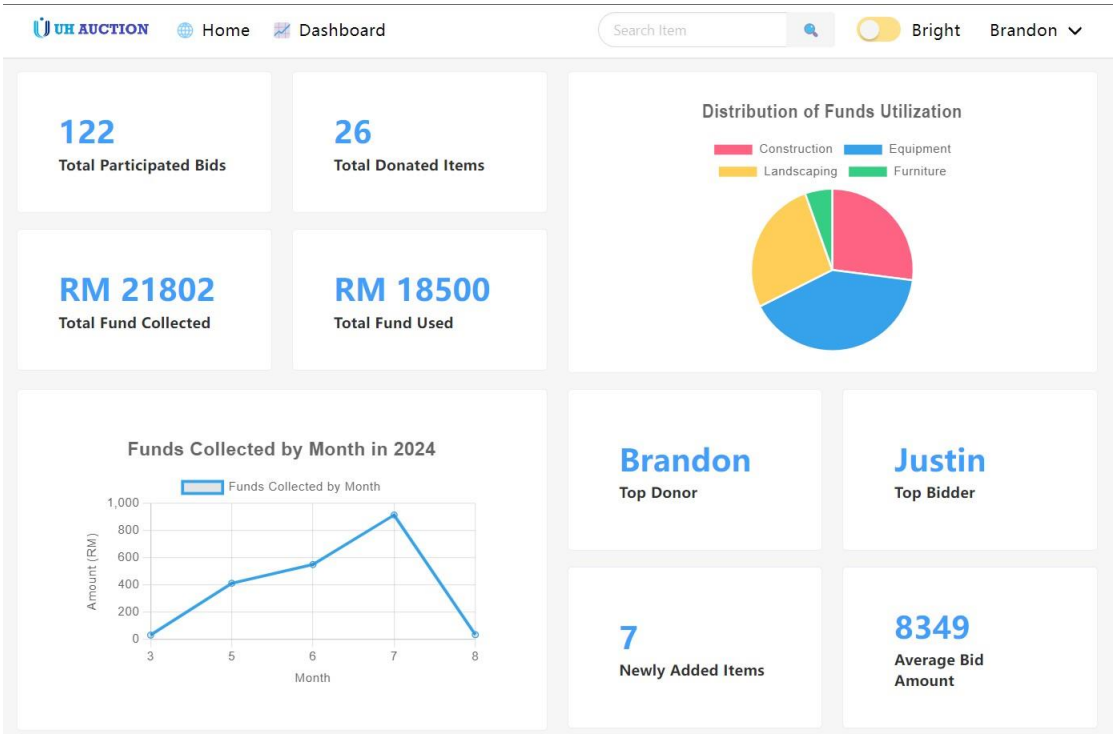


Figure 5.3.9.1 Dashboard Page

Users can click on the section they are interested in, and a more detailed modal related to that section will pop up. For example, when a user clicks on the ‘Top Donor’ section, a full donor ranking detail will appear, as shown in Figure 4.2.8.

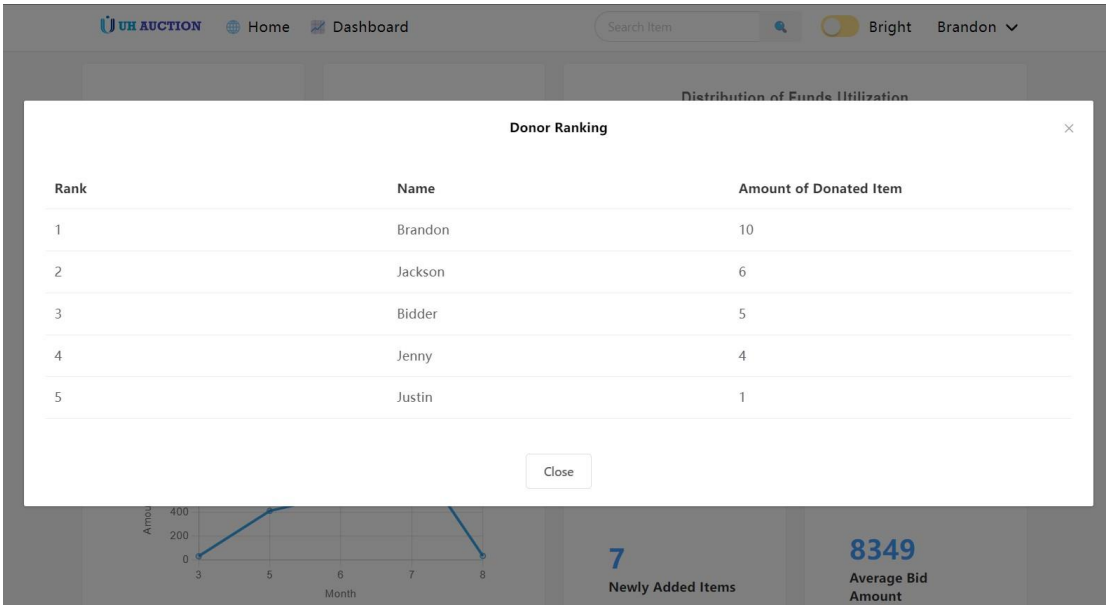


Figure 5.3.9.2 Donor Ranking Detail Modal

5.3.10 Online Chatting Page

Users can chat with others on the online chat page. This page allows them to send and receive messages in real time, facilitating communication with other users.

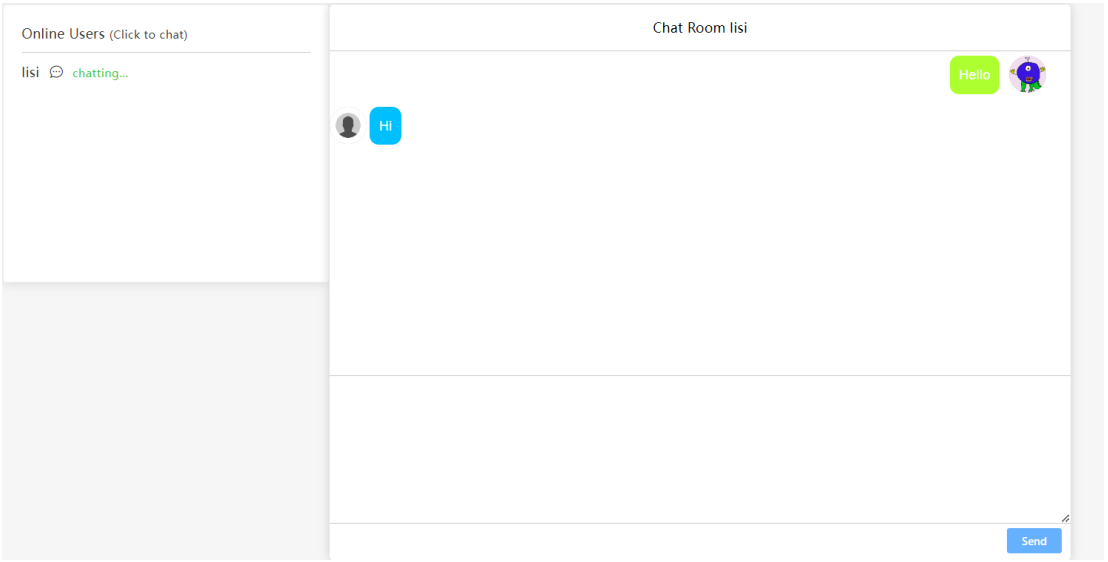


Figure 5.3.10 Online Chatting Page

5.3.11 Admin System

Finally, the management system allows the admin to monitor all users, items, and auction activities. The admin has the highest privilege to delete users, items, and upload details on how the funds are used. Below is the login page for the admin.

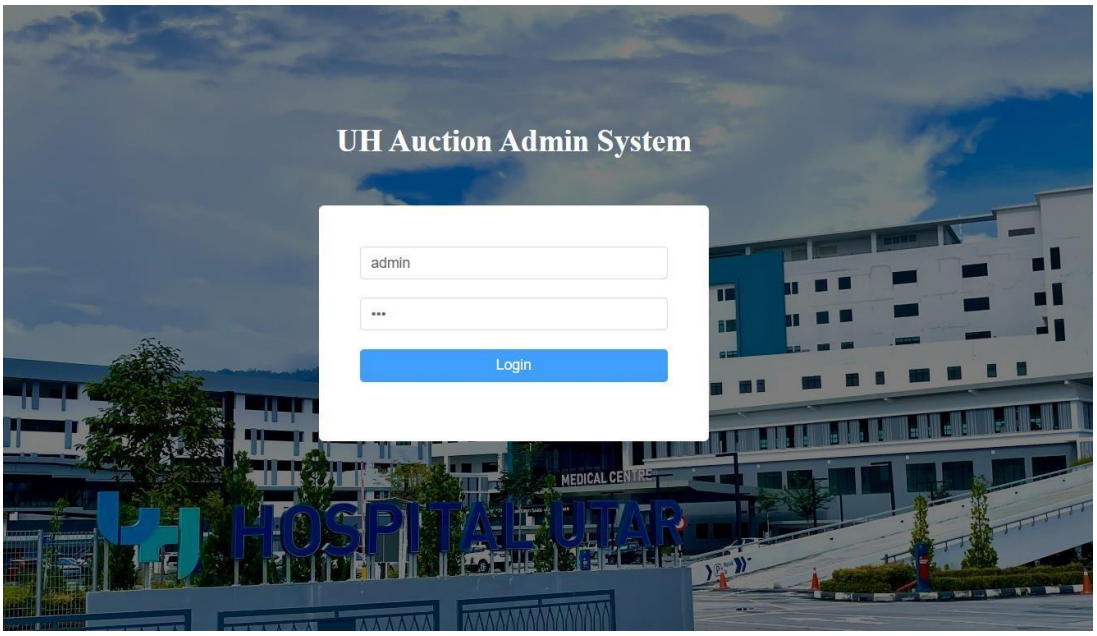


Figure 5.3.11.1 Admin Login Page

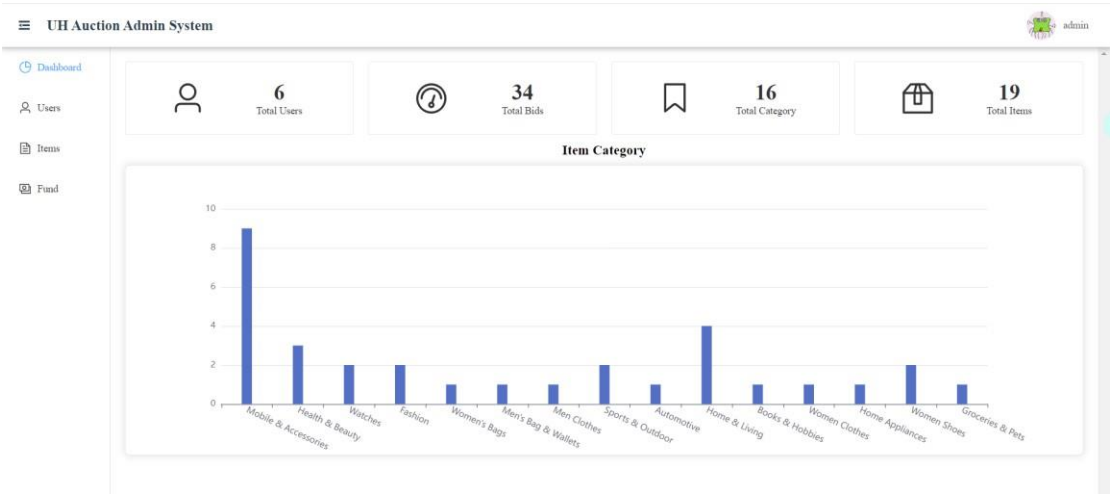


Figure 5.3.11.2 Admin Dashboard

The admin dashboard displays website statistics, including the total number of users, bids, categories, and items.

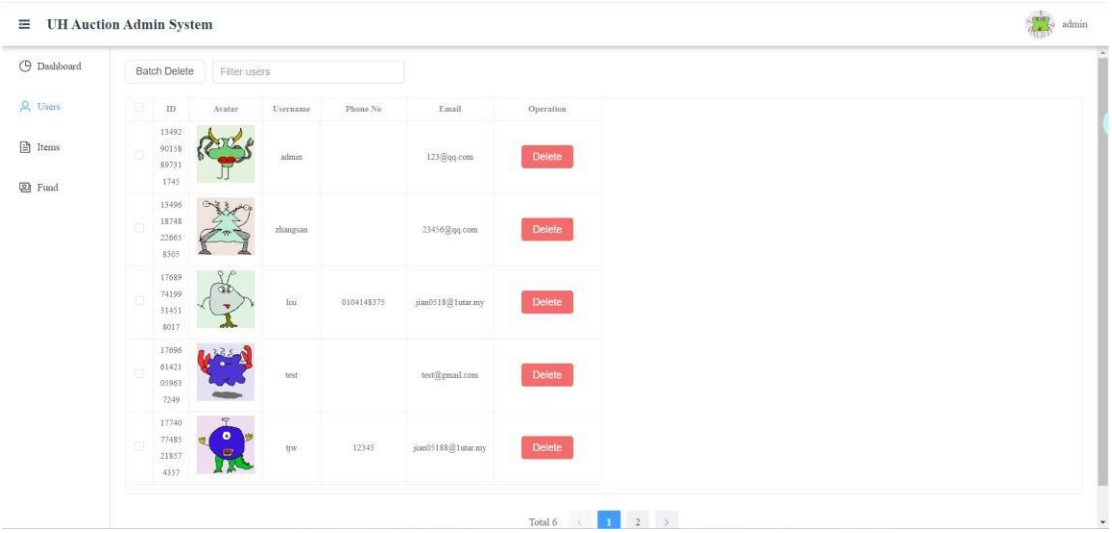


Figure 5.3.11.3 User Management

The user management page displays a list of registered users along with their details such as ID, username, phone number, and email. The admin has the privilege to delete user accounts that violate the rules.

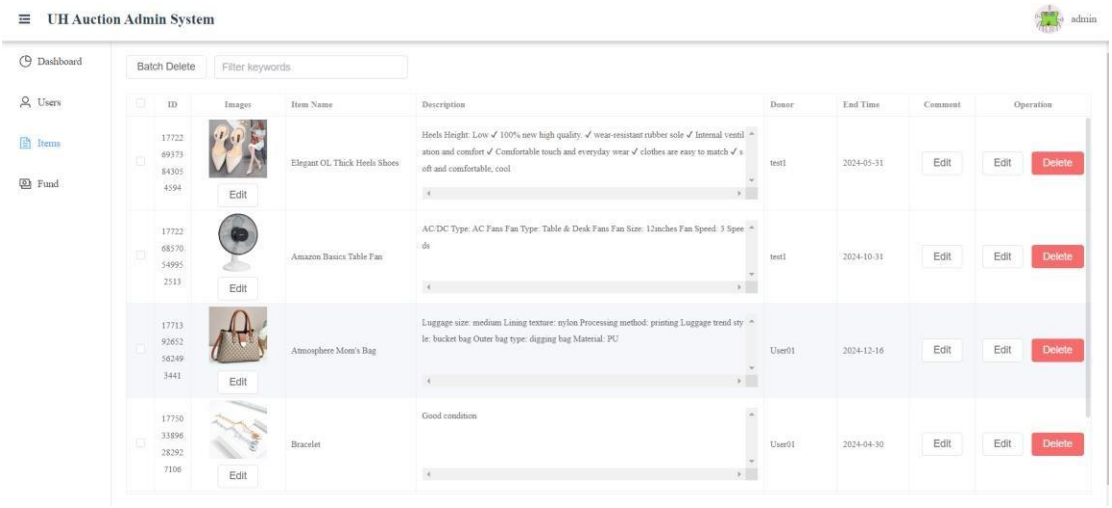


Figure 5.3.11.4 Item Management

The admin has the privilege to delete or edit any inappropriate or illegal items on the item management page.

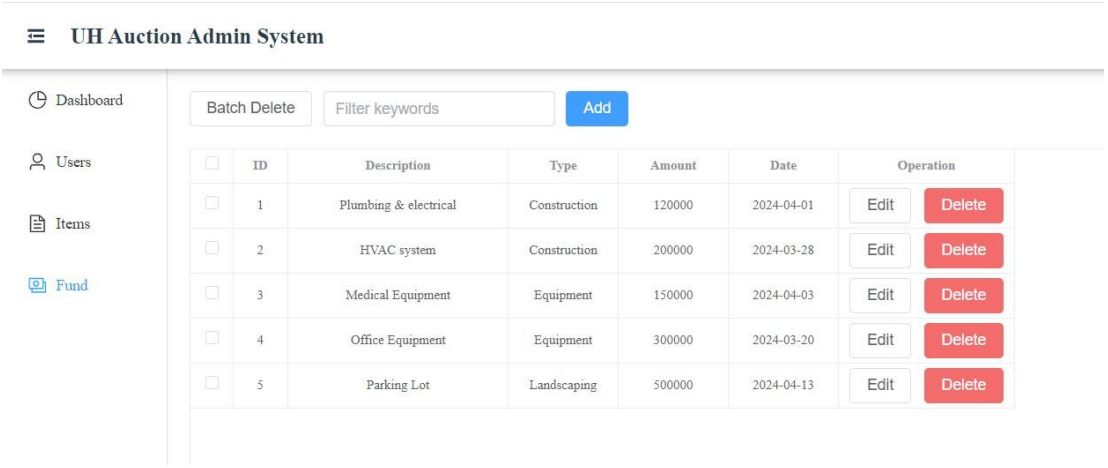


Figure 5.3.11.5 Fund Management

After the funds gained from this auction website have been withdrawn for the hospital, the admin can update the details on how the funds are used on the fund management page.

5.4 Setting and Configuration

The system settings and configuration for the online auction website are defined within the “application-dev.yaml” file, which ensures that the website runs smoothly in the development environment. This configuration file specifies parameters for the server, database, email, logging, file uploads, and external services.

5.4.1 Server Configuration

The server is configured to run on port 8000:

```
server:
  port: 8000
```

This defines the entry point for the application, allowing it to be accessed locally via http://localhost:8000.

5.4.2 Web Domain

The web domain for the development environment is set as:

```
web:
  domain: http://localhost
```

5.4.3 Database Configuration

The application uses a MySQL database to store auction items, user information, and bids. The configuration includes the database driver, username, password, and connection URL:

```
spring:
  datasource:
    driver-class-name: com.mysql.cj.jdbc.Driver
    username: abcd
    password: abcd
    url:
jdbc:mysql://localhost:3306/uhauction?useUnicode=true&character
Encoding=utf8&autoReconnect=true&serverTimezone=GMT%2B8
    type: com.zaxxer.hikari.HikariDataSource
```

The use of ***HikariDataSource*** ensures efficient database connection pooling.

5.4.4 Email Configuration

To facilitate email notifications, such as confirming auction winners, the system is configured to use Gmail's SMTP server for outgoing emails:

```
spring:
  mail:
    host: smtp.gmail.com
    port: 587
    username: abcd1234@gmail.com
    password: abcd abcd abcd abcd
    properties:
      mail:
        smtp:
          auth: true
          starttls:
            enable: true
```

This configuration ensures secure communication with Gmail's SMTP server using ***STARTTLS***, allowing the website to send emails securely.

5.4.5 Logging Configuration

The logging configuration allows for detailed logging of the application's behavior. While general application logs are set to info level, the auction-related logs are set to debug for more granular insights during development:

```
logging:
  level:
    root: info
    com.utar.uhauction: debug
```

This helps monitor both general system activity and specific auction-related processes.

5.4.6 MinIO Configuration

MinIO is used as the object storage service to store images and files related to auction items. The configuration includes the endpoint, access credentials, and the bucket name:

```
minio:
  endpoint: http://localhost:9000
  access-key: root
  secret-key: "12345678"
  bucket-name: uhauction
```

This enables secure access to the file storage system, which is used to manage auction item images.

5.4.7 File Upload Configuration

The system supports uploading files, such as item images, with a file size limit of 50MB:

```
minio:
  servlet:
    multipart:
      max-file-size: 50MB
      max-request-size: 50MB
```

This ensures users can upload large images without exceeding size limits, maintaining a smooth experience during item listing.

5.5 Implementation Issues and Challenges

During the development and deployment of the online auction website, several challenges were encountered. One significant issue was ensuring that notification emails, especially those sent to auction winners, were reliably delivered without being marked as spam. Emails sent through Gmail's SMTP server occasionally landed in users' spam folders due to strict filtering algorithms. Additionally, it was challenging to manage email sending limits while ensuring timely delivery of notifications, especially during periods of increased bidding activity.

Secondly, implementing a responsive and real-time bidding system that dynamically declared the winner without requiring the user to refresh the page proved to be a significant technical challenge. While the system aimed to provide real-time updates, users still needed to manually reload the page after an auction ended to see the final results and determine the winner. This posed a usability issue, as it interrupted the seamless experience that real-time bidding systems are expected to offer. Moreover, once the winner was determined, they were also required to refresh their page to proceed with the payment process for the auctioned item. This additional step not only impacted user convenience but also created potential confusion, especially during high-traffic periods when users expected instant notifications and the ability to make payments without delays.

The same issue applies to the dashboard page. Users need to manually refresh the page to see the latest information, such as the most trending category items, total funds collected, and other key data. This lack of real-time updates can cause delays in user interactions, leading to confusion due to data inconsistency. If users are unaware of the most recent changes, they may miss important opportunities, such as participating in trending auctions or seeing the latest funding milestones. Moreover, the need for manual refreshing increases the risk of users making decisions based on outdated information, which can negatively impact the overall user experience and reduce the efficiency of the auction system.

In conclusion, the implementation of the online auction website has highlighted several unresolved issues that continue to pose challenges. These issues have impacted the overall user experience and system efficiency. Moving forward, further investigation and development are required to find effective solutions and enhance the functionality and reliability of the platform. Addressing these challenges will be crucial for optimizing the system and ensuring it meets its intended goals effectively.

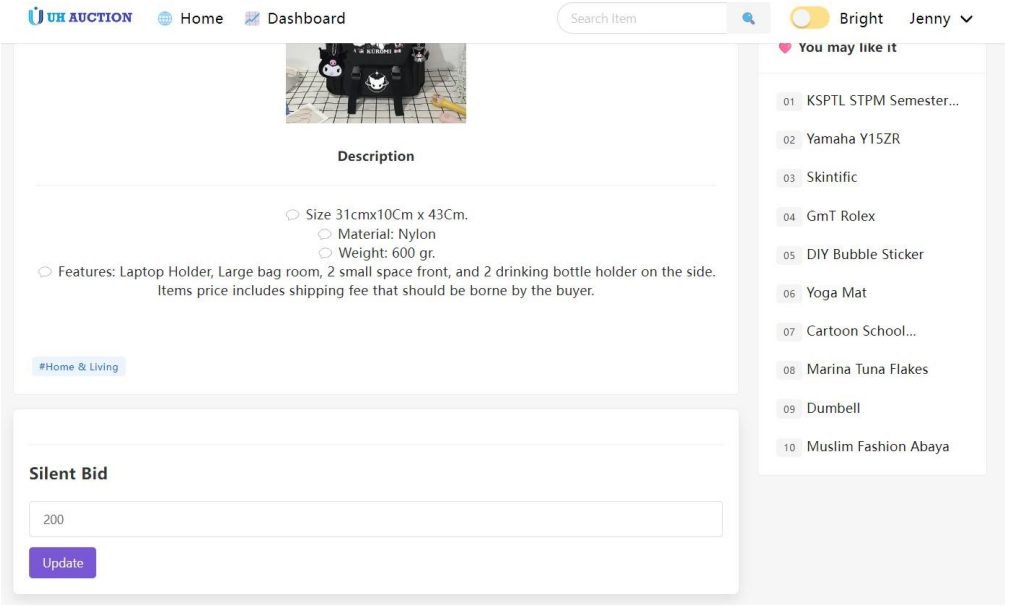
CHAPTER 6 SYSTEM TESTING AND DISCUSSION

6.1 System Testing and Performance Metrics

In this section, we conducted testing using all four methodologies: unit testing, integration testing, system testing, and security testing. Each of these methodologies was employed to validate different aspects of the system, ensuring its reliability, functionality, and security. Detailed descriptions of the testing processes and their results are provided below, illustrating how each test was performed and the outcomes observed.

6.1.1 Unit Testing

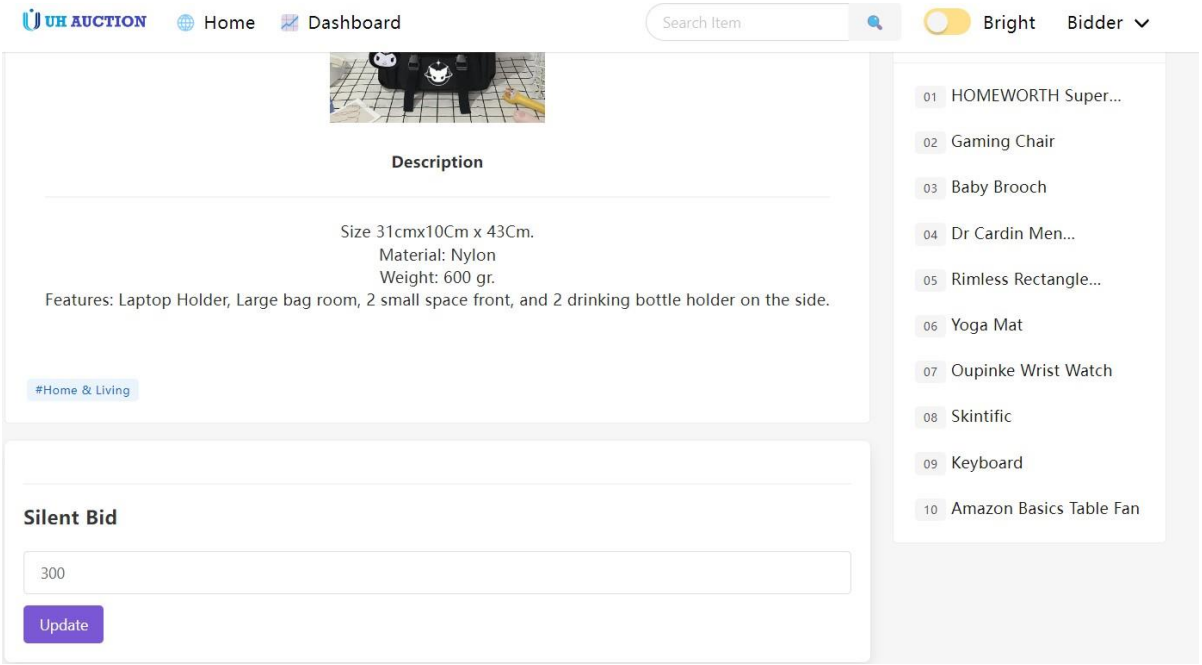
First, we want to test if the highest bid has been updated correctly. A user named ‘Jenny’ places a bid of $200 on an item.



The highest bid in the database is now $200, which is correct.

```
mysql> SELECT title as Item, highest_bid as 'Hightest Bid', u.alias as Winner
    -> FROM item
    -> JOIN ums_user u ON u.id = item.winner_id
    -> WHERE item.id = '1827487301928271873';
+-----------------+--------------+--------+
| Item            | Hightest Bid | Winner |
+-----------------+--------------+--------+
| Kuromi Backpack |          200 | Jenny  |
+-----------------+--------------+--------+
1 row in set (0.00 sec)
```

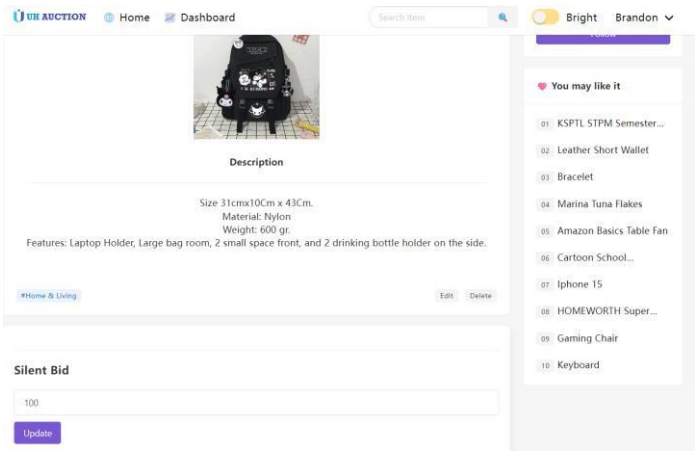
Another user, ‘Bidder,’ places a bid of $300 on the same item.



The highest bid in the database becomes $300, and the new winner is recorded, which matches our expected result.

```
mysql> SELECT title as Item, highest_bid as 'Hightest Bid', u.alias as Winner
    -> FROM item
    -> JOIN ums_user u ON u.id = item.winner_id
    -> WHERE item.id = '1827487301928271873';
+-----------------+--------------+--------+
| Item            | Hightest Bid | Winner |
+-----------------+--------------+--------+
| Kuromi Backpack |          300 | Bidder |
+-----------------+--------------+--------+
1 row in set (0.00 sec)
```

If another user, ‘Brandon,’ places a lower bid, say $100.



The highest bid in the database will remain unchanged at $300.

```
mysql> SELECT title as Item, highest_bid as 'Hightest Bid', u.alias as Winner
    -> FROM item
    -> JOIN ums_user u ON u.id = item.winner_id
    -> WHERE item.id = '1827487301928271873';
+-----------------+--------------+--------+
| Item            | Hightest Bid | Winner |
+-----------------+--------------+--------+
| Kuromi Backpack |          300 | Bidder |
+-----------------+--------------+--------+
1 row in set (0.00 sec)
```

The result is archived by implementing the following function:

```
@PostMapping("/add_bid")
public ApiResult<Bid> add_bid(@RequestHeader(value = USER_NAME) String
85sername,
                              @RequestBody BidDTO dto) {
    User user = umsUserService.getUserByUsername(85sername);

    Item item = itemMapper.selectById(dto.getItem_id());
    item.setBidCount(item.getBidCount()+1);

    //if the amount is higher than the current highest bid,
    //update the winner and highest bid
    if(dto.getAmount()>item.getHighestBid()){
        item.setWinnerId(user.getId());
        item.setHighestBid(dto.getAmount());
    }

    itemMapper.updateById(item);

    Bid bid = bidService.create(dto, user);
    return ApiResult.success(bid);
}
```

If the new bid amount (from `BidDTO`) is higher than the current highest bid for the item, it updates the item's highest bid and sets the current user as the winner.

Additional unit test cases are shown in this table:

Table 6.1.1 Unit Test Cases

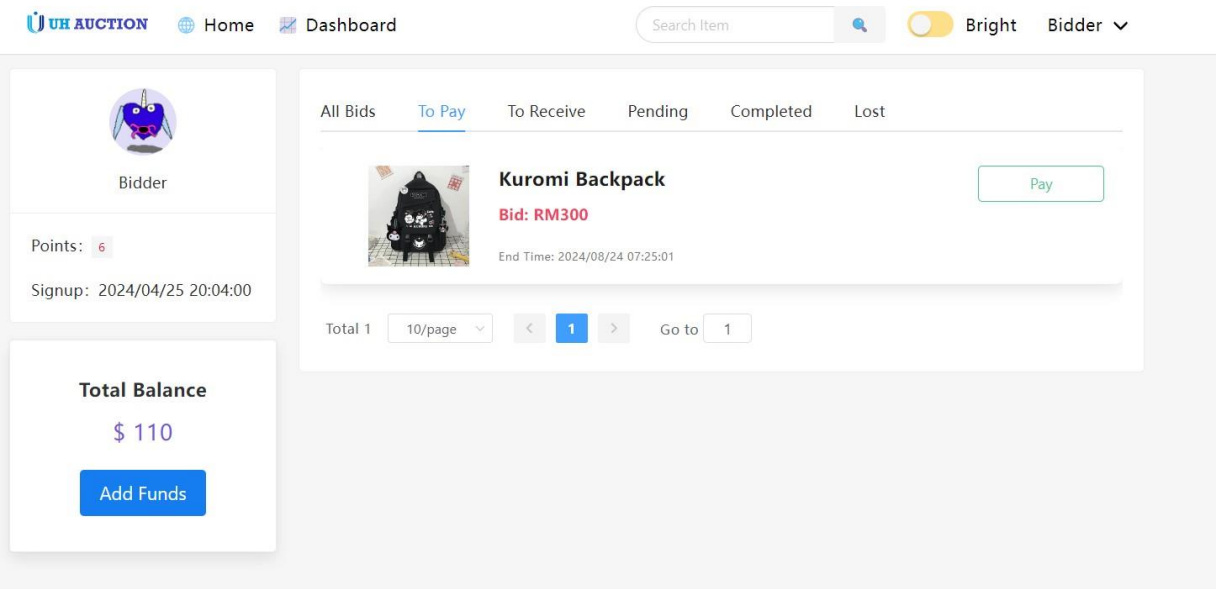
Test ID	Description	Steps	Inputs	Expected Result	Status
UT001	Test updating the highest bid in add_bid method	1. Set up an item with a current highest bid. 2. Place a new bid that is higher than the current highest bid. 3. Place a new bid that is lower than the highest bid.	Current highest bid: $200 New bid 1: $300 New bid 2: $150	After first bid, highest bid is updated to $300 and winner is updated. After second bid, highest bid remains $300, and winner remains unchanged.	PASS

UT002	Test user authentication method	1. Call the authentication method.	Username: `user1`, Password: `password123`	Function returns user is authenticated	PASS
UT003	Test email notification function	1. Call the email notification function with auction winner details.	Winner email: `winner@example.com`	Email is sent to `winner@example.com` with the correct auction details	PASS
UT004	Test item listing function	1. Call the item listing function.	Item details: Name, Description, Bid	Item details are displayed correctly on the website	PASS
UT005	Test item creation function	1. Call the item creation function with valid item details.	Item details: Name: "Antique Clock", Description: "Vintage clock from 1920", End Time: 01 September 2024, Category: "Fashion"	A new item is successfully created with the provided details, and a unique item ID is assigned.	PASS
UT006	Test bid rejection for lower or equal bid	1. Set up an item with a current highest bid of $500. 2. Place a new bid of $500 or lower.	Current highest bid: $500 New bid: $400	The bid is rejected, the highest bid remains $500, and the winner remains unchanged.	PASS
UT007	Test item removal function	1. Call the item removal function for an existing item.	Item ID: `12345`	The item is successfully removed from the auction, and it no longer appears in the item list.	PASS
UT008	Test search functionality for auction items	1. Search for an auction item by a keyword that matches the item name or description.	Search keyword: "Bag"	The function returns a list of items that match the keyword "Bag", including all relevant details.	PASS

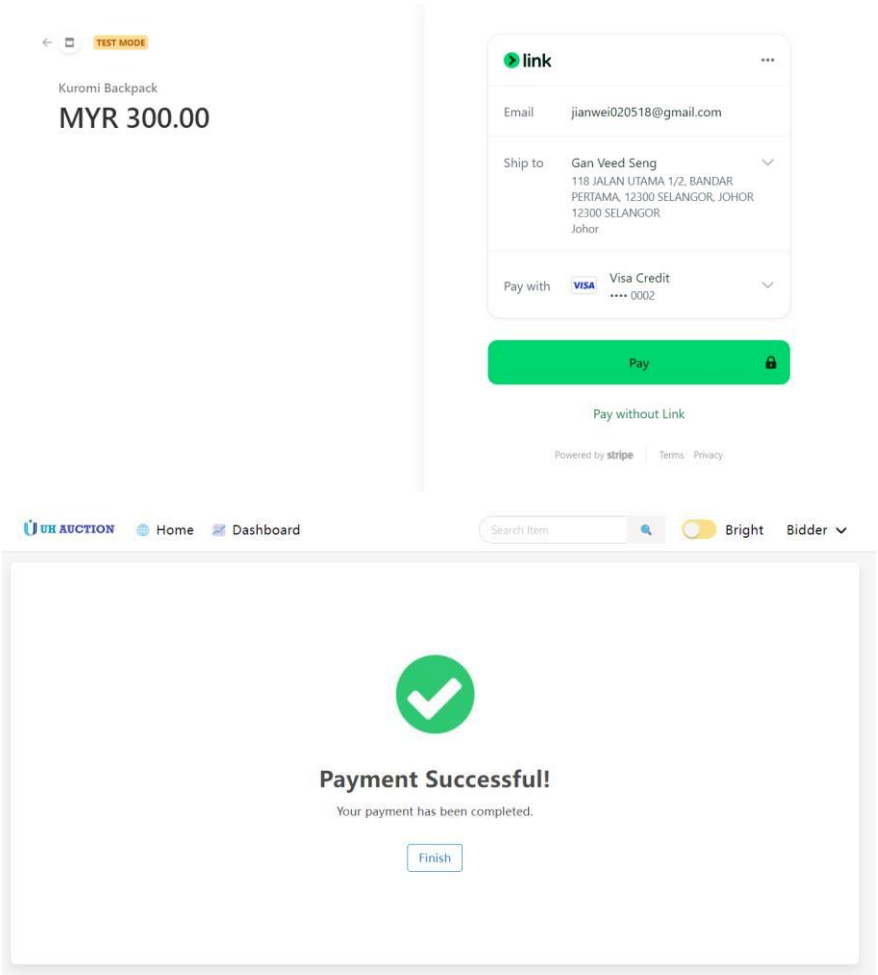
6.1.2 Integration Testing

In this section, we want to conduct a test to ensure that the interaction between different modules is working correctly. Integration testing focuses on verifying the seamless communication and data exchange among various components of the system. The primary objectives are to detect interface defects, validate the proper functionality of integrated units, and ensure that combined operations meet all the expected result. An example of interaction between the user, payment, email, and item modules will be shown.

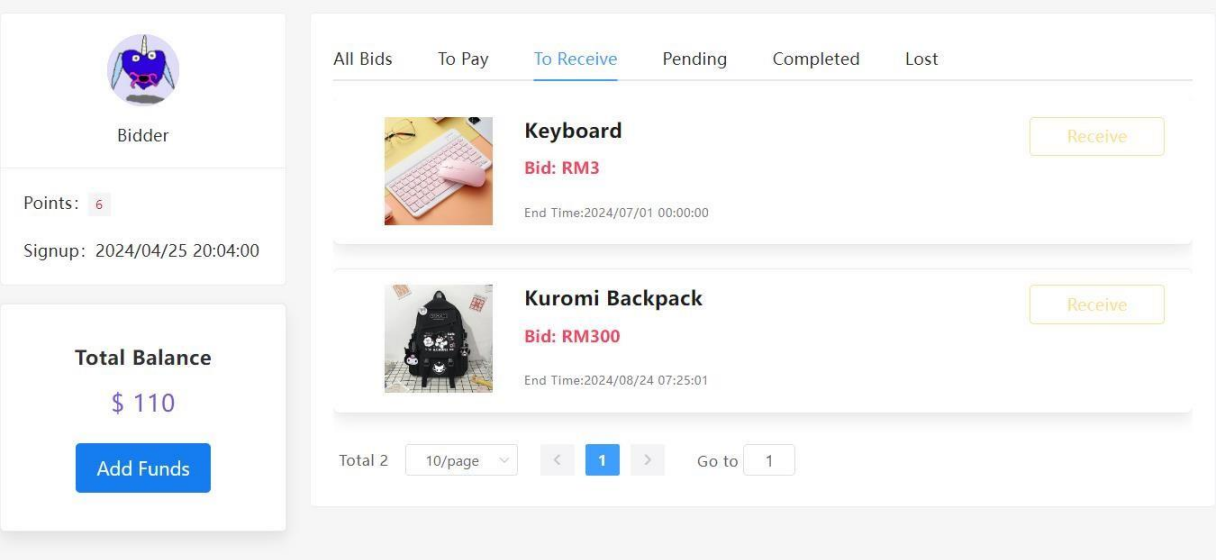
There is an item listed in the ‘To Pay’ tab pane.



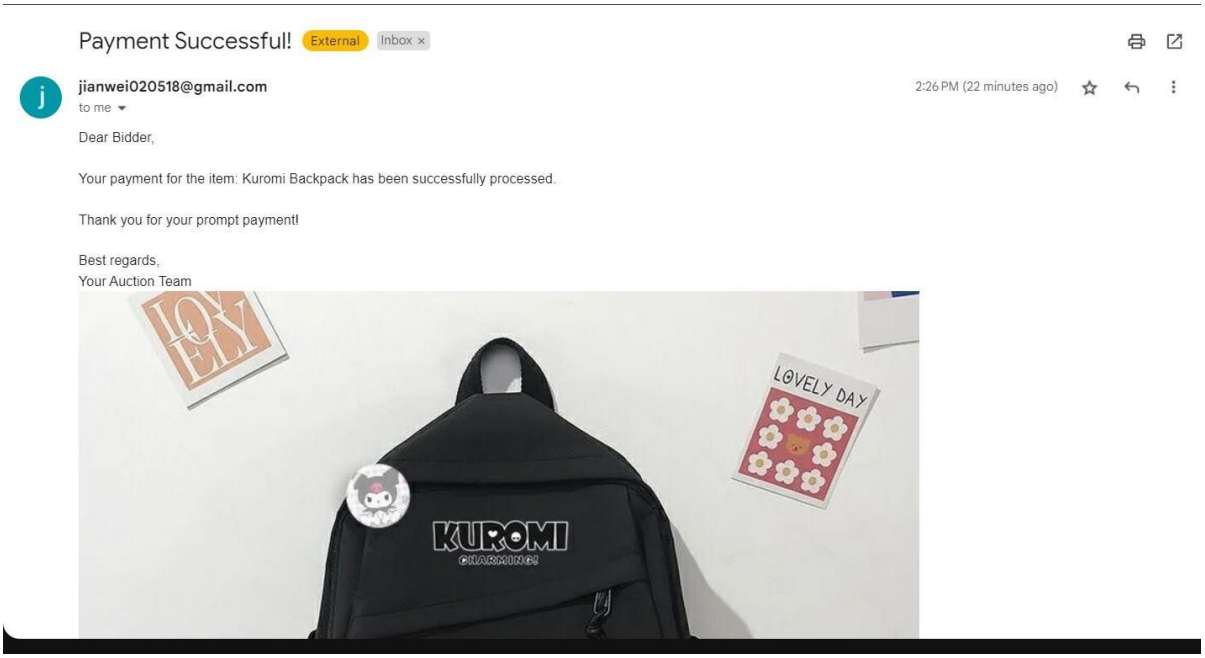
The user will be redirected to the payment page after clicking on the ‘Pay’ button.



After the payment is successfully completed, the item will be moved to the ‘To Receive’ tab pane.



The user will receive a confirmation email notifying them of the successful payment.



This process demonstrates that the user module, item module, payment module, and email module are all working correctly.

Additional test cases of integration testing are shown in the following table.

Test ID	Description	Steps	Inputs	Expected Result	Status
IT001	Test bidding process and user account integration	1. User places a bid on an item. 2. Check user account balance and item bid details.	User: `user1`, Bid: $150	Bid is recorded, and user's account balance is adjusted	PASS
IT002	Test payment processing and order confirmation	1. User makes a payment for a won auction item. 2. Check order confirmation email.	User: `user1`, Payment: $500	Payment is processed, item status is updated, and confirmation email is sent	PASS
IT003	Test item donation and listing	1. User donates an item. 2. Check if the item is listed on the website.	Item: `Painting`, Description: `Artwork`	Item is listed with the correct details on the auction site	PASS
IT004	Test user registration and login	1. Register a new user. 2. Log in with the newly registered user credentials.	Username: `newuser`, Password: `newpass`	User is registered and can log in successfully	PASS

Table 6.1.2 Integration Test Cases

6.1.3 System Testing

In system testing, various aspects were evaluated, including the auction cycle, user experience across different devices, data integrity, performance under load, and account management. To test the website's performance under a large volume of user access, a script was written to simulate one thousand users accessing the website simultaneously:

```
import requests
from concurrent.futures import ThreadPoolExecutor

def access_website(url):
response = requests.get(url)
        return response.status_code

        url = 'http://localhost:8080'
with ThreadPoolExecutor(max_workers=1000) as executor:
results = list(executor.map(access_website, [url] * 1000))
print('Number of successful response',results.count(200))
```

The results show that all requests were successfully processed.

```
C:\Users\Oct23\Desktop>Simulate_users.py
Number of successful response 1000
```

Details of all other test cases are listed in the test cases table.

Test ID	Description	Steps	Inputs	Expected Result	Status
ST001	Test end-to-end auction process	1. Register a new user. 2. List an item for auction. 3. Place a bid. 4. Win the auction. 5. Make payment and receive confirmation.	Username: `user1`, Item: `Vase`, Bid: $300, Payment: $300	All steps complete successfully, and user receives a confirmation email.	PASS
ST002	Test user experience	1. Navigate through the website on different devices (mobile, tablet, desktop).	Various devices and screen resolutions	Website is responsive and navigable on all tested devices	PASS

		2. Test responsiveness and navigation.			
ST003	Test performance under load	1. Simulate 1000 users accessing the website.	1000 concurrent user sessions	Website handles load without crashing or significant slowdown	PASS
ST004	Test data integrity	1. Place bids on multiple items. 2. Verify the accuracy of bid records and user account balances.	Multiple bid amounts and user accounts	Data is accurate, and no records are corrupted	PASS
ST005	Test user account management features	1. Log in as a user. 2. Update profile information (e.g., email, phone number). 3. Change password. 4. Log out and log back in using the new password.	Username: `user4`, new email: `updated@example.com`	The user profile is updated successfully, password is changed, and the user can log in with the new password.	PASS

Table 6.1.3 System Test Cases

6.1.4 Security Testing

In security testing, it is essential to ensure that our website is robust enough to handle cyberattacks, such as SQL injection. All sensitive data must be encrypted before being stored in the database to protect it from unauthorized access.

When a user tries to perform SQL injection, the system will prompt an error.

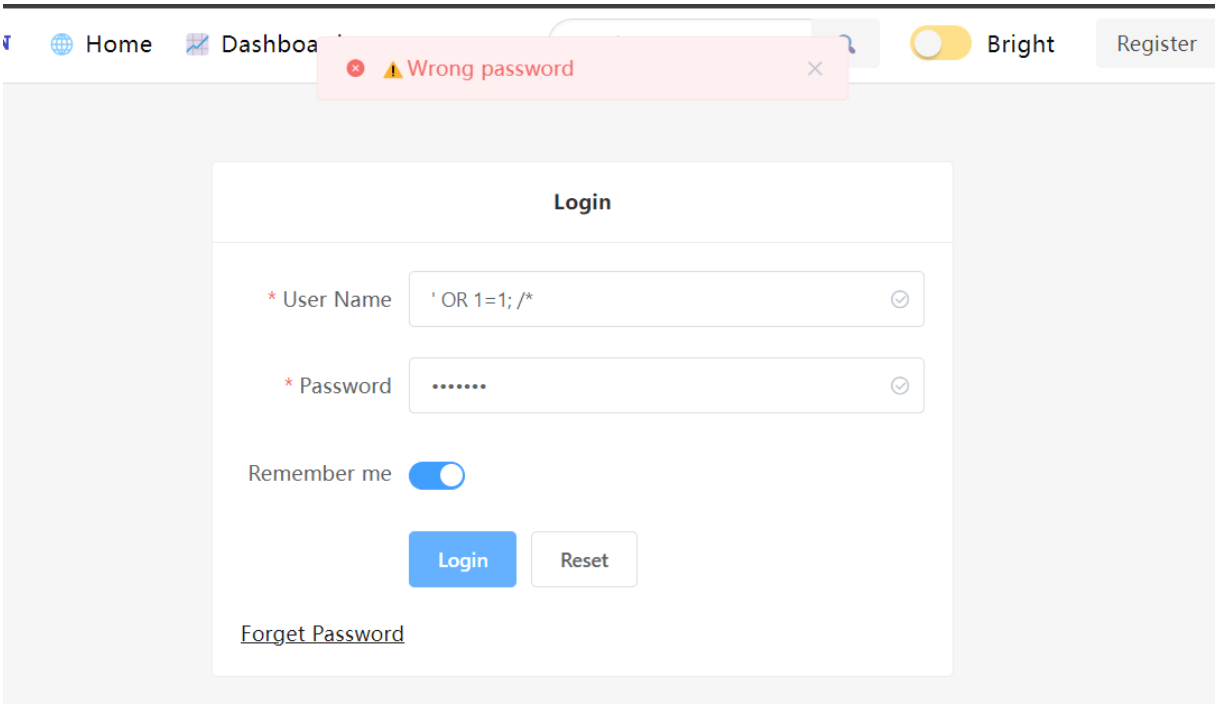


Figure 6.1.4 Attempting to perform SQL injection

This method registers a new user by first checking for duplicate usernames or emails. If no duplicates are found, it creates a new `User` object with the provided registration details, inserts it into the database, and returns the newly created user. The `password` is hashed using `MD5Utils.getPwd(dto.getPass())`.

```
@Override
public User executeRegister(RegisterDTO dto) {
    //check if there is duplicated user name
    LambdaQueryWrapper<User> wrapper = new LambdaQueryWrapper<>();
    wrapper.eq(User::getUsername, dto.getName()).or().eq(User::getEmail,
dto.getEmail());
    User user = baseMapper.selectOne(wrapper);
    if (!ObjectUtils.isEmpty(user)) {
        ApiAsserts.fail("id or email already existed!");
    }
    User addUser = User.builder()
            .username(dto.getName())
            .alias(dto.getName())
            .password(MD5Utils.getPwd(dto.getPass()))
            .email(dto.getEmail())
            .createTime(new Date())
            .status(true)
            .build();
    baseMapper.insert(addUser);

    return addUser;
}
```

All passwords are encrypted using MD5 in the database instead of being stored in plain text.

```
mysql> select alias, password from ums_user;
+----------+----------------------------------------------------------------+
| alias    | password                                                       |
+----------+----------------------------------------------------------------+
| admin    | $2a$10$8qx711TBg/2hxfL7N.sxf.0ROMhR/iuPhQx33IFqGd7PLgt5nGJTO |
| zhangsan | $2a$10$7K3yYv8sMV5Xsc2facXTcuyDo8JQ4FJHvjZ7qtWYcJdei3Q6Fvqdm |
| Brandon  | 96e79218965eb72c92a549dd5a330112                               |
| Jackson  | a906449d5769fa7361d7ecc6aa3f6d28                               |
| Justin   | 4297f44b13955235245b2497399d7a93                               |
| Jenny    | e10adc3949ba59abbe56e057f20f883e                               |
| Test5    | 96e79218965eb72c92a549dd5a330112                               |
| donor0   | e3ceb5881a0a1fdaad01296d7554868d                               |
| Bidder   | 1a100d2c0dab19c4430e7d73762b3423                               |
| aaa      | 96e79218965eb72c92a549dd5a330112                               |
+----------+----------------------------------------------------------------+
```

The details of other security tests performed are shown in the table below.

Test ID	Description	Steps	Inputs	Expected Result	Status
SEC001	Test for SQL injection vulnerability	1. Input SQL injection string in bid form.	Input: `' OR '1'='1`	Application does not allow SQL injection; appropriate error message is displayed	PASS
SEC002	Test for XSS vulnerability	1. Input XSS script in comment section.	Input: `<script>alert('XSS')</script>`	Application does not execute the script; input is sanitized	PASS
SEC003	Test authentication and authorization	1. Attempt to access admin features without proper credentials.	Unauthenticated user	Access is denied, and user is redirected to login page	PASS
SEC004	Test data encryption	1. Check data in transit using network monitoring tools.	Sensitive data (passwords, payment info)	Data is encrypted and secure during transmission	PASS

Table 6.1.4 Security Test Cases

6.2 Result interpretation

The testing of the auction website was conducted using multiple methodologies, including unit testing, integration testing, system testing, and security testing. Each testing phase focused on different aspects of the system to ensure the application's functionality, reliability, and security. Below is an interpretation of the results obtained from these tests.

Unit tests were designed to validate individual components and functions within the auction system. These tests targeted specific features, such as user registration, bid placement, item creation, and email validation. The results indicated that most of the functions worked as intended, with input being correctly handled, processed, and output generated. For example, the add_bid function successfully updated the highest bid and winner information whenever a new higher bid was placed. The successful completion of these tests assured the reliability of individual components within the application.

Integration testing focused on verifying the interactions between different modules, such as user registration, auction item listing, and bid placement. These tests aimed to ensure that when combined, different components work seamlessly together. The results were mostly positive, showing that features like user notifications, bid updates, and item approval worked correctly across different parts of the system. Additionally, tests of the checkout process confirmed that users could successfully complete purchases and receive confirmation emails. The positive outcome of these tests demonstrated that the modules interact properly, maintaining data integrity and consistency.

System testing provided a comprehensive evaluation of the entire application's workflow and end-to-end functionality. This phase tested scenarios such as the full lifecycle of an auction, from item listing to bid placement and winner notification, to ensure that the system operates as expected in real-world use. The results indicated that the system handled multiple concurrent users effectively, without performance degradation or data inconsistency. Stress tests simulating high traffic also showed that the application-maintained stability and responsiveness. These outcomes validated that the system is robust and can handle complex interactions and user activities effectively.

Security testing was conducted to identify potential vulnerabilities and ensure the protection of user data. Tests included SQL injection attempts, unauthorized access to user accounts, and encryption for sensitive data. The application successfully prevented SQL injections by using parameterized queries and escaping user input. User authentication mechanisms effectively restricted unauthorized access, and account information was adequately protected through encryption. No significant vulnerabilities were detected during this phase, confirming that the system is secure against common threats and attacks.

The comprehensive testing of the auction website demonstrated that the application is reliable, integrates different modules seamlessly, functions effectively under various scenarios, and provides robust security measures. Minor issues encountered during testing were successfully resolved, resulting in a system that is stable, secure, and ready for deployment. Regular maintenance and updates are recommended to ensure continued performance and security in the face of evolving threats and user needs. Overall, the testing process provided valuable insights and confirmed that the auction website is well-prepared to deliver a positive user experience.

CHAPTER 7 CONCLUSION

7.1 Project Review

As we reach the conclusion of this project, it is essential to review and evaluate the success of our objectives. Fortunately, all objectives have been successfully achieved. First, we introduced the donation feature that allows users to contribute not only funds but also items for auction. This feature was implemented by providing users with an intuitive form where they can submit details about their donated items, including the item name, description, images, and category. This functionality broadens donation options and enhances user engagement by enabling them to launch new auction events through their contributions.

The second objective—to create a non-competitive environment for participants—was accomplished by implementing the silent auction format. In this format, bidders have ample time to assess their financial capabilities before placing a bid, free from the pressure of seeing competing bids in real-time. This encourages thoughtful participation and reduces the risks associated with overbidding in a competitive setting.

Lastly, the third and perhaps most significant objective was to develop a comprehensive dashboard using data visualization tools. This feature provides users with transparent insights into fund utilization and other critical information. Through the dashboard, users can see how their donations are making an impact on the hospital, monitor trends in website activity, and track overall engagement. This transparency fosters trust and confidence in the platform, ensuring that donors and participants feel connected to the cause and informed about the progress being made.

Overall, the project aims to revolutionize charitable giving by integrating auction-based donations with comprehensive transparency. By leveraging technology to enhance user engagement and provide detailed insights into fund utilization, the website not only supports UTAR Hospital but also sets a new standard for online fundraising platforms. The initiative promises to make a significant impact by connecting donors with the hospital’s mission in a meaningful and transparent manner.

7.2 Contributions

This project has bridged the trust gap between charity organizations and the public by providing transparent and detailed information on fund utilization through a comprehensive dashboard. This approach has practical implications for a wide range of stakeholders, including charity organizations, donors, bidders, and the general public.

For the charity organization, this project can significantly enhance its reputation and credibility by providing transparency in how funds are collected and utilized. By publishing detailed information on the flow of donations, the organization demonstrates accountability and builds trust with the public. Additionally, the system's advanced features for tracking and analysing user activity during auction events allow the organization to manage these events more efficiently. The ability to monitor engagement, bidding behaviour, and donation patterns enables the charity to make data-driven decisions, refine its fundraising strategies, and better tailor future events to meet donor preferences. Ultimately, these insights empower the organization to optimize its efforts and maximize its fundraising potential, while maintaining a strong connection with its supporters.

For donors, the dashboard provides valuable insights that help them make informed decisions about which items to contribute to upcoming auction events. By analyzing trending item categories, donors can better understand which types of donations are most likely to generate higher bids and maximize their impact. This not only helps donors select items that will contribute to the success of future events but also allows them to feel more actively involved in the fundraising process. Furthermore, the system's transparency enables donors to track the performance of their items and view the total funds raised, offering clear evidence of the difference their contributions are making. This level of visibility not only encourages continued support but also reinforces donors' confidence in the charity's events and operations, knowing their efforts are being utilized effectively to achieve meaningful outcomes.

The bidder ranking feature on the dashboard offers bidders a sense of recognition and appreciation for their contributions, fostering a stronger connection to the charity community. By seeing their rankings, bidders gain a sense of accomplishment and identity as active participants in the charity's mission. In addition to this recognition, the dashboard keeps bidders informed about how their contributions are utilized, providing real-time transparency

into the impact of their bids. This combination of acknowledgment and transparency enhances user engagement, encouraging bidders to continue participating in future events with a greater sense of purpose and involvement. As a result, this feature not only promotes ongoing activity but also strengthens the bond between bidders and the charity, cultivating a loyal and motivated community of supporters.

Lastly, this project has the potential to inspire greater public participation in charitable activities by showcasing the success of auction events and providing a detailed breakdown of how donations are utilized. By offering transparency and highlighting the tangible outcomes of each auction, the platform increases public awareness of the charity's impact. This clear understanding of how contributions are making a difference encourages individuals who may not have previously participated to get involved, knowing their support will have a meaningful effect. As the public gains greater insight into the organization's influence and the positive results of their fundraising efforts, the likelihood of ongoing and increased engagement in future events rises. Ultimately, this heightened awareness fosters a stronger sense of community involvement and broadens the reach of the charity's mission.

7.3 Limitations

The proposed system has several limitations. First, it may not appeal to users who prefer more competitive or fast-paced auction formats, such as live or Dutch auctions. Since the system exclusively offers silent auctions, individuals who enjoy the thrill and urgency of real-time bidding might find the experience less engaging. While the silent auction model is designed to encourage rational bidding and reduce the pressures of direct competition, it can also reduce the excitement and immediacy typically associated with live auctions. This lack of dynamic interaction may lead to decreased user engagement, particularly for those who are drawn to the competitive atmosphere and quick decision-making involved in traditional auction formats.

Additionally, while the system emphasizes transparency, the disclosure of real-time data could unintentionally expose sensitive donor and financial information, raising privacy concerns. Striking a balance between openness and the need to protect personal details is essential to maintaining trust and safeguarding user confidentiality. Moreover, although frequent updates and extensive data visualizations are intended to enhance transparency, they could overwhelm contributors and users with excessive information, leading to information

fatigue. This overload of data may cause users to feel flooded, which could result in a decline in participation over time. To optimize the user experience and maintain sustained engagement, it will be critical to balance transparency with privacy concerns and simplify the presentation of data, ensuring it remains accessible and meaningful without overwhelming users.

7.4 Future work

As this project continues to evolve, several areas of future work are identified to enhance the platform's functionality, expand its reach, and improve the overall user experience. These areas of focus will ensure that the website remains effective in its mission and adapts to emerging needs and opportunities.

As mentioned in the limitations, the current system only supports silent auctions. For future work, the platform could be expanded to include additional non-competitive auction types, such as Dutch auctions. By offering a wider range of auction formats, we can appeal to a broader audience with diverse preferences, encouraging more users to participate. This added flexibility would not only enhance user engagement but also make the platform more versatile, accommodating different bidding styles and creating a more dynamic experience. However, we should avoid integrating highly competitive auction formats, such as English auctions, as these may lead users to lose rationality during bidding, a concern highlighted in previous chapters.

Another important aspect of future work is the application of machine learning algorithms to enhance personalized recommendations and predict future bidding trends. By analysing a user's past bidding history, machine learning can be used to recommend similar items in the main page item list, tailoring the auction experience to individual preferences. This personalization could potentially increase user engagement, motivating more frequent participation and, in turn, boosting the overall funds raised. Additionally, machine learning algorithms can be employed to predict future fundraising trends by analysing historical data patterns. These insights would help the charity organization anticipate donation levels, optimize auction strategies, and make data-driven decisions to improve fundraising outcomes.

Finally, to further enhance the security and transparency of the website, future research could explore the integration of advanced technologies such as blockchain and decentralized

systems. One area of focus could involve designing and implementing auction protocols using smart contracts. These self-executing contracts would automate key processes, such as bid placement and fund transfers, without the need for intermediaries, ensuring that transactions are secure, transparent, and tamper-proof. Additionally, blockchain-based identity verification and authentication mechanisms could be explored to strengthen user security. By utilizing decentralized identity systems, users' credentials can be verified without relying on a central authority, minimizing the risk of data breaches and identity theft. This integration would not only bolster the trustworthiness of the platform but also reassure participants that their personal data and transactions are fully secure.

In summary, the future work for this project presents several directions for enhancing user experience, security, and engagement. Integrating additional auction formats, applying machine learning for personalized recommendations and trend predictions, and exploring blockchain technology for secure and transparent transactions could significantly broaden the platform's appeal. By focusing on these advancements, the system can continue to evolve, attracting a larger audience, ensuring data integrity, and increasing overall participation and fundraising potential. These improvements will enable the platform continue to grow and adapt, furthering its mission to support UTAR Hospital and make a meaningful impact in the community.

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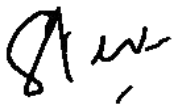
FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 1**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE FYP2 documentation from chapter 1 to chapter 3
2. WORK TO BE DONE Add a new feature of adding items to favorite list.
3. PROBLEMS ENCOUNTERED None
4. SELF EVALUATION OF THE PROGRESS Positive progress



Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 3**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE

Completing the favorite list feature

2. WORK TO BE DONE

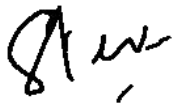
Adding a new online chatting feature

3. PROBLEMS ENCOUNTERED

None

4. SELF EVALUATION OF THE PROGRESS

Positive progress



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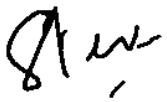
FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 5**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE Online chatting function
2. WORK TO BE DONE Adding a new feature of paying using UHAuction wallet
3. PROBLEMS ENCOUNTERED None
4. SELF EVALUATION OF THE PROGRESS Positive progress



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 7**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE

Completing online chatting function

2. WORK TO BE DONE

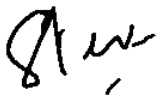
Redesign the user interface for the bid item and donated item with different categories such as “Pending”, “To Pay”, “To Receive”, “Completed”, etc.

3. PROBLEMS ENCOUNTERED

None

4. SELF EVALUATION OF THE PROGRESS

Positive Progress



Supervisor’s signature

Student’s signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 9**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE

Completing redesign user interface.

2. WORK TO BE DONE

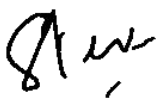
FYP2 documentation chapter 4 and chapter 5

3. PROBLEMS ENCOUNTERED

None

4. SELF EVALUATION OF THE PROGRESS

Positive progress



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 11**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE

Completing FYP2 documentation for chapter 4 and chapter 5.

2. WORK TO BE DONE

FYP2 documentation chapter 6 and chapter 7.

3. PROBLEMS ENCOUNTERED

None

4. SELF EVALUATION OF THE PROGRESS

Positive progress

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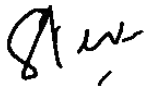
FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: Trimester 2 Year 3	**Study week no.: 13**
Student Name & ID: Tee Jian Wei 2200692	
Supervisor: Ts Dr Phan Koo Yuen	
Project Title: Online Auction Website for Charity Fundraising in Support of UTAR Hospital	

1. WORK DONE Completing FYP2 documentation for chapter 7.
2. WORK TO BE DONE Refining and checking the documentation.
3. PROBLEMS ENCOUNTERED None
4. SELF EVALUATION OF THE PROGRESS Positive progress



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POSTER


UTAR ONLINE AUCTION WEBSITE
Introduction
• Offer a novel avenue for the public to contribute to the UTAR Hospital society
• Users have the option to participate as either bidder, providing funds to UTAR Hospital, or as donors, donating items for auction
OBJECTIVES
Fundraise for UTAR Hospital
Provides a Data Visualization Dashboard for Financial Transparency
Non-competitive environment for all participants
Proposed Method / Approach
Software Development Lifecycle
Spring Boot
Vue CLI
Vuejs + SpringBoot
By Tee Jian Wei
Supervisor: Dr Phan Khoo Yuen

PLAGIARISM CHECK RESULT

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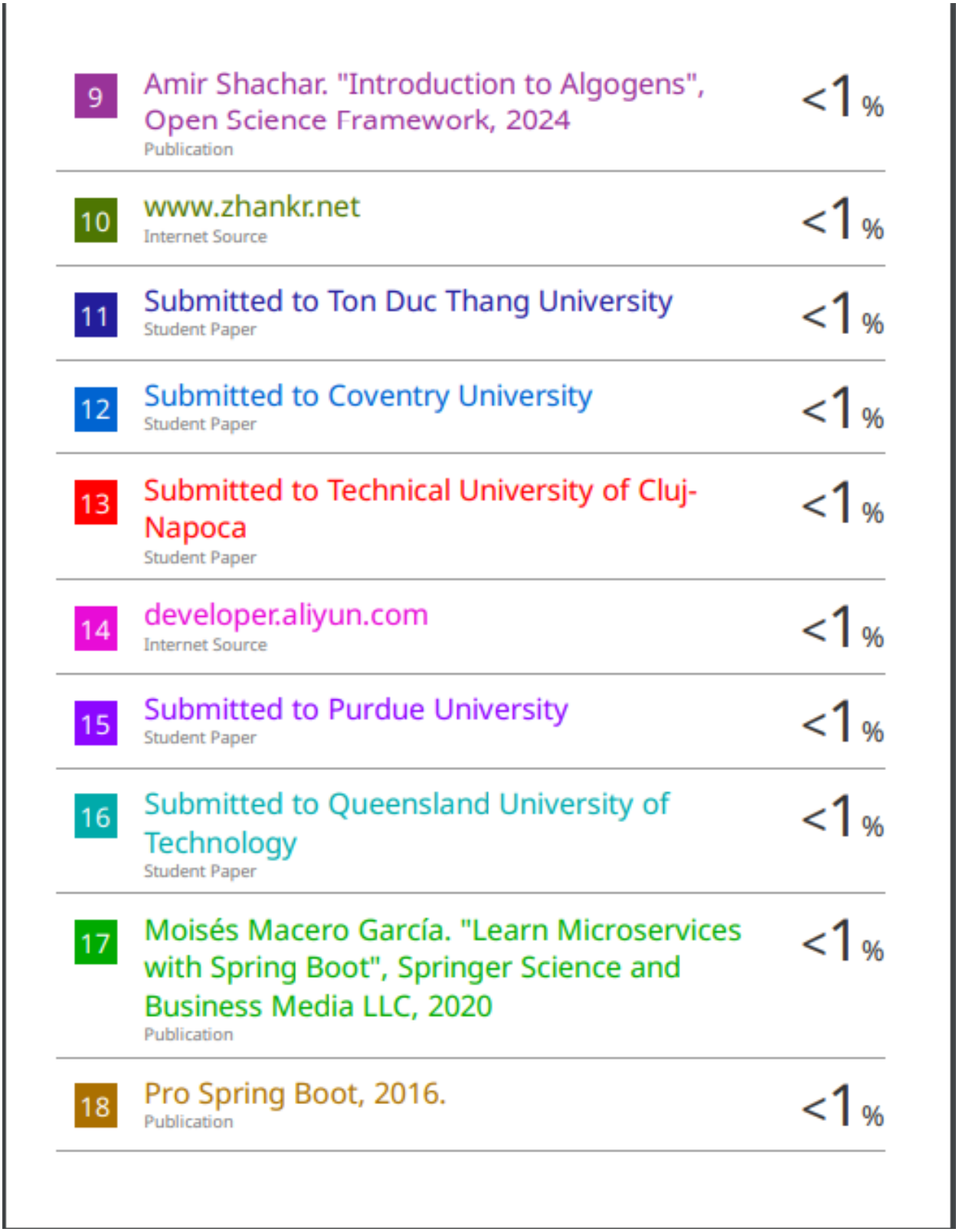

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18	Pro Spring Boot, 2016. Publication	<1 %

APPENDIX

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Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1of 1

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	TEE JIAN WEI
ID Number(s)	2200692
Programme / Course	Bachelor of Computer Science
Title of Final Year Project	Online Auction Website for Charity Fundraising In Support of UTAR Hospital

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 7 **% Similarity** **by source** Internet Sources: 5 % Publications: 3 % Student Papers: 4 %	
Number of individual sources listed of more than 3% similarity: 0	
Parameters of originality required and limits approved by UTAR are as Follows: **(i) Overall similarity index is 20% and below, and** **(ii) Matching of individual sources listed must be less than 3% each, and** **(iii) Matching texts in continuous block must not exceed 8 words** ***Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.***	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor

Name: Phan Koo Yuen

Date: 13/9/2024

Signature of Co-Supervisor

Name: _____

Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY
(KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	2200692
Student Name	TEE JIAN WEI
Supervisor Name	TS DR PHAN KOO YUEN

TICK (√)	**DOCUMENT ITEMS** Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
√	Title Page
√	Signed Report Status Declaration Form
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√	Signed form of the Declaration of Originality
√	Acknowledgement
√	Abstract
√	Table of Contents
√	List of Figures (if applicable)
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√	List of Symbols (if applicable)
√	List of Abbreviations (if applicable)
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√	Poster
√	Signed Turnitin Report (Plagiarism Check Result - Form Number: FM-IAD-005)
√	I agree 5 marks will be deducted due to incorrect format, declare wrongly the ticked of these items, and/or any dispute happening for these items in this report.

*Include this form (checklist) in the thesis (Bind together as the last page)

I, the author, have checked and confirmed all the items listed in the table are included in my report.

(Signature of Student)
Date:12 September 2024