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The Development of ASE Furniture: Mobile Based Furniture Shopping Application

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Abstract

Furniture shopping has evolved significantly with the rise in e-commerce, offering customers greater convenience and accessibility. Arif Sufian Enterprise, a furniture store located in Kuala Sungai Baru, Melaka, has been operating offline for over three years, selling items such as closets, carpets, sofas, and beds. However, the absence of an online platform limits its audience reach and customer engagement. To address these challenges, this project aims to develop an Android mobile application using Flutter that includes modules for user account creation, online purchasing, and a loyalty program to reward returning customers. The Firebase database manages product inventories and user data, ensuring real-time synchronization and scalability. Initial testing demonstrates improved customer engagement, higher satisfaction, and enhanced accessibility compared to the store's offline operations. This project successfully transitions Arif Sufian Enterprise into the digital marketplace, expanding its reach and modernizing its sales processes, thereby positioning the store competitively within the furniture e-commerce industry.

1. Introduction

Malaysians are increasingly embracing online shopping, transforming the retail landscape and encouraging businesses to adopt digital platforms. In the furniture industry, e-commerce has grown significantly, offering retailers opportunities for revenue growth and improved customer convenience [1]. However, traditional furniture shopping often leads to mismatches in dimensions or aesthetics, causing dissatisfaction and high return rates, which are costly for businesses [2]. Local furniture stores still rely on outdated manual methods for operations, making it difficult for customers to explore and purchase furniture conveniently. This traditional model is time-consuming, prone to errors, and limits customer satisfaction in a fast-paced environment where convenience is key [3].

A mobile application could revolutionize furniture shopping by providing digital catalogs, automated inventory tracking, and efficient order management. This solution would improve customer confidence, reduce return rates, streamline store operations, and give local furniture retailers a competitive edge in the growing digital marketplace [4]. Local furniture stores, like Arif Sufian Enterprise, struggle to meet the growing demand for online shopping. Customers often face difficulties visualizing furniture in their spaces, leading to uncertainty,

higher return rates, and dissatisfaction. Additionally, reliance on manual processes causes inefficiencies and poor customer experiences [5].

This project objective is to design and develop a mobile-based furniture shopping app using an object-oriented approach, to develop an online shopping app using mobile based application and to test the effectiveness of the application will be evaluated through user acceptance testing to ensure it meets customer needs and provides a seamless shopping experience [6]. This approach emphasizes modularity and scalability, ensuring the app remains adaptable to future enhancements and business requirements [7].

The remainder of the paper is organized as follows: Section 2 provides an overview of the study domain, the technologies utilized, and the outcomes of the comparative analysis. Section 3 details the selected Agile methodology, along with the findings from the analysis and design phases of the project. Section 4 presents the results and discussion, while Section 5 concludes by summarizing the current progress.

2. Related Work

This section discusses the background of the study, the technologies used, and the result of the comparative analysis between existing applications.

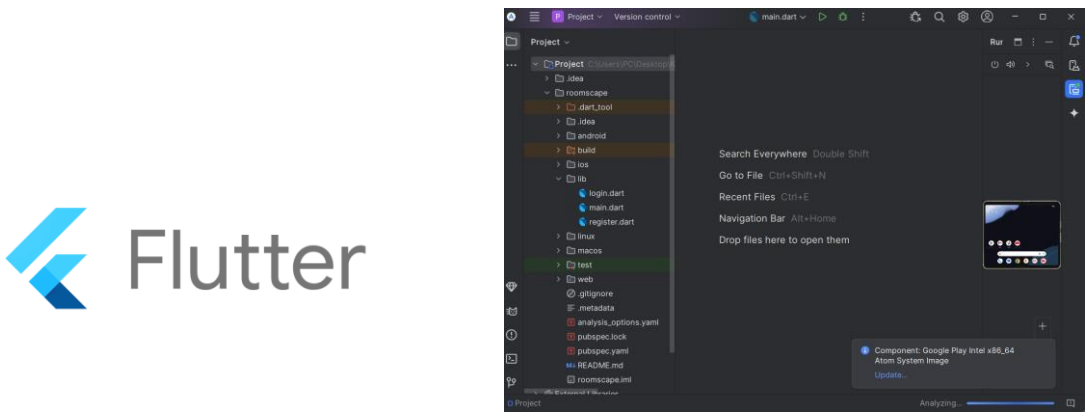
2.1 Arif Sufian Enterprise Business Process

Arif Sufian Enterprise is a traditional furniture store located in Kuala Sungai Baru, Melaka, operating solely offline. Customers visit the store, browse available furniture, and make purchases using cash or online bank transfers, as the store lacks e-commerce capabilities or digital payment options. This limits its market reach and appeals to customers who prefer online shopping [8].

To overcome these challenges, the proposed mobile application will digitize the business model. The app will allow customers to browse furniture, view prices, and place orders online, expanding the store's reach beyond its physical location. Features like a Size Recommender will provide personalized suggestions, improve customer satisfaction and foster loyalty. This transition to a digital platform will modernize the business and enhance its competitiveness in the furniture retail market.

2.2 Flutter

The furniture online shopping app will be developed using Flutter [2], Google's UI toolkit, to create visually appealing, natively compiled applications for multiple platforms from a single codebase. Flutter's rich widget library and customization options make it ideal for a feature-rich furniture shopping app. Android Studio [3], Google's official IDE, will complement Flutter by providing robust debugging tools, an emulator, and Git integration for effective development and collaboration. Together, Flutter and Android Studio will ensure a high-performance app with an engaging user interface for a seamless shopping experience. Fig. 1 show the software program used for development of ASE Furniture.



(a) **(b)**

Fig.1 The Software Program used for Development *(a) Flutter [2] ;(b) Android Studio Interface [3].*

2.3 Comparative Analysis

Comparative analyses were conducted on three related applications to the proposed system. The three applications are Public Furniture [4], Wayfair [5], and Pepperfry [6], as shown in Fig. 2(a), (b), and (c), respectively. Table 1 shows the result of comparative analysis.

The analysis was conducted based on the following key features: Product Filtering, Product Descriptions, Loyalty Program, Regional Availability, and Real-Time Stock Updates.

(a) *(b)* *(c)*

Fig.2 The user interfaces of existing app *(a)* Public Furniture app *[4]; (b)Wayfair app [5]; (c)Pepperfry [6]*

Table 1: ***Application Comparison***

System/Feature	Public Furniture	Wayfair	Pepperfry	ASE Furniture
Product Filtering	Extensive but complex	Intuitive and specific	Moderate	User-friendly & smart
Product Descriptions	Detailed but overwhelming	Comprehensive but inconsistent	Limited	Accurate & reliable
Loyalty Program	None	Strong rewards	Moderate	Tiered & inclusive
Regional Availability	Limited	Global	Limited	Broad
Real-Time Stock Updates	Limited	Moderate	Moderate	Fully integrated

Table 1 presents a comparison of features across four furniture apps which are Public Furniture, Wayfair, Pepperfry, and ASE Furniture. Among them, ASE Furniture stands out for its user-friendly and smart product filtering, accurate and reliable product descriptions, a tiered and inclusive loyalty program, broad regional availability, and fully integrated real-time stock updates. In contrast, Public Furniture offers extensive but complex filtering, detailed yet overwhelming descriptions, and limited loyalty and stock update features. Wayfair provides intuitive filtering, comprehensive but inconsistent descriptions, strong rewards, moderate stock updates, and global availability. Pepperfry is moderate across most features, with limited product descriptions and regional reach. Overall, ASE Furniture offers the most balanced and user-centric approach among the four.

3. Methodology

A methodology provides a systematic framework for planning, developing, and implementing a project effectively, ensuring it meets objectives while mitigating risks. In software development, selecting the right methodology is critical as it impacts task prioritization, development cycles, and delivery. Sommerville [9] defines software development methodologies as frameworks to structure, plan, and control the process of creating information systems.

Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 888-907

3.1 Model Prototype Phase

This project adopts the Agile Model, an iterative and incremental approach that emphasizes flexibility, collaboration, and customer feedback. Agile supports adaptive planning and continuous improvement, making it ideal for projects with evolving requirements. Fig.3 illustrates the six phases in Agile Model, and Table 2 will discuss the output of the five phases in Agile Model.

Fig.3 *Agile Model*

Table 2 *Application Development Workflow*

Phase	Activities	Outputs
Phase 1: Requirement Gathering and Analysis	• Conduct interviews with store owner and potential users • Gather insights on user preferences and expectations • Analyze functional and non-functional requirements	• Defined functional and non-functional requirements • Project scope and objectives
Phase 2: System Design	• Create storyboards for user interface visualization • Develop UML diagrams • Design class diagrams for object-oriented structure	• Architectural blueprint of the system • • Storyboard and UML diagrams
Phase 3: Implementation	• Develop app using Android Studio and Kotlin • Build user interface with Flutter • Implement key features (e.g., loyalty program, account management)	• Functional mobile app • Implemented features such as loyalty program and user account management
Phase 4: Testing	• Perform functional testing (e.g., profile management, purchasing) • Conduct usability testing • Carry out performance testing	• Test results identifying errors or defects • Usability and performance improvements
Phase 5: Deployment of System	• Test app prototype with real users in a live environment	• User feedback and adjustments based on real-world use

3.2 Functional Requirements

In this analysis phase, it is necessary to understand the functional requirements that the system must fulfill to ensure its successful development and operation. Functional requirements specify the system's expected behaviors, features, and capabilities that support business needs. They describe *what* the system should do, including data processing, user interactions, and system responses. Table 3 summarizes the key functional requirements identified for this project, providing a clear foundation for the system's design and implementation.

Table 3 *Functional Requirement*

Modules	Functionalities
Login	• This module allows users to login and registers into the System
Profile Management	• The user should be able to Manage their Account (modify name and related information)
Loyalty Points Management	• Customers should earn points for every purchase, typically based on the total amount of 10 points per RM10 spent. • Customers should be able to check their points in the Loyalty Page. • Customers can claim discounts with these points.
Furniture Management	• Displays available furniture items with options to filter, search, and view details. • The owner can manage the furniture catalog inside an inventory.
Installment Management	• Customers will be able to have installments plan as a payment method • Customer will be able to make consecutive payments for each month • Owner will be able to monitor their payments
Purchase Management	• Customers are able to manage the purchasing process. • Customers can also track their delivery status. • Owner Checkout the item for the customer.
Report Management	• Provides owners to monitor system data in real-time. • Generate a pdf file for the owner to save the report locally
Notifications Management	• Sends customers alerts and updates regarding Furniture delivery and Ordering process through email.

3.3 Non-Functional Requirements

In addition to the functional aspects, non-functional requirements define the *quality attributes* of the system, specifying how the system should perform under various conditions. These requirements address aspects such as usability, reliability, performance, security, and maintainability. They ensure that the system operates efficiently and meets user expectations in terms of speed, stability, and scalability. Table 4 outlines the non-functional requirements identified for this project, helping to guide the system's design to meet quality and performance standards.

Table 4 *Non-Functional Requirement*

Requirement	Description
Performance	• The interaction between the user and the system should not be more than 10 minutes.
Operational	• The system should be user friendly.
Security	• Only the owner can generate the report.

3.4 System Designs

The System Designs phase is a pivotal step in converting the project's requirements into a structured plan that guides the system's architecture and user interface. During this phase, we create both high-level and detailed design artifacts to visualize user experience, interactions, and system workflows.

3.4.1 Use Case Diagram

A use case diagram visually represents the interactions between users (actors) and the system, highlighting the key functionalities of the application. In the context of the furniture shopping app, the primary actors include the customer, admin, and system. The customer can browse the furniture, add items to the cart, make purchases, and participate in the loyalty program. The admin can manage product listings, process orders, and track inventory. Fig.4 shows the use case diagram between customers and owner.

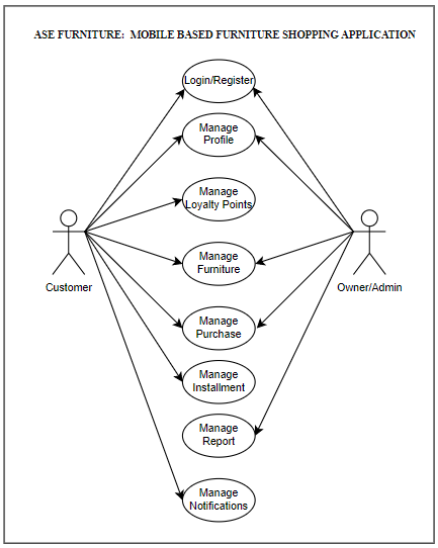


Fig.4 *Use Case Diagram of ASE Furniture*

3.4.2 System Architecture

The system architecture defines the overall structure and interaction of key system components to ensure the application functions effectively and efficiently. The architecture follows a client-server model, where both customer and owner interfaces (Android-based) interact with a centralized database. Customers and owners use their respective interfaces to register, log in, and access different modules depending on their roles. Each interface includes modules such as Profile Management, Shopping Cart, and Furniture Catalogue or customers, and Furniture Management, Order Management, and Installments Management for owners. Fig.5 shows the system architecture of ASE Furniture. For a more detailed flow of the system design, the activity diagram is provided in Appendix A for the activity diagram of the customer and Appendix B for the activity diagram of the owner.

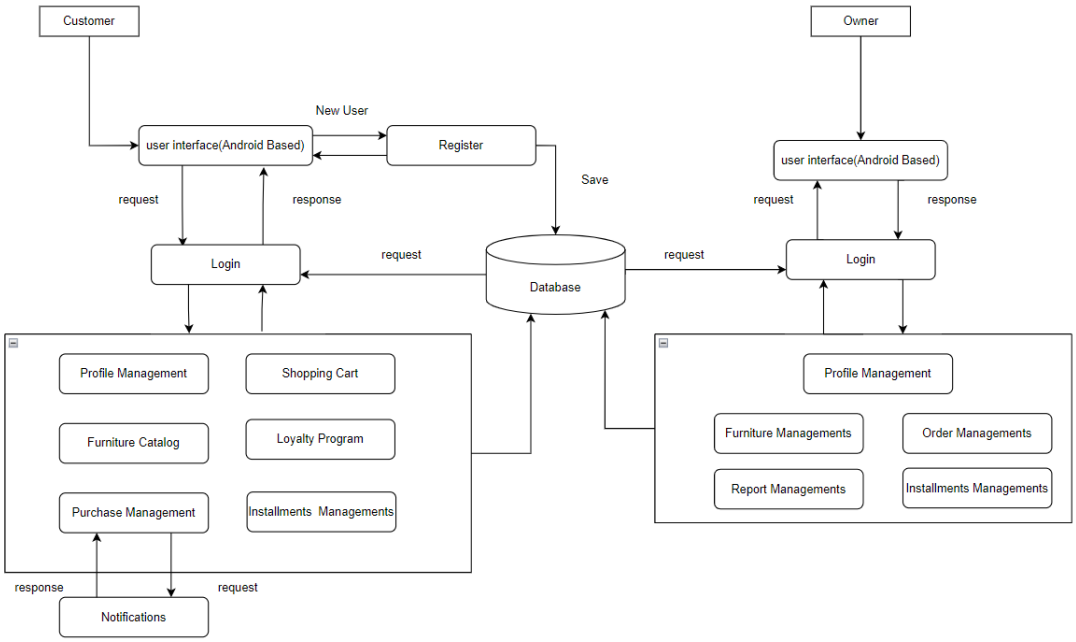


Fig.5 *System Architecture of ASE Furniture*

3.4.3 Class Diagram

The class diagram models in Appendix C show a furniture shopping system with roles for both customers and owners. Customers can register, log in, manage profiles, add furniture items to a cart, place purchases, view loyalty points, and manage installment payments. Owners can log in to manage furniture, purchases, loyalty programs, and view reports. The system supports notifications, catalog updates, and maintains detailed purchase records and installment plans, integrating core shopping, user management, and reward functionalities in a structured manner.

4. Results and Discussion

In this section the implementation and testing phase of the developed Furniture Shopping App system. The system was developed using the programming language Dart for the back-end with the support of Flutter as the framework to help build mobile applications. Android studio has also been used to help in emulating android environments for an accurate testing for the system. Firebase also has been used to perform manipulation for the database.

4.1 System Implementation

In this section, the implementation phase of the developed Furniture Shopping App system is detailed. The system was developed using Dart programming language for the back end, supported by the Flutter framework for building the mobile application. This combination enables cross-platform development and rapid deployment of the mobile application.

4.1.1 Login/Register Module

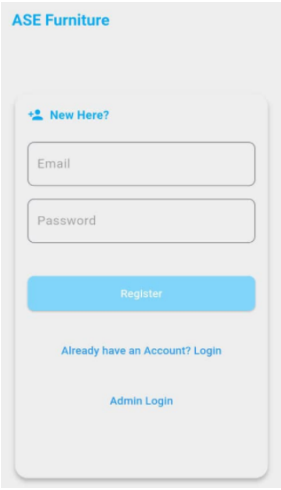
Fig. 4 (a) shows the code for implementing login for the customer and Fig 4(b) shows the code for customers that want to register into ASE Furniture. The customers would need to register a new account before they are able to continue using the system. The customers would need to enter their email and set a new password. The interface will be produced as in Fig.4(c).

```
Future<void> signInWithEmailAndPassword() async {
  try {
    await Auth().signInWithEmailAndPassword(
      email: _controllerEmail.text,
      password: _controllerPassword.text,
    );
```

(a)

```
UserCredential userCredential = await Auth()
    .createUserWithEmailAndPassword(
      email: _controllerEmail.text,
      password: _controllerPassword.text,
    );
```

(b)



(c)

Fig.5 Implementation of Login Page *(a)Code for Login Implementation;(b) Code for Register Implementation Login/Register Interface;(c) Login/Register Module Interface*

4.1.2 Profile Management Module

Fig.5 shows the Profile page for the customer who has successfully created an account and logged into the system. On this page, customers can edit their personal information such as email, phone number, username, address and reset their password. They can log out of the system using the logout button located on the top right corner of the profile page.

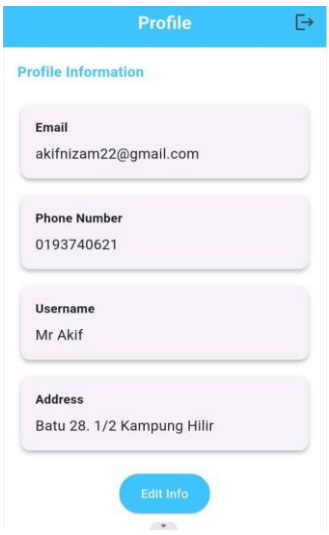
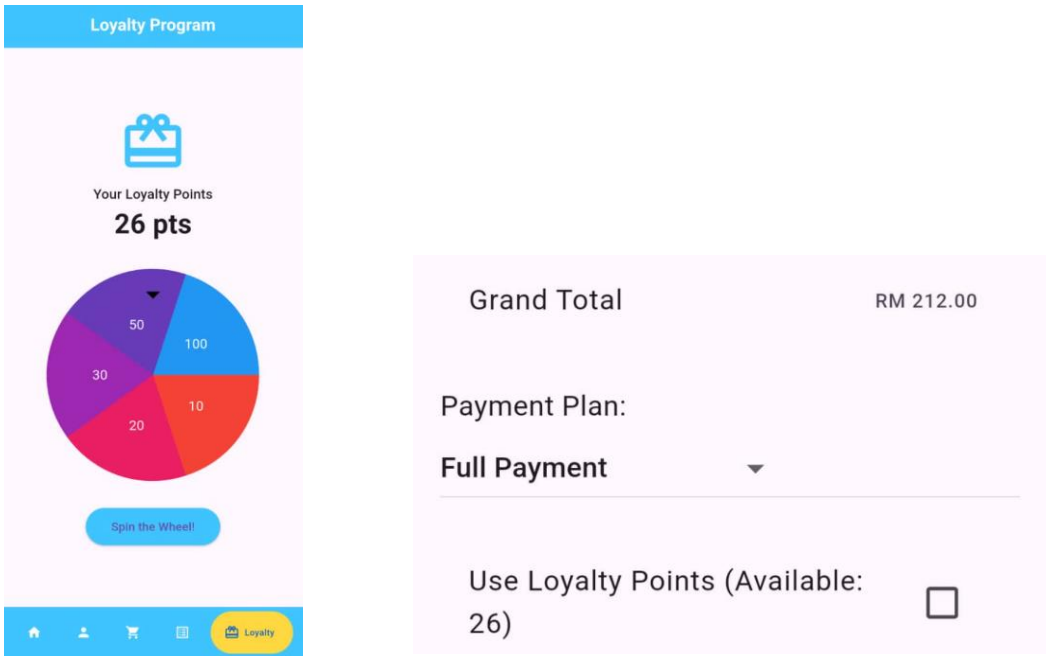


Fig.6 *Customer Profile Page*

4.1.3 Loyalty Points Management Module

Fig.6 (a) shows the loyalty points page for the customer. Every customer who makes their first purchase in the system will begin earning loyalty points at the rate of 1 point for every RM10 spent. Fig.6 (b) demonstrates how the points accumulated will be able to claim as a discount for their purchase, the discount will not proceed more than 10% of the item's total price. Additionally, customers can earn extra loyalty points weekly by playing game "Spin the Wheel!".

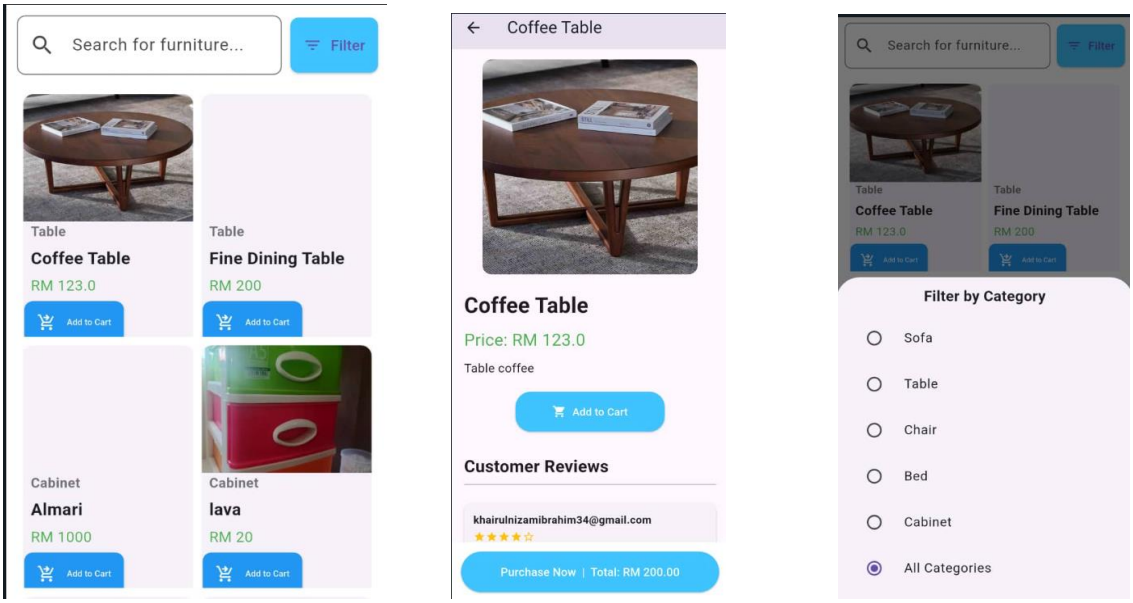


(a) *(b)*

Fig.6 Customer Loyalty Page*(a)Customer Loyalty Points Page; (b)Customer can Claim loyalty points in Checkout*

4.1.4 Furniture Management Module

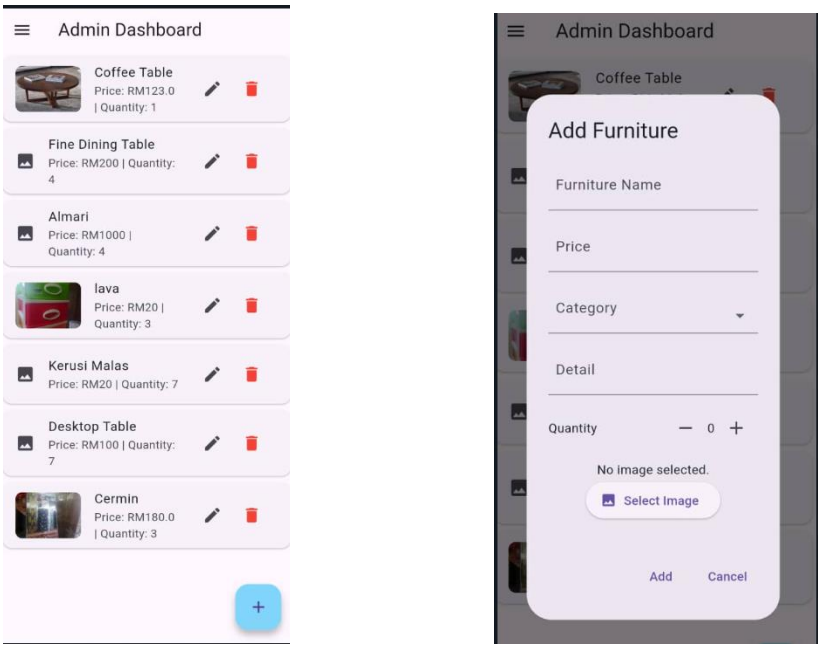
Fig.7 (a), (b) and (c) show the homepage of the system, where the furniture catalog is displayed. Customers can search for or filter the furniture based on categories such as Sofa, Bed, Table, Chair or Cabinet. They can click on any furniture item to view its details, add it to their cart and proceed with the purchase. Additionally, customers can view ratings and comments from previous customers.



(a) *(b)* *(c)*

Fig.7 Furniture Page*(a)Furniture Homepage ;(b) Item Detail page; (c)Filter Furniture by Category*

For the admin interface shown in Fig.8 (a), (b) , administrators can monitor currently available items for sale. They are able to add new furniture by specifying their name, price, category, details, quantity and selecting an image to display. Additionally, admins can edit the item and delete existing items.

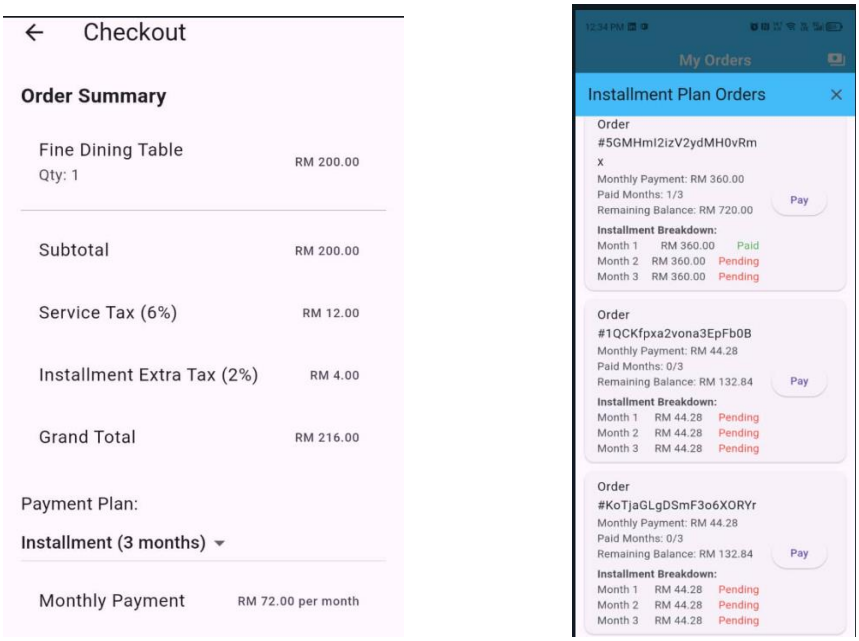


(a) *(b)*

Fig.8 Admin Furniture Page*(a)Furniture Management in Admin Dashboard ;(b) Admin Add New Item*

4.1.5 Installment Management Module

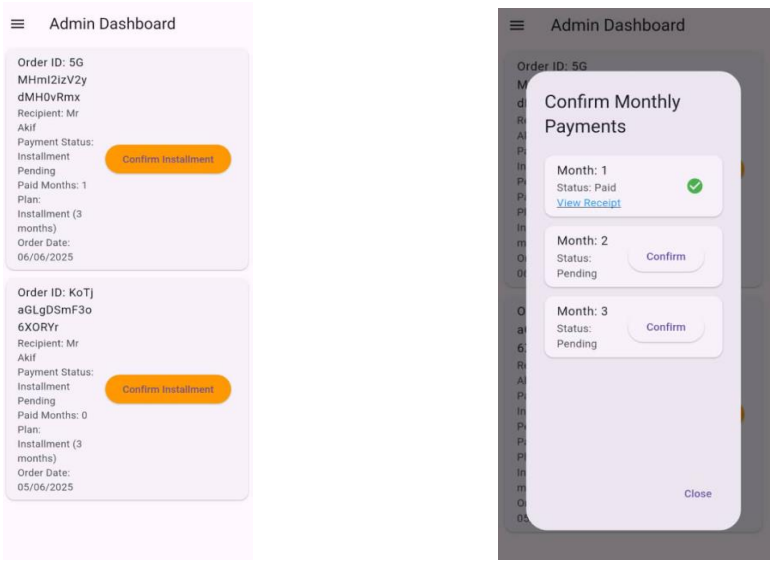
Fig.9 (a) and (b) shows the interfaces for customers who wish to make a purchase through an installment plan. When selecting this plan, the system will automatically calculate the monthly payment amount. Customers can view their installment purchases by going to the Orders page and clicking the icon in the top right corner. To complete their payment plan, they need to make monthly payments one after another and upload their receipts each time they pay.



(a) *(b)*

Fig.9 Customer Installment Process*(a)Customer choose Installment as Payment Plan; (b)Customer check Installments order and make Payment*

In Fig.10 (a) and (b), admin is required to confirm installment payments through Installments Management Tab. Each customer who makes an installment payment will appear in these tabs. Admin are able to confirm their payment based on the receipt uploaded by the customer.

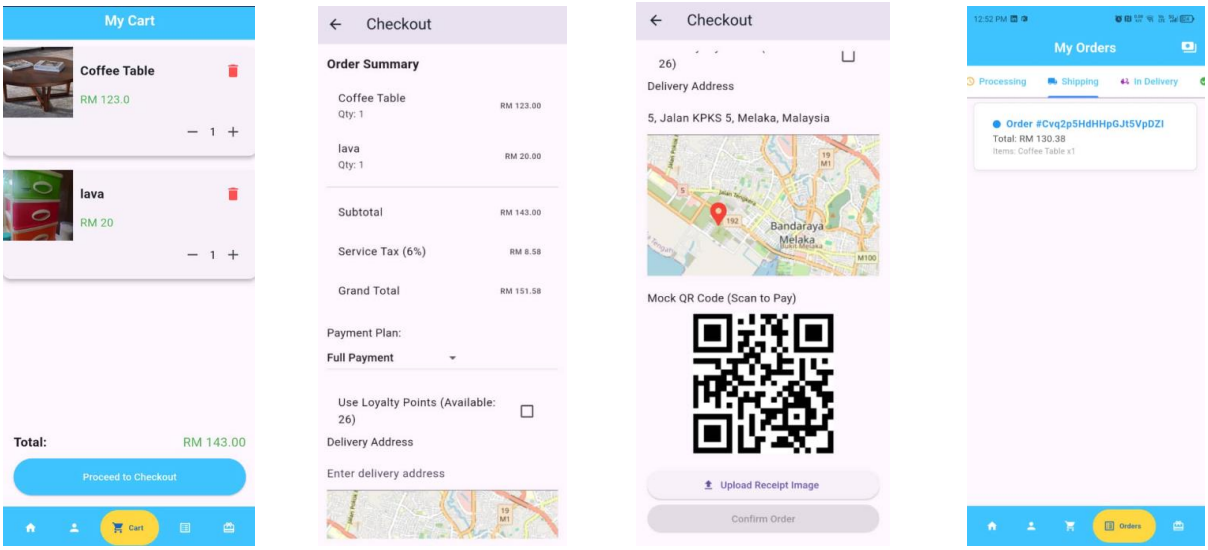


(a) *(b)*

Fig.10 Installment Page of Admin *(a)Installments Orders (b)Admin check to Confirm Payments*

4.1.6 Purchase Management Module

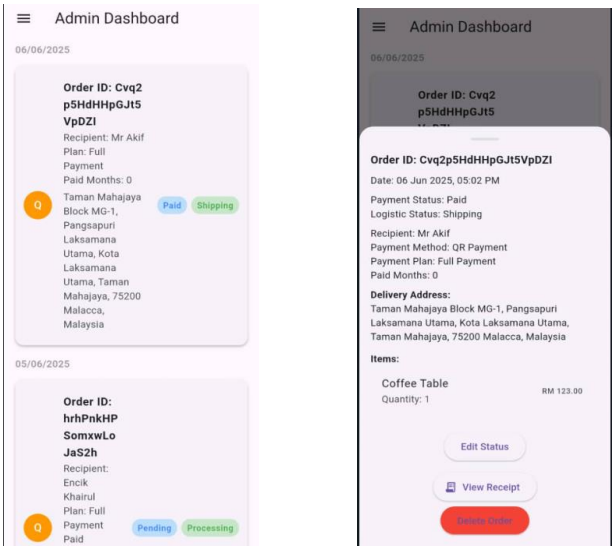
Fig.11 (a) shows the process when customers have added an item to the cart, they can increase the quantity (not more than the stock or lower than 0) or remove the item. The system wil automatically calculate the total price of all items in the cart. When they want to confirm their payment, they can proceed to check out. In Fig.11 (b), the checkout page summarizes the selected items and calculates the total price including tax. Customers can choose the payment plan or apply a discount by redeeming loyalty points. Fig 11 (c) shows that customers are required to enter a delivery address or select a location on the map, which will automatically generate the address. Then, they must proceed with the payment by scanning a QR code. The order will be confirmed once the customer uploads a receipt as proof of payment. Fig 11 (d) shows that the orders will appear in the Orders tab and customers need to wait for updates from the admin.



(a) *(b)* *(c)* *(d)*

Fig.11 Customer Purchase Process *(a)Item in the Cart; (b)Checkout Page; (c)Customer set Address and Make Payment; (d)Orders Page.*

Fig.12 (a) and (b) show the admin side of the orders, which are managed through the Order Management Tab. Here Admin is able to edit the payment status of the customer, set the delivery status, view uploaded receipt and delete orders. Since Arif Sufian Enterprise handles their delivery by themselves (via Personal Van or Truck), they will update the item delivery status.

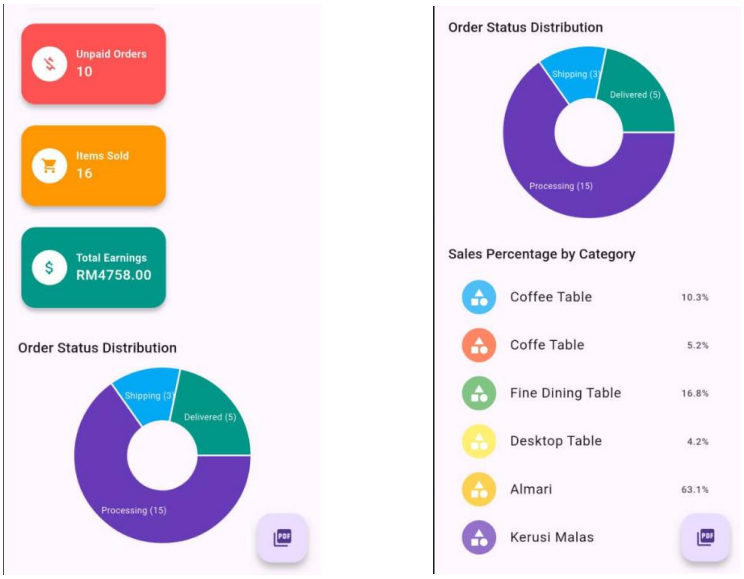


(a) *(b)*

Fig.12 Admin Order Management *(a)Order Management Tabs; (b)Order Status and View Receipt.*

4.1.7 Report Management

Fig. 13 (a) and (b) show the admin dashboard, which displays important data such as total orders, paid orders, items sold, total earnings, sales percentage by category, and an order distribution pie chart. The admin can export this data to PDF for personal documentation.



(a) *(b)*

Fig.13 Report Page *(a)Collected Data; (b)Order status with sales percentage by Category.*

4.1.8 Notification Management

Fig. 14 shows the email notification sent after the admin updates the customer delivery status. Emails were sent using **EmailJS**, a service that allows developers to send emails directly from client-side JavaScript without requiring a separate backend server. This integration helps streamline the process of sending delivery status updates by automatically generating and sending emails to customers whenever their delivery status is updated in the system.

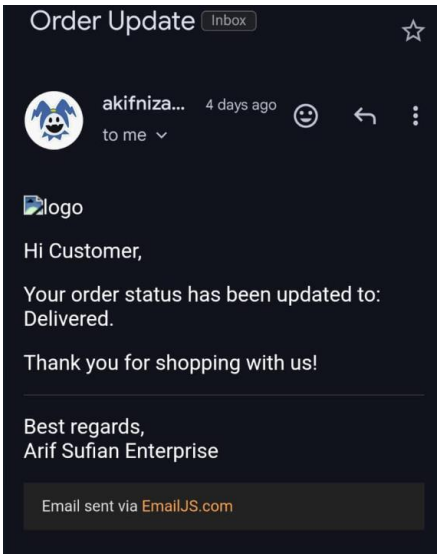


Fig.14 *Customer receive Notifications*

4.2 System Testing (User Acceptance Test)

A user acceptance test has been carried out to ensure that the final system meets the users' expectations. The developed system was tested by twenty respondents who are the key stakeholders (customers), ensuring that the feedback gathered was relevant and actionable. Fig. 15, Fig 16 and Fig 17 present the results of the UAT forms distributed to the respondents. There are three questions which were divided into user experience testing, feature availability testing and UI satisfaction testing. The respondents involves Students of UTHM as the customer.

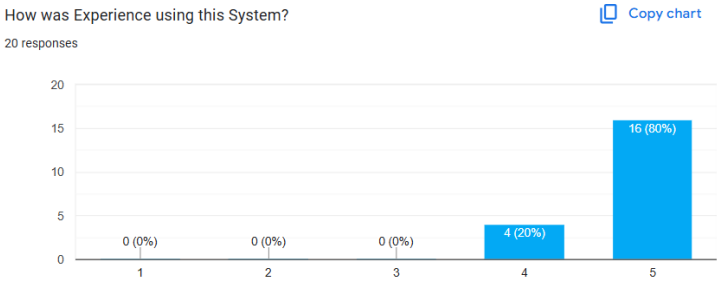


Fig.15 *User Experience Testing*

Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 888-907

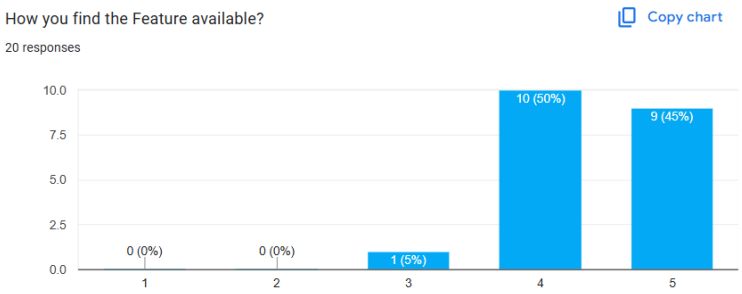


Fig.16 *Feature Availability Testing*

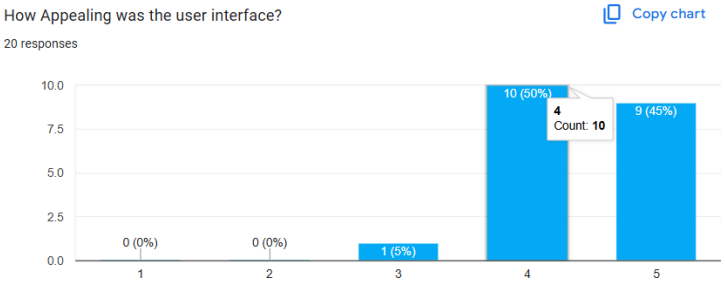


Fig.15 *UI Satisfaction Testing*

The user testing for the online furniture shopping system revealed overwhelmingly positive feedback: 80% of respondents rated their experience using the system as excellent (5), with the remaining 20% rating it as good (4). Similarly, when evaluating the user interface's appeal, 60% of users rated it as very appealing (4), and 45% rated it as extremely appealing (5), with only 5% giving it a moderate score (3). Regarding the availability of features, 60% of users rated them as very good (4), and 45% rated them as excellent (5), again with just 5% giving it a moderate rating (3). Overall, the results suggest that users found the system intuitive, appealing, and well-featured, with no respondents rating it poorly in any category. The functionality testing conducted in Appendix D with the stakeholder, Mr. Jangir Ali from Arif & Sufian Enterprise, confirmed that all modules, including login, loyalty points, furniture management, installment management, and purchase management, passed the acceptance criteria. This successful outcome demonstrates that the ASE Furniture app meets the required functionality and is ready for deployment.

5. Conclusion

In conclusion, the ASE Furniture mobile application successfully achieved its objectives by providing a secure and user-friendly platform that resolves the challenges faced by Arif Sufian Enterprise's manual and offline selling process, such as limited payment options, lack of online presence, and inventory management issues. The system's advantages include streamlined operations, enhanced customer experience through features like a loyalty program and user-friendly catalog browsing, and secure payment processes. However, some disadvantages include limited installment payment flexibility (currently restricted to three months) and compatibility issues with iOS devices and web platforms. To address these, future recommendations include extending installment options to cater to a broader range of customer financial needs, enabling iOS and web platform support for wider accessibility, and allowing multiple images per furniture item to improve product visualization. Overall, ASE Furniture is poised to remain a leading solution in digital furniture retail by continuously adapting to customer needs while ensuring secure, efficient, and satisfying shopping experiences.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Akif Khairul Nizam, Dr. Nurezayana Zainal; data collection: Akif Khairul Nizam; analysis and interpretation of results: Akif Khairul Nizam, Dr. Nurezayana Zainal; draft manuscript preparation: Akif Khairul Nizam, Dr. Nurezayana Zainal. All authors reviewed the results and approved the final version of the manuscript.

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Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 888-907

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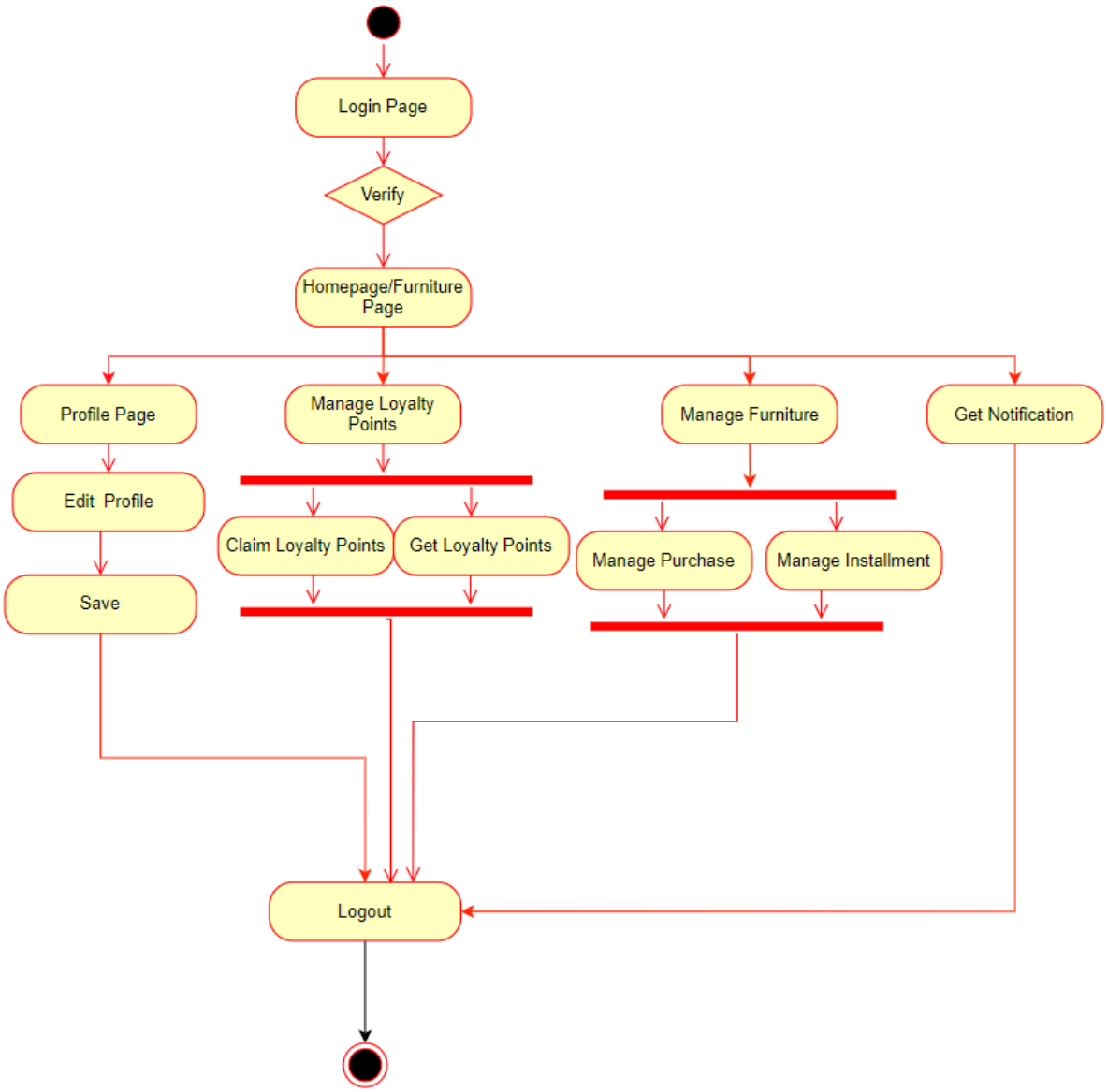
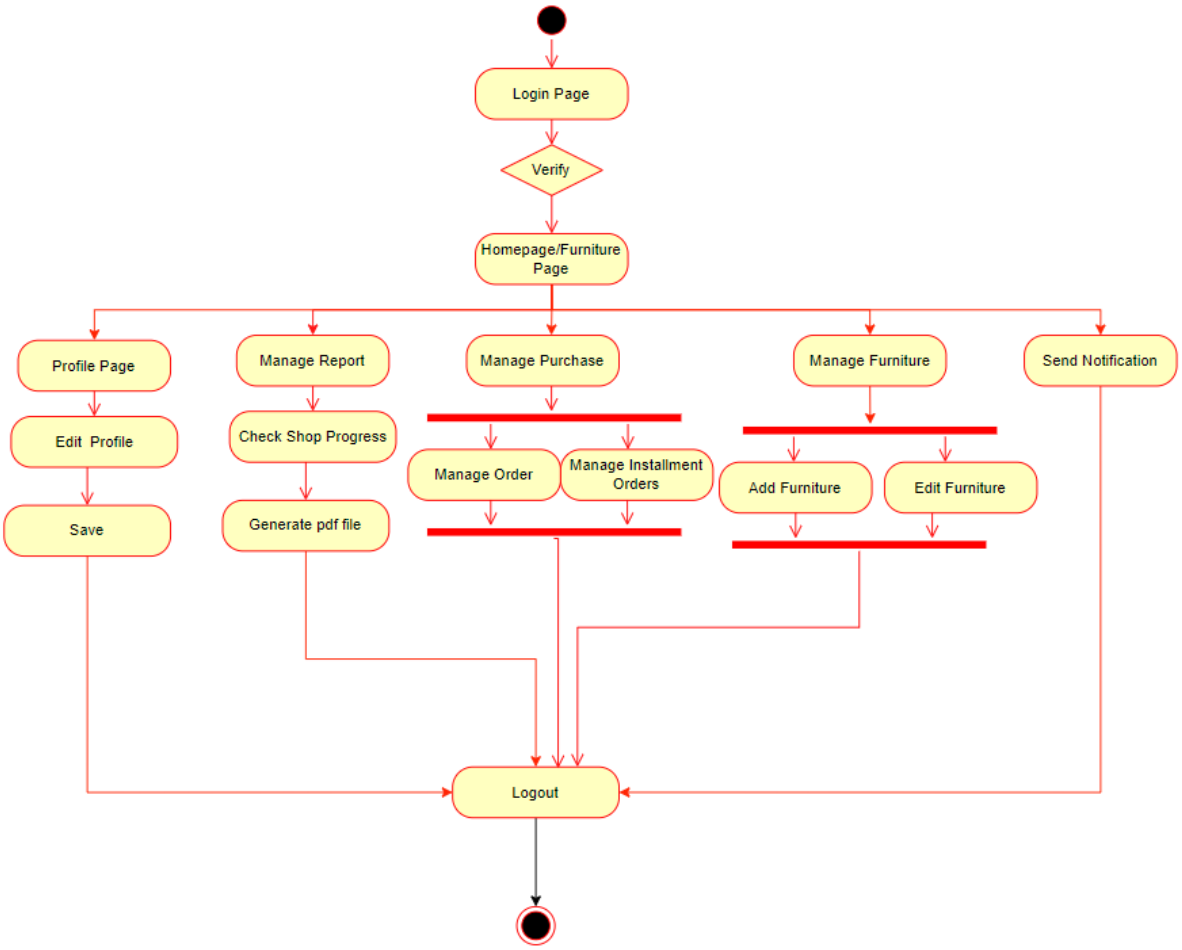
Appendix A: Activity Diagram of Customer

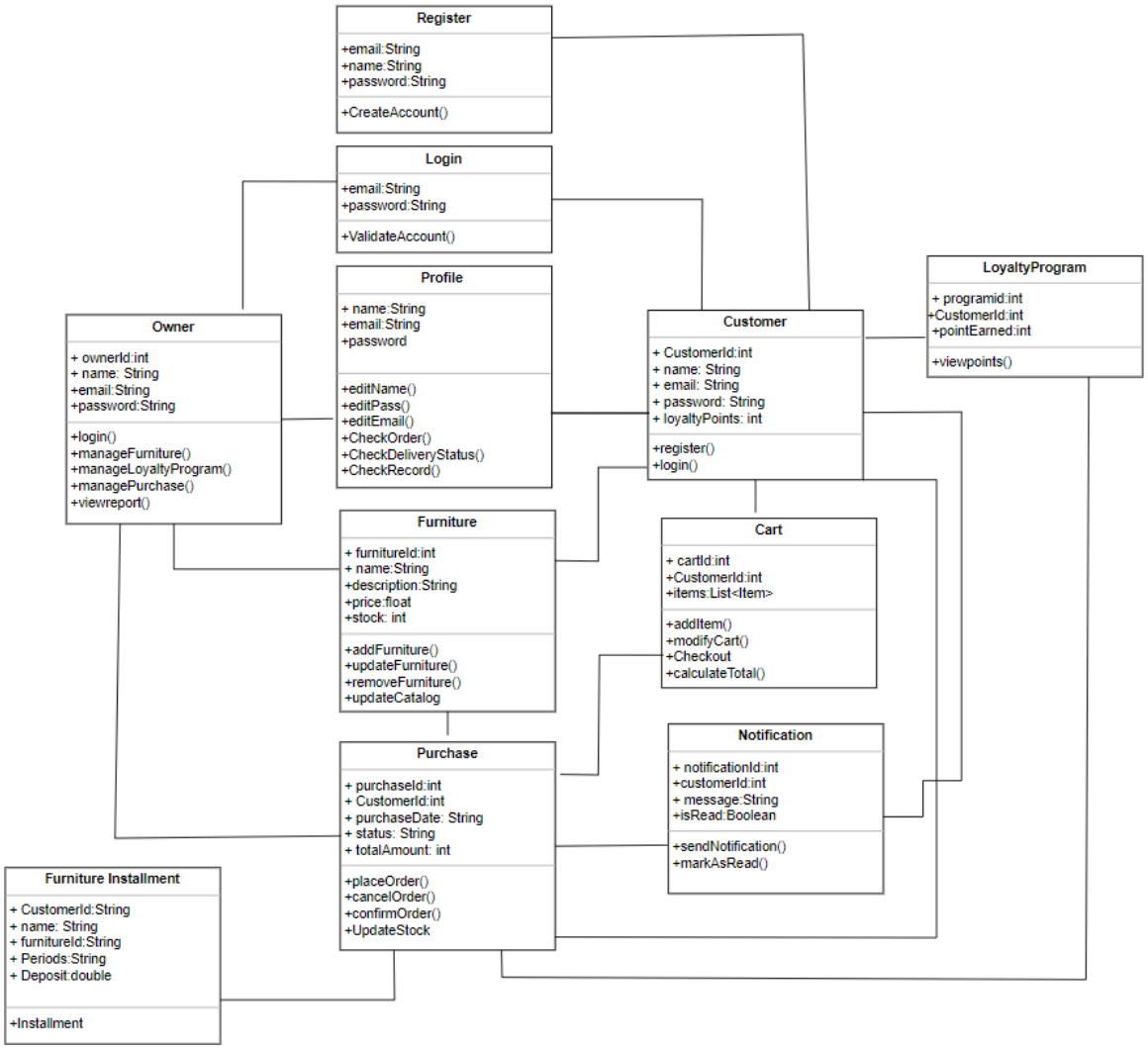


Applied Information Technology and Computer Science Vol. 6 No. 2 (2025) p. 888-907

Appendix B: Activity Diagram of Owner/Admin



Appendix C: Class Diagram for ASE Furniture



Appendix D: UAT Form (Functionality Testing)

USER ACCEPTANCE TESTING (UAT)

ASE FURNITURE : MOBILE BASED FURNITURE SHOPPING APP

Name: Jangir Ali

Date: 6/6/2025

Phone Number:

Company: Arif & Sufian Enterprise

No.	Module/Acceptance Criteria	Test Result		Remarks (If any)
		Pass	Fail	
1	**Login/Register**			
	There is a login/register page in the system	✓		
	Able to register a new user account	✓		
	Able to login with valid credentials	✓		
	System shows an error message if login fails	✓		
	Able to navigate to homepage after login	✓		
2	**Profile Management**			
	There is a user profile page in the system	✓		
	Able to view personal details	✓		
	Able to update personal details	✓		
3	**Loyalty Points Management**			
	There is a loyalty points page in the system	✓		
	Able to view loyalty points balance	✓		
	Able to redeem loyalty points	✓		
	Points update after transactions	✓		
4	**Furniture Management**			
	There is a furniture management page in the system	✓		
	Able to add new furniture items	✓		
	Able to edit furniture details	✓		
	Able to delete furniture items	✓		
	Able to search and filter furniture	✓		
5	**Installment Management**			
	There is an installment management page in the system	✓		
	Able to view installment schedule	✓		
	Able to mark installment as paid	✓		
6	**Purchase Management**			
	There is a purchase management page in the system	✓		
	Able to create new purchase order	✓		
	Able to view purchase history	✓		
	Able to cancel purchase order	✓		
7	**Report Management**			
	There is a report management page in the system	✓		
	Able to generate reports	✓		
	Able to export reports	✓		
8	**Manage Notification**			
	Notification are able to be generate t	✓		
	Able to view notifications	✓		
	Able to mark notifications as read	✓		
	Able to delete notifications	✓		

I am Jangir Ali hereby declare that the information provided is true and correct.

Agreed by:

Name: Jangir Ali

Position: Worker

Date: 6/6/2025

Witnessed by:

Name: AKIF BIN KHAIRUL NIZAM

Position: Developer

Date: 6/6/2025