UKM SECOND-HAND MARKETPLACE (UKMTHRIFT): A SECURE WEB-BASED PLATFORM FOR SUSTAINABLE TRADING WITHIN THE UKM COMMUNITY

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Abstract

Pasar Barangan Terpakai UKM (UKMThrift) telah dibangunkan sebagai laman web rasmi dan selamat yang menghubungkan pelajar, staf dan pengurusan UKM untuk urusan jual beli barangan terpakai. Platform ini mengatasi masalah perdagangan tidak teratur melalui media sosial dengan menyediakan pengesahan ID UKM yang sah, sistem pesanan langsung, dan kategorisasi produk yang teratur. Dibangunkan menggunakan HTML, JavaScript, CSS, PHP, dan MySQL dengan metodologi Waterfall, platform ini telah menunjukkan keberkesanan dengan kadar kejayaan ujian 96.47% dan tiada kecacatan kritikal. Sistem ini menyokong matlamat kelestarian UKM dengan menggalakkan penggunaan semula barangan dan mengurangkan pembaziran.

Abstract

The UKM Second-Hand Marketplace (UKMThrift) has been developed as a secure web-based platform connecting UKM students, staff, and management for second-hand goods trading. This platform addresses the chaotic trading issues through social media by providing valid UKM ID verification, direct messaging systems, and organized product categorization. Developed using HTML, JavaScript, CSS, PHP, and MySQL with Waterfall methodology, the platform demonstrated effectiveness with a 96.47% test success rate and no critical defects. The system supports UKM's sustainability goals by promoting goods reuse and reducing waste.

Keywords: Second-hand marketplace, Sustainability, UKM community, Web development, E-commerce

1.0 INTRODUCTION

1.1 Background

Currently, there is no organized, secure marketplace within the UKM neighborhoods to facilitate second-hand goods trading, resulting in chaotic, risky, and disorganized transactions. Students and staff exchanges typically occur through social media platforms and messaging applications lacking essential features such as identity verification, transaction tracking, and proper product classification.

The informal trading system creates several challenges:

1. Risk of fraud due to lack of user verification
2. Communication barriers without secure channels
3. Resource wastage due to inefficient item sharing
4. Lack of transaction documentation
5. Difficulty in establishing trust between parties

1.2 Problem Statement

Students and staff of Universiti Kebangsaan Malaysia (UKM) frequently buy, sell, or dispose of second-hand items such as books, electronics, furniture, and clothing through informal methods consisting of social media groups or messaging apps. These channels, while convenient, come with serious downsides including no identity verification, ineffective communication, and no proper transaction documentation.

1.3 Objectives

The UKMThrift platform aims to:

1. Develop a secure platform specifically for the UKM community (students and staff)
2. Achieve at least 100 registered users at launch with 50% completing transactions
3. Facilitate 70 exchanges/donations in the first year
4. Maintain 20 daily active users with five transactions daily average
5. Obtain feedback from 60% of users to build trust and improve the platform

1.4 Scope and Constraints

In Scope:

1. User registration and login system using UKM matriculation numbers
2. Item listing and categorization functionality

3. Search and filter options
4. Messaging system for buyer-seller communication
5. Transaction features for buying, selling, and donating
6. Wishlist functionality

Out of Scope:

1. Payment integration (transactions handled independently)
2. Logistics and shipping arrangements
3. Mobile app development (web-based solution only)
4. Advanced data analytics and business intelligence

2.0 LITERATURE REVIEW

2.1 Existing Online Marketplaces Analysis

A comprehensive analysis of existing second-hand platforms revealed both strengths and weaknesses in current market solutions:

Table 2.1: Comparison of Online Marketplaces

Platform	Strengths	Weaknesses	Security Level
Carousell	User-friendly mobile interface, wide product range, in-app communication	High fraud risk, limited verification	Medium
Mudah	Popular in Malaysia, large listings, free posting	High fraud risk, less effective moderation	Low
eBay	Global reach, buyer protection, feedback system	Transaction fees, not community-specific	High
Facebook Marketplace	Social integration, local transactions, free listing	No payment protection, fraud potential	Medium
Craigslist	Simple interface, free listings, wide reach	Very high fraud risk, minimal security	Low

2.2 Research Gaps

The analysis revealed that existing platforms lack:

1. Community-specific verification systems
2. Integration with institutional frameworks
3. Sustainability-focused features
4. Educational environment optimization

3.0 METHODOLOGY

3.1 Development Approach

The project adopted the Waterfall development methodology, chosen for its structured approach and clear phase definitions:

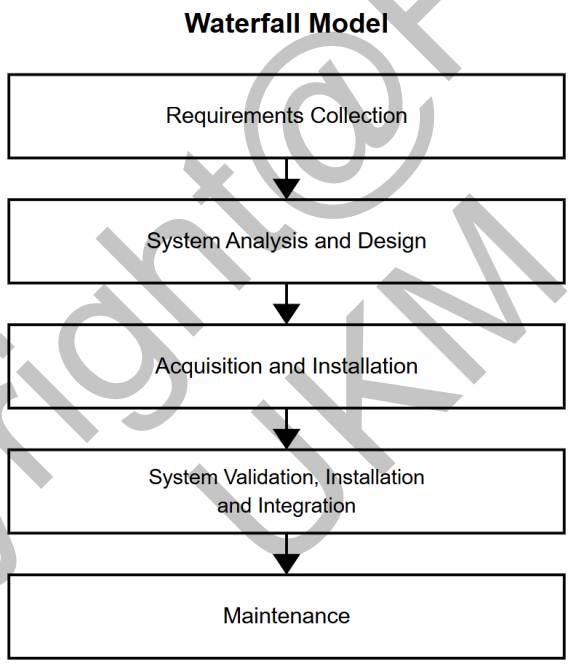

Image 3.1 Waterfall model diagram

Table 3.1: Project Implementation Schedule

Phase	Task	Start Date	Duration (days)	Finish Date
1	Requirements Analysis	11/11/2024	6	17/11/2024
2	Literature Review	20/11/2024	10	30/11/2024
3	System Design	5/12/2024	10	15/12/2024

Phase	Task	Start Date	Duration (days)	Finish Date
4	Implementation	15/12/2024	19	3/01/2025
5	Testing	20/2/2025	15	25/02/2025
6	Final Report	1/1/2025	30	31/1/2025

3.2 System Requirements

Table 3.2: Hardware and Software Requirements

Component	Specification
Development Hardware	
Brand	Lenovo
Processor	AMD Ryzen7 5800H
Operating System	Windows 11
Memory	16GB RAM
Storage	512GB SSD
Software Requirements	
Frontend	HTML5, CSS3, JavaScript
Backend	PHP 8.0
Database	MySQL 8.0
Development Tools	Sublime Text, phpMyAdmin
Design Tools	Canva, Figma

3.3 System Architecture

The platform follows the Model-View-Controller (MVC) architectural pattern:

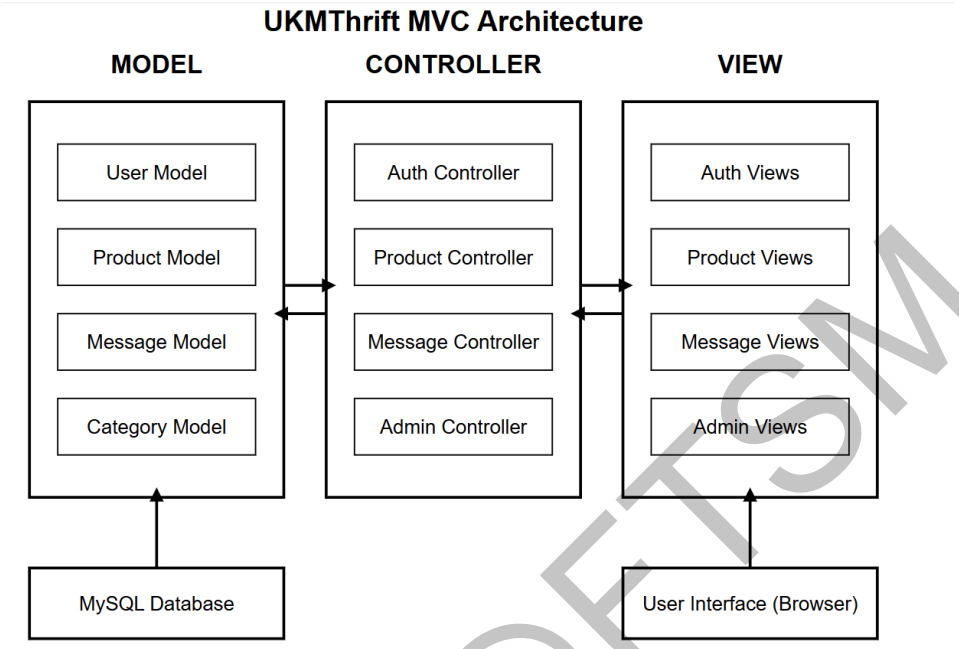

Image 3.2 MVC architecture diagram

Key Components:

1. **Model:** Database interactions and business logic
2. **View:** User interface and presentation layer
3. **Controller:** Request handling and application flow control

3.4 Database Design

The database structure consists of nine interconnected tables:

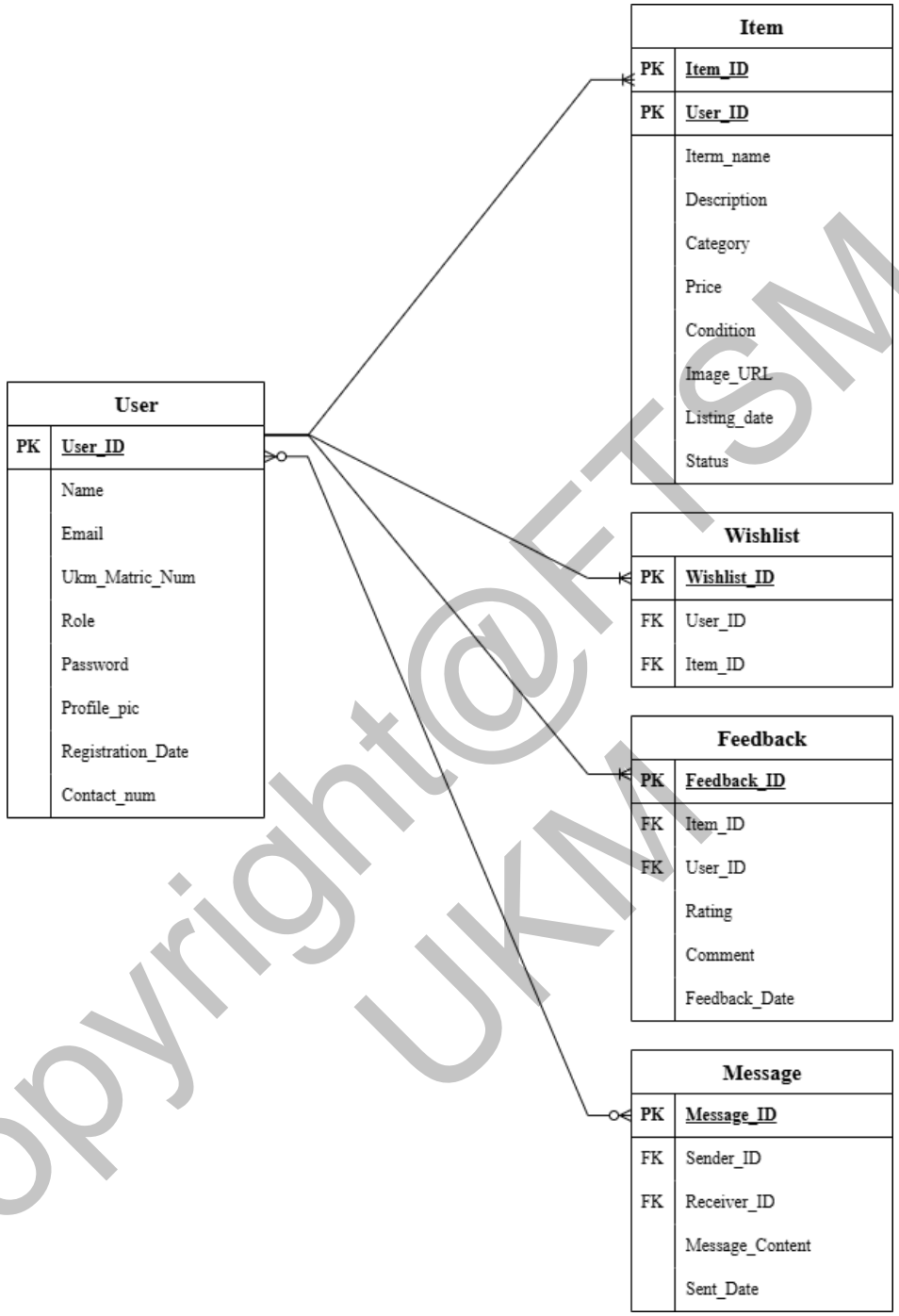

Image 3.3 Database Entity Relationship Diagram

Core Tables:

1. Users: Account credentials and personal information
2. Products: Item listings with descriptions and images
3. Categories: Product classification system
4. Messages/Conversations: Communication system

5. Cart_items: Shopping functionality
6. Admin_logs: Administrative action tracking

4.0 SYSTEM DEVELOPMENT

4.1 Technology Stack

1. **Frontend:** HTML5, CSS3, JavaScript, Bootstrap 5
2. **Backend:** PHP 8.0
3. **Database:** MySQL (MariaDB 10.4.32)
4. **Server:** Apache
5. **Development Environment:** Sublime Text, Visual Studio

4.2 Key Features Implementation

4.2.1 User Authentication System

1. UKM matriculation number validation
2. Secure password hashing using PHP's password_hash()
3. Session management for user context
4. Role-based access control

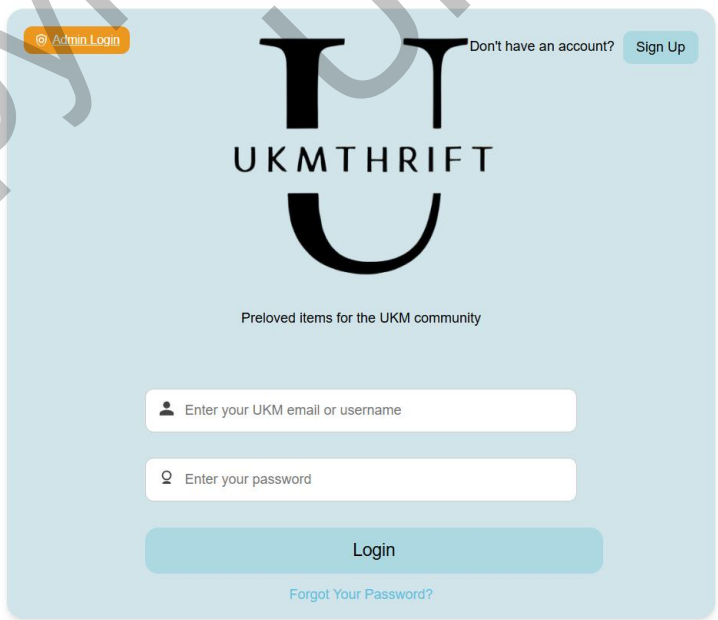

Image 4.1 Login interface

4.2.2 Product Management

1. Drag-and-drop image upload functionality
2. Comprehensive product categorization
3. Advanced search and filtering capabilities
4. Status management (available/reserved/sold)

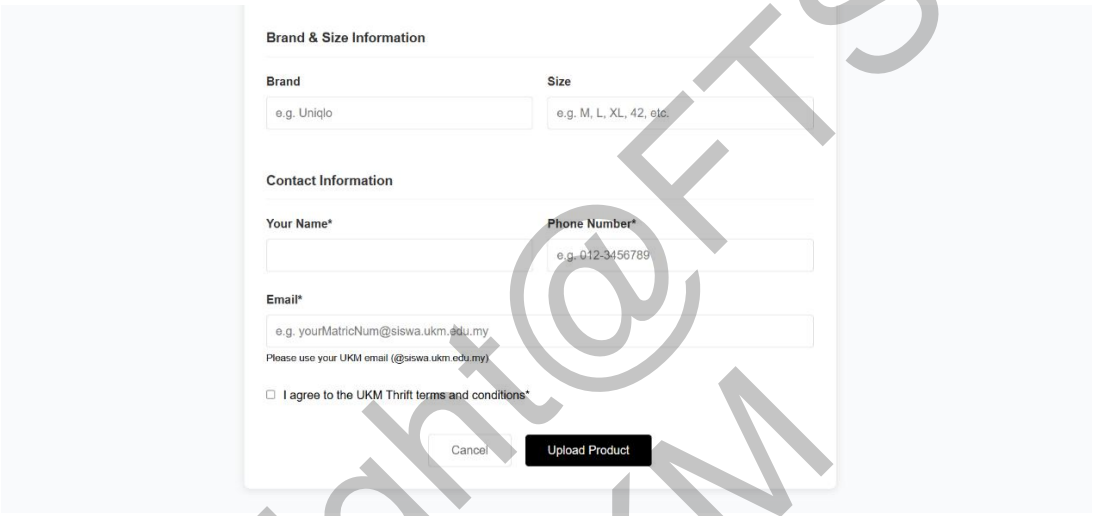

Image 4.2 Product upload interface

4.2.3 Messaging System

1. Real-time communication between buyers and sellers
2. AJAX-based updates every 3 seconds
3. Conversation history management
4. Unread message indicators

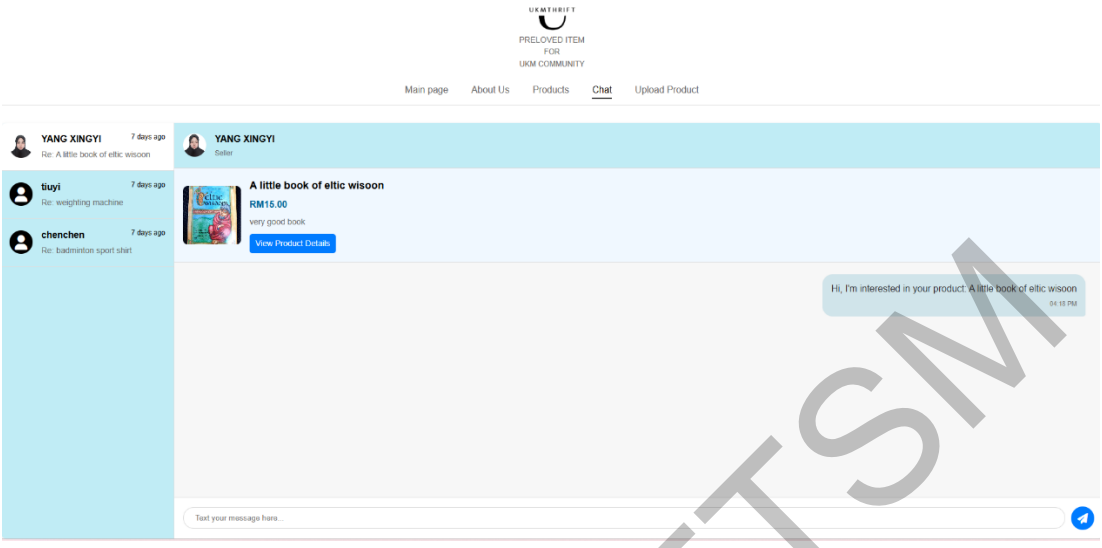

Image 4.3 Chat interface

4.2.4 Administrative Panel

1. Product verification system
2. User account management
3. Activity monitoring and logging
4. Reporting and analytics dashboard

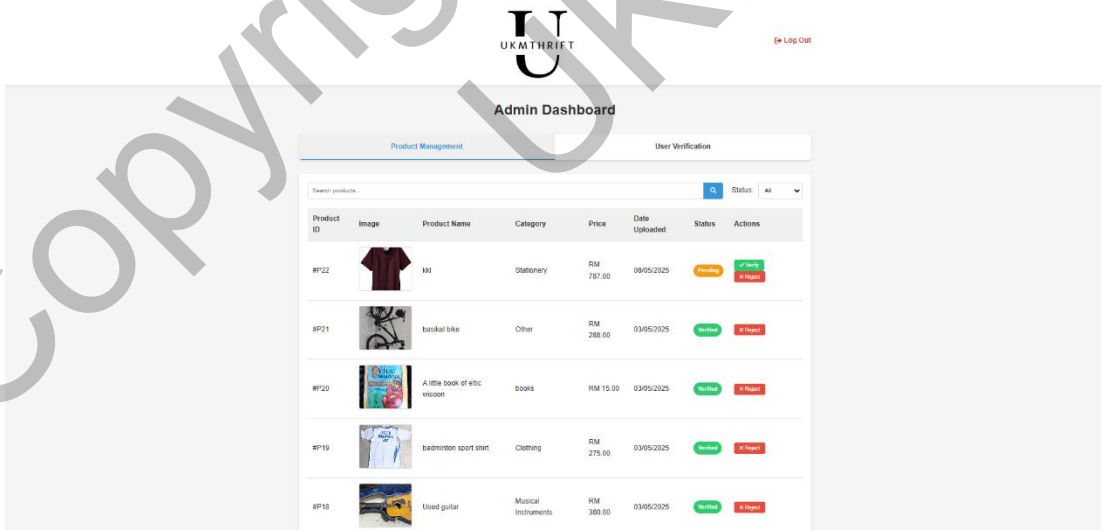

Image 4.4 Admin panel interface

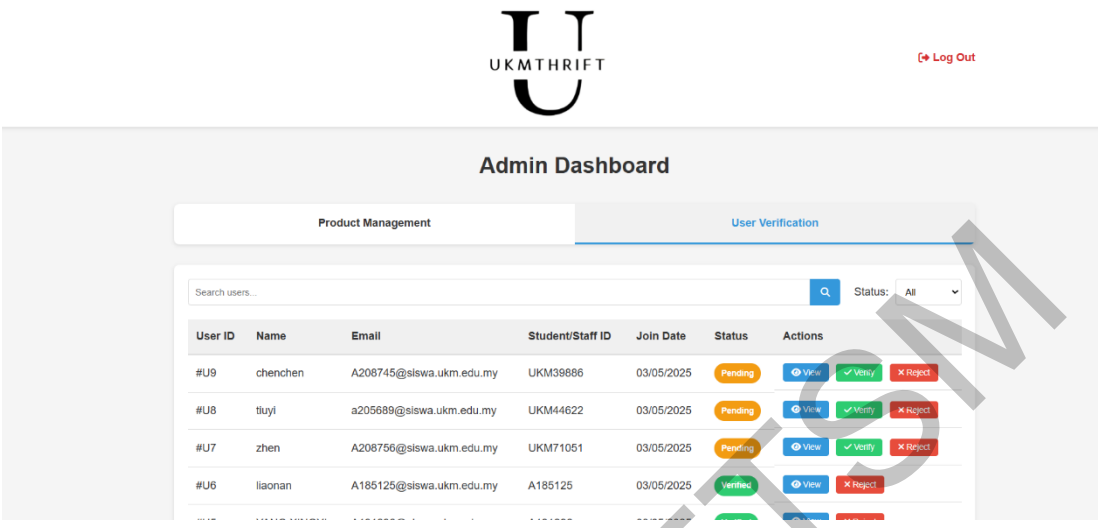

Image 4.5 Admin panel interface

4.3 Security Implementation

1. Input validation and sanitization
2. SQL injection prevention using PDO prepared statements
3. XSS attack prevention
4. Secure file upload handling
5. HTTPS encryption for data transmission

4.4 Development Challenges and Solutions

Table 4.1: Development Challenges and Solutions

Challenge	Issue Description	Solution Implemented
Chat Functionality	Redirect issues with seller pages	Redesigned JavaScript event handling
Shopping Cart	Inconsistent display across pages	Implemented state management system
Image Storage	Performance concerns with database storage	Optimized file handling and compression
Cross-browser Compatibility	Layout inconsistencies	Enhanced CSS and responsive design

5.0 TESTING

5.1 Testing Strategy

Comprehensive testing approach covering:

- **White Box Testing:** Unit testing and statement coverage
- **Black Box Testing:** Functional and system testing
- **Non-Functional Testing:** Performance, usability, and security testing

5.2 Test Results Summary

Table 5.1: Overall Test Results

Test Category	Total Tests	Passed	Failed	Pass Rate
Functional Testing	85	82	3	96.47%
Unit Testing	87	85	2	97.70%
Performance Testing	15	15	0	100%
Usability Testing	25 users	23 satisfied	2 partial	92%

5.3 Code Coverage Analysis

Table 5.2: Statement Coverage Results

Module	Total Statements	Executed	Coverage %	Status
Authentication Controller	151	146	96.7%	Pass
Item Management	223	218	97.8%	Pass
Database Layer	117	113	96.6%	Pass
Messaging System	162	157	96.9%	Pass

5.4 Performance Test Results

Table 5.3: Performance Metrics

Metric	Target	Actual	Status
Response Time	<2 seconds	1.8 seconds	Pass

Metric	Target	Actual	Status
Concurrent Users	100 users	120 users	Pass
Recovery Time	<5 minutes	3 minutes	Pass

5.5 Usability Testing Results

Testing conducted with 25 matriculation students revealed:

1. **Ease of Use:** Mean score 4.02/5.0 (High)
2. **Interface Quality:** Mean score 4.19/5.0 (High)
3. **User Satisfaction:** Mean score 4.14/5.0 (High)

6.0 RESULTS AND DISCUSSION

6.1 System Achievements

The UKMThrift platform successfully addresses the identified problems:

1. **Security Enhancement:** UKM ID verification ensures community-exclusive access
2. **Improved Communication:** Integrated messaging system eliminates external platform dependency
3. **Organized Trading:** Structured categorization and search functionality
4. **Sustainability Promotion:** Facilitates item reuse and waste reduction
5. **User Trust:** Rating and feedback systems build community confidence

6.2 System Strengths

1. Community-specific architecture ensuring trusted environment
2. Comprehensive feature set including real-time messaging and cart functionality
3. Robust database design with proper relationships and constraints
4. Strong security measures including password hashing and input validation
5. Responsive design ensuring cross-device compatibility
6. User-friendly interface accommodating various technical skill levels

6.3 System Limitations

1. Technology stack based on traditional web development practices

2. Image storage through database BLOBs may impact performance at scale
3. Lack of integrated payment gateway requiring external transaction handling
4. Basic search functionality without AI-driven recommendations
5. Limited analytics and reporting capabilities

7.0 CONCLUSION

7.1 Project Summary

The UKM Second-Hand Marketplace (UKMThrift) has been successfully developed as a comprehensive web-based platform addressing the need for organized, secure trading within the UKM community. The platform achieved its primary objectives with a 96.47% test success rate and high user satisfaction scores.

7.2 Contributions

This project contributes to:

1. **Sustainability Initiatives:** Promoting circular economy within educational institutions
2. **Community Building:** Strengthening connections among UKM students and staff
3. **Digital Innovation:** Demonstrating effective community-focused platform development
4. **Educational Technology:** Providing a model for institutional marketplace solutions

7.3 Future Enhancements

Recommended improvements include:

1. **Technology Modernization:** Migration to modern frameworks (Laravel, React)
2. **Payment Integration:** Implementation of secure payment gateways
3. **Mobile Application:** Native iOS and Android app development
4. **AI Integration:** Machine learning for personalized recommendations
5. **Advanced Analytics:** Comprehensive reporting and business intelligence
6. **Scalability Improvements:** Cloud-based infrastructure and microservices architecture

7.4 Final Remarks

UKMThrift demonstrates the potential for educational institutions to develop sustainable, community-focused digital solutions. The platform's success in achieving high user satisfaction and technical performance validates the approach of community-specific marketplace development, setting a precedent for similar initiatives in other academic institutions.

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